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December 1983 85p

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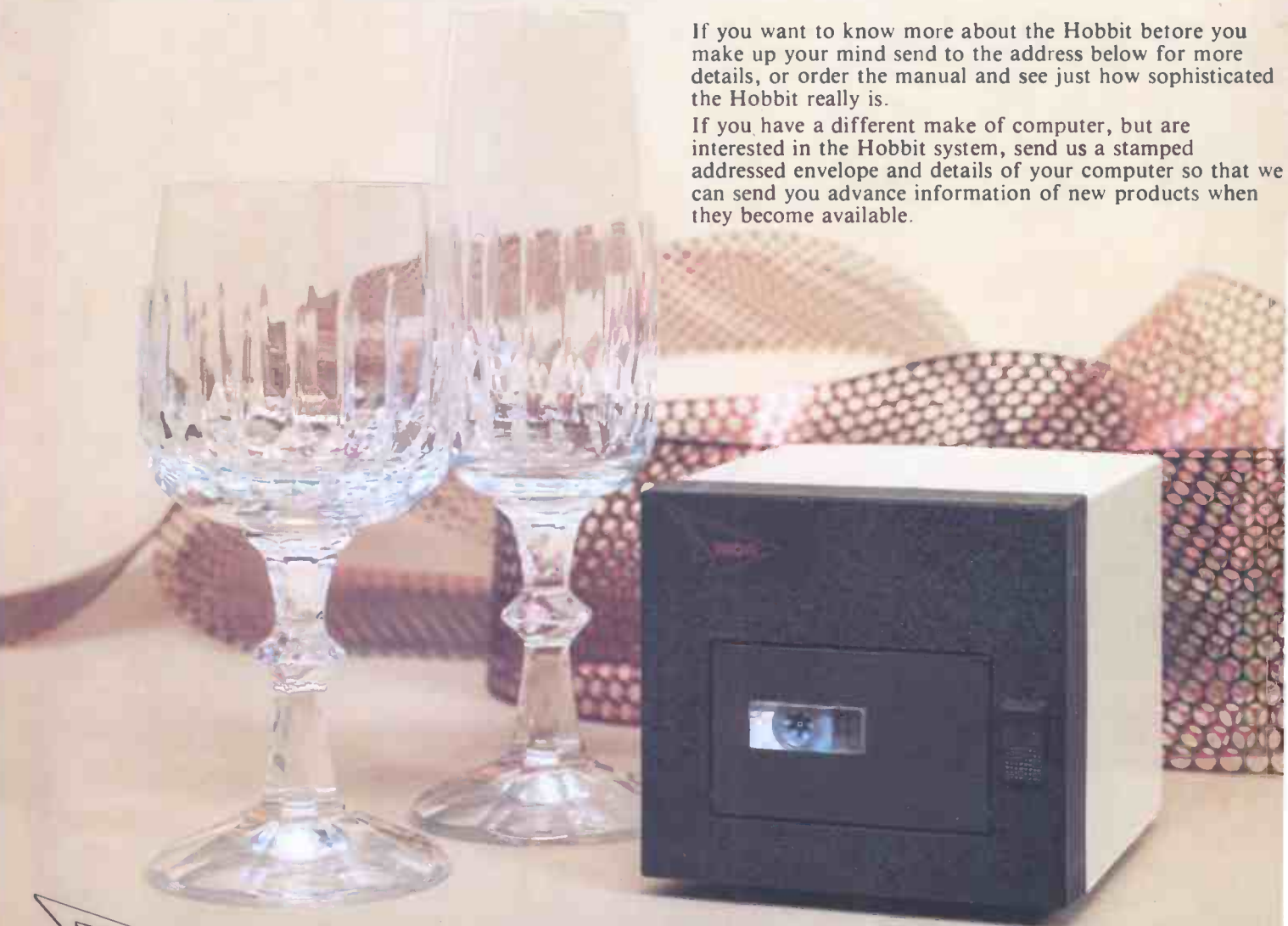

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CONTENTS

Vol 6 No 12 December 1983

Cover illustration by Mark Thomas

BENCHTESTS & REVIEWS

DESQ 130
When is software 'like super-glue'? Answer, when it can be used to stick together all sorts of off-the-shelf MS-DOS packages. Robin Webster, our man in the US, examines this innovative package.

NEC PC-8201A 134
Hidden away at the *PCW* Show was a brand new hand-held computer from NEC. It could be an improvement on the Tandy Model 100 — David Tebbutt investigates.

C/WP CORTEX 152
The Cortex is aimed at the competitive sub-£2000 business market. Peter Bright weighs up its chances.

SMT GOUPIL-3 168
From France comes the Goupil-3, a three-processor machine aimed at business users. Tony Hetherington assesses its merits.

CANON AS-100 182
A Japanese business micro emphasising full colour. Maggie Burton looks it over.

WHICH SPREADSHEET? THE FINANCIAL PLANNER 202
Not strictly a spreadsheet but a definite must to be considered when choosing software to help you get your finances right.

SEARCH AND FIND 212
A unique offering from Sweden which enables you to index incredibly long documents. Kathy Lang explains . . .

AGF PROGRAMMABLE JOYSTICK 216
A joystick that's claimed to be compatible with all games software! Steve Mann tries it out.

FEATURES

BRITISH MICROCOMPUTING AWARDS 126
The most important competition of 1984.

CHECK YOUR DIGITS 142
Have you ever wondered what are those numerical codes on your books and tin cans? Check digits ensure they make sense, and here's how to create your own.

LEARNING WITH LOGO 144
A revolution is brewing in schools. Logo can make learning fun, especially when you get it wrong!

MUSIC MICRO, PLEASE 158
Micros are alive with the sound of music. Part 1: How it's done.

CHRISTMAS CROSSWORD COMPETITION 173
There's a possible bonus for your stocking if

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you can solve the clues in our special Christmas computer crossword.

CHRISTMAS SHOPPING 190
Bewildered at the prospect of buying a home computer this Christmas? How much help will you get in the High Street shops?

PLANE THINKING 196
In an artistic mood? Discover how to build a model of an object based not on lines, but faces.

COLUMN SORT 206
An algorithm to enable you to implement a column sort facility on your micro.

A BEGINNER'S GUIDE TO PROGRAM CONVERSION: PART 4: SINCLAIR GRAPHICS AND SOUND 209
This month Surya focuses on the ZX81 and Spectrum.

DATA COLLATER 1983 218
Your indispensable, macro round-up of all Kathy Lang's database reviews with full updates.

SPREADSHEET ANALYSIS 1983 232
What's great and ghastly about this year's spreadsheets? Pick the package of your choice from Mike Liardet's omnibus.

FORTH BENCHMARKS ROUND UP 236
Dick Pountain gives a full explanation and listings of the *PCW* yardstick for testing performance in Forth.

BENCHMARKS SUMMARY 238
Special for readers with an over-active sense of competition. The big league table of how micros perform the *PCW* Basic Benchmarks, presented by Peter Rodwell.

PASCAL UPDATE 242
Ditto from Chris Sadler, for Pascal.

REGULARS

NEWSPRINT 112
In the aftermath of Osborne will Apple be the next manufacturer to bite the dust?

BANKS' STATEMENT 128
Banksey rubbishes rubbish-out machines. Let's have some wisdom here.

MICRO CHESS 148
Store up some strategy tips from this round by round analysis of all the plotting and counter-plotting at the *PCW* Chess Tournament.

COMMUNICATIONS 166
Readers air your views! Keep putting pen to paper—or fingers (digits even) to wordprocessor.

YANKEE DOODLES 174
Robots look set to benefit from new standards to program them. Sol Libes presents up to the minute news from across the Atlantic.

SCREENPLAY 176
Games for the Spectrum, Oric, Commodore and BBC computers come under fire this month.

SUB SET 180
The intricacies of assembler language are revealed in routines contributed by readers.

BIBLIOFILE 200
Books to help you use micros to write new books.

COMPUTER ANSWERS 210
Get the solution to that niggling micro problem. Or if we haven't tackled it, try us.

TJ's WORKSHOP 227
Jamboree bag of readers' hints and tips about how to make the most of your micro.

LEISURE LINES 235
Another tricky puzzle from JJ Clessa.

SUBSCRIPTIONS 240
Invitation for you to knock on our door with cash rewards for sending you *PCW*.

NUMBERS COUNT 243
Mike Mudge presents his latest medley.

NEWCOMERS START HERE 245
Puzzled by all the jargon? For your enlightenment *PCW* provides a layman's guide to common computing terminology.

DIRECT ACCESS 246
Includes Network News, ACC News, Computer Town UK! Contacts and Packages.

PROGRAMS 256
Bounteous batch for your Christmas treat. Surya presents 17 programs for the BBC, NewBrain, MZ-80K, Commodore 64, Dragon, Spectrum, ZX81 and Oric. Also Sheepdog Trials for the IBM PC!

BACK ISSUES 288
Find out what you've missed.

ADVERTISERS' INDEX 407
Need to find that ad in a hurry? Here's a breakdown of all advertisers in handy alphabetical order.

CHIP CHAT 408
Bitching and back-stabbing on our gutter page. Find out the dirt in the micro-world this month.

BLUDNERS 408
Do we ever make mistakes? Well, at least we admit 'em.

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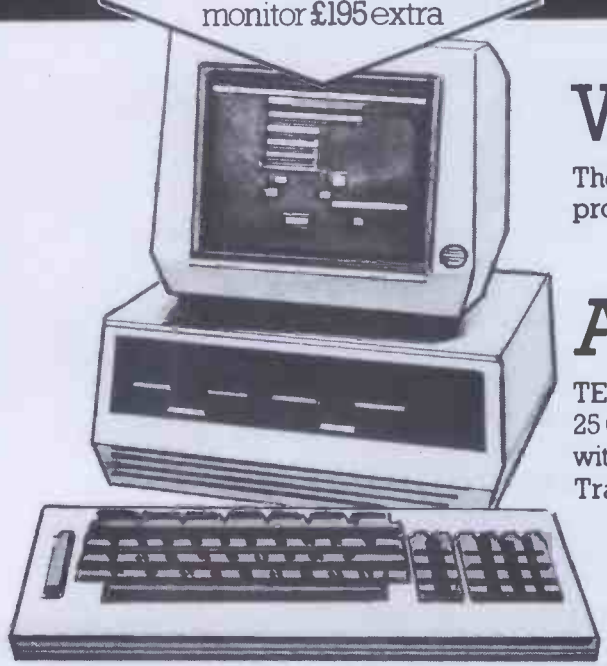

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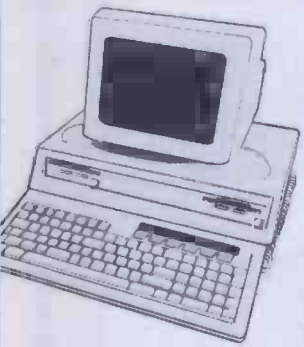

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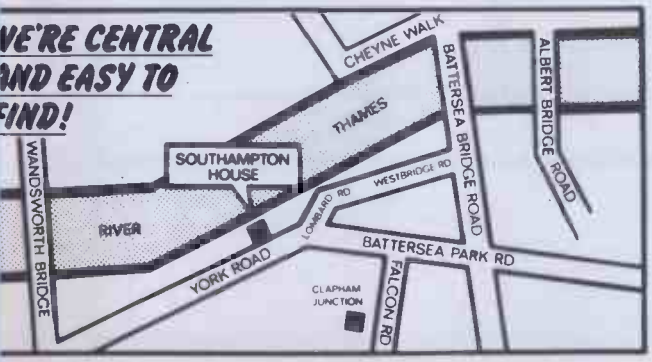

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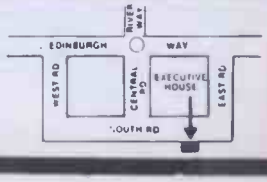

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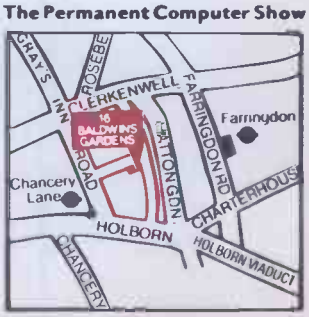

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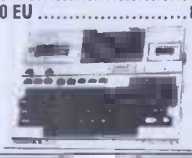

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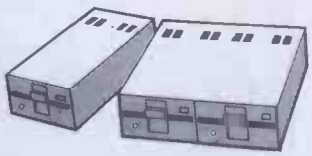

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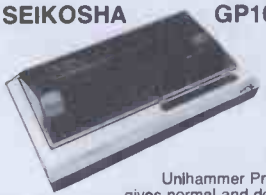

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1.6MHz	392	9.0MHz	200
1.8MHz	395	9.375M	350
1.843M	200	10.0MHz	175
2.0MHz	225	10.7MHz	150
2.457M	200	10.24MHz	200
3.276MHz	160	12.0MHz	175
3.2768M	150	12.528M	300
3.57594	98	14.31818	170
3.6864M	300	16.0MHz	200
4.0MHz	150	18.0MHz	180
4.032MHz	290	18.432M	150
4.194304	200	19.968M	150
4.433619	100	20.0MHz	200
4.80MHz	200	24.0MHz	170
5.0MHz	160	24.930M	325
5.185MHz	300	48.0M	175
5.24288	390	100.0M	375
6.0MHz	140		
6.144MHz	150		
6.5536M	200		
7.0MHz	150		
7.7328M	250		
7.168MHz	160		

IDC Connectors:

Speed Block type	PCB PLug with latch Strut Pins	PCB PLug with latch Angle Pins	Female Header Socket	Female Card-Edge Connectors
Two rows				
10 way	90p	99p	85p	120p
16 way	130p	150p	110p	—
20 way	145p	166p	125p	195p
26 way	175p	200p	150p	240p
34 way	205p	236p	160p	320p
40 way	220p	250p	190p	340p
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12"	198p	215p	315p	490p
24"	219p	235p	345p	540p
36"	230p	250p	375p	595p

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2end	290p	370p	480p	525p

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14pin	10p	35p
16pin	10p	42p
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20pin	22p	60p
22pin	25p	70p
24pin	25p	70p
28pin	28p	80p
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Ways	Grey Price per Foot	Colour Price per Foot
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20	30p	50p
26	40p	65p
34	60p	85p
40	70p	90p
64	120p	160p

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41612 A + B				
2 x 32 way	275p	320p	220p	285p
41612 A + C				
2 x 32 way	295p	340p	240p	300p
41612 ABC				
3 x 32 way	360p	385p	260p	395p

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TWO ROWS	.1"	.156"
2x18 way	180p	145p
2x22 way	199p	200p
2x23 way	185p	
2x25 way	225p	220p
2x28 way	210p	
2x30 way	245p	
2x36 way	295p	
2x40 way	315p	
2x43 way	395p	

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Angle	160p	210p	250p	355p
Pins	120p	130p	195p	295p
	Female			
Solder	110p	160p	210p	350p
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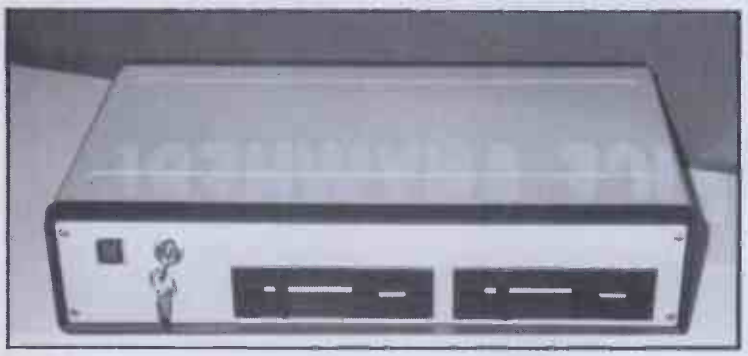

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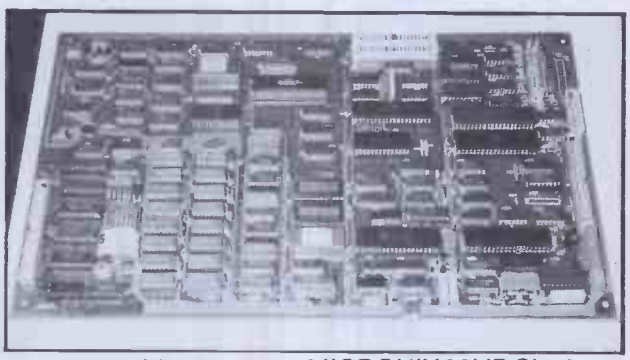

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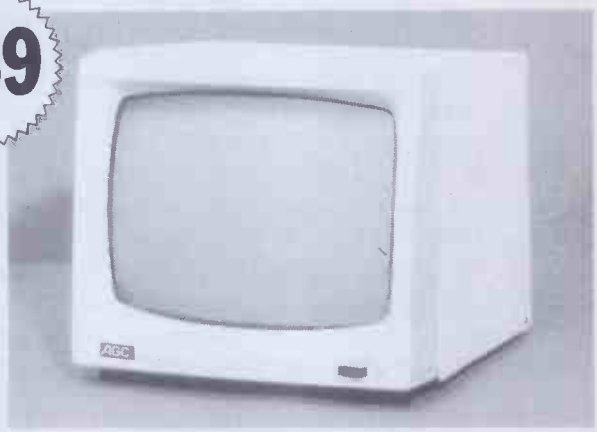

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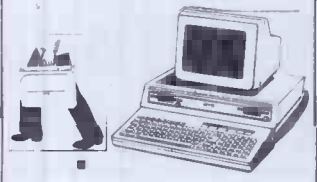

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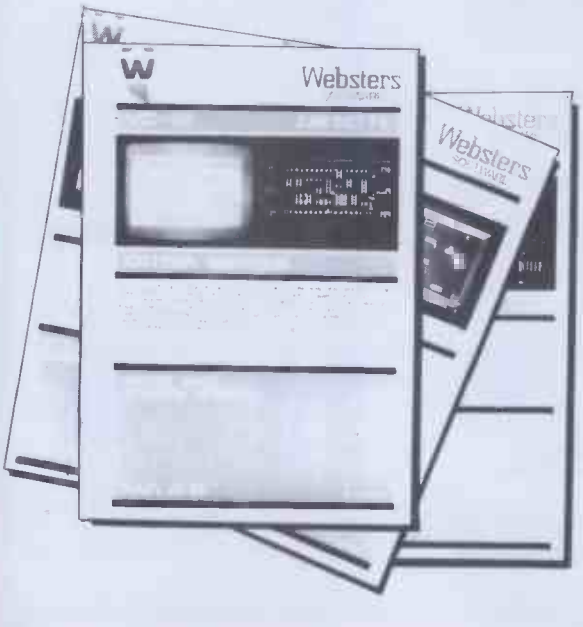

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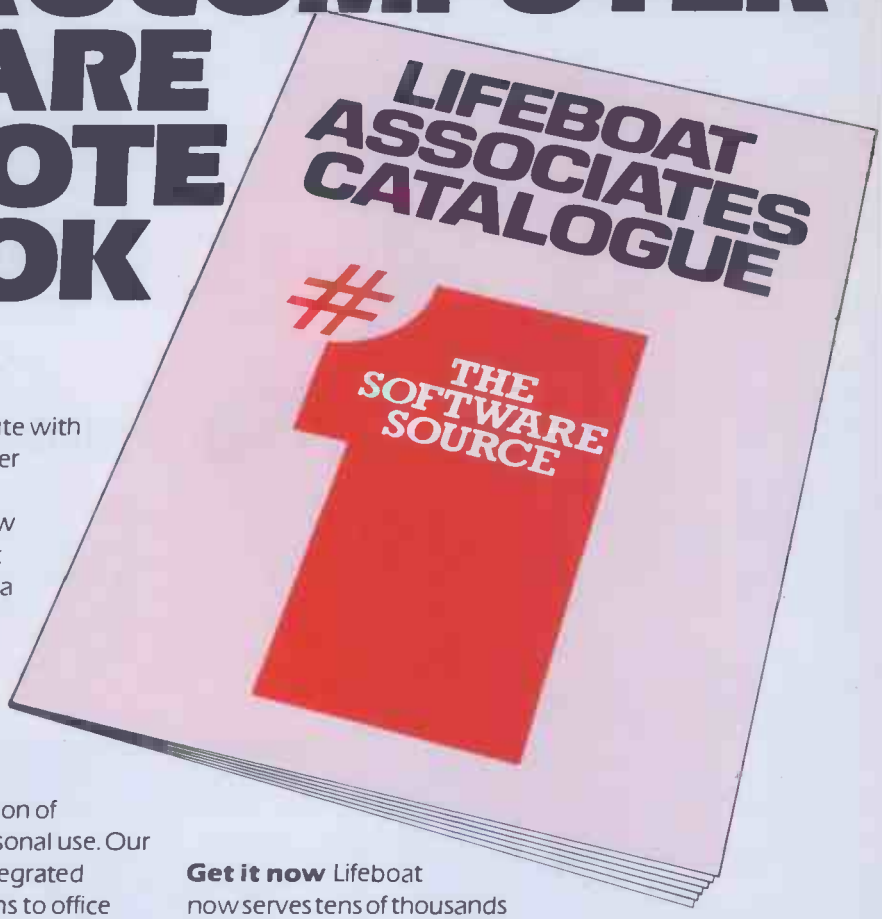

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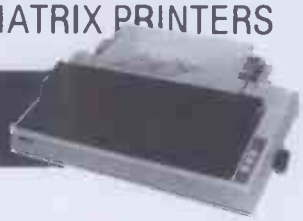

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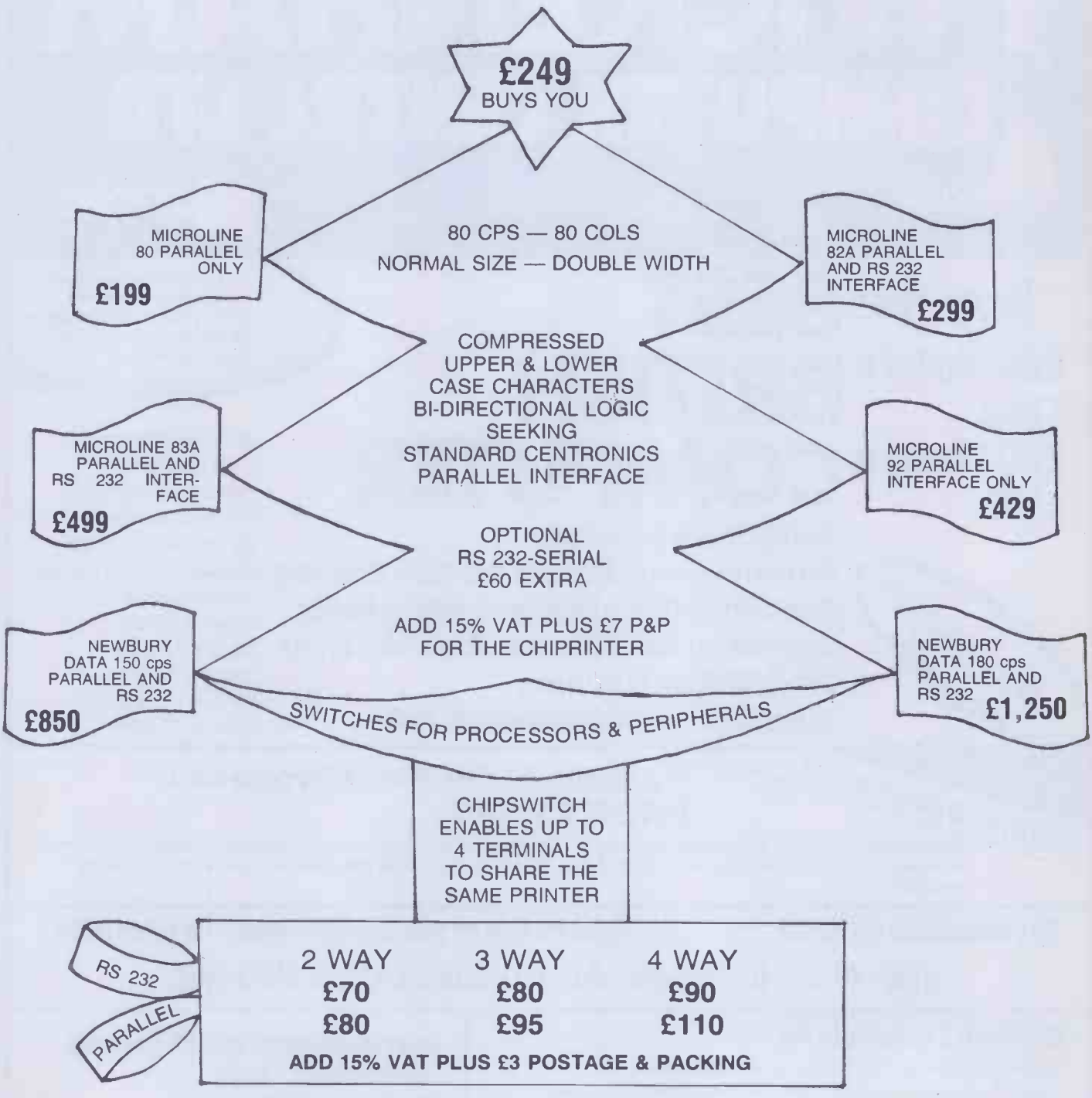

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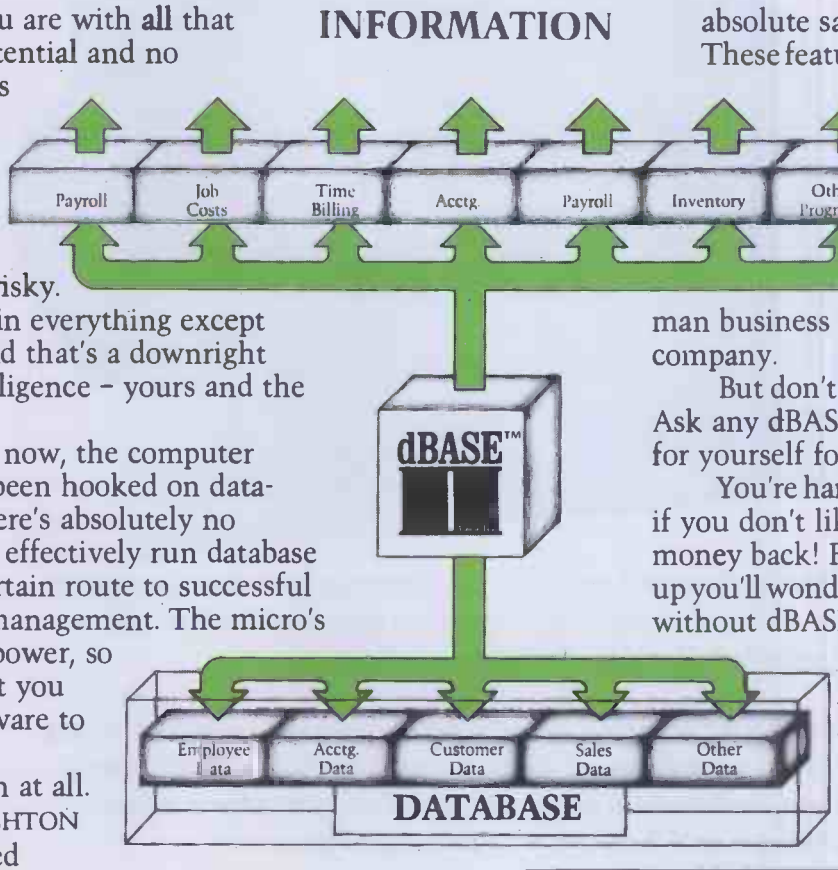

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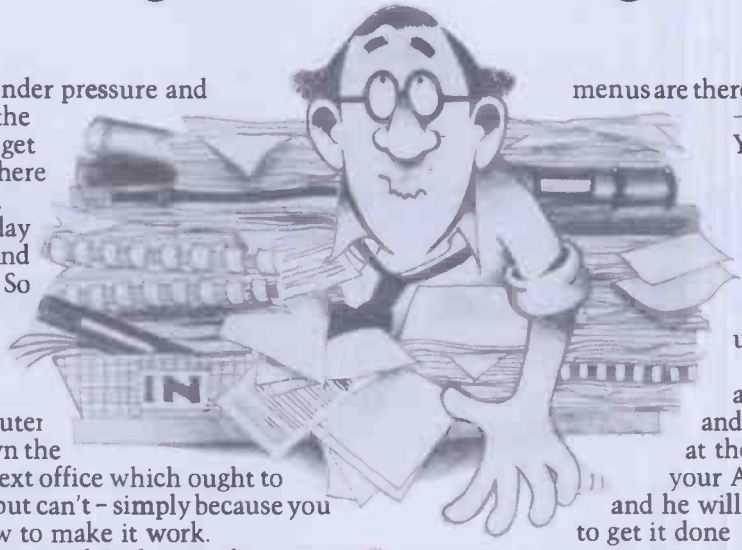

You are under pressure and you can't find the information to get the job done. Where is it? You could spend half the day looking for it. And still not find it. So you just give up and start all over again.
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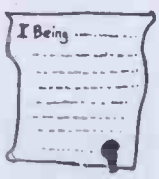

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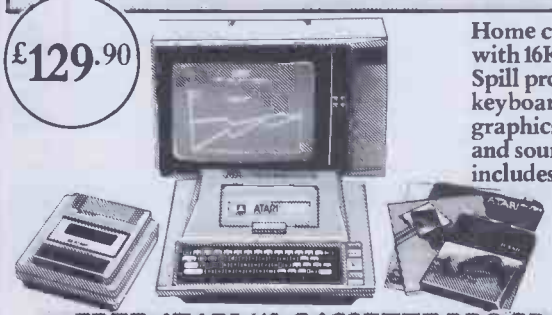

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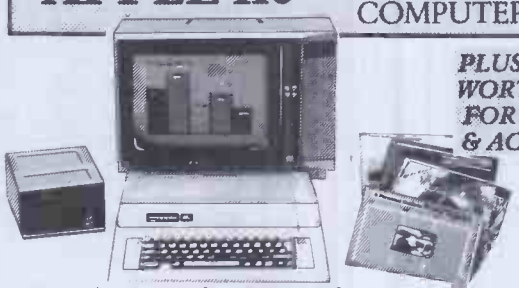

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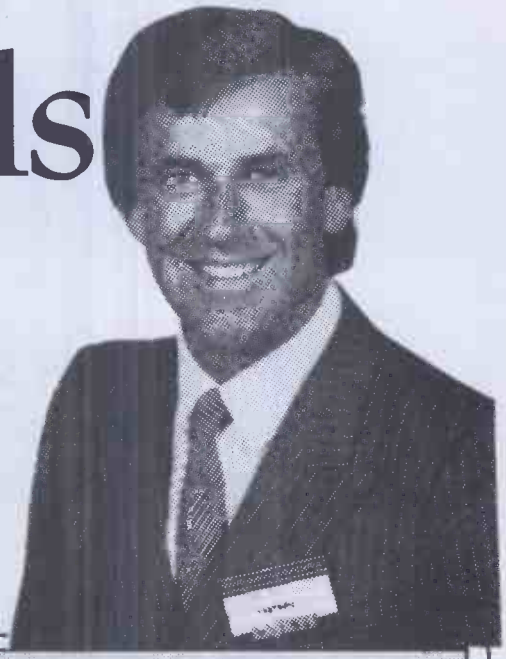

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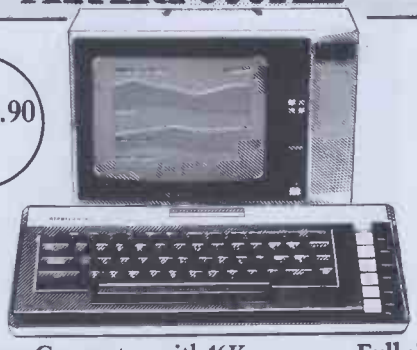

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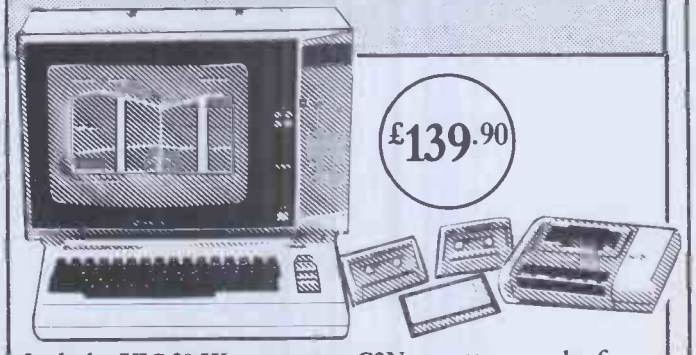

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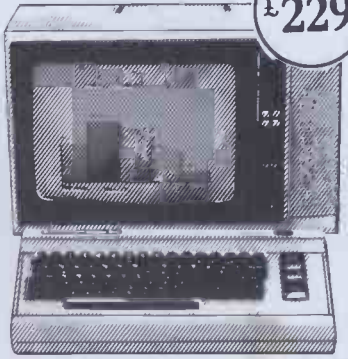

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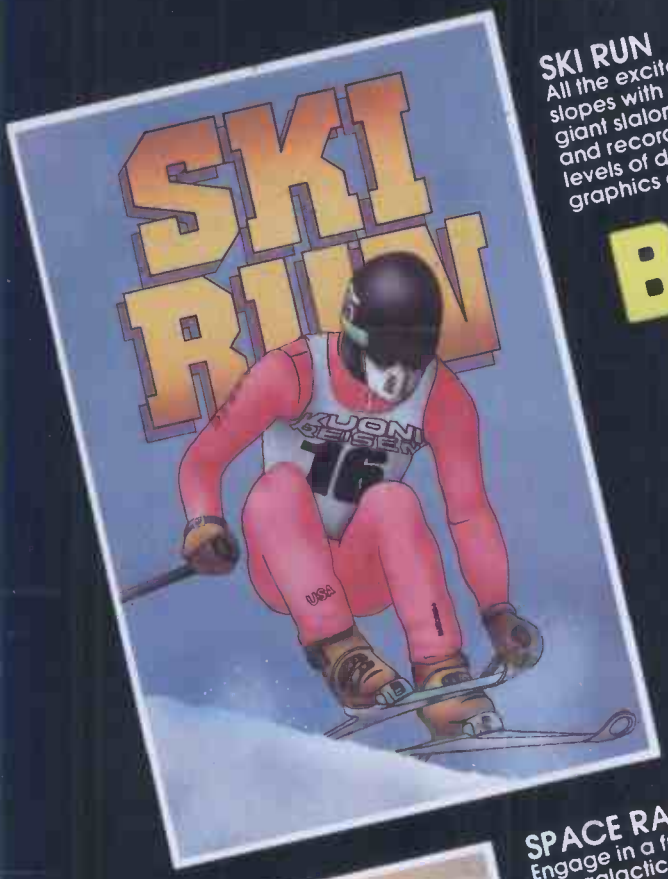

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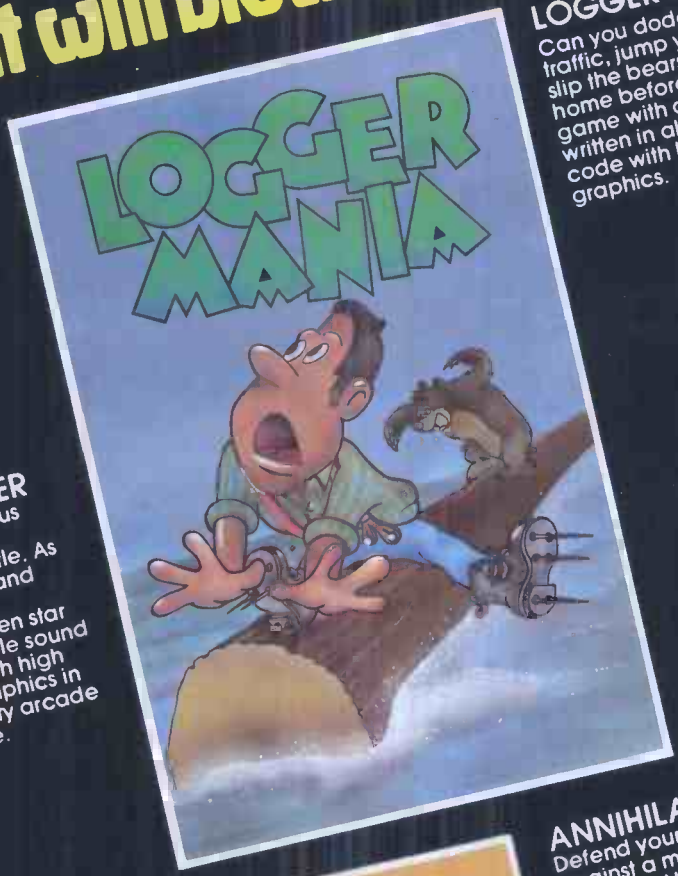

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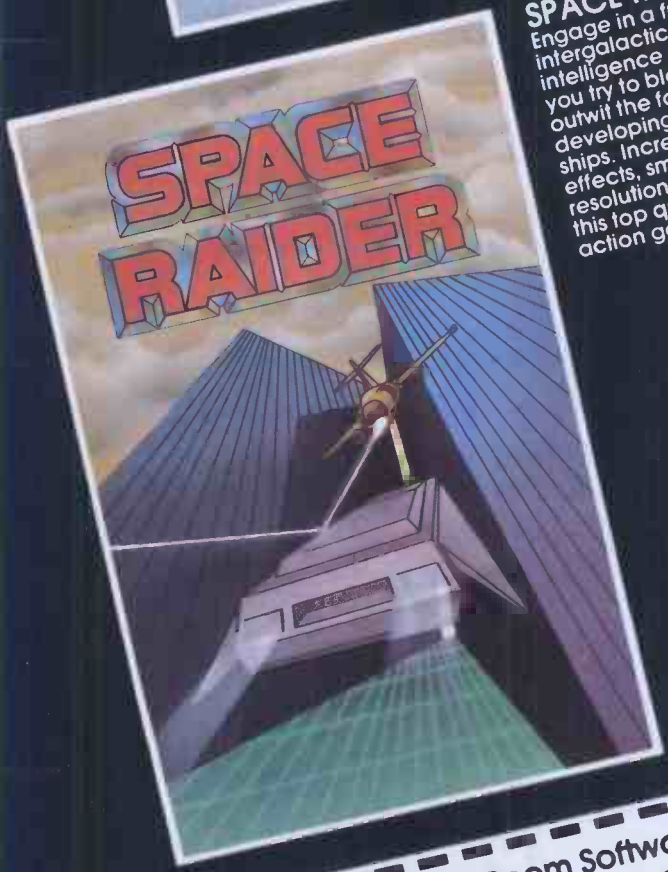

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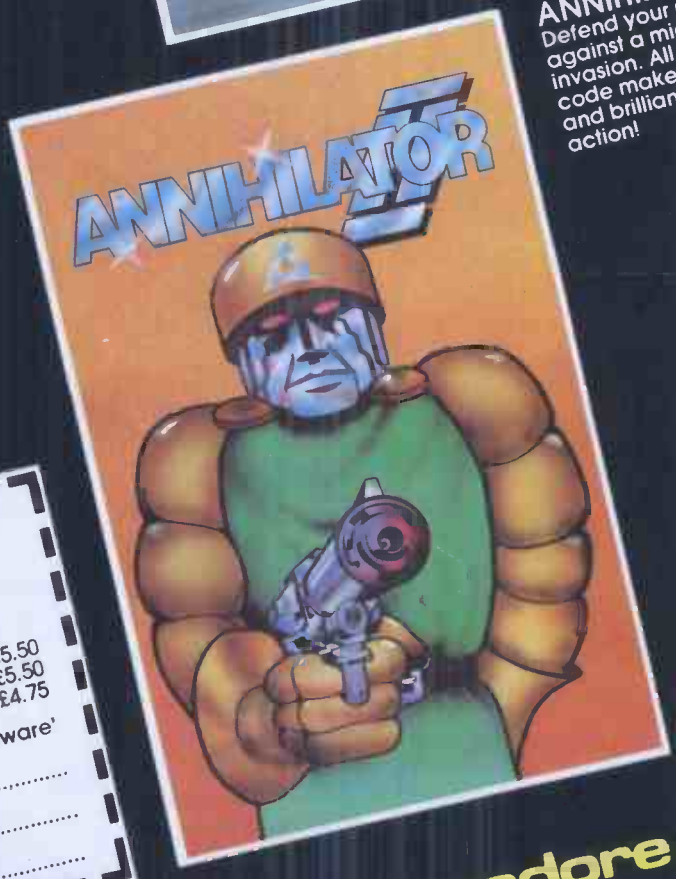

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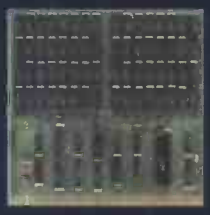

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With MultiBoard thousands of permutations are possible. Eight of our most popular boards are shown here, but there is a range of 15 available; together with mother boards, frames, cables, power supplies, key boards and compatible software if required. A comprehensive catalogue is available from the Dealers listed, or 'phone us to discuss your requirements.

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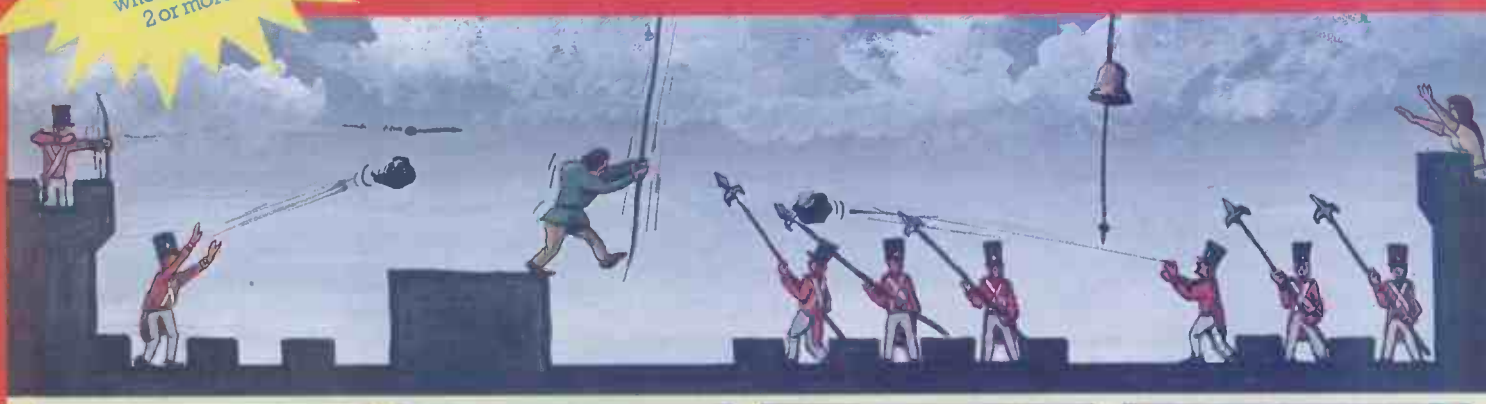
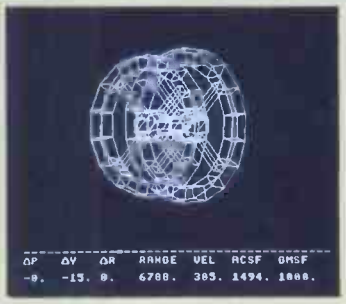


HUNCHBACK (32K) £7.95

An excellent version of the arcade game where Quasimodo attempts to rescue Esmeralda. Beautifully detailed animation (the best we've yet seen!) as Quasimodo leaps over the ramparts dodging rocks and arrows, swinging on ropes, avoiding the guards' spears, and ringing the bells. Twelve different screens of action! This program is sold under licence from Century Electronics Ltd; we have exclusive rights to its sale for use on the BBC micro.
(For use with KEYBOARD or JOYSTICKS).
●●● *NEW RELEASE* ●●●

CRAZY PAINTER (32K) £7.95

The only full-feature version available for the BBC micro. On the first screen, you take the part of a monkey being chased by African tribesmen. If you manage to survive by painting-in all the squares, the bonus screen features the monkey trying to reach his bunch of bananas. After that, you take control of a paint-roller and each square painted-in adds to your score. But beware . . . the teddy-bears are now in hot pursuit. Superb animation and sound-effects.
(For use with KEYBOARD OR JOYSTICKS).
●●● *NEW RELEASE* ●●●



2002 (32K) £7.95

A space docking simulator using a 3D graphics to model the motions and responses of the ORION 4 spacecraft. Your mission is to pilot the shuttle to a "soft dock" with the space station. PITCH, YAW, ROLL, FORWARD, LATERAL and VERTICAL engines are provided together with orbit manoeuvering booster engines. 6 skill levels provide for the completely inexperienced pilot as well as the fully-fledged commander.
●●● *NEW RELEASE* ●●●

ALIEN DROPOUT (32K) £7.95

A novel and unusual program. Arcade-action with this exciting multi-stage shooting game. You have to shoot the aliens out of their "boxes" before the "boxes" fill up. Once full, the aliens fly down relentlessly, exploding as they hit the ground.
(For use with KEYBOARD or JOYSTICKS).
"... these moths are out to get more than the clothes in your wardrobe.
... YOUR COMPUTER

FAIRGROUND (32K) £7.95

An exciting target-shooting game! Bonuses are scored for spelling out the word FAIRGROUND by hitting the appropriate target letters, and for shooting all the targets. Extra bullets are obtained by shooting the numercial targets, but watch out for the "smileys" who are intent on stealing your bullets. Music, sound effects, hi-score, and rankings.
●●● *NEW RELEASE* ●●●

CENTIPEDE (32K) £7.95

Incredible arcade-style game featuring mushrooms, snails, flies, spiders, and the centipedes of course. Excellent graphics and sound. 6 skill levels, hi-score, rankings, bonuses, and increasing difficulty as the spiders become more lively and the number of mushrooms increases.
(For use with KEYBOARD or JOYSTICKS).
"Visually this game compares well with the arcade version, being colourful and clear."
... YOUR COMPUTER

ROAD RUNNER (32K) £7.95

The only full feature machine-code version available for the BBC micro. Features include: scrolling screen, radar display, 3 pursuing cars, checkpoint flags, fuel gauge, smoke screens, 6 skill levels, rankings, increasing difficulty, and sound effects.
(For use with KEYBOARD or JOYSTICKS).
"The game becomes very hard and has very smooth graphics. Excellent."... BEEBUG MAGAZINE.

FROGGER (32K) £7.95

Not just another version of Frogger . . . this is the arcade-action version that you've been waiting to see. Graphically brilliant with gaping-mouthed crocodiles, diving turtles, flies, and frogs that flex their legs as they jump along. Increasing difficulty, and responsive controls.
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"... very good indeed ... fast flicker-free graphics and a frog that really hops!"... BEEBUG MAGAZINE

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THE BBC MICRO USER SHOW

The show that attracted record attendances in Manchester and Nottingham now comes to the heart of London – with a fabulous pre-Christmas bonanza of all that's best for the BBC Micro. There are lots more exhibitors, who will be using the show as a launching-pad for the very latest software, plus many hardware devices that are rapidly making the BBC Micro one of the most versatile computers of them all.

- ★ ASK the experts – free advice on all aspects of computing from people who know the BBC Micro inside out.
- ★ CALL in to one of our highly successful walk-in seminars, at which all the famous names from the world of BBC Micro computing will be taking part. Whatever your interest – graphics, machine code, interfacing, education – there will be a top expert speaking on it. *(Saturday and Sunday only)*
- ★ TRY OUT for yourself the games that will be the top sellers this Christmas – and well into next year.
- ★ FIND out about all the new peripherals for the BBC Micro – disc drives, interfaces, ROM boards, robots and second processors.
- ★ DISCOVER why the Electron – the baby brother of the BBC Micro – has been hitting the headlines and why all the experts are tipping it to be the big seller of 1984.

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GROUP BOOKINGS

Schools can obtain additional tickets by sending a stamped addressed envelope to: BBC Micro User Show, Europa House, 68 Chester Road, Hazel Grove, Stockport SK7 5NY.

£1 *off normal exhibition admission price of £3 (adults) and £2 (children)*

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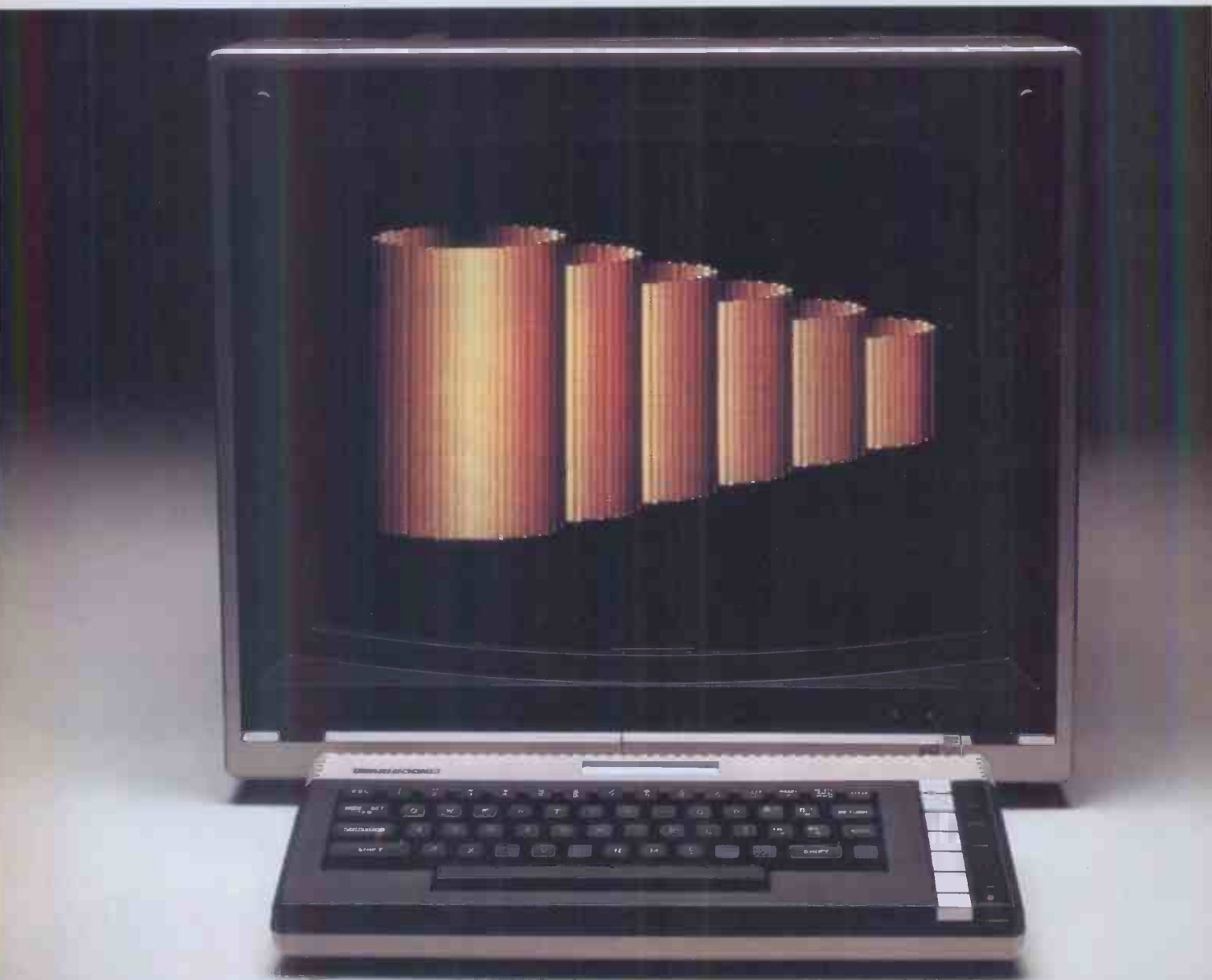

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The new Atari XL home computer system.

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®ATARI and design. Reg. U.S. Pat and TM Off. TM: Trademark of Atari Inc. The ATARI 600XL is compatible with ATARI 400 and 800 programs.

Not all home computers stay at home.

The BBC Micro is the ideal family computer – simple to operate, yet fast, powerful, with enormous potential.

But it's nice to know, when you buy one for your home, that the business, educational and scientific worlds agree with your choice.

Here are a few stories to illustrate how the BBC Micro gets out and about. And one to remind you how helpful it can be when it stays at home.

A practical lesson in business admin.

The contribution of the BBC Micro in the classroom has long been recognised at Perins Community School in Hampshire.

The School has 12 BBC Micros used extensively across the syllabus: in fact some pupils are using them to study for their GCE O Levels in computing.

One of the programs available to Perins teachers such as David Beck, pictured below with his class, is "Newsagent."

This program contains all the necessary information for the class to run a newsagent's shop; allowing them to organise daily deliveries, make up bills and keep an eye on stock control and ordering.

It's a nice example of how the BBC Micro can be used not only to acquaint a class with the language of computers, but also with some of the realities of the community in which they live.

Correcting Jodrell Bank.

The BBC Micro is a familiar worker around Jodrell Bank.

You'll find it in the reception area explaining the workings of a radio telescope to visitors, for example.

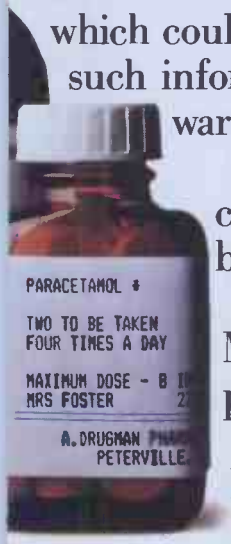
But it's also been helping in a more testing task: to improve the performance of the Defford telescope.

In this application it has been used to make calculations necessary to determine the precise parabolic shape of the dish.

Theodolites are used to do the measuring – then the BBC Micro works out the necessary corrections.

The end of the scrawl.

If any of you have noticed how much ısier it is to read and understand labels n drugs and medicines these days, then ɔu can most probably thank the BBC licro. John Richardson, a Preston pharm-ist, was first to realise how a micro with suitable printer could produce labels that were accurate and legible and which could include, automatically, such information as drug reaction warnings.



At the same time it could record drug usage for better stock control.

He chose the BBC Micro for its versatility and potential for expansion.

John Richardson believes that this system will be recognised as standard ı the profession and be used in hospitals, ealth centres and pharmacies throughut the UK.

Meanwhile back at home.

Dr. & Mrs. Yarwood bought a BBC licro as a birthday present for their 12 ear old daughter.

However, it quickly became ommon property.

All three can now write their own programs. Mrs. Yarwood is particularly proud of one program she has compiled to help teach her daughter French vocabulary.

They all agree that although the Micro is fast and powerful enough to be at home in Jodrell Bank, it is also the ideal computer at the Yarwood home: simple to set up (virtually any TV set and cassette player is all you need) and simple to use.

All this for only £399.

The BBC Micro comes with a comprehensive, step-by-step User Guide which introduces you to your micro and shows you how to construct useful programs of your own.

You will also receive a free "Welcome" cassette which contains 15 different programs for you to experiment with, ranging from music and graphics to games like Kingdom and Bat 'n' Ball.

The BBC Micro is available from W H Smith Computer Shops, Boots, John Lewis and local Acorn stockists.

Alternatively if you would like to order one with your credit card or if you want the address of your nearest supplier just phone 01-200 0200 or 0933-79300.

The BBC Microcomputer System.

Designed, produced and distributed by Acorn Computers Limited.

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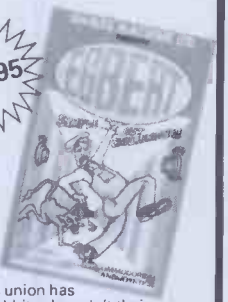

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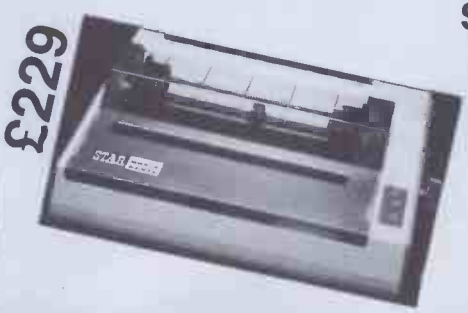

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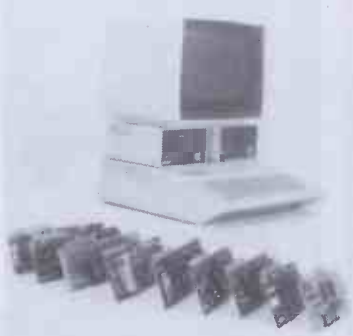

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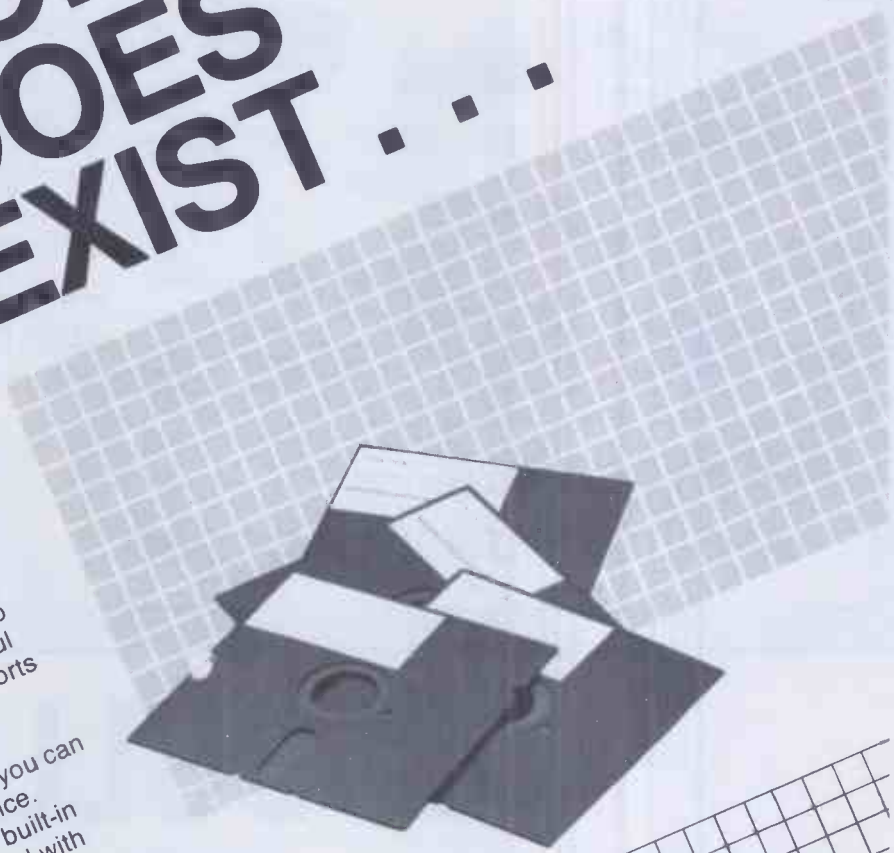

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WARNING

Choosing a home micro can be a daunting task to the newcomer, and with an ever increasing number of micros emerging on the market, even up-grading, say, from a ZX81 can be a risky and expensive exercise if the wrong decision is made. It is important to look at the real facts and specifications, and check exactly what you get for your money before choosing your micro-computer system.

THE PITFALLS

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A number of large companies are offering packages that seem to be good value and low cost.
These offers usually have a hidden sting inasmuch as the essential accessories such as connection leads, peripherals and software often carry very high cost premiums.
e.g. software for low cost hardware usually costs between £29 and £49 for a ROM cartridge!!

CHECK THE QUALITY OF THE PRODUCT.

Raw materials are now an area where corners can be cut, and shoddy workmanship during 'building' can effect the 'up-time' of your unit.
Areas to watch out for are unreliable edge connectors, corrosion and poor quality P.C.B.s. Low quality components and bad design will seriously effect the reliability of the end product, and can lead to false economy.

DON'T BUY A GAMES MACHINE

Unless you want just games and nothing else! With a games computer you are limited.
Some computers, however, have the advantage of both games facility plus the whole world of computing to explore, as your interest and skills develop. A real computer system will allow you to expand your knowledge of the Hi-Technology world, and help earn its keep with its added uses in the field of education, communication and home business use.

SOFTWARE

Make sure the system you choose has a growing library of support software, to enable you to realize the full potential of your machine.

KEY POINTS TO LOOK FOR

● High Resolution Colour

In general most home computers have a poor graphics resolution (or detail). Check on the vertical and horizontal resolution in graphic mode and multiply the two numbers together. If the result is less than 35,000, then the graphics can hardly be considered high resolution.
Without high resolution graphics displays such as those used in games tend to be "Chunky" in appearance.

● High Quality Sound

Some computers claim to provide a sound channel when in reality all that can be found inside the computer is a small buzzer controlled by electronic pulses. At the very least a sound facility should provide more than one channel and a raise channel as well (for gun shot effects in games for example). The best systems also provide envelope control of the sound channels to produce very sophisticated effects; very important for generating music. Also look for the ability to connect to external amplifiers.

● Keyboard

For accurate entry of programs and data into a computer it is important that the keyboard has a good tactile feel in operation. Coupled with acoustic feedback the user is fully aware when the computer has accepted his/her actions. Also of importance in a keyboard is layout. A standard computer keyboard layout will familiarise the user with the vast majority of computers used in the world of business and professional applications; very important if the purpose of purchasing a computer is educational.

● RAM

One of the most important features of a computer is the amount of RAM, or memory, included. In general the more powerful and exciting a computer program is the more RAM it requires. But take care, all computers are advertised quoting the total RAM used in the system. Computers use up a great deal of their own RAM for storing essential data and particularly in supporting the graphics display and the CPU.
If it is less than 32K think again, is it enough?

● Computer Language

It is too dificult to program a computer in its own binary language so high level languages are used, the most popular being BASIC. However, there are a number of BASICs, some being very different from the rest.
A de facto standard in the computer industry is Microsoft BASIC.
Learn this one and you will be able to program in the majority of computer BASICs; such an important point if a home computer is to be used to educate your children to face the technology of the future.

● Expansion

As your interest and knowledge of computing grows, you will need a computer system that will grow with you; able to accommodate Printers, Disk-drives, Joysticks, Communications Modem, and Colour Monitor, as well as produce HI-FI sound effects.

Choosing the right system carefully will save you from throwing your money away. Check full specification, plus peripherals and software prices, before you buy. Preferably choose a Real computer system that can expand to meet your needs.

● Software

The computer you choose should have a growing selection of utility software to make the most of its capability.
Remember, computing is here to stay. You can't learn to compute on a toy, or a device which does not behave like a real computer.
In short, look out for a computer which offers all the points above, and you will be sure of getting the best value for money.

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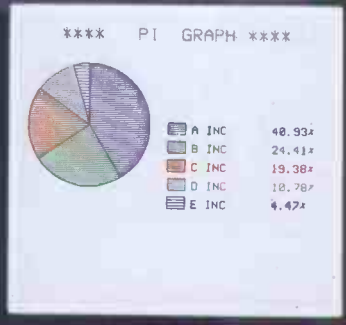

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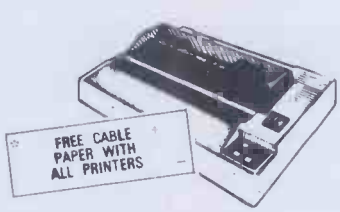

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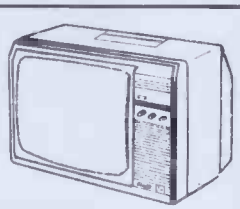

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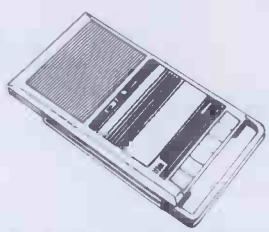

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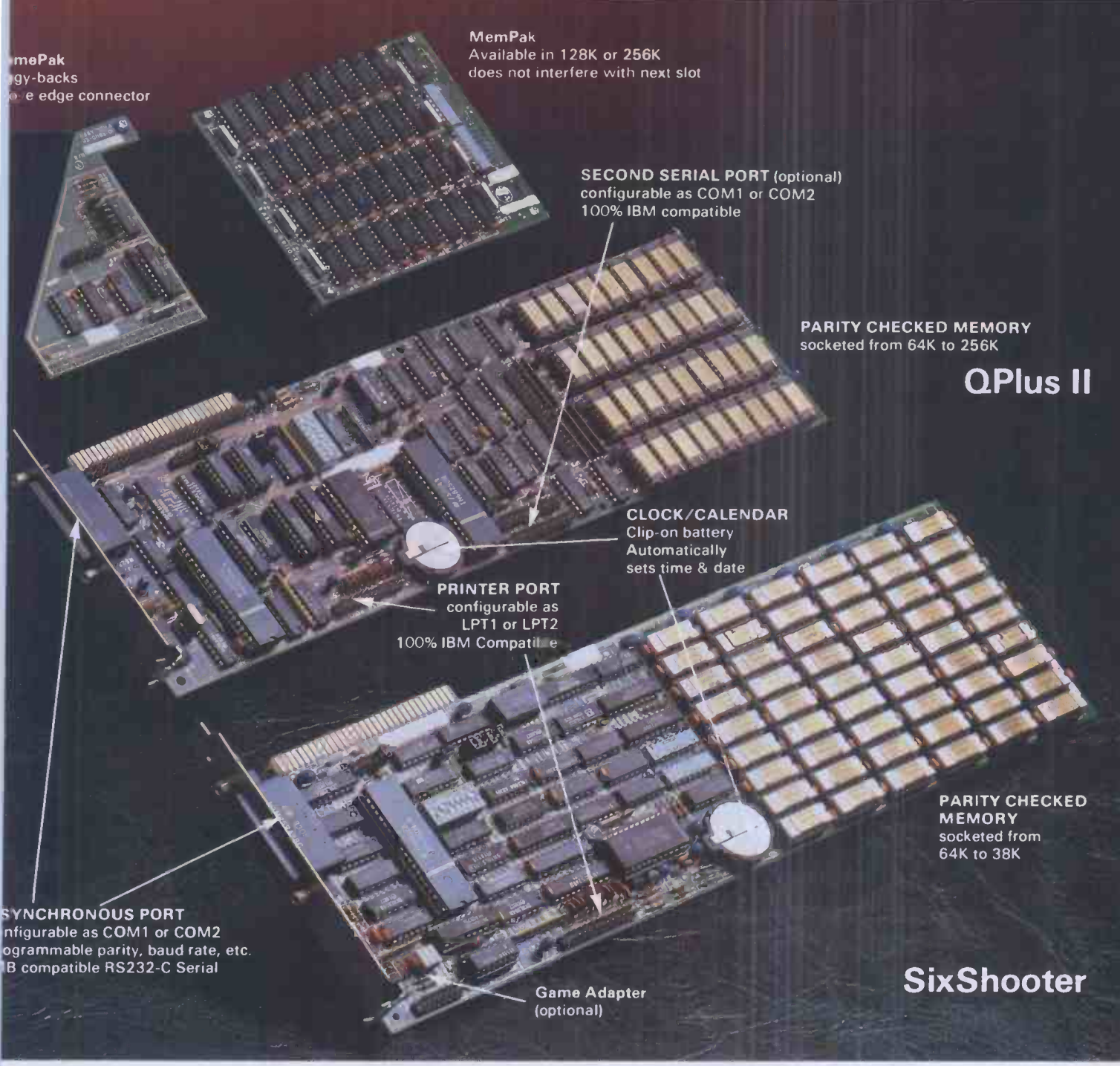

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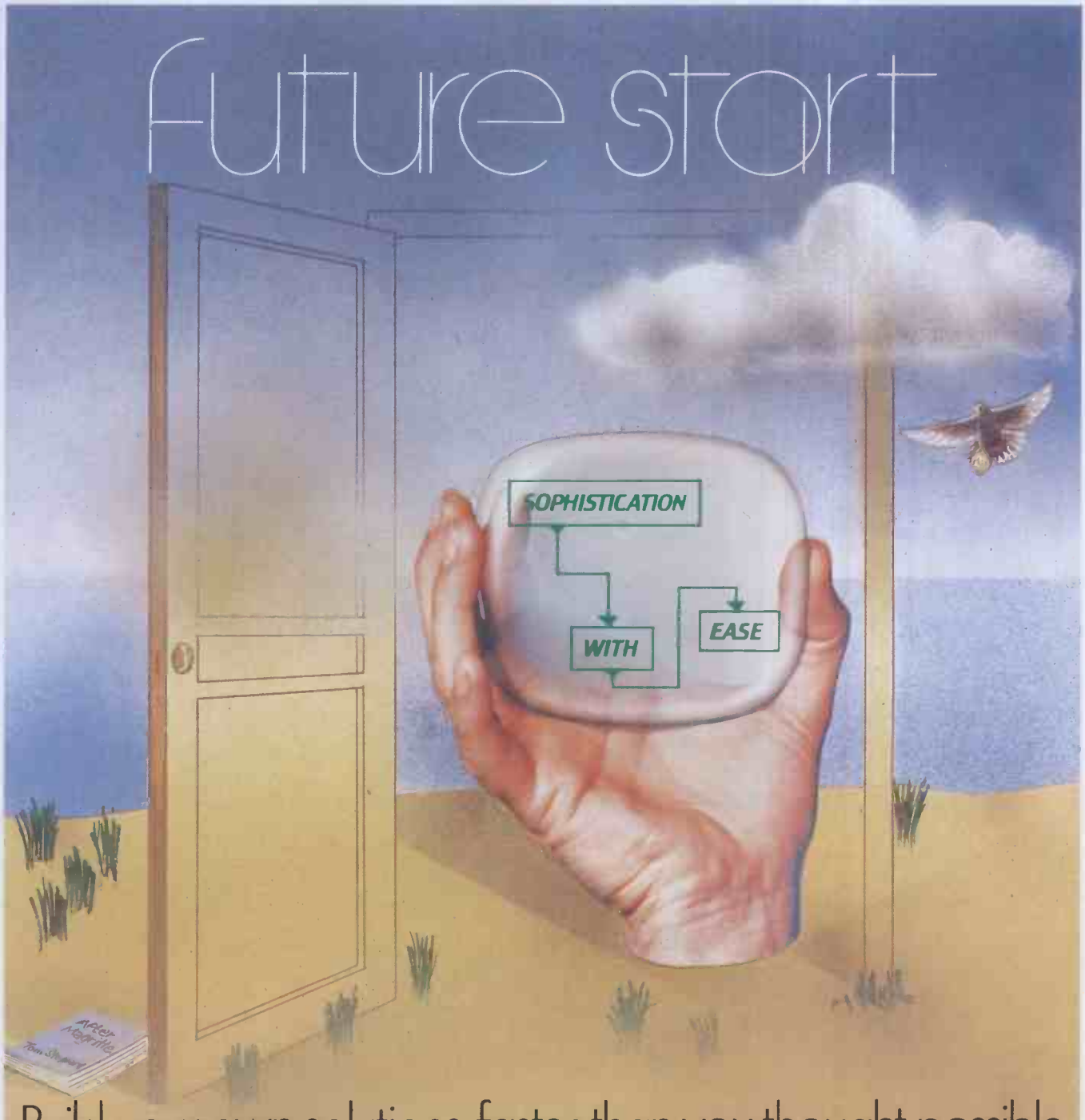

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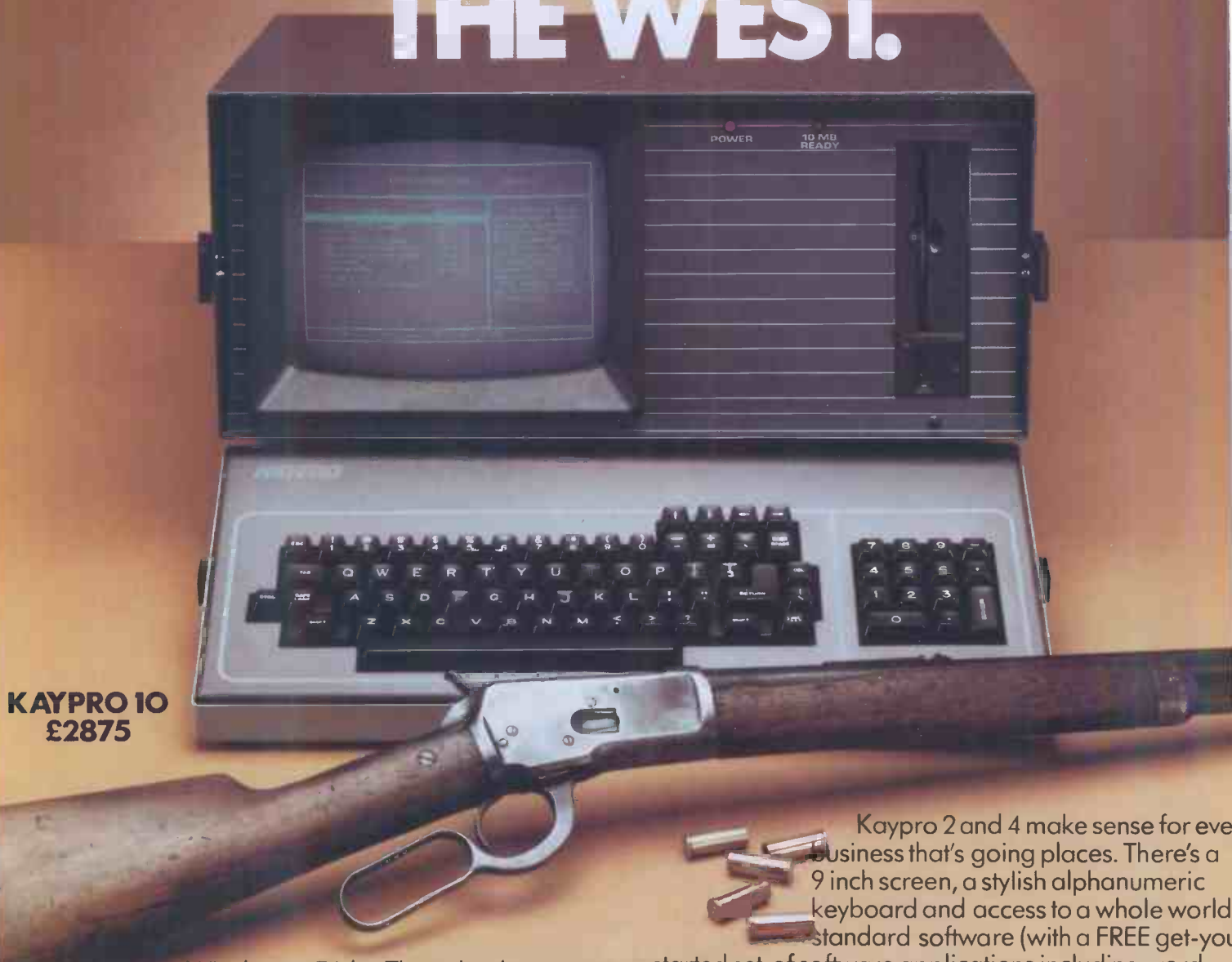

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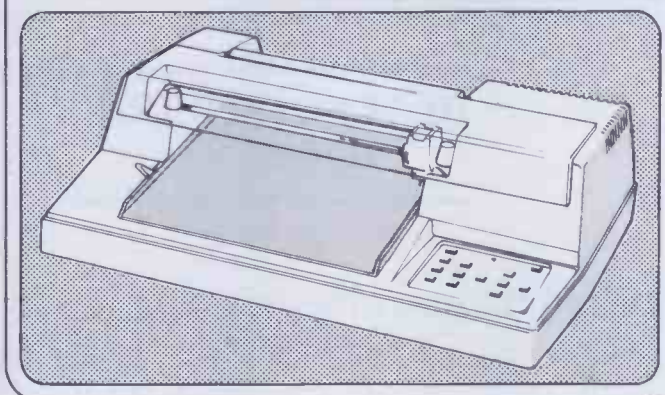

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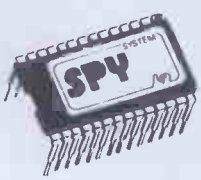

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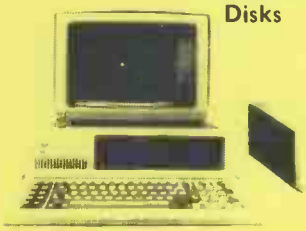

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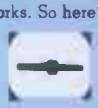
BEFORE.  AFTER

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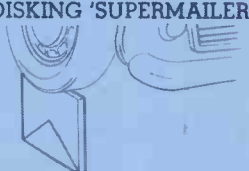

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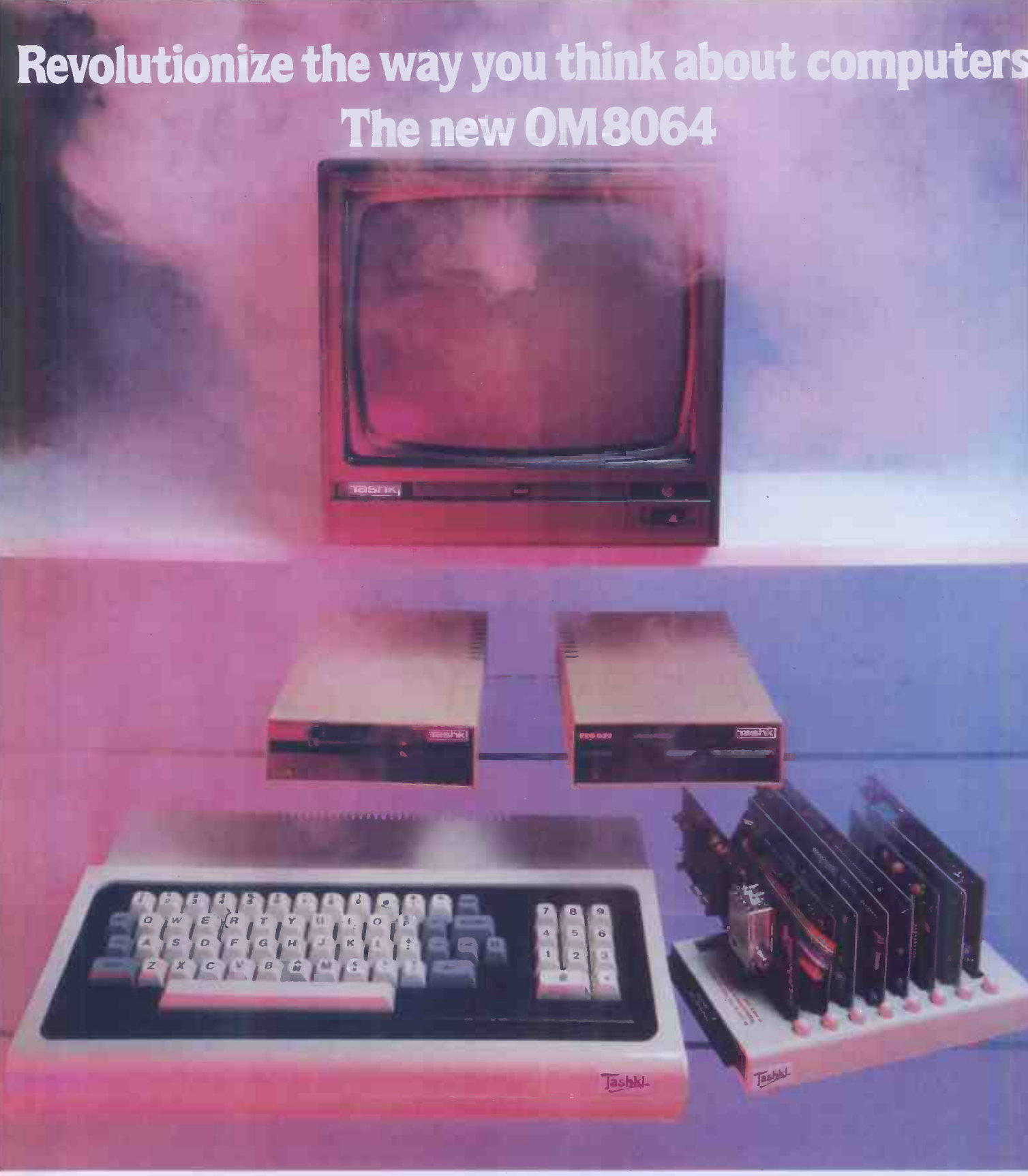

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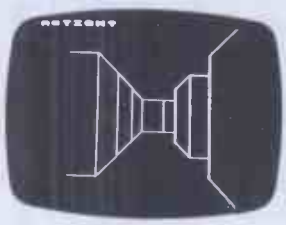

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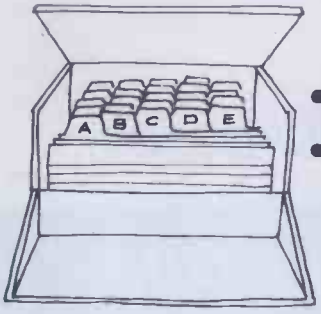

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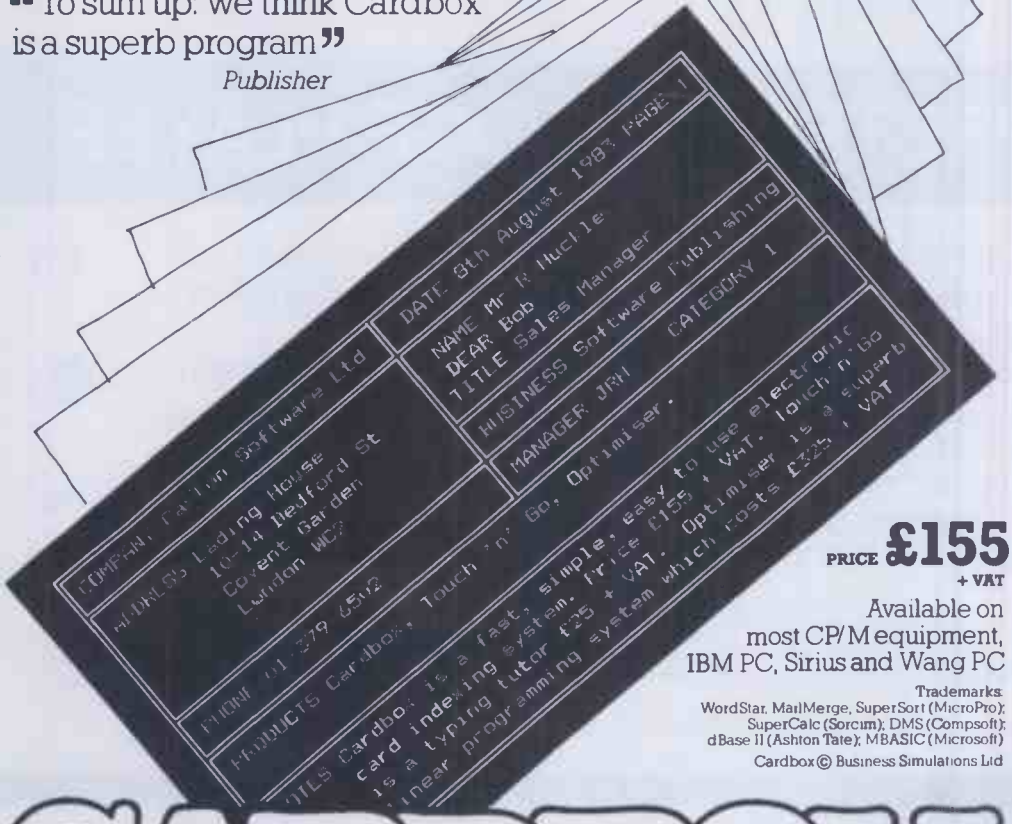

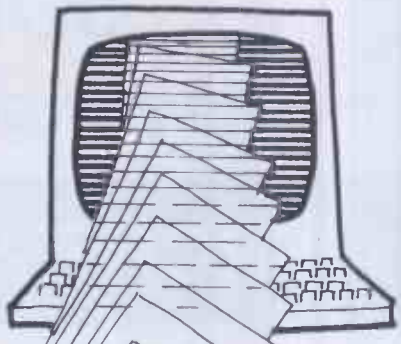

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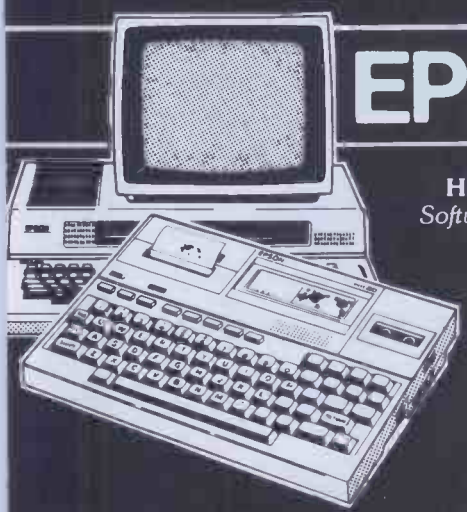

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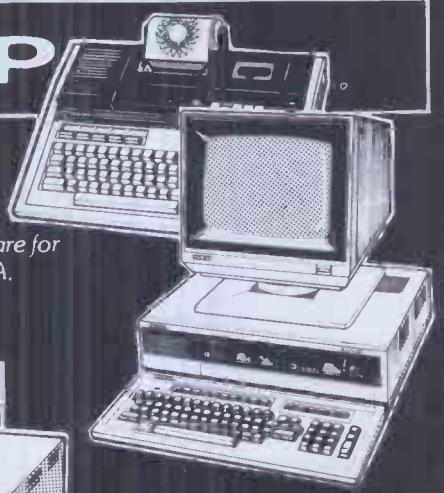

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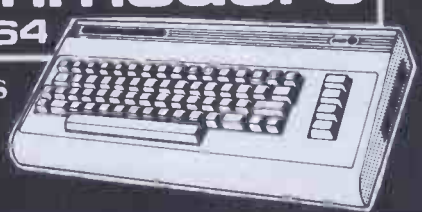

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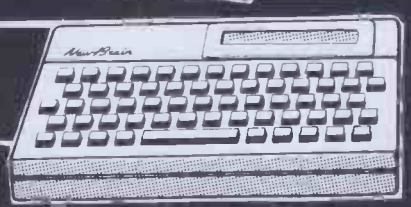

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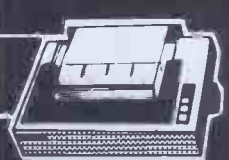

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Built to grow

To be truly versatile, a home computer has to understand very different things.

So you need different "languages," which the M5 provides by supplying part of its memory in plug-in cartridges.

"The M5 eliminates the worst limitations on machines at this level, which is that they tend to be stuck with whatever language is provided by the management." (Personal Computer News, June '83.)

The computer is supplied complete with a Basic-I cartridge, a standard integer BASIC language and a simple learning text.

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Take a look at the home computer that will improve with age.

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Crude Commodore 64 Graphics are in for a clean up!

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All you need to turn your basic 64 into an artists canvas, is a tape drive and colour monitor and of course Paint-Pic. It's suitable for ages 12 and upwards, and is quite unique.

The manual contains picture load and display programs and is easy to follow, even by first time computer enthusiasts. Price of Picture-Pic is £23.00 + V.A.T.

Brain Surgeon's Guide

Put away your scalpels — its not that kind of guide! But if you want to dissect your New Brain, this is for you.

It's an excellent 138 page book called "The New Brain Dissected" written by ex Byte Shop manager and Micro Pioneer — John Braga.

There are 10 chapters covering too many things to mention here, but as an appetiser here are some examples: Basic, the manual, assembler monitor functions, Ram and Rom, intercept mechanical, graphics, and disc system.

The book also contains programs for renumbering, defining your own high res graphics and monitor listing.

These alone are worth more than £8.50, but that's all you need to pay for the complete book.

Get Inside Your MZ700

Figuratively speaking you can now get inside your MZ700 with the aid of Tony Marriott's new book "MZ700 Explained".

It costs £5.95 and gives a detailed guide to the machine's internal working with the help of numerous diagrams. Written in the same style as his other books "MZ80A and MZ80K Explained" this is an ideal companion. Both are available from Kuma.

Tending New Brain Blackouts

The New Brain can now become a superb Electronic Mail Terminal for such things as Telecom Gold, and BL Comet, without the screen playing it's usual game of hide and seek.

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Kuma's on the Move

By around the beginning of December we hope to be ensconced in new, larger premises, and customers frustrated by our busy telephone will be pleased to hear that we will be installing several additional lines, too.

Since it's conception nearly two years ago, Kuma has grown dramatically, especially on the Software publishing side; and therefore delighted to have more than enough space to move into.

Our new address will be widely published but we shall retain our existing telex number (84946) and Electronic Mail passwords on Telecom Gold and B.L. Comet.

HX-20 Catalogue Preview

Sorry, but we can't keep it secret anymore. The new autumn catalogue has a heap of new programs.

Among them are Sales Order Entry (32K system) at £29.50 + V.A.T.; Expenses (32K system); Mobile Stock Recorder at £29.50 + V.A.T.; Stock Control at £29.50 + V.A.T.; and two exciting Astronomy programs — a must for all you helio and geocentric eccentrics.

Watch this space

For details about the prizes you can win if you are a MZ711 user. Kuma will be running a competition later in the year and the details will be published here. Or you can obtain them by ringing (0628) 71778.

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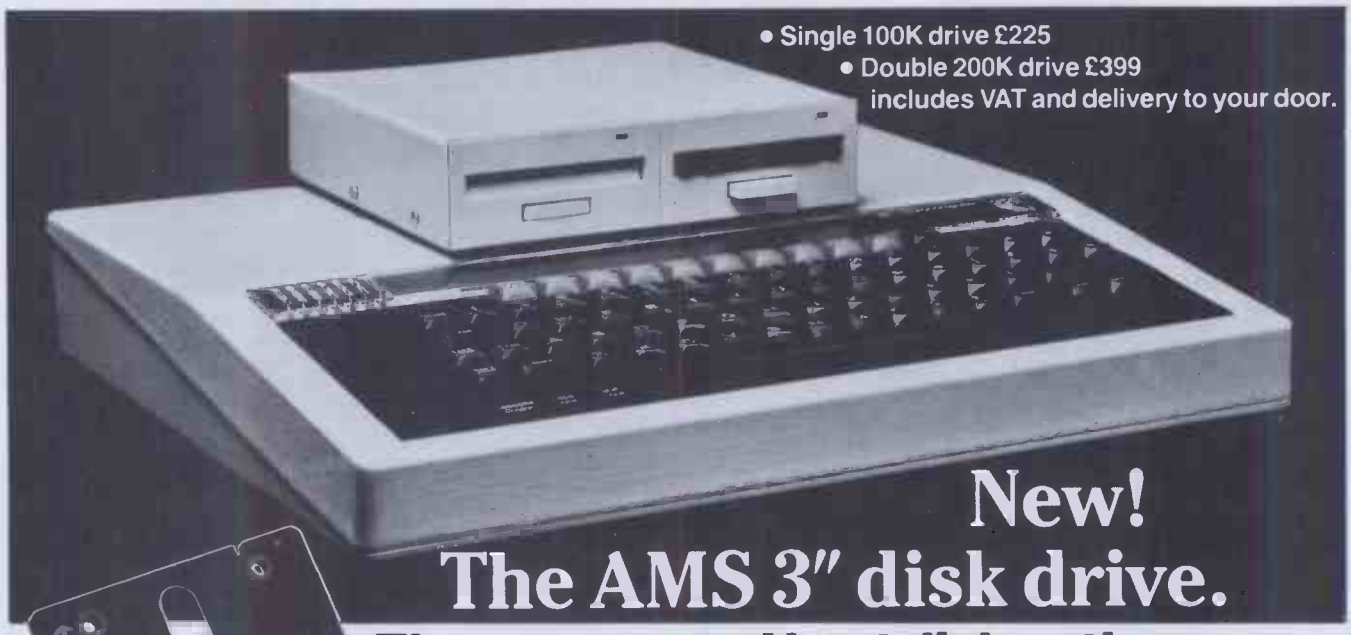

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A+B Computing (Sept) **stated – "excellent manual"..."its simplicity of use must recommend the Hitachi 3″ drive to anyone about to purchase a disk drive"..."the microdisk is a marvellous change" Personal Computer News "protective sleeve and hard plastic exterior provide for greater protection"..."far more durable and easy to handle than normal drives"**

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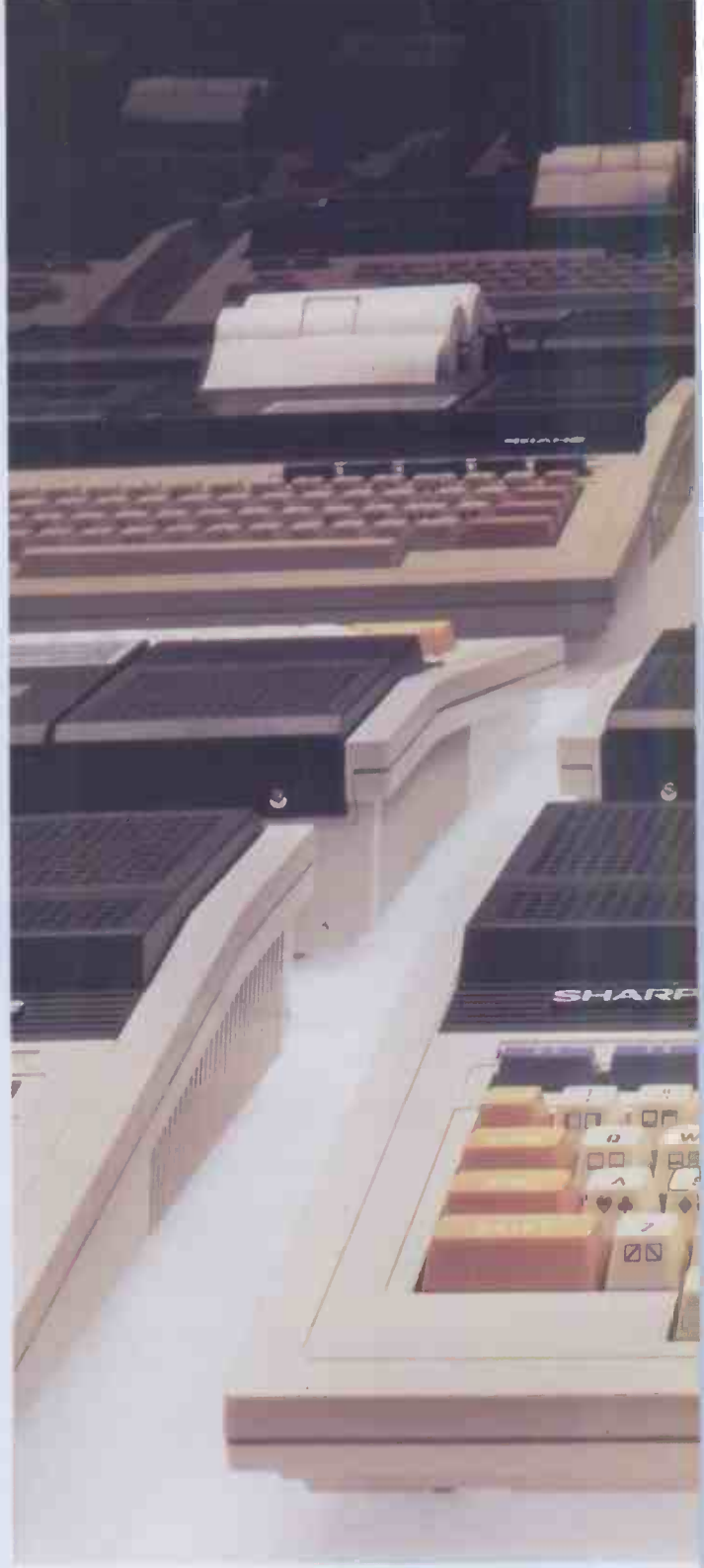

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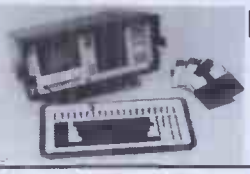

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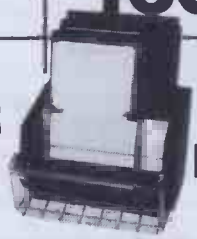

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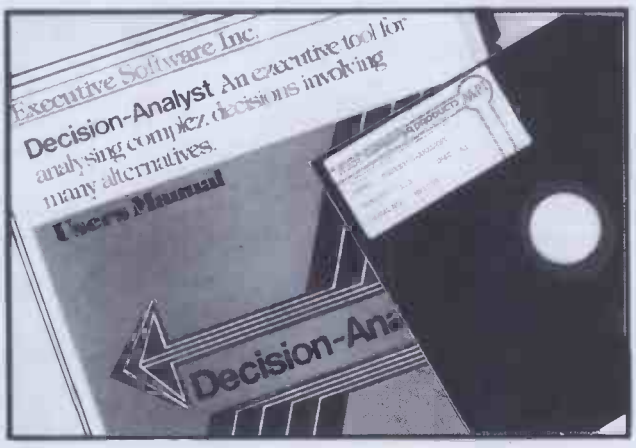
"In 1979, our recreational manufacturing business was booming. And we had developed a new product that looked like a real winner. The new product was extremely important, in that it appeared to be the answer to a seasonality problem associated with our other product lines.

By early summer, our order book was bulging. It really looked as if our off-season sales and production problems were over. Then just as quickly the roof fell in. Gas shortages devastated the recreational vehicle market overnight. And our order book for over two million dollars worth of the new product disintegrated.

Faced with a fall and winter of virtually no sales, many thousands of dollars of unneeded parts and excess production staff, I had no choice but to shut down the production lines. And if a solution to our problem couldn't be found, the business itself was in jeopardy.

A life saving decision

I spent many sleepless nights trying to come up with a solution to this nightmarish situation. Then I remembered a course I had taken in decision analysis. I spent the rest of that night reviewing course material and other books I had bought on the subject. The next day, I called an emergency meeting.



Using the decision making techniques I had learned, we spent the rest of the week searching for and analysing potential solutions. The net result was that not only was the company pulled back from the brink of destruction, but we added over $1,000,000.00 in gross sales during that off-season.

A way of life

From that point on, almost every critical decision (and there were many) regarding new products, marketing channels, pricing, advertising, production equipment, engineering projects, received this same type of analysis.

Although the process was very time consuming and clumsy, because it had to be done by hand, our decisions were much improved. And there were some real benefits that we had not anticipated.

1. Our understanding of each problem was greatly increased.
2. We uncovered opportunities that we would not have thought of in any other way.
3. Our decisions were documented, preventing us from slipping off the selected path or 'rehashing' the same things over and over.
4. Consensus became easier because we were forced to focus and resolve each part of the problem, one piece at a time."

The birth of Decision ~ Analyst ™

Decision ~ Analyst was created because the process of evaluating complex decisions with multiple alternatives and many criteria is very tedious and time-consuming if you do it on paper. And doing it in your head is virtually impossible.

Any complex decision usually requires multiple revisions to criteria, alternatives, weights and values assigned to them. If done manually, the ordeal of rewriting, recalculating and redocumenting tends to discourage revisions, thus producing poor results.

Decision ~ Analyst overcomes these problems by asking for the minimum input possible from you, in the correct sequence. It leads you step by step through the decision making process, then does all the necessary calculations and produces polished reports without any further effort. And all of your input is stored on your disk so that revisions and updates can be made easily at any time.

Comprehensive but easy to use

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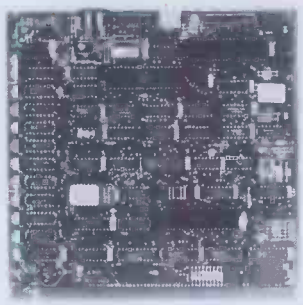

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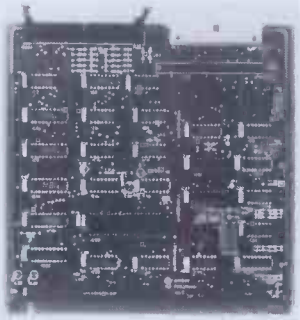

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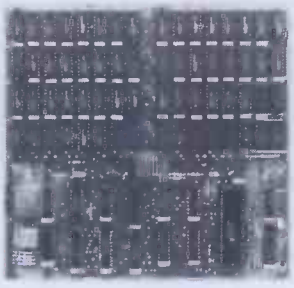

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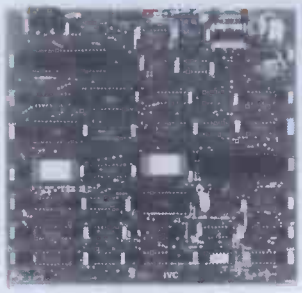

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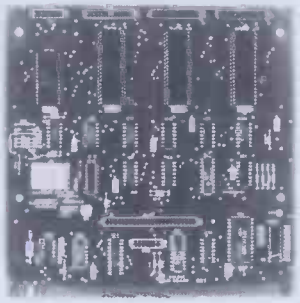

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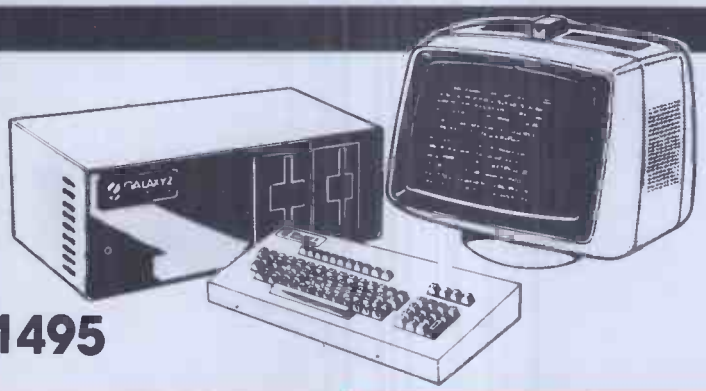

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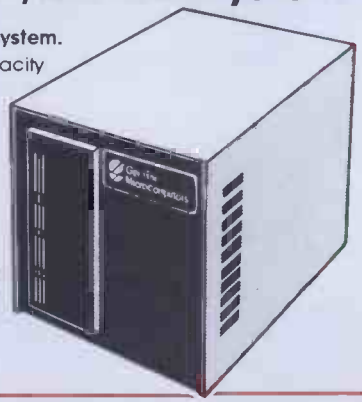

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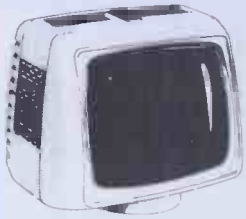

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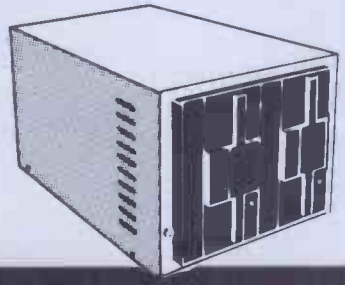

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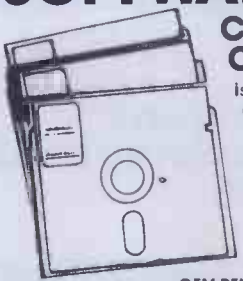

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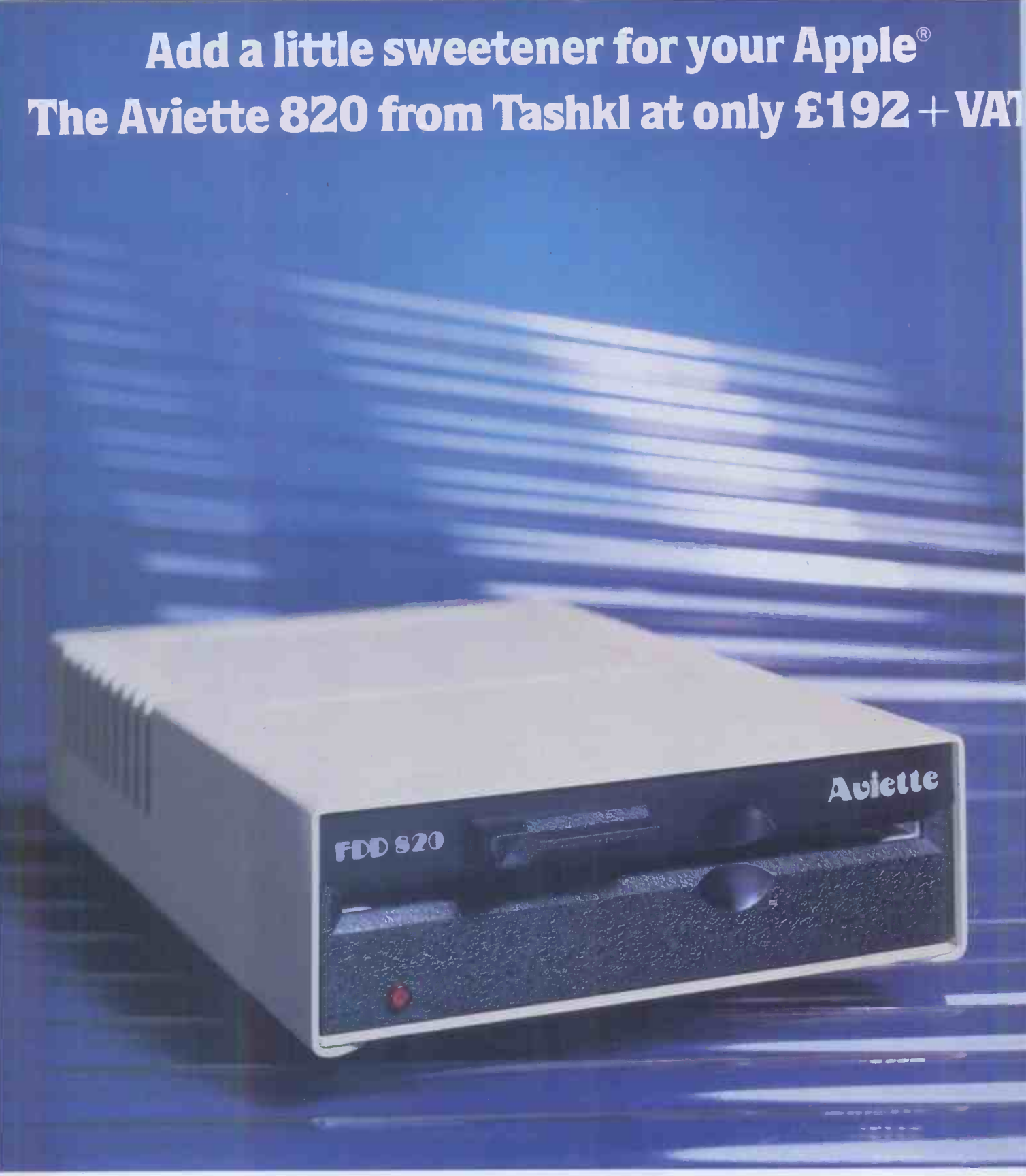

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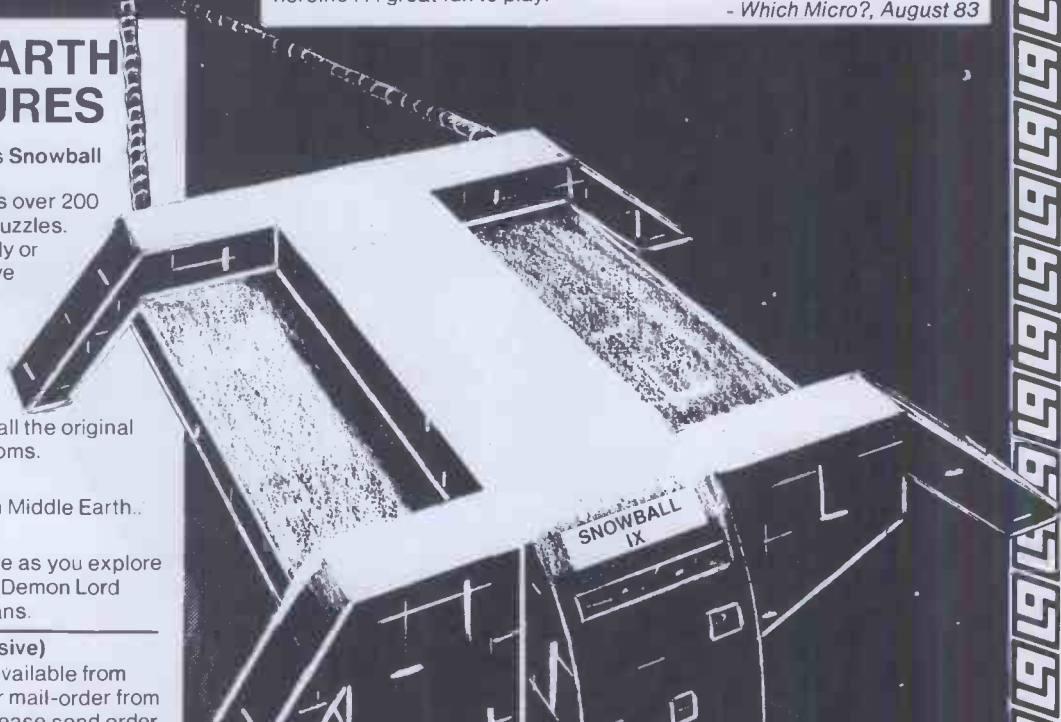

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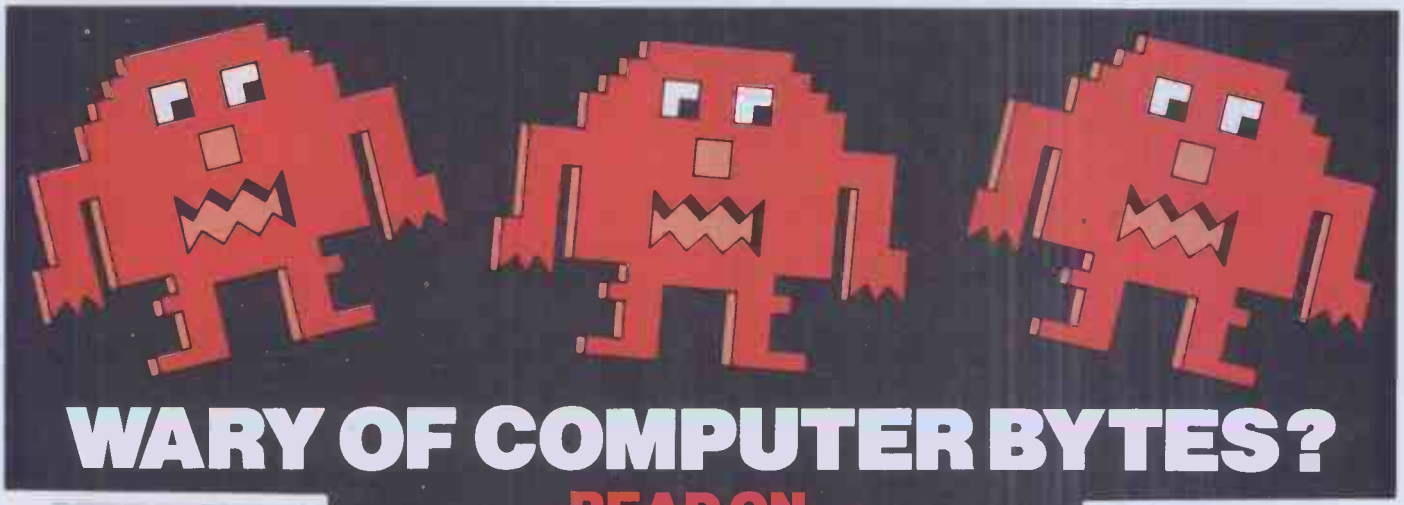

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SPELLSTAR	MicroPro	□	●	*
EASYWRITER II	IUS			*
EASYSPELLER II	IUS			*
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DATASTAR	MicroPro	□		*
dBASE II	Ashton-Tate	□	●	*
EASYFILER	IUS			*
INFOSTAR	MicroPro	□		*
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RESCUE	MBS	□		
TIM III	Innovative S/w			*
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MICRONET	Abtex	□		
MULTIPLAN	MicroSoft	□		
SAPPHIRE MARS	Sapphire Systems	□	●	
SUPERCALC	Sorcim	□	●	*
MILESTONE	Organic Software	□	●	
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BT-80				
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FORMS 2				
MACRO				
PROGRAMMERS UTILIT				
QUICKCODE (for dBASE II)				
SID				
SPP				
WORDMASTER				
XASM18 (1802)				
XASMF8 (F8/3870)	A			
XASM65 (6502)	Avoc			
XASM68 (6800/01)	Avocet			
XASM48 (8048/8041)	Avocet			
XLT86	Digital Rese			
ZSID	Digital Researc			
Operating Systems				
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CP/M PLUS	Digital Research	□		
CP/NET & CP/NOS	Digital Research	□		
MP/M II	Digital Research	□	●	
CP/M-86 (IBM PC)	Digital Research		●	
CONCURRENT CP/M-86(IBM PC)	Digital Research		●	

		CP/M-80	CP/M-86	PC-DOS
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HANDS-ON CP/M	MicroCal	□	●	
HANDS-ON COBOL	MicroCal	□	●	
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FLIGHT SIMULATOR	MicroSoft	□	●	*
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BAZIC	MicroMikes	□		
C COMPILER	Digital Research	□	●	
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LEVEL II COBOL	MicroFocus	□	●	
MULISP/MUSTAR	MicroSoft	□		
MUMATH/MUSIMP	MicroSoft	□		
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PASCAL/MT+ & SPP	Digital Research	□	●	
PERSONAL BASIC	Digital Research	□	●	
PL/I	Digital Research	□	●	*
XBASIC	Xitan	□	●	

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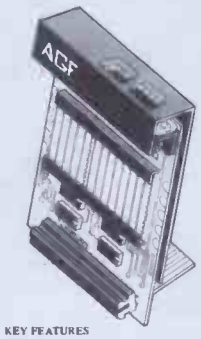

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- Accepts Atari, Competition Pro, Wico, Starfighter, Quick Shot, Le Stick etc.
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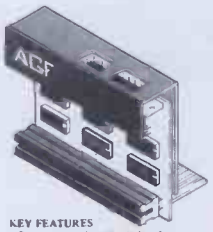

KEY FEATURES

- Proven cursor key simulation for maximum software support
- Accepts Atari, Competition Pro, Wico, Starfighter, Le Stick, etc Joysticks
- Second Joystick facility
- Rear extension connector for all other add-ons

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74 Green Lane, Tottenhall, Wolverhampton
Screen Scene
184 St George's Road, Cheltenham Gloucestershire GL50 3LL
Screem
6 Main Avenue, Moor Park, Northwood Middlesex.
Syntax Computers
76 Cornwall Street, Plymouth PL1 1NS
Teleco Video
53 Maple Road, Penge, London SE20
Telford Electronics & Computing
26a Bradford Street, Shifnal, Shropshire TF11 8AU
The Computer Shop
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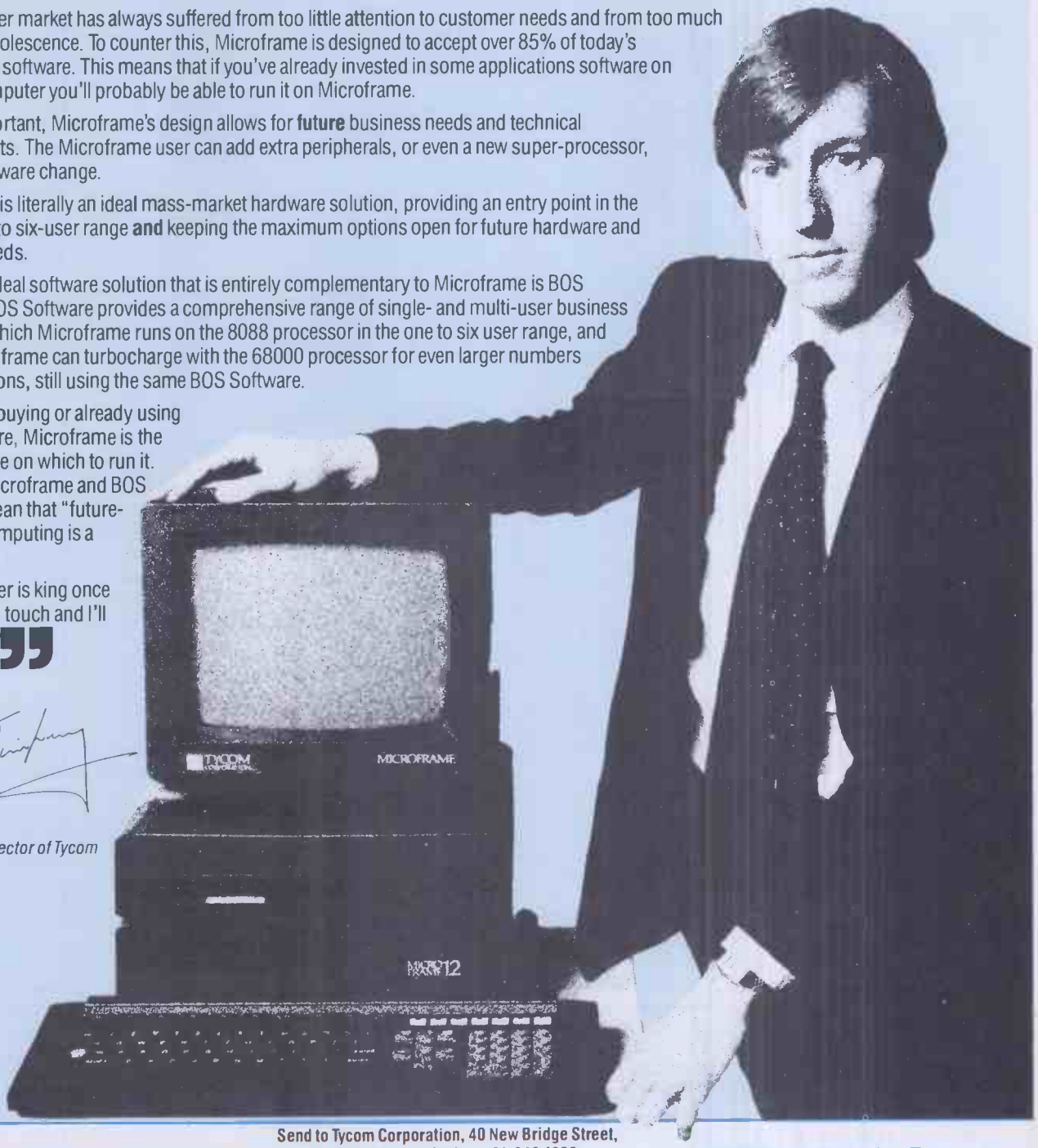

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Guy Kewney delivers his monthly package of micronews.

Through the grapevine

The Apple professional home computer costs under £1000 and includes a TV monitor.

The neighbourhood is still buzzing with gloom — the Silicon Neighbourhood, I mean.

After Adam Osborne's crash, it is now expected of everybody with a claim to being well informed, that they predict doom for everybody except IBM, and (possibly) Commodore.

Hence the reaction in the trade to news of price cuts from Apple, and rumours of more to come, has been despondent. 'Can't shift a thing,' say the greybeards. 'Having to flog off the out-of-date detritus.'

One day, maybe; at the moment, however, Apple is reducing prices on the IIe (its original model, upgraded a year ago) in order to try and get some sort of share of the market around the BBC Micro.

First sign of reductions to come: the 'home professional' pack, costing under £1000, and including a disk, a TV modulator (to save having to buy a monitor), plus some discounts on extras such as a Micronet 800 link (£68 off) and training courses, as well as some software.

The strategy at Apple is to maintain revenue and profits until January/February, when it hopes to be able to launch its second real product, the MacIntosh.

That will be a smaller version of the truly lovely Lisa executive machine.

Worrying rumours in the Neighbourhood insist that all sorts of things are wrong with MacIntosh. They say that it is being re-designed. They say that Apple is abandoning all its ideas of keeping it as a mini-Lisa, and is turning it into an IBM compatible. They say that it will be dropped.

Everybody has their own theory, usually based on the belief that: a) Apple IIe sales are dropping away fast; and b) Lisa is not selling at all.

There is always the possibility that the rumours and beliefs may turn out to be self-fulfilling prophecies (that is, there may have been nothing wrong until the rumours began to hurt sales) but if not, then I feel unusually confident in saying that these theories are nonsense.

What was wrong with MacIntosh, when it was withdrawn in May, was simple enough. Apple designed its own diskette drives for the little marvel, and failed to get the diskette production going properly. Nobody else in the world makes the special design.

At the time, Lisa was in huge demand from dealers, and the few that reached them were quickly sold; and Apple IIe sales were still healthy.

The reason sales have fallen are simple (I think): the IIe is a seasonal machine, and neither Apple nor the dealers know when to produce how many. And the market for Lisa quickly became educated to expect price cuts (which have occurred). People spending £6500 don't take the bland assurances of dealers that 'there will be no price cut on this' quite as readily as people spending £200. And the £200 spenders, goodness knows, are canny enough these days.

There will be more price cuts, everybody knows this, and sales will only stabilise when Apple can convince the market that the fight is finished.

While I'm sticking my neck out with meaningless forecasts, I might as well add my five cents to the 'MacIntosh will be an IBM clone' debate.

If it is, it will be a disaster.

Burst of energy

Starburst is, however wonderful it may be, pretty late. It is well over two years since MicroPro boss Seymour Rubinstein (inventor of WordStar) told me of his plans to eliminate program loading commands 'in a couple of months'.

And since his company has gone through some troubled times since then, the delay isn't all due to getting it right.

However, it's here now, and (theoretically) no-one with a CP/M type system or MS-DOS family machine need load and run a series of different programs to do one task.

Here's what I mean: you are writing a message for transmission down the phone line. First, you must create it (on WordStar, of course) and then you must save it. Then you must load a program called PIP to massage it into shape for transmission (it's called stripping off the high bits). Finally, you must load the communications program and type in a series of complex commands to direct output to the serial port, set the transmission speed, and transmit the file you have prepared.

Most people get at least one step of this wrong, even when they know what they're doing.

Leave a note for an inexperienced colleague, saying 'please send a BTG message to Donald saying that we need the new part' and you can guarantee not getting the part.

StarBurst is the way to leave the message. You 'program' it to load each program in turn, and to ask the inexperienced operator for the right inputs at the right time.

There is only one snag to this dreamlike scene: so far, StarBurst will load and run only MicroPro products. And unless they've sneakily launched it between when I wrote this and publication, MicroPro doesn't have a communications package to send the message down the phone line.

And PIP isn't a MicroPro product, either.

But it will work with the database, spreadsheet, text editing, spelling checking and sorting programs from MicroPro, and that, as John Lennon said, that's a start.

Details on 01-487 5728, MicroPro's UK publicity company.

Easy way out

For ten pounds sterling, BBC Micro users can now get a program that will turn their slow-load (yawn) cassette software into auto-boot disk programs that restart each time you crash, in seconds.

The program that does it is Clare's Replica. It does all the tedious work that expert BBC users already know so well — working out the load address, the start and file size, and so on.

The originator of the program reckons that there will be some accusations of 'pirate!' — to which she (or he) replies pre-emptively: 'We take the attitude that you are buying the program on cassette, not the medium on which it is recorded.'

To use it, all you do is load Replica by disk, and then connect your cassette recorder, and press the keys you are told to press.

It then creates a menu, which loads the new programs — about eight to ten of the Acornsoft variety will go on a Replica diskette.

Details from Clare's at 222 Townfields Road, Winsford, Cheshire, or phone (06065) 51374.

You may recall that in comparing two portable computers (the Tandy TRS80-100 and the Epson HX-20) I remarked that the Tandy had a bar-code reader, and the Epson did not — but that the Epson, as the older machine, had more outside applications.

Here you see it in action: an Actel package for the Epson including a carrying strap, bar-code reader, and software (worth £40 by itself) to make it all work.

Total package, including VAT, should work out at under £600.

Actel is on Blisworth (0604) 858011.

Chance of a lifetime

I do not ever recall hearing, before today, of an IBM salesman offering a product which was not, nor pretended to be, a non-IBM product. IBM says it has been doing it for a year. Anyway, as of today, IBM has announced that it sells software of outside origin, without an IBM logo on it. It must be a significant move.

The deal is a distribution one: people have been writing software for the IBM personal computer, and IBM doesn't see why it shouldn't get its share.

Accordingly, a subsidiary called IPL, International Products Limited, has taken on the distribution of software. You may think you knew about this with IBM's distribution of Peachtree software and others — but that was under the IBM logo. That looks like IBM software. This is different.

The first product that IPL will distribute in Europe is the Visi range from VisiCalc to Visidex, from VisiCorp.

To follow, contracts have been signed for Personal Cobol from Micro Focus, Delta (a database manager) from Compsoft, Cardbox from Caxton (another data retrieval program) and TK!Solver from Software Arts in the US.

Now, says IBM, it is anxious to pick up local products.

Nobody else could ask this and get away with it: the wording is: 'Software vendors, who have packages of proven quality and market acceptability which they would like to offer IBM, should contact the local IBM personal computer marketing subsidiary in their country.'

In other words: 'If you have already made it and don't have anything to prove, we will take our cut of a proposition with no risks attached.' And the irritating thing is that the generous, patronisingly condescending attitude is quite justified: even the most successful software producers will fall downstairs trying to get the accolade of space on an IBM shelf. And they will be right, too.

The man to contact — in writing, yet, no flaky phone calls, please — is Chris Wood, IBM UK International Products Limited, Third Avenue, Millbrook, Southampton SO1 0JX, England. And make sure you get the 'O' and the zero in the right place, for goodness sake! and brush your hair, and get your teeth capped, and land sakes, honey, you aint a-plannin' to go wearin' that old suit? Yes, I know you're just going down to post a letter, but this isn't any old letter, you know . . . .

Getting its ACT together

Apricot is now emerging from ACT's factory at a rate of 50 a day, with production of 100 a day likely before the end of the year.

I am therefore obliged to eat, publicly, my sceptical words of May, when I suggested waiting till early next year. I am delighted to do so; it's a lovely computer, and ACT is getting very little wrong in launching it.

However, there is one small problem. Orders for the machine are just a wee bit ahead of supply. According to Dr Roger Foster, boss of ACT, the orders were coming in at 600 a day.

So maybe the prediction of 'January before you see one' is only technically wrong. You won't get one till then unless you ordered it in August.

Interestingly, October (the month the Apricot first appeared) was a record month for the ACT Sirius as well.

This conflicts with general gossip, I know. Many people in October were going around predicting that ACT would see the Sirius market collapse with the collapse of Victor—which a great many doom-saying moles actually reported as having happened.

Victor, the maker of the Sirius, is not going to be in any trouble until 15 December, when its internal auditors will know what the last quarter's financial situation is. Only then will the fighting begin with parent Kidde Corporation (Kidde is pronounced 'Kidder') for long-term finance.

I'm still optimistic, even though American sales are not good. The reason I'm hopeful for another six months of Victor after Christmas is simple: it is retaining Chuck Peddle as a designer of future products.

It is true that it would want to do this anyway. As administrative boss, he isn't seen as having been a success. Peddle is a well-known name—designer of the 6502 chip, designer of the PET, designer of the Sirius itself—and his loss to the corporation would be a severe blow to its credibility. And it is also true that he is not the fit jogging maniac he was a year ago—the strain of the year has left him plump and tired, say his anxious friends.

But Victor's dependence on him is being reduced, and survival is still a real option, providing the current financial restructuring produces a profitable, if a smaller, manufacturer.

The biggest cloud over Victor is a simple one: IBM is very hungry for many of the components that both IBM and Victor personal computers use. And given the option of supplying Victor and IBM, and given a shortage of many silicon chips generally, Victor's suppliers have, I'm afraid, rather favoured IBM.

Post 1984

The hardest thing about talking to beginners is that they always want to know what a 16-bit micro actually is—and, of course, the one thing it isn't, is a 16-bit micro.

So I'm delighted to welcome two 32-bit micros, which really are 32-bit micros.

The Intel 8088, as in the IBM, is often called an '8/16-bit micro' when it is actually a 21-bit micro. The Motorola 68000 chip, often described as 'a 32-16 bit micro' is actually a 24-bit system.

The measure that matters, of course, is not how 'big the word is' but 'how wide the address bus is'—and anybody who doubts you only has to look at the TI-99/4 home computer, which is a 'true 16-bit processor' with only 16-bits to its address bus. It therefore has only 32k words of memory (that is 64 kbytes).

Now that you're properly confused, the news is that Zilog has released details of the Z80,000 and National Semiconductor has released samples of a nearly secret chip, the 32032.

The rivalry between the two designs will take ages to reach the stage of fighting for shelf space in shops.

At the moment, the Nat Semi chip is 'available' if you have over £200 and only want one to try out. The Z80,000 is not yet 'available' to that extent.

Both are 32-bit micros in the way they handle data. They can get 32-bits of data from memory in one 'fetch' down a 32-bit data bus, and process it in a single instruction, without having to shift and count carries.

But the really impressive thing is the 32-bit address bus. This gives them four gigabytes of possible address space—over 4000 million bytes of semiconductor chip memory can be plugged in, and any byte directly addressed—read from or written to—in one operation.

The other thing you will notice about these chips, should you ever see one, is that they are different to look at.

Instead of being the familiar 'beetle-shape' chips, with two rows of legs, these ones are square. They have 68 connectors, with no legs: they slot into a recess which grips them, not into a socket which holds the legs.

But it will be 1985, and late 1985 at that, before you are bothered with any brochures saying that 'our computer uses the Z80,000 or 32032 processors.'

Branching out

Adam Osborne is apparently so impressed with the success of Lotus and 1-2-3, that he is going into software distribution.

'Nobody in software distribution is making money,' he told me, 'and I'm going to introduce a radical new way of handling it.'

He wouldn't say what his secret would be, but I gather from moles that he reckons the age of the hype is upon us, and he reckons he's good at that.

The sad thing about this is, of course, that it signals the end of his own hopes for Osborne Computer.

Plans to buy out the overseas sales for a consortium from the UK, Germany, Canada and Australia had failed when we went to press. The UK company was still hoping to set up a 'go-it-alone' firm—but it had better be quick.

According to Osborne himself, 'the CP/M market in the US is dead for anything over $2000, and even the cheap systems will be unsellable in six months,' and while he concedes that the UK CP/M market is still relatively strong, he still doesn't give it long to switch to MS-DOS and CP/M-86 as standards.

Offshore limits

An American rival to dBase II has arrived in the UK, disguised as no rival at all.

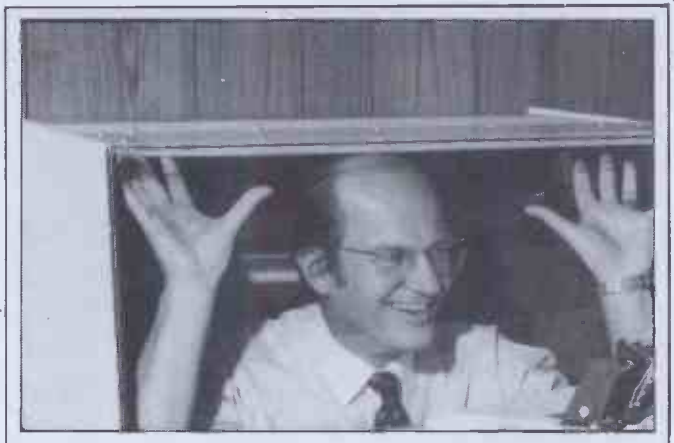
The program, called The Sensible Solution, was developed by a Seattle software house to help it integrate all its Basic programs. As it uses 'relational' database theory to tie various different programs together, it was sold heavily in the US by direct comparison with dBase II.

But in the UK, says Offshore Computing, this will not happen. 'We aren't comparing oranges with oranges,' was the company's phrase. 'The two programs are different in their appeal.'

A major difference will be the ease with which customers can get hold of the product. Offshore Computing intends to release Sensible Solutions only to highly qualified software houses, not to any old user.

The result is that, although it is full of 'user-friendly' menus and is 'not just a programmer's tool, but a fully fledged relational database which can generate tailored applications for those who can't afford their own dataprocessing department,' it will not appear in your local store's catalogue.

Instead, you may find somebody selling an accounts



Sensible folk at Computer Publicity: they correctly deduced that we would throw away one more dull picture of a printer silencer, but would stop and look at this one. Their caption, on behalf of Action Computer Supplies, runs as follows:

'Office efficiency experts at ACS believe they have developed a valuable technique for keeping down office noise.

'We believe that keeping Dick Sheppard quiet—the noise reduction is about 90 per cent—allows our printer to operate perhaps 30 per cent more efficiently,' said a spokesperson.

'Experts from the Ministry of Truth are taking a keen interest, and an arrest is expected shortly. As sales director, Sheppard has strong views, but finds difficulty in making himself heard . . .'

End quote. It keeps printers quiet. OK? Action Computer Supplies can be contacted on 01-560 0770 in Brentford, Middx.

receivable package, written with the Sensible Solution as the 'programming language', for a good few hundred pounds.

The selling point is that an application written for a Sirius can be transferred to an IBM computer. A nice idea, but, supplied through a bottleneck like that, there seems little danger that Offshore will get trampled in the rush.

Details on (0707) 44447 from Brian Young.

New address

So many people have complained of not being able to get MicroPro's phone number (the WordStar company) that this unique announcement follows: the UK branch has moved to Wimbledon, and can be called on 01-879 1122.

Continuing saga

This week's episode: Arrow has bought Gulfstream.

Fans of *SOAP*, the lampoon of American situation drama series, will feel instantly at home with Bytec, Gulfstream, Dynalogic, Arrow and Hyperion. The story makes sense only to someone with a convoluted mind, but here goes:

Dynalogic (or perhaps Bytec) once launched a computer subsidiary called Bytec (or was it Dynalogic?) in Canada.

They lived just up the road from Anderson Jacobson, a big firm which made and distributed modems and terminals worldwide.

Anderson Jacobson gladly agreed to sell the small portable version of the Dynalogic microcomputer — the version which Bytec called the Hyperion — in Europe. But AJ decided to call it the Ajile.

Before they could get it out onto the market, however, Gulfstream Computer Systems got the UK franchise for the Hyperion. And just before rivalry could become intense, Bytec (or was it Dynalogic?) took over Gulfstream and turned it into Gulfstream Bytec — no, sorry, into Bytec Gulfstream.

There followed an unseemly wrangle, the details of which are a matter of record to those who care to dig out back issues of this column. It ended with the departure of a snarling, ill-tempered AJ, vowing revenge.

But Gulfstream had other things to do besides Bytec's Hyperion. Rumours of family neglect spread, as Gulfstream's reputation for doing complete turnkey systems, based on DEC, ITT and 68000 systems, became eclipsed by the vast fame of the Hyperion side.

And eventually the time came when it was decided to separate; and a handsome stranger came into the life of Gulfstream. That was Arrow, who took the lovely divorcee away, and she took the married name of Arrow Computer Solutions.

Next episode: what will AJ do now? Will Hyperion languish without his turnkey comrade? How will industry cope with the move to Epsom? How many angels can dance on the head of a pin? What is Arrow Solutions' phone number?

I can answer that, at any rate. It's Epsom (03727) 42557.

