80p

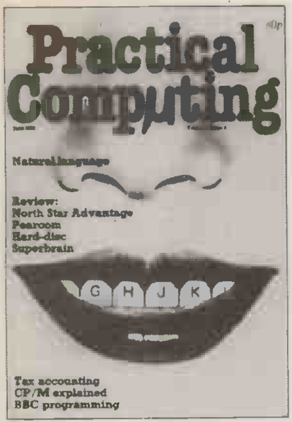
Practical Computing

June 1982 Volume 5 Issue 6

Natural language

Review:
North Star Advantage
Pearcom
Hard-disc
Superbrain

Tax accounting
CP/M explained
BBC programming



Natural language — page 70

Published by IPC Electrical Electronic Press Ltd, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Tel: 01-661 3500. Telex/grams 892084 BIPRESG.
Typeset and printed by Eden Fisher (Southend) Ltd, Southend-on-Sea.
Distributed by IPC Business Press (Sales and Distribution) Ltd, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.
Subscriptions: U.K. £10 per annum; Overseas £16 per annum; selling price in Eire subject to currency exchange fluctuations and VAT; airmail rates available on application to Subscription Manager, IPC Business Press (S & D) Ltd, Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH. Tel: 0444 59188.

ISSN 0141-5433

Would-be authors are welcome to send articles to the Editor but *PC* cannot undertake to return them. Payment is at £30 per published page. Submissions should be typed or computer-printed. Handwritten material is liable to delay and error.
Every effort is made to check articles and listings but *PC* cannot guarantee that programs will run and can accept no responsibility for any errors.

CONTENTS

Prestel page number 357

WATFORD ELECTRONICS

33/35, CARDIFF ROAD, WATFORD, HERTS, ENGLAND
Tel Watford (0923) 40588. Telex: 8956095

ALL DEVICES FULL SPEC. AND FULLY GUARANTEED. TERMS OF BUSINESS: CASH/CHEQUE/P.O.S. (OR ACCESS) WITH ORDER. GOVERNMENT AND EDUCATIONAL INSTITUTIONS OFFICIAL ORDERS ACCEPTED. TRADE AND EXPORT INQUIRIES WELCOME. (P&P add 50p on all orders).

VAT ALL PRICES ARE EXCLUSIVE OF VAT. PLEASE ADD 15% TO THE TOTAL COST INCLUDING P&P.
SHOP HOURS: 9.00am-6.00pm MONDAY TO SATURDAY.
AMPLE FREE CAR PARKING SPACE AVAILABLE.

COMPUTER IC's	
1702	299
1802CP	700
2101-2	110
2112-2	250
2114-L300n	87
2114L-200n	87
2147-3	425
2532-450n	360
2564	£20
2708	225
2716-5V	215
2732-450n	400
2764	£17
4027	240
4116-150n	95
4116-200n	80
44118-250	400
4164-200	620
4315-4K	795
4334-3 (CMOS2114)	325
4816A-120n	290
5101	270
4864-3	785
6116-150nS	450
6167-100ns	00
6502-CPU	399
6503	600
6504-250	550
6505	600
6521	150
6522 VIA	350
6530 RR10T	12
6532 R10T	625
6545 CRTC	10
6551 ACIA	650
6592-PC	£20
6800	300
6802	400
6803	850
6804	160
6805	670
6808	520
6809	895
6810	120
6821	125
6840	412
6843	12
6845	750
6847	850
6850	140
6852	255
6875	500
8080A	350
8085A	550
81LS95	90
81LS96	90
81LS97	90
8123	125
8155	475
8202	£25
8212	170
8214	425
8216	70
8224	200
8226	250
8228	250
8251	320
8253	799
8255	295
8257	800
8T26A	699
8T27	150
8T28A	115
8T	350
8T95N	99
8T97N	99
9364AP	550
AM26L531C	125
AM26L532A	125
AY-3-1015	300
AY-3-8910	600
AY-3-8912	625
AY-5-1013	300
AY-5-2376	600
FD1771	£18
FD1791	28
FD1793	30
FD1795	30
FD1797	35
INS8154	£10
IM6402	380
MC1488	55
MC1489	55
MC14411	695
MC14412	795
MC3447P	315
MM5280D	695
MM58174	825
MM74C922	420
RO-3-2513L	700
RO-3-2513L	700
RO-3-2513U	600
SFF96364E	800
TMS2716-3V	875
TMS6011	365

ULN2003	100
ULN2004	90
Z80CPU5	350
Z80ACPU4M	385
Z80P10	290
Z80AP10	320
Z80CTC	300
Z80ACTC	325
Z80DMA	10
Z80S10-1	£15
Z80AS10	£23
Z80DART	440
Z80ADART	450
ZN41tCE	190
ZN423E	138
ZN424E	130
ZN425E	345
ZN426E	300
ZN427E	600
ZN428E	478
ZN429E	210
ZN1034E	200
ZN1040E	675
74S132	110
74S138	180
74S188	210
74S189	158
74S194	320
74S201	350
74S241	390
74S262	850
74S287	300
74S288	210
74S470	325
74S471	620
74S472	1150
74S475	825
74S571	620
75107	8125
75108	95
75182	99
75183	99
75154	150
75188	55
75189	55
75322	140
75450	80
75451/2	52
75454	85
75491/2	65

TTL7400	
7400	11
7401	11
7402	11
7403	14
7404	14
74L04	85
7405	18
7406	28
7407	28
7408	16
7409	16
7410	14
7411	20
7412	20
7413	24
7414	32
7416	25
7417	25
7420	16
7421	20
7422	20
7423	22
7425	28
7426	30
7427	27
7428	28
7430	16
7432	26
7433	27
7437	27
7438	27
7440	17
7441	38
7443	90
7444	90
7445	65
7446	55
7447	50
7448	50
7450	16
7451	16
7453	16
7454	16
7460	16
7470	35
7472	30
7473	30
7474	25
7475	40
7476	30
7480	48
7481	120
7482	70
7483	50
7484	80
7485	95
7486	26
7489	205
7490	28
7491	45
7492	30
7493	30
7494	34
7495	50
7496	45
7497	120
74100	85
74104	85
74105	65
74107	32
74109	35
74110	40
74111	55
74112	170
74116	88
74118	80
74119	90
74120	75
74121	30
74122	45
74123	650
74125	642
74126	40
74128	42
74132	48
74136	35
74141	70
74142	190
74143	250
74144	250
74145	70
74147	99
74148	75
74150	80
74151	45
74153	45
74154	75
74156	75
74157	45
74159	99
74160	60
74161	60
74162	62
74163	64
74164	64
74165	62
74166	65
74167	185
74170	168
74172	290
74173	65
74174	72
74175	72
74176	55
74177	75
74178	95
74179	68
74180	65
74181	140
74182	75
74184	99
74185	99
74188	290
74190	70
74191	70
74192	70
74193	65
74194	75
74195	65
74196	65
74197	65
74198	99
74199	99
74221	80
74246	150
74247	150
74248	150
74249	150
74251	80
74259	195
74265	95
74273	195
74276	150
74278	160
74279	90
74283	90
74284	199
74285	199
74290	105
74293	125
74297	236
74298	100
74351	195
74365	55
74366	55
74367	55
74368	55
74390	99
74393	99
74490	120

74LS	
LS00	12
LS01	13
LS02	14
LS03	14
LS04	15
LS05	15
LS06	15
LS08	15
LS09	15
LS10	15
LS11	15
LS12	15
LS13	30
LS14	48
LS15	15
LS20	15
LS21	15
LS22	15
LS26	18
LS27	15
LS28	20
LS30	18
LS32	15
LS33	16
LS37	16
LS38	16
LS40	16
LS42	35
LS47	40
LS48	80
LS49	60
LS51	15
LS54	15
LS55	30
LS63	150
LS73	25
LS74	25
LS75	20
LS76	20
LS78	24
LS83	50
LS85	70
LS86	38
LS90	35
LS91	80
LS92	36
LS93	36
LS95	45
LS96	120
LS107	43
LS109	30
LS112	30
LS113	40
LS114	40
LS122	44
LS123	55
LS124	105
LS125	30
LS126	30
LS132	45
LS133	35
LS136	28
LS138	35
LS139	38
LS145	75
LS147	199
LS148	99
LS151	39
LS153	39
LS155	90
LS155	39
LS156	39
LS157	35
LS158	36
LS160	41
LS161	41
LS162	41
LS163	41
LS164	48
LS165	145
LS166	85
LS170	170
LS173	72
LS174	72
LS175	58
LS181	130
LS183	275
LS190	58
LS191	58
LS192	58
LS193	65
LS194	40
LS195	40
LS196	58
LS197	85
LS200	345
LS202	345
LS221	60
LS240	60
LS241	96
LS242	85
LS243	85
LS244	80
LS245	70
LS247	40
LS248	65
LS249	68
LS251	40
LS253	40
LS257	48
LS258	40
LS259	85
LS261	195
LS266	25
LS273	290
LS279	88
LS280	2250
LS283	45
LS290	57
LS293	595
LS295	215
LS298	130
LS299	420
LS300	157
LS302	175
LS320	270
LS323	270
LS423	200
LS323	270
LS324	200
LS325	320
LS326	330
LS327	315
LS347	150
LS348	190
LS352	185
LS353	186
LS3365	37
LS366	37
LS367	37
LS368	90
L373	75
LS374	75
LS375	48
LS377	90
LS378	69
LS379	65
LS384	395
LS3385	378
LS390	62
LS393	60
LS395	199
LS445	140
LS471	620
LS490	245
LS541	135
LS640	226
LS641	225
LS645	210
LS668	175
LS669	160
LS670	550
LS674	750

CMOS	
4000	14
4001	14
4002	14
4006	66
407	18
4008	62
4008	62
4009	35
4010	40
4011	15
4012	18
4013	34
4014	75
4015	66
4017	48
4018	68
4019	42
4020	61
4021	70
4022	66
4023	20
4024	46
4025	.19
4026	130
4027	38
4029	77
4030	50
4031	170
4032	125
4033	165
4034	195
4035	95
4036	275
4037	115
4038	110
4039	290
4040	59
4041	78
4042	60
4043	70
4044	65
4045	170
4046	75
4047	75
4048	56
4049	30
4050	30
4051	78
4052	78
4053	78
4054	125
4055	125
4056	120
4057	1915
4059	480
4060	690
4061	1225
4062	995
4063	99
4066	36
4067	399
4067	399
4068	22
4069	20
4070	626
4071	20
4072	20
4073	20
4075	20
4076	60
4077	26
4078	26
4081	26
4082	21
4085	65
4086	70
4089	140
4093	43
4094	68
4095	90
4096	90
4097	320
4098	88
4099	95
4160	95
4161	99
4162	99
4163	99
4174	99
4175	105
4194	105
4408	790
4409	790
4410	725
4411	695
412	800
4415	480
44419	280
4422	770
4433	770
4435	850
4440	999
4450	850
4451	350
4490	350
4500	675
4501	28
4502	90
4503	50
4504	105
4506	65
4507	40
4508	265
4510	68
4511	68
4512	75
4513	199
4514	195
4515	198
4516	75
4517	415
4518	42
4519	29
4520	78
4521	200
4522	125
4526	.95
4527	115
4528	80
4529	150
4530	90
4531	130
4532	110
4534	500
4536	295
4538	115
4539	115
4541	140
4543	135
4544	150
54549	395
4553	299
4554	190
4555	50
4556	55
4557	320
4558	120
4559	395
4560	180
4561	104
4562	495
4566	175
4568	260
4569	175
4572	36
4580	460
4581	250
4582	99
4583	99
4584	48
4585	99
4597	330
4598	290
4599	595
40097	88
40100	215
40101	130
40102	180
40103	175
40104	95
40105	115
40106	75
40107	60
40108	450
40109	100
40110	300
40114	240
40163	108
40193	108
45106	595

WATFORD'S UNIVERSAL MICRO EXPANSION SYSTEM

Designed by Watford Electronics, this extremely versatile and economical Expansion System as published in E.T.I., starting from Dec. 1981 issue, offers a low cost flexible expansion system for ZX81, UK101, SUPERBOARD, ACORN ATOM, PET, TANGERINE, etc.

The Motherboard (interfaces with the computer) has capacity to accept up to five daughter cards and can be paralleled for even more daughter cards.

All PCBoards are of computer grade finish and are supplied in kit form.

Just look at the Expansion possibilities.

MOTHERBOARD — Accepts up to five daughter cards. Full kit: £36.50

SOUND CARD — Utilising up to three AY-3-8910 sound chips (one supplied with the kit). Full kit: £24.95

PIO CARD — Using two 6520 PIA chips, this Board offers Centronics parallel printer driver, digital to analogue converter, and a host of other output facilities. Full Kit: £19.95

PROM PROGRAMMER — This simple but extremely useful card can blow 2716r single rail EPROMS. (2732) Full Kit: £25.95

PROM CARD — PCB cards for housing four 2716 or two 2732 EPROMS.
(4 x 2716) Full Kit: £11.95
(2 x 2732) Full Kit: £11.75

RAM CARD — 8K RAM card. Accepts 16 x 2114 RAMs. Board is supplied fully populated. Full Kit: £28.50

Soon available: SPEECH CARD; HIGH RESOLUTION GRAPHICS CARD; DISC INTERFACE CARD; 32K DRAM CARD

(NB PCBs may be bought separately).

WE MON — WATFORD'S Ultimate Monitor IC.

A 4K Monitor Chip specially designed to produce the best from your Superboard Series I & II, Enhanced Superboard & UK 101. As reviewed by Dr. A.A. Berk in Practical Electronics, June 1981.

Price only £15

NEW SEIKOSHA GP100

Unihammer Printer, gives normal and double width characters as well as dot resolution graphics 10" Tractor feed. Parallel interface standard. £195

SOFTY-2

As reviewed in PE September 1981. The complete microprocessor development system for Engineers & Beginners. New powerful instruction. Accepts any 24 pin 5V single rail EPROM. Supplied fully built, tested & enclosed in a black ABS case. Price incl. encapsulated plug-in power supply. £169

SPECIAL OFFER

	1+	25+
2114L-300n	87p	80p
2114L-200n	87p	80p
2532	360p	345p
2716	215p	200p
2732	400p	375p
4116	75p	68p
4334-3	325p	290p
6116-150nS	450p	420p
6522	350p	320p
6520	150p	125p
6820	150p	125p

We stock thousands more items. It pays to visit us. We are situated behind the Watford Football Ground.

Buy it with Access

Just phone your order through, we do the rest

EPSON MX Series PRINTERS

Now available from stock at very competitive prices.

- MX80T 10" Tractor Feed, 9x9 matrix, 80 column Speed 80 CPS bi-directional Centronics Interface, Baud rate 110-9600 (RS232) £315
- MX80FT Has Fricton & Tractor feed plus all the MX80T's facilities. £345
- MX80FT2 Has high resolution Graphics option plus all the MX80FT's facilities. £390

VIDEO MONITOR 9" B&W. Fully cased. Professional quality. Fully guaranteed. Only £75

ACCESSORIES

- TEX EPROM ERASER. Erases up to 32 ICs in 15-30 min. £33
- TEX EPROM ERASER with incorporated Safety Switch £39
- Spare UV lamp bulbs £9
- 5V/5A PSU Ready built and tested £25
- Attractive Beige/Brown ABS CASE for Superboard/UK101 or Home Brew £26
- Full ASC11 coded keyboard type '756' £39
- NUMERIC Keypad (Ready built) £9
- 4 x 4 matrix keypad (reed switch assembly) £4
- C12 Cassettes in Library Cases 40p
- 8½" Fan fold paper (500 sheets) (no VAT) £6
- ½" Fan fold paper (500 sheets) (no VAT) £5
- Teleprinter Roll (no VAT) 250p
- UHF Modulator 6MH2 280p
- UHF Modulator 8MH2 450p
- Stack Pack 5 Drawers (10 sections) Cassette racking Unit £2
- Stack Pack Unit incl. 10 C12 Cassettes 550p

CRYSTALS	
32.768KH	100
100KHz	270
200KHz	295
455KHz	375
1MHz	295
1 008M	290
1 6MHz	392
1.8MHz	395
1.843M	220
2.0MHz	240
2.4576M	220
3.2768M	150
3.57594M	98
3.6864M	300
4.0MHz	150
4.032M	290
4.80MHz	200
4.1943M	200
4.433619	120
5.0MHz	160
5.185M	300
5.24288	390
6.0MHz	140
6.144MHz	225
6.5536M	200
7 0MHz	150
7.168MHz	160
7.68MHz	200
8.0MHz	150
8.08333	395
8.867237	175
9.0MHz	200
9.375M	350
10.0MHz	175
10.7MHz	150
10.24MHz	200
12.0MHz	290
12.528M	300
14.31818	170
16 0MHz	250
18 0MHz	180
18.432M	150
19.968M	150
20.0MHz	325
24.0MHz	170
24.930M	325
26.69M	150
26.67M	325
27.125M	295
27 145M	190
38 6667	175
48 0M	175
100 0M	375
116 0M	300

IDC CONNECTORS

(Speed Block type)	PCB Plug with latch Strt Pins	PCB Plug with latch Angle Pins	Header socket	PCB Pins Strt	PCB Pins Angle
2x5 way	90p	99p	85p	60p	65p
2x8 way	130p	150p	110p	70p	78p
2x10 way	145p	166p	125p	80p	92p
2x13 way	175p	200p	150p	95p	110p
2x17 way	205p	236p	160p	110p	135p
2x20 way	220p	250p	190p	125p	150p
2x25 way	235p	270p	200p	150p	175p

JUMPER LEADS: Ribbon Cable Assembly DIL PLug (Headers)

Single Ended Lead, 24" Long

Length	14pin	16pin	24pin	40pin
24"	145p	165p	240p	380p
Double Ended Leads				
6"	185p	205p	300p	465p
12"	198p	215p	315p	490p
24"	210p	235p	345p	540p
36"	230p	250p	375p	595p

ID Header Socket Jumper Leads

24"	20pin	26pin	34pin	40pin
1 end	160p	200p	260p	300p
2 ends	290p	370p	480p	525p

DIL SOCKETS

	Low Prof	Wire Wrap
8pin	8p	25p
14pin	10p	35p
16pin	10p	42p
18pin	16p	52p
20pin	22p	60p
22pin	25p	70p
24pin	25p	70p
28pin	28p	80p
40pin	30p	99p

RIBBON CABLE

Ways	Grey (Price/foot)	Colour (Price/foot)
10	12p	22p
20	25p	40p
26	35p	52p
40	55p	70p

DIL PLUGS (Headers)

	Soldr	IDC
14pin	44p	100p
16pin	49p	120p
24pin	88p	170p
40pin	250p	265p

AMPHENOL PLUGS

24way IEEE	575p
34 way Centronics Parallel	550p

ZIF DIL SOCKETS

24way	575p
28way	850p
40way	975p

VIC 20
Micro Computer
Ready built, tested and elegantly cased. Connects directly to a colour TV. Has 5K RAM expandable to 32K Available ex-stock £165

CASSETTE Deck for above including a free 6 program Cassette £39

EURO CONNECTORS

DIN	Socket	Plug Strat Pins	Plug Angle Pins
41618 31 way	180p	—	195p
41612A+B 2 x 32 way	290p	220p	235p
41612A+C 2 x 32 way	310p	225p	240p
41612A+B+C 2 x 32 way	380p	245p	280p

EDGE CONNECTORS

(Double type)	1"	.156"
2x10way	—	135p
2x15way	—	140p
2x18way	180p	145p
2x22way	199p	200p
2x23way	210p	—
2x25way	225p	—
2x30way	245p	—
2x36way	295p	--
2x40way	315p	—
2x43way	395p	—
2x75way	550p	—

'D' CONNECTORS Mini (Solder Bucket)

Ways	Plug	Socket	Cover
9	55p	110p	100p
15	130p	160p	98p
25	160p	210p	95p
37	250p	350p	135p
Right Angle PCB Pins			
25	210p	275p	95p

● Circle No. 102

the filing, typing and

Silicon Office is the latest microcomputer software program from the Bristol Software Factory.

Designed specifically for use with the Commodore PET 8096, it'll help you run your office with the minimum amount of effort and maximum efficiency.

Think of it like three normal software packages in one, each separate package totally interactive with the other.

For around £4,500, you can have the complete electronic office, the solution to practically all your business problems. The price includes Commodore hardware, a high quality daisy wheel printer and Silicon Office software.

Silicon Office is made up from a flexible information management system which lets you create and maintain an extensive filing arrangement. Allowing you to search quickly through your records, making cross references between files in order to gain the facts you require.

A highly sophisticated word processing program allows you to generate letters, documents and reports. Letting secretaries get on with the more important tasks.

And a fully comprehensive calculator means you can handle all the number crunching you're ever likely to do in a business situation. Leaving the accounts department to concentrate on more profitable things.

But that's not all by any means.

Silicon Office also has a special programmability feature which means you or your dealer can expand and tailor the Silicon Office program to your business.

When Silicon Office is used in an everyday business situation, certain command sequences are inevitably repeated. By writing short, very simple programs which are entered into the computer's memory, Silicon Office can perform the necessary tasks, automatically.

And last, but by no means least is an optional communications facility.

It doesn't take much imagination to see the potential of Silicon Office in virtually any line of business.

So to get a better grasp, send away for our brochure. It'll only cost you a stamp. And it could save you a fortune. Or talk to your local Commodore dealer who has all the facts at his fingertips.

You'll soon see how you're much better off with Silicon Office. Than without.

commodore COMPUTER

I can't wait to get my hands on a free copy of the Silicon Office brochure.

Name____________________

Position____________________

Company____________________

Address____________________

A/PC 2

I own a Commodore PET (Please tick box) YES ☐ NO ☐

BSF Send to: Bristol Software Factory, PO Box 14, Horley, Surrey.

SILICON OFFICE

● Circle No. 104

nascom MEANS SOLUTIONS
nascom MEANS PERFORMANCE

Nascom have come a long way since their acquisition by Lucas. With the knowledge of over 30,000 units already in the field you can buy with confidence from NASCOM.

PRODUCTS:
We have kits, built and tested boards, and our fully assembled and tested NASCOM 3 system with a full choice of configuration either cassette or disc based. Alternative operating systems include NAS DOS and CP/M.

SOFTWARE:
We have a team of programmers who are writing software and courseware especially for UK educational business and domestic users.

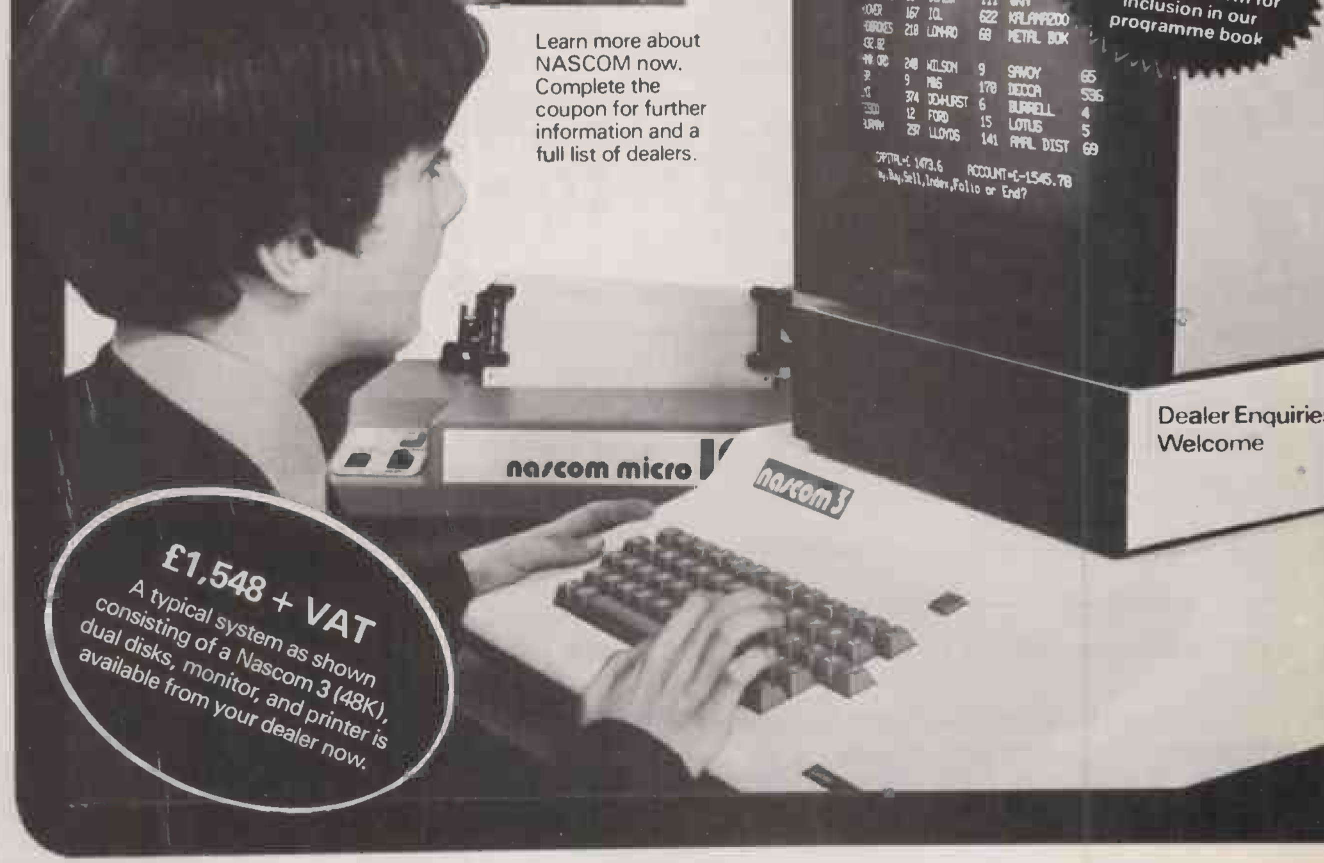
FREE ADVICE:
We have appointed experts to advise on the specialist use of micro computers in U.K. schools, homes or businesses.

BACK-UP:
We have a nationwide dealer network giving full sales back-up and after sales service. From our head office we have a service line to sort out any problems.

SYSTEM EXPANSION:
NASCOM machines are designed to grow with users. Easily and simply NASCOM systems can be expanded by adding extra modules to the basic system.

LUCAS LOGIC LIMITED
NASCOM MICROCOMPUTERS DIVISION,
Welton Road, Wedgnock Industrial Estate,
Warwick CV34 5PZ. England.

Learn more about NASCOM now. Complete the coupon for further information and a full list of dealers.



MPI micro computer products
INTERNATIONAL LTD.

SOFTWARE FOR CP/M COMPUTERS

Retailer and OEM terms available

	Software & Manual	Manual Only
BYROM SOFTWARE		
BSTAM—Utility to link one micro-computer to another also using BSTAM	£95	£6
BSTMS—Utility to link a micro to a mini or mainframe	£95	£11
CP/M USER LIBRARY		
51 Volumes—Price per volume		
8" disc (one volume per disc)	£5	
5" disc (one volume per 2 discs)	£10	
Index	£2	
DIGITAL RESEARCH		
CBASIC v 2.08	£65	£15
MPM 1.1	£195	£20
MPM 2.0	£250	£30
CP/M86	£160	£27
CP/M 2.2	£95	£20
CP/NET	£120	£14
SID	£50	£14
ZSID	£55	£14
MAC	£60	£14
TEX	£50	£14
DESPOOL	£33	£6
PL/1	£300	£27
BT-80	£140	£20
FOX & GELLER		
QUICKSCREEN	£87	£12
INFORMATION UNLIMITED		
WHATSIT (Database Management System)	£80	
KLH SYSTEMS		
Spooler for CPM systems v3.0	£70	£6
MPI LTD.		
FORTH	£72	
PAYROLL	£500	£15
SALES LEDGER	£200	£15
PURCHASE LEDGER	£200	£15
NOMINAL LEDGER	£200	£15
INCOMPLETE RECORDS	£1200	£20

	Software & Manual	Manual Only
MICRO-AP		
SELECTOR V	£275	£25
MICROFOCUS		
CIS COBOL version 4.4	£425	£25
FORMS 2 v11	£100	£10
MICROLOGY		
FTNUMB (FORTRAN-80 RENUMBER & REFORMATTER)	£50	£5
MICROPRO INC.		
WORD-MASTER 1.7A	£75	£22
TEX-WRITER 2.6	£37	£17
WORDSTAR 3.0	£250	£38
MAIL MERGE 3.0 (requires Wordstar)	£75	£10
SPELLSTAR 1.0 (requires Wordstar)	£125	£10
WORDSTAR TRAINING MANUAL		£18
WORDSTAR CUSTOMIZATION NOTES	£50	
SUPER-SORT 1.6	£125	£22
DATASTAR 1.101	£175	£25
DATASTAR CUSTOMIZATION NOTES	£50	
CALCSTAR	£150	£25
APPLE VERSIONS		
WORDSTAR 3.0	£188	£38
MAILMERGE 3.0 (requires Wordstar)	£63	£10
SPELLSTAR 1.0 (requires Wordstar)	£98	£10
DATASTAR 1.101	£148	£25
SUPERSORT 1.6	£100	£22
CALCSTAR	£98	£25
MICROSOFT INC.		
BASIC-80 5.21	£185	
BASIC Compiler 5.3	£205	
FORTRAN-80 3.43	£260	
COBOL-80 4.01	£380	
M/SORT 1.01	£75	
EDIT-80 2.02	£65	
MACRO-80 3.43	£105	
MULISP 2.10	£105	
MUMATH 2.10	£130	
MICROTECH EXPORTS		
REFORMATTER		
CPM ↔ IBM	£98	£17
CPM ↔ DEC	£98	£17

	Software & Manual	Manua[l] Only
MT MICROSYSTEMS		
PASCAL MT+ 5.5	£150	£25
PASCAL MT+ 5.5 with SPP	£265	£50
Library Sources	£110	
Speed Programming Pkge. (Softbus)	£125	£25
OSBORNE & ASSOCIATES		
ACCOUNTS PAYABLE & ACCOUNTS RECEIVABLE	£50	£15
GENERAL LEDGER	£50	£15
PHOENIX SOFTWARE ASSOCIATES (For Z80 only)		
PLINK—Disc to disc link loader	£72	£15
PASM—Macro Assembler	£72	£15
PEDIT—Line editor with Macros	£72	£15
BUG—Very powerful debug	£72	£15
PDEVELOP Package with all the above	£193	£33
PLINK—2 Overlay Link Loader	£185	£15
STRUCTURED SYSTEMS (All converted to UK Standard)		
SALES LEDGER	£350	£20
PURCHASE LEDGER	£350	£20
NOMINAL LEDGER	£350	£20
STOCK CONTROL	£350	£20
LETTERIGHT	£95	£11
ANALYST (File management Reporting System)	£125	£11
NAD (Name and Address selection system)	£55	£11
QSORT	£55	£11
SUPERSOFT INC.		
DIAGNOSTICS 1	£45	£9
TERM.	£72	£7
TDL SOFTWARE (Technical Design Labs)		
BUSINESS BASIC	£80	
ZTEL (Text Editing Lang.)	£35	
LINKER	£35	

Full descriptive Catalogue: available £1 — deductable from first purchase

NEW PRODUCTS

DIGITAL RESEARCH	
CB-80	TBA
XLT-86	TBA
MAGIC CIRCLE SOFTWARE	
CPMSIM	£120
MICROPRO	
INFOSTAR	TBA

ORDER INFORMATION

When ordering CP/M software please specify the format you require. All software items are subject to VAT. Manuals, when purchased separately, are not subject to VAT. Please add £4.00 for postage, packing and insurance on each item purchased. For overseas please add £6.50 per item. Most software in this advertisement is available from stock and a 72 hour return service is thereby offered on most prepaid orders. These details and prices are all current as of March 1982. Our prices reflect an exchange rate of U.S. $2.00 to £1.00. Should the exchange rate vary by more than 5 cents, a surcharge may be added or a discount given. All payments must be in Sterling and drawn against a U.K. bank.

MAIL ORDER TELEPHONE ORDER VISIT Send Cash, Cheque, Postal Order, IMO, Access or Barclaycard/Visa number to Microcomputer Products International Ltd., Room PC, 11 Cambridge House, Cambridge Road, Barking, Essex IG11 8NT.

MEDIA AND FORMATS

Altos	A1
APPLE CP/M-80 13 Sector	RG
APPLE CP/M-80 16 Sector	RR
Blackhawk Micropolis Mod II	Q2
California Computer Sys 8 in	A1
CDS Versatile 4	Q2
Columbia Data Products 8 in	A1
Comart Communicator CP50	P2
Comart Communicator CP100	P2
Comart Communicator CP200	P2
Comart Communicator CP500	P2
Compal-80	Q2
CPT 8000	A1
Cromemco System 3	A1
Cromemco System 2 SD/SS	R6
Cromemco System 2 DD/SS	RX
CSSN Backup	T1
Datapoint 1550/2150	A1
Delta Systems	A1
Dynabyte DB8/4	A1
Exidy Sorcerer · CP/M-80	Q2
Exidy Sorcerer · Exidy CP/M-80 8"	A1
EXO	A1
Heath H8 + H47	A1
Hewlett-Packard 125.8in	A1
ICOM 3712	A1
IMSAI VDP-80	A1
Industrial Microsystems 5000	RA
Industrial Microsystems 8000	A1
Intel MDS SD	A1
Intertec Superbrain SSDD	RK
Intertec Superbrain QD	RS
ISC Intercolor 8063/8360/8963	A1
ITT 3030 DSDD	R1
Micromation	A1
Micropolis Mod II	Q2
Morrow Discus	A1
Mostek	A1
Multi-Tech 1	Q2
Multi-Tech 2	Q2
Micromation	A1
Micropolis Mod II	Q2
Morrow Discus	A1
Mostek	A1
Nascom (Gemini Drives SSDD)	R3
Nascom (Gemini Drives DSSD)	R7
Nascom/Lucas	N1
NCR 8140/9010	A1
NNC-80	A1
NNC-80W	A1
North Star Advantage	P2
North Star Horizon SSSD	P1
North Star Horizon SSDD	P2
North Star Horizon QD (MPI CP/M)	P3
North Star Horizon QD (Other CP/M)	P2
Nylac Micropolis Mod II	Q2
Pertec PCC 2000	A1
Rade 1000 SSDD	RL
Rade 1000 DSDD	RM
Rair Black Box	RE
Research Machines 5.25in	RN
Research Machines 8in	A1
SD Systems 5.25in	R3
SD Systems 8in	A1
Spacebyte	A1
Tarbell 8in	A1
TEI 8in	A1
Televideo DSDD	S5
Toshiba T200 DSDD	SF
TRS-80 Modell · Shuffle-board 8in	A1
TRS-80 Modell II	A1
Vector MZ	Q2
Vector Systems 2800	A1
Vector System B	Q2
Vector VIP	Q2
Xerox 820 5.25in	S6
Xerox 820 8in	A1

-and where to find it.

BIRMINGHAM

Based in the heart of the professional area of Birmingham, **Midland Micro Ltd** provides a comprehensive computer service to users in the Midlands.

We supply everything from a single diskette to an advanced network or Mini-computer system using standard software and tailor-made packages.

Services provided by our experienced staff include consultancy, training, maintenance, and full after-sales service.

Contact: Ernest Willcox or Ian Willcox
Midland Micro Ltd
George House, George Road
EDGBASTON, Birmingham B15 1PG
Telephone: (021) 455 7431

CALNE, Wiltshire

Suppliers of accounting and related business software in particular, the Financial Director package incorporating bought and sales ledgers, cash book, nominal ledger, budgets and monthly management accounts.

Other software, eg. order entry, invoicing and stock control, tailored to individual user requirements.

Microshade provides a total sales and support service for the System 10.

Contact: Bryon Horton
Microshade (Business Computers) Ltd
Westhill House, 4 Market Hill
CALNE, Wiltshire
Telephone: (0249) 814879

CAMBRIDGE

The Avery Computer Company showroom caters specifically for the needs of local small businesses. A wide range of systems cover applications from financial modelling, forecasting, payroll etc. to large multi-user systems which can carry out all the functions of the electronic office.

We supply standard and customised software, special computer-aided learning courses and, above all, maintain close client liaison before and after installation.

Contact: Michael Avery or David Spry
The Avery Computer Company
13 The Mall, Bar Hill
CAMBRIDGE CB3 8DZ
Telephone: (0954) 80991

CHELTENHAM

'We won't blind you with science' is the basis of this locally owned company's services to businesses, institutions and individuals.

Partners have wide-ranging business and computer experience and have built up an impressive range of books, manuals, personal computers, business computers, standard software and consumables.

Contact: David Lewis,
Robin Phelps or Don Price
The Computer Shack
14 Pittville Street
CHELTENHAM, Gloucestershire
Telephone: (0242) 584343

EXETER

Teffont Business Systems have specialised in 'word communication' equipment throughout south-west England for the past three years.

The computer division markets Micro and Mini computers. We put strong emphasis on well-proven business software, word-processing, telecomunication, and professional service/training by experienced engineering and training staff.

We also supply 'Europe's No.1' range of facsimile machines and are Prestel dealers.

Contact: Stephen Taylor
Teffont Business Systems Ltd
48-49 High Street, EXETER EX4 3DJ
Telephone: (0392) 30438/9

EPSOM, Surrey

The primary business of **Bryan Wright Ltd** is the production of programmes to meet specialised and individual needs, exclusively for the Millbank System 10 Micro-computer range.

Consultancy and advice to potential Micro-computer users.

Specifications, analysis and programming. A personal after-sales service for users' operational problems, for changing requirements in programming, and system upgrading.

Address labels and mailing-list service, with statistical analysis by areas or other criteria including delivery within a reasonable distance from Epsom.

Contact: Bryan Wright or Denis Wright
Bryan Wright Ltd
1st Floor, 57 South Street
EPSOM, Surrey KT18 7PX
Telephone: (78) 22653

MANCHESTER

Calderbrook Technical Services (CTS) moved successfully into the Micro computer business in the mid 1970s and now offer a wide range of products from personal to business systems, plus a vast software library.

CTS apply a very high level of technical and engineering skills to system design, installation, training and after sales service & maintenance.

Contact: Peter Fawthrop
Calderbrook Technical Services
31-33 Church Street
LITTLEBOROUGH, Lancs OL15 8DA
Telephone: 0706 74342/79332

SWANSEA

Croeso Computer Services is a well established Micro computer systems house specialising in turnkey systems for financial companies, bakeries, licenced trade stock-taking and petrol stations.

We design specialist software systems for individual requirements in business, industry and the professions. A wide range of computer equipment is available.

Contact: Simon Shellard or
Michael Breach
Croeso Computer Services
516 Mumbles Road, MUMBLES
Swansea, West Glamorgan
Telephone: (0792) 61555/6

LONDON (C)

Forte Data Systems offer a complete business computer service from feasibility study to implementation. We provide a wide range of evaluated business packages based on cost-effective solutions to user requirements, using customised software if necessary.

First-time users find our free consultation service an ideal starting point, existing users may be more interested in our main-frame and distributed data processing software development service.

Contact: Mr V. Sippy
Forte Data Systems
27 Rathbone Street, LONDON W1
Telephone: (01) 637-0164

LONDON (N)

B D Computer Systems brings 'mainframe' levels of skills and professionalism to the Micro market. Our experience in selling and installing large computers now provides full operational systems solutions in the Micro market.

Our customers range from a small professional user to a large Government department.

We are ideally placed to serve all London and Home Counties organisations north of the Thames.

Contact: Hugh Benham,
Susan Weitzkorn or Peter Hines
B D Computer Systems
2 Old Brewery Mews
Hampstead High Street
LONDON NW3 1PZ
Telephone: (01) 435-4442

LONDON (S)

Micro Automation Computing Ltd was formed in 1979 with over fifty man years of computer experience to provide and support systems and software based on Micro and Mini technology.

Special emphasis is placed on real time systems for commercial, industrial and engineering applications. Services available include the supply of complete computer systems, tailored turnkey systems and packages, data base applications, specialised drivers for word-processing and colour graphics, and systems software for Micros.

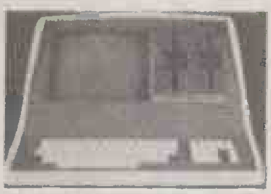
Contact: David Shorter
Micro Automation Computing Ltd
207 Putney Bridge Road
LONDON SW15 2NY
Telephone: (01) 874 2535

This is not a comprehensive list of Millbank dealers so if your area is not covered by any of the dealers listed here call us direct.

Millbank Computers Limited
Millbank House Amyand Park Road
TWICKENHAM TW1 3HN
Telephone: 01-891 4691

● **Circle No. 107**

But the real beauty of the CompuStar is its "shared logic" design concept. Each user station contains its own distinct microprocessor and RAM. The result is lightning fast program execution. Even when all 16 users are on-line. Even when all are performing different tasks! A special multiplexor circuit in the CompuStar ties all external users together to "share" the system's disk resources so that no single user ever need wait on another. An incredibly exciting concept!



A remarkable breakthrough in price/performance, the CompuStar boasts nearly 1 megabyte of on-line mini-disk storage (almost 2 megabytes on CompuStar II) and can be easily expanded to 20, 36 or 96 megabytes of hard-disk in just seconds. And since each user station can accommodate up to 64K or RAM, a total of over one million bytes can be incorporated into the system to tackle even your most difficult programming tasks.

CompuStar user stations can be configured in a countless number of ways. A series of three intelligent-type terminals are offered. Each is a perfect cosmetic and electrical match to the system. The CompuStar 10 - a 32K programmable RAM-based terminal (expandable to 64K) is just right if your requirement is a data entry or inquiry/response application. And, if your terminal needs are more sophisticated, select either our CompuStar 20 or CompuStar 40 as user stations. Both units offer dual disk storage in addition to the disk system in the CompuStar. The Model 20 features 32K of RAM (expandable to 64K) and 350K of disk storage. The Model 40 comes equipped with 64K of RAM and over 700K of disk storage. But, most importantly, no matter what your investment in hardware, the possibility of obsolence or incompatibility is completely eliminated since user stations can be configured in any fashion you like - whenever you want.

Our New CompuStarTM 10 Megabyte Disk Storage System (called a DSS) features an 8 inch Winchester drive packaged in an attractive, compact desktop enclosure. Complete with disk, controller and power supply. Just plug it into the Z80 adaptor of your SuperBrain and turn it on. It's so quiet, you'll hardly know it's there. But, you'll quickly be astounded with its awesome power and amazing speed. The secret behind our CompuStar DSS is its unique controller/multiplexor. It allows many terminals to "share" the resources of a single disk. So, not only can you use the DSS with your SuperBrain, you can configure multiple user stations using our new series of CompuStarTM terminals, called Video Processing Units of VPU'sTM.

G.W. COMPUTERS LTD, 01-636 8210 01-631 4818

*** THE NEW DBMS (DATABASE) ***

DBMS2 is a *record relational* as well as a *file relational* database management tool that is capable of being at different times, many different things. The one core program can be set up to perform tasks normally associated with the following list.

Accounting	Budgeting	Cashflow
Stock control	Address mailing	Letter writing
Simulations	Time recording	Filing
Calc-type predictions	Hospital indexing	Profit analysis
Bureaux services	General analysis	Mathematics
Answer *what-if's*	Employees records	Tabulate values
Print reports	Sort files	Edit records

Within hours perform all the above in French or German.
The list is as endless as that which meets the requirements of your own imagination.
Within the appropriate frames of reference you could ask questions like the following:
Find someone whose name begins with W, who is either in London or Birmingham, and available for work at a salary of less than 10,000.00; and is under 40 years of age, not married, of credit worthiness grade 1, with a car, prepared to travel, and who likes horses, does not mind the hours he works, is congenial and has good references. **When you find such persons** produce a printed list of them showing their names, telephone numbers, and what their salaries are as well as their salary **if increased by 10%** and show their availability for work. At the end of the list enumerate the total of such persons.
Find all stock items that are codes *micro-computers* that are either in warehouse 1 or warehouse 2, where the quantity on hand is more than 50 units, the cost is less than 1000.00, the selling price higher than 2000.00; that are not in cartons, bought from supplier 52, allocated more than 20, rated for tax at .15% and weigh less than 50 lbs. **When you find such categories** then print a report showing the description, cost price, quantity on hand, lead time for refills, what the selling price *should be if raised by 12.3%* as well as the profit in either percent or round figures of that projected selling price.
Find all patients who suffered from cold, that are either girls or women younger than 23 years old, and who live in London at a socio-economic grade higher than 3; do not smoke; have more than 3 children, are currently at work and where treatment failed to effect a cure in under 6 days. **When you find such persons** then print a list showing their age, marital status, income, and frequency of illness in the past 2 years.
Currently you can ask *5 types* of questions *20 times* for a single selection criterion, and then you can compute *10 mathematical relationships* between the questions for the individual *as well as* for the total number of matches. In all some 60 bits of information relating to one record or a **group or records** on simply one permutation of the selection criterion, with a cross referencing facility as well.
Every word in the system, as well as the file architectures, print masks, and field attributes, is capable of alteration by you *without* programming expertise (but with some thought).
ALL IN ONE PROGRAM FROM G.W. COMPUTERS. THE DBMS2 !!.

G.W. COMPUTERS LTD, 01-636 8210 01-631 4818

*** ALL YOU NEED FROM A COMPUTER SYSTEM ***

DATABASE MANAGEMENT + WORD-PROCESSING + MODELLING + DIY INTERPRETER + SERVICE

TWO TYPICAL PACKAGE DEALS	NORMALLY
01 — SUPERBRAIN 64K RAM 320 K	1950.00
02 — EPSON MX80 FT (OR SIMILAR)	475.00
03 — CABLE	25.00
04 — 12 MONTH WARRANTY	235.00
05 — DELIVERY IN U.K.	40.00
06 — TRAINING SESSION	50.00
07 — CPM HANDBOOK	8.75
08 — 50 BASIC EXERCISES	8.75
09 — BOX PAPER (2000 SHEETS)	20.00
10 — DBMS2 (DATABASE)	575.00
11 — MAGIC WAND	190.00
12 — MBASIC-80	150.00
13 — SUPER CALC	150.00
14 — 40 MEMOREX DISKETTES	114.00
15 — DOS+ AND DIAGNOSTICS	125.00
16 — MSORT & DSORT	75.00
17 — RECOVER + AUTOLOAD	25.00
18 — INSTANT BASIC	9.00
19 — 50 GAMES ON DISK	100.00
(NOT INC VAT)	4325.50
OUR PRICE	2995.00

	NORMALLY
01 — SUPERBRAIN OR N/STAR QD	2395.00
02 — NEC 5510 (OR SIMILAR)	1695.00
03 — CABLE ADAPTER	25.00
04 — 12 MONTH WARRANTY	410.00
05 — DELIVERY IN U.K.	50.00
06 — TRAINING SESSION	50.00
07 — CPM HANDBOOK	8.75
08 — 50 BASIS EXERCISES	8.75
09 — BOX PAPER (2000 SHEETS)	20.00
10 — DBMS2 (DATABASE)	575.00
11 — MAGIC WAND	190.00
12 — MBASIC-80	150.00
13 — SUPER CALC	150.00
14 — 25 DYSAN D/SIDE DISKETTES	150.00
15 — DOS+ AND DIAGNOSTICS	125.00
16 — MSORT & DSORT	75.00
17 — RECOVER + AUTOLOAD	25.00
18 — INSTANT BASIC	9.00
19 — 50 GAMES ON DISK	100.00
(NOT INC VAT)	6320.50
OUR PRICE	4950.00

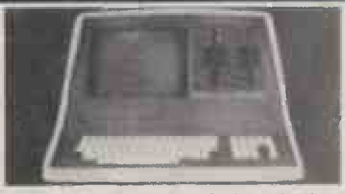
(NOTE: ITEMS 1 AND 2 ARE MORE FLEXIBLE)

EXTRA SPECIAL SUPERBRAIN PROGRAM MAIL ORDER OFFER OF THE 5 MAIN PROGRAMS
DBMS2 + SORTS + MAGIC WAND + MBASIC 80 + SUPER-CALC NORMALLY 1140 POUNDS

OUR PRICE **** 595.00 ****** +VAT**

WARRANTY NOTE: WE HANDLE ALL REPAIRS OURSELVES.
WARRANTY COVERS FREE REPLACEMENT EQUIPMENT IF DEFECTIVE IN FIRST THREE WEEKS.
THEREAFTER UP TO 12 MONTHS THE COVER PROVIDES INSURANCE ON ALL SPARE PARTS AND LABOUR COSTS (EXCLUDING CARRIAGE).
CALL OUT MAINTENANCE IS ALSO AVAILABLE AT 25.00 MINIMUM (LONDON) 50.00 MINIMUM ELSEWHERE IN U.K. PLUS MILEAGE.

CALL ONLY BY APPOINTMENT AT 55 BEDFORD COURT MANSION, BEDFORD AVENUE, LONDON W.C.1. TELEX 892031 TWC G



SuperBrain users get exceptional performance for just a fraction of what they'd expect to pay. Standard SuperBrain features include: two double density mini-floppies with 350K bytes of disk storage, 32K of ram memory (expandable to 64K) to handle even the most sophisticated programs, a CP/M® Disk Operating System with a high powered text editor, assembler, debugger and a disk formator. And, with SuperBrain's S-100 bus adaptor, you can add all the programming power you will ever need . . . almost any type of S-100 compatible bus accessory.

SuperBrain's CP/M operating system boasts an overwhelming amount of available software in BASIC, FORTRAN, COBOL, and APL. Whatever your application . . . General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing, SuperBrain is tops in its class. And the SuperBrain QD boasts the same powerful performance but also features a double-sided drive system to render more than 700K bytes of disk storage and a full 64K of RAM. All standard!

Whatever model you choose, you'll appreciate the careful attention given to every engineering detail. A full ACSII keyboard with numeric pad and user-programmable function keys. A non-glare, specially focused, 12-Inch CRT for sharp images everywhere on the screen. Twin Z-80 microprocessors to ensure efficient data transfer to auxiliary peripheral devices. Dual universal RS-232 communications ports for serial data transmission. And, a single board design to make servicing a snap!

Integrated Desk Top Computer with 12 inch Bit-Mapped Graphics or Character Display, 64Kb RAM, 4 MHz Z80A,® Two Quad Capacity Floppy Disk Drives, Selectric® Style 87 Key Keyboard, Business Graphics Software.

The North Star ADVANTAGE ™ is an interactive integrated graphics computer supplying the single user with a balanced set of Business-Data, Word, or Scientific-Data processing capabilities along with both character and graphics output. ADVANTAGE is fully supported by North Star's wide range of System and Application Software.

The ADVANTAGE contains a 4 MHz Z80A® CPU with 64Kb of 200 nsec Dynamic RAM (with parity) for program storage, a separate 20Kb 200 nsec RAM to drive the bit-mapped display, a 2Kb bootstrap PROM and an auxiliary Intel 8035 microprocessor to control the keyboard and floppy disks. The display can be operated as a 1920 (24 lines by 80 characters) character display or as a bit-mapped display (240 x 640 pixels), where each pixel is controlled by one bit in the 20Kb display RAM. The two integrated 5¼ inch floppy disks are double-sided, double-density providing storage of 360Kb per drive for a total of 720Kb. The n-key rollover Selectric style keyboard contains 49 standard typewriter keys, 9 symbol or control keys, a 14 key numeric/cursor control pad and 15 user programmable function keys.

G.W. COMPUTERS LTD, 01-636 8210 01-631 4818

☆☆☆ BUS ☆☆☆

(BUSINESS EFFICIENCY)

WIDELY USED IN U.K./FRANCE/U.S.A. AND ENGLISH SPEAKING COUNTRIES FOR ITS OVERALL FLEXIBILITY AS A COMPLETE BUSINESS PACKAGE

INCLUDES INVENTORY, DATABASE MANAGEMENT, INVOICING, MAILING ADDRESSES, STATEMENTS, SALES/PURCHASE LEDGER WITH OR WITHOUT AUTO STOCK UPDATE AND DOUBLE ENTRY JOURNALS INCLUDING NOMINAL LEDGER; PLUS A/C RECEIVABLE AND PAYABLE MAKING AUTO BANK ENTRIES.

01 = ADDRESS SECTION	10 = ORDER FILES	19 = NOMINAL ANALYSIS
02 = STOCK CONTROL	11 = 30/60/90 DAY AGE ANALYSIS	20 = AGED DEBTOR ANALYSIS
03 = A/C RECEIVABLES	12 = ARITHMETIC SECTION	21 = DISK DIRECTORIES
04 = SALES LEDGER	13 = PRINT CUSTOMER STATEMENTS	22 = FILE MANAGEMENT
05 = A/C PAYABLES	14 = PRINT SUPPLIER STATEMENTS	23 = SORTS
06 = PURCHASE LEDGERS	15 = PRINT AGENT STATEMENTS	24 = DISK SWAP/EXIT SYSTEM
07 = BANK UPDATE	16 = PRINT TAX STATEMENTS	WHICH OPTION . .
08 = USER DATABASE AREA	17 = RUN SEPARATE PROGRAMS	
09 = INVOICE CREATION	18 = CHANGE VOCABULARY	(LEVEL 8.00@875.00)

++++++++ SUPER — BUS ++++++++ A NEW HIGHER LEVEL OF THE ABOVE PACKAGE . . .
HAS BEEN REDUCED IN SIZE BY 50 PER CENT TO A SINGLE 15K BASIC PROGRAM, MAKING ALL FILE RETRIEVALS A MATTER OF NANOSECONDS. WORKS UNDER M/PM AND COMPUSTAR FOR COMMON DATA RETRIEVAL LEVEL 10.00...... **** 1475.00 ****

DBMS (DATABASE) HAS 01=; 02=; 04=; 06=; 07=; 08=; 17=; 18=; 21=; 24=. PRICE 475.00

DATABASE FEATURES ARE: . . . . FOR ANY SIZE RECORD UP TO TWENTY FOUR FIELDS FILE ARCHITECTURES CAN BE DESIGNED WITH COMPLETE FREEDOM OVER THE LINGUISTIC CONVENTIONS ASSIGNED TO EACH FIELD. THE FILE THEN CAN STORE 32000 RECORDS WHICH CAN BE SEARCHED BY THE RANDOM ACCESS NUMBER (RETRIEVED IN LESS THAN ONE SECOND) OR 'KEY' RANDOM ACCESS ON SPECIFIED FIELD OR SEQUENTIALLY COMPARING FOR LEFT FIELD PARTS, FIELD-INKEYS, OR PARTS OF RECORD, AND THEN CHANGED, PRINTED, DELETED, SKIPPED.

GRAMA (WINTER) LTD/G.W. COMPUTERS LTD. ARE THE PRODUCERS OF THIS PACKAGE WHICH IS UNEQUALLED FOR ITS LEVEL OF TOTAL INTEGRATION, LINGUISTIC FLEXIBILITY AND MAXIMISED DISK/MEMORY CONSERVATION.
AUTHOR TONY WINTER (M.D.; B.A.LIT; B.A.HON.PHIL; AND LECTURER)

G.W. COMPUTERS LTD, 01-636 8210 01-631 4818

IMPORTANT!!!. NO HARDWARE IS ANY VALUE WITHOUT THE SOFTWARE, AND OUR SOFTWARE IS UNEQUALLED. WE GIVE YOU A DISCOUNT TO SET YOU GOING. JUST DECIDE ON THE SYSTEM YOU INTEND PURCHASING, AND TAKE 10% OF ITS VALUE OFF THE PRICE YOU WOULD HAVE TO PAY FOR THE SOFTWARE. YOU COULD GET THE SOFTWARE FREE WITH THE HARDWARE IF YOU CHOOSE THE BEST SYSTEM WE SELL.

SUPERBRAIN	CORVUS DSK	NORTH STAR	COMPUSTAR	PRINTER	PRINTER
64K + 320 K DISK	1995.00	64K MDL 10 VPU	1695.00	OKI MICRO-82A	575.00
64K + 700 K DISK	2495.00	64K MDL 15 PRNT	1595.00	OKI MICRO-83	795.00
64K + 1.5 M DISK	2995.00	64K MDL 20 VPU	2495.00	OKI MICRO-83A	850.00
64K + 6.3 M DISK	4595.00	64K MDL 30 VPU	2795.00	EPSON MX80FT	475.00
N'STAR & GRAPHICS	2395.00	64K MDL 40 VPU	2995.00	EPSON MX100	575.00
5.7 MG CORVUS DSK	2250.00	10 MEG INTERTEC	3250.00	TEXAS 810	1395.00
10 MEG CORVUS DSK	3250.00	BUS VER 8.00	875.00	NEC 5510	1695.00
20 MEG CORVUS DSK	4250.00	BUS MANUAL	25.00	NEC 5525	1895.00
CORVUS MULTIPLEX	695.00	DBMS2	575.00	QUME 9/45	1695.00
CORVUS MIRROR	695.00	N'STAR QD & CPM	2395.00	QUME 5/55	1950.00
ADVANTAGE N/STAR	2395.00	OKI MICRO 80	295.00	DRE 8830	1675.00

SYSTEM 1	**2395.00**	SYSTEM 2	**4595.00**	FORTRAN-80	200.00
64K+750 K DISK		64K+5.6 MEGABYTE CORVUS		PASCAL UCSD	475.00
CRT AND GRAPHICS CP/M		MICRO-WINCHESTER & CRT		SUPER SORT	120.00
IN 1 'N/STAR' UNIT		IN 1 'SUPERBRAIN' UNIT		BASCOMPILER 190.00	
		SYSTEM 3	**2950.00**	MAGIC CALC (CPM)	155.00
		64K+1.5 MEG		BUS VER 8.00	975.00
		CRT AND TWIN 5"		LETTERIGHT	100.00
		IN COMPUSTAR UNIT		COBOL-80	320.00
		MBASIC 80	150.00	WORD-STAR	250.00
		CIS COBOL	420.00	CBASIC	75.00
		MAIL MERGE	55.00	MAGIC WAND	190.00
		DATASTAR	190.00	T/MAKER	150.00
		DBMS (DATABASE)	475.00	BUS VER 9.00	975.00
		DBMS (EXTENDED)	575.00	UTILITIES	75.00
		MSORT & DSORT	75.00		

IF YOU WISH TO MAKE THE WARRANTY TO 1 YEAR THEN ADD 5% OF HARDWARE COST. OTHERWISE NO MAINTENANCE SCHEDULE, SIMPLY ADD-HOC CHARGES AFTER WARRANTY EXPIRATION, SAME QUALITY SERVICE. (SITE MAINTENANCE ON APPLICATION).
MAIL ADDRESS: G. W. COMPUTERS LTD, 55 BEDFORD COURT MANSIONS, BEDFORD AVENUE, LONDON WC1. TELEX 892031 TWC G
. . . . . BOSTON OFFICE TELEX 94-0890.

DUE TO LONG TERM CONTRACTUAL COMMITMENTS, WE ARE ONLY GIVING RESTRICTED DEMONSTRATIONS BY APPOINTMENT AT ONE OF OUR LONDON OFFICES. WE EXPORT TO ALL COUNTRIES.
CONTACT TONY WINTER ON 01-636 8210 OR 01-631 4818 AND IF UNAVAILABLE THEN LEAVE A CALL-BACK MESSAGE (CLEARLY STATING YOUR TELEPHONE NUMBER AND NAME) ON THE 24 HOUR ANSWER-PHONE, WE CALL BACK ANYWHERE IN THE WORLD.
OR SIMPLY LEAVE YOUR ADDRESS AND WE'LL MAIL YOU A STANDARD INFORMATION PACK. MAIL ADDRESS: 55 BEDFORD COURT MANSIONS, BEDFORD AVENUE, LONDON WC1.

CALL ONLY BY APPOINTMENT AT 55 BEDFORD COURT MANSIONS, BEDFORD AVENUE, LONDON W.C.1. TELEX 892031 TWC G

● Circle No. 111

You can't get a Home Computer from Texas Instruments under 16 K RAM.

Make the right move into computing with the Home Computer from Texas Instruments. It gives you a large combined RAM/ROM capacity up to 110 K Byte and the ability to expand with a full range of peripherals and software. So as your knowledge of computers increases the TI Home Computer will grow with you.

Just compare the versatility of the TI Home Computer with its price – you'll find it real value for money that will prove to be a good long term investment.

The TI-99/4A is a sophisticated computer designed not only for the beginner with its ease of operation, but also for the professional with its vast computing power through a 16 bit microprocessor. And it simply plugs into an ordinary household TV set.

With its high resolution graphics with 32 characters over 24 lines in 16 colours (256 x 192 dots), 3 tones in five octaves plus noise, and BASIC as standard equipment and options such as other programming languages – UCSD-PASCAL, TI-LOGO and ASSEMBLER – and speech synthesis, you'll find that the TI 99/4A more than compares with the competition. Especially when the starting price is £340 or less. When you want to solve problems there are over 600 software programs available worldwide – including more than 40 on easy-to-use Solid State Software® Modules.

After all, from the inventors of the microprocessor, integrated circuit and microcomputer, it's only natural to expect high technology at a realistic price.

We'll help you do better.

TEXAS INSTRUMENTS

● Circle No. 113

®Registered Trade Mark Texas Instruments

CHOOSING A COMPUTER MADE SIMPLE

FOR BUSINESS

Made simple...

FOR WORD PROCESSING

Made simple...

FOR EDUCATION

Made simple...

ADVICE

Made simple...

SERVICE AND BACK-UP

Made simple...

IMPROVING ON PET

Not so simple

Choosing a computer is . . . Choosing a computer is more than just choosing a computer. That is, it's a lot more than just hardware. Mind you, PET stacks up very well when it comes to the computer itself. Because at Commodore we've been involved with microcomputers for over 20 years – in fact, many other manufacturers pay us the compliment of using our microchip for their own computers.

So, when you choose PET you know you have a microcomputer that everyone in the business admires and respects.

. . . choosing software . . . Our software programs live up to the quality of our computer. The range, from both Commodore and specialist suppliers, covers everything from word processing, stock control and payroll to accounting and information processing. As well as specialist applications for education and the sciences.

For light relief, we've a pretty impressive range of games and other brain-teasing packages.

. . . choosing value . . . Our computers start at under £200 and go through to £8000 – which will buy you a business system. The extent of our range makes sure that you'll easily be able to choose the right computer for your individual needs.

. . . choosing a dealer . . . As you can see, you do get nationwide dealer back-up with Commodore. What's more, many of our dealers have specific expertise – which means they can advise on anything from business systems to specialist technical applications. So, if your particular problem is of a highly specialised nature, it may be best to contact our Information Department direct. They will then recommend the dealers who understand – and who speak your kind of language.

. . . choosing your computer . . . It all adds up. By choosing a PET you can find out how you can benefit from our experience.

Send to: Commodore Information Services,
675 Ajax Avenue, Slough, Berks. Tel: Slough 79292
I'd like to know how Commodore could make choosing a computer simple for me.

Name ________ Position ________

Nature of Business ________

Company ________

Address ________

________ Tel. ________ 20PR4

COMMODORE PET
Quite simply, you benefit from our experience

Come and see us at the Third International Commodore Computer Show 3rd-5th June, Cunard Hotel, Hammersmith

Commodore Official Dealer List

LONDON
Adda W13
01-579 5845
Capital Computer Systems W1
01-636 3863
Logic Computer Systems SW1
01-222 1122/5492
Merchant Systems Ltd EC4
01-583 6774
Micro Computation N14
01-882 5104
Microcomputer Centre SW14
01-878 7044/7
Sumlock Bondain Ltd EC1
01-250 0505
Informex-London Ltd SE13
01-318 4213/7
CSS (Systems) Ltd E8
01-254 9293
Meares Consultants Ltd NW3
01-431 3410
Data Base NW2
01-450 1388

SURREY & MIDDLESEX
Douglas Moore Ltd Kingston-Upon-Thames
01-549 2121
Micro Facilities Ltd Hampton Hill
01-979 4546/941 1197
PPM Ltd Woking
04867-80111
Datalect Computers Ltd Croydon
01-680 3581
Datalect Computers Ltd Woking
04862-25995
Johnson Microcomputers Camberley
0276-20446
Wego Computers Ltd Caterham
0883-49235
Cream Computer Shop Harrow
01-863 0833
Da Vinci Computer Shop Edgware
01-952 0526
L & J Computers Stanmore
01-204 7525/206 0440

KENT, SUSSEX & HAMPSHIRE
Amplicon Micro Systems Brighton
0273-562163/608331
Business Electronics Southampton
0703-738248
HSV (Microcomputers) Ltd Hants
0256-62444/0703-331422
Millhouse Designs Ltd Alton
042-084517
The Computer Room Tonbridge
0732-355962
Scan Computers Storrington
09066-5432

ESSEX
Dataview Colchester
0206-865835
CSSC Ltd Ilford
01-554 3344
DDM Brentwood
0277-229379
Stuart R Dean Ltd Southend-on-Sea
0702-62707

BERKSHIRE, BUCKINGHAMSHIRE, OXFORDSHIRE & WILTSHIRE
Commonsense Business Systems Ltd High Wycombe
0494-40116
Orchard Computer Services Wallingford
0491-35529
Wymark Micro-Computer Centre Salisbury
04254-77012
Alphascan Ltd Banbury
029575-8202
J R Ward Computers Ltd Milton Keynes
0908-562850
The Computer Shop Oxford
0865-722872
Kingsley Computers High Wycombe
0494-449749

HERTFORDSHIRE & BEDFORDSHIRE
Alpha Business Systems Ware
0920-68926
Bromwall Data Services Old Hatfield
07072-60980/63295
Computer Plus Watford
0923-33927
HB Computers (Luton) Ltd Luton
0582-454466
Photo Acoustics Watford
0923-40698/32006
MMS Ltd Bedford
0234-40601
Brent Computer Systems Rickmansworth
87-71306/70329

EAST MIDLANDS, SOUTH HUMBERSIDE & DERBYSHIRE
Davidson Richards Ltd Derby
0332-366803/4
Roger Clark (Business Systems) Ltd Leicester
0533-20455
Arden Data Processing Leicester
0533-22255
Betos Systems Ltd Nottingham
0602-48108
Caddis Computer Systems Ltd Hinckley
0455-613544

EAST ANGLIA, LINCOLNSHIRE & NORTHAMPTONSHIRE
Arden Data Processing Peterborough
0733-47767
HB Computers Ltd Kettering
0536-520910
Sumlock Bondain Ltd Norwich
0603-26259/614302
Dataview Norwich
0603-616221

WEST MIDLANDS, STAFFORDSHIRE & WARWICKSHIRE
Joseph Ware Associates Birmingham
021-643 8033
Camden Electronics Ltd Birmingham
021-773 8240
Micro Associates Birmingham
021-328 4574
Taylor Wilson Systems Dorridge, Solihull
05645-6192
Walters Computer Systems Ltd Stourbridge
03843-70811
CBS Consultants Ltd Birmingham
021-772 8181
Peach Data Services Burton-on-Trent
0283-44968
Computer Services Midlands Ltd Birmingham
021-382 4171
Business Equipment Rentals Ltd Rugby
0788-65756
Business Equipment Rentals Ltd Coventry
0203-20246

NORTH WALES, CHESHIRE & MERSEYSIDE
Rockliff Micro Computers Mold
0352-59629
North Wales Computer Services Colwyn Bay
0492-33151
Office & Business Equipment (Chester) Ltd Queensferry
0244-816803
Catlands Information Systems Wilmslow
0625-527166
Rockliff Micro Computers Liverpool
051-521 5830
Stack Computer Services Bootle
051-933 5511

MANCHESTER
Cytek (UK) Ltd Old Trafford
061-872 4682
Executive Reprographic Manchester
061-228 1637
Sumlock (Manchester) Ltd Manchester
061-834 4233
D Kipping Salford
061-834 6367/9
Computastore Ltd Manchester
061-832 4761

LANCASHIRE
Preston Computer Centre Preston
0772-57684
Tharstern Ltd Burnley
0282-813299

YORKSHIRE & HUMBERSIDE
Ackroyd Typewriter Co Ltd Bradford
0274-31835
Alcor Computer Systems Ltd Huddersfield
0484-512352
Deans Computer Services Leeds
0532-452966
Holbrook Business Systems Sheffield
0742-484466
Holdene Ltd Leeds
0532-459459
Microware Computers Hull
0482-562107
Mitre Finch Fishergate
0904-52995
Yorkshire Electronics Morley
0532-522181
Computer Centre (Sheffield) Ltd Sheffield
0742-53519/588731
Microprocessor Services Hull
0482-23146
Ram Computer Services Ltd Bradford
0274-391166

NORTH EAST
Currie & Maughan Gateshead
0632-774540
Dysons Instruments Houghton-Le-Spring
0783-260452
Intex Datalog Ltd Eaglescliffe
0642-781193
Key Computer Services Ltd Jesmond
0632-815157

AVON, WALES & WEST COUNTRY
Calculator Services & Sales (Bristol) Ltd Bristol
0272-779452/3
Computer Supplies (Swansea) Sketty
0792-290047
McDowell Kraggs & Associates Worcester
0905-28466
Somerset Business Computers Taunton
0823-52149
Milequip Ltd Gloucester
0452-411010
Reeves Computers Ltd Carmarthen
0267-32441/2
Welsh Computer Centre Bridgend
0656-2757
Sigma Systems Ltd Cardiff
0222-21515/34869
Reeves Computers Newport
0633-212331/2
Computer Shack Ltd Cheltenham
0242-584343
Midland Micro Stourport-on-Severn
02993-77098/6706
Sumlock Tabdown Ltd Bristol
0272-276685/6
Radan Computational Ltd Bath
0225-318483

DEVON & CORNWALL
AC Systems Exeter
0392-71718
Devon Computers Paignton
0803-526303
Jeffrey Martin Computer Services Ltd Truro
0872-71626
AC Systems Plymouth
0752-260861
JAD Integrated Services (Plymouth) Ltd Plymouth
0752-662616/29038

SCOTLAND
Ayrshire Office Services Ltd Kilmarnock
0563-24255/20551
Holdene Microsystems Ltd Edinburgh
031-557 4060
Robox Office Equipment Ltd Glasgow
041-221 8413/4
Gate Microsystems Ltd Dundee
0382-28194
Gate Microsystems Ltd Glasgow
041-221 9372
Mac Micro Ltd Inverness
0463-712774

EIRE & NORTHERN IRELAND
Northern Ireland Computer Centre Co. Down
02317-6548/9
Crowley Computers Ltd Dublin 2
0001-600681
Cork Microcomputer Systems Cork
Cork 20252/20259
CDS Computing Ltd Cork
Cork 23922
QTH Electronics Dunlaoire
Dunlaoire 803358
Microcomputer Systems Ltd Limerick
Limerick 46755
Software Development Services Ltd Dublin 4
Dublin 685 755
Declan Computers Galway
Galway 67156/67157
Microsolve Dublin 14
Dublin 884558
Computer Science Ltd Dublin 6
Dublin 966204

ISLE OF MAN
Resource Planning Ltd Douglas
0624-4247/8

● Circle No. 114

Don't spend more than £500 on a Local Area Network until you know about Clearway

Clearway brings the benefits of Local Area Networking to you **at very low cost.** So if you're thinking about a networking system be sure to find out more about Clearway.

Mail the coupon now for full information

I'm interested in Clearway – the low cost Networking System, please send me details.

REAL TIME

Developments Limited,
Lynchford House,
Lynchford Lane,
Farnborough, Hampshire
GU14 6JA
Telephone: Farnborough (0252) 546213
Telex: 858893 Fletel G

PC6.82

Name ....

Position ....

Address ....

....

....

Telephone ....

Send to: Real Time Developments Limited,
Lynchford House, Lynchford Lane,
Farnborough, Hampshire GU14 6JA

● Circle No. 115

"The best value for money on the small business systems market"

Which Computer? Magazine

SUPERBRAIN

A smart, fully self-contained desk-top unit – that's the SUPERBRAIN microcomputer. It will operate as a complete business system, as a word processor (allied to a high quality printer) and as an intelligent terminal.

- **320K, 680K and 1.5 MB disc drives**
- **Wide range of standard packages**
- **Full graphics facility**
- **Nationwide dealer network**
- **Hard Discs available too – integral or separate**

SUPERBRAIN is ideal for both first time buyers needing a general purpose machine, and for users wishing to upgrade from a personal microcomputer system. Its CP/M operating system will handle the most sophisticated programs. Twin Z80 microprocessors and an RS232 communications port make it easy to extend the system in the future.

The Icarus dealer network

ABRAXAS COMPUTER EMPLOYMENT, 357 Euston Road, LONDON NW1 3AL. Tel: 01 388 2061

A.P. LTD, Maple House, Mortlake Crescent, CHESTER CH3 5UR. Tel: 0244 46024

BASIC BUSINESS SYSTEMS, 61 Loughborough Road, WEST BRIDGEFORD, Nottingham. Tel: 0602 819713

BUSINESS INFORMATION SYSTEMS, 602 Triumph House, 189 Regent Street, LONDON. Tel: 01 437 1069

BORDER COMPUTING LTD, Dog Kennel Lane, BUCKNELL, Shropshire. Tel: 054 74 368

CAMBRIDGE MICRO COMPUTERS, Cambridge Science Park, Milton Road, CAMBRIDGE. Tel: 0223 314666

COMMONSENSE COMPUTING LTD, P.O. Box 7, BIDEFORD, Devon. Tel: 02372 4795

COMPUTECH SYSTEMS, 168 Finchley Road, LONDON, NW3 6HF. Tel: 01 794 0202

CONQUEST COMPUTER SALES LTD, 92 London Road, BENFLEET, Essex. Tel: 03745 59861

CULLOVILLE LTD, Thornfield, Woodhill Road, SANDON, Chelmsford, Essex. Tel: 024 541 3919

DATA PROFILE, Lawrence Road, Green Lane, HOUNSLOW, Middlesex. Tel: 01 572 6381

DATA WARE, 48 Eaton Drive, KINGSTON, Surrey KT2 7QX. Tel: 01 546 2984

DAYTA, 20b West Street, Wilton, SALISBURY, Wilts. Tel: 0722 74 3898

DRAGON SYSTEMS LTD, 37 Walter Road, SWANSEA, W. Glam. Tel: 0792 749486

DUPLEX COMMUNICATIONS, 2 Leire Lane, Dunton Bassett, Lutterworth, LEICESTERSHIRE. Tel: 0455 209131

EASIBEE COMPUTING LTD, 133/135 High Street, LONDON E6 1HZ. Tel: 01 471 4884

ESCO COMPUTING LTD, 154 Cannongate, EDINBURGH. Tel: 031 557 3937

ESCO COMPUTING LTD, 40a Gower Street, GLASGOW G51 1PH. Tel: 041 427 5497

EFFICIENT BUSINESS SYSTEMS, 9 Clarence Street, BELFAST 1, N. Ireland. Tel: 0232 647 538

E.M.G. MICROS 30 Heathfield Road, CROYDON, Surrey. Tel: 01 688 0088

EMTEK COMPUTERS LTD, 102 Queen Street, NEWTON ABBOT, Devon. Tel: 0626 62389

B. FITTON, 97 Melbourne Road, ROYSTON, Herts. Tel: 0763 41949

FOREST ROW COMPUTERS, 53 Feshfield Bank, FOREST ROW, East Sussex. Tel: 034 282 4397

G.T. OFFICE SYSTEMS, 12 Clovelly Road, LONDON W5 5HE. Tel: 01 567 9959

G.I.C.C., P.O. Box 519, Manama, Bahrain.

JAEMMA LTD, Unit 24, Lee Bank House, Holloway Head, Lee Bank, BIRMINGHAM. Tel: 021 643 1609

JENNINGS COMPUTER SERVICES, 55/57 Fagley Road, BRADFORD, W. Yorks. Tel: 0274 637867

KENT BUSINESS SYSTEMS LTD, 85 High Street, Ramsgate, Kent. Tel: 0843 687816.

LONDON COMPUTER CENTRE, 43 Grafton Way, LONDON W1. Tel: 01 388 5721

M.G. ENTERPRISES, 32 Rue Victor Hugo, 92800 Puteaux, France.

MASS MICROS, Wellson House, Brownfields, WELWYN GARDEN CITY, Herts. Tel: 96 31736

MICROAGE LTD, 53 Acton Road, LONG EATON, Nottinghamshire. Tel: 06076 64264

MICROSERVE LTD, 811 Kennedy Way, Pelham Road, IMMINGHAM. Tel: 0724 849 696

MICROCARE COMPUTING LTD, 18 Hawarden Road, NEWPORT, Gwent. Tel: 0633 278040

MICROCOMPUTER CONSULTANCY, Lyngen, Oldhill Wood, Studham, DUNSTABLE, Beds.

NASTAR COMPUTER SERVICES LTD, Ashton Lodge, Abercrombie St., CHESTERFIELD. Tel: 0266 207048

OMEGA ELECTRIC LTD, Flaxley Mill, Flaxley Road, MITCHELDEAN, Glos. Tel: 045 276 532

PROTOCOL COMPUTER PRODUCTS, 49 Beckenham Lane, Shortlands, BROMLEY, Kent.

RANMOR COMPUTING LTD, Nelson House, 2 Nelson Mews, SOUTHEND-ON-SEA. Tel: 0702 339262

ROGIS SYSTEMS LTD, Keepers Lodge, Frittenden, NR. CRANBROOK, Kent. Tel: 058 080 310

S.D.M. COMPUTER SERVICES, Broadway, BEBINGTON, Merseyside L63 5ND. Tel: 051 608 9365

S.M.G. MICROS, 39 Windmill Street, GRAVESEND, Kent. Tel: 0474 55813

SAPPHIRE SYSTEMS, 19-27 Kents Hill Road, BENFLEET, Essex. Tel: 03745 59756

SISCO LTD, 4 Moorfields, LONDON, EC2Y 9AA. Tel: 01 920 0315

SORTFIELD LTD, E. Floor, Milburn House, Dean Street, NEWCASTLE-UPON-TYNE. Tel: 0632 329593

SPOT COMPUTER SYSTEMS LTD, New Street, Kelham Street Indus. Estate, DONCASTER, S. Yorks. Tel: 0302 25159

STAG TERMINALS LTD, 30 Church Road, Teddington, Middlesex. Tel: 01 943 0777

STUKELEY COMPUTER SERVICES, Barnhill, STAMFORD, Lincs. Tel: 0780 4947

TERMACRE LTD, 126 Woodwarde Rd., LONDON SE22 8TU. Tel: 01 693 3037

THAMES VALLEY COMPUTERS, 10 Maple Close, MAIDENHEAD, Berks. Tel: 0628 23532

TURNKEY COMPUTER TECHNIQUE, 23 Calderglen Road, St. Leonards, EAST KILBRIDE. Tel: 03552 39466

THE COMPUTER ROOM, 87 High Street, TUNBRIDGE, Kent. Tel: 0732 355962

WELSH BUSINESS SYSTEMS LTD, 1 Windsor Chambers, Windsor Arcade, PENARTH. Tel: 0222 700059

WORD PERFECT, Old Town Hall, Box 148, READING, Berkshire. Tel: 0734 589068

For further details, or if you want to become a dealer yourself, contact:

ICARUS
Computer Systems Ltd.

Icarus Computer Systems Ltd. Deane House 27 Greenwood Place London NW5 1NN Tel: 01-485 5574 Telex: 264209

● Circle No. 116

SEEMS LIKE WONDERLAND
Alice (reviewing her 80,000 Records): "Now, which of you sounds like Thomson?"
Chorus: Tomson here Miss! Tomasson, if you please Miss! My names Thomass in. . . .

INFORMATION MANAGERS
Are the flavour of '82

SUPERFILE

Is an advanced, elegant, home-grown package that gives:
speed
flexibility
security
unique phonetic matching
an interface to any CP/M language
multi-user capability (the first in the world)
SUPERFILE is a 12K package in Z80 code for any CP/M machine — Xerox, Apple (with Z80 card), Osborne, Superbrain,; multi-user on Equinox under Turbodos, DC4 under MP/M etc.
Two advanced end-user packages are available: SUPERFORMS lets the non-specialist design, store and use screen Forms to enter information, retrieve it and do calculations. Half a dozen Forms — which take only an hour to set up — can do all a small company's book keeping. Tailored software at package prices! SUPERTAB for tabulated Reports, address labels, Mail Merge compatible files. (Ready June 1982)

One-off prices:

SUPERFILE	**£175**
MULTI-USER	**800**
SUPERFORMS	**75**
SUPERTAB	**75**
DEMO DISK	**20**
MANUAL ALONE	**10**

Software dealers:

A BRITISH
(and much better)
ALTERNATIVE

Are you sick of having to say: "I'm very sorry — they're stuck at the airport" "I'm very sorry — we'll get on to California right away" "I'm very sorry — we'll ring you next week"

If you could do without:
Slow deliveries
Poor support
High prices
User-hostile software
Then you might try calling Southdata.

We can give you:
Immediate deliveries
Instant support
Low Prices
Terrific Discounts

Remember — the SUPERFILE package gives you Tailored Software at Package Prices.

Southdata Ltd

10 Barley Mow Passage, London W4 4PH
01-994 6477 Telex 8811418

● Circle No. 117

Apple, Atari and NEC at hard-checked prices*

MAIL ORDER

*Hardware or software, you don't have to shop around. We continually check all our prices and we're certain they are as competitive as you will find anywhere.

PACKAGE SYSTEMS	NET	VAT	TOTAL
Apple Executive System	1950.00	292.50	2242.50
Apple Top Secretary System	2150.00	322.00	2472.50
Apple Education System	1425.00	213.75	1638.75
APPLE HARDWARE			
Apple 48K Video Output only	625.00	93.75	718.75
16K Add on	45.00	6.75	51.75
Disk Drive with Controller (16 sec)	345.00	51.75	396.75
Disk Drive without Controller	275.00	41.25	316.25
ACCESSORIES			
Programmers Aid 1	25.00	3.90	29.90
Auto Start ROM Pack	33.00	4.95	37.95
Graphics Tablet	399.00	59.85	458.85
Appletel System	525.00	78.75	603.75
TV Modulator	14.00	2.10	16.10
INTERFACE CARDS			
Prototype/Hobby Card	12.00	1.80	13.80
Parallel Printer Card	79.00	11.85	90.85
Communications Card	100.00	15.00	115.00
High Speed Serial Card	90.00	13.50	103.50
Centronics Card	100.00	15.00	115.00
Integer Card	90.00	13.50	103.50
Language Card	95.00	14.25	109.25
Controller Card	95.00	14.25	109.25
Eurocolour Card	65.00	9.75	74.75
IEEE-48 Card	200.00	30.00	230.00
16K RAM Card (48K to 64K)	60.00	9.00	69.00
SOFTWARE			
Disk Utility Pack	12.00	1.80	13.80
Apple Post Program	27.00	4.05	31.05
The Shell Games	15.00	2.25	17.25
Elementary My Dear Apple	16.00	2.40	18.40
Apple Bowl Diskette	13.00	1.95	14.95
3.3 Operating System	34.00	5.10	39.10
DOS 3.3 Tool Kit	41.00	6.15	47.15
Apple Writer 1.1	34.00	5.10	39.10
Stellar Invader	13.00	1.95	14.95
Apple Plot	34.00	5.10	39.10
Apple Adventure	19.00	2.85	21.85
APPLE DISTRIBUTED SOFTWARE			
The Go Between (Centronics)	26.50	3.98	30.48
Micro Modeller	375.00	56.25	431.25
Visicalc 3.3	105.00	15.75	120.75
VisiFile	135.00	20.25	155.25
VisiPilot	95.00	14.25	109.25
VisiTrend/VisiPilot	135.00	20.25	155.25
VisiTerm	80.00	12.00	92.00
VisiDex	105.00	15.75	120.75
Desktop Plan II	105.00	15.75	120.75
LANGUAGES			
Pascal Language System	225.00	33.75	258.75
Apple Pilot	75.00	11.25	86.25
Apple Fortran	95.00	14.25	109.25
CIS Cobol with Forms -2	410.00	61.50	471.50

PRINTER & ACCESSORIES	NET	VAT	TOTAL
Silentype Printer	170.00	25.50	195.50
10 Rolls Thermal Paper	28.00	4.20	32.20
VIDEO MONITORS			
BMC 12" Green Screen	120.00	18.00	138.00
9" Black & White Monitor	100.00	15.00	115.00
Cables	5.00	0.75	5.75
OTHER ITEMS	**NET**	**VAT**	**TOTAL**
Z80 Softcard	170.00	25.50	**195.50**
ATARI			
400 16K Computer	250.00	37.50	**287.50**
800 16K Computer	500.00	75.00	**575.00**
410 Tape Recorder	42.61	6.39	**49.00**
810 Disk Drive	260.00	39.00	**299.00**
822 Thermal Printer	200.00	30.00	**230.00**
825 80 Column Printer	400.00	60.00	**460.00**
850 RS 232 Interface	110.00	16.50	**126.50**
16K Ram Upgrade	52.13	7.82	**59.95**
Conversational French	28.26	4.24	**32.50**
Conversational German	28.26	4.24	**32.50**
Conversational Spanish	28.26	4.24	**32.50**
Conversational Italian	28.26	4.24	**32.50**
Assembler Editor Rom	30.39	4.56	**34.95**
Visicalc	105.00	15.75	**120.75**
Word Processor	78.22	11.73	**89.95**
Video Computer System	**69.56**	**10.43**	**79.99**
NEW — N.E.C. PC 8000 SERIES			
PC 8001 Keyboard	500.00	75.00	**575.00**
PC 8011 Expansion Unit	407.83	61.17	**469.00**
PC 8012 I/O Unit	346.96	52.04	**399.00**
PC 8023 Dot Matrix Printer	326.08	48.91	**375.00**
PC 8031 Floppy Disc Drive	543.48	81.52	**625.00**
PC 8041 12" Green or Amber Monitor	129.57	19.43	**149.00**
PC 8043 12" High Resolution CRT Colour Monitor	477.39	71.61	**549.00**

HARDWARE GUARANTEE

All advertised products are guaranteed one year from date of purchase against defects in materials and workmanship.

During the guarantee period, Metrotech will repair or replace, at no extra charge, components that prove defective – providing that the product is returned, shipping or postage prepaid, stating when bought and enclosing proof of purchase.

This guarantee does not apply if, in the opinion of the Company, the product has been damaged by accident, misuse or misapplication.

CONDITIONS OF BUSINESS.

We accept cheques or Access, Barclaycard, American Express and Diners Club Cards. All prices, specifications and terms are subject to change without notice at the discretion of the management. All offers subject to availability.

Prices correct at time of going to press. E. & O.E.

Hardware Post and packaging subject to confirmation.

New CP/M software at hard to beat prices

MAIL ORDER

NEW WORDSTAR 3

WORDSTAR(tm) Version 3.xx has now been released. New features include: column move capabilities, horizontal scrolling – up to 240 columns and even clearer menus. Also released is MicroPro's own spelling checker – SPELLSTAR.

WORD-STAR 3.xx	£195/£30
MAILMERGE 3.xx (optional)	£55/£10
SPELLSTAR (optional)	£105/£10

IN ADDITION METROTECH SUPPLIES A TRUE ENGLISH DICTIONARY, REPLACING U.S. WORDS WITH ENGLISH.

NEW * RECORDS MANAGEMENT

Ideal for office records including personnel, stock, clients and accounts. Features include:

- Comprehensive calculation
- Record selection on updates and reports
- Full sorting facilities
- WORDSTAR INTERFACE – for selective mailing.

COMPSOFT DMS **£345/£25**

NEW * MICROPLAN

If you have any problem that you would normally solve with a pen, paper and a calculator, then MicroPlan will help you. MicroPlan will perform most types of calculations working on rows and columns, as well as advanced financial analysis.

MICROPLAN **£245/£20**

NEW CALCSTAR

CalcStar is MicroPro's new electonic Spread sheet and financial modelling Program – a sophisticated, yet easy to use calculating and planning tool. CalcStar also links with WordStar, so you can easily include your final calculations within your report.

CALCSTAR **£120/£30**

LANGUAGES/UTILITIES

SUPERSORT I	£105/£20
WORD-MASTER SUPERIOR TEXT EDITOR	£60/£20
MET/TWAM INDEX SEQUENTIAL FILE ACCESS IN CBASIC II	£55/£20
CBASIC II COMMERCIAL DISK EXTENDED BASIC	£75/£30
SBASIC COMPILER STRUCTURED BASIC	£175/£30
MICROSOFT BASIC 80 INTERPRETER	£155/£25
MICROSOFT BASIC COMPILER	£195/£25
MICROSOFT FORTRAN 80	£215/£25
MICROSOFT COBOL 80	£315/£25

NEW SUPERCALC BY SORCIM – SUPER FEATURES OF SUPERCALC

Accountants, Planners, Engineers, and Business owners have found Supercalc invaluable for day-to-day "What if?" as well as "Now what?" Questions for the times when the unexpected occurs. And you certainly don't need a programmer – Supercalc is easy to use; it's been designed to use the minimum number of commands to get the maximum power. It's self explanatory. **£190**

NEW BCPL*

BCPL CINTCODE is a full and extended implementation of the popular Systems programming language BCPL CINTCODE gives a dramatic reduction in the space required for programs, requiring about a third of the store of fully compiled Z80 code.

BCPL **£250/£35**

DATA MANAGEMENT

SELECTOR III-C2
An easy to use Information Management System requires CBASIC II **£185/£30**

SELECTOR IV
An advanced Information Management System, requires CBASIC II **£275/£35**

DATASTAR
Powerful data entry, retrieval and update system **£150/£30**

COMMUNICATIONS

BISYNC–80/3780 and BISYNC–80/3270 are full function IBM 2780, 3780 and 3270 emulators for micro computers. BISYNC–80/3780 gives you a Remote Job Entry terminal for the price of a micro! BISYNC–80/3270 combines the local processing power of a micro with a sophisticated screen capability. Make your dumb terminal smart!

MET/TTY will connect your micro to a Timesharing service in simple teletype emulation.

BISYNC–80/3780	£445/£20
BISYNC–80/3270	£445/£20
MET/TTY	£145/£20

FINANCIAL REPORTING

REPORT WRITER You input the values. Report Writer will perform your calculations and produce a report with your headings, totals and summaries. **£70/£10**

GLECTOR General ledger option in Selector III, requires Selector III and CBASIC II **£125/£30**

Newly released software

CB 80	£295/£35
INFOSTAR from MICROPRO	TBA
PL/1-80	TBA

POINTS TO REMEMBER

- All software is Ex-Stock except MDBS and available on standard 8" disks or 5" disks for Vector MZ, Superbrain, Dynabyte and NEC PC 8000.
- Prices shown as Software with manual/Manual only.
- tml WORD-STAR is a trademark of Micropro.
- METROTECH are sole U.K. distributors for DYNABYTE micro-computer systems.

HOW TO ORDER

- State disk type and size
- Add 15% VAT
- Include £2 per Software item for Postage and Packing
- Enclose cheque/PO's payable to METROTECH

Mail to METROTECH MAIL ORDER, WATERLOO ROAD, UXBRIDGE, MIDDLESEX UB8 2YW

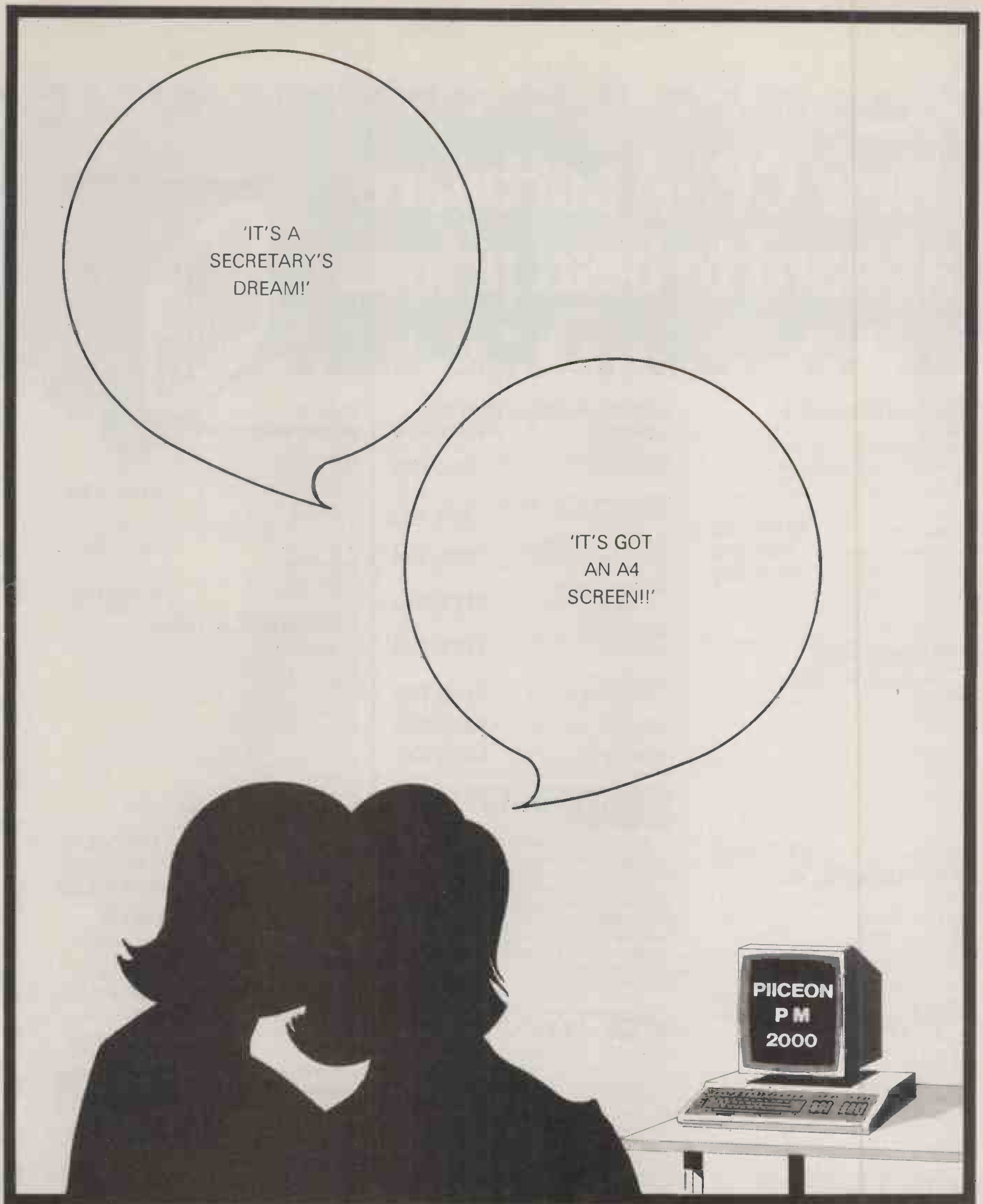
CREDIT CARDS Telephone orders welcome Tel: 0895 58111 Ext 265 or 206

TRADE ENQUIRIES WELCOMED

METROTECH

A MEMBER OF THE GRAND METROPOLITAN GROUP

● Circle No. 118


'IT'S A SECRETARY'S DREAM!'
'IT'S GOT AN A4 SCREEN!!'
PIICEON PM 2000

If your business uses computers, the Willis Disk File is a new idea to save you time and money. Much more than just a storage box, it is a complete filing system for your flexible disks. It keeps them clean – avoiding the risk of errors from dust particles – and lengthens their useful life, as well as keeping them readily to hand.

Disks are stored in 10 sections, each with an ingenious lift mechanism enabling the disks to be fan-displayed five at a time using only the thumb and forefinger.

The file locks for security and prevents the use or removal by unauthorised personnel.

We're sure you'll find the Mini Disk File indispensible for your business and wonder how you ever did without it.

The Mini Disk File with its cream plastic base and tinted polycarbonate lid, is also a handsome modern piece of furniture with the

The new Willis Mini Disk File is now open for business. Only £35.

(plus VAT)

added advantage of being virtually unbreakable. The lid is detachable for easier access if required and, of course, the desk top neatness of the file makes it easily transportable.

Do away with old cardboard boxes and too large filing cabinets. Use the file specially developed after a careful analysis of business requirements by Willis, one of Britain's leading companies for computer supplies.

Order now or ask for further details. Just one of the exciting new items from the 1982 Willis Catalogue.

Mini-Disk Files are £35 each plus 15% VAT.
Postage & Packing extra. Cash with order: carriage free.

To: Willis Computer Supplies Ltd, FREEPOST,
PO Box 10, Southmill Road, Bishops Stortford Herts.
CM23 1BR. Tel: Bishops Stortford (0279) 506491.

Please send.......(Qty) Mini Disk File(s). I enclose cheque/postal order made payable to Willis Computer Supplies for £............(which includes ....p&p), or please debit my credit card.

ACCESS ☐ BARCLAYCARD ☐

Card No. ______

Signature ______

Name ______

Address ______

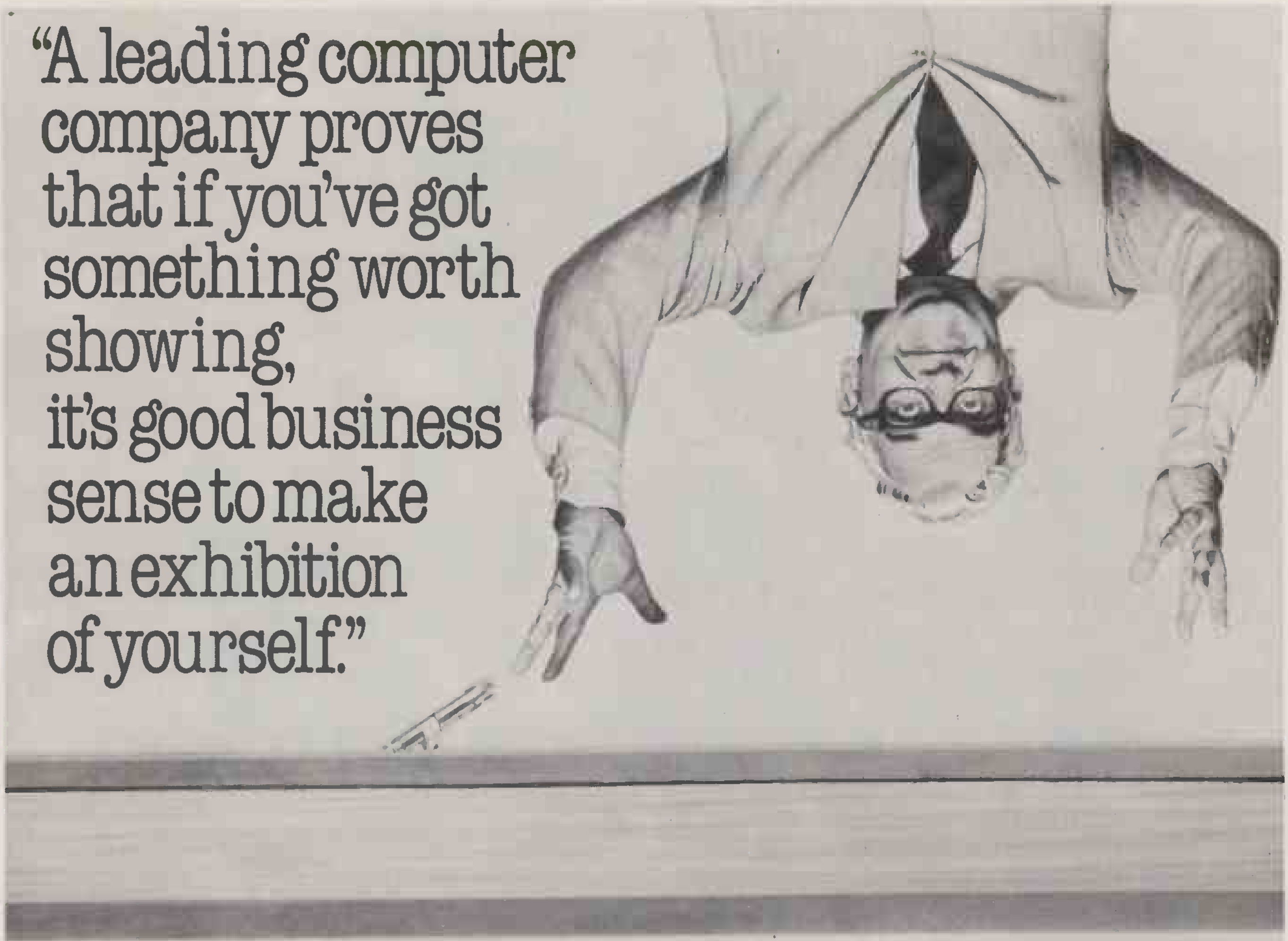
______ Post Code ______

Please send catalogue and details only ☐

WILLIS Computer Supplies
For people who know better.

PC 6/82

● Circle No. 122



THE THIRD INTERNATIONAL COMMODORE COMPUTER SHOW OPENS JUNE 3RD

The Commodore Show is one of the finest opportunities to see the best of today's micro-computer systems in action. A wide range that covers our home colour computer and our selection of sophisticated business systems as well as the latest in software and related products.

Also we'll demonstrate just how they can improve efficiency, whatever line of business you're in.

There'll be seminars on education, communications and a wide variety of business applications.

Guests include knowledgeable and interesting people like Jim Butterfield, who's the foremost authority on the PET and its capabilities.

All in all, it's the biggest and best Commodore Show yet, and definitely not to be missed.

See us at:
The Third International Commodore Computer Show, Cunard Hotel, Hammersmith, London.

Thursday June 3rd	12am - 6pm
Friday June 4th	10am - 6pm
Saturday June 5th	10am - 5pm

For further details ring
SLOUGH (0753) 79292
675 Ajax Ave, Slough, Berks.

commodore COMPUTER

Quite simply, you benefit from our experience

● Circle No. 124

MAKE YOUR SMART TERMINAL SMARTER.

Automatic Date/Time Entry. Simply install the SLC-1 Time Machine between your computer and terminal and it will automatically log the correct date and time of each transaction into your computer. The SLC-1 Time Machine will save you money, both in reduced operator time and the elimination of costly human errors.

The Time Machine contains a precision 24-hour clock and a 100-year self-correcting calendar that automatically adjust for leap years. Time and date functions include: hours, minutes, seconds, day, month and year.

But the SLC-1 is more than a clock. It constantly monitors the output from any computer and provides instant responses to a number of user-defined key phrases. This makes it ideal for use with unattended process control or data acquisition systems. And since the Time Machine is a 6502 microprocessor system, it adds computing power to any terminal.

The Time Machine is easily installed without modification to your operating system. Both RS-232 and 20mA current loop serial link are provided. And because it's battery-supported, the time will always be correct, even after a power failure.

The single quantity price is only £550. Ten-digit display option, £80. For more information or literature on the SLC-1 Time Machine, contact John Birkwood Assoc., Wyvern House, 49 Station Rd., Billingshurst, West Sussex, RH14 9SE. Tel: (040381) 3813.

GET INTO THE TIME MACHINE.

DIGITAL PATHWAYS

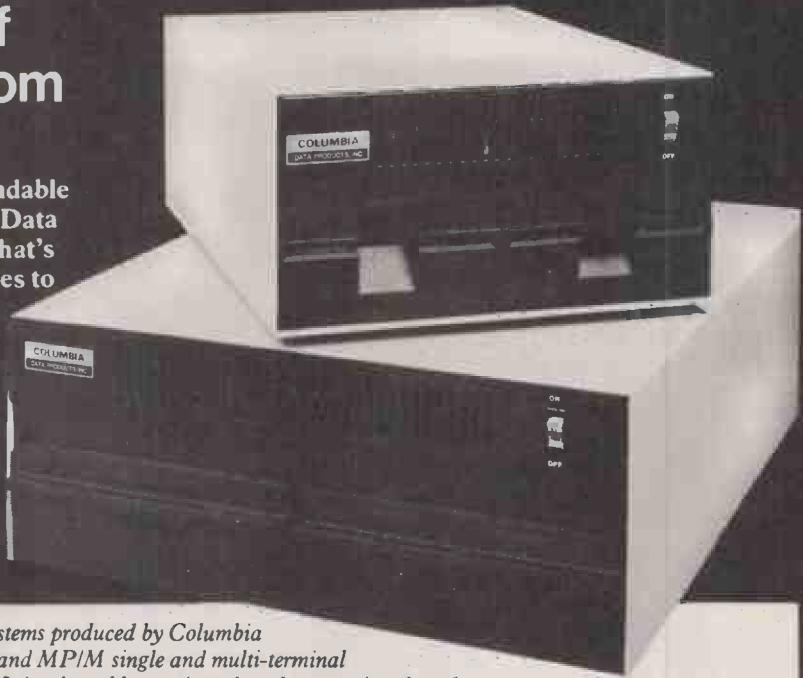
● Circle No. 125

COLUMBIA

A complete range of microcomputers from 320K-80M

Single and multi-user upgradeable/expandable microcomputer systems from Columbia Data Systems offer the disk storage capacity that's exactly right for you. Single user machines to take 5¼" or 8" floppy disks giving 320K-2.4M capacity and multi-user machines with up to 80M on hard disk.

Up to 5 users can work simultaneously while sharing a single processing system. Ideal for word processing, general accounting or other special purpose business applications.



Icarus handle the whole range of microcomputer systems produced by Columbia Data Systems of the U.S.A. This includes CP/M and MP/M single and multi-terminal units with hard and floppy disk storage capacities. It is adaptable to suit each and every micro-based application there is. So whenever you need a microcomputer, for whatever purpose, Columbia and Icarus have the answer.

The Icarus dealer network

ABRAXAS COMPUTER EMPLOYMENT, 357 Euston Road, LONDON NW1 3AL. Tel: 01 388 2061

A.P. LTD, Maple House, Mortlake Crescent, CHESTER CH3 5UR. Tel: 0244 46024

BASIC BUSINESS SYSTEMS, 61 Loughborough Road, WEST BRIDGEFORD, Nottingham. Tel: 0602 819713

BUSINESS INFORMATION SYSTEMS, 602 Triumph House, 189 Regent Street, LONDON. Tel: 01 437 1069

BORDER COMPUTING LTD, Dog Kennel Lane, BUCKNELL, Shropshire. Tel: 054 74 368

CAMBRIDGE MICRO COMPUTERS, Cambridge Science Park, Milton Road, CAMBRIDGE. Tel: 0223 314666

COMMONSENSE COMPUTING LTD, P.O. Box 7, BIDEFORD, Devon. Tel: 02372 4795

COMPUTECH SYSTEMS, 168 Finchley Road, LONDON, NW3 6HF. Tel: 01 794 0202

CONQUEST COMPUTER SALES LTD, 92 London Road, BENFLEET, Essex. Tel: 03745 59861

CULLOVILLE LTD, Thornfield, Woodhill Road, SANDON, Chelmsford, Essex. Tel: 024 541 3919

DATA PROFILE, Lawrence Road, Green Lane, HOUNSLOW, Middlesex. Tel: 01 572 6381

DATA WARE, 48 Eaton Drive, KINGSTON, Surrey KT2 7QX. Tel: 01 546 2984

DAYTA, 20b West Street, Wilton, SALISBURY, Wilts. Tel: 0722 74 3898

DRAGON SYSTEMS LTD, 37 Walter Road, SWANSEA, W. Glam. Tel: 0792 749486

DUPLEX COMMUNICATIONS, 2 Leire Lane, Dunton Bassett, Lutterworth, LEICESTERSHIRE. Tel: 0455 209131

EASIBEE COMPUTING LTD, 133/135 High Street, LONDON E6 1HZ. Tel: 01 471 4884

ESCO COMPUTING LTD, 154 Cannongate, EDINBURGH. Tel: 031 557 3937

ESCO COMPUTING LTD, 40a Gower Street, GLASGOW G51 1PH. Tel: 041 427 5497

EFFICIENT BUSINESS SYSTEMS, 9 Clarence Street, BELFAST 1, N. Ireland. Tel: 0232 647 538

E.M.G. MICROS 30 Heathfield Road, CROYDON, Surrey. Tel: 01 688 0088

EMTEK COMPUTERS LTD, 102 Queen Street, NEWTON ABBOT, Devon. Tel: 0626 62389

B. FITTON, 97 Melbourne Road, ROYSTON, Herts. Tel: 0763 41949

FOREST ROW COMPUTERS, 53 Feshfield Bank, FOREST ROW, East Sussex. Tel: 034 282 4397

G.T. OFFICE SYSTEMS, 12 Clovelly Road, LONDON W5 5HE. Tel: 01 567 9959

G.I.C.C., P.O. Box 519, Manama, Bahrain.

JAEMMA LTD, Unit 24, Lee Bank House, Holloway Head, Lee Bank, BIRMINGHAM. Tel: 021 643 1609

JENNINGS COMPUTER SERVICES, 55/57 Fagley Road, BRADFORD, W. Yorks. Tel: 0274 637867

KENT BUSINESS SYSTEMS LTD, 85 High Street, Ramsgate, Kent. Tel: 0843 687816.

LONDON COMPUTER CENTRE, 43 Grafton Way, LONDON W1. Tel: 01 388 5721

M.G. ENTERPRISES, 32 Rue Victor Hugo, 92800 Puteaux, France.

MASS MICROS, Wellson House, Brownfields, WELWYN GARDEN CITY, Herts. Tel: 96 317 36

MICROAGE LTD, 53 Acton Road, LONG EATON, Nottinghamshire. Tel: 06076 64264

MICROSERVE LTD, 811 Kennedy Way, Pelham Road, IMMINGHAM. Tel: 0724 849 696

MICROCARE COMPUTING LTD, 18 Hawarden Road, NEWPORT, Gwent. Tel: 0633 278040

MICROCOMPUTER CONSULTANCY, Lyngen, Oldhill Wood, Studham, DUNSTABLE, Beds.

NASTAR COMPUTER SERVICES LTD, Ashton Lodge, Abercrombie St., CHESTERFIELD. Tel: 0266 207048

OMEGA ELECTRIC LTD, Flaxley Mill, Flaxley Road, MITCHELDEAN, Glos. Tel: 045 276 532

PROTOCOL COMPUTER PRODUCTS, 49 Beckenham Lane, Shortlands, BROMLEY, Kent.

RANMOR COMPUTING LTD, Nelson House, 2 Nelson Mews, SOUTHEND-ON-SEA. Tel: 0702 339262

ROGIS SYSTEMS LTD, Keepers Lodge, Frittenden, NR. CRANBROOK, Kent. Tel: 058 080 310

S.D.M. COMPUTER SERVICES, Broadway, BEBINGTON, Merseyside L63 5ND. Tel: 051 608 9365

S.M.G. MICROS, 39 Windmill Street, GRAVESEND, Kent. Tel: 0474 55813

SAPPHIRE SYSTEMS, 19-27 Kents Hill Road, BENFLEET, Essex. Tel: 03745 59756

SISCO LTD, 4 Moorfields, LONDON, EC2Y 9AA. Tel: 01 920 0315

SORTFIELD LTD, E. Floor, Milburn House, Dean Street, NEWCASTLE-UPON-TYNE. Tel: 0632 329593

SPOT COMPUTER SYSTEMS LTD, New Street, Kelham Street Indus. Estate, DONCASTER, S. Yorks. Tel: 0302 25159

STAG TERMINALS LTD, 30 Church Road, Teddington, Middlesex. Tel: 01 943 0777

STUKELEY COMPUTER SERVICES, Barnhill, STAMFORD, Lincs. Tel: 0780 4947

TERMACRE LTD, 126 Woodwarde Rd., LONDON SE22 8TU. Tel: 01 693 3037

THAMES VALLEY COMPUTERS, 10 Maple Close, MAIDENHEAD, Berks. Tel: 0628 23532

TURNKEY COMPUTER TECHNIQUE, 23 Calderglen Road, St. Leonards, EAST KILBRIDE. Tel: 03552 39466

THE COMPUTER ROOM, 87 High Street, TUNBRIDGE, Kent. Tel: 0732 355962

WELSH BUSINESS SYSTEMS LTD, 1 Windsor Chambers, Windsor Arcade, PENARTH. Tel: 0222 700059

WORD PERFECT, Old Town Hall, Box 148, READING, Berkshire. Tel: 0734 589068

For further details, or if you want to become a dealer yourself, contact:

ICARUS
Computer Systems Ltd.

Icarus Computer Systems Ltd. Deane House 27 Greenwood Place London NW5 1NN Tel: 01-485 5574 Telex: 264209

● **Circle No. 127**

Computer Supermarket

Big name hardware at cash-and-carry prices - and with service you'll find hard to match

SHARP, COMMODORE, TEXAS, RICOH, ATARI and TANDATA EQUIPMENT
Fully tested before despatch, or collection complete with instruction manuals, tapes, and fitted with 13 amp plugs.

COMMODORE EQUIPMENT

Model	User Ram	exc VAT	inc VAT
4016	12" 40 Col. 16K Mem	445.00	511.75
4032	12" 40 Col. 32K Mem	560.00	644.00
8032	12" 80 Col. 32K Mem	699.00	803.85
8096	12" 80 Col. 96K Mem	1040.00	1196.00
SUPERPET	Micromainframe	1300.00	1495.00
2031	121K Disk	350.00	402.50
4040	347K Disk	560.00	644.00
8050	1M Byte Disk	755.00	868.25
4022	Printer	350.00	402.50
8023	High Speed Printer	785.00	902.75
PET/IEEE	Cable	18.00	20.70
IEEE/IEEE	Cable	20.00	23.00
VIC 20	Personal Computer	173.90	199.99
VIC/C2N	Cassette	36.00	41.40
VIC 1011A	RS232 Int	28.50	32.78
VIC 1110	8K RAM Cartridge	36.00	41.40
VIC 1111	16K RAM Cartridge	60.00	69.00
VIC 1112	IEEE Int	44.00	50.60
VIC 1210	3K RAM Cartridge	25.00	28.75
VIC 1211M	3K RAM (Hi-Res) Cart	28.00	32.20
VIC 1212	Programmers Aid	28.00	32.20
VIC 1213	Machine Code Mon	28.00	32.20
VIC 1515	Matrix Printer	186.96	215.00
VIC 1540	Single Disk Drive	344.35	396.00
VIC Joystick		6.52	7.50
VIC Paddle (Pair)		11.00	12.65
VIC Expansion Unit (Arfon)		78.00	89.70
Lid for above expansion unit (Arfon)		6.95	7.99

SHARP EQUIPMENT

MZ80A	48K Ram	434.78	499.99
MZ80B	64K Ram	950.00	1092.50
MZ80FI	Floppy Disc I/O Card	100.00	115.00
MZ80MDB	Master Diskette & Manual	31.00	35.65
MZ80F15	Cable	9.00	10.35
MZ80FD	Disc Drive	589.00	677.35
MZ80EU	Expansion Unit	50.00	57.50
MZ80P5	Matrix Printer	415.00	477.25

RICOH

RP1600	Letter Qual. Printer IEEE	1200.00	1380.00
RP1600S	Letter Qual. Printer Cent.	1300.00	1495.00

TEXAS EQUIPMENT

TI-99/4A	16K RAM	260.00	299.00

Full range of peripherals available

ATARI EQUIPMENT

Atari 400 16K RAM Computer	260.00	299.00
Atari 800 16K RAM Computer	456.52	525.00

Full range of peripherals available

TANDATA EQUIPMENT

Micro Tantel	152.17	175.00
Alpha Tantel	182.61	210.00

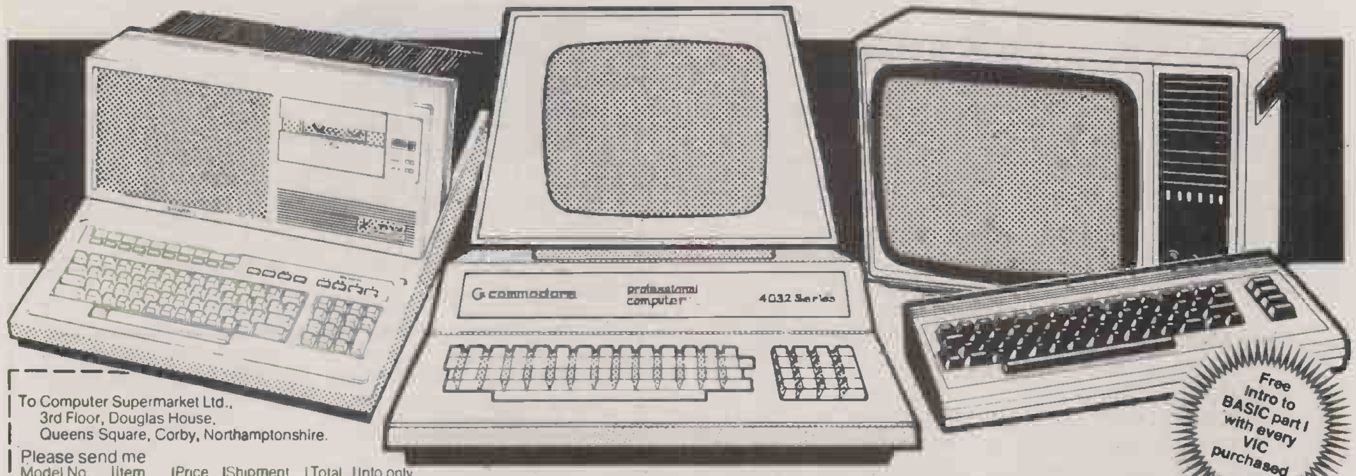
Full colour output. Connects to any TV. Full British Telecom approval. Requires British Telecom 96A jack-plug. Gives access to massive home computer base information from Mortgages to Theatres, Stocks to Holidays.
Telephone us for further information on ease of installation.

Prices are valid only for the cover date month of this magazine

Credit Facilities Available. Ring or write for full details.

Special Price List Available for bonafide Government and Educational establishments.

All orders will be acknowledged by return of post.



To Computer Supermarket Ltd.,
3rd Floor, Douglas House,
Queens Square, Corby, Northamptonshire.

Please send me

Model No.	Item	Price	Shipment	Total	Info only

I enclose my cheque for £ ______
Or debit my Access/Barclaycard/Diners Card/American Express No. ______

(Cardholders may telephone orders to 05363 61587/8)

Signature ______
Name ______
Address ______

(BLOCK CAPITALS PLEASE)

Your remittance should be made payable to Computer Supermarket Reader's Account, and shall remain your money until the goods have been despatched to you at the address specified.
All goods offered are subject to Computer Supermarket conditions of sale, copies available on request. Reg. in England No. 2646589.
Prestel subscribers may order through the Prestel service, Directory No. 400400.

PC

Insured shipment arranged anywhere in UK for an additional £14.37 (inc. VAT). VIC, Atari and Texas shipped by insured post F.O.C.

Approved Distributor for Commodore, Sharp, Atari and Texas.
All goods sold with full manufacturer's warranty and subject to conditions of sale (available on request).
ALL MACHINES ARE FULL UK STANDARD.

COMPUTER SUPERMARKET

COMPUTER SUPERMARKET LTD
3rd Floor, Douglas House, Queens Square, Corby, Northamptonshire.
Telephone 05363 61587/8 and 62571 Telex COMPSU 341543/4 Prestel No. 400400

THINKING ABOUT BUYING A COMPUTER SYSTEM?

TALK TO DATALECT FIRST!

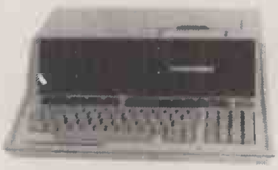
COMMODORE®

No. 1 best seller in the U.K. Tackles your bookeeping, stock control and word processing. This system is reliable and superb value.

APPLE®

One of the most versatile on the market. Expandability up to 48 kbytes of user memory, supported by a large range of programs and peripherals.

HEWLETT PACKARD®



A portable (only 20 lbs) specialist computer with a fully integrated key board, display and printer.

®ACT 800 series

A large microcomputer system supported by an excellent range of programs. Expandable to multi-tasking up to 20 meg.

® Registered trademarks of Commodore, Apple Inc., Hewlett Packard, ACT.

...because who else provides all this–at a price you can afford

We offer you a choice of these budget priced, easy to operate microcomputers. Starting in price from an amazing £200 for a computer, £1,500 for a complete system. All come with a versatile range of programs to meet todays modern business needs.

Try one out for yourself

If you're not sure how a microcomputer can help, call in at our WOKING or CROYDON SHOWROOMS.

Keeping you going

Fast reliable SERVICE if you're based in London and the South.

Buying your system

Attractive terms, leasing and the best deals available in London and the South.

Remember, when you buy from Datalect you're getting 10 yrs EXPERTISE, SERVICE, ADVICE and TRAINING and the best after-sales care.

SHOWROOMS:
CROYDON. 7, St.Georges Walk, Croydon, Surrey.
Tel: 01-680 3581
WOKING. 32, Chertsey Road, Woking, Surrey.
Tel: 04862 63901

NOW IN STOCK! THE 16 BIT MICRO - *sirius 1*

DATALECT
COMPUTERS

Your computer company for London and the South

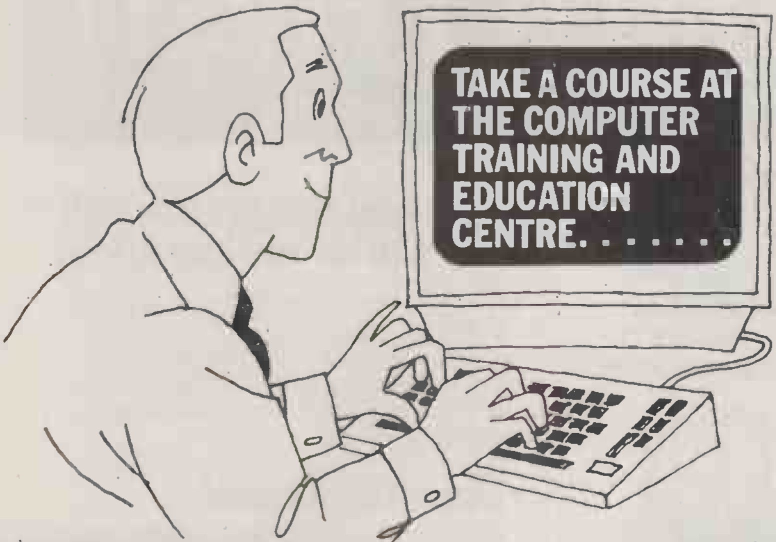
Please send me details and price list.

Name ______________________
Company ______________________
Position ______________________
Address ______________________
____
______________ Post Code ______

DATALECT Computers.
Dept. PC, 33/35 Portugal Rd., Woking, Surrey GU21 5JF

● Circle No. 131

HOW TO GET MORE FROM YOUR MICRO



CP/M* (User level) — **2 days**
A practical course designed for those unfamiliar with CP/M, familiarising the new user with the operation of the typical hardware attached to a disc-based Z80 microprocessor system, and giving an understanding of the facilities available and of its management of disc files.

Advanced CP/M — **2 days**
This course is designed for those who wish to modify the standard CP/M operating system and includes a detailed investigation of BIOS and its interaction with CCP and BDOS. Previous assembler experience is essential.

Programming in BASIC — **1 week**
Giving a thorough understanding of the BASIC language and enabling the student to put this knowledge into practical use, facilitated by hands-on sessions and practical exercises.

CTEC

A professional organisation with first class training facilities in Central London.

**CP/M is the T/M of Digital Research Corp.*
†Wordstar is the T/M of Micropro Corp.

Programming in PASCAL — **3 days**
Giving an understanding of structured programming techniques as used in PASCAL and providing practical experience on a microcomputer.

Wordstar† Wordprocessing — **2 days**
Giving the user an understanding of the facilities available in the Wordstar/Mailmerge Wordprocessing System and hands-on experience which enables this knowledge to be put to practical use.

All courses are in London. A wide range of hardware is available for practical work.

Contact The Courses Secretary, Computer Training & Education Centre Ltd, 102-108 Clerkenwell Road, London EC1. 01-251 4010/4019.

Please send me further information on the course(s) about ....

Name ....

Position ....

Company ....

Address ....

....

Tel. No ....

PC6

● Circle No. 132

A question of band-width

THE ONLY successful economic activities in Britain nowadays seem to be telecoms and company liquidation — the impoverished talking to the broke. Out of that, in recent weeks, we received two pieces of news: one bad and one, possibly, very good.

The bad news, which so far is only a rumour, is that Prestel will fold its tents and steal quietly away into a less public line of business. Some of us can remember, three years ago, hearing about an early demonstration of Prestel to the Directors of IPC, the company that publishes *Practical Computing*. One of them was reported to have said, on being shown the electronic marvel: "It will never catch on". How we all laughed! How we all scorned this bone-headed example of big-business obscurantism! And how very right he was.

When Prestel was first mooted it was quite clearly a Good Thing. One could not exactly explain why it was a Good Thing without waving one's hands about, which is to say that its goodness was so deeply diffused throughout the whole structure of the invention that it did not, and could not, appear at any particular, graspable point. In retrospect, that hand-waving might be seen as a bad sign.

In competition with paper communication Prestel should allow a communication-hungry public to find out anything in very little time. If the 8.50 to Edinburgh is going to be 10 minutes late setting out this morning, the departure time in the Prestel timetable should say so. If there are 20 standby seats on the 1600 flight to San Francisco that should appear. If you want a 1932 Le Mans replica Bugatti, one old-lady owner, Prestel should lead you to her.

In practice it has not been like that. Because people do not rely on Prestel timetables you have no confidence that they are right. You tend to ring up to check, just as you always did. One of our contributors, who has spent three years intimately connected with the beast, confesses that he has only twice in that time used Prestel to find out information that he could have acquired no other way.

Prestel came into a world which had elaborate and effective ways of disseminating information, even if, as seen by the electronic whizz-kids, these methods were so archaic that they could not work. In practice, people knew how to use them and how much to trust them, and the channels of distribution had become woven over the course of time into a dense and satisfactory mat. There is, after all, no reason why you should automatically turn to the back page of *The Guardian* to see what yesterday's temperature was in New York, but some of us do.

A hundred years and more of newspaper publishing have arranged things so that this number is read in New York and transmitted to your breakfast table to arrive in just the place where you expect it. Dozens of people and millions of pounds worth of equipment must be involved, but no one gives it a second thought. How would you find out through Prestel?

Prestel offers a jungle that is very much like the game of Adventure. You have no idea what is hidden in those caves, how to find them and what they will do to you when you do. There is a horrible, groping-in-the-dark feel about using Prestel that compares very badly with printed information products. When you pick up *Practical Computing* you can see exactly what is there. You skim through, this way and that, and build up a picture of the issue in your mind. That ad looks interesting, I'll come back to it. Oh no, not that article again! Skip it.

The human mind has a need to comprehend, even if very vaguely, what it is dealing with. And it is a need Prestel does not satisfy. You only learn about the database by examining it minutely, page by page. It keeps changing, so what you have learned does not persist. It is like the blind men feeling an elephant.

The same difficulty stymies many people when they try to get to grips with micros. You cannot see what is inside the thing. After some months of agonising experiment you learn to "see in the dark", to build up a picture of the internal structures by their actions. The only other job like it is that of the driver who often has to work in such muddy waters that a sense of sight is useless. You must learn to build up a picture of the surroundings by touch, just as though you were blind. Not many people are good at this, and fewer still enjoy having to do it.

The second supposed advantage of Prestel is that it does away with the wasteful and expensive process of cutting down trees, boiling them, marking them and trucking them round the country. It is a process that should not have to happen, but it does and it works fine. Anyone who plans to replace it has to offer very substantial advantages. Prestel does not.

What has been the drawback to Prestel? With hindsight — such a convenient position to pontificate from — it is a question of band-width. The human mind is built to process some 10Mbits of visual information each second; 0.5Mbits of sound, perhaps another 0.5Mbits of touch taste, temperature and internal sensations: a total of around 11Mbits each second. Without it the brain starves.

Unfortunately, all communications technology is narrow-band stuff. You can read about 200 words a minute, so a book has a bandwidth of 160 bits per second or about the same as Morse code. The telephone is limited to about 5Mbits per second, TV provides about 2Mbits per second and wide-screen 70mm. film about 6Mbits per second. You only have to compare the popularity of TV with books to see whether people at large prefer high bandwidth to narrow. Compare the number of people who write voluminous letters to those who send a colour photo.

It takes many years of education to train a person's mind to peer through the narrow-bandwidth keyholes. A minute fraction of the population has been taught properly to read: 98 percent of Americans cannot understand a sentence with more than 30 words, and there is no reason to think the British are any better. The progress of computing is a struggle to train people to compress their minds. The dedicated few may worry their heads about recursive languages and database management, but what the people like is pictures.

Having worked through this rather miserable preamble, we can now come to the good news: the Government's vigorous intention to rewire the country with optical fibre. No doubt there will be wrangles about standards and finance, but the upshot of it all will be long-distance personal information links capable of satisfying the brain's demand for bandwidth. When that can be fulfilled, you can expect the wired society to take off, because it will be capable of supplying what the mass market wants. We really will be able to have two-way mind travel. One would be surprised if this network did not make profound changes in the way people work, shop, go on holiday and go courting.

To go with broad-band data links we need cheap domestic computers, capable of powerful picture manipulation in real-time. In the light of this, the 64-bit micro with 1Mbit of RAM on a chip is not an esoteric engineering toy, but a consumer item that Woolworth's will want to stock before the end of the decade.

Now you can add 64K CP/M® to your Pet Commodore for only £497,-

With the CP/M®aker

It takes only five minutes and £ 497,- to raise your standard Commodore operating level by CP/M and add a hefty 64K RAM.
Not another tag-on box, this module actually plugs inside your present console. No new power supply, no soldering, no fiddling.
Whether you own the 3000, 4000 or 8000 series model you can still add CP/M versatility.

The CP/Maker gives you a massive 96K RAM at your disposal.
The Z80 microprocessor, incorporated in the CP/Maker will also enable you to use your 6502 as an intelligent 1/0 processor.
Look at all these other CP/Maker advantages:

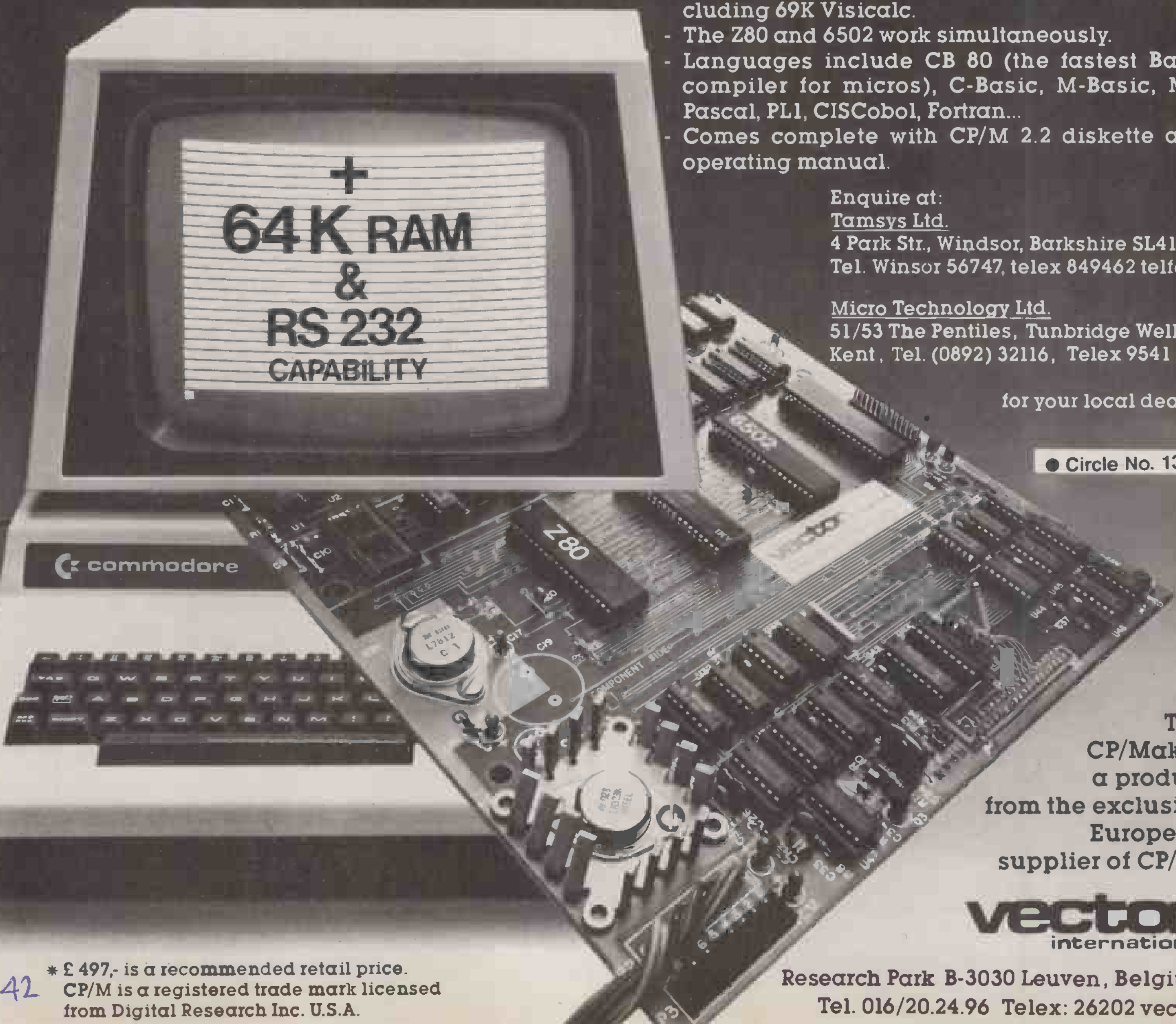
- Compatible with all CP/M software such as wordstar.
- Compatible with all normal CBM software, including 69K Visicalc.
- The Z80 and 6502 work simultaneously.
- Languages include CB 80 (the fastest Basic compiler for micros), C-Basic, M-Basic, MT-Pascal, PL1, CISCobol, Fortran...
- Comes complete with CP/M 2.2 diskette and operating manual.

Enquire at:
Tamsys Ltd.
4 Park Str., Windsor, Barkshire SL41BG
Tel. Winsor 56747, telex 849462 telfac

Micro Technology Ltd.
51/53 The Pentiles, Tunbridge Wells
Kent, Tel. (0892) 32116, Telex 9541

for your local dealer

● Circle No. 133



The CP/Maker, a product from the exclusive European supplier of CP/M:

vector international

Research Park B-3030 Leuven, Belgium
Tel. 016/20.24.96 Telex: 26202 vector

* £ 497,- is a recommended retail price.
CP/M is a registered trade mark licensed from Digital Research Inc. U.S.A.

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback—it is your chance to keep in touch.

Neat layout

MY PROGRAM Neat Layout, Pet Corner, February, contains an error in listing 1. Line 20 should read:

```
20 AL=LEN (A$):IFAL = <WCTHENA$ =
A$+LEFT$(SP$,WC-AL+1):GOTO40
```

Bruce Humphries,
Epsom,
Surrey.

16-bit CP/M

I AM A KEEN ADVOCATE of the new 16-bit CP/M computers, believing this to offer sufficient advantages over the well-known eight-bit CP/M to be a serious alternative. However, the advertisement for the ACT Sirius in the March *Practical Computing* contains two statements which could seriously mislead:

- "It's launched with more software than anything before it."
- "And the ACT Sirius 1 can run any software written for CP/M — that means hundreds of specialised packages."

The CP/M Users' Group has received reports that the problem with 16-bit CP/M is the lack of software, and this is not surprising since CP/M-86 has not been available for long. This is not a reflection on either the performance of CP/M or the 16-bit computers, but simply that application software cannot be written until CP/M-86 computers become available to the software houses.

CP/M-86 is the implementation of CP/M for the Intel family of 16-bit processors known as the 8086 and 8088, which have a completely different machine-instruction set to the 8080 or Z-80 processors used by CP/M-80. Software written in 8080 instructions cannot be run without modification under CP/M-86. As the majority of CP/M software is written for the eight-bit CP/M, the claim that it is launched with more software cannot be substantiated. Indeed, there is currently little software written for CP/M-86, though I am sure this will change very shortly with the availability of 16-bit computers such as Sirius.

Perhaps these two statements appear in the advertisement because of a misunderstanding of the compatibility between the eight-bit 8080 and the 16-bit 8086. Software for the 8080 can run on the 8086, but the crucial factor is that the 8080 assembly-language operation code or mnemonics have to be converted into 8086 code. For each 8080 mnemonic there is an equivalent 8086 mnemonic or set of mnemonics.

Both Intel and Digital Research provide a conversion utility which will read 8080 assembly-language source code and produce an equivalent 8086 assembly-language source code. This code is then assembled using the 16-bit assembler. These converters make it simple for a software house to painlessly convert eight-bit software to 16-bit software, but there are two drawbacks:

- The program produced is likely to be larger.
- The program is likely to run slower on the 16-bit than the eight-bit.

A third limitation of the conversion is that the program space is limited to the eight-bit 64K. The space available for a user's Basic program can actually be less on the 16-bit than on the eight-bit, and can run slower on the 16-bit if the Basic interpreter is only a conversion from the eight-bit.

Any purchaser of 16-bit software should therefore ask if the software is a conversion of the eight-bit or whether it has been rewritten to make full use of the 16-bit features.

David Powys-Lybbe,
CP/M Users Group (U.K.),
London EC2.

Patsy Pokes

PATSY, the Programmer Aptitude Testing System in the March issue turned out to be a real test after all. I have found errors in nine of the Poke statements, which should read.

Line		
10110	Poke 16639, 178	Poke 16640, 69
10210	61	73
10310	10	76
10410	130	79
10510	245	81
10610	109	84
10710	126	88
10810	47	92
10910	73	95

Ted Swann,
Middle Assendon,
Oxfordshire.

Course programming

I READ with interest, and mounting amazement, Michael Smith's article on Programmer Aptitude Testing in the March issue of *Practical Computing*. The article sets out a method and program for testing the logical and analytical skills of an applicant for computer programming using what is effectively a binary-logic test.

It became apparent that the best score could be achieved by pressing the required buttons 4, 5 and 6 using simple combinational selection without any analysis of the problem at all. This will produce a working solution in a maximum of 7 steps, excluding the option of no switches pressed, for each of the night and day states. On average the solution will take only 3.5 steps. The possible combinations are as follows, using 1 to represent "pressed" and 0 to represent "unused":

Key	4	5	6
1 key	0	0	1
	0	1	0
	1	0	0
2 keys	0	1	1
	1	0	1
	1	1	0
3 keys	1	1	1

My amazement is that this rather simple and elegant application of binary counting was not obvious to either the programmer or any of the applicants. Does my solution qualify me for the Crude Programmer of the Year Award, or perhaps a free programming course from Michael Smith?

Brian Robinson,
Lancaster.

Road Racing

I AM SURE many readers must have noticed that Road Racing in March's Open File, Tandy Forum, does not work very well if entered as printed. The program is improved by changing the following lines:

```
160 PRINT @19,"SPEED (10-70 etc.
530 IF ZQ=3 THEN X=X-1:Y=Y-1
550 IF ZQ=8 THEN Y=Y+1
555 IF ZQ=9 THEN X=X-1:Y=Y+1
```

N S Grant,
Heald Green,
Cheadle.

Input or Get?

I ENTIRELY AGREE with the April editorial, "Canned thoughts". One of the reasons why the concepts used in computing are all about computers, rather than the uses to which computers are put, is that people who make a living out of programming come to think that programming is a useful activity in itself, rather than a service to other people.

Even though programmers work with new technology they often hold the "We have always done it this way — therefore it cannot be done any other way" attitude to their work. It is reflected in the actual code written and one particularly infuriating custom is the way in which you have to press Return after you have entered data into the computer before it will stir itself into action. This dates back to the days when you had to use a teleprinter to get information in and out of a computer.

(continued on page 45)

continued from page 43)

Programmers who write games do not use the Return key in this way. Would Space Invaders have caught on if you had to press Return to make your missiles fire? The standard reply to this is, "We need a non-QWERTY user interface".

Yet there are many Space Invaders games that use the standard computer keyboard. Programs can be written which do not require the user to press Return; the problem is that many programmers do not choose to write them.

It is particularly absurd when menu-driven programs require you to press Return after selecting each option. "Please press 1, 2, 3 or 4", says the computer. The new user cautiously presses 1; a 1 appears on the screen, but nothing else happens. After a long pause the user decides he has done something wrong, and that he is not clever enough to operate a computer. So he goes off to a computer expert, who often deals with this kind of query.

"It's quite simple", he says. "Although you pressed 1, it has not been entered into the computer". The user, who can see that the 1 is in the computer by looking through its glass screen starts to wonder why his common sense has failed

Who is wrong? Is it the user, or is it the programmer who used Input out of habit, when he could just as easily have used Get and avoided all the confusion?

J Read,
Martock,
Somerset.

● If the program never wanted more than single-digit inputs, then Get or its equivalents would be fine. But what about questions that like, "What is the most you would pay for a car?" which has to be able to accept from one to seven digits. The only way the computer can know that you mean £700 and do not intend to go on to £7,000 is if you press Return when you have finished. So why should menu options take effect immediately while prices, which are numbers just the same, do not? It seems reasonable to train the user to hit Return after every entry, rather than to discriminate in a way that may not be understood.

Disc dialogue

I FOUND THAT QERA, in the January 1982 issue, would only work under special circumstances. The problem was traced to the fact that Num is not cleared at the start, so the program cannot tell reliably when it has reached the end of the list of "candidates for deletion".

The problem is easily corrected by inserting two lines after the first Push HL:

```
LD A,0
LD (NUM), A
```

When it runs correctly, this is a useful facility — many thanks to David Meeks,

David Coates,
Research Machines,
Oxford.

Apple SI card

WE HAVE recently purchased two Paper Tiger 445 printers for use with our Apple II systems. We are using the standard Apple serial interface card and have uncovered what appears to be a serious shortcoming in this card, at least as far as the use of the Paper Tiger is concerned, and possibly for other printers too.

The problem occurs when listing long programs. After a certain point the listings become garbled, with whole portions missing. It was clear that data was still being sent to the printer while its 2K buffer was full. and a temporary solution was to lower the baud rate from 1,200 to 300. On closer examination we discovered that the interface card has no provision for honouring the "buffer full" signal from the printer. The Data Terminal Ready line, pin 20, from the printer is set low when the buffer is full. The corresponding pin on the serial interface card is not connected and there appears to be no way of utilising the "buffer full" signal without making modifications to the card itself and the controlling software.

Have any other readers encountered this problem, and what solutions have they found?

P E Roberts,
Halton College of Further Education,
Widnes,
Cheshire.

Adventure history

HAVING RECENTLY invested my usual 80p in a copy of *Practical Computing*, I was pleasantly surprised to discover an article in the March issue on my favourite type of computer games, Adventures. Although the article by Dennis Ellis was good it appears to be lacking in a few aspects.

That Adventure games are based on Dungeons and Dragons is, of course, beyond doubt, although I would quibble with the general impression the article gives that Adventure is the more popular of the two. I have been playing Dungeons and Dragons for nigh on eight years, and it is played by more people more often. Those in a position to play both invariably prefer the person-moderated to the computer-moderated game.

Although most of the history in the article is correct, I would argue that Zork was a watered-down version of Dungeon. The Zork available on micros is, moreover, a watered-down version of a Zork running at MITs artificial intelligence labs on a PDP-11. I used to play from time to time over the EPSS/ARPA nets, before British Telecom changed EPSS to PSS and started charging money.

The statement that there are no multi-player, Adventure-like games simply is not true. It may be true for micros, but for nearly four years the Essex University PDP-10 has been blessed with a program called MUD — Multi-User Dungeon. MUD allows up to 36 players in it simultaneously, and was developed by the Essex University Computer Society.

The setting for MUD is The Land, which consists of about 330 areas called rooms, although many are above ground in a kind of mappable wilderness. Rooms can be chained together so that the environments between the MUDs remains consistent and the passage imperceptable — except that you can not yet take things with you or talk across the programs.

Not only did we frequently go to America via the satellite links for the odd game of Zork, but they came over in droves to play MUD. The vision of playing people in Australia is not all that strange: we regularly killed people from MIT, Stanford and UCLA.

Richard Bartle,
Colchester
Essex.

Grandfather Clock

APPLE PIE in the March issue included R D Walker's Grandfather Clock. I think he must have been so excited with the result that he did not wait for an hour before writing in with his progam: the program as published crashes when the clock tries to chime for the second time.

However, all is not lost if you insert the following lines:

```
   8  GH = 19
5081  RESTORE
5082  FOR DT = 1 : READ WE : NEXT DT
```

Michael Trinder,
Sunningdale,
Berkshire.

Tangled web

WE WERE PLEASED to be mentioned as suppliers of Apple software in the article on Adventures in the March issue of *Practical Computing*. We would like to remind readers, however, that our telephone number is 01-680 0267, and has been for some six months.

Dick Williams,
Spider Software,
Croydon,
Surrey.

Nascom Adventures

I READ WITH great interest the Adventure article in March 1982 *Practical Computing*. It is gratifying that microcomputer games are moving away from pub games like Space Invaders, towards games with a tendency towards artificial intelligence. However, the article does give the impression that very few Adventure games are available for the Nascom 1 and 2 range of computers. For several months now, we have been selling a very popular compact 16K version of the mainframe Adventure.

M J Evis,
Syrtis Software,
Bridgwater,
Somerset.

Triple guide to software products

FOR EVERY PROFESSIONAL involved in computing, the International Directory of Software is a must. The book contains 1,360 pages packed with information about systems available in both Europe and the U.S. A total of 4,026 products are listed, more than half of which are appearing for the first time.

Data is indexed in three different ways. Once the relevant product has been identified, the user may discover such details as its date of origin, terms of purchase and operational mode.

The directory is not cheap — at £48 per copy plus postage it costs almost as much as some items of software contained within it; however, it will be of great use to dealers and computer department managers. For a copy of the directory contact Computing Publications Ltd, 430 Holdenhurst Road, Bournemouth, Dorset BH8 9AA. Telephone (0202) 302464.

Bureau link boosts Pets

THE COMMODORE PET computer can now be used as a terminal on-line to a mainframe computer bureau. The Pet requires the addition of a £900 terminal emulator, but is still cheaper than a dedicated terminal. Savings are particularly attractive to those users who already possess Pet computers, which retain their stand-alone computing power.

The new service has been established by the Midlands-based ACT. Managing director Tony Bryan said, "There are a lot of Pet users in the U.K. who may eventually find that the system is not powerful enough for all their processing needs. Instead of discarding the Pet, and buying a bigger system, they now have the option of linking into a bureau".

The bureau is based on an ICL mainframe, which can be accessed by the micro using either a telephone dial-up line or a leased line. Once on the system, a number of commercial accounting procedures become available on a batch or an interactive basis. The scheme represents a new low-level entry point into the world of commercial computing. For details of the ACT bureau service phone 021-454 8585.

T-Pert's way along the critical path

PERT IS a well-known technique used by planners to help arrange work in progress in such a way that wasted time is minimised. Also known as critical path analysis, the methods employed are well-suited to microcomputer application. In the past there has been a lack of appropriate software, but this has now been changed with the introduction of T-Pert written by the Leatherhead-based software house, Thorncroft Manor Services.

Despite the fact that T-Pert has been written in Fortran it will run on any CP/M system with 64K of memory. Up to 750 activities can be time analysed and monitored simultaneously. The package is available to end-users at a recommended price of £465. The results of time analysis are printed out in bar-chart form and printouts are produced giving the permissible timings of activities.

Activities are defined by start and finish nodes, which are numbered. The duration of the activity is then given, and it is also possible to include a text description.

The most common usage of this type of software is in the construction industry where — to quote an obvious example — the roof cannot be put on a house until the walls are completed.

Because T-Pert is available on a microcomputer, work can be carried out on-site for more effective management.

For further information on T-Pert contact Thorncroft Manor Services. Telephone (0372) 376756.

This T/Printer 35 is not only the lowest-priced read-only daisywheel printer on the market, but it is also an electronic typewriter off line. At £475 it is an ideal choice for smaller microcomputer users, who might need letter-quality printout from a word-processing package. The printer is based on the Olivetti Praxis 35 portable electronic typewriter and is comparable in price to many matrix printers. It has a lightweight ABS moulded carrying case, takes paper up to 12in. wide, uses the standard character wheels and can print 120wpm from a microcomputer. Special facilities include variable pitch and numerical fractions. Centronics parallel interface is standard, RS-232 costs extra. For further information contact Datarite Terminals, 144-146 High Road, Chadwell Heath, Essex RM6 6NT. Telephone 01-590 1155.

Ricoh-based daisywheel to mimic Diablo

THE RICOH printer mechanism reviewed in the March issue of *Practical Computing* appears on the market in several guises. One widely advertised incarnation, the Ricoh RP-1600S, seems from the specifications to merit separate coverage.

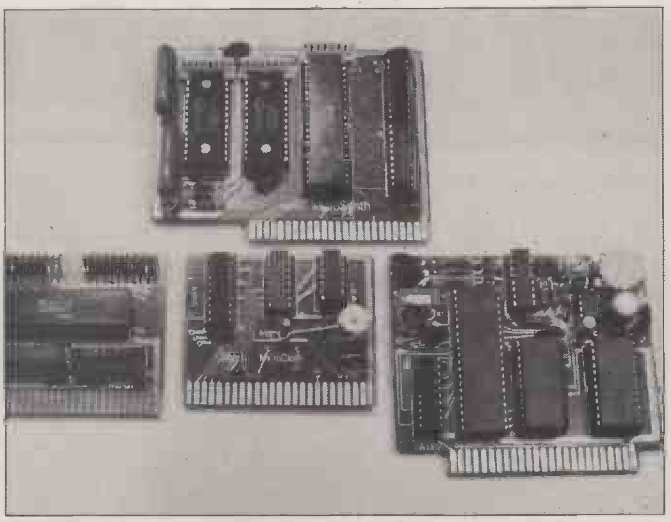
The Cheshire firm of Micropute has beefed up the basic Ricoh carcass with a Z-80 processor board, incorporating a buffer that offers bi-directional printing facilities similar to the Flowriter. Unlike the Flowriter, which has chosen to be a Diablo look-alike, the Micropute "S" emulates the Spinwriter, thereby standardising its method of accessing the additional characters on the Ricoh wheel.

Matsushita's hot graphics

A VERSATILE 40-column bi-directional thermal printer, the Matsushita EUY-3T, is now available in the U.K.

Its graphics facility, which uses a nine-by-280 dot matrix, can be put to a wide range of uses, including microcomputer terminals, personal computers, instruments and point-of-sale terminals.

Contact GMT Products, Newport House, 22 Hartfield Road, London SW19 3TD. Telephone 01-947 7234.



Marchcards are plug-in PCBs for the Apple II and Apple III micro-computers. Top of the line is Microsynth, a sound and music synthesiser card which uses the popular AY-3-8912 chip. Also included are Microtalker based on National Semiconductor's Digitalker, an eight-bit parallel input/output card called Microport, and the real-time Microclock. All come from March Communications, 14/16 Manchester Street, Liverpool L1 6ER. Telephone 051-236 2000.

Spectrum will carry the Sinclair colours

AMID A CRUSH of photographers to rival a Hollywood première the Sinclair ZX Spectrum was launched at the *Practical Computing/Your Computer* Fair. Nobody was quite clear whether the star was Clive Sinclair, or his new microcomputer — though the machine itself deserves to be a winner. A number of people in the microcomputer business are likely to be losing some sleep over their powerful new competitor.

As expected, the Spectrum is a colour machine, with eight available colours all of which may appear on the screen at the same time. It also includes a sound generator.

Attractive as these features are, the main selling point of the Spectrum will be that it is possible to buy a 16K microcomputer for only £125. For those with a little more ready cash, a 48K version is available for £175. Memory expansion from the basic 16K machine to 48K will be available for around £60.

Like its precursor the ZX-81, the Spectrum comes in a smart little black box, measuring just 8.5in. by 5in. by 1in. There is a new 40-key ASCII keyboard, and the Sinclair Basic has been beefed up. The extra commands take control of the micro's colour facilities and operate Sinclair's new ZX Microdrives

ZX Microdrives are tiny tape-loop units that can hold up to 100K of program or data. Information is transferred from them at a rate of around 16K per second, filling the 48K Spectrum in three seconds. As yet, only the prototypes have been built but full production is promised soon.

Up to eight Microdrives can be connected simultaneously to a ZX Spectrum. The quantity of on-line data which may be stored can be increased still further by using the Spectrum's networking capability.

Microcomputer networking is all the rage these days and Sinclair is no slouch when it comes to keeping up with current trends. The networking and RS-232 board is an optional extra, soon to be available at about £20.

The Spectrum contains a 16K implementation of the Sinclair dialect and program conversion to and from the older ZX Basic should be fairly easy. There are 13 new commands and the language can now accommodate multi-statement lines.

The new commands will be bound to delight Sinclair users. Beep will enable the Spectrum owner to enter the fertile pastures of computer music, with over 10 octaves of sound available through an internal speaker or via a jack socket. Ink, Paper, Bright, Flash, Over, and Inverse control the colours and brightness of the screen plotting. The Verify command enables the user to check stored data. The Border command controls the border colour, and Data is a long-awaited addition, providing the standard Basic Data control command together with Read and Restore facilities.

The new machine comes with two manuals, one being an introduction for the newcomer to computing, the other a Basic manual. The ZX Spectrum will be available by mail order only from Sinclair Research, Freepost, Camberley, Surrey GU15 3BR.

Moving keys, not touch-sensitive pads, are used by the Spectrum.

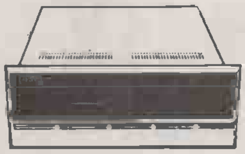
Self-contained stock system

A COMPREHENSIVE stock-management system incorporating sales and order processing has been designed for the first-time computer user by Winchester-based Inchico Business Systems. The system can tackle stock recording, order entry, invoicing, purchasing and stocktake. It will build up a 12-month usage history and allows the user to view, amend or update purchase orders at any time.

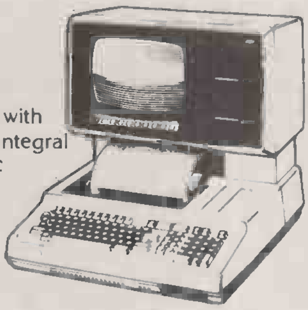
Prices start from under £4,000. Contact Inchico Business Systems, Microcomputer Business Systems, 13 City Road, Winchester, Hampshire. Telephone (0962) 51930.

THE PROFESSIONAL'S CHOICE

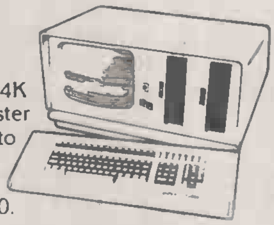
Act Sirius 1
16 Bit Stand Alone micro with superb features.
128K, 1.2MB Floppies, CPM86 as standard – £2395.



Altos
Up to 4 terminals and 40MB of Winchester Disc.
One of the biggest selling small business systems starting at £2350.
16 Bit system with 8 terminals available soon.



OKI 1F800
Quality graphics micro with full colour screen and integral printer. 64K and Basic are standard – £4750.
Wide range of peripherals available.



LSI M3
High specification Stand Alone micro. CPM, 64K and up to 10MB of Winchester in one package. Very easy to use. Detachable keyboard. User programmable function keys. From £2250.

Superbrain
Still a leader in 8 bit price performance. KGB having sold over 400 Superbrains has unbeatable experience on them. From £1875.

Word Processing - Wordstar £250, Mailmerge £75.
Full on-screen facilities enabling the printing of standard letters and preparation of mail shots.

Accounting - From £300 per module.
Integrated accounting systems with Invoicing, Sales, Purchase and Nominal Ledgers.

Financial Modelling - Micromodeller £645.
Budgets, forecasts and accounting data become easy to prepare. Allows "what if" projections.

Calculation - Supercalc £175.
Electronic worksheet for preparation of budgets and tables of data.

Record Keeping - DMS £400.
Personnel, stock or any other records with quick retrieval, sorting and reporting.

Sales Office Management - Sales Desk £300.
For the busy sales office to manage sales leads and marketing lists.

Accounts - IRIS £750.
Incomplete records and time recording systems.

Payroll - Graffcom £500.
Up to 500 employees both weekly and monthly paid. Automatic deduction for items like company pensions.

Graphics - Price depends on application.
Full on-screen graphics both colour and black and white.

Engineering - SPERT £450.
Suite of programmes for PERT analysis and civil engineering applications.

Communications - Liberator £250.
Enables a micro-computer to act like a mainframe terminal and transfer data from Floppy disc to another computer.

Languages - From £175.
Most major computer languages are available: Basic, Cobol, Fortran, Pascal and Assembler.

Solicitors - Solace £1600.
Solicitors accounting, client accounting and time recording.

Multi-terminals - MP/M and Oasis from £350.
Multi-user systems available.

KGB
MICROS LIMITED
14 Windsor Rd. Slough, Berks. Tel: Slough (0753) 38581/38319

● Circle No. 136

ICL advances into the microcomputer market

FOR SEVERAL MONTHS now there have been rumours that ICL is going into the microcomputer business in a big way. First came the news that the British computer giant was going to market the Rair Black Box range of microcomputers under an ICL label. Now the company's plans are brought into perspective its Trader Point scheme.

Trader Point is, as its name suggests, a marketing strategy. It is a bold venture, both from the point of view of ICL and the dealers who enter into agreements with it. Robb Wilmot, managing director of ICL, admits that the company did not know much about the microcomputer market, but is willing to learn.

It is this frank confession by Wilmot that points to the future of ICL — one that certainly looks much rosier than it did a year ago. Because ICL knows little about the micro market, it is prepared to lend its name and expertise to the dealers who, in return, will sell the machines for ICL. Some dealers are expressing concern that they will be competing for sales against ICL salesmen. Others are worried that the lack of local licence agreements will usher in cut-throat selling, signifying the destruction of their businesses.

Despite these fears, the microcomputing industry should benefit by this new development — not least from the prestige bestowed by the famous ICL. Trader Point is not just concerned with selling the new ICL microcomputer, though the machine should make up the bulk of these sales. Other machines covered by the deal are the Wordskil 8800 range, which is a highly sophisticated word-processor based networking system, the system 25, and a very up-market graphics computer; known as Perq.

The ICL personal computer is expected to sell in very large quantities. According to the sales team at ICL, the biggest buyers will be large international and national companies. The main competition is expected to be the IBM personal, which is not yet officially on sale in Europe.

For details about Trader Point or the ICL micro contact ICL at its World Headquarters, ICL House, London SW15 1SW. Telephone 01-788 7272.

Another three for Apple III

ACCESS III is a data communications program, which Apple has introduced for its series III machine to transform it into a conversational terminal.

A Pascal Utilities Library and Script III, a text-editing package for Pascal text files, complete the trio. For further details contact Apple Computers (U.K.), Finway Road, Hemel Hempstead, Hertfordshire HP2 7PS. Telephone (0442) 48151.

HP-125 prices falling as hard disc arrives

THE NEW HP-125 Model 30 is based on a 5.25in. Winchester hard-disc drive, coupled with a 5.25in. floppy in a dual-drive enclosure. Also included in the basic machine are two Z-80 microprocessors, 64K of RAM, 16K display memory, keyboard, and the display unit. The system is the third in the HP-125 range and costs £5,473.60.

Hewlett-Packard claims the new machine offers increased data reliability thanks to the Winchester discs which are sealed against attack from external agencies. A further advantage is the increased speed, and the final benefit is the massive increase in on-line storage.

To coincide with the introduction of the new HP-125 Model 30, Hewlett-Packard has reduced prices on the other models in the HP-125 range, which now starts at £3,238.84. Contact Literature Enquiry Section, Hewlett-Packard Limited, King Street Lane, Winnersh, Wokingham, Berkshire. Telephone (0734) 784774.

Magic spells with CP/M

BRITISH SPELLGUARD is the first truly Anglicised spelling checker for CP/M machines. It will run alongside all the popular CP/M word-processing packages such as Wordstar, Magic Wand and Electric Pencil. The program is based on an American version which has sold over 3,000 copies in the U.S.

The program is available on either 8in. or 5.25in. floppy discs formatted for most popular microcomputers, and comes together with a 116-page instruction book. At a cost of £179 the program comes with a money-back guarantee. Spellguard is fast, being able to read 20 pages in under one minute, and has a dictionary of 20,000 words which may be expanded by the user. For details contact Vision Associates, 57 Woodham Lane, New Haw, Weybridge, Surrey. Telephone (0932) 55932.

This is the world's smallest dot-matrix printer, the ultra-miniature model 150 from Epson (U.K.). The micro-dot printer has been designed to be used in pocket calculators, smaller computers and various other devices. The print head is of the impact dot-matrix type and can print a maximum of 96 dots per line or 16 columns of five-by-seven matrix characters, on 45mm. width paper. The speed of printing is approximately 1 line per second. Ribbons are provided in single-colour cassettes, either in purple or black. The printer uses a 4.5V power supply and the motor draws a current of 0.17A. The overall dimensions of the printer are: width 73.4 mm., depth 42.6mm., height 12.8mm., weight 60g. Further information is available from Epson (U.K.), Dorland House, 388 High Road, Wembley, Middlesex. Telephone 01-900 0466.

Daisywheel typewriter is Canon's new venture

ALREADY RANKING among the world leaders in plain-paper copiers, Canon is preparing to tackle the market for electronic typewriters with its AP-500 and AP-400 machines, which are now available in the U.K. Each machine is controlled by a microprocessor which will help to eliminate chores like centring, column layout, and margin and tab setting.

The top of the range, the AP-500 retails for £1,425. Its special features include a 2K memory which can be expanded to a maximum of 32,000 characters in 10K steps.

The AP-400 costs around £840 and has a 500-character memory, and automatic selectors for pitch, line-space, punctuation, keyboard, impression control, carrier return and underlining. Both machines have a line-frame function for graph and chart construction, a daisywheel print mechanism and an output speed of 20 characters per second. For more information, contact Canon (U.K.), Waddon House, Stafford Road, Croydon, Surrey CR9 4DD. Telephone 01-680 7700.

Polydos runs Gemini discs on Nascoms

POLYDOS IS a complete disc operating system specifically designed for the Nascom 1, 2 and 3 family of microcomputers. It is fully compatible with software written for Nas-Sys 1 or 3 so that programs can be transferred to disc without any changes. To operate the Polydos system the hardware must have a minimum of 48K RAM and either a Gemini GM-815 floppy-disc system with the GM-809 controller card or the GM-805 floppy-disc system.

Operating under Polydos the GM-815 disc system supports both double-sided, single-density and double-sided, double-density discs which yield 175K and 315K of storage per drive respectively. The GM-805 system supports the single-density format only. Discs in the single-density mode may be interchanged between the two drives.

Polydos includes a 4K extension to Basic, a disc-based editor and an assembler. All existing Basic programs will run without any modification. The disc assembler, called Polyzap, is claimed to be the most advanced assembler ever written for the Nascom microcomputers.

Three utility programs are supplied with Polydos; they are Superzap, Format and Backup. Superzap allows the editing of disc sectors; sectors are displayed in hex and ASCII, and bytes can be modified by moving the cursor around. Format allows the formatting and verification of discs, and Backup allows the user to make back-up copies of discs.

Polydos is supplied as a system disc, together with a pair of EPROMs. Documentation is divided into five manuals, and the whole package costs £90 plus VAT. Polydos is available from Microvalue dealers.

This is a new all-British microcomputer, the MC Combo. Designed and built in the U.K. this CP/M-based business system is capable of conversing with mainframes. The basic machine comes with twin double-density, double-sided 5.25in. discs offering 400K of storage. The specifications include Z-80A processor, 64K RAM, 12K ROM including monitor, four serial RS-232 ports, a single Centronics bi-directional port and eight timers, four of which are user addressable. The MC Combo is IBM compatible and there is an optional 6.9Mbyte hard-disc system costing £2,950. The basic system costs £1,088. Contact Megabrain Computers, 2 Ganton Street, London W1. Telephone 01-734 9462.

Twin Z-80s and 64k RAM stars of Galaxy I

GEMINI MICROCOMPUTERS has introduced the Galaxy 1, a microcomputer built around Gemini's Multiboard system. The Galaxy 1 includes twin Z-80 microprocessors, 64K dynamic RAM, a detachable 59-key keyboard and two

double-density 5.25in. floppy-disc drives.

The Galaxy 1 provides a number of sophisticated video facilities. Full cursor-control functions give the user comprehensive on-screen editing capabilities.

Centronics and RS-232 interfaces permit the use of parallel and serial printers. A 1,200 baud Cuts cassette interface and a light-pen input are also included. The Galaxy 1 costs £1,450 plus VAT from Gemini Microcomputers, Oakfield Corner, Sycamore Road, Amersham, Buckinghamshire. Telephone (02403) 28321.

One Expander Card for apple leads to another....

In fact it leads to many others! Joining the amazing success of our PAL Encoder Card, these four new expander cards all featuring the unique 'Digitek Safety Tab' are ready to plug straight into your Apple Computer.

Pal Colour Encoder Card £105 This amazing card with it's on-board modulator, displays exceptional colour graphics to your T.V.

16k Ramcard £91 Insert the card straight into slot Ø, and increase the memory capability of your Apple without having to remove any memory chips.

Z80 Expansion Card £110 Installing the Z80 into your Apple gives you two systems in one, which enables you to run the popular CP/M operating system.

RS232 High Speed Serial Interface £72 The RS232 Interface Card incorporates 13 selectable Baud rates from 75 to 19,200.

Print-master Interface £79 The ultimate parallel interface for Apple to all popular dot matrix printers.

The PRINT-MASTER accepts Apple protocols, 15+ software commands and has on-board graphics dump capability to all popular graphics printers. No need to load clumsy software routines – it's all at your fingertips on the PRINT-MASTER – choice of inverse printing, double size picture, 90° picture rotation, many word processor type text commands, plus many more.

Dealer enquiries welcome

The people who are really into Apples.