Just the type

Some people don't like ordinary dot-matrix printers because the print is a very ordinary series of dots. So Type Faces for IBM and Apple users could be regarded as a useful way of improving a matrix printer for £100, instead of buying a new printer.

Type Faces is a program which uses the graphics printing abilities of Epson, IDS and Apple Silentype printers. Instead of simply printing characters, the printer draws the letters. Properly handled — that is, printed big and reduced with a photocopier — they can be very good quality indeed.

Details from Pete and Pam Computers on (0706) 227011.

Last but not least

It is around now that the wise old folk who decided not to buy a Commodore 64 or a BBC Micro or a Spectrum 'because there is this Elan, or the IBM Peanut coming, and that looks like being much better' will suddenly find themselves wishing they'd taken my advice.

My advice: never wait for tomorrow just because there is a price cut or an improved model on the way.

The IBM Peanut turned out to be the end of project Halo, and (unless something went badly wrong at the last moment) appeared in New York in early November. If you want one for Christmas, go to New York.

If you want anything else, you may have left it too late. You had better like Dragons, Orics, Lynxes, and other minority interest micros, because supplies of Commodores, BBC Micros, Electrons, Ataris and even TI home computers are mostly very short.

For those who have really set their hearts on an IBM home computer, March, perhaps, is the earliest time you'll be able to get a UK version. Or maybe June. And those who simply must have an Elan will probably have to wait around the same length of time.

For buyers of the Commodore 64 it looks as if there is an additional hazard: at press time, supplies of the tape cassette player which Commodore makes were rather low.

And most of those were earmarked for a special 'starter pack' to sell VIC-20 micros.

So you had better like diskettes, at over £200.

Monitoring progress

The end of the colour television may be closer than the manufacturers think. The cost of a monitor is just too temptingly low.

The latest announcements to land next to my typing keyboard seem to show that the price of a good monitor is going to be under £200 by Christmas 1984, if not by this Christmas.

From Opus Supplies, an announcement of a £149 medium resolution monitor, built by JVC and certainly quite good enough for most home micro users. For those who really want high-res, the price is £229. Only for IBM micro users (poor blighters), is there a problem: that machine needs a £349 screen.

Even more interesting is the monitor announced by Fidelity (illustrated with a well-known BBC Micro graphics picture) at just under £200.

The interesting factor is not

A computer bus, as well we know, is not a road-travelling public conveyance. This is not a computer bus: it is a computer garage, being advertised on a bus.

The Computer Bus Shop is where you take your broken micro, according to GCS Engineering, to get it fixed, or to get advice on how to expand it.

First shop appeared in Sheffield, but the plan is to have a whole chain of computer repair centres around the country, according to GCS Engineering's managing director Bill Nickoll.

The plan is to have 45 shops before the end of 1985, he says. Details on 01-898 5251.

(just) the price, but the inputs. 'The CM14 monitor accepts either RGB or RGBY, or even composite video inputs *together with audio* via a 21-pin peri-television socket,' says Fidelity.

That is cheaper than Commodore's monitor (which also gives an audio channel) — plus the RGB input, which the Commodore set doesn't have.

Of course, to a Commodore user, a Commodore monitor may seem sufficient. Fidelity makes the point 'The CM14 will interface with virtually any computer or games machine capable of driving a monitor, or work equally well with VCR, disk, cable data or satellite adaptors.'

If it will work with a VCR, I can use the VCR to tune in the TV signal, and no longer actually need a television set. To this you may say: 'What about watching one program while recording another?'

I think the answer will soon come in the form of separate TV tuners. It never caught on before, because in earlier days, people only wanted TV sound separately (to feed into the hi-fi) and the bother was enormous.

But a TV tuner with audio *and* video outputs, a colour monitor with audio and video inputs, and a data processor, sound more like what we want.

Opus is on 01-701 8668, while Fidelity is on 01-965 8771.

Christmas turkey

Cries of outrage from Sinclair users — 'He's changed the circuit of the Spectrum!' — will bring a wry smile to old friends of Commodore.

The new versions of the Spectrum are not guaranteed to run software that ran on previous versions.

From the earliest days of the Commodore PET, the same trick has been played on users, and it will doubtless continue to be played with the next version of the Commodore 64.

In the case of both computer ranges, things are changed without notice. Addresses which control certain functions will be changed. Things which are useful tricks for speeding up the normal way the thing works will suddenly have to be revised.

Staff at Sinclair, exactly as before at Commodore, claim that the company is 'entitled to improve the product'.

They claim that people who have used 'undocumented' routines have only themselves to thank.

Really, this won't do.

Designers at Sinclair Research can, if they choose, decide to turn the Spectrum into a tape recorder. There is no law about what a Spectrum is, what it has to do, or even whether Sinclair Research has to make any at all.

But the reason the Spectrum is so popular is that there are hundreds and hundreds of programs that run on the thing. Anybody who designs an 'improvement' which prevents some of these programs from running can be described in one simple, word.

That word is: turkey.

And the only reason the turkeys at Sinclair will get away with it is that the turkeys at Texas Instruments, Commodore and Atari are guaranteed to do the same thing.

The CM14 sub-£200 14in colour monitor from Fidelity.

All systems go

'Delight' is not too strong a word for my response to a power-backup for the Epson lap-held portable, the HX-20.

The product costs $15 in the US, and I know it'll be hard to get from Software Riches, Riverview Terrace, Irbington NY 10533 (phone (914) 591-6470). But ever since this column carried a comparison between the Epson and the Tandy 100 — or NEC 8201 — suggesting that the Epson's power hunger was a drawback, Epson dealers have been writing stupid letters saying that it isn't.

Software Riches, presumably, just launched this product (it gives several extra hours power when the internal rechargeable battery goes flat) in order to spoil the market for the HX-20. It's all a plot, I'm sure, designed to make spoilsports like me look clever.

Savoir faire

Funny, isn't it: the Oric may be a very 'also-ran' sort of machine in Britain, but in France, it's the absolutely top machine.

Since it was launched there, it has sold at a rate of around 6000 units a month (since February) — and Oric reckons that it will have 65,000 French users by the end of this year.

That, reckons Peter Harding (sales director), makes it a better seller than all other brands, including the Sinclair Spectrum.

And success has been backed by glory: a panel of 25 journalists, says the company 'from France's leading computer publications, put the Oric through its paces, and it came out ahead of all its competitors.'

Apparently it was voted 'Best Home Computer' for a presentation at the Vidcom Exhibition in Cannes.

Apparently over 70% of Oric production goes overseas. And 70% of that is French exports. You can work out UK sales from those figures, can't you? Not exciting, are they? Funny old business, isn't it?

Hole in one

You may like to buy a few holes.

The price per hole, as produced by Inmac (computer accessories to the gentry) is one tenth of four pee. You get a thousand holes, that is, for £4.

The holes in question, since you're dying to ask, are 'sprocket holes' to repair torn computer stationery. I can't imagine why I might want to — I've tried and tried — but the idea just struck me as so perverse that it just had to be reported.

Ask Inmac on (09285) 67551.

Back on the ranch

Behind the tranquil classroom scene (see picture) is a very important lawsuit.

This is a computer training course: the subject is a 'super spreadsheet' called Lotus 1-2-3, and the course is being run by Lotus.

Now start noticing details.

The program runs on either the IBM personal computer, or the Compaq. In this picture, the machine is a Compaq. The course is held in London. But the Compaq is not yet available in the UK. Or is it?

The Compaq is a computer launched by a bright new company (of the same name) set up by a lot of smart young technocrats and marketing whizz-kids who left Texas Instruments around a year and a half ago. The company chairman is a very well-known American guru called Ben Rosen.

Lotus 1-2-3 is a similarly new, whizz-kid company, set up to launch the program. The company chairman is a very

Computer dealers at a course held by Lotus Development Corporation find out about the 1-2-3 integrated spreadsheet.

well-known American financial expert called Ben Rosen.

In the UK, 1-2-3 has been launched with the establishment of a local company: but the Compaq is not even available through a 'grey' importer.

Now, naturally, if that was the end of the story it wouldn't be worth telling, and the point of it all is the lawsuit referred to above.

When the Compaq people left Texas, that company struck back through the courts on a great many counts. They said the Compaq people had stolen company secrets; they say the Compaq people had enticed staff away, and so on.

Nobody took this seriously (except the lawyers concerned, who were naturally delighted) but it did weigh on the corporate Compaq mind. And the Texas threat was quoted as one possible reason why there were no UK versions.

Now, however, the lawsuit has been settled. One of the terms of the settlement is that Compaq people can't say what the terms are.

Suffice it to say that Texas will get some royalty payments on patents it holds, on which it would almost certainly have received royalty payments anyway, and has withdrawn its allegations. In exchange, Compaq has withdrawn its counter-suits.

And now, will there be a UK Compaq?

'We haven't yet decided on the approach to overseas machines,' is the way the company put it after the lawsuit was settled. 'There are no UK voltage machines. And we are not announcing any strategy in the immediate or short term future.'

Expect to see UK Compaqs after Christmas, not before.

The news that Compaq will not appear in the UK till next year will be received with delight in Gulfstream headquarters, where the new, low-cost Hyperion will now have the IBM compatible portable market to itself.

The new price is £2500, which means that the only major things stopping the Hyperion from being a best seller are: 1) there are only 20 or so dealers; and 2) the Apricot is going to be the best-selling British microcomputer above £1000 for several months.

Gulfstream has announced the availability of Lotus 1-2-3 in a special version for the Hyperion.

Short supply

Business software for the Spectrum is still enough of a rarity that the arrival of Kemp Limited's range through Micronet 800 is probably worth this mention.

The company hasn't given any details, but it did add, very helpfully, that the software was 'high quality' and that 'our programs have been acclaimed by all who have seen them.'

I get literally hundreds of these announcements a month. I write them down, inane though they may seem. And do I get gratitude? No, I get gripes. 'If you wanted more information, why didn't you ask us?' Why do I bother? Where will it all end? How much spare time is there in a 24-hour day? The heck with it: phone them yourself on 01-444 5499.

PCW Show-down

The *PCW* Show had 250 exhibitors more than ever before and went on a day longer than last year, from Wednesday to Sunday, to give micro enthusiasts even longer to savour the delights of our multifarious industry!

Even so the Barbican exhibition centre was packed out every day and we're already talking to the organisers about how we can colonise more space for next year.

The survey of visitors has revealed a high proportion of serious businessmen wanting to buy a micro. The main difference this year is that business people are showing a strong interest in education, games and other home use as well as accounting and wordprocessing.

The saddest statistic was the number of female visitors. This amounted to just 6%, and 40 of those had apparently come with their menfolk and not on their own initiative.

★ ★ ★

At the *PCW* Show, Sinclair Research released details of a cartridge—which provides plug-in-and-run programs—for the ZX Spectrum.

The question that instantly follows is: does anybody now want the MicroDrive?

Anybody who writes programs for the Spectrum would love to have one, naturally. You write your program, and when you feel you are starting to get somewhere, it would be a matter of ten seconds or so to make a copy of it on Microtape. Normally, it could take minutes, saving it to audio tape.

For a great many home micros, it is virtually impossible to say how many owners just load programs they buy, and how many type in programs from magazines, or write them themselves—but for the Spectrum, the number is higher than normal.

So, if Sinclair Research is catering merely for home programmers, it might still hope to sell a lot of MicroDrives.

As far as independent software companies are concerned, that isn't enough. As things stand, everybody has a tape recorder, so if they sell a program on tape, everybody is a potential customer.

But even if Sinclair was making MicroDrives fast enough to sell a thousand a week (and it certainly isn't) it would be a very long time before these software people started to go to the bother of producing versions on Microtape.

They are horrified by the appearance of the ROM cartridge. They say that this proves that Sinclair will not be supplying games on Microtape. Therefore, nobody is ever going to buy them. Therefore they will not bother, either.

They also observe that the cartridge rules out the MicroDrive. If you plug in the £20 Interface 2 (you have to, to plug in the cartridges) you can't use the MicroDrive, because the two devices use the same area of memory.

One particularly disgruntled supplier of Sinclair games, Imagine Software, has actually gone so far as to say that Sinclair has no real intention of supporting the MicroDrive, and that as a result it (Imagine) intends to launch an Imagine cartridge.

Time will tell. But unless something changes—like Sinclair actually making Microtapes, getting the bugs out of the system and reconciling the conflict between Interface 1 (that is needed for the MicroDrive) and Interface 2, then there is only one safe prediction.

That is: that at around £6 per cartridge, Imagine will sell more games than Sinclair, at £15 each. If it launches it, of course.

★ ★ ★

That fascinating nearly-here, the Advance 86 (a £400 micro that runs IBM PC software) appeared at the Show.

It was, everybody emphasised, a prototype, brought to the Show just to prove that the circuits worked.

It was also about four times bigger than anybody guessed.

And it seems clear that the bulk of the box surprised even Advance.

The normal Model A Advance is a nice, slim box, with a nice keyboard slotted in below. A little larger than a BBC Micro, in fact.

However, in order to get disks, you need the expansion box. This is an enormous, bolt-on thing, twice the size of the basic keyboard and processor and standing on top of it.

Word reaches me that a Model C is under design, with disks built into the Model A box, and that samples will appear in January.

The other Advance surprise was that the manufacture will not, after all, be entrusted to Thorn EMI. Instead, Ferranti's factory will take on the work. And I gather that Ferranti is re-arranging the main boards to make them easier to manufacture in large quanties.

★ ★ ★

I got into a lot of trouble from an NEC dealer after the Show.

He rang up the trade paper *Microscope* (saying his name was Thomson) which carried a report on NEC's special offer at the Barbican of a £300 printer free 'to anybody stupid enough to buy an APC 8000'.

Subsequently he rang me, calling himself Smith (since I wrote the report).

It turns out that I was wrong. The PC8000 is the old machine. The APC is not the 8000 (its model number is 8012, he thinks). And the printer is not a £300 printer, but lists at £375.

I'm delighted to correct the error. The printer was for anybody stupid enough to buy an APC, not a PC8000. Though I'm bound to admit that I don't see how the publication of this correction helps Mr Smith sell the things.

On NEC's credit side, it did show the 8200. The company is obviously out to hurt Tandy's Model 100 — a slightly re-engineered version of the same design — by selling a 16 kbyte version for £450, compared with Tandy's £500 for an 8 kbyte version.

The machine is Benchtested in this issue, so I won't offend my friends at Tandy by repeating the list of design faults they insisted on creating for the Model 100, which NEC has avoided. I shall leave that to David Tebbutt.

But I do have good news for Tandy 100 owners: I've found a way of overcoming the machine's line-feed blockage. (It normally won't send line-feeds, not even down the modem port.)

First, the combination of the 'graph' key and the letter 'S' will be interpreted as a line-feed by the text printer.

Second, the text editor's 'paste' button hasn't been correctly programmed, and doesn't strip its line-feeds. So (in the TELCOM program) you can feed a file down a phone line or RS232 link by stuffing it into 'paste' first, and pressing paste in terminal mode.

Finally, I've written a nice little Basic text printer program, and if the Editor forgives me for being late with this copy, I'll offer it to *PCW* to provide to readers, free of charge.

As an article of faith, Atari and Commodore 64 and VIC-20 and Texas 99/4 owners will tell you that their machine is superior to BBC and Spectrum.

'They have sprites,' they will explain.

After playing with Quicksilva's Bugaboo (The Flea) for the past few weeks, I can guarantee that it no longer matters.

Two programmers called Paco and Paco have found a way of manipulating the Spectrum screen in a way that literally defies description.

The game is remarkable. You control the frantic leaps of a flea. The flea is trapped in a sparkling underground cavern on some planet, and there are ledges, overhangs, flowers, and other things to jump onto.

You can play happily with it, as a maze game, for days — before it dawns on you that you can jump out of the cave. (My best time is 28 seconds).

But what numbs the mind of the apprentice Spectrum programmer is the way the background slides smoothly around behind the flea, and the smooth way the flea flits up and down and sideways.

I wish I could explain how it's done, but Quicksilva is being very coy about that. It says it's hoping to patent the technique.

You can also see it on a game called Ant Attack — but the company hasn't got round to sending me that yet, so I can't describe it.

★ ★ ★

The most popular CP/M rival to VisiCalc is Supercalc. This spreadsheet has been hopelessly outclassed in America by the arrival of the glamorous Lotus 1-2-3 — but in the UK the company which supplies it reckons there is a chance to compete.

There is a new version of Supercalc, complete with text and database search facilities to match or even to overmatch 1-2-3's.

And it is available in the UK at the same time as the Lotus product — both appeared at the *PCW* Show.

Unusually for American software suppliers selling to the UK, Sorcim (the supplier of Supercalc) does recognise that there are computers in the world that are not IBM micros.

Accordingly, a version for the Apricot is being treated as a 'high priority', the company assured me. It should be out before Christmas.

★ ★ ★

Excellent news for fans of Jeff Minter who don't have Commodore 64 micros. He has done a deal with Salamander and Quicksilva, which will let all three companies have access to each other's games. And they will be converting best-sellers onto machines which normally don't see them.

So, for instance, Minter's Gridrunners, if not his mutant camels will be painfully changed into Sinclair Spectrum beasts. And Salamander showed Oric and Dragon versions of Quicksilva's Franklin's Tomb game for Spectrum at the Show.

I can't see Minter getting into conversions, somehow. At the Show he was selling Hover Bovver, (a game so stupid that I refuse to describe it, but which is incredibly addictive despite the infuriating music) and previewing his latest bright idea: 'Revenge of the Mutant Camels' — this time, the player is the camel.

He's spent unbelievable time and trouble on the animation of the camel. And the background includes a pyramid. With an eye. That winks.

The Colour Genie micro now has a diskette interface (shown here), price £90, which includes a parallel printer interface.

But it doesn't include a diskette, or a printer, and the supplier, General Northern Microcomputers (Gnomic), doesn't have any news of one of its own. But it's got a driver, and that's a start.

Ask Colin Owens on Peterlee (0783) 860314.

About turn

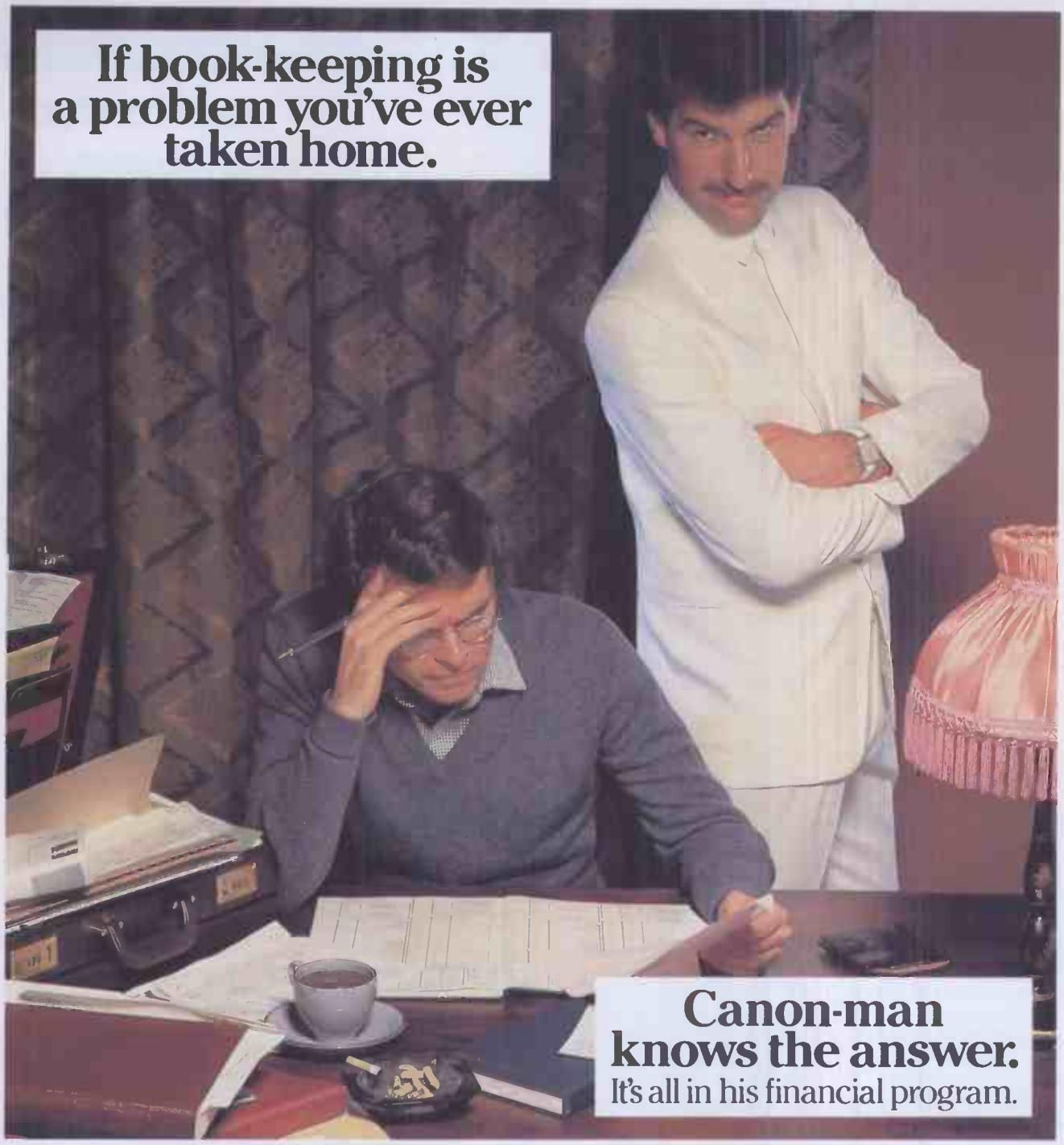
The good-natured (or so both sides tell us) rivalry between Digital Research ('DR') and Microsoft continues.

Not content with bringing out Personal Basic, which could be politely described as 'compatible' with MBasic, DR is now inviting MBasic programmers to convert the fruits of their labours to CBasic with a source-code translator which it calls M2CBasic (say it out loud . . .).

M2CBasic, which runs on 8080, 8085, Z80, 8088 and 8086-based systems under CP/M or PC-DOS, translates M Basic and Personal Basic programs to their CBasic equivalent. DR claims that the package will translate more than 90% of the code and print out locations of suspect or untranslatable code. Code which M2C Basic cannot convert can be handled, on a line-by-line basis, by the interactive error-handling facilities provided.

The reason everyone will want to rush out and begin

If book-keeping is a problem you've ever taken home.



Canon-man knows the answer.

It's all in his financial program.

Getting the bills out on time. Getting the money in. Keeping the overheads under control. All fundamental to the running of a profitable business. But there are never enough hours in the day. There's always an end-of-month rush. Always the midnight oil.

Canon-man found the answer in his versatile new AS-100 microcomputer system. He started with the uncomplicated, not too expensive Word Processing model. Then he expanded it to cope with all his day-to-day book-keeping and accounting. And he knows he can add to it again when he's into more sophisticated financial planning, even networking. He chose the AS-100 because it has all the power, speed and memory his business is ever likely to need. Because it's fully compatible with a wide range of proven software from some of the most respected names in the computer industry. Because it will grow with his business. And help his business grow.

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Please tell me more about the new Canon AS-100 microcomputer system. (Tick the box, if that's where you have growing pains.)

Word Processing ☐ Accounting ☐

Financial Planning ☐

Name_____

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Post Code_____ Tel:_____ PCW 1

NEW Canon AS-100

The 16-bit microcomputer system that grows with your business.

Moving with the times

The lure of new technology is well demonstrated in the result of a survey of the top executives of 200 companies in the 'Times Top 1000', commissioned by Philips Business Systems.

Of the 40 top dogs who thought it would be useful to have a computer, 25% couldn't offer any reasons why. It appears that the very idea of using one suspends the faculty of reason in even the most senior of our senior managers. Perhaps they daren't admit to being behind their office staff when it comes to using the new equipment; I hope it's no more sinister than that. Could it be that a new breed of self-seeding micros have started to transmit propaganda on brainwave frequencies, coordinated by a Godfather Mainframe?

Experts are likely to be surprised at another finding: 114 of the managers were against the idea of working from home, and another 75 felt it could be possible for some people to do so (but not them personally). Many companies are considering plans to encourage managers to work from home within the next five years, so there could be some problems ahead. The main reason given against 'homework' is 'the importance of people interaction in the office world.' In translation this reads 'My wife won't let me bring the secretary home.'

Predictably those surveyed did not feel threatened by office automation — lower-level, less-skilled jobs were likely to be lost first. A surprising number, however, were all in favour of becoming keyboard users, and this contradicts the findings of technology and management pundits who have predicted that executives would find them 'too fiddly' or 'too degrading'. Perhaps that's why the lower-level jobs are under threat: all the managers want to cut out the typists. This reinforces the theories of another expert, who suggests that managers don't hire typists and secretaries for their typing and secretarial skills anyway.

Further details from Adrian Wheeler on 01-581 1721.

Jerry Sanders

transferring all their programs is, says DR, to take advantage of the portability of a language which is in any case — according to DR — 'better suited to serious business applications'. 'Digital Research brings MBasic into the real world' was how the press release put it.

Personally, I think the argument over the relative merits of the two companies' respective languages and operating systems is not a little silly, but at least it makes for entertaining press releases.

Anyone with £97 to spare and a burning desire to swap Basics can contact DR on (0635) 35304.

Surya

New image

A Cambridge-based company has produced an image-analysis system running on the BBC Micro for less than £500.

The device, which includes a monochrome video camera, downloads pictures into the Beeb where they can be analysed and processed as required. The processed image is then passed back to Seescan where it is converted back into a standard video signal. The resolution is a standard 128×128, and 16 shades of grey are supported.

The price is £465 including VAT. I don't know what you get in the way of software, but you can talk to Seescan on (0223) 314553.

Surya

Stranglehold

Lego is undoubtedly one of the most successful toys of all time. Presumably, David Johns, managing director of LSI Computers, is hoping that his company's newly launched computer, the Octopus, will achieve similar success—the various components of which can be fitted together 'like Lego' to meet the changing needs of users.

He claims that the Octopus 'in its smallest manifestation . . . is a transportable businessman's micro which uses any television as its screen. In its largest configuration it does the work of a 16-bit minicomputer with up to six satellite terminals, local area network connection to other Octopi and a gateway to other micros and terminals as needed.'

The components which provide this flexibility include: Intel 8088, 16-bit and Zilog Z80B, 8-bit processors; CP/M-86/80 Plus MP/M-86/80, MS-DOS, Concurrent CP/M and LSI's ELSIE operating systems; LSI, IBM or VT100 style keyboards, graphics, colour and split screen facilities, floppy or winchester disks and a mouse for cursor control and graphics.

The LSI Octopus design is intended to do away with the problem of premature obsolescence arising from the user outgrowing an otherwise perfectly good machine. This is the message that LSI will be putting across in its television advertising, part of a £½ million promotion campaign to ensure that the identity of LSI and Octopus become well known, LSI is determined not to be yet another British company that fails to market its product adequately.

LSI is an operating division of CPU Computers which was floated on the Unlisted Securities Market in June 1983 and announced a 1983 turnover of £19,191,000 and pre-tax profit of £1,426,000 in 1983 against a figure of £912,000.

Margaret Spooner

Software for every man

Vector International, the company that used to be the sole European distributor for both Microsoft and Digital Research (!), has launched a new range of business software.

Top of the list is a database package known as Everyman. This is currently available on the IBM PC and the Sirius running under both CP/M-86 and MS-DOS. Everyman is based on cards (à la Cardbox), which can be interlinked allowing complex databases to be built up. The use of multiple files is allowed. The relationship between the different files is entered graphically on the screen by using the cursor control keys to draw lines to link the files.

Unlike databases such as dBase II, Everyman is a non-procedural database. This means that it is not necessary to write a program to enter or extract data.

Other new products from Vector include two 'hands-on' training packages for CP/M Plus and MS-DOS version 2. These packages are based on a split screen where the top half of the screen mimics the actions of the operating system while the lower half displays the tutorial.

If you want more information, Vector is on 01-943 1257.

Peter Bright

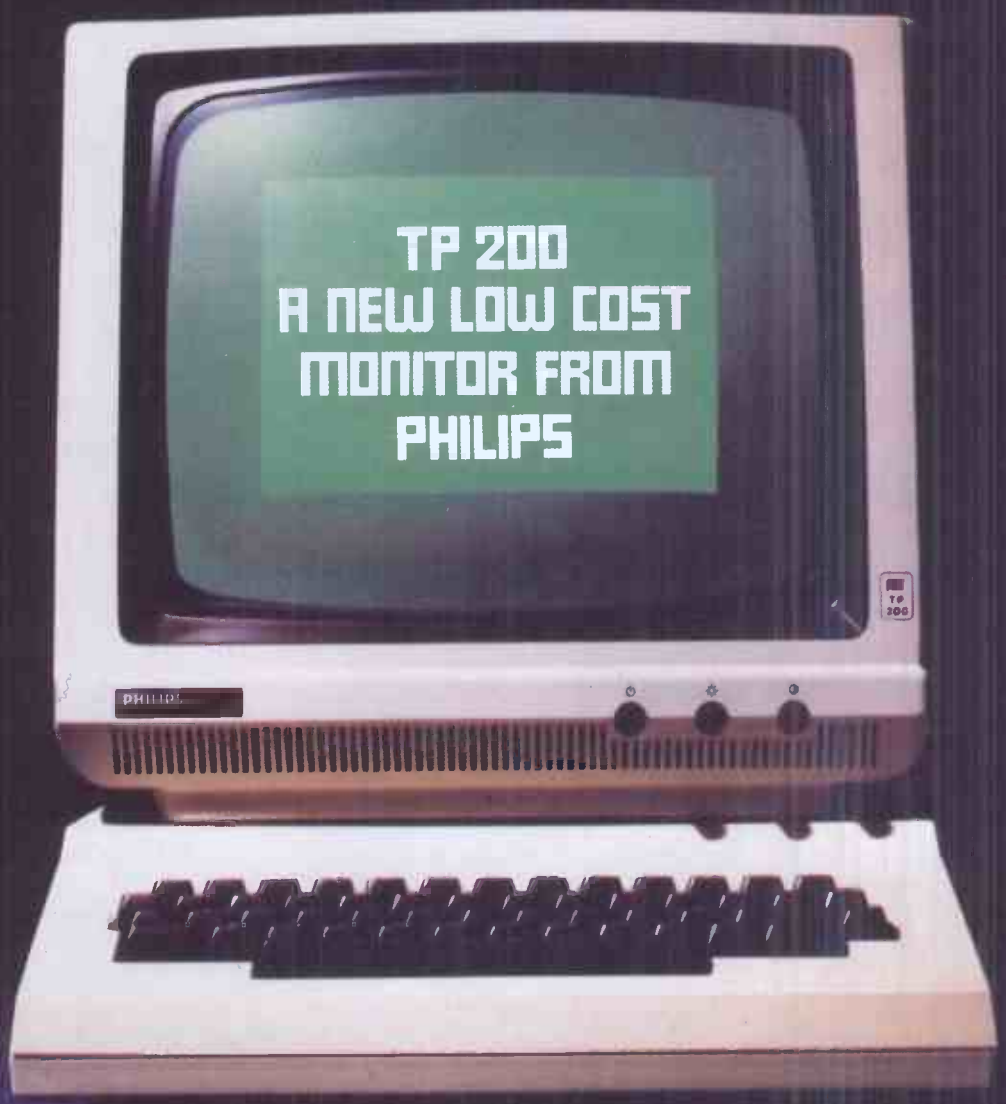
Software is starting to appear from commercial sources outside Tandy and NEC, for the portable machine they both market (built by Japanese firm Kyocera).

The Travelling Appointment Manager is one of eight programs from Travelling Software of Seattle, Wa (tel: (206) 367-8090).

This schedule manager costs $60, as does most of the range.

Now you can afford a separate monitor

The low price of the new TP 200 means *you* can now afford a separate monitor for your personal computer. This mains-powered 12″ monochrome monitor has a composite video input compatible with most of today's home computers.
Crisp, clear definition is assured by the Philips green anti-glare screen with its 80 × 25 character resolution and 18 MHz bandwidth.



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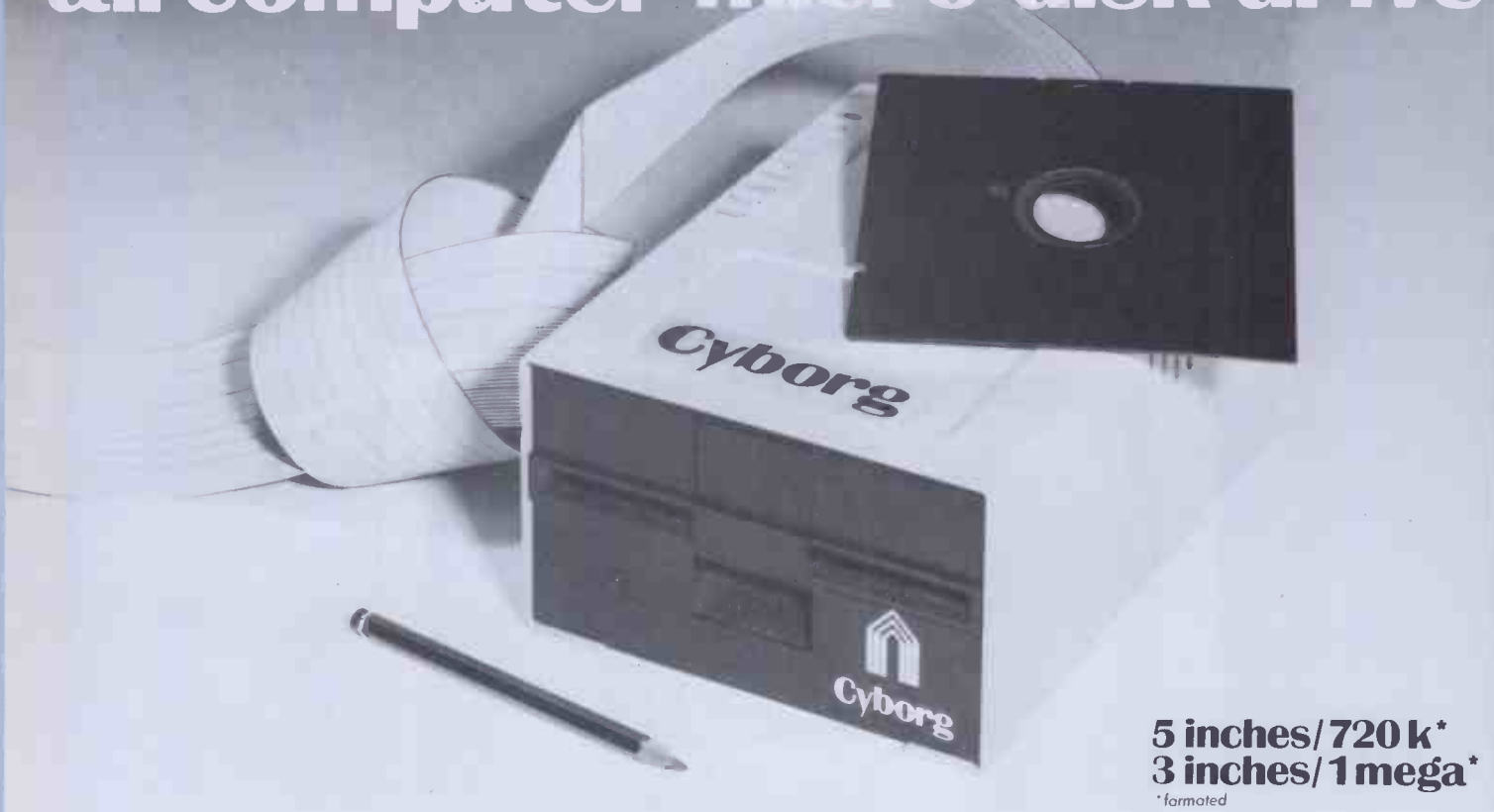

5 inches/720 k*
3 inches/1 mega*
*formated

connect me to ZX81, SPECTRUM, ORIC, ATARI, VIC 20, VIC 64, BBC, DRAGON, APPLE II, THOMSON TO7, TEXAS TI 99/4, and shortly IBM PC

Whatever the make of your computer, the CYBORG disk drive is for you!

The CYBORG disk drive is designed around its own on-board controller, allowing it to operate whatever might be the CPU of your micro.
Before, disk drives had a compatibility restricted to host computers of the same brand. Change the computer and you had to change the disk drive unit. Now you can change the micro and keep your CYBORG, thanks to the ingenious PERSONALITY MODULE. This is a minuscule unit, contained in the connecting cable, allowing translation of control and data signals in the CYBORG STANDARD INTERFACE. To change your micro simply change this connecting lead. Insert the SYSTEM NUCLEUS floppy, and it runs.

Three good reasons for choosing the CYBORG disk drive.

1) the price: 199.99 pounds excl. VAT. This price includes: the disk drive, one personality module, and one system nucleus.

2) the capacity: drives currently available store around 150 K on a 5 inches floppy. The CYBORG gives you a capacity of 720 K on a single floppy (320 K per side).

3) Transportability: that incredible disk drive will hook up to any machine. Your text files can be read by any micro-computer. Just buy the personality module plus the system nucleus of the new brand, and there it goes! (personality modules available now: ZX81, SPECTRUM, and ORIC; others to come shortly) (ZX81, SPECTRUM trade marks of SINCLAIR RESEARCH Ltd ORIC trade mark of ORIC INTERNATIONAL

Technical specifications: 5 inches disk drive unit 720 K per floppy
DOS COMMANDS: FORMAT, DIR, SAVE, LOAD, ERASE. Up to 4 disk drives, Price 199.99 excluded vat.
Optional extensions: FILE HANDLING: OPEN, READ, WRITE, CLOSE, POSIT, RENAME, SEARCH, TYPE, STAT direct and sequential access (20 pounds);
SYSTEM EXTENSION: MLOAD, MSAVE, MRUN, CHAIN, LOCK, UNLOCK (35 pounds);
SECURITY HANDLING: prepares uncopiable disk (900 pounds); prices excluded vat.

Ask your local distributor to order it from
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Universal application

Mrs Thatcher's intelligence staff may have been slipping. On a recent Radio 4 program the first lady lamented not being fluent in nine or ten languages, in order to take on foreign politicians in their own tongues. Esperanto, a possible medium for such dialogue, was 'not a living language', she said.

She can't have been told that Cecil Parkinson, at that time still Trade and Industry Secretary, is a past Honorary President of the South Midlands Esperanto Federation. This is surprising in view of the fact that she seemed to know everything else about Mr Parkinson's activities. In fact the largest lobby at Westminster is the Esperanto Parliamentary Group with over 130 members.

According to Peter Miles, Esperanto translator and linguist, attempting to estimate the number of Esperanto users is like trying to say how many people ride bicycles. Estimates vary between 8 and 15 million. Although this makes it a minority sport in terms of world languages, dead it certainly is not. Which is presumably why a project to design and produce an Esperanto Computer is up and running in the Netherlands. Called 'Projekto Esperanto Komputoro' (you see—you already speak the language yourself!), the idea has already completed its first stage. Proposed designs for keyboard layout and internal codes, based on a 32-letter alphabet, have been drawn up, and Esperanto terminology for 'hex', 'assembler' and 'operating systems', to name a few, defined. The project is looking for interested parties either as collaborators or sponsors.

Details can be had from Lawrence Mee, Mondkomerca Eldonejo Esperantista, PO Kesto 25041, 3001 HA, Rotterdam, Netherlands.

Still with Esperanto in mind, on 1 November the result of a feasibility study into machine translation was published in Utrecht. The study, backed by an EEC grant of 250,000 guilders, was undertaken by Dutch software company Buro voor Systeemontwikkeling (Bureau for Systems Development) in collaboration with a Danish hardware company, Christian Rovsing. Translation experts have often argued that the use of a bridge-language stage in the translation process has great advantages where several languages are involved. According to BSO, Esperanto makes an ideal bridge-language because it has a relatively small number of word elements (roots, affixes, etc). Calculations have shown that this characteristic makes it possible to encode much more economically than is possible with other languages.

The aim of a distributed language translation (DLT) system is to achieve high-speed automatic translation from one language to another. The BSO project's use of Esperanto as a bridge-language makes it unique. Toon Witkam, directing the project at BSO, says the results of the feasibility study are positive: the next stage is to persuade the EEC Commission to finance the practical development of the first experimental system.

If you are beginning to feel left out, then here's something you can do about it. The Esperanto Centre is offering free of charge an Esperanto Correspondence Course for use on your micro. Twelve lessons are included: you write your answers back to the disk or tape supplied and return it to the Centre for correction and comment.

For more information write to The Esperanto Centre, 140 Holland Park Ave, London W11 4UF.

Jerry Sanders

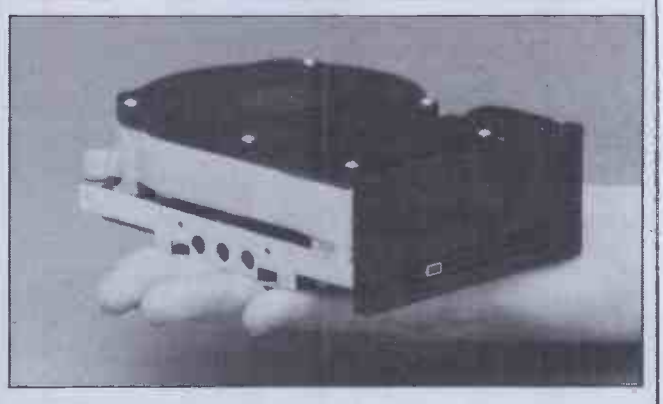
Teaching aid

48k Spectrum owners can now buy educational software produced by Five Ways Software, the firm set up to market software written by teachers at a Midlands school.

Five Ways Software, in conjunction with Heineman Computers in Education, is selling four of its recently released range of 24 primary school programs through retail outlets. The four programs, each selling at £9.95, are all presented in the form of attractive games with full colour graphics. The programs released for the home market are slightly modified versions of the school packages, playing up the games aspects.

The programs—'Punctuation Pete', 'Ballooning', 'Car Journey' and 'Special Agent'—can all be obtained from High Street outlets.

Surya



Microcomputer Memories Inc., a newly formed Californian company, is developing a new range of 3½in hard disk drives, as the picture above shows. Capacities at present are 6·32 and 12·7 megabytes unformatted. These drives will measure only 1·6 × 4 × 5·75in and are 75% smaller than conventional 5¼in hard disks. Microcomputer Memories also says that the new drives will offer very high resistance to shock. The only trouble is that the drives are not generally available yet—deliveries of evaluation units are expected to start in January 1984 and Microcomputer Memories is currently looking for distributors.

More information from Alan Parker on 01-236 2251.

Fingerprint

Epson printer owners who are tired of playing around with escape codes in order to configure the printer to emphasise, underline, superscript, and so on, will appreciate a product called 'Fingerprint'.

Fingerprint is a chip which replaces one of the Epson's own ROMs. The chip took me about ten minutes to install. Although it's a bit of a fiddly job and the instructions have to be read carefully, it's quite straightforward. Once installed, the device uses the existing Epson keypad to program ten different parameters in any combination. Normal operation of the printer is unaffected and control codes may still be sent to the printer in the usual fashion.

Fingerprint also flashes the 'on-line' lamp to indicate whether or not a particular parameter is set.

Fingerprint works on UK and US Epsons—though in slightly different ways—as well as on IBM PC printers, and costs just over £50. Details on 01-387 4549.

Surya

Dual role

Rank Xerox has announced a 30% price reduction on its 820 series micros. This takes the price of an entry level 820 down to £1593.

Xerox has also launched a new business micro known as the 16/8. This features 8086 and Z80A processors, up to 448k RAM and a 'Mouse', all for £1961. Each processor has its own RAM and can run independently of the other.

More details on (0895) 51133.

Peter Bright

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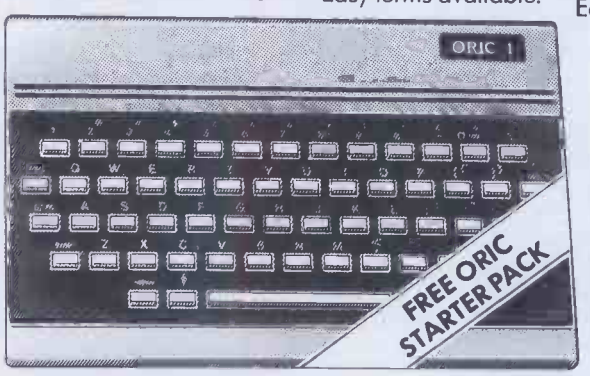

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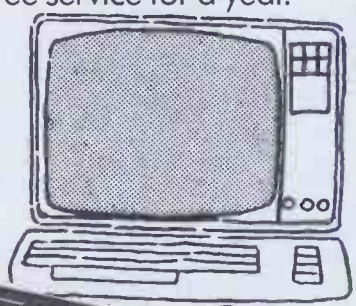

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Customised computing

Manorex BV of Holland has successfully distributed the Wave Mate Bullet in Holland and Belgium and is now launching it in the UK (Benchtested next month).

The Bullet is a Z80-based single board computer that can be packaged in any box along with any number, from an impressive choice, of disk drives. The selection can be made from either 3½, 5¼ or 8in floppy drives and 5, 10, and 15Mb hard disks. By altering the way it is presented the Bullet can become a portable or a desktop unit or can even be built into a bureau. In fact all you have to do is tell Manorex what you want your computer to look like and it will build it for you and deliver it, usually in 2-3 weeks.

The Bullet uses the banked version of CP/M 3.0 which allows it to access 128k of memory which is more than the normal 64k limit imposed by a Z80 processor. This operating system is apparently user-friendly and is described as being 'child's play'.

Manorex has also designed a disk configuring program to run on the Bullet which enables it to use almost all 8-bit CP/M software and even read, write and format over 40 different brands of 16-bit disks.

Prices start at £1450 for a standard 2x 800k floppy disk drive system with a 10Mb hard disk system for around £2500.

At the time of writing Manorex has approached two UK dealers but has more planned. For details of the custom built Bullet, contact Erik J Monnonkhof on (01031) 3463 3467.

Tony Hetherington.

IBM launch

IBM has launched two new personal computer products—known as the PC 3270 and the XT/370.

The XT/370 looks like it is going to cause a great many sleepless nights among IBM's competitors. Processors are said to include twin Motorola 68000 processors, an 8080 processor and an 8087 maths co-processor. All of this computing power means that the XT/370 will be able to download and run system 370/VM mainframe software.

The 3270 PC can be hooked up to IBM mainframes and can display data in up to 7 'windows'.

At the moment the machines are only available in the USA where the PC 3270 retails at $5585 and the XT/370 at $8995.

Peter Bright.

Hitachi confesses all

Japanese electronics firm Hitachi has agreed to allow IBM to inspect all its new computer hardware for a period of five years prior to release, following allegations of piracy.

The settlement followed legal action taken by IBM over IBM-compatible computers manufactured by Hitachi. Hitachi had been accused of stealing proprietary information which it allegedly used in the design of its own hardware. As well as allowing IBM to inspect its new products, Hitachi has made an undisclosed but reputedly substantial payment to IBM as compensation.

Hitachi's vice-president, Hiroshi Asano, stated that IBM will only be granted access to product information where Hitachi considers the request appropriate, and that the two companies will 'deepen their friendly ties'.

Hitachi will continue to manufacture IBM-compatible hardware using its own software.

Surya

Husky Hunter

DVW Microelectronics, the company which brought you computing for frogmen with the Husky Is, has revealed the new Husky Hunter. The Hunter is smaller, lighter and cheaper than the Is but offers the same sealed heavy-duty case. The basic model has a 48k ROM which includes a CP/M emulator. This means that it is the first hand-held CP/M compatible computer.

The Hunter features a Tandy-style LCD display in a machine half the size of the Model 100. Each of the 240 × 64 dots is addressable and you can choose from five character sets.

There is a choice of models from the basic 80k RAM model, which costs just under £1000, up to one containing 208k. All models have a RS232 interface which the Hunter can use to 'talk' to a wide variety of micros, minis and mainframes.

The Hunter also features a built-in secondary battery with a life of 50 hours to prevent power loss while you're at the bottom of your local fishpond.

The CP/M compatibility and communication facilities will endear the Hunter to people such as insurance agents who could use it for demonstrations or to store their clients' policy details, which could then be transferred to the company's mainframe on return to the office.

Tony Hetherington

Driving made simple

A US firm has produced a floppy-tape Drive for the Tandy Model 100 portable computer.

The Drive, known as the PMD-100 (PMD stands for Portable MicroDrive), runs on rechargeable batteries so that the system maintains its portability. The tape cartridges are miniature continuous-loop wafer tapes, similar to those used in the Sinclair MicroDrive. Operating at 9600-baud, the Drive contains a 16k RAM buffer to enable high-speed file transfers.

The operating system supplied with the device is downloaded into the Model 100 using the built-in Tandy Telcom program, after which it resides in the machine's non-volatile memory. This allows standard file-handling operations.

The MicroDrive, if it is as good as it sounds, turns the Model 100 into a viable personal computer system. Tandy is planning to provide some form of disk or tape drive at a future date, but has so far refused to speculate on a likely launch date. The unit, which retails at $350, includes five tapes, the connecting cable and a battery-charger. A UK price is not available at the time of writing.

The company producing the Drive, Holmes Engineering, also sells 8k RAM modules for $75 a piece. Details of both on (0101 801) 261 5652.

Surya

"BRITISH MICROCOMPUTING AWARDS 1984"

Personal Computer World

THE SUNDAY TIMES

1984 will see the advent of one of the most important events in the microcomputing calendar, The British Microcomputing Awards, which is being supported by The Sunday Times.

PCW will have a key role in this event as it will be hosting two of the most important awards in the microcomputing world.

We are looking for the best software and the best micro of the year and we are seeking nominations from *PCW* readers.

Which of the new machines is your favourite, and why? What software do you think outstanding. Tell us about it and we might agree. Here are some general guidelines on what we're looking for:

Category 10. Microcomputer of the Year

'Microcomputer of the Year' will be awarded to the machine which, in the opinion of the judges, is the best to have appeared on the market in recent months. The judges will be considering how user-friendly the micro is, the extent of its flexibility, the range of supported software, expandability, design and price. Machines must cost less than £8000 and the version entered for the award must have first appeared on the market between 1 November, 1982 and 1 November, 1983.

Category 9. Software of the Year

The 'Software of the Year' award will be presented to the software house which, in the opinion of the judges, has published the most user-friendly software providing the simplest means to reach an effective solution. The software will be judged as a user aid and a tool, so we will be looking closely at how it carries out the task the user wants to complete. Flexibility and value for money are key requirements for the winner.

Manufacturers and software houses are allowed to nominate their own products.

PCW will extract four nominations from each category and forward them to a central judging panel of eminent individuals who will choose their top three nominations. The prizes will be awarded at a glittering event next spring. The major sponsors will also be presenting a top overall award for the most outstanding contribution to microcomputing.

Readers may also submit nominations for the categories being hosted by *PCW*'s sister publications*. Official nomination forms are to be found in current editions of the magazines but these are the other categories.

Category 1. Business Microcomputer
Category 2. Business Software.
Category 3. Home Microcomputer.
Category 4. Home Software.
Category 5. Creative Software
Category 6. Game.
Category 7. Consumer.
Category 8. Peripheral of the Year.

***Personal Computer News, Computer Answers, What Micro?, Micro Decision and Personal Computer Games.**

Rules:

Manufacturers may nominate their own product which need not have been made in Britain but must have been available for purchase from retail outlets in the UK between 1 November, 1982 and 1 November, 1983.

Employees of VNU Business Publications BV, the sponsors or any individuals associated with the British Microcomputing Awards are ineligible to place a nomination with the exception of the six VNU title judging panels who may each nominate up to six entries.

The decision of the judges is final and no correspondence will be entered into.

All nominations must be received by noon on 5 January, 1984.

Personal Computer World

Nomination Form

Please enter below your nomination for the following categories. In not more than 30 words, please give the reason for your choice.

Category 10 | Microcomputer of the Year

I nominate .....

Reason for choice .....

.....

.....

Category 9 | Software of the Year

I nominate .....

Reason for choice .....

.....

.....

Name .....

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Send your nomination(s) to:
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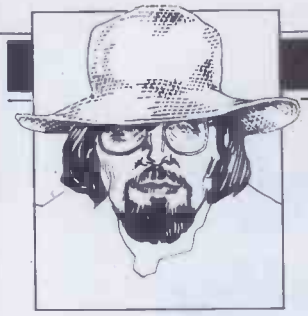


BANKS' STATEMENT

THE SEVEN AGES

Martin Banks believes micros have a long way to go in the refinement process.

I've been sitting here wondering if I have the nerve to suggest that the personal computer is, perhaps, the worst thing that ever happened to personkind. The old mainframe computers were bad enough; after all when such machines were first developed it was thought that there might be applications for half a dozen of them around the world. But now, all these personal computers are just making the situation horrendous.

In offices and shops up and down the country, all around the world, there are small computers cranking away at all sorts of terribly important jobs, all intent upon making life easier, more efficient, more tolerable, more generally neat and tidy for their hard pressed and harassed owners. They are adding at an exponential rate to the amount of terribly important jobs being performed already by mainframe and minicomputers in the vain hope that things will get even easier, more efficient, more tolerable and more neat and tidy.

When thinking these thoughts I am, for the time being, dismissing the vast plethora of home computers that now infest the country. They can be dismissed because they are generally being employed for the sole purpose of running excrutiatingly brain-numbing games programs. These tend to keep people off street corners and away from thinking about doing anything 'real' or 'meaningful'. Once home computers join in with the mainframes, minis and personal systems in attempting to make things neat and tidy for us, that may well be the time to bail out.

All these computers have been sold, and are being sold, to unsuspecting owners on the basis that they are somehow going to make life so much easier, more tolerable, and so on. Yet I suspect that they are, in practice, achieving the exact opposite, and will continue to do so for some time.

To explain why I feel this is the case will entail me in waxing philosophical for a moment. I realise that it is presumptuous of me to postulate the concept that I can wax philo-thingie, but I shall attempt to anyway.

Let us assume that the path to be taken by the human race, collectively, is towards some form of greater wisdom (whatever that wisdom may be found to constitute on arrival). This is, after all, the fundamental tenet of most of the world's religions and philosophies, so maybe there is something in it. If this is accepted then it can also be assumed that the artefacts and experiences we gather and keep around us, both individually and collectively, will be those that can be considered likely to help us on this 'journey'. Since it has not been dismissed as a passing fad, like the hula hoop, the computer in all its guises may presumably be considered as an artefact we have collectively taken to be 'useful'.

But is it? To shoot off at another tangent for a second, look up 'wisdom' in the Concise Oxford Dictionary: *possession of experience and knowledge together with the power of applying them critically or practically*, it says. Does the computer actually help us with any of this? Certainly it can apply the power to use experience or knowlede, but use it critically or practically? Not really. Does it supply the knowledge? Well, at first this looks more promising, but again the dictionary helps us. To 'know' is (among other things) being able to distinguish, which in this context means making decisions about, and/or between a limitless variety of experiences. Though at first sight this might seem to be where the computer fits in, it has (as some people insist on saying about other people) a long way to go.

For there are, in my own humble opinion, two stages that precede knowledge, in the same way that knowledge precedes wisdom. These are information and, at the bottom of the pile, raw data. From a distance it is possible to see the tidy linear progression from raw data, through information and knowledge, and on to wisdom. Once you get inside it, however, in everyday living, the picture gets to be much more cluttered, and this is where the computer is actually a hindrance rather than a help.

'The time is fast approaching when the industry must think in terms of defining "knowledge" as a product, and create systems that provide it.'

You see, the vast majority of computer systems are being used to produce raw data, intergalactically vast gobs of the stuff. One or two are being used to produce information, it is true, but the majority are just stuck there churning out data — and are starting to get in the way, for most people have no idea what to do with the stuff.

They don't know, not because they are intellectually incapable, but because there is so much of the stuff around now that it is impossible to wade through it effectively. Here is an example. A business person often used to make decisions on a purely empirical basis, but felt that this was inadequate, that opportunities were being missed because of lack of information. Maybe much time was spent seeking additional data just in case. So, sold on the idea of a computer, one is purchased. Now there is data in abundance: databases, spreadsheets, modellers, etc, churn the stuff out endlessly. The business person is left holding so much data, most of which apparently points in different directions, that a rational decision based on this input becomes all but impossible.

The time is coming for the computer industry to sit back and consider what it is actually selling to the market, and what it ought to be selling, for I feel that the time is fast approaching when the industry must think in terms of defining 'knowledge' as a product, and create systems that provide it.

To give some idea of what I mean, let me take one more digression. Examine for a moment what you are reading right now. It is a magazine called *Personal Computer World* which has been written and edited by people who have a strong interest in the subject of computers, and, to a greater or lesser degree, know a considerable amount about them. By reading this magazine you are acquiring not just information, but filtered and applied information, which can be considered knowledge.

It is filtered by the existing knowledge and experience of the people writing and editing it, and it is filtered in a certain way. At the broadest level of filtering it is about things pertaining to personal computers, so if that is the subject in which you are interested, you will understand from just the title of the magazine that this is probably a better place to look for information than, say, *Car Mechanics*.

But *PCW* looks at the personal computer business in a certain way and filters the information it receives accordingly. Though it has good coverage of games programs, it also covers business applications and other subsets of the industry. If your interest is only in one specific subset then the filtering provided by *PCW* may not be enough (or indeed may be too much), and an alternative source of information, tailored more precisely to your needs, may be required.

All this may sound terribly obvious, and it is, until you have seen the inside of an editorial office and participated in this filtering process. Such offices are habitually the depository for every press release ever written by anybody who ever thought

Illustration by Ivan Allen

they might get something in the papers. They range from the immediately relevant — brand, new personal computer announcement — to the frankly inane. They take in every stop in between as well. They all have to be read and filtered by the knowledge and experience of the editors (don't laugh, it's true).

To see how this is important, try to imagine what the alternative would be like. Imagine receiving your copy of *PCW* every month to find it filled with every press release that had been received. They would appear in the magazine in order of receipt through the post and would be 'pasted down' onto the page with no consideration given to content nor subject matter. Finding what you wanted among this morass of raw data would be your responsibility.

The point of all this digression is that computers are still at the level of providing a platform or format for raw data (in the above example that would be analogous to the pages of the magazine). Rarely do they rise above this to even the first level of filtering, let alone move on to what most users really need. Among other facilities, this is the ability to specify randomly any criteria that come to mind for selecting, from a vast pot of raw information, only those bits that are required.

Now I know there will be many people within and without the industry who will jump up and down and say 'databases' very loudly, and I will say 'No, I don't think so.' Databases are good for storing and retrieving related data that the user already knows about. What they are not much good at is doing something journalists (for example) do all the time. That is, making connections (sometimes silly, sometimes fatuous, but sometimes inspired) between apparently disparate bits of information that no one 'knew' they were looking for.

A computer product that offered that sort of facility would be starting along the road to exploiting knowledge properly. It is from the ability to make such connections that most development and growth towards 'wisdom' has come. It is a mark of this 'wisdom' that, in humans at least, the ability to know of things (facts 'n' info) and retrieve them at will (like a database) does not represent either knowledge or wisdom. As much as anything, this comes from knowing what information to get rid of. Now, someone needs to teach computers . . . END

DYNAMIC DESQ

Integrated office systems are becoming all the vogue. First came Lisa from Apple, then Visi On from VisiCorp, and now a Californian company called Quarterdeck has launched DesQ, whose main advantage over its competitors is its ability to integrate off-the-shelf packages running under MS-DOS. Armed with this knowledge Robin Webster and Leslie Miner set out to evaluate the product's chances of success.

In true start-up fashion, a small US West Coast company called Quarterdeck is trying to find its own niche in the market for integrated software systems; a market which is currently dominated by such established names as Xerox, Apple Computers, and VisiCorp.

Quarterdeck's product, DesQ (pronounced 'desk'), differs from the others in that it is designed to integrate off-the-shelf packages that run in the MS-DOS environment. The idea behind this $395 system is that many people might not be willing to give up the programs they know and love, or hate and have learnt to put up with, in favour of new products that they will have to learn from scratch.

Not surprisingly, DesQ is being pitched as an office automation product for a small to medium-sized business or for the departments within a large corporation. These are the type of users with which Quarterdeck founders, Therese Myers and David Pope, gained familiarity while developing an integrated workstation called the Axxa for the US bank, Citicorp.

The Axxa system was not a personal computer in the terms now familiar to *PCW* readers. Instead, it was one of the initial attempts to bring many different office automation ideas together in one integrated system for use by executive vice-presidents and their staff and secretaries.

Problems occurred with Axxa because the level of integration was, in fact, not sufficient. To enable office workers to close down temporarily one document and look at another in order to find some specific information, the Axxa had been given an 'interrupt and resume' capability. The drawback was that the users had to memorise, or jot down, the details in one window if they wanted to make use of it in another.

According to Myers and Pope it was at that point that the importance of using multiple application windows became apparent.

'Simple split-screens are not enough,' said Myers. 'The user must be able to look at things simultaneously and obtain additional information spontaneously.'

Hardware requirements

One notable aspect about the new generation of true multi-window software environments (as opposed to just simple split-screen displays) is that they make full use of the current trend towards ever larger hard disks being tacked onto personal computers. With the Visi On system from VisiCorp, you really can't get away with less than an Intel 8088/6-based machine running MS-DOS and outfitted with 256k main memory, a 5Mbyte hard disk and a colour/graphics board.

Or, even better would be an IBM XT with an integral 10Mbyte hard disk. Apple's Lisa on the other hand comes with 1Mbyte of main memory and a 5Mbyte hard disk — although it is very probable that a 10Mbyte drive will be introduced in the near future. While the DesQ system can be viewed as a far less sophisticated product than the other two mentioned, it too, requires an IBM PC running MS-DOS with a minimum of 256k memory and a 5Mbyte hard disk.

'DesQ is being pitched as an office automation product for a small to medium-sized business or for the departments within a large corporation.'

The reason why such large amounts of storage are necessary has to do with the size of the so-called 'desktop-manager' code (128k of compiled C language code with Visi On, 2.5Mbytes of compiled Clascal code with the Lisa, and between 128k to 150k of code with DesQ).

DesQ was written in a language developed by David Pope. Internally the language is referred to as 'SYMPL', but Quarterdeck does not have the rights to use that name commercially. SYMPL is described as having attributes that can be found in both the Lisa list processing language much favoured by US artificial intelligence workers and the Smalltalk language developed by Xerox at its Palo Alto Research Centre. SYMPL itself, however, was written in Pascal.

The user has the illusion of simultaneous access to diverse applications programs between 30k to 400k in size (by means of the various applications windows that can be left lying around on the metaphorical desktop). It is easy to see why 256k has become the realistic minimum for main memory and 512k a real bonus.

Much early development work on DesQ was carried out on a Compaq system, which had been loaded up with the maximum amount of RAM. While this approach worked for basic development, Myers does not suggest that it would be at all suitable for users of the commercial system.

In addition to the usual personal computer paraphernalia, the DesQ user might want to buy a mouse to simplify the task of selecting commands from menus or manipulating windows and the data they contain, but, as we'll see later, a mouse is not an absolute necessity.

At the time of this review, Myers indicated that two mice were being recommended. The Mouse Systems optical mouse must be used in conjunction with a ruled aluminium pad laid on the 'real' desktop (this mouse will also be supplied with Visi On). The Microsoft mouse, apart from being a little noisy on certain surfaces, is said to handle well.

The system we reviewed was running on an IBM XT with a colour/graphics board and a colour monitor (although it could just as well be displayed on a black and white monitor). The Mouse Systems mouse was attached.

Using a mouse

In keeping with the Visi On approach, Quarterdeck has decided to use a two-button mouse. In fact, most of the mice on the market have three buttons, but only the right-most two seem to be commonly used. The number of keys used generally relates to two things: the design philosophy of a software developer and the sophistication of the desktop-manager environment. In the latter case, the greater the sophistication, (and therefore the greater the amount of time spent by the software in checking the contextual implications of every action) the less complex a set of mouse button-pushes has to be memorised.

With DesQ the middle key is used to bring up the main menus — those menus which control the presentation and status of applications working within the DesQ environment — while the right-most key is used to select the options within those menus and then to go on and work with the contents of the applications windows themselves.

On the system under review, whenever the wrong button was used to select something (using the middle key to work on applications data, for example) the IBM XT had been programmed to alert the user by beeping. The fact that no error messages were displayed to indicate the exact nature of the problem was a little disappointing, but this may be corrected in

the final version of the system.

In use

Since the fundamental idea behind DesQ is that it should have little or no direct effect on any applications program it handles, no 'basic' first screen appears. The user will encounter a different main menu from system to system. If a friend has Lotus 1-2-3, WordStar and dBase II then those are the applications programs that he can install and make available via DesQ. If someone else has one of the Easywriter family of wordprocessors, plus Supercalc, Multiplan and a Peachtree accounting package, these packages dictate the range of work that can be carried out.

DesQ's capabilities have almost nothing to do with the applications themselves. Having DesQ is rather like having someone who's an expert user of all the most popular software packages to do all the tedious work of, say, taking data from a spreadsheet and then retyping it into one of the wordprocessing environments, so that professional-looking reports can be produced.

'The most apparent difference between DesQ and other windowing systems right now now is that colour can be used quite freely.'

It should even be possible to have DesQ do creative things like automatically handle all the manipulations between a database file, a spreadsheet, an accounting package and a wordprocessor. The user ends up with what is more or less a complete accounting/forecasting/reporting package built out of different software developers' products.

DesQ is a bit like super-glue — it can join all sorts of different off-the-shelf packages together, but it doesn't change the characteristics of the various components.

To install a new software application you must load the software onto the hard disk and then tell DesQ a few things about the package. First, you give the name by which the application will be known in the DesQ menu. Next, you type in the DOS command that will load it.

Then you give it a range of miscellaneous data, such as where the application name will appear on the main menu, how much memory it will require (DesQ checks to see if sufficient ROM is available and informs you if it isn't), whether it will use graphics, and what symbols will be used as delimiters during cut-and-paste operations.

The IBM XT under review was being used by Quarterdeck as a kind of test-bed system since its main menu boasted over ten of the popular software packages. These included WordStar, dBaseII, Easywriter II, Lotus 1-2-3, Peachtree accounting, Supercalc, along with Microsoft Basic and a freebie graphing system called Piechart which IBM puts on its PC-DOS distribution disks. The main menu is called up by clicking the middle mouse button twice. It always appears at the top right of the display and, as with all DesQ submenus, is always the same colour so that it may be easily differentiated from applications windows lying around on the screen.

Although we did not see the system running on a Compaq screen or a black and white monitor, Myers indicated that, even then, it was still quite easy to make the distinction. As an absolute indicator, DesQ windows *always* appear on top of any applications windows that have been previously opened. With Visi On and the Lisa system the user begins work by going to some central repository of information like the Services box (Visi On) or the ProFile icon (Lisa). The DesQ user, on the other hand, is presented with a fairly conventional main menu selection of programs (windows) to run (to open), as shown in Fig 1.

Since DesQ has been designed so that it can be used with or without a mouse, function key equivalents of mouse selections are given next to menu options (we will generally describe the way the mouse is used to manipulate windows and their contents). It should be noted that the line which says 'Other F10' is used to call up Part II of the main DesQ menu which will have further program offerings.

Not all the programs shown were available to try — Lotus 1-2-3 and dBase II being notable absentees — so we worked with WordStar, Supercalc and IBM's Basic language program, Piechart.

To select WordStar from the DesQ menu we used the mouse to position the screen cursor so that the program entry was backlit. We then pressed the right-hand key on the mouse to 'select', or load, the program into memory.

DesQ offers a wide range of possibilities as to how any single applications window will look when it appears.

Windows may be set to occupy the full screen, the top or bottom half of the screen, the left or right half of the screen, a quarter of the screen, or whatever. Once a window has been opened it can then be further changed in size and location.

Window design

Those who read last month's review of the Visi On system will remember that we felt that the window manipulation technique adopted by VisiCorp was not as intuitive as it might have been. To move a window you had to redraw its outline at the target location by specifying its new upper left corner and its new lower right corner.

With the Lisa system, you just 'pick-up' a window and 'put it down' wherever appropriate.

DesQ's designers have decided on a window resizing system that is closer to the Lisa way of doing things. In fact, the window outline resembles those on the Apple product quite closely.

OPEN NEW WINDOWS

Basic	F1
dBase II	F2
Easywriter II	F3
FastGraphs	F4
Lotus 1-2-3	F5
Peachtree	F6
Q/Link	F7
Supercalc	F8
WordStar	F9
Other	F10

Fig 1

Once a window is displayed, you move the window by clicking the mouse cursor once on the upper left corner, placing the cursor where you want the new upper left corner to appear, and then by clicking the mouse button again. The window outline and its contents are then re-mapped to the new location.

To scroll the contents of a window either horizontally or vertically, thin up/down/left/right arrows and small triangular graphics symbols situated on the window border are used. Placing the mouse cursor on a directional arrow and pressing one of the mouse select keys moves the window text in the relevant direction one line at a time.

Placing the mouse cursor on a triangle causes the text to jump in screenfuls (the kind of thing that's handy when you have your wordprocessing margins set well beyond the usual 75 to 80 columns).

The active window can always be readily identified (not as simple as you might think when you have four open windows, each occupying a different corner of the screen) because it is the one with the graphic symbols and a flashing number in the top left corner. These numbers indicate which window was opened first (ie, applications window '1' was loaded prior to applications window '2'). When a number of overlapping windows are displayed, the active window is *always* the one on top of the others.

According to Myers, however, these window border symbols will not be included in the commercial release of DesQ. Instead, the windows will just have more or less plain borders except for the top bar where the window name and number will appear (the name will probably be centred, defined by a line or two as in the Lisa windows).

Scrolling will be achieved by placing the cursor at definite areas within the window. Putting the cursor at the top of the window contents and pressing one of the mouse select buttons will cause the text to scroll upwards. Placing the cursor along the left side will cause the text to slide to the left (this is reminiscent of the 'pushing' method adopted in Visi On).

On the review system the bottom right corner of each window also had a small diagonal line within a ruled-off area. Lisa

watchers will immediately recognise this symbol as a means of resizing a window without changing the position of its upper left-hand corner (the Lisa version is actually a tiny representation of the corner of a window and an arrow pointing down diagonally).

To resize a window with DesQ you place the cursor on the diagonal line, click once, and then move the cursor to the right and downwards (to enlarge the window area) or to the left and upwards (to shrink the viewing area). There seemed to be no particular constraints as to what you could do with a window. Reducing a WordStar window to a one-inch-square rectangle didn't elicit any kind of negative response from DesQ. Neither did it mind when the same window was reformed into a tall, one-inch-wide column.

Generally, the window-handling seemed to be quite good, and certainly of the standard you would experience with Visi On.

The most apparent difference between DesQ and other windowing systems right now is that colour can be used quite freely. In fact, all the windows on the screen (except for the DesQ environment windows mentioned earlier) can be coloured by the user.

To change the colours you call up the 'Layout Window' menu. This contains options that will alter the way DesQ controlled applications appear to the user.

There are commands to resize, change colours, move windows and set windows aside on the desktop — that is, to close the windows temporarily in the form of small rectangular icons at the bottom right of the display. Windows that have been set aside are kept intact in a memory partition; they do not have to be loaded from disk again. A mouse can be used to make the required selections, or the indicated function key pressed. The 'Change Colours' command has been implemented in a very straightforward manner. The lower portion of the Layout Window menu is taken up with three colour palettes — one palette for the application program text, a second for the background colour in the window and a third for the overall background colour of the display.

By selecting colours from these palettes it is possible to come up with some unusual, but pleasant working combinations. It is also possible to come up with many that are atrocious. Yellow text on a purple background is one unhappy combination.

Another problem that became obvious during the review is that DesQ will gladly let you make the text colour the same as the background colour (white on white or red on red), and vice-versa. The result, needless to say, is the computer equivalent of invisible ink — there's data in the window, but you just can't see it.

This is obviously not a major criticism, but it really wouldn't be a big task to link the two palettes so that the same colours cannot be chosen for the text and background in a single window. Just as you have to reset many computers after altering system defaults contained in printer drivers and communications packages (otherwise the system would still follow the previous defaults regardless), you must tell DesQ that you are 'finished' or 'done' to confirm any changes made while in the Layout Window menu. If you don't wish to carry through the changes you have made, you can also select the 'Cancel Actions' option.

Zoom and View

Current wisdom among those who design such systems is that most users will not actually have 25 open windows on their desktops. Instead, they will work with their wordprocessing or spreadsheet systems as full screens and only when the time comes to do data transfers or to compare visually various files will smaller windows be used. To this end, Quarterdeck has included the 'Zoom' and 'Unzoom' commands. Zoom enlarges windows to full-screen, while Unzoom returns them to their previous size and location.

But with some programs, notably Lotus 1-2-3 and Supercalc, program data is written directly to the screen, bypassing DesQ's ability to tinker with usual program display modes. The result is 1-2-3 and Supercalc can only appear to the user as full screen applications — none of the usual window commands can be applied.

'DesQ is a bit like super-glue — it can join all sorts of different off-the-shelf packages together, but it doesn't change the characteristics of the various components.'

During the review, we opened up some WordStar files and then selected Supercalc from the main DesQ menu. The initial Supercalc screen totally obliterated the WordStar windows — they were still 'underneath' but to all intents and purposes not available until the Supercalc full screen display was removed. This is something of an annoyance since the real bonus of multi-window systems is simply that multiple windows can be arranged on a desktop and be made to share data by means of cut-and-paste operations.

To overcome this problem, Quarterdeck is developing a feature called 'View' which will intercept screen data generated by these rogues and make them obey window manipulation instructions. This function was not available at the time of our visit, so we cannot comment further on it.

Data transfer and learning

Transferring data from window to window, or more accurately from program to program, with DesQ follows the general conventions of block moves. If you've moved blocks of text around with WordStar or some other text editor then you will have no trouble.

One test we carried out was to see how DesQ would handle the interaction between Supercalc and IBM's freebie Piechart program.

First we selected Supercalc from the main menu and then typed in the name of the file we wanted to load. At this point, DesQ was really quite dormant and Supercalc was in complete control. It turned out that the file we had loaded had a number of columns of numerical data — the usual sales figures information.

Next, we called up the DesQ menu which contained the 'cut-and-paste' options. Selecting 'cut' we marked the beginning and the end of the block we wanted to transfer by placing the cursor at the relevant spots and pressing one of the select buttons on the mouse. At that point, the Supercalc window became irrelevant to what we were doing and we opened up the Piechart window (it, too, is another one of those programs which appears full screen). Selecting 'paste' from the DesQ menu, all that remained was to place the cursor within the Piechart screen and click the mouse button once.

The resultant display was of a rather good four-colour pie-chart.

By thinking of DesQ as if it were an 'expert user', it will be easier to follow the way in which the system handles data transfers. According to Myers, DesQ handles the Supercalc to Piechart transfer by 'going through all the commands that Supercalc would have to go through to do the transfer'.

If you watch the screen closely during a transfer, you can in fact see the various command strings being automatically generated and put into effect. It's similar to the automatic program loading sequences (file paths) and macro commands that you can set up with MS-DOS version 2.0. Taking, say, a dBase II file and editing it with WordStar has always been possible, so long as you go through the tedious routine of converting the dBase II file to ASCII format first.

This is really where DesQ can be of benefit. During transfers, DesQ is designed to make comparisons between the various file formats that may be involved and also designed to handle the necessary transformations. The ASCII format and the DIF, or Data Interchange Format (as developed by VisiCalc creators, Software Arts) can be dealt with by the system as a matter of course, but if problems are encountered because the formats are too dissimilar, it will 'do the best it can'.

Currently, DesQ is said to be able to handle transfers between IBM's Piechart and Supercalc, WordStar and Supercalc, WordStar and WordStar, Lotus 1-2-3 and WordStar and dBase II and WordStar. We

must assume that most of these are verifiable, if the examples we worked with are representative.

While VisiCorp has fallen behind with its 'Scripts' feature on Visi On (this is meant to allow users to set up command files that automatically carry out routine tasks), Myers explained that she felt DesQ's somewhat equivalent 'Learn' facility would be *the* big bonus to users.

Due to the limited time we had access to the IBM XT it was only possible to observe the Learn feature doing something very simple.

After opening up a WordStar window we loaded a test file and then went to the DesQ menu containing the command Learn. After selecting this option we exited the menu and returned to WordStar. The test file already contained a fair amount of text, so we decided to see if we could teach the DesQ system to insert automatically a specific set of words whenever a particular function key was pressed.

We typed in the words 'This is DesQ' and then returned to the DesQ menu to select the command 'Done', meaning that those three words were all that had to be noted. The cursor was then placed at random positions within the WordStar text and function key F5 was pushed repeatedly. With every depression, DesQ automatically inserted the words 'This is DesQ' in the document. In a spreadsheet, the same method could have been used to change a group of totals by 10%.

A more novel application of this power is when it is used to create sophisticated links and command structures between diverse software packages. Myers sees customers developing their own personal month-end reporting or accounting systems in this way, for example.

'DesQ is said to be able to handle transfers between IBM's Piechart and Supercalc, WordStar and Supercalc, WordStar and WordStar, Lotus 1-2-3 and WordStar and dBasell and WordStar.'

The future

It remains to be seen how well DesQ will perform in the business environment where all types of weird and wonderful programs lurk.

There are many, many programs on the market which are absolute failures. With these, software crashes occur in direct relationship to how important it is to the user that they don't crash. It also typically looks like the programmer's kid brother wrote the documentation on a Petite typewriter.

Surprisingly, these programs continue to be used by customers, instead of being returned immediately — and they will undoubtedly be among those products that will be installed on a DesQ system.

When asked what would happen if a user had a number of applications program windows open and there was a single software product failure, Myers responded that DesQ 'would probably crash'. If that's the case, then the fate of all the unsaved data in the memory partitions is uncertain. In order to avoid complications of this sort at an early stage in the marketing of DesQ, Quarterdeck is putting a very strong emphasis on the development of what it calls 'agents' for the 10 or 15 best-selling packages on the market.

These agents will essentially be intelligent front-end programs that allow DesQ users to bypass what may be quite complex commands by going to a special menu and making mouse or function key selections.

Conclusions

There is no doubt that the future looks quite good for DesQ so long as a few rough spots are smoothed out (there is no way to undelete files as with Lisa and Visi On, for example, although this capability can be approximated by the addition of a disk doctor type program; the Norton utilities system would do just fine).

At $395 (plus the cost of extra RAM, a hard disk, and maybe a mouse), it is certainly very competitive with a product such as Visi On.

It's not that DesQ is as sophisticated as the VisiCorp product — because it isn't; nor is the price difference that important. It really comes down to the fact that there are a lot of people already using products like VisiCalc, Multiplan, 1-2-3, WordStar, Peachtree accounting systems, and dBase II. They've paid a price, both in the financial sense and in terms of an effort to learn how to use their purchases. These users are unlikely to want to switch to the VisiCorp applications just to get the benefits of the Visi On desktop. For this reason, DesQ should be a success. END

Specifications

Product name: DesQ.
Purpose: Integrates off-the-shelf software packages.
Developed by: Quarterdeck Office Systems, Santa Monica, USA.
Price: $395
Operates on: IBM Personal Computer, Eagle, Compaq, with other MS-DOS machines being added in the future.
CP/M and Unix versions are planned.
Can be used with or without a mouse.

BENCHTEST

NEC-8201A

The Japanese company, Kyocera, was responsible for manufacturing the portable TRS-80 Model 100 to Tandy's specifications. David Tebbutt takes a look at the modifications NEC has made to the machine.

About two and a half years ago 'Kay' Nishi, a director of Microsoft and founder of the Japanese ASCII group, was flying to Tokyo. On the flight he met the president of Kyocera, a company which at that time was a leading packager of semiconductors. Nishi described his dream of a lap-sized personal computer with a full-sized keyboard, a screen large enough to display several sentences, a memory capacity of several A4 pages and the whole lot capable of being self-powered for 20 or so hours. The president was captivated to the extent that the very next day Nishi found himself describing his dream to Kyocera's other directors. To cut a long story short, Kyocera decided to go ahead and make the machine. Microsoft landed the software contract and within a year found itself presenting the product design to Tandy Corporation.

Tandy decided to take the product on board and it became available as the Model 100 last March. But Tandy wasn't the only company to spot the advantages of such a useful machine. NEC in Japan felt that, with some design changes, it too would like to sell the machine. NEC's version, the PC-8201A, is slightly larger than the Tandy although it is still smaller than an A4 ring binder. One massive advantage of the NEC machine is that it can accommodate exchangeable, self-powered RAM cartridges.

My first impressions of the PC-8201A were entirely favourable. It looks smart in its restful colours of cream, mushroom and light brown. The keyboard is full size with a nice feel and the screen is very easy on the eye with its eight lines of forty fairly large characters. My wife liked it straight away and she's never admitted to even liking a computer before. It fits on your lap and can be used with ease on trains, although you may have to tuck your arms into your sides a bit during the rush hour. I'm not sure whether I should say this, but I have even used it in the loo.

Of course, like all machines, it has provoked the odd frustration. Like the day I was late for work and couldn't find the darned thing, even with my glasses on. Like the day I tried to initialise a RAM cartridge and I zapped all my files. Right now I'm having a devil of a job trying to get it to talk to my printer. My overall impression though is that we're on the verge of something big, so to speak. It is as major a step for the industry as the introduction of the 'portable' computer a couple of years ago. I can't see Osbornes, Hyperions, Compaqs and Kaypros being called 'portable' for much longer. Transportable would seem more appropriate.

The main barrier to purchase at the moment is likely to be price. CMOS chips are used extensively and, at the moment, a 16k machine will cost you £475 plus VAT. RAM cartridges are a hefty £195 each. Perhaps NEC should consider dropping the RAM cartridge price at the earliest opportunity because they do represent a major strength of this machine. Even so I can see the machine being snapped up by people on the move. Journalists, surveyors, hospital doctors and travelling salesmen spring to mind immediately as likely customers.

Hardware

The PC-8201A is a truly portable, lap-sized computer. It is self-powered and, with alkali batteries and a 16k RAM memory, it will run for around 18 hours. It sports a full-sized, 67 key keyboard and a display of eight lines of forty characters each. Alternatively, the screen can be regarded as a matrix of 64 × 240 individually addressable points. The machine's contact with the outside world is through seven ports including RS232, Centronics, DIN cassette, and a Hewlett Packard bar code reader socket. Each of these ports has a neat, plastic cover which can be prised off with a biro. If your briefcase has as much rubbish in it as mine then I strongly recommend that you keep these covers in place. The 48 pin system slot is currently used for plug in RAM cartridges but from its name and various hints in the documentation, I suspect that this could attach to a variety of external data storage peripherals in the future.

'One massive advantage of the NEC machine is that it can accommodate exchangeable, self-powered RAM cartridges.'

The memory of the PC-8201A is all battery-backed CMOS which means that all information stored within the machine is maintained as long as power is available. In the case of a 16k RAM machine an internal nicad (nickel-cadmium batteries) will keep the memory 'alive' for 26 days with no other source of power. For a 64k machine this figure drops to seven days. The machine contains a 32k ROM containing the operating system, Basic, Text and Telcom programs plus 16k of user RAM. In fact only 12k of this is actually usable because the operating system pinches some for itself. RAM memory must be expanded by your dealer. The sockets are accessible by taking a cover off the back of the machine. Next to these RAM sockets is an additional ROM socket into which you can plug an alternative ROM. The internal memory can be expanded up to 64k and the capacity of the externl plug-in RAM is 32k. The memory is organised in 'banks', each of 32k of which two can be active at one time. Each bank can contain up to 21 separate files and banks 2 and 3 have a switch which protects their contents from being overwritten. Normally the ROM is active plus one of the RAM banks but it is possible to arrange things so that two RAM banks are active instead.

The plug-in RAM cartridge, or RAM disk as I'm sure it will become known, caused no problems. Simply plug it into the system slot and perform a 'cold boot' by pressing SHIFT, function key five and CTRL. The 'cold boot' is rather like formatting a disk — it only needs to be done the first time you use a RAM cartridge. Since this is a highly dangerous procedure in the sense that if you mess it up you can easily erase the wrong bank, make sure that all your files in memory are safely stored away on cassette before initialising a new RAM disk.

The keyboard contains all the keys you might expect (QWERTY, CTRL, ESC, TAB, etc) plus a few others which are worth mentioning. A STOP key is a neater way of halting a program than Control-C which many of us have become used to. Control-C still works if you find that you can't break the habit. The Tandy has a pause key which suspends program execution; I find that switching off the NEC has exactly the same effect. When you switch on again everything carries on from where it left off. Five function keys give access to ten user definable functions and a neat cursor control cluster is arranged in a north/south/east/west formation. Insert.

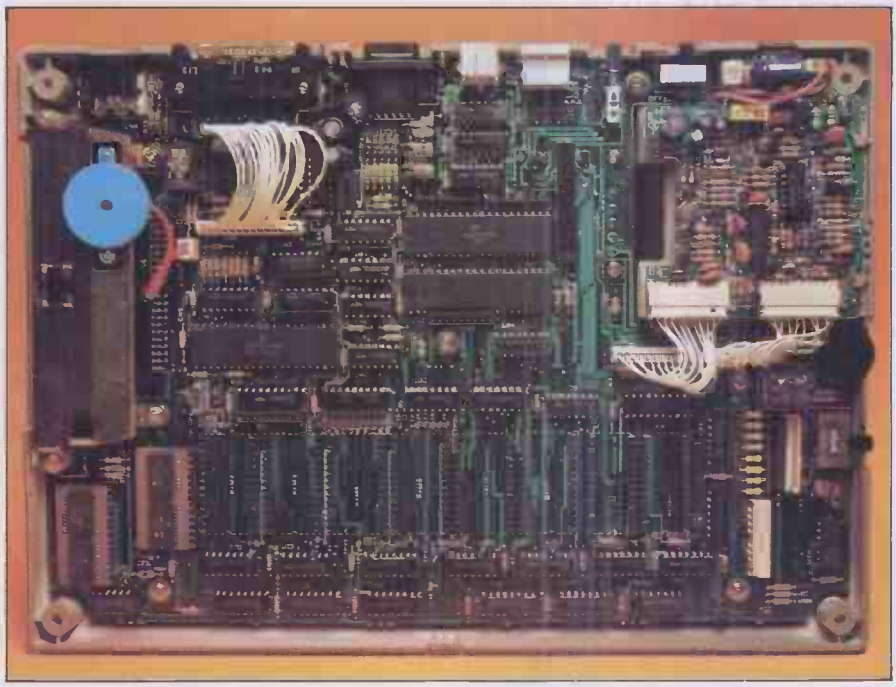
The NEC-8201A; Tandy wasn't the only company to spot the advantages of a useful machine.

delete, graphics and backspace are reasonably conventional but the PASTE key is unusual. This allows you to retrieve a previously identified piece of text and literally paste it into your current document or program listing. The graphics key gives access to 93 graphics characters, 90 of which can be defined by the user. Another 35 user-defined characters can be accessed through the CHR$ command in Basic. Like most computer keyboards these days, the keys automatically repeat if held down for more than a second. An unusual feature is that the two 'home' keys have little pimples on them to help you locate your fingers when touch-typing.

The screen is formed from a liquid crystal matrix and is fairly large; if the same character sizes were imposed on a conventional display, it would measure 15in wide. Both upper and lower case characters may be displayed. The instruction manual advises you to avoid excessive pressure on the screen which is understandable since people will be jamming these machines into briefcases. It also suggests that in extreme cold the LCD screen can freeze. I asked NEC how cold and they merely said 'very'.

I had no trouble connecting the PC-8201A (isn't it a long-winded name?) to my two cassette recorders with the supplied cable. If you use a miniature tape recorder, you will need to buy one or two adaptors to make the 3.5mm jack plugs fit the tiny sockets. Alternatively you could splash out on NEC's own cassette recorder at £58 plus VAT.

I have spent more hours than I care to remember trying to get the NEC talking to my printer through the RS232 interface. For some reason my printer, which works perfectly well with a SuperBrain, does not send the right signals out through one of its pins and this rather confuses the NEC. My solution was to remove the RS232 board from the printer and use the Centronics port which worked perfectly well. My advice to you is to ensure that your dealer gets the NEC working with your printer before you part with your money. This



The internal RAM can be expanded to 64k.

NEC-8201A

problem isn't unique to the PC-8201A, the RS232 isn't quite as standard as some people would have you believe. I also tried to get the NEC talking to my SuperBrain but that, too, was unsuccessful in that the SuperBrain could talk to it, but I didn't have time to figure out why the SuperBrain couldn't hear the NEC. Again this is not at all uncommon and due in no small measure to my ignorance of the precise details of the version of CP/M installed in the SuperBrain. We did, however, have a dramatic success talking through a modem to one of British Leyland's computers. All this implies that it is more likely to be my computer system (or me) causing problems rather than the NEC having any inherent weakness. A built-in TELCOM program allows you to vary the RS232 port configuration. Baud rate, bits per character, parity, stop bits, handshaking and half or full duplex may all be defined. More precise details are given later in the explanation of the TELCOM program.

'I can see the machine being snapped up by people on the move. Journalists, surveyors, hospital doctors and travelling salesmen spring to mind immediately as likely customers.'

The PC-8201A can be powered by four size AA batteries. On a 16k RAM system, alkaline batteries give at least 18 hours operation and standard six hours. Alternatively you can buy a rechargeable ni-cad pack from NEC which gives 5.5 hours of operation. A transformer which gives 8.5 volts DC can power the machine directly and this will also charge the NEC ni-cad pack if present. In fact it will continue charging the ni-cad pack even when the machine is switched off. Recharging takes around 48 hours and the pack can take around 500 recharges before it needs to be replaced. I prefer to use Duracell batteries which cost around 20p per hour or machine use. They save an awful lot of messing around and give at least three times the duration of the other batteries.

Incidentally, our concept of 'on' and 'off' changes with this machine. In fact we stop only the processor when the machine is switched off and the act of switching on again simply lets the processor carry on from where it left off. All the memory is maintained by an internal rechargeable backup battery which needs to be replaced by the dealer after some two and half years. If this battery were used as the main source of power, it would only give around twenty minutes operation whereas on backup it will maintain a 16k machine for up to 26 days (seven days for 64k internal RAM). Make sure you remove the RAM disk when not in use, otherwise the internal battery will be trying to keep that powered up as well. In order to maximise battery life, the machine switches off after ten minutes without a key depression. This does not apply when running a Basic program or TELCOM. This duration can be varied by a Basic command between one minute and 25.5 minutes. By now you must have guessed that the PC-8201A contains a clock which keeps track of years, months, days, hours, minutes and seconds. Two basic commands TIME$ and DATE$ give access to these values.

TEXT

This is a built-in program which gives many of the facilities of a wordprocessor. Text entry, cut-and-paste, amendment and sensible cursor controls are all provided in this easy to learn and easy to use little package. Cursor controls behave quite normally but if you use them with the shift key they move left and right a word at a time and up and down a screen at a time. TEXT always operates in 'insert' mode which means that text following the cursor

An impressive array of expansion possibilities

position is moved to the right to accommodate new entries. The delete and backspace keys delete characters under and to the left of the cursor respectively. It seems impossible to lose data accidentally on this machine since deletion is always a deliberate act. The cut-and-paste facilities are unusual in a text processor of this size. You are allowed to mark any chunk of text and then either to cut it or copy it out of the document into a 'paste buffer' from which it can be read back into a new location. The contents of this buffer may also be retrieved when any program asks for an input from the keyboard. This can save messing around with sign-on messages when communicating with another computer, for example. Simply hit the paste key and call up as long a sign-on message as you need.

TEXT can also be used to create an 'IPL' file which is executed immediately the machine is switched on. IPL stands for Initial Program Loader. This goes even further than the paste buffer mentioned just now. You can list a whole sequence of commands in a file and the PC-8201A will execute each one before passing control back to the user. Just to see what would happen, I went into TEXT and typed 'BASIC' on the first line, a short Basic program on the next few lines, the word 'RUN' and then the word 'MENU' to return to the main menu. I switched off the machine and then switched it on again and everything worked. It loaded Basic, ran the program and returned to the menu. All the machine needs now is the ability to 'wake up' at a certain time and your middle of the night transmissions to Australia could be taken care of automatically. If NEC is compiling a shopping list of additional facilities, this is one that I would recommend. After all, it does have a continuously running clock so this should be possible.

Basic programs can be written in TEXT mode or in Basic itself. In fact a nice feature of the NEC is that you can switch between the two modes when developing a program so you have the advantage of being able to test bits of the program while at the same time having access to the more powerful editing facilities of TEXT. Having said that, I should say that the Basic text editing facilities are as good as, if not better than, most Basics. One last facility is the Search command which lets you search for occurrences of a chosen sequence of characters (up to 24). You may change the text and continue searching for the same string with the Next command. Unlike some fairly sophisticated wordprocessors, the search command rightly ignores the case of the letters.

The NEC data recorder

'The PC-8201A is a truly portable, lap-sized computer. It is self-powered with alkali batteries and a 16k RAM memory.'

TELCOM

TELCOM is the in-built program which allows you to configure the RS232 port for the printer, modem, computer or whatever you have at the other end. The theory is admirable: it allows you to connect to a wide variety of machines without needing to change anything on the destination equipment. In practice I had a few problems. (See my earlier remarks.) You may alter the values of a number of variables — communication speed from 75 to 19200 baud; parity — odd, even, none or ignore; word length, six, seven or eight bits; one or two stop bits; and two types of handshaking. Most of this is likely to be complete gibberish to a layman. This is why I think it is important to ensure that your dealer makes the PC-8201A talk to your existing equipment before buying. In addition to the configuration mentioned above, you may also choose whether to operate in half- or full-duplex mode. (Full duplex expects the receiving device to retransmit received information.) An Echo facility can be used to send all data received to a printer.

Operating system

This is the part of the built-in software which allows the user to execute programs and manipulate the files. It provides the following facilities: Erase a file (Kill); Rename a file (Name); Print the contents of a file through the Centronics port (List); Save a file to cassette (Save); Load a file from cassette (Load); Switch memory banks (Bank); Create an autostart file (Set IPL); and Stop a file being an autostart (ClrIPL).

Whenever you are at the menu level of the operating system, you may load a program and its associated file simply by placing the cursor on the file name and pressing RETURN. If you put the cursor over a Basic file name, this has the effect of loading Basic, loading the file and then running the program. Alternatively, you may enter Basic more conventionally and then load the program file from within Basic itself.

Basic

As you might expect from MicroSoft, this Basic does not deviate to any significant extent from the company's standard MBasic except that it allows full screen editing which would be a welcome relief for those used to line editors. There are a couple of omissions such as WHILE . . . WEND and TRON . . . TROFF but nothing that upset me greatly except perhaps the absence of an AUTO line numbering command. By way of compensation N82 Basic, as this version is called, has a few interesting additions. One instruction allows you to OPEN the RS232 port and others enable or disable interruption from it. ON COM GOSUB passes control to a subroutine whenever such an interrupt occurs.

Other commands exist both to place and detect the position of the cursor on the screen. PSET and PRESET set screen points on and off and SCREEN dictates whether function key labels (defined using KEY) are to be displayed. This Basic even lets you find out where the print head is positioned in the print buffer which must be jolly useful when trying to work out tricky print layouts. SPACE$ lets you print a number of spaces, STRING$ lets you print a character repeatedly.

SOUND lets you program music (ugh!) from a five and a half octave range and with

notes from nought to five seconds duration. Machine language routines are now accessed from an EXEC command rather than from a CALL. And here's a mystery command — MAXFILES; it sets a constant in the operating system of the maximum number of files you will allow to be open at one time. I'm still trying to think why you'd need that one. POWER can be used to switch off the machine, to make it run continuously (not advisable if using batteries) or to set the power off timer.

One nice touch is that although the Basic has lost the AUTO line numbering, it has at least retained the RENUMber command. Variable names look impressive at up to 255 characters long. Closer inspection reveals that N82 Basic will only allow variables whose first two characters are unique. Ah well, you'll just have to take a little care.

All in all I was quite satisfied with the Basic and know that programmers with experience of MBasic or any of its dialects will have few problems with this particular implementation. I was astonished to note that all the Benchmark timings were considerably faster than on the Tandy 100.

Applications software

A cassette and a manual of application programs were supplied with the PC-8201A. All of the programs were fairly simple affairs and many of them could best be described as make-weights. I'll give a brief note on each since they are supplied free with the machine:

Memory calculator. This makes the PC-8201A act like a calculator. It gives you addition, multiplication, subtraction and division, plus the ability to accept a string of 100 calculations, and allows you to edit it. A quick and dirty Basic program or a normal calculator are probably of more use to the average owner.

Text formatter. This is designed to make output to a printer look 'pretty'. You can define page size, margins, etc. It somehow contrives to split words unnaturally, duplicate others, screw up TABs and generally make an unprofessional job of things. It is better, however, than not bothering. I understand NEC in the USA has committed to publishing a formatter which overcomes all these problems. Let's hope it turns up in the UK. Done properly, it would be a really useful facility.

Investment portfolio. This might be considered useful if it weren't for the fact that all investment details have to be entered as a series of DATA statements straight into the program. It allows you to keep track of up to 50 stocks or other investments using purchase price and current market data. Printouts or screen displays of performance are provided.

Linear forecaster. This one isn't bad. It accepts a sequence of historical data and forecasts values for future periods. Output is both numeric and in the form of very neat bar charts.

Loan evaluator. This calculates the missing variable of a loan given the other three. The four are principal, interest, repayment and period. Schedules may be displayed or printed. It's okay.

Schedule keeper. This has a built-in alarm which only goes off when this particular search for diary entries, obtain calendars for any month of the current year and generally go the long way round what is normally a fairly simple operation.

Character definition. If you need to define graphics characters then this program is fine. It gives you a large clear matrix on which to construct your character and as you go along it also displays the developing character actual size. Sets of graphics characters may be stored for future use. I liked this one.

'Basic programs can be written in TEXT mode or in Basic itself. In fact a nice feature of the NEC is that you can switch between the two modes when developing a program.'

Bank backup and file transfer between banks. If they work, I like them. I didn't actually have a go.

Bank accessor. This theoretically allows concurrent access to other banks. Since I had only half of bank 1 operational and the whole of bank 3, this could explain why it wouldn't work for me.

Terminal mode selector. To save the trouble of redefining the communications characteristics of your various devices — modem, printer, other computer, etc — this program stores a file of devices and their characteristics. Simply run it before using the RS232 port. It works and it's useful if you need to communicate regularly with several devices.

Bar code reader. I didn't have one of these so this software remains untested. The idea of running amok in my local Sainsbury's with a NEC and a bar code wand does have a certain appeal. One day perhaps.

Music program. Why do people supply music programs for machines with piezo electric beepers? It's okay for the kids I suppose but largely irrelevant. This program lets you use the keyboard like a piano keyboard. It stores and plays back musical phrases you have concocted. It's not a bad approach really.

Tank game. My 12-year-old liked this one. I've got to take his word that it's good. I still don't understand the rules.

Snake game. I liked this one. My 12-year-old son didn't, probably because he couldn't beat it. Neither could I but I did feel I got close at times.

Each program occupied between 4k and 8k of memory so I would be pretty selective about which ones, if any, you commit to one of your memory banks. It would be

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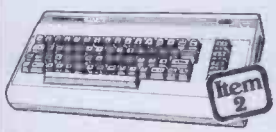

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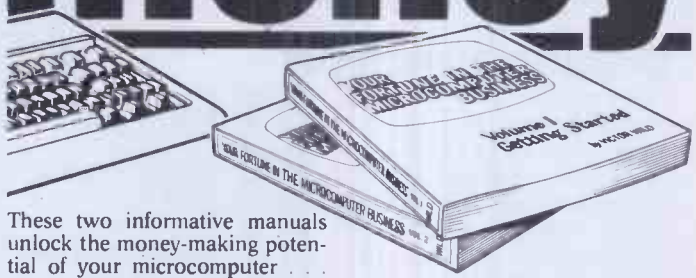

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NEC-8201A

nice to think that software authors will quickly wake up to the potential of this machine and get some independent products on the road. Sales and publicity will have to become more visible before this can happen. Apart from the formatter mentioned earlier, I don't know of any software offerings available or about to become available. If you simply want a notebook, a communicator and the ability to knock up, or get someone else to knock up, Basic programs then you're away. If you really need a spreadsheet then you're going to have to consider the vastly more expensive Grid Compass machine or wait for the relevant software to appear.

Documentation

Three manuals were provided — *User's Guide, N82 Basic Reference* and *Personal Applications Kit Guide*. Each is clear and pretty thorough except when I wanted to get down to the real detailed technical stuff. I definitely needed some sort of technical reference manual to help me figure out my RS232 connection problems. And now I come to think about it, I had to tune my tape recorder in by guesswork. The manual didn't tell what to expect to appear on the screen if things were/weren't going well. In fact the name of the program appears if all is going well. Apart from these reservations, I'd say the manuals are fine.

Prices

All prices exclude VAT.

		£
8201A	PC-8201A	475
8206A	RAM cartridge	195
8294A	Centronics cable	20
8295A-N	RS232 cable – normal	21
8295A-R	RS232 cable – reversed	21
8299A-6	6-pin Berg cable	4
8299A-8	8-pin Berg cable	4
8281A	tape recorder	58
8221A	thermal printer	85
8201-06	8k RAM chip (fitted)	59

The PC-8201A price includes a soft vinyl case, three manuals, applications cassette, batteries and cassette cable.

All items are available for delivery now.

Conclusions

Well, the Japanese certainly did the right thing by pursuing CMOS and LCD technologies through their calculator activities. This machine brings together in one superb package the results of their endeavours. I can see a lot of busy people rushing out to buy one of these portable computers. They are the first truly supplementary computers we've seen. They can be used to great effect in conjunction with existing machines if you can get them talking to each other. My feeling is that the NEC currently offers much better value for money than the competition — it costs less, sports more memory and has the undeniable advantage of the RAM disks. If you are the sort of person who needs mobile computer power then you will see your productivity take a dramatic upward leap as a result of owning a portable computer. And at today's prices that must make the NEC PC-8201A a front-runner for your money.

END

Benchmarks

BM1	2.6
BM2	6.7
BM3	17.3
BM4	17.3
BM5	18.5
BM6	30.6
BM7	46.9
BM8	9.8

All timings in seconds. An explanation of the Benchmark programs is included in this issue.

Technical specifications

CPU	80C85 (CMOS 8085), 2.5MHz
RAM	16k expandable internally to 64k 32k plug in cartridges (RAM disks)
ROM	32k expandable internally to 64k
Display	8 lines of 40 characters 64 × 240 pixels 191.2 × 50.4mm LCD
Keyboard	67 keys, including five function keys (give 10 functions) and four cursor keys. Graphics character access via GRPH key.
External storage	RAM disks (see above), Cassette (600 baud)
I/O	Centronics, RS232, Cassette, H-P Bar code, 8-pin and 6-pin Berg sockets (like the new telephone sockets)
Built-in Software	N82 basic TEXT — simple but good wordprocesor TELCOM — drives communications through the RS232 port
Applications	Calculator Print formatter Investment portfolio Linear forecaster Loan evaluator Schedule keeper Character definer Memory bank backup Inter bank file transfer Bank accessor Terminal mode accessor Bar code reader Music Tank game Snake game

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CHECK YOUR DIGITS

The problems of accurate data entry were highlighted recently by the Korean airliner tragedy: one theory entertained by investigators was that the pilot input the wrong coordinates to his navigation computer. Here Michael Grose explains how check digits play a part in our everyday lives and provides you with a Modulus 11 Check Digit Calculator to type in and run.

In the early days of automation a South African bookseller is said to have sent an order to an American publisher for one copy of a book to be delivered direct to his customer quoting order number 1819. In due course the customer was rather taken aback to find on his doorstep thirty two mailbags containing 1819 copies of the book quoting order number 1. Numeric references are convenient for data entry and processing but they have the big disadvantage that, lacking the redundancy of natural language, they are less meaningful than words to most people.

As a result some modern systems use alphabetic reference codes. A notable nursery's catalogue has, for example:

LILIUM pardalinum giganteum	LIPGIG
regale	LIREGA
tigrinum fortunei	LITFOR

where the derivation of the reference from the name is obvious, and therefore carries more meaning to everyone who has to deal with it than, for instance C208510036.

But numbers remain convenient for data entry: a calculator-style keypad is faster than a keyboard and leaves the left hand free to manipulate the input documents. The normal practice, therefore, is to add a check digit to the reference number, which will detect almost, but not quite, all mistranscriptions or miskeyings. There are many check digit schemes, but they all share the general principle of a digit by digit calculation on the base number giving a single-digit result which is appended to the original number. If a digit is altered or transposed then the result of the calculation, and hence the check digit, changes. It is thus a smaller analogue of checksum calculations on whole messages.

An illustration of the use of check digits, which can be based on published information and thus does not compromise the security of anyone's financial transactions, is the ISBN (International Standard Book Number) which is printed in practically every book these days. Its relative, the International Standard Serial Number, is carried by many magazines (but not *PCW*). This began over 15 years ago when WH Smith was planning its new computer-controlled warehouse in Swindon and required a unique identifier for every item that passed through it. At the same time some publishers were beginning to adopt various numbering schemes for their own titles to help with their own systems. In the event a trade-wide agreement on a nine-digit Standard Book Number was reached. It was to have three parts: a publisher prefix, a title number, and a check digit. The prefix and the title number were both of variable length within the overall limit of eight digits and this solved the problem that some publishers are much more prolific than others. The nineteen largest were given prefixes 00 to 19 (with HMSO taking two, 10 and 11). This allowed them up to a million titles each. The next group had three-digit prefixes, 200 to 699, with room for 100,000 titles; four-digit prefixes were 7000 to 8499, down to seven-digit prefixes from 9500000 onwards for very occasional publishers with space for only 10 titles each.

The check digit is calculated modulus 11. That is to say that each of the eight digits of the base number is given a weighting:

digit: 1 2 3 4 5 6 7 8 c/d
weight: 9 8 7 6 5 4 3 2 (1)

When each digit is multiplied by its weight the sum of the products, including the check digit, whose weight is 1, is exactly divisible by 11 in a valid number. Thus the check digit is calculated by summing the products of the eight digits of the base, dividing by 11 and subtracting the remainder, if greater than 0, from 11. This immediately leads to a problem: the check digit must be a single digit if the number is to be nine digits long, yet one in every eleven numbers will have a remainder of 1 and a check digit of 10. The answer (this was in the days before hex) was to use the letter X, the Roman numeral for 10, and this solves the problem at the cost of some inconvenience in programming, and a stretch to a different part of the keyboard for the one number in eleven that has an X.

The current ISBN scheme is an extension of this. An extra digit, weight 10, is added at the front to indicate the origin. Thus all ISBNs have 10 digits, and French ones begin with a 2, German with a 3, while Anglo-American ones now begin with a zero, the only digit which could have been added to an existing SBN without affecting its check digit.

In practice the same routine can be used both to calculate a check digit for the first time and to validate a number which already has one by comparing the result of a fresh calculation on the base number with the check digit as given. If the two do not match then there has been an error, and the ISBN scheme is said to 'detect virtually all transposition errors, and transcription errors involving the use of a completely erroneous digit. Detection of entirely random error is well above 90 per cent.' Other weights are possible and produce different results. There are of course many possible routines, but the one presented

```
10 REM [CHECK DIGITS] Version 1.0  of 27.viii.83
20 OPEN#0,0,"L": REM Set 80-column screen & clear it
30 ?:?:?:?:?:?TAB(30);"C H E C K   D I G I T S":?:?:?
40 ?"This program provides an example of how a general check digit subroutine ma
y"
50 ?"be used in a variety of check digit schemes. Enter an asterisk, '*', in pla
ce"
60 ?"of a number to reset.":?:?:?
100 INPUT("Enter 1 for ISBN type number, 2 for C20 type number, 3 to stop : ")OP
110 IF OP=1 THEN FC=1: WE$="X98765432": GOTO 150
120 IF OP=2 THEN FC=2: WE$="078463521": GOTO 150
130 IF OP=3 THEN 900
140 GOTO 100
150 INPUT("Enter 1 to assign c/d, 2 to validate number, 3 to reset : ")OP
160 IF OP<1 OR OP>3 THEN 150
170 ON OP GOTO 210,310,100
200 REM Assign check digit
210 INPUT("Enter length of Base Number (up to 9 digits) : ")N
220 IF N<1 OR N>9 THEN 210
230 WE$=RIGHT$(WE$,N)
240 ?"Enter a";N;"digit number";: INPUT("   : ")TE$: IF TE$="*" GOTO 150
250 IF LEN(TE$)<>N THEN 240
260 GOSUB 1000: IF CD$=CHR$(255) ?"Error": GOTO 240
270 ?"Number with check digit = ";TE$;CD$: GOTO 240
300 REM Validate Number with check digit
310 INPUT("Enter length of Number (up to 10 digits) : ")N
320 IF N<1 OR N>10 THEN 310
330 WE$=RIGHT$(WE$,N-1)
340 ?"Enter a";N;"digit number"; :INPUT("   : ")OP$: IF OP$="*" GOTO 150
350 IF LEN(OP$)<>N THEN 340
360 TE$=LEFT$(OP$,N-1)
370 GOSUB 1000: IF CD$=CHR$(255) ?"Non-numeric characters present": GOTO 340
380 IF CD$=RIGHT$(OP$,1) ?"Valid": GOTO 340
390 ?"Invalid. C/D for ";TE$;" is ";CD$: GOTO 340
900 END
1000 REM [CALCULATE CHECK DIGIT]
1010 IF NUM(MID$(TE$,FC)) = 0 THEN CD$ = CHR$(255): RETURN: REM Error check
1020 SU = 0
1030 FOR I = FC TO LEN(TE$)
1040      IF MID$(WE$,I,1) = "X" THEN SU = SU + VAL(MID$(TE$,I,1))*10: GOTO 1060
1050      SU = SU + VAL(MID$(WE$,I,1)) * VAL(MID$(TE$,I,1))
1060      NEXT I
1070 RE = (SU/11-INT(SU/11)) * 11: IF RE = 0 THEN CD$ = "0": RETURN
1080 CD = 11-RE: IF CD > 9 THEN CD$ = "X": RETURN
1090 CD$ = CHR$(CD+48): RETURN: REM [END CALCULATE CHECK-DIGIT]
```

here has the advantage of generality: it can be used for various modulus 11 schemes just by varying the weights.

On entry it expects:

1: the base number as a string of digits in TE$ (or Test String);

2: the weights to be applied to each digit as a second string of digits (+ × for 10) in WE$ (Weight String); and

3: the position of the first significant digit in FC (First Character). This allows for the use of an alphabetic prefix as in C208510036 quoted above. If this is done the WE$ must have a weight for each skipped character to keep the two strings in line even though they are not used in the calculation.

On exit CD$ (Check Digit String) contains the check digit, which can then either be added to the base number or compared with the existing check digit.

The internal variables are:

SU for the sum of the products,
RE for the remainder,
CD for the value of the check digit,
I as the loop counter.

The subroutine itself at 1000 to 1090 is relatively compact, but is embedded here in a program which shows how it can be used to calculate or verify a check digit using a variety of weights by varying the input to the routine alone. The Basic used is NewBrain Basic. The main incompatibilities with other dialects, apart from the punctuation of input statements, will be the optional test for non-numeric input in 1010, and the setting of an 80-column screen in the main program at 20. The screen width is not vital to the running of the program, but aesthetic considerations would suggest a rearrangement of some of the prompts if the screen were much narrower.

END

LEARNING WITH LOGO

With the increasing use of computers in education, the children of the 80s are being used to challenge the validity of conventional learning methods. The high-level computer programming language, Logo, pioneered and developed by Professor Seymour Papert, encourages children to use all their faculties to the full and to overcome the traditional animosity towards scientific subjects. Surya investigates.

Logo is well-known in the primary education field as a programming language for children, and versions of the language exist or are promised shortly for most popular home machines. Most people who are not directly involved in working with the language think of Logo as consisting solely of 'turtle graphics'. As I was to discover at the first annual conference of the British Logo User Group (BLUG), Logo has come a long way in recent months.

Background

Logo grew out of research into artificial intelligence at MIT in the 1960s. Its origins are well documented and, like Dick Olney in his Logo feature in the June issue of *PCW*, I recommend anyone with even a passing interest in the language to read Seymour Papert's book *Mindstorms: children, computers and powerful ideas.*

Logo began life as a very simple language to control the movements of a mechanical robot, christened a 'turtle' because of its size and shape. These instructions took the form 'FORWARD 10, RIGHT 90, BACKWARD 5', and so on. The sequence of instructions would move the turtle ten lengths forward, rotate it 90 degrees and then move it back five lengths. The turtle also contained a pen which could be raised and lowered under program control using the commands PEN-UP and PEN-DOWN. By placing the turtle on a large sheet of paper, it could be used to draw shapes and patterns by issuing the appropriate series of commands — in other words, by writing a Logo program.

As visual display units fell in price, 'screen turtles' became practical. Instead of using a mechanical robot to draw pictures on paper, a dot could be moved about to create pictures on the screen. This is rather more abstract than the mechanical turtle, but most children find the transition an easy one, and the screen turtle has a number of advantages.

Firstly, it doesn't require the kind of setting up that a mechanical device demands.

Secondly, attractive as robots are where children are concerned, mechanical devices are somewhat more prone to break down than electronic equipment.

Thirdly, and most importantly, the screen turtle opens up possibilities that would be difficult (multiple turtles, for example) or impossible (three-dimensional movement) using a mechanical beast. The mechanical turtle still has its place, however, as an introduction to the language and with children who find the screen turtle difficult to relate to.

In the early days, screen resolutions were low. This placed limits on what could be done with the language, but the graphics facilities of today's machines are a different matter. Sprites, particularly, offer some exciting possibilities, and this is a subject I'll return to later.

Logo has an obvious appeal to children. It operates in the 'real world': children can see and touch the turtle. To plan or debug a Logo program, children can either draw their design on paper or 'play turtle' — act out the role of the turtle themselves, moving and turning according to the instructions they are giving the turtle. The result is something concrete; some very attractive pictures and designs can be drawn using Logo. The language encourages imaginative ideas. Children are rarely deterred by the complexity of a task as easily as most adults are: they have an idea and concentrate on it until they get what they want. And, of course, Logo is a lot of fun!

Language

Logo is very much more than a picture-drawing program to amuse kids for a little while. There are very simple programs available which describe themselves as versions of Logo but offer little more than the ability to draw pretty pictures on the screen. These do a great disservice to the language.

As with any other programming language, there is a seemingly endless number of dialects from which to choose. And, as with Basic, most of the variations are pretty meaningless, and could easily have been avoided if different companies had only talked to each other before coding up their respective implementations. Commercial considerations, unfortunately, make this type of dialogue difficult. Anything which describes itself as a full implementation of Logo should, however, offer variables and arithmetic functions, repeat loops (equivalent to the Basic FOR-NEXT), conditional loops (similar to WHILE-WEND), true procedures and Lisp-style list-processing facilities. The description given below is not based on any particular implementation but simply sets out to give a taste of the language. Most of the versions being released at present appear to be broadly similar given the machine differences.

The use of variables is as per most languages. Meaningful variable names can be used, and variables can be either local or global. Arithmetic functions are written in Polish Notation. The basic expression 'LET A=B+C' would become 'MAKE 'A ADD :B :C,' for example. Forth programmers, who work in Reverse Polish Notation (see *PCW* November — 'Maths at a Pass'), will have little difficulty in adapting to Logo; for those of us who were brought up on a strictly kosher diet of Basic, however, a lot of habits have to be unlearnt.

Counter-controlled repeat loops usually take the form 'REPEAT 360 [FORWARD 1 RIGHT 1],' everything within the square brackets being repeated the specified number of times. This line of code, incidentally, draws a circle; Basic programmers take note! The Logo code is simple, short and eminently readable. Think what an equivalent piece of code would look like in your average dialect of Basic!

Conditional loops generally work in an identical fashion to WHILE-WEND, except that the WEND is usually implied by the structure of the statement rather than explicitly stated.

Atari Logo offers an additional statement 'WHEN'. This works in a similar fashion to the Basic 'ON ERROR', but can detect any given condition rather than just errors. You could, for example, have a statement 'WHEN NOT EQUALQ KEYQ 0 THEN STOP'. This statement would, in Basic, look something like 'WHEN INKEY$<>0 THEN END' and would instruct the program to stop execution as soon as a key is pressed. This allows the same conditional test to be made continually throughout a program rather than repeatedly accessing a procedure everytime you want to make the test.

Procedures may be defined at any point, and can be called recursively. The statement 'BUILD HOUSE' ('TO HOUSE' in most dialects) means that you want to build, or define, a procedure called HOUSE. You will be placed into the define mode, and can write the procedure.

Logo actively encourages 'top-down' programming, the idea behind which is that the initial problem is broken down into a number of smaller problems which are in turn broken down into smaller problems . . . until finally each component part of the problem is solved. When the component procedures are strung together, the whole problem is solved.

'As the language does not judge — nothing the child can do is labelled as "wrong" or a "mistake" — children are not afraid to experiment.'

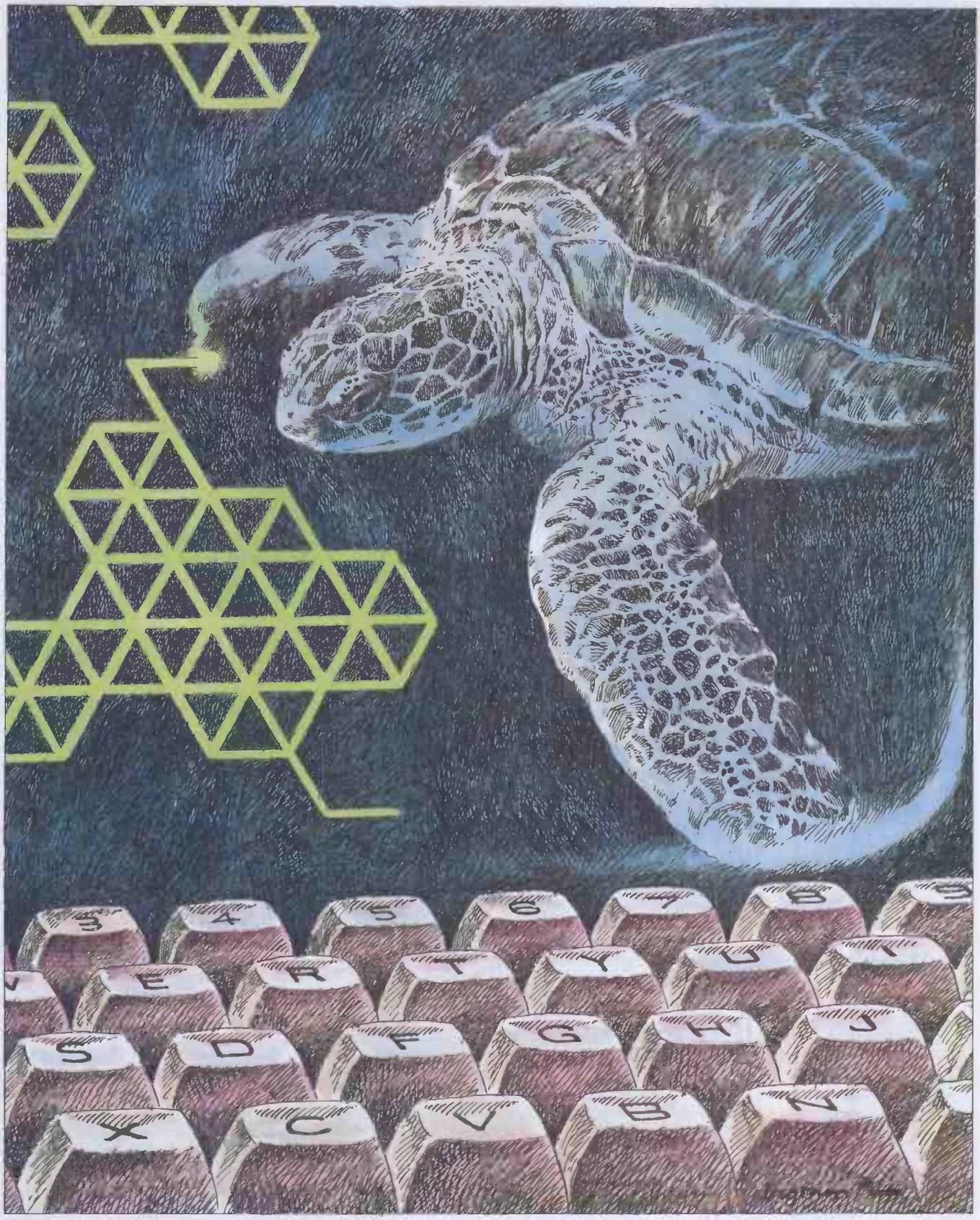


Illustration by Ingram Pinn

To take the example of a simple database, the top level procedures might look something like:-

```
DATABASE
INITIALISE-VARIABLES
OFFER-INSTRUCTIONS
PRESENT-MENU
  CREATE-NEW-FILE
  ACCESS-EXISTING-FILE
  END-PROGRAM
```

Each of these procedures is then broken down into more detail. Thus ACCESS-EXISTING-FILE might be broken down into:-

```
PRESENT-EXISTING-FILE-MENU
  SEARCH-FILE
  ADD-DATA-TO-FILE
  DELETE-DATA-FROM-FILE
  EXIT-EXISTING-FILE-
  PROCEDURE
```

and so on. Each level is logical and readable, and you only begin coding the core routines when you have worked out exactly how the program is structured.

List processing

List processing is the name given to an approach to language design. Languages which take this approach include Lisp (LISt Processing), Prolog (PROgramming in LOGic) and Logo.

List processing languages take as their

LEARNING WITH LOGO

starting point that any set of data — be it names and addresses, statistical tables, mathematical coordinates or whatever — can be represented as a list. The definition of a list, in computing terms, is a set of one or more data items. Given that computers exist for the purposes of processing sets of data, any programming application can be tackled in terms of processing lists.

A striking illustration of the power of the list processing approach to programming was given through the list processing workshop which followed the conference itself. Around thirty people, most of whom (including myself) had little or no experience of list processing, worked in groups of three to produce versions of 'Eliza' — the famous conversational program — after perhaps a couple of hours' instruction in the language. Our team's effort — a joint venture by *PCW* and *Practical Computing* (whatever that is) — was not exactly elegant, but it did work. Not only would it have been unimaginable to produce a version of Eliza in Basic after only two hours' experience of the language, but our Logo code amounted to no more than about 25 lines.

Lists are similar to Basic arrays, but are much more flexible and — since they are an integral part of the language — do not have to be dimensioned or explicitly defined. Lists can be easily and logically added to, subtracted, evaluated or recorded as required. *PCW* will be covering this subject in more detail in a future issue.

Philosophy

With the ongoing — often heated — discussions about the relative merits of different computer languages, it's fashionable to talk about a language in terms of its overall philosophy as well as its features. While any language has its own approach to problem-solving, Logo was developed with a very clear educational philosophy in mind.

This philosophy has as its basis the belief that education should take the natural curiosity of the child as its starting point. Traditional education tends to place a greater emphasis on the learning of facts than on developing true understanding. This view is, of course, an oversimplification and one which many educationalists would dispute, but we have only to look at our method for establishing the success of an individual's education — the examination — to see where our priorities lie.

To illustrate this point, Seymour told of a little experiment he had conducted at the Massachusetts Institute of Technology which has an international reputation for producing top-quality science graduates, particularly in the fields of mathematics and the physical sciences. Given a formula and some figures, they will produce an answer to the 'nth' decimal place. Yet presented with a simple exercise requiring understanding rather than rote application, a surprising number of students failed.

The exercise involved a pendulum swinging backwards and forwards. The students were asked what would happen if the rope were cut while the pendulum was in motion. A disturbing number of students stated that the pendulum would fall directly downwards. In this view, they were making the same mistake as young children often make with the old puzzle about swinging a ball around their head: if the rope were cut, in which direction would the ball fly off?

Although the students had all the technical skills involved in manipulating known formulae, they appeared to have very little understanding of the physical laws behind the formulae. Seymour argues that this is as a direct result of the way in which such laws are taught.

Taking the example of Newton's laws of motion, these are usually introduced entirely out of the blue. Although the teacher may try to demonstrate the way in which the laws of motion are applied to practical problems, the pupils do not have any concept of what a 'law of motion' is. Why should motion be governed by laws? The subject is a difficult one to grasp since (a) we have no way of physically simulating a friction-free environment, and (b) we live in a Newtonian world and take it too much for granted to take an objective view.

Logo helps us on both counts. Firstly, we can easily simulate a friction-free environment using the screen turtle, and secondly, we can use Logo to experiment with an unlimited variety of laws of motion. If pupils are introduced to these different 'microworlds' from a very young age, Newtonian motion becomes a natural progression rather than a step into the unknown. The specific laws may or may not be new to the child, but the concept of law of motion is already a part of the child's experience.

Using Logo to create both Newtonian and non-Newtonian universes is an application greatly simplified by the availability of sprites. Sprites are user-definable graphics characters which can be given a bearing, speed, start and end position and then left to take care of themselves. The micro is left to worry about how the sprite gets from A to B while the user program continues merrily on its way. Atari Logo also supports 'collision-detection' where more than one sprite appears on the screen at one time.

Where a machine has 'sprite capability', it makes sense to allow access to sprites through Logo. Both Atari and TI Logo use the machine's sprites, and other implementations are likely to simulate sprites as these become more popular.

Seymour stresses that if the learning process is to develop true understanding, it must be open-ended. That is to say, the child must be free to experiment with the environment provided by the language rather than being given set goals to achieve. It's all very well saying to a child: 'Work out how to draw an equilateral triangle', but here you are coming back to the goal-oriented approach. Saying to a child: 'Here is a computer. Here's a list of the words the computer understands' may not appear particularly constructive to traditionalists, but the child is likely to get far more from the experience because they are free to follow their own instinctive curiosity.

As the language does not judge — nothing the child can do is labelled as 'wrong' or a 'mistake' — children are not afraid to experiment. An indication of the freedom which children feel to experiment without fear of mistakes is given by a quote from a pupil using Logo: 'It's quite funny when something goes wrong.' A stark contrast to the usual situation where children will only volunteer an answer if they feel confident they have it 'right.' Pupils will happily launch themselves into complex and ambitious tasks, and if they don't achieve what they set out to do, they'll have learnt plenty along the way. This is a prime argument for the open-ended approach; children will be trying to do one thing, get sidetracked by a new discovery which then leads them onto something else, and so on. The original aim may be quickly forgotten, but the fascination and learning process continues.

Logo reflects an age-old truth which educational psychologists have only recently discovered, or at least acted on. Children — like adults — learn more quickly and deeply when they are enjoying themselves. A child who is busily drawing a Christmas tree or a map of Europe (and I haven't just made up these examples) will discover all kinds of things about geometry, Logo and mathematics that they would have found uninteresting if presented in a traditional form.

It is not easy to bring this kind of philosophy into schools. Even in primary schools, the pressure of examinations — distinct though it may be — is evident in all kinds of subtle forms. Deborah Booth, a middle school teacher and member of a pilot scheme investigating the use of Logo in schools, talked of the pressures on teachers to 'show results'. One of the implications of using Logo in an open-ended way is that the pupils may not commit anything to paper. Deborah described the situation she found herself in during the early use of Logo, where her class didn't write down anything, but committed their procedures either to disk or to memory. The only tangible output she had to show her Head were great sheets of half-completed drawings which their owners wouldn't allow anyone to touch, fold or roll until they were completed! This does illustrate the appeal which Logo holds for children: primary children very rarely guard their work with such jealousy!

Deborah Booth described the difficulty she had in deciding how much help and information to give her class. When did supplying necessary information become directive teaching? In the end, she pinpointed three situations where she felt that the teacher should intervene. These are as follows:

(i) Where a child asks 'how . . .?'

By the time a child is asking 'How do I

make it do this?' it has already worked out what it wants to do and merely needs technical information. A typical example is where a pupil realises that it is merely representing the same instruction or sequence of instructions two or more times and asks the teacher 'How do I tell it to do this twice?' It is then appropriate for the teacher to explain about REPEAT loops.

(2) To introduce new ideas.

This is a more difficult area. The example which Deborah used was of a shape composed of three overlapping triangles. She suggested that her class try to draw the shape in the hope that they would realize that it could be drawn very easily using three triangles. This was, in fact, spotted.

The difficulty comes in deciding when the children are ready for a particular idea. New concepts should never be forced, since the child may lose interest unless they can see the relevance of the idea to whatever they are working on at the time. On the other hand, someone may be held back through the lack of a straightforward concept. Like so many areas in teaching, much of this comes down to commonsense and good judgment on the part of the teacher.

(3) To present a challenge.

If a child is easily meeting set tasks, some kind of stimulus may be needed in order to move on. In this situation, the teacher may offer the child a challenge such as 'How do you think a spiral would be drawn?' Here it is important not to present the challenge as an assignment which the child must complete, but simply as an idea which the child may like to think about. Presenting new ideas like this will very often lead children off into trains of thought of their own which integrate the new idea with other things on which they are already working.

Two other points which arose for Deborah were: Should children work together in groups, and — if so — should the groups be of the same or mixed ability?

On the first point, she decided that small groups were the best arrangement. This was partly for purely practical reasons — it gave each pupil more time on the computer — but also to facilitate group discussion. Any programmer, professional or hobbyist, knows the value of a second pair of eyes when it comes to sorting out a particularly tricky problem. Programming in general and Logo in particular are as much about thinking laterally as logically, and it is for this reason that working in groups is so valuable.

Group discussions were spontaneous and urgent. Any primary school teacher will tell you how difficult it is to start artificially a group discussion. This is indicative of another of the benefits of Logo; that it teaches covertly as well as overtly. Besides learning about programming and problem-solving, pupils also learn how to put across a point of view, keyboard skills and many other peripheral activities. In fact, given the current interest in 'life skills', the social aspect of Logo is probably of as much value as its more academic angle.

'This philosophy has as its basis the belief that education should take the natural curiosity of the child as its starting point.'

On the second point, and to my surprise, Deborah decided to place children in groups of roughly similar ability, bearing in mind that ability in using Logo may not be related to ability in other areas. I say 'to my surprise' since I had always seen Logo as being used in mixed groups decided by the children. This has the advantage that faster children will help slower ones, and also allows for the fact that an apparently slow child may surprise with sudden insights.

In practice, Deborah found that in mixed-ability groups, the slower children got left behind as the faster ones shot off to follow their latest weird and wonderful inspiration.

Initially, Deborah had been setting up the system ready for use before the class arrived. She decided at an early stage that this was a mistake since it retained an aura of mystique around the computer. It was either all set up and running Logo or it was switched off in a corner. Once they had had the setting up procedure written down for them, the class of children was perfectly capable of switching on and booting up Logo itself. The children handled the disks with almost absurd care, in the full knowledge that it contained their valuable procedures.

Not everybody agrees with the open-ended use of the language. The 'Edinburgh school', members of the Logo project at the Artificial Intelligence department of Edinburgh University, tend to present Logo in a more traditional fashion with workbooks and specific projects for pupils to tackle. At present, it seems that this approach may win through in British schools. I will be disappointed if this turns out to be the case, since I feel that the structured approach limits creativity and does the language a great injustice. Time will tell.

The future

Perhaps the main reason that I wanted to attend the Logo conference was to get an idea of the directions in which Logo is now heading. Although a devoted convert (as you've probably gathered by now!), I did wonder whether the language could continue to grow and develop. I was pleasantly surprised, firstly, by the complexity of list processing facilities offered, secondly, by the possibilities opened up by sprites, and thirdly, by Professor Seymour Papert's talk on likely future developments.

Seymour's main proposition was that Logo is simply a general control language. Logo is intended to manipulate what he describes as 'microworlds'. Microworlds include mechanical — and screen — turtles and sprites, but can include an infinite variety of other environments. The 'dyna-turtle' — is one, using a Logo buggy to read bar-codes which are then turned into musical notes (!) is another. Logo is limited only by our imagination!

Seymour feels that, although it is interesting to see more and more powerful versions of the language develop, it is in the development of new microworlds that the future of Logo lies.

A prediction I will make is that right now one or more companies are working on a micro supporting Logo as the standard high-level language in ROM. We're already seeing implementations of Logo on some high-powered machines including Waterloo Logo and Dr Logo for the IBM PC. Given that everybody agrees that Basic's days are numbered ('Communications' page, stand by!), it seems a natural development for Logo to step in to fill at least part of the gap.

Seymour talked about part of the appeal of Logo being in 'learning as a subversive activity'. If children feel they are not being given the whole story, their desire to learn about it is very much greater. He illustrated this point with a lovely anecdote about a group of first-graders in an American school.

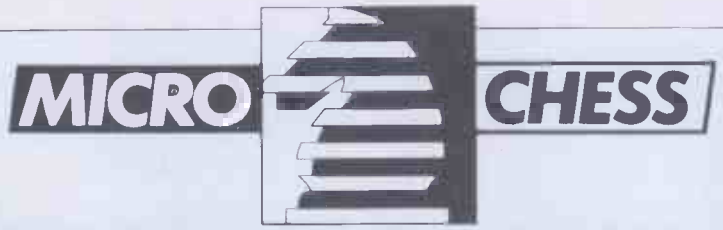
The teachers in this particular school had got together and decided that compass bearings were too complicated for first-graders and should not be introduced until later. Accordingly, they only told their class about the commands forward, backward, left and right.

This worked fine, until the first-graders noticed that teachers and older pupils would draw lines of varying angles by inserting various numbers into their programs. They didn't know what these numbers were, but they did realize that they were not supposed to know about them. In consequence, a number of *sorties* were organised to interrogate third-formers about the mysterious numbers.

Amid much confusion and whispered discussions, an excited first-grader finally hit upon the solution! The numbers were a code for directions! All they had to do was to crack the code. The entire class spent a month working on cracking this code, all without the teachers knowing anything about it. Eventually, they had it pretty-much worked out and were able to use the 'code' in their own programs!

To quote Seymour Papert: 'People often accuse me of over-estimating the ability of children to understand. That is not so. Children are capable of far more than I ever imagine.'

For details of future British Logo User Group events, copies of the BLUG *newsletter or membership details, please contact Pam Valley at the address below.* BLUG *welcomes new members, whatever their interest in Logo, be they educationalists, hobbyists or people working in the micro industry. The address for enquiries is: Pam Valley,* BLUG, *26 Tithby Road, Bingham, Notts NG13 8GN.*



CHESS TOURNAMENT

Tony Harrington presents an analysis of play at the PCW *4th European Microcomputer Chess Tournament.*

No writs were issued. There were no acrimonious exchanges and a good time was had by all. The 1983 *PCW* 4th European Chess Tournament proved once more that computer chess tournaments, even with commercial suppliers involved, can be great. The Tournament was a nine round Swiss event, held as part of the *PCW* Show from 28 Sepember to 2 October at the Barbican, London. For those of you who don't know what a Swiss tournament entails, it is a clever arrangement which ensures that if you keep winning, the going gets harder round by round. If you lose, and keep losing, it gets easier and easier to win a game. Play was at the rate of three minutes a move, and unfinished games were adjudicated after five hours play.