DIGITEK

● Circle No. 137

EXPANDER CARD SERIES

Please send me
Colour Encoder £105 ☐
Ramcard £91 ☐ Z80 £110 ☐
RS232 £72 ☐ Print-master £79 ☐
Further Information ☐

Name...
Address...
.... Post Code ....

I enclose my cheque for £
payable to Digitek International Ltd.
Add 15% VAT to all prices quoted.
Post and packaging FREE.
Telephone orders **0403 66550**

My card...
....
Number is ....

PC6

DIGITEK (INTERNATIONAL) LTD. 37C WEST STREET, HORSHAM, WEST SUSSEX RH12 1PP

51

SEE VIC AT THE INTERNATIONAL COMMODORE COMPUTER SHOW, CUNARD HOTEL, HAMMERSMITH, 3rd-5th JUNE.

3rd June 12 noon-6pm. 4th June 10am-6pm. 5th June 10am-5pm.

"Give me one good reason why I should choose a VIC 20 home computer."

1. VIC is outstanding value for money. No other colour home computer can give so much for under £200.

2. Total standard memory 25K made up of 20K ROM and 5K RAM.

3. Fully expandable to 27½K user RAM.

4. Microsoft Basic interpreter as standard.

5. Accessible machine language via plug-in cartridges.

6. Connects direct to monitor or standard television.

7. Full size typewriter style keyboard.

8. Full colour and sound.

9. All colours easily accessible.

10. 62 predefined graphic characters direct from the keyboard.

11. Full set of upper and lower case characters.

12. 256 displayable characters direct from the keyboard.

13. High resolution graphics capability via plug-in cartridges.

14. Programmable function keys can be used with plug-in cartridges.

15. Automatic repeat on cursor function keys.

16. User-definable input/output port.

17. Machine bus port for memory expansion and ROM software.

18. Standard interfaces for hardware peripherals.

19. VIC 20 is truly expandable into a highly sophisticated computer system with a comprehensive list of accessories (see panel below).

20. Full range of software for home, education, business and entertainment on disk, cassette and cartridge.

21. Books, manuals and learning aids from Teach Yourself Basic to the VIC programmers' reference guide (a must for advanced programmers).

22. Full support for VIC owners – their own magazine 'VIC Computing' as well as a national network of VIC user groups.

23. National dealer network providing full service and support to VIC owners.

24. Expertise and experience – Commodore are world leaders in microcomputer and silicon chip technology.

25. Commodore is the leading supplier of micro computers in the UK to business, schools, industry and the home.

26. VIC 20 is the best-selling colour home computer in the UK.

How many reasons was it you wanted?

Accessories include:

- Cassette tape unit.
- Single drive 5¼" floppy disk unit (170 K bytes capacity).
- 80-column dot matrix printer.
- 3K, 8K and 16K RAM expansion cartridges.
- Programming aid packs; machine code monitor cartridge, programmers' aid cartridge, high resolution graphics cartridge.
- Plug-in conversion box for a full 32K, 40-column x 24 lines VIC including Prestel compatability.
- RS 232C communication cartridge.
- Memory expansion board.
- IEEE/488 interface cartridge.
- Joysticks, light pens, paddles and motor controllers.

commodore

VIC 20

The best home computer in the world.

FOR MORE INFORMATION ON THE VIC 20, TELEPHONE OR WRITE TO: COMMODORE INFORMATION CENTRE, 675 AJAX AVENUE, SLOUGH, BERKSHIRE. TELEPHONE SLOUGH 79292.

● Circle No. 138

Prestel all at sea

Bill Bennet investigates a tele-computing experiment on board a North Sea ferry.

SEAVIEW 82 is one of the simplest, yet also among the most imaginative applications of the British Telecom Prestel system. Essentially it is a way in which shipboard Prestel sets can patch into the network. None of the technology involved is particularly novel, but as with all worthwhile feats of engineering it is the way that existing technologies are combined and applied that is important.

The prototype system is on board the Townsend Thoresen car ferry *Viking Voyager* which treks back and forth across the North Sea between Felixstowe and Zeebrugge. The link into shore-based Prestel is achieved by radio, as with normal ship-to-shore telephone network links, and the base-station radio receiver links into the telephone network.

The funding of the trial — which will cost in total £325,000 — is being met by a number of sources, with the lion's share of 70 percent coming from the Department of Industry. These funds are in addition to the costs met by CAP and Siemens who conducted all the earlier research and development. The money from the Department of Industry comes under the Information Technology Year budget.

Ministerial optimism

The system was recently demonstrated by Under Secretary of State for Industry, John Wakeham, who commented that the project was very much in keeping with the spirit of IT Year. He also envisaged a future system where ships all over the world would be able to contact the Prestel network via communications satellites.

To send the digital signals associated with Prestel, a special type of hardware is required which combines elements of digital and radio techniques. The nominal range of the ship-to-shore VHF radio is about 20 miles, though useful communication can still be achieved 24 miles out. Thanks to the international Gateways in Prestel it is possible to contact other countries' viewdata networks. Especially relevant in the North Sea and English Channel areas are the German and Finnish networks.

Coastal relays

The Seaview system itself was invented by a team from the systems house CAP, which specialises in providing purpose-designed systems to clients' specifications, working in conjunction with a team from Liverpool Polytechnic and Siemens. The communications links for the Seaview system are provided by British Telecom. In all there are 11 manned and 19 unmanned VHF radiotelephone stations dotted around the coast of Britain, and more are on the way.

Ships normally operate a telephone service both for the benefit of the passengers and for the day-to-day business of running the vessel. For the purposes of the Seaview demonstration, at least one of the radio-telephone channels is occupied by the Prestel link.

One of the major partners in the Seaview venture is Townsend Thoresen, the ferry company that is actually using all the high-powered technology. Townsend Thoresen's Felixstowe operation thinks of itself as the technological vanguard of the fleet, and in Seaview it sees an opportunity to keep itself well at the fore of sea-borne information technology.

Why should a ship need Prestel? Of course it is a convenience to have a link to the Prestel service that can be used from a ship, but more to the point it establishes a communications link that will support digital computer signals.

Connecting the ship up to the Prestel system provides the sea-borne user with an interesting set of possibilities including access to distant databases through the Prestel Gateways. In this way for example, an on-board computer is able to patch in to the fleet's main base computer.

Duty-frees

Cross-channel ferries make most of their profit from the duty-free shops and the on-board bars and catering, and it is replenishing these lucrative stocks that takes most of the time when the ferry is in port — clearly an unsatisfactory state of affairs for the ferry operators and the port authorities. Turn-round time can be reduced by the ship's computer contacting the stores computer in advance to ensure that the required supplies are waiting on the quayside.

A service which could make Seaview very popular with the ferry-using public is the facility to book hotel rooms at their destination while still on the boat. Motorists could be informed of traffic hold-ups well in advance of reaching them, and the general news and information services should prove useful to passengers on longer journeys. The expense of remaining on-line to the Prestel network can be cut considerably by saving the pages to tape or disc, and reviewing them later. This would be normal practice prior to leaving the limit of VHF transmissions.

Advantage of graphics

With the Advantage, North Star has produced yet another desk-top micro with built-in discs: Mike Hughes found that it has something special to offer.

THE NORTH STAR Advantage is a Z-80-driven integrated desk-top system comprising 64K of main memory, a 20K high-resolution monochrome display, a 2K bootstrap PROM, 87-position keyboard and twin double-sided 5.25in. hard-sectored disc drives. A second microprocessor, an 8035, is used within the system to provide keyboard and disc-drive control. It will support serial or parallel external printers via plug-in I/O boards, for which there are six slots inside the cabinet. There are currently two I/O-board options — one serial and one parallel.

Keyboard

The keyboard contains three shift keys, designated Shift, Control and Command. Used in conjunction with the other keys, they generate up to 235 different codes. Through software, a "feedback" click can be made to sound whenever a key is depressed. The main keyboard contains an Alpha-lock key which, when active, is illuminated by an LED. Alpha-lock can be switched in and out either manually or through software. The numeric pad carries a similar Cursor-lock key which allows eight of the numeric keys to double as cursor-movement controls. Cursor-lock can be introduced either manually or via software. A further 15 keys, labelled F1 to F15, can be used for special user functions.

The display, when used in conventional character mode, displays 24 lines of 80 characters per line, with each character contained within an eight-by-10 matrix. The matrices for standard characters are contained within the 2K Boot PROM, and provide for proper descenders on lower-case letters. The PROM contains the character-driver routines which are accessible to the user, and allows matrices for special characters to be set up and addressed in RAM. Because of the high-resolution characteristics of the screen, characters do not have to be separated by fixed line intervals. It is possible, with custom-designed software and character pixel data, to display superscripts and subscripts, and even display sloping lines of characters. All this can be done by transporting data to the driver routine via the Z-80's registers. In graphics mode the 20K of display RAM allows every bit to be displayed giving a truly high-resolution display of 240 by 640 pixels.

The versatile video driver allows for reverse-field characters and stepwise or smooth scrolling. Other software permits the cursor to be exinguished, and there are routines which allow the screen to be blanked through software without affecting any writing in progress. A complex drawing can thus be entered with the screen blank, to be switched on subsequently to show the completed drawing.

The Boot PROM allows the system to be loaded from either of the two disc drives, which proved useful on the review system as it slowly developed an unwillingness to read through drive 1. This was probably a simple mechanical problem on an "as delivered" machine and would have been cleared up by an engineer's visit. This brought drive 2 into the limelight which, although a little inconvenient at times, allowed the system to operate satisfactorily. The transfer rate when taking back-up copies of discs appears to be rather slow. Comart confirms that this is so and puts it down to the disc drives being controlled via the firmware of the 8035, as opposed to a hardware control chip.

Memory addressing

The internal "bleep" loudspeaker is driven either from a standard 500ms. bleep, generated by hardware and controlled by a monostable, or from a programmable frequency tone generated by switching a bit in an output register.

Extended memory addressing is used to keep control of up to 256K which is organised as 16 16K pages. The address bus is increased to 18 bits by using bits 14 and 15 to address four registers into which four data bits are loaded to define the pages that are currently required. The normal bits 0 to 13 then address the 16K within each of the selected pages. At any moment only four 16K pages can be current — for obvious reasons. Though this program is very powerful, it could cause a few programming headaches if put to a great deal of use, especially if maskable interrupts are used when the page they are on is mapped out of the system.

Parity checks

The internal 64K of dynamic RAM occupies four of the 16 pages and is unusual in being nine bits wide. The extra bit is used as a parity bit for every memory location and is automatically checked by hardware. In the event of parity failure the hardware can flag it by issuing an interrupt which can be masked out, if desired, by a control register. The parity bit is always set during a write cycle; parity bits could be left in a random state after switching on, so it is essential that all memory locations are written to during initialisation.

The Advantage is well endowed with software control, making it an extremely versatile system. It means, however, that there is plenty to go wrong if the inexperienced start playing around with system software. Fortunately the average end-user need have no fear as the Advan-

(continued on next page)

(continued from previous page)
tage is supplied equipped with a choice of operating systems, neither of which requires intervention for most purposes. The CP/M supplied is up-graded to handle graphics and North Star's graphics operating system, GDOS; the review model was supplied with CP/M 2.2, a full complement of utilities and a handful of command programs introduced by North Star. The most significant of these are a Graphics Dynamic Debugging Tool, which is an upgraded form of DDT; a program for dumping the CP/M directory called DIRDUMP; and GMGRADD.COM which is a graphics subsystem extension to CP/M which is not normally resident in RAM but which can be linked to users' Com files.

Data passed to the graphics subsystem through the Z-80's registers allows four geometric routines to be invoked which respectively draw lines, ellipses, rectangles or polygons. Bounded areas can optionally be filled in with 15 different types of shading, and the bounding perimeter can be deleted if required. Like the standard CP/M I/O call at 0005H, the graphics subsystem is accessed through a call to 000CH once the registers have been set up.

Speedy Graphics

CP/M was used to run WordStar with Mailmerge and Spellstar which did all that could be expected of them. Great fun was had writing a few patched-up graphics routines in assembler, and linking them through the graphics subsystem. As long as the required tables of coordinates were properly set up, the graphics system made the rest of it very easy. The speed with which the most complex drawings are displayed is a sight to behold — it is not often you get the chance to play around so easily with complex high-resolution graphics in assembler.

MBasic was used to carry out a few groundwork checks on the Advantage and, in particular, some of the numerous software-controlled options. Many pages are taken up in the respective manuals describing the bit patterns of control and status registers. The system is organised in such a way that many of the options can be set up through the display output.

By expedient use of the Print CHR$ statement, you are able to switch to reverse video, switch the keyboard "click" on and off, sound the "bleep", clear a line, clear the screen or clear to end of screen, turn on smooth scrolling at high or low speeds, switch the cursor on or off, or switch the display on or off. It is very disconcerting to switch off the screen by using the Print CHR$(29) statement as the last in the program — you tend to draw a blank if you then try to find out what has gone wrong.

It is also possible to switch the display into Hybrid mode. It clears the top 20 character lines of the display and reserves this space for graphics, while the bottom four lines continue to be used as a scrolling text area for normal alphanumerics.

Penalties exacted

Impressive as this wealth of options may be, there is a drawback in having so many control options accessed through the Character Out channel. This shows itself when you try to Type a non-printing file when in CP/M's command mode. Strange things may happen when a non-printing code is output: the screen can blank out, the video can reverse, bleeps sound, the keys start to click and, sometimes, you can find yourself "hybridised". Worse still, in a few cases the screen fills up with a pretty pattern and the system crashes. Perhaps it is a just punishment for being naughty, but North Star, through Comart, ought to sort out this problem.

Though the performance of the Advantage under Graphics CP/M is impressive, it is overshadowed by the spectacular things that can be done using North Star's own Graphics Basic which runs under Graphics DOS. It is a full-blown Basic interpreter with a host of special graphics-handling statements. An imaginary cursor can be positioned anywhere within the screen's area by means of the Move statement and, relative to that position, lines, circles, ellipses, rectangles, arcs of circles, "pie-slices" and chorded arcs of circles can be drawn with or without shading.

A sad day

Its simplicity is demonstrated by this two-line program, which draws a near-perfect high-resolution circle of 50 pixels radius centred 100 pixels from the left of the screen and 80 pixels up from the bottom:

```
10 MOVE 100, 80
20 CIRCLE 50
```

Substituting

```
CIRCLE 50,29
```

in line 20 produces a solid circle, and

```
CIRCLE 50,32
```

produces a circular area of diagonal slash lines without an external perimeter line.

The Graphics Basic may not be as fast as doing the same thing in assembler, but it does make complex graphics programs possible even for the most mediocre of programmers. It was, indeed, a sad day when Comart asked for the machine to be returned.

Conclusions

- **The Advantage is a compact, highly-sophisticated piece of hardware with a multitude of versatile, software-controlled options.**
- **It is well supported with software through CP/M and North Star's Graphics DOS and, in particular, Graphics Basic. If WordStar were patched to make use of the 15 function keys instead of the usual control keys for the more commonly used word-processing operations, the Advantage would act as an easy-to-use office letter writer.**
- **It is housed in a strong cabinet that will easily stand up to a normal office environment. With 720K of disc storage within, it would form a significant small business system.**
- **Disc-to-disc transfer rates are slower than in other systems.**
- **The hardware and software documentation presented for review is weighty, well presented and easy to follow. It contains all the necessary facts, but if you wish to make use of the software-controlled options at a system level you will, nevertheless, need to read it very carefully indeed.**
- **The graphics-handling ability of the Advantage leaves very little to be desired of such a reasonably priced machine, but much of the credit for this goes to the graphics software.**

Specifications

Dimensions: 480mm. deep, 510mm. wide, 315mm. high.
Weight: 19.5kg.
Power requirements: 230V/at 1A.
Ambient operating temperature range: 10°C to 40°C; cooling by integral fan.
Central processor: Z-80 operating at 4MHz plus 8035 microprocessor for keyboard and disc control
Memory
Main RAM: 64K by nine-bit (eight bits plus parity)
PROM: 2K by eight-bit; contains Bootstrap
Display RAM: 20K by eight-bit
Video display: 11in. green phosphor screen
Normal display: 24 lines of 80 characters per line
Character matrix: five-by-seven character in eight-by-ten dot matrix
Graphics display; 240 pixels high by 640 pixels wide
Keyboard: 87 keys: 49 alphanumeric, Qwerty layout; 14-key numeric pad; 15 programmable function keys; nine control keys
Disc drives: twin 5.25in. double-sided hard sectored; 720K total capacity; 35 tracks per side; 10 hard sectors per track; 512 bytes per sector; 250 kilobits per second transfer rate; 5ms. access time, track to track
Input/output
Integral: internal loudspeaker for bleep
Extendable: six slots for optional I/O boards within cabinet with provision for sockets to the outside world
I/O boards
Serial I/O: RS-232 serial port; current loop option; 45baud to 19.2Kbaud, asynchronous; 2,400baud to 51Kbaud, synchronous
Parallel I/O: eight-bit data in and out, with three handshake lines
Distributor: Comart, St Neots, Cambridgeshire PE19 3JG. Telephone Huntingdon (0480) 215005
Price: £2,295 plus VAT

...now on the IBM Personal Computer.

TABS unique business software is a flexible package designed to maximise business efficiency and profitability.

TABS is also **modular**. Each IBM module may be run individually or together. Modules currently include System Generation, Sales Ledger, Purchase Ledger, Nominal Ledger, Stock Control and Payroll.

The system is **fully integrated** so that updated information on one module automatically updates information on a related module e.g. items entered on the Sales Ledger would deplete Stock Control.

Each module is **parameter driven** enabling end users to adapt each module to suit their unique accounting requirements.

The TABS system is **upgradeable**. It bridges the gap between micro and mini computers facilitating expansion from the single user system to the multi user system on SYSTIME and D.E.C.

Finally, TABS is **universal**. The modular system currently running on the IBM Personal Computer, PET, Apple and Superbrain will shortly be available on most CPM microcomputers.

We would, however, like to add a word of caution to the end user. Naturally a package as flexible as this is a sophisticated product and although simple to operate we strongly advise professional help either from your Dealer or from TABS during its installation.

● Circle No. 140

PC IBM

For more details about TABS software and hardware, please tick box(es) and return coupon to us. We are pleased to offer credit card facilities to our customers.

Dealer enquiry

☐ Please send me details of your Dealer Plan

User enquiry

☐ Please send me details about TABS accounting systems

☐ Please send me the TABS User Manual £20 inc p&p

I enclose cheque/postal order for £ ____________

Signature ____________

Name ____________

Address ____________

____

Tel. No. ____________

TABS Ltd, Sopers House, Chantry Way, Andover Hants. SP10 1LU
Telephone: Andover (0264) 58933

Accounting Business Systems
TABS

At first sight this European competitor to the Apple looks like an expensive choice but, as Simon Rushbrook Williams has found, it could be the economical alternative for some purposes.

PEARCOM IS A NEW Dutch-built contender for the Apple sector of the market. Although the hardware is different, from the point of view of software it can be made to look identical to an Apple II.

The machine is supplied as a microcomputer frame with 32K of RAM and no software language at all. There are no PROMs on board, and no operating system or monitor programs. The review machine was already fitted with an Apple Autostart ROM set which is recommended by Pearcom. In this way the copyright of Apple software is not infringed.

Pushing the start button illuminates three coloured LEDs. A green glow confirms that power is being supplied, red that the main board has a clock running, and yellow that the keyboard is running, or at least has a pulse train on it. These seem an unnecessary gimmick. If there is a need for indicators of properly functioning boards, then they should be on the boards so they will be seen by a service engineer.

Keyboard quirks

The manual praises the high quality of the reed-switch keyboard but the keystroke is long, the keyboard is uneven and it feels cheap. Keyboards are personal things and I did not like this one. In addition to the normal keys there is a numeric keypad and seven function keys. Three are used for a special shift function and allow access to the ASCII characters normally forbidden on an Apple. The others are available as user keys.

To the right of the keyboard is a cover held by a screw. On the pictures in the manual and in the advertisements this holds a zero-insertion-force socket, presumably for a PROM programmer, but on my sample there was just a blank panel with ideas in the manual on what to do with it. It can be useful to have a customising area and this should tidy up some applications. It was unfortunate that the blank panel was on the right of the machine as the main board was below it. If it had been on the left of the machine then the full depth of the case would have been available for circuits without danger of shorting out the board below.

There are four sockets on the side of the case. Two DIN plugs allow connection to cassette and one of them carries the sound output of the internal speaker so that you can record program output.

One video output is a modulated colour output to a PAL standard, together with a sound carrier, so a TV can give both colour and the output of internal speaker if required. The second output is for a black-and-white monitor.

To compensate for the lack of colour here, a true 16-level grey scale is supplied. This is a very fine feature compared to Apple outputs on a normal black-and-white which are often confusing if colours are used. If you wish to play sound from the TV only, then a volume control for the internal speaker is supplied on the board.

Inside the case there is plenty of space.

Specifications

Processor: 6502, compatible with all Apple hardware and software
Languages: None supplied
Monitor: None supplied; UHF/PAL colour output
Keyboard: QWERTY, numeric keypad and seven function keys
Memory: 32K RAM, expandable to six 96K
Expansion: 14 I/O expansion slots; six ROM or EPROM sockets; bus compatible with Applesoft card
Dimensions: width 520mm., depth 490mm., height 130mm. (all approximate)
Price: £975

PEARCOM

At the bottom is a large circuit board, with 14 I/O slots along the back which are identical to the seven slots to be found on the Apple. The usual games I/O socket is found near the centre right of the board.

The ROM sockets are selectable to be 2716 EPROM compatible or Applesoft ROM compatible by soldering a jumper pair together, so you could make your own system software.

There are plenty of sockets for 4116-type RAM. The basic Apple 48K of RAM is there, although to keep the price below the magic £1,000 figure only 32K is provided. The rest of the RAM sockets are for four extra pages of the top 16K of memory. Any page can be selected but only one can be active at any time.

The output on a black-and-white monitor was excellent and the grey scale improved many of the low-resolution graphics pictures with no harmful effects on the high-resolution output. The colour output to a TV was sharp and good. Pearcom has given four extra colours with the effect that Apple black 2 is now green, so some of my programs produced unexpected colours on a green background. Versawriter confused many colours; however, a few software patches should cure all, and new colours are always welcome.

All of the expansion cards worked without flaw. The Pearcom can work just like an Apple, but if that is all you want then the Pearcom is an expensive way to get it.

Pearcom's control comes from address −16288 or C060 hex, the cassette input port with bit 7 connected to the tape. However, Pearcom has made this a read-write port with bit 7 still as was, bit 6 not used and the lower six bits used to control all the Pearcom goodies.

Bits 5 and 4 control the character set displayed. Both upper and lower case, together with Greek and special symbols reside in the EPROM on the keyboard. What appears on the screen when a key is pressed depends on the value in these bits. If both bits are zero then the system looks Apple-like. If bit 4 is set, lower case is sent to the screen.

With the addition of a little software the keyboard allows proper shift operation. Bits 0, 1 and 3 control the extra RAM, which is configured usefully. If all three bits are zero then the system is Apple-like. However, the top 16K of RAM can be addressed using bits 0 and 1 to give one of four possible pages. So, for example, on a disc boot Dos will reside in the default page. If you now change bits 0 and 1, then Dos no longer occupies the top 10K and you have blank RAM. Obviously your software must handle these bits so that then the 0 page is selected when you want to use disc.

Extra graphics pages

If bit 3 is set to logic 1, then the memory is changed to be page mapped in text, low-resolution graphics or high-resolution graphics, whichever is active. In other words, you now have page maps of your screen. As each screen already has two areas in Apple RAM, pages 1 and 2, you end up with 10 possible text or graphics pages available by changing a single address. Those programmers who already use HGR1 and HGR2 commands will see immediately the use of the extra eight pages. You can have 10 pictures all set up and switch between them in a few microseconds.

The last bit, bit 2, selects which seven of the 14 slots are active. All the DMA and interrupts are active all the time, and while I cannot see how to poll which slot is interrupted, I managed to get a clock running in an extension slot while the normal slots were active and still update software on an interrupt from the clock.

A nice feature of location C060 is that when read, it not only displays the cassette data, but also the current state of your control latches. This makes programs a little easier.

Trial and error

The Pearcom comes with a file-like manual and an address to write to for a year's free update. The translation into English leaves much to be desired, and though a considerable amount of information is included it took a long time to find it. There are technical errors where 8 is printed as 3 or B. There are five pages on binary number systems but only one page on the screen mapping of the extra memory. I found the manual very confusing and often resolved what it meant only by trying out ideas on the machine. It is not for the beginner.

Suggestions for changing component values to increase repeat-key rate, and to solder jumpers on the board were dangerous. While it is often possible to improve or fine tune a board, it is not for a beginner, and unclear instructions in a manual could lead to warranty problems.

If you were to buy an Apple and expand the number of I/O slots, buy a colour card, an upper- and lower-case card and some memory expansion, together with a numeric keyboard, then you would have to lay out more than required if you were to buy a Pearcom, an Apple PROM set and some RAM. For those people who would require these systems extensions, or for a dedicated control unit, the Pearcom frame is ideal. For a user who intends to demonstrate Apple cards or for a research group with a number of I/O cards, the Pearcom could be the solution.

Some problems which present difficulties for an Apple can be solved instantly on the Pearcom. There is a place for the Pearcom in the market, but costing needs to be done carefully.

Conclusions

- **The system works just like an Apple and all software and peripherals should work.**
- **The documentation is poor but contains all necessary information if you are prepared to look for it.**
- **If you do not intend to use the extras, then the Pearcom is a more costly option than an Apple.**

Superbrain prepared for hard times ahead

With a 6Mbyte hard disc in place of one of the mini-floppies, Encoltel's modified Superbrain should give you memory to spare. Peter Laurie has been finding out more.

THE ARRIVAL of hard discs in the same size boxes as 5.25in. floppy drives has produced a new kind of machine: the true desk-top information box. The first we have tried is a Superbrain conversion from Encotel of Croydon, using the Rodime system described in December's *Practical Computing*.

The 6Mbyte drive which replaces the second mini-floppy runs under CP/M 2.2. Although the outward manifestations of this change are slight — all you can see is a flat black surface in place of the disc door — the effect on performance is startling. Even more amazing, the thing worked as soon as we turned it on. This is by no means universally true with equipment we get for review.

When the machine is swtched on, the helpful prompt appears:

```
Hit any key to boot off hard disc
F to boot off floppy
```

On booting, a directory appears of the logged-in drive.

Although CP/M 2.2 will control up to 8Mbyte of disc, Encotel has chosen to split the 6Mbyte available into two 3Mbyte drives, A and B. If you boot off the floppy, they become E and F, while B, C and D are transferable drive names that make it easy to copy from one floppy to another in the single drive.

Size is the great asset of a hard disc, though even 6Mbyte — which needs six months' non-stop typing to fill up — disappears surprisingly fast. Speed is also impressive: accesses off the hard disc seemed to be about six times as fast as those off the floppy. You can take standard CP/M software, transfer it to the hard disc and relax.

Unlike earlier hard-disc drives the Rodime is tough and quiet. You do not need to lock it before you move it and unlock it before you use it. The machine will stand being bumped about from car to desk. In use it is so quiet that you have to press your ear to the casing to detect head movement.

The only defect we found in the machine after a couple of weeks of energetic use was a very obvious bug — which is not connected with the hard disc — in the keyboard scanning routine. It would capture but fail to print about one key stroke in 10. This made many programs almost unworkable, but Encotel says that the problem is being remedied.

A hard disc takes a minute or so to run up to speed. If you boot too early, it may work and it may not. This gave us a few nasty moments, when the hard disc appeared to have vanished together with its precious parcel of data. However, switching off once again and waiting for a while before booting restored matters to a proper condition.

Conclusions

- **The Rodime installation in the Superbrain is neat and works well.**
- **It gives greatly increased storage and speed, and would make a very desirable personal computer. A 12Mbyte version is on the way, and on the horizon Rodime and other manufacturers are talking about 50 to 100Mbyte systems.**
- **We ran the machine for only a fortnight so we can say nothing about long-term reliability.**
- **Back-up is still a problem. However reliable a hard disc is, I would not be happy using it without some simple method of back-up. The prospect of shuffling a couple of dozen mini-floppies every evening does not appeal.**

Compelling v... of MBasic's c...

Chris Bidmead found that the compiled variant of this powerful Basic dialect increases its speed and security while retaining the programming flexibility of the slower, interpreted version.

IN THE BEGINNING, that is the mid-1970s, an Arizona software house was supplying a small but handy, cassette-based Basic interpreter to companies like Exidy, Radio Shack and Apple. As the microcomputer momentum grew the firm grew too, and so did its Basic.

The modest 8K package grew into a larger disc version, which went on to become the extended disc Basic that is now as much a standard piece of silicon furniture as CP/M itself.

In 1980 Microsoft released a package that enabled MBasic source code to be crunched down to .Com command files that would run independently of the interpreter. In theory, at least, this gave Basic programmers a big advantage over the Cobol and Fortran fraternities, namely the luxury of interactive development under the relatively slow interpreter, with the opportunity to produce fast stand-alone programs as a final product.

The MBasic interpreter takes the source code a line at a time, then does the necessary computation by calling the big bundle of subroutines it keeps standing by in core memory. In addition to knowing how to unravel the English-like code you have written, this run-time package must contain all the routines to do anything the language will allow.

Pre-processing

Microsoft's 1980 release was a compiler. Whereas the interpreter crunches the source code at run-time, the compiler goes to work on the source code in a series of separate stages that must take place before the program can be run.

At first pass the compiler package produces relocatable code, so called because all its addresses are stored as relative rather than absolute quantities. This way the code postpones having to define where exactly in memory it will be placed before it is run.

In the second pass, when the proper computations are done on the addresses, the linker patches together this relocatable code with similarly structured standard routines borrowed from the MBasic standard library. The result is a single, coherent program.

Compiling and linking take time and trouble. The compiler is also expensive — somewhere around £200 on top of the cost of the interpreter — but its chief advantage is speed. In contrast to the purpose-built code the compiler produces, the interpreter is a time waster.

If you had some horrendous number-crunching program that would take 100 hours to run under the interpreter, the compiler might be able to reduce this to 10 hours. This does not apply to programs that have to hang around for real-world devices like discs. In a program which keeps the discs spinning as it sorts names into alphabetical order, for instance, compilation will not shorten the run-time.

Security problems

However, compilation has other advantages. Interpreted source code can be read, its cosmetics altered, and the package resold by the software pirate. Although MBasic interpreter from version 5.2 anticipates this problem by allowing you to set a /P, Protection, switch when you save, to prevent the user listing the file, Lifeboat Associates now markets Unlock. This is described as "a development tool for the Basic programmer". What it does is unravel protected MBasic code.

Compiling, on the other hand, really can prevent what the copyright notices call "unauthorised access". Although compiled code is not entirely immune to the determined unraveller, it takes so much time that anyone with the knowledge necessary to disassemble it would probably be better off rewriting the thing from scratch.

A professional software house might use compilation to keep the code away from the user for another reason. If it sells a program for grown-up money it is going to be expected to support it. Support implies systematically collecting bug reports, issuing revisions and dealing with the odd one-off mysterious crash. This process is hair-raising enough without the suspicion that users may be reporting faults on code they have tweaked in the privacy of their own workplaces. Electrical-goods manufacturers like to seal their products with the notice "No user-serviceable components beyond this point". Software houses are following their example.

Simpler for users

Compilation has an advantage for the customer too. It is possible to configure an interpreted business system with CP/M's Submit facility so that the user simply types Run Accounts. Many modern CP/Ms now offer an autoboot feature that allows you to boot up directly into the program suite without having to enter anything at the keyboard. Comprehensive instructions would still have to be given for loading the interpreter and the program separately if for any reason the turnkey version failed to work.

A compiled program presents a simpler face to the non-computing user. And even though the latest version of the compiler does require a few odd bits and bobs in addition to the Com file, these are more or less invisible to the user.

The MBasic interpreter takes up a lot of space in the machine, limiting the amount left available for the program itself. Because the compiler has an opportunity to digest the source code in chunks larger than single lines it is able to do a certain amount of optimising, and having "seen" the whole program before run time, it knows to leave out routines that are never going to be called.

More compact

Well-designed compiling systems search a large library file and pick out only those routines that the programmer's code calls for. So although a run-time package of subroutines still has to be appended it is likely to be more compact than its interpreter counterpart.

Compilation lets you write bigger and more useful programs in the same space as simpler interpreted code. What happens if you are taking advantage of MBasic's unique facility to debug code prior to compilation, by running it interactively with the interpreter? How can you compile programs larger than the interpreter can handle?

The MBasic compiler has borrowed a trick from the up-and-coming Bell Labs language C. The compiler allows a %Include instruction that will pull in code from a defined file and process it exactly as if it were part of the current source file. Once you become reasonably proficient at manipulating the compiler and designing your code in modules, as the structualists recommend, you can soak test your subroutines separately in interpreter mode and patch them all together at the moment of compilation.

The linking of .Rel files is a technique derived from Basic's predecessor, Fortran. Any .Rel file can also be produced from assembler code, and the facility for doing this — an assembler called Macro 80 (M80.COM) — is thrown in as part of the MBasic compiler package. By this means chunks of assembler code can be incorporated into your MBasic routines, providing an extremely powerful extension to the language.

Macro 80 is one of the most comprehensive 8080/Z-80 assemblers we

...rtues ...ompiler

know, but recent graduates from MBasic interpreter should not be deterred by the weight of the manual. Learning to write short bursts of assembler requires nothing more than patience and the ability to think like a chip — simple, pure thoughts that would not strain the understanding of your average eight-year-old. M80 is packed with facilities to make all this even simpler, but unfortunately they are rather complicated to explain.

Call routines

As in the interpreter, external code can also be reached from Basic through the Call statement. For example,

```
CALL ZAP(A,B,C)
```

transfers execution to the memory address given by the variable Zap, with arguments A,B and C, all of which must have been assigned values earlier in the program. In the interpreter an absolute value will have to be assigned to Zap in a previous line, but the compiler expects Zap to be a global symbol set up by some other chunk offered up to the linker. So to compile a program that calls an absolute location such as a CP/M routine you will have to link in a small assembler patch along these lines:

```
      PUBLIC  ZAP     ;declare ZAP
                      globally
ZAP:  EQU     33423   ;the address of
                      the code start
      END
```

or of course the code you are calling could always be written directly in the assembler from the label Zap onwards. The USR facility can be made to do the same sort of job, but it is really only there to provide upward compatability with the cassette-based 8K version, and is best avoided.

The linker, L80, is the same program supplied with Microsoft's other two main languages, Cobol-80 and Fortran-80, so it is possible in theory to write code in any of these languages and link it all together to form a single running program. In practice parameter passing tends to become difficult across languages, so you will probably stick to pure Basic, with the odd machine-code routine thrown in.

Your early attempts at compiling will be discouraging. You have written your program in the MBasic interpreter, and it works. To run it through the compiler the simple CP/M command level instruction

```
BASCOM = <yourprog>
```

will do the trick if you do not want to change any of the defaults.

Some options can be added to the command line such as

/O — use the original version of the library at Link time
/Z — write Z-80 code wherever possible
/D — include extra debugging and error handling code

Discs will whirr, and then a sinister line will appear on the screen saying:

```
37 Fatal Errors
```

or words to that effect. Even when you become proficient and manage to write programs the compiler does not balk at, the compiler will still close with:

```
0 Fatal Errors
```

reminding you that you only just got by with it that time.

The grudging approval of the compiler is no guarantee that you are home and dry with a runnable program. The linker has its own criteria to fulfil: in particular it has to find a subroutine in the library, unless you supply it, to match the name of every function your program is trying to evoke. Called globals, because unlike local names they are known and understood outside the parish of each individual chunk of code you are linking, these are the rivets that stick the whole thing together.

The linker will throw up the names of those that do not match. So when you get an incomprehensible screenful of

```
UNDECLARED GLOBALS
```

do not think your computer is just being insulting.

If you come to it from the Basic interpreter, the whole process will strike you as quite time-consuming.

On ordinary 8in. discs a compilation and a link of a moderately sized program may take 10 minutes while it creates the necessary symbol tables, writes them back to temporary files on the disc and updates them. With mini-floppies the process can take even longer, although one of the new mini-Winchester devices may trim the time to no more than a minute or so. To make any substantial program work you will probably have to go through the compilation/link process several times to iron out the bugs, at least until you get to know the compiler's little idiosyncrasies.

In principle the interpreter and the compiler are the same language, but in practice there are small but important differences. Obviously the compiler has nothing to do with the interpreter's Immediate mode, and the Edit command is out, along with Auto, New, Renum and Save. Another difference that should not raise an eyebrow is the compiler's refusal to deal with lines longer than 128 characters, whereas the interpreter can cope with 255. The compiler limitation refers to physical lines, and once you advance to the stage of writing long logical lines you will have learnt how to format them properly into short physical lines using the line-feed character.

Some versions of the interpreter are reputed to support constructs such as

```
400 FOR I = 1 TO 10
410 FOR J = 0 TO 5
. . . .
450 NEXT I
460 NEXT J
```

which the compiler sensibly throws out, and a similar restriction applies to While-Wend. The careless rapture of jumping into the middle of both sorts of loops with a Goto, permitted in the interpreter, is also beneath the compiler's dignity. If you insist on writing code like this you will have to stick to the interpreter.

Arrays will have to be declared statically. If you have found it handy in the interpreter to be able to say

```
10 IF BIG THEN A = 20 ELSE A = 10
20 DIM BUFFER(A)
```

you will have to do some rewriting. The compiler has to set aside space in the .Rel file to accommodate the array, and cannot wait till run time to know the dimensions. For similar reasons Erase will no longer let you scrub out an array prior to redimensioning. The line containing the Dim statement must physically precede the use of the array; you cannot, as in the interpreter, tidily collect all your Dim statements into a subroutine at the end of the program.

Where the difference can become annoying is in the input/output routines. You may have discovered in the interpreter that an empty carriage return in response to a line like

```
20 INPUT A$
```

loads an empty string in A$, i.e., puts A$ = "". This is handy in a routine like menu selection, where you can offer a series of options

```
ENTER "A", "B", "C" OR "D"
```

or let the user fall back on a default by hitting carriage return.

Still waiting

The compiled version of the code responds to a carriage return by waiting for the string it was promised. One way out is to abandon the use of Input altogether and employ Input $(n) instead. If n is greater than 1 you and your program will probably be thrown by the fact that back-spaces entered by the user to correct mistakes in the input count as characters.

It is simpler to use Input$(1) — some versions allow Inkey$ — and write a small routine that catches back-spaces and unwanted control characters. An editing input routine like this would be worth considering as an assembler module, to be linked in as a .Rel file.

Writing larger and larger packages will eventually bring you up against a particularly infuriating feature of the package: a program that runs under the interpreter and has been compiled without errors may come unstuck with L80 because your .Rel files are bigger than the available memory.

The only way out of this is Plink, a

(continued on next page)

(continued from previous page)
providential package available from Lifeboat Associates. Plink can link files larger than memory by winding them on and off discs, so the size of the files it can deal with are limited only by the disc space at your disposal.

With the release of the new compiler it may not be necessary to write files this big. In MBasic it has always been particularly easy to Chain files, so that a complete business system can be built up out of a series of sections, each one a self-contained Basic program. This is the ideal way of structuring Basic programs.

Unfortunately the old version of the compiler lacked the facility, available in the interpreter, of passing values from program to program through variables designated as Common. The alternative method of communication between modules was by temporary data files, although the disc accesses that this implied necessarily slowed the program down.

New version

The new version of the compiler takes a big step forward. An early code line will list the variables whose values are to appear identically in the Chained and Chainer programs:

```
100 COMMON A, WEEKSPAY, N,
  EMPLOYEE$()
```

and the job is done. The same statement must appear in all the programs that are supposed to be tapping into these values and the variables must be listed in the same order.

With a large program the designation may run to several program lines. In this case the burden of the clerical work can be lightened by making use of the %Include instruction. The Common statements can comprise a separate small file, called Comdef.Bas, or whatever. This file is then written into every file interested in the variables if each of them carries

```
??? %INCLUDE COMDEF.BAS
```

where ??? represents any line number that precedes the first executable statement.

The bad news about this new version of the compiler is its size. Instead of having the Basic .Rel file pick out only the subroutines it needs from the Bascom library, which takes quite a lot of time during the link run, Microsoft has bundled the more commonly used routines into a discrete run-time file called BRun.Com, which every compiled MBasic program will now have to pull into memory as its first act of office. BRun.Com is 16K in size. However short your program, it will always occupy at least that much memory.

Because Basic does not allow subroutines created by the user to be called by name, and because of the limitations in passing parameters to those routines, Basic compiler writers try to soften the rough edges of the language by offering more and more built-in statements and functions. BRun.Com is an admission that the inclusion of the Chain with Common facilities has made the Baslib library unmanageably large.

The idea of a separate run-time package is not new. CBasic has it, as do some of the Pascals, notably Pascal/M. But Bascom ingeniously does its best to make the extra file invisible to the user. Whereas the traditional CBasic user has to prefix a call to CRun2 before the reference to the program he wants to run, the MBasic machinery is set to make the calling of the run-time package automatic when the program name is fed to CP/M's command line.

The only difficulty arises when the user program finds that BRun.Com is not on the expected disc. The location of BRun.Com has to be defined at link time, and the linker reads it from a small text file called BCLoad.

Time saved

The invisible machinery is fine for substantial programs, especially for dealing with a series of programs that Chain each other. The bulk of the run-time package stays put and the application programs are overlayed in the memory area above it. The library does not have to be called in from disc each time a new program is brought in, and disc transfer time is saved.

Nonetheless the whole arrangement is rather cumbersome for the sort of short and sweet programs that Basic does best. For this reason Microsoft includes on the release disc a copy of the old version of the compiler library, now renamed Obslib.Rel. Obs does not stand for "obsolete", indeed the old library is still an important part of the development package. The code it creates takes less memory, and will run independently of any outside help. What it will not do is support Chain with Common.

To check the mechanism we took a short test program:

```
10 DEFINT K: DEFSNG B
20 PRINT "START"
30 FOR K = 1 to 5000
40 B = K/K
50 BB = K*K
60 NEXT K
70 PRINT "STOP"
```

and put it through the mill in three different ways as shown in table 1. These timings are obviously hardware dependent, particularly as the compile and link figures include the time taken to pull the systems files in off our rather slow Micropolis 5.25in. discs. The third row gives genuine computation time, taken from the program's Start and Stop prompts, and you will see from this that compilation gives an improvement of 130 percent. Run timings are identical between the old and new libraries, but the improvement in link time, even for this small program, is very noticeable.

	Interpreter	New library	Old library
Compile	N/A	25s.	25s.
Link	N/A	1min. 20s.	1min. 55s.
Run time	46s.	20s.	20s.
Disc size	2K	2K	10K
Mem size	28K + D	16K + D	10K

Table 1. Performance of test program under interpreted and compiled MBasic.

Memory space

The disc-size row reflects the fact that typical mini-floppy implementations of CP/M try to improve disc speed by refusing to deal with memory transfers below a certain minimum, the block size. The actual size of the test program in memory under the interpreter is trivial, designated in the last row of the table as D. Most of memory in that case consists of the 28K of the interpreter.

Similar remarks apply to the program as compiled with the new library: the bulk is taken up by the 16K BRun package that must co-reside in memory. Notice that the total compiled size is larger under the new system; the 10K in the last row shows that the linker has selected only those routines associated with the test program.

As with all benchmark tests, the language comprises more than the two statements tested in this program so be cautious with the run-time figures. Change the program lines:

```
40 B = K^.5
50 BB = K^3
```

and you have a program that runs at 5 minutes 20 seconds whether you compile it or not.

Conclusions

- **The MBasic compiler package can be used without the interpreter, the programmer writing the source code as an ASCII file.**
- **Probably the best use of the compiler is in crunching down Basic programs developed under the interpreter. Used like this the whole MBasic5 package makes a very powerful program-development system.**
- **The new version of the compiler lets you create a complete suite of programs that pass values from one to the other. Very sophisticated business software can result, as there is now virtually no limit to the total size of the code.**
- **The bad news is that Basic is still Basic. It is worth repeating that a language should help you think about the problem, as well as code it.**

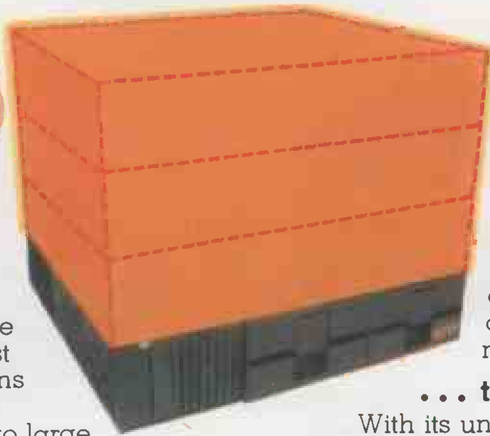
STACKED WITH FEATURES

Each unit supports up to three users – each with 4MHz Z80A and 64K RAM

Standard serial and parallel interfaces; CP/M-compatible operating system

Virtually no limit on number of users; hard discs

Prices from £1299



The Ring and the Stack

The Sig/net concept – the simple interconnection of functional computing modules on the unique Sig/net Ring – achieves the widest variety of hardware configurations at the lowest possible cost. From single-user floppy drive systems to large multi-user configurations sharing hard discs and expensive printers, Sig/net can provide the right specification. And it can be expanded at low cost from a basic system to multi-user operation in which each user has a processor for full speed operation. There is virtually no limit to the hardware configurations possible.

The newly introduced 1000 Series has been designed especially for multi-user systems. One slim unit, serving up to three users, stacks on top of another. A twelve user system with over 800KB of internal memory and 16MB of hard disc requires only five units and measures just 420mm square and 450mm high!

All this advanced hardware is backed by an established dealer and distributor network to guarantee end user support and the CP/M-compatible operating system ensures the availability of the widest range of proven business software.

For you to sell as a dealer . .

Sig/net offers you advantages of advanced hardware, the backing of a professional distributor network and usual trade margins.

. . . to specify as a consultant . .

With its unrivalled expansion potential and flexibility at low cost, Sig/net enables you to tailor a system exactly to a client's needs and to add new facilities as required.

. . . to buy as a user . .

Sig/net offers a high specification at low cost, the potential for expansion with your business, the backing of a national dealer network for continued support and the widest range of business software. Compare it with other systems and see if they match up.

Post the coupon to Shelton Instruments Limited, 22-26 Copenhagen Street, London N1 0JD today or contact your nearest distributor for details.

North Micropute: contact Peter Casey 0625 612759
South and East Interam: contact John Lagan 01-675 5325/6/7
South and West Malvern Micro Systems: contact Ray Mansell 06845 68500
Scotland Video Vector Dynamics: contact Chris Morrow 041-226 3481
Northern Ireland ECL Group: contact Alan Richardson 0232 664737
Eire ECL Group: contact Reg Vian 0001 767042

MAKE THE RIGHT CONNECTION NOW

To: Shelton Instruments Limited, PC2
22–26 Copenhagen Street, London N1 0JD

I am interested in a Sig/net dealership ☐
Please send me further details of Sig/net ☐
Ask my nearest dealer to contact me ☐

Name________ Position________

Company________

Address________

________ Tel:________

Tel: 01-278 6273

shelton sig/net

● Circle No. 142

Sinclair ZX81 Personal Computer – the heart of a system that grows with you.

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

In March 1981, the Sinclair lead increased dramatically. For just £69.95 the Sinclair ZX81 offers even more advanced facilities at an even lower price. Initially, even we were surprised by the demand – over 50,000 in the first 3 months!

Today, the Sinclair ZX81 is the heart of a computer system. You can add 16-times more memory with the ZX RAM pack. The ZX Printer offers an unbeatable combination of performance and price. And the ZX Software library is growing every day.

Lower price: higher capability

With the ZX81, it's still very simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, *and* to drive the new ZX Printer.

New BASIC manual

Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.

Kit: £49.95

Higher specification, lower price – how's it done?

Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

New, improved specification

- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function – useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer.
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

Built: £69.95

Kit or built – it's up to you!

You'll be surprised how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 700 mA at 9 V DC nominal unregulated (supplied with built version).

Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.

iter-

Available now– the ZX Printer for only £59.95

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alpha-numerics *and* highly sophisticated graphics.

A special feature is COPY, which prints out exactly what is on the whole TV screen without the need for further intructions.

At last you can have a hard copy of your program listings – particularly useful when writing or editing programs.

And of course you can print out your results for permanent records or sending to a friend.

Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your computer – using a stackable connector so you *can* plug in a RAM pack as well. A roll of paper (65 ft long x 4 in wide) is supplied, along with full instructions.

16K-byte RAM pack for massive add-on memory.

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

With the RAM pack, you can also run some of the more sophisticated ZX Software – the Business & Household management systems for example.

How to order your ZX81

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day.

BY FREEPOST – use the no-stamp-needed coupon below. You can pay by cheque, postal order, Access, Barclaycard or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR. **Order**

Qty	Item	Code	Item price £	Total £
	Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (700 mA at 9V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack.	18	29.95	
	Sinclair ZX Printer.	27	59.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
	Post and Packing.			2.95

☐ Please tick if you require a VAT receipt TOTAL £______

*I enclose a cheque/postal order payable to Sinclair Research Ltd, for £______

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable.

Please print.

Name: Mr/Mrs/Miss

Address:

FREEPOST – no stamp needed. PRC06

sinclair
ZX81

6 Kings Parade, Cambridge, Cambs., CB2 1SN.
Tel: (0276) 66104 & 21282.

● Circle No. 143

Memotech's New Memory System for the ZX81

It grows as you progress

Memopak 16K Memory Extension - £39.95 incl.VAT

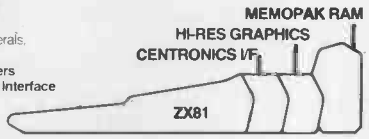
It is a fact that the ZX81 has revolutionised home computing, and coupled with the new Memopak 16K it gives you a massive 16K of Directly Addressable RAM, which is neither switched nor paged. With the addition of the Memopak 16K your ZX81's enlarged memory capacity will enable it to execute longer and more sophisticated programs, and to hold an extended database.

The 16K and 64K Memopaks come in attractive, custom-designed and engineered cases which fit snugly on to the back of the ZX81, giving firm, wobble-free connections.

See below for ordering information.

Coming Soon...

A complete range of ZX81 plug-in peripherals.
Memotech Hi-Res Graphics
Centronics Interface and Software Drivers
Memotech Digitising Tablet RS232 Interface



All these products are designed to fit 'piggy-back' fashion on to each other, and use the Sinclair power supply. WATCH THIS SPACE for further details. We regret we are as yet unable to accept orders or enquiries concerning these products – but we'll let you know as soon as they become available.

How to order your Memopak.

By Post: Fill in the coupon below and enclose your cheque/P.O./Access or Barclaycard number.

By Phone: Access/Barclaycard holders please ring Oxford (0865) 722102 (24-hour answering service).

Memopak 64K Memory Extension -£79.00 incl.VAT

The 64K Memopak is a pack which extends the memory of the ZX81 by a further 56K, and together with the ZX81 gives a full 64K, which is neither switched nor paged, and is directly addressable. The unit is user transparent and accepts basic commands such as 10 DIM A(9000).

BREAKDOWN OF MEMORY AREAS

0–8K . . . Sinclair ROM

8–16K . . . This section of memory switches in or out in 4K blocks to leave space for memory mapping, holds its contents during cassette loads, allows communication between programmes, and can be used to run assembly language routines.

16–32K . . . This area can be used for basic programmes and assembly language routines.

32–64K . . . 32K of RAM memory for basic variables and large arrays.

With the Memopak 64K extension the ZX81 is transformed into a powerful computer, suitable for business, leisure and educational use, at a fraction of the cost of comparable systems.

Unique 3 month trade-in offer!

When your programming needs have outgrown the capacity provided by 16K RAM, and you find it necessary to further extend your ZX81's capacity, we will take back your 16K Memopak and allow a discount of £15.00 against your purchase of our 64K model.*

**We reserve the right to reject, for discounting purposes, units which have been either opened or damaged in any way.*

Please make cheques payable to Memotech Limited

Please debit my Access/Barclaycard* account number

*Please delete whichever does not apply.

SIGNATURE ____________ DATE ________

NAME ____________ ADDRESS ____________

Please send me:

	Quantity	Price	Total
16K RAM, Assembled		£39.95	
64K RAM, Assembled		£79.00	
		Postage	£2.00
		Total Enclosed	

We want to be sure you are satisfied with your Memopak – so we offer a 14-day money back Guarantee on all our products.

Memotech Limited, 3 Collins Street, Oxford OX4 1XL, England Telephone: Oxford (0865) 722102/3/4/5

From simple arithmetic to A-level chemistry

Publishers have traditionally been unwilling to risk producing software for schools. Now Michael Trott asks if 1982 is to be the year of educational software.

THE MICROELECTRONICS Education Programme offers some Government support to authors of educational software, but equally important from the publisher's point of view supports teacher training and awareness in the application of microcomputers in education. This is likely to create a larger market, making it more profitable for publishers to enter this area.

A few publishers have already taken the plunge. One of the first to do so is Longman, already well established in the educational book market, who last year announced a proposed micro software series. Two of the earliest packages available are Chemdata and Janeplus, both available in disc and cassette versions for the Pet and RML 380-Z initially.

Chemdata is aimed at those teaching chemistry to GCE A-level and provides graph-plotting facilities on the first 38 elements of the periodic table. Chemdata may be used either to teach a whole class or by individual students, although it is perhaps more suited to the former.

Simple plotting

The program stores information related to the following: atomic volume, melting point, boiling point, ionisation energy, atomic radius, oxidation states, group numbers, enthalpy of fusion and enthalpy of variation, any of which may be chosen to form the vertical axis. The horizontal axis may be atomic number, transition metals or a group. It is easy to plot the graphs using simple commands, and equally easy to change either or both of the axes. Facilities for printer output are provided to give hard copy of the graphs or the data file.

A useful command available at any time is Help which provides a list of the commands available. The program is carefully designed so that the user is unlikely to find any real difficulties while running the program, although it is advisable to read the brief but clear guide and running the program.

The review copies supplied were on cassette for the 380-Z and disc for the Pet. The 380-Z version plots points on the graph in low resolution; the Pet version draws vertical lines, the height of which represent the values to be displayed. Both versions have to approximate the values to be represented, because of the screen graphics used, but the errors on the Pet screen are more noticeable, in some cases displaying zero as one character on the screen.

The scaling, particularly of the vertical axis, is poor to the point of obscurity, displaying only upper and lower values with no intermediate markings.

The printed material consists of a manual which provides details of the design and structure of the program, including subroutines and variables and a full listing of both versions which is clearly explained section by section. The manual also explains how to add routines to the program and must be regarded as a plus point in Longman's favour. A running sheet is also provided for novice users, giving clear instructions on loading for the various versions available.

A teacher/student booklet gives details of the facilities available in the program and a short study guide.

The program is reasonably good value for money and is attractively packaged. However, the facilities of the program are rather limited and a colleague who has taught A-level chemistry for some years and is a keen micro user was not particularly impressed.

Janeplus is aimed at a wider ability and a five-to-18 age range. It is designed to be used by the teacher with groups or individual pupils to encourage children to discuss simple mathematical functions. The program draws small figures on the screen, who change numbers in accordance with the function in question. The teacher then uses this as a basis for class discussion.

There are a number of characters in Janeplus, each of which represents a different function, for example, "add 7" or "multiply by 3". The user may choose a one- or two-function problem from these characters.

A typical run through the program might start with two boxes appearing on the screen with a character called Peter between them. The children are then invited to "give Peter a small number". The answer could then be displayed by pressing A, when Peter appears to transfer the number given to him from the left-hand box to the right, changing it in some way. The children would then be asked to suggest what Peter's function is, i.e., what he has done to the number. From the answers suggested, the children can then proceed to narrow down the possibilities by giving Peter further numbers. When an answer has been agreed upon it can be checked by giving Peter another number and entering the children's answer. If they are correct the right-hand box is enclosed in stars and a bell sounds if a printer is connected.

Single functions can be used to investigate either addition or multiplication, and two-function problems present a combination of these. By using the inverse situation, subtraction and division can also be examined. The girl characters multiply and the boys add and in each case the range of integers to be used may be selected as between +2 and +6 or −6 and +6. The program provides opportunities and stimulus for class discussion, and pupils responded well to the program.

The teacher's handbook is very clearly set out, providing details of the program and the decision points, observations in the classroom as well as general advice to the teacher. A program listing is also provided with a summary of the drive-chart conventions. The concept of using drive charts was developed by the ITMA project based at the College of St Mark and St John in Plymouth and has been incorporated into a number of programs from that source. Programs from ITMA have been tested and developed in schools.

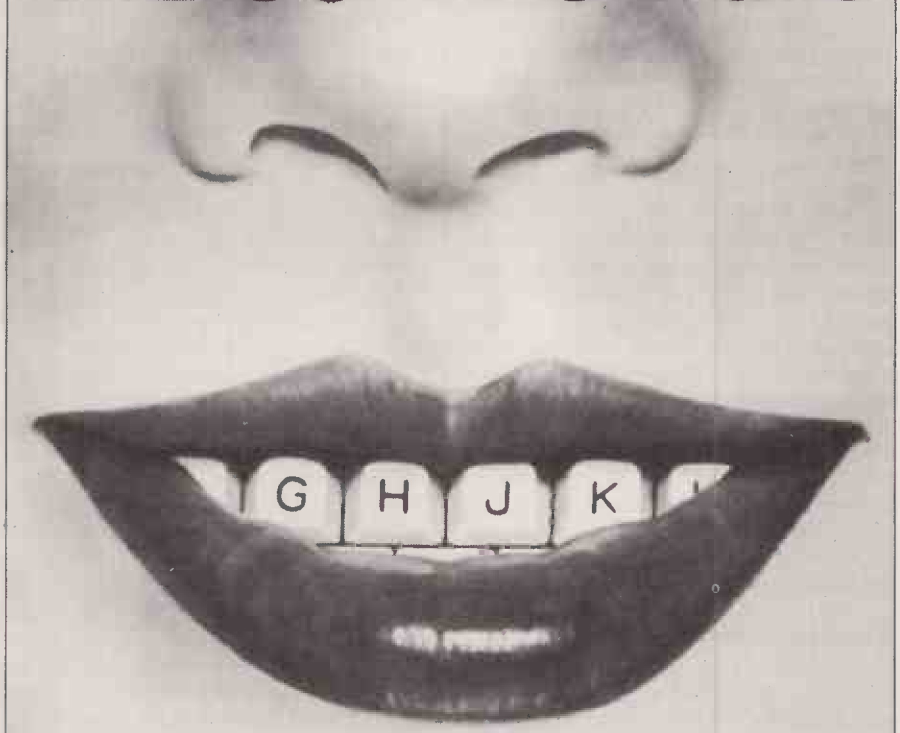
Teachers' introduction

A program called Testdrive is supplied with Janeplus. It is an excellent and amusing program intended to familiarise teachers with the use of drive charts by calling up one of three animals: Claude the cat, Wilfred the wolf or Katie the kangaroo. These animals can then be made to wink an eye, wag a tail and move off the screen, using single-key commands. The program, which comes with an accompanying booklet, provides a really excellent means of introducing the novice teacher to the use of a micro for teaching, thanks to the use of drive charts to run the program.

Conclusions

- **Chemdata and Janeplus each cost £12.50 on disc and £9.50 for the cassette version.**
- **Chemdata is attractively packaged and represents reasonably good value for money, though its facilities are rather limited.**
- **Janeplus is excellent value for both junior and lower-secondary schools. The program provides ample variety to hold children's interest, and is robust and reliable.**

Famous first words



Can computers acquire language naturally? Chris Naylor's simple program takes a few faltering steps towards eloquence.

IF YOU LIKE problems to be so subtle as to verge on the insoluble, a good way of spending the best years of your life is to concentrate on a problem in the field of natural language. Any problem in the field will do, since natural language — English, for instance — is something we all know well while being unable to say exactly how we know it.

That is the essence of the matter as far as computers are concerned. A computer usually has to be told exactly what to do in order to do it. When you learned your native language you were not told how to do it.

All that can usually be said with any attempt at concreteness is that people seem to have a language-acquisition mechanism — LAM, as it is usually called. The LAM somehow enables them to learn a language simply by being exposed to it, rather than by being programmed with specific rules for that language. So you can learn English at a very early age. You could have learned German or even Chinese using the same mechanism.

Your computer is rather different. In all the time you have owned the thing, it probably has not learned a single word, no matter how much you shouted at it. A human infant receives language as a stream of sounds. Sounds which are unfamiliar at first become more familiar as time progresses. From these sounds the infant has to join together words one to another if they make phrases.

The infant is receiving what is known as continuous speech, a solid input stream, unmarked at word boundaries. You can give your computer the same input. To avoid complications — after all, this is only a demonstration — give the machine text rather than audio input and present it in a solid stream. For instance, "present it in a solid stream" is input as

PRESENTINASOLIDSTREAM

which should give you some idea of the problem facing the infant. It is much harder to read with no spaces or punctuation in it. Equally, continuous speech is hard to disentangle when the beginnings and endings of words run into each other.

Your computer now has something to work on which approximates to continuous speech. In its memory you put nothing that will tell it what the words of the language are, or even what the letters are. It has to work that out for itself.

The computer now has to "listen" to a stream of this text and learn the language by doing so. It does this in two ways:

- By scanning the test and noting all the different elements in it: at first these are just the letters of the alphabet to which it is exposed. You do not give it an alphabet to start with, and it does not learn the alphabet all at once, but only as new letters come along.
- By scanning the text and choosing a pair of elements which it thinks go together. When it finds such a pair it adds them to the lexicon as a new word which it has "learned".

Figure 1 is based on the text "it is sunny", which has been turned into a continuous stream "ITISSUNNY" and input to the machine. On input, the program gradually builds up its own lexicon to contain I, S, T, U, N and Y. The program registers in the matrix what letter combinations occur, and the frequency with which they occur.

In this short example no combination occurs more than once, so each element of the matrix contains 0 or 1. With a larger sample, higher-frequency combinations would normally be present.

The program now has to decide which pair of lexicon items can be added together to create a new lexicon item. Having made this decision the lexicon is incremented by one item and the matrix rearranged. Figure 1 shows the arrangement if "it" were to be selected as a word. T disappears from the lexicon, as it ceases to be an item which occurs by itself, and IT is added. The matrix is rearranged to present the new letter combinations considering IT as a letter all by itself.

Programming this much is fairly straightforward. The difficulty lies in choosing which letter pair — in general which pair of lexicon items — to join together. Three types of decision can be made:

A wrong decision: for instance, TI, which is wrong because in this example TI only occurs at a word boundary, not within a word.

A right decision: for instance, IT, which is right because in this example IT only occurs within a word.

An ambiguous decision: for instance, TI, if the text also contained the word "time". It would be ambiguous because it could occur either within a word or at a word boundary.

With extremely large text samples almost all elements would appear to be ambiguous so the problem would appear, initially, to be academic. However, whereas all the elements may be ambiguous, some are still more likely to occur within words than at word boundaries and consequently some make better selections than others. For instance, if the

Figure 2. Original text.

It is summer time. School is over, and the long summer holiday is here.

Jane and Peter talk about their long summer holiday, and what they are going to do.

"I like school," says Peter, "but I am glad the holiday has come."

"Yes, I am glad too," says Jane. "I like sunny days when we have no work to do. There are so many nice things to do in the holiday when it is sunny."

"Yes," says Peter, "and Dad thinks it does us good to get out in the sun. We will be out every day when the sun comes out."

"Do you know there is an old donkey up at the f

Figure 3. Input text.

ITISSUMMERTIMESCHOOLISOVERAND
THELONGSUMMERHOLIDAYISHERE
JANEANDPETERTALKABOUTTHEIRLONG
SUMMERHOLIDAYANDWHATTHEYARE
GOINGTODOILIKESCHOOLSAYSPETER
BUTIAMGLADTHEHOLIDAYHASCOME
YESIAMGLADTOOSAYSJANEILIKE
SUNNYDAYSWHENWEHAVENOWORK
TODOTHEREARESOMANYNICETHINGS
TODOINTHEHOLIDAYWHENITISSUNNY
YESSAYSPETERANDDADTHINKSIT
DOESUSGOODTOGETOUTINTHESUN
WEWILLBEOUTEVERYDAYWHENTHE
SUNCOMESOUTDOYOUKNOWTHEREIS
ANOLDDONKEYUPATTHEF

Figure 4. Analysed text.

HE	DO	
THE	SUM	SAYS
HO	SUMME	SC
AY	RE	SO
AN	SUMMER	IT
LI	IN	JAN
HOLI	HEN	HIN
HOLID	ER	VER
HOLIDAY	TODO	SCHO
ME	HA	LIKE
SU	PE	SAYSPETER
UT	PET	SUMMER
AYS	PETER	HOLIDAY
TO	IS	ITIS
SUN	WHEN	JANE
AND	KE	

program chose TI early on, it would have a hard job choosing the words "it" and "is" when they occur together. Every time the machine sees "itis" it assumes the segmentation I TI S. The pairs of elements IT and IS are removed from the matrix when TI was formed.

In order to be able to choose which items to join together, the program has to have some information about them. There must be variables associated with the various combinations. However, like a new-born infant, the program knows nothing about the letters themselves — it only knows what it can build up from experience. Obviously such information must be independent of any particular language, otherwise the program could only learn that one language.

Frequency information is available independent of the particular language, and the following variables suggest themselves:

- frequency of occurrence of each combination, A
- frequency of occurrence of the first item in the combination, B
- frequency of occurrence of the second item in the combination, C
- number of items with which the first element occurs, K1
- number of items with which the second element occurs, K2

In the example, IT has A=1, B=2, C=1, K1=2, K2=1. We can then choose which pair to select from the equation.

FF= B1*a + B2*b + B3*c + B4*d + B5*e

B1 to B5 are numerical coefficients and a to e are transformations of the variables derived from an analysis of large samples of text. They are shown in table 1. I, J are the rank order of B and C respectively, and SL is the sum of the rank orders. Thus if B is the most frequent first element it has the rank of 1. The least frequent first element will have the rank LC — the number of items in the lexicon. SL clearly has the value 1+2+3+ . . . +LC. The pair is chosen to give the greatest value for FF.

Figures 2 to 5 show how the program learns words from small samples of English and German text. A simpler mechanism can be used which just works on the basis of selecting the most frequently occurring pair of items each time the program examines the matrix. This can be useful when writing the program to make sure that all of the other parts are working correctly.

Figure 2 contains the first 400 characters from a Ladybird children's reader, *Sunny Days.* The end may seem a little abrupt, but that is the result of arbitrarily deciding to see what happens with 400 characters.

The text is presented to the language-acquisition mechanism with all spaces and punctuation removed, as in figure 3, to simulate continuous speech. The LAM produces a series of segments, in the order shown in figure 4, which are then added to the lexicon.

Though the machine acquires some units of language, it does not find all of them. It finds some which have occurred in the small amount of text it was given, plus a few segments which do not appear anywhere in the text but still happen to be words, e.g. HE, ME, etc. The mechanism has taken a very small amount of text and tried to squeeze as much out of it as possible.

This short demonstration gives some idea of the robustness of the technique, but in practice, the program would be given a threshold level of certainty. It would not form a new segment unless it was sufficiently certain that it was one it wanted. Lacking such certainty, it would simply continue inputting new text until it had sufficient information to make a more certain judgement. It would learn more slowly, but more surely.

You might pause to consider what you would make of 400 characters of unsegmented text in a language you had never seen before. Viewed in that light, perhaps the machine does not do too badly.

One factor which favours the existence of a language-acquisition mechanism in humans, rather than an innate knowledge of language as such, is the commonplace observation that a human infant learns with equal ease whichever language it happens to be exposed to. So if the computer's language-acquisition mechanism is anything like the human one it should be able to learn foreign languages without any difficulty.

One problem in testing this hypothesis is that different languages use different alphabets. German, for example, uses Ä, Ö, Ü and β — which approximates to the sound "sz" — in addition to the 26 letters of the English alphabet. On most computers, numerals or graphics characters must be used to represent these.

The segments generated from 400 words of German continuous text are shown in table 5, about 25 percent of which are genuine German words. That this is not as good a performance as it produced in English may, in the absence of further evidence, be due to the nature of the German language, or to the characteristics of the particular passage which was chosen. Nevertheless, it demonstrates in principle that a mechanism could be devised which would enable a computer to learn a fair amount about a language simply by being immersed in it.

(continued on next page)

Table 1.

B1= 2,407	a= log(A)
B2= 18.431	b= I/SL
B3= .1123	c= J/SL
B4= 1.184	d= log (LC+.5 −K1)
B5= .8004	e= log (LC+.5 −K2)

Figure 1.

LEXICON	MATRIX	I	T	S	U	N	Y
I	I	0	1	1	0	0	0
T	T	1	0	0	0	0	0
S	S	0	0	1	1	0	0
U	U	0	0	0	0	1	0
N	N	0	0	0	0	1	1
Y	Y	0	0	0	0	0	0

If "IT" is selected as a new word we have:
(IT) ISSUNNY

LEXICON	MATRIX	I	S	U	N	Y	(IT)
I	I	0	1	0	0	0	0
S	S	0	1	1	0	0	0
U	U	0	0	0	1	0	0
N	N	0	0	0	1	0	0
Y	Y	0	0	0	0	0	0
(IT)	(IT)	1	0	0	0	0	0

(continued from previous page)

A system of this kind, particularly one which could run on voice input would offer certain advantages. You would not need to program in the "rules" of the language in advance, and you would not have to specify the vocabulary in advance. The machine would build up its own vocabulary and understanding.

If a workable recognition process could be devised, it would have less difficulty with continuous speech than programs which give the computer a prior definition of each word in speech since the machine would have learned its vocabulary from continuous speech. It would, therefore, learn language as it is spoken naturally rather than as it is defined formally.

Beyond pure form

This approach has yet to be tested in the field of natural languages. Certainly, it holds more promise than pretending that natural languages are just very complicated formal languages analogous to a super-high-level computer language.

The Language program was developed as a simulation of human language acquisition. It is able to select nouns and other fairly "central" words in preference to less directly meaningful items from continuous text. Foreign languages suit it just as well as English.

Given the raw elements on its input, it is a method, specifically expressed as a formula, for starting to acquire a language.

To derive the central equation of the program, a large sample of text was analysed. It was assumed that people, like the program, had to be able to join together separate items as a first step in learning any language. The equation in the program defines a mechanism which would be likely to acquire the language analysed in the samples.

Figure 5. Analysis of German.

ER	ES	IH
TE	SIE	IM
HER	KA	IMM
AR	HERRM	IN
HERR	HERRMÜ	ING
ND	HERRMÜL	IT
UND	HERRMÜLL	EN
IE	HERRMÜLLER	ÜB
WAR	DER	ÜBER
BE	ZU	ÜBERZIEHER

Over a long period of time, so one theory goes, people have developed their language and reduced it to written form. Their children have been able to acquire this language and have continuously modified it. That being the case, you expect language to be easy for a human infant to learn and to evolve to become even easier. The easiest parts to learn would be those with the highest survival value.

The precise meaning of "easy to learn" is not easy to define. It makes sense to think that language has evolved to match the mechanism which acquires it, and that the mechanism which acquires it has evolved to match the language available. The result is that, quite naturally, an image of the acquisition mechanism must lie somewhere in the properties of the language itself. The properties of the human acquisition mechanism should contain clues for a machine language-acquisition method.

At first sight such a mechanism appears to be of academic interest only. Yet suppose you have an office with memos and reports flying around it. You engage a new filing clerk, who drifts up to you one day with a piece of paper and asks where it should be filed. You look at the paper and pronounce accordingly. After a while the clerk begins to get the idea and calls out that a given piece of paper seems to be about, say, holidays. Well, you explain, file it under Recreations.

Now transfer that to machine. All of the memos are on disc and they need filing, categorising, call it what you will, so that various people have access to particular documents or have copies printed for them or, at any rate, the memos are actioned in some way.

How do you decide what action to take? The filing clerk has gone and you are reduced to either specifying all the key words in advance, or reading all of the documents in order to build up the key words.

Sensitive to meaning

A computer could help you by scanning the documents and presenting you with a list of all the different words used. This would enable you to specify key words without having to read all the files, but it is still a considerable effort.

Yet if the language-acquisition technique is used, the system no longer needs to learn words as such because all of that information is present in the segmented text. Furthermore, the mechanism works by learning words in a particular order much as a human observer might. It tends to be picking on those words with the highest "meaning" in the sense of the most concrete terms.

This mechanism could be used to scan documents intelligently, asking about only those words which strike it as "interesting" and asking the operator what to do when it encounters such a word. Subsequent recognition of these words would be easy with normally segmented text, and the operator's response could be

(continued on page 77)

Static run listing without recogniser.

```
10  HOME : PRINT "LANGUAGE":
11 B1 = 1.184015211:B2 = .8004171
     67:B3 = 18.43103375:B4 = .11
     2255309:B5 = 1.625639319:B6 =
     1.476639897:HF = .5
20 W = 1:XT = W::TW = 2:TH = 3:T =
     100:TT = 1000:EI = 8:ML = TW
     :HI = W:HJ = W:TC = TT:TY =
     36:C1 = B1 + B2 + B5:C2 = TW
      * (B1 + B2):T3 = TT
30  REM :S$() HOLDS THE I/P STRIN
     G.L$() HOLDS THE LEXICON. PL
     %() HOLDS LEXICON FREQUENCIE
     S.
40  REM :THIS SECTION TAKES IN TH
     E I/P STRING AND BUILDS UP A
      LEXICON AND FREQUENCY COUNT
     .
50  DIM S$(2000),L$(T),PL%(T),L%(
     T,T),X%(TT),I(T): DEF  FN KM
     (A) =  SGN (A) - W: DEF  FN
     KP(A) = W -  SGN (A - W)
60  INPUT "HOW MANY CHARACTERS AR
     E YOU ENTERING AT A TIME ?";
     SC
61  INPUT "DO YOU HOLD THE CHARAC
     TERS ON TAPE ? Y/N";A$
62  IF A$ = "Y" THEN : PRINT "REC
     ALL X%": STOP : FOR I = W TO
     SC:S$(I) =  CHR$ (X%(I)): PRINT
     S$(I);: NEXT : FOR I = SC +
     W TO TT:S$(I) =  CHR$ (X%(I)
     ): NEXT : GOTO 95
79  FOR I = W TO SC
80  GET S$(I):X%(I) =  ASC (S$(I)
     )
81  IF  ASC (S$(I)) = EI THEN :I =
     I - W:S$(I) = "": PRINT : PRINT
     : FOR J = W TO I - W: PRINT
     S$(J);: NEXT : GOTO 80
90  PRINT S$(I);: NEXT
91  PRINT : INPUT "DO YOU WISH TO
     STORE THESE CHARACTERS ON T
     APE ? Y/N";A$
92  IF A$ = "Y" THEN : PRINT "STO
     RE X%": STOP
94  REM  :THE NEXT SECTION SETS U
     P L%(I,J) AS A JOINT PROBABI
     LITY MATRIX.
95 HI = Z: FOR I = W TO SC
110  FOR J = Z TO LC
120  IF S$(I) <  > L$(J) THEN : NEXT
130 PL%(J) = PL%(J) + W: IF J = L
     C + W THEN :LC = LC + W:L$(L
     C) = S$(I)
140  IF HI THEN :L%(HI,J) = L%(HI
     ,J) + W:L%(HI,Z) = L%(HI,Z) +
      FN KP(L%(HI,J)):L%(Z,J) = L
     %(Z,J) +  FN KP(L%(HI,J))
150 HI = J: NEXT I: PRINT
160 HI = W:HJ = W: GOSUB 700: GOSUB
     800
326 NX = SC - W:SL = LC * (LC + W
     ) / TW:NC = Z: FOR I = W TO
     LC:I(I) = I:NC = NC + L%(I,Z
     ): NEXT
329  FOR I = TW TO LC:C = W:CC =
     I(I - W)
330  IF PL%(I) = PL%(I - W) THEN
     :CC = CC + I(I):C = C + W:I =
     I + W: IF I <  = LC THEN 330
331  IF C > W THEN : FOR J = I -
     C TO I - W:I(J) = CC / C: NEXT
332  NEXT :D3 = LC + HF:D1 = B3 /
     SL:D2 = B4 / SL:HH = TR - C1
      *  LOG (NC) + C2 *  LOG (LC
     ) + B5 *  LOG (NX) + B6:H =
     HH
333  FOR I = W TO LC:FA = B1 *  LOG
     (D3 - L%(I,Z)) + D1 * I(I): FOR
     J = W TO LC
334  IF L%(I,J) THEN :FF = FA + B
     2 *  LOG (D3 - L%(Z,J)) + D2
      * I(J) + B5 *  LOG (L%(I,J)
     ): IF FF > HH THEN :HI = I:H
     J = J:HH = FF
340  NEXT : NEXT
347 HA = L%(HI,HJ):HB = PL%(HI) -
     HA:HC = PL%(HJ) - HA:H = HH -
     H + TR: PRINT "COEFFICIENT F
     F = ";H
349  PRINT "LEXICON ADDITION IS :
      ";L$(HI) + L$(HJ)
370 LC = LC + W:L$(LC) = L$(HI) +
     L$(HJ)
380  IF L$(HI) <  > X$ AND L$(HJ)
      <  > X$ AND X$ <  > "" THEN
     : PRINT "I SUGGEST THAT ";
383  INVERSE : PRINT X$;: NORMAL
386  PRINT " IS A WORD IN ITS OWN
      RIGHT"
390 X$ = L$(LC)
+LIST391,850
465  IF  LEN (L$(LC)) > ML THEN :
     ML =  LEN (L$(LC))
490 I = W
500 IW = I + W: IF S$(I) + S$(IW)
      = L$(LC) THEN :S$(I) = L$(L
     C): FOR J = IW TO SC - W:S$(
     J) = S$(J + W): NEXT : GOSUB
     900:SC = SC - W
510  PRINT S$(I);" ";
520 I = IW: IF I < SC THEN 500
530  IF I = SC THEN : PRINT S$(I)
540 PL%(LC) = PL%(LC) + HA:L%(HI,
     HJ) = Z:PL%(HI) = PL%(HI) -
     PL%(LC):PL%(HJ) = PL%(HJ) -
     PL%(LC):L%(HI,Z) = L%(HI,Z) -
     W:L%(Z,HJ) = L%(Z,HJ) - W
550  PRINT : PRINT "SC = ";SC
555  GOSUB 700: GOSUB 800
570  GOTO 326
700  REM   :SORT ROUTINE
710  IF HJ < HI THEN :HI = HJ
715  FOR I = W TO LC - HI:C = Z
720  FOR J = HI TO LC - I:JW = J +
     W
730  IF PL%(J) < PL%(JW) THEN :H =
     PL%(J):PL%(J) = PL%(JW):PL%(
     JW) = H:A$ = L$(J):L$(J) = L
     $(JW):L$(JW) = A$: FOR K = Z
      TO LC:H = L%(K,J):L%(K,J) =
     L%(K,JW):L%(K,JW) = H: NEXT
     : FOR K = Z TO LC:H = L%(J,K
     ):L%(J,K) = L%(JW,K):L%(JW,K
     ) = H: NEXT :C = C + W
750  NEXT : IF C THEN : NEXT
760  IF PL%(LC) = ZERO THEN :L$(L
     C) = "":LC = LC - W: GOTO 76
     0
770  RETURN
800  REM :PRINT LEXICON ROUTINE.
810  PRINT "LEXICON = ";LC
820  PRINT "I","L$(I)";"  FREQUEN
     CY-PL%(I)"
830  FOR I = W TO LC
840  PRINT I,L$(I),PL%(I)
850  NEXT : RETURN
900  REM :READJUST L%(I,J) ROUTIN
     E.
910 C = TW: FOR K = W TO LC
920  IF S$(I - W) = L$(K) THEN :L
     %(K,LC) = L%(K,LC) + W:L%(K,
     HI) = L%(K,HI) - W:C = C - W
     :A =  FN KP(L%(K,LC)):B =  FN
     KM(L%(K,HI)):L%(K,Z) = L%(K,
     Z) + A:L%(Z,LC) = L%(Z,LC) +
     A:L%(K,Z) = L%(K,Z) + B:L%(Z
     ,HI) = L%(Z,HI) + B
925  IF IW = SC THEN : NEXT : RETURN
930  IF S$(IW) = L$(K) THEN :L%(L
     C,K) = L%(LC,K) + W:L%(HJ,K)
      = L%(HJ,K) - W:C = C - W:A =
      FN KP(L%(LC,K)):B =  FN KM(
     L%(HJ,K)):L%(LC,Z) = L%(LC,Z
     ) + A:L%(Z,K) = L%(Z,K) + A:
     L%(HJ,Z) = L%(HJ,Z) + B:L%(Z
     ,K) = L%(Z,K) + B
940  IF C THEN : NEXT
950  RETURN
```

The new generation that interfaces with most microcomputers

Mannesmann-Tally's new MT100 series of matrix serial printers for microcomputers is now available from local computer shops and suppliers.

MT100 series printers are utterly reliable. They're a new generation of Europrinters made in West Germany with full technical and service back-up from our headquarters here in the UK.

They give high performance at a very reasonable price. Ideal for professional businesses. Or educationists. Or enthusiasts who value the latest technology.

Two basic models – MT120 and 140

Main difference is in column width. The MT120 is the 80 columns version whilst the 140 features 132 columns.

Both models come in three variants giving a range of standard features which normally are beyond the scope of microcomputer orientated printers.

9 x 7 matrix, 160 cps high speed output – often doubled by microprocessor control choosing shortest possible print path **in** either direction.

Selectable 18 x 40 matrix for **high definition correspondence quality.**

10 different character sets, 96 characters each.

OCR A and B character fonts using 9 x 9 matrix.

Four different character pitches between 10 and 20 cpi, each of which can be printed in double width.

Two colour printing.

All MT100 series printers are small, quiet and highly versatile. End user prices start at £390.

For further pricing and availability **use the MT100 hotlines on Reading (0734) 586446/7/8** or look in at your computer shop. Alternatively write to us for full details.

MANNESMANN
TALLY

the source of the Europrinter

● Circle No. 145

Mannesmann Tally Limited, 7 Cremyll Road, Reading, Berkshire RG1 8NQ. Tel: Reading (0734) 580141. Cables: Tally-Reading. Telex: 847028.

OSBO

Dual floppy disk drives. Two 5¼" floppy disk drives provide 100,000 characters each of data storage, or about 60 pages of typed, doublespaced text.

Diskette storage. The floppy diskettes can be removed, providing infinite permanent information storage. Two compartments provide storage for up to 25 diskettes.

RS-232C Interface. Enables the OSBORNE 1 to connect with serial printers, or other devices using this popular industry-standard interface.

IEEE 488 Interface. Connects the OSBORNE 1 to the standard instrumentation bus, for data communication with test instruments.