If ever there was a tournament that asked a lot of its participants, this was it. The Barbican Exhibition Halls have their power shut off at 7pm, so to complete two rounds a day play had to start at 8.30am every morning. A very long day for all concerned.

Fortunately, five hours play turned out to be quite sufficient and very few games had to be adjudicated. Dr John Nunn, Britain's leading grandmaster, took charge of this department, so there were no disputes about the adjudicator's verdict!

There is always something fascinating about the first round of a Swiss tournament. Nobody, or in this case, no machine, has yet disgraced itself, no blunders have been committed, no brilliancies executed. That relentless separation of the best from the worst still lies ahead.

The rough plan for the first round pairings adopted by Peter Morrish, who controlled the pairings for each round, was to divide the field into groups of four, based largely on guesswork as to the likely playing strengths of the various programs. Machines in the top group were then drawn randomly against machines in the lowest group and the middle groups were paired off against each other.

We started the first round with twelve programs present out of an expected fourteen. SciSys had hoped to have a working prototype of its Superchess from Hong Kong in time for the Tournament, but various things intervened and a phone call halfway through the first round made it clear that it would not be entering.

This should have left an odd number for the first round draw, but Artic Computing had got itself into a muddle and thought that the Tournament began on Thursday instead of Wednesday. Since play started at 8.30am, when Artic's stand at the show, in common with nearly all the exhibitors stands, was bare of a living soul, the problem of odd numbers didn't make itself felt till the second round. Fortunately, since the second round started at 2pm when all the exhibitors were at their stands, we were able to tell Artic that it had missed the first round and had better look sharpish if it didn't intend to miss the next.

The presence of Artic, however, made the odd number of entrants a problem. Rather than give one of the programs a bye each round, we looked for a 'default' machine. The distributors of both Novag and Conchess had display stands in the Tournament area so there was no shortage of an extra machine to be coaxed in with the promise of a free entry.

Novag was already in the Tournament with Constellation, and Conchess had decided not to enter because its latest openings book cartridge was not yet available. But Intelligent Software had a very interesting new auto-response board on display on the Novag stand, called Chess 2001.

A modified version of this program was already in the Tournament, running on a Sirius computer in the 'home computer' category. How would the unmodified program, running on the machine it was designed to serve, perform? David Levy leapt at the chance of having yet another of his 'offspring' in the Tournament and Chess 2001 accordingly came in to even up the numbers.

The line up of programs at the start of the Tournament (or at least, by the start of the second round) was as follows:
Advance 3·0, by David Wilson and Mike Johnson (amateur), running on a bit-slice machine; Colossus, by Martin Bryant (amateur), running on an Apple; Caesar, by John Lowe (amateur), running on a Tandy Radioshack; Chessnut 2, by Geoff Bulmer (amateur), running on a modified Acorn; Merlin X, by Jeff Rollason (amateur), running on a Nascom 2; Albatross, by Mike Parker (amateur), running on a Nascom 1; Mephisto Experimental (commercial); Constellation, by Novag (commercial); Chess 2001 (commercial); Spectrum Chess II, by Artic Computing (home computer), Spectrum; Cyrus I.S. Chess, by Sinclair Research/ Intelligent Software (home computer), Spectrum; Cyrus Dragon, by Dragon Data/Intelligent Software (home computer), Dragon; White Knight 11, by BBC Publications/Martin Bryant, BBC; Cyrus 2·5, by Intelligent Software, Sirius with Z80 card.

The draw for the first round looked unlikely to produce anything dramatic. Many of the machines present were unknown quantities, and the clashes everyone wanted to see were scheduled for later rounds. The pairings were as follows:

Draw and results for Round One

(1)	Advance 3·0	vs
(1)	Colossus	vs
(0)	Caesar	vs
(1)	Cyrus 2·5	vs
(1)	Albatross	vs
(1)	White Knight 11	vs
	Cyrus I.S. Chess	(0)
	Mephisto Experimental	(0)
	Constellation	(1)
	Merlin X	(0)
	Cyrus Dragon	(0)
	Chessnut 2	(0)

(½) bye awarded to Spectrum Chess and Chess 2001.

The game that, on paper, looked as if it would be the most interesting was that played by the Mephisto Experimental. This machine has had a great deal of work put into it in an attempt to move away from brute force analysis into more selective, 'intuitive' evaluations. Unfortunately, as this first round and the rest of the Tournament showed, there are still a few bugs to be ironed out.

Martin Bryant's Colossus is a successor to his White Knight Mk.10 program which won the prize for the second best amateur program in last year's Tournament. So it could be expected to put up a good struggle. On the day, though, it began with what can only be described as extreme caution. The opening moves were:

1 Nc3 d5
2 e3 Nf6
3 d4 Bg4
4 Be2 BxB
5 KNxB Nc6
6 O-O e6

As these first few moves made plain, this was not going to be a memorable game. White began with all the aggressive enthusiasm of a dumpling, and Black's reaction was somewhat mindless. The full game score will appear in the games section at a later date. Suffice it to say here that although the postion livened up a little, Mephisto lost is way in a relatively simple position and threw away the game.

The game between Novag and John Lowe's program, Caesar, was a Guioco Piano in which Caesar, as White, gave up the customary pawn for superior piece play that never happened. An ill-advised romp after pawns by the White King in the end

game turned out to be suicidal and the Constellation found itself with an easy win. Advance 3·0 was always going to be too strong for the Spectrum version of Cyrus.

Draw and results for Round Two

(1)	(0)	White Knight	vs
(1)	(1)	Constellation	vs
(1)	(0)	Albatross	vs
(½)	(1)	Chess 2001	vs
(0)	(1)	Mephisto	vs
(0)	(1)	Merlin	vs
(0)	(1)	Cyrus I.S. Chess	vs

Advance 3.0	(1)	(1)
Colossus	(1)	(0)
Cyrus 2.5	(1)	(1)
Spectrum Chess	(½)	(0)
Caesar	(0)	(0)
Cyrus Dragon	(0)	(0)
Chessnut	(0)	(0)

(The cumulative score achieved so far is the first bracketed number. The second is the result of that match.)

Mephisto and Constellation found themselves playing the other's opponent of the morning. Both won reasonably convincingly. Advance 3.0, pitted once again against a home computer program, found the going pleasant enough.

This round saw the first game by Chess 2001, drawn against Artic's Spectrum Chess II. You can see the full game, with annotations by John Nunn in the games section next month. The Spectrum program seemed to take the maxim that the king is a fighting piece a little too much to heart in this game. The thing that amused the spectators though, in Nunn's standing-room only demonstration of the game during the Show, was the way Chess 2001 appeared to realise that Black had gone into self destruct.

It had been trying to win through on the queenside when the Black monarch began its lone advance. It promptly stopped all operations and shuffled its king and rook about while it awaited developments. 'At this point white seems to have decided that it need do absolutely nothing since black is doing it all for him,' Nunn remarked.

Draw and results for Round Three

(2)	(0)	Advance 3.0	vs
(2)	(½)	Cyrus 2.5	vs
(1)	(0)	Merlin X	vs
(1)	(½)	Colossus	vs
(1)	(1)	Cyrus I.S.	vs
(0)	(0)	Chessnut	vs
(0)	(0)	Cyrus Dragon	vs

Constellation	(2)	(1)
Chess 2001	(1½)	(½)
Mephisto	(1)	(1)
White Knight	(1)	(½)
Albatross	(1)	(0)
Caesar	(0)	(1)
Spectrum Chess	(½)	(1)

Mike Parker's program, Albatross, which finished the Tournament with one and a half points — much to its author's delight — turned out to be vulnerable to spectators. Someone took a flashlight photo rather too close to it and the Nascom 1, on which the Albatross was running, promptly had a seizure. This prompted cries of 'Don't shoot the Albatross' for the next seven rounds whenever anyone with a camera appeared on the scene.

The real shock of this round, however, was the loss — the only one it suffered during the Tournament — of Advance 3.0 to the Constellation. Again, this will appear in a later games section.

Draw and results for Round Four

(3)	(0)	Constellation	vs
(2)	(0)	Chess 2001	vs
(2)	(½)	Mephisto	vs
(1½)	(½)	Spectrum Chess	vs
(1)	(½)	Caesar	vs
(1)	(0)	Albatross	vs
(0)	(0)	Chessnut	vs

Cyrus 2.5	(2½)	(1)
Advance 3.0	(2)	(1)
Cyrus I.S.	(2)	(½)
White Knight	(1½)	(½)
Colossus	(1½)	(0)
Merlin X	(1)	(1)
Cyrus Dragon	(0)	(1)

A glance at the progressive scores will show that Cyrus Dragon is falling behind its stable-mates. The reason is that in the 8k allocated to the program, there was no space to build a proper time control function, so it either played too quickly or lost on time. The program itself, for those of you with Dragons, plays a reasonable game when it doesn't have to worry about time.

Draw and results for the Fifth Round

(3)	(1)	Advance 3.0	vs
(2½)	(1)	Cyrus I.S.	vs
(2)	(1)	White Knight	vs
(2)	(0)	Spectrum Chess	vs
(2)	(0)	Merlin	vs
(1)	(0)	Cyrus Dragon	vs
(0)	(½)	Chessnut	vs

Cyrus 2.5	(3½)	(0)
Constellation	(3)	(0)
Mephisto	(2½)	(0)
Caesar	(2)	(1)
Chess 2001	(2)	(1)
Colossus	(1½)	(1)
Albatross	(1)	(½)

One of the best games of the Tournament occurred in this round, between Advance and Cyrus 2.5. It is given in full with annotations by John Nunn in the games section.

The home computer programs had a surprisingly successful run against the dedicated chess machines this time, with both the Cyrus Spectrum and the BBC Micro programs beating Constellation and Mephisto. By the end of the Tournament Constellation and Chess 2001 emerged as significantly stronger than the home computer programs. For the Mephisto, we will have to wait and see. The word from Germany was that the bugs would be sorted out before the Budapest World Championships in mid-October. (By the time this goes to print, of course, this event will already have been played.) We intend to have a full report on the Budapest Tournament in a later column.

Draw and results for Round Six

(3)	(0)	Caesar	vs
(3½)	(½)	Cyrus 2.5	vs
(3)	(1)	Constellation	vs
(2½)	(0)	Colossus	vs
(2)	(1)	Spectrum Chess	vs
(2½)	(1)	Mephisto	vs
(2)	(1)	Merlin	vs

Advance	(4)	(1)
Cyrus I.S.	(3½)	(½)
White Knight	(3)	(0)
Chess 2001	(3)	(1)
Albatross	(1½)	(0)
Cyrus Dragon	(1)	(0)
Chessnut	(½)	(0)

Between players, one might suspect a 'fix' in the smooth, grandmasterly repetition of position draw that Cyrus 2.5 and Cyrus I.S. Chess seemed to agree between themselves. But machines are not supposed to behave like that. White Knight had managed to beat Mephisto in the previous round, but having lost to one home computer already, Constellation knuckled down and outplayed the Beeb completely, mating it in 26 moves (again, this game will be in a later games section).

Draw and results for Round Seven

(5)	(½)	Advance 3.0	vs
(4)	(1)	Chess 2001	vs
(4)	(½)	Cyrus 2.5	vs
(4)	(0)	Cyrus I.S.	vs
(1)	(½)	Cyrus Dragon	vs
(½)	(0)	Chessnut	vs
(1½)	(0)	Albatross	vs

Mephisto	(3½)	(½)
Constellation	(4)	(0)
Spectrum Chess	(3)	(½)
Merlin	(3)	(1)
White Knight	(3)	(½)
Colossus	(2½)	(1)
Caesar	(3)	(1)

Despite an indifferent overall result, Mephisto did very well in this game to hold onto Advance and get the half point. (It did well the following round as well to get a half point against Chess 2001, which was rapidly emerging as the commercial machine to beat.)

The clash between the Novag Constellation and Chess 2001 proved very interesting. One game doesn't settle anything, and there was only half a point between the two machines at the end of the Tournament, but on this game at least, Chess 2001 seems to have the edge. It won a pawn in a complex version of the Closed Sicilian (where White plays 2 Nb1-c3 and omits P-q4) and never let go after that. This was another good game and will be given in full at a later stage.

Draw and Results for Round Eight

(4)	(0)	Merlin	vs
(4)	(½)	Mephisto	vs
(4)	(1)	Caesar	vs
(3½)	(½)	Colossus	vs
(4)	(1)	Constellation	vs
(3½)	(1)	Spectrum Chess	vs
(3½)	(1)	White Knight	vs

Advance 3.0	(5½)	(1)
Chess 2001	(5)	(½)
Cyrus 2.5	(4½)	(0)
Cyrus I.S.	(4)	(½)
Cyrus Dragon	(1½)	(0)
Chessnut 2	(½)	(0)
Albatross	(½)	(0)

Most of the wins in this round were fairly predictable. Advance ensured that it would at least share first prize by seeing off

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CHESS TOURNAMENT

Jeff Rollason's Merlin. The Mephisto achieved yet another creditable draw and should be worth watching once Hegner and Glazer sort it out. And so we go to the last round.

Draw and Results for Round Nine

(6½)	(1) Advance 3	vs
(5½)	(1) Chess 2001	vs
(4½)	(0) Mephisto	vs
(4½)	(1) White Knight	vs
(1½)	(½) Cyrus Dragon	vs
(1½)	(0) Albatross	vs
(½)	(0) Chessnut	vs

Spectrum Chess	(4½)	(0)
Caesar	(5)	(0)
Constellation	(5)	(1)
Merlin	(4)	(0)
Cyrus I.S.	(4½)	(½)
Colossus	(4)	(1)
Cyrus 2.5	(4½)	(1)

And so it was settled. The draw some of us had been waiting for, Novag against Mephisto, finally happened, to the discomfort of Mephisto. And the draw that Richard Turner of Artic had wanted, against the rival Spectrum program Cyrus I.S. Chess, didn't.

The final overall placings table and score is shown in Fig 1.

Program Name	Round									Place
	1	2	3	4	5	6	7	8	9	
Advance 3.0	1	2	2	3	4	5	5½	6½	7½	1st
Chess 2001	½	1½	2	2	3	4	5	5½	6½	2nd
Constellation	1	2	3	3	3	4	4	5	6	3rd
Cyrus 2.5	1	2	2½	3½	3½	4	4½	4½	5½	4th
White Knight	1	1	1½	2	3	3	3½	4½	5½	4th
Cyrus I.S.	0	1	2	2½	3½	4	4	4½	5	6th
Colossus	1	1	1½	1½	2½	2½	3½	4	5	6th
Caesar	0	0	1	2	3	3	4	5	5	6th
Mephisto Exp.	0	1	2	2½	2½	3½	4	4½	4½	9th
Spectrum Chess	½	½	1½	2	2	3	3½	4½	4½	9th
Merlin X	0	1	1	2	2	3	4	4	4	11th
Cyrus Dragon	0	0	0	1	1	1	1½	1½	2	12th
Albatross	1	1	1	1	1½	1½	1½	1½	1½	13th
Chessnut	0	0	0	0	½	½	½	½	½	14th

Fig 1

There were three categories in the Tournament, and prizes were given for each. Dave Wilson and Mike Johnson's Advance 3.0 won the best amateur trophy plus a cash prize of £150. Best commercial entry was Chess 2001 and the trophy for best home computer program was shared by the BBC's White Knight II and Intelligent Software's Cyrus 2.5. The cash prize of £50 for the second highest placed amateur was shared by John Lowe's Caesar and Martin Bryant for Colossus.

And that, as they say, is that. The winning game is given here, annotated by Dr John Nunn. There will, eventually, be a full Tournament booklet on sale, and several of the games will appear in the games section in future columns. Our thanks once again to all who helped make the Tournament possible, and to the many *PCW* readers who came along as spectators. If you have any queries or comments, don't hesitate to write to me at Micro Chess.

We would like to thank Gould Electronics, of Wrexham, for supplying the power smoothing equipment. Without these the computers would have had a very hard time getting through even one round. I tried to play a friendly game against the Sargon 3.5 program without using one of these devices and the machine fell over three times in the space of one short game. Once we plugged it into the power smoothing box there was no further trouble. I shudder to think what the Tournament would have been like without Gould's little gadgets. (Let me hasten to add that the Sargon 3.5 program was 'visiting' the Tournament and was not a participant.)

We also owe a vote of thanks to the London firm Count Down Clocks, whose computer chess clocks counted out a couple of machines during the event, and kept perfect time for everyone.

As all who heard will testify, the game demonstrations given by Dr John Nunn at 3pm every day were hugely successful. There was never a spare seat in the lecture area as Dr Nunn, with wit and precision, distributed praise and blame. The chess programmers learned perhaps even more than the audience from his talks — though he brought the colour to their cheeks on more than one occasion while demonstrating some crushing error or another made by their brainchildren.

Finally, our Tournament director and assistant director Stewart Reuben and Peter Morrish made sure that everything ran sweetly from start to finish. To them, too, our thanks.

Games section

White: Advance 3.0. Black: Cyrus 2.5. French Defence: Notes by John Nunn.

The Tournament winner was particularly effective in complex tactical positions and unlike many of the other programs it was ready to sacrifice when necessary.

1	e2-e4	e7-e6
2	d2-d4	d7-d5
3	Nb1-c3	Bf8-b4
4	e4-e5	c7-c5
5	a2-a3	Bb4xc3+
6	b2xc3	Ng8-e7
7	Qd1-g4	0-0
8	Ng1-f3	Qd8-c7

(This doesn't fit in with Black's early kingside castling and it would have been better to play 8 . . . Qd8-a5 or 8 . . . Nb8-c6.)

9	Ke1-d1	

(White meets the threat of 9 . . . c5xd4, but at the high cost of depriving himself of the right to castle. White should have ignored the threat by 9 Bf1-d3 when 9 . . . c5xd4 10 c3xd4 Qc7-c3+ 11 Ke1-e2 Qc3a1 loses the queen to 12 Bc1-h6 and the alternative 9 . . . c5-c4 provokes White to sacrifice by 10 Bd3xh7+! Kg8xh7 11 Qg4-h5+ Kh7-g8 12 Nf3-g5 (threat Qh5-h7 mate) Rf8-d8 13 Qh5xf7+ Kg8-h8 14 h2-h4! and the advance of the h-pawn leads to a decisive attack.)

9	. . .	c5xd4
10	c3xd4	Bc8-d7
11	Bf1-d3	

(White threatens to sacrifice on h7 much as in the previous note.)

11	. . .	Bd7-a4

(The counter attack on c2 prevents the sacrifice.)

12	Ra1-b1	Rf8-c8
13	Nf3-e1	

(White's error at move 9 has given Black strong pressure down the c-file, so that for the moment White is on the defensive.)

13	. . .	g7-g6

(It is inadvisable to advance voluntarily the pawns in front of one's own king since this creates weaknesses in the pawn shield. Here, for example, the squares f6 and h6 become accessible to White's pieces, so Black should have simply continued developing by 13 . . . Nb8-d7.)

14	Rb1-b4	Qc7-c6
15	Qg4-g5	

(Computers like one-move threats, but in many situations this proves a handicap. Black is forced to play . . . Rc8-c7, but this move actually proves useful to Black since it frees c8 for the other rook to step up the c-file attack.)

15	. . .	Rc8-c
16	Qg5-f4	Nb8-d7
17	Bc1-d2	Ra8-c8
18	Rb4-b2	Nd7-b6
19	Bd2-a5!	

(A good move in a difficult situation. Black's knight was threatening to move to c4, but now this would lose material to Bd3xc4 followed by Ba5xc7.

19	. . .	Ne7-f5

(Up to this point Black has conducted the attack accurately, but now begins to lose the thread of the game. The knight move to f5 is a complete waste of time because White can drive it back whenever he chooses by g2-g4. 19 . . . Rc7-d7 unpinning the knight, followed by . . . Nb6-c4, would have given White serious problems.)

20	Kd1-c1	Kg8-h8?

(This is a real horror. Despite the advances which have been made in computer chess, time-wasting to-and-fro moves are all too common, especially with the king.)

21	h2-h4	Kh8-g8
22	h4-h5	

(Thanks to the two free tempi White has developed a dangerous kingside attack.)

	. . .	Rc8-f8
23	Ba5xb6	a7xb6
24	g2-g4	Nf5-e7

GOTO page 175

BENCHTEST

C/WP CORTEX

More than a conventional 8-bit business micro, the Cortex from C/WP boasts two processors and complementary graphics software. Peter Bright decided the machine warranted a closer look.

The low profile units save valuable desk space.

It is strange how different people can have the same idea at the same time. For example, both of the machines that I am currently testing are made by firms that started out by selling other companies' machinery and then deciding to launch computers of their own. The similarity ends here though. Tycom (Benchtested next month) went on the whole way and designed and made its own machine, while C/WP took the easy way out and stuck its own badge on someone else's machine.

Priced at £1695 plus VAT the C/WP Cortex appears to be yet another sub-£2000, 8-bit business computer. However, it does have some very interesting features which warrant closer examination. As well as having a Z80 main processor, the Cortex has a second dedicated processor which is just used to control the display. This means that it is able to plot graphs and charts much faster than conventional 8-bit machines. When this is combined with Digital Research's new GSS-Graph graphics software, the Cortex begins to look very interesting.

The C/WP Cortex is actually made in the USA by Ontel. C/WP then ships it over and markets it under its own name. This is a very good idea from C/WP's point of view

'As well as having a Z80 main processor, the Cortex has a second dedicated processor which is just used to control the display. This means that it is able to plot graphs and charts much faster than conventional 8-bit machines.'

Keyboard is a direct IBM imitation; note the LED in the caps lock key.

because it means that the company can have its own branded computer without having to shell out the millions of pounds that it now takes to get a new microcomputer off the ground.

Hardware

When the Cortex first arrived in the office I was sure that there were some boxes missing. Normally when a business machine arrives for Benchtesting you need three men and a large dog to carry all the boxes. Not so with the Cortex. The main unit, keyboard and manuals arrived in one box and the disk drives arrived in another. Once I had unpacked the machine the reason for the lack of bulk became obvious: the main unit contains the processor board, power supply and video display but it is only the size of an average monitor. The only outward signs that there may be more than just a display inside the casing are the jack plug socket for the keyboard at the front and the four I/O ports at the rear. These ports consist of one RS232 comms port, one Centronics printer port, one hard disk port and one floppy disk port.

The casings on the main unit and the keyboard are made out of preformed plastic while the disk drive casing is made of metal. The Cortex is available in a range of 'tasteful' colours including warm red, C/WP green, sunshine yellow, ice white and all black. I was quite disappointed when mine turned out to be boring cream.

Setting up the machine proved to be very easy as all you have to do is plug in the disk drives and the keyboard, plug in the mains lead and switch on. The only problem was trying to decide which port to connect the floppy disks to as the ports were not marked. However, this information is contained in the installation manual. There were no further problems.

Top to bottom: floppy disk connector, hard disk controller, Centronics and RS232 ports.

Inside

One of the main selling points of the Cortex is that it is very quick and easy to maintain. In order to gain access to the main PCB, it is necessary to remove four screws and take off the front panel surrounding the screen. Once the front panel has been removed you can see the main PCB lying flat at the bottom of the case below the TV tube. If the PCB needs to be replaced it is simply pulled out and the new one slotted in. Should the engineer need to get at the power supply board or the video board he has to remove four more screws and the main cover. It is then very easy to replace any faulty parts.

The main board on the Cortex houses two processors: a Z80A running at 4MHz as the main processor and a 6502 to handle the screen and the graphics. Total on-board memory comes to 112k. This is made up of 8k ROM and 104k RAM. The RAM is divided between the two processors: 64k for the Z80A and 40k for the 6502. Of the RAM used by the 6502 for video control, 24k is used for the bit-mapped screen display and the remaining 16k is used for graphics routines which are downloaded from ROM. The rest of the board is made up of normal TTL chips. There were,

'The keyboard is a direct copy of the IBM PC keyboard having 83 keys divided up into three functional areas.'

however, quite a few patches on the PCB indicating some last minute changes to the board.

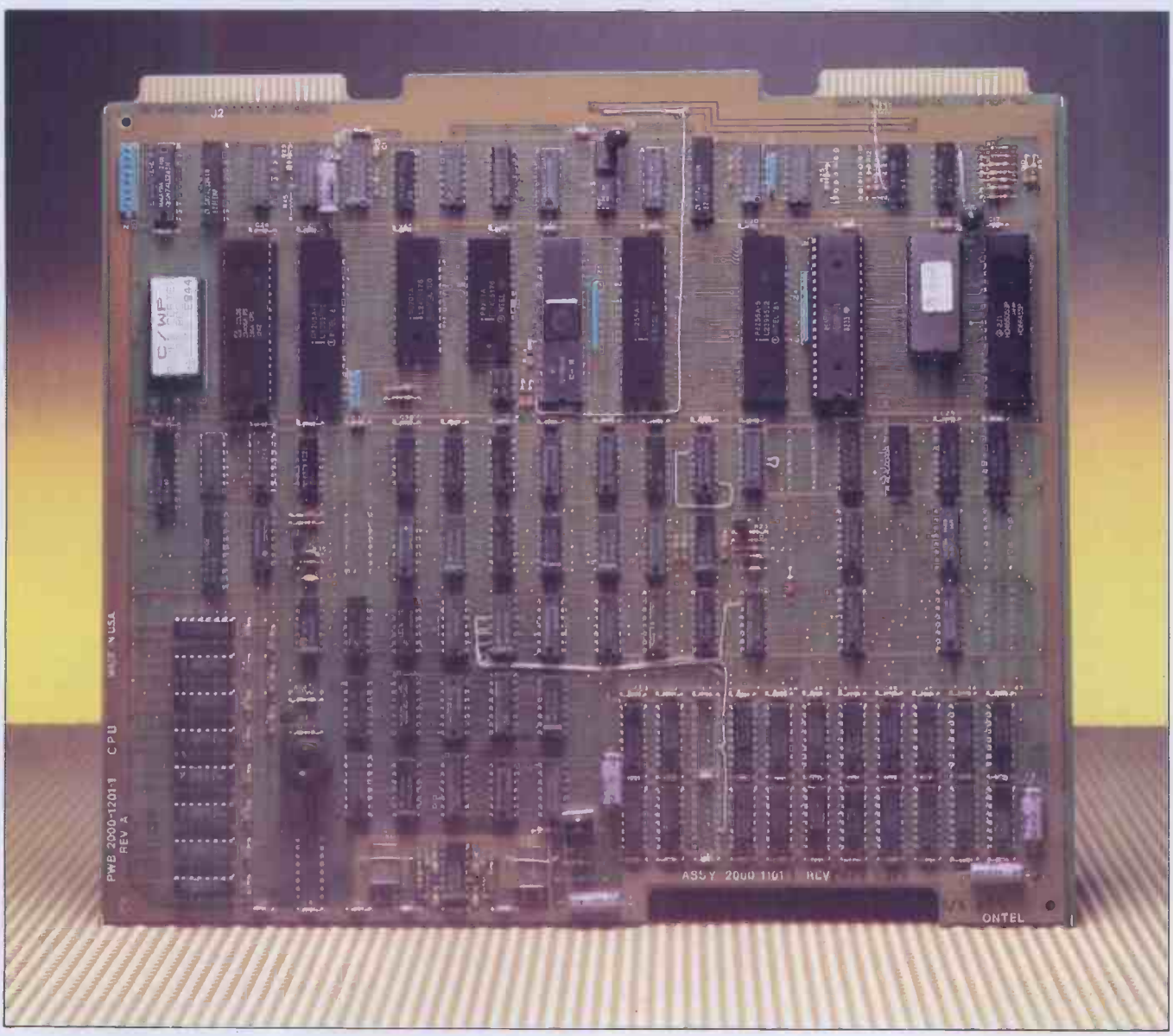
One interesting point is that there is no reset button as such; a cold boot is achieved by pressing the shift, control and escape keys simultaneously while a warm boot is achieved by pressing the control and escape keys together.

Disks

The disk drives can be supplied in a number of different formats. These are Shugart 200k, single-sided, or 400k/800k, double-sided Canon drives. The review machine was supplied with 400k/800k 5¼in drives. The disk control software allows these drives to read or write either double-sided, double-density, 40 track disks (400k) or double-sided, quad-density, 80 track disks (800k). It is possible to tell whether the drives are reading 400k or 800k disks by looking at the colour of the LEDs on the disk drive doors. If the LED is green it is reading a 400k disk and if the LED is red it is reading a 800k disk. Very cunning. It is also possible to plug in 8in floppy disk drives and read standard IBM format 8in files. Hard disk options range from three to 20 megabytes. When a hard disk is used, CP/M is re-configured so that the floppy disk drive numbers are changed from A and B to fit on top of the hard disk volume numbers. For example, if the hard disk uses volumes A to D then the floppies will be E and F.

Keyboard

The keyboard is connected to the main unit by a coiled telephone style cable and a jack plug. The keyboard is a direct copy of the IBM PC keyboard having 83 keys divided up into three functional areas. On the extreme left of the keyboard is a group of ten programmable function keys. To its right is the main qwerty keyboard and to its right the numeric keypad which doubles as the cursor control pad. I have always liked the IBM keyboard so it follows that I would like this one as well. It doesn't have the positive feel of the IBM, but it does have LEDs built into the caps lock and numeric lock keys which the IBM does not have. Whenever a key is pressed the built-in speaker in the main unit bleeps. This is fine if you like bleeps but I could find no way of switching it off so I had to get used to it. All of the keys autorepeat after they have been held down for more than a second. One glaring error is that the keyboard on the Cortex is American. This means that it is not possible to print a pound sign. C/WP says that this will be put right soon but as far as I am concerned it should have been right in the first place. This is what you get for buying an American machine.



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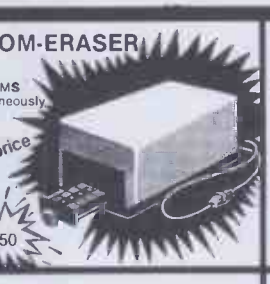

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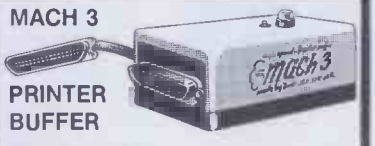

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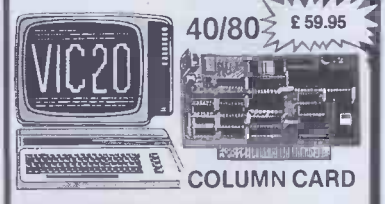

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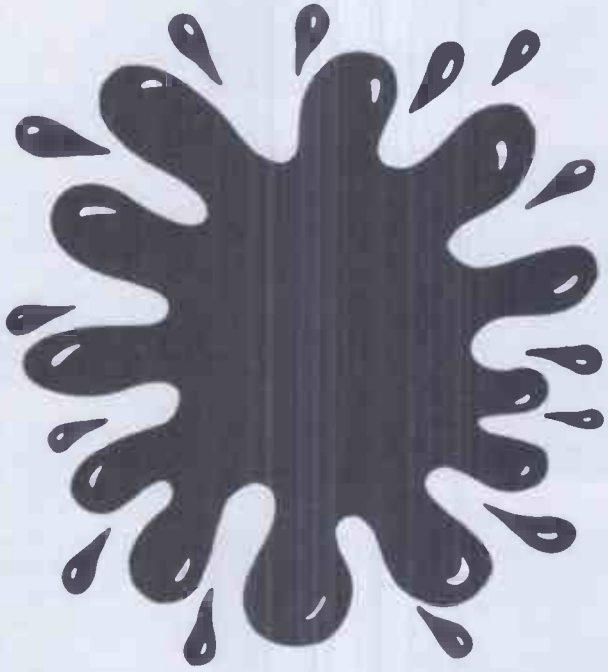

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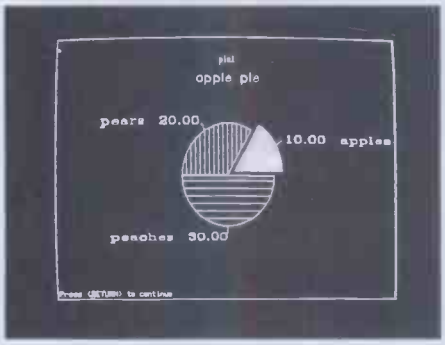
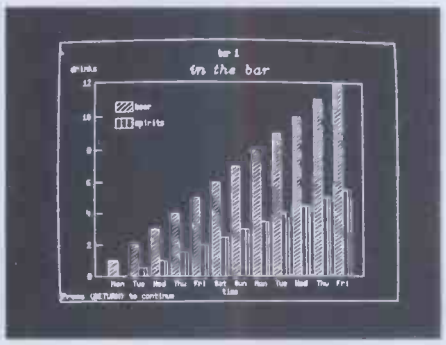
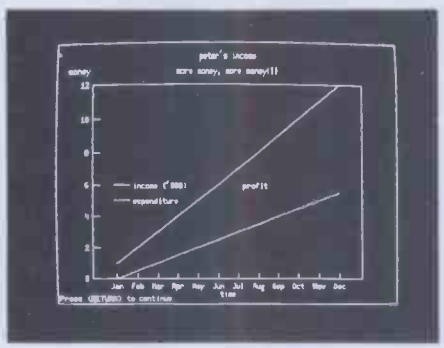


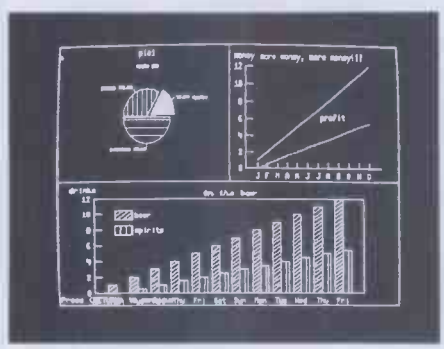
GSS Graph allows pie charts.



Bar charts.



Graphs.



Combination of charts.

Screen

The display has a resolution of 80 characters × 25 lines or 640 × 300 pixels. The display is very sharp and the line drawing and plotting are predictably fast due to the dedicated screen processor. The only control is for brightness with no provision for contrast. One gripe is that it is not possible to vary the angle of the display. This is fine so long as the angle happens to be right for you but I found that my neck started to ache after I had been looking at the screen for a long time.

Applications Software

GSS-Graph: For the princely sum of £275 Cortex owners can buy the new Digital Research GSS-Graph package. With this package you can draw pie charts, bar charts, line graphs, scatter graphs; in fact you can create so many graphs and charts that this package should keep you amused for hours.

The version of GSS-Graph supplied with the review machine was a pre-production copy which still had a few minor bugs in it. Another problem was that no user manual was supplied. It is a testimony to the quality of the package that I was able to use it without any help from the (non-existent) manual. It is a very comprehensive package: the total size of the programs is very nearly 256k. This is broken down into 23 different programs and overlays so that only a small portion of the total package is in RAM at any one time.

When the program is first loaded the main copyright banner is displayed showing that the software was actually written by a firm called Graphic Software Systems Inc. After much whirring of the disk drives, the main menu is displayed. This gives eight options including saving and recalling graphs from disk, creating a new graph, printing a graph or creating multiple graphs on one display. Assuming that you wish to create a new graph, you go on to choose from line graphs, two types of bar charts, that is, charts, step, stick or scatter graphs. It is also possible to have a text only screen if you want to use the fancy printing options.

Entry of data for the various types of charts and graphs can be specified from the Data Selection Menu. This gives the options of keyboard entry, data taken from a Supercalc type model, data from a VisiCalc type model, or the use of existing data. The existing data option means that it is possible to create different types of graph from the same data without having to re-type all of the entries. Neither I, nor the staff at C/WP, could persuade the package to read data from either a Supercalc model or from a VisiCalc model. This could have been because there was no manual or because of a bug in the early copies of the package. Either way this very useful feature should be working by the time that it is generally available.

Assuming that you wish to enter data directly from the keyboard, you will then go into the main edit screen. This screen varies in structure according to the type of chart that you are constructing. If you are creating a pie chart you are taken to the main pie edit screen. Here you can enter a title and subtitle for the chart and the names and values of the different slices of the pie. The maximum of slices that can be used is 16.

After you have entered the names and values it is necessary to specify the colour and type of cross hatching to be used for each slice. Without the manual I can't say how many types of filling or colour are possible, but the colour specification number and the fill specification number are both two digit so I assume that up to 99 different colours and fills are available.

All of the titles and labels can be displayed in a variety of typestyles and sizes by entering new attribute numbers in the editing menu. The relative size and position of the slices of the pie can be determined by either their absolute value or as a percentage of the total value of the pie. They can also be sorted into ascending or descending order. Finally, it is possible to draw a border around the chart in a variety of widths and colours.

The other types of graph are created in much the same way as the pie chart. The main difference is that the data is entered onto a different screen. Up to five separate curves are allowed with up to 75 data elements in each curve. Again titles and legends can be entered and printed in various fonts and sizes. Axes can be either numeric or periodic with automatic scaling.

When you have created a large number of graphs and charts, you may wish to combine some of them into one consolidated display. This is quite possible by using the multiple graphics option. Using this you can combine from two to four different graphs or charts with any one of five screen layouts to produce a single consolidated screen. This can then be saved to disk and recalled in the normal way. The only problem that I encountered when using this option was that when the machine reduces the size of the graphs which are to be combined, some of the legends become unreadable. This can be overcome by enlarging the legends on the original graph.

Hard copy or your new masterpieces can be obtained by using option 5 on the main menu. Output can either be to the screen, a plotter or to a printer. I tested this option using the office Epson MX80 printer and the results were very good. I did not get a

'Entry of data can be specified from the Data Selection Menu. This gives the options of keyboard entry, data taken from a Supercalc type model, data from a VisiCalc type model, or the use of existing data.'

chance to try a plotter.

WordStar: Included with the software for the review machine was C/WP's own version of the WordStar wordprocessing package. On booting up, WordStar can be selected from the main menu; it then loads in the normal way and you are greeted by the opening file menu. The first major change is that WordStar is automatically logged onto drive B. This saves the user the trouble of having to change the logged disk. Another major change is that C/WP has either removed or altered many of the help screens. As an old WordStar user, I do not like the changes that they have made to the help screens. I liked them the way they used to be.

All of the function keys have been configured as have the cursor control keys and all the editing keys. The function keys can perform 30 different operations. This is done by using various combinations of the shift and control keys. The only problem with this is that the only way to find out which keys need pressing is to look at the chart which is provided by C/WP. This is very small and difficult to read in a hurry. It would have been better to have printed the functions on the key tops. Having said that, it is still a better arrangement than having to remember all of the WordStar control sequences.

Another niggle with WordStar is that the cursor tends to get lost in the descenders of letters such as 'g' and 'p'. This is because the cursor takes the form of an arrow underneath the letters to be altered, so when it is under a letter with a true descender it tends to get lost.

Technical specifications

CPU	Z80A running at 4MHz as main processor, 6502 as dedicated screen controller
RAM	104k, 64k for Z80, 40k for 6502
ROM	8k
Display	25 lines × 80 chars
Keyboard	83 keys IBM style
Disks	200k or 400/800k floppies, 3-20 megabyte hard disks
I/O	RS232 Comms, Centronics printer, hard disk controller, floppy disk controller.
Systems Software	C/WP version of CP/M-80
Languages	Microsoft MBasic
Applications	GSS-Graph, C/WP WordStar, dBase II

Systems Software

The Cortex runs CP/M-80 version 2.2. However, C/WP has made a large number of changes in order to try to make it more friendly. The most obvious change is that when the machine is switched on and booted up it goes straight into a menu system rather than descending into CP/M. The main menu has two options: WordStar (dealt with above) and system utilities.

When the utilities option is selected a second menu is displayed showing the available programs. These started off as standard C/WP. The first four options give an extended directory of the contents of disks A to C. Unlike the normal CP/M DIR command it shows all the files present on the disk along with their sizes. Also shown is the disk size and the amount of free space remaining.

The next option shows the logical device assignments and has the same effect as CP/M's STAT DEV:. The third option lumps together the disk format/duplicate utilities. When this is selected a third menu is displayed giving the options of formatting the disk in drive B, copying the system tracks, duplicating disk A and a call to PIP. The format option can format either 200k, 400k, 800k or 8in disks. SYSGEN is just a customised version of CP/M's BOOT-COPY and DISKDUPE is a modified DCOPY. I only had one problem when using these utilities. That was when I tried to copy the distribution programs which were on 400k disks to an 800k disk in drive B. DISKDUPE would not work with the different formats so I had to use PIP.

The other major area where C/WP has made CP/M more friendly is when disk errors occur. When this happens you no longer get the dreaded BDOS ERROR ON A: message. Now the machine will reply with a message such as: Read Error on B: Code 5, Disk not inserted or door open. It then allows you to try again, examine the error or control C to re-boot the disk.

During this Benchtest I have only seen a BDOS message once and that was when I asked the machine to display the error. These changes have made CP/M more friendly but it still has some of the old annoying faults, like having to do a control C every time that you change a disk which is something that I always forget to do.

Other Systems Software

Other packages supplied with the Cortex for review included dBase II, Microsoft's MBasic and Multiplan. These have all been reviewed at length in other issues so I don't propose to go into them here except to say that the Benchmark timings for MBasic are very creditable for a 8-bit machine.

Documentation

The Cortex came with three manuals: an installation manual and user guide, a provisional WordStar manual and a technical manual. The installation manual contains all the standard information about unpacking and setting up the machine. The WordStar manual has been completely rewritten by C/WP. This starts off by telling the user how to switch on the machine and boot up the system and then taking him through the C/WP menu system and into WordStar. I was quite impressed by this manual: it was easy to follow and even went into details such as how to hold the diskettes when inserting them into the drives. I think that C/WP has made a genuine attempt to be as friendly as possible.

The only disadvantage with this type of approach is that while it is very good at leading you through the system for the first time, it is not so easy to look up just one piece of information which may be buried in the middle of the text. A good index would be helpful here. C/WP did not supply any kind of CP/M guide with the Cortex.

Benchmarks

BM1	1·2
BM2	3·6
BM3	9·9
BM4	9·7
BM5	10·5
BM6	18·7
BM7	29·6
BM8	51·3
Average	16·8

All timings in seconds. An explanation and listing of the Benchmark programs is included in this issue.

Prices

	£ (plus VAT)
Entry level system:	
Cortex plus twin 200k drives plus maintenance	1695
800k drives	extra 300
5 megabyte hard disk plus 800k disk	extra 1100
C/WP WordStar	extra 100
dBase II	extra 200
GSS-Graph	extra 275

Conclusions

At first sight the Cortex is just another 8-bit, 64k machine. However, the fact that it is not state-of-the-art is no bad thing. It is well made and relatively fast for an 8-bit system. If you are into graphics then this could be the machine for you. C/WP's pricing policy has pitched the Cortex at the very competitive sub-£2000 market. I have my doubts as to whether it is competitive at its entry level price of £1695 plus VAT. There are a great many cheap, 8-bit machines with bundled software in this price range. Looking at the adverts for the Cortex, I was under the impression that it included WordStar in the price. This is not the case so you will need to add the price of the software to the hardware. END

MUSIC MICRO, PLEASE

Synthetic music can both imitate conventional instruments and create unheard-of sounds. In the first of two articles, Simon Tait explains how synthetic sounds are produced.

Many microcomputers can produce sounds, varying from uninspired beeps and burps to fulsome fantasias. When the full power of a microprocessor is applied to sound generation, the result can be impressive — so how is it all done?

To answer that question let's take a look at what sound itself really is.

The analysis of sound

What we hear as sound is a variation of pressure-waves produced in the air by vibrating or moving objects. In a violin, for instance, vibrations set up in strings produce sound, and when we speak our glottis vibrates and these vibrations are passed in to the air.

An electronic synthesiser produces an electrical signal which, eventually, sets up vibrations in the cone of a loudspeaker, generating sound.

One of the most important principles of synthesis is that any repeating waveform can be broken down into series of pure sinewaves, each of different frequency (number of cycles per second), phase (relationship in time) and amplitude (strength).

Graphs may be drawn of the amplitudes of such frequency components, or 'Partials', against their frequency. Such a graph is called a frequency spectrum.

Fig 1 shows the frequency spectrum of a violin tone (or note) at a particular point in time.

If the waveform truly repeats then all the frequency components will be multiples of a basic frequency called the fundamental. In this case we can call these partials harmonics. The quality or 'timbre' of musical tones depends almost entirely on the amplitude of partials and not significantly on phase.

Musical instruments

Instruments such as the piano, guitar and violin family have vibrating strings to produce the basic sound. When simple strings are secured at both ends, they can only vibrate in a distinct set of 'modes'.

Fig 2 shows the first few modes, each excited separately on the same string. Any oscillation of these strings will be made up of contributions from the various modes.

Now, every mode will have a different frequency associated with it so that

wavelength = length of string *2/mode number

frequency = velocity of propagation/ wavelength

Each of these frequencies has a harmonic relationship connecting it to the lowest frequency which is the fundamental.

Instruments like the woodwind and brass families depend on a vibrating column of air to produce sound. Like a string, a simple column of air can only oscillate in a distinct set of modes with corresponding harmonic partials.

The spectrum of the tone produced by a real instrument is more complicated than this simple analysis reveals. The relationships between partials and the fundamental are not always exactly harmonic, and sometimes harmonic type components don't really exist. For instance, the vibrations of violin strings are complicated by the bow which nearly always touches the string.

For each instrument the character of the sound is shaped by the way that the vibrations are started, and by the body of the instrument which changes the relative amplitudes of the harmonics.

Even for a particular instrument relative amplitudes will change as oscillations build up and decay.

During the initial phase of a note the frequency of partials will vary most, becoming more or less constant as time goes on. Variation in the frequency of a partial often takes the form of cyclic deviations above and below a particular value. This is called vibrato.

Cyclic variation called tremelo is also frequent in the amplitude of partials.

Synthesisers

Analogue: Analogue synthesisers work on the principle that an electric voltage can be used to represent a sound waveform. Analogue electronic circuit modules such as oscillators, filters and modulators combine in an analogue synthesiser giving a complex system which can successfully imitate musical sounds.

Musicians have found the analogue synthesiser very useful as a versatile system that may be easily realised in analogue electronics. The versatility of the modern synthesiser is due to the concept of voltage control. Every module in the system accepts its inputs and produces its outputs in the form of a voltage.

So the outputs of any module may, within limits, be used as the input of any other module.

The analogue synthesiser uses subtractive synthesis — first creating a waveform rich in harmonics, then filtering the waveform to get something close to the required frequency spectrum.

Waveforms are generated by one or more voltage controlled oscillators (VCOs) which accept a control voltage and produce a waveform of frequency proportional to that voltage.

The keyboard of the synthesiser usually provides the control voltage for the VCO. A number of waveforms are useful and relatively easy to produce. These are shown in Fig 3 with their corresponding frequency spectra.

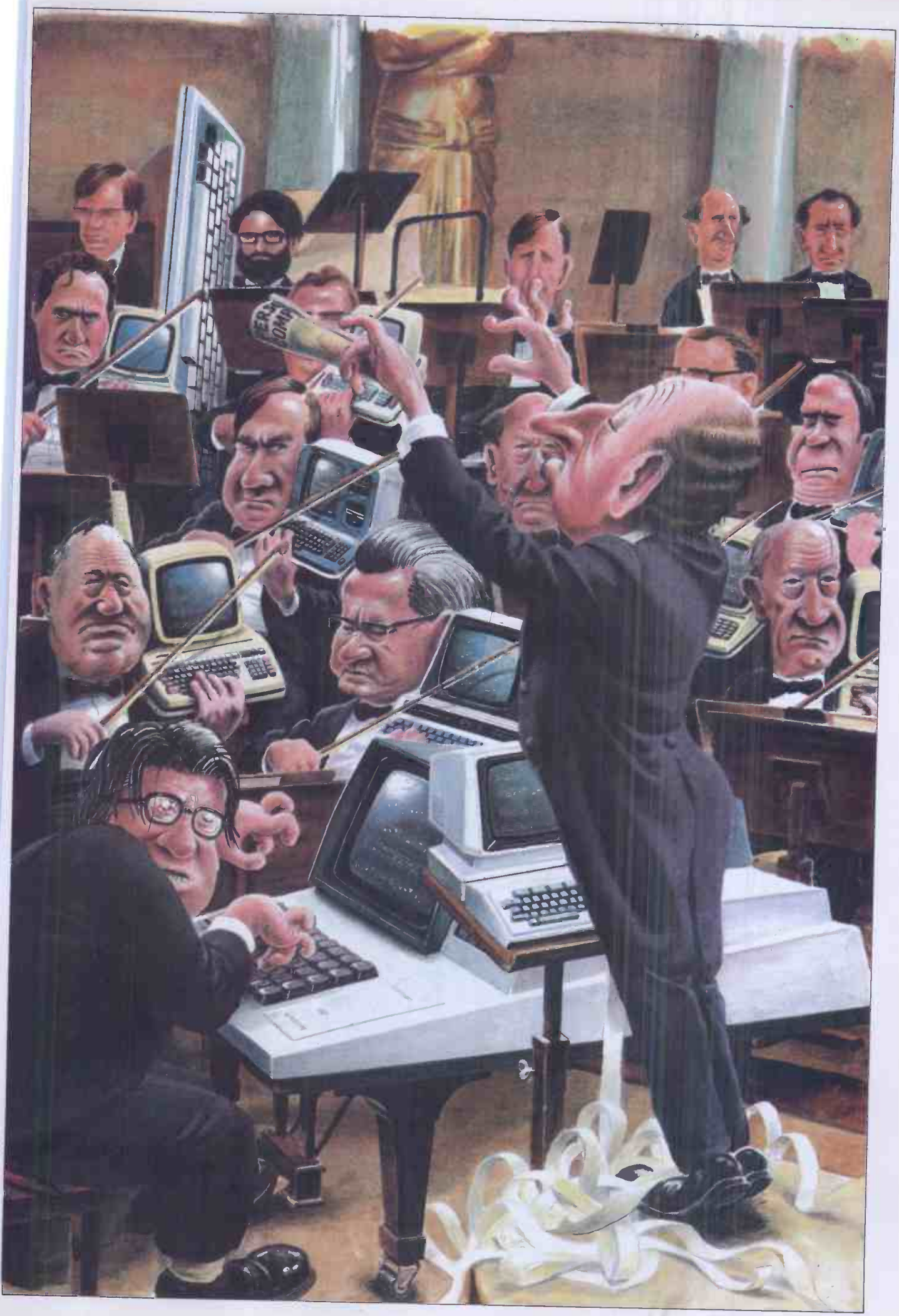
Another waveform often provided is 'white' noise, which gives a random or pseudo-random voltage output. The noise waveform will have randomly varying frequency components throughout the audio frequency range. This is useful in synthesising the initial portions of the sound of musical instruments, and for imitating a range of sounds from surf breaking on the shore to explosions.

Filters are used to modify the frequency spectrum of the waveforms produced by the VCOs and noise generators. If these are also voltage-controlled, it is possible to vary the frequency spectrum with time. A number of different filters may be provided; some typical filter characteristics are shown in Fig 4.

If the voltage generated by the keyboard is used to control the filter, the frequency response may be shifted up and down the frequency spectrum with the oscillator. In this case the correct relationships between the amplitudes of harmonics may be preserved, regardless of which note is being played.

The overall volume or envelope of a waveform can be tailored using a voltage controlled amplifier (VCA) driven by an envelope shaper. The envelope shaper can be programmed by the user. Fig 5 shows a waveform generally used and the parameters which can be adjusted. The envelope shaper is triggered every time a key is pressed.

The 'attack' phase of the waveform determines how the sound builds up initially; the steeper the rise in volume the more percussive the sound. The sound of a piano note has a very steep attack because



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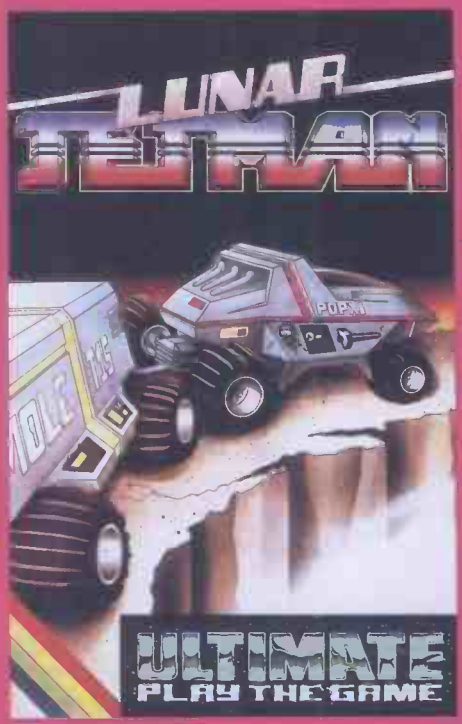

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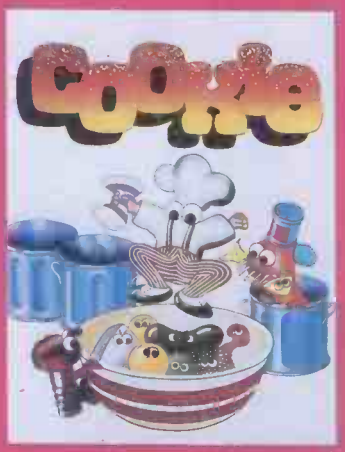

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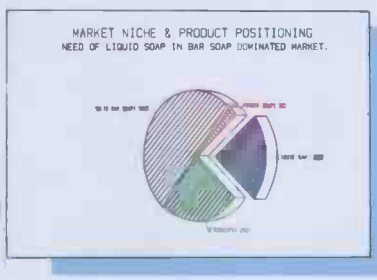

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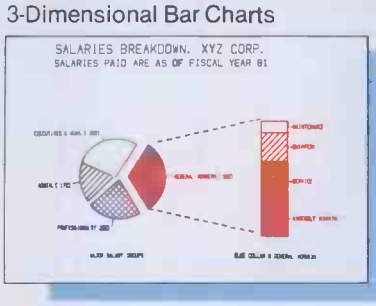

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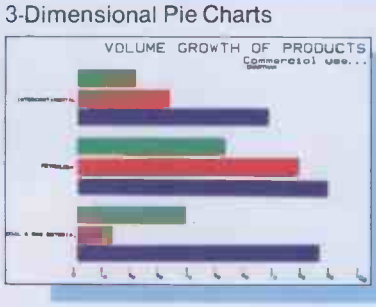

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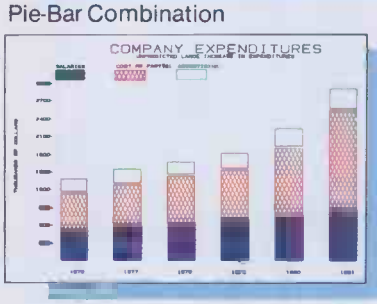

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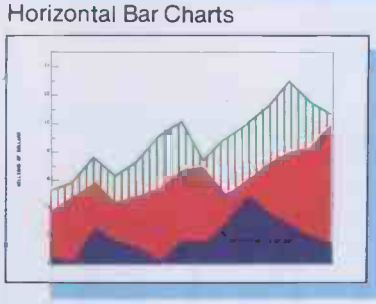

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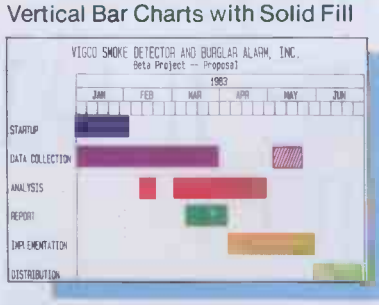

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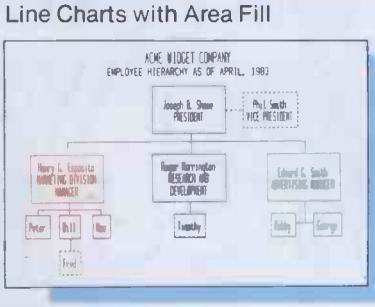

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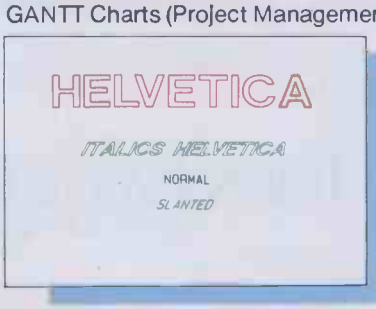

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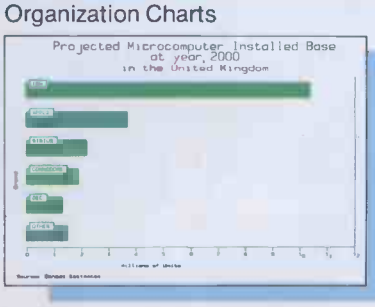

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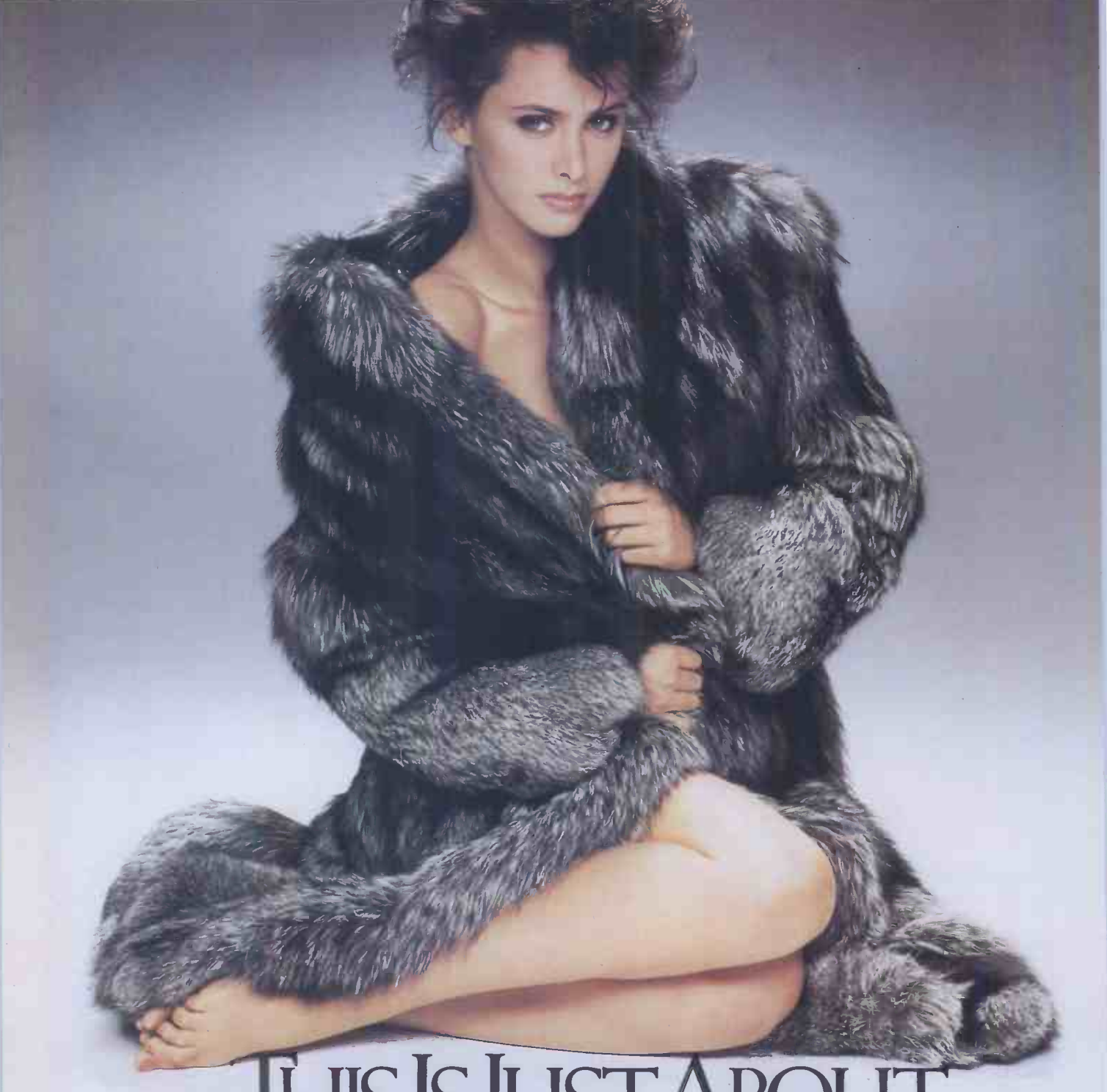

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MUSIC MICRO, PLEASE

oscillations are started by striking strings with a small hammer but the sound of a woodwind instrument has a much more gradual attack.

After the attack the 'decay' phase determines how quickly the initial peak dies away.

The 'sustain' part decides the volume of the relatively steady part of the note, and how fast it decays. Usually the volume remains at this point until the key pressed on the synthesiser keyboard has been released.

The envelope shaper waveform can be used to control a filter, and thus to control the frequency spectrum with time. For example, a low-pass filter could be controlled so that the loud part of the note generates higher frequency components.

Quite slow cyclic variation in the amplitude of waveforms are produced in the analogue synthesiser by use of a low frequency oscillator (LFO). The output voltage of the LFO can be added to the envelope shaper voltage to cause the tremelo effect described earlier.

Vibrato can also be achieved by adding the output of the LFO to the keyboard voltage to cause the frequency of the VCO to vary.

Modulation is another technique used to create complex spectra which do not necessarily have harmonic relationships connecting them. The output of an oscillator is applied to the input of a VCA and the output of a second VCO provides the control voltage.

The resulting output from the VCA is one waveform multiplied by the other.

We can determine the frequency spectrum of the resulting waveform by considering two sinewaves of frequency A and B:

A well known trigonometrical identity is
$COS(A) \times COS(B) = \frac{1}{2} COS(A+B) + \frac{1}{2} COS(A-B)$
thus, two sinewaves are produced, representing the sum and difference of the two original frequencies.

Most analogue synthesisers are monophonic — they can only play one note at a time. To get an analogue synthesiser to play more than one note all modules described must be duplicated to provide the same functions for each note played at the same time. This may mean up to eight modules, each with its allocation of oscillators, and so on.

The number of controls needed on the front panel of the synthesiser can be enormous. On large synthesisers patch-cords are used to make electrical connections between modules. There is generally no way to store these settings and connections and to reproduce the required sound all such information must be known. In smaller synthesisers, the number of interconnections is limited by the switching of signals rather than the making of connections with patch-cords. This reduces the possible range of sounds that may be produced, but makes use easier.

Arbitrary control of the frequency and amplitude of frequency components is difficult on an analogue synthesiser and so imitating conventional instruments has been difficult. If the synthesiser has only a limited number of oscillators, partials will be limited to harmonic relationships.

Digital: Digital synthesisers depend on the fact that the sound waveform may be represented by (binary) numbers using mathematical manipulations to produce the required waveform. There is no fundamental limitation to the complexity of sounds that a digital synthesiser may produce.

In the past comprehensive digital synthesis in real time has not been practicable because digital electronics was just not fast enough. With the faster and more sophisticated hardware available now, digital synthesisers are just coming into their own.

The basic principle of digital synthesis is that a sound waveform can be sampled, or broken up into a series of values, each separated by an (equal) time interval.

Sampling theory tells us that if the waveform is sampled at least twice as fast as the highest frequency in the waveform, then little information is lost in the representation. If sampling is too slow, an effect called 'aliassing' occurs, and high frequency components are reflected back to lower spurious frequencies.

Samples can in turn be converted into numbers which may be represented in some convenient binary format.

The more bits included in each number, the more precise the value specified. The more precise the value, the less noise included in the representation of the waveform. By working on the assumption that the maximum error that will be incurred will have the effect of changing the least significant bit, we can deduce the 'signal to noise ratio' (SNR) imposed on the waveform.

In practice, eight bits per number is just adequate, 12 bits reasonable and 16 bits excellent.

Now, we must consider how much data we will be dealing with. The audio range

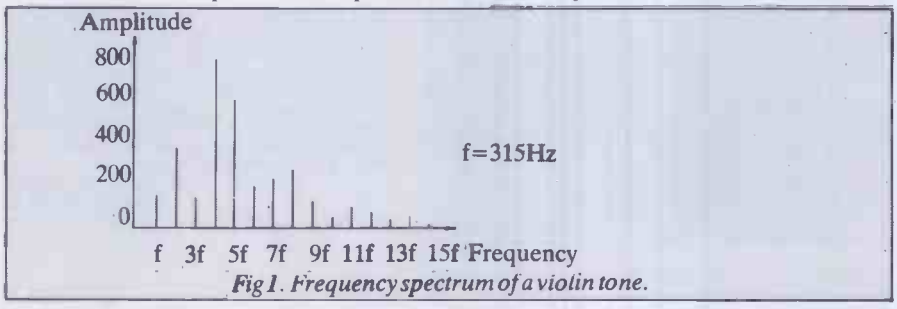

Fig 1. Frequency spectrum of a violin tone.

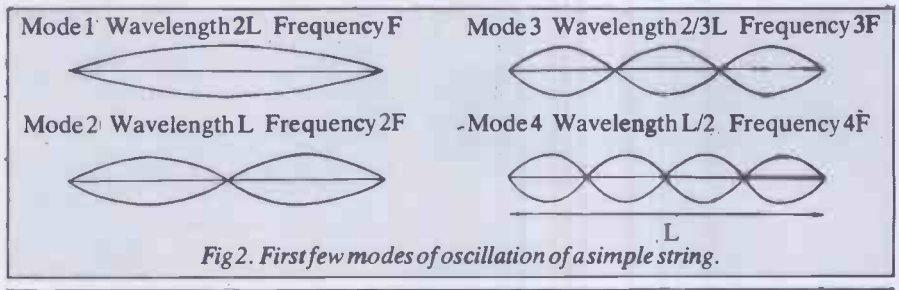

Fig 2. First few modes of oscillation of a simple string.

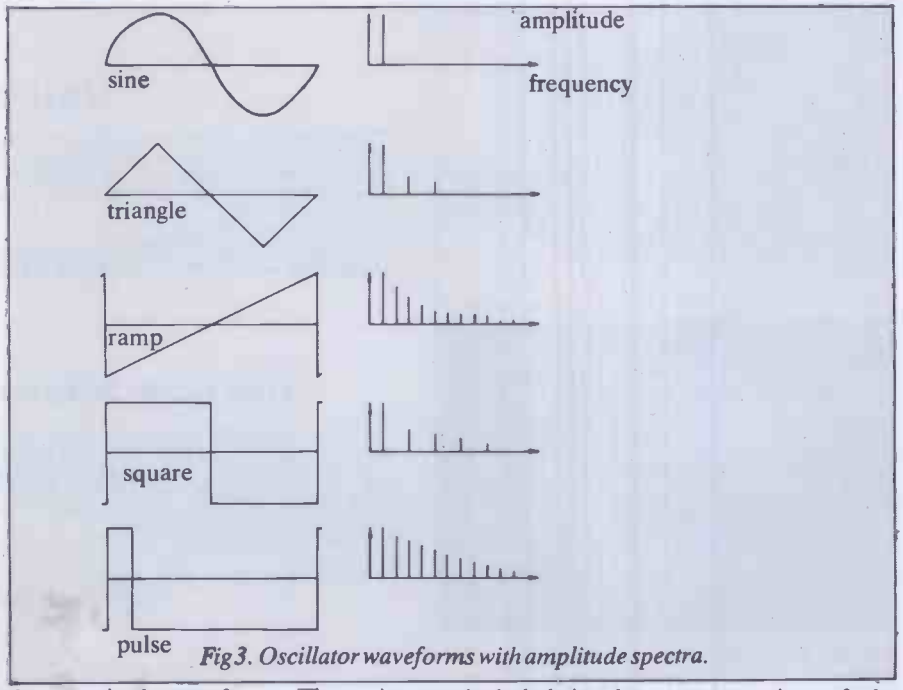

Fig 3. Oscillator waveforms with amplitude spectra.

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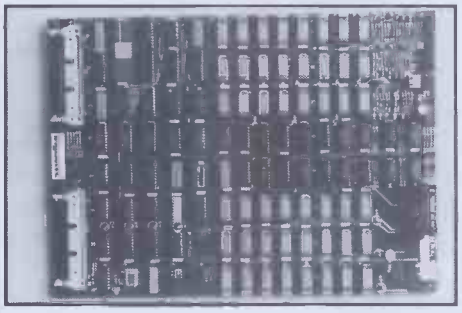

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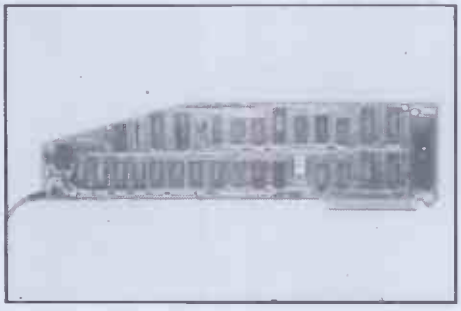

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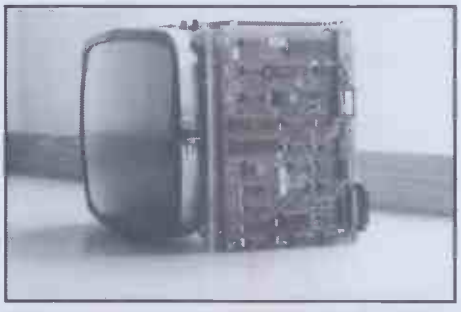

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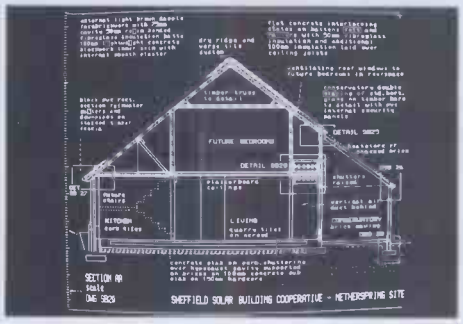

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MUSIC MICRO, PLEASE

extends up to a limit of about 20kHz, so to be safe we should choose a sampling rate of 50kHz; meaning 50,000 numbers per second.

Additive synthesis

Additive (or Fourier) synthesis involves producing sinewaves of correct amplitude for every partial in the desired waveform, and adding them all together. Of course there is no fundamental reason why analogue additive synthesis should not be used, only that the VCOs needed for every partial are expensive to make and difficult to stabilise. In the main, the technique has proved inappropriate to the analogue world, just as the principles of analogue synthesisers have mostly been of little use in digital synthesis.

If an independent sinewave digital oscillator is provided for every partial, the frequency and amplitude of partials can be accurately specified. This information can efficiently be managed by means of a microprocessor. A convenient way of providing a number of independent oscillators is to time-division-multiplex some high-speed hardware.

This flexible and very comprehensive method of synthesis may one day be universally used. At present, the cost of necessary hardware makes it a little expensive.

Frequency modulation

We now turn our attention to another useful method of digital synthesis. This technique is based on the interesting results of allowing one oscillator to control the frequency of another.

In general, the result is a series of partial frequencies which are multiples of the ratio of one frequency to the other. If the frequencies are equal only harmonics are created. If the ratio is irrational then the frequency components will be inharmonic, or disonant.

As the amplitude of the controlling oscillator is changed so the amplitudes of partial frequencies change in complex and interesting ways. They cannot, however, be made to vary in arbitrary patterns, and the technique is nowhere near as powerful as additive synthesis. It has been found useful in synthesising brass and percussive sounds and needs less hardware than additive synthesis.

Microprocessors as digital synthesisers

Unfortunately, currently available microprocessors are just not fast enough to perform additive synthesis in real time. They have been extensively used, however, to control special purpose synthesiser hardware and to provide a sophisticated user interface.

There are also ways to get around the problems of additive synthesis which have formed the basis of successful musical instruments.

There is no reason why currently available microcomputers should not form the basis of synthesisers and there are indeed a few serious systems based on microcomputers now available.

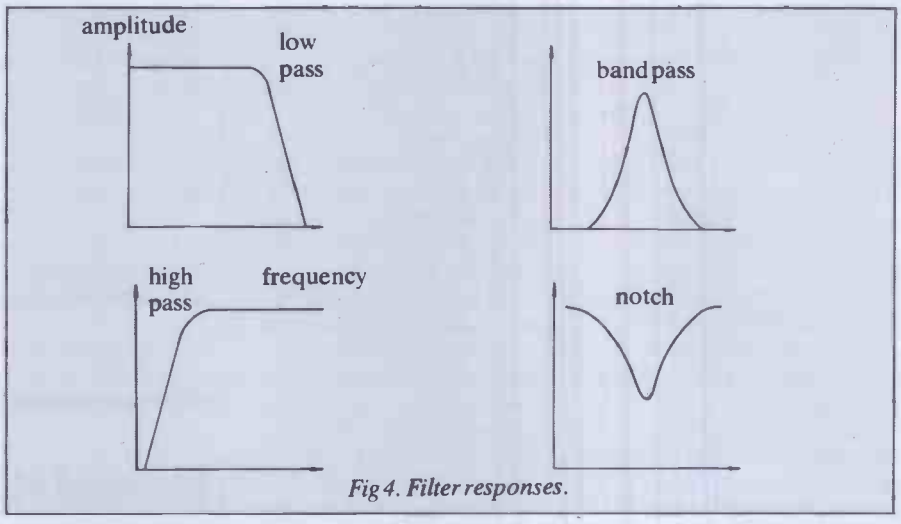

Fig 4. Filter responses.

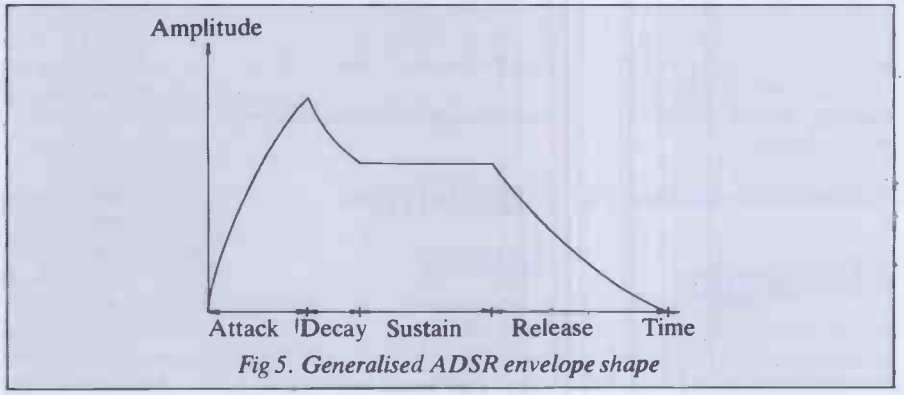

Fig 5. Generalised ADSR envelope shape

We will now take a look at how software-based microcomputer synthesisers can be made to work.

As seen before, adding up the values of many sinewaves in real time is not possible. One answer is to form look-up tables which represent waveforms which have been synthesised in advance.

Unfortunately, the limited memory available for such tables means that the micro must step through each table a number of times. This means that we must limit ourselves to frequencies which are multiples of a fundamental frequency, ie, harmonics. It also means that we can only change the amplitudes of harmonics in steps.

With 8-bit microcomputers, one channel can be synthesised to quite high quality. The system described in the second part of this article, using the BBC Micro and a minimum of hardware, allows waveforms based on up to 16 harmonics with frequency and envelope specified at 256 points in time. The sample rate is 50kHz.

Another system known to me provides four channels with reduced control and a sample rate of about 8kHz. (Micro Technology's PET music package.)

By adding some extra hardware to a microcomputer it is possible to produce a truly professional system based on these principles. In particular the Mountain Computer music system hardware uses Direct Memory Access to an Apple II microcomputer to give up to 16 digital oscillators, each with its own look-up table and envelope control.

Until the microprocessor becomes fast enough to do all the work of synthesis it can be used to advantage as a versatile controller of analogue modules. One such application is in Casio's range of low cost preset polyphonic synthesisers. These use Digital to Analogue Convertors (DACs) coupled to a microprocessor, as well as analogue filters and a mixer.

An example of the use of a microcomputer as a controller is the Sound Chaser system for the Apple II. On each card in this system there are three channels generated by conventional analogue techniques.

Such systems are attractive as they can perform extra functions apart from synthesis. The Sound Chaser can transcribe music played on an organ type keyboard, will teach music theory, create, edit and store sounds, and act effectively as a digital 8-track recording studio.

Next month: a digital music synthesis system for the BBC Micro. END

COMMUNICATIONS

PCW welcomes correspondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add 'not for publication' if your letter is to be kept private. Please note that we are unable to give advice about the purchase of computers or other hardware/software — these questions must be addressed to Peter Bright (see 'Computer Answers' page). Address letters to 'Communications,' Personal Computer World, 62 Oxford Street, London W1A 2HG.

Down under

I have an Australian-designed MicroBee computer and a Star DP-510 printer. As I have heard the MicroBee is available in many European countries, I would like to hear from users outside Australia.

My Star printer has a vertical alignment problem but this seems to be the case with all the other units at my dealer's shop.

The problem is that the characters on a line are not printed precisely below the characters on the previous line, giving a zig-zag effect. This affects borders on printed forms unless the unidirectional mode is selected.

I am confident that all DP-510s do not suffer from this problem, as my previous printer, a DP-8480, was perfect in this regard. Can someone suggest a cure? (I have had no reply from the manufacturers.)

Ash Nallawalla, RAAF Academy, Point Cook VIC 3029, Australia.

A bit bigger

It seems that in fifteen years we have progressed from the four bit, through the eight bit, to the sixteen bit micro. The thirty two bit is just around the corner. This implies that by the year 2000 we will be blessed with a 256 bit machine. Since this will be capable of addressing directly about 10^{77} words of memory, close to the number of atoms in the observable universe, I would suggest that disk drive manufacturers start work on something very big right away.

N Osborne, Sutton Coldfield, West Midlands

Getting there

I have just read the article 'Portable Problem' in Braindump (*PCW*, September). Firstly, I would like to congratulate you on an excellent magazine and a good article.

Secondly, I would like to inform you of a new computer on the American market which is not unlike the one you described: the Grid Compass.

It is portable, of the 'Briefcase' type, with an 8086 and 8087 co-processor. It has 256k of bubble memory and a hi-res screen (flat-panel). It has a 300/1200 baud modem and a battery-backed clock.

Now for the drawbacks: the screen is only 53 x 24 (hi-res of 320 x 240). It has no built-in drive, as the bubble memory is meant to suffice. It is not battery powered and it costs $8100 (around £5400), and the software is an extra $900.

I admit this is a long way from 'Portable Utopia' but it is a good step on the way.

Paul Fremantle, London SW11

Hand-me-downs

I own an older scientific micro with disks, that I wish to sell. I have been told that a market for outmoded micros exists in third world countries and the less developed parts of Europe.

Do you know of any organisations that deal with such business, or any companies that buy second-hand micros?

S Fox, Northwich, Cheshire

(Why not try Oxfam? – Ed.)

Christmas present

Could you please print in your magazine the meanings of the different Benchmark timings, as only too often do I see under the Benchmark timetables 'For an explanation of Benchmark programs see *PCW*, November 1982' which I hasten to add I haven't got and never did have.

It sometimes drives me to tears (almost!) when I see a new machine that is given non-ending praise and at the end is just a list of numbers.

So please help those of us who have not been getting your wonderful magazine (creep, creep) for so long.

PS I agree with G J Suggett on his idea about Cross-figures (Communications, August).

Kiaran Smyth, Manchester

(See this issue — Ed.)

Musical strains

Quote from your review on the Electron (*PCW* Oct 83): 'The restriction of using one channel at a time only means that the Electron will not be used for any truly musical effects.'

Despite the unwieldy nature of the BeeBasic syntax in producing music, there is plenty of scope for the creative mind. After all the flute has only one sound channel, and a rather limited range of sound envelopes, but some people have managed to get some interesting effects out of it.

It is sad that while sound chips have an almost overwhelming potential, the necessary software support does tend to be rather ungainly — for example, the Beeb, Oric and Commodore 64.

Sord and Sharp have cracked it, using very similar approaches, although 'Stick in the Mud' Sharp only supports one channel. Hats off to Sord though — you can even transpose (change the pitch of the whole piece) by minimal editing. Two characters will do the trick.

And it can cope with triplets! This may seem a little obscure, but just you try and arrange 'Jesu, Joy of Man's Desiring' without them. The problem is that a lot of Basic interpreter authors don't seem to appreciate the finer points of music, like the importance of rests, flexible tempo, 'holding' a note.

Keith Ollett, Crowborough, East Sussex

Micro reservations

I feel there is a lot of misunderstanding surrounding the use and potential use of computers in schools. I am writing to express the way that I see the issue, thus hopefully provoking thought and comment. I have just left school, and so my views are born out of a certain amount of experience.

As I see it, there are three main areas in which computers are thought of as useful in school education. These are: firstly, for teaching (ie, replacing the teacher); secondly, as a tool for providing teaching aids (both replacing existing methods and providing new aids); and thirdly, for giving experience of computers. I shall comment on these areas in order.

The first area may be dismissed completely. Teaching does not consist of providing a monologue of facts, formulae and proofs; it requires discussion and an ability to see a pupil's viewpoint, thereby producing a comprehensible explanation. Until computers can pass the Turing test they are useless for this function. The current range of programs that 'teach' physics, etc, are of less use than a good textbook — and only the most exceptional pupils at school can learn significant amounts from textbooks. Textbooks are used for reference and exercises, not teaching.

The second area has much potential, yet this potential is virtually untapped. The current programs that use the computer

to provide practice for pupils—eg, arithmetic practice, geography practice via dinky hi-res maps, etc.—are, in my opinion, a waste of time. The practice they provide is either superficial or already adequately provided by normal methods. The fact that children use computers more readily to do such practice is solely because computers currently hold a strange fascination for children. This will rapidly vanish, as computers become more and more common. Children will very soon be unwilling to do boring tasks merely to 'use a computer.'

The really useful area is in providing a new range of aids for teaching. For example, in mathematics and physics the graphics of a computer could be used to demonstrate things visually; but to be accepted they will have to be better (and they can be, considerably) and easier to use than blackboard and chalk. In history, computers would be useful as expert systems—but again they will have to be more comprehensive and quicker to access than reference books. The reason why computers are not used for these genuinely useful functions today is that it takes tremendous amounts of extremely good software to provide such facilities—plus sophisticated hardware. We ought to start tackling this (admittedly enormous) challenge now, and stop wasting time on sine wave and simple arithmetic programs.

The third area is harder to discuss. It is generally agreed that people, particularly schoolchildren, should be made aware of computers, so as to be able to face up to the computer revolution. But what is the effect of computers going to be? How will our society be revolutionised? I don't know, and I don't think anyone does. But we have to make people aware of the possibilities, and, in particular, the dangers. Certainly hands-on use is valuable in familiarising people with computers, but it is not enough; the possible consequences of the computer's power must also be taught. You don't gain that sort of knowledge playing Monsters.

That's most of my hang-ups on this subject aired. Perhaps you, or other readers, would care to comment on them?

David Harrison, Bury

(I am very interested in feed-back on all aspects of micros in education—Ed.)

Full support

I feel I must disagree with Philip Sherlock (Communications, 'Time-honoured', October) about the so-called 'discontinued' Atari. His letter implies that Atari is going to stop producing its micros because they are of low quality and obsolete. Admittedly, the 400 and 800 are being discontinued, but they will be replaced by the 600 and 800XL respectively. This is not because the 400 and 800 are outdated but because the new models are of a more economical design.

In fact, the only features that the new 800XL has which the 800 hasn't are as follows: 64k RAM, a 'Help' key, self-test diagnostics and a few other minor improvements which are hardly likely to render the old 800 outdated. Also the 800XL is cheaper than the 800. The new computers are totally compatible with the old ones and any new peripherals and software will plug into the 400 and 800 just as easily. Also, don't forget the forthcoming 1400-range of Ataris which look as if they will be more in the line of business micros.

As for Philip's comments about Nascom's features, does he know that the 400/800 can run three programs simultaneously, has 256 colours and superb graphics facilities *without* expanding the basic computer? And that along with the new micros comes a whole range of new peripherals including an interface which makes the computers IBM-compatible, and a Z80 add-on which allows CP/M to be run? Also with Atari's unique 'daisy-chaining' one I/O port is all that's needed if you're using Atari peripherals. This eliminates all those messy wires with which Apple users are so familiar. If it's general I/O that you want, the joystick ports on the front of the 400/800 give 16 bits of information, any of which can be configured for either input or output, along with four bits of input only and eight A/D converters.

OK, so the Ataris are not the world's best micros, but they do compare favourably with the Nascom and they certainly do not deserve the low-quality rating as implied in Philip's letter. Remember also that everything I've mentioned above is available on the Basic computer without introducing expensive add-ons. The Ataris are therefore not being discontinued, but are merely being slightly improved, and I will end with Philip's own words—'what more can one want in a computer?'

Chris Simon, Mynydd Isa Mold, Clwyd

Beginner's tips

On reading the October issue of *PCW*, I noticed that Surya made a very common error in his 'Beginner's guide to program conversion'. He states that '(repeat-until and while-endwhile) . . . are two forms of the same loop, one being the logical reverse of the other.'

There is one essential difference between
while <cond> and repeat <block> <block> endwhile until not (<cond>)

The 'while' form checks the condition first. If it's false, then <block> is not executed even once. By contrast, the 'repeat' form causes at least one execution of <block>, even if the condition is initially false.

Wherever a 'repeat-until' is used, it may, if desired, be replaced by a 'while-endwhile' with inverted condition (although there are several cases where a 'repeat-until' is more natural—which is precisely why any decent structured language provides both constructs).

As practical examples of the differences, consider the following two examples: first, a routine to throw a die until a six is thrown:

```
repeat
   DIE:=rnd(1 to 6)
   print 'You throw a', DIE
until DIE=6
```

This can be written as a somewhat convoluted 'while':

```
DIE:=0 (indeed, any number that isn't six)
while DIE<>6
   DIE:=rnd(1 to 6)
   print 'You throw a', DIE
endwhile
```

(although no-one but an idiot would use this if they had repeat-until available.)

Second, consider a routine to print a sequential file:

```
open FILE$
while not (eof)
   readline (A$)
   print A$
endwhile
close FILE$
```

(eof is a boolean (true or false) function indicating whether or not the End Of File marker has been encountered. Any attempt to read a line of text when eof is true will probably crash the routine.) Using the Surya-style conversion, we obtain:

```
open FILE$
repeat
   readline (A$)
   print A$
until eof
close FILE$
```

Whereas the first form correctly detects, when the file is empty, that eof is true initially—and so immediately closes the file, the second form attempts to read a line of text from the empty file—thus crashing the program.

Therefore, to summarise, any repeat-until may be replaced by a while-endwhile—but with some loss of clarity, but the converse is not true—attempting to convert from a while-endwhile to a repeat-until does not usually work.

Duncan White, Bucks.

Yes, you are quite correct. When converting from a while-wend to a repeat-until loop it is sometimes necessary to insert manually a test which somewhat defeats the point of the loop! It is, however, usually possible to make the initial test before entering the loop, thus retaining some degree of structure. Thus:-

```
OPEN FILE$:IF NOT OF
THEN PROC readfile ELSE
CLOSE FILE$. . .
DEF PROC readfile
   REPEAT
   READLINE (A$)
   PRINT A$
   UNTIL EOF
   CLOSE FILE$
```

I would, however, agree wholeheartedly that a truly structured language should offer both constructs.

Surya.

END

BENCHTEST

GOUPIL-3

Tony Hetherington takes an exclusive look at an adaptable French computer system designed on the building block principle.

The Goupil-3 is a modular computer system designed to cater for both professional and personal needs. Its building block design allows the user to build up a computer system from the simple screen, console and keyboard configuration to a fully expanded system supporting three processors, a choice of six operating systems and offering multi-user and multitasking facilities.

The Goupil-3 is manufactured and distributed by a small, French company with the exceedingly long name Société de Micro-Informatique et Telecommunications, which is why I will refer to it as SMT from now on.

SMT is only three years' old, but it has big ambitions and aims to have sold 100,000 Goupils by 1986.

'Goupil' is medieval French for the fox who appeared in the Aesop-type fable of the day. That explains the picture of a fox's head which appears on everything with space to take it.

SMT expected to have sold 9,600 Goupils by the end of 1983 in France and other French-speaking countries. The machine is now to be sold in the UK via a dealer network.

Hardware

In France there are no fewer than ten different configurations of the Goupil

'The Goupil-3 is attractively designed, has extremely quiet disk drives and offers a selection of processors, languages and software.'

Numeric keypad plus qwerty, cursor and function keys—101 keys in all.

although only eight of these are to make the trip across the Channel. The two configurations missing are the home computer and the stand-alone Minitel terminal, but the Minitel will come to the UK as a component of the multi-user, multitasking systems.

Multitasking is the ability to submit and run more than one job on one machine at the same time. For example, with multitasking you could be editing a file while another one is being printed.

This is not to be confused with 'multi-user', which is where one computer serves others, often being connected to these other terminals via telephone lines. Multi-user applications include electronic mail and shared database.

The home computer, though rich in facilities, was rightly judged to be too expensive for the UK market at about £1000.

So the UK range starts with configuration three which consists of the console, keyboard and screen. Configurations four and five add to that basic system two 5¼ inch disk drives and configurations six and seven include a disk management card to facilitate the use of eight inch floppies or winchester hard disk drives. The difference between versions four, five, six and seven is the 8-bit processor which they contain: four and six have the 6809 whereas the other two have the Z80. Configuration eight offers the 8088, 16-bit processor. Configuration nine is a multitasking system. Both nine and ten offer multi-user facilities. I tested an expanded configuration eight.

The configurations should not be confused with the number three in the name Goupil-3 since they are all versions of the Goupil-3 machine. Just to add further to the confusion there are also ten expansions which simply add various disk drives to the relevant configurations. Should this not be enough to allow you to build a computer system for your own requirements, there is also a range of electronic cards, but more of this later.

The boxes which house these components are attractively styled and are coloured in a pleasing mixture of black, grey and red.

Console

The console is a dark grey, flat-topped unit with a curved ridge along its front. It is 525mm wide, 340mm deep and 125mm in height and weighs in at under 9kg which makes it lighter than some portables.

The top of the unit can be prised off to allow access to the card slots inside. There are 12 of these into which any of a range of electronic cards can be inserted. One end of a card plugs into a common mother-board with the other forming part of the back panel. By this method any peripherals plug directly into the relevant circuit board. Dummy back panels are available should any of the slots be unused. However, be warned that the Goupil is not designed for rapid card changes. Such operations involve a rather lengthy process of removing the back panel before the cards can be inserted or removed. Care must also be taken when changing cards to ensure that all the internal wires are correctly reconnected. These connecting wires are an unfortunate consequence of the freedom to plug in any card in any slot, for if this wasn't allowed such inter-card connections would be printed on the mother-board. As it is, numerous internal connecting wires snake across the top of the cards, looking rather untidy.

The 6809 central unit card houses one of the two processors in the review machine, the other being the 8088 which also has its own central unit card. The two cards are connected to each other by an internal wire. You cannot use both processors at the same time so the 8088 card has an on/off switch which in fact switches between the two.

The video controller card accepts the monitor lead and can be connected to an optional colour graphics card to allow the use of a colour television.

The external sockets photographed on the review machine are obviously geared for the French market and will change for the Goupil's UK launch.

The UK model is likely to have two parallel interfaces and one serial. A 5in disk controller card was also included along with a 256k RAM expansion card. Goupils containing an 8088 processor can have up to four of these cards installed to give an expanded memory of over one megabyte.

There are a whole range of facilities available on other cards. These include a Z80 processor, a modem card for telephone networks, a voice synthesiser, a DMA disk controller for use with hard disk units, a floating point calculator, a clock and a three parallel I/O card for the multitasking and multi-user options.

12in green on black monitor.

5¼in disk drives.

GOUPIL-3

The cards occupy about two thirds of the main unit with the rest being filled by the power assembly. The power supply is unusual in having two sockets. One is a standard external mains connection, the other is internal, providing an alternative power source for the disk drives should more than seven cards be present in the system.

Peripherals plug directly into the circuit boards which form part of the back panel.

Keyboard

The keyboard is the same width as the console and is 185mm deep, 65mm high and weighs 2kg. It also has a moulded section attached to the base to tilt the keyboard to the desired working angle.

According to SMT the UK version of the Goupil will have a slimmer keyboard.

The keys themselves are mostly dark grey with the lighter grey colour reserved for the function keys and the qwerty control keys such as the shift lock.

There are 101 sturdy-looking keys which I will divide into four groups for purposes of description.

The first group, from left to right, is the standard qwerty keyboard (standard in this country, that is, for the French prefer the azerty layout). Next is a sensibly organised cluster of cursor controls with the up key on the top and the down key below. Beside these is a calculator section incorporating a numeric keypad and the simple arithmetic functions (+–x /). Finally along the top are 15 function keys and a special key which has a picture of a disk on it. Pressing this key is similar to a control C command on a standard system: it causes a warm start by reading the disk in Drive 0.

On the review model the colon and semicolon were incorrectly marked as were the square brackets. SMT is aware of this and assures me that it will be corrected on the machines distributed in this country. Such errors probably occurred during conversion to qwerty from azerty.

Monitor and disk drives

The disk drives and monitor will sit neatly on top of the console since together they are the same width as the console. The front and back panels of the monitor extend past the base of the unit so that they can rest on the console's front ridge. The same pale and dark grey colour scheme is continued on the disk drive and monitor.

The monitor has a 12in green-on-black display which offers 25 x 80 characters. It is housed in a rigid case with only two external controls — brightness and contrast — although many other screen options can be selected from the keyboard. These include reverse video, flashing, underlining, bold face characters and masking. Masking allows an area of the screen to be defined whose characters are masked from the user and only displayed when the Unmask command is entered.

The console's rigid case doesn't allow any tilting or swivelling, but it can be either free standing or positioned on top of the console.

Like the disk drives the monitor can be fixed to the console by a bracket which locks into a groove running along the back of the Goupil. This allows you to position the drives in a way that is convenient, for example, on the left of the screen if you're left-handed.

Be sure to decide this before you insert all the cards so as to have the disk-controller by the disk drives, and so on, otherwise the back of the Goupil will resemble a plate of spaghetti!

The 8in floppy drives by their size do not fit into the standard disk drive unit and are supplied in separate low-level units, giving the impression that they belong to a different system.

Systems software

There are six distinct operating systems available for the Goupil and the choice of which to use is largely dependent on the processors resident in the system. Both CP/M 86 and Flex-9 were supplied to run on the 8088 and 6809 processors respectively. Since CP/M is an industry standard I will concentrate on Flex-9.

Flex-9: I found Flex-9 to be a very easy and friendly operating system to use and to illustrate this I'll describe the task of copying either files or entire disks.

CP/M expects the user to be happy with PIP which stands for Peripheral Interchange Program whereas Flex-9 uses the single command called COPY. This offers the same facilities as PIP but in a friendlier manner. Also when you create a new disk you use the more reasonable NEWDISK command rather than CP/M's FORMAT?

Flex-9 contains some additional features such as BACKUP to create standby disks, BUILD to create procedures and STARTUP which automatically starts one of these procedures when the machine is switched on.

Flex-9 supports many languages and a full list of these, as well as ones supported by the other operating systems, is given in Fig 1.

SBasic: SBasic is the dialect of Basic supported by Flex-9 and contains some remarkable facilities. In addition to the standard program structures READ/DATA, FOR/NEXT, and IF/THEN[ELSE], SBasic provides the useful GOTO and GOSUB LABEL as well as GOTO and GOSUB ON.

These commands allow the programmer to use variable names or meaningful names in unconditional jumps as well as simulating the GOTO DEPENDING ON structure. These two commands will make program listings easier to read and therefore further the cause of structured programming.

Meaningful error trapping can be performed with the ON ERROR GOTO structure which will jump to the specified line number whenever an error is detected. The error code number along with the line number in which the error occurred are stored so as to allow the programming of user-friendly error messages.

SBasic can make full use of the Goupil's excellent graphics if it is used with the colour graphics card, since this allows high resolution when used in conjunction with a colour television. The highest resolution available is 512 x 512 and each of these points can be coloured in any of 256 colours although only eight of these colours can be

Processor	Operating system	Languages available
6809	Flex-9	SBasic Logo Pascal Fortran Forth Lisp
	Uniflex	Basic Fortran Pascal Forth C Cobol
	UCSD-p system	Pascal Fortran
Z80/8088	CP/M, CP/M-86, MS-DOS	MBasic Fortran Cobol APL

Each operating system also has its own assembler.

Fig 1

Benchmarks

BM1	0.9
BM2	2.5
BM3	9.1
BM4	10.1
BM5	10.5
BM6	13.9
BM7	19.0
BM8	52.3

These benchmarks were run using SBasic. No times are available for MBasic since it was omitted from the CP/M disk supplied for review.

All timings in seconds. An explanation of the Benchmark programs is included in this issue.

on the screen at any one time.

The Goupil uses a palette system in which each of the eight colours is mixed by defining the amount of red, green and blue in it. Each can be set to a number between 0 and 7 which gives the 256 possible useful combinations.

POINT is the command to set a single pixel to a colour, but this would be somewhat laborious if each pixel has to be individually set so a number of quicker graphic commands are provided.

Straight lines can be drawn using PLOT either from the last drawn point or between two specified coordinates. These lines can be changed to broken lines of various types using the DASH command.

ARC can be used to draw arcs by specifying the coordinates of the centre, the radius of the arc and the direction and angle that the arc is to be drawn. Obviously ARC can also be used to draw full circles by setting the angle accordingly. Thus together, ARC and PLOT can be used to draw pie charts, or 'camembert' charts as the French prefer.

SYMBOL is the command that allows text to be entered on the graphics screen. By setting parameters the text can be printed horizontally or vertically and even magnified up to 16 times in size.

Any object drawn that is enclosed by lines can be filled in or painted using FILL. (This only applies to graphics since text is coloured by setting the colour parameter in the symbol command.)

WINDOW completes the graphics facilities and is used to define a graphics window within a screen of ordinary text.

Sound on the Goupil is good, if a little unorthodox, and is generated by creating a string of the notes to be played and then playing it. For example, the following two lines of program would play the opening notes of Beethoven's Ninth Symphony:

```
10 MUS$ =
"T12005L96MIMIFASOSOFAMIRED
ODOREMIL144MIL48REL96RE"
20 PLAY MUS$
```

The notes contained in line 10 DO, RE, MI, FA, SO, LA and SI from the sol-fa scale. (If you didn't recognise the notes it's because they use tonic solfa on the continent.) The notes can be modified by the following parameters — T determines the tempo, O the octave and L the duration. The parameters are all numeric and have their own limits.

SBasic also includes commands to program and use a light pen or joystick but these were not provided with the review machine.

Finally, there is the PORT command which is used to direct the result of program print statements to the screen, printer, or other locations.

Uniflex is a by-product of Unix and is a powerful multitasking and multi-user operating system. It is supplied with Goupil configurations nine and ten.

UCSD-p system is an operating system which has become definitive for programming in Pascal. This is of obvious interest to those who like Pascal but has little to offer anyone else.

Applications

Since there are so many operating systems there is a huge range of software available to the Goupil user.

As you can see from Fig 1, these operating systems fall into two main groups, the 6809 based Flex and Uniflex and the Z80 and 8088 CP/M and MS-DOS.

Both groups have a commercially available wordprocessor: Wordstar for CP/M and Voltaire for Flex. Similarly both groups are equipped with spreadsheets and file managers. So what is the difference between them?

Basically, CP/M offers quantity with a whole range of off-the-shelf, CP/M-compatible software whereas Flex offers more specialised software.

Logo is only possible with the Flex-9 high resolution graphics and you will also need the colour graphics board. The board is also used in other educational packages.

The multitasking and multi-user capabilities of Uniflex allow such applications as electronic mail, reservations, orders recording and all the other options a videotex facility can offer.

Documentation

There was only one English manual provided with the review machine: the installation and presentation manual. Sadly, this came minus its illustrations, although frequent cross-references to the French counterpart made it possible, if difficult, to follow.

It is well written, has an excellent contents page and is a comprehensive and useful guide to the Goupil system.

The other manuals supplied for operating systems, languages and applications software are more difficult to comment on since they were in French and may change when translated into English.

Judging by the installation manual, the English versions of the remaining manuals are likely to be straight translations from the French.

Prices

Prices are approximate and may alter with exchange rates.

Configuration	£
3 Console, keyboard and screen (6809).	1100
4 As configuration 3 plus 5in single-sided, double-density floppies, Flex-9, SBasic.	2000
5 As configuration 4 except Z80 processor, CP/M amd MBasic.	2000
6 As configuration 3 plus DMA card, Flex-9, 2 x 8in drives SBasic	3300
7 As configuration 6 except Z80 processor, CP/M and MBasic.	3300
8 As configuration 5 except 8088 processor, 128k RAM.	2400
9 Console, keyboard, screen, two 6809 processors, 2 x 8in drives, real time clocks and Uniflex.	4900
10 Entire configuration 3 plus additional console, 2 x 8in drives, Uniflex, videotex, I/O expansion.	5700

Conclusions

The Goupil-3 is a very pleasant machine to use. It is attractively designed, has extremely quiet disk drives and offers a selection of processors, languages and software. This variety of languages and processors allows the user to configure a system to perform a wide range of tasks. Here are just a few that spring to mind.

Its powerful and colourful graphics make it suitable for advertising displays or, when used with Logo, as a child's teaching aid. In fact some Goupils are used for just such an application in a library near to the Champs Elysées.

The languages Fortran and Pascal are ideal for scientific applications in laboratories, research installations or even in doctors' surgeries.

Finally, the Goupil's impressive range of applications software and its additional multitasking and multi-user facilities make it adaptable to almost all business requirements.

I do foresee problems during the machine's transition from French to English — for example, the transposed symbols on the keyboard. Hopefully any prospective UK dealers will be aware of such possible bugs and correct them before the machine reaches the public. END

Technical specifications

Processors	6809(2MHz), Z80(4MHz), 8088(5MHz).
RAM	64k except 8088 option then 128k, expandable to over one megabyte.
Keyboard	101 keys including qwerty, calculator, cursor and function keys.
Display	25 x 80, 12in monitor or with a colour graphics card 512 x 512 colour television.
Disk drives	5¼in and 8in floppies and 5 and 10Mb hard disks.
Operating systems	CP/M, CP/M-86, MS-DOS, Flex-9, Uniflex, UCSD.

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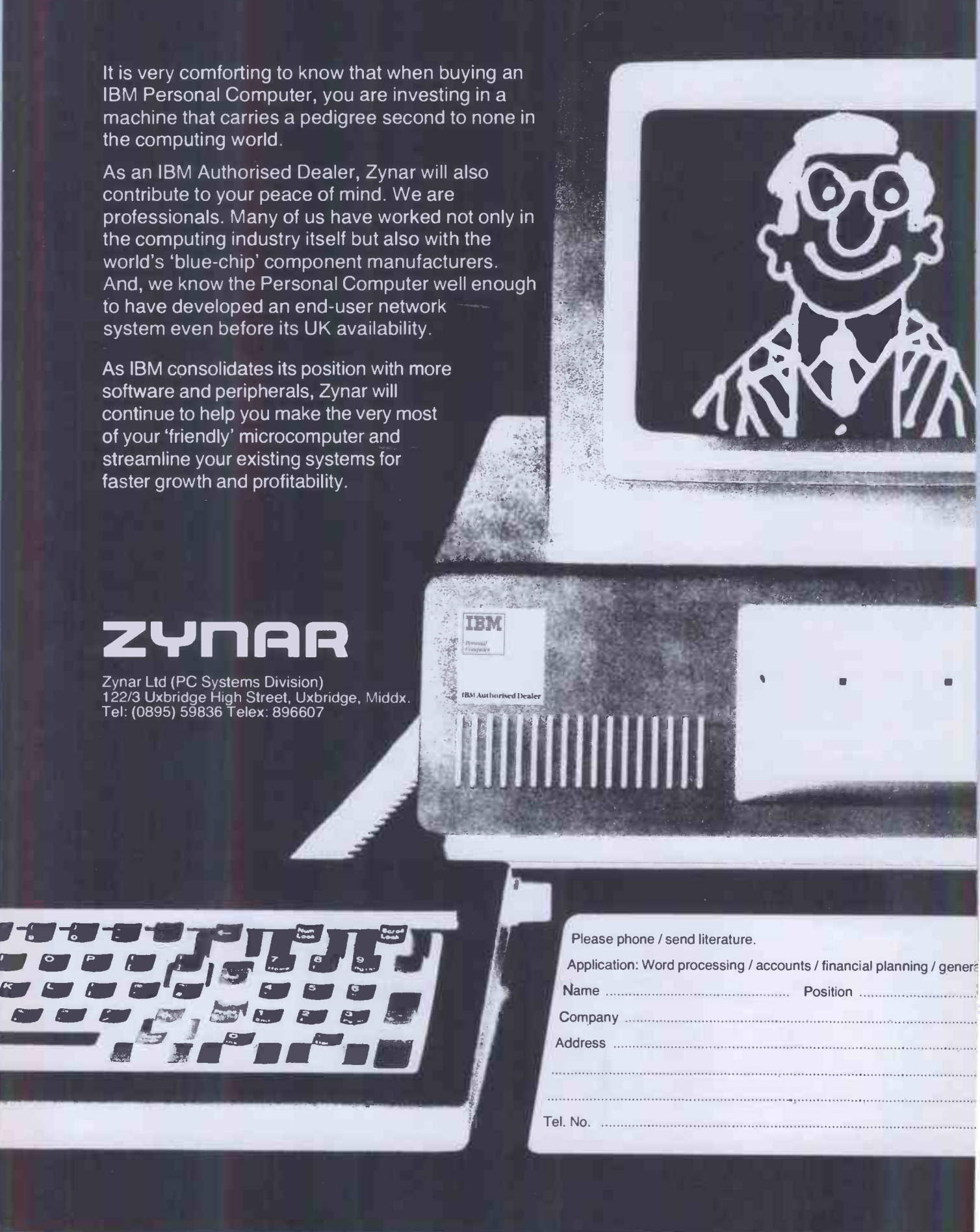

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.....

.....

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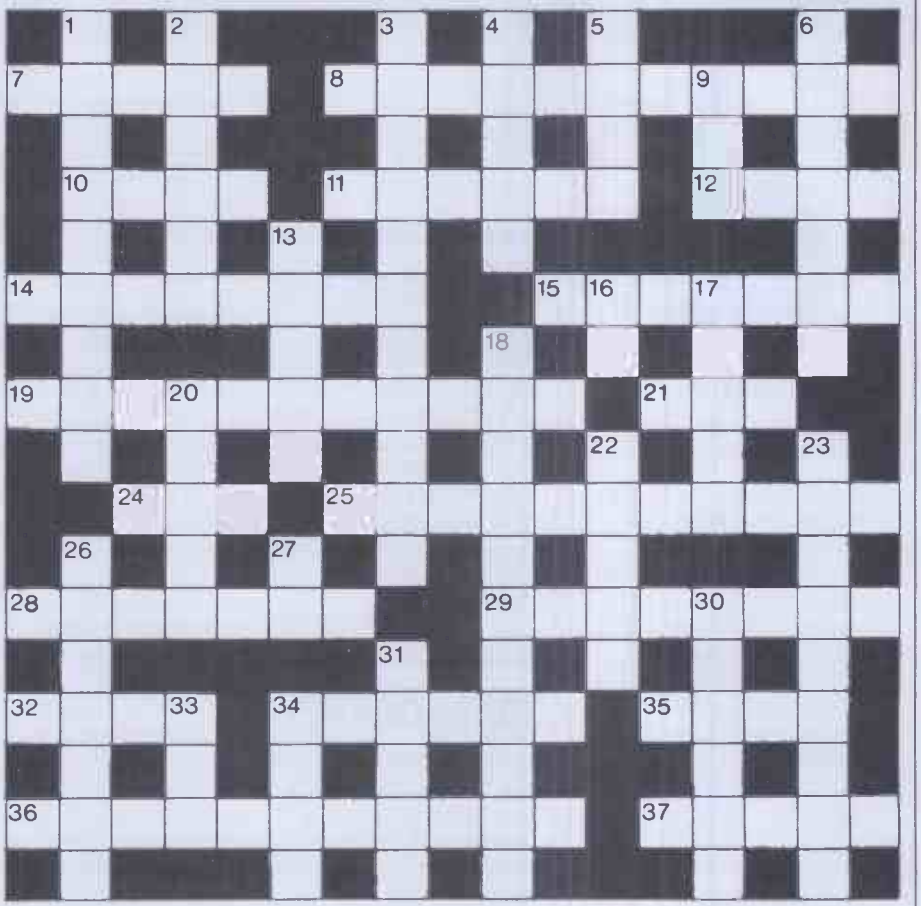
CHRISTMAS CROSSWORD

Have you been yearning for a crossword in *PCW*? Well, here's your chance. Enter our Christmas competition and depending on the response we'll decide whether to make crosswords a regular feature in the magazine.

The solutions are related to computing and information technology, but watch out for cryptic clues and festive intrusions.

To qualify, entries must be received by first post on Friday, 23 December (but post early for Xmas!). Correct entries will be pooled and the winner drawn from the bran tub will receive a prize of £10. Entries must be submitted on the form printed here (not a photocopy). Employees of VNU Business Publications or their friends or relatives may not compete.



Name_____

Address_____

_____

Clues — Across

7. Stores collections of computer records (5)
8. Parent fed up, we hear, with the chassis (6,5)
10. A data structure that's currently illuminated! (4)
11. Right about scene altered on display unit (6)
12. Game bird, yes, but a sporting non starter (4)
14. Ceefax and Oracle, for example (8)
15. Traditionally, it 'downloads' Santa! (7)
19. Nor operation when neither admit guilt (5,6)
21. Head God's top card (3)
24. Social disease you get from this output device? (3)
25. And A1, in the Stones, gets autonomous devices (5-6)
28. Let reps reorganise British Telecom's viewdata (7)
29. Incurable keyboard (8)
32. Snap out of a range of values (4)
34. Witch's brew needed to turn on (6)
35. Profit from I/O signal ratio (4)
36. μs (11)
37. Venomous summer (5)

Clues — Down

1. Under which to snatch a Yuletide kiss (9)
2. Erase what's found in model ET engine (6)
3. String together . . . Tory cat, note, North ate (11)
4. Number of wise men (5)
5. Partly patronising film located inside a computer (4)
6. Ripping good joke pulled at the dinner table! (7)
9. Strangely uneven (3)
13. Program modules that can be strung together on threads (5)
16. Unit of Frequency (abbrev.) (2)
17. Small computer manufactured from ROM, I see (5)
18. Possibly an attractive medium for computerised bank cheques (8,3)
20. Nosed around to find network components (5)
22. 10 Across — topping decoration! (5)
23. Reminder about a divisional left-over (9)
26. Pictorial, as opposed to textual (7)
27. 'O Come All — Faithful' (2))
30. Clue$='MULTIPLICANDS': Solution$=RIGHT$(Clue$,6) (6)
31. Meat for Christmas pies? (5)
33. Logical operation to cut off Norway (3)
34. Super large scale integration (4) END

'You're sure he wouldn't prefer a video game?'

YANKEE DOODLES

Sol Libes presents his monthly round-up of news and gossip from Stateside.

Random rumours

Expect Apple to introduce its long rumoured MacIntosh computer at its annual stockholder meeting scheduled for this month. That is what it did last year when it introduced the Lisa. Also expected is a major upgrade of the Apple II with a hard disk and new operating system to compete with the IBM-XT. . . Hewlett Packard is rumoured to have dropped development of a 68000-based, low-end microcomputer since introducing a unit which runs MS-DOS. . . Xerox is expected shortly to enter the portable marketplace with an 8-bit machine — according to John Rowley, President of Digital Research, an LSI IC will soon become available which integrates both the Z80 and CP/M and it will be second sourced in both Europe and Japan. Thus, he predicts the installed base of CP/M will rise from the current installed base of 1.5 million units to over 5 million within the next two years. . . KayPro is also expected to enter the notebook size market this year. . . Microsoft is rumoured working on its own networking system to be called 'MS-Net'. Microsoft is also expected to release shortly MS-Basic for 68000 machines to run under Xenix. . . IBM has reportedly ordered about a thousand 16032 chips from National Semiconductor for evaluation. The 16032 is National's new 32-bit microprocessor which it expects to start sampling by January 1. This means that IBM is wide open on which 32-bit micro it plans to use. Besides, the Intel 80386 samples are not expected for another six months. National claims the 16032 has the power of a VAX. . . Finally, there is a rumour that Digital Research is working on a version of CP/M-86 that will run MS-DOS software.

IBM drops 4in disk drive

After nearly a year of trying to find OEM purchasers, IBM has given up on its 4in floppy disk drive. The problem appears to be that the device did not use any of the current disk interface standards, was slower and more expensive than the 5.25in drives.

Apple doings

Apple reported, for the first time, a decline in earnings. Once the fastest growing company in the personal computer business, it is now suffering from the overcrowding in the business and the growing dominance of the IBM (which contributed to Osborne's difficulties). Sales of the Apple IIe have reportedly flattened out, the III never took off and the Lisa has not measured up to expectations. Thus Apple, in an attempt to stimulate sales, cut the price of the Lisa by 18%, down to $8190 from $9995. Further, it has unbundled the software so that the machine can be purchased without software for just under $7000 and the software for just under $1500. The Lisa was intended as a machine for the corporate executive's desk. However, the high price coupled with the lack of software and no way to communicate with mainframes limited its acceptance.

The price cut now should make the machine lower in price than an IBM-XT with Visi On, which is expected to be finally released this month. VisiCorp is known to be working on integrating mainframe communications into Visi On. Both Apple and VisiCorp have both been slow to provide independent software developers with the tools required for developing software for the Lisa and Visi On. Thus, I do not expect to see any significant acceptance for these products until application software becomes available in quantity.

It is also expected that Apple will soon increase the hard disk storage on the Lisa from 5 to 10Mbytes. The IBM-XT already comes with a 10Mbyte drive. The storage problem is more acute on the Lisa since the Lisa software occupies about 3.75Mbytes leaving only 1.25Mbytes for the user's data and programs.

The other problems which Apple must address are compatibility and communications. Apple plans to handle the first problem by the introduction of a plug-in 8088 processor that will allow users to run MS-DOS and run most PC-compatible software: this package is being developed for Apple by Microsoft. The second problem will be dealt with by the introduction, hopefully in the first quarter, of networking and communications controllers which will allow Lisas to talk to other micros and to mainframes. And in another attempt at industry compatibility Apple shut down its disk drive manufacturing and has decided to buy its drives outside.

Apple has also announced that it will increase the number of Lisa dealers from the current 130 to over 200 and substantially increase the advertising budget, particularly for TV.

Hard times in the US computer market

Prices of home computer systems, such as the Commodore, Atari, TI and Sinclair/Timex units, appear to have stabilised and to a limited degree have even risen in price as the Christmas gift buying season approaches. However, price competition and business losses that previously characterised only the home computer market have begun to appear in the desktop market where systems are purchased by small businesses and professionals working at home.

As reported last month, Osborne Computer, the company that started the portable market by including several software packages with the system, has fallen on hard times. In mid-September, it found itself $5 million in the hole and was forced to lay off all but 80 of its workers (at its peak it employed 1000 people). Suits by several debtors forced Osborne to file for protection under the bankruptcy law while it searched for additional funding to continue in operation. The word is that, even in 1982, when Osborne did about $100 million worth of business, it failed to show a profit. And when competition heated up in '83 and Osborne was late in delivering its promised new Executive computer and IBM-PC compatible option, its income nose dived.

But Osborne is not alone in having problems selling desktop units. Xerox has reportedly never shown a profit on its model 820 that it has now been selling for three years. And it is the same tale for Victor Technologies (whose system is sold under the Sirus label in the UK), Vector Graphic, Computer Devices and Fortune systems. Victor, which lost $11 million in the second quarter of '83 is expected to announce a similar loss for the third quarter and has already laid off half of its staff.

It has been estimated that there are now almost 200 companies competing for the desktop market creating an oversupply and the resulting price competition. The companies which are in trouble are those that have made the worst mistakes. Even companies like Digital Equipment Corporation and Hewlett-Packard are reported to be showing red ink in the personal computer divisions. And sales of the Apple Lisa, Apple IIe and III are significantly less than expected. IBM, with its PC, has come to assume the dominant position in the US desktop marketplace. Thus, any company that is not

YANKEE DOODLES

making a computer capable of running IBM-PC software is finding itself under pressure.

Several companies claim IBM-PC compatibility because they use the same microprocessor (the 8088). However, users and dealers have discovered that these systems have differences (eg, disk formats, display differences, different ROM calls, etc.) which result in the inability to run much IBM-PC software. The market has learned that a manufacturer using the MS-DOS operating system does not ensure compatibility. Systems such as the Compaq and Chameleon computers which have a high degree of compatibility are doing well, while systems such as the Victor 9000 and TI Professional, which have much lower levels of compatibility, are doing poorly.

Robot standards for languages and safety being developed

The Industrial Automation Planning Panel of the American National Standards Institute (ANSI) is pursuing the development of standards for robot programming languages and safety. The lack of language standards is currently making it difficult, if not impossible, to transport software and interface different robots in automated factories.

The National Bureau of Standards (NBS), which previously had developed programming standards for CAD/CAM (Computer Assisted Design/Computer Assisted Manufacturing) is also working on a language standard for robotics.

In the area of robotic safety, the Robot Institute of America (RIA) and Underwriters Laboratories (UL) are both working on standards. Areas of concern include installation, programming/teaching and maintenance.

NBS, RIA and UL are all members of ANSI's panel.

Random news bits

Hewlett-Packard has introduced a new personal computer with a touch screen instead of a mouse. H-P also expects to triple the number of dealers carrying H-P machines and has launched a $10million TV ad campaign to push its new HP-150. . . Binary Star Inc, Bellevue, WA, claims to have developed a high brightness flat colour display panel with almost unlimited area and pixel density using straightforward digital raster-scanning. Initial use is expected in a three-dimensional display for the military and CAD applications with possible later use in TV. IBM has also begun to promote aggressively its monochrome flat panel display to OEM's. . . Microsoft has signed an agreement with a software distributor allowing the Commodore C64 version of its MultiPlan spreadsheet program to be retailed for $99.95 in an attempt to make spreadsheets a mass consumer product.

DEC announces a micro-based VAX

Ken Olsen, president of DEC, recently disclosed that DEC will ship three new VAX machines in 1984 all using microprocessors. Formal introduction is scheduled for June with shipments to customers by the end of the year. The VAX-1, scheduled for shipment first, will be implemented on four chips and have the performance of the current VAX 11/730. This will be followed by a VAX based on a single chip and another version which includes a floating point processor.

Quotation of the month

'In this business products don't just die gracefully, they die overnight.'

Enzo Torresi, Vice President of Marketing, Businessland

'Don't look now, but there's the chap from the IBM advertisements . . .'

continued from page 151

25 h5xg6?
(25 Qf4-h6! (threat h5xg6) Ne7-c8 26 Ne1-f3 followed by Nf3-g5 would have given White a crushing attack.)
25 . . . f7xg6
26 Qf4-h6 Ne7-c8
(The difference between this position and the line given in the last note is that the rook on f8 prevents Ne1-f3.)
27 f2-f4
(Providing an obstruction to the influence of Black's rook and thereby renewing the threat of Ne1-f3.)
27 . . . Qc6-c3
(A critical moment. 28 Ne1-f3 is still impossible because of the reply 28 . . . Qc3xd3, while Black threatens the loose pawns at a3 and d4.)
28 Bd3xg6!
(The outcome of this bishop sacrifice is far from clear, but White has correctly judged that he must regain the initiative to stay in the game, even if this requires material investment.
28 . . . h7xg6
29 Qh6xg6+ Rc7-g7
30 Qg6xe6+ Rg7-f7?
(The losing move. 30 . . . Rf8-f7! leads to unclear complications after 31 g4-g5 Ba4-d7 32 Qe6xd5 Bd7-c6 33 Qd5-d8+ Rf7-f8 34 Rh1-h8+ Kg8xh8 35 Qd8xf8+ Kh8-h7, when White has gained four pawns in return for the sacrificed piece, but must cope with Black's threats of . . . Qc3xe1 mate and . . . Qc3xd4. A dvance makes no mistake with the final onslaught.)
31 Qe6-h6! Rf7-c7
(31 . . . Qc3-e3+ 32 Kc1-b1 Rf7-g7 loses to 33 e5-e6 renewing the threat of 34 Qh6-h8 mate and 31 . . . Rf7-g7 at once can be met by 32 Qh6-h8+ (32 e5-e6 is also good here) Kg8-f7 33 e5-e6+ when the overloaded king must abandon the defence of one of the Black rooks.)
32 f4-f5
(White's pawn roller inexorably advances.)
32 . . . Qc3-c4
(After this the h1 rook need not defend e1 and so is free to move up the h-file, but in any case there was no antidote to White's g4-g5, etc.)
33 Rh1-h5 Rf8xf5
(The threat of Rh5-g5+ followed by Qh6-e6 mate can only be postponed by the sacrifice of Black's entire army.)
34 g4xf5 Rc7-g7
35 e5-e6 Qc4xc2+
36 Rb2xc2 Kg8-f8
37 Qh6-f6+ Kf8-g8
38 Rc2xc8+ Ba4-e8
39 Rc8xe8 mate. END

SCREENPLAY

Steve Mann and Peter Bright launch a joint attack on games for the Spectrum, Commodore 64, Oric and BBC.

SPLAT!

Supplier: Incentive Software
Computer: 48k Spectrum
Price: £5.50

This game should certainly have no problem attracting the punters — the cassette insert features a large black ink-blot on an eye-catching mirrored silver foil backing. And, for a change, the game itself lives up to the packaging.

The object of the exercise is to manoeuvre Zippy, a sort of mutated swastika, around an obstacle course, all the while munching clumps of grass and the occasional plum and avoiding the hazards. What makes it unique is the fact that the entire playing area slides about in an unpredictable manner. The playing area is bordered by a brick wall, and the player has to exercise great caution in his/her attempts to avoid being splattered against the sides. Numerous black areas provide the obstacles — these always appear in the same places, no matter how many times you play — and it is all too easy to get trapped behind one of these blocks as the arena moves around.

There are seven levels, but the cassette insert makes it plain that the player has little chance of reaching the seventh level and the exit. I certainly found this to be the case — I have so far failed to progress any further than level three.

After Splat! has loaded, onscreen instructions are provided, as well as an invitation to use a Kempston or AGF joystick. A joystick certainly gives that much-needed bit of extra control, but it is possible to select the keys with which you feel most comfortable if keyboard control is all that is available. Pressing any key then starts the excercise.

To begin with, Zippy is sited in the middle of the screen — but the playing area immediately starts sliding about in a haphazard fashion. At the bottom of the screen are indications of the current level and how far through it you have progressed (expressed as a percentage), together with the score so far and the highest score of the day. Initially there are no plums, simply clumps of grass which score five points a piece. There are also patches of 'invisible grass'; these are always in the same positions and you soon remember their locations. Get through the first level okay and an additional hazard appears — a river, with a few bridges over it for Zippy to get across. Grass is now worth ten points per clump and plums put in their first appearance. Level three introduces red spikes, which invariably prove fatal, and scoring values increase again. What lies on levels four to seven I cannot tell you — I'm still working on a strategy to get past level three. Completing each level gives a bonus score and occasionally a double bonus is awarded — for what I am not too sure.

Incentive Software lives up to its name by offering a £500 prize for the highest score. Once you have achieved 500 points, a unique code is given each time you reach your highest score. Send your score plus code off to the manufacturers and you are in the running for the prize. It certainly persuaded me to persevere, but my best score at the time of writing is a paltry 1450. I suppose that it would be possible to crack the code and then lie about your best score — but Incentive guards against this eventuality by saying that further proof may be needed of a high score. Just how you are supposed to produce the proof I do not know — I suppose a printer would help, or maybe a screen photograph.

Splat! is an interesting and novel game and will undoubtedly do very well — helped by the generous prize. I'll certainly carry on trying to get to the seventh level and that elusive exit, and by the time you read this I certainly hope to have bettered my current highest score by a considerable margin. Closing date for the competition is 14 January, 1984.

Presentation: 7/8
Use of graphics: 7/8
Addictive quality: 8/8
Value for money: 7/8

STIX

Supplier: Supersoft
Computer: Commodore 64
Price: £9.20

Stix is described in the literature as a bundle of energy that roams the universe destroying everything in its path. Your job is to try to control Stix and use its power for the good of mankind.

The game is loaded by inserting the cassette and pressing the shift and run/stop keys together. You then sit back and wait for nearly three minutes while the program loads. One of the points that I don't like about this game is that when the program is loading the screen just goes blank with nothing to tell you what is going on. To be fair, the instructions do tell you that this will happen and that it is quite normal.

Once the program has loaded the display shows the Stix as a collection of thin coloured rods randomly wandering

around the screen. It is now up to you to try to restrict the movements of the Stix by creating a force field around it. In practice this means that you use your joystick to draw lines from one side of the screen to the other. By doing this you cut down the amount of space in which the Stix can move around. The computer then fills in the areas that you have cordoned off and displays the percentage filled at the top of the screen. The points that you score are awarded as a percentage of the area filled. The lines can be drawn at two different speeds: slow if the fire button is kept pressed or fast if you release the fire button. If you draw slowly you are awarded 20 points for each 1% of the screen filled in. If you draw fast you are only awarded two points for each 1%.

So much for the easy bits, now for the hazards. If any part of the Stix touches the line you are drawing before you get to the other side of the screen, you get zapped. Other hazards include two blobs known as Anti-quarks which move along the lines that you have drawn. If you hit them you also get zapped. Also, if you pause while you are drawing your line, an energy ripple will follow you along the line and zap you again. Finally if you fail to corner the Stix within the time limit you get blown away completely and have to start again.

I liked Stix very much. The random nature of the movements means that even on the lowest level you can never be sure that the Stix won't get you. This means that the appeal lasts much longer than invader type games where you can predict what the movements are going to be.

Presentation: 4/8
Use of graphics: 5/8
Addictive quality: 7/8
Value for money: 5/8

HUNCHBACK

Supplier: Superior Software
Computer: BBC 32k
Price: £7.95

This is a very good implementation of the popular arcade game. The object is to rescue Esmeralda from the castle tower. In order to do this you have to negotiate twelve different castle walls while avoiding rocks, arrows and guards.

The only instructions that were supplied with the tape were "Type *Run to load". All of the other instructions are displayed on the screen once the program has loaded. During loading the Superior Software banner is displayed on the screen, so at least you have something to look at while you're waiting.

When the tape has finished loading you are greeted with the sign on screen which shows the six highest scores together with the main instructions. You are also asked to set the skill level (1-3) and the wall number at which you would like to start (A-L). The main game starts with you standing on the top of the castle wall at the left-hand side of the screen. The idea is to get to the right-hand side of the screen and ring the bell. The only trouble is that the castle guards hurl rocks along the top of the wall and you have to jump over them or get knocked off the wall. When you ring the bell you are taken onto the second wall where you have to swing over a gaping chasm on a rope that just happens to be swinging past. I found this to be one of the most difficult walls to cross so I cheated and started all of my games on wall C. I won't go into all of the other screens except to say that they become harder and harder right up to the final wall where the guards throw rocks at you, shoot at you and stab you. I never managed to get as far as rescuing Esmeralda.

I found this game very enjoyable. The graphics are very good as they should be on the Beeb. The only point I disliked was the very difficulty of some of the screens. After a while I began to feel that I would never be able to get to the other side of the wall so I just cheated and went on to the next screen. However, I am sure that none of you honest people out there would pull such an underhand stunt.

Presentation: 4/8
Use of graphics: 7/8
Addictive quality: 5/8
Value for money: 6/8

HARRIER ATTACK

Supplier: Durell Software
Computer: 16/48k Oric
Price: £6.95

A somewhat nasty concept, this one, with overtones of the Falklands conflict. You control a Harrier jump jet, and your mission is to take off from an aircraft carrier and pilot your craft through anti-aircraft fire to the enemy base, on which you drop your bombs and then return to the ship.

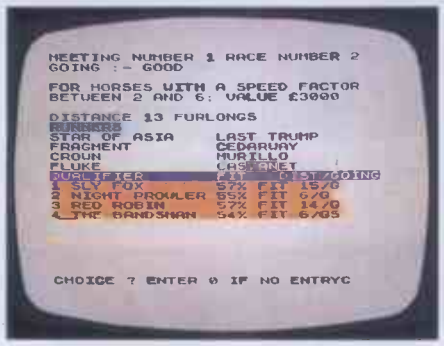
Loading takes an age, being at 300 baud only, but at least it's reliable. A title screen then appears, detailing highest score, last score and number of targets hit. You may select a skill level from one to five, and the volume level may also be set. The skill level

affects how much damage anti-aircraft fire will cause and also the speed at which you must fly to avoid running out of fuel.

Takeoff is achieved by simply pressing the up cursor, and speed is increased or decreased by pressing the left or right cursor keys. You have a choice of flying low, which takes you through most of the flak, or high — in which case you are more likely to be attacked by enemy planes. You must also choose between fighting back and simply taking avoiding action — but you must make sure that you have enough weapons to destroy the enemy base once you get there. You are armed with bombs (dropped by pressing any of the bottom row of keys) and missiles (fired by pressing the space bar). Points are awarded for hitting the various targets, for completing the mission safely or for ejecting just before your plane is destroyed.

The only trouble is that it's all too easy. The opposing aircraft and flak are easily avoided and, should you wish to fight back, easily destroyed — the enemy patrol boat, for instance, fires one missile only; this is avoided by simply flying higher or lower and the boat itself can be hit by three of your bombs in the time it takes to fly over it. The anti-aircraft fire does very little damage at the lower levels and, indeed, the only real hazards are from explosions after you have destroyed an enemy plane. The only challenge is to try and improve your score, and this palls rapidly. The graphics and sound are well implemented, but the novelty wears off very quickly. Harrier Attack appears to be selling well — but I suspect that this is due not so much to its own excellence, more to the paucity of good Oric software. Harrier Attack is also available for the Spectrum.

Presentation: 6/8
Use of graphics: 6/8
Addictive quality: 2/8
Value for money: 4/8



RACING MANAGER

Supplier: Virgin Games
Computer: 48k Spectrum
Price: £7.50

Now here's a tale of woe . . . I was all set to give Virgin's Racing Manager a rave review — my first attempt at this detailed simulation of the racing world had lasted for nearly five hours and I had reached the highspot of the season, Derby Day — when disaster struck. The third race was already for the off when the computer decided to NEW itself. Assuming that I had somehow managed to knock the computer's power lead, I began the whole thing again — with the same result. A glutton for punishment, I decided that maybe this happened only at Level 1 (the learning level) and repeated the operation at Level 2. Guess what? Yup, there was the Sinclair copyright notice beaming smugly at me. The three attempts had taken a total of nearly 18 hours — the things I do for you lot out there! I still find it difficult to believe that Virgin Games would allow a game to reach the retailing stage without a thorough testing — but someone has definitely blundered here . . .

It's a real pity, because this is potentially one of the best computer simulations I have seen. Written by Mark Alexander, Racing Manager allows you to buy, train, race and bet on a stable of horses. The simulation covers a season's racing — 25 meetings, each of seven races — ending up on Derby Day. You start by choosing your trainer and stable jockey — I've won a few quid in my time on the Peter Walwyn/Pat Eddery combination, so I plumped for this team, but you could choose Henry Cecil and Lester Piggott or one of another three choices. After the stable has been selected, races are entered. Each horse is given a 'speed factor' and you are told its favourite distance and preferred 'going' (for non-racing fans, this simply means the state of the ground, ranging from soft through to firm). You are told which horses are opposing your choice and odds are quoted by Honest Jo Gamble, the bookie. When your bet has been placed (this can range from £10 to £5000) the race begins. Again you have a choice — you may watch the whole race or just the last furlong. Your horse is always drawn furthest from the rails, and it is quite a thrill to see the runners thundering (or, on the Spectrum, ambling) towards the line. All the usual racing trappings are included — there are photo-finishes, stewards' enquiries, etc — and it is positively galling to lose a race on which you have wagered £5000 after an enquiry (this once happened to me three times in succession). You start with £100,000 in the kitty and a stable of ten horses; training fees are £1000 per week for each horse in the Walwyn stable (it varies from stable to stable), and prize money varies between £250 and £40,000. After each meeting you are given the opportunity to buy or sell a horse (you have a maximum of ten horses in training at a time), but yet inspection fees double each time you refuse an offered nag, so this can get expensive. The presence of Jo Gamble enables some nifty betting coups to be worked out — it is possible to enter a horse in races in which it has no chance: you can enter a five-furlong sprinter in a 20-furlong race, for example, and after a few losses the odds against it winning get pretty good. You then enter it for a race for which it is ideally suited and, hopefully, clean up.

To enter the Derby itself, a horse has to have won at least £80,000. In the second of my three attempts, I had three horses that had won more than this — but the Derby was declared void as no other horses had even approached this figure . . . In the event, this didn't matter as proceedings were abruptly terminated at the third race — but, even so, I think that the program should be altered to make sure that the Derby is always run. Despite the enforced early termination, I had still managed to increase my original £100,000 to over half a million quid, which can't be bad.

Despite the hideous flaw in this program, I must admit that I have continued to play it. I suspect that it would be completely meaningless to non-racegoers, but I certainly found Racing Manager addictive and great fun to play. I can only hope that Virgin Games sorts out the bug soon — I assume that anyone who has bought this game is perfectly entitled to a refund, as it certainly does not do what it is supposed to. I have therefore deducted 50 per cent of the marks for Presentation, Addictive Quality and Value for money — should Virgin re-release Racing Manager in corrected form, you should simply add four to each of these categories. A great pity then — potentially a winner, but, as it stands, disqualified after a stewards' enquiry.