Osborne 1.
It doesn't need a room of its own.
Or even a desk of its own.
With its optional battery pack, in fact, it doesn't need mains electricity for up to two hours.
It's – as you can see – portable.
Weighing under 24lb in its weatherproof case, it can be carried in one hand. Or in your car. Or tucked under an airline seat.
But its performance is equal to, often better than, small business computers several times as big and twice as expensive.
The Osborne 1 will achieve in seconds commercial, engineering or scientific calculations which, without a computer, would take days.
And store a whole library of data for instant retrieval and use any time.

Connected to a printer, it will operate as a word processor and produce letters, documents, reports – anything you want word- (and figure-) perfect.
And carry out financial planning, too, using an electronic spreadsheet, providing fast, accurate cash flow forecasts and instant answers to those important 'what if' questions.
You can see an Osborne 1 – and try it out – at any of the dealers listed below.
And then happily walk away with it.

For £1,250* the only personal business com

*excluding VAT.

See the Osborne 1 at any of these authorised dealers:

LONDON
Adda Computers Ltd, Mercury House, Hangar Green, Ealing, London W5 3BA. Tel: (01) 997 6666

Business Computers (Systems) PLC, The Pagoda, Theobald Street, Borhamwood, Herts WD6 4RT. Tel: (01) 207 3344

Byteshop Computerland, 324 Euston Road, London NW1. Tel: (01) 387 0505

Digitus Limited, 10/14 Bedford Street, Covent Garden, London WC2E 9HE. Tel: (01) 379 6968

Equinox Computer Systems Ltd, Kleeman House, 16 Anning Street, New Inn Yard, London EC2A 3HB. Tel: (01) 739 2387/729 4460

Lion Microcomputers, Lion House, 227 Tottenham Court Road, London W1. Tel: (01) 637 8760

Microcomputers at Laskys, 42 Tottenham Court Road, London W1 9RD. Tel: (01) 636 0845

O Computers, 108 Rochester Row, London SW1P 1JP. Tel: (01) 630 5449

Star Computer Group PLC, 64 Great Eastern Street, London EC2A 3QR. Tel: (01) 739 7633

Subscription Services, 70 Warren Street, London W1P 5PA. Tel: (01) 388 2663

The|Xerox|Store, 84 Piccadilly, London W1V 9HE. Tel: (01) 629 0694
77 High Holborn, London WC1V 6LS. Tel: (01) 242 9596
110 Moorgate, London EC2M 6SU. Tel: (01) 588 1531

BELFAST
Northern Ireland |Business Systems Ltd, 7/9 Botanic Avenue, Belfast BT7 1JH. Tel: (0232) 48340

BIRMINGHAM
Byteshop Computerland, 94/96 Hurst Street, Birmingham B5 4TD. Tel: (021) 622 7149

Microcomputers at Laskys, 19/21 Corporation Street, Birmingham B2 4LP. Tel: (021) 632 6303

BRISTOL
*Microcomputers at Laskys, 16/20 Penn Street, Bristol BS1 3AN. Tel: (0272) 20421

CAMBRIDGE
Cambridge Computer Store, 1 Emmanuel Street, Cambridge CB1 1NE. Tel: (0233) 65334/5

CHESTER
Microcomputers at Laskys, The Forum, Northgate Street, Chester CH1 2BZ. Tel: (0244) 317667

DERBY
Datron Micro Centre, Duckworth Square, Derby DE1 1JZ. Tel: (0322) 380085

EDINBURGH
Microcomputers at Laskys, 4 St James Centre, Edinburgh EH1 3SR. Tel: (031) 556 2914

GLASGOW
Byteshop Computerland, Magnet House, 61 Waterloo Street, Glasgow G2 7BP. Tel: (041) 221 7409

Microcomputers at Laskys, 22/24 West Nile Street, Glasgow G7 2PF. Tel: (041) 226 3349

GUILDFORD
Systematic Business Computers, Braboeuf House, 64 Portsmouth Road, Guildford, Surrey GU2 5DU. Tel: (0483) 32666

LIVERPOOL
Microcomputers at Laskys, 14 Castle Street, Liverpool L2 0TA. Tel: (051) 227 2535

MANCHESTER
Byteshop Computerland, 11 Gateway House, Station Approach, Piccadilly, Manchester 1. Tel: (061) 236 4737

Microcomputers at Laskys, 12/14 St Mary's Gate, Market Street, Manchester M1 1PX. Tel: (061) 832 6087

NEWCASTLE
Sage Systems, Hawick Crescent, Newcastle upon Tyne NE6 1AS. Tel: (0632) 761669

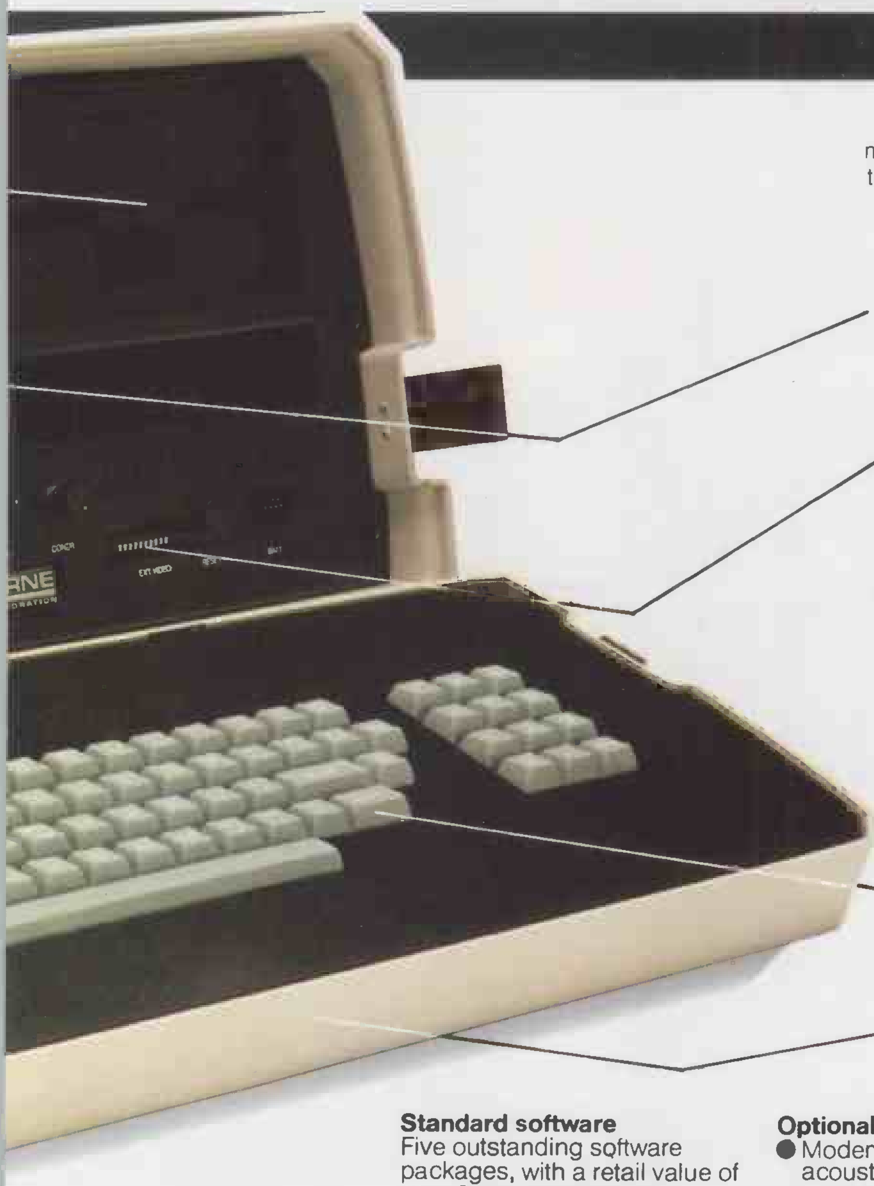
NOTTINGHAM
Byteshop Computerland, 92A Upper Parliament Street, Nottingham NG1 6LF. Tel: (0602) 40576

*Microcomputers at Laskys, 1/4 Smithy Row, Nottingham NG1 2DU. Tel: (0602) 415150

PRESTON
Microcomputers at Laskys, 1/4 Guildhall Arcade, Preston PR1 1HR. Tel: (0772) 59264

RNE 1

TM



Internal electronics. Z80A™ CPU, 64K bytes RAM memory (60K available to the programmer, 4K used to run the screen.) System software is held in ROM in a separate address space.

Screen. Clear, 5", 24-row screen displays a 52-character window on a 128-character line with automatic horizontal scrolling.

Monitor Interface. Connects the OSBORNE 1 to any monitor screen.

Keyboard. A standard typewriter keyboard plus numeric, adding-machine keypad for fast entry, and cursor control keys for easy cursor movement.

Case. The plastic case snaps together to form a weatherproof, 24-pound package that fits underneath the standard airline seat.

Standard software

Five outstanding software packages, with a retail value of over £800 are included:

- CP/M® Operating System
- WORDSTAR® with MAIL MERGE®
- SUPERCALC™
- MBASIC®
- CBASIC®

Optional extras

- Modem cable for use with acoustic couplers for telephone transmission of data
- Battery pack
- Double density disk drives with 200K bytes of storage per drive

● Circle No. 146

Trademarks: SUPERCALC: Sorcim Corporation; Z80A: Zilog Corporation.
Registered Trademarks: OSBORNE 1: Osborne Computer Corporation; CP/M Digital Research; WORDSTAR, MAILMERGE: MicroPro International; MBASIC: Microsoft; CBASIC: Compiler Systems, Inc.

puter you can take anywhere.

SHEFFIELD
Datron Micro Centre, 2 Abbeydale Road, Sheffield S7 1FD. Tel; (0742) 585490
Microcomputers at Laskys, 58 Leopold Street, Sheffield SL1 2GZ. Tel: (0742) 750971

SLOUGH
The Xerox Store, 3/4 William Street, Slough, Berkshire SL1 1XY. Tel: (0753) 76957

SOUTHAMPTON
Xitan Systems Limited, 23 Cumberland Place, Southampton SO1 2BB. Tel: (0703) 38740

TORQUAY
Crystal Electronics, 40 Magdalene Road, Torquay, Devon. Tel: (0805) 22699

* Opening shortly

For further information and full specification, return the coupon to The Marketing Manager, Osborne Computer Corporation (UK) Ltd, 38 Tanners Drive, Blakelands North, Milton Keynes, Buckinghamshire MK14 5BW. Telephone: 0908 615274. Telex 825220

More information on Osborne 1, please.

Name____________________

Address____________________

PC 6 Tel____________________

OSBORNE
COMPUTER CORPORATION (UK) LTD.

5¼" WINCHESTERS

- * Complete Systems Available
- * Sub-Systems for S100 computers
- * Sub-Systems for Z80 computers
- * Fast Drives with Buffered Seeks
- * Versatile Controller

Drives Available NOW!

The long-awaited 5.25" Winchester drives are available now from Hotel Microsystems. The greatly improved speed and storage capacity made available by the mini-Winchesters now make feasible many applications, for which floppy drives were too small, too unreliable or too slow. Drives of different capacities ranging from 2.5Mb to 12Mb are available. All the drives we supply have their own microprocessor and are thus able to provide buffered seeking resulting in vastly improved performance.

Versatile Controller

The XCOMP Winchester controller is a custom designed microprogammable controller which consists of two printed circuit boards. It has buffered seeking capabilities and is upwards compatible to higher capacity drives.

Complete Systems

The North Star Horizon microcomputer is now available incorporating any of the mini-Winchester drives featured above.

S100 Sub-Systems

An upgrade kit for users of S100 microcomputers contains all the hardware required to add a Winchester in place of a mini-floppy drive. The XCOMP ST/S S100 controller is included together with an S100 card which provides the necessary power supplies to connect to the Winchester. Fitting to the microcomputer is straighforward — no soldering is required and the Winchester is housed in the same place as the floppy drive it replaces. Horizon users have a choice of software; either the high-performance HMSOS single/multi-user operating system or CP/M.

Z80 Sub-Systems

The sub-system for Z80-based microcomputers consists of a packaged drive and controller with power supply. The controller is the XCOMP ST/R custom desgined microprogrammable controller. The two printed circuit boards are connected via a 50-way ribbon cable to an interface board which plugs into the Z80 socket in your microcomputer. The sub-system is housed in an alloy cabinet with a power supply. Source listings of CP/M drivers are available.

Hotel MicroSystems Limited

69 Loudoun Road London NW8 0DQ Telephone 01-328 8737/8 Telex 266828 H M S-G

● Circle No. 147

(continued from page 72)

used to build up a job file of appropriate actions. The system would learn as it goes along and would avoid swamping the operator with queries about every little item.

The mechanism has, in some ways, a sense of attention. It does not look at things randomly, but pays attention to things which look as if they are meaningful or go together in some way. This enables it to pick out words in text as being more "significant" than others even though it does not know what they mean.

The Language program works on a string, S$(1000). You have to input the number of characters which the program is to consider, in the range 1 to 1000. If the string is not on tape, key it in. The programme uses Get, so the keyboard is on-line. Errors can be corrected by keying left-arrow.

When the given number of characters are keyed in they can be stored using Store X%, where X% is the ASCII equivalent of S$. Subsequent runs with the same string input can be initiated using Recall X% instead of keying.

The program then operates on the string information, producing new segmentations and displaying them on the screen together with the entire string data, with spaces inserted to show the segmentation process to date. It runs slowly, as it is designed for ease of modification rather than speed. Most of the time is spent on a time-consuming sort which is helpful for analysis.

Segments are formed according to the value of the coefficient FF. The higher the value of FF, the better. By the time FF has dropped to a value of about 3 the segments chosen may contain occasional errors; a value of 4 or more is desirable. Much of the central code is concerned with scaling FF to give a consistent range of values of FF, irrespective of the sample size chosen initially or the subsequent progress of the program. Input characters may be any valid string variable, not just letters of the English alphabet.

This method of running is a static run: the same text is worked to exhaustion without further input. A dynamic run consists of inputting further string information to the mechanism according to a given criterion. For instance, to reduce the probability of mistakes occurring, a high threshold value of FF may be set — say, 4·5 — and a new segment will only be acquired if it exceeds the threshold. If no FF exceeds this threshold then S$ is searched for more input for the mechanism. As data is input from S$ a recognition routine may be used to identify segments within the input stream as segments previously acquired.

If N characters are input there are, in general, 2^{N-1} different ways of segmenting them, so 20 characters may be segmented in a maximum of 524,288 different ways. Fortunately, many of these ways may be excluded as containing segments which the mechanism has not previously acquired. The correct segmentation may occur along with 50 or more other possibilities after only a short run. Recognising the correct segmentation is a considerable problem.

The program runs on an Apple II with cassette recorder and 48K main memory. Disc is not needed and DOS should not be loaded. For large amounts of data all arrays may be converted to disc files or additional RAM or any other method that works. [illegible]

Listing with recogniser routine.

```
10  HOME : PRINT "LANGUAGE": INPUT
     "INPUT THRESHOLD (DEFAULT=0)
      = ";TR
11 B1 = 1.184015211:B2 = .8004171
    67:B3 = 18.43103375:B4 = .11
    2255309:B5 = 1.625639319:B6 =
    1.476639897:HF = .5
12  INPUT "DO YOU WANT RECOGNITIO
    N ROUTINE ? Y/N:";RR$
20 W = 1:XT = W::TW = 2:TH = 3:T =
    100:TT = 1000:EI = 8:ML = TW
    :HI = W:HJ = W:TC = TT:TY =
    36:C1 = B1 + B2 + B5:C2 = TW
     * (B1 + B2):T3 = TT
30  REM :S$() HOLDS THE I/P STRIN
    G.L$() HOLDS THE LEXICON. PL
    %() HOLDS LEXICON FREQUENCIE
    S.
40  REM :THIS SECTION TAKES IN TH
    E I/P STRING AND BUILDS UP A
     LEXICON AND FREQUENCY COUNT
    .
50  DIM S$(2000),L$(T),PL%(T),L%(
    T,T),X%(TT),I(T),B%(30,TY),K
    F%(TY): DEF  FN KM(A) =  SGN
    (A) - W: DEF  FN KP(A) = W -
     SGN (A - W)
60  INPUT "HOW MANY CHARACTERS AR
    E YOU ENTERING AT A TIME ?";
    SC
61  INPUT "DO YOU HOLD THE CHARAC
    TERS ON TAPE ? Y/N";A$
62  IF A$ = "Y" THEN : PRINT "REC
    ALL X%": STOP : FOR I = W TO
    SC:S$(I) =  CHR$ (X%(I)): PRINT
    S$(I);: NEXT : FOR I = SC +
    W TO TT:S$(I) =  CHR$ (X%(I)
    ): NEXT : GOTO 95
80  FOR I = W TO SC: GET S$(I):X%
    (I) =  ASC (S$(I))
81  IF  ASC (S$(I)) = EI THEN :I =
     I - W:S$(I) = "": PRINT : PRINT
     : FOR J = W TO I - W: PRINT
    S$(J);: NEXT : GOTO 80
90  PRINT S$(I);: NEXT
91  PRINT : INPUT "DO YOU WISH TO
     STORE THESE CHARACTERS ON T
    APE ? Y/N";A$
92  IF A$ = "Y" THEN : PRINT "STO
    RE X%": STOP
94  REM  :THE NEXT SECTION SETS U
    P L%(I,J) AS A JOINT PROBABI
    LITY MATRIX.
95 HI = Z: FOR I = W TO SC
110  FOR J = Z TO LC
120  IF S$(I) (  ) L$(J) THEN : NEXT
130 PL%(J) = PL%(J) + W: IF J = L
    C + W THEN :LC = LC + W:L$(L
    C) = S$(I)
140  IF HI THEN :L%(HI,J) = L%(HI
    ,J) + W:L%(HI,Z) = L%(HI,Z) +
     FN KP(L%(HI,J)):L%(Z,J) = L
    %(Z,J) +  FN KP(L%(HI,J))
150 HI = J: NEXT I: PRINT
160 HI = W:HJ = W: GOSUB 700: GOSUB
    800
326 NX = SC - W:SL = LC * (LC + W
    ) / TW:NC = Z: FOR I = W TO
    LC:I(I) = I:NC = NC + L%(I,Z
    ): NEXT
329  FOR I = TW TO LC:C = W:CC =
    I(I - W)
330  IF PL%(I) = PL%(I - W) THEN
    :CC = CC + I(I):C = C + W:I =
    I + W: IF I (  = LC THEN 330
331  IF C ) W THEN : FOR J = I -
    C TO I - W:I(J) = CC / C: NEXT
332  NEXT :D3 = LC + HF:D1 = B3 /
    SL:D2 = B4 / SL:HH = TR - C1
     *  LOG (NC) + C2 *  LOG (LC
    ) + B5 *  LOG (NX) + B6:H =
    HH
333  FOR I = W TO LC:FA = B1 *  LOG
    (D3 - L%(I,Z)) + D1 * I(I): FOR
    J = W TO LC
334  IF L%(I,J) THEN :FF = FA + B
    2 *  LOG (D3 - L%(Z,J)) + D2
     * I(J) + B5 *  LOG (L%(I,J)
    ): IF FF ) HH THEN :HI = I:H
    J = J:HH = FF
340  NEXT : NEXT : IF HH ) H THEN
    347
345  IF RR$ = "Y" THEN : GOSUB 20
    00:HI = W:HJ = W: GOSUB 700:
     GOTO 326
347 HA = L%(HI,HJ):HB = PL%(HI) -
    HA:HC = PL%(HJ) - HA:H = HH -
    H + TR: PRINT "COEFFICIENT F
    F = ";H
349  PRINT "LEXICON ADDITION IS :
     ";L$(HI) + L$(HJ)
370 LC = LC + W:L$(LC) = L$(HI) +
    L$(HJ)
465  IF  LEN (L$(LC)) ) ML THEN :
    ML =  LEN (L$(LC))
490 I = W
500 IW = I + W: IF S$(I) + S$(IW)
     = L$(LC) THEN :S$(I) = L$(L
    C): FOR J = IW TO SC - W:S$(
    J) = S$(J + W): NEXT : GOSUB
    900:SC = SC - W
510  PRINT S$(I);" ";
520 I = IW: IF I ( SC THEN 500
530  IF I = SC THEN : PRINT S$(I)
534 TC = TC - HA: FOR I = SC + W TO
    TC:S$(I) = S$(I + HA): NEXT
540 PL%(LC) = PL%(LC) + HA:L%(HI,
    HJ) = Z:PL%(HI) = PL%(HI) -
    PL%(LC):PL%(HJ) = PL%(HJ) -
    PL%(LC):L%(HI,Z) = L%(HI,Z) -
    W:L%(Z,HJ) = L%(Z,HJ) - W
550  PRINT : PRINT "SC = ";SC
555  GOSUB 700: GOSUB 800
570  GOTO 326
700  REM  :SORT ROUTINE
710  IF HJ ( HI THEN :HI = HJ
715  FOR I = W TO LC - HI:C = Z
720  FOR J = HI TO LC - I:JW = J +
    W
730  IF PL%(J) ( PL%(JW) THEN :H =
    PL%(J):PL%(J) = PL%(JW):PL%(
    JW) = H:A$ = L$(J):L$(J) = L
    $(JW):L$(JW) = A$: FOR K = Z
     TO LC:H = L%(K,J):L%(K,J) =
    L%(K,JW):L%(K,JW) = H: NEXT
    : FOR K = Z TO LC:H = L%(J,K
    ):L%(J,K) = L%(JW,K):L%(JW,K
    ) = H: NEXT :C = C + W
750  NEXT : IF C THEN : NEXT
760  IF PL%(LC) = ZERO THEN :L$(L
    C) = "":LC = LC - W: GOTO 76
    0
770  RETURN
800  REM :PRINT LEXICON ROUTINE.
810  PRINT "LEXICON = ";LC
820  PRINT "I","L$(I)";"  FREQUEN
    CY-PL%(I)"
830  FOR I = W TO LC
840  PRINT I,L$(I),PL%(I)
850  NEXT : RETURN
900  REM :READJUST L%(I,J) ROUTIN
    E.
910 C = TW: FOR K = W TO LC
920  IF S$(I - W) = L$(K) THEN :L
    %(K,LC) = L%(K,LC) + W:L%(K,
    HI) = L%(K,HI) - W:C = C - W
    :A =  FN KP(L%(K,LC)):B =  FN
    KM(L%(K,HI)):L%(K,Z) = L%(K,
    Z) + A:L%(Z,LC) = L%(Z,LC) +
    A:L%(K,Z) = L%(K,Z) + B:L%(Z
    ,HI) = L%(Z,HI) + B
925  IF IW = SC THEN : NEXT : RETURN
930  IF S$(IW) = L$(K) THEN :L%(L
    C,K) = L%(LC,K) + W:L%(HJ,K)
     = L%(HJ,K) - W:C = C - W:A =
     FN KP(L%(LC,K)):B =  FN KM(
    L%(HJ,K)):L%(LC,Z) = L%(LC,Z
    ) + A:L%(Z,K) = L%(Z,K) + A:
    L%(HJ,Z) = L%(HJ,Z) + B:L%(Z
    ,K) = L%(Z,K) + B
940  IF C THEN : NEXT
950  RETURN
2000 A$ = "": PRINT "STRING I/P T
    O RECOGNISER :-"
2030  FOR I = SC TO SC - ML + W STEP
     - W
2040 A$ = S$(I) + A$: IF  LEN (A$
    ) ( ML - W THEN : NEXT
2045 MS = I:NN = SC - MS + ML
2050 J = Z: PRINT
2060  FOR I = MS - W TO SC + ML -
    W
2062  FOR K = W TO LC
2066  IF S$(I) (  ) L$(K) THEN : NEXT
2068 B%(J,Z) = K: IF K = LC + W THEN
    :LC = LC + W:L$(LC) = S$(I)
2070  IF J ) Z THEN : PRINT L$(K)
    ;" ";: IF I (  = SC THEN :PL
    %(K) = PL%(K) - W:L%(K1,K) =
    L%(K1,K) - W:L%(K1,Z) = L%(K
    1,Z) +  FN KM(L%(K1,K)):L%(Z
    ,K) = L%(Z,K) +  FN KM(L%(K1
    ,K))
2080  IF I ) SC THEN :A$ = A$ + L
    $(K)
2090 K1 = K:J = J + W: NEXT I
2200  PRINT :MI = J - W
2210 X$ = A$:J = W:K = W:L0 =  LEN
    (A$):TK = W: FOR I = W TO TY
    :KF%(I) = L0: NEXT
2220 CO = Z: FOR I = W TO LC
2235  IF L$(I) (  )  LEFT$ (X$, LEN
    (L$(I))) THEN : NEXT : GOTO
    2270
2240 CO = CO + W: IF CO = W THEN
    :B%(Z,K) = J:B%(J,K) = I:KF%
    (K) = KF%(K) -  LEN (L$(I))
2242  IF CO (  = W THEN : NEXT : GOTO
    2270
2245 TK = TK + W: FOR Q = W TO J -
    W:B%(Q,TK) = B%(Q,K): NEXT :
    B%(J,TK) = I:KF%(TK) = KF%(K
    ) -  LEN (L$(I)) +  LEN (L$(
    B%(J,K))):B%(Z,TK) = J
2249  IF TK ) MK THEN :MK = TK
2250  NEXT
2270  IF TK ) W THEN : GOSUB 2500
2350 L1 = L0: FOR K = W TO TK: IF
    KF%(K) ) Z AND KF%(K) (  = L
    1 THEN :L1 = KF%(K):KH = K
2370  NEXT : IF L1 AND KF%(KH) THEN
    :K = KH:X$ =  RIGHT$ (A$,L1)
    :J = B%(Z,K) + W: GOTO 2220
2380 TI = TK: IF TK = W THEN :OP =
    W: GOTO 2600
2400 HH = TT + TW: FOR I = W TO T
    K:E = Z:CH = Z: FOR J = W TO
    MI:E = E + PL%(B%(J,I)): NEXT
    :E = E / MI: FOR J = W TO MI
    :CH = CH + ((PL%(B%(J,I)) -
    E) ^ TW) / E: NEXT : IF CH (
    HH THEN :OP = I:HH = CH
2440  NEXT : GOTO 2600
2500  REM :RECOGNISER SHRINK
2502  FOR I = W TO TK: IF KF%(I) =
    Z AND B%(Z,I) ( MI THEN :MI =
    B%(Z,I)
2504  NEXT
2510  FOR I = W TO TK
2520  IF B%(Z,I) ) MI OR B%(Z,I) =
    MI AND KF%(I) THEN : FOR Q =
    Z TO B%(Z,TK):B%(Q,I) = B%(Q
    ,TK): NEXT :KF%(I) = KF%(TK)
    :TK = TK - W:I = I - W
2523  IF I = TK THEN 2530
2525  NEXT
2530  FOR I = W TO TK: IF KF%(I) THEN
    : RETURN
2540  NEXT : POP : GOTO 2380
2600  REM  :PRINT CHOSEN OPTION(S
    ) AND THEN INTO 3000
2610  PRINT "RECOGNISER GIVES :-"
    : PRINT : FOR I = W TO B%(Z,
    OP): PRINT L$(B%(I,OP));" ";
    : NEXT : PRINT
2620  IF TI ) W THEN : PRINT "TIE
    -BREAKER": STOP
3000  REM :ROUTINE TO TAKE ON MOR
    E INPUT
3020 SC = SC - NN + ML - W + B%(Z
    ,OP)
3060  FOR I = W TO B%(Z,OP)
3070 PL%(B%(I,OP)) = PL%(B%(I,OP)
    ) + W
3080  NEXT
3090 A = B%(Z,Z):B = B%(W,OP)
3120 L%(A,B) = L%(A,B) + W:L%(A,Z
    ) = L%(A,Z) +  FN KP(L%(A,B)
    ):L%(Z,B) = L%(Z,B) +  FN KP
    (L%(A,B))
3125  IF B%(Z,OP) (  = W THEN 316
    0
3130  FOR I = W TO B%(Z,OP) - W
3132 A = B%(I,OP):B = B%(I + W,OP
    )
3140 L%(A,B) = L%(A,B) + W:L%(A,Z
    ) = L%(A,Z) +  FN KP(L%(A,B)
    ):L%(Z,B) = L%(Z,B) +  FN KP
    (L%(A,B))
3150  NEXT
3160 DI = NN - B%(Z,OP):TC = TC -
    DI: IF DI ( Z THEN : FOR I =
    TC TO SC + W STEP  - W:S$(I)
     = S$(I + DI): NEXT
3165 J = W
3170  FOR I = SC - B%(Z,OP) + W TO
    SC
3180 S$(I) = L$(B%(J,OP)):J = J +
    W
3190  NEXT
3200  IF DI ) Z THEN : FOR I = SC
     + W TO TC:S$(I) = S$(I + DI
    ): NEXT
3220  RETURN
```

Filling gaps in a sentence is more than just a game. Using Chris Harrison's Cloze program it can provide a scientific test of language ability.

Watch this space

THE CLOZE testing procedure is a reliable and well-validated system of language testing. The candidate is required to complete a language item such as a paragraph of text by filling in blanks that appear at regular intervals.

This Cloze program gives the tester an instrument which enables a passage of virtually unlimited length to be written to the screen. Words are then deleted at regular intervals and the student fills in the gaps.

Easily portable

The program is fairly simple, and could be easily modified to draw on prepared and stored texts. It is written for a standard Video Genie, but can be made machine-portable without difficulty. The principal variables are:

A$ holds individual words of the text, each one defined by the spaces between them. The program shows a Clear of 1000 and a dimension of A$(100), but both can be increased to the limit if you want a text longer than 100 words.
R$ holds the student's response, which does not need to be dimensioned.
M is used to count and number the words in the text.
N counts the letters in each word, in case back-spacing is required for corrections. Since each word is defined as soon as a space is added it is not possible to backspace over blanks. If you are not likely to want to make alterations it is better to use Data statements instead, or a routine that calls text from store and then counts words by using the blanks between them. If this is to remain simple, though, the text will be limited to 256 characters.

Text is entered using Inkey$, and printed to screen. If you are a fast typist, using a lower-case modification, you may find this rather slow but it is satisfactory for most purposes. The Rems in the listing show exactly what is happening and can be omitted from the program.

Sample run of Cloze program.

```
 I ONCE ---- BACK FROM - SKIING TRIP ------ TO FIND ---- A SNOWSTORM --- FALLEN
AT --- AIRPORT AND ---- THE DOOR ----- ON ALL --- CARS IN --- CAR PARK ---- SO F
ROZEN -- THAT IT --- IMPOSSIBLE TO ------ A KEY.

COME

NO, BAD LUCK. tRY AGAIN.
CAME

                    I ONCE CAME

A

                    I ONCE CAME BACK FROM A

ABROAD

                    I ONCE CAME BACK FROM A SKIING TRIP ABROAD

THAT

                    I ONCE CAME BACK FROM A SKIING TRIP ABROAD TO FIND THAT

WAS

NO, BAD LUCK. tRY AGAIN.
HAVE

NO, BAD LUCK. tRY AGAIN.
HAD

                    I ONCE CAME BACK FROM A SKIING TRIP ABROAD TO FIND THAT A SNOWS
TORM HAD

THE

                    I ONCE CAME BACK FROM A SKIING TRIP ABROAD TO FIND THAT A SNOWS
TORM HAD FALLEN AT THE

DOOR

NO, BAD LUCK. tRY AGAIN.
LOCKS

NO, BAD LUCK. tRY AGAIN.
THAT

                    I ONCE CAME BACK FROM A SKIING TRIP ABROAD TO FIND THAT A SNOWS
TORM HAD FALLEN AT THE AIRPORT AND THAT

LOCKS

                    I ONCE CAME BACK FROM A SKIING TRIP ABROAD TO FIND THAT A SNOWS
TORM HAD FALLEN AT THE AIRPORT AND THAT THE DOOR LOCKS


ETC ETC
```

The inputter is asked what interval is required between spaces. The screen is then cleared and the Clozed text is then printed out, with a message asking the student to supply a word for the first available blank. Certain areas of the screen are used for messages and replies

(continued on next page)

Cloze program listing.

```
10 CLS
20 PRINT@410,"C L O Z E";
30 PRINT@597,"BY CHRIS HARRISON     1982";
40 FOR I=1 TO 1000:NEXT
49      REM A$=words of text; R$=students response to
         first available blank.
50 CLEAR  1000:DIMA$(200),R$(200)
59      REM asterisk required by Program to show the
         end of the Program
```

(listing continued on next page)

(continued from previous page)

— see lines 300, 330, 350, 360, 380 — and these locations are all up against the left-hand side of the Video Genie screen, 0 to 960, Step 64.

The student is given three tries, and if unsuccessful is given the correct answer. It should be quite simple to write a routine that allows students to move the cursor to the beginning of a space that they think they can fill, but this refinement is far from essential.

Reliable test

If you are planning to use the technique, it is advisable to make sure that you understand the research and evaluation on which it is based.

There is little doubt that the regular blanking out of words, say one word in six, gives a very much more reliable measure of language competence than blanking out, say, all prepositions. Alderson reports that deleting every 12th word did not necessarily result in an easier test than deleting every sixth, eighth or 10th word, and that Cloze items are, on the whole, unaffected by content greater than five words. Anderson shows that the Cloze techniques correlate with difficulty levels and discriminate well between students.

Learning effects

Bialystock shows that it is possible to improve students' inferencing abilities through classroom training. Briere finds that it is possible to discriminate between students of foreign languages according to their level of instruction — first, second or third term — even when the languages involved are different. Darnell reports on ways of scoring Cloze tests, and Oller indicates that Cloze tests are internally consistent, reliable, valid and easily constructed, administered and standardised, and that Cloze tests measure a grammar of expectancy.

Key articles

Alderson, J Charles, "The effect on the Cloze test of changes in deletion frequency", *Journal of Research in Reading* (Leeds), 2 (1979), 108-119.

Anderson, Jonathan, "The application of Cloze procedure to English learned as a foreign language in Papua and New Guinea", *English Language Teaching* (London, **27** (1972), 66-72.

Bialystock, Ellen, "Inferencing as an aspect of Cloze test performance", *Working Papers on Bilingualism* (Toronoto), **17** (1979) 24-36.

Briere, Eugène J, "A look at Cloze testing across languages and levels", *Modern Language Journal* (St. Louis, Mo) **62**, (1978), 23-26.

Darnell, Donald K, "Clozentropy: a procedure for testing English language proficiency of foreign students", *Speech Monographs* (New York), **37** (1970), 36-46.

(listing continued from previous page)

```
60 CLS:PRINT@2,"WRITE YOUR TEXT IN HERE WITHOUT USING COMMAS.
   WHEN YOU HAVE FINISHED MAKE A SPACE AND FOLLOW
  IT WITH AN ASTERISK THUS 'END.*'"
69     REM Now we turn on the cursor for INKEY input
70 PRINT:PRINTCHR$(14);
79     REM it's necessary to count and number each
        word
80 M=M+1
89     REM N will set letters in the word counter
90 N=1
99     REM text is now input one letter at a time
100 I$=INKEY$
109    REM a delicate process thus line 110
110 ON ERROR GOTO 90
120    REM now we allow for erasure. If N<1 then we
        start the word again. If backspace is used,
        then we must reverse the cursor and ignore the
        previous letter. No backspacing over blanks!
130 IF N<1 THEN GOTO 90ELSE IF I$=CHR$(8)
   THEN A$(M)=LEFT$(A$(M),N-2):N=N-1:ON ERROR
   GOTO 90:PRINT CHR$(8);:GOTO100
140 IF I$=""THEN100
149    REM we must ensure that a space isn't counted
        as a word, but we use it to mark off each word
150 N=N+1:IF I$=" " THEN PRINT" ";:GOTO80
159    REM if input ='*' text is finished and program
        moves on to next stage.
160 IF I$="*"THEN210
169    REM if return key is pressed no action is taken
170 IF I$=CHR$(13)THEN 100
179    REM Each word is built up from individual letters
180 A$(M)=A$(M)+I$
189    REM now we print out each letter
190 PRINTI$;
199    REM repeats the process
200 GOTO 100
209    REM S is used for intervals of spacing.......
210 PRINT:PRINT:INPUT "  WHAT INTERVAL DO YOU WANT";S
219    REM.....but an entry of '3' means 2 words then
        a blank
220 S=S-1
230    REM OK. now we are ready. Clear screen and.....
240 CLS
249    REM turn off cursor
250 PRINTCHR$(15);
269    REM now we print a space before each word, and
        print the words except for those every S-1 when
        we print as many dashes as there are letters
270 PRINT" ";:FOR I=1 TO MSTEPS:FOR J=I TO I+S-1:
   PRINTA$(J);" ";:NEXT J:
   PRINTSTRING$(LEN(A$(J)),45);" ";:I=I+1:NEXTI
279    REM Now allow for as many answers as there
        are blanks
280 FOR I=S+1 TO M STEP S+1
299    REM now blank out the part of the screen (897)
        we will use for messages and allow for answers
300 PRINT@897,STRING$(64,32);:
   PRINT@897,"NOW FILL IN THE BLANKS";:INPUT R$(I)
309    REM is the answer correct?
310 IF R$(I)=A$(I)THEN 350
325 IF V>1 THEN PRINT@770,"BAD LUCK. THE
   WORD IS ";A$(I);ELSE 330
326 FOR L=1 TO 300:NEXTL:GOTO 350
329    REM if reply was wrong we give another try
330 PRINT@770,"NO, BAD LUCK. TRY AGAIN.";:V=V+1:GOTO300
349    REM if the reply was correct we reprint the
        original text up to the point we have reached
350 PRINT@0," ";:FOR K=1 TO I:PRINTA$(K);" ";:NEXT K
359    REM and blank out the 'no' message
360 PRINT@770,STRING$(64,32);
369    REM repeat if more blanks remain
370 V=0:NEXT I
379    REM blank out the request to fill in blanks
380 PRINT@897,STRING$(64,32);
389    REM allow for a re-run
390 PRINT@897,"DO YOU WANT ANOTHER (Y/N)";:INPUT R$
400 IF R$="Y" ELSE IF R$="y" THEN 50
410 CLS:PRINT@400,"F I N I S H"
420 GOTO 420
```

Make the most of your Sinclair ZX Computer...

Sinclair ZX software on cassette.

£3.95 per cassette.

The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with other programs to form a single-subject cassette.

Each cassette costs £3.95 (including VAT and p&p) and comes complete with full instructions.

Although primarily designed for the Sinclair ZX81, many of the cassettes are suitable for running on a Sinclair ZX80 – if fitted with a replacement 8K BASIC ROM.

Some of the more elaborate programs can be run only on a Sinclair ZX Personal Computer augmented by a 16K-byte add-on RAM pack.

This RAM pack is described below. And the description of each cassette makes it clear what hardware is required.

16K-BYTE RAM pack

The 16K-byte RAM pack provides 16-times more memory in one complete module. Compatible with the ZX81 *and* the ZX80, it can be used for program storage or as a database.

The RAM pack simply plugs into the existing expansion port on the rear of a Sinclair ZX Personal Computer.

Cassette 1 – Games

For ZX81 (and ZX80 with 8K BASIC ROM)

ORBIT – your space craft's mission is to pick up a very valuable cargo that's in orbit around a star.

SNIPER – you're surrounded by 40 of the enemy. How quickly can you spot and shoot them when they appear?

METEORS – your starship is cruising through space when you meet a meteor storm. How long can you dodge the deadly danger?

LIFE – J. H. Conway's 'Game of Life' has achieved tremendous popularity in the computing world. Study the life, death and evolution patterns of cells.

WOLFPACK – your naval destroyer is on a submarine hunt. The depth charges are armed, but must be fired with precision.

GOLF – what's your handicap? It's a tricky course but you control the strength of your shots.

Cassette 2 – Junior

For ZX81 with 16K RAM pack

CRASH – simple addition – with the added attraction of a car crash if you get it wrong.

MULTIPLY – long multiplication with five levels of difficulty. If the answer's wrong – the solution is explained.

TRAIN – multiplication tests against the computer. The winner's train reaches the station first.

FRACTIONS – fractions explained at three levels of difficulty. A ten-question test completes the program.

ADDSUB – addition and subtraction with three levels of difficulty. Again, wrong answers are followed by an explanation.

DIVISION – with five levels of difficulty. Mistakes are explained graphically, and a running score is displayed.

SPELLING – up to 500 words over five levels of difficulty. You can even change the words yourself.

Cassette 3 – Business and Household

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack

TELEPHONE – set up your own computerised telephone directory and address book. Changes, additions and deletions of up to 50 entries are easy.

NOTE PAD – a powerful, easy-to-run system for storing and retrieving everyday information. Use it as a diary, a catalogue, a reminder system, or a directory.

BANK ACCOUNT – a sophisticated financial recording system with comprehensive documentation. Use it at home to keep track of 'where the money goes,' and at work for expenses, departmental budgets, etc.

Cassette 4 – Games

For ZX81 (and ZX80 with 8K BASIC ROM) and 16K RAM pack

LUNAR LANDING – bring the lunar module down from orbit to a soft landing. You control attitude and orbital direction – but watch the fuel gauge! The screen displays your flight status – digitally and graphically.

TWENTYONE – a dice version of Blackjack.

COMBAT – you're on a suicide space mission. You have only 12 missiles but the aliens have unlimited strength. Can you take 12 of them with you?

SUBSTRIKE – on patrol, your frigate detects a pack of 10 enemy subs. Can you depth-charge them before they torpedo you?

CODEBREAKER – the computer thinks of a 4-digit number which you have to guess in up to 10 tries. The logical approach is best!

MAYDAY – in answer to a distress call, you've narrowed down the search area to 343 cubic kilometers of deep space. Can you find the astronaut before his life-support system fails in 10 hours time?

Cassette 5 – Junior Education: 9-11-year-olds

For ZX81 (and ZX80 with 8K BASIC ROM)

MATHS – tests arithmetic with three levels of difficulty, and gives your score out of 10.

BALANCE – tests understanding of levers/fulcrum theory with a series of graphic examples.

VOLUMES – 'yes' or 'no' answers from the computer to a series of cube volume calculations.

AVERAGES – what's the average height of your class? The average shoe size of your family? The average pocket money of your friends? The computer plots a bar chart, and distinguishes MEAN from MEDIAN.

BASES – convert from decimal (base 10) to other bases of your choice in the range 2 to 9.

TEMP – Volumes, temperatures – and their combinations.

Cassette 6 – Family Quiz

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack.

Four different quizzes, each consisting of 10 questions suitable for the whole family. There's a target time for each quiz, and at the end you're told how long you took to answer the questions – and how many you got right. The quizzes cover a range of topics – including maths, English grammar, and general knowledge.

How to order

Simply use the order form below, and either enclose a cheque or give us the number of your Access, Barclaycard or Trustcard account. Please allow 28 days for delivery. 14-day money-back option.

sinclair ZX SOFTWARE

Sinclair Research Ltd, 6 Kings Parade, Cambridge, Cambs., CB2 1SN. Tel: 0276 66104.

To: Sinclair Research FREEPOST, Camberley, Surrey. GU15 3BR.

Please send me the items I have indicated below. *Please print*

Qty	Code	Item	Item price	Total
	21	Cassette 1 – Games	£3.95	
	22	Cassette 2 – Junior Education	£3.95	
	23	Cassette 3 – Business and Household	£3.95	
	24	Cassette 4 – Games	£3.95	
	25	Cassette 5 – Junior Education	£3.95	
	26	Cassette 6 – Family Quiz	£3.95	
	17	*8K BASIC ROM for ZX80	£19.95	
	18	*16K RAM pack for ZX81 and ZX80	£29.95	
		*Post and packing (if applicable)	£2.95	
			Total £	

*Please add £2.95 to total order value only if ordering ROM and/or RAM.

I enclose a cheque/PO to Sinclair Research Ltd for £ ______

Please charge by Access*/Barclaycard/Trustcard no. ______

**Please delete as applicable.*

Name: Mr/Mrs/Miss ______

Address: ______

SOF07

● Circle No. 149

Get it out of our system

You'll get a lot more out of Palantir than just a very professional multi processor computer system. Using all standard products, it gives you the flexibility to match your requirements exactly and to expand later at very low cost. And as it is fully compatible, you can use any other terminal or printer you choose.

Palantir gives you all the options – 232C serial ports (2 are standard), ASCII parallel ports, 2 megabyte dual 8" floppy drives, number of terminals expandable from 1 to 24 (more if required).

And each terminal has its own 64K Z80A computer allowing maximum processing speeds with minimum delays.

The hard disc drive with fixed and removable discs allows rapid access of information with a data transfer rate 40 times faster than most floppy discs and expandable from 10-96 megabytes.

And industry standard CP/M allows access to a wealth of existing or special software with all the service and maintenance you would expect.

Simply, it's a more economical way of doing things. You can only really appreciate the potential of the Palantir system by seeing it demonstrated. We'll arrange this, or simply send you literature if you prefer. Just ask.

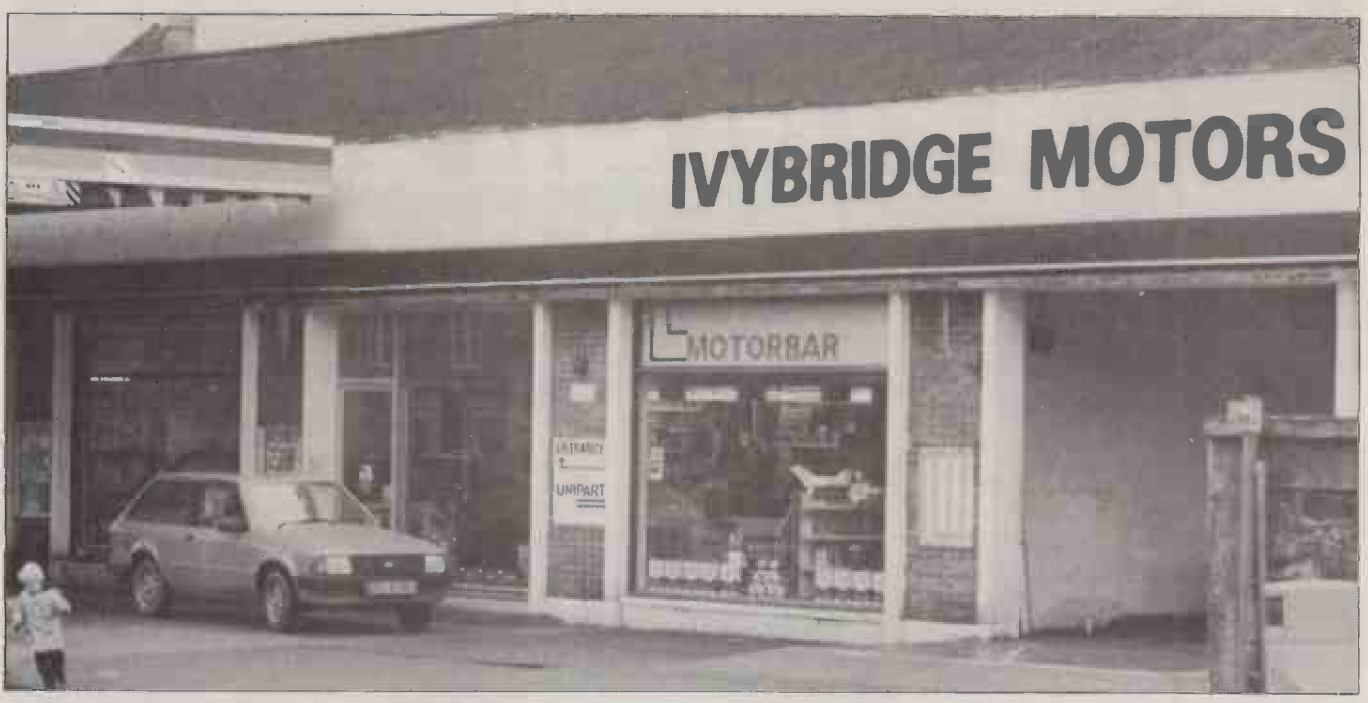
Harmer Simpson (U.K.) Ltd.
Ferrari House, 258 Field End Road,
Eastcote, Ruislip, Middlesex HA4 9UZ
Tel: 01-429 1266 Telex: 929804 HARMER G

Expandability Economy Compatability Standardisation

Palantir

Multi Processor Computer Systems

● Circle No. 150



DAVE TATTERSALL runs a thriving garage business in the South Hams town of Ivybridge, on the edge of Dartmoor. As well as selling petrol and offering car repairs and servicing, Ivybridge Motors is a BL retail outlet dealing in BL cars and components. The stores hold over 3,000 lines in BL and Unipart spares, and a wide range of items such as cigarettes, sweets and car accessories are sold in the shop.

Stock information

Keeping track of such a large and diverse selection of stock is no mean feat — how many of each line you have, where the items are, what it is all worth, and which lines are worth continuing. A comprehensive up-to-the-minute stock information service is the key to profitability in this line of business.

Over the past 18 months, Dave Tattersall had been approached by a number of people touting computerised stock-control systems at prices ranging from £250 to £25,000. The cheapest system offering simply quantity-in-stock for sequentially-numbered stock items, was written off as "Probably great for a toothbrush salesman stocking 50 different lines, useless to us". The most expensive, jointly marketed by ICL and BL, was clearly designed for big main dealers, and was far too high-powered for the pocket or the needs of the High Street retail dealer. Nobody was offering the level of sophistication needed, at a price that was realistic. Convinced that microcomputers held the key to stock management for the High Street retailer, Tattersall concluded that it was up to him to define a system to suit his needs.

I first met Dave Tattersall, and his parts manager Chris Hatch, when they signed up for a short introductory course on computing which I was running at Ivybridge Community College. We talked over the application he had in mind, and the sort of hardware he was likely to need. I was a little disappointed to hear that they already had someone lined up to write the software, a professional programmer working for a major corporation locally. With substantial real-time experience on the British Airways reservations network behind me, I fancied trying my hand at stock control on a micro.

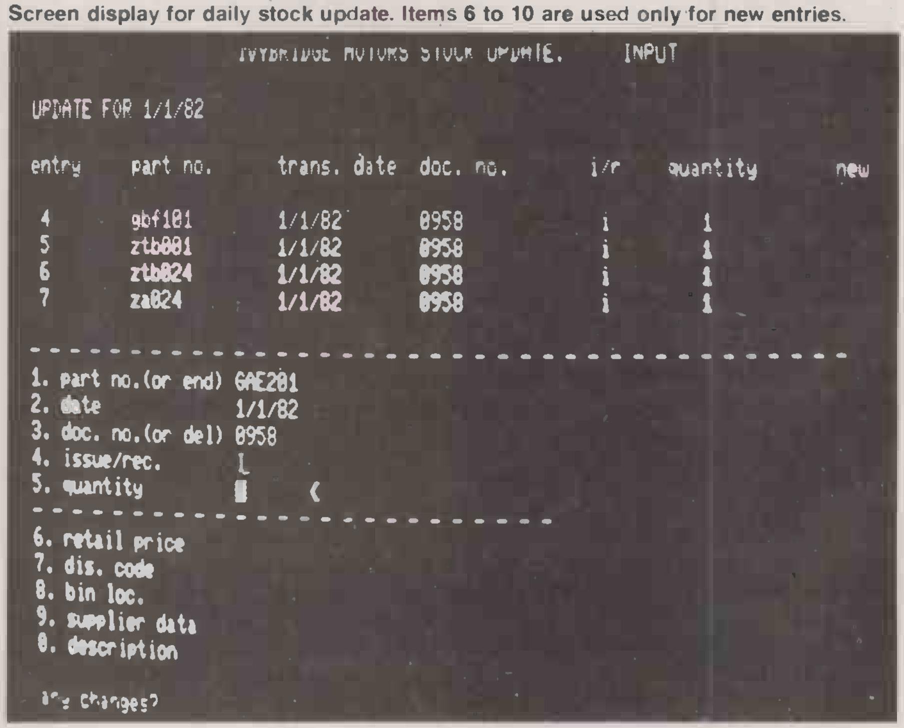
Tattersall shopped around, and chose his hardware carefully. He settled on the Commodore 8032 "Super Pet" with 0·5Mbyte twin discs and a high-speed 132-column printer. His programmer set to work on flowcharts and file layouts while waiting for the equipment to arrive.

About this time, things started to go awry. There was a hold-up, as ever, in the delivery of this system. By the time it arrived, his programmer had already been told that his firm was pulling out of Devon and he was due to move to the States in a matter of weeks. On his departure, Ivybridge Motors became the proud possessor of an unproved and very unwieldy prototype system, a poor match for the £3,000-worth of hardware supporting it.

Software misgivings

I was a little surprised to hear from Dave Tattersall again, and listened with some misgivings to his suggestion that I take on software maintenance of his new

Screen display for daily stock update. Items 6 to 10 are used only for new entries.



Keeping track of spare parts — they managed it on a micro

Grahame Blackwell took part in a bid to automate a High Street garage's stock list.

programs. After seeing the system in action, I tactfully suggested that instead I work with Chris Hatch on developing a comprehensive stock control system from scratch. A feasibility study soon established that Tattersall's chosen equipment was capable of supporting a real-time system with response times of three to four seconds on an inventory of over 5,000 line items.

The months that followed were very interesting and highly educative for both sides, though not always easy. Few computer users appreciate how long and involved is the path from testing an idea to making it foolproof and fully operational, and Ivybridge Motors was no exception. Getting the best out of the computer in terms of speed, storage and user interaction involved copious reference to *The Pet Revealed* and a few phone calls to Commodore.

Chris Hatch has picked up a good deal of knowledge about computer programs, and has on a number of occasions sat at the keyboard and modified a program as I phoned the amendments to him. For my part I learned a great deal about the garage business, and how to relate a computerised information system to that business.

User friendly

I also learned how closely Chris Hatch had followed my evening classes; he regularly quoted back at me my bland statement that "It is not up to users to adapt to the computer — it should be the other way round", whenever he felt that a little more programming could make his job easier. This guiding principle has led us to a system that is quick and simple for the non-specialist to use, and which meets all the main record-keeping requirements of Chris Hatch and others in his line of business.

The initial specification was for a system to hold detailed stock information on up to 5,000 line items, and permit access to that information and amendment of it. The system was also to have included a facility to update stock information on a daily basis, reflecting the day's transactions, and to provide a printout of those transactions suitable for audit trial. The information to be held for each item included:

part number
description
retail price
cost price
discount code
minimum stock level
quantity in stock
supplier details
on-order indicator
sales category, to indicate throughput

Over the months, various features have been added as the need for them became apparent, such as

special handling of sale-or-return stock
"Customers' Bench" one-off orders

giving a finished system several stages removed from the first draft.

Justifiably proud

Chris Hatch is more than pleased with the facilities the system now offers him, and is justifiably proud of his part in defining it. In just 10 minutes at the end of the day he can feed in all the information on the day's transactions, including items sold, orders delivered and stock ordered.

At any time he may access comprehensive information on any stock item, and can modify that information if necessary after input of a security code. He may also obtain a full printout of stock information, or of a selection of stock items under one of a number of different categories, including a cost and retail stock evaluation for each line item and for total stock. These printouts are in part-number order corresponding to BL catalogues and price lists, rather than a simple alphanumeric ordering.

After each day's stock update, he is provided with a transaction list, a printout of the new state of stock affected and a reorder list. Special facilities ease the twin burdens of stocktaking and repricing. The system monitors monthly throughput of each line item, and a variable indicator gives a constant check on profitability for each.

The package has received the seal of approval from the accountants who act for Ivybridge Motors and they intend to recommend it to other clients. Satisfied that his first step into the computer world has been amply justified, Dave Tattersall has recently purchased a business accounts package to run on his Commodore system. For a total outlay of under £5,000, he now has a comprehensive management information system which should increase efficiency and profitability and reduce expenditure on other management aids, such as bin price list for stock. He expects the system to have paid for itself in a relatively short period and is now looking to this computer to streamline other facets of his business, such as customer follow-up.

Vested interests

It is perhaps as well the system was up and running before Dave Tattersall received a BL circular detailing the findings of a consultative committee. It stated, in effect, that it would not be possible to maintain stock information for such a business on a microcomputer. One wonders how such findings are arrived at, and whether micros are being judged according to criteria handed down from mainframe experience.

Chris Hatch explains the system's finer points to manager Dave Tattersall.

Ivybridge Motors' short-lived initial package bears this out. Its file structures and program layouts were a model of good commercial programming practice, and worked well on test data of 200 items. Yet the full database of over 3,000 items led to an unacceptable four-minute response time, and the system ran out of disc space. Its extravagant file layout, with repetitive record headers and superfluous field delimiter characters, and programs making use of sequential disc searches over large numbers of records were totally inappropriate to the micro environment. The programmer himself was the first to agree that a rethink was needed.

The microcomputer is now the best solution to many medium and large-scale problems in information handling. It would be a shame if vested interest or inflexible outlook were to pronounce it unfit for service. By the same token, those from a mainframe or minicomputer background who are prepared to adapt to the micro's particular operational constraints will be able to bring a much-needed wealth of experience to bear on this fast-growing infant.

Did you pay too much tax last year? Elizabeth Acraman shows how to button. The program can also be modified to assess your 1982/83 liabilities.

Keeping income tax in

ONE OF THE LEAST popular ways in which the Government raises money is by income tax. It is levied on your total income, with some minor exceptions, less the allowances to which you are entitled during the tax year — the 12-month period ending on April 5 each year. This program will enable you to check your income tax liability according to the present Finance Act. It is written for a 40-column Pet with a CBM 3022 printer.

After establishing your name, the computer asks for your status — male or female; single, married or widowed. If you are a married woman it asks if you wish to calculate income tax just for yourself, in which case you will be regarded as a single woman, or jointly with your husband, when you will be regarded as a married man.

If you are a widow, the Pet asks if your husband died before April 6, 1981 in order to establish your entitlement to the Special Bereavement Allowance for the year in which your husband died. If applicable, it is calculated by reference to the date of his death.

You are then asked to enter details of your income and outgoings for the year:

- Earnings — that is salary or wages — including overtime, commission, etc.
- Benefits in kind, such as company car, cheap loans, etc. Note that some benefits are not taxable and some are only taxable if you count as "higher paid". Your employer should be able to advise you of the amount of benefit on which you are liable to tax.
- Allowable expenses, which are defined as those necessary for your work, such as tools, professional subscriptions etc.
- Pension contributions to your employer's pension fund. This does not include your National Insurance deductions.
- State pensions receivable which are taxable, such as retirement pension — excluding supplementary, widow's pension, etc.
- Other pensions receivable, for example, from former employer or personal pension if you were given tax relief on the payments you made into the scheme.
- Gross amount of any income you receive under a deed of covenant, and the tax deducted from it.

1981/82 tax liability check.

```
100 REM**INCOME TAX**
110 REM**E.G.ACRAMAN**
120 REM**COPYRIGHT FEB 1982**
130 CLR
140 DIMA(17,3),I$(17),C%(7),A$(8),D%(5)
150 DEFFNA(X)=LEN(STR$(X))
160 FORX=1TO3:OPENX,4,X-1:NEXT
170 Y$=CHR$(29)
180 F$="  999999-"
190 F1$="   AAAAAAAAAAAAAAAAAAA  "+F$+F$+F$+" "
200 F2$="   AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA"+F$+" "
210 FORR=1TO17:READI$(R):NEXT
220 FORX=1TO8:READA$(X):NEXT
230 FORR=1TO7:READT$(R):NEXT
240 FORR=1TO4:READD$(R):NEXT
250 GOTO420
260 REM**INPUT SUBROUTINE**
270 PRINT"PLEASE INDICATE 'Y' OR 'N'"
280 Z$="YN"
290 GETA$:IFA$=""THEN290
300 FORZ=1TOLEN(Z$)
310 IFMID$(Z$,Z,1)=A$THENRETURN
320 NEXT
330 GOTO270
340 INPUT" DAY   ";D
350 INPUT" MONTH ";M
360 INPUT" YEAR  ";Y:IFY<1900THENY=Y+1900
370 IFD<1ORD>31ORM<1ORM>12ORY<1981THEN340
380 IFD>5THENWA=16-M
390 IFD<6THENWA=17-M
400 IFY>1981THENWA=WA-12
410 RETURN
420 PRINT"WHAT IS YOUR NAME ?"
430 INPUTN$
440 C=2
450 PRINT"ARE YOU :-"
460 PRINT"1)   MALE"SPC(31)"2)   FEMALE
470 PRINT"PLEASE INDICATE 1 OR 2
480 INPUTSE:IFSE<1ORSE>2THEN450
490 PRINT"ARE YOU :-
500 PRINT"1)   SINGLE OR DIVORCED
510 PRINT"2)   MARRIED
520 PRINT"3)   WIDOWED
530 PRINT"PLEASE INDICATE 1,2 OR 3
540 INPUT SS:IFSS<1ORSS>3THEN490
550 IFSE=2ANDSS=2THENGOSUB700
560 IFSE=2ANDSS=3THEN580
570 GOTO840
580 PRINT"DID YOUR HUSBAND DIE
590 PRINT"BEFORE 6 APRIL 1981 ?"
600 GOSUB260
610 IFZ=1THEN840
620 PRINT"PLEASE ENTER DATE OF DEATH IN NUMBERS"
630 GOSUB340
640 REM**CALCULATE WIDOWS ALLCE**
650 B(3)=INT(WA/12*770)
660 B(1)=1375
670 PRINT"PLEASE ENTER YOUR INCOME AND OUTGOINGS"
680 PRINT"SINCE YOU WERE WIDOWED"
690 GOTO860
700 PRINT"DO YOU WISH TO CALCULATE
710 PRINT"INCOME TAX :-
720 PRINT"1)   JUST FOR YOURSELF
730 PRINT"2)   JOINTLY WITH YOUR HUSBAND
740 PRINT"PLEASE INDICATE 1 OR 2
750 INPUTSC:IFSC<1ORSC>2THEN700
760 IFSC=1THENSS=1:RETURN
770 SE=1
780 RETURN
790 REM**MARRIED MAN**
800 PRINT"NOW PLEASE ENTER THE SAME
810 PRINT"DETAILS IN RESPECT OF YOUR WIFE
820 C=3
830 GOTO860
840 PRINT"PLEASE ENTER YOUR INCOME
850 PRINT"AND OUTGOINGS FOR THE YEAR
860 FORR=1TO16
870 PRINT"ENTER "I$(R)
880 INPUTQ:A(R,C)=INT(Q):NEXT
890 GOSUB1720
900 A(3,C)=-A(3,C):A(4,C)=-A(4,C)
910 D%(1)=D%(1)+A(8,C):A(8,C)=0
920 D%(2)=D%(2)+A(10,C):A(10,C)=0
930 D%(3)=D%(3)+A(13,C):A(13,C)=0
940 A(11,C)=A(11,C)-70
950 IFA(11,C)<0THENA(11,C)=0
960 Q=A(14,C)*30/70:D%(4)=D%(4)+Q:A(14,C)=INT(A(14,C)+Q)
970 A(15,C)=-A(15,C):A(16,C)=-A(16,C)
980 GOSUB1890
990 IFSE=1ANDSS=2ANDC=2THEN790
1000 FORQ=7TO16
1010 A(Q,1)=A(Q,2)+A(Q,3)
1020 A(Q,2)=0
1030 A(Q,3)=0
1040 NEXT
1050 FORR=1TO17
1060 I=I+A(R,1)
1070 S=S+A(R,2)
1080 W=W+A(R,3)
1090 NEXT
1100 T=I+S+W
1110 Q=0
1120 PRINT"DO YOU CLAIM DEPENDENT
1130 PRINT"RELATIVE ALLOWANCE ?"
1140 GOSUB260
1150 IFZ=1THEN1170
1160 GOTO1200
1170 INPUT"  FOR HOW MANY RELATIVES ?";Q
1180 IF(SE=2ANDSS=1)OR(SE=2ANDSS=3)THENB(4)=145*Q:GOTO1200
1190 B(4)=100*Q
1200 IFSS<>3THEN1240
1210 PRINT"DO YOU CLAIM HOUSEKEEPER ALLOWANCE ?"
1220 GOSUB260
1230 IFZ=1THENB(5)=100
1240 PRINT"DO YOU CLAIM ADDITIONAL
1250 PRINT"PERSONAL ALLOWANCE
1260 GOSUB260
1270 IFZ=1THENB(6)=770
1280 PRINT"DO YOU CLAIM ALLOWANCE"
1290 PRINT"FOR SON/DAUGHTER SERVICES ?"
1300 GOSUB260
1310 IFZ=1THENB(7)=55
1320 PRINT"DO YOU CLAIM
1330 PRINT"BLIND PERSONS ALLOWANCE ?"
```

(continued on page 88)

ind out at the touch of a

check

Gross amount of dividends received, and the tax deducted from them

Total amount of interest received from a National Savings Bank ordinary account last year. In the first and last years of receipt of such interest the amount should be the current year's interest. The first £70 of such interest is tax free, and this will be automatically allowed for in calculating your income tax.

Any other investment income, such as bank interest, local authority loan, etc., and the tax deducted from this.

Interest received from building society accounts. Building society interest is received "tax paid" but for some purposes it must be grossed up for the notional basic rate of tax. This is calculated by the program and the notional tax is treated as tax already deducted.

Mortgage interest allowable, and then any other interest allowable on qualifying loans.

The Pet then asks if you wish to check your entries. If so, each item and the amount you entered will be displayed in turn. You may agree or amend any item. You are then asked if any of your duties were performed abroad; if you worked abroad for the whole year, your earnings will not be subject to income tax. If you worked abroad for more than 30 days in the year, a quarter of your earnings for that period are free of tax, and this will be automatically calculated and allowed.

If you are a married man you are then asked to enter all the information on income, pensions, interest, etc., in respect of your wife. If you were married during the year only your wife's income after your marriage should be entered.

The next stage is to enter your entitlement to various allowances, such as for dependent relative, housekeeper — only available to a widower or widow — additional personal allowance for those bringing up children on their own, son's, daughter's services, and blind person's allowance. You are then asked if you — or your wife if you are a married man — were born before April 6, 1917, to establish your entitlement to Age Relief. This is a higher rate of personal allowance, but is subject to abatement if your taxable income is above a specified level. All the relevant calculations are built into the program.

If you are a married man the program asks if you were married before April 6, 1981. If not, your married man's personal allowance is adjusted to take account of the date of your marriage and, again, this calculation is built into the program. For the year of your marriage your wife is treated as a single woman — with the full single person's personal allowance — for the first part of the tax year up to the date of your marriage. For the second part of the tax year, after the date of your marriage, she is entitled to the wife's earned income relief on her earnings during that period.

Your personal allowances, wife's earned-income relief, if applicable, together with income tax payable at the various rates and investment income surcharge are all calculated by the program. If you are entitled to any repayment of tax, this is also calculated and shown.

You then have the option of having the calculations displayed on the screen in three sections — Income, Allowances and Tax Payable — or printed out. The program is designed to cater for straightforward income tax assessments, which covers the majority of cases. If there are individual circumstances which affect your particular case you will need to adjust the calculations to take account of them.

Cassettes of this program for both the 1981/82 and 1982/83 tax years are available from the author at 49 Kingsend, Ruislip, Middlesex for £4, including postage and packaging.

	Present Value (1981/2) £	Variable	Line number(s)
Allowances			
Personal allowance			
single	1375	B(1)	660, 1420, 1470
married man	2145	B(1)	1540, 1670
Age relief (maximum)			
single	1820	B(1)	1450
married	2895	B(1)	1650
trigger for abatement	5900		1460, 1660
Additional personal allowance in year of marriage	770		1620
Widows bereavement allowance (whole year)	770	B(3)	650
Wife's earned-income relief (maximum)	1375	B(2)	1690, 1700
Dependent relative			
for single woman	145	B(4)	1180
other	100	B(4)	1190
Housekeeper	100	B(5)	1230
Additional personal allowance	770	B(6)	1270
Son or daughter services	55	B(7)	1310
Blind person	180	B(8)	1350
Tax			
Tax rate bands			
first	11250		2060, 2100, 3820
next	2000		2090, 3820
next	3500		2110, 3820
next	5500		2130, 3830
next	5500		2150, 3830
Rates of tax			
first	30%		2060, 2080
second	40%		2090, 2100
third	45%		2110, 2120
fourth	50%		2130, 2140
fifth	55%		2150, 2160
top	60%		2170
Investment income surcharge			
trigger	5500		2190, 2200
rate	15%		2200
Notional tax on building society interest	30/70	Q	960
Overseas earnings			
minimum number of days eligible for relief	30	N	1980
proportion of earnings relieved	25%		1990
Tax-free interest on ordinary savings accounts	£70		940
Dates			
date of birth for eligibility to age relief	6.4.1917		1390, 1510
beginning of tax year	6.4.1981		590, 1560, 370, 400
current tax year	1981/82		3010

Variables for checking 1981/82 tax.

(continued from page 86)

```
1340 GOSUB260
1350 IFZ=1THENB(8)=180
1360 REM**PERSONAL ALL-MARRIED COUPLE**
1370 IFSE=1ANDSS=2THEN1490
1380 REM**PERSONAL ALL-SINGLE**
1390 PRINT"WERE YOU BORN BEFORE 6 APRIL 1917 ?"
1400 GOSUB260
1410 IFZ=1THEN1440
1420 B(1)=1375
1430 GOTO2010
1440 REM**SINGLE-AGE RELIEF**
1450 B(1)=1820
1460 IFT>5900THENB(1)=INT(B(1)-((T-5900)*2/3))
1470 IFB(1)<1375THENB(1)=1375
1480 GOTO2010
1490 REM**MARRIED COUPLE**
1500 PRINT"WERE EITHER YOU OR YOUR WIFE
1510 PRINT"BORN BEFORE 6 APRIL 1917 ?"
1520 GOSUB260
1530 IFZ=1THEN1640
1540 B(1)=2145
1550 PRINT"WERE YOU MARRIED BEFORE"
1560 PRINT"6 APRIL 1981 ?"
1570 GOSUB260
1500 IFZ=1THEN1680
1510 PRINT"ENTER DATE OF MARRIAGE IN NUMBERS"
1600 GOSUB340
1610 REM**CALCULATE ALLOWANCE**
1620 B(1)=1375+INT(WA/12*770)
1630 GOTO1680
1640 REM**MARRIED-AGE RELIEF**
1650 B(1)=2895
1660 IFT>5900THENB(1)=INT(B(1)-((T-5900)*2/3))
1670 IFB(1)<2145THENB(1)=2145
1680 REM**WIFE EARNED INCOME**
1690 B(2)=1375
1700 IFW<1375THENB(2)=W
1710 GOTO2010
1720 PRINT"WOULD YOU LIKE TO CHECK
1730 PRINT"YOUR ENTRIES ?"
1740 GOSUB260
1750 IFZ=1THEN1770
1760 RETURN
1770 FORR=1TO16
1780 PRINT"":PRINTI$(R),A(R,C)
1790 PRINT"IS THIS ONE ALRIGHT ?"
1800 GOSUB260
1810 IFZ=1THENNEXT
1820 IFZ=2THEN1840
1830 RETURN
1840 INPUT"PLEASE INPUT REVISED AMOUNT";Q:A(R,C)=INT(Q)
1850 PRINT"DO YOU WISH TO CONTINUE ?"
1860 GOSUB260
1870 IFZ=1THENNEXT
1880 RETURN
1890 REM**OVERSEAS EARNINGS**
1900 PRINT"WERE ANY OF YOUR DUTIES
1910 PRINT"PERFORMED ABROAD ?"
1920 GOSUB260
1930 IFZ=1THEN1950
1940 RETURN
1950 PRINT"HOW MANY DAYS WERE SPENT ABROAD ?"
1960 INPUTN
1970 IFN>364THENA(17,C)=(A(1,C)+A(2,C))*-1:RETURN
1980 IFN<30THENRETURN
1990 A(17,C)=-INT(A(1,C)/4*N/365)
2000 RETURN
2010 REM**CALCULATE TAX**
2020 FORR=1TO8
2030 B=B+B(R)
2040 NEXT
2050 C=T-B
2060 IFC>11250THENC%(1)=11250*.3:GOTO2090
2070 IFC<0THENC%(1)=0:GOTO2180
2080 C%(1)=C*.3:GOTO2180
2090 IFC>13250THENC%(2)=2000*.4:GOTO2110
2100 C%(2)=(C-11250)*.4:GOTO2180
2110 IFC>16750THENC%(3)=3500*.45:GOTO2130
2120 C%(3)=(C-13250)*.45:GOTO2180
2130 IFC>22250THENC%(4)=5500*.5:GOTO2150
2140 C%(4)=(C-16750)*.5:GOTO2180
2150 IFC>27750THENC%(5)=5500*.55:GOTO2170
2160 C%(5)=(C-22250)*.55:GOTO2180
2170 C%(6)=(C-27750)*.6
2180 REM**INVESTMENT INCOME SURCHARGE**
2190 IFI<5500THEN2210
2200 C%(7)=(I-5500)*.15
2210 REM**TOTAL TAX LIABILITY**
2220 FORR=1TO7
2230 TT=TT+C%(R)
2240 NEXT
2250 REM**TAX ALREADY DEDUCTED**
2260 FORR=1TO4
2270 E=E+D%(R)
2280 NEXT
2290 REM**NET TAX PAYABLE**
2300 F=TT-E
2310 PRINT"DO YOU WANT TO :-"
2320 PRINT"1)   DISPLAY ON SCREEN
2330 PRINT"2)   PRINT OUT
2340 PRINT"3)   END
2350 PRINT"PLEASE ENTER YOUR CHOICE (1-3)
2360 INPUTK:IFK<1ORK>3THEN2350
2370 ONKGOTO2380,3000,3660
2380 REM**SCREEN DISPLAY**
2390 PRINT"":PRINTTAB(29)"E A R N E D
2400 PRINTTAB(20)" INVMT   SELF   WIFE"
2410 FORR=1TO17:FORX=1TO3
2420 IFA(R,X)<>0THENGOSUB2450
2430 NEXT:NEXT
2440 GOTO2490
2450 X=3
2460 PRINTI$(R)TAB(25-FNA(A(R,1)))A(R,1);
2470 PRINTTAB(32-FNA(A(R,2)))A(R,2)TAB(39-FNA(A(R,3)))A(R,3);
2480 RETURN
2490 PRINTTAB(19)"------  ------  ------"
2500 PRINT"TOTAL NET INCOME"TAB(25-FNA(I))ITAB(32-FNA(S))STAB(39-FNA(W))W
2510 PRINTTAB(19)"------  ------  ------"
2520 PRINT"TAXABLE INCOME"TAB(32-FNA(T))T
2530 PRINT"NEXT PAGE ?"
2540 GOSUB260
2550 IFZ=2THEN2310
2560 PRINT"ALLOWANCES"
2570 FORR=1TO8
2580 IFB(R)<>0THENGOSUB2610
2590 NEXT
2600 GOTO2630
```

```
2610 PRINTA$(R)TAB(32-FNA(B(R)))B(R)
2620 RETURN
2630 PRINTTAB(25)" ———————"
2640 PRINT"TOTAL ALLOWANCES"TAB(32-FNA(B))B
2650 PRINTTAB(25)" ———————"
2660 PRINT"NET TAXABLE INCOME"TAB(32-FNA(C))C
2670 PRINT"NEXT PAGE ?"
2680 GOSUB260
2690 IFZ=2THEN2310
2700 PRINT"▥TAX LIABILITY"
2710 FORR=1TO7
2720 IFC%(R)<>0THENGOSUB2750
2730 NEXT
2740 GOTO2770
2750 PRINTT$(R)TAB(25-FNA(C%(R)))C%(R)
2760 RETURN
2770 PRINTTAB(20)"———————"
2780 PRINT"TOTAL TAX LIABILITY "TAB(32-FNA(TT))TT
2790 PRINT"▥TAX ALREADY DEDUCTED:-"
2800 FORR=1TO4
2810 IFD%(R)<>0THENGOSUB2840
2820 NEXT
2830 GOTO2860
2840 PRINTD$(R)TAB(25-FNA(D%(R)))D%(R)
2850 RETURN
2860 PRINTTAB(20)"———————"
2870 PRINT"TOTAL TAX DEDUCTED "TAB(32-FNA(E))E
2880 PRINTTAB(26)"———————"
2890 PRINT"NET TAX PAYABLE"TAB(32-FNA(F))F
2900 PRINTTAB(26)"———————"
2910 IFF<0THENGOSUB2950
2920 PRINT"PRESS ANY KEY TO CLEAR"
2930 GETZ$:IFZ$=""THEN2930
2940 GOTO2310
2950 Q=TT-D%(4)
2960 IFQ<0THENQ=0
2970 G=E-D%(4)-Q
2980 PRINT"TAX REPAYABLE"TAB(32-FNA(G))G
2990 RETURN
3000 REM**PRINTOUT**
3010 PRINT#1,TAB(29)"INCOME TAX COMPUTATION 1981/82"
3020 PRINT#1
3030 PRINT#1,TAB((80-LEN(N$))/2)N$
3040 PRINT#1
3050 PRINT#1,TAB(43)"E A R N E D
3060 PRINT#1,TAB(27)"INVESTMENT     SELF       WIFE"
3070 PRINT#3,F1$
3080 FORR=1TO17:FORX=1TO3
3090 IFA(R,X)<>0THENGOSUB3120
3100 NEXT:NEXT
3110 GOTO3150
3120 PRINT#2,I$(R)Y$A(R,1)A(R,2)A(R,3)CHR$(13);
3130 X=3
3140 RETURN
3150 PRINT#1,TAB(28)"————————   ————————   ————————"
3160 PRINT#2,"TOTAL NET INCOME"Y$,I,S,W
3170 PRINT#1,TAB(28)"————————   ————————   ————————"
3180 PRINT#3,F2$
3190 PRINT#2,"TAXABLE INCOME"Y$,T
3200 PRINT#3,F1$
3210 PRINT#1,"ALLOWANCES"
3220 FORR=1TO8
3230 IFB(R)<>0THENGOSUB3260
3240 NEXT
3250 GOTO3280
3260 PRINT#2,A$(R)Y$,B(R)
3270 RETURN
3280 PRINT#1,TAB(28)"————————"
3290 PRINT#3,F2$
3300 PRINT#2,"TOTAL ALLOWANCES"Y$,B
3310 PRINT#1,TAB(38)"————————"
3320 PRINT#2,"NET TAXABLE INCOME"Y$,C
3330 PRINT#1,TAB(38)"————————"
3340 PRINT#1,"TAX LIABILITY"
3350 PRINT#3,F1$
3360 FORR=1TO7
3370 IFC%(R)<>0THENGOSUB3400
3380 NEXT
3390 GOTO3420
3400 PRINT#2,T$(R)Y$C%(R)
3410 RETURN
3420 PRINT#1,TAB(28)"————————"
3430 PRINT#3,F2$
3440 PRINT#2,"TOTAL TAX LIABILITY"Y$TT
3450 PRINT#1,"TAX ALREADY DEDUCTED"
3460 PRINT#3,F1$
3470 FORR=1TO4
3480 IFD%(R)<>0THENGOSUB3510
3490 NEXT
3500 GOTO3530
3510 PRINT#2,D$(R)Y$D%(R)
3520 RETURN
3530 PRINT#1,TAB(28)"————————"
3540 PRINT#3,F2$
3550 PRINT#2,"TOTAL TAX DEDUCTED"Y$E
3560 PRINT#1,TAB(38)"————————"
3570 PRINT#2,"NET TAX PAYABLE"Y$F
3580 PRINT#1,TAB(38)"————————"
3590 IFF<0THEN3610
3600 GOTO3660
3610 Q=TT-D%(4)
3620 IFQ<0THENQ=0
3630 G=E-D%(4)-Q
3640 PRINT#2,"TAX REPAYABLE"Y$G
3650 GOTO2310
3660 CLOSE1:CLOSE2:CLOSE3
3670 END
3680 REM**INCOME HEADS**
3690 DATATOTAL EARNINGS,BENEFITS IN KIND
3700 DATAALLOWABLE EXPENSES,PENSION CONT'BNS
3710 DATAPENS:RECD-STATE,PENS.RECD-OTHER
3720 DATACOVENANT INC-GROSS,TAX DEDUCTED
3730 DATADIVIDEND INC-GROSS,TAX DEDUCTED
3740 DATAORD SVNGS INTEREST,OTH INV INC-GROSS
3750 DATATAX DEDUCTED,BLDG SOC.INTEREST
3760 DATAM'GAGE INT ALLBLE,OTHER INT ALLBLE
3770 DATAO'SEAS EARNINGS
3780 REM**ALLOWANCES**
3790 DATAPERSONAL,WIFES EARNED INC.,WIDOWS ALLCE,DEFENDENT RELATIVE
3800 DATAHOUSEKEEPER,ADDTL PERSONAL,SON/DAUGHTER,BLIND PERSON
3810 REM**TAX RATES**
3820 DATAON FIRST 11250,ON NEXT  2000,ON NEXT  3500
3830 DATAON NEXT  5500,ON NEXT  5500,ON BALANCE
3840 DATAINVESTMENT SURCHARGE
3850 REM**TAX DEDUCTED**
3860 DATADEED OF COVENANT,DIVIDENDS,OTHER INV INCOME
3870 DATABLDG SOC. INTEREST
READY.
```

Digital Research's CP/M disc operating system is a household name in the micro world, yet few of its users understand even remotely how it works. Adrian Hill explains its basic elements and shows how you can extend the use of CP/M routines by linking them to your tailor-made machine-code programs.

The secret life

IT IS QUITE straightforward to include any of the CP/M routines into standard assembly-language code, but first you need some understanding of how CP/M works and what the internal routines will do for you.

CP/M is a monitor program in just the same way as Nascom uses Nasbug and NasSys, Tangerine uses Tanbug, and so on. In its simplest form, a monitor might be used by the user to control the system hardware, providing routines to allow such features as obtaining input from the keyboard, displaying results or user instructions on the VDU, or reading from and writing to a cassette machine. As CP/M is a disc operating system, it is much more complicated than many other monitors, and consists of four distinct sections.

The basic input/output system, Bios, contains all the routines required to allow access to the input/output devices such as the VDU and keyboard, which are collectively known as the console under CP/M, as well as tape or paper-tape units, printers and other peripheral devices. In particular, Bios allows the user to print characters on the screen either individually or in text strings, to obtain from the keyboard either single characters or lines of text, and to query the availability of input from the keyboard.

BDos and FDos

The basic disc operating system, BDos, contains all the routines required to allow access to and from the disc drives. The main operations supported by the BDos are the creation and deletion of named files, opening and closing named files for future processing, and reading and writing specific records to named files.

The console command processor, CCP, contains the routines which request, obtain and interpret user commands, providing the interface between CP/M and the user. The transient program area, TPA, is the area of RAM in which programs are actually run.

The Bios and BDos are collectively known as the floppy-disc operating system, FDos. All the routines within FDos are fully accessible to any user who is willing to write some machine code.