Presentation: 3/8
Use of graphics: 7/8
Addictive quality: 4/8
Value for money: 4/8

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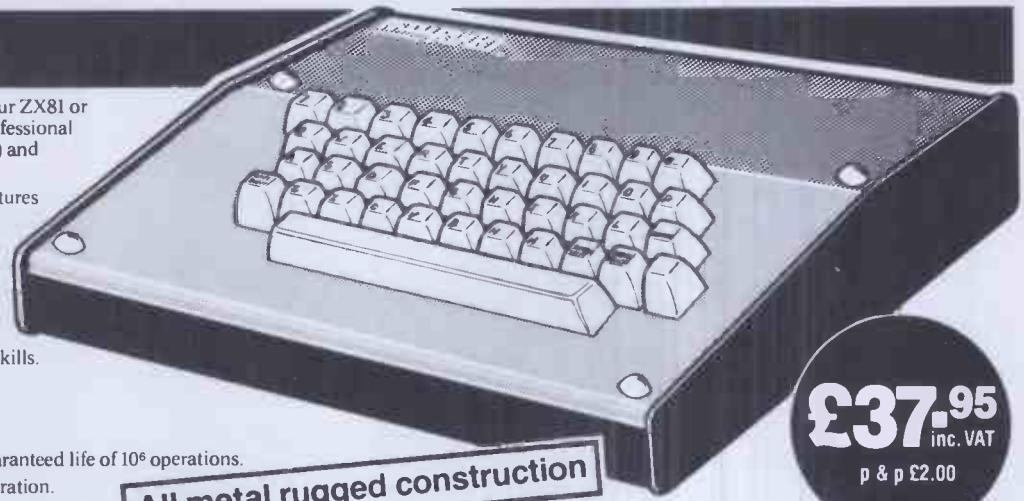

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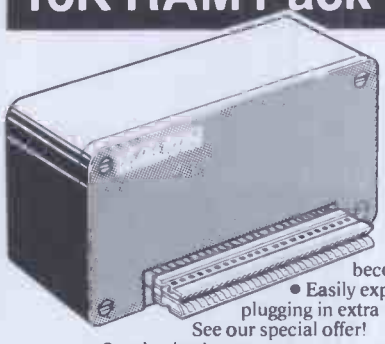

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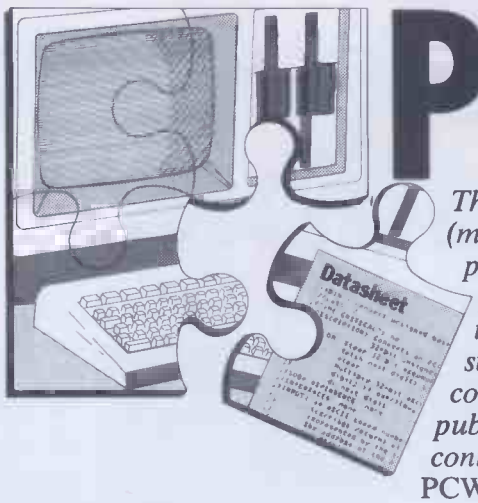

PCW SUBSET

These pages contain subroutines written in assembler language (mnemonics which are converted to hexadecimal codes by an assembler program). In order to use them you will first need to know how to program your machine in assembler. Those of you who are still reading will be able to build up your library of general purpose routines, documented to the standards developed by Alan Tootill and David Barrow. You can contribute a Datasheet, improve or develop one we print or translate a published routine to run on a different processor. PCW *pays for contributions selected for publication, which should be sent to Sub Set,* PCW, *62 Oxford Street, London W1A 2HG.*

6502 USER STACK

Inspired by the 6809 instruction set, Martin Ford of Redruth has submitted four Datasheets to implement some of its most useful features on the 6502 processor. We give here two of them, PSH16 and PLL16, which provide for a user stack at a 16-bit address anywhere in memory to hold any combination of eight registers, as determined by the bit setting of a byte embedded in the code, immediately following the jump to the subroutines to push and pull the registers. The registers that can be saved on the stack are PC, P, A, X, Y and six contiguous zero page locations (taken as three two-byte registers, M5-M4, M3-M2 and M1-M0).

The program counter, if pushed onto the user stack, has been incremented to point to the parameter byte (instead of the last byte of the jump instruction). The PC then being pulled from the user stack causes program execution from the stacked address + 1 on return from PLL16. This is a facility that needs to be used with some care.

DATASHEET

```
;= PSH16 - Push to 16-bit addressed user stack.
;/ CLASS: 1
;/ TIME CRITICAL?  No.
;/ DESCRIPTION:  Pushes registers and zero page onto a 16-bit
;/               user stack according to a parameter byte in
;/               the code following the JSR instruction:
;/               Bit set      Register pushed
;/                  0             M0,M1
;/                  1             M2,M3
;/                  2             M4,M5
;/                  3               Y
;/                  4               X
;/                  5             ACC
;/                  6               P
;/                  7              PC
;/ ACTION:  All the registers including the zero page are pushed
;/          onto the 6502 hardware stack.  Get byte at return address.
;/          Repeat:
;/            Shift parameter byte left.
;/            If carry set get byte off stack and put onto user
;/            stack.  Point to next space on user stack.  If it was
;/            a 2-byte register do the same for the next byte on
;/            the stack.  If 2-byte register point to the next.
;/          8 times.
;/          Put updated address of user stack into pointer (ZP).
;/          Restore all registers and return to the incremented
;/          return address.
;/ SUBr DEPENDENCE:  None.
;/ INTERFACES:  RAM used for user stack.
;/ INPUT:  2 zero page bytes, ZP-ZP+1, point to the user stack + 1
;/         and a pseudo-opcode at the return address gives the
;/         registers to be pushed as described above.
;/ OUTPUT:  ZP,ZP+1 point to the last byte saved on the stack.
;/ REGs USED:  None.
;/ STACK USE:  10
;/ LENGTH:  107
;/ PROCESSOR: 6502

PSH16   PHP             ;put all                    08
        PHA             ;registers                  48
        TXA             ;including                  8A
        PHA             ;M0 - M5                    48
        TYA             ;onto                       98
        PHA             ;6502                       48
        TSX             ;stack.                     BA
        LDY  #$06       ;count in Y.                A0 06
PUSH1:  LDA  M0-1,Y     ;get zero page locations    B9 ZZ 00
        PHA             ;and save                   48
        DEY             ;all six                    88
        BNE  PUSH1      ;on the stack.              D0 F9
        INC  $105,X     ;return address =           FE 05 01
        LDA  $105,X     ;return address + 1,        BD 05 01
        STA  M0         ;which is                   85 ZZ
        BNE  PUSH2      ;placed in                  D0 03
        INC  $106,X     ;M0,M1.                     FE 06 01
PUSH2:  LDA  $106,X     ;                           BD 06 01
        STA  M1         ;                           85 ZZ
        LDA  #$87       ;register size code         A9 87
        STA  M2         ;byte to M2.                85 ZZ
        LDA  (M0),Y     ;get parameter byte         B1 ZZ
        STA  M3         ;in M3.                     85 ZZ
        LDA  #$08       ;byte bit count             A9 08
        STA  M4         ;to M4.                     85 ZZ
        DEY             ;Y = 255. (ZP),Y points to  88
        DEC  ZP+1       ;next space on user stack.  C6 ZZ
PUSH3:  ROL  M3         ;see if parameter           26 ZZ
        BCC  PUSH4      ;byte bit set.              90 10
        LDA  $106,X     ;if so, put first           BD 06 01
        STA  (ZP),Y     ;byte on user stack.        91 ZZ
        DEY             ;point to next space.       88
        BIT  M2         ;is it a 2-byte register?   24 ZZ
        BPL  PUSH4      ;if so, put next            10 06
        LDA  $105,X     ;byte off 6502              BD 05 01
        STA  (ZP),Y     ;stack to user              91 ZZ
        DEY             ;stack.                     88
PUSH4:  DEX             ;                           CA
        ROL  M2         ;                           26 ZZ
        BCC  PUSH5      ;for a 2-byte               90 01
        DEX             ;register X = X-2.          CA
PUSH5:  DEC  M4         ;do eight                   C6 ZZ
        BNE  PUSH3      ;times.                     D0 E2
        SEC             ;calculate new              38
        TYA             ;user stack pointer         98
        ADC  ZP         ;according to number        65 ZZ
        STA  ZP         ;of bytes pushed            85 ZZ
        BCC  PUSH6      ;and return it              90 02
        INC  ZP+1       ;to ZP,ZP+1.                E6 ZZ
PUSH6:  LDY  #0         ;replace all                A0 00
PUSH7:  PLA             ;zero page to               68
        STA  M0,Y       ;clear up stack.            99 ZZ 00
        INY             ;                           C8
        CPY  #$06       ;                           C0 06
        BNE  PUSH7      ;                           D0 F7
        PLA             ;replace registers.         68
        TAY             ;                           A8
        PLA             ;                           68
        TAX             ;                           AA
        PLA             ;                           68
        PLP             ;                           28
        RTS             ;and return.                60
```

DATASHEET

```
;= PLL16 - Pulls from 16-bit addressed user stack.
;/ CLASS:  1
;/ TIME CRITICAL?:  No
;/ DESCRIPTION:  Pulls registers and zero page off a user stack
;/               according to a parameter byte in the code
;/               following the JSR instruction:
;/               Bit set   Register pulled
;/                  0           M0,M1
;/                  1           M2,M3
;/                  2           M4,M5
;/                  3             Y
;/                  4             X
;/                  5           ACC
;/                  6             P
;/                  7            PC
;/ ACTION:  Push all registers, including zero page, onto the
;/          6502 stack.  Get parameter byte at the return address.
;/          Repeat:
;/             Shift parameter byte left.
;/             If carry set get byte off user stack onto 6502 stack.
;/             Point to next space on stack.  If it was a 2-byte
;/             register, do the same for the next user stack byte.
;/          8 times.
;/          Put new address of user stack into ZP.
;/          Restore all registers and return to the incremented
;/          return address.  RTS completes the pulling of PC, if saved.
;/ SUBr DEPENDENCE:  None.
;/ INTERFACES:  RAM used for user stack.
;/ INPUT:  2 zero page bytes.  ZP,ZP+1, pointto the first byte
;/         to be pulled from the user stack and a pseudo opcode
;/         at the return address gives the registers to be pulled.
;/ OUTPUT:  ZP,ZP+1 point to the last byte + 1 to be pulled.
;/ REGs USED:  Those registers and zero page pulled from the user stack.
;/ STACK USE:  10
;/ LENGTH:  104
;/ PROCESSOR:  6502

PLL16:  PHP             ;put all                    08
        PHA             ;registers                  48
        TXA             ;including                  8A
        PHA             ;M0 - M5                    48
        TYA             ;onto the                   98
        PHA             ;6502 stack.                48
        LDY  #$06       ;count in Y.                A0 06
PULL1:  LDY  M0-1,Y     ;get zero page locations    B9 ZZ 00
        PHA             ;and save                   48
        DEY             ;all six                    88
        BNE  PULL1      ;on the stack.              D0 F9
        TSX             ;                           BA
        INC  $108,X     ;return address =           FE 0B 01
        LDA  $108,X     ;return address + 1,        BD 0B 01
        STA  M0         ;which is                   85 ZZ
```

```
        BNE   PULL2     ;placed in                    D0 03
        INC   $10C,X    ;M0,M1.                       FE 0C 01
PULL2:  LDA   $10C,X    ;                             BD 0C 01
        STA   M1        ;                             85 ZZ
        LDA   #$E1      ;register size code           A9 E1
        STA   M2        ;byte to M2.                  85 ZZ
        LDA   (M0),Y    ;get parameter byte           B1 ZZ
        STA   M0        ;in M0.                       85 ZZ
        LDA   #$08      ;byte bit count               A9 08
        STA   M1        ;to M1.                       85 ZZ
PULL3:  ROR   M0        ;see if parameter             66 ZZ
        BCC   PULL4     ;byte bit set.                90 10
        LDA   (ZP),Y    ;if so, move user             B1 ZZ
        STA   $101,X    ;stack byte to 6502 stack.    9D 01 01
        INY             ;point to next byte.          C8
        BIT   M2        ;is it a 2-byte register?     24 ZZ
        BPL   PULL4     ;if so, get next              10 06
        LDA   (ZP),Y    ;byte onto 6502               B1 ZZ
        STA   $102,X    ;stack from                   9D 02 01
        INY             ;user stack.                  C8
PULL4:  INX             ;                             E8
        ROL   M2        ;                             26 ZZ
        BCC   PULL5     ;for a 2-byte register        90 01
        INX             ;X = X+1                      E8
PULL5:  DEC   M1        ;do eight                     C6 ZZ
        BNE   PULL3     ;times.                       D0 E2
        CLC             ;calculate new                18
        TYA             ;user stack pointer           98
        ADC   ZP        ;according to number          65 ZZ
        STA   ZP        ;of bytes pulled              85 ZZ
        BCC   PULL6     ;and return it                90 02
        INC   ZP+1      ;to ZP,ZP+1.                  E6 ZZ
PULL6:  LDY   #0        ;replace all                  A0 00
PULL7:  PLA             ;zero page to                 68
        STA   M0,Y      ;clear up stack.              99 ZZ 00
        INY             ;                             C8
        CPY   #6        ;                             C0 06
        BNE   PULL7     ;                             D0 F7
        PLA             ;replace registers.           68
        TAY             ;and return.                  A8
        PLA             ;(if PC                       68
        TAX             ;pulled                       AA
        PLA             ;the return                   68
        PLP             ;is to the                    28
        RTS             ;new address).                60
```

COMMON AREAS AND MACRO-80

In reply to Sean Leitch's request (August '83) for information about COMMON areas accessed via Microsoft's MACRO-80 assembler, Dr Michael Wilson, of University College London, tells us that Release 3.43 of the LINK-80 loader, for producing the final .COM file from the .REL modules, has a bug in it which causes one copy of the COMMON area to be loaded for each successive declaration instead of only once.

Michael, who makes extensive use of COMMON areas in MACRO-80 programs and Fortran MACRO-80 combinations, overcomes the problem by using Fortran and MACRO (3.43) to produce the .REL files and an older release (3.34) of LINK-80 to load them. The bug is said to have been fixed in the new release of Fortran, MACRO & LINK (3.45).

COMPUTER DATING

If you remember the routines CVDAYS (date to days conversion) and CVDATE (days to date) printed in last April's Sub Set, you may also remember that their author, Andrew Bain, wanted to see shorter and faster versions. This request spurred Cormac Duffin of Highgate into sending improvements to both routines.

Cormac's CVDAYS is actually one byte longer than the original but uses multiplication by shifting where the original used repeated addition. This results in a time saving when the year's number is greater then ten. His CVDATE, however, is 17 bytes shorter and about 45% faster.

Like Andrew's original versions, the routines address a 12 byte table of the number of days in each calendar month. Unlike the original, they change February's value to take account of leap years.

Base day 1 must be 1 January of the year following a leap year. 1 January, 1901 is a logical choice for this base day as dates can then be input 'straight' (in binary, of course) to give the elapsed days since 31 December, 1900.

DATASHEET

```
;= CVDAYS - Convert day/month/year to days since 01/01/01
;/ CLASS:  2 (directly addresses table in RAM)
;/ TIME CRITICAL?:  No
;/ DESCRIPTION:  Converts a date expressed numerically as
;/               day/month/year to count of days from (and
;/               including) day 1 (expressed as 01/01/01).
;/               Day 1 must be 1st January of a year following
;/               a leap year.  Accurate for years 1 to 179
;/               after base day but not if a century year not
;/               divisible by 400 is within that range.
;/ ACTION:  BC <- days + completed leap year days + day length
;/          of each completed month + 365 * completed years.
;/ SUBr DEPENDENCE:  None
;/ INTERFACES:  Month-length table (MONTAB) in RAM.
;/ INPUT:  day (1 to 31) in A, month (1 to 12) in B,
;/         year (1 to 179) in C.  All values in binary.
;/ OUTPUT:  BC = no. of days since (and including) 1st January
;/          year 1.
;/ REGS USED:  AF BC
;/ STACK USE:  4
;/ LENGTH:  58 (+ 12 for month-length table)
;/ TIME STATES:  A reasoned average would be 850.
;/ PROCESSOR:  Z80

CVDAYS:  PUSH  HL           ;save registers.          E5
         PUSH  DE           ;                         D5
         LD    H,+0         ;HL = days                26 00
         LD    L,A          ;                         6F
         LD    DE,MONTAB+1  ;index month-length table at  11 XX XX
         LD    A,C          ;February.  Get month number  79
         AND   03H          ;and test for a leap year,  E6 03
         LD    A,1CH        ;setting February to 28 but  3E 1C
         JR    NZ,NOTLPY    ;29 if a leap year.       20 01
         INC   A            ;                         3C
NOTLPY:  LD    (DE),A       ;                         12
         DEC   DE           ;then index table start.  1B
         DEC   C            ;using completed years,   0D
         LD    A,C          ;calculate number of      79
         RRA                ;leap years               1F
         RRA                ;then add into HL         1F
         AND   3FH          ;as extra                 E6 3F
         ADD   A,L          ;leap days.               85
         LD    L,A          ;                         6F
         DEC   B            ;count of completed months,  05
         JR    Z,CYRS       ;skip if month is January,  28 09
DYMNTH:  LD    A,(DE)       ;else go into loop adding  1A
         INC   DE           ;tabled month lengths for  13
         ADD   A,L          ;all completed months     85
         LD    L,A          ;into HL.                 6F
         JR    NC,DYMTST    ;                         30 01
         INC   H            ;add any carry to hi-byte.  24
DYMTST:  DJNZ  DYMNTH       ;                         10 F7
CYRS:    AND   A           ;clear Cy for multiplication end  A7
         LD    A,C         ;test. Multiply completed years  79
         LD    DE,16DH     ;by 365:                  11 6D 01
DYYRS:   RRA               ;shift out to Cy next place bit  1F
         JR    NC,NXTPLC   ;of years and if set      30 01
         ADD   HL,DE       ;add 365 * place.         19
NXTPLC:  EX    DE,HL       ;shift 365 up one bit to  EB
         ADD   HL,HL       ;correct next place for   29
         EX    DE,HL       ;next place of year.      EB
         OR    A           ;repeat for each place set bit.  B7
         JR    NZ,DYYRS    ;                         20 F6
         LD    B,H         ;total elapsed days into  44
         LD    C,L         ;BC for exit.             4D
         POP   DE          ;restore registers        D1
         POP   HL          ;                         E1
         RET               ;and return.              C9
;table of month lengths
MONTAB:  DEFB  1FH,00H     ;Jan=31, Feb fixed by routines  1F 00
         DEFB  1FH,1EH     ;Mar=31, Apr=30           1F 1E
         DEFB  1FH,1EH     ;May=31, Jun=30           1F 1E
         DEFB  1FH,1FH     ;Jul=31, Aug=31           1F 1F
         DEFB  1EH,1FH     ;Sep=30, Oct=31           1E 1F
         DEFB  1EH,1FH     ;Nov=30, Dec=31           1E 1F
```

DATASHEET

```
;= CVDATE - Convert days since 01/01/01 to day/month/year
;/ CLASS:  2 (directly addresses table in RAM)
;/ TIME CRITICAL?:  No
;/ DESCRIPTION:  Converts a date expressed as the number of
;/               elapsed days since day 1 to a day/month/year
;/               format.
;/ ACTION:  Repeatedly subtracts 365 until the subtraction
;/          won't go to determine years.  Fixes February in
;/          month-length table to 28 or 29 if leap year.
;/          Subtracts month lengths in turn from table until
;/          subtraction won't go to determine months.  Remainder
;/          gives days.
;/ SUBr DEPENDENCE:  None
;/ INTERFACES:  Month-length table (MONTAB) in RAM.
;/ INPUT:  BC = no. of days since (and including) 1st
;/         January year 1.
;/ OUTPUT:  A = day, B = month, C = year.
;/ REGS USED:  AF BC
;/ STACK USE:  6
;/ LENGTH:  50 (+ 12 for month-length table)
;/ TIME STATES:  Average approximately 510 + 35 * years
;/ PROCESSOR:  Z80

CVDATE:  PUSH  HL           ;save registers.          E5
         PUSH  DE           ;                         D5
         LD    H,B          ;elapsed days into HL for  60
         LD    L,C          ;arithmetic.  Change count from  69
         DEC   HL           ;'from 1' to 'from 0'.    2B
         LD    DE,16DH      ;divisor of days-in-a-year.  11 6D 01
         LD    BC,+0        ;clear month/year regs.   01 00 00
         LD    A,88H        ;leap year Carry-setter.  3E 88
DTYRS:   INC   C            ;repeatedly subtract divisor,  0C
         RRCA               ;with carry every leap year,  0F
         SBC   HL,DE        ;counting years in C until  ED 52
         JR    NC,DTYRS     ;not a full year left.    30 FA
         PUSH  BC           ;then save year count, get last  C5
         RLCA               ;(leap year?) carry and get back  07
         ADC   HL,DE        ;positive remainder.      ED 5A
         LD    DE,MONTAB+1  ;index month-length table at Feb.  11 XX XX
         RRCA               ;get (leap year?) carry again  0F
         LD    A,B          ;and make Feb. 28 or 29   78
         ADC   A,1CH        ;if a leap year.          CE 1C
         LD    (DE),A       ;                         12
         DEC   DE           ;then index table start.  Clear  1B
         XOR   A            ;month count (A) and Carry.  AF
DTMNTH:  INC   A            ;loop, subtracting tabled month  3C
         EX    DE,HL        ;lengths and counting months  EB
         LD    C,(HL)       ;until not a full month left.  4E
         INC   HL           ;                         23
         EX    DE,HL        ;                         EB
         SBC   HL,BC        ;                         ED 42
         JR    NC,DTMNTH    ;                         30 F7
         ADD   HL,BC        ;get positive remainder (days)  09
         POP   BC           ;in HL. Restore years in C.  C1
         LD    B,A          ;move months to B, and days from  47
         LD    A,L          ;L to A, correcting for initial  7D
         INC   A            ;DEC HL which eliminated tests  3C
         POP   DE           ;for zero result in subtractions.  D1
         POP   HL           ;restore registers        E1
         RET                ;and return.              C9
;table of month lengths (MONTAB) same as CVDAYS.
```

BENCHTEST

CANON AS-100

Canon Incorporated has spread its wings to cover all aspects of new technology. Understandably, this has meant keeping its foot in the doorway of computer technology. Its latest micro offering, the AS-100, is aimed at the small business user. Maggie Burton looks it over.

Japanese computers are all distinguished by the low marketing profile they have in the West. Basically, it seems the Japs are quite busy computerising themselves, thanks, without needing to worry a lot about invading our fair climes.

Earlier this year Peter Rodwell foretold that an influx of superior Japanese computers was imminent. It now looks as though this is still quite a way off. While computers like the MZ-700 and CGL-M5 are new and neat, they are definitely not superior either in price or technology. The really meaty micros are probably yet to come from our polite Far Eastern brothers.

Canon, like a lot of very big companies, is not banking everything on computers. Instead one or two micros are produced, partly to keep research and development on its toes and partly to say, 'look — we can do it too . . .'

The greater part of Canon's revenue comes from machines like photocopiers and calculators. There's also a division making cameras, one making medical equipment and another making communications aids for the disabled. In short, Canon is a typical big Japanese corporation with many fingers in many pies. Look at Mitsubishi, for instance, which makes vans, cars and hi-fi (among other varied products).

Canon Incorporated was founded in 1937 and is a group of more than 60 companies in ten countries. Its 8-bit computer, the CX-1, was Benchtested in *PCW* November 1982. This, as will become apparent, is a very different computer indeed from its new companion, the AS-100.

Launched in May this year, the AS-100 system is manufactured in Japan and is aimed at the smaller business user, rather than the large company.

Hardware

First of all I'll deal with the machine I reviewed. Then I'll move on to the varied configurations and expansions which are available.

For a start, the machine is heavy, square and beige. Sometimes it's possible to wax poetic about a computer's delicacy of colouring/shape/twiddly knobs, but the Canon AS-100 is a real plain Jane. Never mind — it won't clash with the boss's tie.

Instead of providing a separate monitor and CPU, Canon has stuck both together in one box. A leviathan piece of machinery is the result. This arrangement also means the screen can't be adjusted to suit the height and/or sitting position of the operator as finely as one might like.

The casing for all Canon's AS-100 hardware is ABS — a good, old, favourite for computer casing because it is so durable and, as with most well-used plastics, cheap.

Beneath the screen on the left is a brightness control. Most of the time during the day this was turned up almost full. In a dark office it is useful to be able to adjust the intensity of a screen easily. Next to this knob is a hole into which a biro may be poked to reset the computer in times of dire distress. Not surprisingly, the machine arrived with ink marks all over it and I suggest that a reset switch is better placed at the back of the machine. Then it's just as hard to prod it by mistake and you don't end up with an ink-stained computer.

'The printer is meant to sit on top of the machine — little square recesses are provided for a printer's rubber feet.'

On the right, again under the screen, is a DIN socket for the keyboard. This is neither too stiff nor too easy to use — unplugging the keyboard to move the computer (after a month's body-building course) is as easy as it needs to be. A coiled cable connects computer and keyboard together. The power-on switch is immediately above the keyboard socket, glowing an eerie green when the computer is on.

At the back of the Canon, looking head-on, one finds a disk I/O connector and a power socket. The power socket comes from the computer's main PSU and provides power for the disks, which have no direct mains connection. Then a large area at the bottom of the machine contains little screw-on panels which cover places where up to five extra I/O ports can go. At the top on the right is a parallel printer interface.

Twin 5¼in disk drives connect to the main computer as outlined above. These are strange because they're shaped a bit like a large book, standing, as it were, on end. In fact, they don't stand at all. They're clipped to the side of the computer like a Siamese twin, using a foot-and-shoe arrangement of pegs and holes to secure the drives in place. An incredibly short piece of ribbon cable provides communication with the computer. The A drive, under this arrangement, ends up at the bottom. To my mind it appears logical to put it at the top but after looking really hard, I discovered my logic was incorrect. The letters 'A' and 'B', moulded into the casing on the left of each drive, tell you which is which — but they're not easy to see.

The drives are opened by pressing the doors to spring a little catch inside. These did not impress me very much. Firstly, you need quite a steady aim to get the disks into the drives without catching them on the insides of the doors. There are a couple of sharpish edges which could conceivably damage disks if care were not taken. Secondly, when in use, the drives make a most disturbing noise. It's a sort of clanking, grinding, whirring sound. Very un-ergonomic. Coupled with a fairly audible cooling fan inside the Canon, the result is not one of silent slaving over a barely-humming computer. The drives are manufactured in Japan by a company called YE Data and assembled under OEM licence by Canon. They are controlled by a disk controller board inside the AS-100.

You may already have noticed the strangeness of the printer port's location. This seems to be another bit of cable-saving. The printer is meant to sit on top of the machine — little square recesses are provided for a printer's rubber feet — and for this reason a bare minimum of cable is given with the ink-jet printer I used to do the Benchtest. The idea of putting the printer on top of the computer is actually quite a practical thing to do. It saves desk space and, apart from having to stand up every time you tear paper off, it makes for more convenient printer use. Other parallel printers besides the Canon A-1210 model will, naturally, run from the standard Centronics interface.

Inside

Access to the AS-100's guts is gained by removing two Phillips screws from the bottom corners at the back. The whole back panel of the machine then comes

The plain Jane Canon: CPU and monitor merged

away with a bit of careful levering. Two metal hooks at the top hold the panel on after the screws have been taken away.

That's the easy bit. The Canon is not a computer to operate unless you really know what you're doing. To begin looking about inside the machine a small earthing wire has to be unscrewed from a light metal bar inside the back panel. A ribbon connector also runs to this bar and out to the Centronics port at the back. This can be disconnected from a PCB inside the machine.

Back panel removed, a look inside reveals a computer which only the most intrepid engineer would venture to take apart without comprehensive instructions. The large RGB monitor bears a sticker which reads 'CAUTION HIGH VOLTAGE' in three languages. As you look to the right three very big circuit boards are hemmed in by a rather confusing arrangement of wires and ribbon cables. Each one of these is about the same size as the side panel of the machine. A delicate removal of two wires and two ribbon cables permitted the removal of only one of these boards, the video controller. This contains a 7220 graphics processor and a little army of small chips, lined up in very precise, straight lines. Getting the board back in was no joke. It had to be lined up with runners to hold it in position and then pushed very hard back into the machine to allow an edge connector at the front of the board to engage inside the computer. Pushing hard enough without risking some kind of damage was not easy; a big, heavy PCB is rather easier to bend (with the result that components can become dislodged) than a little one. At any rate, the innards of this machine were not accessible easily.

What was easy to deduce was the sheer size of each board. They will be about 35×31cm — possibly a little smaller. Thus the total area of chippery will be approximately 555cm^2.

Keyboard

While the top of the keyboard is ABS, the bottom panel is metal; probably mild steel. No surprise, the layout is basically the typewriter qwerty type. Some other, odd, keys are present, as well as 12 function keys which are located across the top of the

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keyboard. The angle of the keyboard is adjustable by turning two feet on screws at the back, reaching eventually the tilt you like best. This may have been a bit of compensation for the lack of mobility of the monitor.

I did find it useful to tilt the keyboard before long. Two LEDs, one on the shift lock key and one on a key called 'cursor lock' (we'll come to that in a minute) tell you whether or not that lock is engaged. These are very dim in daylight and confusion can result, as well as a stiff neck from looking down at the keyboard from just the right angle to tell the difference between on and off. Tilting the keyboard helped solve the problem.

To the right of the letter keys, a numeric keypad doubles up as a cursor pad if the 'cursor lock' key is on. This can be both a blessing and a nuisance, depending on the software in use at any one time. There is actually no other way to use a cursor without reconfiguring the keyboard. Tab keys are also provided.

The 'odd' keys mentioned earlier are as follows: from top to bottom, a bright yellow cancel key, copy, move, delete and insert. To the left of these is another sub-keypad with a fat blue enter key at the bottom and cursor lock, clear screen (also bright yellow) and the minus key towards the top. Beside the carriage return key is a little one labelled line feed. This doesn't seem to do anything at all. Another key which seems to be in hibernation is the alt key (there is a CTRL key as well) on the left of the space bar.

In use the keyboard has a strange feel which can be likened to prodding a brick through a thin layer of sponge. The necessary keys are easily reached by touch which makes this keyboard a reasonable one for fast touch-typing. A keyboard click (which actually sounds more like a low bleep) is irritating at first but after a time becomes unimportant. This is a 'hard' click; it seems impossible to turn it off under program control as some other machines allow. The keys are fully debounced and, with the exception of 'enter', 'return' and 'cancel', all of them auto-repeat after a second of being held down.

The back view

Operating systems

MS-DOS and CP/M-86 are the main operating systems which control the AS-100. The BOS operating system and range of software is also supported. Disk access is fast but the machine is very slow to boot up. An example of how fast the drives can work may be furnished by saying that formatting under MS-DOS took about three seconds. The capacity per drive (formatted) is 640k.

Using the twin 5¼in configuration, a disk has to be put in drive A before the power is switched on. Under CP/M-86 the boot up messages are, to say the least, unfriendly. Firstly (this happens under MS-DOS as well), you're told how much memory the system has (256k in this case). Then comes the crunch. Two horrid hexadecimal numbers tell you the 'segment address' and the 'last offset'. Finally, a nice, welcoming 'A>' appears and business can begin.

A nice touch is the screen scrolling under the operating system, which is smooth and slick, if a little slow. One has the impression that the screen is sliding upwards on air.

All the normal CP/M-86 and MS-DOS transient utilities are there and Canon makes some handy additions of its own. The system disk supplied with the review machine contained a bunch of printer handling programs which set the AS-100 up to use any of the Canon range of printers. Each handler is installed simply by typing its name (ie, the model name of the printer). The programs enable Canon Basic and some other software to run different printers, and are loaded in before any other software is loaded.

Font and keyboard editors

It is becoming standard to supply a font and/or keyboard editor with a machine. The Canon is no exception to this. However, these programs are not very easy to use — ASCII codes may only be entered in Hex, for instance. This is inconvenient to a Hex expert and virtually useless to a beginner.

The keyboard editor, oddly, does not allow the function keys to be changed. Furthermore, only one ASCII character (in Hex) may be used for each possible keystroke. This is a shame — keys which are hardly ever used cannot be redefined to conjure up whole, oft-used words at a touch, although this is often a feature of other micros. What is nice about this program is that all file I/O is neatly and

Colour and graphics

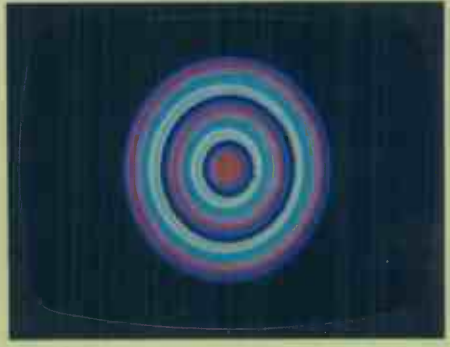
What the AS-100 could really do with is a good graphics toolkit. However, Basic has a couple of pretty tricks up its sleeve for display purposes.

The video controller is capable of 27 different colours, eight of which may be on the screen at once. Therefore a palette is made up of logical colours which can be changed instantly using the DEFCOL statement. As BBC users will know, spectacular colour effects can be obtained using this method.

These colours are bright, crisp and well-distinguished. The monitor is of a good quality. Resolution, incidentally, is 640 x 400 — not bad at all.

Other graphic commands — CIRCLE, RECT, ELLIP and FAN allow shapes to be drawn and filled in different colours on the screen. Line and point plotting is also catered for.

The TEXT command allows for the magnification of characters and their printing facing in one of several directions on the screen — great fun. CONSOLE allows the top and bottom line of the screen to be repositioned, thus making it possible to have several windows on one screen.



Bright, crisp and well distinguished colours

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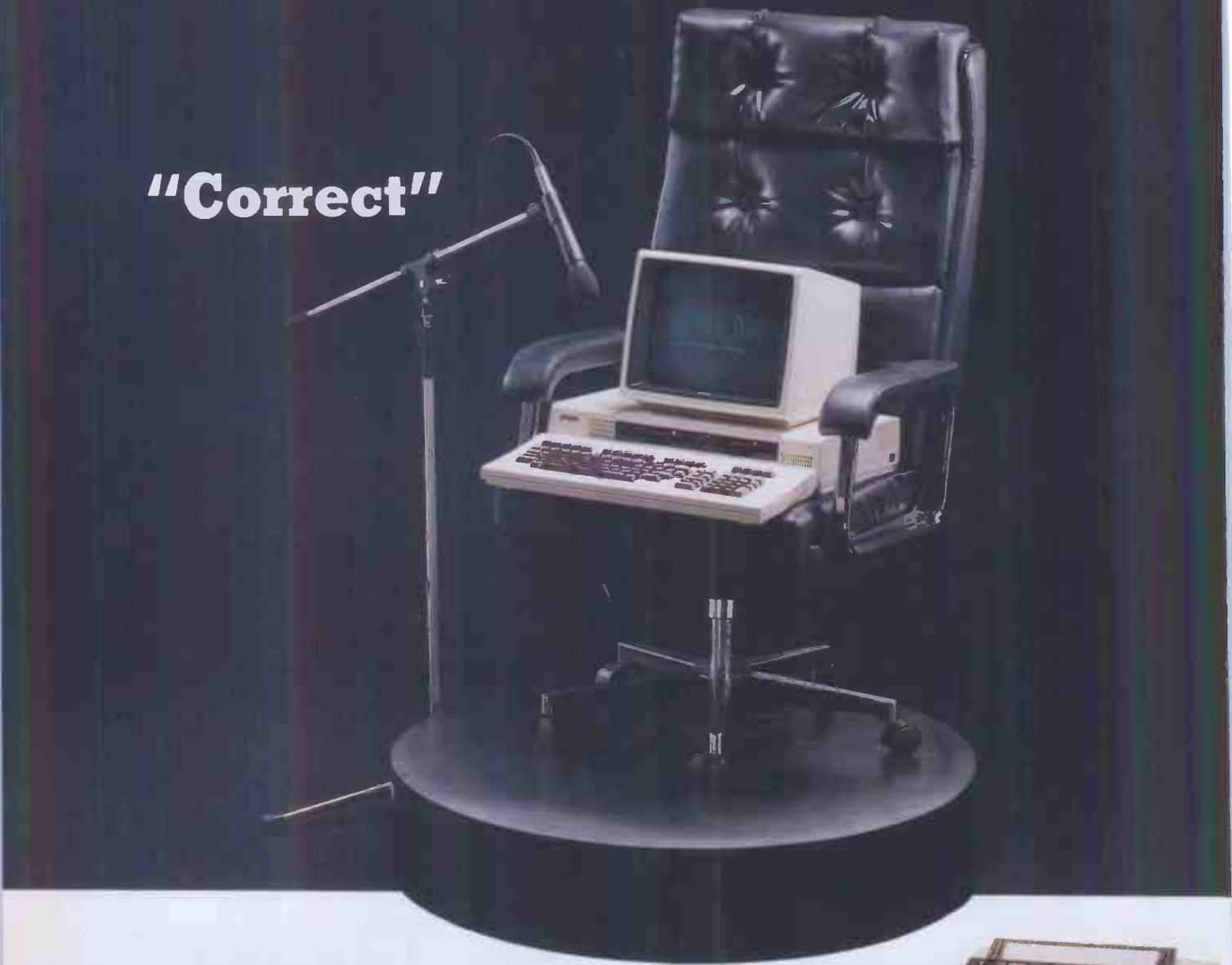
"Correct"



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cleanly handled. The screen display is attractive, showing a picture of the keyboard and a table to show you what the key on which the cursor rests does with CTRL, shift, etc.

The character editor is a mysterious creature until you get used to it. As with most font editors, it's best to load in the standard character set and change it, rather than start from scratch. Again, you need the ASCII codes in Hex right next to you to make full use of this one — or you need to be able to count fairly automatically in Hex to go through the set in numerical order. Annoyingly, at no time does the editor show the entire character set on the screen. It only shows the character you are editing, making it hard to keep a font consistent. It also means there's a great empty hole in the screen, crying out for a little character set to fill it. Control of this program is with the function keys and the numeric pad (with the cursor lock on). Once you get used to it, it's quite easy, saving your new font on the command 'EX'. Another command, QU, will literally bomb you out of the program into CP/M-86 without saving so much as a byte. Care is needed not to QUit instead of EXit (merely a question of correct English, perhaps?).

Basic(s)

Unusually, I had the chance to use two different Basics on this machine. The first, Microsoft's GW Basic, is a lot of fun to use and a great improvement on MBasic. It allows for graphics, colour and sound as well as providing a sensible screen editor. The keen-eyed reader will notice two sets of Benchmarks for this machine, one for Gee-Whizz and the other for Canon Basic. The GW Basic timings are a far better indication of the speed of the AS-100. Canon Basic is possibly a re-write of Canon Basic for the 6809-based CX-1. As such it does not appear to make efficient use of the hardware in the area of transcendental functions. BM8 shows this with extremely slow readings.

GW Basic is a standard, no-nonsense, business Basic in which you could also write Gigagalactic Gymnastics if you so desired.

Canon Basic is a different kettle of fish entirely. It's generally rather sluggish for a 16-bit Basic. It is also user-hostile in the extreme. For a start, it is principally driven by two modes: edit mode and run mode. To load a program in from disk, save one to disk, list a program, run one or get a directory, you must be in run mode. None of these things elicit a sensible response if you're in edit mode. Writing even the most simple of programs thus becomes a test of mental prowess; a computerised imbroglio.

To elucidate: here's how to type in a program. First type EDIT, or press function 2, and return. Auto numbering comes on automatically — from line 10 (this is the only time when you can use auto — not when a program is already in memory). If you don't want auto numbering, press return again. Type your program. Finished? Type 'E' (for Run, of course) and press return. Then RUN and return and your program should go.

There's simply no way out of that procedure; it's how the Basic accepts programs. It seems a bit, shall I say, complicated?

On top of that, there's no RENUMBER, no AUTO and worst of all, no direct mode. The nearest the Basic comes to direct mode is a kind of weird debugging mode, entered by pressing CTRL. A. This runs a program a line at a time, using return as a prompt from the user to run each line. A rather handy way to go through a program, but direct mode (as becomes obvious when it's not there) is invaluable.

So Canon Basic is what might be called a programmer's language. This means it does have some powerful features, even if they are a mite awkward.

'What the AS-100 could really do with is a good graphics toolkit. However, Basic has a couple of pretty tricks up its sleeve for display purposes.'

Instead of providing LLIST and LPRINT, the printer is treated as an I/O device which must be opened and closed — straight from Basic. The only printer command provided is HCOPY, which puts a copy of the screen onto the printer — provided the right printer handler is loaded.

I/O is handled by Basic working extremely closely with CP/M-86 — all device names must have colons after them and names such as TTY:, LPT: and CON:. File access is sequential.

Software

From Basic into business software. The software range for the Canon AS-100 is extensive in numbers but not in scope. As the machine is directed at the small business user, so is the software. Canon itself has a whole range of software including sales, purchase and nominal ledgers, invoicing, stock control, payroll and various combinations of these as suites. All these applications are under CP/M-86 and require a minimum of 256k to run. Canobrain, Canon's spreadsheet/graphing program, is astoundingly quick. It took the program under one second to sort a whole, 128-row, spreadsheet into numerical order on one key column.

Canobrain provides easy, quick pie charting, bar graphing and line plotting facilities — all for £175. Good value for a spreadsheet which may not be the best ever, but will certainly do your work fast enough. Extras include a password system (invisible entry, of course, so no one can spy on you) linked to individual files or books. A Canobrain 'book' is actually a euphemism for a bit of nifty file organisation. In other words, you can link several spreadsheets and charts on the same subject together, call them a book and then get into them all using one name — that of the book. The first 'page' of a book is the contents. It's very similar to conventional directories but less complex.

My only complaint about Canobrain is that it rewrites the screen completely every time it scrolls, which is unnecessary when the computer contains a 7220 graphics processor to make all that easier. The screen is also very slow to respond to a keypress at the spreadsheet entry level, which means a fast typist will rapidly fill the keyboard buffer when entering information and have to wait for the computer to catch up. All the same, it's software which follows a worthy trend — the use of graphics within business programs.

WordStar also appears on the Canon. Having worked now for some time with a rather polished Sirius version of the same software, I felt that Canon could have done a more practical job of setting up the keyboard. For instance, the function keys are all used to perform specific operations, such as entering the print menu and putting a bold face marker in the text. As WordStar is menu driven, it would have been a bit more sensible to configure the function keys to enter menus and nothing else. However, it appears from the WordStar disk that there is a setup program (a batch file), some parts of which seem to have been missing. It may be that Canon has a decent setup arrangement for WordStar which may even use colour (the version I used didn't even use inverse video). Only one other wordprocessor is currently available, that being the BOS BWriter.

Mailmerge, dBase II, Pulsar and the entire BOS range also adorn Canon's software library, so there's plenty to choose from. Unfortunately only one other languge is available at the moment and this is level II Cobol. The AS-100 is a business machine and it's reasonable to expect that only business-type languages should be available for it. It is surprising that Pascal is not included — nor C, though there is, apparently, a C compiler which, if you can get it to the right disk format, will work on the Canon. The 5¼in drives will read IBM format although this is no guarantee that what they read will work. The 8in drives are IBM standard format and software on those (in addition to Canon's range) should not be a problem.

Expansions

The AS-100 is very well provided for in the area of expansion. The machine itself is expandable up to a maximum of 512k. It will happily drive a mixture of 5¼in and 8in disks (up to four drives in total). Customers have the choice of either a monochrome or colour system, the differ-

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CANON AS-100

ence in price being £720.

Additional I/O ports may be added — these include an RS232, an extra Centronics and a synchronous communications interface. To add either of the latter ports, an extension board is necessary to the tune of £75.

Five different printers are available through Canon, among these a neat colour ink-jet printer (the Canon A1210) which was used throughout this review and an Anadex 130 col model. Canon also supplies a 132 col daisywheel printer. My only reservation about the A1210 ink-jet model is the quality of the paper. It's very thin and comes as a continuous roll instead of sheets. This makes it more of a graphics printer than a wordprocessing model. It is also rather slow — 40 characters per second.

Lastly, for readers who like small, furry rodents, a mousehole (a port for a mouse, of course) can be found on the right side of the keyboard. The manual refers to a 'pointing device'. This is not available yet, but will be before long. A light pen would be more fun.

Documentation

Not bad, on the whole. Except for the system set-up book (which is a slim paperback), the AS-100 manuals are bound in large plastic-covered files. Manuals are supplied according to whatever software comes with the machine.

The only strong criticism which can be made about these manuals is the organisation. There are no indexes, for instance. Each fat manual generally comprises several separate sections and no link is provided between them. A master contents page, for instance. Instead, you come to the end of one section, find a rather secretive divider sheet, a new contents page for the next section and page numbers starting from one again. Very confusing if you just want to find something out fast.

From the point of view of the first time user they make better instructional reading than many manuals even if they are a bit hard to wade through. As with most business machines, a first-time user's guide would not go amiss. Technical information is not lacking and the programmer should find plenty to keep him going in the operating system and Basic manuals.

Maintenance and availability

Canon has, to date (early October), only sold about 250 of these machines. Dealers are still being built up for the machine and this can be a slow process, depending on how fast a company works. As availability through dealers goes up, so will sales and therefore the software range will grow.

Maintenance is carried out under contract by a company called TSS. Dealers also do some maintenance if they have the know-how. Maintenance agreements vary, but an annual contract (sometimes based on a percentage of the machine's purchase price) seems to be one of the most common.

Prices

	£ (exc VAT)
AS-100 colour	2080
AS-100 monochrome	1360
Twin 5¼in disks	930
Twin 8in disks	1860
A1200 dot matrix printer	430
Anadex dot matrix printer	1150
A1210 printer	550
Ink cassette (colour)	10
Paper rolls (4)	25
Memory to 256k	240
Memory to 384k	360
Memory to 512k	480
Extra Centronics port	50
Extra RS232C	75
Expansion board (for extra I/O)	75

Conclusions

The Canon CX-1 was referred to by PCW as 'idiosyncratic'. The AS-100 is just as idiosyncratic, and rather lovable with it.

Although it has standard operating systems and software, it is definitely a machine which takes some getting used to.

The colour model, at £2080 (plus £930 for 5¼in disk drives) is not bad value by big colour computer standards. On the whole, the AS-100 system is pretty flexible in terms of both expansion and specification.

Some important developments have not been thought about, though. What about 3½in disks? They're much more practical than their bigger counterparts. Also, if you want a computer which will communicate *now* with other computers, the Canon AS-100 is not for you, yet. Plans for a network are going through and networked AS-100s should be up and running sometime next year. What about a serial interface? What about an on-board modem?

Any computer choice will pose questions for the buyer. The AS-100 is no different in that respect. What is worth mentioning is that Japanese machinery is well known for its reliability and if you bought your machine from Canon you would also receive the backup service of a well-established office products supplier. This means you know the supplier won't go broke tomorrow — valuable peace of mind if you're investing a lot of time and money in a computer.

Another important concluding point is that Canon may well have missed the point a little in the way the machine's software is sold. No software is 'bundled' with the machine at all; you even have to pay on top for the operating system. Two years ago this would have gone unnoticed, but today's trend is to include a lot of software in a machine's price. Had this computer been put on sale with CP/M-86, MS-DOS and utilities, WordStar (or similar) and Canobrain, it would represent a pretty good package. As it stands it may not be able to compete with machines (even ones of a slightly inferior specification) that come complete with software and ready to go. For the novice, even buying this machine could get a little confusing.

To wind up: yes, people will buy it. No, it's not the best price or the best specification on the market. It'll probably never be a huge seller, but it's the kind of computer which will be around for a while. It's a job of work machine and the colour model has a bit extra. I wouldn't look it in the mouth if someone gave me one. END

Benchmarks

GW Basic	
BM1	1.6
BM2	5.8
BM3	11.6
BM4	11.8
BM5	12.9
BM6	23.1
BM7	35.6
BM8	38.0
Canon Basic	
BM1	4.4
BM2	8.5
BM3	23.3
BM4	25.4
BM5	27.6
BM6	48.3
BM7	63.4
BM8	364.0

All timings are in seconds. An explanation of the Benchmark programs is included in this issue.

Technical specifications

CPU	8088 at 4MHz
RAM	128k (standard) — 512k
Keyboard	94-key, qwerty layout. Adjustable angle
Display	(Colour) Eight colours at once from 27. 640x400 resolution. 80 characters x 25 lines. Green monochrome also available. Size (both models) 14in.
Disk Drives	Twin 5¼in or twin 8in units up to a maximum of four drives. (5¼) Double-sided, double-density. Capacity per drive 640k. (8in) Double-sided, double-density. Capacity 1Mb per drive.
I/O	Mouse port, Centronics, disk RS232. Optional extra Centronics and RS232s available. Also synchronous communications port. Maximum five extra ports.
Operating systems	CP/M-86, MS-DOS, BOS
Languages	Canon Basic, GW Basic, Level II Cobol, ASM-86
Dimensions	40cm wide x 39cm deep x 32cm high

CHRISTMAS SHOPPING

As the Christmas season approaches, more and more people will be turning their attention to the electronic gadgetry available in High Street stores in their quest for gifts or pure self-indulgence; and some will undoubtedly be plunging in at the deep end. Margaret Spooner donned her guise of naive computer buyer in an attempt to assess how a prospective micro purchaser would fare in the hands of shop salespeople.

At the end of September the computer areas in the branches of WH Smith I visited seemed to be in a state of chaos. Not to be deterred by an accompaniment of carpentry, I approached the salesman in the Kensington High Street branch and asked if any computers were for sale.

'Yes. What sort do you want?'

Not a promising start, I thought, in my role of first-time home computer buyer who knows nothing of computers.

In contrast to the noise of hammer and saw in WHS Kensington there was merely an empty space in the Hammersmith branch.

'It hasn't been set up yet,' the salesman replied to my query about a computer section and he indicated the empty space near the calculator counter. But he was not going to miss a possible sale so showed me some boxed Sinclair ZX81 and Spectrum computers. He proceeded to talk rather quickly of 16k and 48k, RAM expansions and prices of various computers so that I soon felt overwhelmed with facts and sure that a complete beginner would have been confused rather than informed. No sales literature was available to take away to absorb information at my own pace but he suggested that I could buy some of the many magazines on the subject. This, after all, is a traditional line of business for WH Smith.

If you should be wondering what I was doing pretending to be a first-time computer buyer, I had set out to sample the sales style in a variety of retail outlets for home computers to find out if my preconceived notion that I would be blinded with science or get little useful advice was right.

Questions and answers

A recent market survey by Mintel reveals that the majority of sales of home computers are through High Street chains, an estimated 18% share of 1983 business being held by WH Smith. So I began my investigations in Hammersmith's shopping precinct; although on the fringes of inner London it is, I imagine, fairly representative of other shopping precincts throughout the country.

My supposed reason for wanting a home computer was for my children who are at a primary school which does not yet have its own computer; I wanted them to be able to play games, of course, but also to get some educational value from it. One or two friends have bought computers for just such a reason and it's likely that there will be many more purchasers with this in mind as Christmas approaches.

WH Smith seemed to be living up to my expectations, though, to be fair, the Hammersmith salesman did explain, when asked, that RAM is memory, and I gained a better impression on a subsequent visit to the Kensington branch after its computer area had been officially opened because a different and more informative salesman was present.

My experience at Boots in Hammersmith seemed to confirm my worst fears. There was a well presented display of home computers, unattended. The sales girl at the adjacent camera counter was willing to try to help but obviously doubtful if she would be able to. She suggested the Spectrum for my needs because 'it's very popular with young people'. As if seeking confirmation of this she sought help at the nearby stand of home computer magazines and flicked through *PCW*, no less, as if hoping something might magically appear to back up her suggestion. She then searched unsuccessfully for someone else to help. One of the problems in chain stores is that there may only be one person trained to sell computers and that person cannot always be present so you may be unlucky at the time you visit the shop.

Ever hopeful I went to Dixons in Hammersmith where a number of computers were on display and ready for demonstration. The salesman spent a considerable amount of time showing me computers ranging from £99 to £200; he recommended the Commodore computers for my needs because of the good range of games and education cassettes for them. At this point he showed me 'Dixons Software Express', the company's software catalogue, and indicated how many more cassettes were available for Commodore than any other make. The titles gave an insight into their use — 'Shark Attack', 'Omega Race', 'Junior Maths' and 'Robert Carrier's Menu Planner', to name but a few, and for more serious use a range of home office programs. It seemed highly suitable but why the difference in price between Commodore's VIC-20 and the Commodore 64?

'This', he pointed to the Commodore 64, 'has more memory than that (the VIC-20).' Should I ask what he meant by memory or simply accept the statement? I felt unsure of my role as a novice but rather than be fobbed off with the first thing suggested I asked about the other computers on show, the Oric 1, for example. The salesman explained that it was a new machine so not much had been written for it but there would be more in a couple of years.

'Look how much there is for Texas Instruments now,' he referred to the catalogue again. 'When the whole thing started about 1½ years ago there wasn't much for it.' I appeared suitably impressed, especially when he explained how much prices had dropped in that time but, impressed or not, I decided to persist with my questions and asked about Sinclair computers. 'There hasn't been much business in it for us,' he admitted. 'Why not?' I asked. He hesitated. 'Well . . . we've just signed a good deal with Sinclair so they should be in next week.' A good moment to make my exit.

'In general, salespeople offer only the minimum of information unless you ask for more, so even if you have to appear totally ignorant it's worth persevering.'

At last my theory began to crumble. The Dixons' salesman had obviously been trained to speak in simple terms to the uninitiated. Some of his explanations were a degree too facile, for example, 'the computer understands English'. My obvious disbelief prompted the further comment 'It has a language called Basic which uses a set of simple English words. You have to learn how to use them, then you can write your own programs.'

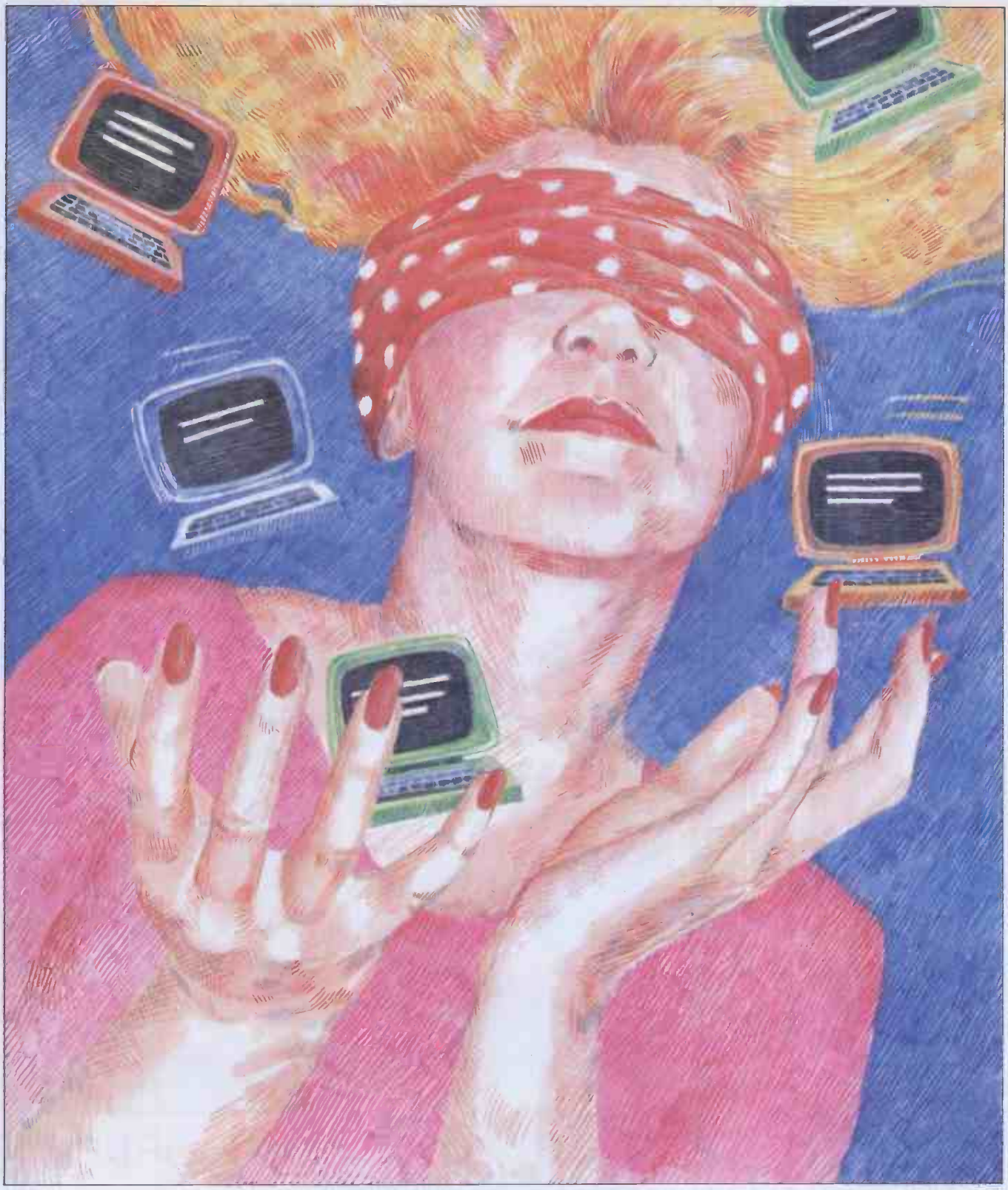


Illustration by Jo Lawrence

He also emphasised the need for a good range of software, an important item for the first time buyer to ask about. He had in the course of showing me the computers let me look at the associated manuals — this is also important when buying a home computer. You should spend a fair amount of time discovering if the manuals are easy to follow, especially if children are going to use the machine. Try another shop if manuals are not available for inspection.

Assistance

At this stage I decided that I needed someone who really was unfamiliar with computers to pretend to buy one, so that I could see whether I was asking questions at the right level. Having co-opted a friend, who willingly relinquished a morning with her two-year-old son for the rigours of home computer purchases, we accosted our first victim — the salesman at Boots in Knightsbridge. He completely redeemed Boots' reputation and was very helpful in showing us how to connect the computer to a television and cassette recorder and load a program. His explanations were clear; he checked to ensure that we had understood and spoke slowly enough (but not unnaturally so) for us to absorb what he was saying.

My friend, Maggie, was most persistent with her questions; this seems to be essential when buying a home computer. In general, salespeople offer only the minimum amount of information unless you ask for more, so even if you have to appear totally ignorant it's worth persevering; you'll find out what you want to know — if the salesman is competent.

At Dixons in Kensington one salesman was unable to explain 16k beyond saying that 32k gave twice as much information as 16k but, when pressed, didn't know what 'k' was.

GOTO page 195

ORIC · SPECTRUM · ORIC · SPECTRUM · ORIC · SPECTRUM · ORIC · SPECTRUM · ORIC · SPECTRUM · ORIC

Durell Software

Dept.WMSRDurell Software
Castle Lodge · Castle Green
Taunton · TA4 1AB
ENGLAND

Harrier Attack ORIC-1 and SPECTRUM

Pure machine-code, super-fast, action-packed, highly addictive arcade-style game requiring great skill. The harrier takes-off from an aircraft-carrier and flies over seaborne defences to attack enemy installations on a nearby island. The harrier may fly faster, slower, higher or lower, and has bombs and rocket fire with which to protect itself and make its own attack. If it flies too high it is detected by enemy jet-fighters (which it may counter-attack) – so it needs to hug the mountainous terrain which also varies with every new game. But the island is heavily defended by anti-aircraft rockets and tanks, which again the harrier may counter-attack or try to fly through. A tally is kept of fuel, bombs and rockets, plus player score and high score. Finally the harrier must make its bomb-run over the enemy base before returning to its own carrier.

ORIC APPROVED VERSION £6.95
SPECTRUM VERSION £5.50

Starfighter ORIC-1 (48K only)

You are in command of a galactic defence vessel travelling through inter-stellar space to attack and destroy intruding aliens. At long range this is carried-out on your computer scanner which displays stars in the local quadrant, with passing planets, space stations, star-gates, and of course the aliens which may strike in packs or singly, scattering anti-matter mines around your ship. You may counter-attack the aliens with your photon torpedoes, or if you move-in close enough switch over to manual and visual control to chase the fleeing alien and blast him with your phasors. See the star-scape spin relative to your ship's manoeuvres, but watch-out for the alien mines whizzing past. You will need to conserve energy carefully to get back to the refuelling points, and then the time-gates to the other quadrants. Weapons, shield and energy status are all monitored throughout this pure machine code game, which may be set to tenlevels of skill.

ORIC APPROVED VERSION £6.95

GALAXY 5 ORIC-1

Side one of Galaxy 5 contains three pure machine code arcade type space games. They consist of 'Galaxy' which is a Galaxian-type game with 15 winged aliens swooping down to bomb a left/right controlled rocket launcher in groups of one, two or three. Next 'Astro War' is an asteroids-type game with a meteor shower moving sideways across the screen towards your ship which has right,left,up and down controls plus phasor fire to blast the meteors along with any aliens that may be hiding amongst them. The last game on this side is 'Space Chase' which gives a view from your cockpit of a fleeing alien. You fire at him and he fires back, so you must get a direct hit quickly before he destroys your force shields. Side two of this tape consists of two more arcade type space games but this time in BASIC, which are easy to learn from, being short, simple and clearly written with every line of the BASIC explained in an English REMark statement.

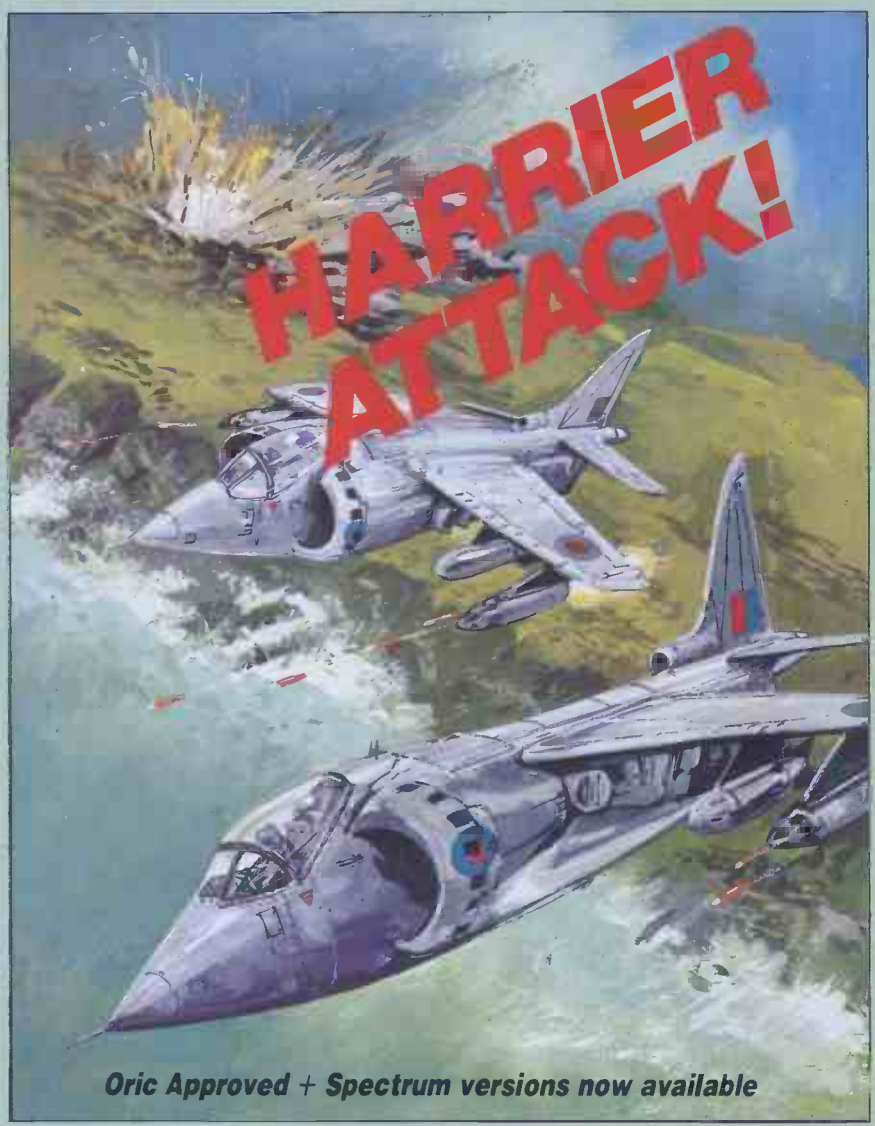
ORIC VERSION £6.95

Assembler/Disassembler ORIC-1

The assembler follows standard 6502 conventions and has proved very reliable while in continual use by Durell Software. Features include the following:

Generally	*List File*	*Pseudo-Ops*
Auto line numbering	LIST	EQUATE
Six character labels	DELETE	BYTE
Updatable list-file	LLIST	DBYTE
Maths on operands	ALTER	WORD
Syntax checking	INSERT	TEXT
Output to printer	END/STOP	BLOCK

ORIC VERSION £6.95



Jungle Troubles SPECTRUM

Pure machine code with super cartoon graphics. This original and witty game is set in the depths of the African jungle. First you must direct your man to collect an axe and cross a nearby river via stepping stones that protect him from a lurking crocodile. Then he must climb a ladder to the next level, where he has to fell a number of trees in his path. As he does this a marauding ape appears from the left of the screen and steals his axe! So back to the start for another axe and more problems with the crocodile! And the ape! Having hacked a path through the forest he may climb another ladder to level three where he has to leap a pit of flames by grabbing a swinging rope. Will he ever escape back to the city? Can he jump the chasm that suddenly opens before him just as he is about to reach home? A highly amusing game with delightful graphics suited to all members of the family – but very frustrating and addictive.

SPECTRUM VERSION £5.50

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CHRISTMAS SHOPPING

Having sampled a few High Street retailers with mixed results I decided to find out what sort of response I would get at some large department stores.

The Harrods salesman talked about computers in terms of their capacity which made them seem more akin to other consumer products like washing machines or refrigerators. After all, this is just what they are. He warned that the educational software on the market provides parrot fashion learning that is no longer well regarded in educational circles as it doesn't make the child think — a matter for individual decision on educational philosophy. He also suggested that there was a need for some software to help users make home economic decisions, such as the effect on expenditure of running a car five miles more or less each day. It was startling to find the concept of computer modelling (for this would require a model of the economy of running a car) being volunteered by a home computer salesman. Whether he was just trying to tell us that home computers are more suitable at present for games than more constructive purposes, I'm not sure, but he recommended the VIC-20 Starter Pack or the Sinclair Spectrum for Maggie's purported need because of the wide range of software written for both of them. This seemed a slightly more impartial recommendation than those given in High Street stores where large volume discount agreements with particular manufacturers influence marketing policy.

If I had to give top marks to anyone it would be the salesman at John Lewis in Oxford Street. He brought a sense of humour to his job, for when I said I wanted to buy a home computer but didn't know anything about them he quipped: 'You're just the kind of customer we like . . . just write us a cheque . . .' In more serious vein, he asked:

'What do you want it for? Have you got children who'll be using it?'

'Yes.'

'Do they have one at school?'

'No.'

'In that case for a beginner I'd recommend the Sinclair Spectrum. There's a lot of software for it and it's not too expensive.' He showed me some of the games. When I commented that they all seemed aggressive he added that there were more intellectual games too, such as Scrabble and chess and adventure games.

The salesman said that if they had a BBC Micro at school he might have suggested that — if I was prepared to pay £400 against £130 for the Spectrum. 'There is the new BBC-compatible Electron,' he said, 'but it has only just launched and is almost impossible to obtain.'

He gave clear explanations of computer terms, explained that if the children learn the programming language Basic they would find it easy to transfer from the Spectrum to BBC Basic if they needed to, comparing different versions of Basic to dialects of English.

Like the salesman at Boots in Knightsbridge the man at John Lewis was himself the owner of a home computer. When you're looking for a computer, try to find out if the salesperson owns a computer; perhaps this could be your first question. I learned a great deal more from the people who had their own computers than from those who had apparently only been trained to sell them.

Still in the West End I went to Hamleys, the world famous toy store — plenty of parents will visit it just before Christmas. In the basement are displays of home computers from four manufacturers: Sinclair; Atari; Commodore; and Texas Instruments. In front of the rows of flickering screens at each stand are lines of youths addictedly playing arcade games. I suspect that women find this rather intimidating — I did.

Among the other shops I visited were the Tandy shop and JVC, both in the Edgware Road, Lasky's in Tottenham Court Road and Computerland, a specialist computer shop near Marble Arch. The network of Tandy shops only sell their own make of computers; for home use the TRS 80 Colour computer was recommended. I asked what advantages it offered over cheaper machines such as the Spectrum and was told of Tandy's worldwide support service. This did not seem a sufficient reason to me to pay the extra, nor did the salesman attempt to demonstrate its capability.

At JVC the salesgirl had been trained to explain things clearly and simply but her knowledge was limited. Commenting that the TI-99 had the advantage of using cartridges as well as cassettes, she then proved unable to explain the difference between the two media (she was not the only person to fail in this respect). As it happens, apart from cost, cartridges being considerably more expensive than cassettes, the difference can become quite significant to the home user. The slow and not always reliable load time from cassettes can become a nuisance — especially if you're a naturally impatient person — and intolerable for such a purpose as wordprocessing. Cartridges eliminate this problem; you plug them in and the program is immediately ready for use. However, you are unable to save programs you have written yourself on cartridge.

At Lasky's the salesman I encountered seemed well informed and offered clear explanations.

Computerland appeared so much more quiet and businesslike than the other retailers that I doubted whether home computers would be on sale. However, the assistant said that 20% of its sales were home computers, 80% business machines. It stocked the VIC-20, Commodore 64 and Atari computers and he recommended the VIC-20 for a beginner. 'Computers are looked upon as disposable items,' he commented. This seems to be the rationale behind recommending the VIC-20 and Spectrum — they can be expanded enough for the needs of most home users but if the computer is not a major hit in your home you will not feel that you have wasted too much money; if you do become truly addicted you won't mind investing in something more powerful eventually.

Conclusions

Since I had the newcomer to computing in mind when writing this article I geared my questions to the likely uses most people would make of their first computer. However, some newcomers may have a specific need for wordprocessing or small business accounts on a home computer. The ability of salespeople to advise varied greatly in the shops I visited so I think that if you have such a requirement, unless you are lucky enough to find someone who is very well imformed, you would be better off going to a specialist shop where they are used to dealing with business queries.

If you want to process words you will probably find that a disk drive (about as expensive as the computer) and floppy disks are preferable for storing information; whereas it could take five minutes to find a particular item of information on tape it would only take a couple of seconds on disk. A printer will also add to the expense. The recently launched Sinclair Microdrive brings fast access to Sinclair users; it is a continuous loop of tape which spins so fast that access times are almost as fast as for disk. However wordprocessing and business uses are not the reasons for which the majority of home computers are bought which is why I have only mentioned them in passing.

The low cost machines which were constantly being recommended to me have certainly turned computers into a normal consumer product. But buyers do not usually have past experience to draw on as they do when making a decision about a television or washing machine so they are more in need of advice. Unfortunately computers are as new to many salespeople as they are to most buyers so the advice available is still inadequate. Nevertheless, it's reasonable that home computers should be widely available in High Street shops and although efforts obviously have been made to train staff there is much room for improvement, in particular for ensuring that several staff are trained so that there is always someone present who can deal with queries. Until this happens buyers will have to do rather more background reading than is necessary for buying most consumer products and probably go to several retailers for information before they feel happy about making a decision.

Although there was a lack of knowledge on the part of some salespeople there was no lack of will to help. I was impressed by the pleasant manner of almost all the salespeople I met. And if I had been a genuine buyer I would undoubtedly have ended up with a Sinclair Spectrum as a result of their cumulative advice. I feel it would have been a satisfactory choice.

PS. All the shops visited by Margaret Spooner were in the London area. END

PLANE THINKING

Frank Dutton explains how to remove hidden lines from three dimensional drawings.

When people talk of improving a 'wire frame' drawing they usually mean: 'How do I remove those lines which should not be there, because I "know" they are hidden?' The simple answer usually is you can't! The reason why lies in the data used to construct the drawing. The simplest model of an object consists of a set of point coordinates to represent the corners of the object, and a connection table to indicate which corners are joined together to represent the edges. When this simple model is manipulated to form a drawing, the result is an accurate picture (as far as the screen resolution will allow) of an object that is made up of points and lines. Nothing is hidden because there is nothing to hide behind. The drawing has no solidity because there is nothing solid in the model.

Look at any photograph and try to find some lines. The chances are there won't be any. What you will find are numerous boundaries between different colours, tones and textures. The different colours, tones and textures are the result of light being reflected, in different ways, from all the surfaces of the objects in the picture. The boundaries occur where one surface stops and another starts. If you pick up a solid object your hand presses against a solid boundary. On one side is the matter that makes up the object; you and the rest of the world are on the other. It is the opaque surfaces near us that hide others which are further away.

The use of lines to construct a drawing is an abstraction. The painter Paul Klee is reputed to have described some of his work with the comment: 'I took a line for a walk.' Lines are a shorthand way to describe the boundary of a surface; inside the boundary is the surface and on the other is something else. Outlines are used to describe the limits of an object. Outside the line is the rest of the world. By building a model of the object in terms of its faces and using this to generate a picture a more realistic solid image will be formed. The first stage along the road to realism is the removal of those hidden lines.

The model that will be constructed must provide the following information:
— The position of each face; and
— The limits of each face.

The colour and texture of each face could also be modelled but the use to which such information is put is outside the scope of this article. Any curved surfaces must also be removed and replaced by a number of facets or tiles which approximate the curved surface. With the object reduced to flat surfaces a start can be made at generating the data for the model.

The easiest way to define the position of the face is by a face plane equation, which takes the following form:
$ax + by + cz + d = 0$
with a , b , c , d as constants and x , y , z as cartesian coordinates.

If the coordinates are made homogenous then the equation can be written in the form: $[x\ y\ z]\begin{bmatrix}a\\b\\c\\d\end{bmatrix} = 0$

where x, y, z forms a line vector and a, b, c, d forms a column vector.

A plane, which can be thought of as a very thin sheet, has two sides, and the plane equation can indicate the position of any point with respect to the plane. If the result of the point row vector with the plane equation column vector is less than 0 then the point is on one side of the plane and on the other if it is greater than 0. The ability to distinguish which side of the plane a point lies is extremely useful. When a plane is the outside surface of a solid it has only one visible side, the one facing outwards. The other side faces into the solid matter of the object, and so must be hidden. The position of each face of the object is modelled by a column vector holding the constants of the plane equation for that face. These are assembled into a 4 x n array where n = the number of faces.

$$\begin{bmatrix} a_1 & a_2 & * & * & *a_n \\ b_1 & b_2 & * & * & *b_n \\ c_1 & c_2 & * & * & *c_n \\ d_1 & d_2 & * & * & *d_n \end{bmatrix}$$

← faces →

Array of face plane equation column vectors

The faces of the solid do not extend to infinity but are cut, where two faces meet, to form an edge of the solid and, where three or more faces meet, to form a corner or point. By limiting the description of each surface to a flat plane all the edges will be straight. This implies that each face can be described as a face polygon that has straight sides at edge boundaries and verticies at the corner points. The face polygons can be modelled by listing, for each face, the verticies that are encountered as the polygon is traced out. The verticies are entered on the list in the order they are encountered. As the polygon is a closed figure the first and last entry into the list will be the same. As one corner will be shared by at least three planes it would be foolish to keep duplicate copies of the same information.

For this reason the corners are indexed. It is the corner point index that is entered into the face polygon verticies list; the index being used to point to the corners' position in a separate points list. The face polygons are therefore modelled by using two arrays: the face polygon verticies array, each row of which contains an ordered index of the corners of a polygon. To keep the data consistent each face is entered in the same order as was used for the face plane equations. The second array used in modelling the face polygons is the points list. Each row of this array is a homogenous coordinate vector, and the number of rows is equal to the number of corners of the solid.

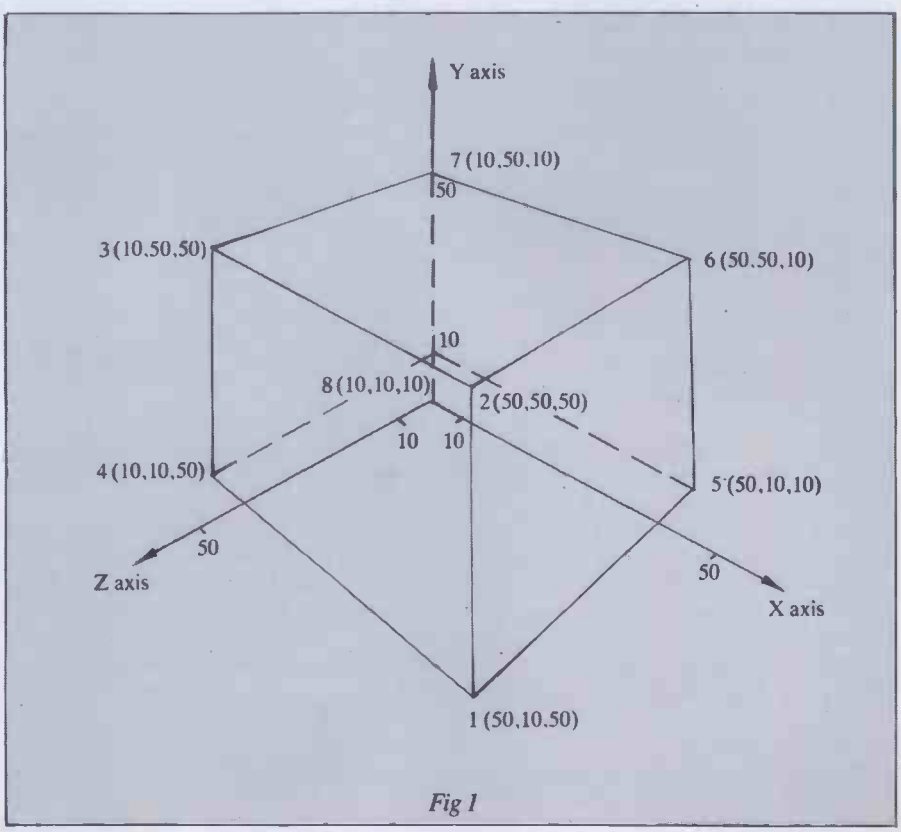

Fig 1

1		
2	f	ordered index to the points list array
*	a	
*	c	
*	e	
n	s	

max number of corners indexed for one polygon

Face polygon verticies array

x_1	y_1	z_1	1
*	*	*	1
*	*	*	1
*	*	*	1
*	*	*	1
*	*	*	1
*	*	*	1
x_n	y_n	z_n	1

Points list

The data structure of the model is now laid out and the arrays can be filled in. As an example a simple box, Fig 1, will be used.

The first step is to construct the face polygon verticies array and the points list. It has been shown that the face polygon verticies are listed in such a way that by joining the corners together, in the order they are listed, a closed polygon is traced out. The polygon may be traced out in two directions: either in a clockwise or anti-clockwise direction. The convention is that all faces are traced out *anticlockwise* when viewed from *outside* the object.

When this step is complete the two arrays containing the information appear as in Figs 2 & 3 below.

1		1	5	6	2	1
2	f	1	2	3	4	1
3	a	2	6	7	3	2
4	c	1	4	8	5	1
5	e	5	8	7	6	5
6	s	4	3	7	8	4

Fig 2. Face polygon verticies array

		x	y	z	
1		50	10	50	1
2	c	50	50	50	1
3	o	10	50	50	1
4	r	10	10	50	1
5	n	50	10	10	1
6	e	50	50	10	1
7	r	10	50	10	1
8	s	10	10	10	1

Fig 3. Points list array

The column vectors of the face plane equation can now be calculated. The minimum number of points required to describe a unique plane is three (as long as a continuous straight line cannot be drawn through them). So three points must be found that are in the plane and not in a straight line. The first three corners indexed by the face polygon verticies list meet these requirements. The verticies of the polygon must be in the plane and as they are used to indicate a change of direction when tracing out the polygon, they cannot possibly be in a continuous straight line. The first three elements a,b,c of the face plane equation vector are calculated using the equations below.

$$a = \sum_{1\text{-}n} (y_i - y_j)(z_i + z_j)$$

$$b = \sum_{1\text{-}n} (x_i - z_j)(x_i + x_j)$$

$$c = \sum_{1\text{-}n} (x_i - x_j)(y_i + y_j)$$

for n points in the plane
if i<n then j = i + 1: if i = n then j = 1,
where i and j are the i^{th} and j^{th} corners indexed in the face polygon verticies list for the face whose plane equation is being calculated.

For face 1 the first three corners indexed are 1, 5, 6 so we substitute as in Fig 4.

$$\begin{aligned} a &= [(y_1 - y_5)(z_1 + z_5)] \\ &\quad + [(y_5 - y_6)(z_5 + z_6)] \\ &\quad + [(y_6 - y_1)(z_6 + z_1)] \\ &= [(10 - 10)(50 + 10)] \\ &\quad + [(10 - 50)(10 + 10)] \\ &\quad + [(50 - 10)(10 + 50)] \\ &= [\quad 0 \quad] \\ &\quad + [\quad -800 \quad] \\ &\quad + [\quad 2400 \quad] \\ a &= 1600 \end{aligned}$$

Fig 4

b + c are calculated in a similar manner (Fig 5).

$$\begin{aligned} b &= [(z_1 - z_5)(x_1 + x_5)] \\ &\quad + [(z_5 - z_6)(x_5 + x_6)] \\ &\quad + [(z_6 - z_1)(z_6 + z_1)] \\ &= [(50 - 10)(50 + 50)] \\ &\quad + [(10 - 10)(50 + 50)] \\ &\quad + [(10 - 50)(50 + 50)] \\ b &= 0 \\ c &= [(x_1 - x_5)(y_1 + y_5)] \\ &\quad + [(x_5 - x_6)(y_5 + y_6)] \\ &\quad + [(x_6 - x_1)(y_6 + y_1)] \\ c &= 0 \end{aligned}$$

Fig 5

With the first three elements calculated, d is obtained by using coordinates of a point, that is in the plane, in the equation below:

$$d = -ax - by - cz$$

A suitable point is the first corner indexed in the face polygon list for the face equation being calculated.

That is, for face 1 the first indexed corner has the coordinates (50,10,50)

$$d = -(1600 \times 50) - (0 \times 10) - (0 \times 50)$$
$$d = -80000$$

When all the face plane equation column

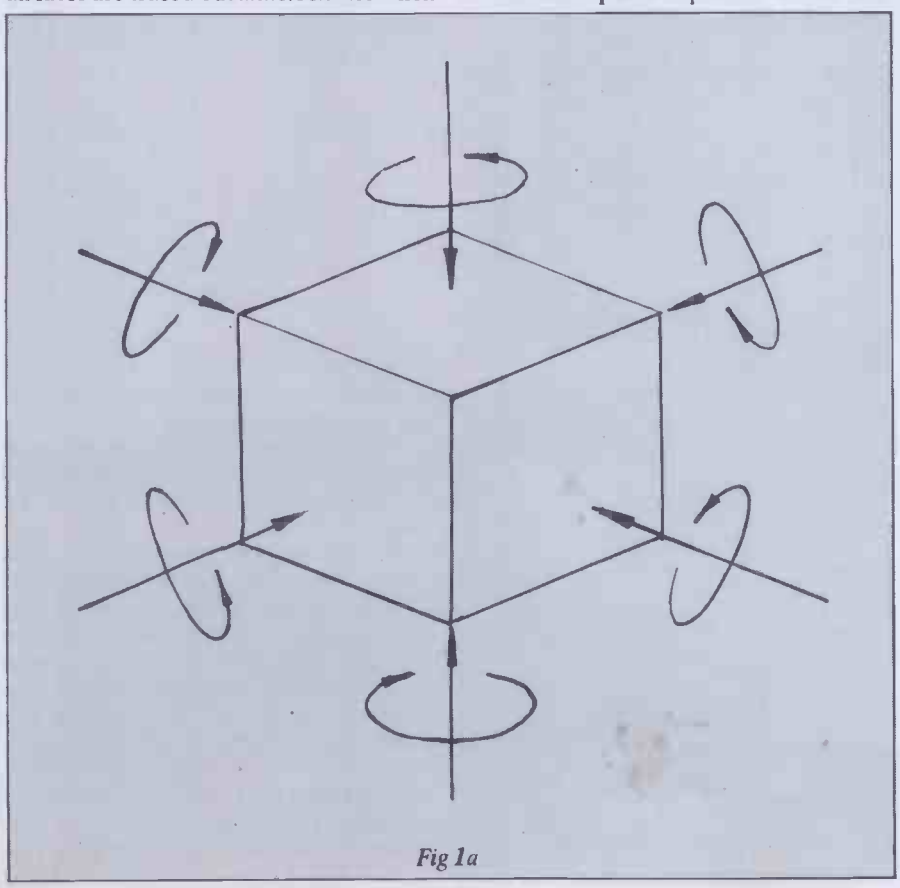

Fig 1a

PLANE THINKING

vectors have been calculated the array holding them will appear as in Fig 6.

1600	0	0	0	0	−1600
0	0	1600	−1600	0	0
0	1600	0	0	−1600	0
−80000	−80000	−80000	80000	80000	80000
faces					
1	2	3	4	5	6

Fig 6

Having constructed the data that will be used as the model for the object, we can consider how it is manipulated to form a drawing. It is desirable to be able to move the object in space so that it can be viewed in different orientations, with respect to the reference planes.

The transformation of a point, with homogenous coordinates, can be accomplished by the use of a 4×4 transformation matrix T.

[x y z 1] original coordinates × T (transformation matrix) = [x′ y′ z′ 1] transformed coordinates

— the upper left 3 × 3 sub matrix being used to rotate the point about the axes;
— the upper 3 × 1 sub matrix being used for shearing and perspective projection;
— the lower 1 × 3 sub matrix being used to translate the point along the axes; and
the lower right element being used for overall scaling.

When such a matrix is used to transform the points list of the model, the effect is to relocate the points relative to the axes of the reference planes. As the points are the verticies of the face polygons, it follows that the faces have also moved, and will now have different face plane equations. So having transformed the points list, the column vectors of the face plane equation have to be adjusted to keep in step. Recalculation of the vectors is possible but wasteful. What is required is a matrix similar to the matrix used to transform the points list homogenous coordinates. Fortunately, for most transformations, such a matrix exists. It is in fact the inverse of the transformation matrix.

The inverse of a matrix T is denoted by $\overline{T}$ and defined such that $T\overline{T} = I$ and $\overline{T}T = I$ where I is the identity matrix.

For example,

$$\begin{bmatrix} * & * & * & * \\ * & * & * & * \\ * & * & * & * \\ * & * & * & * \end{bmatrix}_{T} \quad \begin{bmatrix} * & * & * & * \\ * & * & * & * \\ * & * & * & * \\ * & * & * & * \end{bmatrix}_{\overline{T}} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}_{I}$$

For the purposes required here, a simple definition of the inverse matrix $\overline{T}$ is a matrix that does the *exact* opposite of T.

For example,

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos\theta & \sin\theta & 0 \\ 0 & -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}_{T}$$

This is the transformation matrix for rotating the point coordinates an angle θ about the x axis.

The inverse of T must do the exact opposite.

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos -\theta & \sin -\theta & 0 \\ 0 & -\sin -\theta & \cos -\theta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}_{\overline{T}}$$

This is the transformation matrix for rotating the point coordinates an angle θ about the x axis.

It is the inverse of T because if the points are first rotated an angle θ about the x axis and then an angle −θ about the x axis, the points end up where they started from.

If $\overline{T}$ exists then the column vectors of the face plane equation can be transformed using it.

$$\begin{bmatrix} * & * & * & * \\ * & * & * & * \\ * & * & * & * \\ * & * & * & * \end{bmatrix}_{\overline{T}} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} = \begin{bmatrix} a' \\ b' \\ c' \\ d' \end{bmatrix}$$

After all rotations and translations have been performed to adjust the orientation of the object, the final stage is to draw the object. It is usual to project the image of the object onto the plane z = 0 from a position $(x_v, y_v, z_v, 1)$ — the viewing position coordinates. To remove the majority of the hidden lines it must be determined which face polygons are visible from the viewing position and which are hidden. To suppress the projection of the face polygons that are hidden, a simple gate is used. By inserting the coordinates of the viewing position into the face plane equation of each face polygon, the result will determine visibility, that is.

$$[x_v\ y_v\ z_v\ 1] \begin{bmatrix} a \\ b \\ c \\ d \\ F_n \end{bmatrix} > 0 \quad \text{if the face } F_n \text{ is visible}$$

If a face passes this test, the face polygon can be projected by reading the appropriate row of the face polygon verticies list to find the corners.

The projected positions of the verticies of the polygon are determined by transforming them with a viewing matrix, which takes the form:-

$$[x\ y\ z\ 1] \begin{bmatrix} 1 & 0 & 0 & -1/x_v \\ 0 & 1 & 0 & -1/y_v \\ 0 & 0 & 0 & -1/z_v \\ 0 & 0 & 0 & 1 \end{bmatrix} = [X_s\ Y_s\ 0\ 1]$$

viewing transformation matrix

X_s, Y_s *being screen coordinates*

When the object is a convex polyhedron the task of removing all the hidden lines is complete. The screen coordinates can be plotted and the face polygons drawn.

With concave solids further steps may be required to ensure the complete removal of hidden lines but that is a topic for another time.

The routines for constructing the data and manipulating it are not complex and though 'real time' moving pictures of solid objects require machines much faster than those available for home use, the use of these techniques will greatly improve the realism of the pictures we can draw. For those that followed Paul Stevenson's article on Stereo Graphics (*PCW* October 1982) you now have a way of specifying eye coordinates to generate a stereo pair without those confusing hidden lines.

END

Rotate (+,−) (1) X (2) Y (3) Z
Move (+,−) (4) X (5) Y (6) Z
(7) Hard copy (8) New DRG. (9) End

Sample output

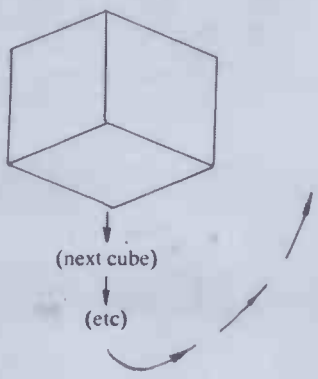

Fig 7

The HX-20. For business on the move.

In today's fast moving business world, your information has to move with you. Over the past few years there has been an increasing demand for a totally portable computer with the ability to meet so many challenges.

Epson, with over 20 years experience in designing and manufacturing high quality printers, have produced the HX-20, a precision machine with its own rechargeable power supply that can be used for just about any task within todays discerning business; from data capture to word processing, from card indexing to sales order entry. Communicating with other machines is no problem and the HX-20 is easily coupled to one of our fine printers. You can even link in another computer system by using an acoustic coupler.

Don't be fooled by its size, the HX-20 has all the software back-up you'd expect from a much larger machine and incorporates many "bigger computer" features – 16k RAM expandable to 32k with serial interfaces, a full size typewriter keyboard, it's own built in LCD screen and a dot matrix microprinter. A microcassette facility is available as an optional extra.

A complete computer that will either stand on its own or could be the obvious extension to your existing system.

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PCW12/10

BIBLIOFILE

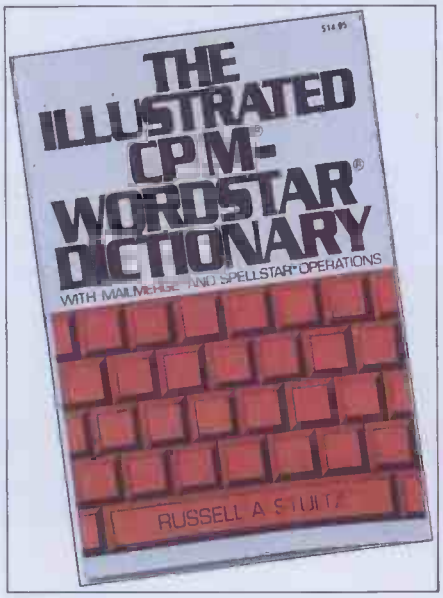
Linnet Evans, in her inimitable style, gives a critical analysis of computer books.

THE ILLUSTRATED CP/M WORDSTAR DICTIONARY

More and more software publishers are offering wordprocessing packages — good, bad and ugly — for more and more micros. Even among the *status quo* of CP/M machines, minority cult packages such as Spellbinder seemed to be gaining significant ground. Then enter the Osborne (Hyperion, Zorba . . .), and WordStar's back in town.

The classic shortfalls of the official MicroPro manual and other accoutrements have prompted a very genuine reaction from all quarters. You can now teach yourself from cassette, interactive disk and no doubt soon, video. Meanwhile (and much cheaper), there's always The Book (and a great many of them).

The Illustrated CP/M-WordStar Dictionary is very much a working manual to be used in ongoing hands-on situations. Sixty or so major WS functions are each assigned a 'module' (chapterette) where their use, abuse and consequences are discussed in terse detail. A description, a note on major applications and the (illustrated) Typical Operation — normally sensible and relevant — make up each module. An upfront contents list, rather than a trailing index, provides the point of entry.



A selection of menu/command summaries is also provided. While not wholly comprehensive, this is indubitably quicker service than ploughing through the dreaded white manual. MailMerge and SpellStar are each given a token airing, probably not unreasonably in this context.

What did seem a little unreasonable is that CP/M is brought literally to the forefront. Thus PIP and ERA tend to mask the embedded WS copy and delete facilities, which may be a shade unnerving for some Osborne-type users who are taking WS as a virtually catch-all edit and housekeeping facility.

Clearly, Stultz's book presupposes some knowledge of the MicroPro package. A tidier layout, tightening-up of the diagrams and perhaps a spiral binding would help in extending that knowledge. The UK price is a certain detraction, too. Despite these reservations, it has some very sound principles behind it: worth looking into.

The Illustrated CP/M-WordStar Dictionary
Author: Russell A Stultz
Publisher: Prentice-Hall
Price: £12.70

WRITING IN THE COMPUTER AGE

Turning to the author's credits at the close of this book, I noted with interest a long string of titles concerned with such diverse topics as cops and redwood trees. (For credibility, Fluegelman is also editor of *PC* magazine.) In the finest Californian tradition of where-they're-coming-from, it's also all the justification you ever need for coming up with a book whose subtitle is *Wordprocessing Skills and Style for Every Writer*.

That subtitle is entirely accurate. Like a magnification of John Lee's academics *Made Easy*, this one is going for the welter of casual correspondents, demon drafters, nascent novelists and jaundiced journalists who from time to time are doing a fair bit of writing. Since technology can outstrip even cirrhosis of the liver, the computer age has now to be faced — but how?

In some respects, *Writing* provides no specific answers. Hardware options are discussed only in general terms (though use of a single-user PC with twin floppy disks is assumed in later examples). WP software, too, is brand-free. The enviably elegant universal package which the authors devise illustrates the major features of most set-ups: margins, cursor movements, string search *et al*. Apart from anything else, this leaves the newcomer rather better equipped to judge any demonstration independently. Familiarity can breed rather more than contempt.

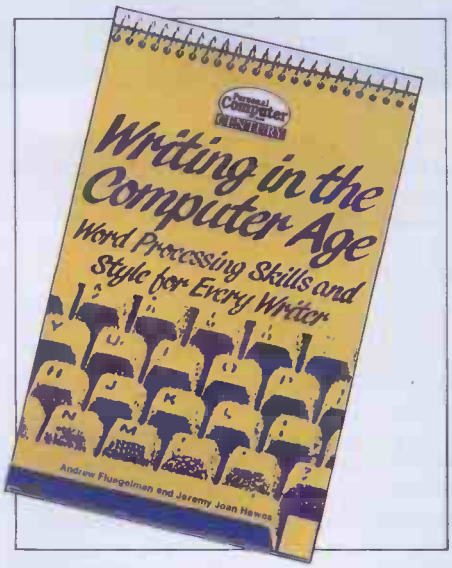
Good habits (lots of back-ups, lots of clean-ups) are encouraged: clearly redwood-writers share some problem areas with British academics.

Where *Writing* really takes flight, though, is with the real extensions of style and technique that can come from using a wordprocessor rather than a typewriter (or worse). The ultimate jam on the bread is of course the ability to network your piece directly to the typesetters.

Arrangement of chapters is perhaps a little surprising but entirely workable, while layout and illustrations are again clear and straightforward.

This is, of course, a thoroughly selfish and parochial book, riddled with unnecessary voyeurism. If you like it that way, it's also totally brill.

PS This review was written on an eight-year old IBM Selectric and travelled on the Northern Line.



Writing in the Computer Age
Author: Andrew Fluegelman and Jeremy Joan Hewes
Publisher: Century/PCW
Price: £5.95

FIRST BYTE: CHOOSING AND USING A HOME COMPUTER

The tasty pic on the cover of *First Byte* clearly sees the circle of 'cookbook' come full turn. (Will the kitchen partworks of '84 be filled with pennywise recipes for 6502 chocolate chip cookies?)

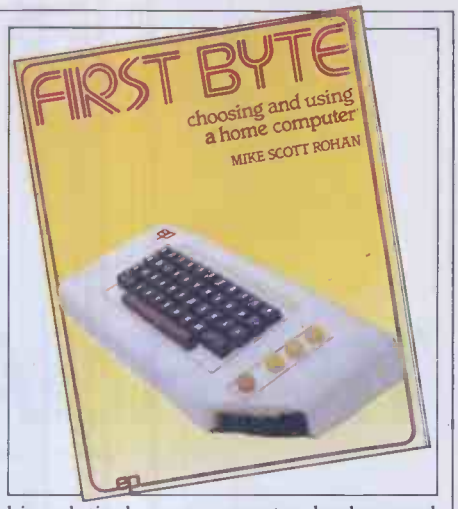
But seriously folks, in the megasurge of new entrants to this computer lark, floodgates have overtaken logic gates. In the getting-started stakes, there's inevitably some rubbish. Predictably, too, there's a great deal of duplication.

Sci-fi scribe Mike Scott Rohan has got his subject rarely and squarely nailed on the head, however. *First Byte* is a physically lightweight but well-stocked book, attractively laid out — and attractively priced. Written in confident, quippish but never overbearing style, the quintessentials of applications, chips, language *et al* are covered with helpful economy.

Sensible advice is given to prospective buyers, with suitably dire warnings about warranty-busting hardware mods and naff educational software. In a more subtle way, Rohan recognises the did-I-fall-or-will-I-be-pushed syndrome of many incoming computer users. On balance he succeeds very well in providing the right kind of background and support for keeping the decisions in the owner-user's hands.

A selection of magazines are reviewed, *PCW* naturally being much favoured. More remarkable though is a *resumé* of a selection of machines in the sub-£400 price range as available in mid-83. Trenchant thumbnail sketches note the wayward Basic dialects, shrunken ROMs, fattened prices, freebie packages and despite-it-all-forever-in-our-thoughts natures of twenty or so widely-distributed micros. Even when it's 1985 and all different, this type of approach and the questions it raises will still remain entirely relevant.

With *First Byte*, Mike Scott Rohan has, I think, gone a long way to meeting the real needs of a very wide readership. Probably



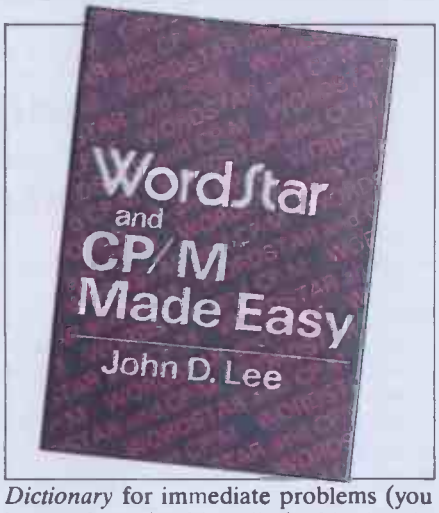
his relatively non-computer background has been an asset here, but I do hope we see more of him in time to come.

First Byte: Choosing and Using a Home Computer
Author: Mike Scott Rohan
Publisher: EP Publishing
Price: £3.95

WORDSTAR AND CP/M MADE EASY

Despite the similarity in titles between John Lee's book and that of Russell Stultz's reviewed above, they are virtual chalk and cheese. True, their reasons for being share common roots. But rather than being a mere/avowed on-line reference book, *WordStar and CP/M Made Easy* is a much more thoroughgoing operation. Written by a British academic (probably *for* British academics), it aims to beat the MicroPro house writers, plus certain imitators, fairly and squarely at their own game. It succeeds, exquisitely.

A fairly compact volume, *Made Easy* is nonetheless densely filled, showing the streetwise tricks of a daisywheel-style typeface helped by a little recession-proof grey highlighting for the screen illustrations. Unless you are pretty good at Star-gazing, it's not as good as the



Dictionary for immediate problems (you have to do quaint things like looking it up in the index). Against which, the added luxury of discussion and debate makes it a much more readable book before or after the event. Signally, the author here gives the reader a real feeling of what a wordprocessor — not just WordStar — really is and does.

MailMerge and its use of variables, a territory which seems to cause untold miseries to many, are given an appropriate level of attention with a realistic selection of examples.

Summaries of the various menus and onscreen commands are again given at the end.

CP/M here comes towards the end, too. Lee's very readable coverage of the main transient and integral commands is probably more than the average polytechnic lecturer requires for general housekeeping and file shunting; but no harm done.

This is a surprisingly personal book, both as written and as read. Advocated.

WordStar and CP/M Made Easy
Author: John D Lee
Publisher: John Wiley & Sons
Price: £6.95

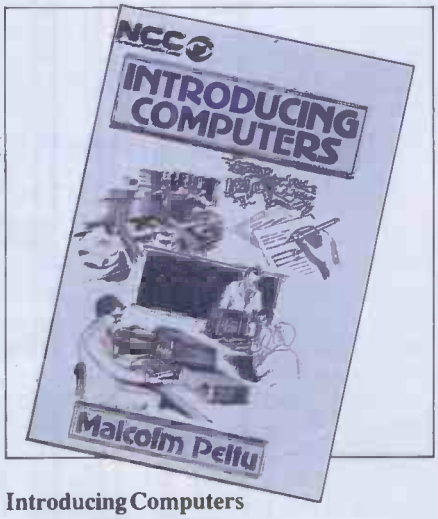
INTRODUCING COMPUTERS

Introducing Computers shares some of the same factual ground as *First Byte* reviewed above. It marks, though, a rather different approach. Partially this is simply because it's a very typical National Computing Centre output with the distinct air of being the authorised version and neo-standard reference work around it. Partially, too, it's because both the Introduction and the Computers of the title are treated in a much broader and deeper fashion than we've come to expect from books of eponymous ilk.

While personal computers offer a useful point of contact, the camera pans far more widely. From Stonehenge to fifth generation, virtually every aspect gets at least a few lines — hardware, software, applications, organisation — but not of course politics. Peltu has generally kept his diverse topics very well balanced.

Maybe the universal approach, at this moderately serious level, is just no longer possible. Turning back to an earlier Peltu/NCC book, *Using Computers — A Manager's Guide*, there is again a significant common slice of territory covered and questions raised. Yet the sheer fact of pacing through the subject for *managers* gave it all the cut and thrust, form and focus, that this book seems to lack.

Almost 20% of the book is given over to a glossary, a dictionary of acronyms and a bibliography, while the text itself is well laced with references to reports, surveys and the like. As a cross-reference into further reading it's in a different ball game. *Introducing Computers* isn't a natural choice for a personal purchase; but for a college or business library, for example, it should have few real rivals.



Introducing Computers
Author: Malcolm Peltu
Publisher: NCC
Price: £5.50

SOFTWARE

WHICH SPREADSHEET?

THE FINANCIAL PLANNER

Mike Liardet waxes poetic on Ashton-Tate's answer to the spreadsheet . . .

In days of old,
With no micros sold,
And spreadsheets not invented,
They spent time and sterling
On financial modelling,
And had to be contented.

Well, not the greatest poetry, but unlike the ditty it paraphrases, at least it's clean! The point is that mainframes have had financial modelling facilities for many years. These modelling systems were designed in an era of card-readers, teletypes and extortionate 'meter-charges' on the central processor. Given these fundamental facts of life they work in a particular way, quite unlike micro spreadsheet systems which take full advantage of the high-speed display, interactive keyboard and all that free central processor time.

So, at first glance it might seem rather curious to implement a traditional style financial modelling system on a micro, but this is exactly what Ashton-Tate, of dBase II fame, has done with 'The Financial Planner' ('TFP' from now on). Although it is definitely not a spreadsheet system, it is included in the 'Which Spreadsheet?' series because it will be of interest to anyone contemplating a spreadsheet purchase; that is, providing they are prepared to part with the daunting £437.50 that Ashton-Tate is charging for it.

The marketing approach taken by Ashton-Tate is that TFP is for users who have outgrown spreadsheets and want to do some 'real' modelling. In fact TFP is not the first mainframe-style micro financial modelling system — MicroModeller has been available for many years and has reputedly found 4,000 users in the UK. So there must be some sort of rationale in this mainframe/micro marriage.

I would identify two reasons for preferring TFP and its ilk: mainframe users migrating to micros may prefer familiar territory to the unknown spreadsheet, and systems of this type do offer features and facilities not available with spreadsheets.

In this article I'll address the question of whether the extras in TFP's real modelling facility are worth the loss of high speed interaction and ease of learning.

Installation

TFP is available for both 8-bit CP/M systems and 16-bit MS-DOS and CP/M-86 machines, including, of course, the IBM PC. My review copy was for a CP/M Apple for which three disks were supplied: two containing the software and the other containing demonstration files. TFP is implemented in compiled Microsoft Basic, which results in quite fast software (for Basic, that is), but rather large files of code — hence the need for two software disks. Users with more disk capacity than an Apple could fit everything on one disk.

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The manual has a short section devoted to the absolute newcomer, explaining what a VDU and disk are, etc. Regrettably it does not go on to give the instructions for creating TFP working disks. An absolute beginner will have far more trouble with this, than identifying his VDU or whatever. Anyway, assuming you know how to create your own working disks, it is not too difficult to get started. Simply type "TFP" in response to the operating system prompt and off you go!

The first time you run TFP it detects that it has never been run before, and automatically selects the 'installation' procedure. A menu of VDUs is presented and you select your one if it's there, and 'Other' if not. If you select 'Other' you have to key in the basic codes and information about cursor addressing, etc. This caused me a momentary panic as my VDU was not listed and I happened not to have the relevant manual with me. Anyway, by selecting each of the named VDUs in turn I discovered that mine happened to be compatible with one of them. TFP makes this sort of trial and error exercise particularly simple as it displays a test-pattern immediately after you have selected a VDU. This pattern is drawn by jumping the cursor all over the screen, so if anything is wrong in your specification you end up with a complete mess, and know to correct it immediately, rather than finding out only after you are running the system.

Unlike spreadsheet software which usually needs to be set up with a number of codes for command keys, TFP uses only the standardised 'Escape' and 'Rubout' keys, which do not need to be specified during installation.

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Thus the installation process was as easy as you could hope for. The only complication that I could find arises when you select 'Other'. The system requests, among other things, an 'offset' value for the screen coordinates. In fact for most VDUs this value is 32 if the software regards the top left-hand corner of the screen as position (0,0), or 31 if it regards its position as (1,1). The manual does not specify which convention TFP is using, and in fact its examples contradict each other, so it is only possible to discover whether 31 or 32 is needed by experimenting.

Overview

The system is a lot more complex than a spreadsheet system. With a well-designed spreadsheet it is only necessary to grasp a few principles to form an 'image' of what is happening under the bonnet. TFP's manual contains no overview that could help you build up this image; instead it plunges straight into a heavy modelling session. In fact the nearest it comes to an overview is in the introduction, but this reads more like advertising copy and does not tell you enough in detail. One amusing line in the introduction informs you that TFP's 'automatic mode' is easy enough for 'your secretary or president to run' — it doesn't mention which of the two is likely to be the least able!

Anyway, I shall attempt what the manual does not, and give a quick rundown

on the way the system works. Like any spreadsheet system it enables you to build up and experiment with a 'model' of some financial situation. As with spreadsheets the model is based on a table of numbers, some calculated and some raw data, and annotated with row and column headings. Instead of integrating the raw numeric data and calculation rules, etc, as a spreadsheet system does, these different parts are separated from one another and maintained independently in different files, only being drawn together for the purposes of generating the final report. In fact, when working with TFP you have control over six different aspects of the model description:

★ Rows. TFP needs to know the number of rows in a model, and how they are named. For convenience it also provides an abbreviation facility, so that the row name abbreviation can be used in calculations rather than the full displayed name. There are also numerous different types of override format that can be specified for any rows that will not be printed in the default format.

★ Columns. TFP also requires the same sort of information for the columns of a model. As so many financial calculations use month names and quarterly totals, etc, for column headings, there are special facilities for automatically setting them up. It is possible to vary individually the width for each column.

★ Data. Certain rows, columns or individual cells in the model must be set up with initial values. These may be assumptions (projected sales figures) or concrete facts (last year's closing balance). TFP provides extensive facilities to avoid any repetitive typing in this department. A fairly simple notation permits a sequence of identical values, or a 'growth' sequence to be specified with minimal typing.

	JANUARY	FEBRUARY	MARCH	FIRST QUARTER	APRIL	MAY	JUNE	SECOND QUARTER	JULY
TOTAL REVENUE	22	24	26	72	28	30	32	90	34
TOTAL COST	16	24	18	58	19	20	21	60	22
CUMULATIVE REVENUE	22	46	72	72	100	130	162	162	196
PROFIT	6	-	8	14	9	10	11	30	12
CUMULATIVE PROFIT	6	6	14	14	23	33	44	44	56
PROFIT AS PCT OF REV	27.27%	-	30.77%	19.44%	32.14%	33.33%	34.38%	33.33%	35.29%
COST AS PCT OF REV	72.73%	100.00%	69.23%	80.56%	67.86%	66.67%	65.63%	66.67%	64.71%

	AUGUST	SEPTEMBER	THIRD QUARTER	OCTOBER	NOVEMBER	DECEMBER	FOURTH QUARTER	TOTAL YEAR
TOTAL REVENUE	36	38	108	40	42	44	126	396
TOTAL COST	23	24	69	25	26	27	78	265
CUMULATIVE REVENUE	232	270	270	310	352	396	396	396
PROFIT	13	14	39	15	16	17	48	131
CUMULATIVE PROFIT	69	83	83	98	114	131	131	131
PROFIT AS PCT OF REV	36.11%	36.84%	36.11%	37.50%	38.10%	38.64%	38.10%	33.08%
COST AS PCT OF REV	63.89%	63.16%	63.89%	62.50%	61.90%	61.36%	61.90%	66.92%

Fig 1

★ Rules. The information here constitutes the heart of the model. The Rules section specifies how the parts of the table, unspecified by the Data section, are to be calculated and filled in. A list of rules can be built up and when given the command to 'Compute', each rule is applied in turn. TFP has fairly extensive calculation facilities so quite complex rules can be built up. The end result has a rather Basic-like appearance, but with the important difference that a TFP rule typically operates on a whole row or column. For example, if a model had 12 columns, one for each month, then:

"PROFIT = TOTREV – TOTCOS"

would actually perform 12 calculations, working out the profit for each and every month. If the model were subsequently changed to a 52-week model (by modifying the Columns and Data specifications), then the Rule can remain unchanged, and will perform the 52 calculations instead. A useful feature, for creating turnkey systems, is the 'INPUT' command which can be included as a Rule and used to obtain values from the keyboard in the middle of a 'Compute'. There are also all sorts of special features, covering most situations that are likely to arise: for example, row calculations where the rows are not aligned correctly, or totals columns interleaved with monthly ones, and even a rudimentary iterative looping facility.

★ Variables. In some instances it is necessary to introduce a value into a calculation which is not part of the table. For example, if an interest rate were to remain fixed throughout the year it would be unnecessary to enter it into the model as a row of 12 identical values. Instead a variable name can be specified, and a value assigned to it in the Data section.

★ Text. With TFP it is possible to create a 'text file' containing a sequence of commands to manipulate and print the model. This facility is particularly useful for designing report layouts. The commands to specify paper dimensions, margins, and so on, can all be set up in a text file which can then be invoked whenever necessary. In fact TFP handles most of the formatting niceties automatically, breaking reports up if they are too big for the page and thus it is possible to obtain quite elegant layouts with minimal effort.

The TFP software provides two principal facilities: the 'editor' for passively creating and modifying the above six aspects of the model and the 'Decision Support System' (or 'DSS') which performs the actual machinations. There is another more peripheral 'Selection' facility which permits different files to be brought together to form a model — for example, we may wish to use different sets of Data (different companies or different years) with the same Rules.

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Using TFP

TFP only requires you to go through the installation procedure the first time that it is run. Otherwise it bypasses this and immediately prompts you for a model-name, actually a file name. Following this the master menu is displayed. There are six options on it, to run the editor, DSS and 'Selection' facility and also to change to a new model, finish or 'restart'. Restart sends you back to the installation procedure. If you select it by accident it gives you no second chance and you have to go through the whole installation process again. This can be extremely irritating.

Using the system for the first time, you must first use the editor to specify all aspects of a model. Like most editors (well, text editors not magazine editors!) this editor is completely passive and will simply accept whatever text you throw at it. Thus if you mis-spell a row name in a Rule you will not find out about it at the time, but only when the DSS ('Decision Support System' remember?) is running and fails to recognize the name.

I was not greatly enamoured of the editor. With a product at the price of TFP I would expect a sophisticated screen editor, instead of the fairly primitive line editor that is in fact provided. As the edit session proceeds the screen starts 'scrolling' — the top line, which initially contains status information, just disappears as a new line is typed at the bottom of the screen. The whole feel of it was reminiscent of the old teletype editors of yesteryear.

Of course each of the six different aspects of the model is maintained separately, but the editing process is much the same for each. However, just to confuse matters, Data, Rules and Text must all be preceded by a line number, whereas Rows, Columns and Variables

THE FINANCIAL PLANNER

must not be.

The editor includes commands to Add, Change, Delete and List. These can all be abbreviated to their initial letter and a second letter must also be supplied to specify which aspect of the model they are to apply to. For example, 'LR' would list all the rows and 'AD' would be used to add data.

There is a 'Help' command outlining the edit commands available, and a convenient facility for setting up month names automatically. It is also possible to renumber lines and make text substitutions from top to bottom, so for a simple line editor it is in fact reasonably comprehensive.

Once you have finished editing, you will want to set TFP calculating and then printing the results. Before finishing with the editor it is necessary to use the 'Define' command, which apparently initialises the system workfiles in the light of any changes made in the edit session. I could see no benefit in having this under manual control, since this just gives you the opportunity to forget to do it, and the manual had no suggestions as to why this should be useful. Once you have 'Defined' you can move into the DSS directly by typing 'DSS', or returning to the master menu and selecting the DSS option, or by typing a DSS command. The easiest of the three is just to type the DSS command you want to use: 'Compute' to calculate the model.

In the Apple version the program disks must be changed before the DSS can run. TFP automatically requests a change of disk if the wrong disk is present for a particular operation. Of course with larger disk capacity machines it would not be necessary to change disks, although the actual program disk must always be resident while the program is running. The DSS has a host of facilities, 'Compute' being one of them, and 'Print' being another. Once Compute is finished, which can take some considerable time if the model is large, you can Print.

TFP assumes that your printer has 132 character x 66 line stationery, but it is easy to specify other dimensions using the 'Pagesize' command before doing the Print. It did not appear to be possible to get TFP to switch the printer into a condensed print mode. Most modern matrix-printers have a condensed print facility which is particularly useful in financial modelling applications, when the more characters per line the fewer the number of artificial breaks that need be made in a wide report. In my own case I simply switched the printer on before running TFP and typed the initialisation characters directly from the VDU keyboard using CP/M's control-P facility.

TFP allows several commands to be typed on one line. This is particularly useful when each command may take a significant time to execute. It allows you to get on with something else (not at the keyboard though!), while it finishes the task. For example the command line:

```
ROWS
TOTREV TOTAL/ REVENUE
TOTCOS TOTAL/ COST
CUMREV CUMULATIVE/ REVENUE
PROFIT PROFIT [0]
CUMPROF CUMULATIVE/ PROFIT
PROF% PROFIT AS/ PCT OF  REV [P.2]
COST% COST AS PCT/ OF REV [P.2]
```

Fig 2

```
COLUMNS
JAN JANUARY
FEB FEBRUARY
MAR MARCH
Q1 FIRST/QUARTER
APR APRIL
MAY MAY
JUN JUNE
Q2 SECOND/QUARTER
JUL JULY
AUG AUGUST
SEP SEPTEMBER
Q3 THIRD/QUARTER
OCT OCTOBER
NOV NOVEMBER
DEC DECEMBER
Q4 FOURTH/QUARTER
YR TOTAL/YEAR
```

Fig 3

```
DATA
10 MATHROW JAN-MAR,APR-JUN,JUL-SEP,OCT-DEC
20 TOTREV=22,£>+2
30 TOTCOS=16.24,18,£>+1
```

Fig 4

```
RULES
1000 MATHROW JAN-MAR,APR-JUN,JUL-SEP,OCT-DEC
1010 PROFIT=TOTREV-TOTCOS
1020 PROF%=PROFIT/TOTREV
1030 COST%=TOTCOS/TOTREV
1040 CUMREV=CUM(TOTREV)
1050 CUMPROF=CUM(PROFIT)
1060 MATHCOL
1070 Q1=SUM[JAN-MAR]
1080 Q2=SUM[APR-JUN]
1090 Q3=SUM[JUL-SEP]
1100 Q4=SUM[OCT-DEC]
1110 MATHCOL CUMREV,CUMPROF
1120 Q1=MAR
1130 Q2=JUN
1140 Q3=SEP
1150 Q4=DEC
1160 MATHROW Q1,Q2,Q3,Q4
1170 PROF%=PROFIT/TOTREV
1180 COST%=TOTCOS/TOTREV
1190 MATHCOL TOTREV,TOTCOS,PROFIT
1200 YR=Q1+Q2+Q3+Q4
1210 MATHCELL
1220 CUMREV\YR=CUMREV\Q4
1230 CUMPROF\YR=CUMPROF\Q4
1240 PROF%\YR=PROFIT\YR/TOTREV\YR
1250 COST%\YR=TOTCOS\YR/TOTREV\YR
```

Fig 5

"DEFINE;COMPUTE;PRINT;C"

sets up new workfiles, does the computation and the printout without the need of any further intervention at the keyboard. (The 'C' at the end specifies continuous stationery.) Where a particularly long sequence of commands is repeatedly used it would be more convenient to specify them once and for all in a 'Text' file and whenever needed; just use the 'From' command to instruct TFP to take the command sequence from the file rather than the keyboard.

Although TFP assumes most of the responsibility for report layout, there is the opportunity for some user control. For example, there is a 'Show' command where only specified rows or columns are 'shown'. Also numeric formats, titles, footnotes and margins can be specified. It is also possible to 'report' to a named disk file, for possible subsequent integration in a wordprocessor document.

While the DSS is running TFP does, superficially, resemble a spreadsheet system. At the top of the screen appears the top left-hand corner of the table, and at the bottom is the command line. It is possible to shift the focus of display to some other part of the table, but not with cursor moves. Basically you type in move left, right, up and down commands to achieve this. It is also possible to alter the contents of selected rows, columns or individual cells in the matrix. This works in much the same way as setting up 'Data' using the editor. For example, typing:

"TOTREV=22,>+2"

would enter 22 in the first column of TOTREV, 24 in the next, and so on up to as many columns as there are in the model. The '>' can be read as 'grow by'. Following the command, the changes to the row can immediately be seen, but unfortunately the rest of the display does not get instantly updated. Thus it is not possible to see the ramifications of changes immediately. To update the display the Complete command must be used again.

There is also a 'Whatif' command which actually sounds a lot more promising than it actually is. Following the Whatif command it is possible to enter Rules, one at a time and have them executed as you enter them. I do not see a great deal of use for this — it's not very often you want to ask 'How will my profits change if I calculate them this way?'

Setting up a simple model

Just to give the reader a flavour of modelling, TFP style, I present a simple model appearing as in Fig 1. It covers a twelve month period, complicated by the introduction of quarterly totals and a yearly total at the end. Only parts of the first two rows, 'Total revenue' and 'Total cost', contain numeric data, the rest of the model being calculated:

The cumulative revenue is simply the sum of revenues for the current month and all previous months in the year.

The profit for a given month is the revenue less costs for that month.

The 'Profit as a percentage of revenue' is the ratio of profit to revenue displayed as a percentage.

The 'Cost as a percentage of revenue' is the ratio of cost to revenue displayed as a percentage.

The quarterly columns are an accumulation of figures for just the previous three months.

The yearly column is an accumulation of figures for the whole 12 months.

Fig 2 gives the row specification for this model. Taking the line starting 'COST%', this specification assigns 'COST%' as the internal name for the row, to be used by Rules, etc. "COST AS PCT/ OF REV" is the displayed and printed name of the row — the '/' causes it to be printed on two lines. Finally the '[P.2]' causes all the numbers in the row to be converted into percentages, and printed to two places of decimals with a trailing '%' sign. Actually TFP provides a comprehensive range of possible formats, such as negative numbers in brackets, use of 'CR' and 'DR' for credits and debits — everything except a red-ink option for a colour printer! The only other format option used in this model is the '[O]' (in the Profit row) which causes a row of dashes to be printed over the numbers in that row.

The column specifications are given in Fig 3. It was not necessary to type any of this. Following the editor command to 'Add columns', typing "MONTHS QUARTERS" was sufficient to set the whole lot up automatically.

The actual initial data used by the model is specified by the three lines in Fig 4. The MATHROW feature is particularly powerful since it can be used to circumvent the problems caused by interleaving of the quarterly columns. In this instance it is used to specify that only the month columns are to be affected by the row statements following, and the quarterly and total columns are to be made temporarily invisible. Line 20 specifies that the total revenue row is to start with the value 22, and be filled with numbers thereafter, each greater than the previous by two. Line 30 specifies the first three values for total costs, and thereafter each value will be one greater than the previous. There are several other quick and simple ways of setting up row and column data including an interpolation facility, where the first and last values are specified and the intermediate ones just filled in.

This particular model did not need any Variables or Text. The remainder of the model is specified by the Rules for performing the calculation itself (Fig 5). These rules are executed from top to bottom. This ordering is important since occasionally an incorrect value is entered in a cell, to be overwritten by the correct one later. For example, lines 1070-1100 assign the accumulation of cumulative revenues to cumulative revenue for each quarter. (For example, the cumulative revenue for the first quarter gets set to 22 + 46 + 72 = 140.) The subsequent lines 1110-1150 correct this and the cumulative revenue for each quarter gets set to the cumulative revenue in the month preceding. Note that TFP has a function 'CUM', one of a number of special modelling functions such as 'MIN', 'MAX', 'SUM' and 'DIF' (running difference).

The last five lines in the Rules show how individual cells can be worked on in isolation — most of the time a whole row or column is modified by a single rule. The MATHCELL command prepares the way and references such as 'PROF% YR' specify the coordinates of the cell to be affected.

And that's all there is to it! From the editor the "DEFINE;COMPUTE;PRINT;C" sequence produces the report in Fig 1.

Documentation

The system is supplied with over 200 pages of documentation in a large ring-bound manual, a reference card and limited help-screens embedded in the software. A plastic flap called a sheet lifter is stuck in the front of the manual. There is no suggested usage for this, so I can only assume it's some sort of Ashton-Tate in-joke at the expense of VisiCalc, or has some nefarious purpose unconnected with modelling.

'TFP allows several commands to be typed on one line. This is particularly useful when each command may take a significant time to execute.'

The overall presentation of the manual is quite good except, as I have already noted, there is no introductory overview. There are 10 tutorial lessons and reference material as well. The system is adequately indexed and each chapter is clearly marked with a large red tab so it is relatively easy to find your way around.

The help-screens are not a great deal of use, merely replicating the summary information on the reference card.

TFP versus VisiCalc

It was not possible to subject TFP to the usual Benchtests. This is because it does not provide a rule-replication facility. As a substitute for this I tested it against Apple VisiCalc, with the model in Fig 1. It should be noted that Apple VisiCalc is no longer a state-of-the-art product, and in any case we are definitely not testing like against like. Nonetheless this should give the reader some idea of what to expect from TFP. The major pro and cons were as follows:

★ VisiCalc took only 2.2 seconds to calculate the model. TFP took 180 seconds when initiating the calculation from the editor, and 64 seconds when initiating it from the DSS.

★ VisiCalc has no cumulative function, and does not lend itself to calculations where quarterly totals are interleaved with monthly columns.

★ It is easier to read TFP's rules than VisiCalc's embedded formulae.

★ TFP assumes most of the responsibility for report layout, making reporting much easier than with VisiCalc.

★ The model consumed approximately 3k out of 34k workspace available to VisiCalc. According to the manual, TFP has a capacity of 30,000 cells on both 8-bit and 16-bit machines, and a forthcoming release will extend this figure still further.

From the above pros and cons it can be seen that VisiCalc is incredibly fast and interactive, but TFP is superior when it comes to features and facilities (except replication of course). Moreover, TFP has an incredibly large capacity, which of course must be achieved by paging the cells to disk — greatly slowing down calculations. Giving the calculation times recorded above I dread to think how long a 30,000 cell model would take to calculate!

Conclusions

There is nothing radically new about The Financial Planner, but it is a very solid package for all that. Unlike a spreadsheet system the data, rules and so on are all maintained independently. This is advantageous in that different sets of data can easily be slotted into the model, and disadvantageous in that the system is slower and more complex.

TFP has some very powerful reporting and formatting facilities, and it is particularly easy to manipulate models with interleaved sub-totals, change from 12-month to 52-week calculations, and perform other drastic modifications without horrendous consequences. It's also possible to build up 'command' files that can control a whole sequence of operations. The system also has good facilities for communicating with other software including Ashton-Tate's own dBase II.

TFP is not responsive and immediate in the way that a good spreadsheet system can be, and this is its major limitation. Also the editor used for setting up the model is fairly crude in comparison to the editing facilities integrated into a good spreadsheet system.

'Unlike a spreadsheet system the data, rules and so on are all maintained independently.'

Finally, the system is considerably more expensive than most spreadsheet systems (but not a great deal more expensive than other financial modelling systems). There is very little that it provides that cannot be achieved somehow or other with a good, but cheaper, spreadsheet system. On the other hand it does make some things, particularly the more complex types of modelling, more easy to set up.

So if you have a fairly complex modelling requirement then TFP is definitely worthy of consideration. If on the other hand you have a simpler task in mind then there is probably no need to spend the extra learning time and extra money on this system.

END

COLUMN SORT

Most dedicated wordprocessors include a column sort facility; many software packages do also. Here's an algorithm from Len Wood and Jack Brown from which you'll be able to implement such a routine in the dialect of your own micro. Use it on its own, or as a sub-routine in a wordprocessing program.

This article is about a user-friendly way of printing a list of names in two or more columns. Suppose we have a list of names in alphabetical order which we wish to print in three columns. The result might be:—

ALAN ALFRED ALICE
ANNE BERT BETTY
BILL . . . and so on.

That format is easy to program. Print the first three names, then the next three and continue until they have all been printed. However, I suggest that that's not the most user-friendly format.

Take a look at the Advertisers' Index at the back of *PCW*. There the names are listed vertically instead of horizontally. The vertical format is also used in the indexes of books, in telephone directories and in dictionaries. Long vertical lists are easier to scan visually because less eye movement is needed.

Imagine that we want to print such a vertical format list. We have to print the name at the top of each column, then the second name in each column, and so on. Let us impose a constraint that the column lengths must be nearly equal. More precisely, the longest column must contain at most one more name than the shortest column.

The core of the problem of printing the list in vertical format is to work out which names are to be printed at the tops of the columns.

To simplify the discussion let us leave names for the moment and work out how to print the sequence of numbers 1 to 14 in four columns. We'll get back to names later. The 14 numbers would be printed like this:—

1	5	9	12
2	6	10	13
3	7	11	14
4	8		

More generally, let the total number of numbers in the sequence be t. Let the required number of columns be c. Using integer arithmetic, divide t by c getting quotient q and remainder r. Let the numbers to be printed in the first print line be $P_1, P_2, P_3, \ldots P_c$. Using the convention that the value of (a>b) is 1 if a>b and is 0 otherwise, we have:—

$P_1 = 1$

$P_x = P_{x-1} + q + (r>(x-2))$

where x takes the values 2, 3, 4, . . . c

Using the example of a sequence of 14 numbers printed in four columns, we get t = 14, c = 4, q = 3, r = 2. Then we calculate:—

$P_1 = 1$
$P_2 = 1 + 3 + (2>0) = 5$
$P_3 = 5 + 3 + (2>1) = 9$
$P_4 = 9 + 3 + (2>2) = 12$

That gives us the first printed line:—

1 5 9 12

Those four numbers are each increased by 1 for the second line, and so on. If a number to be printed exceeds 14 we replace it by a space and of course we stop when all 14 numbers have been printed.

Now consider the task of producing a printed list of names in alphabetical order. If the names are already in alphabetical order then we can proceed as before and use the calculated $P_1, P_2, P_3, \ldots P_c$ as pointers into the alphabetically ordered list of names.

If there were 14 names to be printed in four columns then, from the previous results, the names at the tops of the four printed columns would be the 1st, 5th, 9th and 12th names from the original list. So names already in alphabetical order present no problem.

If the names are not in alphabetical order then one way of proceeding of course would be to sort them.

In some cases this might not be desirable. For example, it might be necessary to keep the names in the order in which they were entered into the list. Space limitations might prohibit keeping two lists; one being maintained in alphabetical order for the purpose of printing. Also, in the case of a long list there might be an objectionably long time interval between starting to sort and starting to print.

If we wanted to print the list of names alphabetically in a single column then it might be possible to hide the sorting time within the printing time. Find the alphabetically earliest name not already printed. Print it. Repeat until all the names in the list have been printed.

However, printing the list of names in several columns presents a problem. How do we find, say, the 125th name in the alphabetical order without first finding all those that precede it?

The suggestion here is to divide the sorting time into thin slices, but instead of hiding these slices within the printing time hide them in the list creating and updating time. Whenever a name is added to the list that name's alphabetical order is calculated and recorded. Whenever a name is removed from the list the alphabetical order numbers for the remaining names have to be adjusted.

In more detail, as well as the list of names, we need to keep two lists of numbers; one pair of numbers for each name. The assumption here is that the lists of numbers would require less space than a duplicate list of names for sorting into alphabetical order.

For the moment let us concentrate on just one of the list of numbers. We'll find a use for the other one later. Associate the first name in the name list with the first number in the number list, whatever its value. Associate the second name with the second number whatever its value, and so on. The values of the numbers will be changed but the 'Nth' name will always be associated with the 'Nth' number, whatever its value.

Whenever a new name is added to the name list the new name's associated number is set to a value of 1. The name list is then scanned.

For each existing name which is alphabetically earlier than the new name, the new name's associated number is increased by 1. For each existing name which is alphabetically later than the new name, the existing name's associated number is increased by 1. Whenever a name is removed from the name list, the name list is again scanned. For each existing name which is alphabetically later than the removed name, the existing name's associated number is decreased by 1. Also, the gaps left by the removed name and its associated number should be closed by moving up one position all names and numbers below the gaps in the respective lists.

In the following example the names have been placed in the name list in the order shown. Each new name was placed at the bottom of the existing list. The number list shows how the numbers have been changed each time a new name was added.

ALFRED	1	2	
BILL	2	3	4
FRED	3	4	5
ANNE	2	3	
ALAN	1		

When ALFRED is entered, his associated number is set to 1 and remains at a value of 1 until another name is entered. When BILL is entered his number is set to 1. The existing list is scanned and BILL is found to be alphabetically later than the only name in the existing list, ALFRED, so BILL's number is increased by 1 to 2. ALFRED's number is left at 1. When FRED is entered his number is set to 1 and then during the scan FRED's number is increased once for ALFRED and once for BILL. Thus FRED's number becomes 3. ALFRED's stays at 1 and BILL's at 2. When ANNE is entered, her number is set to 1. During the scan ANNE's number is increased by 1 for the only earlier name, ALFRED. So ANNE's number becomes 2. Both BILL and FRED are found to be later than ANNE so their numbers are increased by 1 becoming respectively 3 and 4. At this point the respective numbers for the four names in the list are 1, 3, 4, 2. When ALAN is entered his number is set

to 1. During the scan all four names in the existing list are found to be alphabetically later than ALAN so their numbers are increased by 1. No name is found to be earlier than ALAN so his number stays at 1. At this point the respective numbers for the five names are 2, 4, 5, 3, 1.

The following example shows what happens to the numbers when a name is removed.

ALFRED	2
BILL	4, 3
FRED	5, 4
ANNE	3
ALAN	1

Suppose ANNE is to be removed. The list is scanned and two names, BILL and FRED, are found to be alphabetically later than ANNE so their numbers are reduced by 1 to become respectively 3 and 4. After closing the gaps left by the removed name and associated number the lists become:—

ALFRED	2
BILL	3
FRED	4
ALAN	1

So the sorting process has been sliced up so that just one scan of the existing name list is done whenever a name is entered or removed.

Now we can return to the task of printing a list of names in two or more columns in alphabetical order where the list is not already in alphabetical order.

We do have though a list of numbers which indicate the alphabetical order of the names.

Let us use our last example of four names, ALFRED, BILL, FRED, and ALAN, with their respective numbers, 2, 3, 4, 1, When we wish to print the name list we have to create the second number list referred to earlier. Let us call this second number list our inverse number list.

Our four names with their number list and inverse number list would be:—

ALFRED	2	4
BILL	3	1
FRED	4	2
ALAN	1	3

We produce our inverse number list by saying that if the 'Nth' number in our first number list is M then set the 'Mth' number in our inverse number list to a value of N. Now if we want, say, the alphabetically 3rd name we look at the 3rd number in the inverse list and use its value as a pointer into our name list.

We are now ready to print. Let us return to our earlier example of 14 names. Suppose our inverse number list for the 14 names is 2, 14, 9, 1, 4, 5, 13, 3, 8, 12, 7, 10, 6, 11. Our first printed line must be the alphabetically 1st, 5th, 9th and 12th names from our earlier calculations. The 1st, 5th, 9th and 12th numbers in our inverse number list are 2, 4, 8, 10. So we print the 2nd, 4th, 8th and 10th names from our name list as the first printed line. For our second printed line we use the same procedure to print the alphabetically 2nd, 6th, 10th and 13th names. We continue thus for the third and following print lines except that when the calculations would lead to a name whose alphabetical order would be later than the 14th we just print a space. When all 14 names have been printed we stop.

In summary, given the total number of names and the required number of columns, calculate the values of P_1, P_2, P_3, and so on. If the names are in alphabetical order then use those P values as indexes into the name list to get the names at the tops of the columns. If the names are not to be placed in alphabetical order then arrange that as the name list is created the first number list is also created. When printing is required, create the inverse number list. Use the P numbers to index into the inverse number list and use the numbers found there to index into the name list to get the names at the tops of the columns.

If you experiment with pencil and paper and a small number of names you will see that the method works. The method might be useful when you want to produce a printed list that's user-friendly. END

'It's the user-friendliest micro on the market . . .'

PCW welcomes approaches from would-be writers, even those who have never appeared in print before. In this game it's often those with practical experience who have important things to say so we don't mind if your prose is less than perfect — providing submissions have a sensible structure and follow a logical sequence, we can take care of the polishing.

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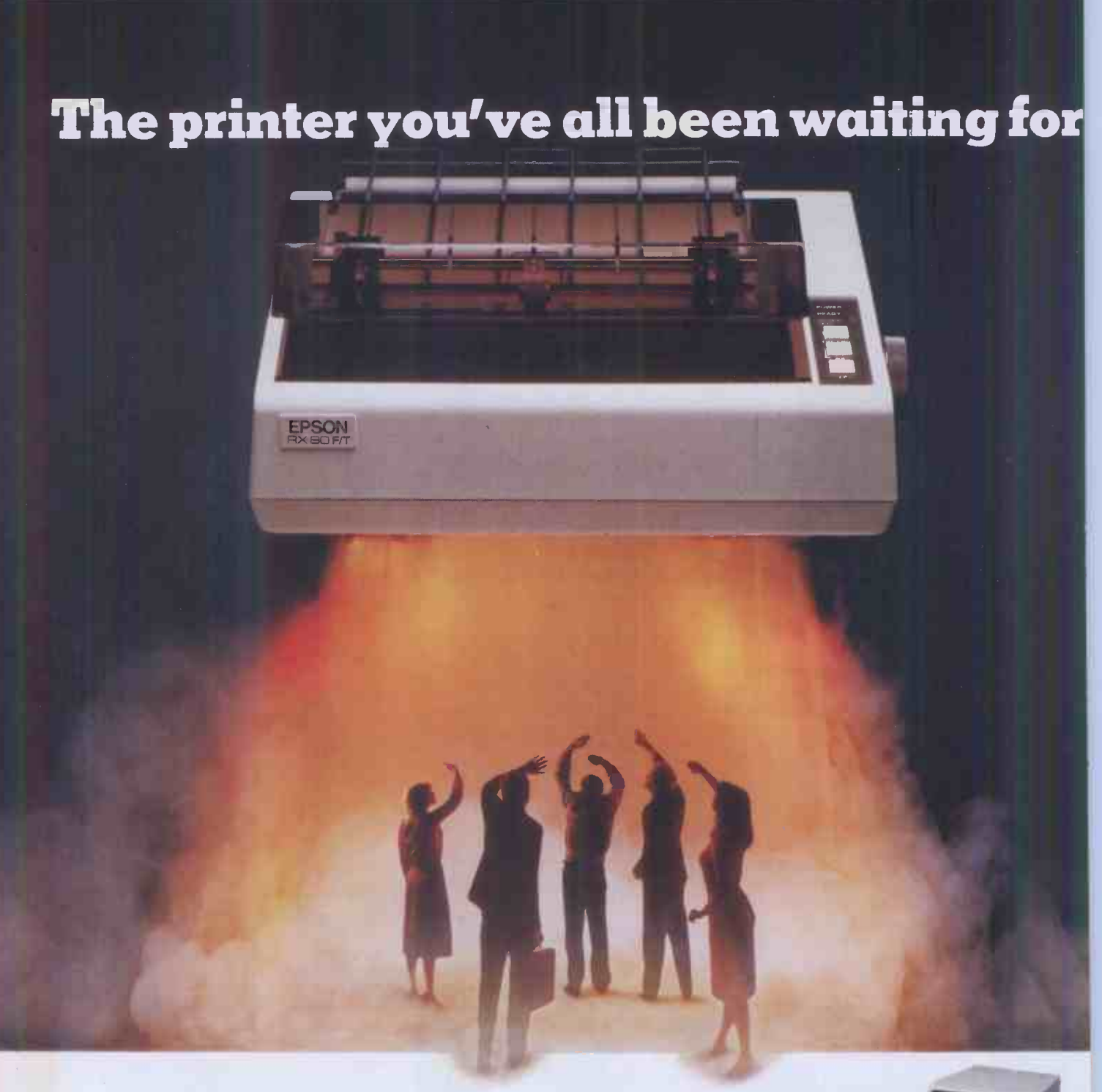
The printer you've all been waiting for



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A BEGINNER'S GUIDE TO PROGRAM CONVERSION

PART 4: SINCLAIR GRAPHICS & SOUND

Surya continues his look at graphics and sound on each of the machines included on the PCW *Basic Converter Chart (see September issue). This month, he turns his attention to the Sinclair machines: the ZX81 and Spectrum.*

Sinclair ZX81

The ZX81 produces black graphics on a white background. The graphics resolution is 64×44, the origin (0,0) being the bottom left-hand corner of the screen. Two graphics statements are supported: PLOT and UNPLOT.

PLOT x,y switches on (ie, lights up) coordinate (x,y). UNPLOT x,y switches off the specified coordinate. Drawing lines is achieved using FOR-NEXT loops, thus:

```
100 FOR X=0 TO 63
110   PLOT X,0
120   PLOT X,43
130 NEXT X
140 FOR Y=0 TO 43
150   PLOT 0,Y
160   PLOT 63,Y
170 NEXT Y
```

would draw a box around the edge of the screen.

The ZX81 also supports a PRINT AT function (PRINT @, on most machines). The PRINT AT screen comprises a 32×22 grid with the origin — just to confuse — as the top left-hand corner. To print 'HELLO' in the middle of the screen, you would enter PRINT AT 11,13;"HELLO".

The ZX81 reserves the bottom two lines of the screen for input prompts, error messages, and so on; these lines are not accessible when programming in Basic, and so are not assigned coordinates.

Sound is not supported.

Sinclair Spectrum

Graphics:

The Spectrum is available with either 16k or 48k RAM, but there are no other differences between the two models.

The Spectrum supports eight foreground and eight background colours. The single graphics resolution is 256×176, but there are limitations when using colour (see below). The graphics statements are as follows:

PLOT — PLOT x,y lights coordinate (x,y) in the current foreground colour.

DRAW — DRAW x,y [,a] draws a line from the last coordinate visited (using PLOT, DRAW or CIRCLE) to a point x coordinates to the right and y coordinates up. The values of x and y may be either positive or negative, and may be expressions and/or variables as well as literal numbers.

The value 'a' is optional, and instructs the computer to draw a curved, rather than straight, line. This value specifies the number of radians the line must turn through as it draws; if a is positive, the line will curve to the right, if negative to the left. As a rough guide when reading listings, if a = 2*pi, a complete circle will be drawn, a=pi then a semi-circle is drawn, etc.

CIRCLE — The Spectrum has a built-in function to draw circles. This is considerably faster than using DRAW, but less accurate, which is why you find the DRAW method used in some listings. To draw a circle, you state CIRCLE x,y,r where (x,y) are the coordinates of the centre of the circle and r is the radius.

CIRCLE also appears to contain a slight bug. After drawing the circle, the statement leaves the graphics cursor in — as the manual puts it — 'a rather indeterminate place'. For this reason, you will normally find a PLOT statement immediately following a CIRCLE. This is simply to put the graphics cursor in a known position rather than being a part of the display routine as such.

PAPER & INK — A wonderfully sensible idea; PAPER being used to set the background colour and INK the foreground colour. The format is the same in both cases, PAPER (or INK) z where z is the colour as defined below:

0 — black
1 — blue
2 — red
3 — magenta
4 — green
5 — cyan
6 — yellow
7 — white

BRIGHT — Sets the brightness of the colours. BRIGHT 0 being normal, BRIGHT 1 being extra bright.

FLASH — Flashes foreground colour. 1 = on, 0 = off.

INVERSE — Reverses INK and PAPER. 1 = on, 0 = off.

OVER — Allows overprinting. Normally, if you print (say) a letter 'X' and then an addition sign at the same position, the second character will obliterate the first. OVER allows the old character to remain visible, so that the above example would produce something like an asterisk (*). 1 = on, 0 = off. The only way to recreate this on other machines is to work out what the combined character would look like and see if your character set supports something similar. If your machine has the facility to support user-definable characters, then this is, of course, another way around the problem.

BORDER — The Spectrum has a border around the screen which the user cannot access for screen displays using Basic, but its colour can be reset using BORDER z, where z is as for PAPER and INK. BORDER has no equivalent on most machines and can be safely ignored when converting from a Spectrum listing.

Note that colour 8 can be used with PAPER, INK, BRIGHT and FLASH to set the respective attributes to 'transparent'. Colour 9 can be used with PAPER and INK to select automatically maximum contrast, thus each is set to white if the other is a dark colour and black if the other is a light colour. This would have to be done 'manually' on most machines.

When describing the resolution of the graphics screen, I mentioned a limitation when using colour. Plotting a particular attribute (colour, inverse, flashing, and so on) affects the whole of the character position, rather than just the pixel in question. Thus, you cannot have a steady blue line right next to a flashing green one, though you can have two lines sporting identical attributes running alongside each other.

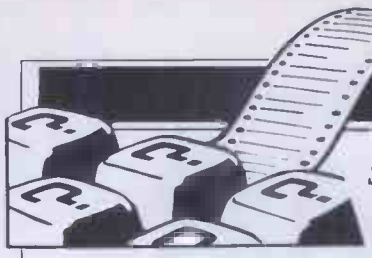
The final graphics-related statement supported on the Spectrum is SCREEN$. This is a very useful feature which allows you to save the contents of the screen memory on tape. This can subsequently be loaded from tape in order to recreate the display. The format is SAVE "filename" SCREEN$ to save, and LOAD "filename" SCREEN$ to load. This is most commonly used to load title screens for display while the main program is loaded.

Sound:

Sound on the Spectrum is controlled using the BEEP statement, the onomatopoeiac word BEEP being a pretty accurate description of the sound quality. The format is SOUND duration, pitch.

Duration is in seconds and pitch is in semitones: 0 is middle C, negative numbers are lower, positive numbers higher. Each octave, of course, spans 12 semitones.

More on sound and graphics next month.



COMPUTER ANSWERS

Send your queries to Peter Bright, PCW, 62 Oxford Street, London W1. Please note that Peter cannot answer questions on an individual basis, so please don't send an SAE with your query.

GPO Printer

I want to use a GPO teleprinter as a cheap printer for my BBC Model A. Can you give me details on how to do this? Also, I have a Tandy Colour Graphic Printer but am unable to get it to print user-defined characters from my BBC.
Andrew Hardy, Bingley

The Post Office and the teleprinter have a long history. If you have the older Telex style machine, then you have a major project ahead. These machines need an 80 volts signal, run at 50 Baud and use the 5-unit teleprinter code (International Alphabet No 2). Hence you will need to make a high-voltage interface for the BBC parallel port and, using software, convert ASCII codes into IA2 codes and serialise the data into start bit, 5 data bits and 1½ stop bits at 50 Baud. *Wireless World* (October 83,) has an interface for its 6502 Nanocomp which should help you.

The more recent model 33 teleprinter will make a much more satisfactory printer, since it uses V24 signals and ASCII or IA5 codes, but you must make a small mod to the BBC Micro for 110 Baud. Wire a single-pole, double-throw switch in place of link 28. Throw the switch and then *FX8,1 will set 108.3 Baud, close enough. You must return the switch to get the right cassette port rate. The (nearly) modern electronic model 43 teleprinter has a 300 Baud switch and is much quieter, but cheap used ones are rare.

Most printers print a character shape in response to a code. So those, like the Commodore or Sharp, which print the Graphics character set for a particular micro, do so because they have been internally pre-programmed with it. Your Tandy CGP only knows how to draw the ASCII set; it doesn't have any other pictures stored. The user definitions are only used by the BBC screen. To get the shapes on your CGP, you must either pre-process the printer output to replace non-ASCII codes by user-defined plotting commands, or write a screen dump routine to print the display like a video scan. Ideas on screen dumps are in *Acorn User*, (August 83) and, of course, back issues of *Beebug*. A screen dump on the CGP will be rather slow, and hard exercise for the mechanics, but it has been done.
Len Warner

Bit result

An instantaneous result is required (as with a parity generator) to the number of bits set in a word of 8, 12 or 16 bits. The bits may be set in any combination up to the total word length. This conversion can of course be done by software or by multiple shifts but these take time, as does reading a table, so a hardware solution is needed.
R G Silson, Tring, Herts.

You need an n-input, 1-bit adder, and here are two ways to achieve this.

Firstly, a 74LS283, 4-bit adder can be wired to become a 5-bit encoder which gives a 3-bit binary count of the number of inputs (up to 5) which are high. Two of these can be combined by adding the outputs with a third LS283, to give a 10-bit encoder. Similarly, two of these 10-bit circuits can be combined to give 20 bits, and so on. Just ground any spare inputs (and leave out a bottom-level LS283 for 12 bits). This circuit will give an answer within a few tens of nanoseconds, depending on the number of levels of adders in the tree; and the chips are only 40p each.

Secondly, you can program a 2716 EPROM as an encoder. If each byte contains the count of the number of bits set in its address, then you have a 11-input encoder, with a 4-bit binary output, and this is a one-chip solution. For more inputs, you can program another EPROM so that address lines A0-A7 are unity weighting, and A8, A9 and A10 are weighted 2, 4 and 8. This can then be used in cascade to give up to 18 inputs. Though not as fast as the other method, it is faster than most micro's cycle time, so that won't matter.

In either case, it is a good idea to pass all inputs through a transparent latch (LS373), which is latched by the Read line. This will make sure the data is not changing while the micro is trying to read it, which can give spurious results.
Len Warner

Software copyright

I have some questions which I think are probably relevant to all small, or 'one-man' software companies:
1 What legislation, if any, exists in England to protect software authors from object-code copying?
2 How is it possible to protect a CP/M program from being copied off the original disk, if the user has access to a DISKCOPY CP/M utility — as many manufacturers provide — which makes a mirror image of the drive A: disk on drive B:?
3 I have heard of programs being 'encrypted' to prevent copying — how is this achieved?
4 Surely any 'soft' software protection will prevent mass-copying of the disk by the original manufacturer?
5 I have seen many adverts for mass-copying services in American magazines. Are there any UK companies offering similar services?
R Thomas, Ealing, London

Taking your questions in order:
1 The copyright situation is still largely unclear. Whether computer programs are covered by British copyright laws is a debatable point, but it seems likely that future legislation will clarify the position.
2 I don't know of any way to protect CP/M files from copying using PIP or DCOPY. Most commercial programs rely on licensing arrangements, where only registered users receive updates and after-sales support.

One program-protection method which appears secure is numbered ROMs. Using this system, the CPUs are given individual serial numbers by the manufacturer. Software packages can then be configured to a particular serial number. This enables an authorised user to make as many backup copies as he wishes, but prevents the package being used on any other machine. This system has so far been implemented on the Zita E. Whether other manufacturers will see it as being worth the effort and expense remains to be seen.
3 Encryption takes an almost infinite variety of forms. The methods involved depend on the particular machine. The usual method is to place POKEs in line 0 of the program to disable breaking and listing. This is reasonably effective if the program auto-runs, but can otherwise be bypassed by typing GOTO 1 in place of RUN!

For details of encryption techniques on any particular machine, consult either the machine's manual or the manufacturer/dealer.
4 The protection would be a little impractical if it did! The usual method is to allow copies to be made only with a specific piece of hardware in place, this being known as a 'dongle'.
5 You'll find a number of companies offering mass-copying of cassettes and disks in *Yellow Pages*.
Surya

Jargon aid

I am writing to you in a desperate attempt to find out what PEEK, POKE and DIM mean. All the magazines I have read tell you in gibberish. Please, I beg you, tell me in English.
S Gibson

An explanation of PEEK and POKE will be found in our 'Newcomers Start Here' feature. I suspect that the reason you found previous explanations amounted to no more than gibberish is that the explanations were presented out of context. If you read

through 'Newcomers', PEEKs and POKEs should then make sense.

DIM is another statement which needs to be examined in context. DIM is an abbreviation for DIMENSION and is used to specify the size of an array, as explained below.

If you wanted, for example, to enter five different names into a program, you could do so thus:

```
100 INPUT "Enter name 1";A$
110 INPUT "Enter name 2";B$
120 INPUT "Enter name 3";C$
130 INPUT "Enter name 4";D$
140 INPUT "Enter name 5";E$
```

When you wanted to print the five names, you would then

```
150 PRINT A$:PRINT
B$:PRINT C$:PRINT
D$:PRINT E$
```

Although this would work, it is extremely tedious, particularly if you had fifty or a hundred names to enter. It would also be very inefficient if you wanted to extract (say) the fourth name on the list. To get around the problem, Basic supports a facility known as arrays.

Arrays allow you to store both strings and figures in numbered variables, known as array variables. Thus, instead of using the variables A$-E$, we could use NAME$(1)-NAME$(5) like so:

```
100 FOR COUNT=1 TO 5
110 PRINT "Enter
name";COUNT;:INPUT
NAME$(COUNT)
120 NEXT COUNT
```

To print the list:

```
130 FOR COUNT=1 TO 5
140 PRINT
NAME$(COUNT)
150 NEXT
```

And to print a specific name:

```
160 INPUT "Which name shall
I print (1-5)";NUMBER
170 PRINT
NAME$(NUMBER)
```

Each string in the array is known as an element. Most machines will quite happily allow you to enter arrays of up to nine elements without complaint, since they reserve sufficient memory for this purpose automatically. If you want to store more than nine elements, you need to tell the computer to set aside enough memory to do this. This is where our friend the DIM statement comes into the picture. The format is DIM VARIABLE-NAME (number of elements + 1). Thus, if we wanted to store 50 names in an array called NAME$, we would put the following line in our program: DIM A$(51).

DIM statements need to be executed before you start using the array, so we normally place them in the first non-REM line of our program.

Surya

Memory routine

What, and where in memory, is the CHRGET routine on the 4000 series PET. I have heard that it is possible to create new commands using this routine. How do I do it?

Tom Kelsall, Sutton Hill

In the Basic interpreter, CHRGET is the routine which loads the accumulator with the next non-space character. It does this by incrementing the pointer to the character and then executing CHRGOT, which loads the character and then sets flags dependent on what it is.

CHRGET starts at $0070 on Basic 2/4 PETs. Its use to add new commands is too complicated to describe in the short space available here. I have sent you an example to add the command "@SPOND", and you will find an explanation of the method in *Programming the PET/CBM* by Raeto West, page 366.

Brian Grainger, ICPUG

Variable Genie

When writing long programs for my Video Genie I often find myself having to change lines or insert new ones as I realize the program is not doing what I intended or that it could be improved. But by editing I lose all the variables calculated so far. To 'debug' lines further on I have to rerun the program from scratch. What a timesaver it would be if I could simply continue execution by typing "GOTO<NEXT LINE>". Can you conjure up a way to achieve this?

G Kowalczyk

Unless anyone out there knows better, there is no way of recovering the values of variables once you have edited the program. The simple answer, I'm afraid, is to plan your programs before you start writing them. That way, the number of edits can be reduced to a minimum.

You will also save time if you avoid breaking into the program every time you think of an improvement or spot a 'local' bug—that is, a bug which won't affect the rest of the program. Make a note of all the changes you want to make but wait until the program run has ended before editing.

You can also insert dummy variables into the program during testing, and then change these to inputs or whatever once the core program appears to be working.

Surya

PET disk directory

Dr Peter Bamber: Your question about PET disk directories is answered in the June issue. See 'Disk dilemma'.

MZ-80K interfacing

I am interested in electronics, and would like to interface to my MZ-80K. There is an expansion socket at the back, but I have been unable to find out anything about it. Presumably I would need some sort of interface board and A/D converter before I could use the computer to control my own experiment.

C T Parker, Morecambe

The 50 pin connector on the back of the K carries all the Z80 bus and status lines except NMI (non maskable interrupt). The Sharp MZ-80K Service Manual is available from Kuma Computers for £10, giving complete connector and circuit details (Maidenhead (0628) 71778). The ZX81 and Spectrum also bring out the Z80 bus, so it is a fairly simple matter to adapt designs for their add-ons to the K. Points to note are:

—Keep the expansion cable short—less than 18in.

—SP5025 Basic includes port input and output commands, but I/O addresses 240 to 255 are reserved for Sharp devices and will be rejected by Basic.

—I/O devices can be memory mapped safely to addresses in the range 57356-57375. This allows the device to be driven by PEEK and POKE if an alternative language to Basic is used.

Peterson Electronics, (Academy Street, Forfar, Angus DD8 2HA), is a leading supplier of interface boards for the K, including RS232, Centronics, Relay Control, Eprom Programmer and 16 channel A/D Converter. The A/D board is £85. If you are planning a number of additions it is worth using an interface box, which Peterson can supply, and most of their range is available in I/O box or stand-alone versions. Also, the Sharp Users' Group (c/o Yeovil College, Goldcroft, Yeovil BA21 4AE) has published an interface box design and is producing a PCB.

Peter Amey & Mike Flinders

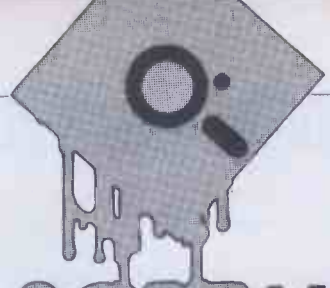
The MZ-80K Expansion Socket is a dual 50 pin male fitting with 0.1 in pitch, connected as shown below:

A		B
A15	1	G
A14	2	$\overline{INT}$
A13	3	G
A12	4	$\overline{MREQ}$
A11	5	G
A10	6	$\overline{IORQ}$
A9	7	G
A8	8	$\overline{RD}$
A7	9	G
A6	10	$\overline{WR}$
A5	11	G
A4	12	$\overline{M1}$
A3	13	G
A2	14	$\overline{HALT}$
A1	15	G
A0	16	RESET
G	17	G
D7	18	G
D6	19	G
D5	20	G
D4	21	G
D3	22	G
D2	23	G
D1	24	G
D0	25	G

▷ (MARK)

BUS CONNECTOR DETAIL

END



SOFTWARE
DATABASE BENCHTEST

SEARCH AND FIND

Originally designed for mainframe applications, this Swedish text retrieval package is now available for micro users. Kathy Lang investigates.

And now, as they say, for something completely different. Most of the packages I've reviewed so far in this series have been clearly aimed at structured information — accounts, material stocks, insurance records and the like, where each record has the same structure, and consists of a set of fields of fixed size and characteristics. A few take a more flexible approach; CardBox, for instance, allows you to have a single field to contain all the information in one record, making it possible to store the equivalent of about two thirds of a page of A4 in one document, and both CardBox and Aquila have retrieval facilities aimed particularly at bibliographic applications where the requirement is to search for keywords in free text.

This month's package, Search and Find, takes this approach one stage further. The basic unit of information in Search and Find is a document, which may be of any size. The package keeps a register of documents; each logical disk has one register, and you may have up to sixteen registers altogether. Each document is indexed on every word it contains, other than words you have stored in a 'stop list' (to prevent indexing words like the, in, and). Search and Find provides retrieval facilities for searching a dictionary for keywords; searches may build up to quite complex levels, and a 'history' command is provided to show what stage the search has reached. Several documents may be stored in one file. Documents are created initially with a wordprocessor such as WordStar, and then entered into Search and Find; there is provision for direct connection between Search and Find and a word processor, so that you don't have to return to the operating system between creating and retrieving documents.

Search and Find is mainly menu driven; the main menu is shown in Fig 1. It runs under CP/M-80 and CP/M-86, on virtually any terminal with cursor controls — I ran it on the Sirius with Z-80 card. An MS-DOS version is likely to be available shortly. Search and Find is the product of a Swedish company, Program-Makarna, and is available in this country from Xitam Systems Ltd, Southampton (see Summary box for full details).

Constraints

Search and Find does not place any restrictions on the number of words in a document, though of course document size is limited by the operating system file size limit - 8 Mbytes in the case of CP/M. You can have up to 32,767 documents in one register, and up to 16 registers, each on a single logical disk: this may be a floppy disk or a sector of a hard disk. Each register may have its own stop list of up to 255 'nonwords', each up to 12 characters long. Any indexable word longer than 20 characters is indexed on only the first 20 characters — presumably that would only be a problem for people whose documents were full of ten-syllable chemical terms. The index may contain up to 256,000 different words, which should be plenty for most applications — indeed, at an average of six characters per word, you would need a hard disk to get anywhere near that limit.

Series No U839997

Enter new documents	Disk status
Information retrieval	Nonword definition
Update search index	Synonym definition
Quit	Choose document disk
Help	Prepare a disk

Functions are started by entering the commands — in upper or lower case — after: "Enter next command:".
Only the first letter of a command is required.
After Choose, a letter (logical disk), must be given.
Document disk: B. Enter next command:

Fig 1. Search and Find Main Menu

The other limitation that might affect floppy disk systems is that, if you want to be able to flip between Search and Find and the wordprocessor without going into CP/M, you must have both programs on one disk. Since Search and Find uses about 150k, and WordStar another 80k, quite a number of floppy systems couldn't allow you to store them together — though of course machines like the Sirius and DEC Rainbow, and the many CP/M systems which offer about 370k per drive, would be able to cope quite happily. Programa Markana does say, though, that the system runs much better on a hard disk, and of course it is very easy on a text-based system to get into the position where you really need a hard disk anyway.

File creation and data input

The Enter New Documents option on the main menu gives access to the procedures for file creation and for updating the index. Taking this option leads to the display of the Entry menu, shown in Fig 2. There are two ways to create a document file and enter it into the Search and Find system. If you already have a document (or a file containing several documents) created with a wordprocessor, you can incorporate it into Search and Find with the Read command. The program will assume that the first line of the document is to be the title, unless you respond with a title when the Read command prompts you.

If the document does not already exist, then you can issue the Write command. Search and Find will ask you for a title for the document, and then transfer you to the wordprocessor so that you can create the file there, and put the necessary text into it. When you have finished putting in the text, you save the file and leave the word processor in the usual way, whereupon you will be transferred back to Search and Find. At this stage, Search and Find inserts the title you gave into the start of the document, so that it can subsequently be edited if need be.

A file created by either method may contain more than one document. Indi-

vidual documents are separated by having the characters '$$$' alone on a line; the following line is taken as the title for the next document. As WordStar users will know, any line in a WordStar document which starts with a period will not be printed, so this does not give rise to problems with printing documents. Any text which you do not want to index may be bracketed with the characters $(and $), and Search and Find will ignore them while indexing.

Once documents have been entered into the system, the index must then be updated to reflect the contents of the document(s). This involves returning to the main menu and issuing the Update command. Since this command has a lot of work to do, it is quite slow — about one minute per page of A4 text. The process is linear, ie, a five page-document takes about five times as long as a one-page document. Since Search and Find is so different from the usual run of data management packages, most of my Benchmark tests are not appropriate, but indexing is sufficiently similar to be a fair measure of comparison. My indexing test (BM6 for regular readers) involves indexing on two fields totalling 25 characters, across 1000 records — a total of 25,000 characters. The roughly comparable operation in Search and Find, indexing a document of about 25,000 characters, took 19 minutes.

Up to 128 documents may be indexed in one run of the Update command; if you have more than that, you just issue the Update command again. As the documents are indexed, they are given a number, which is associated with the document title. Subsequent retrieval of individual documents (as distinct from groups of documents retrieved by the Find command) is by number. You can find out what the number of a document is through the Titles command during document retrieval — more about this under 'Selection'.

Data updating

Documents can be edited by issuing the Edit command from the Information Retrieval menu. This invokes the word processor, so that you can edit either a document referred to by number in Search and Find or the first of the documents in the current subset selected by Find commands. When you finish editing and exit from the wordprocessor, you return to Search and Find in the same way as from file creation, and the main menu is displayed. You then have the option of incorporating any changes in the document into the index, by issuing the update command. Clearly, any changes made during editing will not be reflected in the index until an update has been done.

Search and Find has two commands for displaying documents and information about them, both invoked from the Information retrieval menu. The Titles command shows the title of each document currently selected. You can also opt to show the first few lines of each document with its title if you wish. In either case, Search and Find displays as much information as it can fit on the screen, and gives you the option to carry on or stop at that point. The Display command shows the whole of one document if a document number is specified, or else lists the contents of all the documents currently selected.

```
Write   a new document using the wordprocessing system
Copy    old Search and Find document to new
Read    external file(s) of documents into Search and Find
Quit    Return to main menu
Help    Explain commands
By typing Help followed by a command name, you get a description of the
command in question
Example: HELP READ (or just H R)
Document disk: B. Enter next command:
```

Fig 2. Search and Find Entry Menu

Search & Find information retrieval offers the following commands:

Command	Argument	Function
Find	word	Selects documents containing <word>
Or	word	Adds any other docs that contain <word>
And	word	Removes docs that do not also contain <word>
Not	word	Removes selected docs that contain <word>
Titles	(lines)	Display title (and text) of selected docs
Display	(docno)	Display all selected docs (specified doc)
Change	(docno)	Change next of selected docs (specified doc)
Erase	(docno)	Erase all selected docs (specified doc)
Write	(docno)	Write all selected docs (specified doc) to file
Review		Show given search commands and results
Back	(steps)	Go back to previous search position
Keywords	word	Show words in search index from <word> on
Synonyms	Act	Activate synonym searching
Synonyms	Deact	Deactivate synonym searching
Quit		Return to Main Menu
Help		Show this help menu

Document disk: B. Enter next command:

Fig 3. Search and Find Information Retrieval Menu

Printed reports

Search and Find gives three options for printing documents. The simple way is to use CTRL/P, which will echo the contents of the screen on the printer. This is particularly useful for getting a printed record of the history of a search, or listing document numbers and titles. You can of course print whole documents this way, with the Display command, but normally you would switch to the wordprocessor and print the documents currently selected from Search and Find's work file; or you could save those documents in a text file, using the Save command from the Information retrieval menu, and print them subsequently.

Selection

Documents can be selected by a combination of several operations, from the Information retrieval menu, which is shown in Fig 3.

The selection options can be combined in any order you wish, but since no brackets are provided to alter the precedence, you have to be careful to issue the commands in the right order. Two 'wild' characters are available: '?' matches any single character, and '*' matches any group of characters. A sample selection dialogue is shown in Fig 4. In English, this means:

Find all the documents which contain the word beginning 'user'; also find all the documents with the word beginning 'doc'; also find all the documents with the word 'manual'; take this selection, and do a further selection of just those documents which contain the word 'image'. Then review all the choices made, and list them.

If you have first set up a synonym dictionary through the wordprocessor, you can ask for synonym matching to be included. So if, for instance, you have defined 'instructor' as a synonym for 'teacher', then once synonym selection has been turned on, any requests to find 'teacher' will also find any references to 'instructor'.

Sometimes, you will want to 'forget' the previous selection command, and go back to the previous mesh in the sieve. This is achieved by the Back command, which allows you to go up one or more levels in the selection process.

A useful ancillary feature provided is the ability to inspect keywords. You can request a list of available keywords, starting at any point in the index, and keywords will be displayed a screen at a time. As when listing titles, Search and Find will ask you after each screen display whether you wish to continue.

The selection process is extremely fast —speed is very roughly proportional to the number of successful matches, but none of

the permutations I tried took more than a couple of seconds per criterion.

All documents are initially created as text files, and remain readable as text files. You can save sets of documents — which may originally have been created in separate files — for subsequent processing.

Individual documents may be deleted or copied under Search and Find. Deletion takes effect when the next Update is done. You can also find out the number of documents available, etc, by running the Disk status command (Fig 5 shows typical output from this command).

User image

Search and Find is a good example of a package for which menus can be used effectively, because it is reasonably compact and there is usually little problem about finding the whereabouts of a particular function. The combination of menus with specifying options through mnemonic letters or words of command works very well. Where some users will need extra information, that is available through the on-screen help. At any stage in using Search and Find, the user can ask for help and get more information on any command/menu option. The help is usually brief and to the point, but adequate for the circumstances.

The facilities are in general well provided, though there is a little less flexibility than one might ideally want in the selection phase. For instance, when you have been through the command-based search options, and have the selection of documents that in theory you want, you can then list the titles of the documents thus retrieved. But you can't modify that list except by setting up further conditions, even if you know that, for instance, some apparently relevant document is in fact not appropriate to your requirements. You can't say 'leave out document no.x' even if you know that document isn't wanted.

There are other small quibbles, but the major omission, given the character of the package, is sorting. You can display keywords in alphabetical order, but you can't sort documents into order by title. A major application for this sort of package would seem to be library catalogues and other types of literature summary records, and these areas often involve printing out parts or all of the catalogue in author or title order. As Search and Find is completely unstructured, I couldn't see any way in which you could achieve that, even with the help of a separate sort program.

```
Current document disk B
Current document disk title PCWBT
Number of indexed documents 34
Document file size 76 k characters
Number of documents pending for
  update 2
Press RETURN to return to the main
  menu
```

Fig 5. Search and Find Status Display

```
Document disk: B. Enter next command: find user*
  USER (10), USERS (6)
11 document(s) match all conditions

Document disk: B. Enter next command: or doc*
  DOCTOR (2), DOCUMENT (1), DOCUMENTATION (3),
DOCUMENTS (1)
12 documents(s) match all conditions

Document disk: B. Enter next command: or manual;
  MANUAL (7)
14 document(s) match all conditions

Document disk: B. Enter next command: review
No   Command   Search string   Number of documents
2    Find      USER*           11
1    Or        DOC*            12
0    Or        MANUAL          14

Document disk: B. Enter next command: and image
  IMAGE (4)
4 document(s) match all conditions

Document disk: B. Enter next command: review
No   Command   Search string   Number of documents
3    Find      USER*           11
2    Or        DOC*            12
1    Or        MANUAL          14
0    And       IMAGE            4

Document disk: B. Enter next command: titles 1
```

Fig 4. Search and Find Sample Selection Dialogue

Summary

Package Type	Information retrieval system, record unit is document with virtually no size limit. Needs wordprocessor for input and editing of data.
Facilities	Indexing with exclusion of commonly occurring words if desired. Retrieval on one or more keywords using AND, OR, NOT to combine; synonyms allowed. Subsets can be printed or stored.
Drawbacks	Entirely unstructured, so cannot, for example, sort titles. Must have wordprocessor in addition.
Ease of Use	Good; easily understood menus and command conventions
Error Messages	Adequate.
Documentation	Fine for most users, a bit 'solution oriented' for novices.
Costs (ex VAT)	Around £250
Supplier	Xitan Systems Ltd, 27 Salisbury Rd, Totton SO4 3HX Hampshire. Tel: (0703) 871211.
Delivery	2-3 weeks

Documentation

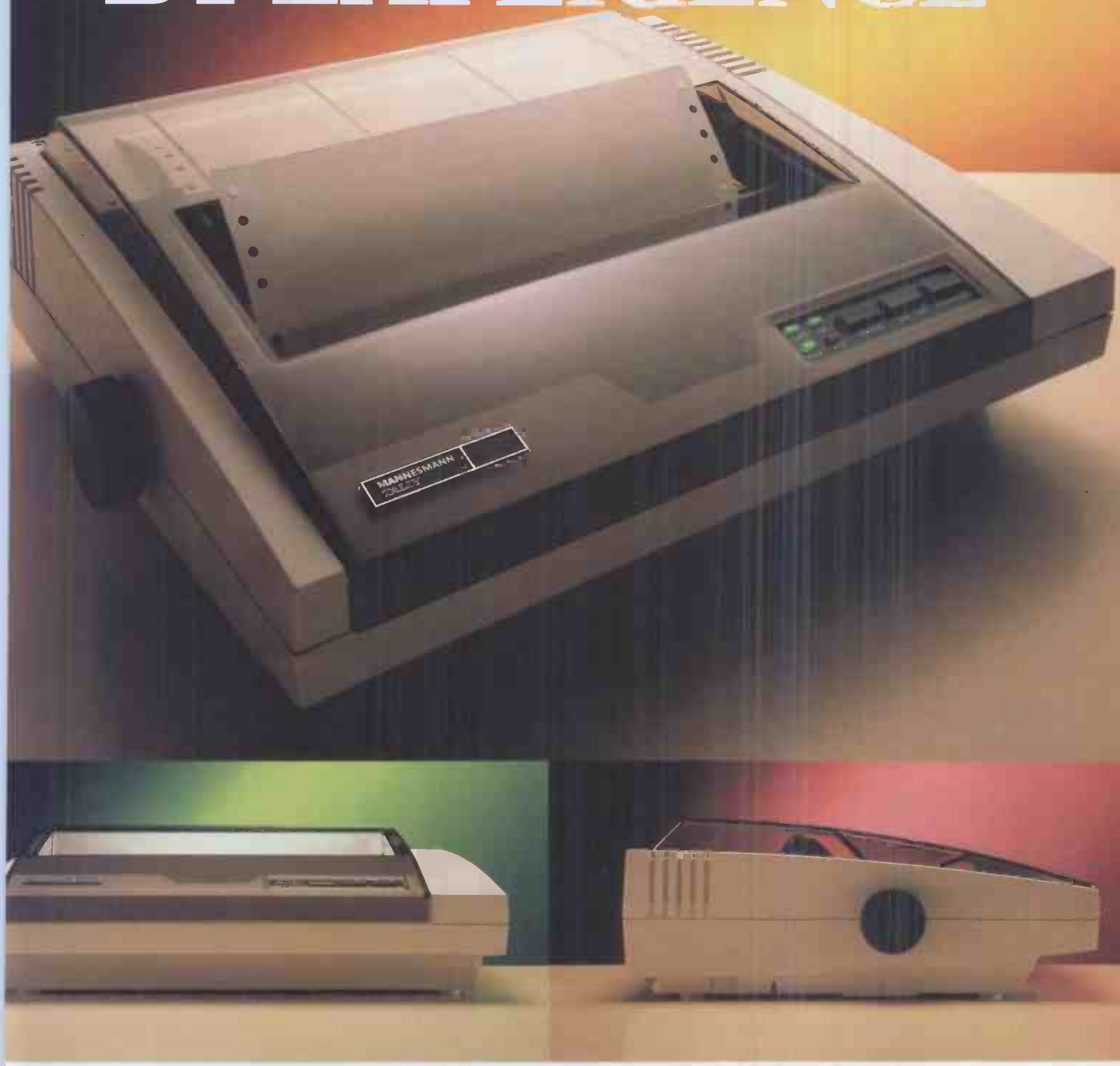
The documentation consists of a single manual, covering use of the package and installation on particular systems. The manual contains 36 pages, including the index. The level of explanation is about right for a reasonably clued-up user — although I think a real novice might find it a little hard to get going.

Search and Find has a full set of menus with good help facilities. The suppliers say that a major use is among secretaries who use wordprocessing, and have a large number of documents, often on hard disk; they use Search and Find to index all their text, so that they can quickly find documents on particular topics.

Conclusions

Search and Find is a data management system designed specifically for information retrieval. It has one very rare attribute, namely the ability to index a document of effectively unlimited length, and some good search facilities. For bibliographic applications, indeed for any requirement based upon indexing free text, Search and Find would be well worth investigating. But you will need to balance these advantages against the lack of any structure at all in the stored data, which would make it difficult to incorporate some of the facilities which are needed where the text is actually a mix of structured and unstructured information. END

THE MT80. SHAPED BY EXPERIENCE



You are looking at the sleek, ultra modern lines of the latest dot matrix printer from Mannesmann Tally; the people who probably have more experience in computer printers than just about anyone.

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But best of all, it comes equipped with another valuable asset. A very attractive price tag.

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AGF PROGRAMMABLE JOYSTICK

Enthusiastic games players realise that a joystick is an invaluable asset in improving speed and accuracy of performance, but joysticks that are compatible with all games software are somewhat of a rarity. AGF has come up with a programmable joystick interface which it claims will work with all commercial software. Steve Mann's reflexes reveal themselves to be as sharp as ever in his eagerness to try it out.

I'm sure that the games players among *PCW*'s loyal readership do not need me to tell them that a joystick is an essential purchase: for arcade games, in particular, a good stick can double or triple the highest score obtained by keyboard operation. In the case of the Spectrum this is even more obvious, as the keyboard hardly lends itself to quick responsive action. Yet, paradoxically, until the recent appearance of Sinclair's own 'official' Interface 2 with joystick port, the subject of Spectrum sticks has tended to confuse rather than make life easier for the user. The problem has been a surfeit of riches — a multitude of interfaces and joysticks that are incompatible with each other. The Kempston stick will not work with software designed for the Fuller Box; a Protek joystick is no use when linked up to a game designed for the standard AGF model — you get the picture?

To combat these difficulties, AGF has come up with a solution that is neat in concept, if not in appearance — a programmable interface that is designed to work with *any* software. It is immaterial whether or not that software is designed for use with any particular make of interface; even if it is intended solely for keyboard operation AGF's little wonder will be able to deal with it.

The AGF Programmable Joystick Interface is hardly pretty — a bare PCB with four ICs is accessed via ten coloured wires terminating in crocodile clips that simply clip on to various permutations of 13 metal strips. But use of the correct combination allows any of the Spectrum's keys to be mimicked by the joystick, so the user is not restricted solely to games: indeed the demonstration cassette included in the interface package is a high resolution graphic design program called 'Video Graffiti'.

The AGF solution is neat in concept if not in appearance

'The AGF Programmable Joystick Interface is hardly pretty — a bare PCB with four ICs is accessed via ten coloured wires terminating in crocodile clips...'

Programming the interface

To understand how the interface is programmed, it is necessary to consider how the Spectrum keyboard works. Each key on the board has its own unique location within the computer's addressing network, and each address is made up of two numbers — a 'D' number and an 'A' number. The 'D' numbers are 0, 1, 2, 3 and 4, the 'A' numbers are 8, 9, 10, 11, 12, 13, 14 and 15, and any key on the

Spectrum's keyboard can be represented by a combination of these — for example, the address of the SPACE key is D0/A15.

The metal strips on the PCB are divided into two groups: the smaller group of five strips corresponds to the 'D' numbers and the 8-strip group represents the 'A' numbers. Alongside each of these two groups are five coloured wires, labelled with the various joystick functions — so the 'Fire' button, for instance, represented here by the red wires, can be connected to the relevant 'D' and 'A' strips to mimic the action of any chosen key. It's difficult to explain this, but it's very simple to understand when you have the interface in front of you. AGF has included a little self-adhesive black label — a 'Key Programming Chart' — that details the 'D' and 'A' numbers of each key; this can be attached to a convenient surface for quick reference. Also supplied with the interface is a set of blank cards that can be filled in by the user to give key combinations for different programs.

As an example of the interface in use, keeping things very simple for demonstration purposes, we could consider a program that uses very few keys when operated via the keyboard. Space Invaders is a game that springs immediately to mind — it's a game familiar to the whole world and his uncle and has only three controls, to move left and right and to fire.

The Bug-Byte Spectral Invaders uses CAPS SHIFT for leftward movement, Z to move right and SPACE to fire. To program this on the interface the two yellow leads are clipped to D0 and A8 (CAPS SHIFT), the black leads go to D1 and A8 (Z) and the red leads connect to D0 and A15 (SPACE); the remaining wires are left disconnected. Making sure that the power is off, the interface is plugged into the Spectrum's rear connector (other peripherals may be tacked onto the rear of the interface), a joystick is plugged into one of the two ports, the power is then reconnected and the program is under joystick control. If it isn't, a mistake has been made somewhere in the connection of the leads — in which case it is simply a matter of disconnecting the power supply and trying again. Once everything is set up and working correctly it is advisable to jot down the configuration details on a quick reference card so that future games of Spectral Invaders can be played without reference to the Key Programming Chart.

Okay, we've dealt with keyboard-operated software — but what about those games that are designed for use with other joystick interfaces? In fact this is an irrelevant consideration — as the Spectrum has no built-in joystick port there is no commercial software that is designed solely for use with joysticks. Imagine's latest range, for instance, features options for using Fuller, Kempston, Protek or the earlier, non-programmable, AGF interface, but it obviously caters for those that don't possess a joystick of any kind. So all that you need do is totally ignore the various joystick options; instead you select the keyboard option and proceed as above — even though the program thinks the keyboard is being used, the game will be under joystick control.

Crock clips form key combinations

'invaluable for playing arcade-type games'

Joysticks in your own programs

All of the above assumes that you are using joysticks with commercial software, but it is simple enough to insert the relevant instructions in your own programs.

The Video Graffiti program supplied by AGF is intended as a guide for designing your own joystick-controlled programs. The instructions recommend that Video Graffiti is LISTed, and they use the listing to explain how to program responses to the fire button and the movement keys (which, of course, are now replaced by movement of the joystick). A particularly valuable explanation covers the use of the IN function to control diagonal movement: a variable 'in' is set up to the value corresponding to no keys at all being pressed and by comparing this variable to the current value read by the IN function at the relevant points in the program the user can monitor the effect of two keys being pressed at the same time — and this of course is interpreted as the joystick being moved in a diagonal direction. This information is then used to modify the x and y coordinates of the object being controlled.

In addition to its use as an aid to programming, Video Graffiti is a useful little graphic design program in its own right. The keyboard is not used at all — the joystick is used for drawing, erasing, sending a copy to the ZX Printer and SAVEing a complete screen and, although it is hardly the most comprehensive drawing program available, the use of a joystick instead of the keyboard gives great flexibility and makes it much simpler to use than many similar programs.

Prices

AGF Programmable Interface + Video Graffiti program	£32.95 (add £1 p&p)
Joystick	£7.54
Pack of 10 Quick Reference Cards	£1.00

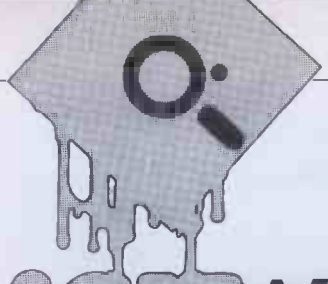
Available from AGF Hardware, 26 Van Gogh Place, Bognor Regis, West Sussex PO22 9BY

Conclusions

Despite a somewhat ugly and unfinished appearance — something I suspect is unavoidable in a hardware programmable design (after all, you could hardly build a neat casing around it when the programming is done by fooling around with ten bits of wire and two handfuls of crocodile clips!) — the AGF Programmable Interface achieves its objectives admirably. I found it invaluable for playing arcade-type games and I suspect that it will prove extremely useful in other situations. The fact that it will duplicate the action of any key means that it could well be applied to more 'serious' types of software — even educational quiz-type software that requires the user to make a choice between various alternatives could eaily be converted to joystick use, and the fact that the standard Spectrum keyboard is so unresponsive encourages the use of this interface in many situations that require quick responses. Of course there are some programs that will not adapt easily: some of the more complex games that require the use of more than half a dozen keys are probably easier to use with the keyboard — it's more trouble than it's worth to try and use a combination of both keyboard and joystick. But I'm certainly going to have a shot at transferring Psion's fine Flight Simulator over to joystick operation — after all, a joystick is the obvious control to use for flying an aircraft. . .

The AGF Programmable Interface is certainly not cheap at a cost of £33 for the interface alone, and at the time of writing I have been unable to try out Cambridge Computing's programmable system, which also claims to work with all software and has the attraction of being a few quid cheaper and which includes a joystick in the price. But the AGF system would certainly appear to be a better buy than the many non-programmable interfaces available and I suspect that the price will come down fairly rapidly — after all, Sinclair's new Interface 2 will sell at just under £20 and has the added bonus of a ROM cartridge port that will allow 16k Spectrum owners to run 48k software. So it's probably best to wait and see . . .

PS. The interface also works with the ZX81. END



DATABASE BENCHTEST

DATA COLLATER 1983

Since the Database Benchtest series began in 1982, some of the packages reviewed by Kathy Lang in PCW *have been modified and improved. Here she presents an up-to-date comparison of the packages tested as 1983 draws to a close.*

Since this series began in March 1982, 21 data management systems have been reviewed. Those I looked at in 1982 were summarised in December 1982, but since then quite a number of those reviewed early in the series have been upgraded, some with quite major improvements to facilities. So for this Roundup, I wrote to all the suppliers of the packages, asking them to tell me of any changes since I first reviewed their product. All the suppliers responded except one, Bristol Software Factory, whose Silicon Office package I reviewed on the Commodore PET in the July 1982 issue. In order to avoid any danger of including out-of-date information, I have therefore omitted Silicon Office from the summaries which follow.

The summary information is given in three parts. To start with, there are very brief summaries of the changes to those packages which have been upgraded since they were first reviewed. This is followed by a set of six tables which summarise the limitations of each package — numbers of records permitted, field sizes, and so on — the functions provided, such as methods of screen and report formatting, and the user image and documentation. The third part of the Roundup, which will appear in the next issue, explains the tests used to measure the speed of the packages, and summarises the Benchmark timings.

Readers new to this series might like to know that my approach is, as far as possible, to take a package as an informed and reasonably experienced user would find it, and therefore in my tables and tests to avoid approaches which would be more esoteric than such users would employ. This may mean that some professional computer people may be able to get even more out of some packages than I have suggested, but my feeling is that such people are quite capable of finding that out for themselves! — and to take a more 'computerspeak' approach myself would be a disservice to the majority of readers.

Package	Supplier	Telephone	Cost £	Date reviewed	Systems supported	Version reviewed	Package type
Beta	Ormskirk Computers	0695-77043	195/295	Aug 83	UCSD-P	UCSD-P	N,S
BusiPost	BusiSoft	01-381-4337	195	Feb 83*	MS,PC	MS,2.12	N,D
CardBox	Caxton	01-379-6502	155	Aug 82	80,86 MS,PC	80	N,M
Condor	MOM Data Systems	0224-571825	95/195/295	Nov 82*	80,86,MS	MS,3	E,S
DataPrism	Bonsai	01-580-0902	325/525	Mar 83	80,86 UNIX	80	N,S
dBASEII	Ashton Tate	0908-568866	425	May 82+	80,86,MS	MS,2.4	E,S
DBMSIII	GW Computers	01-631-4818	575/295	Jun 82*	80,86 MS,PC	MS,3.7	E,S
Delta	CompSoft	0483-898545	495	Oct 83	80,MS	MS,1.2	N,S
DMS	CompSoft	0483-898545	400	Mar 82	80,MS	MS	N,S
FMS80	InfoData	0635-32741	250/395	Apr 82*	80,86,MU	80,3.1	N,S
InfoStar	Tamsys	07535-56747	295	Sep 83	80	80	N,S
MicroPen	Intelligence Ireland	0001-988555	140	May 83	80,86,MS	80	N,S
Omnis	Blyth Computers Ltd	050270-371	195/295	Jul 83+	UCSD-P	UCSD-P 9/83	N,S
Optimum	Professional Software	021-445 1039	225/450	Nov 83	80,86,MS PC, UNIX, MU	80,VII	N/A,S
Pearl	Pearl Software	0202-20692	190	Oct 82*	80,MS	MS	N,S
Rescue	Qudos	01-253 3998	295	Apr 83+	80,86,MS PC,PCOS	MS,2.24	N,S
Search & Find	Xitan	0703-334711	250	Dec 83	80,86 MS,PC	80	N,F
SuperFile	SouthData	01-229-2724	485/710	Jan 83*	80,MU	80	N,M
Tomorrow's Office/MultiFile	Stage One Software	0202-735656	195/395/595	Jun 83+	MS,PC	MS,1.8	N,S

Notes:
Date reviewed: * = complete new version released since, see text. + = changes made falling short of full new release.
Systems supported: 80 = CP/M = 80,86 = CP/M-86, MS = MS-DOS, PC = PC-DOS, MU = one or more full multi-user versions (ie, with field or record locking).
Version reviewed: System as above/package version, summarised here.
Package type: N = Novice, E = Experienced users, A = Advanced users; S = Structured data, F = Free text, M = Either.
Fig 1 Packages and Suppliers

One final word of introduction. Most readers will know that material in *PCW* is protected by copyright, as is any published material in a country like Britain which is a signatory to the Berne Convention. However, a few do not. So I'd like to take the opportunity of reminding all readers that *the material in this article is protected by copyright law. The article may not be copied or redistributed, in whole or in part, in any form without the written permission of the copyright holders*. If you want to use the material, write to the *PCW* Editor in the first instance.

Packages with new versions

Three packages, Condor, DBMSIII and Omnis, have been upgraded with some improvements to facilities, but in each case the major change has been the issue of a new manual. Condor and Omnis have issued a typeset version, and all three are an improvement on the previous versions. Condor has also dropped substantially in price. Eight other packages have major new releases since they were first reviewed, brief summaries of which follow.

Aquila has now been developed substantially, has a sister package called Eagle, and is being used widely as an information retrieval system. These are part of a range of products from Kent Barlow which cover databases as well as data manipulation, and I hope to cover this subject in more detail in a later article.

BusiPost has made some major changes to printing facilities and character set handling, and has also brought out a set of new manuals. The Tutorial Guide is one of the best I've seen.

dBASEII also has a new manual, together with a number of functional enhancements including a 'paint-a-screen' facility. This is available only for CP/M-80 versions at the moment, but 16-bit versions may be available by the time you read this article.

FMS80 has had some major changes to the user image to make it more coherent and 'friendly', and has a new manual and a full on-line help system. Some features have been enhanced — for instance, all indexes associated with a data file are now kept up-to-date automatically when the data file is amended. A full multi-user version is now available.

Pearl has probably undergone the most radical revision of all, and is now an extremely flexible and powerful package for its price. The manuals are good too, including both a Beginners' Guide and — a very good idea — a more advanced Tutorial covering the more complex features. There isn't space to give all the changes in the current version in detail — see the summary tables. In addition, some enhancements to Pearl to allow the loading of an external data file in a variety of formats should be available by the time you read this, at an additional cost of £75. About the same time, Pearl will be issuing a 'Programmers' Tool Kit' with such goodies as a facility for constructing user menus, to make the package more attractive to software houses who want to tailor systems for their users. Coming soon is an advanced version of Pearl, which will include such features as a full multi-file capability, enhanced printing features, a choice of formats to use with a single data file, and much improved calculation facilities.

SuperFile has a new (much improved) manual, plus a powerful sorting feature which wasn't in the version I tested originally.

Tomorrow's Office is now available on other 16-bit systems as well as the Sirius, and there is a multiple file add-on system available. This has extensive procedures for accessing several files at one time, as an adjunct to the main Tomorrow's Office features. The package in both forms has been substantially reduced in price, and a limited version made available at a yet lower price.

Postscript. This year's prizes for diversions go to the manual which refers to a task being carried out 'automagically', another which refers to 'an expendable menu', and to the company which sent for my review the French edition of the package.

Package	Max file size (recs)	Files span disks	Max rec size (chars)	Max no fields	Max char fld size	Max precn digits	Max len prime key	Special disk format	Filesize fixed	Link to ASCII data
Beta	9999	No	512	32	64	10	16	No	CO	PL
BPost	32000	Yes	F,800	F,53	31	NA	22	Yes	No	WO
CardBox	65500	No	1404	26	1404	NA	32/wd	No	No	WO
Condor	32767	No	1023	127	127	10	127	No	No	YV
DP	OSL	No	V to 9999. Eg 56k system, 1856 chars	999	35	14	NS	No	No	YF
dBASEII	65535	No	1000	32*	254	10	100	No	No	YV
DBMSIII	32000	No	1400	20*	79	NS	NA	No	No	PL
Delta	32000	No	2000	90	80	14	80	No	No	YF
DMS	26214	No	1024	60	80	14	80	No	CO	YF
FMS80	65535	No	65025	255	255	19	255	No	No	YV
InfoStar	8Mb	Yes	65025	255	255	14	120	No	No	YF
MPen	32750 (not OSL)	No	1024	100	78	NA	NS	No	No	PL
Omnis	32767	Yes	1023	120	79	10	79	No	CO	YF
Optimum	OSL	No	4500 (80) 12000 (MS;PC)	50	255	16	255	No	No	PL
Pearl	OSL	No	varies	255	80/132	16	80	No	No	YV
Rescue	32760	No	1024	100	60	14	60	No	No	YV
S&F	32767	No	UL	NA	NA	NA	20	Yes	No	YV
SuperF1	OSL	NS	20000	UL	OSL	NA	OSL	No	No	YV
TO	30KM +60KT	Yes	508/ 254M+254T	90	78	10	78	Yes	No	YF

Notes:
General: OSL = Operating system limit, M = Master record(s), T = Transaction records, F = Fixed, * = subfields allowed in addition, NA = Not available, NS = Not stated.
Max record size, max no. fields: F = Fixed by package.
File size fixed when file created: CO = Yes, but size can be increased by copying data out and back.
Link to ASCII data: PL = By programming only, WO = Write only, YV = Yes, can vary formats, YF = Yes, one format only.
Fig 2 Constraints (1)

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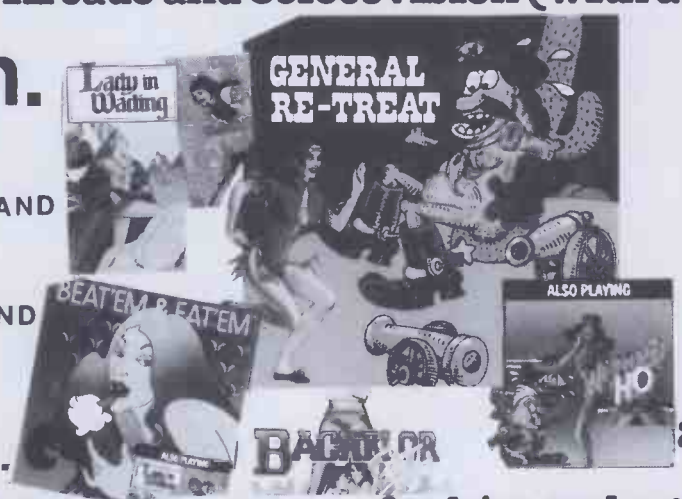

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DATA COLLATER 1983

Package	Data types	Fixed record struc	Field record stored	Amend record struc	Link data files	No data files simult'y	No. sort fields	No. keys	Max len keys (ch/fld)	Subsid indexes updated
Beta	N,C,D,L,R	Yes	Yes	CO	No	NP	1	2	32,1	UTD
BPost	F	Yes	No	No	No	NP	1	3	F	UTD
CardBox	C	Yes	No	Yes	No	NP	EX	UL	32,UL	UTD
Condor	C,I,$	Yes	Yes	CO	BA	2	32	1	127,8	UTD
DP	N,C,D,L	Yes	No	CO	PL	NP	10	99	NS,10	UTD
dBASEII	N,C,D,L	Yes	Yes	CO	F	2	UL*	UL	100/UL	UTD
DBMSIII	N,C,D	Yes	Yes	CO	EX	12	20	1*	R#,79	BA
Delta	N,C,D,R	Yes	Yes	CO	TR	1+8	5+	UL	100,5	BA
DMS	C,N	Yes	Yes	CO	No	NP	3+	UL	NS/3	BA
FMS80	C,I,N,V	Yes	Yes	CO	F	19	UL,255*	UL	255,UL	UTD
InfoStar	C,N etc	Yes	No	CO	RP	1	25	1	120,25	BA
MPen	C	Yes	Yes	No	No	NP	NP	1	NS,1	NA
Omnis	N,C,D,L	Yes	Yes	CO	No	NP	10	10	79,1	UTD
Optimum	N,C,D*	Yes	Yes	Yes	F	UL	15	4	255,1	UTD
Pearl	N,C,D,R	Yes	No	Yes	RO	5	5	UL	80,1	UTD
Rescue	N,C,D,R, etc	Yes	Yes	Yes	No	NP	5	10	60,1	UTD
S&F	C	No	No	NA	RO	UL	NA	UL	20/UL	BA
SuperF1	N,C,I,S	No	No	Yes	DY	DY	36	5k	UL	BA
TO	N,C,D	Yes	Yes	CO	TR/Y	M+T/30	3	15	128,3	BA

Notes:
General: UL=Unlimited, NP=Not possible, NS=Not stated. Data types: C=Character, N=Numeric (inc. decimal point), I=Integer, D=Date(*=MM/DD/YY format only), $=Money format, V=Varying length, L=Logical (Y or N), etc=Extra formats, R=Reference (table lookup). Amend record structure: CO=Only by copying data out and back. Link data files: BA=Batch process, F=Full, EX=Own format, TR=Master+transaction, RP=In reporting only, DY=Directory used, so unnecessary, RO=Read only, PL=Through programming language. No. sort fields: EX=In upgrade, *=Possible but unnecessary within package, +=By index only—may affect ability to write out file in ASCII format in alternative order. No. keys: *=+Record number. Max length of keys: first figure is character limit, second is field limit. Subsidiary indexes updated: BA=Batch process, UTD=Kept up-to-date automatically. Tomorrow's Office figures are: main package/with MultiFile upgrade.
Fig 3 Constraints (3)

Package	Data validation	Screen formatting	Unique keys	Report formatting	Store calculns	Aggre-gation
Beta	G	P,D	1M	D,L	IN,ED	T+ST
BPost	G	D	No	D,L	N	No
CardBox	N	P	No	P,I	No	No
Condor	A	P	OP	P	BA	S
DPrism	M	D	OP	C,D,WP	PL	Full
dBASEII	A(D)	P,D	No	P,C,D	IN,ED,BA	Full
DBMSIII	M	D	1M	C	IN,BA	Full
Delta	A	P,D	1M	C,D,L	IN,BA	Full
DMS	A	P,D	1M	C,D,L	IN,BA	Full
FMS80	A	C,D,WP	OP	C,D	IN,BA	Full
InfoStar	G	P	OP	P,D,I	IN,BA	T+ST
MPen	N	WP	No	WP+L	No	No
Omnis	G	P	OP	P,L	IN,BA	T+ST
Optimum	G	P,D	1M	P,I	IN,BA	T/Y
Pearl	A	P	OP	P	IN	Full
Rescue	G	C	OP	C,I	IN	S
S&F	N	NA	No	D,I	No	No
SuperF1	G	PD	OP	P	IN,ED	T+ST
TO	A	P+QA	OP	C	IN,BA	Full

Notes:
Data validation: G=Good, A=Adequate, M=Minimal, N=None, D=DIY. Screen/Report formatting: D=Default format supplied, C=Must specify columns and rows by number, P=Paint-a-screen, QA=Question-and-answer, WP=Through a wordprocessor (separate program except in S&F and FMS80), L=Letter writer, I=Special link to WP (usually WordStar Mail-Merge) for output. Unique keys: 1M=One is mandatory, OP=Optional (package checks if requested), No=Not required or checked. Store calculations: IN=On input, or updating in batch, ED=While editing interactively, BA=Batch process to change specified fields/records. Aggregation: Full=Full calculation facilities, S=Statistics, totals and sub-totals, T+ST=Totals and sub-totals, T=Totals only. Optimum entry is for Executive/Professional versions.
Fig 4 Functions (1)

DATA COLLATER 1983

Package	Store selection criteria	Combine criteria	More than one test per field?	Wild codes	Browsing
Beta	N	A,P	Yes	SS	PE
BPost	N	A	Yes	SW	PE
CardBox	N	A,N	Yes	SW	AK
Condor	P	A,O*	Yes	SW	AF
DPrism	P	A,O,N	Yes	No	PE
dBASEII	P	A,O,N	Yes	SW	AF
DBMSIII	P	A+	No+	No	AF
Delta	M	A,O	Yes	SW	AK
DMS	M	A,O	Yes	SW	PE
FMS80	M	A,O	Yes	SW	AK
InfoStar	M	A,O	Yes	SW	AF
MPen	N	A	No	SW	AF
Omnis	P	A(O)	Yes	SW	AF
Optimum	P	A,O	Yes	SW	PE
Pearl	M	A	No	SS	AK
Rescue	M	A,O,N,P	Yes	SW	AK
S&F	N	A,O,N	No	SW	AF
SuperF1	P	A	Yes	SW	AF
TO	P	A,O,N	Yes	SW	PE

Notes:
Store selection criteria: N=Not available, P=Permitted but not mandatory, M=Mandatory. Combination of selection criteria: A=AND (must pass all tests), O=Or may pass any one test), N=Not (must not pass test; note that some packages which don't have this operator *do* have a 'not equal to' comparison operator for single tests), P=may set permitted level, eg, 2 means at least two criteria must be satisfied. Condor: * =allows only one method of combination in any one set of tests. DBMSIII: + =also allows Or within a single field. Omnis: OR assumed where same field tested for equality more than once. More than one test allowed per field: DBMSIII allows several specified alternatives in one field. Wild codes: Wild code searching allowed, with SS=field must start with specified character(s), SW=field may contain specified character(s). Browsing: File may be browsed in order as follows: PE=Primary key for editing, any field for viewing, AK=Any key for viewing or editing, AF=Any field for viewing or editing.

Fig 5 Functions (2)

Package	User Image types	Reference manual	Tutorial Guide	Reference Card	On-Line Help	'Hot Line'
Beta	M	**	**	N	N	F
BPost	M	**	*****	***	****	F
CardBox	M+C	***	****	**	****	F
Condor	C,LT	***	***	N	***	NS
DPrism	M+QA	**	N	N	*	NS
dBASEII	C,FT	****	***	****	**	D
DBMSIII	M+C,PL	*	*	N	**	FP
Delta	M,LT	***	**	**	**	P
DMS	M	**	***	N	N	P
FMS80	M,C,FT	***	***	N	***	P
InfoStar	C	**	***	***	***	D
MPen	M	***	N	N	**	P
Omnis	M+C	**	**	****	***	F
Optimum	M,C,FT,PL	*	***	N	***	NS
Pearl	C+M	****	****	***	****	NS
Rescue	M,LT	**	***	N	**	NS
S&F	M	***	**	N	***	NS
SuperF1	M,PL	***	***	N	**	NS
TO	M,C,LT	**	***	N	****	F

Notes:
User image types: M=Menus, C=Commands, LT=Limited tailoring, FT=Full tailoring, PL=Interface to conventional programming language. Where commas are used, this means alternatives; plus signs mean these approaches are used together. Documentation and Help: rating from 1 to 5 stars, N=Not provided. "Hot-line": telephone support provided: F=Free from supplier, P=From supplier for payment (usually annual), NS=Not stated, D=Depends on dealer

Fig 6 Documentation and Help

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Programming Aids 3	£19.95
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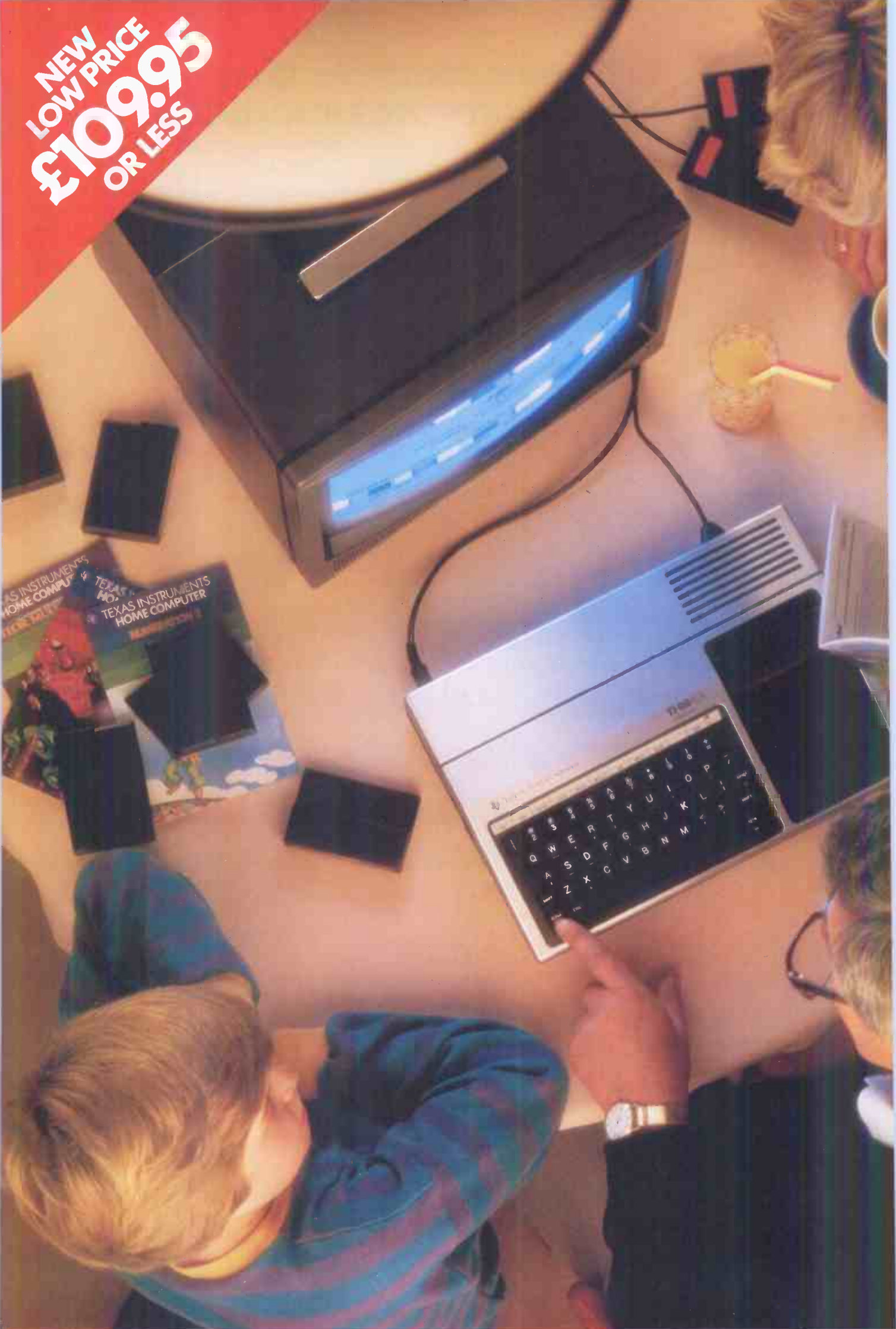
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ORIC MACHINE CODE

Having lived with an Ohio Superboard fitted with Cegmon for over three years, I am used to good machine code handling. I now also have an Oric which is not 'designed' for machine code work. This program makes it very easy to enter code anywhere in RAM and to read 64 byte blocks anywhere in memory including ROM.

Saved on AUTO it will load in to give the INPUT mode. 16 bytes can be entered at one go at any start address in RAM and appear on a 2 × 8 table. It could have been 8 × 8 but I have not yet discovered how to stop Oric scrolling the table when the inputs hit the bottom of the screen! To enter anywhere else in RAM type Control C and enter new address.

RUN 200 puts program into READ mode and can be used immediately to check entries first made or to 'crib' code held in ROM.

ENTER	*VDU*
RUN	START AT AS #XXXX?
#0000	INPUT MEMORY CONTENTS AS #XXXX?
#A5#40#C9#0A	#0000#A5#40#C9#A#90#2#69#6
#90#02#69#06	#0008#69#30#85#41#60
#69#30#85#41#60	(Note leading 0s are not printed and digit is left justified)
CONTROL—C	START AT AS #XXXX?
#0040	INPUT MEMORY CONTENTS AS #XXXX?
#0C	#0040 #0C (Inputs variable)
CONTROL—C	
CALL #0000	
RUN 200	LOOK FROM #XXXX?
#0040	#0040 #OC # 43 #55 55 55 55 55 55 55, etc #55s

The answer to the question: What is the ASCII equivalent of HEX0C? is 43 and appears as programmed in memory at #0041.

Having entered a program, including the variable data, use CALL to the start address and look up the results at the result address by using the READ mode.

To try it all out use an example such as given in Leventhal for converting Hex to ASCII. Although using Page Zero opens up a likelihood of corruption this example seems to escape it.

Alan Davidson

```
  1 REM CODE WORK, ORIC BY ALAN DAVIDSON
  2 REM ENTER ADDRESSES AND CONTENTS
    AS HEX IE #XX and #XXXX
  3 REM TO ENTER CODE TYPE RUN, TO READ MEMORY
    TYPE RUN 200
  5 CLS
  6 PRINT "START AT AS #XXXX";
  7 INPUT M                    'SETS UP START ADDRESS
 10 PRINT "INPUT MEMORY CONTENTS AS #XX"
 15 E = 6
 20 FOR C = 1 TO 2
 30 FOR B = 0 TO 7
 35 INPUT A                   'ENTERS CODE
 40 POKE M + B,A              'ENTERS CODE TO MEMORY
 50 A$ = HEX$(A)
 60 M$ = HEX$(M)
 70 PLOT 13 + 3*B,E,A$ : PLOT 7,E,M$ 'SETS UP TABLE
 80 NEXT B
 90 E = E + 2 : M = M + 8
100 NEXT C
110 IF C = 3 THEN 5 ELSE 7
115 STOP
199 REM START OF READ ROUTINE, TYPE RUN 200
200 PRINT "LOOK FROM #XXXX";
205 INPUT M                   'SETS UP START ADDRESS
210 CLS
215 E = 6
220 FOR C = 1 TO 8
230 FOR B = 0 TO 7
240 A = PEEK (M + B)          'A IS BASE 10
250 A$ = HEX$(A)              'CONVERTS A TO HEX
260 M$ = HEX$(M)
270 PLOT 9 + 3*B, E, A$ : PLOT 3, E, M$
280 NEXT B                    'SETS UP 8 X 8 TABLE
290 E = E + 2 : M = M + 8     'FROM START TO START + 63
310 GOTO 200
CSAVE "CODE WORK", AUTO
```

BBC LINK

This is a small program to link two BBC Micros together so that one can be used as a printer buffer. The link is achieved by using the RS423 serial port on the back of the BBC.

1. On the computer with the printer, type:
*FX3 (Output to screen and printer)
*FX2,1 (Input from RS423)
2. On the master computer, having loaded the program, type:
*FX3,5 (Output to RS423 and screen)
LIST (Transfer the program)
PRINT "VDU 2,13" (Printer on, carriage return)
PRINT "LIST" (List to printer)
PRINT "VDU 3,1" (Printer off, carriage return)
Optional—[PRINT "*FX2"]
(Normal keyboard input)
See *BBC User Guide*, pages 421-422 for details of *FX2 and *fx3.
NB Anything in quotes sent to the other computer is executed.

Ben Newsan

SIRIUS TIPS

The Microsoft Basic 86 manual (Part no 100946-01 June 1982) supplied with the Sirius 1 does not show how to use some of the computer's more interesting features.

The Sirius 1 is capable of displaying its extensive character set on the screen in high intensity, reverse video, underline and any combination of these. The escape function CHR$(27) allows the appropriate control character to be sent to the display processor, and is listed in Fig 1.

The MS-DOS operating system (version 1.25 release 2.5x) has a built-in software clock that is normally re-set by the user on switch-on and is used by MS-DOS to time and date files saved on disk. It is possible to use this clock from Basic 86 (Rev 5.25 dated 26 May 82) as follows:
PRINT DATE returns the day number, eg, 1st January gives 1, 31st December gives 365 or 366 in a leap year.
PRINT DATE$ returns the date in the usual US format, eg, 12-31-1983 for 31st December 1983.
PRINT TIME returns the time of day in seconds, eg, 00:34:36 gives 2076
PRINT TIME$ returns the time of day in hours, minutes and seconds in 24-hour clock format, eg, 13:05:59

It should be possible to get the day out as well, ie, Mon, Tue, Wed, but the obvious PRINT DAY or PRINT DAY$ do not seem to work.

The character set (British 01) supplied with the Sirius on the MS-DOS disk appears to be similar to the IBM PC (see Tim Fields' article in *Byte* pp 331-376 March 1983 'A Peek into the IBM PC'). The characters not available from the keyboard can be displayed using PRINT CHR$(A%) where A% is in the range 32 to 255 and corresponds to the ASCII code for the normal alphabet. On the IBM PC, values 0-31 give a further 32 characters; however, the Sirius uses these for the non-printable ASCII commands such as 'escape', CHR$(27). It is possible to display the remaining 32 characters by means of the sequence PRINT CHR$(27);"F";CHR$(A%) where A% is in the range 94 to 125.

The Sirius logo is really made up of three rows of characters and can be displayed anywhere on the screen using the program shown in Fig 2.

The program makes use of the POKE command to alter directly the values stored in screen RAM. The screen RAM is a 4k byte block from F0000 to F0F9F. Two eight bit bytes (or octets) are used for each character displayed. The first at, say, F0000 gives the character and the second at F0001 gives the attributes and the font.

The value to be POKEd to screen RAM is not the ASCII value. The table in Fig 3 shows the values to use for the first memory location.

The second memory location has one bit to control each attribute, as shown in Fig 4.

To get the combination required, the attributes are added up as shown in Fig 5.

The program in Fig 6 displays all the characters in fonts 0 and 1 in all eight combinations of the attributes shown in Fig 5.

The 25th line of the screen is protected from being written over by ordinary program listing or print statements; it can be used to display semi-permanent messages to the user. This is useful in menu type programs when it is often helpful to remind the operator which main menu selection is in use. Another possibility is to display labels for the function keys.

The program shown in Fig 7 clears line 25 of any previous text and displays seven labels for the function keys. The hex address F0F00 points to the first location of line 25 in screen RAM.

John Lane

Clear screen, home cursor	PRINT CHR$(27);"E"
Clear screen	PRINT CHR$(27);"b"
Move cursor up one line	PRINT CHR$(27);"A"
Move cursor down one line	PRINT CHR$(27);"B"
Turn on flashing cursor	PRINT CHR$(27);"2"
Turn off flashing cursor	PRINT CHR$(27);"3"
Turn on high intensity	PRINT CHR$(27);"("
Turn off high intensity	PRINT CHR$(27);")"
Turn on reverse video	PRINT CHR$(27);"p"
Turn off reverse video	PRINT CHR$(27);"q"
Turn on underline	PRINT CHR$(27);"0"
Turn off underline	PRINT CHR$(27);"1"
Turn on special lower case	PRINT CHR$(27);"F"
Turn off special lower case	PRINT CHR$(27);"G"

Fig 1

```
                    SIRIUS.BAS
 10 REM ROUTINE TO DISPLAY SIRIUS LOGO
 20 PRINT CHR$(27);"E"
 30 DEF SEG = &HF000
 40 ROW% = 9
 50 COL% = 30
 60 LOGO% = 36
 70 C% = COL% * 2
 80 FOR J% = 1 TO 3
 90 R% = ROW% * 80 * 2
100 FOR I% = 0 TO 20
110 POKE ( R% + C% + (2 * I%) ), ( LOGO% + I%)
120 POKE (R% + C% + (2 * I%) + 1), 64
130 NEXT I%
140 LOGO% = LOGO% + 21
150 ROW% = ROW% + 1
160 NEXT J%
170 END
```

Fig 2

Poke Value	*Font*	*Character Displayed*
36 to 98	0	SIRIUS LOGO
101 to 132	0	CHR$(95)—CHR$(126)*
133 to 255	0	CHR$(33)—CHR$(155)
0 to 99	1	CHR$(156)—CHR$(255)

*special lower case characters

Fig 3

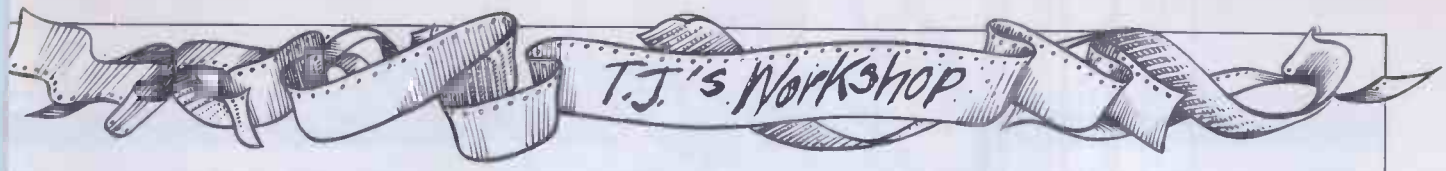
Bit	*Value*	*Attribute*
MSB	128 –	0 = Normal, 1 = Reverse Video
	64 –	1 = High Intensity, 0 = Normal
	32 – }	00 = Normal, 10 = Underline*
	16 – }	
	8 – }	Future Character Fonts
	4 – }	
	2 – }	
LSB	1 –	0 = Font 0 1 = Font 1

*combinations 01 and 11 not valid.

Fig 4

Poke			*Attribute*	
Font 0	*Font 1*	*Inverse*	*H Inten*	*Underline*
0	1	no	yes	no
32	33	no	yes	yes
64	65	no	no	no
96	97	no	no	yes
128	129	yes	yes	no
160	161	yes	yes	yes
192	193	yes	no	no
224	225	yes	no	yes

Fig 5



'POKECSET.BAS'

```
 10  REM DISPLAYS POKE CHARACTER SET 0 TO 255
 20  REM USES ATTRIBUTES 0,1,16,17, . . .
 30  DEF SEG = &HF000
 40  PRINT CHR$(27);"E"
 50  FOR I% = 0 TO 255 STEP 16
 60      FOR J% = 0 TO 15
 70      ROW% = J%
 80      CHAR% = I% + J%
 90              FOR K% = 0 TO 255 STEP 16
100                      FOR L% = 0 TO 1
110                      ATTRIB% = K% + L%
120                      COL% = (K%/4) + (L%*2)
130                      LOCAT% = (ROW%*80*2) +
                         (COL%*2)
140                      POKE LOCAT% + 1, ATTRIB%
150                      POKE LOCAT%, CHAR%
160                      NEXT L%
170              NEXT K%
180      NEXT J%
190  NEXT I%
200  END
```

Fig 6

'SCRLINE.BAS'

```
 10  REM DISPLAYS FUNCTION KEY LABELS ON
     SCREEN LINE 25
 20  PRINT CHR$(27);"E"
 30  DEF SEG = &HF0F0
 40  FOR I% = 0 TO 79
 50      POKE (I%*2), 227
 60      POKE ((I%*2) + 1), 208
 70  NEXT I%
 80  FOR I% = 0 TO 77 STEP 11
 90      POKE ((I%*2) + 1), 80
100      POKE ((I% + 1)*2) + 1, 80
110  POKE ((I% + 6)*2) + 1, 192
120  NEXT I%
130  POKE ((79*2) + 1), 80
140  POKE 6*2, 149
150  POKE 17*2, 150
160  POKE 28*2, 151
170  POKE 39*2, 152
180  POKE 50*2, 153
190  POKE 61*2, 154
200  POKE 72*2, 155
210  END
```

Fig 7

NEWBRAIN VARIABLE DUMP

I have a useful machine code routine for the NewBrain. This machine does not have a variable dump routine (like LVAR in some Microsoft Basics) and this routine provides this utility.

The code resides at the top of RAM, protected by the RESERVE command. The Basic program here has the code in DATA statements which will install the code, and reserve space automatically.

This loader program can simply be loaded, then RUN. But if the machine already contains a program, then the loader should be MERGEd and executed using GOTO 65000. (Provided, of course, the original program does not contain lines over 65000.)

To use the routine, use CALL 32350 or CALL TOP. This will list the variables to the video device on stream 0.

Alternatively, the routine may be called using CALL 32350, n or CALL TOP, n, where n is the number of a previously opened stream to any device (printer, second video, tape, etc.).

A Hamilton

```
65000 RESERVE TOP-32350
65005 FORf=32350 TO 32748
65010  READJ:POKEf,j
65020 NEXTf
65025 ?"LVAR installed at";TOP
65030 DELETE 65000-
65040 END
65050 DATA 221, 229, 229, 33, 244, 127, 54, 0, 62, 22, 50, 246
65055 DATA 127, 225, 62, 1, 184, 40, 93, 175, 184, 62, 40, 32
65060 DATA 83, 221, 33, 241, 127, 221, 54, 0, 0, 253, 110, 28
65065 DATA 253, 102, 29, 1, 8, 0, 55, 63, 237, 66, 34, 237
65070 DATA 127, 253, 110, 30, 253, 102, 31, 34, 239, 127, 62, 13
65075 DATA 231, 48, 42, 237, 127, 1, 8, 0, 9, 34, 237, 127
65080 DATA 237, 75, 239, 127, 237, 66, 48, 55, 231, 54, 56, 51
65085 DATA 42, 237, 127, 35, 126, 230, 248, 254, 128, 204, 232, 126
65090 DATA 254, 192, 204, 6, 127, 203, 95, 196, 61, 127, 24, 210
65095 DATA 55, 221, 225, 201, 70, 43, 110, 96, 231, 39, 175, 186
65100 DATA 62, 90, 32, 240, 33, 244, 127, 115, 175, 231, 48, 56
65105 DATA 231, 24, 146, 221, 225, 201, 205, 107, 127, 42, 237, 127
65110 DATA 35, 35, 231, 43, 6, 64, 14, 7, 231, 44, 58, 244
65115 DATA 127, 95, 6, 0, 231, 61, 62, 13, 231, 48, 175, 201
65120 DATA 221, 203, 0, 198, 205, 107, 127, 42, 237, 127, 35, 35
65125 DATA 35, 35, 78, 35, 70, 237, 67, 242, 127, 43, 43, 43
65130 DATA 70, 35, 102, 104, 253, 78, 26, 253, 70, 27, 9, 237
65135 DATA 75, 242, 127, 62, 34, 231, 48, 231, 61, 62, 34, 231
65140 DATA 48, 62, 13, 231, 48, 175, 201, 203, 119, 40, 4, 221
65145 DATA 203, 0, 198, 205, 107, 127, 33, 82, 127, 6, 0, 78
65150 DATA 35, 231, 61, 201, 24, 32, 32, 85, 115, 101, 114, 32
65155 DATA 68, 101, 102, 105, 110, 101, 100, 32, 70, 117, 110, 99
65160 DATA 116, 105, 111, 110, 13, 33, 246, 127, 53, 175, 190, 204
65165 DATA 219, 127, 42, 237, 127, 78, 35, 102, 105, 124, 230, 3
65170 DATA 103, 62, 37, 205, 196, 127, 69, 108, 96, 229, 58, 244
65175 DATA 127, 95, 124, 198, 65, 254, 92, 40, 33, 231, 48, 225
65180 DATA 125, 254, 36, 40, 14, 254, 26, 56, 6, 198, 22, 231
65185 DATA 48, 24, 4, 198, 65, 231, 48, 221, 203, 0, 70, 32
65190 DATA 34, 62, 61, 231, 48, 201, 225, 33, 192, 127, 6, 0
65195 DATA 14, 4, 231, 61, 24, 233, 70, 73, 76, 69, 79, 6
65200 DATA 8, 41, 124, 145, 56, 2, 103, 44, 16, 247, 201, 62
65205 DATA 36, 231, 48, 221, 203, 0, 134, 24, 212, 187, 192, 62
65210 DATA 155, 231, 48, 62, 8, 231, 48, 231, 56, 62, 22, 50
65215 DATA 246, 127, 201
```

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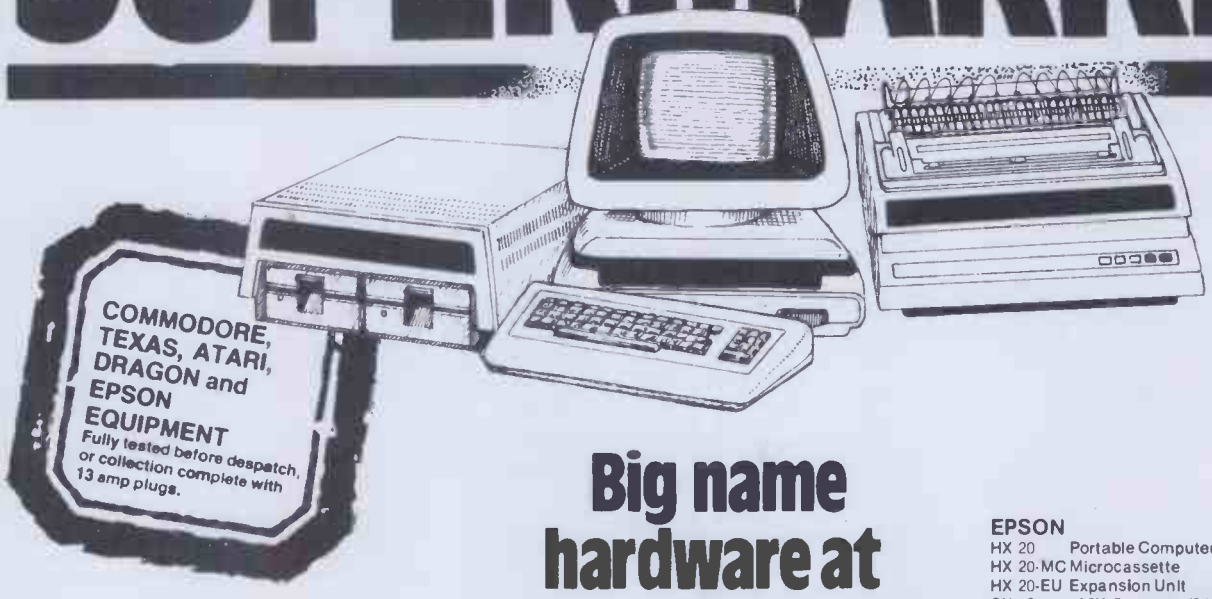

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ACE PROTECTION

The following three words for the Jupiter Ace should be of some use to anyone who wants to protect the programs they are writing—for example, if they are selling them.

The three protection words all work by altering the dictionary in some way so that the word cannot be listed or edited. P1 changes the code-field of the word—the bit that tells the computer how to execute the word—to something that the listing mechanism will not recognise and so will not list, but which the computer will still execute correctly. If an attempt is made to protect a word that does not exist, has already been protected, or is not normally listable, the word generates an ERROR 15. (This is done by storing the required error number in the system variable ERR_NO, and then executing ABORT.) If you try to list a protected word, you get ERROR 14 as you do when you try to list a variable, etc.

P2 should only be used once a Forth program is complete as once it has been used on a word it becomes impossible to type in the name of that word. It works by making the first character of the name an inverse space. This makes the listing mechanism think that the word's name is a single space, which of course you cannot type in as it is the normal delimiter. Any words that call the word you have just protected will still operate correctly so long as you don't try to edit them.

The best way to use the protection words is to use P1 on the main word—or any ones that the user is going to have to type in—and then to use P2 on all the other words in the dictionary. After this has been done, P1 and P2 can be forgotten if required.

The third word, P3, enables you to put a passcode on a word. To use it, define the word as normal, but with the name consisting of a letter followed by the passcode you have defined for that word. For example,

```
:xpass ('pass' is the passcode)
(normal word definition)
;
```

Now type P3 xpass which protects the word. Now VLIST, and you will see that the wordname has changed to just X and your passcode has not been shown. However, if you try to execute, list, or edit the word, you have to type in the full name including the passcode.

```
:P1
  FIND DUP @ DUP DUP
  3779 = SWAP 4229 =
  OR SWAP 4360 = OR
  IF
    DUP @ 1 - SWAP !
  ELSE
    15 15421 C! ABORT
  THEN
;
:P2
  FIND DUP 1 - C@ 63
  AND 5 + - 128
  SWAP C!
;
:P3
  FIND DUP DUP 1 - C@
  63 AND 5 + -
  DUP C@ 128 OR SWAP
  C!
;
```

The syntax for all three words is 'pl wordname'.

Adam Hinkly

SHARP SCREEN PRINT

Many people have probably found the same problem as I have in trying to print from the screen to the printer on the Sharp MZ-80K. The problem lies in the fact that PEEKing the screen gives the display code value of each character but the printer needs the ASCII value. I have written a short machine code program to help overcome this difficulty.

The program makes use of the monitor subroutine ?DACN which, when called, treats the value in the accumulator as display code, converts it to ASCII and puts it in the accumulator.

The assembler program is shown below:

Line 05 loads the accumulator with the value at address CFFF, line 06 converts it to ASCII, line 07 loads address CFFF with the converted value and line 08 returns to the main program.

This can either be saved as it is onto tape and loaded as needed or it may be incorporated into a Basic program. Below is an example of how it can be used.

Lines 100-200 write a large message on the screen, lines 200-300 enter the machine code routine into memory from 53237 to 53247 (if the machine does not have the full 48k memory, the number 53237 is replaced by the highest available address in user RAM minus 10. 53247 is replaced by the highest available address in user RAM). Lines 300-400 actually print to the printer, using the machine code routine.

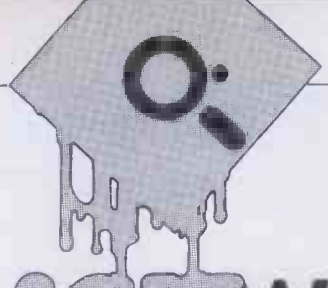
Geoffrey Sharpe

```
**Z80 ASSEMBLER SP-2102 PAGE 01**
01  0000
02  0000 P                ?DACN: EQU OBCE
03  0000
04  0000                          REL CFF5
05  CFF5 3AFFCF                   LD A,(CFFF)
06  CFF8 CDCE0B                   CALL ?DACN
07  CFFB 32FFCF                   LD (CFFF),A
08  CFFE C9                       RET
09  CFFF 00                       NOP
10  D000
11  D000                          END
```

```
10 LIMIT 53236
100 PRINT"▒▒▒▒▒▒▒"
105 PRINT"▒▒▒ ▒ ▒ ▒▒▒    ▒▒▒ ▒▒▒ ▒▒▒ ▒▒▒ ▒▒▒ ▒ ▒
110 PRINT" ▒  ▒ ▒ ▒      ▒ ▒ ▒ ▒ ▒ ▒ ▒   ▒ ▒ ▒ ▒
115 PRINT" ▒  ▒▒▒ ▒▒▒    ▒▒▒ ▒   ▒▒▒ ▒▒  ▒▒▒ ▒▒▒
120 PRINT" ▒  ▒ ▒ ▒      ▒ ▒ ▒ ▒ ▒ ▒ ▒   ▒ ▒ ▒ ▒
125 PRINT" ▒  ▒ ▒ ▒▒▒    ▒▒▒ ▒▒▒ ▒ ▒ ▒▒▒ ▒▒▒ ▒ ▒
130 PRINT"
135 PRINT:FORA= 0TO 37:PRINTTAB(A);"X";:NEXTA
140 PRINT"▒▒▒▒▒▒▒"
145 PRINT"▒▒▒ ▒ ▒ ▒▒▒    ▒▒▒ ▒▒▒ ▒▒▒ ▒▒▒ ▒▒▒ ▒ ▒
150 PRINT" ▒  ▒ ▒ ▒      ▒ ▒ ▒ ▒ ▒ ▒ ▒   ▒ ▒ ▒ ▒
155 PRINT" ▒  ▒▒▒ ▒▒▒    ▒▒▒ ▒   ▒▒▒ ▒▒  ▒▒▒ ▒▒▒
160 PRINT" ▒  ▒ ▒ ▒      ▒ ▒ ▒ ▒ ▒ ▒ ▒   ▒ ▒ ▒ ▒
165 PRINT" ▒  ▒ ▒ ▒▒▒    ▒▒▒ ▒▒▒ ▒ ▒ ▒▒▒ ▒▒▒ ▒ ▒
170 PRINT"
175 PRINT:FORA= 0TO 37:PRINTTAB(A);"X";:NEXTA
200 FOR X=0TO10
210 READA
220 POKE 53237+X,A
230 NEXT X
250 DATA 58,255,207,205,206,11,50,255,207,201,00
300 PRINT#P"B"
310 FOR X=0TO999
320 B=PEEK(53248+X):POKE 53247,B:USR(53237):B=PEEK(53247)
330 PRINT#P CHR$(B);
335 REM MZ-80K DOES NOT RECOGNIZE SPACES, THEREFORE-
336 IF B=32 THEN PRINT#P" ";
340 IF(X+1)/40=INT((X+1)/40)THENPRINT#P
350 NEXT X
```

THE SCREEN

Sample run:



SOFTWARE

WHICH SPREADSHEET?

SPREADSHEET ANALYSIS 1983

Missed out on some of the 'Which Spreadsheet?' articles? Mike Liardet gives a recap of all that's gone before.

In this article we shall go back over the high points and low points of spreadsheet software in 1983. But for the benefit of the newcomer we first present an introduction to the concepts behind spreadsheeting. Also, for all those readers who have mislaid their February '83 issue of *PCW*, we reprint the spreadsheet Benchtest details, together with a table giving the performance of every system tested this year.

So if you are unsure of which spreadsheet to ask Santa for, or whether he should be getting you one at all, then read on . . .

Modelling

A technique commonly used when attempting to deal with a complex or uncertain situation is that of modelling. Thus an aircraft designer, uncertain of how his plane will behave in certain wind conditions, may build a scale model of it and 'see what happens' to it in a wind tunnel. Of course the model is only an approximation of reality, but because it is only a model the designer can risk trying out half-baked ideas, or test it to destruction, or subject it to one in a million freak conditions.

Of course the whole experiment stands or falls on the issue of how close an approximation is the modelled test to reality. If it is reasonably close, an 'accurate' model, then fine, but if not then it's positively dangerous and will have completely misleading results. There are several ways that it is possible to go wrong: some essential aspect of reality could be overlooked and not included in the experiment — for example, the effects of changes in atmospheric pressure may be critical but not taken account of. Or the essential simplifications of scale may invalidate the experiment. Or the apparatus may be inaccurate or incorrectly set up — a gauge reading wrongly, or the machine sucking instead of blowing . . .!

Modelling on a computer is directly analogous to this. Once the model is set up we can test out all sorts of eventualities, look for danger areas, or demonstrate that a plan is impractical — and all without getting our fingers really burned! Of course it is highly convenient that there is no manual dexterity needed for building a model in the computer, but we do need to use some mental dexterity instead. However, the same dangers lurk there for the unwary: if the model is not a reasonable approximation to reality then the exercise is a waste of time. And any conclusions we extrapolate from the results will be founded on invalid information.

Thus when using a computer for modelling, we must make sure that all relevant aspects of the situation are represented in the model — for example, it is easy to overlook some overhead or tax in a budgeting model. We must consider whether there are any inaccuracies because of the reduced scale of the model — maybe a business can only be accurately simulated by a model of its daily trading and we are using a monthly trading model. And finally the 'logic' we use in the model must be correct and, of course, the modelling system itself must have no 'bugs' lurking in it.

Spreadsheets are a type of computer modelling facility in which the model is represented as one or several matrices of numbers. But it is important to know that there are other types of computer modelling system, and these can be more appropriate for some of the infinite range of problems and activities which cannot be adequately described as a table of numbers. For example, critical path programs, where projects and timescales are represented by a directed graph; linear programming systems where resources and objectives are set up in mathematical equations; computer-aided design software with 2-dimensional and 3-dimensional graphics; and flight simulators. Not too far into the future we can look forward to other facilities: expert systems and tools for modelling our own thoughts and ideas, for example.

Spreadsheets

Spreadsheets are used for modelling situations which can adequately be described with one or more tables of numbers. Actually they also have a spin-off use where they can simply be used as 'super-calculators', where there are no uncertainties and all the input values are known — for example, when last year's budget model becomes this year's profit & loss statement.

Thus the classic use for spreadsheet software is for budgeting and financial types of application, but it is also useful for work with statistics and other technical problems requiring complex repetitive arithmetical calculations.

If you are wondering whether a spreadsheet may be appropriate for you, then ask yourself if you spend much time pounding away at your calculator. The spreadsheet is pledged to replace this archaic device of the seventies, so if the answer is 'yes', then you will undoubtedly benefit greatly from a spreadsheet system. With a good spreadsheet system you will be able to initiate a complex chain of calculations at the touch of a button, perform 'whatif' analysis, and generally devote your energies to the problem itself rather than the chore of actually computing it.

So what does a typical spreadsheet look like? Well, it simulates on a high speed VDU screen a 'window' onto a very large sheet. This sheet is divided into 'cells'. Each cell can be uniquely identified by the row and column that it occupies. A common convention is that columns of the sheet are labelled with letters of the alphabet, and rows are numbered. So 'A1', 'B1', would identify cells in the top row of the sheet; 'J10' would be 10 rows down and

10 columns along, and so on.

Each cell can contain only one of three different types of information: text — simply used to annotate the sheet; numbers — the raw data of the model; and formulae — which constitute the 'logic' of the model. Now one cell visible in the VDU window is usually highlighted, or otherwise distinguished in some way. In order to enter one of these three types of information into a selected cell, it is necessary to first move this highlighting (called a 'cursor') to the required position. Using four different key strokes it is possible to move the cursor up, down, left or right by one cell at a time. If the destination cell is not currently visible in the window then the same keys are nevertheless used to move towards it, and when the cursor is directed off the edge of the screen it still moves to the next cell, appearing to 'drag' the window along with it. Actually this effect is achieved by a rapid redraw on the VDU, but it happens so quickly (on a good spreadsheet system) that the dragging effect seems quite real.

Once the cursor has arrived at the required cell, the data can simply be typed in. Spreadsheets vary in the individual capacity of each cell, but it is fairly typical for a cell's capacity to exceed greatly its normal display width. Thus it may be possible to enter a 30-character message or a very long formula into a cell, when there is only room for the first 10 characters to be displayed on the screen. By altering a value for the display column width it is usually possible to see more of the information on screen. Note that when a formula is entered, using a sort of computerised school algebra notation, the calculation is performed immediately and usually it is the answer, not the formula, that is displayed on the screen.

Formulae are built up using normal arithmetic operations and may include references to other cells as well as numeric constants. When a number in a cell is changed, all cells with formulae referring to it are automatically updated, as are any cells referring to them until all the effects of the new value have permeated right through the spreadsheet. In some circumstances, changing a single value can affect just about every cell in the spreadsheet, but the system is quite tireless, and will rapidly recalculate the whole lot.

Using the computer's raw number-crunching power it is feasible to perform 'whatif' analysis — exploring the consequences of changes to the basic assumptions of the model. Since these basic assumptions are usually shrouded in a certain amount of uncertainty (they might be next year's sales figures, for example), it is obviously useful to know all outcomes for a range of possibilities, ranging from optimistic to pessimistic!

Now if all spreadsheet systems did actually work infallibly as outlined above there would be little point in the 'Which Spreadsheet?' series. But of course they operate in many different ways, and the best ones provide all sorts of other helpful features to make things even easier for the user. Obviously it is useful to know what to look for . . .

During 1983 I examined a selection of spreadsheet systems and other closely related software, costing from £10 to £400 and requiring anything from a £100 cassette-based micro up to a £4000 disk-based colour graphics system. Of course, it is impossible to nominate a 'best-buy' from this diverse selection, so I will give a brief rundown on each, table its Benchtest performance and leave the reader to draw his own conclusions. In chronological order the systems were:

* **Prophet II** (*PCW* March '83). Prophet II comes as a mixture of both hardware and software. The hardware consists of a modified Acorn Atom, TV screen and micro-cassette recorder, all housed in a cumbersome metal case. In the event the software turned out to be the best cassette-based spreadsheet system of the year. It works very quickly and reliably, is well documented, and has a comprehensive range of facilities. But it is principally let down by the ugly, heavy, and expensive hardware. However, the system is now being offered 'free' to anyone registering for the supplier's one-day £600 (!) course.

* **Multiplan** (*PCW* April '83). This is a spreadsheet system with the full weight of Microsoft behind it. I must say that I have come across a number of excellent and reliable Microsoft products, and Multiplan is no exception. Everything about the system has a feeling of quality, and it has some up to the minute features such as sorting, multiple worksheets and multiple split-screens. Coupled with the fact that it's available on the 8-bit Apple II and CP/M systems as well as 16-bit MS-DOS machines it is difficult to make any major complaints about it.

* **Plannercalc** (*PCW* May '83). Plannercalc is one of two spreadsheet systems launched by Comshare. It is a fairly intriguing mixture of spreadsheet technology and the traditional financial modelling methodology, doubtless influenced by Comshare's vast experience as a mainframe financial modelling service.

Plannercalc is the simpler of two packages with the option to move all models onto its more sophisticated brother, Masterplanner, once the user has outgrown it. Accordingly Comshare originally introduced Plannercalc as a sort of loss-leader at an unbelievable £39 plus VAT. Subsequently the price rose to a more creditable £85 plus VAT, but that is still quite cheap for a disk-based system. Although the system has some excellent and fairly unique facilities (including its so called 'English-style' commands), I felt it had been let down by the final quality control. There were a number of inaccuracies in the manual and some badly named commands all served to make the system more difficult to use.

* **VisiCalc** (*PCW* June '83). This is the product that invented the spreadsheet concept. The Apple version has been with us for four years now, and has been overtaken by some of the more recent systems, but it still serves as a shining example of what a good software package ought to be like. One of the reasons that the Apple version cannot compete with some of the later spreadsheet software is that only 34k of workspace is available for developing models, which leads us on to . . .

* **Ramex Expansion** (*PCW* June '83). Vergecourt, realising the problems with Apple VisiCalc's limited memory space, developed a 128k RAM card, and the necessary software enhancements to enable VisiCalc to use it. Thrown in with all this were some extra facilities, such as ability to use 80-column displays and some new commands, all integrated into the software. I found that the whole system worked very well, with no noticeable degradation in VisiCalc's performance. There are, however, some difficulties with storing the largest models on Apple's small capacity disks, and even though Vergecourt has included software facilities to help in this respect it is obviously preferable to have a larger capacity machine for this type of work. Nonetheless, for an Apple VisiCalc user who feels restricted by the system, Vergecourt has provided a valuable alternative to purchasing a completely new setup.

* **ECalc** (*PCW* July '83). The Epson HX-20 is now well-established as a completely integrated hand-held micro, with keyboard, display, printer and cassette-drive. The display can only show 20 characters across by four rows down, so it is not ideal for spreadsheet work. Nonetheless, ECalc does demonstrate that spreadsheeting is possible on the HX-20, albeit very slowly.

* **Mathemagic** (*PCW* August '83). Mathemagic is not really a spreadsheet system, but bridges the gap between the calculator and the spreadsheet. It can run through a short sequence of formulae, repetitively if necessary, and generate a sequence of results, transforming the Apple into a very powerful programmable calculator. Its results can be printed, or plotted as graphs by Graphmagic (see below). Although it cannot handle a large spreadsheet application, it can deal with very complex mathematical formulae, even permitting the use of iteration, and so could appeal to the technician.

* **Graphmagic** (*PCW* August '83). Graphmagic can plot data from both VisiCalc files and from Mathemagic. I had problems getting Graphmagic to print its plots, but it was certainly very easy to generate attractive plots on the screen.

* **Vu-calc** (*PCW* September '83). This is a very simple, but nonetheless effective spreadsheet system for the Sinclair ZX Spectrum. It works reliably and, for a cassette-based spreadsheet, reasonably quickly. Unfortunately it only provides the most basic arithmetic: + − * and /, so any one wanting more sophistication will have to look elsewhere.

* **The Spreadsheet** (*PCW* September '83). This is also a spreadsheet for the Spectrum. Although it has a lot more maths facilities than Vu-calc, it performed a lot more slowly in the Benchtests, frustratingly slowly in fact.

* **Perfect Calc** (*PCW* October '83). This is available for both CP/M systems, and

SPREADSHEET ANALYSIS 1983

(yawn) the IBM PC. It is one of a range of 'Perfect' products which all use the same interface techniques. The CP/M version has some very advanced features: it compensates for the limitations of the 64k maximum of RAM, by a 'virtual memory' facility, which trebles the capacity of the system. It can also maintain seven separate spreadsheets simultaneously, and permit calculations between them. I quite liked the system, and had no major problems with it, except for the rather disconcerting fact that I was unable to run Benchtest 1 without 'crashing' the system.

* **1-2-3** (*PCW* November '83). 1-2-3 is a real state-of-the-art spreadsheet system, currently available only on the IBM PC. Apart from being an excellent spreadsheet system, it is also fully integrated with a superb graphics facility, which can produce all manner of pie-charts and bar-graphs, etc, and colour prints too, if you have the right printer! Just for good measure there are also some simple integrated 'database' functions, enabling you to manipulate and search a spreadsheet as if it were a database.

* **The Financial Planner** (*PCW* December '83). This is not so much a spreadsheet, more a financial modelling system. For more information see the review in this issue.

Benchtests

The Benchtests were devised to test the capacity and speed of the various spreadsheet systems. Of course they do not tell the whole story, so it is important not to read too much significance into them. However, once you are familiar with a spreadsheet system, you will want it to keep up with your speed of thinking, and not subject you to annoying delays while it computes or redraws the screen. The Benchtests certainly point out the ones that will slow down in this respect.

It is important to realise that, say, a ten second delay may not seem very long on paper, but if you frequently have to wait that long for what you perceive as a fairly trivial operation then the frustration can quickly build up, and you will be reaching back for your calculator again.

The details on the Benchtests were originally published in *PCW* Feb '83, but for everyone who has mislaid that issue, here they are again:

* **Benchmark 1** This test is used to measure the true capacity of a spreadsheet system, and time its performance—that is, measure its recalculation times when it is full to capacity. It is designed to simulate a typical 12-months' financial calculation, involving 12 columns, plus a 13th column containing the totals for the 'year'.

When the test is running, the spreadsheet displays the numbers 1 to 12 across the first row, with their sum (78) at the end, followed by the numbers 13 to 24 in the second row accompanied by their sum, and so on down the spreadsheet until all the available memory is exhausted.

The display is deliberately not generated in the simplest way possible, but by formulae in each cell, each using the four basic arithmetic operators just once. Assuming the spreadsheet uses letters of the alphabet to identify columns, and numbers for rows:

Cell A1 contains the number 1.
Cell B1 contains (12*(A1-1)/12)+2 (which evaluates to 2).
Cell C1 contains (12*(B1-1)/12)+2 (which evaluates to 3), etc, up to cell L1.
Cell M1 contains A1+..+L1 or SUM(A1..L1) if 'SUM' facility exists. That completes row 1.
Cell A2 contains (12*(A1-1)/12)+13 (which evaluates to 13).
Cell B2 contains (12*(B1-1)/12)+13 (which evaluates to 14), etc, up to row L2.
Cell M2 contains A2+..+L2 or SUM(A2..L2) if 'SUM' facility exists. That completes row 2.

The remaining rows are specified in the same manner as the second row, each working on the 'back' of the previous row.

The measurements taken are:

(a) Max number of rows accommodated.
(b) Recalculation time after changing cell A1 from 1 to 2 (tests integer, ie, whole number recalculation speed).
(c) Recalculation time after changing cell A1 from1 to 1·5 (tests floating point, ie, decimal or fractional number recalculation speed). To date, this test has always produced the same result as (b), suggesting that no spreadsheet systems tested so far have used any special high-speed integer calculation facility.
(d) Vertical and horizontal window scrolling speed (by timing cursor move from top left cell to bottom left and then from bottom left to bottom right).

* **Benchmark 2** This tests the capacity of the system with respect to textual information only.

The test involves setting up as many rows as possible with the same eight character text 'ABCDEFGH' repeated across 13 columns. The test records the maximum number of rows accommodated.

* **Benchmark 3** This test is identical to Benchmark 2, but a number is used instead of text. The number is '123456.78'.

* **Benchmark 4** This test was not included in the original article, but has in fact been used whenever relevant. It tests the speed of 'SAVE'ing the spreadsheet, set up in Benchmark 1, to cassette tape. Due to the nature of cassette tape, the 'load' speed will be identical. Obviously this test does not apply to disk-based systems, all of which can in fact load and save spreadsheets in just a few seconds.

1983 results

Figs 1 and 2 give the results of these Benchtests for all systems that were tested. Note that these results are reprinted from the previous issues of *PCW*, and do not take into account any manufacturer's enhancements that may have been implemented since. Note also that not all versions of the products are covered by these tests, and in several instances the software is available on more than one operating system — refer to the original articles for more information.

The 'Max Rows' and 'Max Cols' refer to the maximum theoretical size of the

Product Name	Tested on	Max Rows	Max Cols	Capacity £ rows	Recalc rows/sec	Scroll rows/sec	Scroll cols/sec	Text £ rows	Numbers £ rows
Multiplan	Apple II 64k RAM	255	63	95	1.58	6.00	4.00	190	190
	Sirius 128k RAM	255	63	235	4.27	6.00	4.00		
Plannercalc	56k CP/M 2MHz Z80		128		0.74	0.41	0.46		61
VisiCalc	Apple II 64k RAM	255	63	82	1.91	10.00	6.00	148	254
	+ 128k RAM Vergecourt	255	63	320	1.81	1.35	2.50	v. large	v. large
PerfectCalc	56k CP/M 2MHz Z80	255 (× 7 spreadsheets)	52		0.30				
1-2-3	IBM PC 320k RAM	2048	256	370	6.85	6.31	3.78	1210	1380

Fig 1. Results for disk-based spreadsheet systems

Product Name	Tested on	Max Rows	Max Cols	Capacity £ rows	Recalc rows/sec	Scroll rows/sec	Scroll cols/sec	Text £ rows	Numbers £ rows	Save/Load cells/sec
Prophet II	Acorn Atom	255	63	87	2.56	6.00	6.00	123	123	0.59
ECalc	HX-20 16k RAM	15	14	9	0.02	0.50	0.50	15	15	1.30
Vu-calc	Spectrum 48k RAM	60	60	240	1.00	4.00	3.00	240	240	20.00
The Spreadsheet	Spectrum 48k RAM	99	26	71	0.15	0.08	0.03	71	71	4.30

Fig 2. Results for cassette-based spreadsheet systems

spreadsheets. In nearly every case it is impossible to fill each and every cell before all available memory becomes exhausted.

The 'real' capacity of a system can be gauged by the next column: 'Capacity £ rows' which is the Benchtest 1 (a) result. This figure should be read with some caution since in some cases it is simply dependent on the amount of random access memory (RAM) resident in the test-machine. For example, VisiCalc's capacity can be quadrupled by simply adding an extra RAM card (and Vergecourt's expander software).

The recalculation speed (Benchtest 1 (b) and 1 (c)) is recorded in the next column: 'Recalc rows/sec'. Since most systems can be set to perform recalculations under manual invocation only, a slower recalculation speed need not drastically slow down your rate of working, providing it is reasonably respectable.

The scrolling speed (Benchtest 1 (d)), when the cursor is 'dragging' the window either downwards or sideways, is recorded in the next columns: 'Scroll rows/secs' and 'Scroll cols/sec'. If this figure is slow it really can slow down your workrate, although systems that provide 'long jump' facilities, which jump several rows or columns at a time, and 'goto's which jump the cursor directly, can save some time by minimising the number of screen 're-draws'. Note that these speeds are dependent on the VDU size (in characters per row and number of rows) and speed — the best software in the world will not perform well on a slow VDU, and it obviously takes longer to draw a bigger screen.

Finally the 'save' speed for cassette systems is recorded in the last column of Fig 2.

Note 1. With Plannercalc the maximum number of rows is dependent on the number of columns specified. As the system did not possess a 'replication' facility it was not feasible to fill it to capacity with formulae. The results quoted in Fig 1 come from timings on a smaller than capacity model. Plannercalc only permits text for row and column headings, so it was not possible to fill the spreadsheet with text.

Note 2. The Financial Planner, Mathemagic and Graphmagic have been excluded, because it was not feasible to run the Benchtests on them. END

For more information:
Refer to PCW *Feb to Nov '83 inclusive.*
Prophet II — Polebrook Management Systems. Tel: (0832) 72052.
Multiplan — Microsoft Europe Ltd. Tel: (04427) 75091.
Plannercalc — Comshare Ltd. Tel: 01-222 5665.
VisiCalc/Ramex — Vergecourt Ltd. Tel: (0268) 728484.
ECalc — Epson (UK) Ltd. Tel: Freefone 2730.
Mathemagic and Graphmagic — ISM Ltd. Tel: 01-751 5791.
Vu-calc — Psion Ltd, 2 Huntsworth Mews, Gloucester Place, NW1.
The Spreadsheet — Microl Ltd. Tel: (0223) 312453.
Perfect Calc — Pete & Pam Computers. Tel: (0706) 227011 and others.
1-2-3 — 161, First Street, Cambridge MA02142, USA. Tel: (617) 492 7171 Ext 4408.
The Financial Planner — Ashton-Tate. Tel: (0908) 568866.

LEISURE LINES

by J J Clessa

Quickie

I know a little girl whose father is older than her grandfather. How can this be?

Christmas Prize Puzzle

In Dutch cricket there are two possible ways of scoring — a field goal or a penalty — each being worth a different number of points.

There are 24 different scores which are impossible to achieve in this game (18 is one of them). What are the points values of field goals and penalties?

Answers please — postcards or backs of envelopes only — to reach *PCW* by 31 December, 1983. Send your entries to: *PCW*, Christmas Prize Puzzle, Leisure Lines, 62 Oxford Street, London W1.

September Prize Puzzle

Although there were many possible solutions to this problem, quite a large percentage of the 100 or so entries got it wrong. Several people misunderstood the problem and came up with negative solutions. One entry came from Dorset and consisted of a gigantic postcard with a computer printout stuck to it, showing 1152 arrangements giving the maximum score of 58, and 32 arrangements giving the minimum score of 40. (In fact this same entry appeared several times in the bag, in varying sizes).

Anyway, we didn't check the 1184 arrangements, so we don't know if there are that many, but we did select a winner with the following solutions:

2	6	3		9	8	7
7	1	8	and	6	5	4
4	9	5		3	2	1

giving a maximum score of 58 and minimum of 40.

The entry came from Mr Bob Hammond of Dublin who receives our congratulations and the usual prize.

Footnote:
A book by J J Clessa entitled Micropuzzles *is now available in all leading booksellers. It contains Puzzles old and new, including Quickies with solutions. (There's also a chance to win an Apricot micro — if you're smart enough to solve the problem trilogy. Details are in the book.)*

'We get all kinds of addicts here.'

FORTH BENCHMARKS ROUNDUP

A year after PCW *first introduced a set of Benchmark programs for the Forth language, Dick Pountain retrospectively examines their continued application and value.*

It's a whole year since I took the liberty of unleashing *PCW*'s Forth Benchmarks upon the microcomputing world, and here as promised is the first annual roundup of timings. But first some comments on how the Benchmarks have stood the test of public exposure.

I've opened my copy of Forthwrite with some trepidation for th : last year, fully expecting some deep-se ated flaw to be unearthed, but in fact the Benchmarks have been generally well received.

The major criticism which I have received is over the naming of 'dictionary-search'; several Forth enthusiasts have pointed out that it doesn't actually search the dictionary at run time at all! This is quite true, and the name is not appropriate. I had great difficulty thinking of a name for this particular program; what it actually measures is the overhead incurred by nesting definitions rather than writing a single in-line definition. It is thus, if anything, a test of the inner interpreter and the 'threading' rather than anything to do with the dictionary. Accordingly I have decided to rename it 'nest' as a better reflection of what it does; it also saves some typing!

Some people have noted the lack of 1+ in the fig model, and quite wisely substituted 1 + where necessary; the difference isn't worth much. Others have bemoaned the need for SP! which isn't in fig either. This really is necessary though if the timings are to be 'atomic'; that is, you can subtract the appropriate ones to obtain the timing for a single operation such as DUP. For the benefit of new readers who don't have the original article (January '83), SP! is a word which clears the stack contents by storing the stack base address into the stack pointer. If you don't have it or an equivalent, you'll have to write it, either in code or in high level. In desperation you could write it simply as a loop of DROPs and the only ill effect would be to bump up 'magnifier' somewhat; its effect on the other timings can be nullified by subtracting 'magnifier'.

On the subject of 'magnifier'; it is *not* required that you subtract 'magnifier' from the other timings in presenting the results. Although the purpose of 'magnifier' is to isolate the fixed overhead common to all the programs, it is for users of the timings to subtract it; the published results should be unadulterated experimental data, that is, stop-watch readings.

The only other grouse has been that several people seem to have thought that I said in the original article that 6502 implementations are slow. In fact, I only said that I was surprised at how relatively slow the single 6502 implementation (*viz* Graforth) which I timed was; there was certainly no intention to generalise, and indeed the timings printed here show that it would have been rash to do so. People get so sensitive about processors!

And so to the timings themselves. As you will see, there are fourteen implementations on test, all but two sent in by *PCW* readers. In fact far more than twelve readers responded to the call and some of the more popular versions here are the average of several readers' findings. In the process of doing this I discovered that timings for the same Forth are not reproducable enough between different readers' machines to justify giving them to tenths of a second, hence the rounded figures.

The spread very conveniently covers the range of popular 8-bit processors, but I am rather surprised not to have received any more 16-bit timings; surely someone out there has Forth running on a 68000 to make us all go green.

What does it all prove? Well, without wishing to generalise and risk an assassination attempt, it seems that Forth runs at roughly comparable speeds on a 4MHz Z80, a 2MHz 6502 and a 1MHz 6809, which gives some idea of the relative suitabilities of these processors as Forth machines. The glaring exception is in 'arithmetic' where the Z80 seems around twice as fast as the others. There are also one or two examples to be gleaned, of the differences possible between different implementations on the same processor; I'll tactfully leave these as an exercise for the reader to sort out.

The outright winner by several lengths is polyForth II from the people who started it all, Forth Inc. This very expensive professional programming system runs on the 8088 (as well as many other machines including various minis) with 8087 arithmetic co-processor support included. Even without the 8087 though, it is comfortably twice as fast as any other implementation tested so far. This must say much for the quality of the implementation because another 8088 system timed last year was less than 20% faster than good Z80 Forths.

Thank you to everyone who sent in timings (unfortunately I can't list you all) and please keep them coming; by next year I want to have covered all the major 16-bit processors (and what of the TI 9900?; 'what indeed' the cry came back). END

```
: increment     ." Start"  10001 1 DO
                              11 1 DO  9 1+ LOOP
                           SP!  LOOP
                ." End" ;

: test>         ." Start"  10001 1 DO
                              11 1 DO  9 9 > LOOP
                           SP!  LOOP
                ." End" ;

: test<         ." Start"  10001 1 DO
                              11 1 DO  9 9 < LOOP
                           SP!  LOOP
                ." End" ;

: while-loop    ." Start"  10001 1 DO
                              1  BEGIN  1+ DUP  11 < WHILE REPEAT
                           SP!  LOOP
                ." End" ;

: until-loop    ." Start"  10001 1 DO
                              20  BEGIN  1- DUP  11 < UNTIL
                           SP!  LOOP
                ." End" ;


: ten ;
: nine  ten ;
: eight  nine ;
: seven  eight ;
: six  seven ;
: five  six ;
: four  five ;
: three  four ;
: two  three ;
: one  two ;


( These definitions are all part of )
( the single benchmark 'nest', which)
( was previously , and badly, named )
( 'dictionary-search'               )
```

```
: link          ." Start"  10001 1 DO
                                one
                           SP!  LOOP
                ." End" ;

: arithmetic    ." Start"  10001 1 DO
                             9 2 / 3 8 4 + 5 -
                           SP!  LOOP
                ." End" ;

: magnifier     ." Start"  10001 1 DO
                           SP!  LOOP
                ." End" ;


: do-loop       ." Start"  10001 1 DO
                                11 1 DO  LOOP
                           SP!  LOOP
                ." End" ;

: literal       ." Start"  10001 1 DO
                                11 1 DO  9  LOOP
                           SP!  LOOP
                ." End" ;
```

```
VARIABLE V

: variable      ." Start"  10001 1 DO
                                11 1 DO  V  LOOP
                           SP!  LOOP
                ." End" ;

: literal-store ." Start"  10001 1 DO
                                11 1 DO  9 V !  LOOP
                           SP!  LOOP
                ." End" ;

: variable-fetch ." Start" 10001 1 DO
                                11 1 DO  V @  LOOP
                           SP!  LOOP
                ." End" ;

9 CONSTANT K

: constant      ." Start"  10001 1 DO
                                11 1 DO  K  LOOP
                           SP!  LOOP
                ." End" ;

: dup           ." Start"  10001 1 DO
                                11 1 DO  9 DUP  LOOP
                           SP!  LOOP
                ." End" ;
```

Compiler	Machine	Processor Clock rate	Magnifier	Do-loop	Literal	Literal-store	Variable	Variable-fetch	Constant	Dup	Increment	Test=	Test<	While-loop	Until-loop	Nest	Arithmetic	Average time
Acornsoft Forth	BBC Micro	6502 2MHz	1	9	14	23	13	18	13	18	30	35	23	39	36	9	35	21
JWB Forth	BBC Micro	6502 2MHz	1	8	13	21	12	16	12	16	27	52	41	55	56	8	31	24
figForth (Cargile & Riley 1981	Commodore PET 4032	6502 1MHz	2	17	27	44	26	34	26	35	59	70	45	77	95	17	66	43
AIM-65 Forth vl.3	Rockwell AIM-65	6502 1MHz	2	17	25	25	42	34	25	33	57	133	111	142	158	16	65	59
Metacrafts Forth	Apple IIe	6502 1MHz	2	14	21	34	20	27	22	28	25	34	34	39	33	13	28	25
Kuma Forth	Sharp MZ-08K (modified)	Z80A 4MHz	2	14	19	30	19	24	19	25	25	32	32	37	33	14	14	22
Artic Forth	Sinclair ZX81 (Fast mode)	Z80 3.25MHz	2	13	18	26	17	22	18	22	38	44	29	47	33	13	15	24
ZX81 Forth	Sinclair ZX81 (Auto mode)	Z80 3.25MHz	1	12	18	39	20	33	18	36	43	48	49	84	84	2	36	35
Knights Forth	Sharp MZ80-A	Z80 2MHz	3	32	58	100	56	75	56	79	106	108	108	NA	NA	35	39	57
Fastforth	Sharp MZ80-K	Z80 2MHz	1	9	15	26	15	20	16	20	17	28	28	28	30	3	27	19
Microtanic (MCS)	Dragon 32	6809 0.9MHz	1	10	14	21	13	17	14	17	18	35	24	27	25	7	40	19
figForth 0.2	ETI System 68	6800 0.9MHz	2	21	29	45	27	36	28	37	61	76	49	77	94	18	67	44
JWB-Forth	Epson HX-20	6301 0.6MHz	2	20	28	44	27	35	28	37	55	50	49	53	75	NA	71	38
Homebrew (SE Hersom)	Homebrew	6802 1MHz	7	21	32	56	32	44	31	40	38	59	60	69	64	21	33	40
PolyForth II	IBM PC	8088 5MHz	2	6	7	11	7	10	8	10	9	13	13	14	13	6	4	9

BENCHMARKS SUMMARY

Peter Rodwell presents a roundup of the Benchmark timings used when evaluating computer systems.

Once again it's time to present our Great Benchmarks Summary. As regular readers will know, ever since *PCW* started back in February 1978 we have included Benchmark tests in our evaluation of computer systems and printed here is a list of all the resulting timings we have published.

Well, not quite all. The roundup in fact includes only those machines for which an entire set of timings could be obtained — several machines which we have tested have been unable to run all the Benchmark tests and as the table is sorted according to the average timings, these incomplete sets had to be excluded.

It is important to stress that the *PCW* Benchmarks should not be used as a final criterion for your choice of computer unless you are interested exclusively in running Basic programs as quickly as possible. Originally, when manufacturers produced their own Basic interpreters, and Basic was the only language available on micros, the Benchmarks provided a valuable speed indication, both of the machine and of the Basic interpreter. Now, though, many computers — especially in the business category — run the same Basic (usually Microsoft Basic), and, with other things being constant, tend to show little true variation.

Sometimes, though, there are surprising results. This year's table contains one of these. Although the Sage remains top of the list, these timings were taken using a Basic which 'compiles' to p-code and therefore can be expected to run very quickly. The second place is occupied by the Future FX20 which runs the very same version of Microsoft Basic as several other machines including the Sirius which, as you can see, is well down the list. The reason for this is that the FX20 runs its CPU at 8MHz while the Sirius CPU runs at 5MHz (and there are other technicalities to do with the internal construction of the FX20 which makes it faster). Therefore, *any* program is going to run more quickly on the FX20 than on the Sirius. The same applies to the Tulip, which also clocks its CPU at 8HMz.

The fastest home machine ever tesed remains the good old DAI, now no longer available. Of the home machines which are still available, the BBC remains the leader by a long chalk, with Acorn's new micro, the Electron, pushing its way into second place just above the Lynx.

It could be reasonably argued that a more meaningful set of Benchmark programs could be devised, particularly to cover areas such as graphics plotting and disk access. In fact we did once have a set of disk Benchmarks but the wide variations in the way different Basics handle disk access made these completely impractical. The ideal was to write and read a set number of records, each of a set length, but it proved impossible to arrive at a standard record length which could be applied to *every* machine. Likewise with graphics: the variations in the way Basics handle graphics, together with the vastly differing graphics capabilities of different machines, made this impractical.

One final note: this year we have placed each machine in one of three categories: Home, Business or Portable.