The FDos routines themselves are known as "primitives", and may be accessed from the user's machine-code program in the same way as a normal subroutine — with one small difference. The primitive can only be called indirectly, by loading a pointer with a number corresponding to the primitive required and then executing a call to the FDos at location 0005H. Each primitive available to the user has its own specific primitive number, and these are listed and briefly explained in the CP/M interface guide supplied with the system. These function numbers are briefly outlined in table 1.

Function performed	Primitive number
Reset system	0
Read character from console	1
Write character to console	2
Read character from tape reader	3
Write character to tape punch	4
Write character string	5
Query input/output device allocation	7
Change input/output device allocation	8
Write contents of console buffer to VDU	9
Read from keyboard to console buffer	10
Check availability of input character	11
Raise disc head	12
Reset disc system	13
Declare disc to be logged in	14
Open a disc file	15
Close a disc file	16
Search for location of file	17
Search for subsequent occurrence of file	18
Delete a disc file	19
Read a record from file	20
Write a record to file	21
Create a new file	22
Rename a file	23
Check for log in	24
Check logged disc	25
Set DMA buffer address	26
Check disc allocation	27

Table 1. CP/M primitive numbers.

The FDos uses register C as the pointer, and registers D and E to contain any required function parameters. It will return any result in register A, or in registers A and B for 16-bit results. The steps required in calling a CP/M primitive from the user's program are:

- Load register C with the required function number.
- Load registers D and E with any required parameters.
- Execute a call to FDos at location 0005H.
- On return from the primitive, the user program should check any returned results and interpret them as neccessary.

Finding files

Using the primitives, it is possible to create and access files held on disc. You must first establish how to identify your target file on the disc. This is accomplished by creating a data structure in RAM which contains the name of the file you wish to access, along with certain other information required by the system in order to allow it to find your file. This

Table 2. FCB locations.

Byte	Contents
0	not currently used — assumed to contain 0
1–8	Filename in ASCII code padded with blanks
9–11	Filetype in ASCII code padded with blanks
12	file size in 128 record blocks (extents)
13–14	not currently used — assumed to contain 0
15	current extent size, number of records
16–31	disc-allocation map, filled-in by system
32	current record for processing

Table 3. Program constants variables and buffers.

Constants

FDos	entry point to floppy-disc operating system
FCB	location of the FCB in RAM
FilBuf	location of disc buffer in RAM
FName	location of the Filename field in FCB
FType	location of the Filetype field in FCB
FCRec	location of the Current Record field in FCB
Init	CP/M primitive number — reset disc system
OpFil	CP/M primitive number — open file
PCBuf	CP/M primitive number — print console buffer
RCBuf	CP/M primitive number — read console buffer
PCCHR	CP/M primitive number — print screen character
CRFil	CP/M primitive number — create new file
CLFil	CP/M primitive number — close file
WRFil	CP/M primitive number — write next record
SetDMA	CP/M primitive number — set disc I/O buffer location

Variables and buffers

IncBuf	location of console buffer in RAM
BufCNT	number of bytes currently in disc buffer
BufLoc	current location of next byte in disc buffer
OldSP	previous stack pointer contents
Stack	location of new stack in RAM
TopSTK	actual top of new stack

Demonstration program — section 1.

```
0100              ORG 100H
0100 C33003       JMP START
0005 =          FDOS       EQU 0005H
005C =          FCB        EQU 005CH
0080 =          FILBUF     EQU 0080H
005D =          FNAME      EQU FCB + 1
0065 =          FTYPE      EQU FCB + 9
007C =          FCREC      EQU FCB + 32
000D =          INIT       EQU   13
000F =          OPFIL      EQU   15
0009 =          PCBUF      EQU    9
000A =          RCBUF      EQU   10
0002 =             PCCHR      EQU     2
0016 =             CRFIL      EQU    22
0010 =             CLFIL      EQU    16
0015 =             WRFIL      EQU    21
001A =             SETDMA     EQU    26
                   ;
0103 80            INCBUF     DB 128
0104               BUFF       DS 128
0184 80            BUFCNT     DB 128
0185 8000          BUFLOC     DW FILBUF
0187               OLDSP      DS 2
0189               STACK      DS 48
01B9 =             TOPSTK     EQU $
```

# of CP/M

structure is known as a file-control block, FCB.

The FCB must occupy 33 bytes of RAM and contain the information shown in table 2. It may reside anywhere in the system RAM, but must be explicitly created by the user's program with the details of the particular file required. The location of the FCB in RAM must be declared to the FDos as a parameter on entry to any disc-access primitives. This is done in registers D and E.

FCB locations

As the FCB can reside anywhere in RAM, there is no reason why you cannot have any number of FCBs present simultaneously at different locations in RAM, allowing access to any number of files in one program, with each one specified by its FCB location. When creating an FCB, it will generally be sufficient for the user to fill in only the fields containing the file name, file type and current record. The rest of the fields may be set to zero and will be changed by the system if appropriate. The FCB, and its correct use, is the key to the successful use of CP/M primitives.

Our example program, which has been split into 10 parts, illustrates the use of a number of primitives. It creates a new file on the disc with a name and type specified by the user; opens this new file for subsequent processing; writes a record as input by the user, to the file on disc; and closes the file after use.

The program logic, such as it is, is shown in the flow-chart in figure 1. Section 1 of the program declares the values of all constants to be used in the program and reserves the locations required for any variables and buffers. Most of the constants are simply the CP/M function numbers of the primitives used. The constants, variables and buffers, are shown in table 3.

Section 2 of the program sets up the text strings which are to be written to the screen by the various error routines. Each is terminated by a $, which is recognised by CP/M as denoting its end.

Section 3 contains the error routines to print the text strings. To print each message, you use the CP/M Print Console Buffer function. The actual buffer, or text strings used depends on the nature of the error. Thus register C is loaded with PCBuf, registers D and E are loaded with the start location of the required buffer, and a call is executed to FDos.

Section 4 of the program contains the subroutine to print a new line — Return — on the screen, which is accomplished by loading register C with PCCHR — print single character on screen — loading register E with the required character in ASCII code, and executing the call to FDos. This procedure is repeated twice: once to send the carriage return, ASCII 0Dhex, and once for the line feed, ASCII 0Ahex.

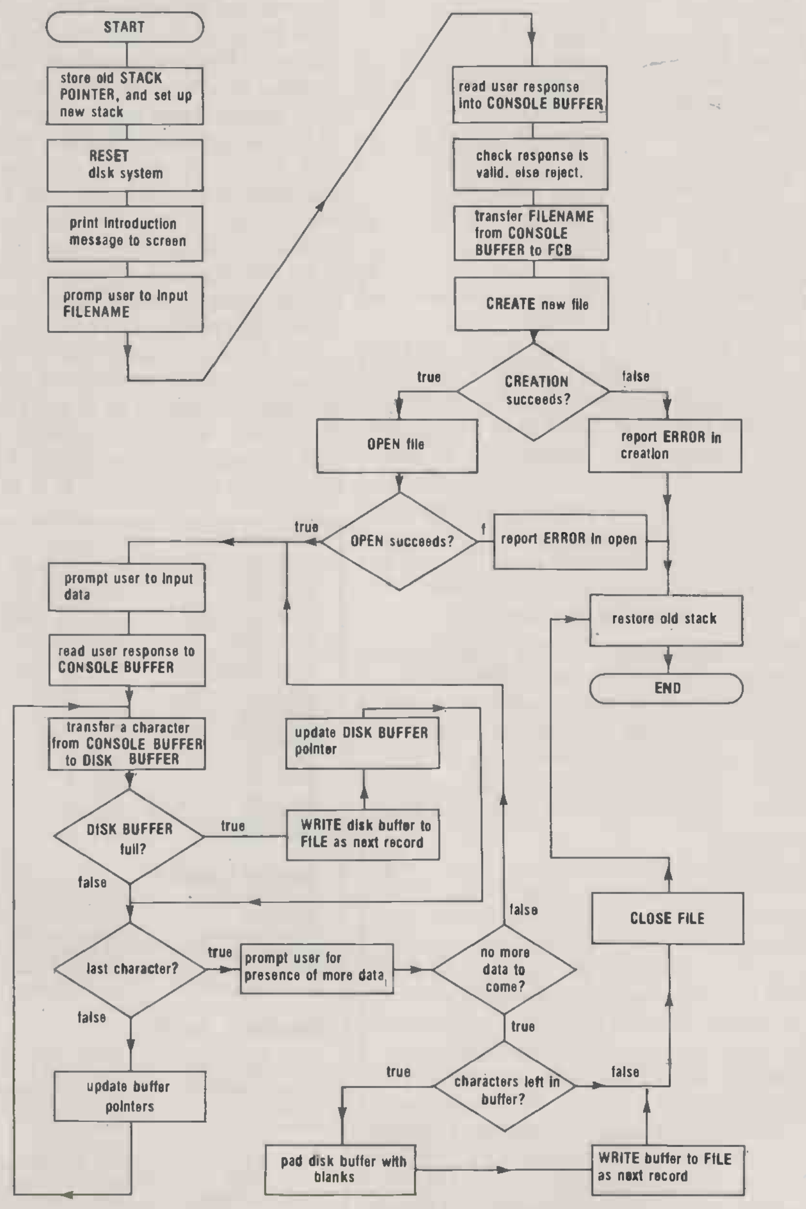
In section 5 subroutine Setter loads the user-transparent FCB fields with nulls. All fields except Filename, Filetype, and Current Record are set by this routine. Setter contains no FDos calls and simply loads register A with zero, and moves this value to the relevant FCB locations as pointed to by register H/L, which is directly set by the routine.

In section 6 Start marks the first section of the main program. Part A stores the contents of the old stack pointer and loads it with the new stack location. It also resets the disc system by loading register C with the Reset Disc System primitive number Init, and executes the call to FDos.

Part B prints two blank lines on the

(continued on next page)

Figure 1. Example program flowchart.



Demonstration program — section 2.

```
01B9 2020204350   INMBUF    DB '   CP/M INTERFACE EXAMPLE$'
01D3 2020205459   M1BUF     DB '   type your filename$'
01E9 2020205459   M2BUF     DB '   type your data.( max 128 CHARS.)$'
020D 202020414E   M3BUF     DB '   any more data?$'
021E 2020204E4F   M4BUF     DB '   now use TYPE to view file.$'
023C 202020454E   M5BUF     DB '   enter any char. to return to CP/M.$'
0263 20204E5641   M6BUF     DB '  INVALID FILENAME  ***$'
027A 2020202A2A   ERR1M     DB '   ***  ERROR - DISK FULL  ****$'
0299 2020202A2A   ERR2M     DB '   ***  ERROR - CAN"T OPEN FILE  ***$'
02BE 2020202A2A   ERR3M     DB '   ***  ERROR - CAN"T ACCESS FILE  ****$'
```

Section 3.

```
02E5 0E09     DERRS MVI C, PCBUF
02E7 117A02    LXI D, ERR1M
02EA CD0500    CALL FDOS
02ED C37403    JMP FEND
02F0 0E09     DERRO MVI C, PCBUF
02F2 219902    LXI H, ERR2M
02F5 CD0500    CALL FDOS
02F8 C37403    JMP FEND
02FB 0E09     DERRW MVI C, PCBUF
02FD 21BE02    LXI H, ERR3M
0300 CD0500    CALL FDOS
0303 C37403    JMP FEND
```

Section 4.

```
0306 C5       CRLF PUSH B
0307 D5        PUSH D
0308 E5        PUSH H
0309 0E02      MVI C, PCCHR
030B 1E0D      MVI E, 0DH
030D CD0500    CALL FDOS
0310 0E02      MVI C, PCCHR
0312 1E0A      MVI E, 0AH
0314 CD0500    CALL FDOS
0317 E1        POP H
0318 D1        POP D
0319 C1        POP B
031A C9        RET
```

(continued from previous page)

VDU, using calls to subroutine CRLF, prints an introductory message and the first set of instructions by using the Print Console Buffer primitive twice in succession. Register C is loaded with PCBuf, registers D and E are loaded with the relevant text buffer location, and successive calls to FDos executed.

Part C reads the input from the user in response to the previous instruction

Enter your file name

The Read Console Buffer primitive is used to read the response from the user into the console buffer, starting at the location specified by registers D and E. Thus register C is loaded with RCBuf, register D/E with the start of the console buffer IncBuf, and the call to FDos executed.

There is one complication when using the RCBuf primitive. The system does not read the user's input directly into the start of the buffer as specified by registers D and E. Instead, the system starts to load the input two bytes from the start of the buffer as the first location is expected to be set by the program so that it contains the size of the buffer, in bytes. On return from the FDos, the second byte will have been set to contain the number of bytes actually loaded by the FDos.

Thus this program reads the byte at IncBuf + 1 to check the number of bytes input by the user. This number is compared with 12, the maximum number of characters in a properly formed file name or file type combination. If the result sets the overflow flag, an error message is printed using PCBuf and the program is terminated by routine FEnd, which simply restores the stack pointer to its previous value and returns to the CP/M system.

In part D of section 6, NexCHR will move the user's Filename data from the console buffer IncBuf to the Filename field in the FCB after checking and validating it. Register A already contains the number of bytes input by the user in part C; registers H and L contains the location of the second byte of IncBuf. Registers D and E are set to the location of the Filename field, FName in the FCB, and the contents of H and L are incremented to point to the first byte input by the user in IncBuf. Register C is used to count the number of bytes actually transferred from IncBuf to FName, and so is set to zero.

FCLP1 is the start of the loop that will move the data. The contents of the byte in IncBuf pointed at by H and L is moved to register A. It is compared with the ASCII code for "." to check if it marks the end of the filename. If it is a ".", a jump is made to GoTPNT; if not, the byte is stored in the Filename field at the location pointed to by D and E.

Section 5.

```
031B C5       SETTER PUSH B
031C D5        PUSH D
031D E5        PUSH H
031E 215C00    LXI H, FCB
0321 3E00      MVI A, 0
0323 77        MOV M, A
0324 216800    LXI H, FCB + 12
0327 77        MOV M, A
0328 23        INX H
0329 77        MOV M, A
032A 23        INX H
032B 77        MOV M, A
032C E1        POP H
032D D1        POP D
032E C1        POP B
032F C9        RET
```

Section 6, part A.

```
0330 210000   START LXI H, 0
0333 39        DAD SP
0334 228701    SHLD OLDSP
0337 31B901    LXI SP, TOPSTK
033A 0E0D      MVI C, INIT
033C CD0500    CALL FDOS
```

Section 6, part B.

```
033F CD0603    CALL CRLF
0342 CD0603    CALL CRLF
0345 11B901    LXI D, INMBUF
0348 0E09      MVI C, PCBUF
034A CD0500    CALL FDOS
034D CD0603    CALL CRLF
0350 11D301    LXI D, M1BUF
0353 0E09      MVI C, PCBUF
0355 CD0500    CALL FDOS
```

Register C is incremented showing the number of bytes moved. Register B is decremented, showing the number of bytes left, and if it results in zero, a jump is made to FEnd which will terminate the routine as the file name must be illegal if the program reaches this point. Otherwise the pointers are incremented — register D and E, and H and L — and the program jumps back to the start of the loop at FCLP1 to continue transferring the data.

In part E of section 6, GoTPNT will pad out the file name entered by the user with sufficient blanks to take it to the full eight characters required in FName. Register A is set to 8, the maximum number of characters. Register C, which already contains the number of bytes which have already been moved, is subtracted from A to give the number of blanks to be inserted into FName. This number is moved to register B as a counter, and A reloaded with the ASCII code for a blank.

Directory space?

BLLP1 moves the contents of A to the byte pointed to be registers D and E in FName, increments D and E, and decrements the counter B. If this results in zero, then enough blanks have been added and the program jumps to Typer; if not, it jumps back to the start of the loop at BLLP1 to add more blanks.

In part F of section C, Typer will transfer the users file type data to the FType field in the FCB in much the same way as the last section transferred the Filename data. Control passes to NXTSTP on completion of this section.

In Section 7 NXTSTP calls subroutine Setter to set the user-transparent FCB locations to zero. The Current Record field must also be set to zero by setting register A to zero, setting registers H and L to the location of the Current Record field in the FCB, and directly moving the contents of A to the byte pointed to by H/L.

The new file is created as a blank file by using the CRFil primitive. Thus C is set to CRFil, D and E are set to the location of the FCB which has now been set up, and the call to FDos is executed.

On return from FDos, the contents of A are compared to 255. If this is the value returned, the FDos has failed to create the new file because there is no space available in the disc directory, and a jump is made to the relevant error routine and the program terminated.

The new file is now opened for processing by using the OpFil primitive. So C is set to OpFil, D and E are set to the location of the FCB, and the call made to FDos. On return from the FDos the contents of register A are checked, and if the value 255 is returned the FDos has been unable to open the file. In this event a jump is made to the relevant error routine and the program terminated.

In section 8, DatInp prompts the user to enter data from the keyboard. It reads the data into the console buffer, and transfers it one byte at a time into the disc buffer FilBuf. This section also keeps a count of the number of bytes input by the user and the number of bytes in the disc buffer. When the disc buffer has been filled, a jump is made to BuFull, and when the last character has been transferred a jump is made to LSTCHR.

A blank line is printed to the screen using CRLF. The user prompt is written to the screen

type your data

Section 6, part C.

```
0358 CD0603        CALL CRLF
035B 0E0A          MVI C, RCBUF
035D 110301        LXI D, INCBUF
0360 CD0500        CALL FDOS
0363 210401        LXI H, INCBUF + 1
0366 7E            MOV A, M
0367 FE0C          CPI 12
0369 F27903        JP NEXCHR
036C 0E09          MVI C, PCBUF
036E 116302        LXI D, M6BUF
0371 CD0500        CALL FDOS
0374 2A8701       FEND LHLD OLDSP
0377 F9            SPHL
0378 C9            RET
```

Section 6, part D.

```
0379 47           NEXCHR MOV B, A
037A 23            INX H
037B 115D00        LXI D, FNAME
037E 0E00          MVI C, 0
0380 7E           FCLP1 MOV A, M
0381 FE2E          CPI '.'
0383 CA9103        JZ GOTPNT
0386 12            STAX D
0387 0C            INR C
0388 05            DCR B
0389 CA7403        JZ FEND
038C 13            INX D
038D 23            INX H
038E C38003        JMP FCLP1
```

Section 6, part E.

```
0391 3E08         GOTPNT MVI A, 8
0393 D601          SUI C
0395 47            MOV B, A
0396 3E20          MVI A, ' '
0398 12           BLLP1 STAX D
0399 13            INX D
039A 05            DCR B
039B CAA103        JZ TYPER
039E C39803        JMP BLLP1
```

Section 6, part F.

```
03A1 116500       TYPER LXI D, FTYPE
03A4 0603          MVI B, 3
03A6 23            INX H
03A7 7E           FTLP1 MOV A, M
03A8 12            STAX D
03A9 13            INX D
03AA 23            INX H
03AB 05            DCR B
03AC CAB203        JZ NXTSTP
03AF C3A703        JMP FTLP1
```

using the PCBuf primitive set in register C, and D and E set to the location of the relevant text string, M2Buf, and FDos called.

The user's response is read into the console buffer IncBuf using the Read from Keyboard primitive, RCBuf. Thus register C is set to RCBuf, D and E set to IncBuf, and FDos called again.

Data transfer

The FDos will have loaded the number of bytes read from the keyboard into the second location in IncBuf, so registers H and L are set to IncBuf + 1 and the contents of this location moved to register A. The contents of A thus loaded are then moved to register C to be used as a counter for the number of bytes to be transferred later. The contents of H and L are incremented so that they point to the first actual byte input by the user. WWRet marks the point in this routine to which control will return from some of the later routines.

The current value of H and L is pushed on to the stack, and will be recovered later, while H and L are reloaded to contain the value currently held at BufLoc, the current disc buffer location. This value too is pushed on to the stack, but is popped off immediately into register D and E, allowing the previous contents of H and L to be recovered from the stack so that

H/L contains the location of the first byte of user's data in the console buffer IncBuf.

D/E contains the location of the first free byte in the disc buffer.

TSFLP1 marks the start of the data-transfer loop, which will move the contents of the byte in H and L to the byte in D and E. The transfer is accomplished very simply by loading register A with the contents of the byte in H and L, and then directly storing this value to the byte in D and E. This is all that is required to transfer one of the user's data bytes.

Register A is now loaded with the contents of BufCNT. Thus A contains the number of bytes in the disc buffer which have still to be filled by the user's data. This value is decremented, and if this results in zero it indicates that the buffer is full and a jump is made to BuFull.

The new value of BufCNT is now restored to its location, the value in C decremented, and if this results in zero no more characters remain in the console buffer and a jump is made to LSTCHR. Otherwise the pointers H and L, and D and E are incremented so that the next user-data byte can be transferred to the disc buffer, and a jump is made back to the start of the loop at TSFLP1.

Section 7.

```
03B2 CD1B03       NXTSTP CALL SETTER
03B5 3E00          MVI A, 0
03B7 217C00        LXI H, FCB + 32
03BA 77            MOV M, A
03BB 0E16          MVI C, CRFIL
03BD 115C00        LXI D, FCB
03C0 CD0500        CALL FDOS
03C3 FEFF          CPI 255
03C5 CAE502        JZ DERRS
                   ;
                   ;
03C8 0E0F          MVI C, OPFIL
03CA 115C00        LXI D, FCB
03CD CD0500        CALL FDOS
03D0 FEFF          CPI 255
03D2 CAF002        JZ DERRO
```

In section 9 BuFull is the routine that will write the contents of the disc buffer to the file on disc. It also resets the values of BufCNT and BufLoc.

The value of H and L is pushed on to the stack to be recovered later. Register A is loaded with the value 80 hex, which is then stored in the BufCNT location as the buffer will be empty — that is, it contains 80 hex free locations — after it has been written to the disc.

(continued on next page)

Section 8.

```
03D5 CD0603     DATINP CALL CRLF
03D8 0E09        MVI C, PCBUF
03DA 11E901      LXI D, M2BUF
03DD CD0500      CALL FDOS
03E0 0E0A        MVI C, RCBUF
03E2 110301      LXI D, INCBUF
03E5 CD0500      CALL FDOS
                 ;
                 ;
03E8 210401      LXI H, INCBUF + 1
03EB 7E          MOV A, M
03EC 4F          MOV C, A
03ED 0C          INR C
03EE 0600        MVI B, 0
03F0 23          INX H
03F1 E5         WWRET PUSH H
03F2 2A8501      LHLD BUFLOC
03F5 E5          PUSH H
03F6 D1          POP D
03F7 E1          POP H
03F8 7E         TSFLP1 MOV A, M
03F9 12          STAX D
03FA 3A8401      LDA BUFCNT
03FD 3D          DCR A
03FE CA0D04      JZ BUFULL
0401 328401      STA BUFCNT
0404 0D          DCR C
0405 CA2C04      JZ LSTCHR
0408 13          INX D
0409 23          INX H
040A C3F803      JMP TSFLP1
```

Demonstration program — section 9.

```
0400 E5          BUFULL PUSH H
040E 3E80         MVI A, 80H
0410 328401       STA BUFCNT
0413 2A8000       LHLD FILBUF
0416 228501       SHLD BUFLOC
0419 C5           PUSH B
041A 0E15         MVI C, WRFIL
041C 115C00       LXI D, FCB
041F CD0500       CALL FDOS
0422 C1           POP B
0423 E1           POP H
0424 FE00         CPI 0
0426 C2FB02       JNZ DERRW
0429 C3F103       JMP WWRET
```

Section 10.

```
042C E5          LSTCHR PUSH H
042D D5           PUSH D
042E E1           POP H
042F 228501       SHLD BUFLOC
0432 E1           POP H
0433 CD0603       CALL CRLF
0436 0E09         MVI C, PCBUF
0438 110D02       LXI D, M3BUF
043B CD0500       CALL FDOS
043E 0E0A         MVI C, RCBUF
0440 110301       LXI D, INCBUF
0443 CD0500       CALL FDOS
                  ;
                  ;
0446 210501      LXI H, INCBUF + 2
0449 7E          MOV A, M
044A FE59        CPI 'y'
044C CAD503       JZ DATINP
044F FE59         CPI 'Y'
0451 CAD503       JZ DATINP
0454 3A8401       LDA BUFCNT
0457 FE80         CPI 80H
0459 CA7904       JZ NOWRTE
045C 4F           MOV C, A
045D 3E20         MVI A, ' '
045F 2A8501       LHLD BUFLOC
0462 0C           INR C
0463 77          BLKLP1 MOV M, A
0464 23           INX H
0465 0D           DCR C
0466 CA6C04       JZ BLKDNE
0469 C36304       JMP BLKLP1
                  ;
                  ;
046C 0E15        BLKDNE MVI C, WRFIL
046E 115C00       LXI D, FCB
0471 CD0500       CALL FDOS
0474 FE00         CPI 0
0476 C2FB02       JNZ DERRW
                  ;
                  ;
0479 CD1B03      NOWRTE CALL SETTER
047C 0E10         MVI C, CLFIL
047E 115C00       LXI D, FCB
0481 CD0500       CALL FDOS
0484 0E09         MVI C, PCBUF
0486 111E02       LXI D, M4BUF
0489 CD0500       CALL FDOS
048C CD0603       CALL CRLF
048F CD0603       CALL CRLF
0492 C37403       JMP FEND
0495              END 100H
```

(continued from previous page)

H/L are loaded with the contents of FilBuf, the location of the disc buffer. This value itself is stored to BufLoc, the actual location which will be used next in the disc buffer. The value of B and C is pushed on to the stack to be recovered later, C is being used as the byte counter.

The disc buffer will be written to disc using the WRFil primitive, so C is set to WRFil, D/E to the FCB location, and the call made to FDos. It is not necessary to specify the location of the disc buffer itself as the default value expected by the FDos is 80 hex, and this is the location of your buffer. If it were at a different location, you would have to identify its location to the FDos by using the SetDMA primitive with D/E set to the location of your disc buffer.

The values previously pushed on to the stack are recovered into their original registers. This operation does not affect the flags, leaving them intact as they were on return from the FDos. You can now test to see if the zero flag is set. If it is not set, a disc error has occurred and a jump is made to the relevant error routine; otherwise the program rejoins the DatInp routine at WWRet.

In section 10 LSTCHR is reached when the last character of the user's input data has been transferred to the disc buffer. Registers H/L, the console buffer pointer, and D/E, the disc buffer pointer, are pushed on to the stack. The old D/E value is recovered immediately in H/L, and this value is stored in BufLoc before the previous H/L value is restored from the stack. Values in D/E cannot be directly stored in the same way as H/L.

A blank line is printed to the screen, using CRLF, before the prompt asking the user to indicate if more data is to be entered is written to the screen using PCBuf. Register C is thus set to PCBuf, D/E set to the relevant text string M3Buf, and the call made to FDos.

On return from the FDos the user's response will be read into the console buffer using the RCBuf primitive by setting C to RCBuf, D/E to IncBuf and executing the call to FDos. On return, H/L is set to IncBuf + 2, as this is the location that will contain the first byte of the user response. The contents of this location are moved to register A, where the value is compared with the ASCII values of Y and y. If it is either, then the program jumps back to DatInp to read the next line of the user's data.

Otherwise, the user does not wish to enter more data and the program continues into the termination section where register A is loaded with the current value of BufCNT. This value is then compared with the value 80 hex. If it is not this value, then the disc buffer contains some of the user's data which has not been written to the disc. If it is 80 hex, then the user's data has already been written to the disc and the program jumps to NoWRTE.

If the disc buffer contains some of the user's data, but not 80 hex characters, then the disc buffer must be padded out with blanks in those positions not filled with user data. The number of bytes in the disc buffer which are not actually user data is the value in BufCNT. This value is moved from A to C to act as a counter in the next section. Register A is now loaded with the ASCII value for a blank, H/L is loaded with the value of BufLoc, and register C incremented.

BLKLP1 is the start of the loop which will move a blank into each of the remaining disc-buffer locations. The value in A, a blank, is simply moved to the location pointed to by H/L. The value in H/L is incremented to point to the next buffer location, register C decremented to show bytes remaining, and if this results in zero then no bytes remain to be filled and the program jumps to BLKDNE; otherwise it returns to start the loop at BLKLP1.

BLKDNE writes the final buffer to the disc as the last record of the file. C is set to WRFil, D/E set to point to the FCB. and the FDos called. On return, a jump is made to the error routine if register A does not contain zero as a disc error has occurred. Otherwise, control moves on to NoWRTE.

NoWRTE calls Setter to set the user-transparent FCB locations to zero and closes the file using the CLFil primitive. So register C is set to CLFil, D/E set to point to the FCB, and FDos called. Finally a termination message is written to the screen using PCBuf again, with D/E set to point to the text string M4Buf. Two blank lines are written to the screen, and the program is terminated by jumping to FEnd.

Our program is fairly long considering what it actually does, but it illustrates the way in which the user can interface to the CP/M routines with very little trouble. Any users who are particularly interested should read through the CP/M interface guide for a full explanation once the basic principles are understood.

New Generation NEC Spinwriter Plus '83

With all the NEC 7710 features, such as: *55 CPS *128 characters *136 columns at 10 characters per inch and 163 columns at 12 characters per inch *16 inch paper *6 or 8 lines per inch *256 char. Receive Buffer *16 char. Keyboard Buffer etc.

plus these N E W   O U T S T A N D I N G *features:*

● 16K RAM ● 16 BAUD FROM 50–19,200, – SOFTWARE/HARDWARE SELECTABLE ● RS232C CENTRONICS PARALLEL, IEEE PORTS, CURRENT LOOP ● SWITCH SELECTABLE PROTOCOLS: NEC 7710, DIABLO 630, QUME SPRINT 5 ● 24 SWITCH SELECTABLE FUNCTIONS ● AUTO BIDIRECTIONAL PRINTING WITH OPTIMISED THRUPUT ● SHEET FEEDER AND GRAPHICS MODES ● AUTO PROPORTIONAL SPACING AND TAB SETTING ● UPGRADE-ABLE TO LATEST SOFTWARE

Now available from:

NORTHAMBER The Printer People LIMITED

3, 4 and 5 DAWES COURT, ESHER, SURREY

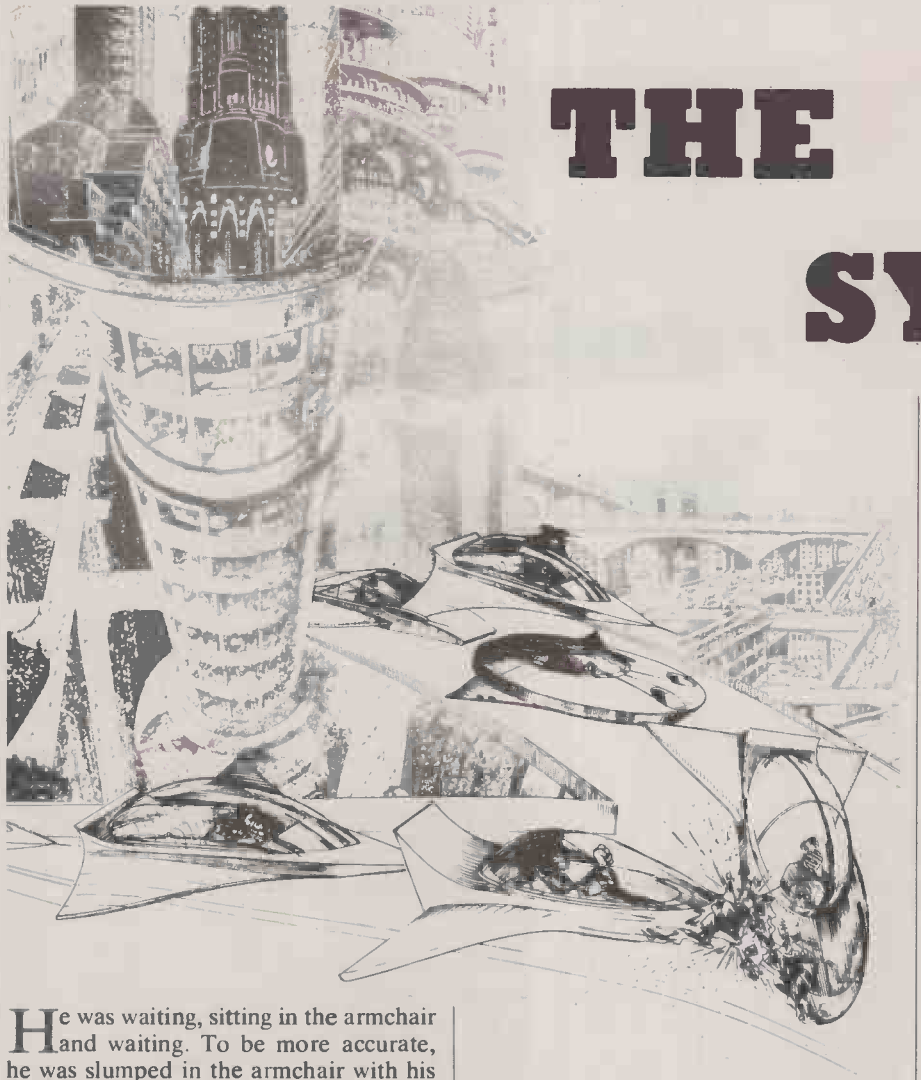
Importers, Distributors and Wholesalers of Computer Products

Tel: ESHER (0372) 66397/62071 Telex: 24123 NAMBER G

(from 01 numbers dial 78-66397 or 78-62071)

● Circle No. 154

CRASHING THE SYSTEM



He was waiting, sitting in the armchair and waiting. To be more accurate, he was slumped in the armchair with his legs dangling over one of the arms, watching the VDUs on the wall before him and controlling them through the keyboard on the other arm.

Waiting. His hand moved restlessly across the keys as he flicked from channel to channel. He was playing with time. He was waiting.

"No signal yet"? asked his mother, coming into the room.

"No".

"You know the time selection is random, you could wait for ever you know. Give me screen 4 for a moment, please".

He pressed the keys and transferred screen 4 over to his mother's manual board.

"Thank you".

He pretended to continue his search through the channels. He even set up a game, but in fact the Level 7 Invaderwar continued to play on automatic. He watched his mother interface with the supply computers and order some food and a shirt for his father. He was always intrigued when his mother shopped like this. He could stare at the catalogues for ages without being able to make a decision.

She finished her orders and checked the updated balance at the bank.

"I must get your father to check our expenditure models", she mumbled, mostly to herself, and keyed that imperative into the personal memory file. She called up the family's nutrition charts for a moment, then flicked over to the news channel.

After absorbing some statistics on today's personnel movement projections

by Chris Waugh

she gave him back screen 4 complete with a defensive program for Level 7.

"Don't forget your B12s this week", she told him as she left the room and headed for the kitchen. He grinned to himself as he keyed in her defence program.

As he resumed his waiting, only the nervous movements of his hand usurped the impression of total lethargy which settled again into all the nooks and corners of the screen room. He waited, as he had done for some days now, his glazed eyes seemingly oblivious to the flickering lights of the VDUs.

It was just past 1600 hours, and the grey winter's day was growing dim. The weather projection was for rain within the hour and that seemed an entirely appropriate expression of the day's events.

A signal on screen 3 had activated his body. As he cut the news he leapt into position bolt upright in the armchair, staring intently at screen 3 his eyes bulging. His listlessness was now replaced by intense concentration. Only his hand operating the armchair keyboard seemed to anchor the otherwise chaotic movements.

Screen 3 was distorting badly and the signal would not come through legibly. After trying the standard Signal Approach Programs he checked the system. Whilst the SAPs reran automatically on screen 3, the results of circuit checks and interference analysis came up on screens 1 and 2. His eyes moved mechanically from screen to screen as his hand played on the keys. As the negative check responses flashed up, he entered a Scramble/Code Signal Check.

He found himself waiting again, this time for the result of the S/CS check. Nervously he set up a game of Level 7 to fill the time, but his eyes strayed continually across to the blank space of screen 2.

He sat in the car and waited for a response to his request for route planning and clearance. During the rush-hour it could take up to five minutes for a request to be processed and granted.

As he waited, he tapped a rhythm on the driving console and thought about the news item he had seen earlier about personnel movement. The details having slipped his memory, he turned into the Newsummary channel and indexed PMP.

He read the transcript of the news item and wondered what PM levels were like five years ago. He had no idea, and the Department of T-CoP's memory problems grew distant as he relaxed his focus on the VDU. The figures flowed into each other and the projections meant nothing. He was nearly asleep, but his hand was still tapping the console.

"You have positive **RP** and C on your PM request. If you wish to cancel your application please state updated intention immediately. Otherwise your PM will commence as soon as planned. Thank you".

The electronic voice had startled him, but he was fully alert again and waiting to leave. Waiting, always waiting.

Stretched out on the circular couch which filled the rear of the car, playing Level 7, it was some time before he noticed the frequency with which he was getting involved in traffic jams. One always anticipated a few hold-ups on the feeder lanes, but the through routes were usually fast-moving. A particularly long hold-up eventually registered in his mind, and he sat up.

Drops of rain were gradually covering the windscreen, and through this distortion he glimpsed something he had always regarded as being impossible. He fairly leapt from the couch to the control console, his fingers instantly in place on the keys and working to call the information which would explain what he saw. He finished keying and as he waited for the computer response he activated the windscreen wipers.

The information he received through the windscreen was of little use to him: there was too much of it for him to process. He could see a jam of vehicles: a single jam, which stretched away before him along the feeder lane and continued down the through route as far as he could see. The same jam blocked the overhead relief lane under which he was stuck. Other feeder lanes behind him and a subsidiary to his own were clogged with stationary vehicles.

He surveyed the spectacle before him for some time, for once unresponsive to the flashings of the VDU on the control console in front of him. His face, after registering the initial shock, was now a blank. Even when he found himself staring into the eyes of a girl in the car stuck beside his, that steely blankness remained unchanged.

Eventually he recovered sufficiently to consult the information which had been flickering before him for some time. The life came back into his fingers. The update on his particular PM was "delay of unspecified duration". No reason was forthcoming, and the overall PMP was unavailable. The rest of the information he received was irrelevant, so he turned to the news update. On no channel could he find any reference to PM problems. Even more confused than before, he returned to the back of the car and lay on the couch.

For a while he lay and waited. Outside the car, all was still except for the rain. Inside, only the tapping of his fingers disturbed the atmosphere of calmness. Soon bored, he idly entered the Basic Information and Definition Index and keyed in "Dept. of T-CoP". The response was instant.

Department of Traffic Control
Programming (T-CoP), The
This department replaced that of TP (Traffic Planning) in 1994 when the latter's future PM requirement projection came to be considered too inaccurate. It was decided that the only solution to the problem of mass viable PM was a central processor which planned and controlled all PM. Thus the whole concept of PM changed overnight — suitable time having been allowed for the conversion of vehicles to centralised automatic operation. Individual manual operation is now only needed in a few sparsely populated areas, which are outside the system controlled by the department's central processor.
It is estimated that in 1996 the system was already 40 percent more efficient timewise, 32 percent more efficient fuelwise, 74 percent more efficient total running-costwise...

He decided to cut the rest of the statistics. Of course it was all totally familiar to him, but somehow he required the confirmation of the existence of this remarkable system. The Index went on to state that "it is generally accepted that nowadays uncontrolled PM based on individual manual operation would be impossible" and he had never accepted anything else. He had been stationary in this one hold-up for nearly half an hour now, and that was a unique event in the history of the Department of T-CoP. It made him uncomfortable.

He decided to check his instructions again, not that he had not done so several times before he left home, but rather he sought some kind of comfort. Reality, perhaps, only confirms itself in the iterative statement of its being.

A-Maze Games Incorporated Presents...
The ultimate computer game...
The Labyrinth of Reality!!!
Why play with time when you can play though time? Why play on a screen when you can play in 3D space? Why interact with pictures when you can interact with people?
The Labyrinth of Reality Instruction One.
Access PM to PH5618/763L immediately. You will receive further instructions whilst you are travelling.
Signal reference as before.

And that was that. He wondered if his progress was being measured somehow and whether that would affect the timing and even content of his next instructions. Of course, he had no idea and his attempted speculations chased their own tails into a void.

The Labyrinth of Reality, developed in response to demand for leisure activity, was a game which was unique to each participant. The participant's own talents and resourcefulness were major factors in the game. Early movements in this direction included games where the computer selected at random one of a number of activities which the participant then undertook. Increasing degrees of complexity had been added to this basic framework and so, eventually, the first version of Labyrinth was born.

In theory, all participants are entered in the game computer. The machine allocates various adventures and activities to different people and groups of people. Each person receives instructions and at "game points" these instructions instigate the interaction of two or more participants in one or more events. The result of each interaction is fed back to the game computer which uses this continual update to calculate the next set of instructions.

The game is extremely fluid, existing in real-time and space. By necessity, it is totally secret. It is also claimed, by A-Maze Games, that spontaneous interactions develop and are often indiscernible from game computer co-ordinated interactions. Enrolment in the game can take place at any time simply by responding to advertisements on the commercial channels. Once the enrolment information has been input, the participant awaits confirmation and the instructions which follow at an unspecified time.

Most people only play a game on a part-time basis, having told the computer when they would be available. A-Maze Games stresses that it is secrecy that makes such flexibility possible, as it is the condition for most aspect of the game.

He found himself staring blankly at the girl in the next car, who returned his stare with equal blankness, when he received his next Labyrinth instruction.

"Your destination is unchanged.

"Instruction update requires that you make contact with the girl in the next car beside yours and bring her with you to your destination.

"Instruction updates continue on this signal reference".

For some reason, convinced of a necessity for immediate response, he got out of the car. The unusual turn of events struck him more as a malfunction than a unique happening. His Labyrinth instructions, under these circumstances, assumed the robes of order rather than adventure.

The girl, like him, was in her late teens. She seemed surprised by his action. At first she refused to let him into her car and would only talk to him with the window lowered half-way.

"Are you in the game, too"? was his opening question.

"Sorry, what game"? He looked up

(continued on next page)

(continued from previous page)
and down the queue of cars, and while no one could hear him, he was certainly the centre of attention.

"You know, Labyrinth. Is this meeting in your instructions"?

"Look, if this is your idea of a casual conversation . . .".

"No, you must have heard of Labyrinth — the game, you know". He looked imploringly at her, unable to find more words. He was earnest but wholly out of his element. That much, at least, she could tell.

"OK, yes, I'm in the game and yes this is in my instructions, but I'm not supposed to admit that, it's supposed to be up to you to persuade me to go with you. But after sitting in this mess for an hour I don't feel like playing too many games. So, we've met, what do we do now"?

"Wait", he said smiling.

He had been leaning on the car, bending down to talk at the window. Now he stood up straight in the orange glow of the lamplight. He looked up and down the queue of cars as he had done before, except that now he felt strangely relaxed. He was waiting once again, yes, but he was sure that his waiting was leading to something significant. The rain had turned into a thin drizzle and in the distance he thought he could see the red tail-lights of cars, moving.

When he awoke it was still dark. He listened but could hear no rain. On the control console an orange light was flashing. He looked across at the figure of the girl. She was still asleep. He sat up as the events of the night gradually returned.

The jam had cleared and they had sped off into the darkness of the countryside. For some time they had talked and played games, always speculating on what their next instructions might contain.

The memories faded into action. He sat before the control console and responded to the orange light. This was a signal to indicate that the destination had been achieved, as programmed. He asked for a site report on the destination and then disengaged the vehicle from T-CoP. As he waited for response, he turned round to look at the girl. She was just beginning to stir.

Small green letters informed him that his programmed destination had been one of the system exists, and therefore that was where he was now. System exists were those points where roads left the area controlled by T-CoP, giving access to those few areas where individual manual operation was still allowed.

"Where are we now"? asked a sleepy voice behind him.

"We've achieved our destination. It's one of the system exists. No instruction update as yet".

Almost as he finished speaking, the VDU began to print out a message which he immediately recognised as an instruction update.

```
Drive down this road for approximately two
miles. You will arrive at a crossroads. This is
your destination.
At this site there is a ruined building. There
you will find a riddle which, once solved, will
give you a clue.
Waste NO time.
Instruction update on this signal reference.
```

Although he had been taught to drive, he had never had to do so in order to get somewhere. He mastered this necessity with surprising speed, and soon they arrived at the crossroads.

He keyed a request into the console.

"Well", he told her. "It will be dark for another hour. Sunrise will be in an hour and 21 minutes. Weather will continue to improve and tomorrow it will be quite warm and sunny".

"Shall we explore, then"? She need not have asked. The instructions had said "waste no time", and anyway they were both curious to a point where all other considerations were excluded. So they left the car and began to explore.

The ruins were those of a church. Overgrown with brambles and roofless, to them it was just a strange old building. They found a clearing in what would have been the chancel, and doubled their search for the riddle. Having found nothing, they eventually sat on a step and discussed their next move.

"I thought the thing we're looking for would be in some obvious form", she said. "You know, words or numbers or something like that. But all I can find is damp, crumbling walls, soaking wet vegetation and . . .".

She broke off with a shout, and pointed through a gap in the masonry to where a line of lights were approaching the ruin. The light was not the familiar beam of hand-torches or headlights, but of flame.

Half-afraid, and half-convinced that this was the riddle, they extinguished their own lights. Not daring to move, they found themselves holding on to each other for security. The lights approached and they could discern the dim shapes of the advancing group, each one bearing a light. They filed into the clearing, forming a circle around the two frightened people.

There was a silence, a pause, and then a woman, spoke.

"Our instructions were simple, nevertheless you followed them. In several months you are the first to have come this far. You are the first whose desire for satisfaction has been strong enough to overcome the lethargy of the time.

"You have heard of us in two ways. You think we are A-Maze Games who juggle with people's lives in an attempt to bring them some genuine excitement, and indeed we are the people responsible for The Labyrinth of Reality. But we are also the people responsible for that T-CoP failure you experienced earlier. In fact we used one to engineer the other.

"We are also responsible for those programming problems on Diana Six and a number of other minor malfunctions which do their best to disturb the sterile perfection of our lives. We are responsible for trying to nudge people from security".

"Then you are members of CRASH", the girl replied. "And what are we, hostages or sacrifices"?

"You have heard of us". There was a tone of approval in the woman's voice. "You are neither. You are here because deep down you wish to join us, because you know the only adventure which satisfies is a real one. Labyrinth of Reality is nothing to this".

"We must have time to think, at least, I must". "Of course", she turned to him, "And what about you"?

He was not paying attention any more. It was all happening too fast for him to understand the implications of any decision.

"You too need time to think, I would say. It's a capacity which you will find takes time to develop, but is well worth it in the end".

He looked up. Through the ruins of a window he could see the first beams of sunrise penetrating the morning mist.

Eric waited patiently, sitting before his treasured invention. It was not unusual for decisions to take some time to be made. After all, it was a rather complex piece of machinery, even if he did think so himself. After two years of research he was more interested in the machine and its programming than anything to do with the stories it produced.

As he waited for the story to continue, he stared out of the window and contemplated the program. There were several areas he needed to expand. His attention was drawn back to the computer some minutes later by a soft crackling noise. He looked at the back of the machine to where the sound was coming from.

A shower of sparks spilled out of the casing from a short circuit inside. Before he had time to recover from the shock, a flame sprang up inside the machine and dark, choking smoke began to pour out.

"Oh my God"! he screamed. He tried to smother the flames but already they had spread to his papers on the bench. The screen was going haywire.

It was the laboratory assistant who pulled Eric from the room, and in the nick of time too. Minutes later the side of the building was torn open by an explosion which would most certainly have killed anyone left inside.

Eric watched the activities of the Fire Brigade while his hands were being expertly bandaged. Two years work was lost; he doubted whether it could ever be repeated.

SOFTWARE FOR CP/M®

HIGH QUALITY SOFTWARE — WITH HIGH QUALITY SERVICE

★ **NEW THE FORMULA £300. Application Builder and Reporter. SPELL STAR £125. Option for Wordstar. SUPER CALC £165. Spread Sheet financial planning.**

WORDSTAR - Professional word processing software. On-screen formatting, wordwrap, pagination, line and character count on view. Micro-Justification on daisy-wheel printer. Search and replace. Block/paragraph manipulation. External file read/write. Background printing during editing etc.	£250
MAIL—MERGE - Powerful Wordstar enhancement for file merging and document personalisation.	£65
DATASTAR Screen orientated system for Data Entry, Retrieval and Updating.	£175
SUPERSORT - Sort, merge and selection program.	£125
CONFIGURABLE BUSINESS SYSTEM (CBS) - Unique information management system with user definable files, powerful report generator, menu-driven for ease of use. No programming experience necessary!	£225
ACCOUNTING PACKAGES by Median - Tec: PAYROLL, SALES, PURCHASE, NOMINAL Specially developed by UK software house to exacting specifications. Written In Microsoft Basic each package may be customised by end user, all are widely used. Ledgers are open item. Payroll caters for weekly and monthly pay.	£300 each
PROJECT COST CONTROL/JOB ACCOUNTING - A comprehensive set of programs to monitor budgets, account for expenditure and project completion etc. Ideally suited for contractors. Written in CBASIC-2.	£150
STATISTICS PACKAGE - Over 25 routines including Regression & ANOVA	£100
MATHS PACKAGE - Over 40 easily used routines.	£100
IBM - CP/M COMPATIBILITY - Powerful utility to transfer data to/from IBM machines in standard disk format.	£110
MICROSOFT BASIC INTERPRETER	£155
MICROSOFT BASIC COMPILER	£205
MICROSOFT FORTRAN COMPILER	£205
MICROSOFT COBOL	£310
MAGSAM - Versatile easy to use Keyed File Management System for Microsoft Basic or CBASIC.	£130
CIS - COBOL - ANSI' 74 implementation to full level 1 standard. Supports random, indexed and sequential files, features for conversational working, screen control, interactive debugging, program segmentation etc.	£425
FORMS-2 - Automatic COBOL code generator for screen formats.	£100
PASCAL-Z	£255
STRUCTURED BASIC - Relocatable compiler	£160
CBASIC-2 - Extended Disk Basic pseudo compiler and run-time interpreter.	£75
SELECTOR III - C2 - Information management system written in CBASIC-2	£185
SELECTOR IV - Upward compatible version of III with enhanced reporting.	£300
BSTAM - Telecomms facility for exchanging files between CP/M computers.	£100
ASCOM - Facility for communicating with other computers.	£95
TRANSFER - CP/M to CP/M file exchange - telecomms source code	£95
MACRO 80 - Macro Assembler	£99
CP/M 2.2 - Standard Version 8" Single Density.	£99

Please contact us for availability of other products
All orders must be PREPAID. Add £1 per item P & P (Minimum £2.00) and VAT
CP/M is trade mark of Digital Research

TELESYSTEMS LTD

P.O. Box 12, GREAT MISSENDEN, BUCKS, HP16 9DD
Telephone (02406) 5314

● Circle No. 156

PAYROLL? **SALES?** **STOCK?**

SUPERBRAIN QD 64K

APPLE II 48K

SUPERPET 134K

TRY BEFORE YOU BUY! If you are considering the acquisition of a microcomputer why not visit our demonstration suite one evening and try our Apples, PETs and Superbrains first. *We can open outside our normal hours to suit you.* Even weekends! Come and see the range of business utilities your competitors are using. We have the full TABS integrated accounting system Nominal, Sales, Purchase Ledgers, Payroll, Stock Control, etc, Video Training films, word-processing, automated filing and financial modelling systems *ready to help you.* We are Authorised Dealers for several micros and are in business to sell you a solution rather than one manufacturer's specific hardware. After all, to a business it's the effort and money you save that's important not the internal machine specifications. We offer our business clients lease/rental terms to bring the benefits sooner, without capital drain.

FOR EXAMPLE A TYPICAL BUSINESS SYSTEM COMPRISING SAY, AN APPLE II, A DISK DRIVE, MONITOR, PRINTER AND VISICALC CAN BE INSTALLED ON YOUR DESK AND WORKING FOR YOU NEXT WEEK FOR LESS THAN £12.00 PER WEEK EX. VAT AND ALL DEDUCTIBLE!

Naturally, we provide full support and after-sales service of the highest level.

INTERESTED? CALL NOW FOR DETAILS.

MASS MICROS

WELWYN GARDEN 31436

WELLSON HOUSE, BROWNFIELDS, WELWYN GARDEN CITY, HERTS. Telex 298641.

● Circle No. 157

Rat Maze

Can you fight your way past the rats and find the treasure in the maze? Bob Merry's simple and entertaining Adventure game is also an exercise in programming techniques.


```
10 REM ****RATMAZE****
20 REM **           **
30 REM *BY BOB MERRY.*
40 REM **           **
50 REM *FOR ALL 40COL*
60 REM **           **
70 REM *****PETS******
80 REM **           **
90 REM ****NOV '81****
97 REM
98 REM +DIMENSIONS AND STRINGS+
99 REM
100 DIM L%(99),R$(14)
110 R$(0)="THERE'S A RATPACK AHEAD. SHALL WE FIGHT OR RUN (F/R)?
120 R$(1)="A DOOR HAS SLAMMED SHUT BEHIND YOU."
130 R$(2)="OH-OH! THAT'S A CAGE DOOR CLOSING!
140 R$(3)="WHOOPS! THERE GOES A PORTCULLIS!
150 R$(4)="HEY! WE'RE FALLING INTO A PIT!
160 R$(5)="IT'S LOCKED TIGHT AND WILL NOT BUDGE!
170 R$(6)="LOOK'S LIKE WE'RE IN THE RAT TRAP!
180 R$(7)="IT'S TOO HEAVY TO LIFT.
190 R$(8)="CAN YOU HEAR A HISSING SOUND?
200 R$(9)="I'M AFRAID THIS IS THE END.......
210 R$(10)="BUT YOU DIED RICH!!!
220 R$(11)="SORRY! YOU'VE DIED OF EXHAUSTION
230 R$(12)="YOUR WOUNDS MAKE IT IMPOSSIBLE TO WALK
240 R$(13)="ANOTHER GAME (Y/N)?
250 R$(14)="PLEASE WAIT A FEW MOMENTS
257 REM
258 REM +INSTRUCTIONS+
259 REM
260 PRINT"RATMAZEBY BOB MERRY
270 PRINT"PRESS 'I' FOR INSTRUCTIONS OR 'S' TO
280 PRINT"START":C$="IS":GOSUB1130
290 IFR$="S"THEN430
300 PRINT"   THE OBJECT OF THE GAME IS TO FIND A
310 PRINT"TREASURE HIDDEN IN A MAZE OF TUNNELS.
320 PRINT"IT IS GUARDED BY FIERCE RATPACKS. YOU
330 PRINT"MAY RUN FROM THEM BUT YOU WILL HAVE TO
340 PRINT"FIGHT SOME IF YOU WANT THE TREASURE.
350 PRINT"IF THEY WOUND YOU, YOUR AGILITY WILL BE
360 PRINT"REDUCED, WHILST THE EFFECT OF FIGHTING
370 PRINT"OR WANDERING TOO LONG IN THE MAZE WILL
380 PRINT"SAP YOUR STRENGTH. SOME TUNNELS LEAD TO
390 PRINT"DEADLY TRAPS. ALL YOUR DECISIONS ARE
400 PRINT"MADE BY PRESSING SINGLE LETTERS. NOW
410 PRINT"PRESS 'S' TO START.
420 C$="S":GOSUB1130
430 PRINTR$(14)
437 REM
438 REM +DATA FOR MAZE TUNNELS+
439 REM
440 DATA 16,56,56,56,10,18,120,72,64,34,34,80,40,16,104,112,40,96,34,96
450 DATA 80,74,80,72,0,48,24,24,26,12,100,48,24,24,44,100,96,16,10,96
460 DATA 96,80,10,20,72,80,28,24,24,0,50,40,34,48,40,112,120,72,80,104
470 DATA 64,80,40,36,98,18,40,68,96,96,2,80,24,72,0,36,48,12,16,40
480 DATA 80,120,40,48,104,48,88,120,120,72,68,48,72,112,8,20,72,16,88,0
487 REM
488 REM +LOAD DATA FOR TUNNELS AND RANDOM RATPACKS+
489 REM
490 RESTORE:FORI=0TO99
500 READL%(I):IFRND(1)>.9THENL%(I)=L%(I)+1
```

(listing continued on page 104)

YOUR OBJECTIVE is to find the treasure hidden in a maze of passages guarded by packs of ferocious rats which must be killed or beaten off. Ratmaze fits into 8K on any Pet, if the Rems are reduced, and it should also be fairly easy to adapt it to another computer that supports the logical And function in a similar way to the Pet.

The four levels

The maze used in Ratmaze has 100 junctions arranged in four levels, each consisting of a five-by-five square. A typical layer is shown in figure 1 — this is not one of the layers in the game itself, but serves to illustrate how the techniques were developed. Each juction can connect to its neighbours in up to six directions: north, south, east, west, up and down. In the diagram the symbol º indicates up and * indicates down.

The original idea was to use a two-dimensional array, such as L%(99,5), to store the maze data. One dimension, 0 to 99, represents the junctions and the other, 0 to 5, represents the directions. Each element holds the number of the junction to which it is connected, and where there is no connection an out-of-range number is used. Zero cannot be used, as this is one of the junction numbers.

The array as it would look for the start of figure 1 is shown in figure 2. However, this method contains a lot of redundant information. The regular structure of the maze means that any move north decreases the junction number by 5; a move south increases it by 5; going east adds 1; and west subtracts 1. Moving one level up decreases the junction by 25 and going down a level increases it by 25.

These characteristics can be built into the program itself so that the array only has to hold a series of Go/No-go statements — see figure 3. The next stage was to develop a program using this two-dimensional array. An old-ROM Pet cannot handle arrays with so many elements, so a version was developed using six separate arrays, one for each direction.

Both versions worked well and there is no reason why this technique cannot be used — indeed, something similar would have to be used to define a non-regular maze. Nevertheless, all those 0s and 1s, should be meat and drink to a micro, and it became clear that it must be possible to simplify the program by using them more directly.

Bit-by-bit basis

In the Pet, the And function is used to compare binary numbers on a bit-by-bit basis. It is also used to compare statements for simultaneous states of truth, for example,

```
300 IF A=64 AND R$="YES" THEN 1000
```

might even meet lines of the form

```
300 IF A AND R$="YES" THEN 1000.
```

The first part means "if A is true", and the computer accepts any positive value of the variable A to be true, and zero or negative values to be false. This abbreviated form is used in Ratmaze.

Logical And compares binary numbers in the following manner:

```
      A=11010110
      B=10001100
A AND B=10000100
```

The statement A And B results in a 1 bit wherever a 1 appears in both A and B in the same position; otherwise a 0 is generated.

Junction 26 from figure 3 can be expressed as a binary number:

011100

If you want to see if you can go north, you simply logical-And this with 100000. The result is 000000 — in logical terms, the condition is False — which means that you cannot go north from junction 26. To go south, you logical-And the same number with 010000. The result is 010000, so the condition is True and you can go south.

Reduced to binary

All the data for the maze can be reduced to a series of binary numbers, which can be held in a single array using their decimal equivalents. In the case of the maze in figure 1 the data in figure 3 can be reduced to the single numbers shown in figure 4.

There are only six directions that you can take at each junction, while eight-digit binary numbers can be used to define them, so there is a little spare capacity in this system for holding other information. In Ratmaze program, one of the spare bits is used to show whether there is a rat pack at the junction to be cleared before you continue. This is shown by a 1 in the least significant bit, while the direction information occupies the following six bits. The most significant bit is unused.

In addition to the three-dimensional maze, the player has to face the rat packs which pop up from time to time. You can run away from them, but the program has been designed to place packs at some key junctions where these must be fought. Strength and agility ratings are included in the game. If either reaches zero, then the player loses.

The program starts by setting up two arrays. The integer array L%(99) contains the details of the maze, while the string array R$(14) contains various phrases that are used; they are loaded into the array in lines 110 to 250. The page of instructions which follows uses the subroutine at 1130. Only letters contained in C$ will cause the program to continue. While it is waiting for an acceptable response, it runs through random numbers to ensure a different game every time.

Integer array

After the instructions comes the Data statements for the maze. They are loaded into the integer array in lines 490 to 510 which also include a simple random placing of rat packs, indicated by setting the least significant bit to 1. Lines 520 to 560 place rat packs at five key junctions, if they are not already there. This is checked by seeing if the least significant bit is 1 or 0:

```
IF (L%(12) AND 1)=0 THEN . . .
```

Line 570 sets to zero the four variables corresponding to strength S, agility A, current location L and possession of treasure TR. It also defines a simple function used to generate random numbers in the range 0 to X.

During the game line 590 determines whether or not there is a loss in strength and it is to this point that the program loops at each junction. To avoid losing strength during the first run through in a game it is by-passed by line 580.

In lines 600 to 660 the appropriate element of the integer array is inspected and the available directions are printed. This routine uses the And function.

Now the players make their choice using a single-letter response. All six directions are included in the permitted responses C$, but you need to check whether the chosen response is valid for the junction in question. If it is, the necessary change to the location number must be made in lines 680 to 740. Line 740 is only reached if all the tests in the previous lines are failed.

Line 750 modifies the location number and checks to see whether the number of the new location is divisible by 25. There are four traps in the maze from which there are no exits: they are the ones which are zero in the data statements and are set at regular intervals in the maze. If the player moves into one of them the program diverts to line 870, which determines which of the traps you have fallen into and prints the appropriate elements from the array R$(14). Line 880 prints end-of-game messages, and 890 to 900 give the option of another game.

Check for rats

If the traps have been avoided the program checks for the presence of a rat pack, and branches forward to 810 unless it is present. This line is a means of checking whether L is zero — signifying the Exit location — since any non-zero value is logically true, causing the program to loop back to 590. If however L is zero, you are at the Exit and success then depends on whether you have found the

(continued on next page)

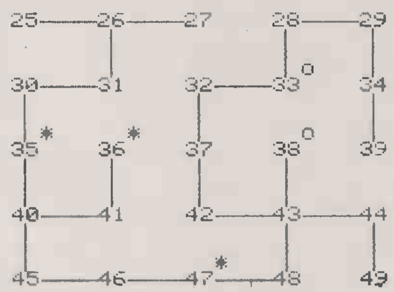


Figure 1.

Element	marker					
5	Direction					
D	Junction					
25	—	—	26	—	—	—
26	—	31	27	26	—	—
27	—	—	—	27	—	—
28	—	33	29	—	—	—
29	—	34	—	28	—	—
30	—	35	31	—	—	—

Figure 2.

	0 N	1 S	2 E	3 W	4 U	5 D
25	0	0	1	0	0	0
26	0	1	1	1	0	0
27	0	0	0	1	0	0
28	0	1	1	0	0	0
29	0	1	0	1	0	0
30	0	1	1	0	0	0

Figure 3.

Junction	Value
25	8
26	28
27	4
28	24
29	20
30	24

Figure 4.

(continued from previous page)

treasure — the condition TR=1. If not, you have the option to re-enter the maze immediately or quit.

When you encounter a rat pack the first choice is to fight or run. The choice to fight causes a branch to 920; running takes you to 790. Line 790 first back-tracks to the previous location, using the modifier still in M. Of course, running away can have its dangers; and if your agility has fallen below 50, subroutine 1240 is called and a random number of wounds — up to 8 — are inflicted. This is reported to you in lines 1250 to 1260, and your agility is further reduced by up to this number of wounds. If A falls below 1, the game is over and this is reported by lines 1170 and 880 to 910.

When you choose to fight, line 920 sets the size of the rat pack to between 10 and 30 rats. They will attack you in waves of five rats at a time, and you will be given the choice of Lunge, Cut or Dodge. A lunge is guaranteed to kill one rat; a cut can kill more, dependent on your strength, but you may also miss entirely. Dodging will reduce the number of wounds you take, but it depends on your agility, as does the ability to make several cuts in succession.

Loss of agility

The choice of response is made using subroutine 1180, and lines 930 to 950 branch to the appropriate part of the program. Line 960 makes the one kill for the Lunge option and this is reported by subroutine 1200. Line 970 then gives the choices for continuing the fight. Making a cut depends on agility, but you can always try to dodge. If you try to continue with another lunge, or if your attempt to cut fails, then the rats get too close and all of them wound you, resulting in a loss of agility in subroutine 1260.

The Cut option starts at line 1000, which allows you to kill a number of rats determined by your current strength. Cutting could also sap your strength, so the next line allows for a random loss of strength. As with the loss of strength when moving about the maze, this could reduce your strength to zero, so this is checked in subroutine 1290.

If all the rats in that wave have been destroyed then the program branches to 1060, where the subroutine to print out S and A is called and the size of the rat pack is checked to see whether there is enough for another wave. Eventually the size of the rat pack will be reduced to four or less, and that location can be cleared of rats by line 1090.

The other option you have is to dodge, and this is covered in lines 1040-1050. This option reduces the number of wounds suffered according to agility, but the rest of that wave gets through and subroutine 1260 reports the number of wounds.

There will always be a rat pack at the treasure location, so you check for this location at the end of the fight sequence before continuing the movement through the maze. Subroutine 1230 is simply a delay to allow you to read some reports before they disappear from the screen.

(listing continued from page 102)

```
510 NEXT
517 REM
518 REM +FIXED RATPACKS+
519 REM
520 IF(L%(12)AND1)=0THENL%(12)=L%(12)+1
530 IF(L%(32)AND1)=0THENL%(32)=L%(32)+1
540 IF(L%(37)AND1)=0THENL%(37)=L%(37)+1
550 IF(L%(56)AND1)=0THENL%(56)=L%(56)+1
560 IF(L%(81)AND1)=0THENL%(81)=L%(81)+1
567 REM
568 REM +SET VARIABLES+
569 REM
570 S=100:A=100:L=0:TR=0:DEFFNA(X)=INT(X*RND(1)+.5)
577 REM
578 REM +STRENGTH REDUCED?+
579 REM
580 GOTO600
590 IFFNA(1)=1THENS=S-.5:GOSUB1290
597 REM
598 REM +AVAILABLE TUNNELS+
599 REM
600 GOSUB1160:PRINT"WE CAN GO ";
610 IFL%(L)AND64THENPRINT"NORTH ";
620 IFL%(L)AND32THENPRINT"SOUTH ";
630 IFL%(L)AND16THENPRINT"EAST ";
640 IFL%(L)AND8THENPRINT"WEST ";
650 IFL%(L)AND4THENPRINT"UP ";
660 IFL%(L)AND2THENPRINT"DOWN ";
667 REM
668 REM +SELECT DIRECTION - CHECK VALIDITY+
669 REM
670 PRINT:PRINT"WHICH WAY (N/S/E/W/U/D)?":C$="NSEWUD":GOSUB1130
680 IFR$="N"AND(L%(L)AND64)THENM=-5:GOTO750
690 IFR$="S"AND(L%(L)AND32)THENM=5:GOTO750
700 IFR$="E"AND(L%(L)AND16)THENM=1:GOTO750
710 IFR$="W"AND(L%(L)AND8)THENM=-1:GOTO750
720 IFR$="U"AND(L%(L)AND4)THENM=-25:GOTO750
730 IFR$="D"AND(L%(L)AND2)THENM=25:GOTO750
740 PRINT"WE CAN'T GO THAT WAY. THINK AGAIN":GOTO670
747 REM
748 REM +MAKE MOVE - CHECK FOR TRAP+
749 REM
750 L=L+M:IFINT((L+1)/25)=(L+1)/25THEN870
757 REM
758 REM +CHECK FOR RATPACK+
759 REM
760 IF(L%(L)AND1)=0THEN810
767 REM
768 REM +FIGHT OR RUN?+
769 REM
770 PRINTR$(0):C$="FR":GOSUB1130
780 IFR$="F"THEN920
787 REM
788 REM +RUN OPTION+
789 REM
790 L=L-M:IFA<50THENGOSUB1240
800 GOTO590
807 REM
808 REM +AT EXIT?+
809 REM
810 IFLTHEN590
820 PRINT"THIS IS THE EXIT!"
827 REM
828 REM +WITH TREASURE?+
829 REM
830 IFTR=1THENPRINT"WELL DONE!!! YOU'VE WON!":GOTO910
840 PRINT"BUT YOU HAVE NOT GOT THE TREASURE. DO   YOU WANT ANOTHER GO (Y/N)?
850 C$="YN":GOSUB1130:IFR$="Y"THEN590
860 GOTO910
867 REM
868 REM +END OF GAME IN TRAP+
869 REM
870 X=INT((L+1)/25):PRINTR$(X):PRINTR$(X+4)
880 PRINTR$(9):IFTR=1THENPRINTR$(10)
890 PRINTR$(13):C$="YN":GOSUB1130
900 IFR$="Y"THENPRINTR$(14):GOTO490
910 ENO
917 REM
918 REM +FIGHT OPTION+
919 REM
920 RP=10+FNA(4)*5:PRINT"HERE THEY COME!
927 REM
928 REM +CHOICE OF RESPONSE+
929 REM
930 RA=5:GOSUB1180:IFR$="L"THEN960
940 IFR$="C"THEN1000
950 GOTO1040
957 REM
958 REM +LUNGE OPTION+
959 REM
960 RP=RP-1:K=1:RA=4:GOSUB1200
970 GOSUB1180:IFR$="C"ANDRND(1)*A>30THEN1000
980 IFR$="D"THEN1040
990 PRINT"THEY'RE TOO CLOSE!!":W=RA:GOTO1050
997 REM
998 REM +CUT OPTION+
999 REM
1000 K=INT(FNA(RA+1)*(S-1)/100):RP=RP-K:RA=RA-K:GOSUB1200
1010 S=S-FNA(2):GOSUB1290
1020 IFRA=0THEN1060
1030 GOSUB1160:GOTO970
1037 REM
1038 REM +DODGE OPTION+
1039 REM
1040 D=INT(A/25+.7):W=RA-FNA(D):IFW<0THENW=0
1050 GOSUB1260
1057 REM
1058 REM +END OF FIGHT?+
1059 REM
1060 GOSUB1160:IFRP<4THEN1080
1070 PRINT"MORE RATS ATTACKING!!":GOTO930
1080 PRINT"YOU'VE KILLED MOST OF THEM AND THE REST HAVE RUN OFF!
1090 L%(L)=L%(L)-1:GOSUB1230:IFL=0THEN820
1097 REM
1098 REM +AT TREASURE?+
1099 REM
1100 IFL<>37ORTR=1THEN590
1110 PRINT"YOU'VE FOUND THE TREASURE! NOW YOU MUST GET OUT.":TR=1
1120 GOSUB1230:GOTO590
1124 REM
1125 REM +SUBROUTINES+
1126 REM
1127 REM
1128 REM +GET REPLY+
1129 REM
1130 GETR$:R=RND(1):IFR$=""THEN1130
1140 FORI=1TOLEN(C$):IFR$=MID$(C$,I,1)THENRETURN
1150 NEXT:GOTO1130
1157 REM
1158 REM +PRINT STRENGTH/AGILITY+
1159 REM
1160 PRINT"STRENGTH:    ";INT(S);TAB(20);"AGILITY:    ";INT(A):RETURN
1167 REM
1168 REM +END OF GAME WITH ZERO S OR A+
1169 REM
1170 PRINTR$(R):GOTO880
1177 REM
1178 REM +LUNGE CUT OR DODGE?+
1179 REM
1180 PRINT"DO YOU WANT TO LUNGE, CUT OR DODGE      (L/C/D)?":C$="LCD"
1190 GOSUB1130:RETURN
1197 REM
1198 REM +NUMBER KILLED+
1199 REM
1200 PRINT"YOU'VE KILLED"K:R$="I8":IFRA>1THENR$="ARE
1210 IFRA=0THENRETURN
1220 PRINT""RA;R$" STILL COMING!":RETURN
1227 REM
1228 REM +TIME DELAY+
1229 REM
1230 FORI=1TO2000:NEXT:RETURN
1237 REM
1238 REM +WOUNDS ON RUN+
1239 REM
1240 W=FNA(8):IFW=0THENRETURN
1250 PRINT"YOU'RE NOT QUITE QUICK ENOUGH
1257 REM
1258 REM +REPORT OF WOUNDS+
1259 REM
1260 PRINT"YOU'VE SUFFERED"W"WOUND";:IFW<>1THENPRINT"S";
1270 PRINT".":A=A-FNA(W):IFA<1THENR=12:GOTO1170
1280 RETURN
1287 REM
1288 REM +STRENGTH TOO LOW?+
1289 REM
1290 IFS<.5THENR=11:GOTO1170
1300 RETURN
READY.
```

Two flexible multi-user systems

The Vector Graphic 5005 and 5032

with 5 megabyte and 32 megabyte Winchester hard discs

The Vector Graphic 5005 & 5032 are multiple-user, multi-tasking hard disc systems for general business and word processing applications.

Supporting up to a maximum of 5 users and giving up to 32 megabytes of high-speed totally reliable Winchester disc technology with Vector's automatic error correction feature.

Total flexibility means that the systems terminals can work independently which permits the widest possible range of usage.

One user could use Execuplan for financial planning whilst the second user is entering sales information with accounting software and the third may run correspondence simultaneously with Vector's Memorite III word processing software.

Most other standard CP/M compatible applications software will run on the system e.g. COBOL, FORTRAN, PASCAL, BASIC COMPILER, ALGOL, PL/I and other statistical and data based management packages.

Up to 5 terminals

The Vector Graphic 5005 & 5032 are ideal for application packages, such as accounts, stock control, payroll, word processing, financial modelling and solicitors packages, all available from Almarc.

For further information write or telephone Almarc. Complete sales and servicing facilities are available throughout the U.K.

Almarc
DATA SYSTEMS

Almarc Data Systems Ltd.,
Great Freeman Street,
Nottingham NG3 1FR
Tel: (0602) 52657/8/9
Telex: 37407 Almarc/G

Also at:
Green Street,
High Wycombe,
Bucks. HP11 2RF.
Tel: (0494) 23804

107

APPROVED ALMARC DEALERS

BALDOCK	Modus Systems	(0462) 894848	LONDON	Micro Systems Consultants	(01) 979 4098
BIRMINGHAM	Taylor Micro Systems Ltd.	(021) 358 2436	LOUTH	Computa-Crop	(0507) 604271/2
BRISTOL	Johnson Micro Computers	(0272) 422061	MACCLESFIELD	Resolux Ltd.	(0602) 412035
CAMBERLEY	Johnson Micro Computers	(0276) 20446	NOTTINGHAM	Almarc Business Systems	(0602) 622501
DONCASTER	Reed Computing	(0709) 67087	OXFORD	Johnson Micro Computers	(0865) 721461
HIGH WYCOMBE	Common Sense Business Systems	(0494) 40116	SWANSEA	Business Microsystems	(0792) 474082
HARROGATE	Business Microsystems	(0423) 68224	TYNE & WEAR	H.P. Micros	(0632) 859923
KETTERING	Shuttleworth Business Systems	(0536) 511357	YEOVIL	Dale Computers	(0935) 72000

● Circle No. 161

See Adda for Osborne

Osborne – the business computer that's a personal, portable productivity package! You can confidently tackle tougher jobs, with a vast increase in **personal effectiveness** wherever you are – plane, train, car, office or home. And at Adda you get advice and service from professionals who know what business users need.

THE ADDA-OSBORNE SUPER DEAL INCLUDES: 12 months parts and labour warranty · Free delivery London and Home Counties · Full set manuals · Comprehensive software including: Wordstar/Mailmerge word processing · Supercalc financial package · CBasic · MBasic · CP/M operating system · 10 diskettes.

For only

£1250

for a complete system excluding VAT

For further information or to place an order telephone 01-997 6666

Dot matrix and Daisy Wheel printers available from £399 excl. VAT.

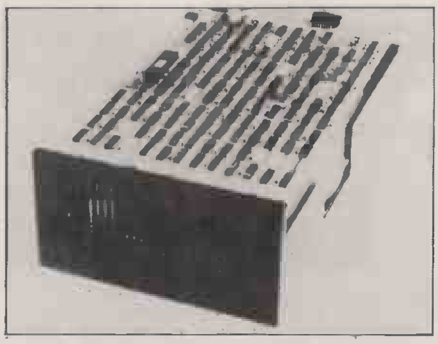
adda

Adda Computers Ltd.
Mercury House
Hanger Green
Ealing London W5 3BA
Tel: 01-997 6666

Only 20 minutes by car or tube from the West End.

● Circle No. 162

The latest generation of hard discs store up to 35Mbyte on a single 8in. unit. Dave Brodsky of Shugart explains some of the technical innovations which have made this level of performance feasible.



Developing heads for more figures

THE DEVELOPMENT of microcomputers over the last year or two has featured one big ingredient which no user will have overlooked — processing ability is going up and cost is going down.

For the manufacturer this has produced a situation where the processor itself is no longer the main cause for concern. The peripheral units are a larger percentage of cost now, have the greatest influence on machine size and are likely to be the real limiting factor to processing ability.

The result is a demand for lower-cost fixed disc storage for microcomputers of a type previously only viable for larger business systems or minis. To answer these demands, disc drive designers are now tending toward compact products suitable for use in shared-logic systems. They tend to incorporate features formerly associated only with large, high-performance devices, especially in the "workhorse" 8in. size.

Multi-user systems

Capacity requirements are growing beyond the 15Mbyte typically offered in today's 8in. drives. Systems with access time of less than 50ms. will need to be acceptable for large multi-user office systems. At the same time, OEM disc-drive users cannot afford to pay twice as much for their peripherals, even if they get a two-fold improvement in capacity and performance. Cost per megabyte has in the past been in the range of £50 to £100 for 8in. Winchester drives.

The trend toward higher performance in smaller drives has spurred the industry in recent months toward the development of higher-precision, closed-loop servo positioning mechanisms in addition to the already existing open-loop designs. They improve positioning precision and permit improved track densities and access times.

The Shugart Fastrak, for example, has positioning information pre-recorded on the bottom surface of the drive's bottom disc. Under the control of a single-chip microcomputer, the servo head, which is mounted on the actuator assembly, reads the servo information and positions the actuator over the correct cylinder. The actuator assembly mechanically couples the servo head to the data heads to improve positioning accuracy. The effects of mechanical and thermal tolerances associated with the typical stepper motor are thereby reduced.

Limiting factor

Position feedback is the key in this type of positioning system. The closed-loop servo system continually provides precise servo information which is used to position the data heads. The stepper motor, on the other hand, operates on a sequence of pulses. After 10 step pulses are sensed, for example, the data head should be on track 10; but there is no positioning feedback signal to tell the system that it really is precisely on track 10.

The lower precision of the stepper motor positioner has been a limiting factor in increasing the track density of drives. Because the positioning is not as accurate, each track has to be wider to allow for the mechanical and thermal tolerances associated with the open-loop stepper principle. This remains acceptable for the low-cost drives used in smaller, stand-alone systems with capacity needs at around 15Mbyte or less, but the new larger and multi-user systems demand the increased performance.

Track density

With the new servo-controlled system and its improved positioning accuracy, track width is reduced by approximately two-thirds. For example, the track density is raised from 172 TPI on Shugart's original SA-1000 8in. Winchester drive, to 500 TPI on the new SA-1100. A two-platter drive with three available data surfaces provides 20.3Mbyte capacity, and a three-platter drive with five data surfaces provides 33.9Mbyte.

Because a closed-loop servo system correlates the overall seek distance with its actual position, an optimum acceleration/deceleration curve can be generated for each length seek, resulting in a low access time. In an open-loop actuator system, with no position feedback, more cautious movement is required and a 35ms. access time cannot be achieved.

There are other areas, too, where gradual design improvements are lowering manufacturing costs yet stepping up drive performance. In the drive itself, the DC motor gives speed control with a variation of less than one percent. Higher reliability comes from fewer mechanical parts and the elimination of a lateral load on spindle bearings from the belt normally associated with an AC motor. The electronics can also be simplified.

The Shugart SA-1100 drives — see photograph — have been designed with approximately 250 discrete components, arrayed on two printed circuit boards, and early production models are assembled in this form. Later models are to be offered with full custom LSI electronics, reducing the number of components to the under-60 range, and eliminating one of the two printed-circuit boards.

Another development which aims to improve reliability is the dedicated head landing/shipping zone, designed to prevent head and disc damage and provide maximum data protection. The heads are moved automatically to this zone when the drive is powered down, when DC power is lost, or when the disc is moving at less than 80 percent of normal operating speed. Once in the landing zone, the heads are held in place by an automatic actuator parking lock. An automatic spindle brake also keeps the disc from rotating when power is removed.

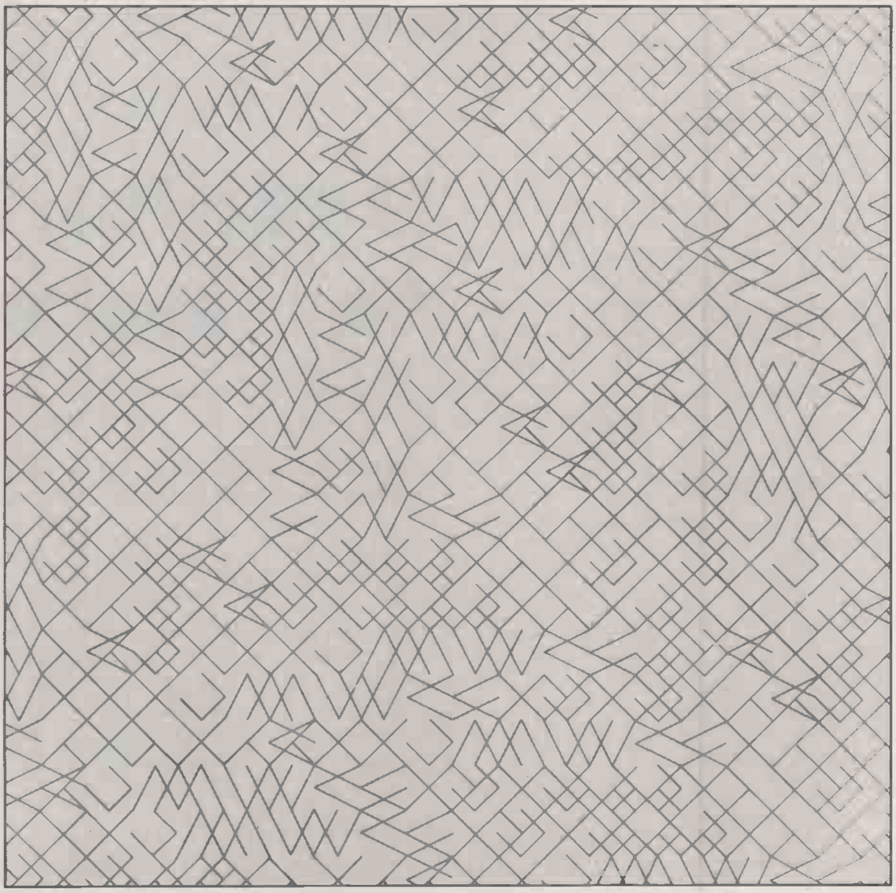
Design improvements

Design changes currently emerging from research and development departments involve few problems in upgrading from standard-performance 8in. Winchesters. For example, to upgrade to the Shugart SA-1100 from an SA-1000-based system, only minor hardware and software modifications are required. In the hardware area, a third head-select line already present in the read/write data cable must be activated. The device controller needs to access this line in order to address the five read/write heads on the three platter SA-1100 model.