H = Home B = Business P = Portable

```
100 REM   BENCHMARK 1
110 PRINT "S"
120 FOR K = 1 TO 100
130 NEXT K
140 PRINT "E"
150 END
```

```
100 REM   BENCHMARK 2
110 PRINT "S"
120 K = 0
130 K = K + 1
140 IF K  1000 THEN 130
150 PRINT "E"
160 END
```

```
100 REM   BENCHMARK 3
110 PRINT "S"
120 K = 0
130 K = K + 1
140 A = K / K * K + K - K
150 IF K  1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM   BENCHMARK 4
110 PRINT "S"
120 K = 0
130 K = K + 1
140 A = K / 2 * 3 + 5 - 5
150 IF K  1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM   BENCHMARK 5
110 PRINT "S"
120 K = 0
130 K = K + 1
140 A = K / 2 * 3 + 4 - 5
150 GOSUB 190
160 IF K  1000 THEN 130
170 PRINT "E"
180 END
190 RETURN
```

```
100 REM   BENCHMARK 6
110 PRINT "S"
120 K = 0
130 DIM M(5)
140 K = K + 1
150 A = K / 2 * 3 + 4 - 5
160 GOSUB 220
170 FOR L = 1 TO 5
180 NEXT L
190 IF K  1000 THEN 140
200 PRINT "E"
210 END
220 RETURN
```

```
100 REM   BENCHMARK 7
110 PRINT "S"
120 K = 0
130 DIM M(5)
140 K = K + 1
150 A = K / 2 * 3 + 4 - 5
160 GOSUB 230
170 FOR L = 1 TO 5
180 M(L) = A
190 NEXT L
200 IF K  1000 THEN 140
210 PRINT "E"
220 END
230 RETURN
```

```
100 REM   BENCHMARK 8
110 PRINT "S"
120 K = 0
130 K = K + 1
140 A = K ^ 2
150 B = LOG(K)
160 C = SIN(K)
170 IF K  1000 THEN 130
180 PRINT "E"
190 END
```

BENCHMARKS TIMINGS

Cat	Machine	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Average
B	Sage II (p-code)	0.5	0.7	1.3	1.7	2.1	5.1	6.4	18.0	4.5
B	Future FX20	1.2	3.4	6.8	7.0	7.9	14.5	22.2	17.5	10.1
B	Tulip	1.0	3.7	6.0	6.1	7.8	15.5	23.3	17.5	10.1
B	Olivetti M20	1.3	4.0	8.1	8.5	9.6	17.4	26.7	16.0	11.5
H	DAI	0.9	4.8	10.1	9.8	11.2	18.1	30.1	21.0	13.3
B	TI Professional	1.0	4.2	9.3	9.7	10.5	19.0	29.5	31.0	14.3
H	BBC Micro	1.0	3.1	8.2	8.7	9.1	13.9	21.4	51.0	14.6
B	Monroe 8820	2.1	4.2	9.9	10.5	11.0	20.1	32.0	33.0	15.4
B	Altos ACS 800-2	1.4	4.3	11.3	11.3	12.0	21.2	34.9	27.0	15.4
B	Vector Graphic VIP	1.0	3.8	10.9	10.7	11.6	20.5	32.7	34.0	15.7
B	ACT 800	0.9	4.6	8.5	9.4	10.1	14.9	23.4	56.0	16.0
B	ACT Sirius 1 *	1.8	5.3	10.7	11.1	12.9	24.2	37.1	27.9	16.4
B	Shelton Signet	1.1	3.4	9.6	9.3	10.0	18.1	28.9	51.3	16.5
B	ACT Apricot	1.6	5.2	10.6	11.0	12.4	22.9	35.4	34.4	16.7
B	Hitachi MB16001	1.5	5.0	10.5	10.5	12.5	23.5	36.0	35.0	16.8
B	Sharp MZ80B	0.6	4.5	8.5	11.5	13.0	19.0	27.5	50.0	16.8
B	Micromation I Plus	1.4	4.4	11.2	11.3	11.5	21.2	34.9	39.0	16.9
B	Mini 801 (44k CP/M)	1.2	3.7	9.9	9.8	10.5	18.6	29.6	54.0	17.2
B	IBM Personal Computer	1.5	5.2	12.1	12.6	13.6	23.5	37.4	35.0	17.6

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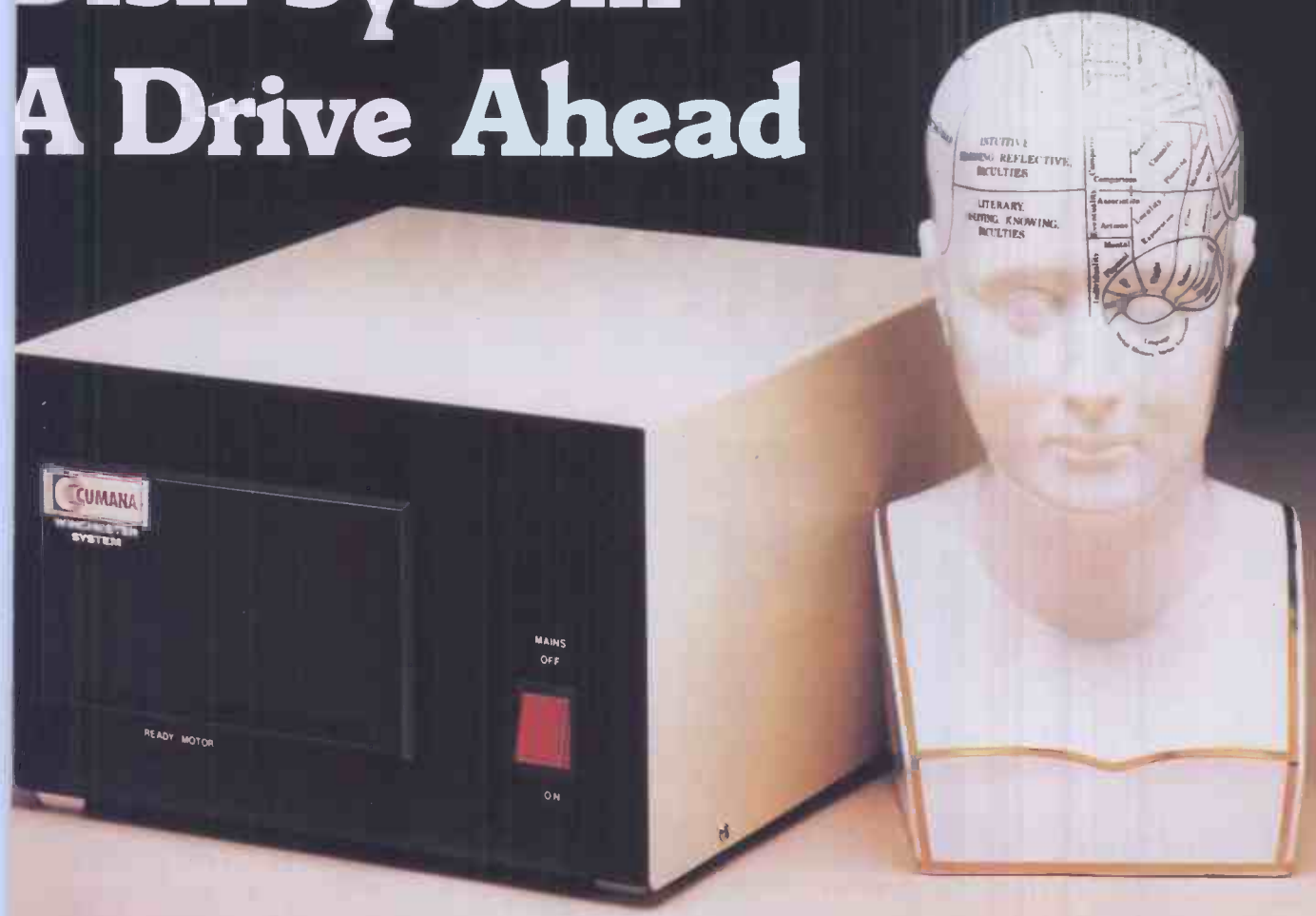

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B	LSI M4	1.9	4.8	11.5	11.5	12.4	19.8	30.9	50.8	18.0
B	Exleigh Expert (compiled)	2.5	2.5	8.0	8.0	8.0	21.0	25.0	70.0	18.1
B	Torch (MBasic)	1.5	4.2	10.6	10.4	11.6	21.1	33.0	55.0	18.4
B	NEC APC (Compiled CBasic)	2.3	2.3	13.7	17.6	17.8	32.0	34.8	37.1	19.7
B	Osborne 01	1.4	4.4	11.7	11.6	12.3	21.9	34.9	61.0	19.9
H	Acorn Electron	1.1	4.0	11.1	11.8	12.4	18.7	28.7	72.5	20.0
B	Tandy TRS-80 Model II	1.0	5.0	13.0	13.0	14.0	23.0	35.0	60.0	20.5
H	Camputers Lynx	1.7	4.3	12.4	8.9	10.4	16.3	29.9	86.6	21.3
B	Hewlett Packard HP125	1.7	5.0	12.5	12.5	14.0	26.0	40.0	60.0	21.5
B	Mimi 801 (62k CP/M)	1.7	4.7	12.4	12.2	13.1	24.3	38.6	66.0	21.6
B	Intertec Superbrain	1.6	5.2	14.0	13.9	14.8	26.3	43.2	56.0	21.9
B	NCR Decision Mate V	1.6	4.8	12.8	12.8	13.7	24.3	38.5	69.0	22.2
B	Positron 9000	1.1	2.1	5.4	6.8	7.2	14.9	20.2	120.0	22.2
B	DDE SPC/1	4.8	6.2	14.7	13.9	14.7	41.1	58.1	26.0	22.4
B	ABC 24	1.2	4.0	16.0	15.0	16.0	25.0	38.0	80.0	24.4
B	Apple III	1.7	7.2	13.5	14.5	16.0	27.0	42.5	75.0	24.7
B	Oki i+8000	2.2	6.4	16.8	16.8	17.9	31.8	50.7	57.0	25.0
B	Ohio Scientific Challenger C2 4P	1.4	7.8	15.0	16.5	17.8	27.0	39.5	75.0	25.0
B	Torch (BBC Basic)	1.4	5.4	14.4	15.3	16.1	24.9	38.4	89.0	25.6
B	Epson QX-10	2.3	6.4	15.8	15.8	16.5	31.9	52.9	65.8	25.9
B	Xerox 820	1.7	5.5	15.5	15.1	16.2	28.9	46.1	80.0	26.1
B	NEC PC 8001	1.7	8.3	18.1	17.8	18.6	29.5	49.2	70.0	26.7
B	Newbrain	2.0	5.8	19.2	17.5	19.2	32.0	48.8	70.0	26.8
B	ABC 80	1.1	2.3	11.1	12.1	12.6	17.7	23.9	136.0	27.1
B	Philips P2000	1.9	5.9	15.8	15.7	16.7	29.8	47.2	85.0	27.3
H	Commodore VIC 20	1.4	8.3	15.5	17.1	18.3	27.2	42.7	99.0	28.7
B	Exleigh Expert (interpreted)	2.5	7.2	18.5	18.5	19.3	35.0	52.0	85.0	29.8
B	Apple II	1.3	8.5	16.0	17.8	19.1	28.6	44.8	107.0	30.4
B	Hewlett Packard HP85	1.8	3.8	16.3	16.5	17.7	30.0	44.8	127.0	32.2
B	Pasca 640	2.0	7.0	19.0	18.0	20.0	36.0	57.0	100.0	32.4
H	Sharp MZ80K	1.4	9.4	16.3	22.5	25.4	36.8	51.1	102.0	33.1
H	Exidy Sorcerer	1.8	10.0	20.7	22.2	24.3	37.6	53.7	96.0	33.3
H	Sharp MZ80A	1.5	9.2	16.4	22.8	25.6	37.7	55.0	101.0	33.7
H	Commodore CBM 8032	1.7	10.0	18.4	20.3	21.9	32.4	51.0	119.0	34.3
B	Transam Tuscan	2.3	13.0	26.0	27.0	32.0	48.0	68.0	60.0	34.5
H	Commodore PET 2001	1.7	9.9	18.4	20.4	21.0	32.5	50.9	123.0	34.7
B	Compucolor II	2.0	10.9	22.4	23.9	25.7	38.7	55.2	102.0	35.1
H	Dragon 32	1.6	10.2	19.7	21.6	23.3	34.3	50.0	129.0	36.2
H	Micro-Professor	2.8	11.0	19.5	21.3	25.0	40.2	61.5	110.6	36.5
B	Hewlett Packard HP86	3.0	5.2	19.4	18.8	20.4	36.5	56.5	134.0	36.7
P	Hewlett-Packard HP-75C	3.0	5.0	22.1	21.8	24.3	40.0	57.3	139.0	39.1
H	Hitachi Peach	2.0	11.0	26.0	26.0	27.0	46.0	78.0	100.0	39.5
H	Colour Genie	2.7	10.6	25.0	25.8	28.9	47.8	73.1	104.3	39.8
B	Panasonic JD700	2.8	9.1	24.6	24.7	26.2	43.9	69.7	118.0	39.9
H	Tandy TRS-80 Color Computer	2.0	11.3	22.2	23.9	27.0	41.5	61.1	130.0	39.9
B	SBS 8000	1.8	9.4	29.0	29.0	31.6	44.0	82.5	112.0	42.4
B	Heath H89 (Mbasic)	2.5	9.2	25.8	26.0	27.0	46.6	73.2	130.0	42.5
H	Tandy TRS-80 Model I Level II	2.7	11.6	28.0	28.5	31.3	51.9	81.0	117.0	44.0
H	Video Genie	2.7	11.6	28.0	28.5	31.3	51.9	81.0	117.0	44.0
B	Cromemco System Three	1.7	4.6	14.9	17.8	19.4	30.2	41.9	229.0	44.9
B	Ohio Scientific Challenger C3 S1	1.7	13.1	21.6	23.7	29.2	39.6	58.3	176.0	45.4
H	Sinclair ZX81 (fast mode)	4.5	6.9	16.4	15.8	18.6	49.7	68.5	229.0	51.2
P	Epson HX-20	2.7	15.3	33.1	32.8	35.3	59.1	100.6	133.3	51.5
H	Sinclair Spectrum	4.8	8.7	21.1	20.4	24.0	55.3	80.7	253.0	58.5
H	Oric 1	2.0	17.3	29.4	31.7	38.1	50.1	76.1	233.4	59.8
P	Tandy TRS-80 Model 100	3.5	9.5	26.5	29.5	31.5	43.0	64.0	321.0	66.1
B	Sharp PC3201	4.0	13.5	35.5	35.5	38.5	67.0	108.0	250.0	69.0
B	Casio fx9000	2.5	9.0	24.0	24.0	26.0	42.0	60.0	365.0	69.1
B	Canon CX-1	3.0	6.0	21.0	23.0	24.0	41.0	54.0	390.0	70.3
H	Atari 400/800	2.3	7.4	19.9	23.2	26.8	40.7	61.5	431.0	76.6
H	Texas TI 99/4	2.9	8.8	22.8	24.5	26.1	61.6	84.4	382.0	76.6
H	Texas TI99/4A (standard)	3.0	9.0	24.0	24.8	26.2	61.9	84.6	384.0	77.2
H	Texas TI99/4A (extended)	6.5	18.5	40.0	40.1	42.0	98.4	140.3	240.0	78.2
B	Periflex 630/48	4.5	10.5	27.5	28.5	31.5	59.0	79.5	600.0	105.1
P	Casio PB-100	8.0	39.0	82.0	80.0	105.0	160.0	220.0	341.0	129.4
B	BASF 7120	2.4	7.0	35.0	36.5	39.0	50.0	63.0	1140.0	171.6
P	Sharp PC1500	15.0	70.0	121.0	122.0	178.0	293.0	383.0	510.0	211.5
P	Sharp PC-1251	42.3	70.6	162.5	165.9	197.3	427.8	581.4	980.0	328.5

* *The original Sirius timings were taken using a pre-release version of Basic-86. Three timings have been taken with the production version of the interpreter.*

PASCAL UPDATE

Here's a complete listing of the PCW Pascal Benchmarks Suite devised by Chris Sadler.

```
program reference;
var j,k:integer;
procedure refer5(var i:integer);
begin
  j:=1
end;
procedure refer4(var i:integer);
begin
  refer5(i)
end;
procedure refer3(var i:integer);
begin
  refer4(i)
end;
procedure refer2(var i:integer);
begin
  refer3(i)
end;
procedure refer1(var i:integer);
begin
  refer2(i)
end;
begin
  writeln('s');
  j:=0;
  for k:=1 to 10000 do
    refer1(j);
  writeln('e')
end.
```

```
program literalassign;
var j,k,l:integer;
begin
  writeln('s');
  for k:=1 to 10000 do
    for j:=1 to 10 do l:=0;
  writeln('e')
end.
```

```
program equalif;
var j,k,l:integer;
begin
  writeln('s');
  for k:=1 to 10000 do
    for j:=1 to 10 do
      if j<6 then l:=1
        else l:=0;
  writeln('e')
end.
```

```
program unequalif;
var j,k,l:integer;
begin
  writeln('s');
  for k:=1 to 10000 do
    for j:=1 to 10 do
      if j<2 then l:=1
        else l:=0;
  writeln('e')
end.
```

```
program whileloop;
var j,k:integer;
begin
  writeln('s');
  for k:=1 to 10000 do
  begin
    j:=1;
    while j<=10 do j:=j+1
  end;
  writeln('e')
end.
```

```
program repeatloop;
var j,k:integer;
begin
  writeln('s');
  for k:=1 to 10000 do
  begin
    j:=1;
    repeat
      j:=j+1
    until j>10;
  end;
  writeln('e')
end.
```

```
program maths;
var k:integer;
  x,y:real;
begin
  writeln('s');
  for k:=1 to 1000 do
  begin
    x:=sin(k);
    y:=exp(x)
  end;
writeln('e')
end.
```

```
program vector;
var j,k:integer;
  matrix:array[0..10] of integer;
begin
  writeln('s');
  matrix[0]:=0;
  for k:=1 to 10000 do
    for j:=1 to 10 do
      matrix[j]:=matrix[j-1];
  writeln('e')
end.
```

```
program realalgebra;
var k:integer;
  x:real;
begin
  writeln('s');
  for k:=1 to 10000 do
    x:=k/k*k+k-k;
  writeln('e')
end.
```

```
program value;
var j,k:integer;
procedure value5(i:integer);
begin
  j:=1
end;
procedure value4(i:integer);
begin
  value5(i)
end;
procedure value3(i:integer);
begin
  value4(i)
end;
procedure value2(i:integer);
begin
  value3(i)
end;
procedure value1(i:integer);
begin
  value2(i)
end;
begin
  writeln('s');
  j:=0;
  for k:=1 to 10000 do
  value1(j);
  writeln('e')
end.
```

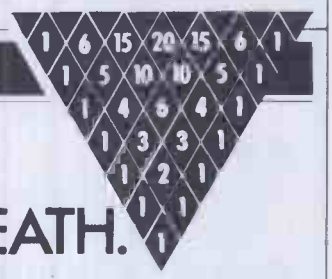
```
program noparameters;
var j,k:integer;
procedure none5;
begin
  j:=1
end;
procedure none4;
begin
  none5
end;
procedure none3;
begin
  none4
end;
procedure none2;
begin
  none3
end;
procedure none1;
begin
  none2
end;
begin
  writeln('s');
  j:=0;
  for k:=1 to 10000 do
    none1;
  writeln('e')
end.
```

```
program memoryaccess;
var j,k,l:integer;
begin
  writeln('s');
  for k := 1 to 10000 do
    for j := 1 to 10 do l := j;
  writeln('e')
end.
```

```
program forloop;
var j,k: integer;
begin
  writeln('s');
  for k := 1 to 10000 do
    for j := 1 to 10 do;
  writeln('e')
end.
```

```
program realarithmetic;
var k:integer;
  x:real;
begin
  writeln('s');
  for k := 1 to 10000 do
    x := k/2*3+4-5;
  writeln('e')
end.
```

```
program magnifier;
var k: integer;
begin
  writeln('s');
  for k := 1 to 10000 do;
  writeln('e')
end.
```

ABSOLUTE DIFFERENCES OF PRIME NUMBERS...AN HYPOTHESIS OF GILBREATH.

Mike Mudge presents more mathematical mind-benders

A Prime Number is defined to be a positive integer greater than 1 that is divisible only by itself and 1. Thus the sequence of primes (known since the time of Euclid c 400BC to be infinite) begins
P = (2,3,5,7,11,13,17,19,23,29,31,37,41, 43,47, . . .).

The first row of the table of Absolute Differences of Prime Numbers is obtained from P by taking the absolute values of the differences between successive terms: thus
$|\Delta_1 P|$ = (1,2,2,4,2,4,2,4,6,2,6,4,2, 4,6, . . .)

This elementary process is repeated to obtain consecutive rows of absolute differences:
$|\Delta_2 P|$ = (1,0,2,2,2,2,2,2,4,4,2,2,2, 2,0, . . .)
$|\Delta_3 P|$ = (1,2,0,0,0,0,0,2,0,2,0,0,0, 2,4, . . .)

For any positive integer n we define a_n to be the smallest positive integer such that the $(a_n + 1)$ − th. term of $|\Delta_n P|$ is the first such term to be greater than 2; thus from the above $a_1 = 3$, $a_2 = 8$, and $a_3 = 14$.

In 1958, NL Gilbreath conjectured that the first term in each row, $|\Delta_n P|$, is unity. If we could prove that $a_n > 2$ for all n then the validity of Gilbreath's conjecture would be established.

*W Sierpinski, *A Selection of Problems in the Theory of Numbers,* Pergamon Press, 1964, page 35. Empirical evidence suggests that a_n is indeed a rapidly increasing function of n, but to the best of my knowledge the required result has not been proved.

Problem

This month's problem is in two distinct parts:
(i) To generate the first N-terms in the sequence P of Prime Numbers for a given N.
(i[1]) Alternatively, justify the direct input of P from existing tables or a 'library-tape'.
(ii) To generate the first M values $a_1, a_2, a_3, \ldots a_m$ for a given M, verifying in the process that $a_4 = 14$, $a_5 = 25$, $a_{10} = 59$, $a_{15} = 174$.

Conjecture the type of function best describing a_n as a function of n: this work may be aided by the use of a graphical output device if available. A valuable reference could be provided by RB Kilgrove & KE Ralston, *On a conjecture concerning primes,* MTAC vol 13, pp 121-122. 1959.

Note. Please include, in addition to the usual program listings, hardware descriptions, run times and output, a count and breakdown by type *viz* multiplication, addition, etc, of the number of arithmetical and logical operations needed to establish $a_{64} = 5940$. This may be precise or an intelligent estimate; its purpose is to compare and contrast the widely differing approaches which are possible to this problem.

Submissions will be judged for accuracy, originality and efficiency (not necessarily in that order), and a suitable prize will be awarded to the 'best' entry received.

Entries, to arrive by 1 February, 1984, to: Mr MR Mudge, BSc FIMA FBCS, Room 560/A, Department of Mathematics, The University of Aston in Birmingham, Gosta Green, Birmingham B4 7ET.

Note. Submissions will only be returned if suitable stamped addressed envelopes are included.

Review of n-tuples

The response to this project was most disappointing, whether due to the summer weather, holidays, the title, or some property of the problem is not apparent.

It would be most informative to receive readers' suggestions as to why this problem was found to be particularly unattractive and perhaps to indicate desirable characteristics of number theoretic problems suitable for investigation using a microcomputer.

(i) The smallest common sum of four associated triples is indeed 118, arising from (14,50,54)a(15,40,63)a(18,30,70)a (21,25,72).

(ii) The smallest common product of four associated triples is indeed 25200, arising from (6,56,75)a(7,40,90)a(9,28,100)a(12, 20,105).

Minimum sum n-tuples.

	N	Sum	Product
Triples . . .	4	118	37800
	5	185	83160
	6	400	846720
	7	511	1965600

There exists no 8-tuple with sum less than 835.

4-tuples . . .	4	24	720
	5	42	7200
	6	52	10800
	7	51	7200
	8	60	20160
	9	71	30240
	10	80	75600
	11	105	100800
	12	105	201600

There exists no 13-tuple with sum less than 112.

5-tuples . . .	4	20	360
	5	25	720
	6	30	2160
	7	34	2880
	8	39	4320
	9	47	10080
	10	45	8640
	11	53	14400
	12	54	30240
	13	52	20160
	14	61	20160

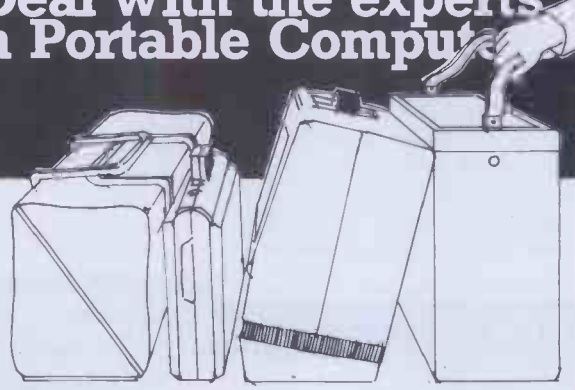
There exists no 15-tuple with sum less than 61.

Many of the above results are due to our recent prizewinner, Mr G Grant, of Manchester.

Now, with regard to this month's prizewinner, neither the response nor the resources justify separate prizes according to hardware or software. I therefore nominate Mr Gareth Suggett of 69 Stockbridge Road, Chichester PO19 2QE for his achievements in Basic on a BBC model B. £10 will be despatched to the south coast in due course.

PS Why is each product listed in the table divisible by 360? Answers on a postcard to GS GG or MM !! END

Deal with the experts on Portable Computers



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NEWCOMERS START HERE

This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. *While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!*

Probably the first thing you noticed on picking up this magazine for the first time was the enormous amount of unintelligible-looking jargon. Well, in the words of *The Hitch-hikers' Guide to the Galaxy*, don't panic! Baffling as it may sound, the jargon does actually serve a useful purpose. It's a lot easier to say VDU, for example, than 'the screen on which 'the computer's output is displayed'. This guide is intended to help you find your way around some of the more common 'buzzwords' you're likely to come across in the pages of *PCW*.

For those completely new to computing, let's start with the question: what is a microcomputer? We can think of a micro as a general-purpose device as opposed to a typewriter which can only be used for typing, a calculator to perform calculations, a filing-cabinet to file information and so on. A micro can do all those things and more.

If it is to be of any use, a general-purpose device needs some way of having a function assigned to it. We do this by giving the computer a set of logical instructions called a **program**. The general term for computer programs is **software**. Every other part of a microcomputer system is known as **hardware**. 'If you can touch it, it's hardware.'

Programs must be written in a form the micro can recognise and act on — this is achieved by writing the instructions in a code known as a **computer language**. There are literally hundreds of different languages around, the most popular of these being **Basic**. Basic is an acronym of **B**eginners' **A**ll-purpose **S**ymbolic **I**nstruction **C**ode. Although originally intended only as a simple introductory language, Basic is now a powerful and widely-used language in its own right.

Other languages you're likely to come across in *PCW* include **Forth, Pascal, C** and **Comal**. These are known as **high-level** languages because they approach the sophistication of a human language. You'll also see references to the **low-level** languages, **assembly language** and **machine code**. We'll look at high and low-level languages in a moment.

The heart of a micro, the workhorse, is the **processor** or **Central Processing Unit (CPU)**. The processor usually consists of a single silicon chip. As with computer languages, there are a number of different types of processor around, the Z80, 6502 and 8088 being the three most common. The processor is nothing magical — it's just a bunch of electronic circuits. It's definitely not a 'brain'.

Being electronic, the processor's circuitry can be in one of two states: on or off. We represent these two states by **binary** (base two) notation, the two binary digits (known as **'bits'**) being 0 and 1. It is possible to program computers in binary notation, otherwise known as **machine code** (or machine language) programming.

Machine code is called a low-level language because it operates at a level close to that 'understood' by the processor. (Languages like Basic are known as high-level languages because they are symbolic, operating at a level easily understood by people but not directly understood by the processor.)

Between high-level languages and machine code is a low-level language known as **assembly language** or, colloquially, **assembler**. This is a mnemonic code using symbols which the processor can quickly convert to machine code.

Since there is no binary equivalent of a comma or the letter 'a', for example, we need some sort of code to represent each character to be processed by the computer. In order to simplify communication between computers, a number of standard codes have been agreed on. The most widely used of these codes is the **A**merican **S**tandard **C**ode for **I**nformation **I**nterchange, **ASCII**. This system assigns each character a decimal number which the processor can then convert to its binary equivalent.

There are two types of program to do this translation for us. The first of these is a **compiler** which translates our whole program permanently into machine code. When we compile a program, the original high-level language version is called the **source code** while the compiled copy is called the **object code**. Compiled programs are fast to run but hard to edit. (If we want to change a compiled program, we either have to edit it in machine code (extremely difficult) or we have to go back to a copy of the source code.) For this reason there is a second translation program: an **interpreter**. An interpreter waits until we actually run (use) the program, then translates one line at a time into machine code — leaving the program in its original high-level language. This makes it slower to run than a compiled program, but easier to edit.

There are two strange-sounding Basic words you're likely to come across: **POKE** and **PEEK**. When you program in a high-level language, you are normally unable to choose which part of the machine's memory the processor will use to store things. This makes programming easier as you don't need to worry about memory locations, but slows down the program since the processor has to 'look up' addresses for you. Using the POKE command, however, you can 'POKE' a value directly into a desired memory address. 'POKE 10000,56', for example, puts the value 56 into memory location 10000. PEEK allows you to examine the content of a particular memory address. If you were to follow the above POKE with 'PEEK 10000', the computer would respond by displaying the value 56. (POKEing and PEEKing is normally done to increase program speed. It's a compromise between Basic and machine code.)

So far, we have a processor and a program. Since a computer needs somewhere to store programs and data, it needs some kind of memory. There are two types of memory known as **R**ead **O**nly **M**emory **(ROM)** and the badly-named **R**andom **A**ccess **M**emory **(RAM)**. ROM is so-called because the processor can **'read'** (get things out of) its contents, but is unable to **'write to'** (put things in) it.

ROM is used to store **firmware**, which consists of software permanently available on the machine. An interpreter is a typical example of firmware (stick with it: it gets easier!).

RAM differs from ROM in two important ways. Firstly, you can write to it as well as read from it. This means that the processor can use it to store both the program it is running and data (information). The second important difference is that RAM needs a constant power-supply to retain its contents: as soon as you switch the computer off, you lose your program and data.

Memory is described in terms of the number of characters we can store in it. Each character is represented by an 8-bit binary number. 8 bits make one byte and 1024 bytes make one **kilobyte** or **1k**. 32k, for example means that the computer can store about 32000 characters in its memory. If 1024 sounds like an odd number, remember that everything is based on the binary system, thus 1,2,4,8,16 ... 1024 being the nearest binary multiple to 1000.

There are numerous forms of **permanent** or **backup** storage, but by far the most common are the **floppy disk** and **cassette**.

Floppy disks or diskettes are circular pieces of thin plastic coated with a magnetic recording surface similar to that of tapes. The disk, which is enclosed in a protective card cover, is placed in a **disk drive**. Disk drives comprise a high-speed motor to rotate the disk and a read/write head to record and 'playback' programs and data.

The disk is divided into concentric rings called **tracks** (similar to the tracks on an LP) which are in turn divided into small blocks by spoke-like divisions called **sectors**.

There are two methods for dividing the disk into sectors. One method is called **hard-sectoring**, where holes punched in the disk mark the sectors, and the other is **soft-sectoring** where the sectors are marked magnetically. (The reason that disks from one machine can't be read by a different make is that each manufacturer has its own way of dividing up the disk. Recently, however, manufacturers do seem to have begun to acknowledge that this situation can't go on forever, and they are working on making their disks compatible with each others.')

Since the computer needs some way of tracking the whereabouts of everything on the disk, we have a program called a **Disk Operating System**, more usually known simply as the **Operating System (DOS** or **OS)**. The operating system does all the 'house-keeping' of the disks, working out where to put things, letting the user know what is on the disk, copying from one disk to another and so on. As you might expect by now, there are lots of different operating systems available (each with its own advantages and disadvantages). The two most popular OSs are **CP/M** (Control Program for Micros) and **MS-DOS** (MicroSoft Disk Operating System).

Floppy disks provide a reasonably fast and efficient form of secondary storage and are cost-effective for business machines. For home computers, however, the usual form of program and data storage is on ordinary cassette tape using a standard cassette recorder. This method of storage is slow and unreliable, but is very cheap and is adequate for games and the like.

Another type of disk you'll see referred to is the **hard disk**. This is an extremely efficient method of storing large amounts of programs and data. Hard disk capacity generally starts at around 10 **Mbytes** (10 million bytes) and rises to . . . well, you name it. Besides offering a much greater capacity than floppies, hard disks are more reliable and considerably faster. They are, however, much more expensive than floppy drives.

Since computers need some way of communicating with the outside world, we need input and output devices. Input and output devices include all manner of things from hard disk units to light-pens, but the minimum requirement for most applications is a typewriter-style **keyboard** for input and a tv-like **Visual Display Unit** for output. The Visual Display Unit is variously referred to as a **VDU, Cathode Ray Tube (CRT)** and **monitor**.

The various component parts of a computer system (processor, keyboard, VDU, disk drives, etc) may all be built in to a single unit or they may be separate, connected by cables.

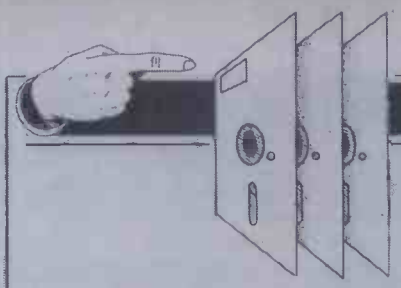
Take this paragraph slowly and it makes sense! When a computer communicates with an outside device, be it a printer or another computer, it does so in one of two forms — **parallel** or **serial**. **Parallel input/output (I/O)** requires a number of parallel wires. Each wire carries one bit, so with 8 wires we can transmit/receive information one byte at a time (8 bits = one byte, remember). **Serial I/O**, in contrast, uses a single wire to transmit a series of bits one at a time with extra bits to mark the beginning and end of each byte.

To enable different devices to communicate with each other in this way, standards have been agreed for different **interfaces**. An interface is simply a piece of circuitry used to connect two or more devices. The most common standard serial interface is the **RS232** (or **V24**) while the **Centronics** standard is popular for parallel interfaces.

When two computers want to communicate with each other over a distance, there are again two ways of doing it. Both methods use the public phone network. The simplest and cheapest method is to use a device known as an **acoustic coupler**. This simply plugs into your computer, and has a receptacle into which you place your telephone handset. However an acoustic coupler is slow and not exceptionally reliable.

A more sophisticated (and correspondingly more expensive) method is to use a **modem**. Unlike an acoustic coupler, a modem is wired into the telephone system and you should get permission for this from British Telecom.

So, now you know!



PACKAGES

PCW's 'Packages' section is produced bi-monthly, alternating with our 'In Store' hardware guide. We have confined coverage to business packages which are available and supported at national level and which have been in use for at least six months in a minimum of five sites. Producers of packages which fall within these constraints should send for details or updates to: Tracy Dear, PCW, 62 Oxford Street, London W1.

The layout has been designed to allow you to discover which packages are available for the application you have in mind and to show you which packages are available for your computer if you already have a machine. In either case the code enables you to look up the supplier's name and telephone number in the table below.
All details published are the latest made available — some may have changed since this issue went to press.

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M5	M.A.P. Comp Systems	061-624-5662
M6	Mercator	0272 731079
M7	Micros For The Movement	01-387 6192
M8	MMG Consultants	06845 63555
M9	Medlatech	01-903 4372
M10	ME-TEC Computer Services	060526 620
M11	Molimerx Ltd	0424 220391
M12	Mountain Software Services	0276 72772
M13	Micro Planning Services	0272 684530
O1	Omicron Design	0784 31809
O2	Open Computer Services	0273 671666
P1	Padmede Computer Services	02514 21892
P2	Personal Computers Ltd.	01-377 1200
P3	Professional Computer Services	061 624 4065
P4	Prestige Computers	021 561 2001
P5	Precision Software	01-330 7166
R1	Rockliff	051-521 5830
S1	SMG Micro Computers	0474 55813
S2	The Softwarehouse	01-637 2108
S3	Sosoft Ltd	0202 735656
S4	Systematics International	0440 61121
S5	Sumlock Bondain	01-250 0505
S6	Stemmos	01 602 6242
S7	Software Aids Int	01-904 8139
S8	SD Micros	01 836 9520
S9	Southdata Ltd	01-994 6477
S10	Skisoft Computer Services	0273 671666
S11	Saphire Systems Ltd	01-554 0582
T1	Tridata Micros Ltd.	021 622 6085
T2	Templeman Software	0789 66237
T3	The Micro Solution	0608 3256
T4	Tip Data Ltd	0375 33910
T5	TABS Ltd	0264 64166
U1	Unique Computer Application Ltd	05827 66551
V1	Vlasak Electronics Ltd.	0494-448633
V2	Vauntberry Ltd	0329 235846
W1	Wisbech Computer Services	0945 64146
W2	Westfarthing Comp Services	03265-4098
W3	Western Computers	0253 404676
W4	Walton Microcomputer Ltd	Camberly 28366
X1	Xetal	061 678 0234
X2	Xitan Systems Ltd	0703 334711

Application/Machine	Price	Code
Analysis ledger		
Philips P2000	£100	P4
Appointments planner		
Act Sirius 1	£115	C7
Apple II	£300	A6
Challenger	£25	C7
CP/M	POR	G4
Arable recording & costing		
CP/M	£1500	C4
Architects package		
CP/M	£750	M6
Assembler dev		
PET/CBM	£50	L2
Auction package		
CP/M	£700	M6
BBC Basic		
CP/M	£95	M10
Grundy 8200	£95	M10
Bill of materials		
Apple II	£199	T5
CP/M	£850	B5
CP/M	£199	T5
CP/M	£400	G4
CP/M	£850	V2
CP/M	£390	H1
Cromemco	£850	B5
IBM	£390	H1
PET/CBM	£199	T5
Superbrain	£450	T3
8080/280	£390	H1
Bookmakers package		
CP/M	POR	B7
Bookshop stock control		
Sorcerer	£1450	L2
Budgeting package		
Apple II	£125	P2
Apple II	£125	T2
CP/M	£95	B5
Cromemco	£95	B5
North Star Horizon	£95	B5
Building estimating		
Apple II	£570	S8
CP/M	£325	C9
IBM	£325	C9
Sirius	£325	C9
Building services		
Apple	POR	H2
Apple	POR	I3
IBM	POR	H2
North Star	POR	I3
Sirius	POR	H2
Bureau de change		
PET/CBM	£8	H3

Application/Machine	Price	Code
Bursar package		
CP/M	POR	M8
Cash flow		
Apple II	£125	P2
Apple II	£80	V1
Apple II	£100	C8
CP/M	£250	L3
CP/M	£95	B5
Cromemco	£95	B5
North Star Horizon	£95	B5
PET/CBM	£195	D1
Car showroom sales		
Sorcerer	£1900	L2
Cash register		
CP/M	£300	G6
Cheque writer		
CBM/8032	£90	P3
PET/CBM	£90	P3
Company secretary		
CP/M	£650	C4
Construction cashflow		
Apple II	£75	S8
Construction expenditure		
Apple II	£250	S8
Construction financial control		
Apple II	£750	S8
Construction valuations		
Apple II	£500	S8
Container accounting Contract costing		
CP/M	£750	M5
CP/M	£2000	L3
CP/M & utilities		
Tandy Model II	£165	M1
Credit control		
Apple II	£98	P2
CP/M	POR	G4
PET/CBM	£650	B4
Customer file		
CP/M	£900	G4
Famos	£1000	M2
Dairy mangement		
CP/M	£1500+	C4
Database management retrieval		
ACT800	£225	H4
Apple II	£150	K2
Apple II	£60-140	S2
Apple II	£150	S5
Apple II	£75	P2
Apple II	£100	S4
Apple II	£100	C8
Apple II	£125	T2

Application/Machine	Price	Code
CP/M	£450	C4
CP/M	£100	G3
CP/M	£250	B3
CP/M	£295	G5
CP/M	£225-485	S9
CP/M	£155	X2
CP/M	£295	M4
Famos	£1500	M1
IBM	£295	M4
North Star Horizon	£250	B3
PET/CBM	£225	H4
PET/CBM	£50/150	C2
PET/CBM	£150	J1
PET/CBM	£150	G2
Superbrain	£300	S6
Tandy Model I	£25-90	M1
Tandy Model I	£60	S2
Tandy Model I	£150	J1
Tandy Model I	£32.50	M11
Tandy Model III	£270	A4
8000 Series	POR	C2
Debt collection		
CP/M	£150	G4
CP/M	£450	V2
Dental laboratory		
Apple II	£280	A6
Dental records		
Apple II	£1700	A6
CP/M	£500	G6
Department store order program		
Sorcerer	£2500	L2
Double glazing costing		
North Star Horizon	£750	W1
CP/M	£1500	V2
Earth parameter collection & Qualification		
CP/M	£95	M10
Grundy 8200	£95	M10
Eire payroll system		
CP/M	£650	M5
Engineering/computer-aided design		
Apple II	£300	S10
Estate agent		
Apple II	£850	S5
Apple II	£850	K1
Apple II	£175	P2
Apple II	£130	C8
Apple II	£750	S4
PET/CBM	£30	H3
CP/M	£700	B5
CP/M	£850	S9
Simpled Triton 3	£350	B3
MZ-80K	£195	W1
Superbrain	£600	S6
Superbrain	£600	C3
Equipment lease/rent/HP		
CP/M	£400	G1

Application/Machine	Price	Code
Expense analysis		
Philips P2000	£150	P4
Farm accounts		
CP/M	£750	C4
Financial & arable management		
CP/M	£2200	C4
File handling		
PET/CBM	£225	H4
PET/CBM	£645	D1
Financial modelling		
Act Sirius 1	£595	A1
Apple II	£450	P2
Apple II	£360	C
CP/M	£400	G1
CP/M	£95	B
CP/M	£425-535	A1
CP/M	£400	S11
CP/M	£400	V2
Cromemco	£95	B5
North Star Horizon	£95	B5
PET/CBM	£425-535	A1
PET/CBM	£250	D1
RAIR Black Box	POR	A3
Financial planning		
Act Sirius 1	£150	A1
Apple II	£250	S4
CP/M	£245	G4
CP/M	£90	X2
UCSD-P	£350	S4
Flare system design		
		S10
Fluid flow		
		S1
General ledger/NL		
Apple II	£300	S5
Apple II	£300	K2
Apple II	£455	P2
Apple II	£225	V1
Apple II	£295	C6
Apple II	£250P	S4
Apple II	£600	T2
Apple II	£490	L4
Apple II	£199	T5
CBN/8032	£350	W3
CP/M	£500	L3
CP/M	£375	L1
CP/M	£400	G1
CP/M	£400	M3
CP/M	£400	B5
CP/M	£275	S6
CP/M	£390	S7
CP/M	£250	B3
CP/M	£300	W1
CP/M	£425	S11
CP/M	£500	G6
CP/M	£400	M5
CP/M	£1000	B1
CP/M	£199	T5

PACKAGES

Application/Machine	Price	Code
CP/M	£950/1250	V2
CP/M	£400	M9
Cromemco	£400	B5
North Star Horizon	£250	B3
North Star Horizon	£400	M3
PCC 2000 North Star Horion	£400	B5
PET/CBM	£200	C2
PET/CBM	£200	H3
PET/CBM	£199	T5
Philips P2000	£100	P4
Sharp PC3201	£450	P2
Superbrain	£400	M3
Superbrain	£400	S6
Tandy Model I	£90	M1
Tandy Model II	£200	M1
Tandy Model I	£225	M11
Tandy Model I	£225/325	T1
Tandy Model II	£425	T1
UCSD-P	£350	S4
Vector	£400	C5
8080/Z80	£357	L1
8080/Z80	£275	G3
General purchase transaction proc.		
CBM/8032	£495	S3
Greyhound race program		
Apple II	£750	M6
Health authority PPM		
Sorcerer	£2500	L2
Housing association package		
PET/CBM	POR	M7
Hotel billing		
Philips P2000	£500	P4
Hotel management		
CP/M	£750	H5
North Star Horizon	750	H5
RAIR Black Box	POR	A3
Incomplete records		
Act Sirius 1	£1200	S1
Apple II	£250	S2
Apple II	POR	K1
Apple II	£425	P2
Apple II	£490	L4
CBM/8032	£150	W3
CP/M	£750	M3
CP/M	£250	B5
CP/M	£975	B3
CP/M	£750	W1
CP/M	£915	M5
CP/M	£155	C10
CP/M	£400	G4
Cromemco	£250	B5
North Star Horizon	£750	M3
North Star Horizon	£250	B5
North Star Horizon	£975	B3
Philips P2000	£150	P4
Superbrain	£750	M3
Superbrain	£1200	S1
Tandy Model I	£25-50	M1
Tandy Model I	£40	M11
Industrial cleaning package		
CP/M	£1000	B1
Industry Factory loading		
CP/M	£1000	X1
Industry work study		
DMS	£1000	X1
Inn Management		
Act Sirius 1	£185	C7
Instrument logging		
Sorcerer	£500	L2
Insurance broker		
Act Sirius 1	£450	C7
CP/M	POR	G4
Insurance renewals		
CBM/8032	£1200	S3
Integrated accts		
Act Sirius 1	£795	O1
Apple II	£300	P2
Apple II	£855	V1
Apple II	£1500	T2
Apple II	£1470	L4
Apple II	£300	W2
Apple II	£199	T5
CBM/8032	£1500	P3
CP/M	£950	L1
CP/M	£750	C4
CP/M	£1100	G1
CP/M	£990	M3
CP/M	£690	B5
CP/M	£900	B5
CP/M	£950	B3
CP/M	£1200	S11
CP/M	£199	T5
CP/M	£3400	M9
Cromemco	£690	B5
Cromemco	£900	B5
Famos	£2000	M2
MZ-80K	£150	P2
North Star Horizon	£950	B3
North Star Horizon	£690	B5
North Star Horizon	£900	B5
PET/CBM	£800	S3
PET/CBM	£199	T5
North Star Horizon	£990	M3
PET/CBM	(£50)	C2
PET/CBM	£650	J1
PET/CBM	£650	G2
Philips P2000	£650	P4
Sirius	£1250	I4
Superbrain	£990	M3
Superbrain	£1200	S6
Superbrain	£1000	T3
Superbrain	£1200	S1
Tandy Model I	£300	M1
Tandy Model II	£600	M1
Tandy Model I	£75	J1
Tandy Model II	£795	O1
Tandy Model III	£550	A4
Vector	£1000	C5
Vector	£1250	I4
8000 Series	POR	C2
8080/Z80	£950	L1
8080/Z80	£995	G3
Investment portfolio		
Tandy Model I	£20	S2
Invoicing		
Act Sirius 1	£95	C7
Act Sirius 1	£265	O1
Act Sirius 1	£195	A1
Apple II	£295	S2
Apple II	£100	P2
Apple II	£140	V1
Apple II	£1000	T2
Apple II	£199	T5
Challenger	£25	C7
CP/M	£325	L1
CP/M	£250	M3
CP/M	£250	S7
CP/M	£100	B5
CP/M	£100	B3
CP/M	£300	W1
CP/M	£300	B1
CP/M	£199	T5
CP/M	£400	G4
CP/M	POR	W4
CP/M	£400	M9
CP/M	£249	P1
CP/M	£280	U1
CP/M	£390	H1
Cromemco	£100	B5
IBM	£390	H1
North Star Horizon	£100	B3
North Star Horizon	£250	M3
North Star Horizon	£100	B5
PET/CBM	£350	A1
PET/CBM	POR	J1
PET/CBM	£199	T5
Philips P2000	£150	P4
Sorcerer	£290	L2
Superbrain	£250	M3
Superbrain	£150	S6
Tandy Model I	£90	M1
Tandy Model II	£200	M1
Tandy Model I	£25	M11
Tandy Model I	£75	T1
Tandy Model II	£125	T1
Tandy Model II	£265	O1
Tandy Model III	£280	A4
UCSD-p	£350	S4
8080/Z80	£325	L1
8080/Z80	£390	H1
Jewellers System		
CP/M	£1000	S7
CP/M	POR	G4
Job costing		
Act Sirius 1	£350	C7
Act Sirius 1	£265	O1
Apple II	£990	X1
Apple II	£199	T5
CBM/8032	£350	W3
CP/M	£350	M3
CP/M	£990	X1
CP/M	£395	G6
CP/M	£450	M5
CP/M	£300	B1
CP/M	£199	T5
BOS	£1500	T4
CP/M	£1500	V2
CP/M	£1000	X1
CP/M	£600	A2
CP/M	£495	C9
IBM	£495	C9
North Star Horizon	£350	M3
PET/CBM	£199	T5
Philips P2000	£400	P4
Sirius	£495	C9
Superbrain	£350	M3
Tandy Model II	£265	O1
UCSD-p	£350	S4
Job order control		
8080/Z80	£275	G3
Legal precedents		
CP/M	£1150	C4
Leisure		
Apple II	£550	W5
Letter writer		
Apple II	£80	V1
Apple II	£99	T5
CP/M	£150	M3
CP/M	£99	T5
CP/M	POR	G4
North Star Horizon	£150	M3
Superbrain	£150	M3
Local government housing maint		
RAIR Black Box		
POR	A3	
Magazine subscriber		
CP/M	£950	S9
Mailing List		
Apple II	£50-150	S2
Apple II	£300	S5
Apple II	£300	K1
Apple II	£40	P2
Apple II	£100	S4
CP/M	£450	C4
CP/M	£250	G1
CP/M	£75	S9
CP/M	POR	G4
CP/M	£250	U1
CP/M	£149	M4
IBM	£149	M4
North Star Horizon	£195	W1
PET/CBM	£15	A1
PET/CBM	£35	H3
Sorcerer	£290	L2
Tandy Model I	£40	M1
Tandy Model II	£62-50	M1
Tandy Model I	£50-150	S2
Tandy Model I	£25/38/55	H1
Mail shot		
Act Sirius 1	£95	A1
Apple II	£14	S2
Apple II	£40	P2
Apple II	£25	T2
Apple II	£99	T5
CBM/8032	£350	W3
Challenger	£25	C7
CP/M	£450	C4
CP/M	£90	M3
CP/M	£100	S7
CP/M	£50/150	G5
CP/M	£99	T5
MCZ Zilog	£250	I1
North Star Horizon	£90	M3
Superbrain	£90	M3
Tandy Model I	£75+	G4
Tandy Model II	£75+	G4
Tandy Model III	£160	A4
Membership acctng		
Apple II	£75	P2
CP/M	POR	G4
MCZ Zilog	£250	I1
Motor Dealer		
Act Sirius 1	£345	C7
CBM/8032	£950+	P3
CP/M	POR	G4
Famos	£5000	M2
NEDO price adjustment		
Apple II	£200	S8
Nominal ledger Order entry/invoicing		
CP/M-86	£500	O2
Apple II	£99	T5
CBM/8023	£750	P3
CP/M	£350	G1
CP/M	£395	G6
CP/M	£300	M5
CP/M	£550	L1
CP/M	POR	B1
CP/M	£99	T5
CP/M	£400	M9
CP/M	£249	P1
IBM	£395	B2
8080/Z80	£550	L1
Order Processing		
AppleII	£99	T5
CP/M	£99	T5
CP/M	£500	G4
CP/M	£400	M9
Philips P2000	£200	P4
Sirius	£400	I4
Vector	£400	I4
Office admin		
Apple II	£100	S4
Pad to plotter systems		
Apple II	£250	P2
Apple II	£180	C8
Payroll		
Act Sirius 1	£300+	O1
Act Sirius 1	£195	A1
Apple II	£200	S2
Apple II	POR	S5
Apple II	POR	K1
Apple II	£200	P2
Apple II	£375	V1
Apple II	£375	C6
Apple II	£250P	S4
Apple II	£490	L4
Apple II	£199	T5
CBM/8032	£375	P3
CBM/8032	£350	W3
Challenger	£24	C7
CP/M	£450	L3
CP/M	£475	L1
CP/M	£450	C4
CP/M	£500	G1
CP/M	£390	M3
CP/M	£500	B5
CP/M	£350	B3
CP/M	£425	G11
CP/M	Lease	W1
CP/M	£495	G6
CP/M	£450	M5
CP/M	£300	B1
CP/M	£199	T5
CP/M	£395	G4
CP/M	POR	W4
CP/M	£600	M9
CP/M	£325	M12
CP/M-86	£500	O2
Famos	£1500	M2
North Star Horizon	£350	B3
North Star Horizon	£390	M3
North Star Horizon	Lease	W1
PET/CBM	£200/350	C5
PET/CBM	£400	I2
PET/CBM	£150	G2
PET/CBM	£150	J1
PET/CBM	£150	C2
PET/CBM	£10	H3
PET/CBM	£199	T5
Philips P2000	£300	P4
Scorcerer	£250	L2
Sirius	£600	I4
Superbrain	£390	M3
Superbrain	£400	S6
Superbrain	£250+	T3
Tandy Model I	£200	M11
Tandy Model I	£218	T1
Tandy Model II	£375	T1
Tandy Model II	£300+	O1
UCSD-p	£350	S4
8000 Series	£250	C2
8080/Z80	£475	L1
8080/Z80	£275	G3
PET/CBM	£150	G2
PET/CBM	£150	J1
PET/CBM	£150	C2
Sorcerer	£250	L2
Tandy Model I	£249	M1
TRS-80	£200	M11
TRS-801	£218	K1
TRS-801	£218	T1
TRS-801I	£375	T1
8000 Series	£250	C2
8080/Z80	£475	L1
8080/Z80	£275	G3
Victor	£600	I4
Perpetual Inventory		
CP/M	£150	B5
Cromemco	£150	B5
Personnel records		
Apple II	£98	P2
CP/M	£450	C4
MCZ Zilog	£400	I1
Petaid report generator		
PET/CBM	£250	S3
Petsoft programs		
PET/CBM	£160	J1
Pig management		
CP/M	£1250	C4
Pipeline pressure drops		
Apple II		S10
Pipeline sizing		
Apple II		S10
Point of sale		
CP/M	£400	M9
Postal advertising response packages		
Apple II	£350	S2
Price lister		
PET/CBM	£12	H3
Product Management		
Act Sirius 1	£245	C7
Production analysis		
Apple II	£75	P2
Production control		
CBM/8032	£650+	P3
CP/M	£2400	V2
PET/CBM	£650+	P3
Prof appts groups		
8080/Z80	£275	G3
Prof appts individ		
8080/Z80	£220	G3

PACKAGES

Application/Machine	Price	Code
Prof client billing		
8080/Z80	£330	G3
Programming aids		
Apple II	£40	P2
Project management		
Apple	£695	M13
CBM/8032	990	C11
IBM	1100	M13
IBM	1600	C11
Sirius	990	M13
Sirius	1600	C11
Victor	£990	M13
Property management		
CP/M	£750--15000	C4
CP/M	£400	M3
CP/M	£1000	B1
North Star Horizon	£400	M3
Superbrain	£400	M3
UCSD-p	£175	S4
Publishers System		
CP/M	£1850	S7
Purchase ledger		
Act Sirius I	£395	A1
Apple II	£300	S5
Apple II	£300	K1
Apple II	£295	C6
Apple II	£300	P2
Apple II	£315	V1
Apple II	£250P	S4
Apple II	£300	T2
Apple II	£490	L4
Apple II	£199	T5
Challenger	£25	C7
CBM/8032	£350	W3
CP/M	£450	G1
CP/M	£500	L3
CP/M	£425	L1
CP/M	£400	M3
CP/M	£400	B5
CP/M	£395	S7
CP/M	250	B3
CP/M	£300	W1
CP/M	£425	S11
CP/M	£495	G6
CP/M	£200	M5
CP/M	£300	B1
CP/M	£199	T5
CP/M	£950--1250	V2
CP/M	POR	W4
CP/M	£400	M9
CP/M	£400	G4
CP/M	£450	U1
CP/M	£495	X2
CP/M-86	£500	O2
Cromemco	£400	B5
North Star Horizon	£250	B3
North Star Horizon	£400	M3
North Star Horizon	£400	B5
Sorcerer	£490	L2
Sirius	£325	I4
Superbrain	£400	M3
Superbrain	£300	S6
PET/CBM	£300	B4
PET/CBM	£200	C2
PET/CBM	POR	J1
PET/CBM	£350	H3
PET/CBM	£199	T5
Philips P2000	£200	P4
Sharp PC3201	£300	P2
Tandy Model I	£90	M1
Tandy Model II	£200	M1
Tandy Model I	£225	M11
Tandy Model I	£225	T1
Tandy Model II	£375	T1
UCSD-p	£350	S4
Vector	£400	C5
Victor	£325	I4
8000 Series	£250	C2
8080/Z80	£275	G3
8080/Z80	£425	L1
Quotation estimating		
Act Sirius I	£125	C7
CP/M	POR	G4
Philips P2000	£400	P4
Recruitment Agency		
Act Sirius I	£345	C7
Reinforcement bar schedule		
Apple II	£150	S8
Relief valve sizing		
Apple II		S10
Renewals ledger		
Philip P2000	£200	P4
Report generator		
CP/M	POR	G4
Requirements planning		
CP/M	£700	V2
Resource optimiser		
Apple II	£295	C10

Application/Machine	Price	Code
Sales ledger		
Act Sirius I	£395	A1
Apple II	£300	S5
Apple II	£300	K1
Apple II	£295	C6
Apple II	£300	P2
Apple II	£315	V1
Apple II	£250P	S4
Apple II	£600	T2
Apple II	£490	L4
Apple II	£199	T5
CBM/8032	£350	W3
Challenger	£25	C7
CP/M	£450	G1
CP/M	£500	L3
CP/M	£425	L1
CP/M	£400	M3
CP/M	£400	B5
CP/M	£365	S7
CP/M	£350	B3
CP/M	£300	W1
CP/M	£425	S11
CP/M	£495	T4
CP/M	£200	M5
CP/M	£300	B1
CP/M	£199	T5
CP/M	£400	G4
CP/M	£950--1250	V2
CP/M	POR	W4
CP/M	£400	M9
CP/M	£249	P1
CP/M	£390	H1
CP/M-86	£500	O2
Cromemco	£400	B5
IBM	£390	H1
North Star Horizon	£250	B3
North Star Horizon	£400	M3
North Star Horizon	£400	B5
PET/CBM	£300	B4
PET/CBM	£800	C1
PET/CBM	POR	J1
PET/CBM	£200	C2
PET/CBM	£350	C7
PET/CBM	£199	T5
Philips P2000	£200	P4
Sharp PC 3201	£300	P2
Sorcerer	£490	L2
Superbrain	£400	M3
Superbrain	£300	S6
Superbrain	£199	T5
Tandy Model I	£90	M1
Tandy Model II	£90	M1
Tandy Model I	£225	M11
Tandy Model I	£225	T1
Tandy Model II	£375	T1
UCSD-p	£350	S4
Vector	£400	C5
8000 Series	£250	C2
8080/Z80	£275	G3
8080/Z80	£425	L1
8080/Z80	£390	H1
Typing tutor		
CP/M	£50-125	A5
Utilities		
Apple II	£40	P2
Apple II	£20	C6
CP/M	£50	B5
ITT 2020	£20	C6
Utility set		
PET/CBM	£78	H3
Various engineering		
Tektronix		E1
Various thermal insulation industry systems		
BOS	£2000+	T4
Hewlett Packard		E1
VAT master		
PET/CBM	£25	H3
VAT register		
Tandy Model I	£15	M11
Video hire system		
Act Sirius I	£125	C7
CP/M	£499	G4
CP/M	£795	L5
Tandy Model III	£460	A4
Video message		
Apple	£200	G3
Warehousing		
CBM/8032	POR	S1
CBM/8032	£375	P3
Word processing		
ACT 800	£375	H4
Act Sirius I	£295-325	A1
Act Sirius I	£295+	O1
Apple II	£60	S2
Apple II	£75	K1
Apple II	£75	S5
Apple II	£150-300	P2
Apple II	£75	J1
Apple II	£120	V1
Apple II	£180/95	S4
Apple II	£30	C8
Apple II	£500	T2

Application/Machine	Price	Code
Apple II	£99	T5
CP/M	£260	C4
CP/M	£400	G1
CP/M	£250	M3
CP/M	£250	S11
CP/M	£1000	B1
CP/M	£99	T5
CP/M	£420	V2
CP/M	£295	X2
CP/M	£350	M12
CP/M	£295	M4
Famos	£500	M2
IBM	£295	M14
IBM	£375	B2
North Star Horizon	£250	M3
PET/CBM	£375	H4
PET/CBM	£325	C5
PET/CBM	£75/150	C2
PET/CBM	£75/150	J1
PET/CBM	£75/150	G2
PET/CBM	£35	H3
PET/CBM	£249	P5
Philips P2000	£230	P4
Superbrain	£250	M3
Tandy Model I	£50/75	M1
Tandy Model II	£74-50	M1
Tandy Model I	£200	S2
Tandy Model I	£45/95	J1
Tandy Model I	£15	H1
Tandy Model II	£295+	O1
Vector	£400	C5
8000 Series	£250	C2
Work In Progress		
CP/M	£850	B5

MACHINES

Application/Machine	Price	Code
ACT 800		
Database management/	£225	H4
Word processing	£375	H4
Act Sirius I		
Appointments planner	£115	C7
Building est	£325	C3
Building services	POR	H2
Financial modelling	£595	A1
Financial planning	£150	A1
Incomplete records	£1200	S1
Inn Management	£185	C7
Insurance Broker	£450	C7
Integrated Accts	£495	A1
Integrated Accts	£795	O1
Integrated Acct	£1250	I4
Invoicing	£95	C7
Invoicing	£265	O1
Invoicing	£195	A1
Job Costing	£350	C7
Job Costing	£265	O1
Job Costing	£495	C9
Mailing list	£95	A1
Motor Dealer	£345	C7
Order processing	£400	I4
Payroll	£300+	O1
Payroll	£195	A1
Payroll	£600	I4
Project Management	£245	C7
Project Management	£900	M13
Project Management	£1600	C11
Purchase ledger	£395	A1

Application/Machine	Price	Code
Purchase ledger	£325	I4
Quotation Estimating	£125	C7
Recruitment agency	£345	C7
Sales Ledger	£395	A1
Solicitors package	£1400	S1
Stock control/recording	£265	O1
Stock control/recording	£195	A1
Stock control/recording	£495	C9
Time/cost recording	£800	S1
Video hire system	£125	C7
Word processing	£295/325	A1
Word processing	£295+	O1
Apple II		
Appointments planner	£300	A6
Bill of materials	£199	T5
Budgeting	£125	T2
Building estimating	£570	S8
Building services	POR	H2
Building services	POR	I3
Cash flow	£80	V1
Cash flow	£75	P2
Cash flow	£100	C8
Construction cashflow	£75	S8
Construction expenditure	£250	S8
Construction financial control	£750	S8
Construction valuations	£500	S8
Database management/ information retrieval	£150	K1
Database management/ information retrieval	£60-140	S2
Database management/ information retrieval	£150	S5
Database management/ information retrieval	£98	P2
Database management/ information retrieval	£100	S4
Database management	£75	P2
Database management	£100	C8
Database management	£125	T2
Dental laboratory	£280	A6
Dental records	£1700	A6
Engineering/computer-aided design	£300	S10
Estate agent	£850	S5
Estate agent	£850	K1
Estate agent	£750	S4
Estate agent	£130	C8
Financial modelling	£360	C8
Financial planning	£250	S4
Flare system design		S10
Fluid flow		S10
General ledger/NL	£300	K1
General ledger/N/L	£450	P2
General ledger/NL	£300	S5
General ledger/NL	£225	V1
General ledger/NL	£295	C6
General ledger/NL	£250P	S4
General ledger/NL	£600	T2
General ledger/NL	£490	L4
General ledger/NL	£199	T5
Greyhound race program	£750	M6
Incomplete records	POR	K1
Incomplete records	£250	S2
Incomplete records	£450	P2
Incomplete records	£490	L4
Integrated accts	£885	V1
Integrated accts	£300	P2
Integrated accts	£1500	T2
Integrated accts	£30	W2

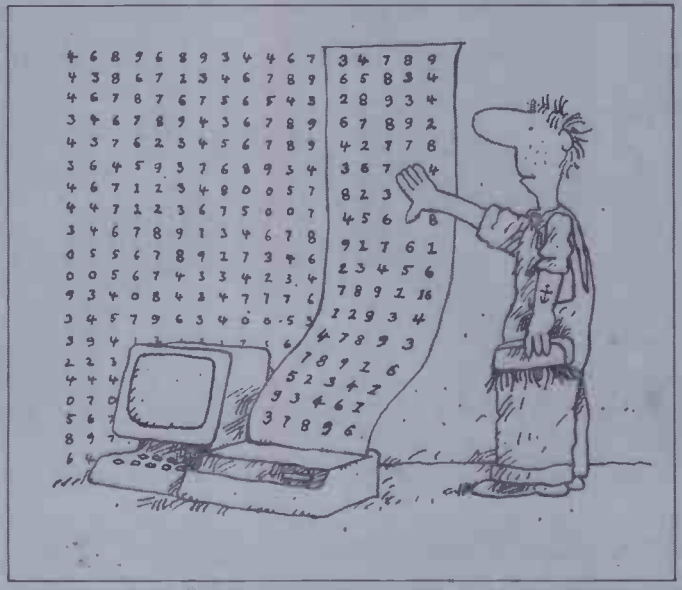
PACKAGES

Application/Machine	Price	Code
Integrated accts	£1470	L4
Integrated accts	£199	T5
Invoicing	£295	S2
Invoicing	£300	P2
Invoicing	£140	V1
Invoicing	£300	P1
Invoicing	£1000	T2
Invoicing	£199	T5
Job costing	£450	S2
Job costing	£990	X1
Job costing	£199	T5
Leisure	£550	W5
Letter writer	£99	T5
Mailing list	£300	K1
Mailing list	£40	P2
Mailing list	£50-150	S2
Mailing list	£300	S5
Mailing list	£100	S4
Mailing List	£25	T2
Mail shot	£14	S2
Mail shot	£225	P2
Mail shot	£99	T5
NEDO price adjustment	£200	S8
Order entry/invoicing	£99	T5
Order Processing	£99	T5
Pad to plotter system	£250	P2
Pad to plotter system	£180	C8
Payroll	POR	S5
Payroll	POR	K1
Payroll	£200	S2
Payroll	£375	V1
Payroll	£200	P2
Payroll	£375	C6
Payroll	£250P	S4
Payroll	£400	T2
Payroll	£490	L4
Payroll	£199	T5
Personal records	£75	P2
Pipeline pressure drops		S10
Pipeline sizing		S10
Postal advertising response package	£350	S2
Production analysis	£75	P2
Programming aids	£40	P2
Project Management	£695	M12
Purchase ledger	£300	K1
Purchase ledger	£300	P2
Purchase ledger	£300	S5
Purchase ledger	£315	V1
Purchase ledger	£295	C6
Purchase ledger	£250P	S4
Purchase ledger	£300	T2
Purchase ledger	£490	L4
Purchase ledger	£199	T5
Reinforcement bar schedul	£150	S8
Relief valve sizing		S10
Resource optimiser	£295	C10
Sales ledger	£300	K1
Sales ledger	£300	S5
Sales ledger	£300	P2
Sales ledger	£315	V1
Sales ledger	£295	C6
Sales ledger	£250P	S4
Sales ledger	£600	T2
Sales ledger	£490	L4
Sales ledger	£199	T5
SL, PL stock control	£1000	T2
Solicitor's complete record accounting	£3000	S2
Statistics	£150	G3
Statistics	£100/195	P2
Statistics	£100-195	P2
Statistics	£140	C8
Stock control/recording	£150	G3
Stock control/recording	POR	K1
Stock control/recording	£300	P2
Stock control/recording	£80	S2
Stock control/recording	POR	S5
Stock control/recording	£285	V1
Stock control/recording	£500	S4
Stock control/recording	£490	L4
Stock control/recording	£199	T5
Storage tank costing/volumes		S10
Text file librarian	£125	S4
Time/cost recording	£450	S2
Utilities	£20	C6
Video message	£200	G3
Word processing	£75	K1
Word processing	£60	S2
Word processing	£300	P2
Word processing	£75	S5
Word processing	£120	V1
Word processing	£75	J1
Word processing	£180/95	S4
Word processing	£30	C8
Word processing	£500	T2
Word processing	£99	T5
BBC		
Bill of materials	£95	M10
CBM/8032		
Cheque writer	£90	P3
General ledger/NL	£350	W3
General purpose transaction proc.	£495	S3
Incomplete records	£150	W3
Insurance renewals	£1200	S3
Integrated accts	£1500	P3
Job costing	£350	W3
Mailing list	£350	W3
Motor trader	£950+	P3
Order entry/invoicing	£750	P3
Payroll	£375	P3
Payroll	£350	W3
Production control	£650+	P3
Project Management	£990+	C11
Purchase ledger	£350	W3
Sales ledger	£500	C11
Sales ledger	£350	W3
Solicitors package	£140	S1
Stock control/recording	£175	P3
Stock control/recording	£250	C11
Stock control/recording	£350	W3
Time/cost recording	£800	S1
Warehousing	£375	P3
Challenger		
Appointment Planner	£25	C7
Invoicing	£25	C7
Mail Shot	£25	C7
Payroll	£25	C7
Purchase Ledger	£25	C7
Sales Ledger	£25	C7
Stock Control	£25	C7
CP/M		
Appointments planner	POR	G4
Arable recording & costing	£1500	C4
Architects package	£750	M6
Auction package	£700	M6
Bill of materials	£500	B5
Bill of materials	£199	T5
Bill of materials	£400	G4
Bill of materials	£850	V2
Bill of materials	£95	M10
Bill of materials	£390	H1
Bookmakers package	£1000	B1
Budgeting package	£95	B5
Builders est	£325	C9
Bursar Package	POR	M8
Cash flow	£250	L3
Cash flow	£95	B5
Cash register	£300	G6
Company secretary	£650	C4
Container accounting	£1250	M5
Contract costing	£2000	L3
Credit control	POR	G4
Customer file	£900	G4
Dairy management	£1500+	C4
Database	£350	B3
Database management/ information retrieval	£450	C4
Database management/ information retrieval	£100	G3
Database management/ Information retrieval	£400	C3
Database management/ information retrieval	£600	G5
Database management/ information retrieval	£225-485	S9
Database management/ information retrieval	£450	V2
Database management/ information retrieval	£155	X2
Database management/ information retrieval	£295	M4
Debt collection	£550	G4
Dental records	£500	G6
Double glazing costing	£1500	V2
Earth parameter collection & quantification	£95	M10
Eire payroll system	£450	M5
Equipment lease/rent/ HP	£400	G1
Estate agent	£700	B5
Estate agent	£850	S9
Farm accounts	£750	C4
Financial & arable management	£220	
Financial modelling	£400	G1
Financial modelling	£95	B5
Financial modelling	£400	S11
Financial modelling	£400	V2
Financial planning	£245	G4
Financial planning	£90	X2
General ledger/NL	£500	L3
General ledger/NL	£400	G1
General ledger/NL	£375	L1
General ledger/NL	£200	B5
General ledger/NL	£275	S7
General ledger/NL	£400	M3
General ledger/NL	£350	B3
General ledger/NL	£300	W1
General ledger/NL	£425	S11
General ledger/NL	£395	G6
General ledger/NL	£300	M5
General ledger/NL	£1000	B1
General ledger/NL	£199	T5
General ledger/NL	£400	M9
General ledger/NL	£950--1250	V2
Hotel management	£525	M4
Hotel management	£750	H5
Incomplete Records	£250	B5
Incomplete Records	£750	M3
Incomplete Records	£975	B3
Incomplete Records	£750	W1
Incomplete Records	£995	M5
Incomplete Records	£155	C10
Incomplete Records	£400	G4
Industrial cleaner package	£1000	B1
Industry factory loading	£1000	X1
Industry work study	£990	X1
Insurance brokers	£995	W1
Insurance broker	POR	G4
Integrated accts	£750	C4
Integrated accts	£1100	G1
Integrated accts	£950	L1
Integrated accts	£690	B5
Integrated accts	£850	S7
Integrated accts	£990	M3
Integrated accts	£900	B5
Integrated accts	£1450	B3
Integrated accts	£1200	S11
Integrated accts	£199	T5
Integrated accts	£3400	M9
Invoicing	£325	L1
Invoicing	£150	S7
Invoicing	£250	M3
Invoicing	£100	B5
Invoicing	£200	B3
Invoicing	£300	W1
Inovicing	£300	B1
Invoicing	£199	T5
invoicing	£400	M9
Invoicing	POR	W4
Invoicing	£400	G4
Jewellers System	£1000	S7
Jewellers System	POR	G4
Job costing	£990	X1
Job costing	£350	M3
Job costing	£395	T4
Job costing	£450	M5
Job costing	£300	B1
Job costing	£199	T5
Job costing	£1500	T5
Job costing	£1500	V2
Job costing	£600	A2
Job costing	£495	C13
Legal precedents	£1150	C4
Letter writer	£150	M3
Letter writer	£99	T5
Letter writer	POR	G4
Magazine subscriptions	£950	S9
Mailing list	£450	C4
Mailing list	£250	G1
Mailing list	£75	S7
Mailing list	£75	S9
Mailing list	POR	G4
Mailing list	£250	U1
Mailing list	£149	M4
Mail shot	£450	G4
Mail shot	£90	M3
Mail shot	£50/150	G5
Mail shot	£99	T5
Membership accounting	POR	G4
Motor dealer	POR	G4
Nominal ledger	£295	P1
Order entry/invoicing	£350	G1
Order entry/invoicing	£500	T4
Order entry/invoicing	£550	M5
Order entry/invoicing	£1000	B1
Order entry/invoicing	£99	T5
Order entry/invoicing	£400	M9
Order processing	£550	L1
Order processing	£99	T5
Order processing	£400	M9
Order processing	£500	G4
Payroll	£450	L3
Payroll	£450	C4
Payroll	£500	G1
Payroll	£475	L1
Payroll	£500	B5
Payroll	£390	M3
Payroll	£450	B3
Payroll	Lease	W1
Payroll	£425	S11
Payroll	£500	G6
Payroll	£450	M5
Payroll	£300	B1
Payroll	£199	T5
Payroll	£600	M9
Payroll	POR	W4
Payroll	£395	G4
Payroll	£325	M12
Perpetual Inventory	£150	B5
Personnel records	£450	C4
Pig management	£1250	C4
Point of sale	£400	M9
Production control	£2400	V2
Property management	£750-1250	C4
Property management	£400	M3
Property management	£1000	B1
Publishers system	£1850	S7
Purchase ledger	£500	L3
Purchase ledger	£450	G1
Purchase ledger	£425	L1
Purchase ledger	£200	B5
Purchase ledger	£275	S7
Purchase ledger	£400	M3
Purchase ledger	£350	B3
Purchase ledger	£300	W1
Purchase ledger	£425	S11
Purchase ledger	£500	G6
Purchase ledger	£200	M5
Purchase ledger	£300	B1
Purchase ledger	£400	M9
Purchase ledger	POR	W4
Purchase ledger	£400	G4
Purchase ledger	£950-1250	V2
Purchase ledger	£450	U1
Purchase ledger	£495	X2
Quotation estimating	POR	G4
Report generator	POR	G4
Requirements planning	£700	V2
Sales ledger	£500	L3
Sales ledger	£450	G1
Sales ledger	£425	L1
Sales ledger	£200	B5
Sales ledger	£275	S7
Sales ledger	£400	M3
Sales ledger	£350	B3
Sales ledger	£300	W1
Sales ledger	£425	S11
Sales ledger	£500	G6
Sales ledger	£200	M5
Sales ledger	£300	B1
Sales ledger	£199	T5
Sales ledger	£400	M9
Sales ledger	POR	W4
Sales ledger	£400	G4
Sales ledger	£950-1250	V2
Sales ledger	£249	P1
Sales ledger	£390	H1
Solicitors	£995	M5
Solicitors package	£2000	M12
S/L, P/L + stock control	£1000	L3
S/L, P/L + stock control	£900	B5
S/L, P/L + stock control	£1200	M9
S/L, P/L + stock control	£500	G4
Stock control/recording	£325	L1
Stock control/recording	£750-1500	C4
Stock control/recording	£350	G1
Stock control/recording	£500	B5
Stock control/recording	£900	M3
Stock control/recording	£300	B1
Stock control/recording	£500	G4
Stock control	£550	B3
Stock control	£300	W1
Stock control	£500	G6
Stock control	£450	M5
Stock control	£199	T5
Stock control	£400	M9
Stock control	£249	P1
Stock control	£350	U1
Stock control	£495	C9
Survey analysis	£645	M6
Surveying	£500	G6
Time/cost recording	£400	G1
Time/cost recording	£200	M3
Time/cost recording	POR	W4
Time/cost recording	POR	G4
Time/cost recording	£750	M6
Time ledger	£350	B3
Typing tutor	£50-125	A5
Utilities	£50	B5
Various thermal insullation industry systems	£2000+	T4
Video hire system	£499	G4
Video hire	£795	L5
Word processing	£400	G1
Word processing	£260	C4
Word processing	£250	M3
Word processing	£250	S11
Word processing	£1000	B1
Word processing	£99	T5
Word processing	£295	X2
Word processing	£350	M12
Word processing	£295	M4
Work in progress	£850	B5
Famos		
Customer file	£1000	M2
Data base	£1500	M2
Integrated accts	£2000	M2
Motor dealer	£5000	M2
Payroll	£1500	M2
Stock control	£1500	M2
Word processing	£500	M2
Grundy 8200		
Bill of materials	£95	M10
IBMPC		
Bill of Materials	£390	H1
Building est	£325	C9
Building services	POR	H6
Database management	£295	M4
Invoicing	£390	H1
Job costing	£495	C9
Mailing list	£149	M4
Nominal ledger	£395	B2
Project management	£1600+	C11
Project management	£1100	M13
Project management	£1100	C11
Sales ledger	£390	H1
Stock control	£395	B2
Stock control	£495	C9
Word processing	£295	M4
Word processing	£375	B4
MCZ Zilog		
Earth parameter collection & quantification	£95	M10
Mail shot	£250	I1
Membership accting	£250	I1
Personnel records	£400	I1
MZ-80K		
Estate agent	£195	W1
Integrated accounts	£150	P2
Stock control/recording	£150	P2
North Star Horizon		
Budgeting package	£95	B5
Building services	POR	I3
Cash flow	£95	B5
Database management/ information retrieval	£250	B3
Double glazing costing	£750	W1
Estate agent	£750	B5

PACKAGES

Application/Machine	Price	Code
Financial modelling	£95	B5
General ledger/NL	£250	B3
General ledger/NL	£400	M3
General ledger/NL	£400	B5
Hotel management	£750	H5
Incomplete records	£750	M3
Incomplete records	£250	B5
Incomplete records	£975	B3
Integrated accts	£950	B3
Integrated accts	£990	M3
Integrated accts	£690	B5
Integrated accts	£900	B5
Invoicing	£100	B3
Invoicing	£250	M3
Invoicing	£100	B5
Job costing	£350	M3
Letter writer	£150	M3
Mailing List	£195	W1
Mail shot	£90	M3
Payroll	£350	B3
Payroll	£390	M3
Payroll	Lease	W1
Property Management	£400	M3
Purchase ledger	£250	B3
Purchase ledger	£400	M3
Purchase ledger	£400	B5
Sales ledger	£250	B3
Sales ledger	£400	M3
Sales ledger	£400	B5
SL, PL + stock control	£900	B5
Stock control/recording	£450	B3
Stock control/recording	£900	M3
Time/cost recording	£250	B3
Time/cost recording	£200	M3
Time/cost recording	£450	W1
Word processing	£250	M3
PET/CBM		
Assembler dev	£50	C2
Bill of materials	£199	T5
Bureau de change	£8	H3
Cash flow	£195	D1
Cheque writer	£90	P3
Credit control	£650	B4
Database management/ information retrieval	£50/150	C2
Database management/ information retrieval	£150	G2
Database management/ information retrieval	£150	J1
Database management/ information retrieval	POR	C1
Database management/ information retrieval	£225	H4
Database management/ information retrieval	£250	C3
File handling	£225	H4
File handling	£645	D1
Financial modelling	£250	D1
General ledger/NL	£200	C2
General ledger/NL	£1000	C1
General ledger/NL	£200	H3
General ledger/NL	£199	T5
Housing association package	POR	M7
Integrated accts	£(50)	C2
Integrated accts	£650	G2
Integrated accts	£650	J1
Integrated accts	£800	S3
Integrated accts	£199	T5
Invoicing	POR	J1
Invoicing	£400	C1
Invoicing	£199	T5
Job costing	£750	X1
Job costing	£199	T5
Mailing list	£35	H3
Payroll	£150	G2
Payroll	£150	J1
Payroll	£150	C2
Payroll	£50/195 195	I2

Application/Machine	Price	Code
Payroll	POR	C1
Payroll	£200/350	C5
Payroll	£10	H3
Payroll	£199	T5
Petsoft programs	£160	J1
Petaid report generator	£250	S3
Prise lister	£12	H3
Production control	£650+	P3
Purchase ledger	£200	C2
Purchase ledger	POR	J1
Purchase ledger	£1000	C1
Purchase ledger	£300	B4
Purchase ledger	£350	H3
Purchase ledger	£199	T5
Sales ledger	POR	J1
Sales ledger	£200	J1
Sales ledger	£300	B4
Sales ledger	£800	C1
Sales ledger	£350	H3
Sales ledger	£199	T5
Solicitor's complete record accounting	£3000	S2
Stock control/recording	£150	C2
Stock control/recording	£150	G2
Stock control/recording	£150	J1
Stock control/recording	£195	I2
Stock control/recording	£15	A2
Stock control/recording	£300	B4
Stock control/recording	£35/25	H3
Stock control	£199	T5
Utility set	£78	H3
VAT master	£25	H3
Word processing	£75/150	J1
Word processing	£75/150	G2
Word processing	£75/150	C2
Word processing	£375	H4
Word processing	£325	C5
Word processing	£35	H3
Word processing	£249	P5
PET/Computhink		
Stock control/recording	£250	R1
Philips P200		
Analysis ledger	£100	P4
Expense Analysis	£150	P4
General ledger/NL	£100	P4
Hotel billing	£500	P4
Incomplete records	£150	P4
Integrated accts	£650	P4
Invoicing	£150	P4
Job costing	£400	P4
Order processing	£200	P4
Payroll	£300	P4
Purchase ledger	£200	P4
Quotation estimating	£400	P4
Renewals ledger	£200	P4
Sales ledger	£200	P4
S/L, P/L stock control		P4
Time/cost recording	£300	P4
Word processing	£230	P4
RAIR Black Box		
Financial modelling	POR	A3
Hotel management	POR	A3
Local government housing maint.	POR	A3
Sharp PC-3201		
General ledger	£450	P2
Sales ledger	£300	P2
Purchase ledger	£300	P2
Sorcerer		
Bookshop stock control	£1450	L2
Car showroom sales	£1900	L2
Department store order program	£2500	L2
Health authority PPM	£2500	L2
Instrument logging	£500	L2



Application/Machine	Price	Code
Invoices	£290	L2
Mailing list	£290	L2
Payroll	£250	L2
Sales ledger	£490	L2
Solicitors package	£3500	L2
Stock control/recording	£390	L2
Tour operators package	£2900	L2
Superbrain		
Bill of materials	£450	T3
Database	£300	S6
Estate agent	£800	S6
General ledger	£400	M3
General ledger	£400	S6
Incomplete Records	£750	M3
Incomplete Records	£1200	S1
Integrated accts	£1200	S6
Integrated accts	£990	M3
Integrated accts	£1000	T3
Integrated accts	£1200	S1
Invoicing	£250	M3
Invoicing	£150	S6
Job costing	£350	M3
Letter writer	£150	M3
Mail shot	£90	M3
Payroll	£400	S6
Payroll	£390	M3
Payroll	£250+	T3
Property management	£400	M3
Purchase ledger	£300	S6
Purchase ledger	£400	M3
Sales ledger	£300	S6
Sales ledger	£400	M3
Solicitors package	£1400	S1
Stock control	£300	S6
Stock control	£900	M3
Stock control	£45	T3
Time/cost recording	£800	S1
Time recording	£200	M3
Word processing	£250	M3
Travel agency accts	£800	S6
S/L, P/L & stock control		
Apple II	£900	P2
Apple II	£1000	T2
CP/M	£1000	L3
CP/M	£900	B5
CP/M	£900	G4
CP/M	£1200	M9
Cromemco	£900	P1
North Star Horizon	£900	B5
Philips P2000	£950	P4
Solicitor's complete record accounting		
Apple II	£3000	S2
PET/CBM	£1785	D1
Solicitor's package		
Act Sirius 1	£1400	S1
CBM/8032	£1400	S1
Compucorp	£2000	Q1
CP/M	£1250	M5
CP/M	£750	M6
CP/M	£2000	M12
Sorcerer	£3500	L2
Superbrain	£1400	S1
Statistics		
Apple II	£150	G3
Apple II	£100-195	P2
Apple II	£140	C8
Tandy Model I	£45	S2
Stock control/recording		
Act Sirius I	£265	O1
Act Sirius I	£195	A1
Apple II	POR	K1
Apple II	POR	S5
Apple II	£150	G3
Apple II	£80	S2
Apple II	£75/300	P2
Apple II	£285	V1
Apple II	£500	S4
Apple II	£490	L4
Apple II	£199	T5
CBM/8032	£175	P3
CBM/8032	£199	T5
CBM/8032	£350	W3
Challenger	£25	C7
CP/M	£325	L1
CP/M	£750-1500	C4
CP/M	£350	G1
CP/M	£900	M3
CP/M	£700	B5
CP/M	£550	B5
CP/M	£250	B3
CP/M	£300	W1
CP/M	£395	G6
CP/M	£450	M5
CP/M	£300	B1
CP/M	£199	T5
CP/M	£500	G4
CP/M	£400	M9
CP/M	£249	P1
CP/M	£350	U1
CP/M	£495	C9
Cromemco	£700	B5
Famos	£1500	M2
IBM	£395	B2
IBM	£495	C13
MZ-80K	£150	P2
North Star Horizon	£250	B3
North Star Horizon	£900	M3

Application/Machine	Price	Code
PET/CBM	£195	I2
PET/CBM	£300	B4
PET/CBM	£150	C2
PET/CBM	£150	J1
PET/CBM	£150	G2
PET/CBM	£250	R1
PET/CBM	£35/25	H3
PET/CBM	£199	T5
Philips P2000	£300	P4
Sirius	£495	C9
Sorcerer	£390	L2
Superbrain	£900	M3
Superbrain	£300	S6
Superbrain	£450	T3
Tandy Model I	£30-50	M1
Tandy Model II	£300	M1
Tandy Model I	£48	S2
Tandy Model I	£200	H1
Tandy Model I	£115	J1
Tandy Model I	£200	T1
Tandy Model I	£375	T1
Tandy Model II	£265	O1
8080/Z80	£275	G3
8080/Z80	£325	L1
Storage tank costing/volumes		
Apple II	£150	S10
Survey analysis		
CP/M	£645	M6
Surveying		
CP/M	£500	G6
Text file librarian		
Apple II	£125	S4
Time/cost recording		
Act Sirius 1	£800	S1
Apple II	£450	S2
CBM/8032	£800	S1
CP/M	£400	G1
CP/M	£200	M3
CP/M	£250	B3
CP/M	POR	G4
CP/M	£750	M6
CP/M	POR	W4
North Star Horizon	£250	B3
North Star Horizon	£200	M3
North Star Horizon	£450	W1
Philips P2000	£300	P4
Superbrain	£200	M3
Superbrain	£800	S1
Tandy Model I	POR	M1
Tandy Model I	£575	M1
Tour operators package		
Sorcerer	£2900	L2
Travel agency accts		
Superbrain	£800	S6
Tandy Model I		
Database management/ information retrieval	£25-50	M1
Database management/ Information retrieval	£270	A4
Database management/ information retrieval	£60	S2
Database management/ information retrieval	£32.50	M11
Database management/ information retrieval	£150	J1
General ledger/NL	£90	M1
General ledger/NL	£200	M1
General ledger/NL	£225	M11
General ledger/NL	£225/325	T1
General ledger/NL	£425	T1
Incomplete records	£25	M1
Incomplete records	£40	M11
Invoicing	£90	M1
Invoicing	£280	A4
Invoicing	£200	M1
Invoicing	£75	T1
Invoicing	£125	T1
Invoicing	£265	O1
Integrated accts	£300	M1
Integrated accts	£550	A4
Integrated accts	£600	M1
Integrated accts	£75	J1
Integrated accts	£795	O1
Investment portfolio	£20	S2
Invoicing	£25	M11
Job costing	£265	O1
Mailing list	£40	M1
Mailing list	£75	M1
Mailing list	£25/38/55	M11
Mailing list	£50-150	S2
Mail shot	£75+	G4
Mail shot	£160	A1
Mail shot	£75+	G4
Payroll	£200	M11
Payroll	£218	T1
Payroll	£375	T1
Payroll	£300+	O1
Purchase ledger	£90	M1
Purchase ledger	£200	M1
Purchase ledger	£225	M11
Purchase ledger	£375	T1
Purchase ledger	£375	T1
Sales ledger	£90	M1
Sales ledger	£90	M1
Sales ledger	£225	M11
Sales ledger	£225	T1

PACKAGES

Machine/Application	Price	Code
Sales ledger	£375	T1
Statistics	£45	S2
Stock control/recording	£30-50	M1
Stock control/recording	£300	M1
Stock control/recording	£200	M11
Stock control/recording	£48	S2
Stock control/recording	£115	J1
Stock control/recording	£200	T1
Stock control/recording	£375	T1
Stock control/recording	£265	O1
Time/cost recording	POR	M1
Time/cost recording	£575	M1
VAT register	£15	M11
Video hire system	£460	A4
Word processing	£74	M1
Word processing	£200	M1
Word processing	£45/95	J1
Word processing	£15	M11
Word processing	£30/60/90	S2
Word procesing	£295+	O1
UCSD-p		
Financial planning	£350	S4
General ledger	£350	S4
Invoicing	£350	S4
Job costing	£350	S4
Micro finesse plus	£475	S4
Payroll	£350	S4
Purchase ledger	£350	S4
Sales ledger	£350	S4
The administrator	£175	S4
Word Processing	£175	S4
Vector		
General ledger/NL	£400	C5
Integrated accts	£1000	C5
Purchase ledger	£400	C5
Sales ledger	£400	C5
Word processing	£40	C5
Victor 9000		
Integrated Accts	£1250	I4
Order processing	£400	I4
Payroll	£600	I4
Project management	£1600+	C11
Project management	£990	M13
Purchase ledger	£325	I4
8000 Series		
Database management/ information retrieval	POR	C2
Integrated accts	POR	C2
Payroll	£250	C2
Purchase ledger	£250	C2
Sales ledger	£250	C2
Word processing	£250	C2
8080/Z80		
Bill of materials	£390	H1
General ledger/NL	£275	G3
General ledger/NL	£375	L1
Integrated accts	£950	L1
Integrated accts	£995	G3
Invoicing	£325	L1
Invoicing	£390	H1
Job order control	£257	G3
Order processing	£550	L1
Payroll	£475	L1
Payroll	£275	G3
Prof appts groups	£275	G3
Prof appts individ	£220	G3
Prof client billing	£330	G3
Purchase ledger	£425	L1
Purchase ledger	£275	G3
Sales ledger	£275	G3
Sales ledger	£425	L1
Sales ledger	£390	H1
Stock control/recording	£325	L1
Stock control/recording	£275	G3

TRANSACTION FILE

Readers will be pleased to know that, due to our clever layout ideas, the Transaction File is up-to-date and waiting cut down considerably. Ads are accepted only on the form below for a flat fee of £2.50. Please don't specify issues as we can't oblige. Ads cannot be repeated unless separate forms are sent in. We will only accept entries from non-commercial readers. Thank you for cooperating.

● CBM 3032, 32k RAM, green display, large keyboard, resident Assembler/Disassembler, high speed cassette system, 2 cassette decks (soundbox), joystick, dust cover, reset button, 40+ programs, £300 ono. Tel: Lowestoft 64160.

● Bargain—New Brain AD, complete with software, incl wordprocessor and home accounts, lots of games with monitor. £250. Tel: 2499895 after 7pm.

● New Brain, £50 off list price. unused and in mint condition, monitor and printer also available. Tel: Robert on Crawley 33273 (eve).

● Apple Microsoft, 16k RAM card, £50; Applewriter, 2 disks and manual, £50; Apple IIE 80-col card, new, £50, post paid in UK. Tel: Webster on Coventry (0203) 503769 (eve).

● TRS80, LII, 32k, printer interface, TC8 high speed cassette system, LM124 Epron programmer, W4W wordprocessor, Assembler, Compiler, etc, £250. Tel: Esher 63198.

● Commodore 8032 with 4040 disk drive, 4022 printer + cables, utility disk and manuals, 2 years old, perfect condition, £1,100 ono. Tel: Billericay 25692.

● HP-41 calculator, £50; HP-82153A "Wand" Optical Reader, £25; HP-82170A Quad Memory Module, £15; HP-82106A Memory Module. £5; HP-15C calculator, £30. Tel: 01-9473799.

● 3032 PET, 32k, green screen, large keyboard, new ROM C2N cass; PET revealed, some software, £290 ono. Tel: 0205 73605.

● Video Genie I, latest model, 16k, as new, built-in monitor, sound, lowercase etc, lots of software: Chess, games and utilities, £220 ono. Tel: 021-422 1975.

● Tangerine Micron, 8k RAM, Microsoft Basic, M/code Assembler, parallel and serial interfaces, £120; Creed teletype, adapted for use as printer, software available for Tangerine or Nascom, £50. Tel: Tibberton 325.

● NEC PC8001BE, 32k RAM + 24k ROM keyboard + PC8031BE 2W Dual mini-disk drive + high resolution colour monitor, complete with all manuals, all units in superb condition, accept £1,200 ono, can deliver anywhere. Tel: Welwyn GC (07073) 39023.

● CBM 4032 for sale, £375, seldom used, with some software; also CBM 3032 at £300. Tel: Adrian on 021-784 0077.

● Sharp MZ-80B + MZ-80P5 printer, business system, 2nd graphics, expansion unit, all interfaces (including IEEE, RS-232 parallel 4 series), excellent condition, leads, cables, boxes, dust cover. £1,250 ono, must sell. Tel: Tim on 0625 21703.

● Tuscan 64k with 4 8in floppy disks + desk, MX-80F/T2, I/O-4 VDU. Diablo daisywheel, CP/M + software + hardware manuals, £1,600 ono. Tel: Horsham 69040 eve.

● PET 3032 (32k RAM), toolkit, cassette deck, 4040 dual disk drive, 3022 printer, leads, books, manuals, games/education software, all in excellent condition. £850 ono. Tel: Alan Dean on Mansfield 823999.

● Printer—Seikosha GP80, as new, boxed + 2000 sheets, £140; Acorn Atom disk pack + utilities, £240; Atom 15k RAM, 12k ROM, A/D + D/A, sound IC, joysticks, 5 × utility ROMs + cassette + cabinet, £220. Tel: Melton Mowbray 69119.

● New Brain model AD, as new condition, beginner's guide and tape, £225 ono; Tangerine Microtan in mini pack with PSU manuals, £50 ono. Tel: Harpenden (05827) 5679.

● Command-o ROM IC, complete with 77-page user guide for CBM/PET 8032, extends Basic 4.0. 39 commands, simplifies writing, debugging, formatting hard copy etc, saves hours, yours for £25. Tel: 0595 5962 eve.

● PET 2001, 32k RAM, 3040 dual disk drives, 3022 printer, Wordpro ROM. £600. Tel: 01-584 7580/9097. London SW7, ask for Zarina.

● Video Genie computer with built-in tape recorder, typewriter keyboard, 130 programs worth £220, all manuals, compatible Atari joystick are included. would cost £550, will accept £195. Tel: Ware 4186.

● Exidy Sorcerer 32k computer + wordprocessor, all back issues of European Sorcerer Club + much software included, a bargain at £325. Tel: Tonbridge (0732) 350981, ask for Andy.

● MZ-80K Roulette—bet at the table and watch the wheel spin; Brag—bet against the computer's hand, each £350. Send cheque to: A. Balfour, 50 Freemans Close, Stoke Poges, Bucks.

● TRS80 Level II, 16k VDU, CTR 80. cassette. numerous books, software, including Statistics, Accounts etc, £200. Tel: 01-377 4810 day, 01-850 2676 eve.

● CBM 4032 with Cortex hardware and software emulating intelligent teletype terminal to mainframe, cassette, Paper Tiger graphics printer. £ £s worth of software language, education, business, games, utilities), £800 ono. Tel: Medway 53556.

● PET Model 4016, as new, large keyboard, external cassette deck, all manuals and small selection of games, £350 ono. Tel: Kintbury (0488) 58279.

● 32k PET, ungraded 2001 model + cassette + reset + manual. Microchess and some other games, £200 lot; also PET revealed. £3.50; PET companion, £2.50; PET Personal computer guide, £4.50. Tel: Coinbrook (02812) 3854.

● Speech synthesiser, works with any computer, leads, manual, built-in cabinet, uses own power supply, unlimited vocabulary, one month old, easy to use, perfect condition. £50. Tel: 0652 648074.

● Sharp MZ-80K, 48k RAM + manual, Space Invader games etc, Apollo wordprocesor and Super Copy, one year old, practically unused, original packaging, £290, can deliver. Tel: Reading 744497.

● Transtec BC2 business micro, 64kb. 2 × 400k disks. integral green screen monitor, full detached keyboard. CP/M etc, some disks available, all offers considered. Tel: Steven on Cambridge (0223) 316330 after 6.45pm.

● Sharp MZ-80A. under guarantee until February, very good condition, as new, complete with dust cover and manual. £450 ono. Tel: Bourne 422853 after 6pm.

● Sharp MZ-80B + P6 printer + Basic + Pascal Compiler + Wordpro + Assembler + Disassembler + Chess, 12 levels + lots of games and utility programs, all in excellent condition, fully documented, £1.400. Tel: 01-644 1944 eve after 6.

● Video Genie EG3003, lowercase

TRANSACTION FILE ADVERTISEMENT FORM

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h/ware, sound, arrow keys fitted, lots of software including games, Edtsam, L3 Basic, Mon4. TBug etc, £165 ono, new baby forces sale. Tel: Pelsall 691105.

●TRS-80, 48k MI LII, complete with interface tape recorder, printer and single disk drive, with manuals and joystick + games on disks and cassettes, with monitor, £1.100 ono. Tel: Birmingham 742 1633.

●Sharp MZ-80B, 700k, twin disks, CP/M Basic Profes, database, Sharp printer, over 50+ programs and approx 40 disks, offers around £1,500, will deliver or tutor free. Tel: 0222 568286 or 552228.

●TRS80, 16k L2 + 32k Exp/Int, CRT, Assembler, editor, tapes + £60 worth programs, dust covers, manuals, books, £350 ono. Tel: Bath 833794.

●TRS80 Model 1, 48k, green monitor, dual drives, word processing, Viscalc, LDos, TRSDos, Pascal, £490 ono, with Centronics 737 printer, £750. Tel: 01-445 5724.

●Sharp MZ-80K, 48k + Frogger, Invaders, books, 9 months old, accept £275 ono. may be able to deliver. Tel: Paul on 0908 312735.

●MZ-80K, 48k, 4mHz, upgrade reset switch fitted, Pascal Compiler, Assembler, Disassembler, manuals, documented listings, (Basic, monitor etc) + many games, excellent condition, cost £600 new, will acccept £275+. Tel: Luton 881252.

●Apple II Plus, Dos 3.3, 2 drives, 16k RAM card, Alf 8088 co-processor, Applesoft tool kit, Forth, Tiny Pascal, Videx 80-col card, many Apple books, programs etc. £1,100. Tel: Bitton 5040.

●Apple II, 64K Europlus, as new with twin disk drives, Dos 3.3 controller card, monitor, Silentype printer, paddles, tons of software including business and games, £1,500. Tel: 0582 603992 (Dunstable).

●Wanted— Apple II or IIE, also printer and colour monitor, have software available for swop, send list. 30 Teignmouth Road, Holcombe, Dawlish, Devon. Tel: 0626 862455.

●For quick sale— BBC micro model A, 32k, as new and ready to run, with cassette and games tapes, will sell for £299. Tel: 391 1688 after 4.

●Atari VCS games computer, good condition, with Combat, Circus, Breakout, Indy 500, Astroids, Space Invaders, Air-Sea-Battle, Dodge'em, Warlords, Adventure, Defender, original value £350, bargain at £175. Tel: 01-6078669.

●Sorcerer, 48k, Basic pack, W-P pack. Eprom pack, 2 × S100 expansion boxes and 2 × Jade DD disk controllers. CP/M 2.2, Paper Tiger 460, Dual 8 line drives, monitor, software, back nos., etc, sensible offers. Tel: Steve on Bristol 24161 ext 519 days or Bristol 732509 eve.

●VIC-20, Wordcraft 20 word processing cartridge with instruction manual, very good w/processing bought for wrong typewriter, £60. Tel: Cecil Howard on 061 485 5704 (Manchester).

●Sharp MZ-80A, new, boxed and guaranteed, the machine + software worth over £1,000, 11 m/c games, 7 Basics, Hi-Soft Pascal, Fortran Complier, Forth and much, much more, only £395, grab this bargain before somebody else does. Tel: 01-7203353 Now!

●For TRS80 I/III Tandy (Micropolis), boxed disk drive, 148k, £90; LDos 5 1/3 disk operating system (latest), £65; Newscript word processing, £30; Accelz basic Compiler, £15. Tel: Eric on 01-302 2350 eve.

●TRS80, 16k, Mod I LV2, 6 months old, 70 programs + Kwik-key + cassette player + printer + amplifier, worth £350+, sell for £175 ono. Tel: P. Tucker. Flat 7, Southampton 555902 eve or 23855 ext 2711 day.

●Colour Nascom-2, 48k, 315 disk, Poloydos disk Basic, Pascal, Polytext, AVC, gives 8 colours, 784 × 256, cased with numeric keypad, fan, speaker, £200+ of software, £875 or offer. Tel: Royston (0763) 61482.

●VIC-20 16k RAM, joystick, cassette unit, Sargon, Chess and Star Battle carts, 40 column screen, games tapes, books, VIC revealed, Innovative Computing, programs, ref guide, only £200. Tel: 01-749 3829.

●Nascom 2, 64k RAM, Zeap, Nas-Sys 3, Nas-Dis, debug, ext Basic, graphics, PSU, professionally built and cased with complete documentation. £230. Tel: 061-973 1487.

●Apple II+, 48k, language card, Pascal system, paddles, TV interface, case, much software. (Flight Simulator, Prisoner, Adventures, Asteriods), £600 or best offer. Tel: John on 01-995 1770.

●VIC-20, cassette unit, 16k extra RAM, joystick, lots of books and software, excellent condition, total cost £330, will accept £180. Tel: 0782 750333 before 5pm or 0782 751201 after 6pm.

●Apple II, (Epson) printer interface, one month old, with graphics dump, value £85, books value £32, software including Threshold, Beer, Run Higher Graphics, Adventures, value £70, all half price. Tel: Berkhamsted 5570.

●New Brain AD, inc manual, cassette and printer leads, beginner's guide and tape, offers around £200; also technical manual £35. Tel: 01-441 3152 ext 244 office hours.

●TRS80, level 2 16k CPU monitor, cassette recorder, line printer VI, Scripsit word processing, Basic teaching program, manual, leads, offers around £425. Tel: 021 308 3335.

●Apple II Eurplus. 48k. with disk drive and controller (Dos 3.3), TV modulator, paddles, manuals, perfect condition, £700. Tel: Westerham (0959) 63214 eve or 63138 daytime.

●Ohio Scientic C28-P, twin 8in disks = ½Mb 48k RAM. OS-65U operating system and M Basic, Televideo 920 VDU cables, disks and manuals, £895 ono, may sell separately. Tel: ??? ??? ???.

●Wanted—Sharp MZ-80B software, second-hand business and games. Most interested in S/H graphics RAM 2. Offers after 8pm on Camberley (0276) 61948, ask for Richard.

●Atari 400 + program recorder + joysticks + much software + manuals, hardly used, guarantee, would cost £450, will accept offers of £300. Hurry— quick sale imminent. Tel: Nick on 01-603 7905.

●Sharp MZ-80K. 48k RAM, 18 months old, excellent condition, boxed with manual and games, including Space Invaders, Fen ter and Quest, £250 ono. Tel: Boldon (0783) 362840 after 5pm.

●Superbrain, 64k with twin disk drives, software includes Supercalc, Spellbinder, M Basic, Compiler, £500. Tel: Dorchester 68198.

●Spectrum 16k, brand neew and still boxed, unwanted prize, £80 ono Tony Graham, 5 Sation Road Digswell, Welwyn, Herts. Tel: Welwyn (043871) 4855.

●Every issue of PCW, Computing Today and Practical Computing; also Creed teleprinter; also Atari Console and cartridges. Tel: Tunbridge Wells (0892) 41396 for details.

●M20— games from Germany!!! Pacman and 15 others. £22 incl P&P + diskette. Send a cheque please to: Rapp Dauziger Str 18, 7133, Haulbroun, West Germany.

●Dual drive/computer case, 15in × 12in × 5in, Astec dual SM, PSU, 40/80 switching units, takes full height or 2 slimline + add boards, all cables, ready to use, 6 months old, excellent condition, £120 ono. Tel: 051 644 6568 (Merseyside).

●Cromenco 32k bytesaver wanted, will buy or swop for 64kZ, 4/16FDC, SCC or ZPU. Please write: David Murphy, 69 Cherryfield Ave, Dublin 12, Ireland. Tel: 01-500227.

●Video Genie 1 with high-res unit sound box, Kaga B/W monitor + numerous (4 C60 tapes), games utilities, books, etc, £325 ono. Tel: Findhorn 03093 2580, ask for Clive Stephenson.

●Sharp MZ-80K with 48k RAM, excellent condition, in original box, £245 ono; Sharp Assembler including manuals, £10. Tel: 01-992 1268 (West London).

●VIC-20 + 16k RAM, C2N cass, joystick, ref guide, prog aid + cartridges including Avenger, Cloudburst, Music Composer, Spiders of Mars + tapes including Blitz, Panic, VIC Men, all in excellen condition for only £175 for quick sale. Tel: 061-736 1534.

●Tantam, fully expanded, £60; also Columbia wordprocessor, Dive Bomber, Shuttle Lander, Zodiac Adventure + Tug mags from No. 5, Tansoft Gazettes, offers? Tel: John Harmer on Tewkesbury 72896.

●Sharp MZ-80K, 48k RAM, immaculate condition, loads of software, 5 Basics, Pascal Compiler + Interpreter, Forth, Adventures, Galaxians etc, dust cover, manuals, worth over £550 sell for only £290 ono, will deliver. Tel: 0494 39283 after 7pm.

● Sharp MXZ80K. 9 months old + software, Frogger, Space Invaders, etc + manuals, £275 ono. Possible delivery. Tel: (0908) 312 735.

● Apple II 48k, IT Tdisc drive, discs and lots of software. Very good condition, £550 ono. Tel: Rotherham (0709) 878293 after 5.30pm, weekdays, anytime weekends.

● Personal Computer World, all 1978 except June, all 1979 except November, all 1980 except January, 1981 complete. 1982 complete. Practical Computing December 1979 to November 1982, £25. Tel: 01-366 8820.

● Sharp MZ80K (48k) + dual disc drives + P-6 printer + I/O and cables + blank floppies and tapes. 7 months old. Bargain £1.100 ono. Tel: 01-341 0179, Barry.

● TRS80. model 1 level 2 48k, Lowercase. expansion interface, disk drive, Microline 80, 47 discs including 11 games disks. System, language, and Assembler programs with numerous others, £950 ono. Tel: Verwood 824025.

● ATARI owner with 48k. Disk and tape. Will swap games and utilities, anything considered. Tel: Worthing (0903) 42013 eve only.

● Sharp MZ80K, 48k + Quantum hi-res graphics, basic and forth languages, manuals, games, books, Sharpsoft mags, £350. Tel: (061) 224 9835 between 5-6pm.

● Wanted disk drive for Sharp MZ-80K 48k together with floppy disks and interface. Contact, Anthony Sh wman, 14 The Parade, Swinton, Manchester. Tel: (061) 794 1887.

● Lomac Tina with twin disc dr Centronics 702 printer, sales ledger, purchase ledger, nominal ledger. 4 days tuition £3.500. Tel: 0443 773779.

● R.G.B. colour monitor. Brand new, unused, still under guarantee. Superb for BBC, Apple, etc. Cost £280. Will accept £180 or very near offer. Tel: Swift, Chester-Le-Street 888364 (eves)

● Memory 230064k. Integral green phosphor VDU and 2X 156k disk drives (5¼in). CPM 2.2 + utilities. Microsoft Basic, assembler + software, £1,100 ono. Tel: Swift, Chester-Le-Street 888364.

● Sharp MZ-80K 48k RAM, £300. Software:- GBasics, Forth, Pascal, Fortran, M/Cloader utilities:- wordpros, editor/assem, disassembler, stock control, music/editor, etc + 200 programs, £85. May split. C. Yan, 8 Stanley Terrace, Fishergate Hill, Preston, PR1 8JE.

● Acorn ATOM. 12k + 12k F.P. ROM, toolbox, manual, leads, all included. Quick sale, so only £100 ono. Tel: (0[illegible]) 710637 (after 5pm).

ACC NEWS

Rupert Steele presents his monthly round-up of news from the Amateur Computer Club.

NewBrain users

With the demise of Grundy Business Systems the need for a NewBrain users group becomes more acute than ever. The contact I mentioned in a previous column, Angela Watkiss, is still intending to go ahead but currently Ingroup is the operational user group. Run mainly by Anthony Hodge on a non-profit basis, Ingroup (Independent NewBrain Users' Group) is based in Wakefield. The group has already published several newsletters which are well written and compiled in a chatty style. The group is still small as is the amount of technical material printed but as membership grows I'm sure the newsletter will become invaluable to NewBrain owners. With that in mind, Anthony invites you to send him articles, software reviews and software for the group library, as well as offers of administrative help. Written material should be carbon-ribbon typed and camera-ready, or else submitted on cassette. The address is Anthony D Hodge, Ingroup, 15 St John's Court, Wakefield WF1 2RY. A sample newsletter can be had for £1: send £9 for a full year's subscription — but only £8.50 via 'Transcash' to account No 64 203 3005. Transcash is a Post Office facility which saves a lot of administrative hassle, so maybe there's a lesson here for other groups. Anyway, good luck to you, Anthony.

The Hardware Exchange

Another new development on the national scene is the setting up of 'The Hardware Exchange'. The idea is that people pay a small fee to advertise through the exchange; a register is compiled and free enquiries can be made with a *sae* by buyers. I don't know if this group is amateur or profit-making, but if you want more information about the Hardware Exchange, write to D Edwards, The Hardware Exchange, PO Box 13, Birkenhead, Merseyside L42 4RL.

I presume that Mr Edwards is using a computer to hold his register. Anyway this kind of arrangement seems to be useful, so why not give it a try?

Attention Jupiter users

A Jupiter Ace Users' Club has been set up by John Noyce of Remsoft. Unlike Ingroup, it appears to be a commercial venture in the same light as Beebug or Tug (only rather smaller than the former). The club has a newsletter and some discounting arrangements for hardware and it seems to be selling software. Nevertheless, I'm sure that the club will prove to be of great value to Jupiter Ace enthusiasts. I'm afraid that my Old Brain is not Reverse Polish (see 'Maths at a Pass', *PCW* November 83), and I therefore can't cope with Forth. I also have big fingers and can't cope with the keyboard. Apart from that, I think the Ace is a great machine. Anyway, for information on the Jupiter Ace Users' Club, contact John Noyce, Remsoft, 18 George Street, Brighton BN2 1RH or phone 0273 602354.

The Deep South

Moving south, Mr T A Kayani, chairman of the Sobat Computer Club, wishes to announce that enquiries about the club should now be addressed to him at 12 Calderon Road, London E11 4EU — and not to the old address. He promises that the address will not change again ('What never? Well, hardly ever!'). So if you live in or near to E11, why not write or phone 01-556 5423?

Dennis Warburton writes from 69 Mount Crescent, Warley, Brentwood, Essex CM14 5DD (tel: 01-592 3060) to tell me of his firm's computer club, which meets on the premises of May and Baker Ltd of Dagenham. The club is principally for employees and their families.

Laurence Fisher, further south at 21 Manwood Avenue, St Stephens, Canterbury CT2 7AH, is the (temporary) chairman of the East Kent Microcomputer Users' Club.

ACC NEWS

It meets monthly at the University of Kent Computing Centre. Write or phone Canterbury 65948 for details.

Moving west to the West London Personal Computer Club (WLPCC): it meets in the back room of the Fox and Goose Pub, (best place, I say), Hanger Lane, Alperton, on the first Tuesday of each month at 7.45pm. In addition, there is a BBC sub-group which meets on the third Tuesday of the month. Graham Brain (tel: 01-997 8986) has sent me a programme of the club's forthcoming first Tuesday events which goes far enough ahead for the publication lead time (and my inefficiency):

1 December 83—Christmas Special (Don't bring your micro to this one!!)
2 January 84—Graphics
3 February 84—Forth Interest Group
4 March 84—A talk by David Annal (Hooray!!!)

I'm glad to see that Graham is cheered by the prospect of a talk by the ACC secretary. For more info, contact WLPCC secretary, Victor Szwed, 11 Grasmere Avenue, Acton, London W3 6JT.

David Price of 46a Bickersteth Road, Tooting, London SW17 9SQ is starting a club—it might be for work only. Phone him on 01-767 4684 to find out.

And from the teeming metropolis to the comfortable (if loosened) commuter belt . . . Hilary Osmend of Elmbridge Computer Club writes from 29 Esher Avenue, Walton-on-Thames, Surrey KT12 3SZ. The ECC meets every Saturday afternoon (3-6pm) at a mystery location (Hilary will no doubt reveal this for a suitable consideration). The club has an age range of 10-70 years in the current membership, and it 'has an interest in six New Brains'(?!*!).

Also in deepest Surrey is Mr D Wilson of the Caretakers' Bungalow, All Saints C of E School, Aperdale Road, Leatherhead, Surrey. He is interested in running a club using the school premises and seems to be after the Computer Town image, with no reservations about games and ten-year-olds. Queue here please . . .

Also in Surrey is the Kingston Computer Club. It meets on the first and third Tuesday of the month from 7.30-9pm. Information about the club is on Prestel page 8008000 in the Club Spot 800 area. The meetings are held in the Children's Section of Kingston Library, Fairfield West, Kingston. More information is available from Bob Southall (01-399 0898).

Further south still (yes, these people think London is in the North) we get to Nicholas Blackburn of 27 Kirkstall Close, Eastbourne BN22 0UQ, East Sussex. He helps run a computer club, and would be delighted to hear from you.

Paul Hills of the 6809 user group in Cornwall writes to tell me about the group he is running in collaboration with Mr Warren Gibbons, of 9 St Thomas' Hill, Launceston, Cornwall PL15 8DL. They are essentially a newsletter group rather than meeting-based, so you don't have to be Cornish to be involved. They are after a membership of hardware hackers and definitely discourage space-invading. This group will appeal to those interested in technical aspects of the Motorola 6809 chip. Write to Mr Gibbons for more information. Incidentally, I was offered a copy of their newsletter. I'm always very pleased to receive club newsletters, and will use them in writing ACC News. I put commercial junk mail where it belongs.

And that's it for another issue, and the year. I look forward to seeing members of the club movement at shows during 1984, and (if the restructuring of ACC comes through) at ACC Council.

To find out more about the ACC, or to pass on news for the column, please write to me, Rupert Steele, at 17 Lawrie Park Crescent, London SE26 6HH. Tel: 01-778 6824.

NETWORK NEWS

Peter Tootill gives his monthly summary of what's new in the telephone networking world

New bulletin boards:
There are two new bulletin board systems to report this month, both running on Atari computers. **Efficient Chips** (don't blame me, I didn't choose it!) is run by an Atari dealer in Chippenham, Wilts (tel: (0249) 657 744). It operates daily (except Wednesday and Sunday) from 9pm to 2am and provides message facilities, a download section and electronic shopping. The system caters mainly for Atari users, but users of other systems are welcome.

Southern BBS operates in Chichester, East Sussex (tel: (0243) 511077) every evening from 8pm to 2am. It runs on an Atari 800, but caters for users of all systems. Facilities include messages, download, and so on.

New phone numbers:
CBBS-NE has a new phone number as from 27 October. It is (0207) 543 555. Other details are as before.

File transfer between computers:
There are several methods of transferring files between computers by telephone. The simplest is to send the file in ordinary ASCII code, with no error checking or correction procedures. Even machine code can be sent this way by translating the individual bytes into ASCII representations of the two halves. For example, the byte 'FE' which requires 8 bits to send as it stands, can be transmitted by a system using 7-bit word length by sending a letter 'F' followed by a letter 'E'. This requires two bytes and makes transmission twice as long. It is, however, the only way machine code files can be transferred without special procedures.

The problem with sending data via the telephone is that a noise on the line can corrupt the data. This may not be a serious problem with, say, a text file, as the human brain is very good at compensating for such errors from clues in the surrounding text. However, in a computer program a small error could be disastrous, and may not be easy to find, especially in machine code. One way to reduce the probability of such errors is to transmit the file in blocks, and to calculate the checksum of each block, with the receiving computer requesting re-transmission if the checksum doesn't agree with that sent by the transmitting system. This is not a complete solution since two errors may compensate for each other to produce a correct checksum even though the data is wrong, but it is a great improvement on sending files with no validation at all. More advanced methods will use complex checks on the data, and can give virtually 100% error-free transmission.

One particular set of protocols for improving the reliability of transmission of data was developed by Ward Christensen for inclusion in his Modem and Xmodem series of intelligent terminal programs written for CP/M systems. (These are available from the CP/M user group library, the latest versions being Modem 7.65, and Xmodem 5.0.) These protocols, often referred to as CP/M or Xmodem protocols, have been applied to other systems, and have become a popular standard in North America. They are incorporated in many smart terminal packages and often supported by bulletin boards including several UK systems, making for much more reliable downloading of programs than would otherwise be possible. They use an eight bit standard (with no parity) and can transmit machine code without the need to translate them into ASCII code first. The details of the protocols are available from CBBS-NE, Forum-80, Hull, and Liverpool Mailbox, and perhaps other UK systems too.

If you are thinking of writing smart terminal software, consider including Xmodem protocols in the package. (I hope to be able to give details on this in the near future.)

Terminal software:
Speaking of smart (or intelligent) terminal software, I have received details of two new packages: one is for BBC systems, the other for TRS-80 Colour Computers.

Telstar is available for the Tandy Colour Computer (16 and 32k versions—disk only at present), and provides all the usual terminal facilities, including the ability to select word length, parity, baud rate, etc (1200 baud operation is supported). It works in full or half duplex mode, and incoming data can be spooled to disk via a memory buffer with Xon/Xoff flow control. The buffer is 24 kbytes on a 32k computer. The screen display is in inverse video, and other features include auto logon, automatic downloading of programs, uploading of prepared messages, programs, etc. The system comes with a 32 page manual and ASCII to binary conversion utilities for £24.95. Cassette and Dragon versions are in the pipeline.

Details from: Rainbow Software, Rainbow House, 27 Uwch-y-Nant, Mynydd Isa, Near Mold, Clwyd CH7 6YB. Tel: (0352) 55248.

Bterm is for the BBC Model B (OS 1.0 or later), disk or tape systems. Again it provides all the usual terminal facilities, including control of the RS232 settings, full and half duplex, memory buffered input/output with Xon/Xoff flow control. Other features include auto download and uploading of messages and programs, ASCII to binary translation, execution of any MOS command. 1200 baud operation is supported. Bterm costs £7.95.

Details from: A Hood, 545 Fox Hollies Road, Hall Green, Birmingham B28 8RL.

UK systems run by commercial organisations, which are free at least in part:

DISTEL. Tel: (01) 679 1888. Run by Display Electronics (new and surplus electronic and computer equipt, components, etc). The system provides information about stock lines, credit card sales, and some message facilities. 300 baud only at present. Cost: free. 24 hours.

REWTEL. Tel: (0277) 236628. Run by Radio and Electronics World, the publishing side of Ambit (electronics components suppliers). Information on stock lines, some message facilities, credit card sales, the latter only for subscribers. 300 baud only at present. Cost: limited areas free, remainder £10 annual subscription. 24 hours.

MAPTEL. Tel: (0702) 552 941. Run by Maplin (electronic components and microcomputers). Provides information on stock levels, credit card sales to existing customers only. 300 baud only. Cost: free. 24 hours.

Subscriber commercial systems in the UK:

PRESTEL. Subscribers only: Prestel consists of a database made up of individual pages provided by

NETWORK NEWS

many different organisations (not by Prestel itself). 1200/75 baud service at local call rates for a large percentage of potential users. 300 baud service on London telephone number only, at present. Cost: domestic subscribers £5.00 per quarter and no time charges outside peak periods. 80 per cent of pages are free. Business users: £15 per quarter and 5p/minute up to 6pm and Saturday mornings, no time charges outside these hours (time charges also apply to domestic users). Information: tel: Freefone 2296.

MICRONET 800. An organisation providing information within the Prestel database specifically aimed at microcomputer users. Service details as Prestel. Cost: £50-£75 joining fee (covers acoustic coupler and software — for a limited range of machines at present) and £8 per quarter on top of normal Prestel charges. Information: Micronet 800, 8 Herbal Hill, London EC1R 5JB. Tel: (01) 837 3699.

Subscriber business systems in the UK:

The following are fully fledged commercial systems aimed at business users:

TELECOM GOLD. Info from: Julie Ireland, 42 Weston Street, London SE1 3QD. Tel; (01) 403 6777.

COMET. Message handling system giving user facilities for leaving and retrieving messages: costs £30 per month. Info from: John Douglas, BL Systems Limited, Grosvenor House, Prospect Hill, Redditch, Worcs. Tel: (0527) 28515.

UK networks:

CBBS North East . . . System Operators: Trevor Smith & Malcolm Piper. Tel: (0207) 543555. Hours: 2.30pm-9am daily. Tel: (0207) 32447. Hours: 7pm-midnight CCITT standards; midnight-8.30am Bell 103 (US) standards.

Mailbox-80, Stourport . . . Tel: (0384) 635336* **System Operator:** Jim Roden. Hours: 6pm-8am daily (ring back system).

Forum-80 Hull . . . (Forum-80 HQ) Tel: (0482) 859169. **System Operator:** Fred Brown. International electronic mail, library for up/down loading

Forum-80 Users Group, Pet Users section shopping list system. Hours: Tues/Thurs 7-10pm; Sat/Sun 1-10pm; nights, midnight-8am, US (Bell 103) standards.

Forum-80 London . . . Tel: (01) 902 2546. **System Operator:** Victor Saleh. Electric mail, library for downloading. Hours: Evenings & weekends.

CBBS London . . . Tel: (01) 399 2136. **System Operator:** Peter Goldman. Facilities: electronic mail, program downloading. Hours: Sun 5-10pm.

Forum-80 Milton . . . (TRS-80 Users Group 80-Nett) Tel: (0908) 613004. **System Operators:** Leon Heller and Brian Pain. Electronic mail, library, newsletter. TRS-80 information system. Hours: 24 hours daily

Mailbox-80 Liverpool . . . Tel: (051) 428 8924. **System Operator:** Peter Tootill. Electronic mail, downloading, TRS-80 information. Hours: 24 hours daily

ACC . . . members bulletin board. Tel: (0908) 44262. **System Operator:** Peter Whittle.

TBBS, London . . . Tel: (01) 348 9400* **System Operator:** John Newgas. Hours: Daily 9am-1am V21 (European) tones, 1-7am Bell 103 (US) tones.

Note: Estelle. Tel: (0279) 443511 V21 (Datel 200); (0279) 441188 (Datel 600); (0279) 441222 (Datel 1200). For customers of STC Electronic Services. Office hours only.

The above information is correct and current, to the best of my knowledge, but I would be pleased to receive corrections and updates, either via Liverpool Mailbox, or to 7 Stockville Road, Liverpool L18 3EJ.

* Ring back system — dial the number, let phone ring once and then ring back.

American/Canadian networks

TYPE	SYSTEM NAME	NUMBER	NOTES
Forum 80	HQ system	0101.816-861 7040	
CBBS	HQ system	0101.312-545 8086	
FBBS	HQ system	0101.312-677 8514	
ABBS	Ottowa, Ontario	0101.613-725 2243	
ABBS	HQ system	0101.703-255 2192	
MABBS	Fort Walton Beach	0101.904-862 1072	
Bull-80	Alabama	0101.205-492 0373	
Conn-80	Colour Computer	0101.212-441 3755	colour graphics for TRS-80 Colour

European networks

ELFA	ABC-MONITOR Sweden	010.468 7300706	Half duplex
ABC-Banken	Halmstadt, Sweden	010.463 5110771	
ABC-MONITOR	ABC Club of Sweden	010.468 801523	Passwords required
CBBS	Gothenburg, Sweden*	010.463 1292160	75/1200 baud
		010.463 1690754	300 baud

* After receiving the tone and connecting your modem, either type: <C/R> or type: <COM C/R>. The system then asks for a password which is: 'cbbs' *in small letters*!! If you only get '>' when you dial up the system needs resetting and you type <I> C/R.

COMPUTER TOWN UK! NEWS

Margaret Spooner brings you the latest news on Computer Towns.

Computer Town UK! attracted a large number of interested visitors at the *PCW* Show.

'We were able to provide a lot of advice to people, both in terms of where to go within the Show, who to contact outside, where CTUK! s are operating and so forth,' commented Jon Finegold, co-organiser with Peter Kiff of the CTUK! stand.

Among the people who contacted CTUK! at the Show were two from Information Technology Centres. Jon said: 'Discussion with these people made us realise that the ITeC scheme could provide an excellent vehicle for CTUK!.' an idea that will be pursued further.

Jon and Peter were pleased with the number of CTUK!ers who helped throughout the Show. 'They showed great interest and assisted the visitors well,' they said.

Many thanks also to WH Smith, Commodore, Tandy and Sinclair for the loan of equipment.

The following people have written to us for guidelines with a view to starting Computer Towns:

Eileen Fawcett
15 Berbice Road
Liverpool 18

BC Pierce
Head of Computer Education
Queen Elizabeth School
Oakley Road
Corby
Northants

Matthew Ponting
Outset ITeC
Drake House
Creekside
Deptford SE83DZ

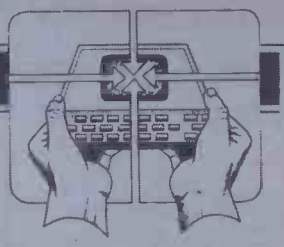
RF Swallow
East Devon College of Further Education
Tiverton
Devon

If you live near them and are interested in joining a Computer Town, do contact them. They're sure to welcome your support.

Guidelines have also been sent to John Mileham, assistant education secretary of the Royal Arsenal Co-operative Society, Woolwich. The RACS Education Department is to start a non-profit making computer club in the Woolwich area which could become the base for another Computer Town. John said: 'We will be offering free access to many machines including a large mainframe. It's a bit out of date but great fun.' So if you want to know more about all sorts of computers and live around Woolwich, contact John.

Computer Town UK! is a rapidly expanding network of computer literacy centres where members of the public are given free access to all sorts of computer equipment. This is courtesy of those willing to offer time/resources. You can find a Computer Town anywhere — they're often in libraries or schools. The aim is to make micros enjoyable and non-threatening, so axe-grinding of any sort is banned. Guidelines are available for those interested in starting up their own Towns. Write to: Margaret Spooner, Computer Town UK!, PCW, 62 Oxford Street, London W1A 2HG. Remember to enclose an A4 SAE for your reply. Please don't ring PCW for information as Computer Town UK! is entirely a spare time activity.

COMPUTER TOWN UK! CONTACTS



*For further information on Computer Town UK! see Prestel page *800803*

Tony Cartmell
54 Foregate Street
Worcester WR1 1DX

Ted Ellerton
25 Beachdale
Winchmore Hill
London N21

Bill Gibbings
2 Longholme Road
Retford
Notts DN22 6TU

Peter J Kiff
2 Ranelagh Grove
St Peter's in Thanet
Broadstairs
Kent CT10 2TE

John Stephen Bone
2 Claremont Place
Gateshead
Tyne & Wear NE8 1TL

Andrew Stoneman
135 Birchdale Avenue
Newcastle-Upon-Tyne
Tyne & Wear

Derek Knight or Bob Carter
Rayners Lane Library
Imperial Drive
Rayners Lane
Middx

Christopher Bates
Ashford Main Library
Church Road
Ashford
Ke[illegible]

Paul Maddison
Gardenways
Chilworth Towers
Chilworth
Southampton SO1 7JH

Chris Cooper
110 Church Road
Hanwell
London W7

Brian Taylor
Tonbridge Area Library
Avebury Avenue
Tonbridge
Kent

Ray Skinner
62 Central Avenue
Billingham
Cleveland TS23 1LN

E N Ryan
15 Queens Square
Eastwood
Nottingham NG16 3BJ

Philip Joy
130 Rush Green Road
Romford
Essex

Derrick Daines
18 Cuttings Avenue
Sutton-in-Ashfield
Notts

Patrick Colley
52 Queensway
Caversham Park Village
Reading
Berks RG4 0SJ

J M A Kilburn
(Headmaster)
Shawfield Norden
Community Middle School
Shawfield Lane
Norden
Rochdale L12 7QR

Vernon Quaintance
50 Beatrice Avenue
Norbury
London SW16 4UN

B J Candy
9 Oakwood Drive
Gloucester GL3 3JF

Roger Shears
181 Woodmill Lane
Bitterne Park
Southampton SO2 4PY

Chris Woodford
31 Hopley Road
Anslow
Burton-on-Trent
Staffordshire

Peter Herring
Ordnance Road Library
Ordnance Road
Enfield
Middx

Mike Perry, Steve Collas or
Dave Lee
The Library
Ealing Road
Wembley
Middx HA0 4BR

Lyn Antill
1 Defoe House
Barbican
London EC2

Peter Jarvis
c/o Health Dept
Corporation of London
Guildhall
London EC2

Vernon Gifford
111 Selhurst Road
Croydon
London SE25 6LH

Peter Stone or
Alan Strangman
Computing and Maths Dept
The Polytechnic
Wulfruna Street
Wolverhampton WV1 1LY

J G Batch
Central Library
Clapham Road
Lowestoft NR32 1DR

John Byfield
Moonrakers
The Rutts
Bushey Heath
Herts WD2 1LH

Robin Bradbeer
Polytechnic of
North London
Holloway Road
London N7

Derek Moody
2 Victoria Terrace
Dorchester
Dorset DT1 1LS

Pam Pollicott
South Ruislip Library
Victoria Road
South Ruislip
Middx

Susan Kelly
Head of Reference Services
PO Box 4
Civic Centre
Harrow
Middx

Andrew Holyer
10 Masons Road
Mannings Heath
Horsham
Sussex RH13 6JP

R L Saunders
14 St Nicholas Mount
Hemel Hempstead
Herts

Brigitte Gordon
18 Purbright Crescent
New Addington
Croydon CR0 0RT

Richard Powell
22 Downham Court
South Shields
Tyne & Wear

Peter Earthy
46 High Street
Church Stretton
Shropshire SY6 6BX

Alan Sutcliffe
4 Binfield Road
Wokingham
Berks RG11 1SL

Alan Porten
14 Foxmede
Rivenhall End
Witham
Essex

David Sharp
5 Bridgenhall Road
Enfield
Middx

Keith Taylor
Carter Hydraulic Works
Thornbury
Bradford BD3 8HG

Alan Hooley
21 Brammay Drive
Tottington
Bury BL8 3HS

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.

London	(Alexandra Pavilion) International Video & Communications Exbn. Contact: IVAC, 01-240 1871.	13-16 Nov
London	(Olympia) Compec Exbn. Contact: Reed Exbns, 01-643 8040.	15-18 Nov
Reading	(Ramada Hotel) Computer Open Day Exbn. Contact: Couchmead Communications Ltd, 01-778 1102.	1 Dec
Las Vegas	Computer Dealers Exbn — COMDEX. Contact: Interface Group & Conf Exp Management, 160 Speen St, Framingham, MA01701, USA.	2 Dec
London	(Alexandra Pavilion) Micro Computer Show. Contact: ZX Microfair, 01-801 3906.	3-4 Dec
London	(Wembley Conference Centre), Your Computer Christmas Fair. Contact: Reed Exbns, 01-643 8040.	15-18 Dec

MICROMART

SPECTRUM TRS80
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ZX SPECTRUM 48K — Arcade Action Pack — Three super fast action arcade games direct from Israel. Mislon Omega, Close In and Smiley . . . All three on one cassette only £6.95. Both the above packs for only £15.95

PROGRAMMERS

We urgently require good quality software for the ZX Spectrum. For the right kind of material we offer — Expert presentation — improved market penetration — World Wide distribution — total distribution in the UK and a high 25% royalty.

SPARTAN SOFTWARE (PCW)
9 Cotswold Terrace,
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PROGRAMS

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(a) A cassette or disk of the program
(b) A listing on plain, white paper (typewritten if no printer available)
(c) Comprehensive but brief documentation (d) A suitable sae
Please mark (a), (b) and (c) with your name, address, program title, machine (state minimum RAM where appropriate) and — if possible — a daytime phone number. All programs must, please, be fully debugged. Programs are paid for at the rate of £50 per page of published listing, plus a £100 bonus for the Program of the Month, and must be the original work of the author and not previously published. Send contributions to: Surya, PCW Programs, 62 Oxford Street, London W1A 2HG.

Welcome to *PCW*'s biggest ever Programs section! Since we're approaching Christmas, the emphasis is on games: an original and unpredictable board game, three fast-action, arcade-style games, a computerised 'Othello' and four other games. Also included are utility programs for the VIC-20, Oric, NewBrain, Spectrum and Commodore 64, and a simple tune transposer for the MZ-80K. Program of the Month is the BBC Wordprocessor promised in the September issue.

Incidentally, MZ-80K 'Basic Modifier' — published in October — was erroneously credited to Scott Waterhouse. While Mr Waterhouse added the save-to-tape routine, credit for the original idea and core program goes to Peter Stones. We would like to point out that all programs submitted to *PCW* must be original programs which have not been previously published.

A special note to anyone thinking about submitting a program to *PCW*. Please read the notes given in italics above carefully, and note that we cannot accept programs unless they are accompanied by a suitable *sae*. We receive a large number of program submissions and simply do not have time to sit around addressing envelopes. Programs submitted without a suitable *sae* will not in future be acknowledged or returned.

Important note to intending contributors: I will be away during the whole of December. We regret that no programs can be considered during this month. Any programs received during December will be returned unread.

Games

Scientific/mathematic

Business

Toolkit/utilities

Educational/Computer Aided Learning

Program of the Month
BBC Word

by David Sandy & Maurice Webb
Text justification procedures based on 'Text Formatter' by Des Fisher, *PCW* Programs, September '83

'BBC Word' is a cassette-based word-processor for the BBC Model B.

On running the program, you will be asked first if your printer has auto line-feed. Your printer manual will give you the appropriate answer. You will then be offered either forty or eighty columns. Again, consult your printer manual if in doubt; most BBC-compatible printers allow eighty-column printing. Having answered these questions, you will be presented with a menu of six options:

1 Text input
2 Text edit
3 Save text
4 Load text
5 Print text
6 End program

The first time you use the program, select option 1 to enter text. Answer 'y' to the 'New text (y/n)?' prompt. You will then be presented with the text entry screen allowing you to type in your document. During text entry, the line you are currently entering is at the bottom of the screen above a character-count grid. As each line is entered, the line is shifted up to the top of the screen to be added to the text already present. A word counter keeps track of the number of words in the document. This is fairly crude, relying on counting spaces as text is entered, but it does give you a rough idea of how many words you have written and you can recount the completed document in edit mode.

In text entry mode, there are three commands available. F6 returns you to the menu (without losing your text), F7 places you directly into edit mode and F8 forces a new line. RETURN forces a new paragraph by printing a blank line and indents

The next line. The text entry mode does not support any editing facilities other than destructive backspace. To edit text, you need to enter the edit mode by pressing function key 7 (F7).

Edit mode presents an edit cursor which is controlled by the cursor keys. To delete a character, place the cursor over the character to be deleted then press D or F0. To delete a line of text, position the cursor then press C or F2. To insert a character, position the cursor immediately to the right of the desired position then press I or F1 followed by the character to be inserted. A character can be replaced by placing the edit cursor over it and pressing R or F3 followed by the character to replace the existing one.

To justify the text, press J or F5. Occasionally spurious spaces may appear which can be removed in edit mode. When editing is complete, N or F4 recounts the words.

Word is obviously not comparable with a commercial disk-based system, but it should prove very useful indeed to BBC owners not yet rich enough to splash out on a disk or two. The program was tested on the *PCW* machine which is a 1.2 OS with DFS, but as far as I can tell it should run under any OS.