The SA-1100 interface also includes two optional input signal lines not available with the SA-1000. One is a fault-clear line that clears unsafe conditions, such as a head drawing too much current. The other is a recall line that commands the selected drive to position the read/write heads to cylinder 0 and reset any seek-error conditions, a task formerly handled by the controller, which is now relieved of this burden.

In these pages Brian Reffin Smith keeps you up to date with computer-based art and design and lays the foundations for graphics routines to use on your own micro.

By all means fool about



One of Jacques Palumbo's designs — nowadays he prefers to play guitar.

I RECENTLY organised a London show of artists and musicians who use computers in their work. Although the show has now finished in London, it is due to visit Paris, and later on Edinburgh — so if you are a jet-setter, or happen to live there, drop in and visit.

The title of the exhibition is "Artists/Computers/Art", which attempts to convey the fact that here is work done by artists, who just happened to be using computers. So much so-called "computer-art" hardly passes muster as art at all, and most art-oriented people are put off by it.

Happier each day

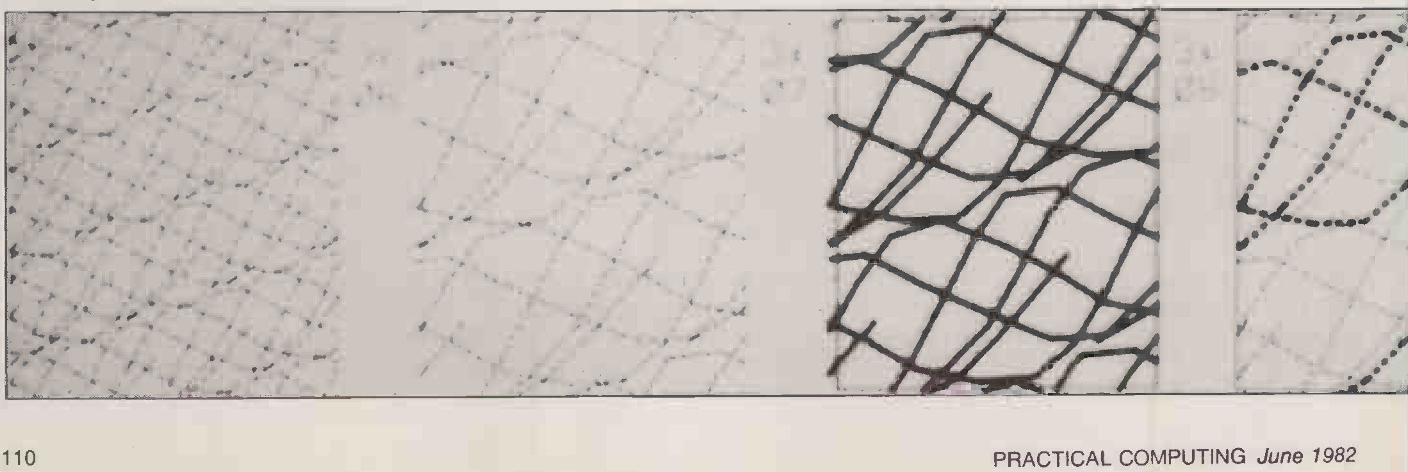
Jacques Palumbo has forsaken his native Algeria and now lives in Canada. His work, I must admit, is not in that category of art that I like most. But I wanted Palumbo in the show for an important reason: he has stopped using computers, at least for the time being. In his previous use of the technology in art, he is fairly typical of those who work with systems of numbers, translating them into some visual form. Permutations and systematic variations feature strongly, and no doubt you can think of many examples that have been seen over the years that use similar ideas.

The fact that he has stopped and, as he now says, sits with his partner and "two marvellous children, playing classical guitar and Renaissance lute, getting a bit happier each day", is worth examination. For on one level, it would not be surprising that any human would prefer to do things like that, rather than draw lines on paper, whose positions correspond to some well-defined numerical progression or permutation.

Yet, the same person, surely not an entirely different being, became quite famous as an artist for doing precisely that, and presumably gained satisfaction from it. He has said previously that he used computers to save him time, allowing the almost instant production of work that would have taken ages by hand. But after a period of this labour-saving approach, he gives up altogether. Could it be that the fact that he hand-drew his earlier work compensated for some other, inherent, sterility? If that is so, does it have any messages for us who use computers — for whatever reason — in our own work?

Gerald Hushlack is Professor of Fine

Five frames illustrating a graphics sequence originated by Gerald Hushlack of the University of Calgary.



Art at the University of Calgary where he has access to some extremely powerful computing equipment. One reason for such riches of computer graphics devices is that the town is firmly based on oil production: the oil corporations make considerable use of graphics to help them visualise the endless streams of data produced by their many and various tests and explorations.

Boston Stranglers

Unlike Palumbo, Hushlack revels in using computers. I remember going out with him to drink several "Boston Stranglers", a lethal local cocktail of which vodka, Tia Maria and cream were some of the less brutal ingredients. Suitably refreshed, we then slipped into the silent offices of an oil company to spend hours producing immense sheets of colour graphics. It must be said, however, that Hushlack also does a great deal of painting, and other hand-work too. Maybe that keeps him relatively sane.

Of his work, he says: "Traditionally, machines used in art-making functioned as tools performing only in an external mode". I think he means external to your head. "Today the computer can assist the artist at all levels: selection and organisation; instant visual playback of information; and an instant memory actively addressing data many years old. Most important of all are present software developments which allow subjective inclinations to become workable information for the artist. The artificial intelligence liberates the artist from the drudgery and laborious activities which are so often necessary in art-making. Possible solutions for determining quality may point in directions which require the redefinition of basic notions of art".

Vital enquiry

Yes indeed — and to see why the use of computers in art may be so important in general terms, you only have to change his final sentence to be about the use of computers in many other spheres. Art, by virtue of its "free" position to explore, play games, fool around and ask strange questions, may become a most vital mode of enquiry into the emerging information environment.

BEGINNING GRAPHICS

Loops and turns

```
10   REM Universal 2D rotation A.Goodhew
20   REM For BBC Micro
30   MODE4
40   INPUT "Numbers of Corners"N
50   DIM X(N),Y(N)
60   FOR I=1 TO N:P."CORNER ";I;:INPUT X(I),Y(I):NEXT I
70   P.:INPUT"Centre of rotation - X,Y"CX,CY
90   P.:INPUT"Clockwise rotation in degrees"R:R=R*PI/180
90   CLS: REM clear screen
100  GOSUB150: REM draw object
110  GOSUB170: REM rotate it
120  GOSUB150: REM draw image
130  END
140  REM  Draw shape in X() & Y()
150  MOVE X(N),Y(N): FOR I=1 TO N: DRAW X(I), Y(I):NEXT I: RETURN
160  REM Rotate shape
170  FOR I=1 TO N
180  X=X(I)-CX: Y=Y(I)-CY
190  D=SQR(X*X+Y*Y): IF X=0 THEN A=PI/2:  GOTO 210
200  A=ATN(Y/X)
210  IF X<0 THEN A=PI+A: GOTO 230
220  IF Y<0 THEN A=2*PI+A
230  T=A-R: X(I)=D*COS(T)+CX: Y(I)=D*SIN(T)+CY
240  NEXT I: RETURN
```

RATHER THAN introduce any new ideas, this month I want to present the winning entries from the first two competitions, published in the February and March "Art" pages. Other people's programs are always the richest source of graphics routines, and these two are no exception.

This is not to say, of course, that you can steal someone else's ideas wholesale and then go on to use them simply for your own profit. But music, poetry and other forms of art progress through their practitioners changing, reacting to and, indeed, using the ideas of others. Computing can, and should, do the same.

After all, a For-Next loop is hardly copyright, nor are the by now well-known ways of manipulating shapes on screen or paper. These routines are, rather, the raw materials which the creative computer user exploits to put forward his or her ideas, using the medium of information technology.

As announced last month, John Hardman is the winner of the February competition which called for the best program or artwork based on a For-Next loop. He submitted two versions of his program — the one printed here is for the Research Machines 380-Z. His alternative program for the ZX-81 requires a high-resolution add-on for the micro in order to run properly.

```
10  REM JOHN HARDMAN
20  PUT12
30  CALL "RESOLUTION",0,2
40  FOR A=0 TO 85 STEP 5
50  X=128+96*SIN(A*.017453292)
60  LET Y=96+96*COS(A*.017453292)
70  LET I=224-Y
80  LET J=X-32
90  LET  Q=256-X
100 LET W=192-Y
110 LET E=256-I
120 LET R=192-J
130 CALL "PLOT",X,Y,2
140 CALL "LINE",I,J
150 CALL "LINE",Q,W
160 CALL "LINE",E,R
170 CALL "LINE",X,Y
180 NEXT A
```

One hopes that all microcomputers introduced in the future, regardless of price, incorporate proper high-resolution graphics capability. After all, what use is a computer without one? Not being able to use graphics to communicate information is rather like motor racing without cars: good for the soul, no doubt, and fine exercise for the drivers as they run round the track, but somehow lacking in finesse.

The competition in March called for a program which rotates a shape about any point by any angle. The winner of the £5 prize is A Goodhew of Eastrea, near Peterborough. We are printing here a version to run on the BBC Micro though the original was, very sensibly, written for the 380-Z.

The program asks for "corners" and puts values into two arrays X() and Y(). If you have access to any kind of digitising device, such as a light-pen, joystick or digitising pad, you will see that you could enter values into X() and Y() automatically.

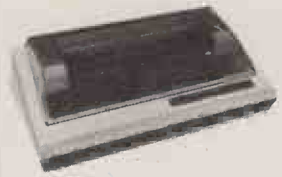
Competition

WE ARE LOOKING for any piece of art that you have made, or worked out, using a computer. But please, nothing that could have been done with a Spirograph. Nationwide fame and a £5 prize await the winning entry.

The address for entries is Art, *Practical Computing*, Room L306, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. As usual, we cannot return any entries, so keep a copy.

PRINTERS

SEIKOSHA GP100



New Design unbelievably low price printer

80 columns. 30 cps 5 x 7 dot matrix. Adjustable tractor up to 10 ins. Graphics. double & standard width printing. Parallel interface as standard. RS232, Apple, IEEE & TRS-80 interface options.

£215

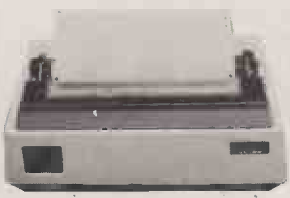
EPSON MX-80 F/T SERIES

Probably the most popular printer in the world.

Type I: 80 cps bidirectional printing logic seeking. 9 x 9 matrix with true descenders. 3 way paper handling. 80 columns with condensed emphasised & enlarged characters. FF, VT & HT. Parallel interface.
Type II: has programmable form feed & line spacing. Bit image printing.

MX80 FT **£399** MX8 FT TYPE II **£445**

OKI MICROLINE 80, 82A & 83A.

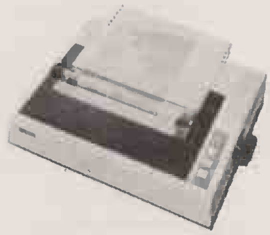


Compact Printers.

80: Unidirectional 80 cps Parallel interface, pin & friction feed.
82A: Bidirectional 80 cps Parallel & serial interface
83A: Bidirectional 120 cps 15 ins 132 cpl at 10 cpi. Parallel & serial interfaces. Graphics & fast serial interface options.

ML-80 **£325** 82A **£465** 83A **£880**

EPSON MX-80T SERIES

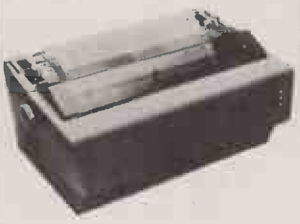


Low Cost, High Quality. Adopted by PET, HP, IBM, Sharp.

MX-80T: Bidirection, logic seeking. 180 cps. 9 x 9 matrix with true descenders. 80 cols. Adjustable pin feed. Normal condensed & enlarged characters. FF, VT, HT Parallel interface.
Type II: has programmable form feed & line spacing. Bit image printing.

MX80-T **£360** MX80-T TYPE II **£399**

TEC STARWRITER

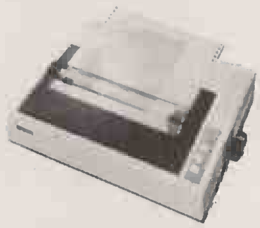


Best-Buy Daisy Wheel Printer.

Bi-direction. 25 cps. Low cost supplies. Standard Daisy Wheel. Carbon and fabric ribbons. Parallel or RS232 interface. Sheet feeder options.

£799

EPSON MX-82 & 100



High Resolution Low cost.

MX-82: As MX-80 spec. plus programmable line spacing & form feed. Bit image printing.
MX-82 F/T.: Adds friction feed.
MX-100: As MX-82 FT with 15½ ins. carriage.

MX-82 **£415** MX-82 F/T **£455** MX 100 **£575**

ANADEX DP–9000 RANGE

High Quality Fast, Versatile Printer.

Six models. Up to 15 inch paper width. Lower case descenders. 160-220 cps bi-directional printing. RS232 current loop & parallel interface. X on X off. Optional 2K buffer. Multiple print densities. Fast print of high-density bit image graphics.

DP-9000L **£747** DP-9001 **£888** DP-9500 **£935**
DP-9000 **£841** DP-9500L **£841** DP-9501 **£982**

FROM

Riva

RIVA TERMINALS LTD.
Head Office: 9, Woking Business Park
Albert Drive, Woking, Surrey GU21 5JY
Tel: Woking (04862) 71001 Telex: 859502

Northern Office: Tel: Harrogate (0423) 503867
Scottish Office: Tel: Strathaven (0357) 22678

● **Prices exclude VAT**

● **Circle No. 163**

SEEING IS BELIEVING

ACT sirius 1

NEW ACT SIRIUS 1

Minicomputer Performance. Personal Computer Price.

16 bit processor: £2,395

The best price/performance ratio you've ever seen on a personal computer.

	ACT Sirius 1	Typical Personal Computers	Typical Business Systems
Memory	128K-1024K	32K-64K	48K-256K
Disk Capacity	1.2Mb-10 Mb	140K-1Mb	1.2Mb-10 Mb
Processor	16 bit	8 bit	8 bit
Operating Systems	CP/M-86, MSDOS	CP/M or Machine Specific	Usually Machine Specific
Languages	Microsoft BASIC Compiled BASIC COBOL PASCAL FORTRAN	Microsoft BASIC perhaps one or two others, eg PASCAL	BASIC and perhaps one or two others
Price	£2395	£1800-£3000	£4500-£8500

ACT Sirius 1 is a new generation personal computer. Quite simply, it has no competition at the price.

It's the first personal computer developed from the outset for business and professional use.

It's launched with more software than anything before it.

It's supported and distributed solely by ACT – the biggest name in personal computer software.

And it's developed by Chuck Peddle, formerly of Commodore and generally regarded as the father of personal computing.

SOFTWARE SPELLS SUCCESS

ACT Sirius 1 has more software than any other new personal computer:

A choice of two operating systems – CP/M-86 or MSDOS, from Microsoft.

For Software Houses

The ACT Sirius 1 has a language for you. Microsoft BASIC 80, two BASIC Compilers, two COBOLS, PASCAL and FORTRAN.

For Applications

Wordstar, Mailmerge, Pulsar, SuperCalc and MicroModeller – all the best sellers.

And the ACT Sirius 1 can run any software written for CP/M – that means hundreds of specialised packages.

THE BODY IN QUESTION

Ergonomics play a vital part in the design of ACT's Sirius 1.

The screen tilts and swivels to suit the user and glare is eliminated.

The display is razor sharp; and the brilliance and contrast can be adjusted using keys on the low-profile detachable keyboard.

STAYING OUT IN FRONT

The ACT Sirius 1 is designed to keep you out in front. Winchesters, networks, multi-user facilities and colour graphics are all scheduled during the next twelve months. And all at the same record-breaking price levels of the ACT Sirius 1.

SEEING IS BELIEVING

The ACT Sirius 1 goes through the most exhaustive quality control process of any microcomputer – including the much vaunted Japanese products.

ACT Sirius 1 has been successfully operating in testing field trials for over 6 months already. And now it's at your nearest ACT Dealer – ready to revolutionise your ideas on personal computers.

Clip the coupon for literature. Better still, call David Low now on the hot line 021-454 8585, get the name of your nearest dealer and see a demonstration as soon as you can – because seeing is believing.

PC6

To: ACT (Microsoft) Ltd, FREEPOST, Birmingham B16 8BR.

☐ Please send a brochure and name of my nearest dealer

☐ I am interested in dealership – send the dealer pack and ask your sales director to contact me.

Name

Position

Company

Address

Telephone

ACT No.1 in Total Computing.

● Circle No. 165

The complete multi-purpose, multi-terminal desktop computer system for business.

Now you can get the world's most powerful, reliable, easy-to-use, multi-user microcomputer system at an affordable price. The ALTOS® Series 5-5D computer (including 5-MByte Winchester hard disc and the MP/M II™ operating system),* which will support up to three smart terminals and a printer, for only £4440.

Our new Altos smart terminals function as independent work stations. Whilst your bookkeeper prepares payroll, other users can be checking inventory, computing cost estimates, doing word-processing and performing hundreds of other business operations.

We can provide all the system software you need, too. Because we support hundreds of CP/M,® MP/M II and OASIS applications programs for Altos computers.

You can also add software that allows you to communicate with other computers and networks.

Thousands of business users throughout the world have improved their productivity with Altos computer systems. For more information, call or write today.

LOGITEK

(E.I.C. Electronics Ltd.)
Logitek House
Bradley Lane
Standish
Greater Manchester
England WN6 0XQ
Telephone: 0257 426644
Telex: LOGITEK G 677354

ALTOS
COMPUTER SYSTEMS

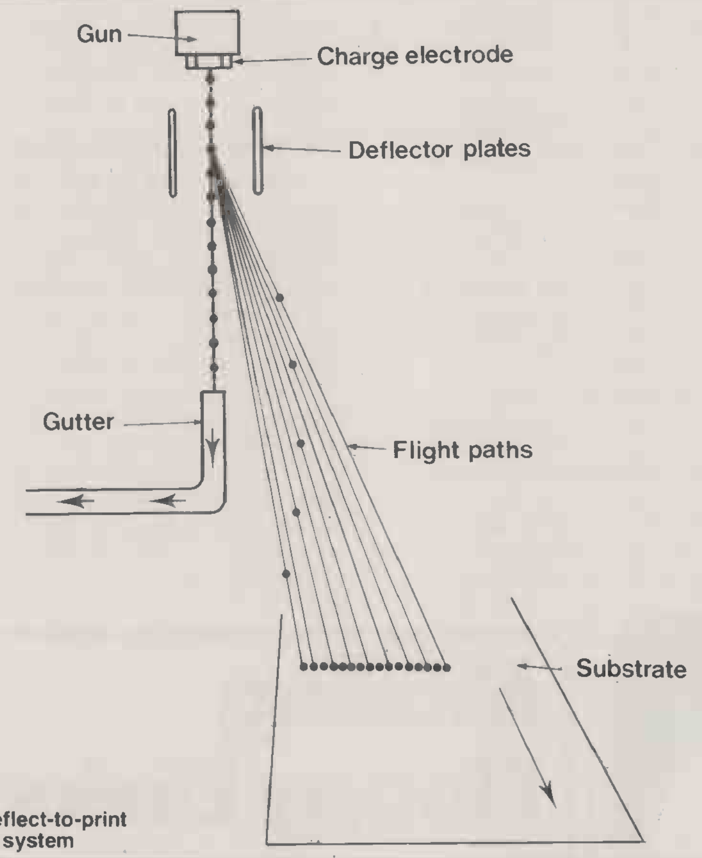
Index House
Ascot, Royal Berkshire
UNITED KINGDOM SL5 7EU
Telex 849426

Packed with fresh ideas for business.

*Series 5-5D includes Z80A processor, 192 KB of RAM, one 1 MB minifloppy and one 5 MB micro-Winchester. Series 5-15D includes Z80A processor, 192 KB of RAM, and two 1 MB minifloppys for £2300.
ALTOS is a registered trademark of Altos Computer Systems. CP/M is a registered trademark, and MP/M II is a trademark of Digital Research, Inc. OASIS is a product of Phase One Systems, Inc.
Z80 is a trademark of Zilog, Inc. ©1982 Altos Computer Systems

● Circle No. 166

Ink jet: a revolution in printing that will make no impact



The deflect-to-print Ink-jet system

A pen that never touches the paper is starting to make its mark. John Lewell explains how ink jets can print 20 metres of characters a second under complete computer control.

CAMBRIDGE LEPIDOPTERISTS are no longer surprised when they catch a butterfly which bears the marking "CCL" on its wings. The initials stand for Cambridge Consultants Ltd, one of the British firms who are developing the technology of ink-jet printing.

"Yes, most of the butterflies round here do have the company logo", admits director Steve Temple, cheerfully. "With inkjet you can print on the most delicate material without damaging it". Indeed, CCL has demonstrated that ink-jet techniques are ideal for printing on a whole range of unusual or sensitive surfaces because nothing touches the surface which is to be printed, the substrate, except the ink.

Charged droplets

These non-impact printers break up a flow of ink into minute droplets. The droplets are given small electrical charges which are controlled by a computer. The ink jet follows the computer's instructions, and each drop of ink is directed towards the substrate at a precisely calculated angle.

In the continuous-flow printer, the ink droplets are given individual electrical charges and are then directed by deflector plates which are maintained at a constant potential. Richard Sweet at Stanford University achieves this by deflecting the charged droplets to the substrate while collecting the uncharged droplets in a gutter. Another method, based on the work of Professor Hertz at the Lund Institute of Technology, is to apply the charge to those drops which are not required for printing, and to deflect them out of the way on to an earthed plate. Both methods require the utmost precision to obtain acceptable resolution.

In the deflected-to-print system, ink is supplied under pressure to a gun which forces it through a nozzle. Inside the nozzle, which may be as small as 35 microns in diameter, the ink is modulated ultrasonically and breaks up into a series of equal-sized drops. These pass through a charge electrode, and a voltage is applied between the electrode and the drop stream.

The electrical charges vary according to the voltage level at the time when the drop separates from the stream. Every drop is thus given a predetermined charge and can be deflected at a calculated angle as it passes the deflector plates.

Until recently, ink-jet printing was restricted to simple tasks like printing addresses for mail-order companies or overprinting "stop press" items. Ironically, though the phrase "stop press" will doubtless continue to be used, ink-jet techniques allow you to change what is being printed without stopping the press — or, for that matter, without "pressing".

Quality improves

The technology was originally applied to alphanumeric printers where speed rather than quality was needed. Now full-colour computer graphics, acceptable both in quality and in size, can be printed.

A single ink jet will print only on to a very small area, so a number of them work side by side in one machine. The paper, or other substrate, moves at a controlled speed a few millimetres beneath the bank of nozzles. Both flatbed and drum printers have been designed, and the system is even used in a few advanced typewriters.

The single-nozzle video jet alphanumeric printers made by A B Dick can produce 1,275 characters per second to a resolution of 30 to 70 points per inch. The finest resolution likely to be achieved over the next few years will probably not exceed 16 to 20 points per millimetre. IBM has a high-quality ink-jet document printer, the 6640, which is used in its System 6 word-processing package. This will print 92 characters per second with 10 points per millimetre resolution.

The alternative unvibrated jet, or Hertz technology, has been the basis of the Applicon product range. Applicon's three-colour plotter will print a 22-by-

(continued on next page)

(continued from previous page)
34in. sheet in seven minutes with a resolution of 125 points per inch. A rotating drum secures the substrate — a precoated diazo-based paper or plastic film — and the jets are moved by a controlled lead screw.

The Applicon system uses a nine-track magnetic-tape unit to transmit data to the printer, so it is a useful product for the mainframe user who wants to build up an image database on tape. Using the subtractive primary colours cyan, magenta and yellow, the system can produce over 4,000 colour shades.

Although relatively slow, this type of equipment has the advantage of producing large pictures to a resolution acceptable for cartography and processing aerial and satellite images.

Transducer pump

The impulse, or drop-on-demand printer, will jet ink only when the computer instructs it to do so. Ink is supplied at a low pressure so that the natural resistance of surface tension will normally prevent the flow. A ceramic transducer in the print head is given an electrical charge to provide a pumping action. Piezo-electric technology reduces the size of the equipment and makes it cheaper to manufacture.

There have been problems such as the formulation and manufacture of suitable inks which dry on the page rather than in the nozzle. This is why most impulse jets are suitable only for printing on paper, and not on other surfaces.

Several companies are using the process for alphanumeric printing. Silonics' Quietype character printer has seven nozzles and prints 210 characters per second. Siemens makes the PT 80 serial printer which has a 12-by-nine matrix and prints at speeds up to 270 characters per second.

PrintaColor has made a big investment in impulse ink jets and believes it can challenge the Applicon dominance in colour plotting. It launched the IS-8001 and GP-1024 desk-top units earlier this year. The standard unit will print a page-sized image in two minutes with a resolution of 90 dots per inch.

Raymond Keithley of PrintaColor is optimistic: "Drop-on-demand ink-jet technology is broadening the range of applications and lowering the cost of colour documentation, making colour graphics more appealing to the small businessman and manufacturer".

Competition in this branch of computer graphics is fierce. New companies such as Advanced Color Technology of Chelmsford, Massachusetts are challenging the market leaders. ACT is making its debut with the typewriter-sized ACT-1 colour copier. This can produce a full-colour page in 90 seconds with resolution of 85 dots per inch vertically and 140 horizontally.

Cambridge Consultants has developed a technique of precision micro-encapsulation — enclosing one droplet of ink inside another. This compound jet could have applications outside the field of printing, perhaps in medical use or in other areas of manufacturing. Mike Keeling, who is in charge of the printing system group at CCL, is sceptical, however, about the ability of ink-jet technology to challenge conventional methods of top-quality printing. He says: "It is unlikely that anything approaching litho or gravure quality will appear at a competitive price within the next five years".

Competing technologies

In the office, ink jet will have to compete with laser xerography. Although ink has the advantage of needing no subsequent processing, laser techniques will be more appropriate for high-volume work.

The benefits of using non-impact systems for printing on rough surfaces are clear. Standard ink-jet products for printing wallpapers and fabrics will soon appear. Ink jet will also become popular in manufacturing industries, reducing the cost of printing instructions, names and logos on a variety of products. There is no shortage of applications. In many cases, ink jet is a practical necessity, not just an alternative or a luxury.

How structured is BBC Basic?

Structures encourage economic programming. John Gordon and Tony Shaw show how to build a library of subroutines using BBC Basic.

OVER THE PAST few years there has been a definite move towards structured programming. There has also been criticism of poorly structured languages such as the primitive Basics of the early micros.

Most of the newer dialects of Basic have introduced structured concepts that go some way towards refuting this criticism. Microsoft Basic 5.1 introduced the While-Wend construct. The Acorn Atom introduced the Do-Until and both had If-Then-Else. Other languages such as Comal and the SuperPet Waterloo Basic have attempted to introduce similar structures to those of Pascal. Roy Atherton gave a detailed discussion of these structures in the June 1981 issue of *Practical Computing*.

The BBC Micro is an inexpensive tool for introducing the techniques associated with structured programming. There are some limitations to the BBC Basic procedures such as its lack of the ability to pass arrays, found in Comal. On the other hand, as well as a structured Basic there is high-resolution colour graphics, an assembler, analogue-to-digital converters and very good debugging features.

A fundamental aid to good programming practice is the ability to use long and meaningful variable names. BBC Basic allows variable names such as Gross Pay, Remainder and Totals for Month. Variable names in BBC Basic can be of unlimited length, and embedded key words are allowed. The only restriction is that variable names must not begin with a Basic keyword.

BBC Basic also includes For-Next, as in traditional Basic, and Repeat-Until, which is similar to the Do-Until of Atom Basic but is more standard. The BBC Basic If-Then-Else construct has only a single line whereas in Comal or Waterloo Basic it is possible to have an If construct spread over many lines. However, by allowing up to 240 characters in a Basic line, fairly extensive If statements may be used.

Criticism justified

BBC Basic does not implement a While-Endwhile construct although the published technical specifications indicate that it was planned. There is also no Case structure, and if a multi-way decision is required On-Gosub must be used. The omission of these two features leaves the BBC Basic open to some criticism, but BBC Basic is entitled to call itself a structured language by virtue of the range of features that it implements.

An additional desirable feature in a structured language is for the programmer to be able to write large programs in the form of a series of smaller procedures, the corner-stones of programming. These procedures can later be combined to form the full program. If the procedures are recorded separately in a library then the language can be effectively extended. These features are present in BBC Basic, and a library of procedures can be built using the cassette-tape storage.

The procedures available in BBC Basic, although not quite of the standard of Comal or Pascal, are well designed and easy to use. For example, to call the procedure shown in listing 4 you simply state its name following the Proc statement. For example,

```
100 PROCprocedure name
```

calls the procedure Procedure Name which is defined in listing 4. It is equivalent to a Gosub in traditional Basic, except that the subroutine name can be meaningful rather than just a line number.

BBC Basic variables can be declared as local to the procedure. In listing 5, Index takes the values 1 to 10 within the procedure PROCjimmy, but maintains its value of 100 in the main part of the program. Values can be passed to parameters that are used within subroutines where such parameters will be local to the procedure. This is accomplished by

(continued on next page)

Listing 5.

```
>LIST
   10 Index=100
   20 PROCjimmy
   30 PRINT "Index= "Index
   40 END
  100 DEF PROCjimmy
  110 LOCAL Index
  120 FOR Index = 1 TO 10
  130  PRINT "How's it gawin Jimmy!!!"
  140 NEXT Index
  150 ENDPROC

  >RUN
  How's it gawin Jimmy!!!
  How's it gawin Jimmy!!!
  How's it gawin Jimmy!!!
  How's it gawin Jimmy!!!
  How's it gawin Jimmy!!!
  How's it gawin Jimmy!!!
  How's it gawin Jimmy!!!
  How's it gawin Jimmy!!!
  How's it gawin Jimmy!!!
  How's it gawin Jimmy!!!
  Index=          100
```

Listing 1.

```
>LIST
  100 FOR I=1 TO 10
  110 PRINT I,I*I
  120 NEXT I
  130 END
>RUN
          1         1
          2         4
          3         9
          4        16
          5        25
          6        36
          7        49
          8        64
          9        81
         10       100
```

Listing 3.

```
>LIST
  100 REM This program exhibits the IF..
  THEN..ELSE construct
  110 REPEAT
  120    INPUT A
  130    IF A<10 THEN PRINT "A<10"
         ELSE IF A<20 THEN PRINT "A>10,<20"
              ELSE PRINT "A>20"
  140 UNTIL A=100
  150 END


>RUN
?3
A<10
?13
A>10,<20
?24
A>20
?100
A>20
```

Listing 2.

```
LIST
100 REM This program shows the
REPEAT...UNTIL construct
110 Ith=0:Last=10
120 REPEAT
130   Ith=Ith+1
140   PRINT "This is the ",
      Ith"th time around
150 UNTIL Ith=Last
160 END

RUN

This is the 1th time around
This is the 2th time around
This is the 3th time around
This is the 4th time around
This is the 5th time around
This is the 6th time around
This is the 7th time around
This is the 8th time around
This is the 9th time around
This is the 10th time around
```

Listing 4.

```
>LIST
 1000 DEF PROCprocedure_name:REM all procedure names begin with PROC
 1010 REM This procedure only prints a message, normally procedures
          would be more useful
 1020 PRINT "This is a silly procedure"
 1030 ENDPROC:REM procedure declarations end with ENDPROC
```

(continued from previous page)

incorporating a parameter list in the procedure declaration

DEF PROCname (parameter 1, parameter 2, ...)

and a set of values in the procedure call

PROCname (value 1, value 2, ...)

where value 1, 2 . . . can be literal values, or variables which have values already assigned to them.

In listing 6, the values of the parameters First, Second and Third are assigned when the procedure is called, and if these parameters are equivalent to some variables in the main program then the values in the main program are unaffected. The only variables in the main program that will be affected by the action of the procedure are those such as Result, that is the Global variables. Any variable not declared as Local or not declared in the procedure heading is Global.

Recursive elegance

An additional feature of procedures in BBC Basic is that they may call themselves recursively. Recursion can be an elegant and concise method of expressing the logic of a program and is much used in mathematical programming. It should however be used with caution. BBC Basic also implements user-defined multi-line functions, which can also be recursive, as in listing 8.

It would be useful to have the ability to build a library of procedures, functions or subroutines which could be loaded from tape to form a single program. As supplied, the BBC Micro can only use a tape for program storage. When a program is loaded from tape it replaces any other program code in memory, at location 0E00 onwards. Thus, although procedures or subroutines can be written and then saved on tape, there is no command designed to successively load them into program memory to form a single program.

The technique in table 1 will overcome this problem as it allows a series of procedures or subroutines held on tape to be loaded into a continuous area of program memory. To use this technique the programmer must ensure that the line numbers of all stored procedures or subroutines are in a distinct high range, for example 10000 onwards, with the main program line numbers in a low range such as 0 to 9000. Using this technique a library of procedures, subroutines and functions can be built up and later linked together, as required.

Table 1. Loading procedures from tape to main program.

Action	Example
Type in or load the main program in the normal way	
Decrease Lomem by 2.	>LOMEM=LOMEM-2
Examine the value of Lomem in hex.	>PRINT~LOMEM
Once this new value of Lomem is known the location in memory into which the procedure is to be loaded can be supplied; xxxx is the hex value of Lomem.	>*LOAD "PROC" xxxx
The micro displays a message that includes the byte length zzzz of the program.	PROC1 yy zzzz
Increment the value of Lomem by the byte count value.	>LOMEM=LOMEM+&zzzz
List the program; this updates the value of Top.	>LIST
Renumber the entire program to ensure that there will be no line number conflict when the next procedure is loaded using the same technique.	>RENUMBER

Example.

```
>LIST
  100 REM MAIN PROG
  110 INPUT "enter three numbers ";A,B,C
  120 PROCminimum(A,B,C)
  130 PRINT "minimum = ";Result
  140 PROCsum(A,B,C)
  150 PRINT "     sum = ";Result
  160 END
>LOMEM=LOMEM-2
>PRINT ~LOMEM
      E8A
>*LOAD "minimum" 0E8A

 Searching

 Loading

 minimum 00 007B

>LOMEM=LOMEM+&7B
>LIST
  100 REM MAIN PROG
  110 INPUT "enter three numbers ";A,B,C
  120 PROCminimum(A,B,C)
  130 PRINT "minimum = ";Result
  140 PROCsum(A,B,C)
  150 PRINT "     sum = ";Result
  160 END
10000 DEF PROCminimum(First,Second,Third)
10010 IF First<Second THEN Result=First
 ELSE Result=Second
10020 IF Third<Result THEN Result=Third
10030 ENDPROC
>RENUMBER
>LOMEM=LOMEM-2
>PRINT ~LOMEM
      F03
>*LOAD "sum" 0F03

 Searching

 Loading

 sum 00 0042

>LOMEM=LOMEM+&0042
>LIST
   10 REM MAIN PROG
   20 INPUT "enter three numbets ";A,B,C
   30 PROCminimum(A,B,C)
   40 PRINT "minimum = ";Result
   50 PROCsum(A,B,C)
   60 PRINT "     sum = ";Result
   70 END
   80 DEF PROCminimum(First,Second,Third)
   90 IF First<Second THEN Result=First
  ELSE Result=Second
  100 IF Third<Result THEN Result=Third
  110 ENDPROC
10000 DEF PROCsum(First,Second,Third)
10010 Result=First+Second+Third
10020 ENDPROC
>RENUMBER
```

Listing 6.

```
>LIST
  100 REM Main program
  110 INPUT "Enter three numbers",A,B,C
  120 PROCminimum(A,B,C)
  130 PRINT"Result= ";Result
  140 END
 1000 DEF PROCminimum(First,Second,Third)
 1010 IF First<Second THEN Result=First
                      ELSE Result=Second
 1015
 1020 IF Third<Result THEN Result=Third
 1030 ENDPROC
>RUN
Enter three numbers?5,6,7
Result= 5
```

Listing 7.

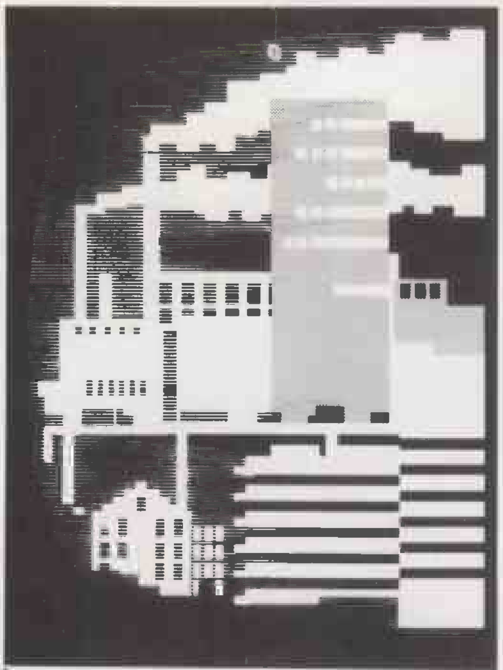
```
  100 REM Main program
  105 Result=-999
  106 PRINT "Result= ";Result
  110 INPUT "Enter three numbers",A,B,C
  120 PROCminimum(A,B,C)
  130 PRINT"Result= ";Result
  140 END
 1000 DEF PROCminimum(First,Second,Third)
 1010 IF First<Second THEN Result=First
                     ELSE Result=Second
 1015
 1020 IF Third<Result THEN Result=Third
 1030 ENDPROC
>RUN
Result= -999
Enter three numbers?1,2,3
Result= 1
```

Notice in the above program the values of Result.

Listing 8.

```
  5 REM This program uses recursion to evaluate N factorial
 10 INPUT N
 20 PRINT FNfactorial(N)
 30 END
100 DEF FNfactorial(N)
110 LOCAL K
120 IF N=1 THEN K=1
         ELSE K=N*FNfactorial(N-1)
130 =K

RUN
?5
         120
```



COMPEC NORTH'82

Belle Vue, Manchester
June 22-24, 1982

Tuesday: 10.00-18.00
Wednesday: 10.00-18.00
Thursday: 10.00-16.30

The most comprehensive computer exhibition in the north is on again soon in Manchester.

For computer users, suppliers, systems and software houses, consultants – anyone who is professionally involved with computers – this is the ideal opportunity to see and compare the whole range of equipment and services.

A day at Compec North is the most effective way of bringing yourself up to date in today's computer market.

MAKE A NOTE TO VISIT

Admission is by business registration and costs £2 at the door, OR

SAVE TIME AND MONEY

by sending now for FREE advance tickets.

COMPEC NORTH'82

COMPEC NORTH is a ComputerWeekly exhibition.
Organised by IPC Exhibitions Ltd.

Please send..............FREE advance registration tickets.
Compec North '82 tickets. IPC Exhibitions Ltd,
Surrey House, 1 Throwley Way, Sutton, Surrey SM1 4QQ.

NAME
COMPANY
ADDRESS

(Applications not accepted after June 14. No school parties or children under 16.)

THE TRANSTEC 1200 VIDEO MONITOR.

At last, a top quality green screen 12" video monitor at a really competitive price.

The Transtec 1200 has a composite video input, compatible with all micro computers and the screen gives a crisp read-out of a full 80 columns.

The unit is housed in a durable plastic cabinet with controls neatly concealed behind a hinged front-access panel.

Why pay more? Send the coupon today for full specification or better still, call us direct in Bristol.

transtec

13A Small Street, Bristol W.1.
Tel: 0272 277462.
Lisburn Road, Belfast.
Tel: 24009.
35 Pearse Street, Dublin 2.
Tel: 713049.
I.D.A. Complex, 22 Macken Street, Dublin 2.
Tel: 713049.

SEND £115 (VAT CARRIAGE INCL.) FOR IMMED. DELIVERY.

DEALERS WELCOME. PRIVATE LABELLING AVAILABLE. ALSO AVAILABLE UNCASED.

JUST £99 COMPLETE.*

I like the Transtec 1200 price — send me more data — fast.

Name
Company
Position

PC6 82

● Circle No. 169

pearcom

The new, APPLE-II* compatible Euro-PAL colour microcomputer now available

NOW AVAILABLE IN STANDARD 48K RAM VERSION WITH 2K PEARCOM MONITOR

ex stock £875

excl. VAT

ALSO AVAILABLE: THE ASSEMBLED AND TESTED PEARCOM MOTHERBOARD WITH 48K RAM FOR £450, EXCL VAT

MAIN FEATURES:
Compact computer with the famous 6502 CPU, APPLE-II compatible, so one can use all the APPLE-II hardware and software without any modification.

Many interesting features give the PEARCOM an enormous technical lead.

Just to name a few:
- 14 I/O expansion slots as standard
- On board expandable to 96 Kbyte of RAM, 32K standard
- 6 ROM/EPROM sockets jumper adjustable.
- Professional reed-switch keyboard with numeric pad
- 7 Function keys
- Built-in HF modulator with HF PAL-colour output
- Sound through TV signal and through built-in loudspeaker
- LED indicators for the main-units
- An industrial type, 5 Amp. power-supply
- Bus compatible with the Applesoft Card and the Z80 Softcard from Microsoft, which comes with CP/M and Microsoft BASIC (optional)

PEARCOM Ltd.
Riverside 1a - Stanstead Abbotts - Ware, Herts SG12 BAP - UK

PEARCOM International Marketing & Publicity Dept.
PO Box 350 - 3720 AH Bilthoven - Tlx 70375 - Holland

VERGECOURT Ltd. (Distributor)
17 Nobel Square - Basildon - Essex SS13 1LP England - Tel. 0268-728484 - Tlx 995323

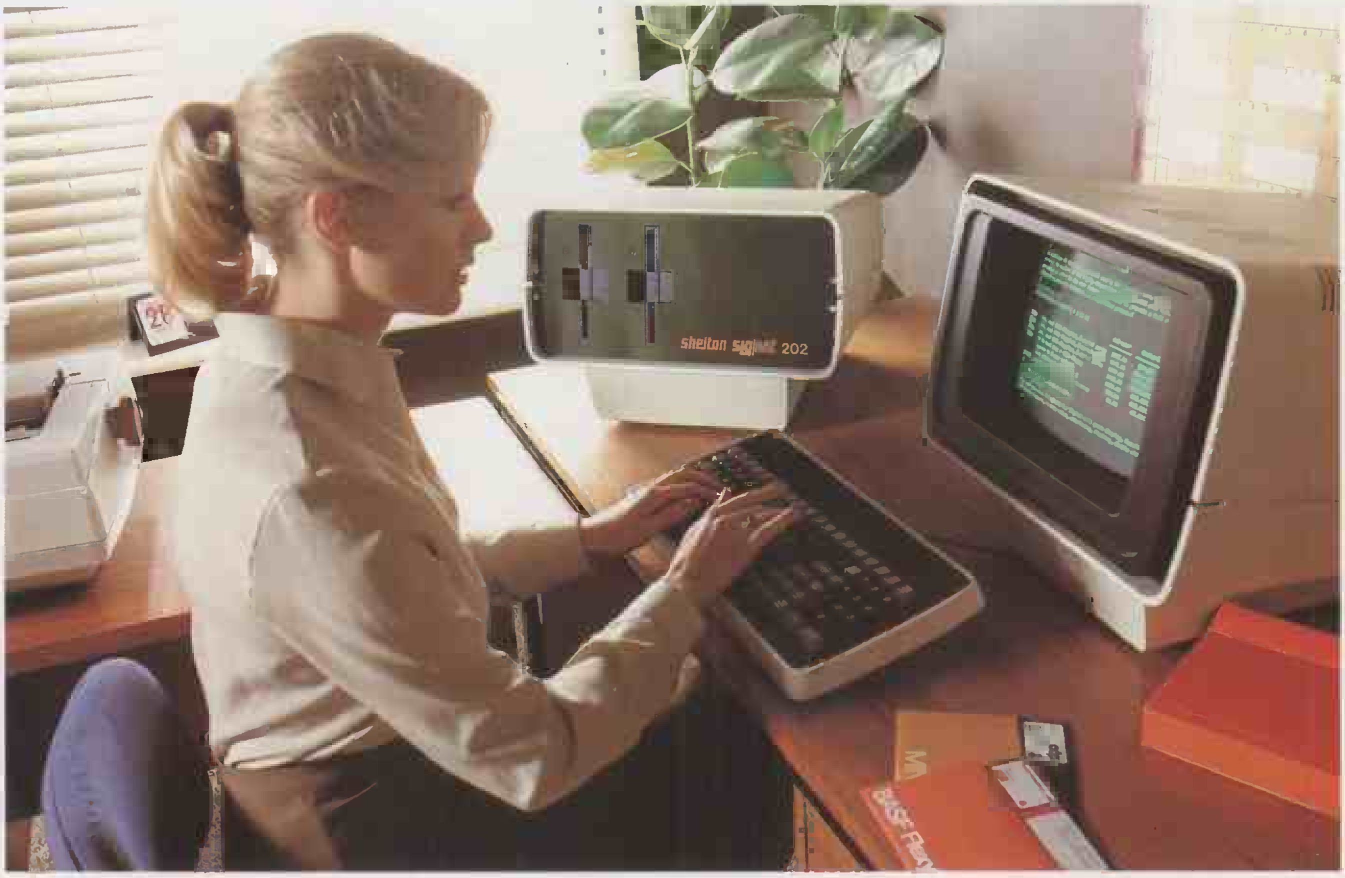
*Apple-II - Trademark of Apple Computer Inc. USA.

PEARCOM
Int. Marketing & Publicity
P.O. Box 350
3720 AH Bilthoven

● Circle No. 170

DEALER INQUIRES INVITED

THE MICROPUTE CHALLENGE:– FIND A COMPUTER TO COMPARE WITH THE signet ...NEVER.



... Because the SIG/NET offers the price advantage of the low cost systems together with the flexibility and infinite expansion capabilities of the high cost systems.

Or in other words a great deal more for a great deal less.

For just **£1,299.00** the standard SIG/NET offers the flexibility to choose the terminal best suited to your requirements, the printer to give the speed and quality you need and disk capacity from 400,000 to 40 Million characters.

The standard SIG/NET 202S	**£1,299.00**
5 Megabyte hard disk system	**£3,100.00**
10 Megabyte 4 User	**£6,000.00**
10 Megabyte 10 User	**£9,500.00**

FOR FURTHER TECHNICAL DATA AND THE NAME OF YOUR NEAREST DEALER SEND THE COUPON **NOW!**

MICROPUTE
Catherine Street, Macclesfield, Cheshire, SK11 6QY. Tel: (0625) 612759.

NAME ____________ POSITION ____________

COMPANY NAME ____________

COMPANY ADDRESS ____________

____________ TEL. NO. ____________

Dealer enquiries invited for certain areas of the Midlands and North.

THERE'S JUST NONE TO COMPARE.

- **Unbeatable value for money.**
- **Advanced and innovative BRITISH design.**
- **BRITISH BUILT.**
- **Unrivalled expansion.**
- **Faster than comparable systems.**
- **Full 64K of memory.**
- **Sold only through approved dealers.**
- **CP/M compatible.**

MICROPUTE

MICROPUTE
microcomputer systems
Catherine Street,
Macclesfield,
Cheshire,
SK11 6QY.
Tel: (0625) 612759.

● Circle No. 171

THE GALAXY 1 COMPUTER

The cost effective solution to your computer needs for only £1,450*

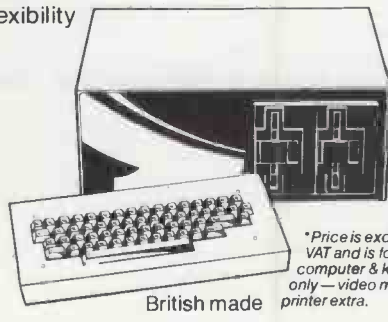
The Galaxy 1 desk top computer system can be used in education, small business applications, word processing, stock control and a host of other environments. Our choice of CP/M as the operating system means that our customers can select a suitable application package from the widest possible range.

However, unlike our competitors, we supply not only the hardware but all the essential system software needed to start using the Galaxy 1 as soon as it is installed. We have adopted COMAL-80 as our standard language. This structured basic is rapidly gaining widespread acceptance and popularity especially in the education market, offering much greater flexibility and ease of use than existing Basics. We also supply a very powerful Z80 assembler/ editor called GEM ZAP with GEM PEN, a compact but very powerful word processing package. The system software suite is completed with GEM DEBUG, a useful machine code program de-bugging utility.

Modular design means reliability and ease of maintenance. Unlike many other manufacturers Gemini offer a full one year warranty (except Disc heads which are guaranteed for 3 months). Our distributors carry a full range of replacement boards thereby facilitating a quick, efficient and cost effective back up customer service.

Features include:

- Twin Z80 Processors
- 64K Dynamic RAM
- 800 K Disc Based Storage
- 80×25 Screen Format
- Dual Printer Interfaces
- Modular Design
- CP/M 2.2 Operating system
- COMAL-80 – Structured Basic
- Z80 Editor/Assembler
- Text Editor & Formatter
- Program De-Bugging Utility



British made

**Price is exclusive of VAT and is for computer & keyboard only — video monitor & printer extra.*

Telephone Amersham 28321 for the name and address of your nearest distributor.
**** Dealer enquiries invited.***

Gemini Microcomputers Oakfield Corner, Sycamore Road, Amersham, Bucks HP6 5EQ.

● Circle No. 172

Get down to the root of the problem

Conventional methods for finding the roots of a polynomial may prove difficult if the function is not well-behaved. Patrick Howden and Noel Kantaris present an original algorithm which does the same job, and is able to deal with closely spaced and complex roots.

TRADITIONAL METHODS for solving for roots of equations depend on being able to differentiate the function concerned. One fairly accurate iterative formula, which usually gives several decimal places of accuracy, is the following:

$$x_0 \simeq a_{n+1} = a_n + \frac{F'(a_n)}{F''(a_n)} \times \left[-1 + \left\{ 1 - \frac{2F(a_n)\,F''(a_n)}{(F'(a_n))^2} \right\} \right]^{\frac{1}{2}}$$

where a_n is the guessed root, $F(a_n)$ is the function evaluated with a_n, and F' and F'' are the first and second differentials of the function.

Such a method requires the prior calculation of the various differential coefficients and is severely limited if either F' or F'' is zero, or if the function inside the curly brackets is negative so that its square root is complex. Furthermore, this precision formula does not have much capture range, which is also true of the series methods of calculating roots as a sum of terms. It would therefore be very useful to have a simpler method which can also deal with multiple roots, even those lying close together or of very large magnitude.

Our equation-solving method presented here has been engineered on empirical lines. It achieves great precision after only a few steps on a simple calculator. Any errors that might be introduced along the way are self-correcting, and the capture range from a trial solution — typically zero — is usually indefinitely large.

An equation which can be represented as a function of x and can be written as $F(x) = 0$ will have a root at x_0 and trial roots given as $a_0, a_1, \ldots, a_n$. Near a root, x_0 can be approximated by

$$x_0 = a_n \pm Q\,[F(a_n)]$$

for some function Q of $F(a_n)$, provided a_n is sufficiently close to x_0 and Q approaches zero as $F(a_n)$ approaches zero, that is, as a_n approaches x_0. In particular

$$x_0 = a_n \pm \frac{F(a_n)}{q}$$

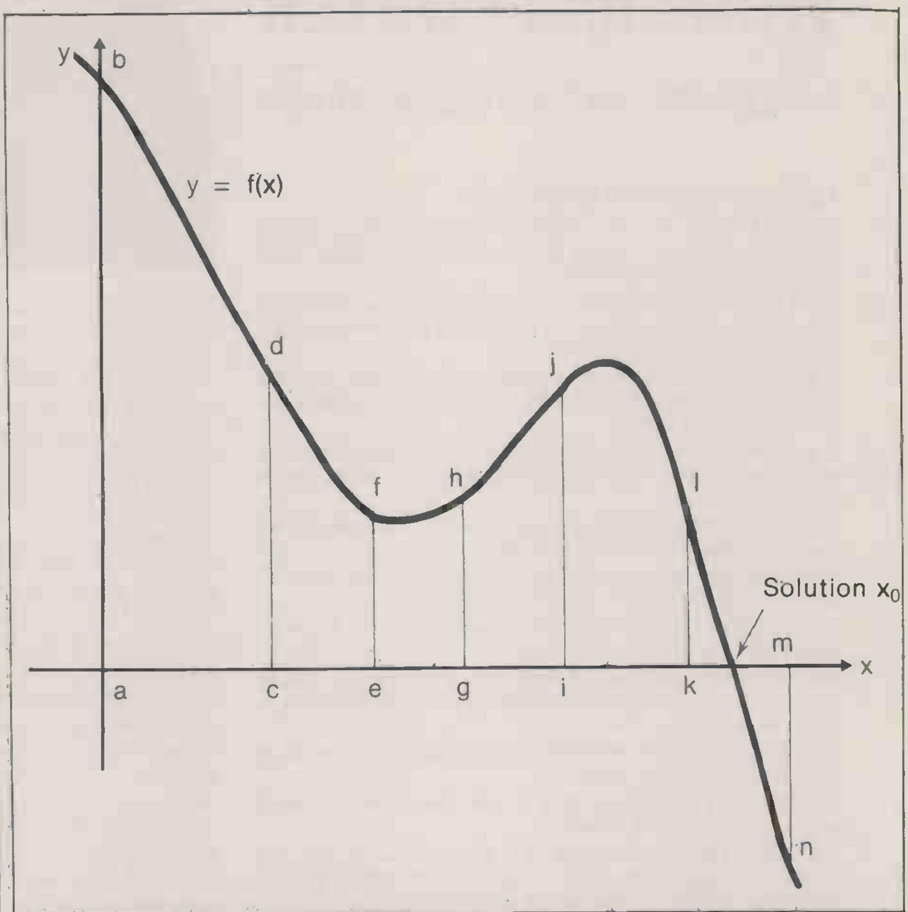


Figure 1. Schematic of $\sinh^{-1}$ function: $ac = \sinh^{-1} ab$, $ce + \sinh^{-1} cd$, etc; note sign change near the root which gives corresponding halving of increment.

where q is an appropriate variable number to be derived later.

If any a_n is substituted into $F(x)$, for example, $a_n = 0$, then $F(a_n)$ could be too impossibly large to iterate. Therefore, Q must act as a well-behaved attenuating function: the larger $F(a_n)$, the heavier the required attenuation. Further, the choice of Q must satisfy two more requirements:

$$Q\,[F(a_n)] = F(a_n)$$

for small $F(a_n)$, and

$$Q\,[-F(a_n)] = -Q\,[F(a_n)]$$

Thus, Q must be monotonic, more or less symmetrical, and must not saturate.

Two such functions were considered and tried. The first,

$$Q = \tan^{-1}\,[F(a_n)]$$

appeared to be a good choice until an attempt was made to evaluate equations with large answers, say $x_0 = 100$. Although the answer was reached eventually, it was rather too slow for comfort. A further disadvantage of this choice is that the $\tan^{-1}$ function has a limiting value of $\pm\pi/2$. A strong advantage, however, is that most reasonably simple calculators support this function.

To overcome the slowness of the $\tan^{-1}$ function, the inverse hyperbolic sine function $\sinh^{-1}$ was chosen as a function for Q. The expression

$$\sinh^{-1}\,[F(a_n)] = \ln\,[F(a_n) + \{F(a_n)^2 + 1\}^{\frac{1}{2}}\,]$$

must be used with those calculators without the $\sinh^{-1}$ function and in any computer programs.

Another valid form for Q could be

$$\frac{F(a_n)}{q}$$

where q is adjusted at each iteration in order to adapt to the conduct of computation — a sort of feed-forward adaptive gain technique. A potential diverging or conversely go-slow tendency, is counteracted by doubling or halving q before any iteration. q is a "gain control" or stability control — it stops oscillations.

To meet both criteria, the adapted function is tentatively shown as

$$x_0 = a_{n+1} = a_n \pm \frac{\sinh^{-1}\,[F(a_n)]}{2^r}$$

where r is a ± integer or zero, especially at the first step. It is better adapted to hand calculators.

(continued on page 127)

WOULD YOU LIKE TO HAVE A PROGRAM TO DEVELOP ALL OF THE APPLICATIONS SOFTWARE YOU WILL EVER NEED ?.......

THEN YOU NEED –

THE PROGRAM WRITER/REPORTER®

A PROGRAM THAT WRITES PROGRAMS

THE PROGRAM WRITER/REPORTER®

Enables **ANYONE** to write complete, running, debugged **BASIC LANGUAGE** Programs in 35 to 40 minutes with **NO PRIOR PROGRAMMING KNOWLEDGE OR ABILITY.**

IF you are one of the many who bought a microcomputer in the belief that with just a little studying you could write your own programs, you know that you can't.

IF you, as a businessman, thought you could have stock software modified at a reasonable cost with reasonable results, you know that's not possible either.

IF you are a hobbyist getting tired of the untold hours it takes to write a program, only to find it takes more hours to debug than to write.

IF you are a skilled programmer you don't have to be reminded of the repetitious time spent on each new application.

IF you have left your microcomputer sitting somewhere gathering dust...meet **THE PROGRAM WRITER/REPORTER®**.

THE PROGRAM WRITER/REPORTER® is not just another data base generator.

THE PROGRAM WRITER/REPORTER®, at your direction, makes complete running programs that are thoroughly documented, easy to modify at any time by **YOU!**

THE PROGRAM WRITER/REPORTER® cuts programming time up to 90% for a skilled programmer.

THE PROGRAM WRITER/REPORTER® will make anyone a skilled programmer in 30 to 35 minutes!

THE PROGRAM WRITER/REPORTER® does the work! You can answer the simple direct questions and **THE PROGRAM WRITER/REPORTER® CREATES...AND ALL IN BASIC LANGUAGE.**

Q. After **THE PROGRAM WRITER/REPORTER®** has produced a program, can it be modified ?
A. Yes, the resulting program is modular, fully documented and readily accessible for alterations or deletions.

Q. Does the program created use so much disc space that there is very little space left for the record storage ?
A. No, the code produced is extremely compact despite complete documentation. If requested **THE PROGRAM WRITER/REPORTER®** will even 'pack' or compress information. You may even delete the 'remarks' making it even more space efficient.

Q. Must I be expert or even conversant with Basic Language ?
A. No, all questions to and answers from the operator require no computer language knowledge, simple, every day English will do.

Q. What about maths ability ?
A. If you can count your fingers and toes, you'll have no problems.

Q. Will the programs which I produce with **THE PROGRAM WRITER/REPORTER®** be bulky, slow or amateurish ?
A. No, the resulting programs will be sophisticated and extremely fast operating. For example, should you create a mailing list or inventory program, the time for any record to be retrieved and displayed from a full disc would take a maximum of 1 second.

Q. Must the programs produced conform to a pre-determined format and file length ?
A. No, you determine format and file size to fit your requirements. You may have as many as 500 fields or as few as 1.

Q. Can I develop my own business programs ?
A. For the most part, yes.

Q. What are the limitations ? What programs can I produce with **THE PROGRAM WRITER/REPORTER®** ?
A. Your own ingenuity and hardware limitations. 100's of different programs.

TECHNICAL ASPECTS

Writes stand alone data base storage/retrieval/update programs to the user's specifications and generates source code in basic (you do not need to use PWR to run generated programs) .

Generated programs are easily modified.

User-defined prompts, edits, error messages and video attributes are standard, fully supported and easily modified.

You may have 500 fields per record with CP/M; 47 fields with APPLE II+; or 200 fields with APPLE III.

You may have up to 32,000 characters per record with CP/M; 3,000 characters per record with APPLE II+ and APPLE III.

Any field may be a key field. New keys may be added at any time. Duplicate keys permitted.

Unlimited records per file (disk limited) .

Unlimited disks per file.

Record deletion automatically supported.

Record access and file maintenance is user transparent.

Record access by a hashing algorithm guaranteeing fast record retrieval.

Minimal disc overhead since there is no special assembly language routine called. No 'basic' overhead.

Programs produced can be transported between 6800, 6502, 8080, Z80, 8085, 8086 and Z8000 based systems.

All packed fields (5 types) may be updated computationally, (2 types – APPLE II) . You may add (or subtract) an amount to a field, or multiply or devide a field by a constant.

Multiple file access and update allowed.

Can be used with Microsoft basic on CP/M systems.

Programs are compilable, using Microsoft's BASCOM (CP/M only) .

Complex selection/exclusion criteria are possible and easily understood when using the reporter.

With the reporter columns may be the result of computations on fields or other columns or intermediate results limited only by the complexity permitted by Microsoft basic. All basic computational functions are permitted, as are all logical and string functions.

AVAILABLE FOR :–
CP/M 8", CP/M 5¼", NEC, OSBORNE, NORTH STAR, VECTOR GRAPHIC, APPLE III & APPLE CP/M AT – £325 + V.A.T. (£373.75)

APPLE II AT – £275 + V.A.T. (£316.25)

PLEASE SUPPLY ________ COPIES OF THE ________ VERSION FOR MY ________ COMPUTER, MODEL ________

PLEASE SEND FURTHER INFORMATION ☐ *TICK BOX*

NAME . . . .

ADDRESS . . . .

. . . .

. . . .

TELEPHONE No. . . . .

DEALER ENQUIRIES INVITED

ASET
Computer Systems and Services

ASET LIMITED, 24 Princes Street
Southport, Merseyside PR8 1EQ
Telephone : 0704 43008

● Circle No. 173

(continued from page 125)

The algorithm, unlike the traditional Newton-Raphson method, tends to be more stable under varied conditions. Although there may be better shaping functions than $\sinh^{-1}$ — calculus of variations schemes would probably reveal them — at best, they could only save a few iteration steps in reaching any desired precision.

Programming is greatly simplified by the adoption of the algorithm

$$x_o \simeq a_{n+1} = a_n \pm 2\left(\frac{p}{3} - r\right) \sinh^{-1} [F(a_n)]$$

where r is bumped up by one when the sign of $F(a_n)$ changes, and p is bumped up by one when the computation is going too slowly.

Gain control

The procedure for finding roots is related to electronic analogue-to-digital conversion, while the 2^r divisor is simply a crude averaging method which is simpler than, say, a parabolic or incremental straight-line fit. Thus, if

$$\pm\sinh^{-1} [F(a_{n+1})]$$

is opposite in sign to that of the previous

$$\pm\sinh^{-1} [F(a_n)]$$

you increment r by one, that is you divide by a further power of 2 while maintaining p the same as before. When they have the same sign, increment p by one while maintaining r at its previous value. This develops the adaptive gain control.

Figure 1 illustrates how the algorithm operates. Newton-Raphson's method would oscillate on this curve unless the starting point were chosen very near the solution. The flowchart in figure 2, when applied to a polynominal, such as

$$F(x) = x^7 + 28x^4 - 480 = 0$$

adequately illustrates the roots solving technique. Initial conditions are set at x = 0, p = 0, r = 0. Sign S of the $\sinh^{-1}$ function is taken as negative. If it were chosen positive it would find other answers, not necessarily of any particular sign. The first S1, a sort of pre-initial sign, is always assumed positive.

The total number of iterations allowed is pegged at 100 in order to prove the absence of a root in that direction. A root is assumed to have been found if

$$\text{Abs } [F(a_{n+1}) - F(a_n)]$$

is less than a desired decimal accuracy, in this case 0.00001.

The first step is to calculate F(0), which is −480 for the particular example. Then H is found from

$$H = -\sinh^{-1} [F(0)] = -\sinh^{-1} [-480] = +6.86699$$

The sign of H is stored in S2, to be compared with the previous sign S1. All that remains is obvious, yielding one solution at x = 1.9228816 after 15 iterations as shown in table 1.

Another solution will usually be found simply by reversing the sign S with the same initial x, and r = 0. However, there happen to be two negative solutions very close together, so that iterating negatively from x = 0 can skip both solutions altogether, unless the iteration takes very small steps by setting r as large as 10, for example. Starting at x = −2.6 with S as negative gives a solution at x = −2.57780046.

Fine searching

To find these closely spaced roots a simple fine-search mode subroutine is included in the program. It hunts for a sign change in the value of F(x), starting from x_{old} and stepping by a small increment L, which is an input parameter. When a sign change is encountered the program continues to evaluate precisely the approximately discovered root as before. In this way, with r = 10, x = 0, L = −0.01 and S = +1, the root at x = −2.45808973 is found. Starting from a slightly more negative value of x, namely −2.46 with S = −1 and the fine-search mode in operation, a third real root is evaluated at x = −2.57780046. All other roots are thus complex.

Figure 3 shows these solutions where, for instance, in order to compute the +1.92 solution, S will have to have a negative sign, with an initial x placed anywhere from the −2.45 solution to +∞. Conversely, the −2.45 solution will be found with a positive S and with x lying between −2.57 and +1.92, and so on for the −2.57 solution.

(continued on next page)

F(x)	Trial x_{old} R	S = sign op ± sinH⁻¹	Increment sign S_1	Max no. of iterations, N	Decimal accuracy P	Optional fine search mode. Increment L, which raises flags K
Equation to be solved	Often both zero. P = 0	Select to find nearest root	Initially +	Always 100	Typically .00001	

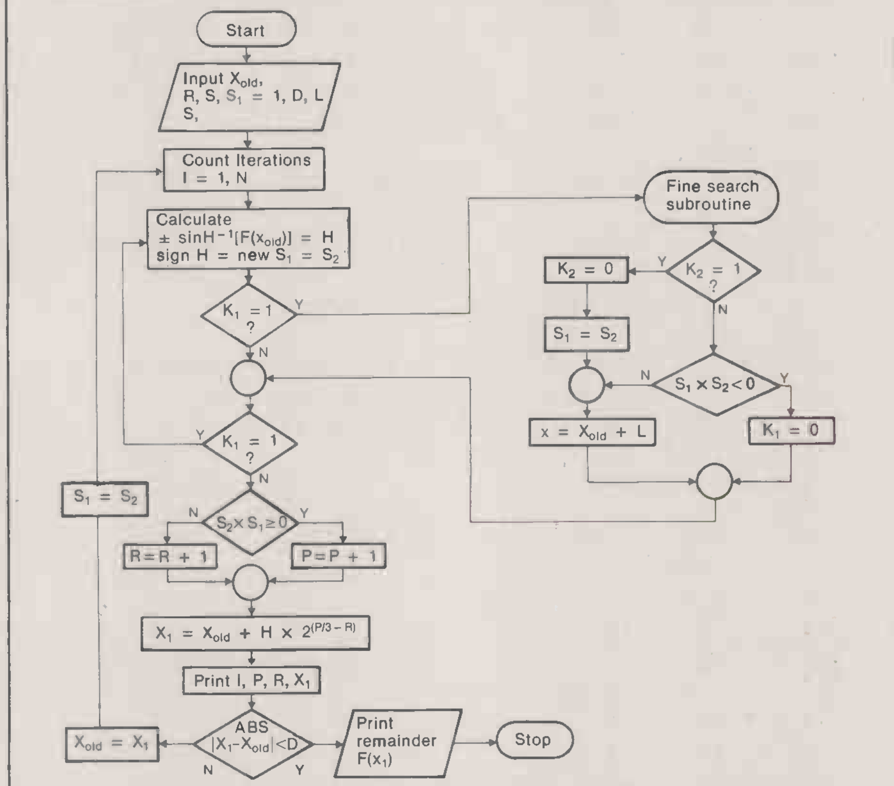


Figure 2. Flowchart for single roots, including a fine-search routing.

Table 1. Solution of one root of seventh-degree trial polynomial.

Enter values for:
X_{old} = 0
(P = 0 — set by the program)
R = 0
Sign = −1
(Maximum number of iterations = 100 — set by the program)
Decimal accuracy = .00001

Iter	P	R	Root
1	1	0	8.65148245
2	1	1	−1.32675618
3	1	2	0.77906635
4	2	2	3.49531867
5	2	3	1.52876973
6	2	4	2.16587852
7	2	5	1.83954148
8	2	6	1.96781340
9	2	7	1.90972184
10	2	8	1.93079275
11	2	9	1.92176434
12	2	10	1.92342333
13	2	11	1.92296889
14	3	11	1.92287386
15	3	12	1.92287964

To change parameters type RUN 50
To change function type RUN ROOTS

Listing 1. Apple Basic implementation of solution algorithm.

```
10  REM ROOTS WITHOUT DIFFERENTIALS
20  HOME : PRINT "TYPE YOUR FUNCTION AS PER EXAMPLE": PRINT
30  PRINT : PRINT "50 DEF FNA(X)=X^2+3*X-10": PRINT : PRINT
40  PRINT "THEN TYPE ...  RUN 50"
50  END : REM SPACE FOR DEFINING FUNCTION
60  DEF  FN S(X) =  LOG (X +  SQR (X * X + 1))
70  HOME : PRINT "ENTER VALUES FOR :-": PRINT
80 P = 0: INPUT "XOLD = ";X: INPUT "R = ";R: INPUT "SIGN = ";
    S
90 N = 100: INPUT "DECIMAL ACCUR. = ";D: INPUT "FINE SEARCH?
     (Y/N) ";K$: IF  LEFT$ (K$,1) <  > "Y" GOTO 110
100 K1 = 1:K2 = 1: INPUT "SEARCH INCREMENT? ";L
110 S1 = 1: PRINT : PRINT "ITER"; TAB( 10);"P"; TAB( 17);"R";
     TAB( 28);"ROOT": PRINT
120  FOR I = 1 TO N
130 F =  FN A(X):H = S *  FN S(F):S2 = H
140  IF K1 = 1 THEN  GOSUB 220: IF K1 = 1 GOTO 130
150  IF S2 * S1 >  = 0 GOTO 170
160 R = R + 1: GOTO 180
170 P = P + 1
180 X1 = X + H * 2 ^ (P / 3 - R)
190  PRINT  TAB( 2);I; TAB( 10);P; TAB( 17);R; TAB( 25);X1: IF
      ABS (X1 - X) < D THEN  PRINT : PRINT "REMAINDER = "; FN
     A(X1): GOTO 210
200 X = X1:S1 = S2: NEXT I: PRINT : PRINT "NOT CONVERGING"
210  PRINT : PRINT "TO CHANGE PARAMETERS, TYPE ... RUN 50": PRINT
     "TO CHANGE FUNCTION ,TYPE ... RUN ROOTS": END
220  IF K2 = 1 THEN K2 = 0:S1 = S2: GOTO 240
230  IF S1 * S2 < 0 THEN K1 = 0:R = R - 1: RETURN
240 X = X + L: RETURN
```

(continued from previous page)

Solution seeking is usually much easier than in this example, where the equation has two roots close together so that they must be approached with the fine-search mode. The same method can be applied, with much less difficulty, to a bridge-cable catenary problem. If the bridge consists of a 300m. heavy cable suspended between two horizontal points 260m. apart, you can find out by how much the cable sags by solving for x in the expression

$$F(x) = x \sinh\left(\frac{130}{x}\right) - 150 = 0$$

and substitute into

$$\text{sag} = x \cosh\left(\frac{130}{x}\right) - x$$

The initial conditions on the algorithm are $x_{old} = 100$, $r = 0$, $S = +1$, which gives the root as $x = 138.325993$m., which in turn gives the sag in the bridge cable as 65.7183163m.

The Apple Basic program used to solve these examples is shown in listing 1. When the program is first run, it allows you to specify your function in line 50, which for the first example should be typed as follows:

```
50 DEF FNA(X) = X^7+28*X^4-480
```

To change the equation, simply retype line 50 with the new equation appearing after the = sign.

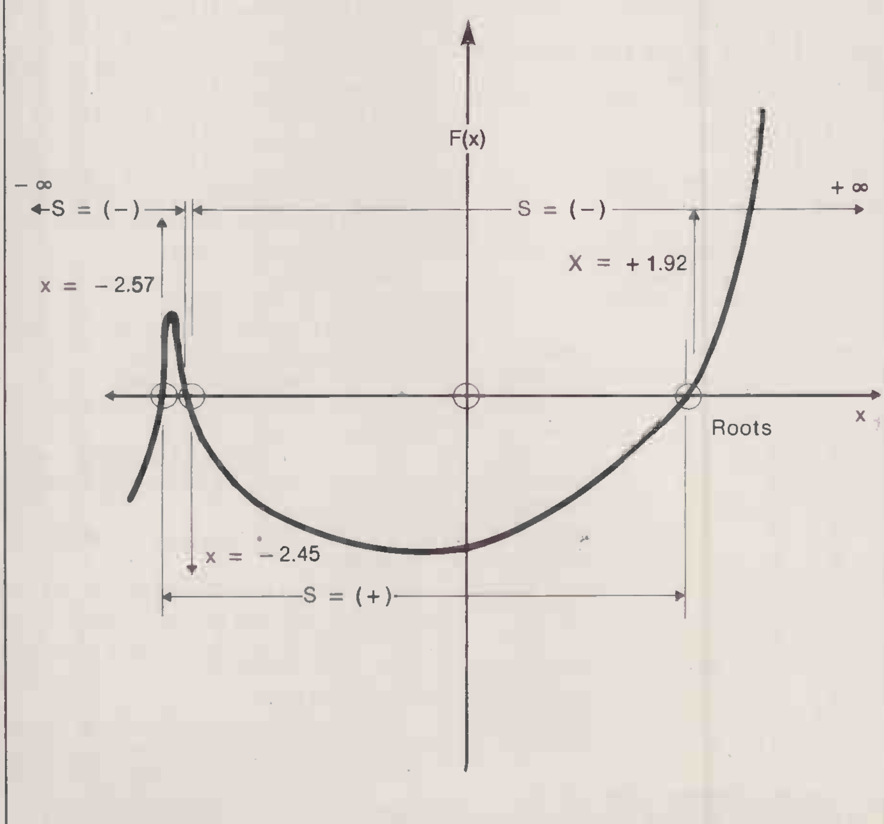


Figure 3. Regions in which trial root can start in order to capture a particular root.

Printers from CPU Peripherals

More exclusive, quality products of outstanding value from CPU Peripherals. All backed by our technical support and service organisation.

PRIMA 165 – £899.*

British built in our Woking factory, this outstanding dot matrix printer offers:

- 165 cps bi-directional printing
- 80 cps correspondence quality print
- 9 x 9, 96 character sets with lower case descenders
- Downline loading of special character sets
- Pin addressable graphics
- Tractors (1 + 5 copies)
- Superscript/subscript
- 7 channel VFU
- Serial and parallel interface (switchable)
- Buffering up to 3K
- Low noise (58 db)

DAISYWRITER – £899.*

A most advanced microprocessor controlled serial impact printer giving letter quality output QUIETLY!

- up to 20 cps bi-directional
- 96 character interchangeable cartridge wheel element
- Snap on/off tractor and sheet feed options
- Parallel or serial interfaces (X-on, X-off, DTR, switch selectable baud rates)
- IBM Selectric Type Cassette Film ribbon
- 1 +5 copies
- 4000 character buffer
- 10, 12, 15 characters per inch
- Forward/reverse paper movement

CPU 100 & 200 THERMAL PRINTERS

40 and 80 character per line Printers. From £190*

- 40 cps bi-directional
- Upper/lower case plus graphics
- Silent operation
- Interfaces to popular Micros
- Suitable for data logging and general micro-computer applications

* One-off End User price

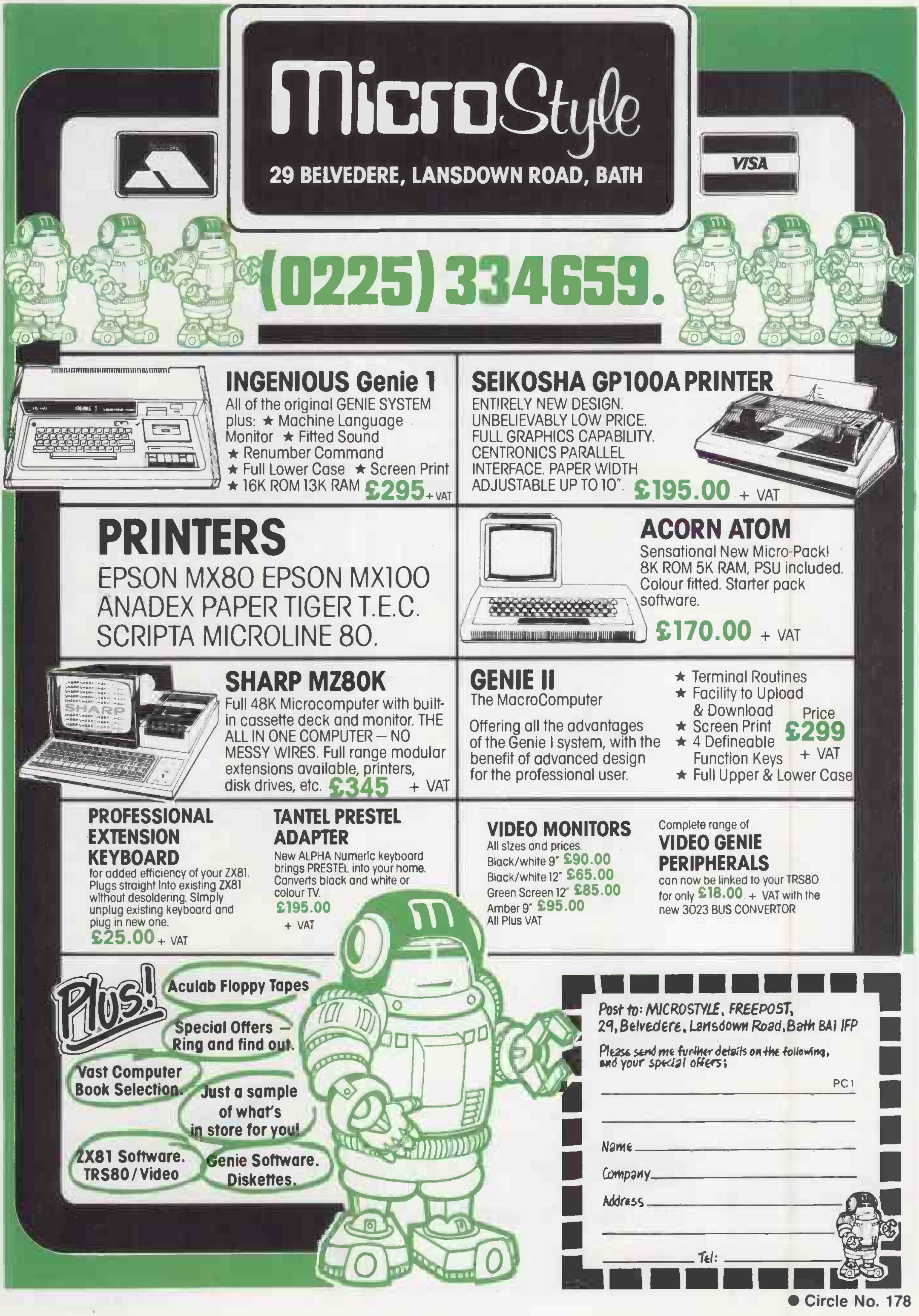
Rodd Industrial Estate
Govett Avenue
Shepperton Middlesex
TW17 8AQ

Telephone:
Walton on Thames 46433/4/5/6
Telex: 922637

CPU PERIPHERALS

● Circle No. 174

● Circle No. 177



● Circle No. 178

Save memory space — dump your assembler

Norman Kirkby continues his series on 6502 assembler programming with a method of expanding your available memory by making sure that you only store essential information.

ASSEMBLER MNEMONICS use a large amount of memory, but you can save space by throwing them away after they have done their job of assembling the machine code. Suppose you are designing and entering a program at the keyboard, and as it grows you find the error message Not Enough Room. You have run out of memory.

There is a great deal you can do to make your program use memory more economically. You can use abbreviations such as P. for Print; put as many statements on a line as possible, saving two bytes for each unnecessary line number and one for each line terminator as well as one for each character; and remove all unnecessary spaces. You can train yourself to write economically; for example,

Q = RND; IFQ = 50GOTO . . .

uses four more bytes than

IFRND = 50GOTO . . .

If your program contains a significant number of assembler mnemonics a vastly greater saving can be made if you can find a way to dispose of them after they have done their job of assembling the machine code. On average, one byte of machine code requires at least three bytes of assembler mnemonic. A program consisting of 4,500 bytes of text — of which one-third is assembler with resulting machine code of 500 bytes — contains a total of 5,000 bytes. It could be reduced by at least 1,500 bytes by disposing of the assembler after use.

What is needed, therefore, is a section of memory that is not normally available for program text, or that is not needed until your program is actually running, where you can temporarily park the assembler part. An obvious choice is the Atom's graphics area which starts at memory location #8200, and will provide 0·5K if you have graphics mode 1, 1K with mode 2, 2·5K with mode 3 and 5·5K with mode 4. Remember that even if your program involves graphics, the graphics memory can still be used temporarily for the assembler part.

To make use of this strategy you must first split your original Basic program into two parts or, if you are writing a new program, write it in two parts. The first will contain only Basic, and the second all the assembler mnemonics and only that Basic needed to make them work.

Enter the Basic part in the normal way, that is at location #2900, or at #8200 on the unexpanded Atom. Enter the assembler part into the temporary memory park, and run it so that it assembles the machine code at the end of the Basic part. The assembler part is now redundant, so amend the Basic part slightly to make it independent of the assembler part. Finally, run the Basic part and save it

(continued on next page)

```
10 REM ORIGPROG
20 DIM S(10),AA(5),LL(4)
25 DIM P(-1)
30 [
40:LL0 LDA @65
50:LL1 JSR #FFF4
60 CLC;ADC @1
70 CMP @73;BNE LL1
80 LDA @32;JSR #FFF4
90 RTS
100:LL2 LDA @72
110:LL3 JSR #FFF4
120 SEC;SBC @1
130 CMP @64;BNE LL3
140 RTS
150]
160 AA(5)=7
170 LINK LL0
180 LINK LL2
190 END
```

(continued from previous page)

with the machine code but without the assembler part, using the *Save routine.

The details of this procedure are much easier to implement than to describe. The OrigProg program, although short and trivial, illustrates the points well enough: it will print letters A to H, a space, and the letters H and A. If you have entered it, execute New to clear it out of the way.

OrigProg is then split into two parts — BasicProg and AssemProg. BasicProg contains only Basic statements, and AssemProg contains all the assembler mnemonics and only that Basic needed to make them work. The line numbers are the same in this example, but they need not be. AssemProg contains the Dim statement for the array LL, but no other arrays or strings from OrigProg, because LL is an array used only for the assembler mnemonics. The End statement is duplicated, of course.

Now enter BasicProg in the usual way, at memory location #2900, for example, and execute

PRINT & TOP

You will find in hexadecimal the first free byte after the program text. Write this down; if you have entered BasicProg exactly as shown you will get #2954. Now execute

?18 = #82

and then execute

NEW

which will switch to the upper text space.

If that memory area is not convenient for any reason, switch to, say, #8400, or #9000, or wherever else is suitable. Now enter AssemProg, leaving the number in line 25 blank for the moment. Add up the total of bytes reserved by the Dim statements in BasicProg, one for each string element that is part of a Dim statement, four for each array element that is part of a Dim statement, and five for each array element part of an FDim statement. An ordinary array element within a Dim statement is a word, and is therefore four bytes long.

Remember to count the zeroth element. For BasicProg the result is 11 × 1 for string S, and 6 × 4 for array AA, totalling 35 bytes. Execute

```
10 REM ASSEMPROG
20 DIM LL(4)
25 P=#2979
30 [
40:LL0 LDA @65
50:LL1 JSR #FFF4
60 CLC;ADC @1
70 CMP @73;BNE LL1
80 LDA @32;JSR #FFF4
90 RTS
100:LL2 LDA @72
110:LL3 JSR #FFF4
120 SEC;SBC @1
130 CMP @64;BNE LL3
140 RTS
150 ]
190 END
```

```
10 REM BASICPROG
20 DIM S(10),AA(5)
160 AA(5)=7
170 LINK LL  0
180 LINK LL  2
note the two extra spaces
190 END
```

PRINT & (#2954 + 35 + 2)

The result is #2979 — the extra 2 is to provide a safety margin — which is the address in hex of the memory location closest to the end of the text of BasicProg, plus its reserved string and array space, at which it is safe to assemble the first machine code.

If it were assembled at a closer location it would be overwritten by assignments of values to the string and array elements. If it were very close, it would overwrite the end of the text of BasicProg.

Line 25 of OrigProg contains the usual Dim P (−1) statement which instructs the Atom to assemble the machine code with the first code at memory location Top plus the memory locations reserved for strings and arrays by previous Dim statements in the current program — OrigProg, in this case. That is fine for an integral Basic-plus-assembler program such as OrigProg, but with AssemProg the machine code needs to be assembled starting at the safest location closest to BasicProg, not at the safest memory location closest to AssemProg itself.

The number #2979 is the address of that memory location, and line 25 of AssemProg instructs the computer to assemble the machine code, starting at location #2979.

Run AssemProg and confirm from the assembly listing that the first memory location is indeed #2979. Write down the address of the last memory location in the assembly listing: it is #2997 and is called the End address. You will need it later when saving. Now execute

?18 = 29
END

to switch back to the test space containing BasicProg and reset Top to that program.

After listing BasicProg you come to the step that makes BasicProg finally independent of AssemProg. Line 170 refers to an array element, and the line instructs the Atom to find out the value assigned to that element, treat it as a memory address, and execute the machine-code program that starts there. These LL-type array elements are creatures of AssemProg, and the values assigned to them by AssemProg disappear with it. The address to which line 170 points, is found by executing

PRINT & LL0

Replace LL 0 in line 170 with that address — it is #2979, of course — and do the same for line 180 and to any other assembler arrays that appear in your real-life equivalent of BasicProg. There is no need to alter any of the references to array elements that appear only in AssemProg. They are used internally in that program to produce actual addresses in the machine code. Lines 170 and 180 now read

170 LINK #2979
180 LINK #298B

They originally had two extra spaces each because the statement Link LL0 — that is, without the extra spaces — occupies eight bytes of program text, whereas Link #2979 occupies 10 bytes. Without those extra spaces, putting in the hex number would have lengthened the text of BasicProg, resulting in any assignments to the array elements overwriting the beginning of the machine code.

AssemProg is now redundant, and you can run BasicProg to confirm that it prints out as for OrigProg. To save BasicProg and its machine code you need the End address #2997 which you established earlier. Add 1 to it, and execute

*SAVE "BASICPROG" 2900 2998

This procedure saves all the contents of memory locations #2900 to #2997. It includes all the text of BasicProg and its machine code.

Now for the acid test. Switch the computer off and on to lose all memory contents. Load BasicProg in the usual way by executing

LOAD "BASICPROG"

and then run it: out comes the familiar printout without any assembler mnemonics being used.

If your real-life equivalent of AssemProg contains forward references you will need to put the assembler nmemonics and line 25 into a For-Next loop or use two Gosubs. If you have no RAM in the lower text space you could enter your real-life equivalent of BasicProg at #8200 as usual, and your AssemProg at, say, # 8300.

In Atom assembler it is possible to refer to Basic variables in two ways. For example, LDA @D means "load the accumulator with the value of the Basic variable D". That works in AssemProg if D has previously been assigned its correct value in BasicProg — one which is no greater than #FF. Without the @ — for example, LDA D — a string must be dimensioned with one element, at least using DIM D(0). LDA D means "load the accumulator with the contents of memory location ?D".

That is obviously a BasicProg variable and so the Dim statement must be part of BasicProg. If, after assembling the machine code, you alter BasicProg such that the length of its text is changed by even one byte either way, the address ?D will also change. So the address in the machine code that refers to ?D, although unchanged, will no longer be correct, and garbage or a crash will be the result. Avoid LDA K or ADC G or similar forms when using this technique. ■

Open File

This regular section of *Practical Computing* appears in the magazine each month, incorporating Tandy Forum, Apple Pie, ZX-80/81 Line-up and the other software interchange pages.

Open File is the part of the magazine written by you, the readers. All aspects of microcomputing are covered, from games to serious business and technical software, and we welcome contributions on CP/M, BBC Basic, Microsoft Basic, Apple Pascal and so on, as well as the established categories.

Each month the best contribution will be awarded £20; others receive £6. Send contributions to: Open File, *Practical Computing*, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Guidelines for contributors

Programs should be accompanied by documentation which explains to other readers what your program does and, if possible, how it does it. It helps if documentation is typed or printed with double-line spacing — cramped or handwritten material is liable to delay and error.

Program listings should, if at all possible, be printed out. Use a new ribbon in your printer, please, so that we can print directly from a photograph of the listing and avoid typesetting errors. If all you can provide is a typed or handwritten listing, please make it clear and unambiguous; graphics characters, in particular, should be explained.

We can accept material for the Pet, Vic and Sharp MZ-80K on cassette, and material for the larger machines can be sent on IBM-format 8in. floppy discs.

Typewriter

THIS SHORT PROGRAM by Andy Scott of Chapel-en-le-Frith, Cheshire, has been chosen as this month's best contribution to Open File. It should prove useful if you occasionally write short messages or reports but cannot run to a full-blown word-processing package.

The program allows you to write text from keyboard on to the screen, with up to 79 characters on each line, while retaining the use of screen Edit keys. When you are satisfied that the line is correct, pressing the Return key copies the line on to the printer. Unshifted keys are lower case and shifted keys upper case, as on a typewritter.

There are a few basic rules to observe when using the program since the line is inputted from keyboard as a string:

- Leading blanks are disregarded, so for the first leading blanks use shift-spacebar. This creates ASCII character 96 instead of ASCII 32, the normal space used. It is the latter which the Pet Basic removes if they are leading.
- Do not start a line with a ". If you require a leading quote, type shift-spacebar, and then the".
- Do not make the last character in a line a quote: follow it by shift-spacebar.
- When inputting data the Pet Basic reads up to commas and colons, then comes up with the message Extra Ignored. To get round this the program uses [and] — the top, right-hand keys on the main alphanumeric block — to replace the comma and colon respectively. When you press Return at the end of a line, the program prints out the appropriate commas and colons.
- No more than 79 characters may be used on each line.
- For a space between lines just press Return.
- When you have finished typing, enter *Return on a new line.
- Provision is made for automatic paging of the paper in the printer.

The main features of the program are as follows:

Line 180 zeros the line count, and is used for paging. *(continued on next page)*

(continued from previous page)

Line 190 opens the keyboard: logical file number 2.

Lines 200-220 prompt for setting up the printer. Location 151 shows which key is being depressed; if the contents are 255, then no key is being pressed.

Line 230 clears the keyboard buffer count.

Line 240 gives lower-case display on screen, clears screen and opens printer.

Line 250 inputs line from keyboard.

Line 260 prints carriage return.

Line 270 checks if contents of line are *, then close files and end.

Line 280 looks for null string, that is user has only pressed Return.

Lines 290-320 redefine the string, inserting commas and colons if appropriate.

Lines 330-340 replace the line on the screen with corrected line as obtained in 290-320. They also cater for whether line is shorter than 40 characters, between 40 and 79 characters, or no characters. The line is then printed.

Line 350 gives automatic paging on to the next page.

Line 360 receives another line.

Line 370 closes current files and end.

If you would prefer not to use [and] for comma and colon alter line 250 to.

250 POKE 623,34: POKE 158,1: INPUT # 2, T$

This places a quote into the keyboard buffer, which is then put on to the screen.The quote will not be transferred to the printer, and commas and colons may now be used. However quotes cannot now be used within the text — the choice is yours.

Typewriter.

```
100 REM** TYPEWRITER BY ANDY SCOTT
120 REM*    TYPE * TO ESCAPE
130 REM* DO NOT LEAD WITH QUOTE "
140 REM*   [ USED FOR COMMA,
150 REM*   ] USED FOR COLON:
160 REM* TO INSET PARAGRAPH USE SHIFTED  SPACEBAR
170 REM*TYPE ONE LINE A TIME TO 79 CHARS
180 PA=0
190 OPEN2,0
200 PRINT"▯▯▯▯▯▯HAVE PUT PAPER AT THE TOP OF A PAGE"
210 PRINT"▯       PRESS ANY KEY IF READY"
220 IFPEEK(151)=255THEN220
230 POKE158,0
240 POKE59468,14:PRINT"▯";:OPEN1,4
250 INPUT#2,T$
260 PRINTCHR$(13);
270 IFT$="*"THEN370
280 L=LEN(T$):IFL=0THEN340
290 FORI=1TOL:P=ASC(MID$(T$,I,1))
300 IFP=91THENT$=LEFT$(T$,I-1)+CHR$(44)+MID$(T$,I+1)
310 IFP=93THENT$=LEFT$(T$,I-1)+CHR$(58)+MID$(T$,I+1)
320 NEXT
330 IFLEN(T$)>39THENPRINT"▯";
340 PRINT"▯";T$:PRINT#1,"▯";T$:IFLEN(T$)=40THENPRINT"▯";
350 PA=PA+1:IFPA=63THENPA=0:FORI=1TO3:PRINT#1:NEXT
360 GOTO250
370 CLOSE1:CLOSE2
```

Cursor speed

I FIND the Pet's flashing cursor irritating and I would much rather have a steady cursor like some other machines, complains Ian Payton of Winnersh, Berkshire. I have tried numerous machine-code routines without success. An alternative is to have a cursor flashing at a higher speed than usual.

Cursor speed.

```
10 INPUT"SPEED (1-19  1=FASTEST)";S
20 IFS>19THENS=19
30 DATA 169,143,141,144,0,169,3,141,145,0,96,165,168,201,20,208,5,169,999
40 DATA 141,168,0,76,888,777
50 INPUT"4000 OR 3000 SERIES ";NO$
60 IFNO$="4000"THENA1=85:A2=228
70 IFNO$="3000"THENA1=46:A2=230
75 IFNO$<>"4000"ANDNO$<>"3000"THEN50
80 FORLL=900TO924
90 READPO
100 IFPO=999THENPO=S
110 IFPO=888THENPO=A1
120 IFPO=777THENPO=A2
130 POKELL,PO
140 NEXTLL
150 SYS900
```

This routine produces a cursor flashing at any speed up to the normal speed. A speed of about 8 I find acceptable. It will run on both 3000 and 4000 series Pets, but not on old Roms without considerable alteration. After using the cassette deck you must restart the routine by typing in Sys 900, which will revert the cursor to flashing at the designated speed. If you with to change the speed, Poke any value up to 19 into 0396 hex.

Directory machine-code routine. Listing 1.

```
LOC    CODE        LINE

0000               ;AUTO LOAD. AFTER LISTING
0000               ;DIRECTORY PLACE CURSOR
0000               ;OVER DISIRED PROGRAM AND
0000               ;PRESS RETURN
0000               ;************************
0000               ;
0000               ;
0000               CHRGET = $70
0000               CHRGOT = $76
0000               * = $0700
0700   E6 77       START  INC $77        ; ***************
0702   D0 02              BNE L88        ; ROUTINE WHICH
0704   E6 78              INC $78        ; CHECKS FOR
0706   86 B3       L88    STX $B3        ; DIRECT MODE
0708   BA                 TSX            ; IF NOT PROCESS
0709   BD 01 01           LDA $0101,X    ; CONTINUES AT
070C   C9 0F              CMP #$0F       ; CHRGOT ($0076)
070E   D0 14              BNE L33
0710   BD 02 01           LDA $0102,X
0713   C9 B4              CMP #$B4
0715   D0 0D              BNE L33
0717   A5 77              LDA $77
0719   D0 06              BNE L34
071B   A5 78              LDA $78
071D   C9 02              CMP #$02
```

(listing continued on page 139)

Directory on 4000

SINCE I took delivery of a new 4000 series Commodore microcomputer and 4040 floppy-disc drive, I have found little need for DOS support, writes H V Blackmore of Bridgend, Mid Glamorgan. This is due to the orientation of the new machine to disc operation.

One of the facilities I did not miss was the directory listing command >$, so I set about writing a machine-code program which not only lists the directory, but also

(continued on page 139)

(listing continued from page 136)

```
071F  F0 08                 BEQ L35
0721  4C 76 00     L34      JMP CHRGOT
0724  A6 B3        L33      LDX $B3
0726  4C 76 00              JMP CHRGOT        : **************
0729  A0 FF        L35      LDY #$FF          ; IF IN DIRECT
072B  C8           GET      INY               : MODE.....
072C  B1 77                 LDA ($77),Y
072E  C9 3E                 CMP #$3E          : CHECK FOR >
0730  D0 02                 BNE L46           : IF IT IS
0732  F0 68                 BEQ DIR           : JUMP TO DIR.
0734  C9 20        L46      CMP #$20          : IF A SPACE
0736  F0 F3                 BEQ GET           : TRY NEXT CHR.
0738  C9 30                 CMP #$30          : IF NOT A SPACE.
073A  30 E5                 BMI L34           : CHECK IF IT IS
073C  C9 3A                 CMP #$3A          ; A NUMBER.
073E  10 E1                 BPL L34           : IF NOT EXIT.
0740  C8           TEST     INY               ; IF TRUE CONT &
0741  B1 77                 LDA ($77),Y       ; GET NEXT CHR.
0743  C9 20                 CMP #$20          : TEST FOR SPACE.
0745  F0 F9                 BEQ TEST          : IF TRUE TRY AGAIN
0747  C9 22                 CMP #$22          ; IF NOT.IS IT (")
0749  F0 0A                 BEQ LOAD          : IF IT IS. JUMP.
074B  C9 30                 CMP #$30          : IF NOT, IS IT
074D  30 D2                 BMI L34           ; ANOTHER NUMBER?
074F  C9 3A                 CMP #$3A          ; IF NOT JUMP TO
0751  10 CE                 BPL L34           ; CHRGOT.
0753  30 EB                 BMI TEST          ; IF YES TRY AGAIN
0755  A9 53        LOAD     LDA #$53          ; ****************
0757  85 DA                 STA $DA           : PROGRAM LOADING
0759  A9 03                 LDA #$03          : FROM DIRECTORY
075B  85 DB                 STA $DB           : LISTING
075D  20 42 E0              JSR $E042
0760  AD 3B 03              LDA $033B
0763  C9 01                 CMP #$01
0765  D0 04                 BNE L101
0767  A9 31                 LDA #$31
0769  D0 02                 BNE L102
076B  A9 30        L101     LDA #$30
076D  8D 53 03     L102     STA $0353
0770  A9 3A                 LDA #$3A
0772  8D 54 03              STA $0354
0775  A2 02                 LDX #$02
0777  A0 07                 LDY #$07
0779  B1 77        NAME     LDA ($77),Y       ; GET PROGRAM
077B  9D 53 03              STA $0353,X       : NAME. IF END
077E  F0 19                 BEQ L43           ; OF NAME WITHOUT
0780  C8                    INY               ; " CHR, THEN
0781  E8                    INX               : SYNTAX ERROR.
0782  C9 22                 CMP #$22          ; CHECK FOR " CHR
0784  D0 F3                 BNE NAME          : IF NOT GET NEXT
0786  CA                    DEX
0787  86 D1                 STX $D1
0789  A9 08                 LDA #08
078B  85 D4                 STA $D4
078D  A9 00                 LDA #0
078F  85 96                 STA $96
0791  85 9D                 STA $9D
0793  20 08 F4              JSR $F408         : LOAD PROGRAM
0796  4C FF B3              JMP $B3FF         ; JUMP TO READY.
0799  4C 00 BF     L43      JMP $BF00         : SYNTAX ERROR.
079C  A9 08        DIR      LDA #$08          ;*****************
079E  85 D4                 STA $D4           ; START OF
07A0  E6 77                 INC $77           ; DIRECTORY LISTING
07A2  D0 02                 BNE L100
07A4  E6 78                 INC $78
07A6  B1 77        L100     LDA ($77),Y
07A8  C9 31                 CMP #$31          : FIND THE DRIVE #
07AA  D0 0C                 BNE L23
07AC  A9 01                 LDA #1
07AE  8D 3B 03              STA $033B
07B1  A9 00                 LDA #0
07B3  8D 3C 03              STA $033C
07B6  F0 20                 BEQ DIRL
07B8  C9 30        L23      CMP #$30
07BA  D0 0C                 BNE L27
07BC  A9 01                 LDA #1
07BE  8D 3C 03              STA $033C
07C1  A9 00                 LDA #0
07C3  8D 3B 03              STA $033B
07C6  F0 10                 BEQ DIRL
07C8  C9 00        L27      CMP #$00          ; IF NOT 0 OR 1,
07CA  D0 CD                 BNE L43           ; OR BOTH, JUMP
07CC  A9 01                 LDA #$01          ; TO SYNTAX ERROR
07CE  8D 3B 03              STA $033B
07D1  8D 3C 03              STA $033C
07D4  A9 00                 LDA #$00
07D6  F0 02                 BEQ DIRL2
07D8  A9 10        DIRL     LDA #$10
07DA  8D 3E 03     DIRL2    STA $033E
07DD  20 7D D8              JSR $D87D         ; LIST DIRECTORY
07E0  4C FF B3              JMP $B3FF         : JUMP TO READY
07E3                        ;
07E3                        ;
07E3                        ;
07E3                        ;****************************
07E3                        ;ROUTINE TO RELOCATE PROGRAM
07E3                        :TO THE TOP OF MEMORY
07E3                        :****************************
07E3                        ;
07E3                        ;
07E3  A5 34                 LDA $34
07E5  38                    SEC
07E6  E9 E3                 SBC #$E3
07E8  85 34                 STA $34
07EA  85 C7                 STA $C7
07EC  A5 35                 LDA $35
07EE  E9 00                 SBC #$00
07F0  85 35                 STA $35
07F2  85 C8                 STA $C8
07F4  85 72                 STA $72
07F6  A9 4C                 LDA #$4C
07F8  85 70                 STA $70
07FA  A5 34                 LDA $34
07FC  85 71                 STA $71
07FE  A0 00                 LDY #$00
0800  84 5C                 STY $5C
0802  A9 07                 LDA #$07
0804  85 5D                 STA $5D
0806  B1 5C        REL      LDA ($5C),Y
0808  91 C7                 STA ($C7),Y
080A  C8                    INY
080B  C0 F5                 CPY #$F5
080D  D0 F7                 BNE REL
080F  60                    RTS
0810                        .END
```

Symbol table.

SYMBOL VALUE

CHRGET	0070	CHRGOT	0076	DIR	079C	DIRL	07D8
DIRL2	07DA	GET	072B	L100	07A6	L101	076B
L102	076D	L23	07B8	L27	07C8	L33	0724
L34	0721	L35	0729	L43	0799	L46	0734
L88	0706	LOAD	0755	NAME	0779	REL	0806
START	0700	TEST	0740				

Listing 2: Basic call routine.

```
0 SYS2019
1 PRINT"        LOAD FROM DIRECTORY LISTING"
2 PRINT"COMMANDS MUST BE GIVEN IN DIRECT MODE"
3 PRINT"  = LIST DIRECTORY ON DRIVE 0 AND 1
4 PRINT"1 = LIST DIRECTORY ON DRIVE 1
5 PRINT"PLACE CURSOR ON THE LINE WHICH CONTAINS
6 PRINT"THE REQUIRED PROGRAM AND PRESS RETURN.
7 PRINT"THIS FACILITY ONLY WORKS AFTER A DRIVE
8 PRINT"NUMBER IS SPECIFIED IN THE DIRECTORY
9 PRINT"LISTING COMMAND"
10 NEW
```

(continued from page 136)

allows you to load a program from the listing. This is achieved by placing the cursor over the program required and pressing Return.

The program also has a relocation routine tagged on to the end. This relocates the main program to the top of memory as well as changing the CHRGet routine and setting the top of memory pointers for protection. The CHRGet routine is changed in the same way as for DOS support so it has the same restrictions to cohabitation with some programs which use the same technique.

(continued on next page)

Listing 3. Basic loader.

```
10 PRINT"C̄↓↓       R̄LOAD FROM DIRECTORY LISTING"
20 PRINT"↓↓↓↓ COMMANDS MUST BE GIVEN IN DIRECT MODE"
30 PRINT"↓↓>  = LIST DIRECTORY ON DRIVE 0 AND 1
40 PRINT"↓↓>1 = LIST DIRECTORY ON DRIVE 1
50 PRINT"↓↓PLACE CURSOR ON THE LINE WHICH CONTAINS
60 PRINT"THE REQUIRED PROGRAM AND PRESS RETURN.
70 PRINT"↓THIS FACILITY ONLY WORKS AFTER A DRIVE
80 PRINT"NUMBER IS SPECIFIED IN THE DIRECTORY
90 PRINT"LISTING COMMAND"
100 E=PEEK(53)*256+PEEK(52)-1
110 S=E-226
111 S1=INT(S/256)
112 S2=INT((S/256-S1)*256)
114 POKE53,S1:POKE52,S2
120 FORI=S-13TOE
130 READ N
140 POKEI,N
150 NEXT
180 SYS(S-13)
190 NEW
900 DATA 169,76,133,112,165,52,133,113,165,53,133,114,96
1000 DATA 230, 119, 208, 2, 230, 120, 134, 179, 186, 189, 1
1001 DATA 1, 201, 15, 208, 20, 189, 2, 1, 201, 180
1002 DATA 208, 13, 165, 119, 208, 6, 165, 120, 201, 2
1003 DATA 240, 8, 76, 118, 0, 166, 179, 76, 118, 0
1004 DATA 160, 255, 200, 177, 119, 201, 62, 208, 2, 240
1005 DATA 104, 201, 32, 240, 243, 201, 48, 48, 229, 201
1006 DATA 58, 16, 225, 200, 177, 119, 201, 32, 240, 249
1007 DATA 201, 34, 240, 10, 201, 48, 48, 210, 201, 58
1008 DATA 16, 206, 48, 235, 169, 83, 133, 218, 169, 3
1009 DATA 133, 219, 32, 66, 224, 173, 59, 3, 201, 1
1010 DATA 208, 4, 169, 49, 208, 2, 169, 48, 141, 83
1011 DATA 3, 169, 58, 141, 84, 3, 162, 2, 160, 7
1012 DATA 177, 119, 157, 83, 3, 240, 25, 200, 232, 201
1013 DATA 34, 208, 243, 202, 134, 209, 169, 8, 133, 212
1014 DATA 169, 0, 133, 150, 133, 157, 32, 8, 244, 76
1015 DATA 255, 179, 76, 0, 191, 169, 8, 133, 212, 230
1016 DATA 119, 208, 2, 230, 120, 177, 119, 201, 49, 208
1017 DATA 12, 169, 1, 141, 59, 3, 169, 0, 141, 60
1018 DATA 3, 240, 32, 201, 48, 208, 12, 169, 1, 141
1019 DATA 60, 3, 169, 0, 141, 59, 3, 240, 16, 201
1020 DATA 0, 208, 205, 169, 1, 141, 59, 3, 141, 60
1021 DATA 3, 169, 0, 240, 2, 169, 16, 141, 62, 3
1022 DATA 32, 125, 216, 76, 255, 179
```

C̄ = Clear screen
R = Reverse
↓ = Down arrow

(continued from previous page)

Once located the program allows you to carry out the following:

List the directory of either drive or both. The command is > [Dn]; the brackets must not be typed, and Dn is the drive number, If no number is given both directories are listed. If no number is given both directories are listed. If a number greater than 1 is typed a syntax error will be given. The listing can be temporarily halted by pressing the space key, and continued by pressing it a second time.

Load any program from the directory listing by placing the cursor on the line which contains the required program, and pressing the Return key. Syntax is checked so that the routine only works from a normal directory listing. Program loading will only take place if a drive number is specified in the directory listing command.

The program will only work in direct mode, so do not try the commands from a Basic program as a syntax error will result.

To set up the program in your machine, first enter the Basic program given in listing 2 which lists the instructions and calls the relocation routine. Enter the monitor by typing Sys4, and key the machine-code routine starting at location $0700 — see listing 1. If you want an Editor-Assembler you might like to enter the program that way.

Finally save the whole program from the monitor by typing

S "0:LOAD/DIR", 08,0400,0810

use S "1: . . . .if saving on drive 1. The program can now be loaded as a Basic Program and run in the usual way.

For those who are not familiar with machine-code programming, a Basic loader version given in listing 3.

Maze

THE MAZE GAME by Ian Payton of Winnersh, Berkshire maker full use of the Pet's graphics characters and cursor controls although you may be able to adapt it to a computer such as the Sharp MZ-80K by changing some of the Poke addresses. For those who wish to do this, the Pet's top, left-hand screen address is 32768 and the screen is 40 by 25 blocks.

The aim of the Maze is to go round the maze in as short a time as possible, incurring as few faults as possible.

Tape of this program or more information can be provided: please telephone Wokingham (0734) 7897775.

Maze.

```
5 J=5
10 GOSUB1050:PRINT"J"
20 PRINT" ────────────────────────────────────── ";
30 A$="▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓"
40 FORA=1TO20:PRINT"|"A$"|";:NEXTA
50 PRINT" ────────────────────────────────────── "
60 IFL=1THENA=32849:GOSUB820
70 IFL=2THENA=33228:GOSUB370
80 POKEA,81
90 GETC$:IFC$=""THEN90
95 IFVAL(C$)=0THEN90
100 B=VAL(C$):TI$="000000":GOTO120
110 GETC$:IFC$<>""THENB=VAL(C$)
120 IFB=7ORB=9ORB=1ORB=3THENB=J
130 FORSL=1TOQ:NEXTSL
140 IFC$="@"THENE=0:GOTO10
150 H=0:PRINT"▓▓▓▓▓"MID$(TI$,3,2)" MINS,"RIGHT$(TI$,2)" SECS,"E") FAULTS"
160 IFB=0ANDC$<>" "THENB=J:GOTO340
170 H$=TI$
180 IFB=5ANDK=2THENB=J:GOTO340
190 C=VAL(C$)
200 IFC$=" "THENGOTO1830
220 IFB=2THENA=A+40:D=40
240 IFB=4THENA=A-1:D=-1
250 IFB=5THENA=A:D=A-(A-32767):J=5:GOTO110
260 IFB=6THENA=A+1:D=1
280 IFB=8THENA=A-40:D=-40
300 H=PEEK(33329)
310 F=PEEK(A)
320 IFC$=" "THEN550
330 IFF<>96ANDF<>32ANDF<>46ANDF<>174THENA=A-D:E=E+1:GOSUB20000:GOTO110
340 POKEA,81:POKEA-D,32
350 J=B
360 GOTO110
370 PRINT"▓"
380 PRINT"▓. . . . . . . . . . . . . . . .        . . . . . . . . . . . . . . . ."
390 PRINT"▓. ───────────────        ───────────────. ."
400 PRINT"▓. |. . . . . . . . . . . . . .        . . . . . . . . . . . . . . |. ."
410 PRINT"▓. |. ─────────────        ─────────────. |. ."
420 PRINT"▓. |. |. . . . . . . . . . . .        . . . . . . . . . . . . |. |. ."
430 PRINT"▓. |. |. ───────────        ───────────. |. |. ."
440 PRINT"▓. |. |. |. . . . . . . . . .        . . . . . . . . . . |. |. |. ."
450 PRINT"▓. |. |. |. ─────────        ─────────. |. |. |. ."
460 PRINT"▓. |. |. |. ───────        ───────. |. |. |. |."
470 PRINT"▓. |. |. |. . . . . . . . . .        . . . . . . . . . . |. |. |. ."
480 PRINT"▓. |. |. ───────────        ───────────. |. |. ."
490 PRINT"▓. |. |. . . . . . . . . . . .        . . . . . . . . . . . . |. |. ."
500 PRINT"▓. |. ─────────────        ─────────────. |. ."
510 PRINT"▓. |. . . . . . . . . . . . . .        . . . . . . . . . . . . . . |. ."
520 PRINT"▓. ───────────────        ───────────────. ."
530 PRINT"▓. . . . . . . . . . . . . . . .        . . . . . . . . . . . . . . . ."
540 RETURN
550 PRINT"J"
560 IFL=2THEN670
570 PRINT"▓▓▓▓YOU TOOK "MID$(H$,4,1)" MINUTES AND "RIGHT$(H$,2)" SECONDS"
580 PRINT"▓▓TO COMPLETE THE CIRCUIT, AND INCURRED"
590 PRINT"▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓ E"FAULTS"
595 IF2000-(VAL(H$)+E)<1THENH$="":E=2000
600 PRINT:PRINT"▓▓▓▓WHICH MAKES A TOTAL SCORE OF"2000-(VAL(H$)+E)
610 IF2000-(VAL(H$)+E)>NTHENN=2000-(VAL(H$)+E):GOTO10000
620 PRINT"▓▓▓▓▓▓▓▓▓TODAY'S HIGH SCORE IS"N
630 PRINT"▓▓▓▓▓▓▓▓▓▓▓▓DO YOU WANT ANOTHER GO ?"
640 GETA$:IFA$=""ORA$<>"N"ANDA$<>"Y"THEN640
650 IFA$="Y"THENE=0:GOTO10
660 PRINT"J";:END
670 O=1000-(VAL(H$)+E)
680 IFO<800THEN750
690 PRINT"WELL DONE ! YOU ARE NOW READY TO DO THE"
700 PRINT:PRINT:PRINT"        ▓▓ ▓ ▓▓ ▓▓ ▓   ▓ ▓ ▓▓"
710 PRINT"        ▓▓▓ ▓ ▓ ▓▓▓ ▓ ▓ ▓▓ ▓ ▓"
720 PRINT"        ▓ ▓ ▓ ▓ ▓ ▓ ▓ ▓ ▓   ▓ ▓ ▓▓"
725 GOSUB22000
730 GETGE$:IFGE$=""THEN730
735 IFGE$="@"THENE=0:GOTO10
740 POKE59468,14:E=0:PRINT"J";:GOSUB1680:L=1:PRINT"J":GOTO20
750 PRINT"BAD LUCK...YOU ONLY SCORED"O*2"POINTS":PRINT
755 PRINT"YOU ARE NOT QUITE READY TO ATTEMPT THE.."
770 PRINT"        ▓ ▓▓ ▓ ▓▓ ▓▓ ▓   ▓ ▓ ▓▓"
780 PRINT"        ▓▓▓ ▓ ▓ ▓▓▓ ▓ ▓ ▓▓ ▓ ▓"
790 PRINT"        ▓ ▓ ▓ ▓ ▓ ▓ ▓ ▓ ▓   ▓ ▓ ▓▓"
795 GOSUB23000
800 GETGE$:IFGE$=""THEN800
810 E=0:GOTO10
820 PRINT"▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓"
830 PRINT"▓. |. . . . |. . . . . . . . . . . . ─────────. . . . . . . . ."
840 PRINT"▓. ────. . . |. |. ────. |. . . . . . . . . . . . |. ────. "
850 PRINT"▓. . . . . . |. |. . . . . . . . ───. ───. ───. . . . . . . ."
860 PRINT"▓. ───. |. |. ────. . . . . . . . . . . . . . ─────. . ."
870 PRINT"▓. ─. . . . . . . . . . . . . ───. ─. ───────. . . . . . ."
880 PRINT"▓. . . . ─. ───────. . . . . . . . |. ───. . . ────. ."
890 PRINT"▓. ─────. ─────────. |. |. |. . . . . . . . |. . . . |. |. |."
900 PRINT"▓. . . . . . . . . . . . . . . . . . |. |. ─────────. |. |. ."
910 PRINT"▓. ─────. ─────. . . . . . . . . . . . . . . . . . . |. . . . ."
920 PRINT"▓. |. . . . . . |. . . . . |. ─────────────. ───. ───"
930 PRINT"▓. . . . ─────. |. |. |. . . . . . . . . . . |. . . . . . . . ."
940 PRINT"▓. |. |. . . . . . |. |. ──────────. |. |. |. ───. ─. "
950 PRINT"▓. |. ──────. |. |. |. . . . . . . . . |. |. |. . . . . . . . ."
960 PRINT"▓. . . . . . . |. |. |. |. |. |. |. |. |. |. ──────. "
970 PRINT"▓. |. ─. |. |. |. |. |. |. |. |. |. |. |. . . . . . . . |. "
980 PRINT"▓. |. ─. |. |. . . . . |. |. . . . . . . . |. ───────. |. "
990 PRINT"▓. . . . . . . ─────. |. |. ──────. . . |. . . . . . . . ."
1000 PRINT"▓. |. |. |. . . . . . . |. |. |. . . . . . . ─|. |. |. |. |. "
1010 PRINT"▓. |. |. |. ──────────. |. ──────────. |. |. |. |. |."
1020 PRINT"▓. |. . . . . . . . . . . . . . |. . . . . . . . . . . . . |. . . . . . ."
1030 PRINT"▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓"
1040 RETURN
1050 POKE59468,14:PRINT"JDO YOU WANT THE INSTRUCTIONS AND RULES ?"
1060 GETA$:IFA$=""THEN1060
1070 IFA$="N"THEN1610
1080 IFA$="@"THENPOKE59468,12:GOTO660
1090 IFA$<>"Y"THEN1060
1100 POKE59468,12:PRINT"J"
1110 PRINT"▓▓▓▓▓▓▓▓▓▓"
1120 PRINT"        ▓ ▓▓ ▓ ▓▓ ▓▓ ▓   ▓ ▓ ▓▓"
1130 PRINT"        ▓▓▓ ▓ ▓ ▓▓▓ ▓ ▓ ▓▓ ▓ ▓"
1140 PRINT"        ▓ ▓ ▓ ▓ ▓ ▓ ▓ ▓ ▓   ▓ ▓ ▓▓"
1150 PRINT:PRINT"      DEVELOPED BY I. PAYTON"
1160 FORA=1TO1400:NEXTA
1170 PRINT"J"
1180 POKE59468,14
1190 PRINT"THIS  IS  A  GAME  WHICH  YOU  WILL ONLY"
1200 PRINT"MASTER IF YOU HAVE GOOD REACTIONS."
1210 PRINT"IT IS DIVIDED INTO TWO PARTS. PART ONE"
1220 PRINT"WILL PREPARE YOU FOR PART 2,WHICH IS :"
1230 PRINT:PRINT"▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓MAZE"
1240 PRINT:PRINT"YOU WILL BE ABLE TO SET YOUR OWN SKILL"
1250 PRINT"LEVEL AND THE OBJECT OF THE GAME IS TO"
1260 PRINT"KNOCK DOWN AS MANY BOLLARDS AS YOU CAN"
1270 PRINT"IN THE SHORTEST TIME WITH AS LITTLE "
1280 PRINT"FAULTS AS POSSIBLE"
1290 PRINT:PRINT:PRINT:PRINT"              HIT A KEY"
1300 GETA$:IFA$=""THEN1300
1310 IFA$="@"THENE=0:GOTO10
1320 PRINT"J"
1330 PRINT"RULES"
1340 PRINT"─────"
1350 PRINT:PRINT"CONTROL THE DOT BY USING THE RIGHT HAND"
1360 PRINT"NUMERIC KEYBOARD IN THE USUAL MANNER"
1370 PRINT"I.E. 8 AND 2 FOR UP AND DOWN
1380 PRINT"     4 AND 6 FOR LEFT AND RIGHT"
1390 PRINT"     5 FOR STOP
1400 PRINT:PRINT"THE TIME WILL BE INDICATED IN MINUTES "
1410 PRINT"AND SECONDS AT THE TOP OF THE SCREEN"
1420 PRINT"FAULTS ARE INCURRED IF YOU DO NOT ALTER"
1430 PRINT"DIRECTION QUICK ENOUGH.WHEN BUTTON '5'"
1440 PRINT"IS OPERATIVE IT WILL HELP TO AVOID"
1450 PRINT"FAULTS"
1460 PRINT:PRINT:PRINT:PRINT"▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓HIT A KEY"
1470 GETA$:IFA$=""THEN1470
1480 IFA$="@"THENE=0:GOTO10
1490 PRINT"J"
1500 IFA$="@"THENE=0:GOTO10
1510 PRINT"WHEN YOU THINK YOU HAVE KNOCKED DOWN"
1520 PRINT"ALL OF THE BOLLARDS,PRESS THE SPACE BAR"
1530 PRINT"(QUICKLY!)
1535 PRINT"IF YOU HAVE NOT KNOCKED DOWN ALL THE    BOLLARDS, 10 FAULTS ARE INCU
RED"
1540 PRINT:REMPRINT"IN AMATEUR SKILL LEVEL,BUTTON '5' IS IN USE"
1550 PRINT"IN PRO. SKILL LEVEL,'5' IS DISABLED"
1560 PRINT:PRINT"IF AT ANY TIME YOU WISH TO COME OUT OF "
1570 PRINT"PROGRAMME,PRESS '@' UNTIL 'READY.' "
1580 PRINT"APPEARS"
1590 PRINT:PRINT:PRINTTAB(15)"(HIT A KEY)"
1600 GETA$:IFA$=""THEN1600
1605 IFA$="@"THENE=0:GOTO10
1610 POKE59468,14:PRINT"JWHICH GAME DO YOU WISH TO PLAY ?"
1620 PRINT:PRINT"▓PART 1 OR ▓MAZE"
1630 GETA$:IFA$=""THEN1630
1640 IFA$="@"THENE=0:GOTO10
1650 IFA$="P"THENPRINTTAB(27)"▓PART 1▓":L=2
1660 IFA$="M"THENPRINTTAB(27)"▓MAZE▓":L=1
1670 IFA$<>"P"ANDA$<>"M"THEN1630
1680 PRINT:PRINT"WHICH SKILL LEVEL                        (▓AMATEUR OR ▓PRO.)
1690 GETA$:IFA$=""THEN1690
1700 IFA$="@"THENE=0:GOTO10
1710 IFA$="A"THENPRINTTAB(27)"▓AMATEUR▓":K=1
1720 IFA$="P"THENPRINTTAB(27)"▓PROFESSIONAL▓":K=2
1730 IFA$<>"A"ANDA$<>"P"THEN1690
1740 PRINT:PRINT"WHICH SPEED RATING ?"
1750 PRINT:PRINT"1=EXPERT"
1760 PRINT"2=AMATEUR"
1770 PRINT"3=NOVICE"
1780 GETA$:IFA$=""THEN1780
1790 IFA$="@"THENE=0:GOTO10
1800 Q=(VAL(A$)-1)*30
1810 IFQ>60ORQ<0THEN1780
1811 IFA$="1"THENPRINTTAB(27)"▓▓▓▓EXPERT"
1812 IFA$="2"THENPRINTTAB(27)"▓▓▓▓AMATEUR"
1813 IFA$="3"THENPRINTTAB(27)"▓▓▓▓NOVICE"
1814 FORZZ=1TO700:NEXTZZ
1820 PRINT"J":POKE59468,12:RETURN
1830 PRINT"▓WAIT.I'LL CHECK IF ALL BOLLARDS ARE DOWN"
1840 FORI=32807TO33768:IFPEEK(I)=46THEN1860
1850 NEXTI:GOTO320
1860 PRINT"▓HAVE ANOTHER LOOK !  (PENALTY=10 FAULTS)"
1865 E=E+10:GOSUB21000
1870 GETC$:IFC$=""THEN1870
1880 IFC$="@"THENE=0:GOTO10
1890 B=VAL(C$):TI$=H$:PRINT"▓                                        ":GOTO150
10000 FORL8=1TO10
10001 PRINT"▓▓▓▓▓▓▓YOU ARE TODAY'S HIGH SCORER!!"
10005 GOSUB22000
10010 GOTO630
20000 POKE59467,16:POKE59466,15:POKE59464,50
20010 POKE59467,0:POKE59466,227:POKE59464,121
20020 RETURN
21000 POKE59467,16:POKE59466,15:POKE59464,0
21010 FORL8=1TO3
21020 FORL9=50TO200STEP5
21030 POKE59464,L9
21040 POKE59464,L9+50
21050 NEXTL9
21060 NEXTL8
21070 POKE59467,0:POKE59466,227:POKE59464,121
21080 RETURN
22000 POKE59467,16:POKE59466,15:POKE59464,0
22010 FORL8=150TO50STEP-1
22020 POKE59464,L8
22030 NEXTL8
22040 FORL8=1TO4
22041 FORL7=100TO230STEP10
22050 POKE59464,L7
22060 NEXTL7
22065 NEXTL8
22070 POKE59467,0:POKE59466,227:POKE59464,121
22080 RETURN
23000 POKE59467,16:POKE59466,15:POKE59464,0
23010 FORL8=1TO20
23020 POKE59464,200
23030 POKE59464,250
23040 NEXTL8
23050 POKE59467,0:POKE59466,227:POKE59464,121
23060 RETURN
```

Moon Lander

WRITTEN IN BASIC for a TRS-80 level II, the Moon Lander program by Ian Butcher of Laindon, Essex is in three sections. Section 1 is a simple representation of the flight from the Earth to the Moon. Section 2 is the orbit of the lander with the 5,000ft. level marked.

The descent from 20,000ft. to 5,000ft. also occurs during section 2. It gives the player the opportunity to slow the descent to a reasonable speed for section 3, which is from 5,000ft. to the landing. This stage draws a random Lunar landscape.

During section 3 the player can fly the lander off screen right or left to a new random lunar landscape, as long as there is enough fuel. At the harder levels there is not enough fuel and the player must get down on the initial landscape.

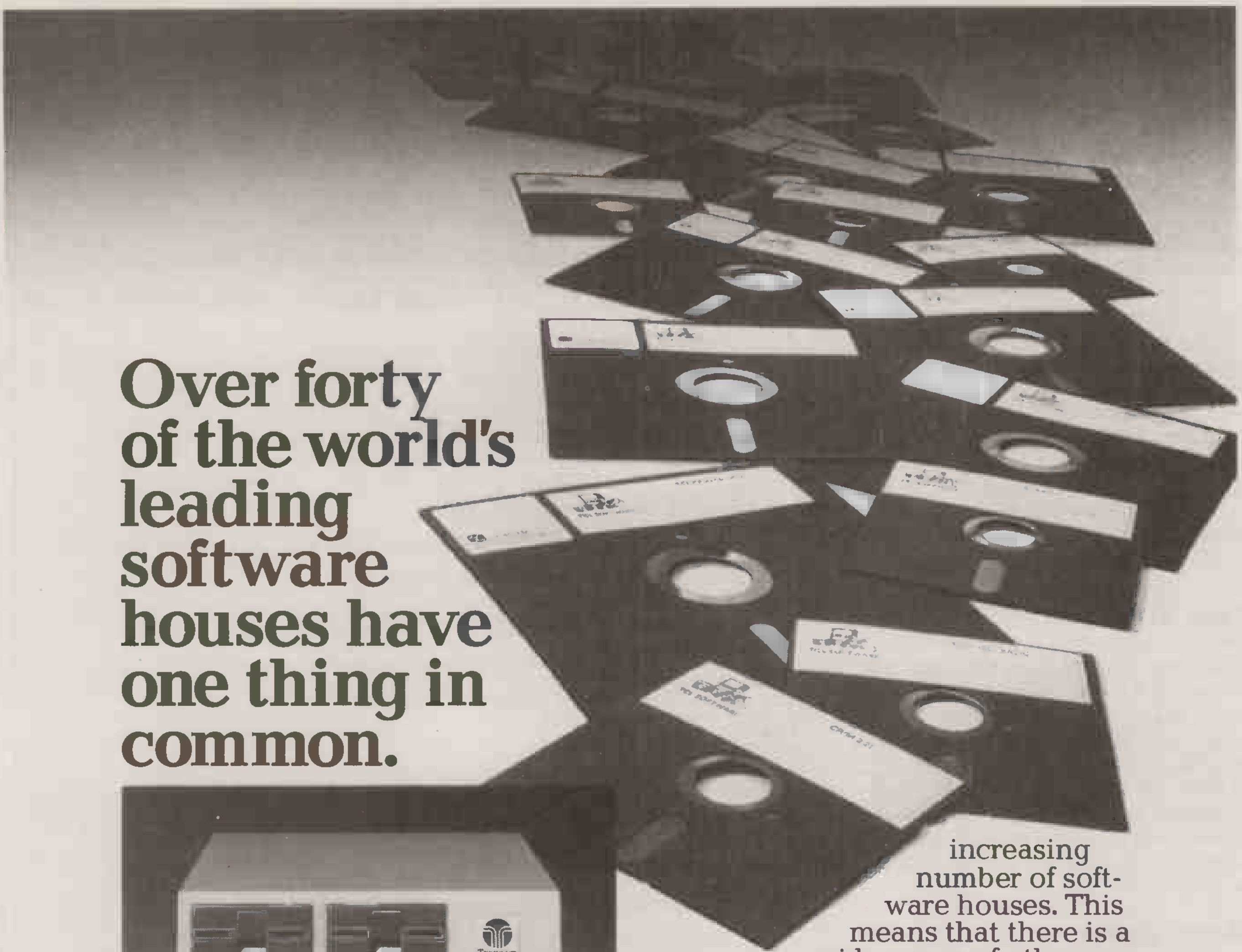
The program uses the TRS-80 set and reset facility to draw the lander and the landscape. Because the program is in Basic the graphics have been kept relatively simple to maintain reasonable speed of play. The program occupies less than 4K of RAM and should be fairly easy to modify for other memory-mapped micros.

The main features of the program are as follows:

Line 12 ensures that if the crash graphics are off the video map then the program jumps to the lander-destroyed routine.
Lines 20-90 are the instructions.
Lines 110-120 set the level of difficulty.
Lines 125-145 form a short routine depicting the Earth-Moon flight. They may be omitted without detriment to the program.
Line 240 initialises values: HH, height; S, speed; RA, divisor for screen co-ordinates.
Lines 250-380 form a routine to draw orbiting lander.
Line 340 looks for start of descent.
Lines 390-430 are the main program loop, and look for cursor key input.
Lines 500-520 form a speed-reduction subroutine.
Lines 600-640 form a move-left subroutine, which also redraws landscape during section if lander moves off screen.
Lines 700-740 form a move-right subroutine.
Lines 800-840 form an instrument-readout subroutine.
Lines 900-990 form a subroutine to increment

(continued on page 144)

```
5 REM A BASIC LUNAR LANDER PROGRAM BY IAN BUTCHER
10 CLS
12 ON ERROR GOTO 2180
15 T=0
20 PRINT"YOU ARE THE PILOT OF A LUNAR LANDER"
30 PRINT"YOU CAN 'FLY' THE LANDER BY USING THE UP, LEFT,"
40 PRINT"AND RIGHT CURSOR KEYS. THE UP KEY WILL"
50 PRINT"REDUCE YOUR SPEED AND RATE OF DESCENT."
60 PRINT"TO COMMENCE THE LANDING USE THE DOWN"
70 PRINT"CURSOR KEY. TO LAND SUCCESSFULLY YOUR"
80 PRINT"SPEED MUST BE LESS THAN TWENTY FEET/SEC. ON IMPACT"
81 PRINT"THE RADAR DISPLAY IS IN TWO STAGES -- FROM 20000 FT. TO 5000 FT"
82 PRINT"AND THEN FROM 5000 FT TO GROUND LEVEL "
83 PRINT"YOU MUST REDUCE SPEED DURING STAGE ONE "
84 PRINT"IF YOU CANNOT LAND YOU CAN MOVE LEFT OR RIGHT TO A NEW SITE"
85 PRINT"BY USING THE LEFT OR RIGHT CURSORS (IF YOU HAVE ENOUGH FUEL)"
90 INPUT"TO COMMENCE PRESS THE ENTER KEY";S$
100 CLS
110 PRINT:PRINT:PRINT:PRINT"ENTER YOUR SKILL LEVEL (1 TO 5 ) --- 5 IS EASY  1 IS
 HARD  ":PRINT:INPUTA :IF A<1 THEN A=1
116 IF A=5OR A=4 OR A=3 THEN F=800:GOTO125
118 IFA=2THEN F=1400
120 IFA=1 THEN F=3000
125 CLS
130 PRINT@198,"MOON";:PRINT@118,"EARTH";
135 FOR Y=5TO0STEP-1:X=126:SET(X,Y):FORT=1TO50:NEXT:RESET(X,Y):NEXT
140 FORX=127TO0STEP-1:Y=0:SET(X,Y):FORT=1TO50:NEXT:RESET(X,Y):NEXT
145 FOR Y=0TO8:X=0:SET(X,Y):FORT=1TO50:NEXT:RESET(X,Y):NEXT
160 CLS
170 PRINT:PRINT"COMMAND MODULE TO LANDER"
180 PRINT:PRINT"YOU ARE NOW ENTERING ORBIT"
185 FORTT=1TO500:NEXT
190 PRINT:PRINT:PRINT"THE COMPUTERS HAVE CLOSED DOWN"
195 FORTT=1TO500:NEXT
200 PRINT:PRINT:PRINT"YOU MUST LAND THE MODULE YOURSELF"
205 FORTT=0TO500:NEXT
210 PRINT:PRINT:PRINT"YOU WILL SEE THE RADAR PICTURE SOON"
215 FORTT=0TO500:NEXT
220 PRINT:PRINT:PRINT"GOOD LUCK COMMANDER"
230 FORT=1TO500:NEXT
240 CLS:HH=20000:S=500:RA=454.5:BR=10
250 PRINT@960,"5000 FT. - - - - - - - - - - - - - - - - - - - - - - - - - - - ";
260 GOSUB800
290 B=1:C=2:D=3:E=3:I=4:G=5:H=0:J=4:K=6
300 FORX=0TO122:GOSUB 5000
310 FORT=1TO100:NEXT
320 GOSUB 6000
330 B=B+2:C=C+2:D=D+2:H=H+2:J=J+2:IF J>127THEN 290 ELSE 340
340 IF PEEK(14426)=16 THEN GOTO 360
350 NEXT
355 GOTO290
360 E=E+2:I=I+2:G=G+2:K=K+2
370 IF K>47 THENK=47:G=46:I=45:E=44
380 GOSUB 5000
390 IF PEEK(14426)=8GOSUB 500
400 IFPEEK(14426)=32 GOSUB 600
410 IFPEEK(14426)=64 GOSUB 700
420 GOSUB 900
430 GOTO 390
500 IF T>899 THEN S=S-((7.5-(F*.001)-2)*A):GOTO506
505 S=S-((50-(F*.001)-2)*A)
506 F=F-(50/A)
510 GOSUB 905
520 RETURN
600 GOSUB 6000
610 B=B-2:C=C-2:D=D-2:H=H-2:J=J-2:IF H<0AND HH< 5000THEN GOSUB 4000: H=123:B=124
:C=125:D=126:J=127
615 IF H<0 THEN H=123:B=124:C=125:D=126:J=127
620 F=F-(50/A):GOSUB800
630 GOSUB5000
640 RETURN
700 GOSUB6000
710 B=B+2:C=C+2:D=D+2:H=H+2:J=J+2:IFJ>127AND HH<5000THEN GOSUB 4000
 :H=0:B=1:C=2:D=3:J=4
715 IF J>127 THEN H=0:B=1:C=2:D=3:J=4
720 F=F-(50/A):GOSUB800
730 GOSUB5000
740 RETURN
800 PRINT@1,"HEIGHT "HH;
810 PRINT@20,"SPEED "S;
815 IF F<150 THEN PRINT@420,"FUEL LOW ";
820 PRINT@45,"FUEL "F;
830 IF F<0 GOTO2000
840 RETURN
900 IF T>899 THEN S=S+1:GOTO905
902 S=S+5
905 T=T+1:TT=TT+1
910 IF T<900 AND HH<5000 GOSUB4000:T=900:TT=900
930 HH=HH-S:RR=INT(HH/RA):IF RR=YR THEN 940 ELSE 935
935 GOSUB6000
940 E=(44-RR):I=(45-RR):G=(46-RR):K=(47-RR):YR=RR
955 IFE<3 THEN E=3:I=4:G=5:K=6
360 GOSUB800
370 GOSUB5000
980 IF POINT(H,K+1)=-1 ANDPOINT(J,K+1)=-1THEN3000 ELSE 990
990 IF POINT(H,K+1)=-1THEN 2000
1000 IF POINT(J,K+1)=-1 THEN 2000
1010 RETURN
2000 IF F<0THEN 2010 ELSE 2150
2010 FORX=ETO42:GOSUB6000
2020 E=E+1:I=I+1:G=G+1:K=K+1:FOR DT=0TO50:NEXT
2030 GOSUB 5000
2150 GOSUB6000
2160 FORX=1TO5:B=B-1:D=D+1:E=E-1:I=I-1:G=G-1
2170 GOSUB5000
2175 NEXT:FOR DT=1TO500:NEXT
2180 CLS:PRINT@320,"YOU ARE VERY DEAD !";
2190 PRINT@384,"THE LANDER IS DESTROYED"
2200 GOTO3020
3000 FOR T=1TO500:NEXT:IF S<20 THEN CLS ELSE 2150
3010 PRINT:PRINT:PRINT:PRINT"CONGRATULATIONS YOU HAVE LANDED"
3020 INPUT"IF YOU WISH TO HAVE ANOTHER GO PRESS ENTER ";S$
3030 GOTO 10
4000 CLS:RANDOM
4010 FORX=0TO125STEP3:Y=RND(3)+38:SET(X,Y):SET(X+1,Y):SET(X+2,Y):NEXT
4020 RA=111
4030 BR=1
4040 RETURN
5000 SET(H,K):SET(B,I):SET(C,E):SET(B,G):SET(C,G):SET(D,I):SET(D,G):SET(J,K)
5010 RETURN
6000 RESET(H,K):RESET(B,I):RESET(C,E):RESET(B,G):RESET(C,G):RESET(D,I):RESET(D,G
):RESET(J,K)
6010 RETURN
```



Over forty of the world's leading software houses have one thing in common.

They support a worldwide standard in software, and so do we.

We understand that one of the most important considerations, before buying a computer, is the software which will be available to you.

This is made easy by the choice of the CP/M operating system. TCL Software, a division of Transam, provides an enormous range of software packages for commercial, scientific, educational and personal needs.

But there is one important difference – we at Transam really understand the CP/M based computer.

CP/M has the advantage of being adopted by an ever increasing number of software houses. This means that there is a wide range of other software packages written to run on a CP/M based system.

And, of course, any programs you may develop yourself will be compatible with, and can be run on, other systems which are CP/M based.

The Transam range of computers are designed and built in Britain. Our experience gives us the capability to support our users at a very high level, with advice and spares only a phone call away.

Call in to our West End showrooms for all the advice you need about computers and what they can do for you, or for further information write to Transam Microsystems Limited, 59/61 Theobald's Road, London WC1. Telephone 01-405 5240/2113.

Transam
MICROSYSTEMS LIMITED

● Circle No. 183

(continued from page 141)

speed, calculate screen co-ordinates, select section 2 and move lander down, if appropriate.

Lines 980-1010 test to see if lander is on level ground

Lines 2000-2200 are the crash routine.

Lines 3000-3030 select repeat game.

Lines 4000-4040 generate the landscape for section 2, and reassigns new RA.

Lines 5000-5010 are the set subroutine.

Lines 6000-6020 are the reset subroutine.

The intention was to write a Basic lunar lander which strikes a reasonable balance between graphics and speed. The program is sophisticated enough to be playable by a wide variety of age groups as it stands, but should also provide an incentive for the more accomplished programmer to modify and improve on it. Apart from the set, reset facility the program uses Basic in a way which should allow fairly easy transportation to 6502-based micros.

User graphics

TWO RELATED PROGRAMS come from John Middleton of Sale, Cheshire. The first prints a £ sign which is not available in the character set of the Tandy Lineprinter VII. The other allows any user-defined character to be printed.

User Definable Characters forms characters row by row. Inputting a 1 causes a dot to be printed at a particular point; inputting a 0 causes a blank space to be printed.

Pound sign.

```
93 REM *************************************
94 REM ***       POUND SIGN PROGRAM        ***
95 REM *** FOR USE WITH LINE PRINTER VII ***
96 REM ***    WRITTEN BY J.MIDDLETON      ***
97 REM *************************************
100 DATA 200,190,169,162,196:' DATA FOR POUND SIGN
105 LPRINT CHR$(18);: ' PUT LINE PRINTER VII IN GRAPHICS MODE
110 FOR I=0 TO 5:'5 COLUMNS PER CHARACTER
115 READ J
120 LPRINT CHR$(J);:'PRINT 1 COLUMN OF POUND SIGN
125 NEXT J
130 LPRINT CHR$(30);:'PUT PRINTER BACK IN CHARACTER PRINT MODE
140 END
```

User Definable Characters.

```
10 CLEAR2000:SA=15360:EA=15744
20 REM ***************************************************
30 REM ***            SA=TOP LEFT OF SCREEN              ***
40 REM *** EA=ADRESS 7 CHARACTERS BELOW TOP LEFT OF SCREEN ***
50 REM ***************************************************
60 CLS
70 A$=INKEY$
80 IF A$="1" OR A$="0" THEN 100
90 GOTO70
100 IF T=5 THEN PRINTCHR$(13);:T=0:D=D+1:' LINE FEED IF 5 CHARACTERS PRINTED
110 IF D=7 THEN 180
120 IFA$="1"THEN PRINTCHR$(191);:ELSEPRINT".";
130 T=T+1
140 GOTO70
150 REM ****************************************
160 REM *** COMPUTE CHARCTER PATERN IN BINARY ***
170 REM ****************************************
180 FORI=EA+J TO SA+J STEP-64
190 IF PEEK(I)=191THEN A$(J)=A$(J)+"1" ELSE A$(J)=A$(J)+"0"
200 NEXTI
210 J=J+1
220 IF J=5 THEN 240
230 GOTO180
240 FORI=0TO4:A$(I)="1"+A$(I)
250 NEXTI
260 REM *******************************
270 REM *** CHANGE BINARY TO DECIMAL ***
280 REM *******************************
290 FORI=0TO4
300 FORJ=0TO7
310 IF VAL(MID$(A$(I),8-J,1))=1THEN V(I)=V(I)+2[J
320 NEXTJ,I
330 REM ******************************************************
340 REM *** SCREEN OUTPUT OF ALTERATIONS TO POUND SIGN PROGRAM **
350 REM ******************************************************
360 PRINT:PRINT"REPLACE THE DATA IN LINE 100 IN THE POUND SIGN PROGRAM WITH"
370 FORI=0TO4
380 PRINTV(I);
390 NEXTI
400 PRINT:PRINT"TO REPRODUCE THE CHARACTER DRAWN ON THE SCREEN"
410 REM ****************************************
420 REM *** OPTION OF PRINTER OUTPUT OF CHARCTER ***
430 REM ****************************************
440 PRINT" DO YOU WANT THE CHARCTER OUTPUT TO THE PRINTER ?"
450 A$=INKEY$:IFA$=""THEN450
460 IF A$="Y"THEN 470 ELSE END
470 LPRINTCHR$(18);:' PUT PRINTER IN GRAPHICS MODE
480 FORI=1TO4
490 LPRINTCHR$(V(I));
500 NEXT I
```

Name finder

IN TANDY FORUM January 1982, M L Arnautov suggests a clever method of loading a system tape with an unknown name. There is, however, a much simpler alternative, writes Tony Edwards of Northwood, Middlesex. Place the tape in the recorder as you would for a normal load and then run the following program

```
10 INPUT#-1,A$:?A$:NEW
```

You will be rewarded with the name of the unknown program. Write it down this time, before you forget it again.

If the program on the tape is in Basic the single-character name is printed, but if it is a system tape the full program name is output preceded by the letter U, the machine-code identifier. If the tape was not a program tape at all but a data tape the output is the first piece of data.

This program also responds to Tiny Pascal program tapes as if they were system tapes.

Data separator

WHERE PROGRAMS contain long lists of items in Data statements, it is often convenient to be able to access different parts of the list independently, writes Michael Smith of Camborne, Cornwall. There are two methods which are often recommended. The data list shown here, for example, is evidently intended to be treated as three separate data lists, but Read statements in the program will treat it as one huge list. Successive Reads simply take one item after another until the end of the list is reached. All that can be done to influence the process is to Restore, to start again at the beginning.

What happens if you want to go

Data separator.

```
10   DATA "THESE","ARE","THE","FIRST","TEN","ITEMS",
"OF","THE","DATA","LIST","AND","WE","WOULD","NORMALLY",
"CONTINUE","READING","HERE","BUT","NOW","WE'VE","CONTINUED",
"READING","HERE","INSTEAD"
20   GOSUB50:GOSUB 60
30   GOSUB50:POKE16639,107:POKE16640,67:GOSUB60
40   PRINT:PRINT:LIST10
50   PRINT:PRINT:RESTORE:FORI=1TO10:READA$:PRINTA$;
" ";:NEXT:RETURN
60   PRINT:FORI=1TO7:READA$:PRINTA$;" ";:NEXT:RETURN
```

Data separator — example data.

```
1300 REM LIST OF TELEPHONE
NUMBERS
1310 DATA "694-0220". "575-3376",
"283-9501"

1400 REM LIST OF DISTANCES IN MILES
1410 DATA 5,8,4,2,9,5,4,6,7,4

1500 REM LIST OF NAMES
1510 DATA "JIM"; "FRED", "JOE", "TOM"
```

straight to the third list of names? One well-known book on programming for the TRS-80 recommends either that you should be aware of the number of items in each group, and just perform the appropriate number of dummy Reads until you reach the part you want. Alternatively you can precede each group with a unique code and then search for that code, again by Reading until you find it. The second method requires that the code must not otherwise be a data item anywhere in the list. Where the part you want is hidden in the middle of a long data list, both methods can take ages.

There is also a mysterious "imaginary pointer" which points to the next data item after a Read. The Pointer Finder program helps you to find the pointer. When it is run, the screen displays the following text:

```
THESE ARE THE FIRST TEN ITEMS OF
THE DATA LIST AND WE WOULD
NORMALLY CONTINUE READING HERE

THESE ARE THE FIRST TEN ITEMS OF
THE DATA LIST BUT WE'VE CONTINUED
READING HERE INSTEAD
```

followed by a listing of Data line 10 so that you can see what has happened.

On the first occurrence of Gosub50, in line 20, the subroutine reads the first 10 data items from the list and prints them. A pointer stored in locations 16639 (LSB) and 16640 (MSB) now points to the comma delimiter after the last item read, that is, to the comma before "and".

The statement Gosub60 in line 20 then reads the next seven items and prints them, just as you would expect.

The procedure is repeated in line 30, but this time, after reading and printing the first 10 items as before, the pointer is reset so that it points to location 17259 (=67* 256 + 107) in memory. As it happens, this location is where the comma before "but" is stored. When subroutine 60 is performed this time, it Reads and Prints the seven items beginning with "but".

So in order to read selectively any part of a data list, find out where the comma before the first item that you want is stored, or the blank space at the start of a Data statement if that is where you want to begin. Set the pointer to that address and start to Read.

One easy way to find the location you require is to count the data items before the one you want to begin on, read items up to that point with a For-Next loop, and do a Peek (16639), Peek (16640) to see where the pointer is now. Then use those numbers in your program. It certainly beats reading the whole data list into an array and accessing it by indexing — that is just a good way to run out of memory.

Unknown tape loader.

```
10 CLS
20 PRINT
30 PRINT"*******************************************"
40 PRINT"*   LOADER FOR UNKNOWN SYSTEM TAPES,      *"
50 PRINT"*   EITHER CASSETTE.                      *"
60 PRINT"*******************************************"
70 '
80 DIM A(37):N=0
90 L=219:M=127:K=32731
100 PRINT
110 INPUT"CHANGE LOCATION OF USR ROUTINE";A$
120 IFLEFT$(A$,1)="Y"THENGOTO140
130 IFLEFT$(A$,1)="N"THENGOTO180ELSE110
140 INPUT"ENTER NEW LOCATION";K
150 IFK<20443ORK>65498GOTO160ELSEGOTO180
160 PRINT"NEW LOCATION >20443 AND <65498
170 GOTO140
180 M=INT(K/256):L=K-256*M
190 KK=K
200 IFKK=>32767THENKK=KK-65536
210 FORX=0TO36:READA(X):POKEKK+X,A(X):NEXTX
220 PRINT
230 PRINT"CASSETTE 1     /";L+256*M
240 PRINT"CASSETTE 2     /";L+256*M+5
250 PRINT"END OF USR CODE IS AT";L+256*M+37
260 PRINT:PRINT
270 PRINT"FOR INSTRUCTIONS TYPE <I>"
280 PRINT"TO LOAD SYSTEM TAPE PRESS ANY KEY"
290 S$=INKEY$:IFS$=""THENGOTO290
300 IFS$<>"I"GOTO400
310 CLS
320 PRINT:PRINT
330 PRINT"TO LOAD MACHINE-LANGUAGE (SYSTEM) TAPE "
340 PRINT"PRESS ANY KEY AFTER SETTING UP TAPE IN CASSETTE."
350 PRINT"THE TAPE WILL LOAD WITH USUAL INDICATIONS AND FINAL PROMPT"
360 PRINT"*?. TO RUN LOADED PROGRAMME TYPE / AND NEWLINE AS NORMAL."
370 GOTO410
380 PRINT
390 PRINT"1 OR 2 ONLY"
400 CLS
410 PRINT:PRINT
420 PRINT"SELECT CASSETTE 1 OR 2";
430 INPUTA
440 GOSUB630
450 PRINT
460 PRINT"LOADING PROGRAMME HAS NAME ";
470 IFN<>0GOTO530
480 GOTO530
490 POKE16526,L:POKE16527,M
500 RETURN
510 POKE16526,L+5:POKE16527,M
520 RETURN
530 Q=USR(0)
540 PRINT"**** NOT EXPECTED FORMAT"
550 PRINT
560 PRINT"TO LOAD SYSTEM TAPE PRESS ANY KEY":N=N+1
570 DATA 243,175,40,3,243,62,49,205,18,2
580 DATA 205,150,2,205,53,2,254,85,32,13,6
590 DATA 6,205,53,2,205,51,0,16,248,195
600 DATA 234,2,205,248,1,201
610 GOTO290
620 END
630 IFA<1ORA>2 THEN GOTO380
640 IFA=1THENGOSUB490ELSEGOSUB510
650 GOTO450
```

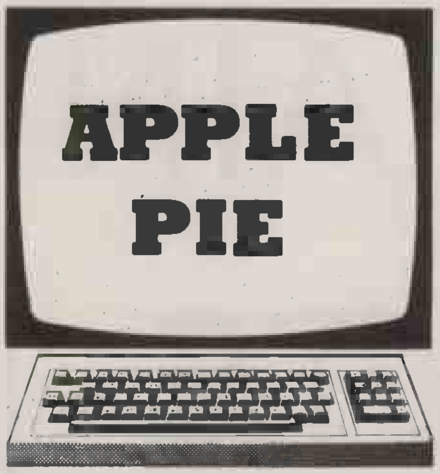
Unknown tape loader

THIS PROGRAM by J A E Bowen of Tamworth, Staffordshire, was originally conceived to permit the loading of system tapes from the second cassette on one of the original Video Genie microcomputers. The program was written in Basic so that it could be loaded from the second cassette on a Video Genie if the internal cassette is faulty. This model had a fixed-level internal cassette only, and it could sometimes be difficult to load a system tape from another source because of recorded level differences.

The main problem was not only to provide a machine-language routine which would allow a system tape to be loaded from the second cassette, but, with only 16K of RAM available, to locate the program in a position where it could not be overwritten and hence abort the loading process. The solution adopted was to initialise the system load from the program and, once past the cassette selection part of the internal routine, jump back into ROM. The routine in the RAM is then redundant and it does not matter if it is overwritten.

The program will load system tapes with unknown names and the selection of either cassette is permitted. As an additional bonus, the name which has been read from the tape during loading is also displayed.

If memory allows, the USR routine may be located in a part of the memory where it will not be overwritten and may be used more than once by calling System and the appropriate entry address displayed by the program.



Galaxy Invaders

GALAXY INVADERS was written by Kevin Irving of Carlisle on an Apple II with Apple DOS. It requires 32 to 48K of memory.

Galaxy Invaders is a fast, difficult game for Space Invader addicts. You control your laser right and left, zapping the Hell's Angels flying down at you. At the same time they are firing continuously in your direction. When you have killed off one fleet you are informed that your commander's ship is in trouble, so you must then save him by docking your ship with his. By this time you are under attack again by some more Hell's Angels.

The program incorporates superb sound and graphics. Background stars give a three-dimensional effect to make the action more realistic. Multicoloured intergalactic explosions, plenty of sound, and fast graphics make a very interesting game.

You use two sets of keys: set 1 controls your movement and firing when the invaders attack; set 2 controls your moves when you are docking your ship.

Set 1
1 moves you left
3 moves you right
0 fires a laser

Set 2
W moves you up
Z moves you down
Right-arrow key moves you forwards

To set up the game you must first type in the Basic program and save it on disc. This program uses a shape table in order to keep up its high speed so you must now type this in. You should follow the following steps:

- Type in Call-151 to enter monitor.
- Type in the shape table by replacing the dash signs with colons. Use the same format of spacing as the listing does so as not to get confused.
- Type 3D0G.
- You are now back in Basic. You can save the shape table on disc using the following line:

  BSAVE GAL-TT, A$4000, L$1B0

Now you may run your program which you saved on disc, and play Galaxy Invaders. When typing in the Basic listing, shorten the Rem statements in lines 71, 137 and 157.

CH — Keyboard scan.
CV — Vertical position of the commander when you dock your ship.
DS — The number of points you must get to dock your ship; it starts at 40 and doubles each time you attempt to dock.
FI — A1 in this location indicates that you want to fire; otherwise FI will equal 0.
FQ and FR — The co-ordinates of your missile, FQ for horizontal, FR for vertical.

Galaxy Invaders shape table.

Number	Description
1	Your ship
2	Hell's Angel Invader
3	Your fire
4	Invaders' fire
5	Explosion
6, 7	Docking ship, your commander
8, 9	Docking ship, your ship
10	Docking ship, your thrust

Galaxy Invaders.

```
24  REM  ** SET UP SOUND
25  DATA  173,48,192,136,208,5,206,1,3,240,9,202,208,245,174,0,3
    ,76,2,3,96,0,0
26  FOR I = 770 TO 792: READ J: POKE I,J: NEXT
27  REM  ** SET SHAPE TABLE                   ADDRESS
28  POKE 232,00: POKE 233,64
29  REM  ** LOAD TABLE
30  PRINT : PRINT  CHR$ (4);"BLOAD GAL-TT,A$4000"
31  SCALE= 1: ROT= 0
32  REM  ** SET UP VARIABLES
33 OP = 140:FR =  - 1:IN =  - 1:MI =  - 1:SC = 0:FI = 0:MO = 0:M
   J = 0:NJ = 0:DS = 40
34  REM  ** INSTRUCTIONS
35  HOME
36  PRINT "****************************************";
37  PRINT "*********** GALAXY INVADERS. ***********";
38  PRINT "****************************************"
39  PRINT " THE GALAXY IS BEING INVADED BY BEINGS"
40  PRINT "FROM ANOTHER SOLAR SYSTEM . THEY HAVE"
41  PRINT "UNLIMITED HIGH POWER MISSILES WHICH "
42  PRINT "CAN DESTROY YOU INTO MILLIONS OF LITTLE"
43  PRINT "PIECES.": PRINT
44  PRINT "YOU ONLY HAVE ONE SHIP AND ONE LIFE"
45  PRINT "WHEN INVADERS ATTACK,PRESS"
46  PRINT "    '0'-TO FIRE"
47  PRINT "    '1'-TO MOVE LEFT"
48  PRINT "    '3'-TO MOVE RIGHT": PRINT
49  PRINT " WHEN YOU DOCK YOUR SHIP,PRESS"
50  PRINT "    W-TO MOVE UP": PRINT "    Z-TO MOVE DOWN"
51  PRINT : PRINT "    RIGHT ARROW TO MOVE FORWARDS"
52  INVERSE
53  VTAB 22: PRINT "PRESS THE SPACE BAR TO START THE ATTACK."
54  NORMAL
55 CH =  PEEK ( - 16384) - 128: IF CH <  > 32 THEN 55
56  HOME : VTAB 20
57  VTAB 23: HTAB 1: PRINT "SCORE ";SC
58  REM  ** SET UP SCREEN
59  HGR
60  FOR ST = 1 TO 150: HCOLOR= ( RND (9) * 7) + 1: HPLOT  RND (9
    ) * 280, RND (9) * 160: NEXT
61  REM  ** PLAY INTRODUCTION
62  POKE 768,50: POKE 769,100: CALL 770
63  POKE 769,100: POKE 768,80: CALL 770
64  PRINT  CHR$ (7);
65  FOR I = 1 TO 4
66  POKE 768,50: POKE 769,50: CALL 770
67  POKE 768,200: POKE 769,50: CALL 770
68  FOR P = 1 TO 50: NEXT : NEXT
69  POKE 768,100: POKE 769,100: CALL 770
70  XDRAW 1 AT 140,157
71  REM
                          ** INVADING ROUTINE **
72  REM  ** TAKE INPUTS
73 CH =  PEEK ( - 16384) - 128
74  IF CH = 49 THEN MO = 1
75  IF CH = 51 THEN MO =  - 1
76  IF CH = 48 THEN FI = 1: POKE  - 16368,0
77  REM  ** MOVE YOU
78 YP = OP - (MO * 8)
79  IF YP > 274 THEN YP = 274
80  IF YP < 6 THEN YP = 6
81  XDRAW 1 AT OP,157
82  XDRAW 1 AT YP,157:OP = YP
83  GOSUB 117
84  REM  ** MOVE YOUR FIRE
85  IF FR < 0 AND FI = 1 THEN FI = 0: GOTO 88
86  IF FR =  > 0 THEN 89
87  GOTO 95
88 FR = 155:FQ = YP: GOTO 92
89 FR = FR - 30
90  XDRAW 3 AT FQ,FS
91  IF FR < 0 THEN 95
92  XDRAW 3 AT FQ,FR
93 FS = FR
94  GOSUB 114
95  REM  ** IS THERE AN INVADER
96  IF IN < 0 THEN IN = 5:JN =  RND (9) * 279:FU =  RND (9) * 11
    : XDRAW 2 AT JM,IM
97  REM  ** MOVE INVADER
98 IN = IN + 5
99  ON FU GOSUB 147,148,149,150,151,152,153,154,155,156
100  XDRAW 2 AT JM,IM
101  IF IN > 155 THEN IN =  - 1: GOTO 106
102  IF JN < 10 THEN JN = 270
103  IF JN > 270 THEN JN = 10
104  XDRAW 2 AT JN,IN
105 JM = JN:IM = IN
106  REM  ** INVADERS FIRE
107  IF MI < 0 THEN MI = 1:MJ = JM:NJ = IM: XDRAW 4 AT MJ,NJ:MK =
     MJ:NK = NJ
108 NJ = NJ + 20:MJ = MJ + ( SGN (YP - JM) * 18)
109  XDRAW 4 AT MK,NK
110  IF MJ > 279 OR MJ < 0 OR NJ > 159 THEN MI =  - 1: GOTO 73
111  XDRAW 4 AT MJ,NJ
112 MK = MJ:NK = NJ
113  GOTO 73
114  REM  ** HAVE YOU GOT A HIT
115  IF JN + 8 > FQ AND JN - 8 < FQ AND IN + 16 > FR AND IN - 22
      < FR THEN 120
116  RETURN
117  REM  ** HAVE THEY HIT YOU
118  IF MJ + 7 > YP AND MJ - 7 < YP AND NJ > 145 THEN 128
119  RETURN
120  REM  ** YOU HIT AN INVADER
121 SC = SC + 10
122  XDRAW 2 AT JN,IN
123 FI = 0:IN =  - 1
124  XDRAW 3 AT FQ,FR
```

FS — Previous vertical position of your missile.
FU — A random number between 0 and 10 inclusive, which will select a course for the invaders, see lines 146 to 156.
JM and IM — Previous co-ordinates of invader; JM for horizontal, IM for vertical.
JN and IN — Co-ordinates of invader: JN for horizontal, IN for vertical.
MI — Equal to −1 if invaders are not firing.
MJ and NJ — Co-ordinates of invaders' missiles: MJ for horizontal, NJ for vertical.
MK and NK — Previous co-ordinates of invaders' missiles: MK for horizontal, NK for vertical.
MO — Your direction of movement: −1 indicates left, 1 indicates right.
OP — Your previous horizontal position.
SC — Your score.
YP — Your horizontal position.
YH — Docking ship, your horizontal position.
YV — Docking ship, your vertical position.
ZH — Docking ship, your previous horizontal position.
ZV — Docking ship, your previous vertical position.

The Rems in the listing explain what each part of the program does. The shape table is stored in high resolution page 2, and high resolution page 1 is used for playing the game. To make the game harder or easier you could change:

- the invader movement functions in lines 146 to 156;
- they multiply-by-eight in line 78 to another value, to change speed;
- line 98, which controls the rate at which the invaders come down;
- line 203, which controls your commander's speed when you are docking your ship.

File parameter finder

HAVING RECENTLY obtained an Apple 2 Plus with a disc drive, DOS 3.3, Allan Ogg of Dumbarton noticed that you are left out in the cold if you want to disassemble a machine-code program or inspect a shape table if these are stored on disc and have been saved by someone else, e.g., by a software house or as on the system master diskette.

You can BLoad to a specified address, but you still have no idea of the length of the file, and a disassembled listing at the wrong addresses is very messy. This information is stored on the disc, so this program, which occupies less than 1K, will retrieve it.

The program uses the RWTS sub-

(continued on next page)

Binary file BSave parameter finder.

```
5   TEXT : HOME : SPEED= 255: VTAB 7: PRINT "BINARY FILE 'BSAVE' PARAMETER
      FINDER.": PRINT
10 BS = 8192:BE = 8221:DB = 8222:T = 8205:S = 8206:P = 11:Q = 221:R = 35
20  FOR I = BS TO BE: READ X: POKE I,X: NEXT
30  INPUT "FILENAME (NONE CANCELS) ";F$: IF F$ = "" THEN 220
40  GOSUB 1000
50  FOR I = P TO Q STEP R:FE = DB + I: IF  PEEK (FE) = 255 THEN 100
60  IF  PEEK (FE + 2) = 4 OR  PEEK (FE + 2) = 132 THEN 70
65  GOTO 100
70 N = 3: FOR J = 1 TO  LEN (F$)
80  IF  CHR$ ( PEEK (FE + N) - 128) <  >  MID$ (F$,J,1) THEN 100
90 N = N + 1: NEXT J: IF  PEEK (FE + N) = 160 THEN 130
100  NEXT I
110  IF L1 = 0 AND L2 = 0 THEN  PRINT "FILE NOT FOUND!": GOTO 220
120  POKE T,L1: POKE S,L2: GOTO 40
130  POKE T, PEEK (FE): POKE S, PEEK (FE + 1): GOSUB 1000
140  POKE T, PEEK (DB + 12): POKE S, PEEK (DB + 13): GOSUB 1000
150 AD =  PEEK (DB) + L1 * 256:D = AD: GOSUB 2000:AA$ = A$
160 LE = L2 +  PEEK (DB + 3) * 256:D = LE: GOSUB 2000:L$ = A$
170  PRINT : PRINT "PARAMETERS             DEC.      HEX."
180  PRINT : PRINT "ADDRESS =" TAB( 20);AD; TAB( 30);AA$
190  PRINT "LENGTH  =" TAB( 20);LE; TAB( 30);L$
200  DATA 169,32,160,9,32,217,3,96,0,1,96,1,0,17,15,26,32
210  DATA 30,32,0,0,1,96,0,96,1,0,1,239,216
220  END
1000  CALL BS:L1 =  PEEK (DB + 1):L2 =  PEEK (DB + 2): RETURN
2000 H$ = "0123456789ABCDEF":A$ = ""
2010 P =  INT (D / 16):Q = D - 16 * P:A$ =  MID$ (H$,Q + 1,1) + A$: IF P >
      0 THEN D = P: GOTO 2010
2020  RETURN
```

```
125  SCALE= 3: FOR R = 0 TO 127 STEP 8: POKE 768,250: POKE 769,3
     : CALL 770: ROT= R: XDRAW 5 AT FQ,FR: NEXT : SCALE= 1: VTAB
     23: HTAB 1: PRINT "SCORE ";SC: ROT= 0
126  IF SC = DS THEN DS = DS * 2: GOSUB 157
127 FR =  - 1: RETURN
128  REM  ** YOU ARE DESTROYED
129  FOR L1 = 1 TO 3
130  POKE 769,10: POKE 768,L1 * 80: CALL 770
131  FOR L2 = 7 TO 1 STEP  - 1
132  SCALE= (L2 / 2) + 1: ROT= L1 * 10
133  HCOLOR= L2
134  DRAW 5 AT YP,155
135  POKE 768,L1 * 40: POKE 769,5: CALL 770
136  NEXT : NEXT
137  REM  ** END
138  FOR P = 1 TO 50: NEXT P
139  TEXT : HOME : PRINT "YOU SCORED "SC
140  VTAB 10: PRINT "DO YOU WANT ANOTHER GAME <Y/N>";
141  CLEAR :FR =  FRE (0)
142  GET A$
143  IF A$ = "Y" THEN 31
144  IF A$ = "N" THEN  HOME : END
145  GOTO 142
146  REM  ** INVADERS MOVEMENT              EQUASIONS
147 JN = JN + 3: RETURN
148 JN = JN - 4.5: RETURN
149 JN = JN - 3: RETURN
150 JN = JN + 6: RETURN
151 JN = JN - 6: RETURN
152 JN = JN + 4.5: RETURN
153 JN = JN -  SIN (JN) * 20: RETURN
154 JN = JN +  SIN (JN) * 20: RETURN
155 JN = JN +  COS (JN) * 15:IN = IN -  SIN (IN) * 20: RETURN
156 JN = JN -  COS (JN) * 15:IN = IN -  SIN (IN) * 20: RETURN
157  REM
                          ** DOCK YOUR SHIP **

158  REM  ** GIVE BRIEFING AND            SET UP
159  HGR
160  PRINT : PRINT : PRINT : PRINT
161 IN =  - 1:MI =  - 1:YP = 140:OP = 140
162 YV = 80:YH = 30:ZH = 13
163  SPEED= 75
164  PRINT "YOUR COMMANDER IS PLEASED WITH YOU FOR  FIGHTING OFF
      THE ALIENS.THE COMMANDERS  SHIP WAS DAMAGED AND IS DRIFTIN
     G TO A   DEAD ALIEN WHERE IT WILL BLOW UP.YOUR   INSTRUCTIO
     NS ARE TO DOCK UP WITH THE    COMMANDERS SHIP AND SAVE HIM"

165  PRINT "            .": PRINT "             ": PRINT : PRINT
166  SPEED= 255
167  REM  ** SET UP SCREEN
168  ROT= 0: SCALE= 1
169  XDRAW 2 AT 243,150: XDRAW 2 AT 273,150
170  ROT= 32: XDRAW 2 AT 258,147
171 CV = 40
172  ROT= 0
173  HCOLOR= 7
174  DRAW 7 AT 250,CV
175  HCOLOR= 5
176  DRAW 6 AT 250,CV
177  POKE 768,100: POKE 769,100: CALL 770: POKE 769,10: CALL 770

178  REM  ** TAKE INPUTS
179  FOR L1 = 1 TO 4
180 CH =  PEEK ( - 16384) - 128
181  IF CH = 21 THEN YH = YH + 3
182  IF CH = 87 THEN YV = YV - 2
183  IF CH = 90 THEN YV = YV + 2
184  REM  ** MOVE YOU
185  IF YV > 140 THEN YV = 140
186  IF YV < 10 THEN YV = 10
187  HCOLOR= 0: DRAW 8 AT ZH,ZV: DRAW 9 AT ZH,ZV
188  DRAW 10 AT ZH - 12,ZV
189  HCOLOR= 7: DRAW 8 AT YH,YV
190  HCOLOR= 6: DRAW 9 AT YH,YV
191  IF L1 / 2 =  INT (L1 / 2) THEN  HCOLOR= 5: DRAW 10 AT YH -
     12,YV
192 ZH = YH:ZV = YV
193  IF L1 < 4 THEN  FOR P = 1 TO 15:SO =  PEEK ( - 16336): NEXT

194  REM  ** CHECK FOR DOCK
195  IF YH > 247 AND YV > CV - 4 AND YV < CV + 3 THEN  PRINT "WE
     LL DONE YOU HAVE SAVED HIM.YOU GET AN  EXTRA 30 PTS.": FOR
     P = 1 TO 200: POKE 769,9: POKE 768, ABS (100 - P): CALL 770
     : NEXT P:SC = SC + 30: GOTO 211
196  REM  ** CHECK FOR CRASH              INTO COMMANDER
197  IF YH > 247 AND YV > CV - 14 AND YV < CV + 15 THEN  PRINT "
     YOU CRASHED INTO YOUR COMMANDER": FOR P = 1 TO 2: FOR L = 1
      TO 200: ROT= L: SCALE= P: XDRAW 5 AT 250,CV: POKE 769,3: POKE
     768, ABS (100 - L): CALL 770: NEXT : NEXT : GOTO 138
198  REM  ** CHECK FOR MISSED             COMMANDER
199  IF YH > 247 THEN  PRINT "YOU HAVE MISSED YOUR COMMANDERS SH
     IP SO  YOU DON'T GET ANY EXTRA POINTS.": PRINT  CHR$ (7): FOR
     P = 1 TO 300:SO =  PEEK ( - 16336): NEXT P: PRINT  CHR$ (7)
     : GOTO 211
200  NEXT
201  REM  ** MOVE COMMANDER
202  HCOLOR= 0: DRAW 7 AT 250,CV: DRAW 6 AT 250,CV
203 CV = CV + 2
204  HCOLOR= 7: DRAW 7 AT 250,CV
205  HCOLOR= 5: DRAW 6 AT 250,CV
206  REM  ** HAS COMMANDER                CRASHED
207  IF CV > 130 THEN  PRINT : PRINT : PRINT "YOU FAILED AND YOU
     R COMMANDER CRASHED": PRINT : FOR O = 1 TO 3: FOR P = 1 TO
     64 STEP 8: ROT= P: SCALE= (P / 16) + 1: POKE 768,(P * 4) -
     1: POKE 769,5: CALL 770: XDRAW 5 AT 250,CV: NEXT : NEXT
208  IF CV > 130 THEN 211
209  GOTO 179
210  REM  ** SET UP FOR INVADER            ROUTINE & LEAVE
           DOCK SHIP
211  HGR : FOR I = 1 TO 150: HCOLOR= ( RND (9) * 7) + 1: HPLOT  RND
     (9) * 280, RND (9) * 160: NEXT : PRINT : PRINT : PRINT : PRINT
     : XDRAW 1 AT YP,157
212  SPEED= 75
```

Parameter finder subroutines.