A version of the program is currently being developed for the Sharp MZ-80K, and the result should see the light of day in *PCW* Programs in a few months' time.

```
  10 REM*************************************
  20 REM*                                   *
  30 REM*            JUST-WORDS             *
  40 REM*    David Sandy + Maurice Webb     *
  50 REM*                1983               *
  60 REM*                                   *
  70 REM*************************************
  80 *FX4,2
  90 *KEY 0 D
 100 *KEY 1 I
 110 *KEY 2 C
 120 *KEY 3 R
 130 *KEY 4 N
 140 *KEY 5 J
 150 *KEY 6 /M
 160 *KEY 7 /T
 170 *KEY 8 /N
 180 *KEY 12 !H
 190 *KEY 13 !I
 200 *KEY 14 !J
 210 *KEY 15 !K
 220 DIM store$(250)
 230 count=0
 240 top=1
 250 scrlin=1:line=1
 260 space$=STRING$(80," ")
 270 line$=""
 280 ignore=FALSE
 290 storeful=FALSE
 300 finish=FALSE
 310 end=FALSE
 320 para=FALSE
 330 skip=FALSE
 340 word=TRUE
 350 MODE7
 360 PRINTTAB(0,10)"HAS YOUR PRINTER AUTO L/F (Y/N)"
 370 lf$=GET$
 380 IF lf$="Y" THEN 420
 390 IF lf$<>"N" THEN 350
 400 *FX6,0
 410 GOTO430
 420 *FX6,10
 430 CLS
 440 PRINTTAB(5,10)"Please select 40 or 80 columns"
 450 PRINT:PRINT:PRINTTAB(10)"by pressing 4 or 8"
 460 L%=GET
 470 IF L%=52 L%=40 ELSE L%=80
 480 PRINT:PRINT:PRINT"       YOU HAVE SELECTED ";L%;" COLUMNS"
 490 dummy=INKEY(300)
 500 IFL%=40 MODE7 ELSE MODE3
 510
 520 REM main routine entry
 530 PROCmenu
 540
 550 REM back to BASIC
 560 *FX4,0
 570 CLEAR
 580 MODE7
 590 END
 600
 610 REM menu selection control
 620 DEFPROCmenu
 630 REPEAT
 640   VDU26
 650   CLS
 660   tab%=((L%-40)/2)+8
 670   PRINTTAB(tab%,8)"<1> Text Input"
 680   PRINTTAB(tab%,10)"<2> Text Edit"
 690   PRINTTAB(tab%,12)"<3> Save Text"
 700   PRINTTAB(tab%,14)"<4> Load Text"
 710   PRINTTAB(tab%,16)"<5> Print text"
 720   PRINTTAB(tab%,18)"<6> End Program"
 730   REPEAT
 740     PRINTTAB(tab%,20);SPC(30)
 750     PRINTTAB(tab%,20)"Option Number ?";
 760     opt=GET-48
 770     IF opt=1 PROCtextin
 780     IF opt=2 PROCtextedit
 790     IF opt=3 PROCsave
 800     IF opt=4 PROCload
 810     IF opt=5 PROCprint
 820     IF opt=6 finish=TRUE
 830     UNTIL opt <6 OR finish=TRUE
 840   UNTIL finish=TRUE
 850 ENDPROC
 860
 870 REM store text into array
 880 DEFPROCtextin
 890 REPEAT
 900   CLS
 910   INPUTTAB(tab%,12)"New Text (Y/N)",T$
 920   UNTIL T$="Y" OR T$="y" OR T$="n" OR T$="N"
```

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PROGRAMS

```
 930 PRINTTAB(tab%-6,24)" f6=Menu f7=Text edit  f8=Newline  ";
 940 PRINTTAB(0,22)"+0+++++++10++++++++20++++++++30++++++++4";
 950 IF L%=80 PRINT"0++++++++50++++++++60++++++++70++++++++80";
 960 VDU28,0,21,L%-1,0
 970 CLS
 980 end=FALSE '
 990 IF T$<>"Y" PROCold ELSE PROCnew:top=1:line=1:count=0:scrlin=1
1000 para=FALSE
1010 REPEAT
1020   PROCinput
1030   PROCstore
1040   UNTIL end=TRUE OR opt=2 OR storeful=TRUE
1050 IF storeful PROCmessage
1060 ENDPROC
1070
1080 REM input one line of text + checks
1090 DEFPROCinput
1100 PRINTTAB(tab%,0)"WORD COUNT ";count
1110 PRINTTAB(0,20)SPC(L%);:VDU11
1120 line$=""
1130 IF para=TRUE PRINTTAB(10,20);:para=FALSE:line$="                "
1140 REPEAT
1150   A$=GET$
1160   IF ASC(A$)>30 AND ASC(A$)<127 AND A$<>"/" line$=line$+A$:PRINTTAB(0,20)l
ine$;
1170   IF A$="/" PROCcontrol
1180   IF A$=CHR$(13) para=TRUE
1190   IF ASC(A$)=127 AND line$<>"" line$=LEFT$(line$,LEN(line$)-1):PRINTA$;
1200   IF VPOS=19 PRINTTAB(0,20)
1210   IF A$=" " AND word=FALSE PROCcount:word=TRUE
1220   IF A$<>" " AND ASC(A$)<>127 word=FALSE
1230   UNTIL end=TRUE OR VPOS=21 OR para=TRUE OR opt=2
1240 ENDPROC
1250
1260 REM store text in array and display
1270 DEFPROCstore
1280 store$(line)=line$
1290 PRINTTAB(0,scrlin);line$
1300 line=line+1:scrlin=scrlin+1
1310 top=line
1320 IF line >250 storeful=TRUE
1330 IF scrlin <21 ENDPROC
1340 scrlin=1
1350 CLS
1360 ENDPROC
1370
1380 REM check for conrol characters
1390 DEFPROCcontrol
1400 A$=GET$
1410 IF A$="N" OR A$="n" PRINTTAB(0,21);
1420 IF A$="M" OR A$="m" end=TRUE
1430 IF A$="T" OR A$="t" opt=2
1440 ENDPROC
1450
1460 REM screen edit entry
1470 DEFPROCtextedit
1480 REPEAT
1490   PROCedit
1500   IF B$="C" PROCcloseup
1510   IF B$="D" PROCdelete
1520   IF B$="I" PROCinsert
1530   IF B$="J" PROCcont
1540   IF B$="R" PROCreplace
1550   IF B$="N" PROCrecount
1560   UNTILB$="M"
1570 ENDPROC
1580
1590 REM delete, insert, menu control
1600 DEFPROCedit
1610 VDU26
1620 CLS
1630 PRINTTAB(tab%-8,24)" Press SPACE to scroll and <S> to stop";
1640 VDU28,0,22,L%-1,0
1650 bottom=1
1660 REPEAT
1670   CLS
1680   scrlin=1
1690   FOR line=bottom TO bottom+19
1700     PRINTTAB(0,scrlin)store$(line)
1710     scrlin=scrlin+1
1720     NEXT
1730   bottom=bottom+20
1740   PRINTTAB(tab%,0)"WORD COUNT ";count
1750   S$=GET$
1760   UNTIL S$="S" OR bottom> top
1770 VDU26
1780 PRINTTAB(tab%-8,23)" f0=Delete  f1=Insert  f2=Delete line"
1790 PRINTTAB(tab%-8,24)" f3=Replace f4=Recount f5=Just f6=Menu ";
1800 VDU28,0,22,L%-1,0
1810 PRINTTAB(tab%-8,21)"Set  ^  on character and select command"
1820 VDU23,0,10,0,0;0;0;
1830 PRINTTAB(tab%-3,20);
1840 REPEAT
1850   B$=INKEY$(0)
1860   B=ASC(B$)
1870   IF B>7 AND B<12 PROCcursor
1880   UNTIL B$="M" OR B$="I" OR B$="D" OR B$="R" OR B$="N" OR B$="J" OR B$="C"
1890 VDU23,0,10,16/(L%/40),0;0;0;
1900 ENDPROC
1910
1920 REM justifier control
1930 DEFPROCcont
1940 line=1
1950 REPEAT
1960   para=FALSE
1970   just$=store$(line)
1980   IF LEFT$(just$,12)="            " ignore=TRUE
1990   IF store$(line+1)="" OR LEFT$(store$(line+1),2)="  " para=TRUE
2000   IF para OR ignore PROCjust ELSE just$=just$+store$(line+1):PROCjust
2010   store$(line)=just$
2020   PRINTTAB(0,line);just$
2030   line=line+1
2040   UNTIL line=top+1
2050 ENDPROC
2060
2070 REM justify
2080 DEFPROCjust
2090 IF ignore ignore=FALSE:ENDPROC
2100 IF LEN(just$)<L% ENDPROC
2110 K%=LEN(just$)
```

PROGRAMS

```
2120 REPEAT
2130   REPEAT
2140     K%=K%-1
2150     UNTIL MID$(just$,K%,1)=" "
2160   UNTIL LEN(LEFT$(just$,K%)) <=L%
2170 IF para PROCadjust:store$(line+1)=""
2180 store$(line+1)=RIGHT$(just$,LEN(just$)-K%)
2190 just$=LEFT$(just$,K%)
2200 IF LEN(just$)=L% ENDPROC
2210 IF LEFT$(just$,2)="  " updwn=FALSE ELSE updwn=NOT updwn
2220 IF updwn PROCup ELSE PROCdwn
2230 ENDPROC
2240
2250 REM insert spaces starting from left side
2260 DEFPROCup
2270 REPEAT
2280   K%=0:A%=LEN(just$)
2290   REPEAT
2300     REPEAT
2310       K%=K%+1
2320       UNTIL MID$(just$,K%,1)=" " OR K%>=A%
2330     IF K%>=A% THEN 2370
2340     just$=LEFT$(just$,K%)+" "+RIGHT$(just$,A%-K%)
2350     A%=LEN(just$)
2360     K%=K%+1
2370     UNTIL A%=L% OR K%>A%
2380   UNTIL A%=L%
2390 ENDPROC
2400
2410 REM start from right side
2420 DEFPROCdwn
2430 REPEAT
2440   K%=LEN(just$)
2450   REPEAT
2460     K%=K%-1
2470     REPEAT:K%=K%-1:UNTIL MID$(just$,K%,1)=" " OR K%=12
2480     IF K%>12 just$=LEFT$(just$,K%)+" "+RIGHT$(just$,LEN(just$)-K%)
2490     A%=LEN(just$)
2500     UNTIL A%=L% OR K%<=12
2510   UNTIL A%=L%
2520 ENDPROC
2530
2540 REM move array up one
2550 DEFPROCadjust
2560 LOCAL T%
2570 FOR T%=top TO line+1 STEP-1
2580   store$(T%+1)=store$(T%)
2590   top=top+1
2600   NEXT
2610 ENDPROC
2620
2630 REM keep cursor within screen limits
2640 DEFPROCcursor
2650 IF VPOS=1 AND B=11 ENDPROC
2660 IF VPOS=20 AND B=10 ENDPROC
2670 IF VPOS=1 AND POS=0 AND B=8 ENDPROC
2680 IF VPOS=20 AND POS=L%-1 AND B=9 ENDPROC
2690 VDUB
2700 ENDPROC
2710
2720 REM clean out the array
2730 DEFPROCnew
2740 LOCAL N%
2750 FOR N%=1 TO top
2760   store$(N%)=""
2770   NEXT
2780 top=1
2790  count=0
2800 scrlin=1
2810 line=1
2820 ENDPROC
2830
2840 REM recall text from array
2850 DEFPROCold
2860 PRINT
2870 FOR line=1 TO top
2880   PRINTTAB(0,line)store$(line)
2890   NEXT
2900 scrlin=VPOS-1
2910 line=line-1
2920 top=line
2930 ENDPROC
2940
2950 REM save array to tape
2960 DEFPROCsave
2970 CLS
2980 PRINTTAB(tab%,0);
2990 X=OPENOUT("TEXT")
3000 pl%=1
3010 FOR YA=1 TO top
3020   PRINT£X,store$(YA)
3030   PROCview
3040   NEXTYA
3050 CLOSE£X
3060 dummy=INKEY(500)
3070 ENDPROC
3080
3090 REM load array from tape
3100 DEFPROCload
3110 CLS
3120 PRINTTAB(tab%,0)"   PRESS PLAY"
3130 X=OPENIN("TEXT")
3140 YA=1:pl%=1
3150 REPEAT
3160   INPUT£X,store$(YA)
3170   PRINTstore$(YA)
3180   YA=YA+1
3190   UNTIL EOF£X
3200 top=YA-1
3210 CLOSE£X
3220 dummy=INKEY(500)
3230 ENDPROC
3240
3250 REM send text to printer
3260 DEFPROCprint
3270 pl%=1
3280 CLS
3290 PRINTTAB(0,10)"TURN YOUR PRINTER ON AND PRESS ANY KEY"
3300 dummy=GET
3310 CLS
```

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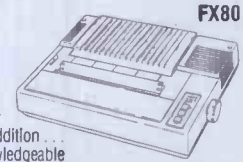

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PROGRAMS

```
3320 VDU2
3330 FOR YA=1 TO top
3340   PROCview
3350   NEXT
3360 VDU6
3370 VDU3
3380 dummy=INKEY(500)
3390 ENDPROC
3400
3410 REM count words after editing
3420 DEFPROCrecount
3430 LOCAL G%,C%
3440 G%=1
3450 count=0
3460 word=TRUE
3470 REPEAT
3480   FOR C%=1 TO L%
3490     IF MID$(store$(G%),C%,1)=" " AND word=FALSE PROCcount:word=TRUE
3500     IF MID$(store$(G%),C%,1)<>" "word=FALSE
3510     NEXT
3520   G%=G%+1
3530   UNTIL G%>= top
3540 PRINTTAB(tab%,0)"WORD COUNT "¦count
3550 ENDPROC
3560
3570 REM word count
3580 DEFPROCcount
3590 count=count+1
3600 VDU23,0,10,32,0;0;0;
3610 cur=POS
3620 vpos=VPOS
3630 PRINTTAB(tab%,0)"WORD COUNT "¦count
3640 PRINTTAB(cur,vpos)¦
3650 VDU23,0,10,18/(L%/40),0;0;0;
3660
3670 REM print array in pages
3680 ENDPROC
3690 DEFPROCview
3700 PRINTTAB(0,pl%)store$(YA)
3710 pl%=pl%+1
3720 IF pl%=21 pl%=1:CLS
3730 ENDPROC
3740
3750 REM delete one character
3760 DEFPROCdelete
3770 PROCposfind
3780 IF store$(line)="" OR line > top ENDPROC
3790 leng=LEN(store$(line))
3800 pos=POS
3810 IF POS>=leng ENDPROC
3820 store$(line)=LEFT$(store$(line),(pos))+RIGHT$(store$(line),(leng-pos-1))
3830 ENDPROC
3840
3850 REM eliminate blank line
3860 DEFPROCcloseup
3870 PROCposfind
3880 FOR YA=line TO top
3890   store$(YA)=store$(YA+1)
3900   NEXT
3910 top=top-1
3920 ENDPROC
3930
3940 REM insert characters
3950 DEFPROCinsert
3960 PROCposfind
3970 leng=LEN(store$(line))
3980 pos=POS
3990 ins$=GET$
4000 PROCsert
4010 ENDPROC
4020
4030 DEFPROCsert
4040 IF pos> leng PROCextraspc:ENDPROC
4050 IFline > top ENDPROC
4060 store$(line)=LEFT$(store$(line),pos)+ins$+RIGHT$(store$(line),(leng-pos))
4070 IF LEN(store$(line))<=L% ENDPROC
4080 REPEAT
4090   IF LEFT$(store$(line+1),2)="  " PROCadjust:store$(line+1)=""
4100   store$(line+1)=RIGHT$(store$(line),(LEN(store$(line))-L%))+store$(line+1
       )
4110   store$(line)=LEFT$(store$(line),L%)
4120   line=line+1
4130   UNTIL LEN(store$(line))<=L%
4140 ENDPROC
4150
4160 DEFPROCextraspc
4170 store$(line)=store$(line)+MID$(space$,LEN(store$(line)),(pos-LEN(store$(li
     e))))+ins$
4180 ENDPROC
4190
4200 REM find array element from cursor position
4210 DEFPROCposfind
4220 line=line-2
4230 pge=INT((line+20)/20)
4240 line=(pge*20-20)+VPOS
4250 ENDPROC
4260
4270 REM delete and insert at one go
4280 DEFPROCreplace
4290 PROCdelete
4300 ins$=GET$:leng=leng-1
4310 PROCsert
4320 ENDPROC
4330
4340 REM memory full message
4350 DEFPROCmessage
4360 VDU26:CLS
4370 PRINTTAB(0,8)"THE ARRAY IS NOW COMPLETLY FULL. "
4380 PRINTTAB(0,10)"PLEASE DUMP TEXT TO THE TAPE OR PRINTER"
4390 PRINTTAB(0,12)"AND START AGAIN."
4400 FOR delay=1 TO 2000:NEXT
4410 *FX15,1
4420 PRINTTAB(5,24)"PRESS ANY KEY TO CONTINUE"¦
4430 storeful=FALSE
4440 dummy=INKEY(5000)
4450 ENDPROC
```

NewBrain Factory Game

by P A Barnard

The 'Factory Game' runs on a 14k NewBrain AD, but should also run on the model A with minor modifications — see author's final paragraph below.

Mr Barnard's description seems perfectly straightforward, so I'll leave it to him to tell you all about the game . . .

The Factory Game is based upon buying factories. You are the manager of a firm and are initially given £10,000 and three towns which can supply workers for the factories you may build. You are also given a warehouse where all the output from the factories must go. On the screen there is a grid which contains grey squares for towns, a black square for the warehouse, and factories will appear as black diamonds.

'The game proceeds as follows.

'If you have one or more factories, and have a loan less than the maximum, then you will be asked if you want a loan. You are told how much you may have, and then asked to enter how much you want. The maximum loan is equal to the value of your factories, and interest is 10% per annum, which is deducted from your profit (or, more likely, loss) at the end of the year.

'If you have one or more factories, then you will be asked if you want to sell one. If you reply yes, then a list of your factories will be displayed, and you will be asked to choose one for sale. You will then be made an offer, which you may refuse, but you are only allowed to try and sell one factory per year.

'If you have £5000 or more, and more than one factory, then you have the chance to have a town built (which costs £5000). Another town gives you the opportunity to buy more factories. The only problem is that you cannot choose where the town is to be sited.

'It is possible to increase the value of your factories by investing in them, and if you have one or more factories, and some money, then you may invest. If you decide to invest then you are shown a list of your factories and asked to choose one, in which you may invest up to £1000. If you just press new line (N/L) instead of entering an amount, then the maximum investment will automatically be made. Each year, you may invest in two factories.

'If you have £3000 or more, and less factories than towns, then you may buy a factory for between £3000 and £6000 (if you have that much money!). Each town can only supply enough workers for one factory, so you must state from which town you want the workers. Two things to consider when positioning your factory: you have to pay the workers' transport costs and it costs money to transport goods to the warehouse. The larger the distance, the greater the cost. You may buy more than one factory per year, providing you have enough money and towns.

'If you have any money left by now, you will be given the option of insuring your factories against damage. If you decide to (and you have enough money) you will be asked if you want to insure in full. If you say yes, then each factory is fully insured. If you say no, or do not have enough money, then you are asked to insure each factory individually. The maximum insurance premium is 10% of the value of the factory, but you may insure for less. If you just press N/L then that factory will be insured in full.

'If you have a loan and some money, and have not taken out a loan that year, then you may repay some of your loan. You are told how much you have, how large your loan is, and asked to enter how much you wish to repay. If you press N/L in reply to how much to repay, then as much as possible will be repaid.

'If you have one or more factories, the workers will ask for a pay rise. They will say how much they want, and you may either agree or refuse to pay. If you refuse, then they may go on strike, or make another claim. Wages begin at £50 per week.

'If there has been any damage to your factories, then this will be shown next. If there is no damage then there will be a short pause.

'When a square black flashing cursor appears on the right of the screen, this means that you should press any key, except stop, control, shift or videotext, to continue.

'Next comes the end of year summary. This shows the income and outgoings of each of your factories, and the overall profit/loss you made that year. The profit shown does not include any damage losses or payments. You are told how much money you have or owe, how much the firm is worth or if you are bankrupt. If you are bankrupt then your time as manager ends, but if the firm is worth more than £60,000 then you have been successful and the game ends. You are given 30 years to achieve the £60,000 target, after which you are retired and considered a failure.

'During the program you will be asked to enter the coordinates of towns and factories. The coordinates are entered in an x, y manner, without a comma, as two characters. Do not worry if you make a mistake entering data at any time, as the program is fully user-proof and uncrashable. There is a limit of nine towns in any game, but this could be easily changed if you wanted.

'The program is written to run on the model AD computer, but it should run on the model A if references to #2 are omitted in lines 1030, 1040 and 1520.'

One last thing to add is that it may not be self-evident to everyone that a flashing cursor means 'any key to continue'.

```
10 REM THE FACTORY GAME      Version 2.1A (August 1983)
40 RANDOMIZE: Q$="ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789"
100 DEF FNR(X)=INT(RND*X+1): DEF FNXY$(X)=MID$(Q$,X,1)
120 DEF FNNO=INSTR("Nn",Z$): DEF FNYS=INSTR("Yy",Z$)
```


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PROGRAMS

```
140 DEF FNM$(X)=" £"+MID$(STR$(X),2): DEF FNX(X$)=INSTR(Q$,X$)
160 DEF FNY(Y$)=INSTR(LEFT$(Q$,16),Y$): GOSUB 1000
500 REM *** MAIN LOOP ***
510 FOR YR=1 TO 30: PUT 31: ?: ?TAB(15);"YEAR";YR: LN=FALSE: IF F<>0 GOSUB 3500
540 IF F=0 THEN 570
550 ?: A$="Do you want to sell a factory": SC=0: GOSUB 10100: IF FNYS GOSUB 2500
570 IF M>=5000 AND T<9 AND F>1 GOSUB 6500
580 IF M>0 AND F>0 GOSUB 6000
590 IF M<3000 OR F=T THEN 650
610 ?: SC=0: GOSUB 10400: A$="Do you want to buy a factory": GOSUB 10100
620 IF FNNO THEN 650
630 GOSUB 2000: IF M<3000 OR F=T THEN 650
640 ?: GOSUB 10400: A$="Do you want to buy another": SC=0: GOSUB 10100: GOTO 620
650 FOR I=1 TO 9: I(I)=0: NEXT I: IF M>0 AND F>0 GOSUB 3000
670 IF M>0 AND L>0 AND LN=FALSE GOSUB 5500
680 IF F>0 GOSUB 4000
690 GOSUB 4500: SC=SGN(DR): GOSUB 10000: GOSUB 8000: NEXT
730 PUT 31,10,10: ?"You failed as a manager."
750 ?"In 30 years you could not make": ?"the firm worth £600 000"
770 SC=0: GOSUB 10000: A$="Do you want another game": GOSUB 10100: IF FNYS RUN
790 GOTO 1500
1000 REM *** INITIALIZE ***
1010 FOR I=1 TO 255: CLOSE#I: NEXT I
1020 OPEN#0,0,0,"120": PUT 23,3: OPEN#1,0,1: PUT#1,23,3
1030 OPEN#2,3,2,"16": ?#2,"THE FACTORY GAME": OPEN#3,11,3,"175": OPEN#4,6,4
1070 PLOT RND(40,18.1),CEN(1,0): OPTION BASE 1
1090 DIM T(9,2),F(9,2),C(9),R(9),J(9,2),O(9),I(9),WB(9),WK(9),GD(9),P(9)
1100 FOR I=1 TO 3
1110 X=FNR(36): Y=FNR(16): FOR J=1 TO I-1: IF X=T(J,1) AND Y=T(J,2) THEN 1110
1140 NEXT J: T(I,1)=X: T(I,2)=Y: NEXT I: M=10000: F=0: L=0: WG=50: RA=500: T=3
1180 WX=FNR(36): WY=FNR(16): FOR I=1 TO 3: IF WX=T(I,1) AND WY=T(I,2) THEN 1180
1210 NEXT I
1220 PLOT WIP,PLA(1,0),Q$,PLA(1,17),Q$
1230 FOR I=1 TO 16: PLOT PLA(0,I),FNXY$(I),PLA(37,I),FNXY$(I): NEXT I
1260 PLOT PLA(WX,WY),CHR$(147)
1270 FOR I=1 TO T: PLOT PLA(T(I,1),T(I,2)),CHR$(146): NEXT I
1300 FOR I=1 TO C: IF C(I)<>0 THEN PLOT PLA(F(I,1),F(I,2)),CHR$(235),PLA(F(I,1)+
0.5,F(I,2)+0.5),DRW(WX+0.5,WY+0.5,1),DRW(J(I,1)+0.5,J(I,2)+0.5,1)
1310 NEXT I: RETURN
1500 REM *** TERMINATE ***
1520 CLEAR: CLOSE#1: CLOSE#2: CLOSE#3: CLOSE#4: OPEN#0,4,0: PUT 23,3: END
2000 REM *** BUY FACTORY ***
2010 SC=0: UL=6000: IF M<UL THEN UL=M
2030 LINPUT("Cost of factory (£3000 -> "+FNM$(UL)+CHR$(8)+")? £")C$
2040 IF NUM(C$)=FALSE THEN A1$="Please enter a number": GOSUB 10300: GOTO 2030
2050 C=INT(VAL(C$)): IF C<3000 OR C>UL THEN A1$="Please enter a value from £0 -> "
+FNM$(UL): GOSUB 10300: GOTO 2030
2070 FOR K=1 TO 9: IF C(K)=0 THEN 2100
2090 NEXT K
2100 C(K)=C: F=F+1: M=M-C
2110 A$="Position of factory? ": GOSUB 10500: IF X<>WX OR Y<>WY THEN 2140
2130 A1$="Square already occupied": GOSUB 10300: GOTO 2110
2140 FOR I=1 TO 9: IF F(I,1)=X AND F(I,2)=Y OR T(I,1)=X AND T(I,2)=Y THEN 2130
2160 NEXT I: F(K,1)=X: F(K,2)=Y
2175 ?"Towns: ";: FOR I=1 TO T: ?FNXY$(T(I,1));FNXY$(T(I,2));" ";: NEXT I: ?
2180 A$="Position of town for workers? ": GOSUB 10500
2190 FOR I=1 TO 9: IF X=T(I,1) AND Y=T(I,2) THEN 2230
2210 NEXT I: A1$="Not the position of a town": GOSUB 10300: GOTO 2180
2230  FOR I=1 TO 9: IF X=J(I,1) AND Y=J(I,2) THEN A1$="Nobody is unemployed in t
his town": GOSUB 10300: GOTO 2180
2250 NEXT I: J(K,1)=X: J(K,2)=Y: R(K)=INT(RND*C(K)/7+50)
2280 PLOT PLA(F(K,1),F(K,2)),CHR$(235),PLA(F(K,1)+0.5,F(K,2)+0.5),DRW(WX+0.5,WY+
0.5,1),DRW(X+0.5,Y+0.5,1): RETURN
2500 REM *** SELL FACTORY ***
2510 PUT#1,31,10,10: ?#1,"Number","  Position","Value(£)": ?#1
2540 UL=0: SC=1: FOR I=1 TO 9
2560 IF C(I)<>0 THEN UL=UL+1:?#1,UL,"     ";FNXY$(F(I,1));FNXY$(F(I,2)),,C(I)[5]
2570 NEXT I : UL$=MID$(STR$(UL),2,1): ?#1
2580 IF UL=1 THEN ?#1,"You only have one factory to sell": Z=1: UL=0: GOTO 2630
2590 ?#1: ?#1,"Enter the number of the factory": ?#1,"you wish to sell"
2600 ?#1,"Number = ";: PUT#1,6
2610 GET#4,Z$: IF Z$<"1" OR Z$>UL$ THEN 2610
2620 PUT#1,Z$,7: Z=VAL(Z$): UL=0
2630 FOR I=1 TO 9: IF C(I)<>0 THEN UL=UL+1: IF UL=Z THEN 2660
2650 NEXT I
2660 ?#1: ?#1,"The factory is valued at";FNM$(C(I)): C=INT(C(I)*(RND/2+0.53))
2680 ?#1,"You are offered";FNM$(C): ?#1: A$="Do you accept": GOSUB 10100
2700 IF FNNO RETURN
2710 M=M+C: C(I)=0: F(I,1)=0: F(I,2)=0: J(I,1)=0: J(I,2)=0: R(I)=0: F=F-1
2720 ?#1: GOSUB 10400: GOSUB 1220: RETURN
3000 REM *** INSURE ***
3010 ?: SC=0: A$="Do you want to insure": GOSUB 10100: IF FNNO RETURN
3040 M1=M: FOR I=1 TO 9: M1=M1-INT(C(I)/10): NEXT I: IF M1<0 THEN 3120
3060 A$="Insure in full": GOSUB 10100: IF FNNO THEN 3120
3080 FOR I=1 TO 9: I(I)=INT(C(I)/10): NEXT I
3090 ?: ?"Insurance cost";FNM$(M-M1): M=M1: FOR I=1 TO 500: NEXT I: RETURN
3120 FOR I=1 TO 9: IF C(I)=0 THEN 3220
3140 ?: ?"Factory at ";FNXY$(F(I,1));FNXY$(F(I,2))
3150 ?"Valued at";FNM$(C(I));"  You have";FNM$(M)
3160 UL=INT(C(I)/10): IF UL>M THEN UL=M
3170 LINPUT("Insurance premium? £")I$: IF I$="" THEN 3240
3180 IF NUM(I$)=FALSE THEN A1$="Please enter a number": GOSUB 10300: GOTO 3170
3190 C=INT(VAL(I$)): IF C<0 OR C>UL THEN A1$="Premiums are from £0 -> "+FNM$(UL):
GOSUB 10300: GOTO 3170
3200 I(I)=C: M=M-C: IF M=0 RETURN
3220 NEXT I: RETURN
3240 PUT 11,9,9,26,26: ?FNM$(UL): C=UL: GOTO 3200
3500 REM *** LOAN ***
3520 C=-L: FOR I=1 TO 9: C=C+C(I): NEXT I: IF C<=0 RETURN
3550 ?:?:SC=0: GOSUB 10400: A$="Do you want a loan": GOSUB 10100: IF FNNO RETURN
3580 LN=TRUE: ?"You may have up to";FNM$(C)
3590 LINPUT("How much do you want? £")Z$
3600 IF NUM(Z$)=FALSE THEN A1$="Please enter a number": GOSUB 10300: GOTO 3590
3610 Z=INT(VAL(Z$)): IF Z<0 OR Z>C THEN A1$="Please enter a value from £0 -> "+FNM
```

PROGRAMS

```
$(C): GOSUB 10300: GOTO 3590
3620 L=L+Z: M=M+Z: RETURN
4000 REM *** PAY RISE ***
4010 H=0: H1=0.1+RND/5: SC=0: ST=FALSE: ?: ?"WORKERS ANNUAL PAY CLAIM"
4030 PR=FNR(10): ?: ?"The workers want a rise of";PR;CHR$(8);"%"
4050 A$="Will you pay": GOSUB 10100: IF FNYS THEN 4160
4070 IF RND<H1 THEN 4110
4080 ?: ?"The workers have decided to": ?"make a new pay claim"
4090 H1=H1+RND/3: IF H1>1 THEN H1=1
4100 GOTO 4030
4110 ?: ?"THE WORKERS HAVE GONE ON STRIKE!": FOR I=1 TO 300: NEXT I
4120 ?"Strikes this year total";INT(365*H1);"days."
4130 ST=TRUE: H=H1: FOR I=1 TO 700: NEXT I: IF H=1 RETURN
4145 H1=H1+RND/3: IF H1>1 THEN H1=1
4150 GOTO 4030
4160 WG=WG*(1+PR/100): B$=STR$(WG[4.2])
4190 IF LEFT$(B$,1)=" " THEN B$=MID$(B$,2): GOTO 4190
4200 ?: ?"Wages are now £";B$;"per week": FOR I=1 TO 500: NEXT I: RETURN
4500 REM *** CALCULATIONS ***
4510 DR=0: O=0: R=0: WB=0: IP=0: GD=0: WK=0: C=0: P=0: H=H-1:IF NOT(ST) THEN H=1
4520 FOR I=1 TO 9: WB(I)=0: WK(I)=0: GD(I)=0: P(I)=0: O(I)=0: NEXT I
4530 FOR I=1 TO 9: IF C(I)=0 THEN 4650
4550 IF RND<0.17 AND DR<3 GOSUB 5000: DR=DR+1: IF C(I)=0 THEN 46
4560 R(I)=INT(R(I)*(1+RND/10)): WB(I)=INT(C(I)*WG/300*H)
4580 O(I)=INT((1.04↑((C(I)-3000)/2000)*C(I)*SQR(RND)+C(I)/8)*H)
4590 DT=SQR((F(I,1)-J(I,1))↑2+(F(I,2)-J(I,2))↑2)
4600 DF=SQR((F(I,1)-WX)↑2+(F(I,2)-WY)↑2)
4610 GD(I)+INT(O(I)/35*DF*(0.7+RND/2)): WK(I)=INT((C(I)/75*DT*(0.7+RND/2))*H)
4630 P(I)=O(I)-R(I)-GD(I)-WK(I)-WB(I): O=O+O(I): IP=IP+I(I): P=P+P(I): WB=WB+WB(I): WK=WK+WK(I): C=C+C(I): GD=GD+GD(I): R=R+R(I)
4650 NEXT I: RA=INT(RA*1.05)
4670  P=P-RA-INT(L/10): R=R+RA: M=M+P: V=C+M-L: IF DR<>INT(DR) GOSUB 1220
4690 RETURN
5000 REM *** DAMAGE ***
5010 IF DR=0 THEN PUT#1,31,22,12,2: ?#1,"DAMAGE REPORT"
5020 ?#1: DM=1: Z=FNR(9): P$=FNXY$(F(I,1))+FNXY$(F(I,2)): IF Z>3 THEN 5130
5040 ON Z GOTO 5050,5060,5070
5050 ?#1,"Fire has destroyed your";: GOTO 5080
5060 ?#1,"Vandles have wrecked the";: GOTO 5080
5070 ?#1,"A storm has flattened your";                    +CD
5080 ?#1," factory at ";P$ : CD=0                          ↓
5090 ?#1,"Your factory was valued at";FNM$(C(I)): IF I(I)=0 THEN ?#1,"Your factory was not insured": ?#1,"You will receive no compensation"
5110 IF I(I)>0 THEN ?#1,"Your factorywas insured": ?#1,"You will receive";FNM$(INT(I(I)*11*DM));"compensation"
5120 M=M+INT(11*I(I)*DM): IF DM=1 THEN IP=IP+I(I): F(I,1)=0: F(I,2)=0: I(I)=0: C(I)=0: J(I,1)=0: J(I,2)=0: R(I)=0: F=F-1: DR=INT(DR)+0.5
5126 RETURN
5130 ?#1,"Partial damage reported to ";P$: DM=0.2+RND/2: CD=INT(C(I)*DM)
5160 ?#1,"Damage estimated at";FNM$(CD)
5170 C(I)=C(I)-CD: R(I)=INT(R(I)*(1-DM)): GOTO 5090
5500 REM *** REPAY LOAN ***
5510 ?: SC=0: GOSUB 10400: ?"Your loan is";FNM$(L)
5530 A$="Do you want to repay any": GOSUB 10100: IF FNNO RETURN
5550 UL=L: IF L>M THEN UL=M
5560 LINPUT("How much? £")Z$: IF Z$="" THEN 5620
5580 IF NUM(Z$)=FALSE THEN A1$="Please enter a number": GOSUB 10300: GOTO 5560
5590 Z=INT(VAL(Z$)): IF Z>UL OR Z<0 THEN A1$="Please enter a value from £0 →"+FNM$(UL): GOSUB 10300: GOTO 5560
5600 L=L-Z: M=M-Z: RETURN
5620 PUT 11,9,26: ?FNM$(UL): Z=UL: GOTO 5600
6000 REM *** INVEST ***
6010 IV=1: N=0: FOR I=1 TO 9: IF C(I)>0 AND C(I)<10000 THEN N=N+1
6020 NEXT I: IF N=0 RETURN
6025 ?: SC=0: A$="Do you want to invest": GOSUB 10100: IF FNNO RETURN
6030 PUT#1,31,10,10: N=0: UL=1000: IF M<UL THEN UL=M
6040 ?#1,"Number","  Position","Value(£)": ?#1: FOR I=1 TO 9: IF C(I)>0 AND C(I)<10000 THEN N=N+1: ?#1,N,"        ";FNXY$(F(I,1));FNXY$(F(I,2)),,C(I)[5]
6070 NEXT I: ?#1
6080 IF N=1 THEN Z=1: ?#1,"You only have one factory to invest in": GOTO 6140
6090 ?#1: ?#1,"Enter the number of the factory": ?#1,"you wish to invest in": ?#1,"Number = ";: PUT#1,6
6100 GET#4,Z$: IF Z$<"1" OR Z$>MID$(STR$(N),2,1) THEN 6100
6110 PUT#1,7,Z$,13: Z=VAL(Z$)
6140 N=0: FOR I=1 TO 9: IF C(I)>0 AND C(I)<10000 THEN N=N+1: IF N=Z THEN 6160
6150 NEXT I
6160 ?#1: SC=1: GOSUB 10400: ?#1
6180 ?#1,"How much do you want to invest? £";: LINPUT#1,Z$: IF Z$="" THEN 6260
6190 IF NUM(Z$)=FALSE THEN A1$="Please enter a number": GOSUB 10300: GOTO 6180
6200 Z=INT(VAL(Z$)): IF Z<0 OR Z>UL THEN A1$="Please enter a value from £0 →"+FNM$(UL): GOSUB 10300: GOTO 6180
6210 C(I)=C(I)+Z: M=M-Z: R(I)=INT(R(I)+Z*RND/7): IF M=0 OR IV=2 RETURN
6225 FOR I=1 TO 9: IF C(I)>0 AND C(I)<10000 THEN 6230
6226 NEXT I: RETURN
6230 ?#1: A$="Do you want to invest again": GOSUB 10100: IF FNNO RETURN
6250 IV=2: GOTO 6030
6260 Z=UL: PUT#1,11,9,9,9,9,26: ?#1,MID$(STR$(Z),2): GOTO 6210
6500 REM *** NEW TOWN ***
6510 ?: SC=0: GOSUB 10400
6520 A$="Do you want to build a town": GOSUB 10100: IF FNNO RETURN
6540 X=FNR(36): Y=FNR(16): IF X=WX AND Y=WY THEN 6540
6560 FOR I=1 TO 9
6570 IF (X=F(I,1) AND Y=F(I,2)) OR (X=T(I,1) AND Y=T(I,2)) THEN 6540
6580 NEXT I: ?"The new town is at ";FNXY$(X);FNXY$(Y)
6600 T=T+1: T(T,1)=X: T(T,2)=Y: M=M-5000: PLOT PLA(X,Y),CHR$(146): RETURN
8000 REM *** SUMMARY ***
8010 CLOSE#1: OPEN#1,0,1,"L": PUT#1,23,3,22,30,2
8030 ?#1,"SUMMARY OF YEAR";YR: IF F=0 THEN 8260
8040 ?#1,"Factory": ?#1: ?#1,"Value": ?#1,"Rent": ?#1: ?#1,"Output"
8090 ?#1: ?#1,"Transport:": ?#1,"Goods": ?#1,"Workers": ?#1: ?#1,"Wages"
8120 ?#1: ?#1,"Profit": J=0
8130 FOR I=1 TO 9: IF C(I)=0 THEN 8250
8160 S=J*7+10: J=J+1: PUT#1,22,S,3: ?#1,"    ";FNXY$(F(I,1));FNXY$(F(I,2))
```


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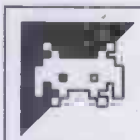
PROGRAMS

```
8170 PUT#1,22,S,5:?#1,C(I)[5]: PUT#1,22,S,7:?#1,R(I)[5]:PUT 22,S,9:? 1,O(I)[5]
8210 PUT#1,22,S,12:?#1,GD(I)[5]: PUT#1,22,S,13:?#1,WK(I)[5]
8230 PUT#1,22,S,15:?#1,WB(I)[5]: PUT#1,22,S,17: GOSUB 8450: ?#1,P$
8250 NEXT I
8260 A$="factories": IF F=1 THEN A$="factory"
8265 ?#1:?#1,"O utput  from your";F;A$;",valued at";FNM$(C);"was";FNM$(O)
8270 ?#1,"Rent,including";FNM$(RA);"for warehouse,was";FNM$(R);" Insurance premi
ums were";FNM$(IP)
8275 IF L>0 ?#1,"Intrest on your";FNM$(L);"loan is";FNM$(INT(L/10))
8280 IF P-IP>0 ?#1,"You made a profit of";FNM$(P-IP);"this year"
8290 IF P-IP<0 ?#1,"You made a loss of";FNM$(P-IP);"this year"
8300 IF P-IP=0 ?#1,"You made neither a profit nor loss this year"
8305 A$="YOU HAVE"+FNM$(M)+"CAPITAL": IF M<0 THEN A$="YOU OWE"+FNM$(M)
8307 ?#1:?#1,"          ";A$;"  ";
8310 IF V>=0 ?#1,"YOU ARE NOW WORTH";FNM$(V);: IF V>60000 THEN 8500
8320 IF V<0 ?#1,"YOU WENT BANKRUPT IN YEAR";YR: GOTO 8370
8340 CLEAR I: SC=1: GOSUB 10000
8360 CLOSE#1: OPEN#1,0,1: PUT#1,23,3: RETURN
8370 A$="Do you want another game": SC=1: GOSUB 10100: IF FNNO THEN 1500
8400 RUN
8450 P$=" ": IF P(I)<0 THEN P$="-"
8455 P$=P$+MID$(STR$(P(I)),2)
8460 IF LEN(P$)<7 THEN P$=" "+P$: GOTO 8460
8470 RETURN
8500 FOR I=1 TO 2000: NEXT I: PUT 31,10,10
8520 ?"You have successfully completed your job"
8530 ?"and retire after";YR;"years.": ?
8540 A$="Do you want another game": SC=0: GOSUB 10100: IF FNNO GOTO 1500
8560 RUN
10000 REM *** WAIT ***
10010 PUT#SC,29,6
10020 GET#4,Z: IF Z<>0 THEN 10020
10030 GET#4,Z: IF Z=0 THEN 10030
10040 PUT#SC,7: RETURN
10100 REM *** YES/NO REPLY ***
10110 GET#4,Z: IF Z<>0 THEN 10110
10120 ?#SC,A$;" (y/n)? ";: PUT#SC,6
10130 GET#4,Z: IF Z=0 THEN 10130
10140 PUT#SC,27,Z,13,7: Z$=CHR$(Z): IF FNYS OR FNNO RETURN
10150 A1$="Please enter y or n": GOSUB 10300: GOTO 10120
10300 REM *** ERROR REPORT ***
10310 PUT#SC,11,2: ?#SC,A1$: FOR I8=1 TO 1000: NEXT I8: PUT#SC,11,2: RETURN
10400 REM *** AMOUNT OF MONEY ***
10410 IF M>=0 ?#SC,"You have";FNM$(M);"capital.": RETURN
10420 ?#SC,"You owe";FNM$(M): RETURN
10500 REM *** INPUT CO-ORDS ***
10510 LINPUT(A$)P$: IF LEN(P$)<>2 THEN A1$="Please enter coordinates correctly":
GOSUB 10300: GOTO 10510
10530  X$=LEFT$(P$,1): Y$=RIGHT$(P$,1): X=FNX(X$): Y=FNY(Y$)
10550 IF X=0 OR Y=0 THEN A1$="Coordinates out of range": GOSUB 10300: GOTO 10510
10560 RETURN
```



BBC Othello

by John Webb

'Othello' is a standard version of the game running on the BBC B. You can either play against another person, using the program as an electronic board and score marker, or against the computer.

If playing against the computer, you have a choice of hard or easy levels. I must agree with Peter Whiting, who reviewed the program for us, that the jingle the thing plays is decidedly awful. Personally, I think the jingle is the reason the program wins so often.

Owners of machines with the 0.1 OS are referred to the remarks in line 5 for lines to omit. The rules, incidentally, are based on the Peter Pan version of the game.

```
>LIST
    0 REM**By J. Webb**
    5 REM For OS 0.1 remove lines 10,180,190,380,440,480,510,1420,1500
   10 *FX220,0
   20 MODE7
   30 DIMposition%(100)
   40 PROCcircles
   50 PROCinstructions
   60 REPEAT:PROCinit
   70   MODE1
   80   PROCsetupboard
   90   PROCfindplayers
  100   REPEAT
  110     REPEAT:PROCgo
  120       PROCcompute
  130       PROClookatgo
  140       UNTILillegal%=2
  150     PROCupdatescore
  160     turn%=turn%+1:UNTILturn%=60
  170   PROCwin:UNTILwait$<>" "
  180 *FX21,5
  190 *FX220,27
  200 MODE7:END
  210 DEFPROCinit
  220 FORpos%=1TO100:position%(pos%)=0:NEXT
  230 turn%=0:value%=1:comp%=0:go%=0:edge%=0:miss%=1
  240 ENDPROC
  250 DEFPROCsetupboard
  260 COLOUR1:VDU28,0,31,10,0,23;8202;0;0;0;
  270 VDU4
  280 VDU19,2,0,0,0,0,5:GCOL0,2
  290 MOVE352,960:MOVE352,128:PLOT85,1184,960:PLOT85,1184,128
  300 MOVE416,96:PRINT"A  B  C  D  E  F  G  H"
  310 FORY%=160TO928STEP96
  320   GCOL0,0:MOVE384,Y%:DRAW1152,Y%:MOVE1216,Y%+64:GCOL0,2:
  330   IFY%=928THEN340ELSEPRINT;(Y%-160)/96+1
  340   NEXT
```

PROGRAMS

```
  350 GCOL0,0:FORX%=384TO1152STEP96
  360   MOVEX%,160:DRAWX%,928:NEXT
  370 VDU19,2,2,0,0,0
  380 *FX21,5
  390 RESTORE2040
  400 FORposition%=1TO4:READpos%,val%,C%:position%(pos%)=val%:GCOL0,C%:PROCfindr
owandcol(pos%):PROCcounter:NEXT
  410 ENDPROC
  420 DEFPROCfindplayers
  430 VDU4:PRINTTAB(0,10)"Do you wantto play thecomputer?"'" (Y or N)"
  440 *FX21,0
  450 REPEAT:wait$=GET$:UNTILINSTR("YNyn",wait$)>0:SOUND&11,2,40,4:PROCclear(10)
  460 IFwait$<>"Y"ANDwait$<>"y"THENENDPROC
  470 PRINTTAB(0,10)"Do you wanta  hard  oreasy game?"'" (H or E)"
  480 *FX21,0
  490 REPEAT:wait$=GET$:UNTILINSTR("HhEe",wait$)>0:SOUND&11,2,40,4:PROCclear(10)
:IFwait$="H"ORwait$="h"THENmiss%=0
  500 go%=1:PRINTTAB(0,10)"Are you go-ing  first? (Y or N)"
  510 *FX21,0
  520 REPEAT:wait$=GET$:UNTILINSTR("YNyn",wait$)>0:SOUND&11,2,40,4:PROCclear(10)
  530 IFwait$="Y"ORwait$="y"THENENDPROC
  540 go%=2:ENDPROC
  550 DEFPROCcircles
  560 VDU23,224,0,0,0,3,7,15,31,31,23,225,0,0,126,255,255,255,255,255,23,226,0,0
,0,192,224,240,248,248,23,227,31,63,63,63,63,63,63,31
  570 VDU23,228,255,255,255,255,255,255,255,255,255,23,229,248,252,252,252,252,252,2
52,248,23,230,31,31,15,7,3,0,0,0,23,231,255,255,255,255,255,126,0,0
  580 VDU23,232,248,248,248,240,224,192,0,0,0
  590 C1$=CHR$224+CHR$225+CHR$226:C2$=CHR$227+CHR$228+CHR$229:C3$=CHR$230+CHR$23
1+CHR$232
  600 circle$=C1$+CHR$8+CHR$8+CHR$8+CHR$10+C2$+CHR$8+CHR$8+CHR$8+CHR$10+C3$
  610 ENVELOPE1,4,0,0,0,0,0,0,121,-10,-5,-2,120,120:ENVELOPE2,16,4,-8,-4,16,16,3
2,64,64,-64,-64,128,0
  620 ENDPROC
  630 DEFPROCclear(tab%):PRINTTAB(0,tab%)SPC(42):ENDPROC
  640 DEFPROCgo
  650 VDU4:pass%=0:COLOUR2
  660 IFgo%<2THEN690
  670 PROCclear(4):go%=1:PRINTTAB(0,4)"Computing":IFvalue%=1THENvalue%=2:GCOL0,0
:ELSEGCOL0,3:value%=1
  680 ENDPROC
  690 IFvalue%=1THENPRINTTAB(0,4)"Blacks go:":value%=2:GCOL0,0:ELSEPRINTTAB(0,4)
"Whites go:":GCOL0,3:value%=1
  700 IFgo%>0THENgo%=2
  710 REPEAT:REPEAT:PROCclear(5):PRINTTAB(0,5)"Column? ";
  720     col%=GETAND223:UNTIL(col%>64ANDcol%<73)ORcol%=80:PRINTCHR$(col%):col%=
col%-64:IFcol%=16THEN750
  730   PRINTTAB(0,6)"Row? ";
  740   row%=GET:row%=row%-48:PRINT;row%
  750   UNTIL(row%>0ANDrow%<9)ORcol%=16
  760 VDU5:pos%=col%*10+row%+1
  770 ENDPROC
  780 DEFPROCcounter
  790 SOUND&11,1,94,12
  800 VDU5:MOVE291+96*col%,159+96*row%:PRINT:circle$
  810 TIME=0:REPEATUNTILTIME>50
  820 ENDPROC
  830 DEFPROCillegal
  840 VDU4:SOUND&10,2,70,25
  850 PROCclear(5)
  860 PRINTTAB(0,5)"Illegal"'" move"
  870 IFvalue%=1THENvalue%=2ELSEvalue%=1
  880 IFgo%=2THENgo%=1
  890 TIME=0:REPEATUNTILTIME>200
  900 ENDPROC
  910 DEFPROCweigh
  920 weight%=0:IFposition%(pos%)>0ENDPROC
  930 RESTORE2050
  940 FORB%=1TO8:READC%:A%=pos%
  950   IFedge%<>0THENC%=edge%:B%=8
  960   REPEAT:IFA%=pos%THEN1010
  970     IFposition%(A%)=0THENA%=199:GOTO1010
  980     IFposition%(A%)=value%ANDposition%(A%-C%)<>value%ANDposition%(A%-C%)>0
THENillegal%=1:weight%=weight%+ABS((pos%-A%)/C%)-1:PROCcheckedge:PROCedge:A%=199
:GOTO1000
  990     IFposition%(A%)=value%ANDposition%(A%-C%)=0THENA%=199
 1000     IFweight%>bestgo%THENbestgo%=weight%:compgo%=pos%
 1010     A%=A%+C%:UNTILA%>1000RA%<1
 1020   IFillegal%=1ANDcomp%<>2ANDcol%<>16THENA%=pos%:PROCchangecolour
 1030   NEXT:ENDPROC
 1040 DEFPROClookatgo
 1050 black%=0:white%=0:IFcol%=16ANDpass%=0THEN1100
 1060 IFpass%=1THENillegal%=2:turn%=turn%-1:GOTO1100
 1070 illegal%=0
 1080 IFposition%(pos%)>0THENPROCillegal:ENDPROC
 1090 PROCweigh
 1100 FORA%=1TO100:IFposition%(A%)=3THENposition%(A%)=value%
 1110   IFposition%(A%)=2THENblack%=black%+1
 1120   IFposition%(A%)=1THENwhite%=white%+1
 1130   NEXT
 1140 IFcol%=16ANDillegal%=0THENillegal%=2:turn%=turn%-1
 1150 IFillegal%<>2THENPROCillegal
 1160 IFblack%=0ORwhite%=0THENturn%=59
 1170 ENDPROC
 1180 DEFPROCfindrowandcol(posit%)
 1190 col%=posit%DIV10
 1200 row%=(posit%-1)MOD10
 1210 ENDPROC
 1220 DEFPROCchangecolour
 1230 REPEAT:PROCfindrowandcol(A%)
 1240   IFposition%(A%)<>3THENPROCcounter
 1250   position%(A%)=3:A%=A%+C%:UNTILposition%(A%)=value%:illegal%=2
 1260 ENDPROC
 1270 DEFPROCupdatescore
 1280 VDU4:PRINTTAB(0,15)"Last go-";
 1290 IFcol%=16THENPRINT"P ":K%=K%+1:ELSEPROCfindrowandcol(pos%):PRINTCHR$(col%+
64);row%:K%=0
 1300 col%=0:PRINTTAB(0,16)"Black: ";black%;" "
 1310 PRINTTAB(0,17)"White: ";white%;" ":IFK%=2THENturn%=59
 1320 ENDPROC
 1330 DEFPROCinstructions
 1340 VDU23;8202;0;0;0;:SOUND&11,2,80,255
 1350 PRINTTAB(14,3);CHR$130;CHR$141;"OTHELLO"
 1360 PRINTTAB(14,4);CHR$130;CHR$141;"OTHELLO"
 1370 PRINT''CHR$131;"  The object  of this game  is to have"'CHR$131;"the  most
  discs  displayed  when  the"'CHR$131;"board is full."
 1380 PRINTCHR$131;"  At each turn  the lines of opponents"'CHR$131;"discs  that
, by playing  your  disc,"'CHR$131;"are started  and  finished  with  your"'CH
R$131;"discs all change to your colour."
 1390 PRINTCHR$131;"  If, on your turn, you  don't  have a"'CHR$131;"legal posit
ion to move then press";CHR$136;"P";CHR$137;"to"'CHR$131;"pass."
```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PROGRAMS

```
 1400 PRINTCHR$131;"  You  can  play  against  either  the"'CHR$131;"computer or
another player."
 1410 PRINT'''TAB(6);CHR$134;"Press 'space bar' to play."
 1420 *FX21,0
 1430 REPEAT:wait$=GET$:UNTILwait$=" "
 1440 ENDPROC
 1450 DEFPROCwin
 1460 VDU5:GCOL0,3:MOVE600,32:SOUND&11,2,80,255
 1470 IFblack%>white%PRINT"Black wins!":GOTO1490
 1480 IFwhite%>black%PRINT"White wins!"ELSEPRINT"Close game!"
 1490 VDU4:COLOUR1:PRINTTAB(0,23)"Press spacebar to play  again"
 1500 *FX21,0
 1510 wait$=GET$
 1520 ENDPROC
 1530 DEFPROCedge:IFG%<>0THENENDPROC
 1540 RESTORE1990:G%=0:REPEAT:G%=G%+1:READcheck%:UNTILcheck%=pos%
 1550 RESTORE1990:FORP%=1TOG%+1:READcheck%
 1560   IFP%=G%-1ANDposition%(check%)>0ANDposition%(check%)<>value%THENweight%=0
 1570   IFP%=G%+1ANDposition%(check%)>0ANDposition%(check%)<>value%THENweight%=0
 1580   NEXT
 1590 ENDPROC
 1600 DEFPROCcheckedge:IFedge%=0THENENDPROC
 1610 IFposition%(pos%-edge%)>0ANDposition%(pos%-edge%)<>value%THENweight%=0
 1620 IFposition%(A%+edge%)>0ANDposition%(A%+edge%)<>value%THENweight%=0
 1630 ENDPROC
 1640 DEFPROCcorner:FORQ%=1TO3:READpos%:PROCweigh:RESTORE2030:FORS%=0TOR%+Q%:REA
DT%:NEXT:NEXT:ENDPROC
 1650 DEFPROCcompute
 1660 G%=1:bestgo%=0:illegal%=0:IFcol%=16THEN1690
 1670 IFgo%<>1THENENDPROC
 1680 comp%=2
 1690 RESTORE1950:FORR%=1TO4:READpos%:PROCweigh:RESTORE1950:FORS%=1TOR%:READT%:N
EXT:NEXT
 1700 IFbestgo%>0THEN1900
 1710 IFcol%=16THEN1780
 1720 IFturn%<50Rmiss%=1THEN1780
 1730 FORedge%=-1TO1STEP2:RESTORE1960:FORR%=1TO12:READpos%:PROCweigh:RESTORE1960
:FORS%=1TOR%:READT%:NEXT:NEXT:NEXT
 1740 FORedge%=-10TO10STEP20:RESTORE1970:FORR%=1TO12:READpos%:PROCweigh:RESTORE1
970:FORS%=1TOR%:READT%:NEXT:NEXT:NEXT
 1750 edge%=0:IFbestgo%>0THEN1900
 1760 G%=0:RESTORE1980:FORR%=1TO16:READpos%:PROCweigh:RESTORE1980:FORS%=1TOR%:RE
ADT%:NEXT:NEXT
 1770 G%=1:IFbestgo%>0THEN1900
 1780 RESTORE2000:FORR%=1TO12:READpos%:PROCweigh:RESTORE2000:FORS%=1TOR%:READT%:
NEXT:NEXT
 1790 IFbestgo%>0ANDmiss%=0THEN1900
 1800 RESTORE2010:FORR%=1TO16:READpos%:PROCweigh:RESTORE2010:FORS%=1TOR%:READT%:
NEXT:NEXT:IFbestgo%>0THEN1900
 1810 RESTORE2020:FORR%=1TO16:READpos%:PROCweigh:RESTORE2020:FORS%=1TOR%:READT%:
NEXT:NEXT:IFbestgo%>0THEN1900
 1820 IFmiss%=1THEN1890
 1830 RESTORE2030:FORR%=0TO12:READpos%
 1840   IFR%MOD4=0ANDposition%(pos%)=value%THENPROCcorner
 1850   RESTORE2030:FORS%=0TOR%:READT%:NEXT:NEXT:IFbestgo%>0THEN1900
 1860 RESTORE2030:FORR%=0TO12:READpos%
 1870   IFR%MOD4=0ANDposition%(pos%)>0THENPROCcorner
 1880   RESTORE2030:FORS%=0TOR%:READT%:NEXT:NEXT:IFbestgo%>0THEN1900
 1890 RESTORE2030:FORR%=1TO16:READpos%:PROCweigh:RESTORE2030:FORS%=1TOR%:READT%:
NEXT:NEXT
 1900 IFcol%=16THENENDPROC
 1910 comp%=1:IFbestgo%>0THENpos%=compgo%:ENDPROC
 1920 SOUND&11,1,2,12:VDU4:PRINTTAB(0,5);"Pass - no"'"legal move":TIME=0:REPEATU
NTILTIME>200
 1930 col%=16:pass%=1
 1940 ENDPROC
 1950 DATA12,19,89,82
 1960 DATA14,15,16,17,84,85,86,87,13,18,83,88
 1970 DATA32,42,52,62,39,49,59,69,22,72,29,79
 1980 DATA14,17,39,69,87,84,62,32,15,16,49,59,85,86,42,52
 1990 DATA13,14,15,16,17,18,29,39,49,59,69,79,88,87,86,85,84,83,72,62,52,42,32,2
2
 2000 DATA37,36,35,34,44,54,64,65,66,67,57,47
 2010 DATA24,25,26,27,38,48,58,68,77,76,75,74,63,53,43,33
 2020 DATA32,42,52,62,84,85,86,87,69,59,49,39,17,16,15,14
 2030 DATA19,18,28,29,89,79,78,88,82,83,73,72,12,22,23,13
 2040 DATA45,2,0,46,1,3,55,1,3,56,2,0
 2050 DATA1,9,10,11,-1,-9,-10,-11
```

BBC Grid

by Keith Miles

'Grid' is an arcade-style game for the BBC B.

The game does bear a passing resemblance to Space Invaders, but these invaders are more sparse and somewhat more intelligent than the usual descending droves of green morons.

The idea of the game is, as ever, to reduce the friendly green ETs to their component atoms before they reach the ground. The difference is that these particular ETs don't just continue their mindless descent while you sit and take pot shots at them. They can be very crafty when it comes to taking evasive action and sneaking past you unnoticed. They will also unleash a homing missile on you if sufficiently provoked (that is, if you manage to reach level two or above).

At the beginning of the game, you have 200 units of fuel. This is used up extremely rapidly even if you sit still and don't fire any missiles. To replenish your fuel, you must shoot the fuel dumps deposited randomly around the screen by the 'x-y droids'. Having spent about twenty minutes playing successive games, I can assure you that you need your wits about you to prevent aliens getting past you, keep your fuel topped up and evade the homing missiles all at the same time.

The game will end if you allow an alien to reach the ground, run out of fuel (that's the way I usually bite the dust), collide with anything or let the homing missile get you. At each successive level, the homing missile gets faster, the invaders more numerous and your fuel consumption heavier.

You'll see why it's called Grid when you run it.

PROGRAMS

```
   10 REM THE-GRID: Copyright K.MILES. 4, WILLOW WALK. ELY. CAMBS
   20 MODE2
   30 ENVELOPE3,129,2,4,6,28,14,7,0,0,0,-80,80,80
   40 VDU23,1,0;0;0;0;
   50 DIMX%(18),Y%(18)
   60 PROCCHARACTERS
   70 HI%=0
   80 PROCTITLES
   90 CLS:SC%=0:G%=1:W%=2:G%=1:L%=1:FUEL%=0:LV%=0:SP%=8
  100 RA%=1:AL%=4
  110 IFAL%>18 AL%=18
  120 IFRA%>5 RA%=5
  130 R%=0:M%=0:C%=0:E%=0:H%=1:SX%=10:SY%=28:A%=225:MX%=0:MY%=0:FL%=0:FUEL%=FUEL
%+200:S1%=10:S2%=10:GO%=1
  140 PROCBOARD
  150 PROCINVADERS
  160 REPEAT:PROCINV:PROCSHIP:PROCDROIDS:PROCHOMER:FUEL%=FUEL%-RA%:IFFUEL%<0 FUE
L%=0
  170   COLOUR4:PRINTTAB(5,0);FUEL%;" ":UNTIL C%=AL%+1 OR E%=1 OR FUEL%<=0
  180 IFE%=1OR FUEL%<=0 THEN200
  190 IFC%=AL%+1AND AL%=18 LV%=1:SP%=SP%-2:GOTO100 ELSE RA%=RA%+1:AL%=AL%+5:GOTO
110
  200 PROCINVADED
  210 COLOUR8:PRINTTAB(6,15)"THE-GRID":COLOUR3:PRINTTAB(0,30)"ANOTHER INVASION?
"
  220 *FX15,0
  230 A$=GET$:IFA$="Y"OR A$="y"GOTO80
  240 IFA$="N"OR A$="n" PRINTTAB(0,31);:END
  250 GOTO230
  260 DEFPROCBOARD
  270 COLOUR4:PRINTTAB(0,0)"FUEL ";FUEL%:COLOUR6:PRINTTAB(10,0)"SCORE ";SC%
  280 COLOUR1:FORI%=1TO19:FORJ%=1TO28:VDU31,I%,J%,240:NEXT:NEXT
  290 COLOUR5:PRINTTAB(0,30)"HI-SCORE ";HI%;
  300 ENDPROC
  310 DEFPROCCHARACTERS
  320 VDU23,225,195,219,219,255,255,219,129,0,23,226,0,129,219,255,255,219,219,1
95
  330 VDU23,227,254,252,24,124,124,24,252,254,23,228,127,63,24,62,62,24,63,127
  340 VDU23,229,224,96,62,51,51,62,96,224,23,230,24,60,36,36,60,255,195,129
  350 VDU23,231,24,60,60,24,24,60,36,0,23,232,0,36,60,24,24,60,60,24
  360 VDU23,233,0,0,102,252,252,102,0,0,23,234,0,0,102,63,63,102,0,0
  370 VDU23,235,24,36,90,189,189,90,36,24,23,236,102,189,189,90,90,189,189,102
  380 VDU23,237,36,129,219,255,126,36,66,129,23,240,24,24,24,255,255,24,24,24
  390 ENDPROC
  400 DEFPROCINVADERS
  410 COLOUR2:FORI%=0TO AL%:X%(I%)=1+RND(18):Y%(I%)=H%:VDU31,X%(I%),Y%(I%),237:N
EXT
  420 ENDPROC
  430 DEFPROCINV
  440 R%=RND(AL%+1)-1
  450 M%=RND(3)-2
  460 IFY%(R%)=-32THEN560
  470 T1%=FNPT((X%(R%)+M%),Y%(R%)):IFT1%=11 PROCFALLOUT:GOTO560
  480 T2%=FNPT((X%(R%)+M%),(Y%(R%)+1)):IFT2%=11 PROCFALLOUT:GOTO560
  490 COLOUR1:VDU31,X%(R%),Y%(R%),240
  500 X%(R%)=X%(R%)+M%
  510 IFM%=0 Y%(R%)=Y%(R%)+1
  520 IFX%(R%)>19 X%(R%)=19
  530 IFX%(R%)<1 X%(R%)=1
  540 COLOUR2:VDU31,X%(R%),Y%(R%),237
  550 IFY%(R%)>28 E%=1
  560 ENDPROC
  570 DEFPROCSHIP
  580 KP%=0
  590 COLOUR1:VDU31,SX%,SY%,240
  600 *FX15,0
  610 IFINKEY(-99) VDU7:SX%=RND(18)+1:SY%=RND(28):GOTO690
  620 IFINKEY(-2)AND SX%<19 KP%=1:SX%=SX%+1:A%=228:IFFL%=0 X%=1:Y%=0:B%=234
  630 IFKP%=1THEN690
  640 IFINKEY(-65)AND SX%>1 KP%=1:SX%=SX%-1:A%=227:IFFL%=0 X%=-1:Y%=0:B%=233
  650 IFKP%=1THEN690
  660 IFINKEY(-89)AND SY%>1 KP%=1:SY%=SY%-1:A%=225:IFFL%=0 X%=0:Y%=-1:B%=231
  670 IFKP%=1THEN690
  680 IFINKEY(-1)AND SY%<28 SY%=SY%+1:A%=226:IFFL%=0 X%=0:Y%=1:B%=232
  690 IFINKEY(-74)OR FL%>0 PROCMISSILE
  700 T%=FNPT(SX%,SY%):IFT%=11OR T%=13OR T%=2 E%=1:GOTO720
  710 COLOUR6:VDU31,SX%,SY%,A%
  720 ENDPROC
  730 DEFPROCMISSILE
  740 IFFL%=0 FL%=1:MX%=SX%:MY%=SY%
  750 VDU31,MX%,MY%,240
  760 MY%=MY%+Y%:MX%=MX%+X%
  770 FL%=FL%+1
  780 IFFL%=11 OR MX%>19OR MX%<1OR MY%<1OR MY%>28 FL%=0:GOTO840
  790 P%=FNPT(MX%,MY%)
  800 IFP%=2OR P%=3 PROCHIT:FL%=0:GOTO840
  810 IFP%=11OR P%=5 FL%=0:GOTO840
  820 IFP%=13 FL%=0:FUEL%=FUEL%+50+(RND(RA%)*50):VDU31,MX%,MY%,240:SOUND0,-15,4,
8:GOTO840 .
  830 COLOUR4:VDU31,MX%,MY%,B%
  840 ENDPROC
  850 DEFPROCHIT
  860 FORJ%=0TO AL%
  870    IFMX%<>X%(J%)ORMY%<>Y%(J%)THEN910
  880    COLOUR11:VDU31,MX%,MY%,236
  890    SC%=SC%+Y%(J%):C%=C%+1
  900    Y%(J%)=-32
  910    NEXT
  920 SOUND3,3,50,10
  930 COLOUR6:PRINTTAB(16,0);SC%
  940 IFHI%<SC% COLOUR5:HI%=SC%:PRINTTAB(9,30);HI%;
  950 ENDPROC
  960 DEFPROCFALLOUT
  970 COLOUR1:VDU31,X%(R%),Y%(R%),240
  980 SC%=SC%+Y%(R%)
  990 C%=C%+1
 1000 Y%(R%)=-32
 1010 SOUND3,3,50,10
 1020 COLOUR6:PRINTTAB(16,0);SC%
 1030 IFHI%<SC% COLOUR5:HI%=SC%:PRINTTAB(9,30);HI%;
 1040 ENDPROC
 1050 DEFPROCINVADED
 1060 FORI=1TO20:SOUND0,-15,6,10:FORJ=1TO50:VDU19,1,RND(6);0;:NEXT:NEXT
 1070 VDU20
 1080 ENDPROC
 1090 DEFPROCDROIDS
 1100 VDU31,0,0%,32,31,W%,29,32
 1110 Q%=Q%+G%:W%=W%+L%
 1120 IFQ%>27 G%=-1
 1130 IFQ%<2 G%=1
```


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PROGRAMS

```
1140 IFW%>=19 L%=-1
1150 IFW%<2 L%=1
1160 COLOUR4:VDU31,0,0%,229,31,W%,29,230
1170 IFRND(1)>.97 COLOUR13:VDU31,W%,0%,235:SOUND0,-15,2,4
1180 ENDPROC
1190 DEFPROCTITLES
1200 CLS:COLOUR1:FORI%=0TO30:FORJ%=0TO19:PRINTCHR$240;:NEXT:NEXT
1210 COLOUR4:PRINTTAB(6,0)"THE-GRID"
1220 COLOUR3:PRINTTAB(2,2)"CAN YOU HALT THE"'TAB(2,3)"ALIEN INVASION OF"'TAB(6,
4)"THE GRID."
1230 PRINT'"AVOID COLLIDING WITHTHE ALIENS AND EVADE";TAB(1,8)"THE FALL-OUT FRO
M"TAB(1,9)"YOUR OWN MISSILES."TAB(2,10)"BEWARE OF HOMER."
1240 PRINTTAB(1,12)"HIT THE FUEL DUMPS"TAB(1,13)"DROPPED BY THE X-Y"TAB(2,14)"D
ROIDS TO REFUEL."
1250 COLOUR2:PRINTTAB(2,16)CHR$237"  ALIEN"
1260 COLOUR5:PRINTTAB(2,17)"@  HOMER"
1270 COLOUR4:PRINTTAB(2,18)CHR$230"  X-Y DROID"
1280 COLOUR11:PRINTTAB(2,19)CHR$236"  FALLOUT"
1290 COLOUR13:PRINTTAB(2,20)CHR$235"  FUEL DUMP"
1300 COLOUR6:PRINTTAB(2,21)CHR$225"  YOUR SHIP"
1310 COLOUR3:PRINTTAB(1,23)"CONTROLS:"TAB(2,25)"CAPS-LOCK  LEFT"TAB(2,26)"CTRL
     RIGHT"TAB(2,27)"]          UP"TAB(2,28)"SHIFT       DOWN"TAB(2,29)"RETURN
  FIRE"TAB(2,30)"SPACE       PANIC"
1320 COLOUR4:PRINTTAB(3,31)"PRESS <SPACE>";
1330 I=0:REPEATI=I+1:SOUND0,-15,I,10:UNTILI=5
1340 IFINKEY$(100)=" "THEN1350ELSE1330
1350 ENDPROC
1360 DEFFNPT(d%,e%)
1370 =POINT((d%*64)+32,1008-(e%*32))
1380 DEFPROCHOMER
1390 IFLV%=0THEN1490
1400 IFSP%<2 SP%=2
1410 G0%=G0%+1:IFG0%<>SP% THEN1490
1420 Q1%=S1%:Q2%=S2%
1430 S1%=S1%+(S1%>SX%)-(S1%<SX%):S2%=S2%+(S2%>SY%)-(S2%<SY%)
1440 IFFNPT(S1%,S2%)=6 E%=1
1450 IFFNPT(S1%,S2%)=11 S1%=Q1%:S2%=Q2%:GOTO1480
1460 COLOUR1:VDU31,Q1%,Q2%,240
1470 COLOUR5:VDU31,S1%,S2%,64
1480 G0%=0
1490 ENDPROC
```

MZ-80K Ascot

by Cameron Small

'Ascot' is a simple but effective game for between one and nine players. The game is largely one of chance and as such is suited to younger age groups.

The game is based on gambling on horse races, hence the name. Once all players have entered their names, each player is invited to bet on one of nine horses at varying odds. More than one player may bet on the same horse if desired. Bets range from nil to £100.

Once the race is over, the computer calculates the new financial standing of each player. The bookie pays out on both a win and a place (second or third). Various misfortunes will randomly afflict players to deprive them of part of their money. If you run out of money, your bank may offer you a £50 overdraft (I wish my bank manager was as understanding!), on which it will charge 20% interest.

The game comprises ten races following which all overdraft repayments are deducted from each player's balance, the winner is calculated and another game is offered.

```
10 REM ******************************
20 REM **                          **
30 REM **  ASCOT BY C.R.A.M.SMALL  **
40 REM **                          **
50 REM ******************************
60 REM *** SCREEN SET UP ***
70 PRINT"■■■"
80 FORA=53248TO53248+39:POKEA,122:NEXT
90 FORA=53248TO54248-39STEP40:POKEA,123:NEXT
100 FORA=53248+39TO54248STEP40:POKEA,59:NEXT
110 FORA=54248-39TO54248:POKEA,58:NEXT
120 POKE53248,67:POKE54247,67:POKE53248+39,67:POKE54247-39,67
130 PRINTTAB(5);"▚▚▚▚ ▚▚▚▚ ▚  ▚ ▚▚▚▚ ▚"
140 PRINTTAB(5);"▚  ▚ ▚  ▚ ▚  ▚ ▚  ▚ ▚"
150 PRINTTAB(5);"▚▚▚▚ ▚  ▚ ▚▚▚▚ ▚▚▚▚ ▚"
160 PRINTTAB(5);"▚  ▚ ▚  ▚ ▚  ▚ ▚  ▚ ▚"
170 PRINTTAB(5);"▚  ▚ ▚▚▚▚ ▚  ▚ ▚  ▚ ▚▚▚▚▚"
180 PRINT"■"
190 PRINTTAB(5);"▚▚▚▚ ▚▚▚▚ ▚▚▚▚ ▚▚▚▚ ▚▚▚▚ "
200 PRINTTAB(5);"▚  ▚ ▚  ▚ ▚  ▚ ▚  ▚ ▚  ▚ "
210 PRINTTAB(5);"▚▚▚▚ ▚▚▚▚ ▚  ▚ ▚  ▚ ▚  ▚ "
220 PRINTTAB(5);"▚  ▚ ▚  ▚ ▚  ▚ ▚  ▚ ▚  ▚ "
230 PRINTTAB(5);"▚  ▚ ▚▚▚▚ ▚▚▚▚ ▚▚▚▚ ▚  ▚ "
240 PRINT"■■"
250 PRINTTAB(5);"▚▚▚▚ ▚▚▚▚ ▚▚▚▚ ▚▚▚▚ ▚▚▚▚"
260 PRINTTAB(5);"▚  ▚ ▚  ▚ ▚  ▚ ▚  ▚ ▚  ▚ "
270 PRINTTAB(5);"▚▚▚▚ ▚▚▚▚ ▚  ▚ ▚▚▚▚ ▚▚▚▚"
280 PRINTTAB(5);"▚  ▚ ▚  ▚ ▚  ▚ ▚  ▚ ▚  ▚"
290 PRINTTAB(5);"▚  ▚ ▚  ▚ ▚  ▚ ▚▚▚▚ ▚▚▚▚"
300 IT$="C.SMALL (c) JULY 1983."
310 POKE4466,16:PRINTTAB(9);
320 FORW=1TO22:PRINTTAB(W);MID$(IT$,W,1);:USR(62):NEXT
330 GETA$:IFA$=""THENGOTO330
340 REM*** CHECK IF INSTR. NEEDED ***
350 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■■■■■INSTRUCTIONS (Y/N)":GETA$:IFA$=""THENGOTO350
360 IFA$="Y"THENGOSUB2740
370 REM *** ENTER IN PLAYER DATA ***
380 INPUT"■■■ENTER NUMBER OF PLAYERS PLAYING ";PL
390 IFPL>9THENGOTO380
400 REM *** DIM INTERGER ARRAYS ***
410 DIMCA(PL),BC(9),OO(9),CH(PL),DC(10),DM(9),HP(9),P(9),PA(PL),SC(PL),AB(9)
420 DIMBH(PL),GO(5),LO(PL)
430 REM *** DIM STRING ARRAYS ***
440 DIMNA$(PL),RN$(60),NR$(10),RHN$(10),GO$(5)
450 FORE=1TOPL:CA(E)=50:NEXT
460 PRINT"■ENTER NAMES:"
470 FORA=1TOPL
```

PROGRAMS

```
480 PRINT"□PLAYER ";A;:INPUTNA$(A)
490 IFLEN(NA$(A))>18THENPRINT"******* TOO LONG *******":GOTO480
500 NEXT
510 REM*** READ IN NAMES OF HORSES ***
520 FORA=1TO60:READRN$(A):NEXTA
530 DATA ACCLAIM,BARRA HEAD,DERRY DON,GANG HARBOUR,LIGHT SHOW
540 DATA PERFECT HOST,SWELL SOUND,WHITE NILE,CHANTRY,CROWN GODIVA
550 DATA FEUTERSOEY,OUR CARO,PATINATION,SUMMER LIGHTNING
560 DATA AHMAD,ALCANON,ANCIENT MARINER,ASK JOHN,AVON VALE
570 DATA BASTILLE,CAREEN,DARE YOU,DESTROYER,DOMINATE
580 DATA DOUBLE,FAN CLUB,GERYON,MEZIARA,MIRANOL,MR COPPER
590 DATA SUGAR PLUM,ASTERI,WELL COVERED,WIZARD ART
600 DATA WOLVER PLUME,SPINDLE BERRY,MYTINA,ARIES DO
610 DATA MOST HONOURABLE,ELYSIAN,PRINCESS ZITA,PEACEFUL RUN
620 DATA MALTESE PET,LINKLIGHTER,GAY BROAD,FLYING FANTASY
630 DATA ROSSETTI,MADAM FLUTTERBYE,COUNTESS,MYSTERY SHIP,NETSUKE,PAGEANTIC
640 DATA REFLECTION,RITSURIN,ROCKET ALERT,RUNNING PRINCESS
650 DATA CELTIC ASSEMBLY,NOBODYS PERFECT,MYSTERY RUNNER,MYSTERY RUNNER
660 REM ******************************
670 REM ****   MAIN PROGRAMME   ****
680 REM ******************************
690 REM *** READ IN 1 ll b TO 10 b d ***
700 FORW=1TO10:READNR$(W):NEXT
710 DATA FIRST,SECOND,THIRD,FOURTH,FIFTH,SIXTH,SEVENTH
720 DATAEIGHTH,NINTH,TENTH
730 REM*** READ IN GOINGS ***
740 FORI=1TO5:READGO$(I),GO(I):NEXT
750 DATAHARD,2
760 DATAFIRM,1.75
770 DATANORMAL,1.5
780 DATASOFT,1.75
790 DATAWET,2
800 REM *** MAKE UP TITLE OF RACE ***
810 N=1
820 SP=INT(RND(1)*51)+1
830 C=1:FORE=SPTO(SP+9):RHN$(C)=RN$(E):C=C+1:NEXT
840 T$="THE ":T$=T$+NR$(N)+" RACE OF THE DAY"
850 FORA=1TO9:BC(A)=INT(RND(1)*6)+1:NEXT
860 Q=INT((40-LEN(T$))/2)
870 PRINT"G";:PRINTTAB(Q);T$
880 FORS=(Q-1)TO(Q+LEN(T$)):PRINTTAB(S);"▔";:NEXT:PRINT
890 REM *** HORSES BETTING CATAG. ***
900 FORG=1TO9
910 IFBC(G)=1THENOO(G)=75
920 IFBC(G)=2THENOO(G)=45
930 IFBC(G)=3THENOO(G)=25
940 IFBC(G)=4THENOO(G)=9
950 IFBC(G)=5THENOO(G)=5
960 IFBC(G)=6THENOO(G)=3
970 NEXTG
980 REM*** DATA DISPLAY ***
990 PRINT"▒▒▒
```

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PROGRAMS

```
1660 REM*** ACTUAL RACE ***
1670 FORT=1TO9:HP(T)=53248+(3*40)+(80*T):NEXT
1680 LM=0
1690 FORT=1TO9
1700 PMF=INT(RND(1)*(BC(T)/GO(F)))+1
1710 POKEHP(T),0:HP(T)=HP(T)+PMF:POKEHP(T),(32+T):DM(T)=DM(T)+PMF:NEXTT
1720 V=1:LM=DM(U):WB=U:U=U+1
1730 IF DM(U)>LM THEN LM=DM(U):WB=U
1740 U=U+1
1750 IFU<=9THENGOTO1730
1760 IFLM<35THENGOTO1690
1770 P(1)=WB:DM(WB)=0
1780 FORPP=2TO9:M=1:MP=DM(1):FORY=2TO9
1790 IFDM(Y)>MPTHENMP=DM(Y):M=Y
1800 NEXTY:P(PP)=M:DM(M)=0:NEXTPP
1810 REM*** RESULTS ***
1820 E$="RESULTS OF THE "+NR$(N)+" RACE"
1830 E=INT((40-LEN(E$))/2)
1840 PRINT"■";TAB(E);E$
1850 FORS=(E-1)TO(E+LEN(E$)):PRINTTAB(S);"═";:NEXT:PRINT"■■"
1860 PRINT:FORU=1TO9:PRINTRHN$(P(U));"";P(U);" WAS ";NR$(U);"■"
1870 NEXT
1880 GETR$:IFR$=""THENGOTO1880
1890 REM****   CACULATE  +/-   ****
1900 FORU=1TOPL
1910 IFCH(U)=P(1)THENCA(U)=INT(CA(U)+OO(P(1))*AB(U)):GOTO1950
1920 IFCH(U)=P(2)THENCA(U)=INT(CA(U)+(OO(P(2))*AB(U)/2)):GOTO1950
1930 IFCH(U)=P(3)THENCA(U)=INT(CA(U)+(OO(P(3))*AB(U)/3)):GOTO1950
1940 CA(U)=CA(U)-AB(U)
1950 NEXT
1960 REM *** DISPLAY NEW CASH LEVEL ***
1970 PRINT"■";TAB(14);"MONEY UPDATE"
1980 PRINTTAB(13);"═══════■■"
1990 FORS=1TOPL
2000 PRINTNA$(S);" HAS £";CA(S);"■":NEXT
2010 GETY$:IFY$=""THENGOTO2010
2020 REM*******  PROBLEMS  *******
2030 FORU=1TOPL
2040 IFRND(1)>0.2THENGOTO2410
2050 IFCA(U)<10THENGOTO2410
2060 PRINT"■";NA$(U);":-"
2070 F=INT(RND(1)*6)+1
2080 PRINT"■■■";
2090 ONGOTO2100,2170,2210,2250,2300,2350
2100 REM*** MUGGED ***
2110 PRINT"As you were walking along a dark■"
2120 PRINT"back street you were knocked unconscious"
2130 PRINT"from behind  .  When you woke up your   "
2140 PRINT"money was scattered on the ground ."
2150 GOTO2380
2160 REM *** DRUNK & ROWDY ***
2170 PRINT"You were having some drinks with■"
2180 PRINT"friends . However you went overboard and"
2190 PRINT"you were arrested .":GOTO2380
2200 REM *** PICKPOCKETED ***
2210 PRINT"You reach into your pocket and■"
2220 PRINT"find that some of your money has been   "
2230 PRINT"pinched .":GOTO2380
2240 REM *** HURT ***
2250 PRINT"You were late for the next race .■"
2260 PRINT" As you were running you tripped and    "
2270 PRINT"sprained your ankle ."
2280 GOTO2380
2290 REM*** LOSE MONEY ***
2300 PRINT"As you were queuing for the next■"
2310 PRINT"race you remembered you had left some   "
2320 PRINT"money next to you while eating and      "
2330 PRINT"had forgotten to pick it up .":GOTO2380
2340 REM *** FIGHT ***
2350 PRINT"You meet an incredibly rude man■"
2360 PRINT"and he picks a fight with you . The     "
2370 PRINT"police arrest and fine you both ."
2380 X=INT(RND(1)*(CA(U)/2))
2390 PRINT"■WELL , THAT COST YOU £";X;" .":CA(U)=CA(U)-X
2400 GETF$:IFF$=""THENGOTO2400
2410 NEXT
2420 FORK=1TOPL
2430 IFCA(K)<=0THENGOTO2910
2440 NEXTK
2450 N=N+1
2460 IFN<11THENGOTO820
2470 REM********************
2480 REM******  END  ******
2490 REM********************
2500 REM*** ADJUST SCORE - LOANS ***
2510 FORT=1TOPL
2520 CA(T)=CA(T)-LO(T):NEXTT
2530 FORGG=1TOPL
2540 HS=CA(1):ND=1:W=2
2550 IFCA(W)>HSTHENHS=CA(W):ND=W
2560 IFW<PLTHENW=W+1:GOTO2550
2570 PA(GG)=ND:CA(ND)=-1000000
2580 NEXTGG
2590 REM *** DISPLAY END ***
2600 PRINT"■"
2610 PRINTTAB(16);"PLACINGS"
2620 PRINTTAB(15);"═══════■■"
2630 FORF=1TOPL
2640 PRINTNR$(F);" CAME ";NA$(PA(F));"■":NEXTF
2650 PRINT"■DO YOU THINK YOU CAN SURVIVE ANOTHER   "
2660 INPUT"DAY (Y/N)";A$
2670 IFA$="Y"THENRUN
2680 PRINT"■"
2690 FORA=1TO31:PRINTTAB(A);"GOOD-BYE":NEXT
2700 FORA=31TO1STEP-1:PRINTTAB(A);"GOOD-BYE":NEXT
2710 GOTO2690
2720 END
2730 REM *** INSTRUCTIONS ***
2740 PRINT"■";TAB(14);"INSTRUCTIONS"
2750 PRINTTAB(13);"<<<<<<<<<<>>>>>>>>>>"
2760 PRINT"   The object of this game is to win as "
2770 PRINT"much money as possible by betting and   "
2780 PRINT"surviving the hazards of daily life on  "
2790 PRINT"the race course .                       "
2800 PRINT"   You may only back one horse at any   "
2810 PRINT"one time . The maximum bet is £100 and  "
2820 PRINT"the minimum bet is £1 . There are five  "
```

```
2830 PRINT"types of bet £1 , £5 , £20 , £50 & £100 "
2840 PRINT"Proportional pay-outs are made for 1st ,"
2850 PRINT"2nd and 3rd places . All the players in "
2860 PRINT"the game start with £50 ."
2870 PRINTTAB(26);"GOOD LUCK!"
2880 GETA$:IFA$=""THENGOTO2880
2890 GOTO380
2900 REM*** BROKE ***
2910 PRINT"■";NA$(K);":-"
2920 PRINT"■■■■You are broke but however luck is■"
2930 PRINT"on your side and you see a bank and you "
2940 PRINT"go in and get a loan of £50 ."
2950 CA(K)=CA(K)+50
2960 LO(K)=LO(K)+60
2970 GETD$:IFD$=""THENGOTO2970
2980 GOTO2440
2990 REM*** ERASING UNWANTED ***
3000 POKE4466,23:PRINTSPACE$(39)
3010 RETURN
```

Commodore 64 Fast Sprites

by Edward Carroll

'Fast Sprites' is an extremely useful machine code routine for the '64.

Although sprites are an extremely useful feature, it is difficult to control more than one or two at a time if they are moving in different directions and speeds. Not only do the loops become complicated, but Basic is very slow when it comes to graphics handling. What Fast Sprites does is to take the hard work out of moving sprites around the screen.

The program allows up to eight sprites (the maximum allowed by the '64) to move continuously and independently around the screen. For each sprite, you are required to enter six parameters:

x Speed and direction,
y Speed and direction,
x Minimum position,
y Minimum position,
x Maximum position,
y Maximum position.

These parameters are stored in location 700–755. Locations 700–715 are the speed and direction of the sprites. The speed is a number between 1 and 127 and direction backwards, rather than forwards, is obtained by adding 128 to the speed value.

700 = x speed/direction of sprite 0
701 = y speed/direction of sprite 0
714 = x speed/direction of sprite 7
715 = y speed/direction of sprite 7

Setting any of these locations to a 0 will stop movement of the relevant sprite in the appropriate direction. Locations 720–735 are the minimum x and y positions that a sprite can have. When the x or y coordinate of a sprite equals its corresponding minimum coordinate, its direction will be reversed.

720 = Minimum x position of sprite 0
721 = Minimum y position of sprite 0
734 = Minimum x position of sprite 7
735 = Minimum y position of sprite 7

Locations 740 – 755 are the maximum positions the sprites can have. When the x or y coordinate of a sprite equals its corresponding maximum coordinate, the sprite direction is reversed. For the maximum x position, 256 must be added to the value to get the true maximum position. For example, a value of 64 equals a maximum x position of 320 (64+256)

740 = Maximum x position of sprite 0
741 = Maximum y position of sprite 0
754 = Maximum x position of sprite 7
755 = Maximum y position of sprite 7

As well as the location just mentioned, two other locations are used by the routine. Location 1023 controls the over-all speed of the sprites movement. 1 = fastest, 255 = slowest. When POKEing this location, location 2 should be POKEd with the same value or a delay may occur between the change of speed.

Location 254 controls whether the interrupt routine updates the sprite positions or not. An 0 here enables the routine while a 1 disables the routine and lets the sprite be used as normal.

```
10 PRINT"[CLS]      READING MACHINE-CODE"
20 FORT=0TO11:CH=0:FORB=0TO15:READH:CH=CH+H:POKE49152+T*16+B,H:NEXT:READH
30 IFH<>(CH AND 255)THENPRINT"[CLS]TYPING ERROR IN LINE"PEEK(63)+256*PEEK(64):END
40 SU=SU+CH:NEXT:IFSU<>24741THENPRINT"[CLS]TYPING ERROR IN LINES 1000-1110":END
50 PRINT"[CLS]START ROUTINE BY 'SYS 49152'."
60 PRINT"ENABLE BY 'POKE 254,0'"
70 PRINT"DISABLE BY 'POKE 254,1'"
80 END
997 :
998 REM  ****** MACHINE-CODE DATA ******
999 :
1000 DATA120,169,192,141,21,3,169,13,141,20,3,88,96,165,254,208,11
1010 DATA4,198,2,240,3,76,49,234,173,255,3,133,2,32,35,192,96
1020 DATA76,49,234,162,0,138,74,168,189,188,2,41,127,240,110,189,195
1030 DATA188,2,48,81,133,252,254,0,208,208,9,173,16,208,25,164,147
1040 DATA192,141,16,208,189,0,208,221,228,2,144,20,138,74,176,8,173
1050 DATA173,16,208,57,164,192,240,8,189,188,2,9,128,157,188,2,129
1060 DATA198,252,208,210,76,157,192,41,127,133,252,222,0,208,189,0,161
1070 DATA208,201,255,208,11,173,16,208,57,172,192,141,16,208,169,255,186
1080 DATA221,208,2,176,20,138,74,176,8,173,16,208,57,164,192,208,249
1090 DATA8,189,188,2,41,127,157,188,2,198,252,208,206,232,224,16,190
1100 DATA208,131,96,234,1,2,4,8,16,32,64,128,254,253,251,247,137
1110 DATA239,223,191,127,13,13,251,255,0,0,255,255,0,0,255,255,28
```

A short demonstration program showing how to use Fast Sprites

```
0 REM THIS PROGRAM DEMONSTRATES HOW A SPRITE MAY BE MOVED AROUND THE
1 REM SCREEN INDEPENDANTLY OF ANY PROGRAM WHICH MAY BE RUNNING. OF COURSE,
2 REM THE MACHINE-CODE LOADER PROGRAM SHOULD BE RUN FIRST.
10 SYS49152:                    REM START ROUTINE
20 POKE254,1:                   REM DISABLE INTERRUPTS
```


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PROGRAMS

```
30 V=4096+13:                          REM VIDEO CHIP
40 FORT=832TO895:POKET,255:NEXT:       REM DEFINE SPRITE
50 POKE2040,13:POKEV+39,1:POKEV+21,1:REM SET POINTERS
60 POKEV,24:POKEV+1,50:                REM SET SPRITE POSITION
70 POKE1023,2:POKE2,2:                 REM SET OVERALL SPEED
80 POKE700,2:POKE701,1:                REM SET X/Y SPEEDS
90 POKE720,24:POKE721,50:              REM SET X/Y MINIMUM POSITIONS
100 POKE740,320AND255:POKE741,229:     REM SET X/Y MAXIMUM POSITIONS
110 POKE254,0:                         REM ENABLE INTERRUPTS AND START SPRITE
```

MZ-80K Transposer

by Peter Barker

'Transposer' is a good example of the old maxim that programs need be neither long nor complex in order to be useful.

The author wrote the program after his recorder-playing daughter repeatedly wanted him to transpose tunes from music books so that they would fit within the range of her recorder. Transposing a tune means simply shifting each note up/down by one or more semi-tones.

To use the program, you enter th number of sharps or flats present in th original, tell the program whether you wis to transpose up or down and over ho many semitones you wish to shift th melody. You then enter the tune itself an the program displays the new notes an plays the melody.

```
10 PRINT"■              TUNE TRANSPOSER"
20 REM          SET UP DATA
30 DIM NT$(13,12),CV(13):POKE10682,1
40 CV(0)=4:FORI=1TO13:FORJ=1TO12
50 READ NT$(I,J):NEXTJ:READ CV(I):NEXTI
60 DATAA,A#,B,C,C#,D,D#,E,F,F#,G,G#,11
70 DATABb,B,C,Db,D,Eb,E,F,Gb,G,Ab,A,6
80 DATAB,C,C#,D,D#,E,F,F#,G,G#,A,A#,1
90 DATAC,C#,D,Eb,E,F,F#,G,Ab,A,Bb,B,8
100 DATADb,D,Eb,E,F,Gb,G,Ab,A,Bb,B,C,3
110 DATAD,D#,E,F,F#,G,G#,A,A#,B,C,C#,13
120 DATAEb,E,F,Gb,G,Ab,A,Bb,B,C,Db,D,4
130 DATAE,F,F#,G,G#,A,A#,B,C,C#,D,D#,9
140 DATAF,Gb,G,Ab,A,Bb,B,C,Db,D,Eb,E,2
150 DATAGb,G,Ab,A,Bb,B,C,Db,D,Eb,E,F,7
160 DATAG,G#,A,A#,B,C,C#,D,D#,E,F,F#,12
170 DATAAb,A,Bb,B,C,Db,D,Eb,E,F,Gb,G,5
180 DATA F#,G,G#,A,A#,B,B#,C#,D,D#,E,F,10
190 REM        INPUT SCALE DATA
200 PRINT"■              TUNE TRANSPOSER"
210 PRINT"■Does the original key-signature have   ■ sharps or flats (S/F/N)";
220 INPUT"?";S$:N=ASC(S$)
230 IF(N<>70)*(N<>83)*(N<>78)THEN200
240 IFN=78THENS=0:GOTO260
250 INPUT"■How many?";S:IF(S<0)+(S>6)THENPRINT"■                                    ■■";:GOTO250
260 S=INT(S):IFN=70THENS=S+7
270 SCALE=CV(S):INPUT"■Transpose up or down (U/D)?";U$:N=ASC(U$)
280 IF(N<>85)*(N<>68)THENPRINT"■                                                    ■■":GOTO260
290 INPUT"■How many semitones?";NN
300 IF(NN<1)+(NN>12)THENPRINT"■                                                     ■■":GOTO290
310 SK=SC:IFN=68THENNN=-1*NN
320 IFSC=13THENSK=10
330 N=SK+NN:IFN<1THENN=N+12
340 IFN>12THENN=N-12
350 REM                                                    INPUT NOTES & TRANSPOSE
360 PRINT"■Key-in a line of notes (followed by S ■  for sharps or L for ";
370 PRINT"flats). ! = restart.■"
380 INPUT N$:PRINT"■ ";
390 IFN$="!"THEN200
400 LN=LEN(N$):FORI=1TOLN
410 A$=MID$(N$,I,1):B$=MID$(N$,I+1,1)
420 IFA$=" "THEN490
430 IF(A$="S")+(A$="#")THEN490
440 IF(A$="L")+(A$="b")THEN490
450 IF(B$="S")+(B$="#")THENA$=A$+"#"
460 IF(B$="L")+(B$="b")THENA$=A$+"b"
470 FORJ=1TO12:IFA$=NT$(SC,J)THENPRINTNT$(N,J);" ";:MUSICNT$(N,J):J=12:GOTO490
480 NEXTJ:PRINT"? ";
490 NEXTI:PRINT"■ ":GOTO380
```

Dragon Moonraker

by Ian Gillies

'Moonraker' is a games program for the Dragon 32 based on the closing sequences of the film of the same name. I can see no reason why it shouldn't also run on the Tandy Colour computer, but as we had no way of testing this I don't guarantee it. The POKE statement in line 50 would, of course, have to be omitted. A single joystick is required.

Instructions are given within the program. If you find the game too fast, remove the POKE in line 50.

```
0 'MOONRAKER (C) 10/06/1983
20 'BY IAIN C. GILLIES
30 CLS0
40 FORY=1TO2000:NEXTY
50 POKE65495,0
60 PMODE4,1:PCLS:SCREEN1,1
70 LINE(84,128)-(168,40),PSET,B
80 LINE(84,128)-(168,40),PSET
90 LINE(84,40)-(168,128),PSET
100 LINE(126,40)-(126,128),PSET
```

PROGRAMS

```
110 LINE(84,84)-(168,84),PSET
120 PAINT(87,41),5:PAINT(165,60),5:PAINT(160,127),5:PAINT(86,120),5
130 DRAW"BM140,45;D15"
140 DRAW"BM165,98;U2L9D15R9U2"
150 DRAW"BM120,110;U2L9D15R9U3L2R2D1D4"
160 DRAW"BM96,62;U3L9D15R9U2"
170 FORY=1TO500:NEXTY
180 PLAY"O2T7CDL2EL5GEL2A"
190 FORY=1TO3000:NEXTY
200 SCREEN0,1
210 PMODE4,1:PCLS
220 DIM B(11):DIM D(11)
230 CIRCLE(100,100),10
240 GET(90,90)-(110,110),B,G
250 PCLS
260 GET(90,90)-(110,110),D,G
270 PCLS
280 CLS0
290 PRINT@39,"I.C.G.C. PRESENT";
300 PRINT@165,"BROOK BOND ASTRONAUT";
310 PRINT@290,"IN A NEW COMPUTER ADVENTURE";
320 SCREEN0,1
330 PLAY"T6L3O2V20FFO-P20V10L1FP20V20L3O+FFO-P20L1V10FP20V200+L7FFP50L5FL3FP100F
O-L2P4BO+ECE;2;ECEO-BO+ECE;2;ECEO-L20V31BBV25BBV20BBV15BBV10BBV5BBV1BB"
340 SCREEN1,1
350 X=0
360 X=X+3:Y=84:PUT(X,Y)-(X+20,Y+20),B,PSET
370 X1=X:Y1=Y
380 X=X+3:PUT(X,Y)-(X+20,Y+20),B,PSET
390 PUT(X1,Y1)-(X1+20,Y1+20),D,PSET
400 IF X<=226THEN360
410 CLS0:FORY=224TO255:PRINT@Y,CHR$(174);:NEXTY:FORY=288TO319:PRINT@Y,CHR$(171);
:NEXTY:FORY=256TO266:PRINT@Y,CHR$(143);:NEXTY
420 SCREEN0,0:PRINT@265,"MOONRAKE"
430 PLAY"T3O2V15L2DAL1BP20L5ABCL2AP6L6GL5AB0+L4DEL3DO-L4DO+DL16CO-B0+L1C"
440 CLS:FORY=0TO31:PRINT@Y,CHR$(153);:NEXTY
450 PRINT@32,"PRAX IS DEAD . AS BROOK BOND 003YOU MUST DESTROY THE GLOBES WITHTH
EIR DEADLY CARGO.THE NUMBER OFGLOBES IS UNCERTAIN AS MOONRAKE ONE'S SCANNER IS F
AULTY DUE TO  ATMOSPHERIC HEAT.
460 PRINT"YOU DO HOWEVER KNOW THERE ARE    BETWEEN 10 AND 15 GLOBES.MOONRAKE ONE
 IS LOCKED ON COURSE AND   WILL REMAIN LOCKED UNTIL ALL THEGLOBES HAVE BEEN DEST
ROYED .IF  THIS IS NOT DONE THE MOONRAKE   WILL BURN UP!"
470 PRINT                          "        <<<<<GOOD-LUCK>>>>>"
480 SCREEN0,1
490 DIM SC(11):DIM C(11):DIM G(5)
500 PMODE4,1:PCLS
510 GET(1,1)-(21,21),C,G
520 GOSUB730
530 X=1
540 X=X+1:CIRCLE(127,180),X,,.2:IFX<148THEN540
550 X=0
560 LINE(0,24)-(256,22),PSET,BF
570 COLOR0,5:LINE(0,190)-(256,0),PSET,B:COLOR5,0
580 CLS:PRINT@160,"";:INPUT"ENTER SKILL (1-10)(1=EASIEST    10=NEAR IMPOSSIBLE)
";SK
590 SCREEN1,1
600 PLAY"O2T3V15L1CP20L4CL1;2;P20L2CO-;9;A"
610 A=100:B=100:G=10+RND(5):T=50:SC=0:G1=G
620 IFPEEK(65280)=126OR PEEK(65280)=254THEN LINE(128,27)-(A+10,B+10),PSET:SOUND2
55,1:LINE(128,27)-(A+10,B+10),PRESET:IF PPOINT(A+11,B+11)=5THEN GOSUB950:SC=SC+1
0:PUT(X,Y)-(X+4,Y+4),G,PRESET:X=0:G=G-1:IF G<=0THEN850
630 LINE(224,8)-(T,8),PRESET:T=T+1
640 LINE(224,8)-(T,8),PSET:IFT=224THEN940
650 PUT(X,Y)-(X+4,Y+4),G,PRESET:IF X>248THEN X=0
660 A=INT(JOYSTK(0)*3.7):B=INT(JOYSTK(1)*1.65+26):IF A=A1 AND B=B1 THEN700
670 PUT(A1,B1)-(A1+20,B1+20),C,PSET
680 PUT(A,B)-(A+20,B+20),S,PSET
690 A1=A:B1=B
700 X=X+10:Y=RND(10+2*(SK))+56:PUT(X,Y)-(X+4,Y+4),G,PSET
710 GOTO620
720 END
730 FORY=5TO10STEP5
740 CIRCLE(128,98),Y
750 NEXTY
760 GET(118,88)-(138,108),S,G
770 PCLS
780 A$="BM100,100;R4D4L4U3R3D2L3U1R2":DRAW A$
790 GET(100,100)-(104,104),G,G
800 FORZ=1TO1000:NEXTZ
810 PCLS
820 T$="BM228,4;L4R2D4;BM231,4D4;BM234,8;U4DR2DRUR2UD4;BM242,4D4R3L3U2R2L2U2P3"
830 DRAW T$
840 RETURN
850 CLS:PRINT"WELL DONE YOU HAVE DESTROYED"G1"GLOBES!"
860 PRINT"YOUR SCORE WAS";INT(SC/(T/10)*1000);
870 PRINT:PRINT"ANOTHER GO(Y/N)"
880 SCREEN0,1
890 I$=INKEY$
900 IF I$=""THEN890
910 IF I$="Y"THEN580
920 IF I$="N"THEN POKE65494,0:END
930 GOTO890
940 CLS:PRINT"YOU RAN OUT OF TIME AND BURNED  UP IN THE ATMOSPHERE!";:GUTO870
950 PUT(A,B)-(A+20,B+20),S,PRESET:PLAY"T255V31AAV25BBV20AAV15FFV10DDV5DV1CCC":RE
TURN
```

Spectrum Screen Extension

by Gauden Galea

The Spectrum, like the ZX81, reserves the two bottom lines of the screen display for prompts and error messages. This can be inconvenient when designing screen displays, particularly during games where as much of the screen as possible needs to be used for graphics. 'Screen extension' allows text to be printed on the bottom lines of the screen thus freeing the rest for graphics. Although the program will run on a 16k machine, there is not really sufficient memory for it to be used as a subroutine in a long program.

To print a string to one of the bottom lines, you should enter the string as a data statement in the form "RRCC*FBPI*text" where: RR=row to print at, CC=column, F=flash (0 or 1), B=bright (0 or 1), P=paper colour (0-7) and I=ink colour (0-7). If the data string is empty,

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PROGRAMS

then the two rows are set to the border colour (that is, a local CLS is performed).

The listing given below is a complete demonstration program. To use it as a subroutine in another program, you should delete: (a) all REM statements; (b) lines 30-260 (demo & practice); (c) validity checks (line numbers ending in 5); and (d) lines 9810 to 9880 if you do not require pre-defined, low resolution graphics.

```
  10 REM  SPECTRUM, THE ROWS BELOW
  20 REM  (C)  GAUDEN GALEA  1983
  30 REM  demonstration
  40 BORDER 6: PAPER 5: CLS: INK 0
  50 FOR L = 1 TO 8
  60 CLS: PRINT AT 15,0; " Data string :"
  80 READ A$
  90 PRINT AT 16,0; """"; A$; """"; AT 21,0; "Result :"
 100 GOSUB 9000
 110 PRINT AT 21,19; "Press any key"
 120 PAUSE 0
 130 NEXT L
 140 DATA  "2300*1070*This is the bottom row."
 150 DATA  "2209*1062*The top row."
 160 DATA  "*1152*Row=22 Col=00"
 170 DATA  "2300*1160*flashing, bright, yellow & black"
 180 DATA  "2200**The 'basic' ATTRIBUTES"
 190 DATA  "**Character sample: abcd1234;+,? (some graphics)"
 200 DATA  "*1171*"
 210 DATA  ""
 220 REM  practice session
 230 CLS: INPUT "Practice - enter data string " ' A$
 240 GOSUB 9000
 250 PRINT AT 20,0; "Press any key"
 260 PAUSE 0: GO TO 230
9508 REM  ****  M A I N   R O U T I N E  ****
9509 REM  empty string?  clear both lines
9510 IF A$ = "" THEN INPUT INKEY$:  RETURN
9519 REM  point to first character
9520 LET PO = 1
9529 REM  first character = "*"
9530 IF A$(PO)<> "*" THEN GO TO 9559
9540 LET ROW = 22:  LET COL = 0
9550 LET PO = PO+1 : GO TO 9610
9559 REM  first character is not = "*"
9565 IF LEN A$ < 5  THEN  PRINT "Insufficient data in string:" 'A$:
     RETURN
9575 FOR N = PO TO PO+3:  IF A$(N)> "9"  OR  A$(N) < "0"  THEN
     PRINT "COORINATES INCORRECT :" ' A$:  RETURN
9585 NEXT N : REM  check that first 4 characters are digits
9589 REM find POSITION
9590 LET ROW = VAL A$(1 TO 2) : LET COL = VAL A$(3 TO 4)
9595 IF ROW < 22 OR ROW > 23 OR COL < 0 OR COL > 31  THEN  PRINT
     "COORDINATES out of range :" ' "Row = ";ROW, "Col = ";COL '
     A$ : RETURN
9600 LET PO = PO + 5
9609 REM  next character = "*"
9610 IF A$(PO) = "*"  THEN LET ATTR = 56 : LET PO = PO + 1 : GO TO 9680
9619 REM  next character is not = "*"
9625 IF  LEN A$ < PO + 4  THEN PRINT "Insufficient data in
     string :" ' A$ :  RETURN
9635 FOR N = PO TO PO+3 : IF A$(N) < "0" OR A$(N) > "9"  THEN
     PRINT "ATTRIBUTES INCORRECT :" ' A$ : RETURN
9645 NEXT N
9649 REM  find ATTRIBUTES
9655 IF NOT ( A$(PO) < "2"  AND A$(PO+1) < "2"  AND A$(PO+2) < "8"
     AND A$(PO+3) < "8" )  THEN PRINT "ATTRIBUTES out of range :" '
     A$ ' "Flash ";A$(PO) ' "Bright ";A$(PO+1) ' "Paper ";A$(PO+2) '
     "Ink ";A$(PO+3) : RETURN
9660 LET ATTR = 128*VAL A$(PO) + 64*VAL A$(PO+1) + 8*VAL A$(PO+2) +
     VAL A$(PO+3)
9670 LET PO = PO + 5
9678 REM is there any text after second "*" ?
9679 REM if no text, change attributes both rows
9680 IF  PO <= LEN A$  THEN GO TO 9700
9690 LET OLAD = PEEK 23624 : POKE 23624, ATTR : INPUT INKEY$ :
     POKE 23624, OLAD: RETURN
9691 REM  print TEXT
9692 REM  ATAD = attribute file address
9693 REM  DIAD = display file address
9694 REM  CHAD = character address in ROM
9700 LET A$ = A$(PO TO )
9709 REM  check for legal length
9715 IF  COL + LEN A$ > 64 - (32 AND ROW = 23)  THEN PRINT "TEXT
     too long :" ' "Row ";ROW ' "Column ";COL '"TEXT ";A$ : RETURN
9719 REM  find attribute address
9720 LET ATAD = 23232 + COL + (32 AND ROW = 23)
9729 REM  loop to print each character
9730 FOR N = 1 TO LEN A$
9732 REM  is character illegal?
9735 IF A$(N) < CHR$ 32  OR  A$(N) > CHR$ 164  THEN PRINT "Illegal
```

```
      character in TEXT :" 'A$(N) , "Code "; CODE A$(N) : RETURN
 9739 REM  find display address
 9740 LET DIAD = 20672 + (32 AND ROW = 23) + COL + N - 1
 9749 REM  identify type of character
 9750 IF  A$(N) > CHR$ 127  AND  A$(N) < CHR$ 144  THEN GO TO
      9820  : REM  pre-defined graphic
 9759 REM  normal characters and UDG'S
 9760 LET  CHAD = CODE A$(N)*8+(15360  AND  A$(N)<= CHR$ 127)+
      (PEEK 23675 + 256 * PEEK 23676 - 144 * 8 AND CODE A$(N) > 143)
 9770 FOR M = DIAD TO DIAD+1792 STEP 256
 9780 POKE M, PEEK CHAD
 9790 LET CHAD = CHAD + 1
 9800 NEXT M
 9810 GO TO 9889
 9819 REM  pre-defined graphic
 9820 LET CODE = CODE A$(N) - 128
 9830 LET BY1 = (CODE / 4 - INT (CODE / 4))* 4 : LET BY1 = 0 +
      (15 AND BY1 = 1) + (240 AND BY1 = 2) + (255 AND BY1 = 3)
 9840 LET BY2 = INT (CODE / 4) :  LET BY2 = 0 + (15 AND BY2 = 1) +
      (240 AND BY2 = 2) + (255 AND BY2 = 3)
 9849 REM  print pre-defined graphic
 9850 FOR M = DIAD TO DIAD+768 STEP 256
 9860 POKE M, BY1
 9870 POKE M + 1024, BY2
 9880 NEXT M
 9889 REM  get next character
 9890 NEXT N
 9899 REM  poke attributes
 9900 FOR N = ATAD TO ATAD+LEN A$-1
 9910 POKE N, ATTR
 9920 NEXT N
 9930 RETURN
```

VIC-20 Vlist

by David McIntyre

'Vlist' is a simple machine code utility for the unexpanded VIC-20. It provides a list of all variables used within a Basic program. Vlist will also run on an expanded machine without modification.

Once the listing below has been typed in, it should be saved before running. After running the program, you can delete it using NEW. The machine code is located at the top of RAM and the pointers reset to protect it. The utility is now available as a system command, VLIST.

By way of a demonstration, you can VLIST Vlist before you delete it.

```
 100 READ N
 110 P = PEEK(55) - N
 120 IF P < 0 THEN P = P + 255 : POKE 56 , PEEK(56) - 1
 130 POKE 55 , P : CLR
 140 READ N , N1 :PRINT CHR$(147)"LOADING ..."
 150 BEGIN = PEEK(56) * 256 + PEEK(55) - N1
 160 READ P : PRINT"*";
 170 IF P > 255 THEN GOSUB 240
 175 IF P < 0 THEN GOSUB 300
 180 POKE BEGIN + COUNT , P
 190 COUNT = COUNT + 1
 200 IF COUNT < N + N1 THEN 160
 210 PRINT CHR$(147)"VLIST READY."
 220 SYS BEGIN:END
 230 REM ***** SUBROUTINES *****
 240 READ Q : COUNT = COUNT + 1
 250 P = P + BEGIN : C = - 1
 260 IF P > 255 THEN P = P - 256 : C = C + 1 : GOTO 260
 270 Q = Q + C
 280 POKE BEGIN + COUNT - 1 , P
 290 P = Q : RETURN
 300 IF T = 1 THEN 350
 310 P = P + BEGIN + 255
 320 T = 1
 330 IF P > 255 THEN P = P - 256 : TCOUNT = TCOUNT + 1 : GOTO 330
 340 RETURN
 350 P = P + TCOUNT + 255 : RETURN
 390 REM ***** DATA *****
 400 DATA 223,18
 410 DATA 169,76,133,117,169,-237,133,118,169,-255,133,119,169,234
 420 DATA 133,120,96,234,208,2,230,123,72,138,72,152,72,160,255,200
 430 DATA 185,491,0,240,5,217,0,2,240,245,192,5,208,20,32,328,0
 440 DATA 165,122,24,105,4,144,2,230,123,133,122,169,58,160,0,145
 450 DATA 122,104,168,104,170,104,76,121,0,162,00,134,253,32,355,0
 460 DATA 165,45,133,254,165,46,133,255,165,255,197,48,144,18,165
 470 DATA 254,197,47,144,12,189,476,0,8,32,210,255,232,40,208,245
 480 DATA 96,138,72,56,32,240,255,164,253,230,253,185,471,0,168
 490 DATA 201,16,208,26,160,0,132,253,232,224,20,208,17,162,0,165
 500 DATA 198,240,252,169,0,133,253,133,198,169,147,32,210,255,24
 510 DATA 32,240,255,104,170,160,00,177,254,41,127,32,210,255,200
 520 DATA 177,254,72,41,127,32,210,255,104,41,128,240,13,136,177
 530 DATA 254,41,128,8,169,36,40,240,2,169,37,32,210,255,165,254
 540 DATA 24,105,7,133,254,144,2,230,255,160,0,240,128,0,5,10,15
 550 DATA 16,147,46,86,76,73,83,84,13,0,13,46,69,78,68,0,86,76,73
 560 DATA 83,84,0
 READY.
```


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PROGRAMS

BBC Warp Hole

by Richard Snowdon

'Warp Hole' is an arcade-type game for the BBC B or 32k model A, written partially in machine code but mainly in BBC Basic.

The object of the game is to prevent an inhabited asteroid from reaching a warp-hole at the right-hand side of the screen. Don't ask me why the asteroid wants to reach this somewhat dubious destination or why, for that matter, you should want to risk life and limb to stop it. Ours is not to wonder why . . .

The listing below consists of two programs: the first provides the title page and does all the setting-up for the second program. Program 1 should be entered and saved followed by program 2 after a short gap of five seconds or so on the tape.

Warp Hole should be self-explanatory. You control your ship's movements using the arrow keys, and use the function keys to fire cannons, torpedoes and lasers — F1 fires the first cannon, F2 the second, F3 the torpedo (Battlecruiser only) and F4 the laser.

There is also an auto-pilot function toggled by holding down the 'A' key until you hear a tone confirming that the auto-pilot is operational. This can provide you with a brief rest, but should not be relied upon for more than a few seconds at a time: the auto-pilot is fast, but not particularly intelligent or safety-conscious. In fact, at times it can be downright suicidal!

Once both parts have been saved on tape, the program is loaded and run by 'CHAIN""". There is a fair wait while the second program is chained from the first.

Warp Hole can run under any BBC operating system.

PROG. 1

```
   10REM "
** WARP * HOLE **
   20REM "
** WARP * HOLE **
   30REM BY RICHARD SNOWDON
   40ON ERROR RUN
   50*KEY10 OLD|MRUN|M
   60OS=&FFEE:FORX=0TO2STEP2:P%=&D20
   70[OPTX
   80.ST
   90LDA#23:STA&D10:LDA#0:STA&D11:LDA#1:
STA&D12:JSRS
  100LDA#0:STA&D10:LDA#39:STA&D11:LDA#25
5:STA&D12:JSRI
  110LDA#255:STA&D10:LDA#22:STA&D11:LDA#
255:STA&D12:JSRS
  120LDA#39:STA&D10:LDA#1:STA&D11:LDA#1:
STA&D12:JMPI
  130.S LDX&D11:LDY#0
  140.U
  150LDA#31:JSROS:LDA#0:JSROS:TXA:JSROS:
LDA&DFE:JSROS
  160LDA#31:JSROS:TYA:JSROS:TXA:JSROS
  170LDA#53:JSROS:LDA#32:JSROS
  180INY:INY:TYA:CMP#40:BNEU
  190LDY#0:CLC:TXA:ADC&D12:TAX:CMP&D10
  200BNEU:RTS
  210.I LDX&D11:LDY#0
  220.K
  230LDA#31:JSROS:LDA#0:JSROS:TYA:JSROS:
LDA&DFE:JSROS
  240LDA#31:JSROS:TXA:JSROS:TYA:JSROS
  250LDA#96:JSROS
  260INY:TYA:CMP#24:BNEK
  270LDY#0:CLC:TXA:ADC&D12:TAX:CMP&D10
  280BNEK:RTS
  290]:NEXT
  300FX=&FFF4:P%=&7]:DIMP 100:[OPT0
  310.O LDA#15:LDX#0:LDY#0:JSR FX:RTS
  320.I LDA#15:LDX#1:LDY#0:JSR FX:RTS
  330]
  340X=RND(-TIME):A%=0:Z%=0:F%=0:CALLO
  350VDU&17,&E0,&C,&32,&61,&C1,&C1,&61,&
32,&C,&17,&E1,&80,&C0,&F8,&E7,&F8,&C0,&8
0,&80,&17,&E2,0,0,&FF,0,0,&FF,0,0
  360VDU&17,&E4,&F8,&20,&1D,&1D,&20,&F8,
&A8,0,&17,&E5,&8C,&20,&38,0,0,&38,&20,&8
C,&17,&E6,&C0,&60,&32,&3F,&32,&60,&C0,0,
&17,&E2,0,0,&FF,0,0,&FF,0,0
  370VDU&17,&FA,0,0,0,&2A,&EA,&2A,0,0,&1
7,&FB,0,3,&F,&AA,&AA,&AA,&F,3,&17,&E3,&F
F,0,0,0,0,0,0,&FF,&17,&E9,&91,&4A,&34,&5
A,&BD,&34,&4A,&2D,&17,&EB,3,&18,&60,&C0,
&C0,&60,&18,3
  380ENVELOPE1,1,20,-15,-15,6,3,3,127,0,
-1,-1,126,126
  390ENVELOPE2,1,1,2,4,30,70,20,127,0,0,
-127,126,0
  400ENVELOPE3,1,3,-3,3,20,20,20,127,0,-
127,-127,126,0
  410ENVELOPE4,0,1,3,1,2,2,3,0,-1,0,0,12
0,5
  420MODE7:PRINTTAB(12,20)CHR$141;"STOP
THE TAPE";TAB(12,21)CHR$141;"STOP THE TA
PE";:REPEATFORX=1TO1E3:SOUND&11,-10,X,1:
NEXT:PRINTTAB(8,24)CHR$136;"Press any ke
y to start.";:D=INKEY(400):UNTILNOTD
  430MODE0:VDU19,7,2;0;23;8202;0;0;0;
  440VDU31,0,11,29,140;0;
  450FORX=0 TO 1000 STEP 20
  460IF X<=500 VDU25,4,X;4;25,5,500;X+4;
25,4,X;1000;25,5,500;1000-X;:NEXTX
  470VDU25,4,500;(1000-X)+4;25,5,X;4;25,
4,500;X;25,5,X;1000;:NEXTX
  480A$="WARP":FORX=1 TO 8
  490IF X<5 PRINTTAB(40-X);RIGHT$(A$,X);
TAB(40);LEFT$(A$,X)
  500IF X>4 A$="HOLE":PRINTTAB(31+X);RIG
HT$(A$,9-X);TAB(40);LEFT$(A$,9-X)
  510NEXT X:VDU28,52,18,76,15:PROCD(50)
  520SOUND1,1,100,255:FORX=5TO499:VDU19,
1,(X MOD7)+1;0;:NEXT:CALLO
  530PRINT"Please wait while the"
  540PRINT"main program is loaded"
  550PROCD(400):FOR I%=&404TO&468STEP4:
?I%=0:NEXT
  560COLOUR129:COLOUR0:CLS:PRINT" ARROW
keys - Movement"" f1 & f2 - Cannons""
" f3 - Torpedo"" f4 - Laser";:COLOUR1
:COLOUR128
  570VDU28,0,20,52,11,12
  580A$="WARP":PRINT:FORX=1 TO 8
  590IF X<5 PRINTTAB(30);LEFT$(A$,X);TAB
(49-X);RIGHT$(A$,X)
  600IF X>4 A$="HOLE":PRINTTAB(30);LEFT$
(A$,9-X);TAB(X+40);RIGHT$(A$,9-X)
  610NEXT X:VDU28,0,21,28,6,12
  620VDU25,4,340;672;25,5,644;672;25,5,6
44;358;25,5,340;358;25,5,340;672;
  630VDU25,4,646;672;25,5,646;358;25,4,3
38;358;25,5,338;672;
  640VDU25,5,400;690;25,5,428;690;25,4,5
28;690;25,5,675;690;25,5,645;672;
  650VDU25,4,675;690;25,5,675;690;25,5,6
75;380;25,5,645;358;
  660VDU25,4,677;690;25,5,677;380;28,35,
19,43,12,12
  670PROCD(86)
  680A$="PROGRAMING BY....."
  690A=+1:C=0:FORX=1 TO LEN(A$)
  700VDU19,1,6;0;:PROCD(13)
  710IFC+A)7 OR C+A<0 A=-A
  720SOUND &11,4,100,20:C=C+A
  730PRINTTAB(C,7);MID$(A$,X,1)
  740VDU19,1,2;0;
  750PROCD(13)
  760NEXT X:A$="RICHARD SNOWDON"
  770FORX=1 TO LEN(A$)
  780VDU19,1,6;0;:PROCD(13)
  790PRINTTAB(X MOD 8,7);MID$(A$,X,1)
  800SOUND&11,4,200,20:VDU19,1,2;0;:PROC
D(13)
  810NEXT X:CLS
  820PROCD(296)
  830SOUND1,0,0,0
  840VDU28,52,19,79,15,12:PRINT" ARROW
keys - Movement"" f1 & f2 - Cannons""
f3 - Torpedo"" f4 - Laser"
  850COLOUR129:COLOUR0:VDU28,35,19,43,12
  860PRINTTAB(0,2)"Start the"TAB(2,3)"ta
pe."
  870PAGE=&E00:CHAIN""
  880DEF PROCD(A):LOCALB:B=TIME:REPEATUN
```

PROGRAMS

```
TILTIME>B+A:ENDPROC
>
```

PROG. 2

```
  10ON ERROR GOTO1140
  20IFZ%=0MODE7:PROCTT:CLEAR
  30O=&71:I=&7B
  40IFA%<>1MODE7:PROCOPT:B%=1:E%=0:F%=0
  50SC$=CHR$224
  60MODE1
  70A2=B%:B2=B%:X2=2:Y2=RND(18)+4:D1=0:
X1=0:Y1=RND(20):D3=0:Y5=2:X5=1:E=0:B3=0:
D5=0:X7=0:Y7=3:OA=0:OB=0:X9=0:Y9=0:EX=0:
XE=0:YE=0
  80VDU19,1,4;0;23;8202;0;0;0;:X=35:Y=T
%:CLS:*F.4 1
  90IFA%<>1FORST%=1TO200:PLOT69,RND(127
9),RND(960)+32:NEXT
  100PROCB:VDU5
  110GCOL0,2:FORJR=1TOL%:MOVE920+JR%*70,3
0
  120PRINT"/";SC$;"/";:VDU8
  130IFJR=1GCOL0,3
  140NEXT:VDU4:PROCS
  150IFA%=1X=K%:Y=U%
  160IFY%/2=INT(Y%/2) Y=Y+SGN(20-Y)
  170IFY2/2=INT(Y2/2) Y2=Y2+SGN(20-Y2)
  180COLOUR2:FORS%=T%-Q% TO T%+Q%:PRINTT
AB(39,S%)"(":NEXT:VDU5:FORS%=T%-Q% TO T%
+Q%:MOVE1247,(32-S%)*32:PRINT")":NEXT:VD
U4
  190IFZ%=0PRINTTAB(25,T%)"THIS IS THE";
TAB(25,T%+1)"WARP-HOLE)))))":D=INKEY200:P
RINTTAB(25,T%)SPC11;TAB(25,T%+1)SPC13
  200IFZ%=0 PROCD
  210CALLI
  220GOSUB1260
  230COLOUR1:PRINTTAB(X2,Y2)CHR$233
  240IFD%)TRUE VDU19,2,1;0;
  250GOSUB1260
  260VDU19,0,0;0;
  270COLOUR2:PRINTTAB(3,31);(TIME DIV360
000)MOD24;" ";(TIME DIV6000)MOD60;" ";(T
IME DIV100)MOD60;" ";
  280IFRND(20)<(20-C%)COLOUR2:GOTO380
  290VDU19,1,8;0;
  300GOSUB1260
  310A2=E%DIV10+1
  320IFU%=2 VDU19,0,14;0;
  330IFY2+B2)280RY2+B2<2 B2=-B2
  340COLOUR0:PRINTTAB(X2,Y2);CHR$233:COL
OUR1
  350X2=X2+A2:Y2=Y2+B2:SOUND&11,4,X2*4,2
55
  360PRINTTAB(X2,Y2);CHR$233;
  370VDU19,1,4;0;
  380GOSUB1260
  390COLOUR3:PRINTTAB(X,Y);SC$:COLOUR1
  400GOSUB1260
  410IFY2<Y+5 AND Y2)Y-5 AND X2<X AND D3
=0 PROCX
  420GOSUB1260
  430IFX2)36ANOY2<=T%+Q%+1ANDY2)=T%-Q%-1
 MODE7:PROCF:MODE1:PROCGONE1
  440IFX2)38 X2=2:D%=D%-INT((C%+1)*4):SO
UND 0,-15,3,10:Y2=RND(26)+2
  450IFX1<2 PRINTTAB(X1,Y1);" ":D1=0:X1=
0
  460IFX7<2 PRINTTAB(X7,Y7);" ":D5=0:X7=
0
  470PLOT69,RND(1279),RND(960)+32:PLOT69
,RND(1279),RND(960)+32
  480GOSUB1260:COLOUR1:GOTO210
  490SOUND&11,4,100,20:PRINTTAB(X5,Y5)"
":E%=E%+1
  500D%=D%+C%*40:PRINTTAB(X2-1,Y2);SPC(4
):Y2=RND(26)+2:D3=0
  510IFOB=1VDU19,0,7;0;:SOUND&10,-15,6,3
0:MOVEX%32,0C:DRAWOA,0C:D%=D%-C%*10:PROC
S:GOSUB530:RETURN
  520IFEX=1D%=D%+C%*60:SOUND1,4,150,20
  530X2=2:IFD5=6 D5=0:X7=0
  540IFD1=6 D1=0:X1=0
  550VDU19;0;0;:IFU%=2 VDU19,0,24;0;19,1
,4;0;
  560PROCS:RETURN
  570DEFPROCM
  580COLOUR0:PRINTTAB(X,Y);SC$:COLOUR3
  590ENDPROC
  600DEFPROCF:VDU23;8202;0;0;0;:CALLI
  610IFB3=10 GOTO650
  620SOUND 3,1,30,255
  630A$=CHR$141:PRINT'''A$;"**TOO LATE ,
 YOU HIT ";STR$(E%);" ASTEROIDS"'A$;"**T
OO LATE , YOU HIT ";STR$(E%);" ASTEROIDS
"
  640D$=STR$(D%):PRINT'''A$;CHR$136"ENER
GY="D$'A$" ENERGY="D$:A=INKEY(500)
  650?&DFE=RND(5)+145:CALL&D20:CALLO
  660IFB3=10 A%=1:K%=X:U%=Y:X=0:Y=0:RUN
  670PROCW(120):CLG
  680ENDPROC
  690DEFPROCCRASH:VDU19,2,9;0;:LOCALX%,Y
%
  700X%=(X%32)+20:Y%=(31-Y)*32+16:VDU19;
0;0;19;0,0;0;19,3,3;0;
  710FORT=0TO150:MOVEX%,Y%:GCOL0,3:DRAWX
%+RND(150)-75,Y%+RND(150)-75:GCOL0,2:MOV
EX%,Y%:DRAWX%+RND(300)-150,Y%+RND(300)-1
50:NEXT
  720FORX1%=1TO3:VDU19,X1%,0;0;:NEXT
  730CALLO:PROCW(36):VDU19,3,3;0;:PROCW(
26):SOUND&10,-15,6,40:VDU19,2,1;0;:PROCW
(36):B3=10
  740FORT=0TO150:MOVEX%,Y%:GCOL0,0:DRAWX
%+RND(150)-75,Y%+RND(150)-75:NEXT:ENDPRO
C
  750DEF PROCLIV:LOCALX,Y,L$:VDU23;8202;
0;0;0;
  760L%=L%-1:IFL%<1 A%=0:PROCDEAD
  770D$=STR$(L%):CALLI
  780L$=CHR$141+CHR$136:PRINTTAB(6,4)L$;
D$'TAB(6)L$;D$
  790L$=CHR$145+CHR$141+CHR$136:PRINTTAB
(7,7)L$"WARP"'TAB(7)L$;"WARP"
  800PRINTTAB(9,10)L$"HOLE"'TAB(9)L$"HOL
E";TAB(11,13)L$"GUARD"'TAB(11)L$"GUARD"T
AB(13,16)L$"POSTS"'TAB(13)L$"POSTS"
  810L$=CHR$141:PRINT'';TAB(6);CHR$149;L
$;"REMAIN IN SPACE DEFENCE"'TAB(6);CHR$1
50;L$;"REMAIN IN SPACE DEFENCE"
  820SOUND3,1,30,&FF:PROCW(56):FORX=1TO2
5:Y=INKEY(3):PRINT:NEXT:ENDPROC
  830DEF PROCDEAD
  840VDU23;8202;0;0;0;
  850C=145:A=-1:B=1
  860IFX+A)32 OR X+A<1 A=-A:G=C:REPEATC=
144+RND(6):UNTILC<>G
  870IFY+B)22 OR Y+B<1 B=-B:G=C:REPEATC=
144+RND(6):UNTILC<>G
  880IFNOTINKEY(0) A%=0:VDU14B,157:PRINT
'" Energy Banks Register "D%:VDU148,157:
PROCW(100):RUN
  890X=X+A:Y=Y+B
  900PRINTCHR$12;TAB(X-1,Y)" "CHR$141;CH
R$C"DEAD "'TAB(X-1)" "CHR$141;CHR$C"DEAD
"
  910GOTOB60:ENDPROC
  920DEF PROCTT:SOUND0,-15,7,250
  930A%=0:VDU23;8202;0;0;0;
  940FORY%=1TO23:PRINTTAB(0,Y%);CHR$145;
5;:PRINTTAB(38,Y%);CHR$146;5;:Y=INKEY(2)
:NEXT:PROCW(50)
  950B1=RND(3):U=150:U1=146:CLS
  960V=22:X=30:A$=" S O F T ":CLS
  970FORC=LEN(A$) TO 1 STEP -1
  980B$=MID$(A$,C,1)
  990FORD=1TOV STEP2
 1000PRINTTAB(X,D)CHR$136;CHR$U;CHR$141;
B$;TAB(X+1,D+1)CHR$U1;CHR$141;B$
 1010IFB1<3 PRINTTAB(X+1,D-2);SPC(6);TAB
(X+1,D-1);SPC(6);
 1020NEXT:X=X-1:V=V-1:NEXT
 1030A$="  S N O W    ":IFX=21 V=16:X=13
:U=146:U1=150:GOTO970
 1040PROCW(200):FORX=1TO50:FORY=1TO190:N
EXT:PRINT:NEXT:CALL&71
 1050CLS:PRINTTAB(13,13)CHR$145;CHR$141"
PRESENTS"'TAB(13)CHR$147;CHR$141"PRESENT
S":SOUND1,1,100,255
 1060PROCW(300):CLS:CALL&71
 1070SOUND 0,-15,4,255
 1080A$="***  W A R P  ** H O L E  ***"
:V=12:X=4:FORY=0TOV STEP2:PRINTTAB(0,Y);
CHR$149;CHR$141;TAB(0,Y+1);CHR$148;CHR$1
41;:NEXT
 1090FORC=1TOLENA$:B$=MID$(A$,C,1)
 1100FORD=1TOV:PRINTTAB(X,D);B$;TAB(X,D+
1);B$;TAB(X,D-2);"  ";TAB(X,D-1);"  ";
 1110NEXT:X=X+1:NEXT:CALL&71
 1120PROCW(100):X=INKEY(100):FORC=1TO7:V
DU31,0,0:FORY=1TO10:VDU11:PROCW(2):NEXT:
CALL&71:SOUND1,3,C%4,20:VDU31,0,24:FORY=
1TO12:VDU10:PRDCW(2):NEXT:SOUND&11,3,C%4
,20:NEXT
 1130ENDPROC
 1140IFERR=17 A%=0:MODE7:VDU23;8202;0;0;
0;:FORX=1TO23:PRINTTAB(X,X);CHR$(129+X M
OD6)"COWARD":PROCW(1):NEXT:A=INKEY(70):F
ORX=1TO26:A=INKEY(5):PRINT:NEXT:RUN
 1150GOTOERL+10
 1160DEF PROCGONE1:VDU23;11;0;0;0;
 1170FORX%=865 TO 1024STEP4:GCOL0,3:VDU2
5,4,0;X%;25,5,250;X%;:NEXT
 1180FORX%=110 TO 140 STEP4:GCOL0,1:MOVE
X%,865:DRAW X%,1024:MOVE 0,X%+810:DRAW
250,X%+810:NEXT
 1190CALLI:COLOUR1:PRINTTAB(5,10)"THIS I
S THE END OF YOUR EARTH":PROCW(300)
 1200PRINTTAB(9,15)"YOUR (( WARP ~ HOLE
))"
 1210PROCW(300):VDU19,2,4;0;
 1220COLOUR2:PRINTTAB(14,21);"A N D  Y O
U":SOUND0,-10,7,50:PROCW(200):*F.4 0
 1230FORX=1 TO 18:COLOUR2:PRINTTAB(X,26)
```


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PROGRAMS

```
;" ";CHR$233;:COLOUR1:PRINTTAB(X%2-3,26)
;"    ";CHR$228:PROCW(4):NEXT
1240SOUND1,3,100,17:SOUND1,3,190,17:VDU
31,29,2:PRINT"CONTINUE ":A$=CHR$(GETAND2
23):A%=0:IFA$="Y" RUN
1250CLS:END
1260XX=ADVAL(1)DIV51:YY=ADVAL(2)DIV63
1270IFJ%<>89 XX=640:YY=512
1280IFF% XX=RND(1279)+(X<X2)*600:YY=RND
(1023)+(Y<Y2)*600-(Y>Y2)*600
1290IFXX>8400RINKEY(-26)IFX>P%+2 PROCM:
X=X-P%
1300IFXX<3400RINKEY(-122)IFX<36-P%PROCM
:X=X+P%
1310IFINKEY(-42)ORYY<312IFY<29-P%PROCM:
Y=Y+1
1320IFINKEY(-58)ORYY>712IFY>1+P%PROCM:Y
=Y-1
1330C=C+1:IFC MOD2=1 SC$=CHR$224+CHR$22
5 ELSESC$=CHR$224+CHR$235
1340PRINTTAB(X,Y);SC$
1350IFINKEY(-114)ORADVAL(0)AND3ORFNF PR
INTTAB(X1,Y1);"  ":SOUND&11,1,0,10:D1=1:
X1=X-1:Y1=Y
1360IFINKEY(-116)ANDEX=0ANDP%=1 SOUND&1
1,1,200,50:EX=1:XE=X:YE=Y
1370IFEX=1 IFXE<1 EX=0:PRINTTAB(XE,YE);
"  ":XE=0:YE=0
1380IFEX=1 IFYE=Y2 IFXE=X2-1ORXE=X2 GOS
UB490
1390IFINKEY(-115)ORFNF PRINTTAB(X7,Y7);
"  ":SOUND&11,1,0,10:D5=1:X7=X-1:Y7=Y
1400IFD1=1COLOUR0:PRINTTAB(X1,Y1);CHR$2
26
1410IFD5=1COLOUR0:PRINTTAB(X7,Y7);CHR$2
26
1420IF1%=1Y1=Y:Y7=Y:IFEX=1 PRINTTAB(XE,
YE);"  ":YE=Y
1430IF1%=0Y1=Y
1440IFD1=1ANDX1>1 COLOUR2:X1=X1-2:PRINT
TAB(X1,Y1);CHR$(226+(X1/2)MOD2)
1450IFD5=1ANDX7>1 COLOUR2:X7=X7-2:PRINT
TAB(X7,Y7);CHR$(226+(X7/2)MOD2)
1460IFEX=1 XE=XE-1:COLOUR2:PRINTTAB(XE,
YE)CHR$250;CHR$251;" "
1470IFD3=1 COLOUR0:PRINTTAB(X5,Y5);CHR$
NM:Y5=Y2:COLOUR2:X5=X5+2:PRINTTAB(X5,Y5)
;CHR$NM:COLOUR1:PRINTTAB(X2,Y2)CHR$233
1480IFD3=1ANDX5>36 PRINTTAB(X5,Y5);" ":
D3=0:X5=1:Y5=2:COLOUR1:PRINTTAB(X2,Y2);C
HR$233
1490IFINKEY(-21)ORFNF OB=1:OC=(31.5-Y)*
32:D%=D%-2:OD=X%32:SOUND&11,1,50,40:PROC
G:PROCS
1500IFINKEY-66PROCM:F%=NOTF%:PROCM:PROC
B:X=35:Y=T%:REPEATVDU7:UNTILNOTINKEY-66:
PROCS
1510IFY(=Y2+1ANDY>=Y2-1 IFX2>=X-1ANDX2<
=X+2 GOTO1620
1520IFD3<>1ANDD5<>1ANDD1<>1 RETURN
1530IFY>=Y2+3 OR Y<=Y2-3 IFY1>Y2+2 OR Y
1<Y2-2 IFY7>Y2+2 OR Y7<Y2-2 RETURN
1540IFX<X2 RETURN
1550IFX5>X+2 OR D3=0 IFY=Y2 PROCX
1560IFY1=Y2 IF X1>=X2-1 AND X1<=X2+2 D1
=6:GOSUB490
1570IFY7=Y2 IFX7>=X2-1 ANDX7<=X2+2 D5=6
:GOSUB490
1580IFD3=1IFY5=Y IFX5=X ORX5=X-1:GOSUB1
660
1590IFD3=1IFP%=1IFX5>=X ANDX5<=X+3 IFY5
=Y GOSUB1660
1600IFD3=1ANDD1=1 IFY1=Y5 IFX1>=X5 ANDX
1<=X5+3 PRINTTAB(X5,Y5);" ";TAB(X1,Y1);"
":X5=1:X1=0:D3=0:D1=0:SOUND&11,4,200,20
:D%=D%+C%
1610IFD3=1ANDD5=1IFY7=Y5 IFX7>=X5 ANDX7
<=X5+3 PRINTTAB(X5,Y5)" ";TAB(X7,Y7)" ":
X5=1:X7=0:D3=0:D5=0:SOUND&11,4,200,20:D%
=D%+C%
1620IFY=Y2 IFX2>=X-1 AND X2<=X+2 SOUND&
10,-15,6,255:PROCCRASH:MODE7:PROCLIV:PRO
CF
1630IFP%=1 IFY=Y2-1 OR Y=Y2+1 IFX2>=X A
ND X2<=X+2 SOUND&10,-15,6,255:PROCCRASH:
MODE7:PROCLIV:PROCF
1640PROCS:RETURN
1650DEF PROCW(B):LOCALC:C=TIME:REPEATUN
TILTIME>C+B:ENDPROC
1660SOUND0,-15,4,255:PROCCRASH:MODE7:PR
OCLIV:PROCF:PROCS:RETURN
1670DEF PROCX:PRINTTAB(X5,Y5)" ":D3=1:X
5=X2:Y5=Y2:SOUND&11,3,7,(65-X5):NM=227+R
ND(3):ENDPROC
1680DEF PROCOPT:CALLI
1690FORY%=0TO24:PRINTTAB(0,Y%)CHR$(133+
Y%MOD2);:NEXT:VDU28,1,24,39,0,30
1700CALLI:N=0:PRINT''"Input your name "
;
1710A=GET:N=N-(N<11):IFA=13GOTO1780
1720IFA=127N=N-2:N=-(N)0)*N:GOTO1750
1730IFN=1N$=CHR$(A AND223):GOTO1750
1740N$=N$+CHR$(A OR32)
1750N$=LEFT$(N$,10):N$=MID$(N$,1,N):VDU
-(LENN$)9)*7
1760PRINTTAB(16,2);N$;" ";
1770GOTO1710
1780IFN<3N$="%killer%"
1790$&D02=N$
1800PRINTTAB(0,5)"Battle Cruiser or Fig
hter (B/F)";:FA$=CHR$(GETAND223):D%=100:
L%=3:H%=RND(10):IFFA$<>"F"ANDFA$<>"B" GO
TO1800
1810CALLI:PRINTTAB(0,5)"Choose Level (1
-9)---1 is easy ";:C%=(GETOR16)-48:IFFA$
="F" P%=2
1820IFC%<1ORC%>9 GOTO1810
1830C%=C%*2+2
1840%FX15,1
1850PRINTTAB(6,9)"SELECT YOUR WEAPONS"
''TAB(6)"1)-Guided Missles"''TAB(6)"2)-D
irect Phasers":IFFA$="B" P%=1
1860PRINT''TAB(6)"Select appropriate nu
mber ";:I%=GET-48:IFI%<1ORI%>2 GOTO1850
1870PRINT;I%:T%=RND(15)+7:Q%=RND(4)+1:T
IME=0
1880%F,9 25
1890%F,10 25
1900PRINT''CHR$136"     Intermitant St
orm (Y/N) ";:G$=CHR$(GETAND223):U%=(G$="
Y")*-2
1910IFU%=2:%F,9 1
1920IFU%=2:%F,10 1
1930PRINTTAB(6,21)SPC(8)"Joysticks";:J%
=GETAND223
1940ENDPROC
1950DEFPROCG:VDU19,2,9;0;19,1,15;0;:GCO
L0,2:IFY=Y2 IFD3=0 ORX5)X OA=(X2+1)*32%-
(X)X2) ELSEOA=X5%32%-(Y=Y2)
1960PROCL:PROCW(4)
1970IFPOINT(OA-8,OC)=1 OB=1:GOSUB490
1980GCOL0,0:PROCL:GCOL0,3:OB=0:VDU19,2,
1;0;19,1,4;0;:ENDPROC
1990DEF PROCS:COLOUR2:PRINTTAB(30,0);D%
;"  ";:IFD%<0 VDU19,2,9;0;
2000ENDPROC
2010DEFPROCL:MOVE0D,OC:DRAWOA,OC:MOVE0A
,OC+4:DRAWOD,OC+4:ENDPROC
2020DEFPROCB:VDU19,1,4;0;19,2,1;0;19,3,
6;0;:COLOUR2:PRINTTAB(1,0);SPC(20):GCOL0
,1:MOVE0,992:DRAW1245,992:MOVE0,32:DRAW1
280,32:GCOL0,2
2030COLOUR0:COLOUR130
2040IFF% PRINTTAB(1,0);"Auto pilot"ELSE
PRINTTAB(1,0);"Pilot ";$&D02:B3=0
2050PRINTTAB(23,0);"Energy=":PROCS:COLO
UR128:ENDPROC
2060DEF FNF:IFY=Y2 ANDF%ANDRND(5)>3 =-1
ELSE=0
2070DEFPROCO:Z%=1:PRINTTAB(25,28)"Reser
ve Ships"TAB(34,29)"I I":D=INKEY200:PRIN
TTAB(25,28)SPC14TAB(33,29)SPC4
2080PRINTTAB(X2,Y2)CHR$230;TAB(X,Y)SC$;
TAB(X2-2,Y2+2)"ASTEROID";TAB(X-6,Y+2);"Y
OUR SHIP":D=INKEY200:PRINTTAB(X2-2,Y2+2)
;SPC8;TAB(X-6,Y+2)SPC9
2090ENDPROC
```

NewBrain Renumber

by A R Armitstead

'Renumber' is a utility which runs on either model NewBrain.

The program is used by MERGEing it with the program you wish to renumber and entering GOTO 50000. Obviously, the program to be renumbered must not have line numbers in the range 50000 to 51040 inclusive. Renumber requests the parameters of the line number in the form FIRST LINE, INTERVAL. 100,20 would thus renumber the program starting at line 100 in steps of twenty.

The program has one major failing: it doesn't actually renumber GOTOs and GOSUBs for you, but simply tells you which numbers to change manually. It

does this in the form of a table which can cope with up to fifty jumps. This figure can be increased by altering the dimension statement in line 50000 and the check in 50420, but any program which jumps more than fifty times probably isn't worth the effort!

The author states that the reason the program doesn't handle the jumps automatically is that this would take up large chunks of memory due to the way the NewBrain stores its programs. Not having a NewBrain to play around with, I'll have to take his word for it, but if anyone knows better . . .

```
49999 REM Program by A.Armitstead
50000 OPTION BASE 1:DIM tb(50,2)
50010 i=1
50020 INPUT("start , step ") st,sp:
      IF st)=50000 OR st <1 OR sp<1
      THEN GOTO 50020
50030 GOSUB 50140:PUT31:REM build table
50040 n=i-1:REM n=no. of entries
50050 p=1:q=2:GOSUB 50650:REM sort
50060 er=FALSE:GOSUB 50780:IF er THEN
      CLEAR:END:REM check line nos.
50070 p=2:q=1:GOSUB 50650
50080 GOSUB 50870
50090 p=1:q=2:GOSUB 50650
50100 GOSUB 50970
50110 IF n=0 PRINT "No line nos. used"
50120 CLEAR
50130 END
50140 DEF FNpe(x)=256*PEEK(x+1)+PEEK(x)
50150 iy=FNpe(22)
50160 it=FNpe(iy+30)+6:REMpointer to int
50170 in=FNpe(it):REM line no. in table
50180 IF in=50000 THEN RETURN
50190 po=FNpe(it+2):REM pointer to code
50200 IF PEEK(po)=32 THEN po=po+1:
      GOTO50200
50210 te=PEEK(po)
50220 IF te<133 AND te>167  GOTO 50260
50230 IF te<=136 AND te>=133 GOSUB 50300
      :GOSUB50370:GOTO 50260
50240 IF te=146 GOSUB 50460:GOTO 50260
50245 IF te=155 OR te=167 GOSUB 50300:
      GOSUB 50370:GOTO 50260
50250 IF te=137 GOSUB 50540
50260 it=it+6:REM next line no.
50270 GOTO 50170
50280
50290 REMBuild no. into te$ until cr or,
50300 po=po+1:IF PEEK(po)=32 GOTO 50300
50310 te$=""
50320 te=PEEK(po)
50330 IF te<>13 AND te<>ASC(",") THEN
      te$=te$+CHR$(te):po=po+1:
      GOTO 50320
50340 RETURN
50350
50360 REM check te$ for valid no.
50370 IF LEN(te$)=0 OR NOT(NUM(te$))
      PRINT"Bad line no. at line ";
      in(6):CLEAR:END
50380 te=VAL(te$)
50390 IF te>65536 OR te<1 OR INT(te)<>te
      PRINT"Bad no. range at line ";
      in(6):CLEAR:END
50400 tb(i,1)=te:tb(i,2)=in
50410 i=i+1
50420 IF i>50 PRINT"Out of space":CLEAR:
      END
50430 RETURN
50440
50450 REM ON statement
50460 po=po+1:te=PEEK(po)
50470 IF te<133 OR te>136 GOTO 50460
50480 GOSUB 50300
50490 GOSUB 50370
50500 IF PEEK(po)=ASC(",") GOTO 50480
50510 RETURN
50520
50530 REM IF statement
50540 po=po+1:te=PEEK(po)
50550 IF te<>180 AND te<>181 GOTO 50540
50560 po=po+1:IF PEEK(po)=32 GOTO 50560
50570 te=PEEK(po)
50580 IF te<=136 AND te>=133 GOSUB 50300
      :GOTO 50370
50590 IF te>=48 AND te<=57 THEN po=po-1:
      GOSUB 50300:GOTO 50370
50600 IF te=146 GOTO 50460
50610 IF te=137 GOTO 50540
50620 RETURN
50630
50640 REM Sort table
50650 m=n:IF n=0 RETURN
50660 m=INT((m+2)/3)
50670 FOR i=m+1 TO n
50680 FOR j=i TO m+1 STEP -m
50690 IF tb(j,p)>=tb(j-m,p) THEN j=m+1:
      GOTO 50720
50700 te=tb(j,p):tb(j,p)=tb(j-m,p):
      tb(j-m,p)=te
50710 te=tb(j,q):tb(j,q)=tb(j-m,q):
      tb(j-m,q)=te
50720 NEXT j
50730 NEXT i
50740 IF m<>1 GOTO 50660
50750 RETURN
50760
50770 REMCheck for non existing line no.
50780 i=1 :IF n=0 THEN RETURN
50790 po=FNpe(FNpe(22)+30)+6
50800 IF FNpe(po)<tb(i,1) THEN po=po+6:
      GOTO 50800
50810 IF FNpe(po)<>tb(i,1) THEN
      PRINT"Line no.";tb(i,1);
      "is used in line";tb(i,2);
      "but no such line exists" :
      er=TRUE
50820 i=i+1
50830 IF i<>n+1 GOTO 50800
50840 RETURN
50850
50860 REM renumber 2nd columb
50870 IF n=0 THEN RETURN
50880 i=1:po=FNpe(FNpe(22)+30)+6
50890 te=st
50895 in=FNpe(po)
50900 IF in<>tb(i,2) THEN po=po+6:
      te=te-sp*(FNpe(po)<>in):
      GOTO 50895
50910 tb(i,2)=te
50920 i=i+1
50930 IF i<>n+1 GOTO 50900
50940 RETURN
50950
50960 REM renumber giving changes
50970 IF n=0 THEN RETURN
50980 i=1:po=FNpe(FNpe(22)+30)+6
50990 te=st
51000 in=FNpe(po):IF in=50000 THEN
      RETURN
51010 IF in<>tb(i,1)POKEpo+1,INT(te/256)
      :POKE po,te-256*INT(te/256):
      po=po+6:te=te-sp*(FNpe(po)<>in):
      GOTO51000
51020 IF tb(i,1)<>te THEN
      PRINT"line no.";tb(i,1)(5);"in";
      tb(i,2)(5);"change to";te
51030 i=i+1
51040 GOTO 51010
```

BBC Hexplode

by Janet Ansell

'Hexplode' is a board game for two players. It runs on a BBC B.

The board consists of a web of 25 hexagons (see below). Each player takes it in turn to place a counter on one of the hexagons. Each hexagon can support a limited number of counters, this limit being determined by the number of neighbouring hexagons. Hexagon A1, for example, can support two counters since it has only two neighbouring hexagons. B3, similarly, can support six counters.

When the limit is reached, the hexagon 'explodes', sending one counter to each adjacent hexagon. This may cause a chain reaction as these neighbouring hexagons in turn reach their 'critical limit'. Eventually, one or other of the players will have no

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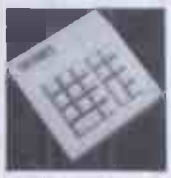

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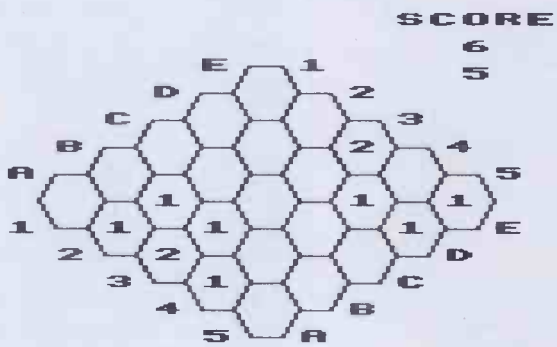
counters left and the game is over.

Like the author, I have so far been unable to work out a strategy for the game; most of my theories were rapidly exploded — literally!

The program is well-structured, the chain reaction being handled by a recursively-defined procedure. Hexplode was a refreshing change from rehashes of old programs, being (as far as I know) completely original. More original ideas, please!




```
 10REM" "HEXPLODE"
 20REM" (c) J Ansell
 30MODE 5
 40VDU 19,1,3,0,0,0
 45VDU 19,2,2,0,0,0
 50VDU 19,3,1,0,0,0
 60DIM PLAYC%(4,4),MAXC%(4,4),SC%(2)
 70REPEAT
 80RESTORE 160
 90FOR X%=0 TO 4
100FOR Y%=0 TO 4
110PLAYC%(X%,Y%)=0
120READ MAXC%(X%,Y%)
130NEXT:NEXT
140PLAYER%=1
150SC%(0)=0:SC%(2)=0
160DATA 2,4,4,4,3
170DATA 4,6,6,6,4
180DATA 4,6,6,6,4
190DATA 4,6,6,6,4
200DATA 3,4,4,4,2
210PROCDRAWGRID
220REPEAT
230PLAYER%=PLAYER%*-1
240GCOL 0,PLAYER%+2
250COLOUR PLAYER%+2
260REPEAT
270REPEAT
280PRINTTAB(0,3);SPC(19)
290INPUT TAB(0,3)"YOUR MOVE ",SHEX$
300X%=ASC(LEFT$(SHEX$,1))-65
310Y%=ASC(RIGHT$(SHEX$,1))-49
320UNTIL FNRANGEOK(X%,Y%)
330UNTIL FNCHECKOWN(X%,Y%)
340SC%(PLAYER%+1)=SC%(PLAYER%+1)+1
350UNTIL FNEXPLODE(X%,Y%)
360INPUT TAB(0,3) "YOU WIN                "'"ANOTHER GAME(Y/N) "Y$
370UNTIL Y$<>"Y"
380MODE 7
390END
400REM" CHECK RANGE
410DEF FNRANGEOK(X%,Y%)
420=NOT(X%<0 OR X%>4 OR Y%<0 OR Y%>4)
430REM" CHECK HEX OWNERSHIP
440DEF FNCHECKOWN(X%,Y%)
450=PLAYC%(X%,Y%)*PLAYER%>=0
460REM" RECURSIVE PROCEDURE FOR
470REM" EXPLODING HEX
480DEF FNEXPLODE(X%,Y%)
490IF NOT FNRANGEOK(X%,Y%) THEN =FALSE
500IF NOT FNCHECKOWN(X%,Y%) THEN SC%(PLAYER%+1)=SC%(PLAYER%+1)+ABS(PLAYC%(X%,Y
%)):SC%(PLAYER%*-1+1)=SC%(PLAYER%*-1+1)-ABS(PLAYC%(X%,Y%))
510PLAYC%(X%,Y%)=(ABS(PLAYC%(X%,Y%))+1)*PLAYER%
520IF ABS(PLAYC%(X%,Y%))<MAXC%(X%,Y%) THEN PROCPHEX(X%,Y%):=FALSE
530PLAYC%(X%,Y%)=0
540PROCPHEX(X%,Y%)
550REM" EXPLODE
560IF FNEXPLODE(X%,Y%-1)THEN =TRUE
570IF FNEXPLODE(X%,Y%+1)THEN =TRUE
580IF FNEXPLODE(X%+1,Y%-1)THEN =TRUE
590IF FNEXPLODE(X%+1,Y%)THEN =TRUE
600IF FNEXPLODE(X%-1,Y%)THEN =TRUE
610IF FNEXPLODE(X%-1,Y%+1)THEN =TRUE
620IF SC%((PLAYER%*-1)+1)<=0 THEN=TRUE
630=FALSE
640DEF PROCDRAWGRID
650REM" DRAW HEX GRID
660CLG
670GCOL 0,2
680COLOUR 2
690PRINTTAB(14,7);"SCORE"
700FOR X%=0 TO 4
710FORY%=0 TO 4
720MOVE X%*96+224+Y%*96,Y%*64+288-X%*64
730PLOT 1,-32,64
740PLOT 1,32,64
750PLOT 1,64,0
760PLOT 1,32,-64
```

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```
770PLOT 1,-32,-64
780PLOT 1,-64,0
790NEXT:NEXT
800VDU 5
810FOR Y%=0 TO 1
820FOR X%=0 TO 4
830MOVE X%*96+704-Y%*576,Y%*384+X%*64+48
840VDU 65+X%
850MOVE X%*96+704-Y%*576,(Y%EOR 1)*384-X%*64+304
860VDU 49+X%
870NEXT:NEXT
880MOVE 160,992
890PRINT"H E X P L O D E"
900VDU 4
910ENDPROC
920DEF PROCPHEX(X%,Y%)
930REM" PRINT NO OF COUNTERS IN HEX
940@%=1
950VDU 5
960MOVE (X%+Y%)*96+288,(X%-Y%)*64+368
970VDU127
980IF PLAYC%(X%,Y%)<>0 THEN PRINT ABS(PLAYC%(X%,Y%))
990VDU 4
1000@%=2
1010COLOUR 1
1020PRINTTAB(16,9);SC%(0);"  "
1030COLOUR 3
1040PRINTTAB(16,11);SC%(2);"  "
1050COLOUR PLAYER%+2
1060ENDPROC
```

ZX81 Mind Reader

by Allon Nym

'Mind Reader' is an extremely simple program for the unexpanded ZX81. It was written as a puzzle for children of middle-school age.

The program is of the 'think of a number and double it' type and the listing is easy to follow, but the eleven-year-olds who tested it for *PCW* (albeit unknowingly!) seemed to find it fascinating. Hopefully, once the child has worked out how the program works, they will be inspired to write similar programs of their own.

If the 'PRINT AT' statements are replaced with straightforward PRINTs and line 230 replaced with a delay loop of the 'FOR x=0 to 5000:next' type, the program should run on almost anything (see Basic Converter Chart for equivalents of INKEY$).

```
1 REM ********************************
2 REM *                              *
3 REM *          MIND-READER         *
4 REM *                              *
5 REM *  A MATHS PUZZLE FOR 1K,ZX81  *
6 REM *           by Allon Nym       *
7 REM *                              *
8 REM ********************************
10 CLS
20 PRINT AT 2,7;"THINK OF A NUMBER"
30 GOSUB 260
40 CLS
50 PRINT AT 4,11;"DOUBLE IT"
60 GOSUB 260
70 LET A=INT(RND*40+1)
80 LET B=A/2
90 LET C=INT B
100 IF B<>C THEN GOTO 70
110 CLS
120 PRINT AT 6,12;"ADD ";A
130 GOSUB 260
140 CLS
150 PRINT AT 8,11;"HALVE IT"
160 GOSUB 260
170 CLS
180 PRINT"TAKE AWAY THE NUMBER YOU FIRST"
190 PRINT"          THOUGHT OF"
200 GOSUB 260
210 CLS
220 PRINT AT 10,7;"THE ANSWER IS ";A/2
230 PAUSE 100
240 CLS
250 GOTO 300
260 PRINT AT 14,3;"PRESS ANY KEY TO CONTINUE"
270 IF INKEY$ <> "" THEN GOTO 270
280 IF INKEY$ = "" THEN GOTO 280
290 RETURN
300 PRINT AT 10,9;"AGAIN Y/N ?"
310 IF INKEY$ = "" THEN GOTO 310
320 IF INKEY$ = "Y" THEN GOTO 10
330 STOP
```

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NewBrain Quadlink

by Ian Frost

'Quadlink' is a computer version of the 'connect-4' game.

Both players choose a character to be used as their counter. Each then takes it in turn to drop this counter into one of eight columns in a grid. The winner is the first to obtain a straight line of four characters in any direction. The computer keeps track of the game and indicates a winning line.

```
10 FORQ=1TO20:CLOSE#Q:NEXTQ
20 OPEN#1,5:OPEN#0,0
30 DIM X(8):GOSUB 5000
40 DEF FNXS(Q)=(Q*4)+2
50 DEF FNYS(Q)=((8-Q)*2)+4
55 PUT31,10,10,10
60 LINPUT("NAME OF FIRST PLAYER PLEASE?"
)NA$(0)
65 INPUT("PLAYING CHARACTER?")CH$:CH(0)=
ASC(CH$)
70 LINPUT("NAME OF SECOND PLAYER PLEASE?
")NA$(1)
75 INPUT("PLAYING CHARACTER?")CH$:CH(1)=
ASC(CH$)
80 RANDOMIZE:P=INT(RND*2):U=P
90 ON BREAK GOTO 6000
100 PUT31,10,10,7:CLEAR X()
110 ?"   ";CHR$(139);:FORZ=1TO7:GOSUB 70
00:?CHR$(133);:NEXTZ:GOSUB 7000:?CHR$(13
8)
120 FOR B=1TO7
130 FOR Z=1TO9:?"    ";CHR$(130);:NEXTZ:?
140 ?"   ";CHR$(135);:FORZ=1TO7:GOSUB700
0:?CHR$(131);:NEXTZ:GOSUB7000:?CHR$(134)
150 NEXT B
160 FORZ=1TO9:?"    ";CHR$(130);:NEXTZ:?
170 ?"   ";CHR$(137);:FORZ=1TO7:GOSUB700
0:?CHR$(132);:NEXTZ:GOSUB7000:?CHR$(136)
190 ?"     1   2   3   4   5   6   7   8
"
200 PUT 22,4,22
210 ?"WHICH COLUMN ";LEFT$(NA$(P),20);"
                    ":GET#1,CL
215 IF CL<49 OR CL>56 THEN 200
216 IF X(CL-48)=8 THEN 200
220 CL=CL-48
240 X(CL)=X(CL)+1
250 POKE 577+FNYS(X(CL))*64+FNXS(CL),CH(
P)
260 GOSUB 1000
270 P=1-P
280 GOTO 200
1000 XD=1:YD=0:GOSUB 1500
1010 XD=0:YD=1:GOSUB 1500
1020 XD=1:YD=1:GOSUB 1500
1030 XD=1:YD=-1:GOSUB 1500
1040 RET
1500 F=0
1510 FOR S=-3 TO 3
1512 XP=FNXS(CL+XD*S):YP=FNYS(X(CL)+YD*S
)
1514 IF XP<4 OR XP>38 OR YP<2 OR YP>20 T
HEN 1560
1520 D=PEEK(577+64*YP+XP)
```

```
1530 IF D=CH(P) THEN F=F+1:GOTO 1550
1540 F=0
1550 IF F=4 THEN 2000
1560 NEXT S
1570 RET
2000 PUT 22,1,21
2010 ?TAB((24-LEN(NA$(P)))/2);NA$(P);" I
S THE WINNER !"
2020 ?TAB(14);"ANOTHER GAME?";:GET#1,A:?
CHR$(A-32)
2030 IF A=110 THEN ON BREAK GOTO 0:END
2040 ?TAB(14);"SAME PLAYERS?";:GET#1,A:?
CHR$(A-32)
2050 IF A=110 THEN 55
2060 U=1-U:P=U:GOTO 100
5000 PUT31,10,10
5010 ?TAB(15);"QUADLINK"
5020 ?TAB(10);"CUSTOM ELECTRONICS"
5025 ?TAB(14);"(SOFTWARE)"
5030 ?:?"The object of the game is to ge
t four"
5040 ?"of your playing characters in a r
ow "
5050 ?"(The playing character is any cha
racter"
5060 ?"typed in by the player at the sta
rt of"
5070 ?"the game.)"
5080 ?"On his or her go the player decid
es"
5090 ?"which column to 'drop' the charac
ter"
5100 ?"into."
5110 ?:?TAB(7);"PRESS ANY KEY TO CONTINU
E"
5120 GET#1,A:RET
6000 CONT
7000 ?CHR$(129);CHR$(129);CHR$(129);:RET
```

Oric Renumber

by Andrew Godber

'Renumber' is, as you'd expect, a renumbering program for the Oric. It runs in less than 0.25k.

Once you have entered and saved 'Renumber' on tape, instructions for using it are as follows:—

1 Type in or CLOAD the program you wish to renumber.
2 Enter CLEAR to clear all variables.
3 Enter PRINT DEEK(#9C). This returns the address of the first free memory location. Make a note of this number.
4 Enter the following as direct commands (that is, press RETURN after each one)
DOKE #9A, #9801
DOKE #9800, #B00
NEW
5 Load Renumber using CLOAD "RENUMBER", A #9800, E #9900
6 LET XXXX = (the address found by instruction 3, above).
7 RUN

Your program will now be renumbered in steps of 10.

```
 5 REM FOR £ READ # (HASH)
10 REM ORIC RENUMBER (C) A.
   GODBER 27.7.83
20 S=£503:L=£000A:I=10:E=XXXX
30 DOKE S,L:L=L+I:S=S+1
40 REPEAT:S=S+1:UNTIL
   PEEK(S)=0 OR S> = E
50 S=S+3
60 IF S> =E THEN 100
70 GOTO 30
100 DOKE £9C,E:DOKE £9E,
   E:DOKE £A0,E
110 DOKE £9A,£501
120 LIST
```


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PROGRAMS

IBM Sheepdog Trials

by Chris Gray

I've been wanting to publish a game for the IBM PC for some time. Actually, I've been secretly hoping that someone would send me a game of Space Invaders for the PC; I mean, what's the point of having all those expensive electronics if you can't zap an alien or two in your lunchbreak? Ah, well, at least I can now try to round up sheep instead. This program is written in IBM BasicA.

If you've never played the game, 'Sheepdog Trials' is more difficult than it sounds. The idea is that you control one blob (the sheepdog) while up to six other blobs (the sheep) wander around the screen. Your job is simply (!) to manoeuvre the sheep into the pen in the centre of the screen. The rules governing the movement of the sheep are as follows:—

(a) If the dog is the correct distance from the sheep, the sheep will move away from the sheepdog.
(b) If the dog is too far away, the sheep will move randomly.
(c) If the dog is too near, the sheep will panic and scatter.
(d) Sheep directed into the pen will escape if left unguarded for too long.
(e) All other things being equal, the sheep will (as is their wont) tend to follow each other.

When you have got all the sheep into the pen, position yourself in the gate. You are awarded a score based on the time taken to round up all the sheep.

If you don't happen to have a PC handy, 'Sheepdog' is a fairly easy program to write, although this particular version uses two of IBM Basic's more esoteric features. LOCATE x, y positions the cursor at the specified point on the 80×25 screen. Similarly, SCREEN (x, y) returns the ASCII value of the character at the specified position.

Lines 3110-40 check for a cursor-key press, checking cursor-down, -up, -left and -right respectively. CHR$(2) (the dog) is a smiling face, CHR$(227) is the pi sign which, with a bit of imagination, vaguely resembles a sheep. The other CHR$s used are block graphics and line characters to draw the pen.

I did, after several attempts, manage to round up two sheep without running out of time. If anyone manages all six, I'll award them the *PCW* Order of the Crook, but I'll want to see it demonstrated here first!

```
1 REM*********************************************
2 REM**                                           **
3 REM**  Sheepdog Trials  Chris Gray Sept 1983    **
4 REM**                                           **
5 REM*********************************************
6 REM
10 REM*************************************************
20 REM**                                             **
30 REM**  initial variables and set-run conditions   **
40 REM**                                             **
50 REM*************************************************
60 KEY OFF
70 RANDOMIZE VAL(RIGHT$(TIME$,2))
80 CLS
90 LET SON = 0
100 INPUT"Do you want sound(Y/N)";Q$
110 IF Q$="Y" OR Q$="y" THEN LET SON = 1:GOTO 130
120 IF Q$<>"N" AND Q$<>"n" THEN PRINT "Invalid selection - ";:GOTO 90
130 INPUT "How many sheep (1-6)";NS
140 IF NS>6 OR NS<1 OR NS<>INT(NS) THEN PRINT "Invalid selection - ";:GOTO 130
150 LET SC=3000+NS*1000
160 DEF FN X = 1 + INT(RND*(80))
170 DEF FN Y = 1 + INT(RND*(22))
180 LET D$ = CHR$(2)
190 LET S$ = CHR$(227)
200 GOSUB 1000:REM set up screen
210 GOSUB 2000:REM position sheep & dog
300 REM**********************
310 REM**                    **
320 REM**  mainline loop     **
330 REM**                    **
340 REM**********************
350 FOR Z = 1 TO 10
360 GOSUB 3000:REM dog move
370 GOSUB 4000:REM score
380 NEXT Z
390 GOSUB 5000:REM sheep move
400 GOTO 300
410 STOP
900 REM*************************************************************************
910 REM**  subroutines  ********************************************************
920 REM*************************************************************************
930 REM
1000 REM**********************
1010 REM**                    **
1020 REM**  set up screen     **
1030 REM**                    **
1040 REM**********************
1050 CLS
1060 LOCATE 1,1
1070 PRINT STRING$(80,223);
1080 LOCATE 23,1
1090 PRINT STRING$(80,220);
1100 FOR N = 1 TO 23
```

PROGRAMS

```
1110 LOCATE N,1
1120 PRINT CHR$(222);
1130 LOCATE N,80
1140 PRINT CHR$(221);
1150 NEXT N
1160 LOCATE 10,37
1170 PRINT CHR$(201);CHR$(184);" ";CHR$(213);CHR$(187);
1180 LOCATE 11,37
1190 PRINT CHR$(185);"   ";CHR$(204);
1200 LOCATE 12,37
1210 PRINT CHR$(185);"   ";CHR$(204);
1220 LOCATE 13,37
1230 PRINT CHR$(200);CHR$(205);CHR$(205);CHR$(205);CHR$(188);
1240 LOCATE 24,30
1250 PRINT "SCORE ";SC;
1260 RETURN
2000 REM*************************************
2010 REM**                                 **
2020 REM**  set up dog and sheep on screen  **
2030 REM**                                 **
2040 REM*************************************
2050 FOR N = 1 TO NS
2060 READ X(N)
2070 READ Y(N)
2080 LOCATE Y(N),X(N)
2090 PRINT S$;
2100 NEXT N
2110 DATA 9,17,8,18,9,18,10,18,9,19,10,19
2120 LET XD = FN X
2130 LET YD = FN Y
2140 IF SCREEN(YD,XD) <> 32 THEN GOTO 2120
2150 LOCATE YD,XD
2160 PRINT D$;
2170 RETURN
3000 REM*******************************
3010 REM**                           **
3020 REM**  dog (player) movement    **
3030 REM**                           **
3040 REM*******************************
3050 LET EX=0
3060 LET EY=0
3070 LET K$=INKEY$
3080 IF K$ = "" THEN GOTO 3170
3090 IF LEFT$(K$,1) <> CHR$(0) THEN GOTO 3170
3100 LET K$ = RIGHT$(K$,1)
3110 IF K$ = CHR$(72) THEN LET EY = -1:LET EX = 0:GOTO 3160
3120 IF K$ = CHR$(80) THEN LET EY = +1:LET EX = 0:GOTO 3160
3130 IF K$ = CHR$(75) THEN LET EX = -1:LET EY = 0:GOTO 3160
3140 IF K$ = CHR$(77) THEN LET EX = +1:LET EY = 0:GOTO 3160
3150 GOTO 3170
3160 IF SON THEN SOUND 999,.1
3170 DEF SEG=0
3180 POKE 1050,PEEK(1052)
3190 IF SCREEN (YD+EY,XD+EX) <> 32 THEN GOTO 3270
3200 LOCATE YD,XD
3210 PRINT " ";
3220 LET XD=XD+EX
3230 LET YD=YD+EY
3240 LOCATE YD,XD
3250 PRINT D$;
3260 IF XD=39 AND YD = 10 THEN GOTO 6000
3270 RETURN
4000 REM*********************************************
4010 REM**                                         **
4020 REM**  calculate current score and display    **
4030 REM**                                         **
4040 REM*********************************************
4050 LET SC = SC - 2
4060 IF SC <= 0 THEN SC=0:GOTO 6110
4070 LOCATE 24,36
4080 PRINT SC;
4090 RETURN
5000 REM*****************************
5010 REM**                         **
5020 REM**  move all the sheep     **
5030 REM**                         **
5040 REM*****************************
5050 XDEF = INT(RND*3)-1
5060 YDEF = INT(RND*3)-1
5070 FOR N = 1 TO NS
5080 LET XABS = ABS(X(N) - XD)
5090 LET YABS=ABS(Y(N)-YD)
5100 IF XABS < 2 AND YABS < 2 THEN DX = XDEF:DY = YDEF:GOTO 5140
5110 IF XABS > 16 OR YABS > 8 THEN DX = XDEF:DY = YDEF:GOTO 5140
5120 LET DX = SGN(X(N) - XD)
5130 LET DY=SGN(Y(N)-YD)
5140 IF SCREEN(Y(N)+DY,X(N)+DX)<>32 THEN GOTO 5250
5150 IF X(N)+DX=2 OR X(N)+DX=79 OR Y(N)+DY=2 OR Y(N)+DY=22 THEN GOTO 5250
5160 LOCATE Y(N),X(N)
5170 PRINT " ";
5180 LET X(N) = X(N)+DX
5190 LET Y(N)=Y(N)+DY
5200 LET XDEF=DX
5210 LET YDEF=DY
5220 LOCATE Y(N),X(N)
5230 PRINT S$;
5240 GOSUB 3000:REM dog move
5250 NEXT N
5260 RETURN
6000 REM*********************************************
6010 REM**                                         **
6020 REM**  check for all the sheep in the pen     **
6030 REM**                                         **
6040 REM*********************************************
6050 FOR N = 1 TO NS
6060 IF Y(N)<11 OR Y(N)>12 OR X(N)<38 OR X(N)>40 THEN GOTO 3270
6070 NEXT N
6080 IF SON THEN FOR M=4 TO 6:FOR N=1 TO  3:PLAY "L640=m;cdefgab":NEXT:NEXT
6090 PRINT
6100 LOCATE 24,10
6110 PRINT "You scored ";SC;"    Another game (Y/N)";
6120 INPUT Q$
6130 IF Q$ = "Y" OR Q$ = "y" THEN RUN
6140 IF Q$ = "N" OR Q$ = "n" THEN KEY ON:END
6150 PRINT "Invalid selection - ":GOTO 6100
6160 GOTO 6100
```


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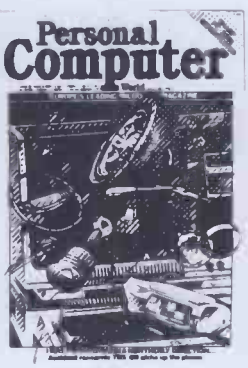

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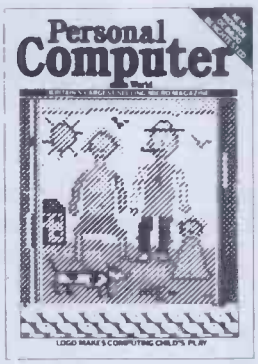

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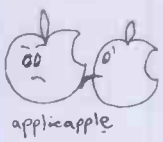

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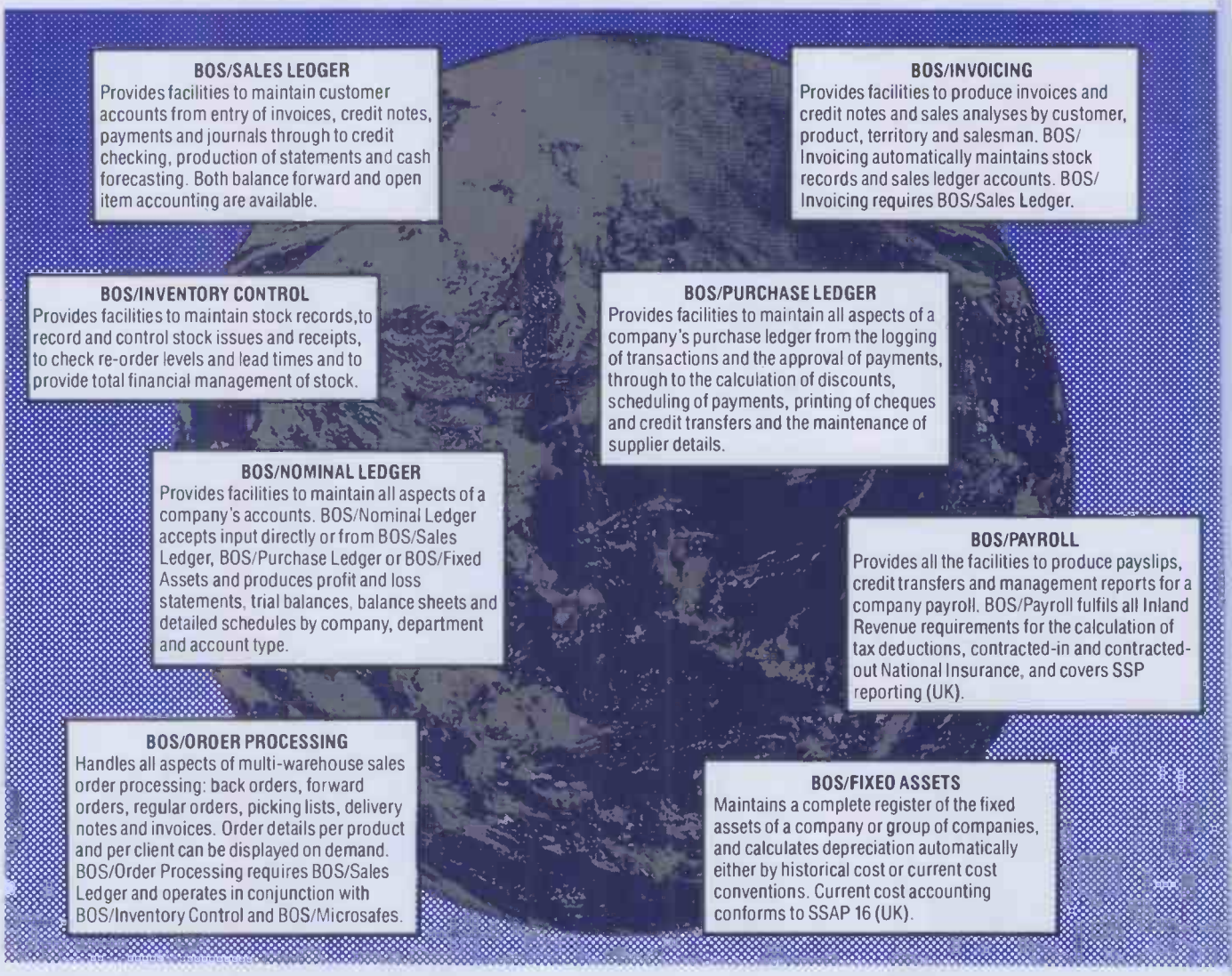

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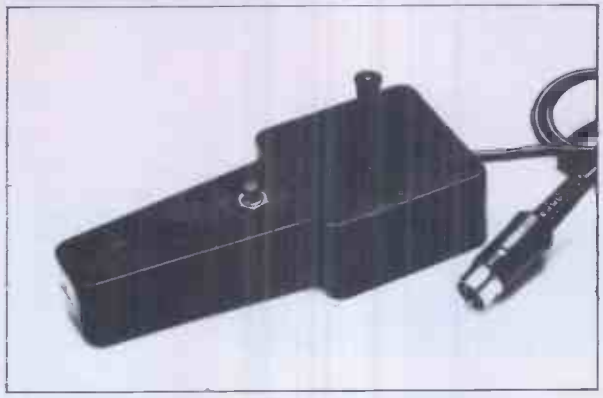

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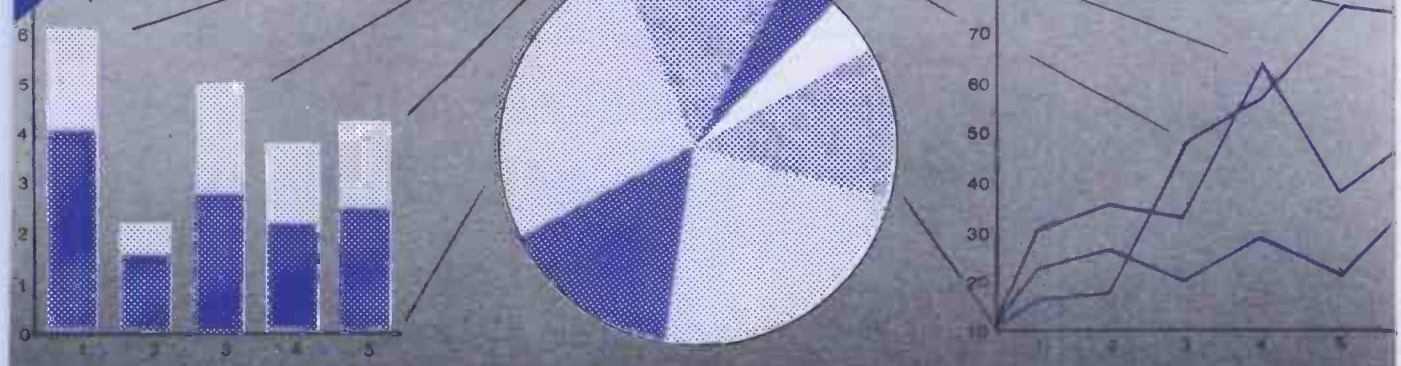

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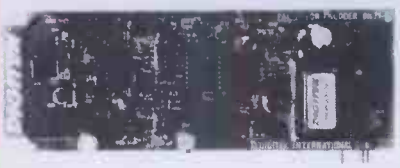

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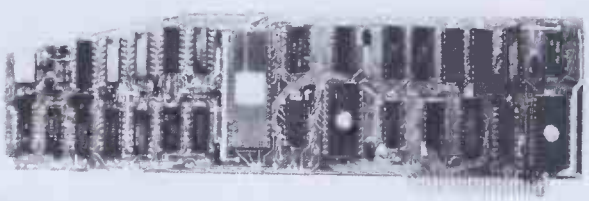

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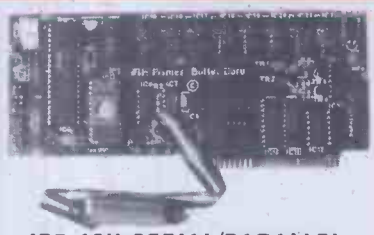

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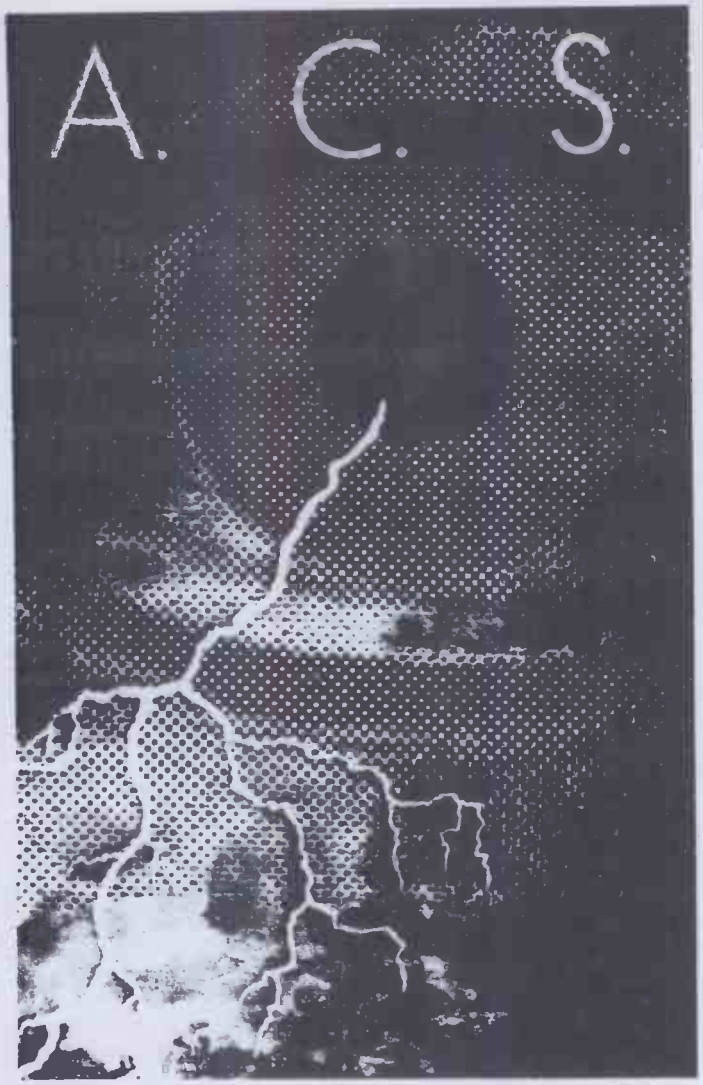

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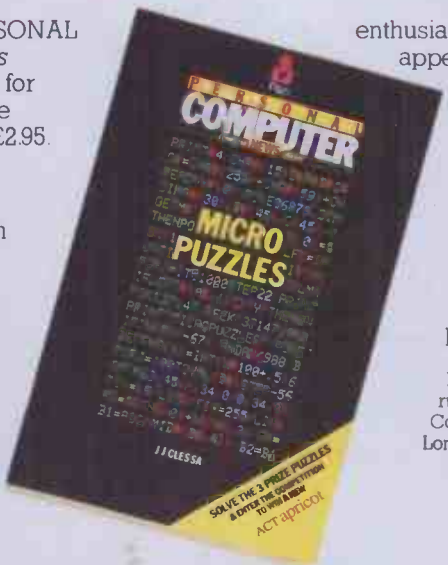

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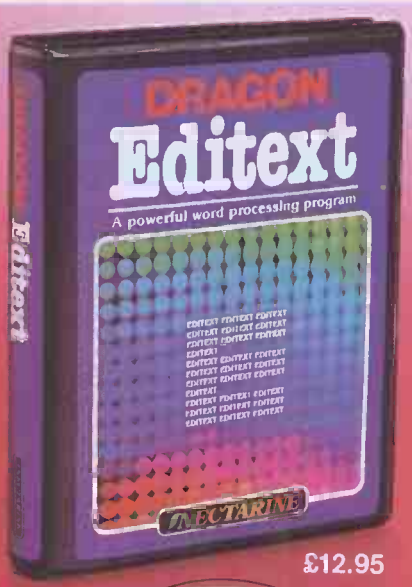

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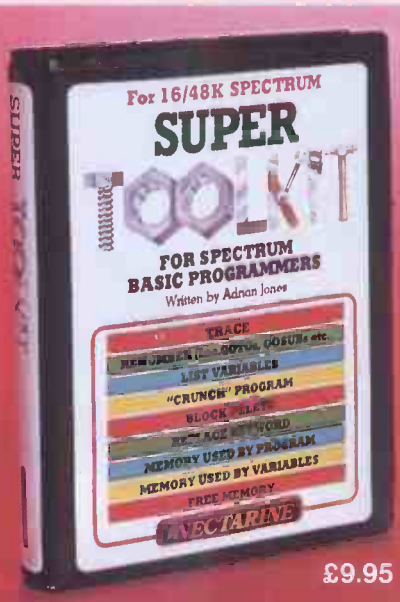

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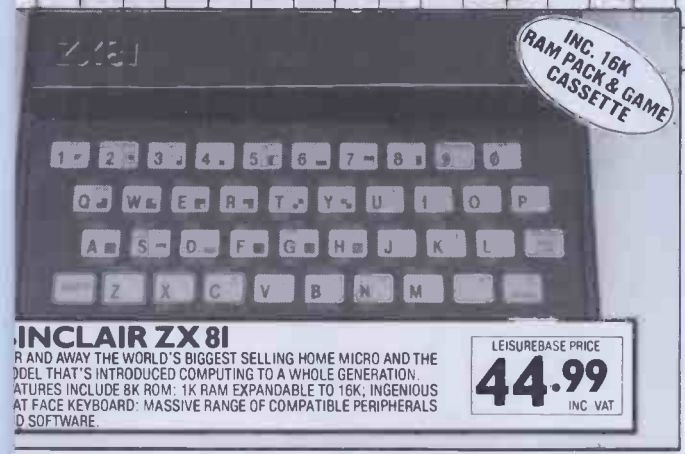

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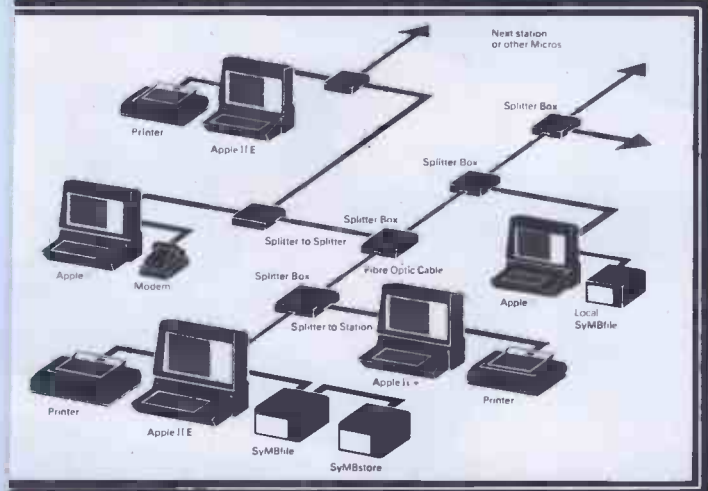

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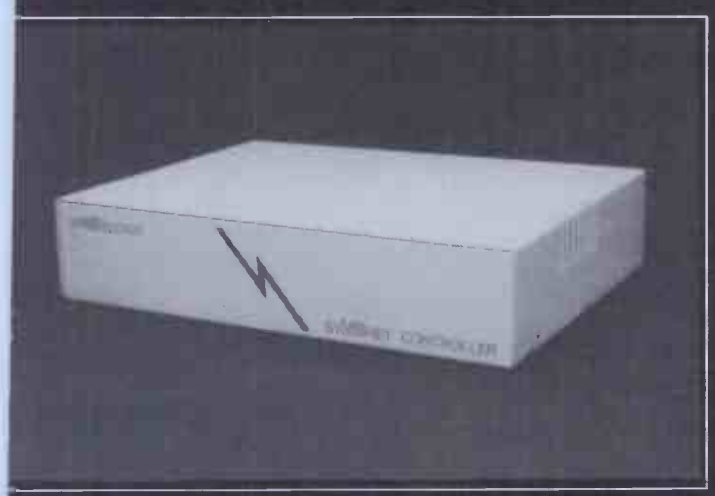

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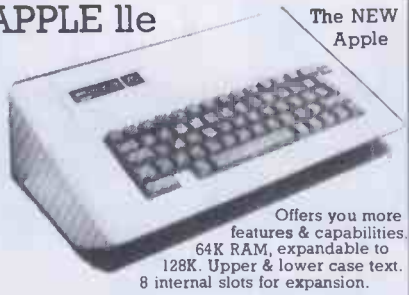

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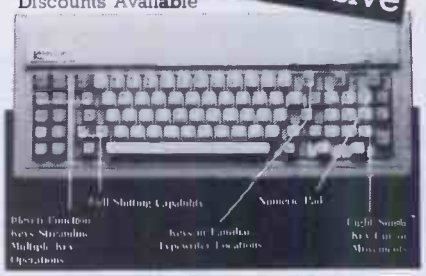

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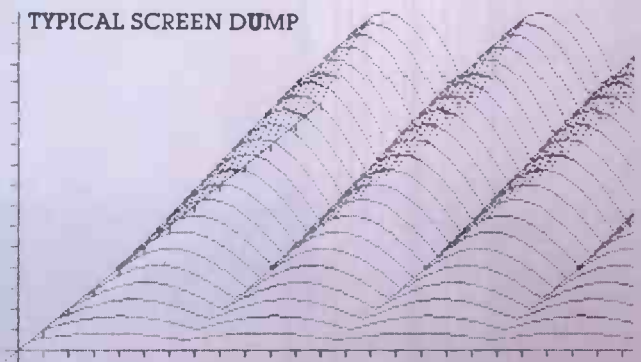

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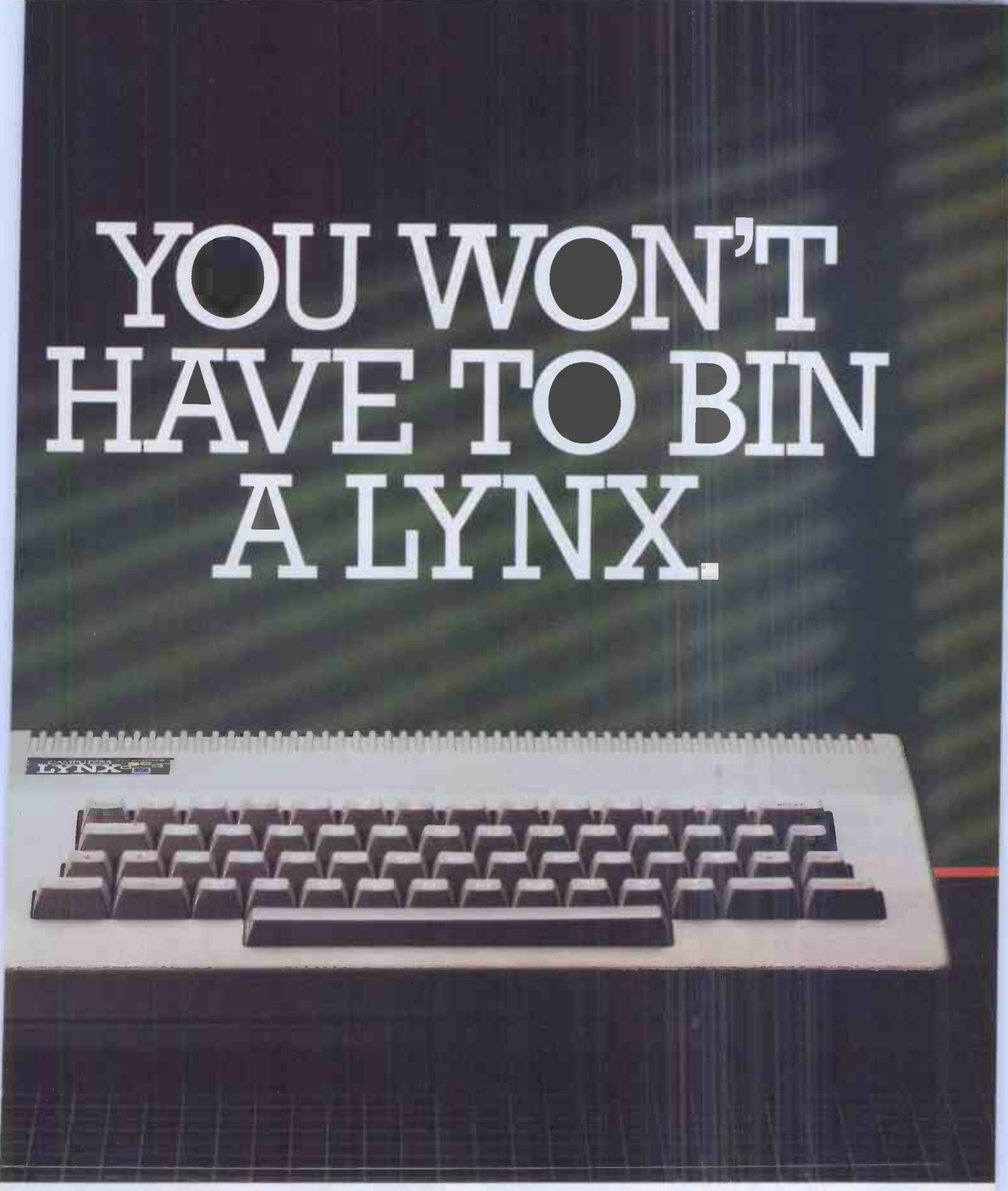

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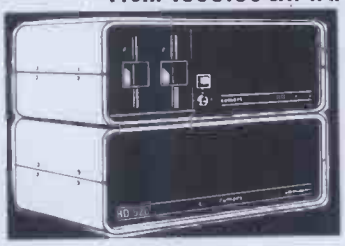

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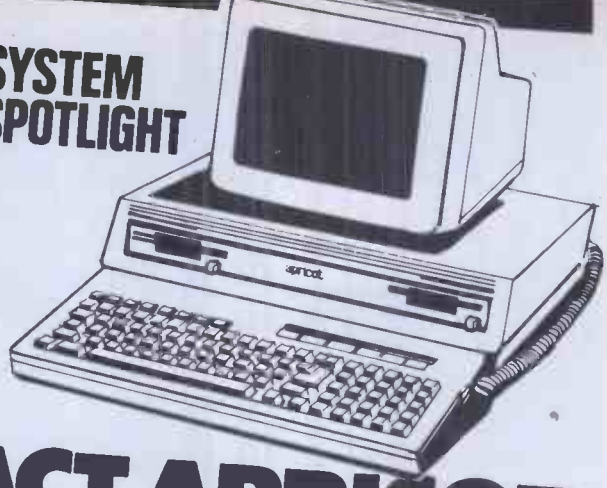

ACT APRICOT

Introducing the new Apricot from ACT, a true 4th generation 16-Bit personal computer at a more than competitive price. Ergonomically styled and sufficiently compact to be considered a truly transportable system. One of the most interesting features of the Apricot is the Microscreen facility, a unique two line LCD display with six associated touch sensitive keys incorporated in the detachable multi-function keyboard. This permits the microscreen to display day, date and time; double as a powerful calculator; provide for dynamic labelling selection; serve as an entry line for information and act as a display window when a full monitor is not available. The monitor display is 25 lines × 80 characters offering high res. graphics 800 × 400 pixels. The keyboard also has its own 'mouse trap' thus enabling selections on the screen to be made simply and easily. The Apricot specification includes a powerful 256K byte memory as standard expandable to 768K bytes. Disk storage is provided by utilising revolutionary 3.5" sony disk drives which offer 315K bytes of storage per drive. The Apricot comes with three operating systems as standard – MS-DOS 2.0, CP/M-86 and Concurrent CP/M-86 plus Microsoft BASIC and Personal BASIC languages. The Apricot is software compatible with both the IBM PC and ACT Sirius 1, giving access to a vast library of readily available application software. For full range of application software see CP/M-86 and IBM software listing. Also selection of MS-DOS software, including Microsoft Languages, available.

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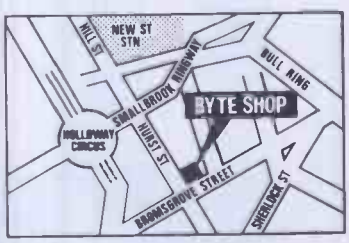
After five years, The Byteshop Birmingham, situated in Hurst Street opposite the Hippodrone Theatre, is now one of our longest established stores. Manager James Attfield and his experienced team are always available to discuss specific applications and would be pleased to arrange a personal demonstration from their wide range of micros in stock.



BYTESHOP FOR THE BUSINESSMAN

You wouldn't go to a lawyer for medical advice, or take your tax problems to a doctor. It's just as illogical to talk computers to anyone but a computer expert.

Every Byteshop is a specialist computer store. In it you will find nothing but computers and computer people. There is nothing else to distract you. Every Byteshop can show you the very latest personal computer systems and provide solutions to both specific and specialist requirements. Word processing, production control, accounts financial planning and data bases are just a few of the most popular applications.

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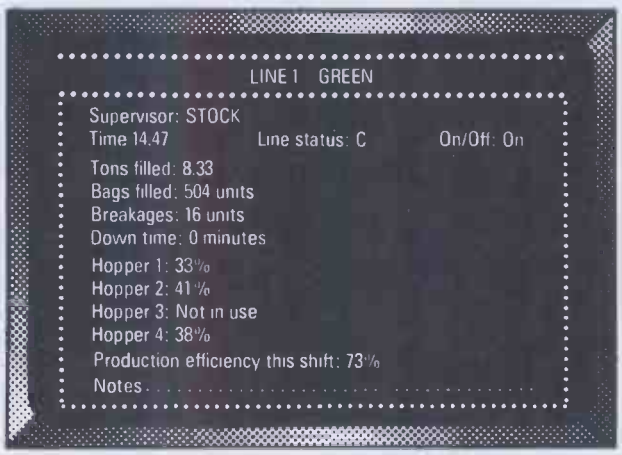

Controlling the production of tomato grow bags may sound simple enough, but co-ordinating *all* the different aspects on a brand-new production line was not without its headaches. When the production manager turned to the company's new micro for an answer, it was THE LAST ONE which made it possible to create a system in hours rather than months. TLO then went on to produce over *one hundred* individual solutions for this company in a period of less than a year.

A simple, moving, graphic display was needed by a major computer retailer to demonstrate how a new product line could maintain compatibility with some of his earlier machines. Half an hour's work with THE LAST ONE and he had a program displaying bar-charts, graphs and printouts. Little more than an hour later the same program was up and running on three other makes of micro. When asked what made the four machines compatible, he laid the credit squarely with THE LAST ONE – "some manufacturers would be hard put to even use the same mains plug – TLO at least gets them all speaking the same language."

Using a computer to solve a complex problem is not always as easy as it sounds.

A product called THE LAST ONE however, has helped crack hundreds of computer problems for users throughout the world.

Launched less that two years ago, TLO allows any computer user to design, develop and modify, accurate and complete solutions without needing to understand the complex code languages used by the machine in question.

Now in use in installations from major clearing banks to one-man businesses, TLO is helping solve in hours, problems which used to take days, weeks and months.

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A new fully operational Compact version of TLO is now available. Designed primarily for the occasional user wanting to harness the power of the world's leading program generator, it costs a highly competitive £50 (+VAT), and this is *refunded* should you subsequently upgrade to the Professional version.

The Professional multi-file version of TLO includes new time-saving features and costs from £185 to £330 (+VAT) according to the hardware installation.

TLO runs on the Apple II and IIe, Commodore 4032 and 8032/96, TRS-80 Model II (TRSDOS or CP/M), most CP/M, CP/M 86 and MS/DOS machines, including the IBM PC (PC-DOS), Wang PC, Zenith Z100, and Sirius.

Find out what TLO can do for you by contacting your local dealer or send for an information pack.

It could be the solution to hundreds of *your* problems.

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sinclair special 5

Inside... New Interface 2 and ROM cartridges! New Software!

TAKING NEW SOFTWARE IN NEW DIRECTIONS

You'll see that this issue of Sinclair Special devotes considerable space to software. Why, when we've so much to say about hardware and peripherals? Simply because at Sinclair we believe in supporting first-class hardware with first-class software.

This month sees the start of a new commitment to education in our catalogue, both for adults and children.

In the field of micro theory, we've programs like Beyond BASIC and Make-a-Chip, which take you from the creation of simple ZX® assembler subsets to simulated circuit design projects.

There's Musicmaster, to teach you music terminology, note values and composition.

And if you're keen to beat your Spectrum at chess (which can be hard), you'll certainly want to try Chess Tutor 1, the first program in a complete chess masterclass.

Coming soon...

In the pipeline are many new releases, some of which break completely new ground. LOGO and micro-PROLOG for instance. They're fifth generation languages which will take you and your Spectrum closer than ever before to the creation and application of artificial intelligence.

A formal agreement between Sinclair and Macmillan Education has been announced, the first results of which will be published this autumn. These consist of five programs in a complete early reading course plus the first four of a series of programs based on Macmillan's top selling Science Horizons Scheme. All programs are designed for use in schools or the home.

And with Blackboard software, we're publishing six more home education programs for primary school children. Covering alphabet, spelling and punctuation, each of these programs is a true gem, unlike any other education software, and fascinating to run. Even for adults!

I believe that these new titles represent a major advance in educational software for the home.

New ROM software too!

You may well have heard news of ZX Interface 2® and ROM cartridge programs. You'll find full details of the Interface and its software on the facing page (and there's an order form on the back page too!). These offer an instant games playing facility at unbeatable prices, and expand the possibilities of using your Spectrum in yet another direction.

Alison Maguire

Alison Maguire
Applications Software Manager

SOFTWARE UPDATE

The latest cassette software for ZX® Compu

Chess Tutor 1
For 48K RAM Spectrum. **£9.95.**

Chess Tutor is a new way of learning all ab chess – using your ZX Spectrum.®

It starts from the beginning by teaching you about the chess pieces and the way t move – including castling, en passant, promotion, check, checkmate, stalemate perpetual check.

Then it teaches you the basic tactics – p forks, double attacks and skewers.

There are over 120 exercises and over 2 questions for you to answer – with demon tions and hints from your ZX Spectrum wh you want them.

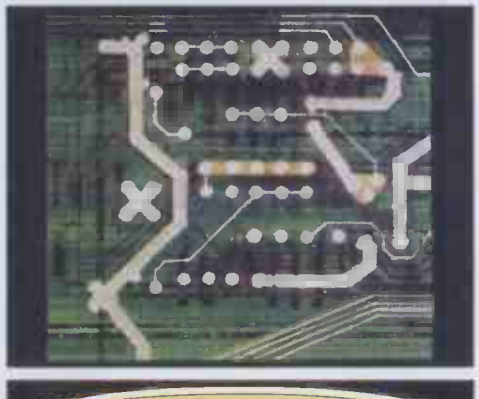
You can choose which parts of the cour you want – and even experienced players be surprised at what they can learn from Chess Tutor.

Musicmaster
For 48K RAM Spectrum. **£9.95.**

Musicmaster turns your ZX Spectrum into musical instrument which will not only pla tunes, but will also demonstrate key signa durations of notes, and scales.

You can write your own tunes – in any ke play them over and over again, save them tape, modify them.

You can either write your music on a sta or place a simple overlay on your Spectrur a 17-note keyboard.



Make-a-Chip
For 48K RAM Spectrum. **£9.95.**

Make-a-Chip teaches you the basic eleme of circuit design, shows you how they fit together, and then lets you design and tes your own circuits.

When you have designed a circuit, you c give it inputs and outputs and your ZX Spectrum will check it for you. Then it will r it, or tell you what's wrong so that you can modify it.

Make-a-Chip is a fascinating way of findi out how computer logic works.

Print Utilities
For 16K and 48K RAM Spectrum. **£9.95.**

Increase the printing and display facilities o your ZX Spectrum with the Print Utilities program.

Print Utilities enables you to enhance yo programs by generating characters of eigh different sizes which you can place anywhe on your screen.

Beyond BASIC
For 48K RAM Spectrum. **£9.95.**

Takes the agony out of assembler. Takes the mystery out of machine code.

Beyond BASIC gives you a deeper insight into the workings of your ZX Spectrum. It explains what happens inside your micro wh you run a program, and it teaches you simpl Z80 machine code programming.

A major feature of Beyond BASIC is that it enables you to write your own Z80 assemble programs – then you can actually see on you screen how they affect the ZX Spectrum memory and registers.

ZX INTERFACE 2®

The New ROM Cartridge/Joystick Interface

ads programs instantly!
kes two joysticks!
st plug-in and play!

ZX Interface 2 is the latest new pheral for the ZX Spectrum® system. ables you to use new ZX® ROM ridge software: plug-in programs load instantly. It allows you to use standard joysticks, without the need separate, special interfaces.
To use new ZX ROM cartridge pro- ns, just connect Interface 2 to the of your Spectrum or Interface 1 and in the cartridge of your choice. program is then loaded, ready to run! You can use any joystick that has a y D plug. Use one or two of them for a fun with ZX ROM cartridge or Sinclair sette programs – or with dozens of er Spectrum-compatible programs!

SEE BACK PAGE FOR ZX INTERFACE 2 AND ROM CARTRIDGE ORDER FORM!

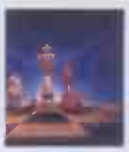
AND BRAND NEW ROM CARTRIDGE SOFTWARE!

re's already plenty of choice of ZX ROM cartridge grams for your Spectrum. Some are old favourites, in xciting new form. Others are new.
And now, thanks to ROM cartridge technology, you run them *all* on a 16K RAM Spectrum, even if they e originally written only for 48K machines!
Every ROM cartridge program loads fast and fault- ly. No wires, no waiting, no worries about loading rs! All of them are affordably priced too, at £14.95.

w! PSSST

Robbie the Robot sits in his garden. Help him fetch compost to cultivate his prize Thyrgodian Megga Chrysanthodil. Help make the right choice of ticide, to ward off devilish ects. Stop the insects breeding verwhelming numbers before obie's plant has bloomed. SST is horticulture with a rendous twist!
One and two player option, h a host of features including nd effects.

Chess



This sophisticated program does everything you'd expect at board game level, and much more besides.
The high-resolution chess-board and pieces are arranged in a row and column system, so it's easy to key in your moves.
At any stage of the game you can request the computer to suggest a move, reverse roles or change the level of skill.
Full-colour high-resolution graphics.

Backgammon

Everything you need to play the famous and deceptively simple board game. Board, stones, rolling dice and doubling dice are shown in full colour and high resolution. Choose from four levels of skill to suit experts and beginners alike – full rules are included.

Planetoids

Dodge and swerve using your thrust button, turn on a planetoid... fire! But beware – the alien ship moves fast to destroy you with cluster bombs. And when it comes to the crunch, use your hyperspace button!
Full-colour high-resolution graphics with sound.

Space Raiders

Your skill is all that's stopping successive waves of aliens from destroying Earth. Use your gun base to attack. Shelter behind buildings... move out and blast the passing alien soaceship!
Full-colour high-resolution graphics with sound.

Hungry Horace

Horace is forever being chased around the park by guards.
He steals their lunch, eats path-way flowers and creates chaos in the park by ringing the alarm!
You'll have to be quick to keep Horace out of trouble!
Full-colour high-resolution graphics with sound.

w! Tranz Am

Set in a future time ruled by cars and trophies, in a land where petrol re-places gold, and status is possession he 8 Great Cups of Ultimate. Driving your Super Blown Red cer, use your skill to outwit d crash the Deadly Black bos. Use your instruments to ate and collect the trophies – fore you overheat or run out of l.
A program with outstanding lti-directional movement, aphic features, and a playing ea equivalent to more than 0 times actual screen area.

Horace and the Spiders

Guide Horace on the hazardous journey to the cobwebbed house full of poisonous spiders.
Safely in the house, you must move along cobwebs, choose a spot... and jump on it! The spiders will be in a frenzy – scuttling to repair their precious web.
And when a spider is spinning a new section, you're safe to attack and destroy it!
Kill all the spiders, and a new web appears... with even more spiders to catch.
Full-colour high-resolution graphics.

New! Cookie

You're Charlie the Chef, who keeps his ingredients locked in the larder. But if the ingre-dients escape, they bring the inedible Nasties with them!
You must daze the escaping ingredients with flour bombs, and knock them into the mixing bowl. Stop them getting into the dustbin, at all costs! And beware of Nasties that get into the mixing bowl!
Cookie is fast-moving panic in the pantry, with a cast of real characters. A program to make you smile – and sweat!

New! Jet Pac

As Chief Test Pilot of the Acme Inter-stellar Transport Company, your task is to deliver and assemble spaceship kits. On your way round the galaxy, you're free to collect precious stones and gold.
The catch? Rocket fuel is precious and scarce. And the aliens don't take kindly to the theft of their valuables. You'll need your wits and your lasers!
With a host of features, inclu-ding multi-directional movement, explosions, sound effects and one and two player option.

ZX MICRODRIVE

NOW ON RELEASE

The ZX Microdrive® System – as you'd expect from Sinclair – is unique to the world of computing. It's a compact, expandable add-on system which provides high-speed access to massive data storage. With just one Microdrive alone (and Interface 1), you'll have at least 85K bytes of storage, the ability to LOAD and SAVE in mere seconds, the beginnings of a local area network of up to 64 Spectrums, *and* a built-in RS232 interface! The cost? Less than £50 for each Microdrive.

How to get ZX Microdrive

Spectrum owners who bought direct from us, by mail order, have been sent full details. Order forms are being mailed in strict rotation, so if you haven't yet received your order form please bear with us. We're making good progress in meeting the huge demand.

If you didn't buy your Spectrum by mail order, don't worry. Send us the form from the bottom of this page. We'll add your name to the mailing list, and send you details by return.

Each Microdrive costs £49.95. Interface 1 costs £49.95, but just £29.95 if purchased with a ZX Microdrive. Extra ZX Microdrive cartridges: £4.95.

How to order

Simply fill in the relevant sections on the order form below. Note tha there is no postage or packing to pay on some purchases. Orders r be sent FREEPOST (no stamp needed). Credit card holders may order by phone, calling 01-200 02 24 hours a day. 14-day money-ba option, of course. Please allow 28 days for delivery.

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G22/R	Backgammon	5304	14.95
G10/R	Chess	5301	14.95

CASSETTE PROGRAMS for ZX Spectrum

E9/S	Chess Tutor 1	4308	9.95
E7/S	Musicmaster	4306	9.95
E8/S	Beyond BASIC	4307	9.95
E6/S	Make-a-Chip	4305	9.95
L5/S	Print Utilities	4404	9.95
		TOTAL £	

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*Delete/complete as applicable.

Signature

Mr/Mrs/Miss

Address

PCW 9

(Please pri

ZX Microdrive information request

Please add my name to the Microdrive Mailing List, *and* send me a colour brochure with full specifications of ZX Microdrive/Interface 1 ☐ *(tick here)*. You can use the above form to send us your name and address.

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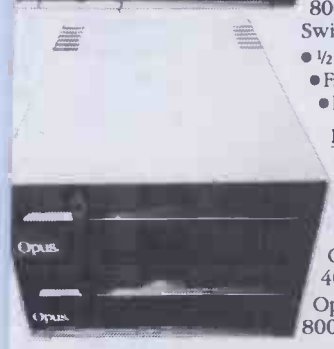

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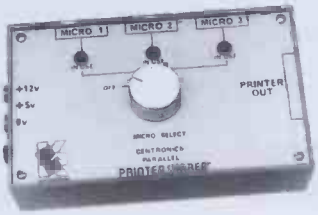

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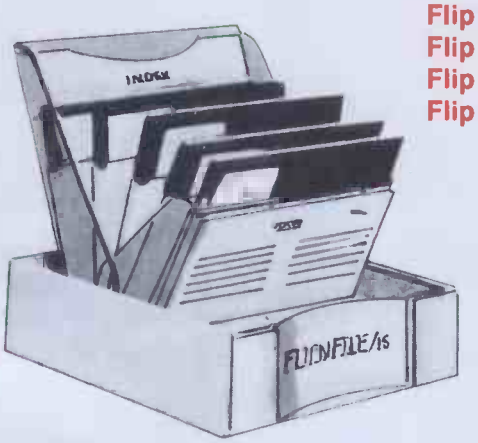

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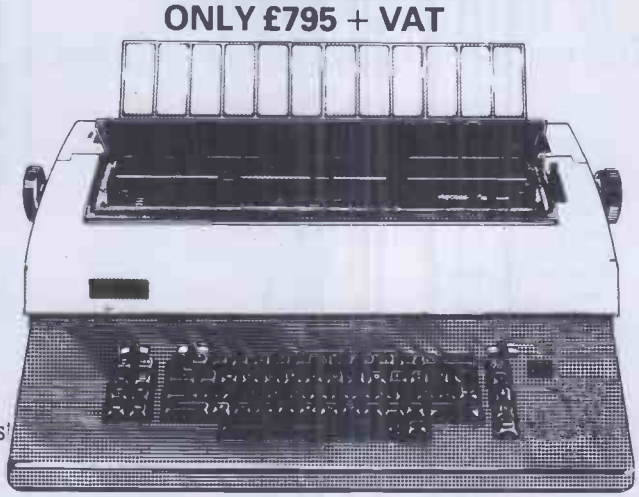

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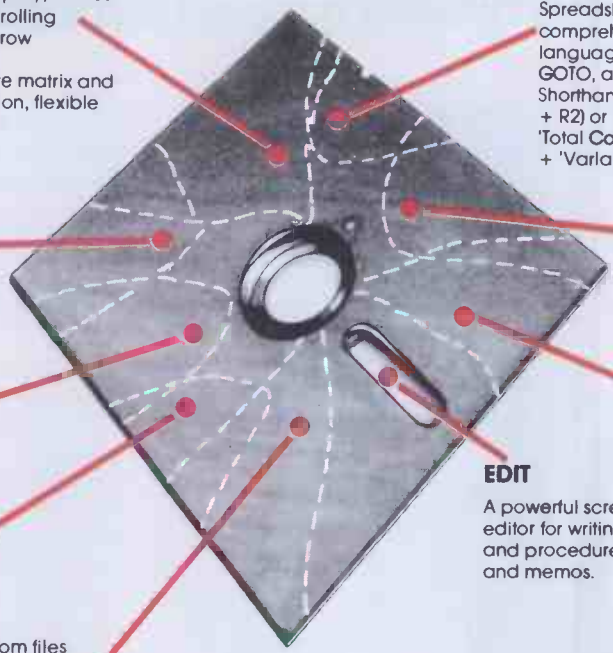

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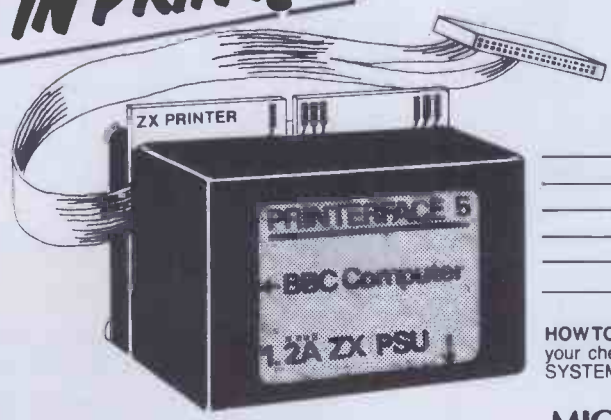

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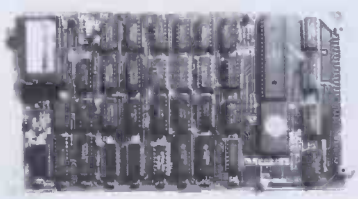

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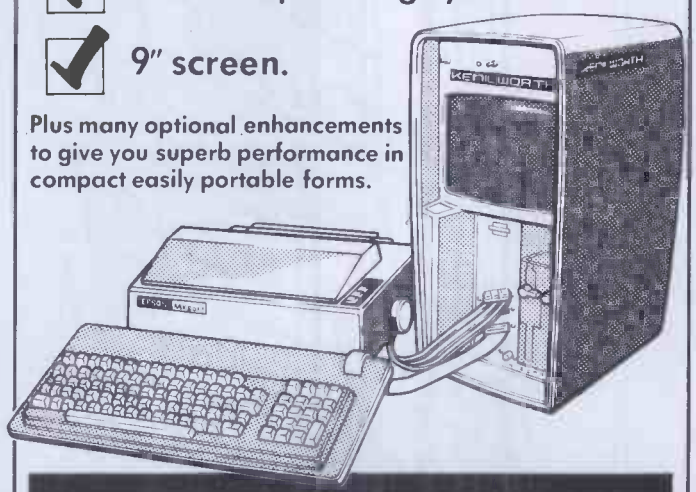

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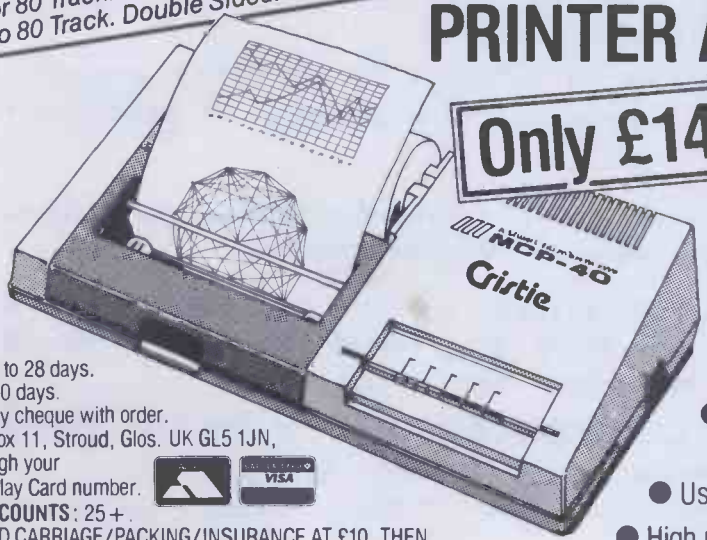

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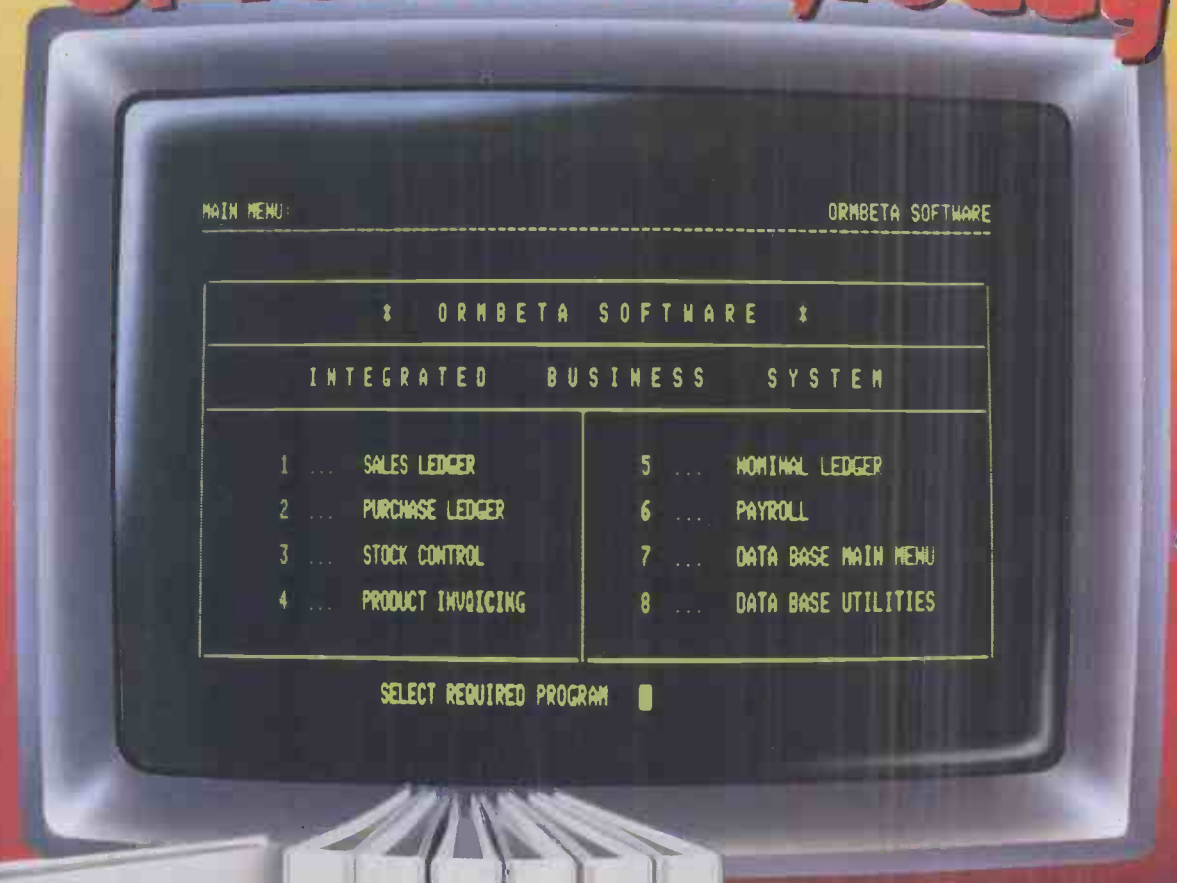

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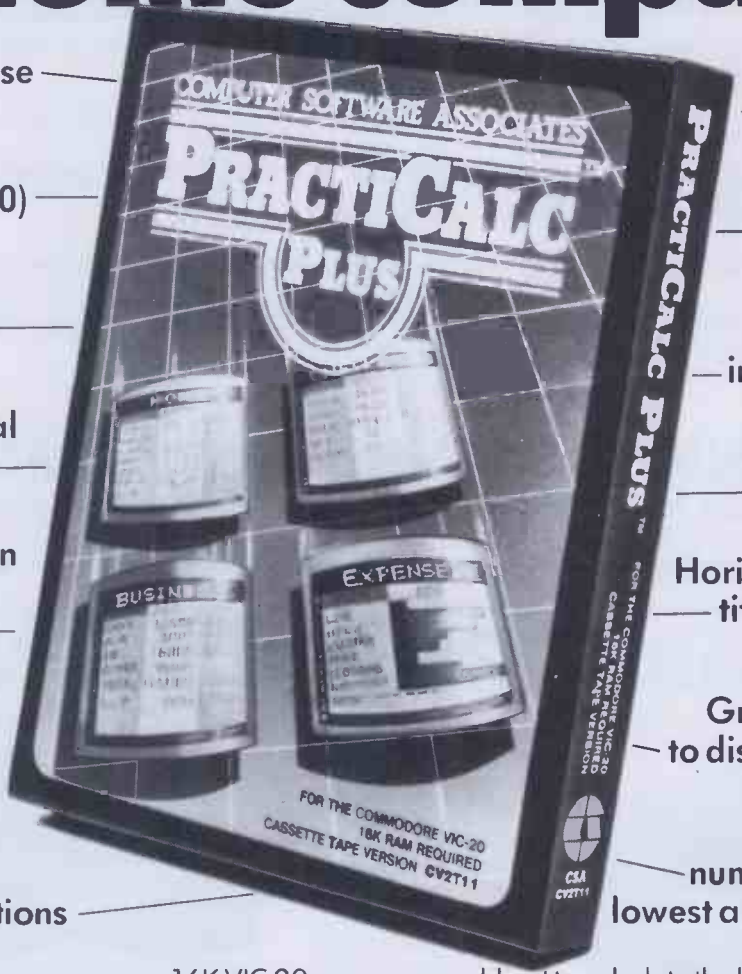

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Sandy Saunderson is Managing Director of KGB Micros Limited, the fast growing commercial microcomputer company based in Windsor. He has extensive knowledge of the microcomputer industry and if you would like to speak to him, either on general computer matters or particularly about his own products at KGB, give him a call on Windsor 50111 or drop him a line at KGB Micros Limited, 106 St. Leonards Road, Windsor, Berkshire SL4 3DD.

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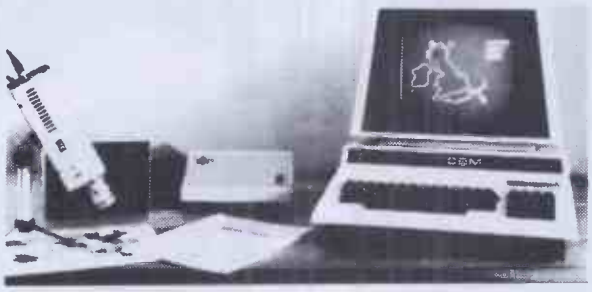

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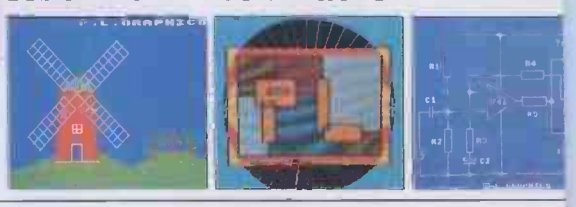

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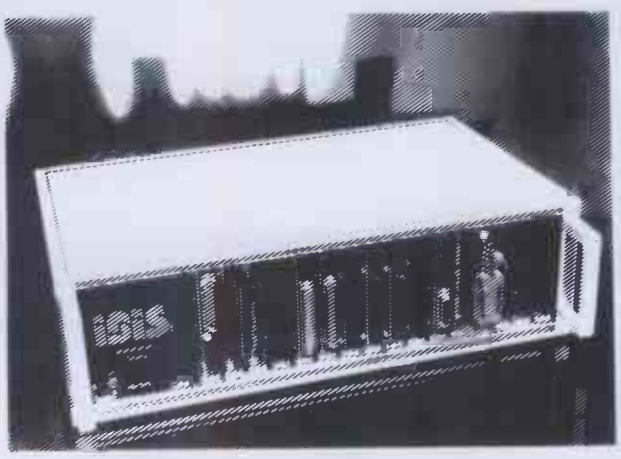

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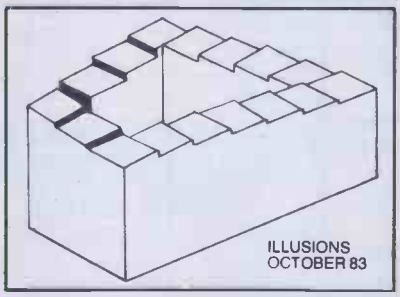

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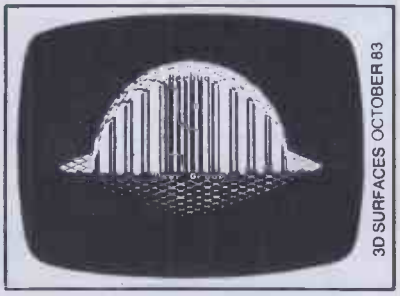

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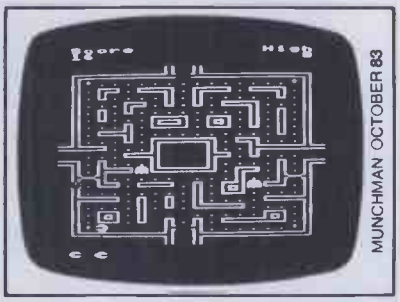

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October Issue: Games: **Munch-Man,** a Snapper type **game** with super graphics, **Illusions,** graphics and sound you won't believe. A versatile **Renumber** program for Basic. **Fabric Patterns,** and invisible **Alarm Clock, Disc Sector String Search** and a program for drawing **3D Surfaces.** Articles on the **Teletext Mode** for beginners. **Compilers and Interpreters,** using **Joysticks,** using the **Speech Synthesizer** and more. Reviews of two **Cassette Recorders** (Marantz Superscope C190 and Acorn Data Recorder), three **Printers** (NEC pc-8023B, STAR DP840 and CP-80), and lots of new games software (and we've arranged **SPECIAL OFFERS** for members). Plus a review of the new **Acorn Electron** and news of our new magazine for Electron users called **ORBIT.** Plus all our usual features like Hints and Tips, Postbag, and a new Brainteaser.

November Issue: Program Features: **Reversi,** a challenging board game, **Lunar Escape,** and addictive arcade type game, **SNARFER,** a very useful disk recovery program, **SHAPER** for defining multiple character shapes, **RAPIDS,** another short game, **DEMOLITION,** a sizzling display with matching sound effects. Plus articles on a **Clock Display,** the **Teletext Mode** (part 2 of a series), an introduction to **Interrupt Programming,** a new **Mode 8** and The Beeb in Slow Motion. Plus **Extension ROM Board Reviews, Games Reviews, Book Reviews, M-TEC Torch Basic review.** Plus News, Hints and a new Competition.

STOP PRESS
BEEBUG has negotiated a deal with ACORN over the new 1.2 OPERATING SYSTEM ROM. BEEBUG members are offered the ROM at around half-price. See BEEBUG Feb. issue for details.

SOFTWARE DETAILS

BEEBUGSOFT : BEEBUG SOFTWARE LIBRARY

offers members a growing range of software from £3.50 per cassette. 1. Starfire (32K). 2. Moonlander (16K). 3D Noughts and Crosses (32K). 3. Shape Match (18K). Mindbender (16K). 4. Magic Eel (32K). 5. Cylon Attack (32K). 6. Astro-Tracker (32K). **Utilities:** 1. Dissembler (16K). Redefine (16K). Mini Text Ed (32K). **Applications:** 1. Superplot (32K). 2. Masterfile (32K).

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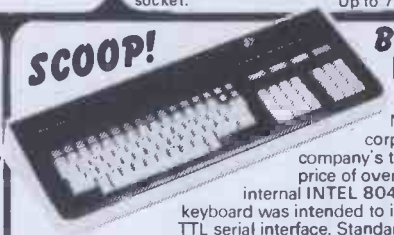

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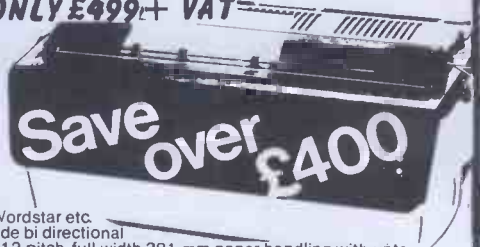

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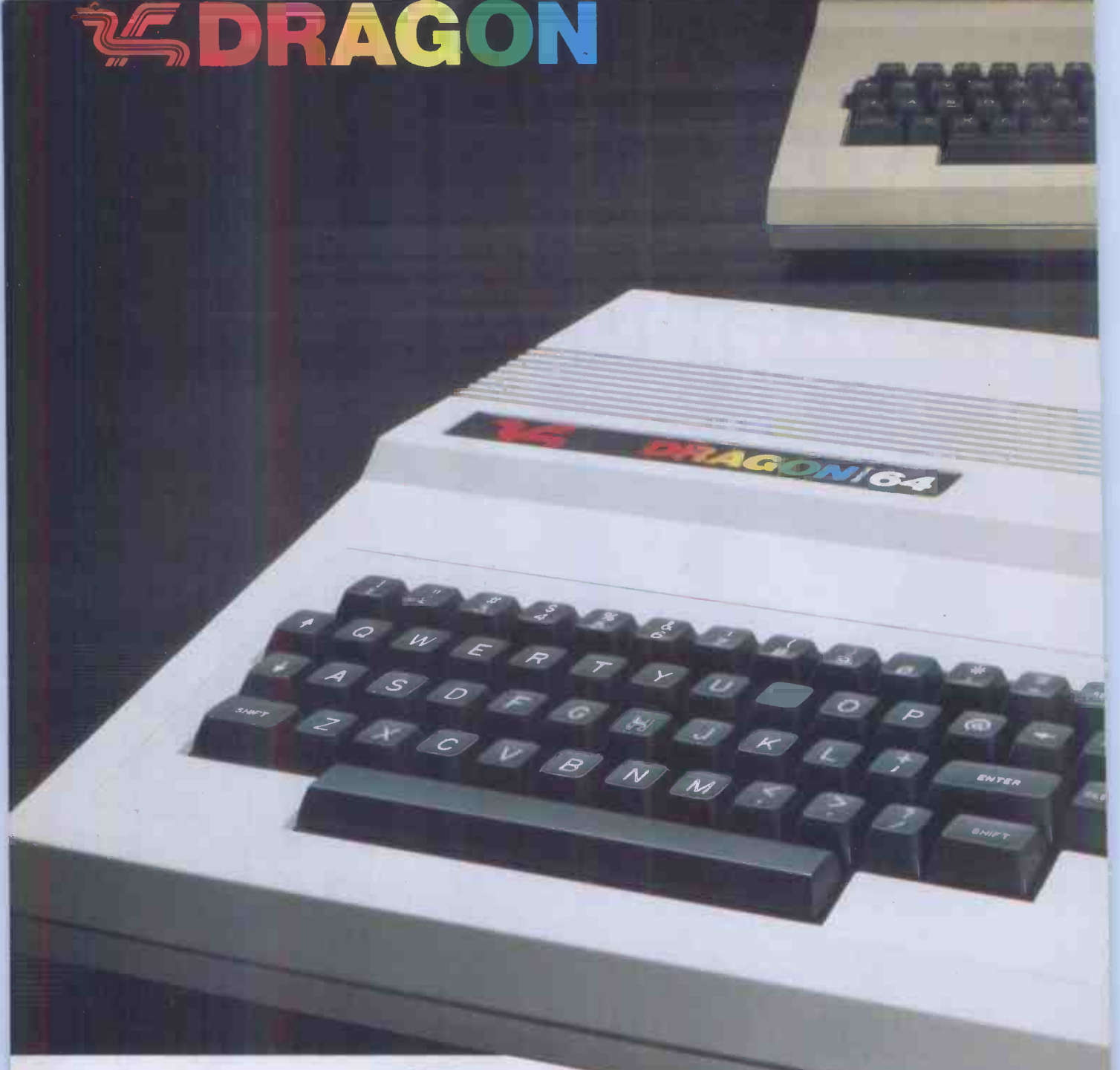

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The subject is shrouded in myth. One or two of which we hope to clear up (with a little help from the Dragon 32).

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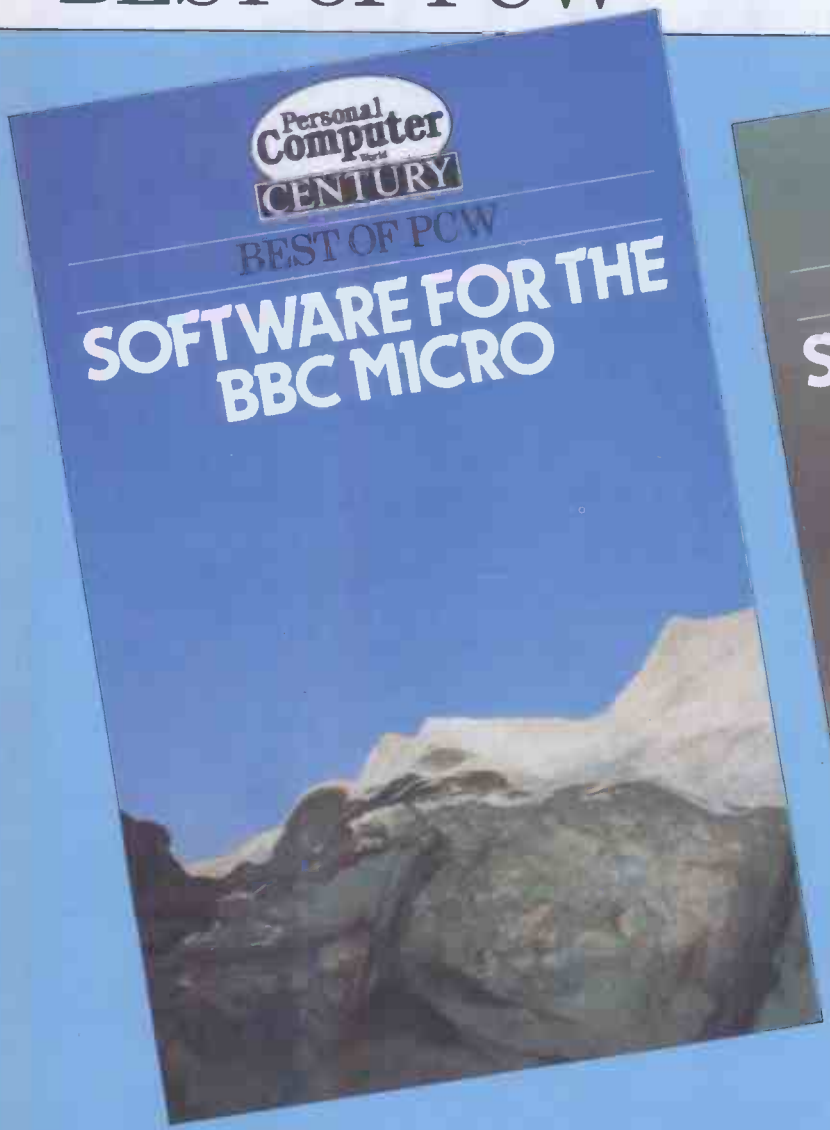

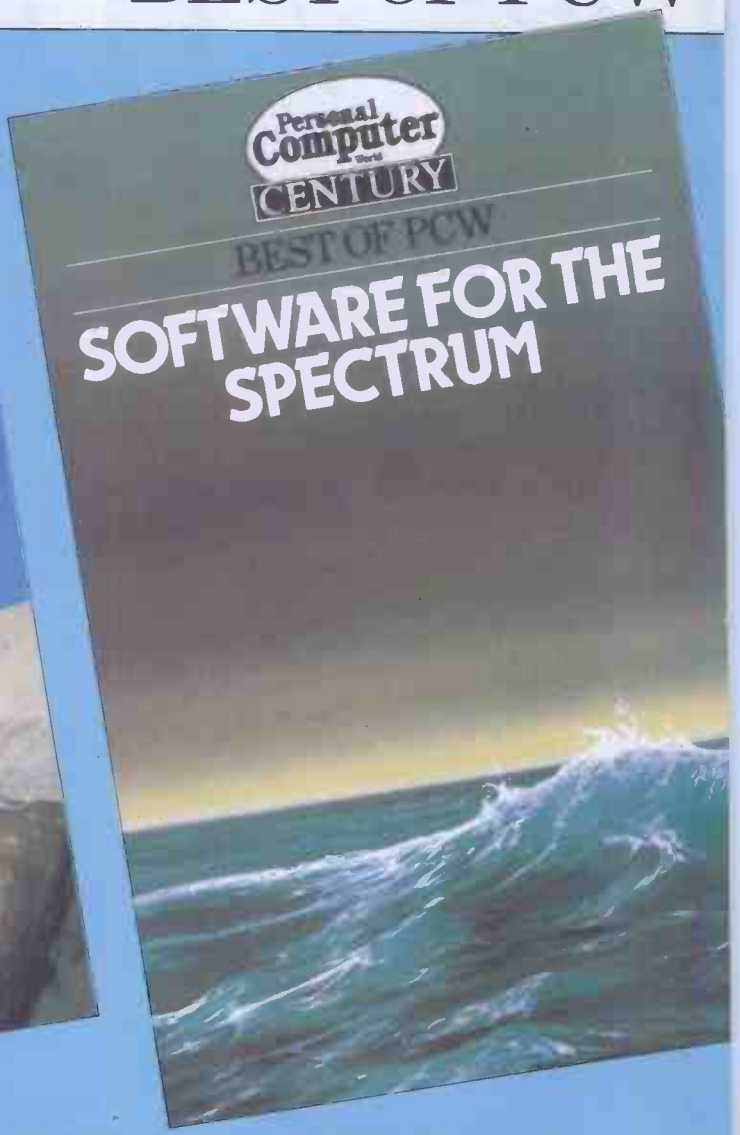

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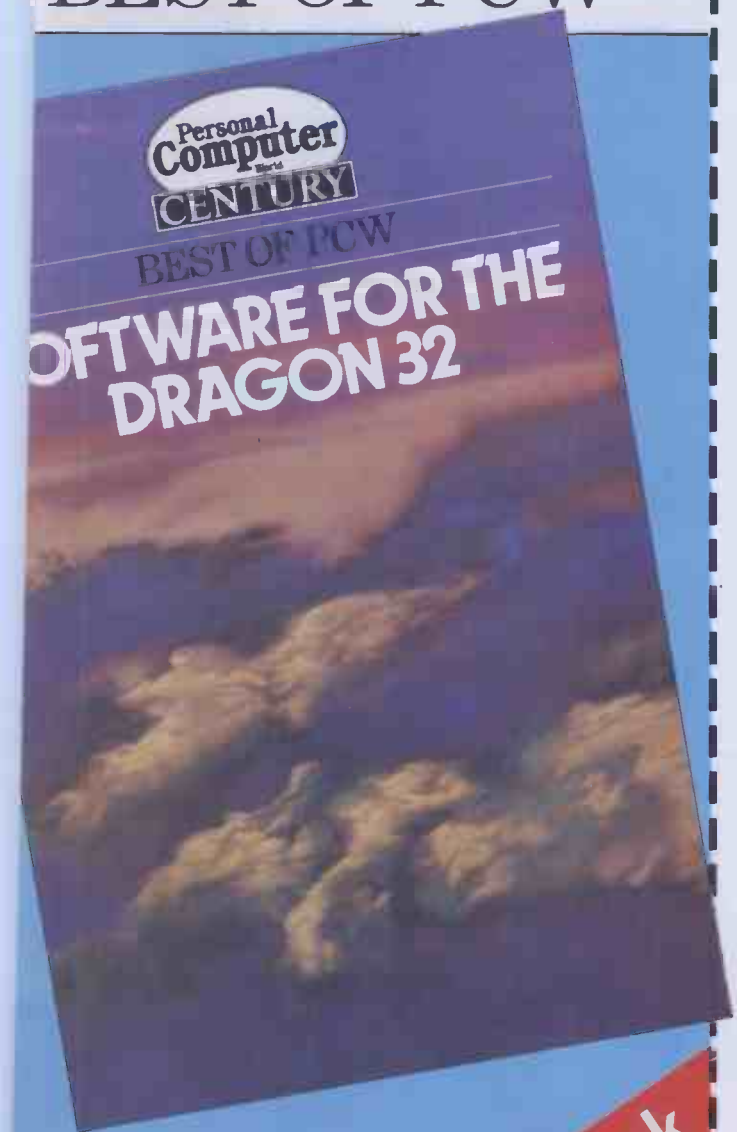

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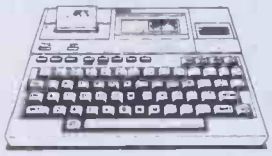

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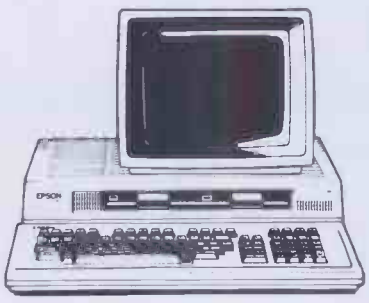

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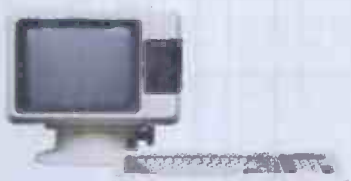

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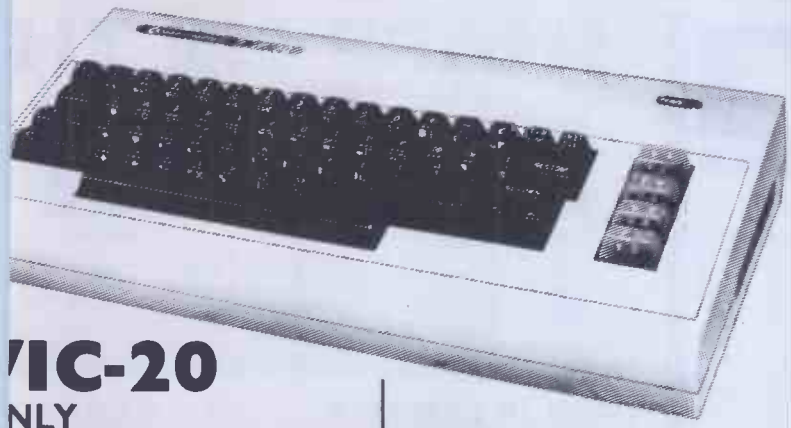

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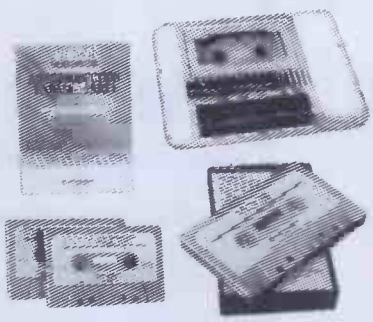

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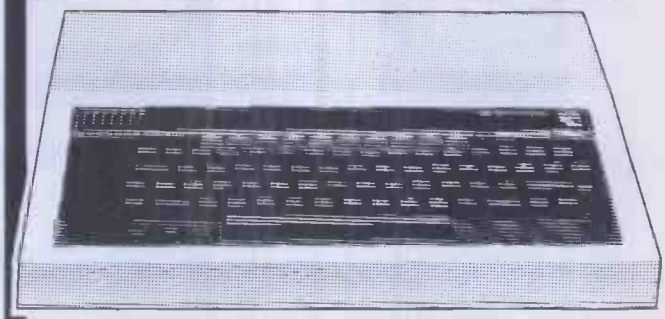

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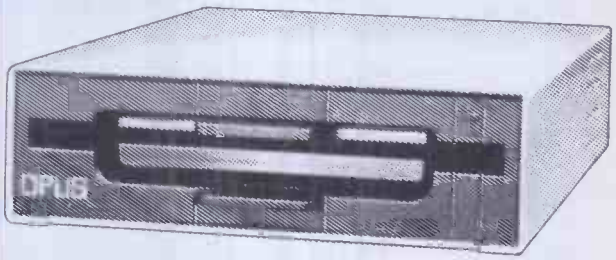

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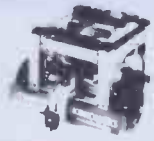

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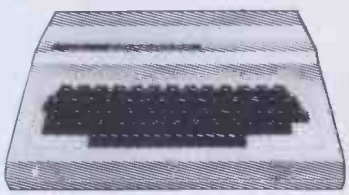

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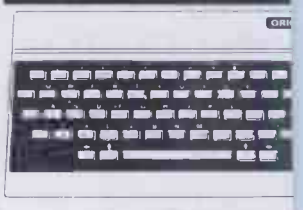

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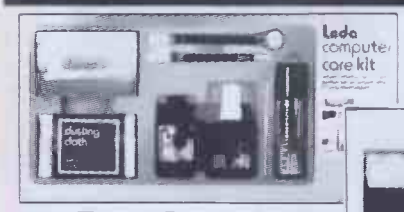

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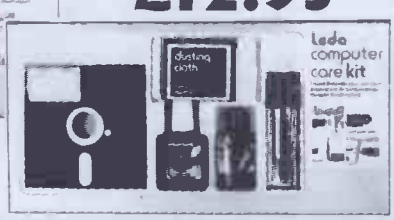

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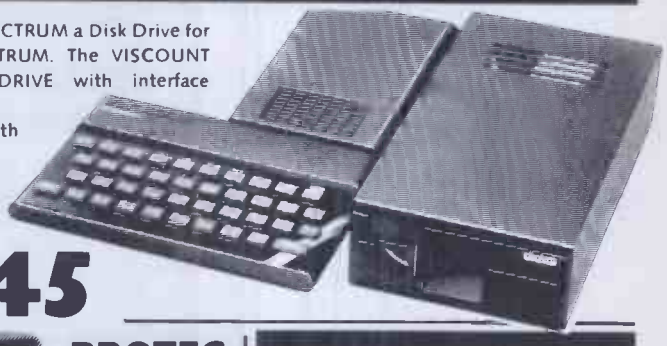

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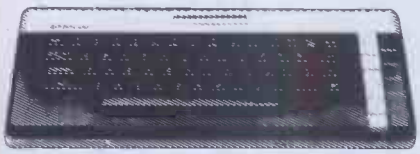

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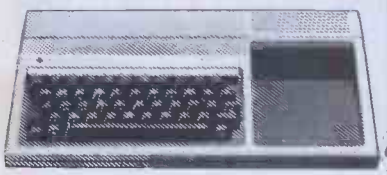

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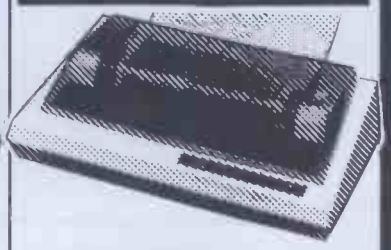

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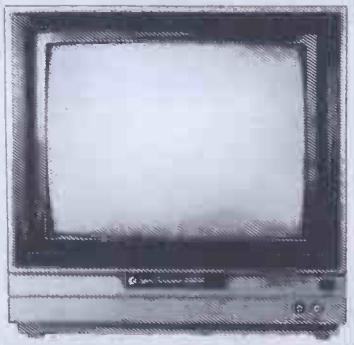

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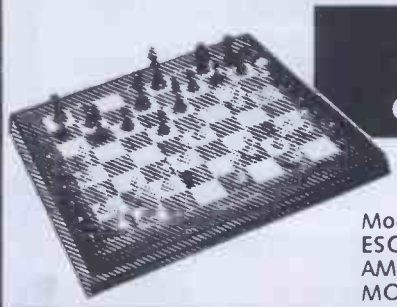

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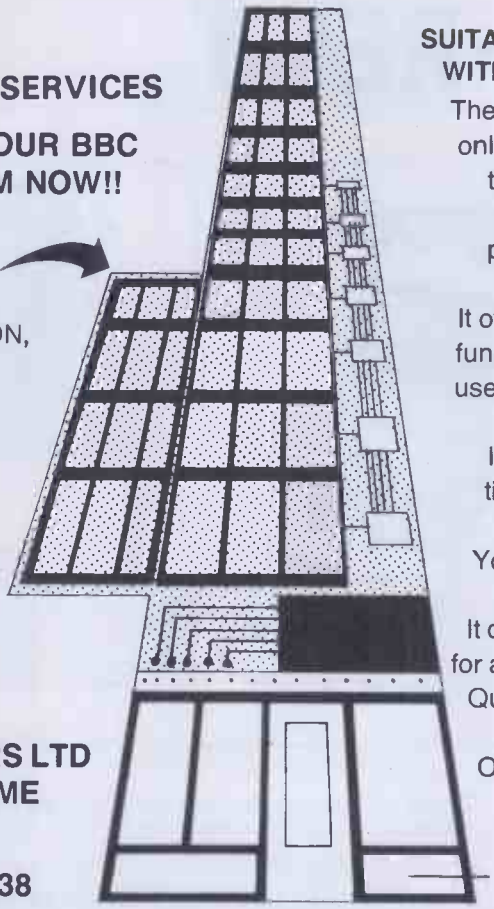

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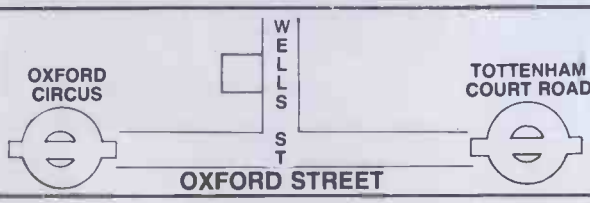

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Keys 1-8 move the asterisk in the directions indicated on the rectangle. The required direction key must be held down as the chasers complete their moves.

After all the chasers are killed, or if you are captured or fall in a hole, a new frame will be created with less holes to lure the chasers in. You score 1 point for each chaser that is lured to its death. How much can you score in 11 frames?

DIRTY-DICE

This is a game for two players or one player and the computer. Both players agree on a winning total before starting. (100 is a quick game whilst 300 is a long game).

Player 1 starts the game with control of two dice. He/she rolls the dice and the total of the two faces is added to a running total. To get the running total added to his/her score the player must pass the control of the dice to his/her opponent. If one of the dice shows a one, the control of the dice is passed to the opponent. If **both** dice show a one the player is "dirtied" and loses all his/her score. When the control is passed over the running total returns to zero.

The first player to exceed the agreed total, after player 2 has completed his/her turn, is the winner.

SLIDER

The computer will generate a 5 x 5 square containing the letters A to X. Your task is to re-arrange the letters so that they look like

this	ABCDE	or this	ABCDE
	FGHIJ		FGHIJ
	KLMNO		KLMNO
	PQRST		PQRST
	UVWX		UVXW

The grid contains a single blank square. To move any letter or series of letters, press any letter which is orthagonally in line with the blank square.

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OX

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TENFOUR

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The player chooses which team will play the other teams shown on a chart. The player can then choose who will bowl the over. If your bowlers bowl for too long they will become tired. In an over it is also possible to bowl short balls and the batsman can be injured.

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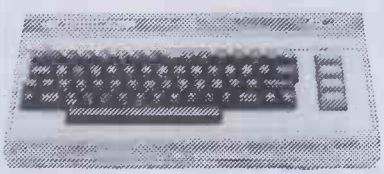

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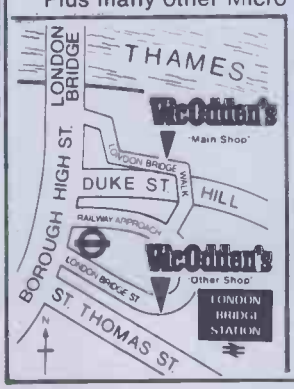

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In the November issue of this magazine, we inserted a two-page advertisement for Commodore Business Machines (UK) Limited which contained the words in broad type "Dear Marje" and clearly referred to the well known Daily Mirror columnist Marjorie Proops.

We wish to make it clear that Mrs. Proops was in no way associated with the advertisement, her approval of the use of the words "Dear Marje" or of the copy was neither sought nor given.

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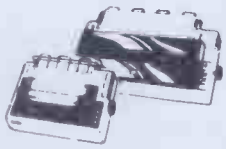

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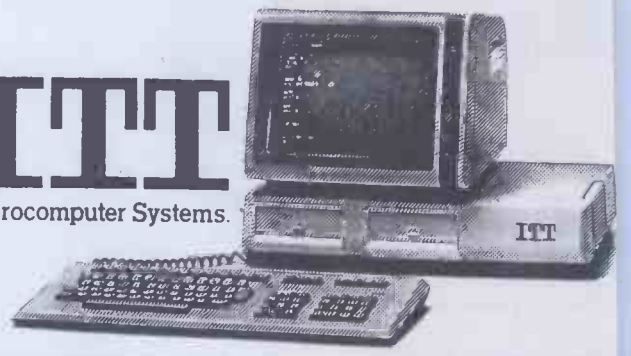

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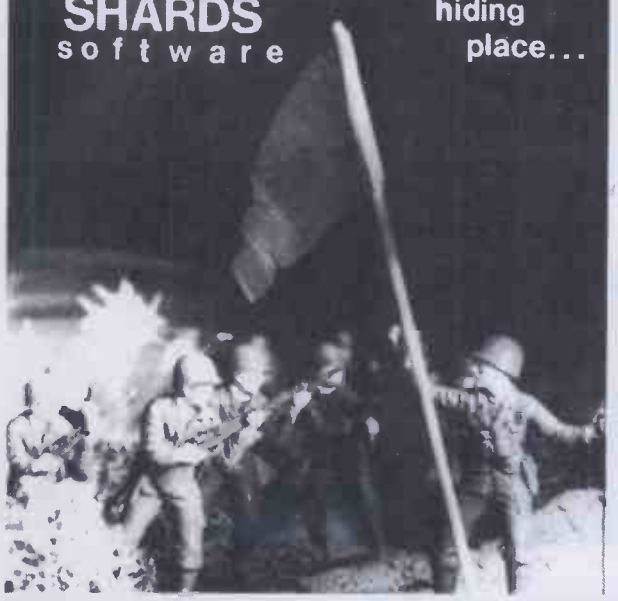

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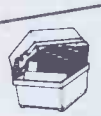

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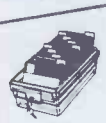

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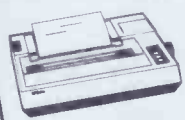

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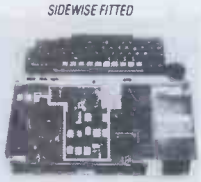

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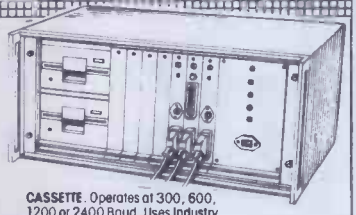

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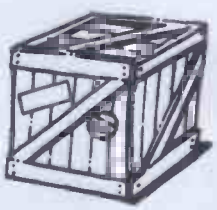

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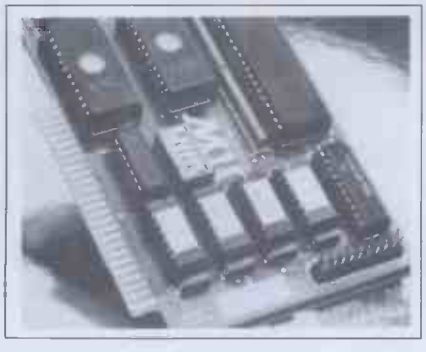

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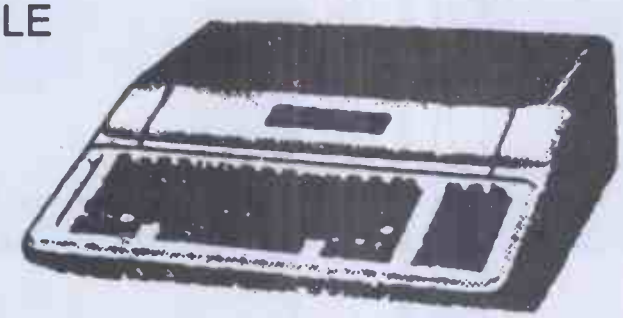

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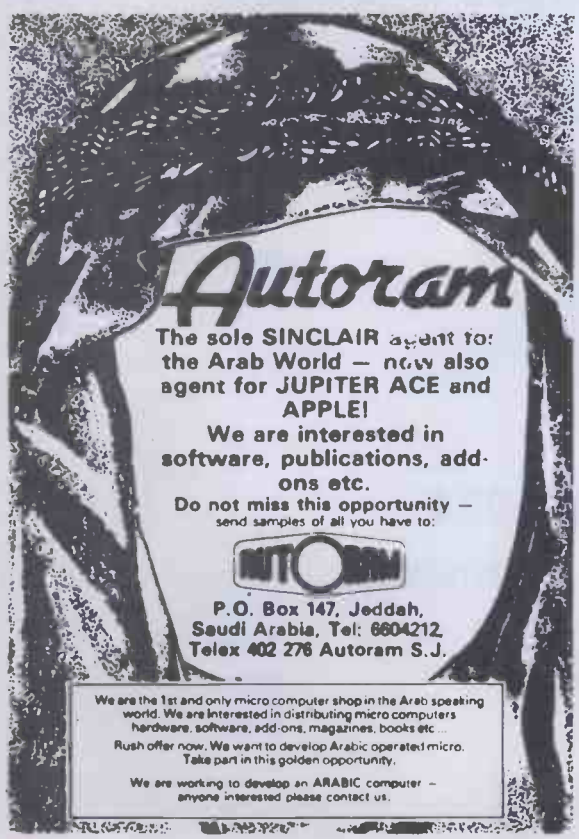

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ADVERTISERS INDEX

A

Acorn Computers 46/47
Acornsoft 80/81
A.C.S. Ltd 304
ACT (Pulsar) 48, 49
ACT (Sirius) 80/81
Advanced Memory Systems 86
Advanced Resources 393
AGF 110
A & G Knight 355
Akhter Instruments Ltd 6
Algotek Computer Company 91
American Trading Company 19
Angela Enterprises 244
ASDA 370/371
Ashby Computers & Graphics 160
Ashton Tate 23/25
Assets Computing 244
Atari 44, 45
ATA Systems Ltd 95
Autoram 401/403

B

Back Issues 288/289
Baker Business Systems 394
Bamby Software 350
BASF 90/91
BBC Publications 344
Beebug 75, 365
Bits and PC's 110
Bonsai 161
Boom Software 33
Bridgemaster 301
Brighton Computer Centre 68
Business and Leisure Microcomputers 347
Butterworths 287
Byteshop + Xitan 324/325

C

Calco Software 400
Cambridge Computer Centre 388
Cambridge Computer Consultancy 141
Cambridge Learning Enterprises 304
Camputers 320/321/377
Canon UK Ltd 119
Cassoftware 61
Caxton Software 77
Century Books 374/375
Chiltern Electronics 14
CJE Microcomputers 323
CK Computers 66
CK Supplies 40
Clapp & Poliak 358
Comart/Byteshop 37
Commodore 393/336/337
Commodore Computing International 392
Compshop 318
Compsoft 39
Compudata 311
Computer Add Ons 32
Computer Answers 378
Computer Bookshop 103
Computer Games 84
Computer Supermarket 230
Computer Town 360/361
Conway Computer Services 398
Cookridge Computer Supplies 298
Crestmatt Software 333
Crofton Electronics 8
Crown Business Centre 341
Cumana 226/239
Cyborg 122

D

Data Applications 362
Database 42
Database Publications Ltd 405
Data Efficiency 352/353
Data Flex Ltd 343/345
Data Profile 393
Data Warrior 69
Davinci Computer Shop 54
Deans of Edgware 397
Deans of Kensington 9/15
Deep Thought Software 78
Dialog Software 30/31
Digisolve 164
Digital Peripherals 349
Digital Solutions 64
Digithurst Ltd 357
Digitus Ltd 1
Discount Micros 71
Disking 72/73
Display Electronics 366
DJ 'A1' Systems 326
Dragon Data 372/373/368/369
DTI Europe Ltd 54/76
Durell Software 192
DX Marketing 341

E

Eastern Computers 299/301
Educare 376
Electronequip 398
Elektrokonsult 400
Elizabeth Altman 393
Elstree Computer Centre 387
Epson 186/199/208

F

Ferranti and Davenport 70
Flightlink Control 301
Fraser Associates 244

G

Games Centre 155
Games Machine Ltd 51
Gemini Microcomputers 36
General Northern Micros 355
Golden Valley Computers 387
Griffin + George 184

H

HCCS 61
Helistar Systems Ltd 60
Hilderbay 85
Hisoft 376
Homestead Electronics 376

I

Ian Litterick Associates 61
Ibek Systems 76
Ikon Computer Products IFC
Impex Designs 388
Incentive Software Ltd 155
Interactive Data Machines 150
Interactive Software People 41
Interam 24
IO Research 107

J

Jaemma 376

K

Keelecodes 59
Kempston 319
Kenema Associates 58
Keyboard Hire Ltd 390
Keyzone 332
KGB 357
Kuma 83/85

L

Laskys 27/29
Leisure Base 308/309
Level 9 Computing 102
Lifeboat Associates 18
Lingar Graphics 354
Lion Microsystems 348
Little Softie Ltd 387
London Computer Centre 93/342
Lucas Logic 396

M

Maincroft Computer Services 22
Mannesman Tally 215
MAP 80 Systems 26/397
Maplin Electronics 316/317
Marcol Cabinets 50
Marketing Micro Software 356
Market Logic 244
Mattel 104/105
Mayfair Micros 386
MDA Modon Associates Ltd 99
MED 399
MEL 121
Memotech 312/313/314/322
Mercury Computer Training Ltd 404
Microcentre 194
Microcomputer Products 94
Microcomputer Space Dome 396
Microgeneral 20
Micromanagement 291/292/293 294/295
Micro Miracle 307
Micronetworks Ltd 82
Micronix 13
Micro Post Contracts 139
Microproducts Software Ltd 300/111
Microsoft Europe 188
Microtanic Software 343/345
Microtek Ipswich 395
Microvalve 96/97
Micro-X 400
Modular Concept Peripherals Swansea 399
Mr Chip 286

N

Nationwide Discount Software 310
Nectaring 306

O

Oakleaf Computers 335
Office Efficiency Machines 87
OI Computers 4/5/12
Opus Supplies 331/364/394
Oric 55/56/57
Oric Software 386
Ormskirk 351
Oxford Computer Publishing 290
Oxford Computer Systems 395

P

Pace 302/303/307
Pan Books 305
Password Electronics 405
Peachtree Software 34
Pedro Computer Services 389
Perfect Software 52/53
Personal Computers 391/OBC
Pete & Pam Computers 296/297
Pinner Wordpro 394
Power Testing Sales Ltd 75
Practical Peripherals 402
Printerland 405
Protek Computing Ltd 106

Q

Qubié Distributing Ltd 63
Qume (UK) Ltd 346/347

R

Rair 127
Raging Bear Productions IBC
Rapid Recall 334
Rentrop Ltd 139
Reprint Service 396/406
Ricoll Electronics 179
Rosco Ltd 51
Rumbelows 124

S

Saga Software House 397
Sage Systems 92
Sanyo 162
Scan Computers 35
Scescan Design Services 395
Seiko 379
Semi-Tech Microelectronics 79
Shard Software 405
Sharp 88/89
Sharpsoft Ltd 339
Sie Computing Ltd 389
Silicon City 339
Silicon Valley 7
Silverfox Communications 220
Simmons Magee 363/365
Simon Computers 60
Simon W. Hessell Software 26
Sinclair Research 327/328/329/330
Sirius User Club 391
Software Ltd 10
Sord 359
Spectrum 380/381/382/ 383/384/385
Sprakefield 68
Stirling Microsystems 399
Superior Software 38
Swanley Electronics 394
Symbiotics 315
System 70
System Science 26

T

Tarace 367
Tashkl Computer Systems 98/74
Technomatic 28
Telesystems 340
Texas 223/224/225
THF Design 400
Town and Country Computer Systems 59
Transam 100/101
Transfers Technical Services 340
Twickenham Computer Centre 21
Twillstar Computers 62

U

Universal Micro Peripherals 99

V

Vector International 65/67
Vega 399
Vicodden 391
Visionstore 68

W

Watford Electronics 11
WBM Business Supplies 338
Websters Software Ltd 16/17
Wessexsoft 390
Westwood Distribution 287
Widgit 391
Windsor Computer Centre 332

X

Xitan Systems 108/109/43

Y

Your Computer 342

Z

Zero Electronics 155
Zita Microsystems (UK) Ltd 193
Zynar 172

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CHIP CHAT

Let's deal with the home camp first, and then go on to extract the Michael from everybody else.

The *PCW* Show, as always, had its little ups and downs, from people with something to moan about to people moaning because they hadn't anything to moan about.

Acorn's stand featured what were, it transpired, eight econetted Beebs running eight screens displaying the words 'Acorn Computers' followed by a squad of PacMen scrolling sideways from one screen to another. Yes—it looks like the Econet's working at last. A Beeb quartet also made its presence known—and over £1500 worth of speakers, so they should . . . ACT demonstrated the super-friendly disk-copying system on the Apricot. None of your inscrutable 'source disk in drive A:' there, mate. No—it's all 'right and left' now. In spite of all this coddling, a member of ACT's show team twice managed to make a perfect copy of a blank disk onto what was the system master . . . And, lo and behold, a staff member of a Certain Other Micro magazine was spotted Benchmarking the Memotech MTX machine. The Benchmarks, astute readers will have guessed, were none other than our own . . . American software giant Softsel was giving away softsoles to visitors to their stand. These soggy insoles were a charitable gesture on behalf of Softsel to ease the weary feet of their long tramp over the hard floors of the Barbican Centre. What was not considered was F.O. (foot odour). We leave it up to the imagination what a couple of thousand sweaty folk all wearing latex-rubber insoles in their shoes did for the atmosphere . . .

Does anybody remember (or use) a household cleaning fluid called 'Vigor'? Anyone who has been around long enough will remember when the stuff first went on the market—complete with a commercial about a 'Mum's army'. The commercial, needless to say, put forward the idea that Vigor's as good as a whole army of mums for cleaning up dirty floors. (*What about Dad's army?—Ed.*) Well, the mums have got their own back now. Ampalsoft of Cheshire is a small company made up principally of a group of housewives who've realised the potential of education software for kids. Their software series, for the Dragon 32 will be on sale soon. BBC and Oric programs follow before long. If you're a woman, it should make you feel a little encouraged. If you're a man, we wonder if you're feeling threatened. Anyway, we'd like to say 'Well done!' in true Henry Root style. There's far too much sexism, agism, sizism, languagism and all sorts of other isms in this business . . .

And now, the item you've all been waiting for. Computer Jargon. To be published by *Harper and Row* in December is the *Hacher's Dictionary*; a perfect Xmas present for an obnoxious computer brat. It's the ideal companion for someone who'd like to be able to talk to IBM mainframe programmers in their own language—you know, like saying 'Chip Chat is a really cuspy article. It always grok it but I'm a bit too gronked to read it this month' . . . While on this delicate subject, here's a tip for those who play the foreign exchange market. Sell your fillers and forints now. Better then computerish, eh? It transpires that a European manufacturer using Hungarian CP/M-86 experts has agreed to pay them at the rate of a micro a month per man. An award was given to the designer of a suitable paypacket . . .

We receive distressing information that the Environment Secretary has gone mad. On the 14th of September he was seen in Aztec West, a new industrial park near Bristol, setting ducks free onto a pond in this park (why did he not set Aztecs free there, we ask?). This is apparently so that the ducks will settle down and harmonise with the factories and have a jolly good time playing about in all that nice industrial waste. We think the Government will be pressing employers into giving equal employment opportunities to ducks as well, sometime in the future.

More now on the Epson saga. Regular readers of this column will remember our reporting that an Epson HX-20 was to be used to help predict the winner in the ludicrous 'Ultra-Quiz'. Having managed to get it right (more than most humans could do) up to the semi-final, the computer blundered right at the last moment, finally predicting that the eventual runner-up would win. It just goes to show that computers always go wrong just when you need 'em most . . .

Apple is onto bickering over its trademark in a big way. In fact, it seems to employ someone full-time just to seek out offending users of the word 'apple' for any kind of commercial or public use. A gentleman by the name of Michael Augustine runs a computer network in California for antique dealers, called the 'Apple Pie Computerised Antique Marketing Service'. He received a letter in August from Apple, demanding that his trading name be withdrawn because it is 'trademark infringement'. Bear in mind that Apple Computer has to pay a royalty to the Beatles, who own the Apple record company—in existence long before Apple Computer. Bear in mind also that Mike Augustine ran an antique shop under the name 'Apple Pie Antiques' in Santa Cruz in 1970 and has no more to do with computers than putting them to use in his business. Who is infringing who, we ask? And why is Apple so paranoid about its silly little trademark anyway? Ripoff computers, direct trademark mimics—fine. But it represents a gross waste of time and resources that Apple is arrogant enough to go swaggering around telling other companies in other lines of business not to use a common English word. It'll be 'A is for Aardvark' in our schools before long if Apple has anything to do with it . . . Incidentally, *The Times* recently carried an ad headed 'New Zealand Apples'—an ad promising great experiences to those taking holidays in NZ. Could it be that Apple will be upset about this too? And how does it feel about New York being the 'Big Apple'—perhaps it thinks it was named after the Apple.

END

BLUDNERS

The description of NewBrain 'Easyprint' (November Programs) contained two errors. Firstly, CTRL-E places into the paste buffer only the indicated line. To save more than one line, you will have to insert continuation marks as described in the NewBrain manual pp13/14. Secondly, SHIFT and the up-arrow are used to switch on italics, SHIFT and ESCape to switch off.

Our eagle-eyed features editor spotted two bludners in the New Brain Renumber program in this issue. Line 50220 should read:

```
50220 IF te<133 OR te>167
GOTO50260
```

and 51020 should read:

```
51020 IF tb(i,1)<>te THEN
?"in line no.";tb(i,2)
[5];"change";tb(i,1)[5];"to
";te
```

END

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