RWTS call subroutine.

```
]CALL-151

*2000L

2000-    A9 20          LDA    #$20
2002-    A0 09          LDY    #$09
2004-    20 D9 03       JSR    $03D9
2007-    60             RTS
```

DOS IOB and device characteristic table.

```
2008-    00             BRK
2009-    01 60          ORA    ($60,X)
200B-    01 00          ORA    ($00,X)
200D-    11 0F          ORA    ($0F),Y
200F-    1A             ???
2010-    20 1E 20       JSR    $201E
2013-    00             BRK
2014-    00             BRK
2015-    01 60          ORA    ($60,X)
2017-    00             BRK
2018-    60             RTS
2019-    01 00          ORA    ($00,X)
201B-    01 EF          ORA    ($EF,X)
201D-    D8             CLD
201E-    C0 DD          CPY    #$DD
2020-    8C C0 68       STY    $68C0
```

Program data.

```
*2000

2000- A9
*
 20 A0 09 20 D9 03 60
*

2008- 00 01 60 01 00 11 0F 1A
*

2010- 20 1E 20 00 00 01 60 00
*

2018- 60 01 00 01 EF D8 C0 DD
*FF
```

(continued from previous page)

routine. It should be convertable to DOS 3.2 with only a few changes to the file-search routine, as the IOB and device-characteristic table are the same format. The RWTS call locations should be easily relocated if necessary — they were placed in high-resolution screen one for simplicity.

The program first sets the RWTS subroutine to read in the first directory sector — track 17, sector 15. It then asks for a file name and enters a loop to search the seven file entries held on each directory sector. The files are rejected if the entry is a deleted file, not binary then finally if the file-name does not match.

If the file is not found, the program reads in the next, if any, directory sector and searches again. It continues until the file is found or the directory ends. Once found, the program reads in the file's Track/Sector List from the disc, and from that it reads in the first file sector which contains the necessary information. The parameters are then printed out in decimal and hexadecimal for convenience. The copy of the program gives the parameters of binary files supplied on the system master diskette.

Parameter finder sample run.

```
FILENAME (NONE CANCELS) BOOT13

PARAMETERS          DEC.        HEX.

ADDRESS =           5888        1700
LENGTH  =           2288        8F0

FILENAME (NONE CANCELS) COPY.OBJ0

PARAMETERS          DEC.        HEX.

ADDRESS =           704         2C0
LENGTH  =           267         10B

FILENAME (NONE CANCELS) FID

PARAMETERS          DEC.        HEX.

ADDRESS =           2051        803
LENGTH  =           4686        124E

FILENAME (NONE CANCELS) FPBASIC

PARAMETERS          DEC.        HEX.

ADDRESS =           53248       D000
LENGTH  =           12288       3000

FILENAME (NONE CANCELS) INTBASIC

PARAMETERS          DEC.        HEX.

ADDRESS =           4096        1000
LENGTH  =           12288       3000

FILENAME (NONE CANCELS) MASTER CREATE

PARAMETERS          DEC.        HEX.

ADDRESS =           2048        800
LENGTH  =           1791        6FF

FILENAME (NONE CANCELS) MUFFIN

PARAMETERS          DEC.        HEX.

ADDRESS =           2051        803
LENGTH  =           6397        18FD

FILENAME (NONE CANCELS)
```

Source list

I BECAME AWARE of the need for this program while enhancing Apple Spiel and converting it to machine code, writes Neil Lomas of Crewe, Cheshire. The assembly-code routines are now approaching 2,000 lines and take nearly an hour to compile if producing a hard-copy listing.

When creating or amending hundreds of lines of assembly code, there is bound to come a time — however good the editor — when a hard copy of some or all of the code would be helpful. The Editor/Assembler on the DOS Toolkit will only output to the printer during the assembly phase, which causes many errors to be printed where references are made to labels which have not yet been input.

Source List will produce a formatted listing of any part of a source text file. The formatting is semi-intelligent in that the first three spaces on any line are treated as tabs, without regard to context. This produces a listing which closely resembles the screen listing output by the editor. Six blank lines are thrown after every 60 source lines. Where only part of the source is being printed, the decision to throw blank lines depends on the line numbers, not on the number of lines.

When run, the program asks for the name of the source file and the disc drive number — the slot number is assumed to be the current one — together with the first and last line numbers to be printed. To print to the end of the file, any suitably high end line number may be given.

Although intended for use with the DOS Toolkit Assembler, it should work equally well with any assembler which stores source as serial text files. If your printer does not support line feed, you will need to change line 120. All line numbers ending in 9 may be omitted. There are no Goto's referring to Rem lines.

Source list.

```
10   REM  ASSEMBLER SOURCE LISTER - N. LOMAS DEC 1981
20   GOTO 250
99   REM  FINISH IF PAST END POINT
100   IF Y% > B% THEN 500
109   REM  DON'T PRINT IF START NOT REACHED
110   IF Y% <  = A% THEN 130
119   REM  PRINT LF'S IF PAGE THROW DUE
120   IF 60 *  INT ((Y% - 1) / 60) = Y% - 1 THEN  PRINT L$;L$
      ;L$;L$;L$;L$
130   PRINT D$;"READ ";F$
139   REM  READ NEXT CHAR FROM FILE
140   GET Z$: PRINT D$
149   REM  END OF LINE IF 'RETURN'
150   IF Z$ <  >  CHR$ (13) THEN 175
159   REM  PRINT LINE IF START REACHED
160   IF Y% >  = A% THEN  PRINT Y$
169   REM  UPDATE LINE NO AND START NEXT LINE
170  Y% = Y% + 1:Y$ =  RIGHT$ ("    " +  STR$ (Y%),4):Y$ = Y$ +
      " ":Z =  FRE (0): GOTO 100
175   IF Y% < A% THEN 130
179   REM  APPEND CHARACTER TO LINE IF NOT SPACE
180   IF Z$ <  > " " THEN Y$ = Y$ + Z$: GOTO 130
189   REM  ADD SPACES TO REACH NEXT TAB
190   IF  LEN (Y$) < 13 THEN Y$ =  LEFT$ (Y$ + "         ",13)
      : GOTO 130
200   IF  LEN (Y$) < 18 THEN Y$ =  LEFT$ (Y$ + "     ",18): GOTO
      130
210   IF  LEN (Y$) < 28 THEN Y$ =  LEFT$ (Y$ + "          ",2
      8): GOTO 130
219   REM  IF LAST TAB PASSED, ADD SPACE
220  Y$ = Y$ + Z$: GOTO 130
250   TEXT : HOME
260   INVERSE : PRINT  SPC( 40)
270   FOR I = 2 TO 22: VTAB I: HTAB 1: PRINT " ";: HTAB 40: PRINT
      " ";: NEXT
280   VTAB 23: HTAB 1: PRINT  SPC( 40): VTAB 5: HTAB 2: PRINT
       SPC( 38);: NORMAL : POKE 33,30: POKE 32,9
290   VTAB 3: HTAB 5: PRINT "SOURCE LISTER": VTAB 12
300   INPUT "FILENAME: ";F$
310   INPUT "DRIVE NO: ";D%
320   INPUT "START LINE NO: ";A%
330   INPUT "END   LINE NO: ";B%
340  D$ =  CHR$ (4):I$ =  CHR$ (9):L$ =  CHR$ (10): POKE 32,0
      : POKE 33,40
350   PRINT D$;"OPEN ";F$;",D";D%
360  Y% = 1:Y$ = "   1 "
370   ONERR  GOTO 500
380   PRINT D$;"PR#1"
390   PRINT I$;"K";I$;"80N";: PRINT
400   GOTO 100
500   PRINT
510   PRINT D$;"PR#0"
520   PRINT D$;"CLOSE"
```

Sharp printer interface

THIS SHORT ROUTINE for the Sharp MZ-80K by Simon Brown of Tunbridge Wells, Kent, enables you to output codes to a printer which are otherwise unprintable. For example, the code for Escape is 27 decimal but CHR$(27) in Basic is converted to a null by the interpreter. Any printer control codes using unprintable numbers are not readily available to the Basic programmer.

This machine-code subroutine uses subroutines in Sharp Basic SP-5025 to output one or more code numbers to the printer. For example,

USR (PR), 27, 65, 1

would send ESC A <1> to the printer, which is the Epson MX-80 instruction to set the line spacing to 1/72in. The routine should interest Sharp users because it illustrates the use of several of the Basic subroutines.

Printer Interface.

```
12 REM USR(PR),exp1,exp2,...,expN is equivalent to
13 REM PRINT/P CHR$(exp1);CHR$(exp2);...;CHR$(expN);
14 REM For example,USR(PR),27,65,1 outputs ESC A <1> which sets the
15 REM line spacing for EPSON MX80 printers to 1/72".
16 REM However the advantage of the routine is that it allows you to output
17 REM codes to the printer which would normally be converted tq nulls by the
18 REM BASIC interpreter.
19 REM Thus it is now possible to use the full set of printer control codes
20 REM conveniently.
21 REM NOTE-This routine uses subroutines within Sharp BASIC SP-5025.
22 REM
23 REM The following code sets up the routine and is executed by GOSUB 1000.
999 REM≣≣≣≣≣  set up printer interface routine  ≣≣≣≣≣
1000 PR=50000:LIMIT PR
1010 FOR I=0 TO 22
1020 READ E:POKE PR+I,E
1030 NEXT
1040 E=PR+19
1050 POKE PR+15,E-256*INT(E/256)
1060 POKE PR+16,INT(E/256)
1070 RETURN
1100 DATA 205,151,22,44,205,169,25,123,205,119,60
1110 DATA 205,139,22,44,0,0,24,241,34,1,72,201
1999 REM≣≣≣≣≣  Z80 source code  ≣≣≣≣≣
2000 REM SEND    CALL 1697H       ;skip first comma
2010 REM         DEFB ","         ;
2020 REM SEND1   CALL 19A9H       ;evaluate expression into DE
2030 REM         LD A,E
2040 REM         CALL 3C77H       ;send code to printer
2050 REM         CALL 168BH       ;look for comma
2060 REM         DEFB ","         ;if not present
2070 REM         DEFW EXIT        ;jump to EXIT
2080 REM         JR SEND1         ;else loop back to SEND1
2090 REM EXIT    LD (4801H),HL    ;move text pointer past USR statement
2100 REM         RET              ;return to BASIC
```

Upgrading to Z-80B

RECENT COVERAGE given to the Z-80B processor chip has led to a number of people inquiring about the possibility of replacing standard Z-80 or Z-80A central processor units in their microcomputers with the faster Z-80B, writes John Parker. The substitution is possible, but before it is carried out the following points should be noted. Whatever make or type of microcomputer is involved, the basic configuration will be the same, and the same considerations will apply.

The Z-80B CPU is functionally identical to all other versions of the Z-80. The A and B variants are simply graded examples of the basic chip. Minor variations in the production process mean that some chips are capable of working up to a higher clock frequency than others: a chip is tested to 10MHz before it is given a B designation, though Zilog will not guarantee performance above 6MHz.

The old Z-80 CPU can be unplugged and replaced by a Z-80B, and the system will continue to work perfectly well. The problems only start when the clock frequency is increased.

A complete microcomputer consists not just of a CPU but must also include ROM, RAM, I/O, etc., to enable it to store programs and data and to communicate with external devices. These peripheral devices form part of the microcomputer and must be capable of operating at the same speed as the CPU. The Z-80 has an associated family of peripheral devices — PIO, CTC, SIO, DART, etc. — which are all graded in the same way as the CPU. If a Z-80B is substituted for a basic Z-80, the clock frequency cannot be increased without upgrading the system's peripheral devices at the same time.

During an op-code fetch cycle, the first T state is used for loading program-counter address information to memory. During the memory's access time, the second T state increments the program counter. The third T state is used for loading memory output data into the instruction register or accumulator. If the memory's access time exceeds the length of the second T state, there will be no data on the memory's output bus when the processor requires it.

The length of one T state represents the microprocessor's clock period — which is 500ns. at 2MHz. At this speed, low-cost 450ns. access time memories can be used. At 6MHz, the clock period is 167ns., which is considerably less than the original memory's access time. To enable the system to work at the higher speed, it will be necessary to use memories with a shorter access time, or at least to check that the original memories have this capability.

The printed-circuit board and layout for your microcomputer will have been designed for the maximum clock frequency of the original CPU. At 6MHz, impedances created by capacitance effects will be correspondingly less, which could be a problem if, for example, unbuffered lines are used on data/address buses and clock outputs.

Remember that changing the clock crystal may not necessarily change the clock frequency as required, which will depend on the clock chip or oscillator employed. In some cases, changing the crystal will suffice, but in others, certain other components will have to be changed to accommodate the new resonant frequency.

Nascom backgammon

IT ALWAYS SEEMS that the interesting programs are written for other people's machines writes Y. T. Ho from Kuala Lumpur, Malaysia. To modify the Backgammon program — *Practical Computing May 1981* — by Bob Snell and Barbara Colley for the Nascom 2 here are some suggestions:

- The Get command is given in the Nascom manual.
- The cursor commands for the Pet may be replaced by ASCII CHR$(18) to CHR$(20).
- As the number of lines on the Nascom is limited follow the printer display shown.
- To generate a truly random drive routine replace the original program lines with:

```
9 GOSUB 91:GOSUB 96:
  I=RND(-G1 *10): O=-1
251 G=USR (0):G1=RND(1):
  IF G=0THEN 251
252 A$=CHR$ (G): RETURN
```

This samples the pseudo-random sequence RND(1) at varying intervals, depending on the time taken by the player for his responses.

Atom EPROM programmer

THE ACORN ATOM has a vacant expansion socket inside for a utility ROM which will accommodate up to a 4K by eight-bit device, writes John Flower of Cowplain, Hampshire. The EPROM which can be fitted is the 2532, which is made by Texas Instruments and a number of Japanese suppliers. This device is a 32K chip organised as 4,000 words of eight bits. The chip is readily available for about £6.

You can program your favourite game or a useful machine-code routine on to this device so that it can become a permanent part of your computer's operating system. You could even write your own toolkit program. The 2532 EPROM is remarkably easy to program with the Atom since most of the necessary circuitry for an EPROM programmer is already inside the Atom's VIA chip. If you decide to have a go at building this design then you will have to buy and fit the optional 6522 versatile interface adaptor chip to your machine.

For a programmer interface you only need to provide an address latch externally to address each location in turn while the data is presented and the programming operation takes place. The circuitry consists of two LS374 eight-bit latches to hold the address word plus a zero-insertion-force socket to carry the EPROM without risk of bending the pins.

Pin 21 of the 2532 EPROM is connected to +5 volts when reading data. Data is read by pulsing pin 20 low while looking at the data pins. The device works in reverse if pin 21, which is normally held to 5 volts, is taken to 25 volts. In this case data present at the data pins is programmed into the eight locations whose address is present at the address pins. This happens if pin 20 is pulsed low for exactly 50ms.

The program performs the necessary operations to copy, program and verify EPROMs. Programs to be copied from an EPROM or to be programmed into one are stored in the graphics memory from location #8400 onwards. The program is menu driven and prompts to see what operations you wish to perform.

The VIA chip writes the relevant address on to ports A and B and clocks the address latch to store the 12-bit address. Then the eight-bit data is either presented to or read from port B.

Construction of the circuit should present little difficulty. Only two integrated circuits are involved, plus four resistors, two diodes, an npn transistor and one capacitor. You will need to fit an Acorn bus connector to your computer and buy the appropriate 64-way Eurocard DIN connector mating socket.

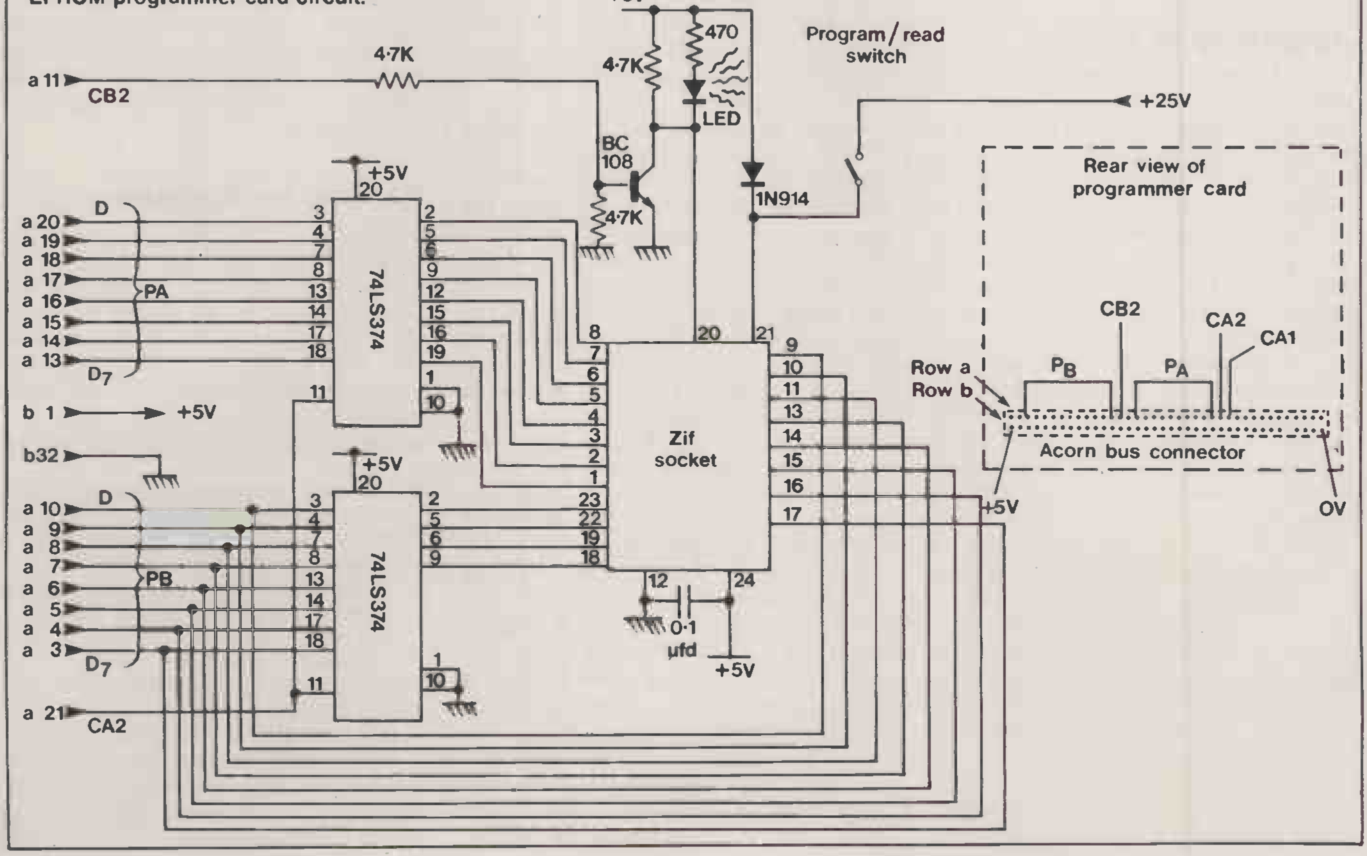
The circuit diagram shows the bus connections that are used, viewed from the rear of the programmer card. The 64-way right-angle plug is fitted to the Atom, and the socket is fitted to a piece of Veroboard upon which the programmer is to be constructed.

The light-emitting diode serves to show that Read or Write operations are taking place. The other diode — 1N-914, or similar — ensures that +5V is connected to pin 21 of the EPROM when normal reading of the device occurs. When +25V is applied to the device for programming purposes, the diode becomes reverse-biased so that the 5V power supply is not affected. It is very important to connect this diode the right way round to avoid serious damage to the computer's power supply. The anode of the diode must be connected to the Atom's +5V supply. The cathode is usually marked by a thick painted ring on the diode body and should be connected to pin 21 and the programming switch.

After constructing the circuit you do not need the programmer card to prove that the program is working: with the card unplugged the program will copy

(continued on page 156)

EPROM programmer card circuit.



TRADE AND EXPORT

Definitely the very best deal for

O.E.M., DISTRIBUTORS AND DEALERS

throughout Europe

THE SINGLE SOURCE FOR MICROCOMPUTER EQUIPMENT, PERIPHERALS, SUPPLIES AND SOFTWARE

EPSON – ANADEX – TEXAS INSTRUMENTS – QUME – DIABLO – NEC – RICOH – OKI – CENTRONICS – TEC – OLYMPIA – ADLER – APPLE – COMMODORE – HITACHI – SHUGART – CONTROL DATA – BASF – FACIT – FUJITSU – PRINTRONIX – DATA PRODUCTS – OLIVETTI – ETC. ETC.

Obtain substantial savings by combining your purchases with hundreds of other trade buyers throughout Europe

- **No commitment to purchase minimum quantity**
- **Parts and labour warranty**
- **Fast delivery**

Telephone or write for details of

INFORMEX CONSORTIUM PURCHASE SCHEME

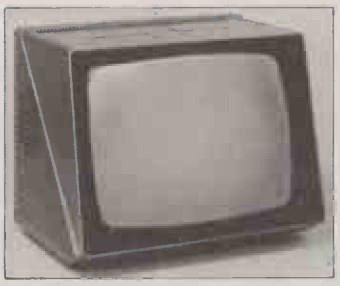
INFORMEX-LONDON LTD
8-12 Lee High Road, London SE13 5LQ
Tel: 01-318 4213 (10 lines) Telex: 892622

INFORMEX

AGENTS REQUIRED WORLDWIDE

● Circle No. 188

9" PM 101



12" PRINCE in Apple colours.

Become part of our Dealer Network.

Buy from us! We'll sell for you.

Our Monitors probably offer the best cost/performance ratio available.

Send or phone for data.

CROFTON ELECTRONICS LIMITED

35 GROSVENOR ROAD, TWICKENHAM,
MIDDLESEX TW1 4AD
Telephone 01-891 1923/01-891 1513
Telex 295093 CROFTN G

● Circle No. 189

PHOTO ACOUSTICS LTD

THE ONE STOP COMPUTER SHOP—

VIC 20 computer	£189.95
Expansion box	£97.95
3K RAM packs	£29.95
8K RAM pack	£44.95
16K RAM pack	£74.95
Joysticks	£10.00
C2N cassette deck	£44.95

★★ Software Available ★★

CBM 8032	£875.00
CBM 8050	£875.00
CBM 8026	£1,006.00
CBM 4032	£690.00
CBM 4040	£690.00
CBM 4022	£399.00

These prices are Cash and Carry. Ring Dick at Watford for quote.

Apple II computer	£784.00
Disc drive + cont.	£384.00
Disc drive without	£301.00
Eurocolor card	£70.00
9" Hi-res B/W monitor	£99.00
9" Hi-res green monitor	£110.00
12" B/W monitor	£79.00
12" green monitor	£87.00

★★ Games software avail. ★★

Genie I computer	(Ring for quote)
EG3014 Expansion	£228.00
EG3013 Expansion	£234.00
EG3013/WExpansion	£264.00
EG400 disk drive	£243.00
12" B/W monitor	£79.00
12" green monitor	£87.00

★★ Software avail. ★★

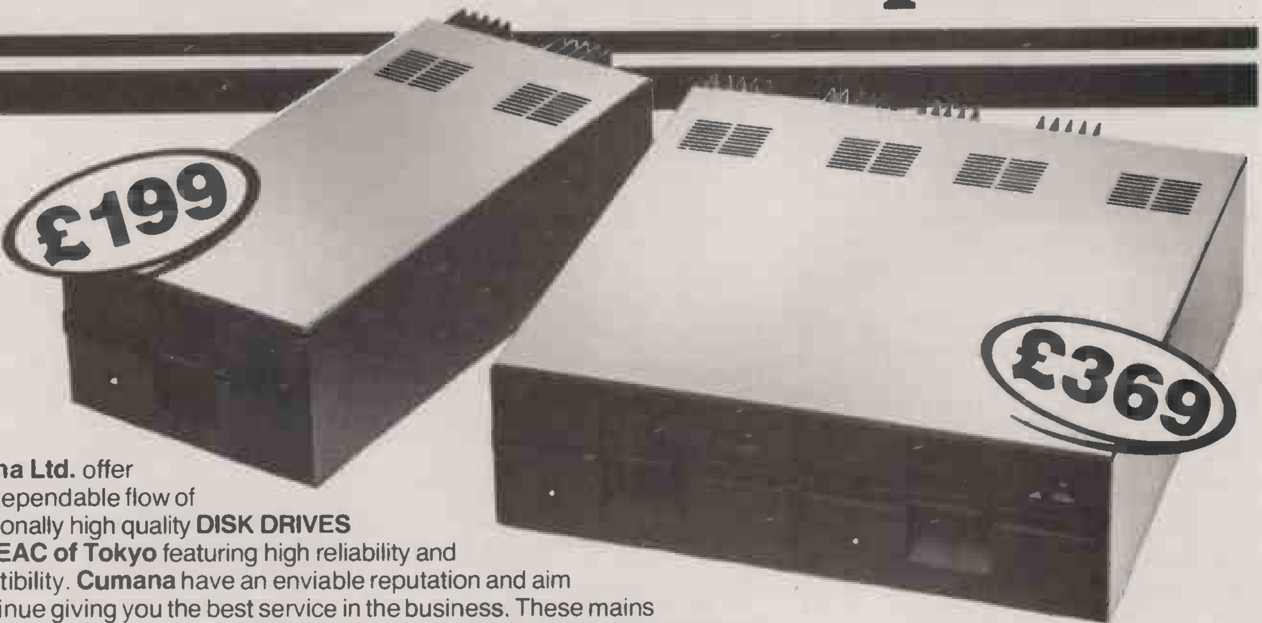
58, High Street
Newport Pagnell
Bucks.
Tel: 0908 610625

255a St. Albans Road,
Watford, Herts.
(entrance in Judge Street)
Tel: 0923 32006

ALL PRICES INCLUDE VAT
CREDIT CHARGE MAIL ORDER

● Circle No. 190

Better buy Cumana strictly dependable top Quality Products like TEAC... like no one else for price!



Cumana Ltd. offer you a dependable flow of exceptionally high quality **DISK DRIVES** from **TEAC of Tokyo** featuring high reliability and compatibility. **Cumana** have an enviable reputation and aim to continue giving you the best service in the business. These mains powered Disk Drive units are designed to interface to a wide range of computers such as **TRS 80 models I** and **III. Genie I** and **II, SWTP, Heathkit, Superbrain, Nascom** and the **BBC Micro, Model B.**

Floppy Disk Drives 40 and 80 Track Cased Units

Single Disk Units		Dual Disk Units		Disk Drive Cables	
1x40 Track single sided Drive	**£199**	2x40 Track single sided Drives	**£369**	2 Drive Cable	**£15.00**
1x80 Track single sided Drive	**£265**	2x80 Track single sided Drives	**£495**	4 Drive Cable	**£25.00**
1x80 Track double sided Drive	**£429**	2x80 Track double sided Drives	**£799**		

Please add VAT to all prices. Delivery at cost will be advised at time of order.

CUMANA LTD 35 Walnut Tree Close, Guildford, Surrey GU1 4UN. Telephone: (0483) 503121. Telex: 858306.

Call your nearest dealer for a demonstration: *Write or 'phone for Data Sheets – **Dealer and O.E.M. enquiries welcome.***

RADIO SHACK LTD., London NW6. Tel: 01-624-7174
COMPSHOP LTD., New Barnet, Herts. Tel: 01-441-2922
COMPSHOP LTD., London W2. Tel: 01-262-0387
COMPSHOP LTD., Dublin 2. Tel: 604165
LONDON COMPUTER CENTRE, London W1. Tel: 01-388-5721
N.I.C. London N15. Tel: 01-808-0377
CROYDON COMPUTER CENTRE, Thornton Heath, Surrey. Tel: 01-689-1280
P J EQUIPMENT LTD., Guildford. Tel: 0483-504801
R.D.S. ELECTRICAL LTD., Portsmouth. Tel: 0705-812478
TANDY HASTINGS LTD., Hastings. Tel: 0424-431849
MICROWARE COMPUTING SERVICES, Bristol. Tel: 0272-279560
BLANDFORD COMPUTERS, Blandford Forum. Tel: 0258-53737
TAPE SHOP Brighton. Tel: 0273-609099
PARWEST LTD., Chippenham. Tel: 0249-2131
COMPUTER SHACK Cheltenham. Tel: 0242-584343
TANDY GLOUCESTER, Gloucester. Tel: 0452-31323
COMSERVE, Bedford. Tel: 0234-216749
CLEARTONE COMPUTERS, Abercarn, Gwent. Tel: 0495-244555
EMPRISE LTD., Colchester. Tel: 0206-865926
MAGNUS MICRO-COMPUTERS, Kidlington, Oxford. Tel: 08675-6703
CAMBRIDGE COMPUTER STORE, Cambridge. Tel: 0223-65334
I.C. ELECTRONICS, Biddenden, Kent. Tel: 0580-291816
MICRO CHIP SHOP, Fleetwood, Lancs. Tel: 03917-79511
HARDEN MICRO-SYSTEMS, Blackpool. Tel: 0253-27590
AMBASSADOR BUSINESS COMPUTERS LTD., Shipley, W. Yorks. Tel: 0274-595941
Q-TEK SYSTEMS LTD., Stevenage, Herts. Tel: 0438-65385
COMPUTER & CHIPS, St. Andrews, Fife, Scotland. Tel: 0334-72569
HEWART MICRO-ELECTRONICS, Macclesfield. Tel: 0625-22030
KARADAWN LTD., Great Sankey, Warrington. Tel: 0925-572668
PHOTO-ELECTRICS, Sheffield. Tel: 0742 53865
ARC ELECTRONICS, Nr. Wakefield, W. Yorks WF2 6SL. Tel: 0924-253145
VICTOR MORRIS LTD., Glasgow, G2 8LY. Tel: 041-221 8958
COMPRITE LTD., Laisterdyke, Bradford. Tel: 0274-663471
GNOMIC LTD., Blackhall, Hartlepool. Tel: 0783-863871
BRIERS COMPUTER SERVICES, Middlesbrough, Cleveland. Tel: 0642-242017
3 LINE COMPUTING Hull. Tel: 0482-445496
H.C. COMPUTER SALES LTD., Gateshead. Tel: 0632-874811
EWL COMPUTERS LTD., Glasgow. Tel: 041-332-7642
EVERYMAN COMPUTING, Westbury, Wilts. Tel: 0373-864644

● **Circle No. 191**

(continued on page 152)

FF into each screen RAM location. You can check this by first clearing the mode 4 screen, then adding line 95

?#B000 = #F0

Running the EPROM copy routine will let you see the memory being filled, which takes about four minutes. The verify routine reads the EPROM and compares it with the contents of the screen RAM. Any errors will be listed and a simple check-sum is computed by adding the decimal contents of each location together. See if the answer for the all-#FF case comes to 4,096 × 255.

Having satisfied yourself that the program works plug in the programmer card and set the Read/Program switch to Read, connection to +25V open-circuit. The diode has been connected correctly if you can measure 5V on pin 21 of the ZIF socket.

The light-emitting diode should flash during the Copy, Verify and Program modes. If it does not, it may be connected around the wrong way, so try reversing it. Next insert line 95 to watch the memory being loaded with the copy routine. If you short-circuit pin 20 to each data pin in turn on the ZIF socket, you can see from the bit pattern whether each data bit is being read. Do not try to fit an EPROM or connect 25V until you are satisfied that everything is in order.

Try reading an EPROM or ROM. You could unplug and read the floating-point ROM if you have a fully expanded Atoms. When you are ready to program a 2532 EPROM you can connect a 25V supply to the programmer card: four 6V transistor radio batteries connected in series are a simple way of obtaining it.

If you follow the program instructions to the letter, there should be no problem in programming your own EPROMs, and when you can program EPROMs, you will soon want to erase them. Unfortunately there is no simple method of doing so: intense ultraviolet radiation at a wavelength of 275.8nm, is required.

You can buy small fluorescent tubes which radiate at the correct frequency, but if you make your own eraser it is essential to mount the tube in a light-tight box to protect the eyes from harmful UV radiation. EPROMs to be erased should be exposed for about 20 minutes about 3cm. from the tube. Commercial erasers usually have an automatic timer and safety cut-out switch to disconnect the light if the box is opened. Be careful with the erase timing since too much UV bombardment can shorten the number of program-erase cycles obtainable from the EPROM.

Programmer card component list.

Component	Quantity	Comments
74LS374	2	eight-bit latch
BC108	1	transistor; any npn switcher will do)
1N914	1	diode (any 50V PIV diode suitable)
LED	1	any type
4,700ohm resistor	3	
470ohm resistor	1	may be omitted if diode LED not fitted
Single-pole switch	1	

64-way Eurocard DIN connectors (plug and socket)
Verocard or similar prototyping card, about 5in. square
24-pin zero-insertion-force socket

UV lamps can be obtained from Watford Electronics, 33-35 Cardiff Road, Watford, Hertfordshire.

EPROM programmer.

```
10DIMT(1);@=5;?#208=#55;?#880C=#CC
15P.$12"    2532 eProm Programmer"'''
20REMc J C FLOWER 1981
25P."PROGRAMS MUST RESIDE IN"'
30P."4K BYTES STARTING AT #8400"'
35P."DO YOU WISH TO PROGRAM (P)"'
40P."COPY (C) OR VERIFY (V)"''';P."enter letter"''';INPUT$T
45 IF$T="P" GOS.a
50 IF$T="C" GOS.b
55 IF$T="V" GOS.c
60 G.15
65bP.$12;P.''"   eProm copying facility"''
70P."check THAT READ/PROGRAM SWITCH"'"IS ON read"''
75P."INSERT EPROM WITH PIN 1 ADJACENT"'"TO ZIF SOCKET LEVER."
80P.'''"WHEN READY, Press a letter key"
85LINK#FFE3;P.$12'''''
90P."        "$128"reading"$128"eprom"$128'''
95B=0;A=0;?#B80C=#CC;C=#8400;Z=0;S=0;?#E1=0
100DO
105?#B80E=#00
110?#B802=#FF;?#B803=#FF
115?#B800=A;?#B801=B
120?#B80C=#CE;?#B80C=#CC
125?#B802=#00
130?#B80C=#EC;?C=?#B800;S=S+?#B800
135?#B80C=#CC;C=C+1
140P.(B+Z)'$11;B=B+1
145IF B=256 A=A+1;B=0;Z=A*256
150UNTIL B=0 AND A=16
155P.'''"checksum="S'"PRESS A KEY";LINK#FFE3
160R.
165aP.$12;P.'"   eProm Programming facility"''
170P."check THAT READ/PROGRAM SWITCH"'"IS ON read"''
175P."EPROM WILL BE PROGAMMED WITH 4K"'"BYTES STARTING AT LOC."
180P." #8400"''"INSERT EPROM WITH PIN 1 ADJACENT"'
185P."TO ZIF SOCKET LEVER."''
190P."WHEN READY, SWITCH READ/PROGRAM"'"SWITCH TO Program"'
195P."Press"$128"a"$128"letter"$128"key";LINK#FFE3
200P.$12'''''"       "$128"Programming"$128"eProm"$128'''
205B=0;A=0;C=#8400;Z=0;?#E1=0
210DO
215?#B80E=#00
220?#B802=#FF;?#B803=#FF
225?#B800=A;?#B801=B
230?#B80C=#CE;?#B80C=#CC
235?#B800=?C;?#B80C=#EC;WAIT;WAIT;WAIT;?#B80C=#CC;C=C+1
240P.(B+Z)'$11;B=B+1
245IFB=256 A=A+1;B=0;Z=A*256
250UNTIL B=0 AND A=16
255P.$7$7$7$7$7$7$7$7$7$7$12''''"SWITCH READ/PROGRAM SWITCH"'
260P." TO read"''"Press a letter key";LINK#FFE3
265R.
270cP.$12;P.'"   eProm verifying facility"''
275P."check THAT READ/PROGRAM SWITCH"'"IS ON read"''
280P."EPROM CONTENTS ARE COMPARED WITHTHE CONTENTS OF"
285P." MEMORY.STARTING AT LOC.#8400"'"ERRORS WILL LIST"
290P.'''"press"$128"a"$128"letter"$128"key";LINK#FFE3
295P.$12'''''"       "$128"verifying"$128"eProm"$128'''
300B=0;A=0;C=#8400;Z=0;S=0;?#E1=0
305DO
310?#B80E=#00
315?#B802=#FF;?#B803=#FF
320?#B800=A;?#B801=B
325?#B80C=#CE;?#B80C=#CC
330?#B802=#00
335?#B80C=#EC;V=?#B800
340?#B80C=#CC
345P.(B+Z)'$11
350IF V=?C G.360
355P."ERROR AT "(B+Z),&V'
360C=C+1;B=B+1;S=S+V
365IF B=256 A=A+1;B=0;Z=A*256
370UNTIL B=0 AND A=16
375P.'"checksum",S'"PRESS A KEY";LINK#FFE3
380R.
```

Volume and Hunt

THIS PROGRAM by Roy Carnell of Kirkcaldy, Fife is designed for use on the 1K ZX-81. It will calculate the volume of a cylinder, sphere or cuboid and display the answer in cubic centimetres, litres and gallons. To use it input the measurements in centrimetres of each dimension when asked for by the computer.

Hunt is a game for the 1K ZX-81 in which you are the hunter and the hunted. To score points you must guide your marker O to intercept the moving *, at the same time avoiding the X which gobbles up everything in its path.

The game ends when you have been "chomped" by the X. To move your marker use keys 5, 6, 7 and 8. Your O will move in the direction of the arrows on the keyboard.

10-pin bowling

THIS PROGRAM by G L Stoneman of Wigan, Lancashire is a novel computer simulation of the popular bowling-alley game. The computer prints out the pins before each ball is bowled and automatically keeps your score.

There are 10 frames per game with two balls per frame. If you are lucky enough to make a strike — by knocking down all 10 pins with the first ball of a frame — you are awarded 30 points. Knocking down all 10 pins using both balls wins you 15 points. Otherwise each pin knocked down is worth one point. Pressing Newline rolls the next ball.

The pins still standing are represented by 0 and those that have been knocked down are shown as *. The program can be run in either Fast or Slow mode.

Volume.

```
5    REM "VOLUME"
10   PRINT AT 8,8; "CYLINDER PRESS 1", AT 10,8;
     "SPHERE PRESS 2", AT 12,8; "CUBOID PRESS 3"
15   INPUT N
20   CLS
25   IF N=3 THEN GOTO 40
30   PRINT AT 8,12; "RADIUS?"
35   INPUT R
37   IF N=2 THEN GOTO 100
40   PRINT AT 8,12; "HEIGHT?"
45   INPUT H
50   IF N=1 THEN GOTO 90
60   PRINT AT 8,12; "LENGTH?"
65   INPUT L
70   PRINT AT 8,12; "BREADTH?"
75   INPUT W
80   LET A = (H*L*W)
85   GOTO 105
90   LET A = (Pi*R**2*H)
95   GOTO 105
100  LET A = (4/3*Pi*R**3)
105  PRINT AT 8,2;A; "      CUBIC CENTIMETRES"
110  PRINT AT 10,2; A/1000;     "    LITRES"
115  PRINT AT 12,2; A/1000/4.5461; "    GALLONS"
120  STOP
```

Hunt.

```
10   REM "HUNT"
20   LET T=0
30   LET C=15
40   LET D=15
50   PRINT AT 7,11; "SCORE  ";T
60   FOR A=10 TO 18
70   RAND
80   LET B=INT(RND*8)+11
90   PRINT AT A,B; "*", AT B,A; "X" AT B,A; "  "
100  IF INKEY$ = "5" THEN LET C=C-1
110  IF INKEY$ = "6" THEN LET D=D+1
120  IF INKEY$ = "7" THEN LET D=D-1
130  IF INKEY$ = "8" THEN LET C=C+1
140  PRINT AT D,C; "O"
150  IF A =D AND B=C THEN GOTO 190
160  IF B=D AND A=C THEN GOTO 220
170  NEXT A
180  GOTO 60
190  PRINT AT D,C; "inverse space" AT D,C;
     "graphic y " AT D,C; "graphic y" A T D,C; "0"
200  LET T = T+1
210  GOTO 50
220  PRINT AT D,C; "CHOMPED", AT D,C; "7 spaces"
230  GOTO 220
```

10-pin bowling.

```
10  DIM A(10)
20  LET Y=0
30  LET S=0
40  FOR B=1 TO 10
50  FOR E=1 TO 2
60  PRINT "FRAME  ";B,,,,"BALL  ";CHR$ (E+156)
70  PRINT ,,,,
80  LET Z=0
90  FOR C=1 TO 10
100 IF E=2 THEN GOTO 120
110 LET A(C)=52
120 IF A(C)=52 AND INT(RND*2)+1=1 THEN LET A(C)=23
130 IF A(C)=23 THEN LET Z=Z+1
140 NEXT C
150 PRINT, CHR$ A(10);" ";CHR$ A(9);" ";CHR$ A(8);" "CHR$ A(7)
160 PRINT ," ";CHR$ A(6);" ";CHR$ A(5);" ";CHR$ A(4)
170 PRINT ,"  ";CHR$ A(3);" ";CHR$ A(2)
180 PRINT ,"   ";CHR$ A(1)
190 PRINT AT 15,0;"SCORE THIS FRAME IS ";Z
200 IF E=1 AND Z=10 THEN GOTO 350
210 IF Z>9 THEN LET Z=15
220 IF E=2 THEN LET S=S+Z
```

(continued on next page)

(continued from previous page)

```
230 PRINT AT 17,0;"SCORE SO FAR";S
240 INPUT U$
250 CLS
260 NEXT E
270 NEXT B
280 PRINT "SCORE FOR THAT GAME WAS";S
290 IF S<Y THEN GOTO 310
300 LET Y=S
310 PRINT "HIGHEST SCORE SO FAR";Y;AT 9,0;"PRESS N/L TO PLAY."
320 INPUT U$
330 CLS
340 GOTO 30
350 PRINT AT 7,3;"STRIKE"
360 LET E=2
370 LET S=S+15
380 GOTO 210
```

Obstacle

THE GAME of Obstacle by Loll Holt of Worsley, Manchester, incorporates moving graphics into a 1K ZX-81. The object of the game is to move the asterisk as quickly as possible from the top left-hand corner of the screen to the opposite corner and back again, avoiding the blocks.

The asterisk is moved using the unshifted cursor-control keys. Once it has begun to move, both start and finish are marked by inverse asterisks. The time in seconds is displayed after each move, which begins as soon as the asterisk appears and only appears to end when you are not touching the keyboard.

Memory is obviously very tight, and an Out of Memory error will require you to restart the program. Use the Break key to stop the game.

Average players complete a game in 43 to 50 seconds. The record, so far, is 41·46 seconds.

Obstacle.

```
5   RAND
10  FOR I = 1 TO 35
15  PRINT AT RND * 21, RND * 7; "graphic H"
20  NEXT I
25  LET L=0
30  LET C=0
35  POKE 16437,  99
40  POKE 16436,  99
45  PRINT AT L,C; "*"
50  PRINT AT 4,9; (25443 - PEEK 16436 - 256 * PEEK 16437)/50
55  IF INKEY$ = "" THEN GOTO 55
60  PRINT AT L,C; " "
65  PRINT AT 0,0; "inverse asterisk"; AT 21,7; "inverse asterisk"
70  LET M = L
75  LET D = C
80  LET L = L + (INKEY$ = "6") - (INKEY$ = "7")
85  LET L = L + (L<0) - (L > 21)
90  LET C = C + (INKEY$ = "8") - (INKEY$ = "5")
95  LET C = C + (C < 0) - (C > 7)
100 PRINT AT L,C;
105 IF PEEK(PEEK 16398 + 256 * PEEK 16399) <> 128 THEN GOTO 45
110 LET L = M
115 LET C = D
120 GOTO 45
```

Variable list

HERE is a machine-code routine which, when called, lists the names of the ZX-81's stored variables, writes Ian Stewart of Alva, Clackmannan. The routine works in both 1K and 16K, but since it uses 104 byes of memory it is really much more useful with 16K machines than with unexpanded ZX-81s.

The routine is relocatable in memory and can be stored in a Rem statement perfectly safely, although if you store it there you must not try to bring the Rem line down with Edit. Perhaps the best place for it is at the top of the memory. To call the routine, type

IF USR XXXXX THEN

and then press Newline. The syntax looks odd, but it provides a safe way of running any machine-code program.

The output consists of the names of the variables, but not their values, separated by inverse spaces. For-Next control variables are identified by an asterisk, arrays by a < sign, and strings by the standard $. These conventions can be changed by using different values in place of the ones in my program — they are underlined in the listing.

The routine should relieve all those who have typed in a Let command some time ago, and then forgotten the variable's name. The listing is in decimal to speed entry. Note that it is to be entered reading down the first column, then down the next, and so on. It is 104 bytes long.

Variable list.

42	127	203	64	215	127	13	35
16	40	111	215	17	40	12	24
64	10	40	17	18	249	13	165
126	203	64	6	0	214	32	214
254	119	24	0	25	128	2	32
128	40	6	25	24	24	62	14
200	12	203	24	200	224	19	1
71	203	111	212	214	14	215	24
62	111	40	214	128	0	35	232
128	40	36	192	215	214	94	214
215	76	24	215	35	96	35	160
120	24	21	62	126	215	86	24
203	21	214	23	203	62	25	248

Superzap

FROM GEOFFREY HARMAN at Solihull, West Midlands come no less than four entertaining programs for the 1K ZX-81. Superzap is an invader game in which the object is to shoot down as many invaders as possible before the alien lands on Earth. The controls are:

0 for up
8 for down
1 for fire

Be careful not to press two keys at once.

Line 70 contains 26 minus signs, and line 80 contains 26 spaces. Line 150 is simply a delay between each Martian's appearance on the screen. The record score to date is 28.

Martian Invasion is similar to Superzap, but two aliens approach you at the same time. You have to run the program after being told your score. The controls are the same as in Superzap.

Circles allows you to draw circles of any size at any position on the screen. Adding the line

80 RUN

fills the screen with circles.

The first input asks how far across to draw the circle, and the second how many pixels up. The third defines the size, which cannot be greater than 10.8. The computer starts the drawing to the left of the circle, so this should be borne in mind when specifying the position.

In Lem you have to land a lunar entry module from a height of 1,000 metres. Enter the thrust each time, and the computer calculates altitude, fuel remaining and speed. The program counts the number of turns you need to land. A total of under 20 turns is quite good. The game is over when your velocity reaches zero.

(continued on page 160)

Superzap.

```
1   LET Z=0
2   PRINT,, "PRESS 3 TO START"
4   IF INKEY$<> "3" THEN GOTO 4
5   LET A=29
10  LET D= INT(RND*10+5)
20  LET X=10
40  CLS
45  PRINT AT D,A;"graphic E, graphic F, graphic R"
50  IF INKEY$ ="0" THEN LET X=X-1
55  IF INKEY$ = "8" THEN LET X=X+1
60  PRINT AT X,3; "graphic H"
65  IF INKEY$ <> "1" THEN GOTO 105
70  PRINT AT X,4;"--------------------------"
80  PRINT AT X,4;"                          "
85  IF X=D THEN GOTO 150
105 LET A=A-1
110 LET D=D+INT(RND*3-1)
115 IF A=Z THEN GOTO 170
130 GOTO 40
150 LET C=SIN 45*SIN56*SQR TAN 54.8
152 CLS
155 LET Z=Z+1
160 GOTO 5
170 PRINT AT 15,2;"YOU ZAPPED ";Z;" ALIENS"
200 RUN
```

Martian Invasion.

```
1   LET Z=0
10  LET A=INT(RND*10+5)
20  LET C=INT(RND*15+3)
30  LET B=28
40  LET X=10
60  IF INKEY$ ="0" THEN LET X=X-1
70  IF INKEY$ ="8" THEN LET X=X+1
75  PRINT AT X,3; "inverse space"
80  IF INKEY$ <>"1" THEN GOTO 130
90  PRINT AT X,4;"twenty six minus signs"
100 IF X=A THEN LET A=30
110 IF X=C THEN LET C=30
130 IF A=30 AND C=30 THEN GOTO 300
140 IF A<30 THEN LET A=A+INT(RND*3-1)
150 IF C<30 THEN LET C=C+INT(RND*3-1)
170 LET B=B-1
180 CLS
190 IF A<30 THEN PRINT AT A,B; "graphics E,F,R"
200 IF C<30 THEN PRINT AT C,B; "graphics E,G,R"
210 IF B>2 THEN GOTO 50
230 PRINT"THE MARTIANS HAVE LANDED AFTER ";Z;" ATTEMPTS"
240 STOP
300 LET Z=Z+1
310 LET K=SIN 23*COS 65 *SQR TAN 45
320 GOTO 10
```

(continued from page 158)

The thrust acts as a brake and reduces speed but slows down descent. The rockets can develop up to 50,000 pounds of thrust. The program also takes into account gravitational force, and you should watch the fuel gauge.

Lem.

```
5   LET V=100
10  LET A=1000
20  LET M=2500
30  LET S=1
40  LET U=0
50  PRINT AT 5,0;S
60  PRINT AT 6,0;"ALTITUDE",A;"
70  PRINT AT 8,0;"SPEED",V
80  PRINT AT 10,0;"FUEL",M-2000-U
90  INPUT F
100 PRINT AT 12,0;"THRUST",F;"
110 IF F>50000 THEN GOTO 90
115 LET S=S+1
120 LET U=F/50000*50
130 LET M=M-U
140 LET V=V-((F/M)-2)
150 LET A=A-V
160 IF A<=0 AND V<5 THEN GOTO 300
170 IF M<=2000 OR A<=0 THEN GOTO 350
180 GOTO 650
300 PRINT AT 18,3; "WELL DONE"
310 STOP
350 PRINT AT 18,3; "YOU CRASHED"
```

Circles.

```
5  REM *****HOW MANY PIXELS ACROSS*****
10 INPUT X
15 REM *****HOW MANY PIXELS UP*****
20 INPUT Y
25 REM *****HOW LARGE TO MAKE CIRCLE*****
30 INPUT T
40 IF T>10.8 THEN GOTO 30
50 FOR N=1 TO 13 STEP 0.1
60 PLOT X+(2*(T-T*COS(N/6*PI))),Y+(2*(T+T*SIN(N/6*PI)))
70 NEXT N
```

Effective programming

A J PEGG of Abergavenny, Gwent has some useful hints on making programs for the ZX-81 more efficient. When you want to print blank lines on the screen it is often possible to simply add extra commas to the end of the previous Print statement. For example,

PRINT "TITLE",,,

will print a blank line after title.

Every number written in a Basic program, except line numbers, takes up six bytes plus the number of figures in the number. If the same number occurs three times or more in a program it therefore saves space if the number is assigned to a variable for use throughout the program.

A subroutine should be used when a set of instructions or single instruction is used more than once. There is a net saving of space if the repeated routine takes up more than 14 bytes of memory.

When converting ZX-80 Basic for the ZX-81, remember that RND (N) produces an integer random number in the range O to N. The equivalent statement for the ZX-81 is

INT(RND *(N+1))

The ZX-80 function TL$(A$) has the effect of placing the left-hand characters of A$ in the string required, and removing it from A$. For example

LET B$ = TL$(A$)

would become,

LET B$ A$(TO 1)
LET A$ = A$(2 TO)

in ZX-81 code.

Data commands

THIS PROGRAM provides the equivalent of Data, Read and Restore commands for the ZX-81, writes Andrew Rushton of Wakefield, West Yorkshire.

The command Gosub 50 puts the next word from the Rem statements into A$. Words can be placed in Rem statements anywhere in the program, starting from line 3, but operation of the program is faster if the Rems are between lines 3 and 50. Words, letters, numbers and phrases should be separated by commas, and the last character in each Rem statement should also be a comma.

The example program should incorporate the Rem statements given in the main program. The statement

LET ZZ = 16540

anywhere in the program will take you back to the first words in the Rem statement.

Data commands — sample program.

```
100 FOR A = 1 TO 8
110 GOSUB 50
120 PRINT A$; "(SPACE)";
130 IF A = 2 OR A = 5
    THEN PRINT
140 NEXT A
```

Data commands routine

```
1   LET ZZ=16540
2   GOTO 100
5   REM WORDS OR PHRASES, SHOULD, BE STORED,
10  REM IN REM, STATEMENTS,ANYWHERE, IN THE, PROGRAM,
50  IF PEEK (ZZ+1)<28 OR PEEK (ZZ+1)>63 THEN GOSUB 80
55  LET A$=""
60  LET ZZ = ZZ+1
65  IF PEEK  ZZ = 26 THEN RETURN
70  LET A$ = A$ + CHR$ PEEK ZZ
75  GOTO 60
80  LET ZZ =  ZZ + 1
85  IF PEEK ZZ = 234 THEN RETURN
90  GOTO 80
100 START OF MAIN PROGRAM.
```

Superior Systems Ltd.

178 West St, Sheffield S1 4ET. Tel.(0742)755005

ACORN

ACORN ATOM 8K rom, 5K ram, P.S.U. & COLOUR BOARD	199.00E
ATOM DISK PACK, 96K SINGLE DISK DRIVE	299.00E
ATOM COLOUR BOARD	39.00C
WORD PACK ROM	26.00A
BUSINESS	10.00A
BUSINESS BOOK	6.95A
DESK DIARY	10.00A
DATABASE	10.00A
ADVENTURES	10.00A
ATOM CHESS	10.00A
FLOATING POINT ROM	20.00A
B.B.C. ROM PACK	PHONE
B.B.C. BASIC PROGRAMMING BOOK	5.95B

NEC

PC 8001 (32k computer)	599.00E
PC 8011 32K EXPANSION UNIT	489.00E
PC 8012 32K EXPANSION UNIT	399.00E
PC 8023 DOT MATRIX PRINTER	399.00E
PC 8031B DUAL DISK DRIVE	669.00E
PC 8032B ADD ON DUAL DISK UNIT	569.00E
PC 8041 12" GREEN/ORANGE MONITOR	159.00E
PC 8043 HIGH RES. COLOUR MONITOR	579.00E
PC 8045A LIGHT PEN	199.00E
CP/M DISK & MANUAL	64.00D

VIC 20

VIC 20 COMPUTER	PHONE
VIC CASSETTE DECK	39.09D
VIC PRINTER	200.00E
SINGLE DISK DRIVE	344.35E
PROGRAMMERS AID CARTRIDGE	30.39B
MACHINE CODE CARTRIDGE	30.39B
3K RAM CARTRIDGE	26.04B
8K RAM CARTRIDGE	39.09B
16K RAM CARTRIDGE	65.17B
VIC REVEALED	10.00B
GETTING AQUAINTED WITH THE VIC 20	7.95B
VIC PROGRAMMERS REFERENCE GUIDE	14.95B

CASSETTE SOFTWARE

PACK MAN (high resolution)	7.50A
SUBMARINE	7.50A
GUNMAN (high resolution)	7.50A
NAVAL BATTLE	7.50A
SPACE INVADERS	7.50A

ACT SIRIUS ONE

ACT SIRIUS ONE 16 BIT COMPUTER	2395.00
INCLUDING CP/M MICROSOFT 86 BASIC & UTILITIES.	
MEMORY UPGRADE TO 256K	495.00E
MEMORY UPGRADE TO 512K	1495.00E
ACT 911 MATRIX PRINTER	695.00E
ACT 921 DAISY WHEEL PRINTER	1295.00E

SIRIUS SOFTWARE

PULSAR ACCOUNTING PACKAGE	495.00D
PULSAR DATABASE	295.00D
SUPERCALC	150.00D
MICROMODELLER	595.00D
WORDSTAR	295.00D

SHARP

MZ80K (48k)	PHONE FOR
MZ80A (48k)	BEST
MZ80B (64k)	PRICE
MZ80 P3 PRINTER FOR MZ80K	360.00E
MZ80 I/O INTERFACE UNIT MZ80K	95.00E
MZ80 FB DUAL FLOPPY DISK UNIT	550.00E
MZ80 EU INTERFACE UNIT FOR MZ80B	46.00B
MZ80 P6 PRINTER FOR MZ80B	409.00E
PC 1211 POCKET COMPUTER	69.50D
PC 1500 POCKET COMPUTER	139.00D
CE 122 PRINTER INTERFACE (pc1211)	60.83D
CE 150 4 COLOUR PRINTER (pc1500)	125.00D

SOFTWARE

WORD PROCESSOR (tape)	39.50B
WORD PROCESSOR (disk)	79.95B
APOLLO WORD PROCESSOR (tape)	34.95B
DATABASE (cassette based)	29.50B
MZ80 CALC II	34.50B
ZEN EDITOR ASSEMBLER	19.50B
ZEN DOS (editor assembler disk)	37.50B
ZEN DISASSEMBLER	10.50A
MZ80K DUST COVER	5.00A
P3 PRINTER DUST COVER	5.00A

APPLE

APPLE II (48k) COMPUTER	670.00E
DISK DRIVE WITH CONTROLLER	370.00E
DISK DRIVE WITHOUT CONTROLLER	290.00E
12" B.M.C. GREEN SCREEN MONITOR	119.50E
EPSON MX80 F/T I PRINTER	399.00E
EPSON-APPLE INTERFACE CARD	85.00D
GRAPHICS TABLE	480.00E
14" COLOUR MONITOR	250.00E
D.M.S. COLOUR CARD	90.00D

APPLE II SOFTWARE

VISICALC	104.00D
MICRO MODELLER	420.00D
VISIDEX	105.00D
VISIPLOT	96.00D
VISITREND/VISIPLOT	135.00D
VISITERM	80.00D
APPLE WRITER	39.00D

VIDEO GENIE

GENIE I COMPUTER	295.00E
GENIE II COMPUTER	295.00E
EG 3014 EXPANSION UNIT	199.00E
EG 3015/16 16K RAM CARD	91.50C
EG 3015/32 32K RAM CARD	128.80E
EG 400 SINGLE DISK DRIVE	215.00E
COLOUR BOARD FOR GENIE I/II	35.00B
DUST COVER FOR GENIE I/II	5.00B

SOFTWARE

AQUIRE BUSINESS GAME	11.27B
ADVENTURES (various titles)	11.97 each B
ADVENTURE SAMPLER	8.75B
ASTEROIDS	8.75B
ACCEL II BASIC COMPILER	39.95C
COPYSIS PROGRAM COPIER	11.25B
DATABASE	25.00B
EDITOR ASSEMBLER PLUS	21.70B

ADLER

SPECIAL ADLER PACKAGE
THE ADLER P2 COMPUTER, integral unit with twin disk drives, 12" green monitor, THE ADLER SE 1010 Typewriter/Printer, & the LEXICOM II WORD PROCESSOR.

SPECIAL PACKAGE PRICE 2900.00E

Postage Rates
a.75p b.1.00 c.1.50 d.2.50 e.5.00

ALL PRICES EXCLUDE VAT

Prices and offers were prepared many weeks before publication of this magazine, and whilst every possible effort will be made to meet our offers, in some cases, prices may fluctuate and we would advise you to confirm by telephone before ordering.

MAIL ORDER

Please Supply ________ £ ____
________ £ ____
________ £ ____
________ £ ____
________ £ ____
Access/Barclay/Cheque P&P+VAT £ ____
Card No. ________ Total £ ____

Name ________
Address ________
Code ____ Tel ____

● Circle No. 193

NOW IN STOCK

THE NEW & *EXCITING* TRS80 MODEL III

EXTENDED GUARANTEE BY COMPUCARE

48K **£599** + VAT

The Radio Shack TRS-80™ Model III is a ROM-based computer system consisting of: ● A 12-inch screen to display results and other information ● A 65 key console keyboard for inputting programs and data to the Computer ● A Z 80 Microprocessor, the "brains" of the system ● A Real-Time Clock ● Read Only Memory (ROM) containing the Model III BASIC Language (fully compatible with most Model I BASIC programs) ● Random Access Memory (RAM) for storage of programs and data while the Computer is on (amount is expandable from "16K" to "48K", optional extra) ● A Cassette Interface for long term storage of programs and data (requires a separate cassette recorder, optional extra) ● A Printer Interface for hard-copy output of programs and data (requires a separate line printer, optional extra) ● Expansion area for upgrading to a disk based system (optional extra) ● Expansion area for an RS-232-C serial communications interface (optional extra)
All these components are contained in a single moulded case, and all are powered via one power cord

Disc Drives Kit with 2x40 Track Drives – £599 + VAT
Disc Drives Kit with 2x80 Track Drives – £729 + VAT

EXTENDED GUARANTEE BY COMPUCARE — Microline 83 & 82 NOW IN STOCK — NEW

MICROLINE 80 £289 + VAT

● 80 cps Uni-directional ● Small size: 342 (W) × 254 (D) × 108 (H) mm. ● 160 Characters, 96 ASCII and 64 graphics ● 3 Character sizes: 40, 80 or 132 chars/line ● Friction and Pin Feed ● Low noise: 65 dB ● Low weight: 6.5 kg

INTRODUCING THE NEW SHARP MZ-80B

NEW — EXTENDED GUARANTEE BY COMPUCARE

£999 + VAT

● 4 Mhz Z-80CPU ● Dynamic RAM ● 2K ROM ● BASIC is provided ● High Resolution Graphics ● 9" High Focus Green Display ● Upper and Lower Case ● 80/40 Characters x 25 line display ● Electro Magnetic Cassette Deck included ● ASC11 Keyboard ● Numeric Keypad ● Sound Output ● Built-in Clock and Music.

Available Soon-Discs, Printers and other Accessories.

INTRODUCING THE NEW GENIE

Ideal for small businesses, schools, colleges, homes, etc. Suitable for the experienced, inexperienced, hobbyist, teacher, etc.

GENIE I

EXTENDED GUARANTEE BY COMPUCARE

STILL ONLY £279 + VAT

NOW **INCLUDED:** Sound, Upper and lower case, Extended BASIC and Machine Code enabling the Writing and Execution of Machine Codes Programming direct from Keyboard.
16K RAM, 12K Microsoft BASIC
Extensive Software Range.
Self-Contained PSU UHF Modulator Cassette. External Cassette Interface. Simply plugs into TV or Monitor. Complete and Ready to Go. Display is 6 lines by 32 or 64 Characters Switchable. 3 Mannuals included, Users Guide, Beginners Programming and BASIC Reference Mannual. BASIC Program Tape Supplied. Pixel Graphics.

GENIE II

EXTENDED GUARANTEE BY COMPUCARE

£299 + VAT

The **NEW GENIE II** an ideal Business Machine. 13K Microsoft BASIC in ROM. 71 Keyboard. Numeric Keypad. Upper & Lower Case. Standard Flashing Cursor. Cassette Interface 16K RAM Expanded externally to 48K.

GENIE I & II EXPANSION UNIT WITH 32K RAM £199 + VAT

PARALLEL PRINTER INTERFACE CARD
£35.00 + VAT

HITACHI PROFESSIONAL MONITORS

EXTENDED GUARANTEE BY COMPUCARE

9" – ~~£129~~ **£99.95** + VAT
12" – ~~£199~~ **£149** + VAT

● **Reliability** Solid state circuitry using an IC and silicon transistors ensures high reliability. ● **500 lines horizontal resolution** Horizontal resolution in excess of 500 lines is achieved in picture center. ● **Stable picture** Even played back pictures of VTR can be displayed without jittering. ● **Looping video input** Video input can be looped through with built-in termination switch. ● **External sync operation** (available as option for U and C types) ● **Compact construction** Two monitors are mountable side by side in a standard 19-inch rack.

DUE TO IMMENSE POPULARITY SALE CONTINUED

EUROPE'S FASTEST SELLING ONE BOARD COMPUTER

COMPUKIT UK101

★ 6502 based system — best value for money on the market. ★ Powerful 8K Basic — Fastest around ★ Full Qwerty Keyboard ★ 1K RAM Expandable to 8K on board ★ Power supply and RF Modulator on board. ★ No Extras needed — Plug in and go ★ Kansas City Tape Interface on board ★ Free Sampler Tape including powerful Dissassembler and Monitor with each Kit. ★ If you want to learn about Micros, but didn't know which machine to buy then this is the machine for you.

KIT ONLY **£99.95** + VAT
Fully Assembled – **£149** + VAT
PLUS £4.60 Post & Packing

NEW

ACORN ATOM

UNIQUE IN CONCEPT – THE HOME COMPUTER THAT GROWS AS YOU DO

Fully Assembled **£157.50** + VAT inc. PSU

EXTENDED GUARANTEE BY COMPUCARE

Special features include ● Full Sized Keyboard ● Assembler and Basic ● Top Quality Moulded Case ● Optional High Resolution Colour Graphics ● 6502 Microprocessor

WE ARE NOW STOCKING THE APPLE II AT REDUCED PRICES

AUTOSTART EURO PLUS

EXTENDED GUARANTEE BY COMPUCARE

48K **£649** + VAT

Getting Started APPLE II is faster, smaller, and more powerful than its predecessors. And it's more fun to use too because of built in features like: ● BASIC — The Language that Makes Programming Fun ● High-Resolution Graphics (in a 54,000 Point Array) for Finely-Detailed Displays. ● Sound Capability that Brings Programs to Life. ● Hand Controls for Games and Other Human-Input Applications. ● Internal Memory Capacity of 48K Bytes of RAM, 12K Bytes of ROM; for Big-System Performance in a Small Package. ● Eight Accessory Expansion Slots to let the System Grow With Your Needs.
You don't need to be an expert to enjoy APPLE II. It is a complete, ready-to-run computer. Just connect it to a video display and start using programs (or writing your own) the first day. You'll find that its tutorial manuals help you make it your own personal problem solver.

TEAC DISK DRIVES

EXTENDED GUARANTEE BY COMPUCARE

- TEAC FD-50A has 40 tracks giving 125K Bytes unformatted single density capacity.
- The FD-50A can be used in double density recording mode.
- The FD-50A is Shugart SA400 interface compatible.
- Directly compatible with Tandy TRS80 expansion interface.
- Also interfaces with Video Genie, SWTP, TRS80, North Star Horizon, Superbrain, Nascom, etc, etc.
- Address selection for Daisy chaining up to 4 Disks.
- Disks plus power supply housed in an attractive grey case.

40 TRACK
Single Disk Drive **£225** + VAT — Double Disk Drive **£389** + VAT

77 TRACK
Single Disk Drive **£299** + VAT — Double Disk Drive **£499** + VAT

THE EPSON MX SERIES

EXTENDED GUARANTEE BY COMPUCARE

- 80/132 Column
- Centronics Parallel
- Bi-directional
- Upper & lower case
- True Descenders
- 9x9 Dot Matrix
- Condensed and Enlarged Characters
- Interfaces and Ribbons available

MX80T £339 + VAT
MX80F/T £389 + VAT

"Europes Largest Discount Personal Computer Stores"

Delivery is added at cost. Please make cheques and postal orders payable to **COMPSHOP LTD.**, or phone your order quoting **BARCLAYCARD, ACCESS, DINERS CLUB** or **AMERICAN EXPRESS** number.

MAIL ORDER AND SHOP: **CREDIT FACILITIES ARRANGED** send S.A.E. for application form.
14 Station Road, New Barnet, Hertfordshire, EN5 1QW *(Close to New Barnet BR Station – Moorgate Line).*
Telephone: 01-441 2922 (Sales) 01-449 6596 Telex: 298755 TELCOM G
OPEN (BARNET) – 10am - 7pm – Monday to Saturday

NEW WEST END SHOWROOM:
311 Edgware Road, London W2. Telephone: 01-262 0387
OPEN (LONDON) – 10am - 6pm – Monday to Saturday

IRELAND: 19 Herbert Street, Dublin 2. Telephone Dublin 604165

TELEPHONE SALES
OPEN 24 hrs. 7 days a week
01-449 6596

BARCLAYCARD VISA — AMERICAN EXPRESS — DINERS CLUB INTERNATIONAL

● **Circle No. 194**

Data Structures using Pascal

By A M Tenenbaum, and M J Augenstein. Hardback £10.95. Prenice-Hall. ISBN 0 13 196501 8.

WHETHER THIS BOOK is mainly about data structures or the limitations of Pascal is not clear, but it is certain that in parts the book is seriously wrong. The authors claim on page 1 that "A computer is a machine that manipulates information", whereas most of us to think that a computer manipulates electrical impulses according to set rules. It is the users who give meanings to these impulses, to enable us to derive information from the bits, bytes and words.

"Information" requires us to give a meaning to patterns. To confuse the notion of information with the presence of patterns might explain why the authors make the absurd assertion on page 6: "Thus we see that information itself has no meaning", a statement, which becomes understandable as "Thus we see that patterning in itself has no meaning".

When they start with more "complex" structures, the authors use Pascal to produce illustrative procedures. By using it, many of Pascal's disadvantages as a proper language appear. For example, on page 73 they discuss how to implement a stack for real numbers: "this can be done simply in Pascal by introducing a new type stackitem and defining a stack in terms of this new type". One defines a set of routines using stackitem and, for an integer stack, one declares

```
TYPE stackitem = integer
```

The same routines can be used to manipulate a stack of reals by changing the Type declaration, but this means that one cannot have both real and integer stacks at the same time. In Algol 68 this would not be a problem, for the routines to perform stack manipulation could be set up as operators, and the same named operater could be used for different types of stack. The lack of a proper block structure in Pascal leads to further complications, as does the static allocation of storage.

The chapter on stacks is followed by one on Recursion, and the chapter is as full of imprecisions as ever. I was pleased to read on page 100: "Let us examine a less familiar example" but then I read "The Fibonacci sequence . . ." The Fibonacci sequence is one of the most common of the pointless examples used to illustrate recursion.

I decided that Tenenbaum and Augenstein were sledgehammer users. Unfortunately they are not the only sledgehammer users trying to sell computing textbooks. Though this book is no worse than many I have seen, I cannot recommend it. It conforms to most of my prejudices concerning certain forms of computer science education — as Dijkstra has said, sledgehammers to crack eggs.

Boris Allan

Pet Interfacing

By James M Downey and Steven M Rogers. Howard W Sams and Co. £11.85.

THERE HAS ALREADY been much written about the Pet and its use as a controller for other hardware, but much of it has been in magazine articles. This book sets out to provide the essentials of Pet interfacing in one place, and to provide ideas for the use of the various interface connectors provided by the Pet microcomputer.

The first two chapters provide an introduction to the Pet hardware and building instructions for a breadboard to give easy access to the user-port signals. The circuit is used as the basis for all the user-port projects in the book. Included in this chapter is the description of a simple logic probe which eliminates the need for expensive test equipment. The third chapter is concerned with applications using the user port and includes serial input and output as well as the conversion of analogue to digital signals and vice versa.

The next three chapters describe in a similar way the experiments and projects using the memory port. As with the user port there are many useful circuits such as address decoders and more advanced interfacing techniques. Chapter 7 provides a miscellany of interfacing techniques including the control of mains and other high-power devices. The final chapter covers the IEEE port in detail and includes circuits for the user of the Pet as both an IEEE bus controller and as a listener/talker. Appendices provide the flowcharts and assembler-program listings required to implement such facilities.

The book uses a clear step-by-step approach throughout and little is taken for granted. In addition there is comprehensive software support by the provision of routines for inclusion in user programs. This book illustrates why the Pet has been adopted by many sophisticated users for laboratory and other control purposes, the addition of a few pounds worth of components turns it into a very competitively priced controller.

Conclusions

- **A practical book for the experimenter or a useful reference for anyone using the Pet as a controller.**
- **Although comprehensive, this book is accessible to anyone who has the slightest knowledge of or interest in electronics. The only knowledge required is how to handle sensitive modern devices and how to solder a connection.**
- **Except for the proprietary circuit board used for the user-port circuits, for which there are suitable alternatives, all the components used are readily available.**
- **An essential book for Pet enthusiasts who are interested in hooking up their computers to other equipment.**

Martin Wilson

Writing Interactive Compilers and Interpreters

By P J Brown. Paperback 265 pages, £5.95. John Wiley & Sons. ISBN 0 471 10072 2.

THE TITLE is perhaps the worst part of this book. It sounds as if it might describe some particularly dry and dire product of the computer science schools. Instead it is a lively, interesting and practical guide to the hinterland of really tough computing.

Professor Brown, who teaches at the Computing Laboratory of the University of Kent at Canterbury, chose this topic not so much because more than a handful of his readers would ever want to write an interactive compiler, as because if you can write one you can do almost anything. Hidden inside your machine's Basic which you take for granted every day is some of the cleverest software you will ever use. This book not only explains why it is clever, it also makes the reader understand why it may not be as clever as it could be and what might be done about it.

The author has evidently suffered, and his book is written from a deeply realistic standpoint. For instance, in discussing coding errors and what an interpreter should do about them, he says: "We have emphasised in this book that the error case is the normal case. Thus a parser (the bit of an interpreter that 'reads' program lines) should be regarded as a tool for pointing out syntactic errors in users' programs. Once in a while a user will produce a completely correct program, and will make use of a parser's secondary function — its use in helping to create the internal program".

Anyone who writes applications software should have this stencilled inside his hat, because it applies to any program. Errors are normal, accurate inputs the exception: programmers ought to realise which is more important.

If Professor Brown earns, as he ought, the gratitude of end users he may well find himself drummed out of the obfuscating fraternity of computer scientists. For instance: "If a user manual looks like a mathematical thesis, most people will never look at it. Many languages have suffered from being presented to the world in a form the world does not understand. It is important to have a formal notation that is both precise and easy for ordinary people to read". These are dangerous words.

Peter Laurie

SYSTEM 4000
EPROM EMULATOR/PROGRAMMERS

EX-STOCK

P4000 PRODUCTION EPROM PROGRAMMER

This unit provides 'simple, reliable' programming of up to 8 EPROMs. It has been designed for ease of operator use — a single 'program' key starts the blank check — program — verify sequence. Independent blank check and verify controls are provided along with mode, pass/fail indicators for each copy socket and a sounder to signal a correct key command and the end of a programming run. Any of the 2704/2708/2716 (3 rail) and 2508 / 2758 / 2516 / 2716 / 2532 / 2732 EPROMs may be selected without hardware or personality card changes.

2 year warranty. Price **£545 + VAT: + £12.00 DELIVERY**

VM10 VIDEO MONITOR

This compact, lightweight Video Monitor gives a clean crisp picture on its 10" screen. Suitable for use with the EP4000, SOFTY and other systems. 12 month warranty. Price **£88 + VAT, carriage paid.**

EP4000 EPROM EMULATOR/ PROGRAMMER

The microprocessor based EP4000 has been designed as a flexible, low cost, high quality unit for emulating and programming all the popular NMOS EPROMs without the need for personality cards, modules or hardware changes. Its software intensive design permits selection of the 2704 / 2708 / 2716 triple rail EPROMs and the 2508 / 2758 / 2516 / 2716 / 2532 / 2732 single rail EPROMs for both the programming and emulating modes.

The video output (T.V. or monitor) for memory map display in addition to the built-in Hex LED display, for stand alone use, is unique in this type of system. This, with the double function 28 key keypad, powerful editing features, powered down programming socket, buffered tri-state simulator cable and 4k x 8 data RAM gives you the most comprehensive, flexible and compact systems available today.

2 year warranty. Price **£545 + VAT: + £12 DELIVERY**

MODEL 14 EPROM ERASERS

MODEL UV140 EPROM ERASER

Similar to model UV141 but with out timer. Low price at **£61.50 + VAT, postage paid.**

MODEL UV141 EPROM ERASER

EX-STOCK

- 14 EPROM capacity
- Fast erase time
- Built-in 5-50 minute timer
- Safety interlocked to prevent eye and skin damage
- Convenient slide-tray loading of devices
- Available Ex-Stock at **£78 + VAT** Postage Paid

DISTRIBUTORS REQUIRED — EXPORT ENQUIRIES WELCOME

GP INDUSTRIAL ELECTRONICS LTD,

UNIT E, HUXLEY CLOSE, NEWNHAM INDUSTRIAL ESTATE, PLYMOUTH, DEVON PL7 4JN
TELEPHONE: PLYMOUTH (0752) 332961 (Sales) / 332962 (Technical Service).

SOFTY SYSTEMS

EX-STOCK

SOFTY 2
LOW COST 2716 EMULATOR/PROGRAMMER

● Direct output to T.V. ● High speed cassette interface ● On card EPROM Programmer ● Multifunction touch keypad ● 2K Monitor in 2716 ● 2K RAM ● 128 byte scratchpad RAM ● 2K EPROM Emulation ● Can program 2732/2532 in two halves ● Editing facilities including — Data entry/deletion, Block shift, Block store, Match byte, Displacement calculation ● Supplied with ZIF socket, Simulator cable, comprehensive manual, Antistatic lined EPROM tray and PSU. SOFTY 2 **£169 + VAT** (includes p&p)

SOFTY 1
LOW COST 2704/2708 EMULATOR/PROGRAMMER

● Direct output to T.V. ● High speed cassette interface — On card EPROM Programmer ● Multifunction keypad ● 1K Monitor in 2708 ● 1K RAM ● 128 byte scratchpad RAM ● 1K EPROM Emulation ● Comprehensive editing facilities ● Supplied with ZIF socket, Simulator cable and comprehensive manual.

SOFTY 1 (Built and tested) **£120 + VAT**
SOFTY 1 Power Supply **£20 + VAT**

SOFTY 1
CONVERSION CARD

Enables SOFTY to program the single rail EPROMs, 2508 / 2758 / 2516 / 2532. Selection of device type and 1K block are by pcb slide switches. ZIF Programming socket. Supplied built and tested. **£40 + VAT.**

EX-STOCK EPROMS

	1-24	25-99	100 up
2732	6:50	5:75	4:95
2716	2:80	2:60	2:40
2708	2:80	2:60	2:40

ADD VAT AT 15% – POSTAGE PAID

WRITE OR TELEPHONE FOR DETAILS ON ANY OF OUR PRODUCTS

● **Circle No. 195**

Word search

by Douglas Nunn

E	E	E	I	L	E	R	A	W	D	R	A	H	R	D
L	Z	B	U	S	A	Y	B	N	O	E	T	U	R	M
I	P	Y	B	B	G	C	A	M	C	T	X	O	I	O
P	R	P	I	H	M	R	S	S	H	U	W	N	V	N
M	O	P	C	G	T	P	I	A	I	P	I	U	E	I
O	C	O	C	R	O	R	C	C	P	M	N	D	M	T
C	E	L	O	A	L	I	O	A	W	O	O	V	A	O
M	S	F	B	P	I	N	Q	F	L	C	I	S	R	R
A	S	Y	O	H	P	T	F	H	E	O	I	J	F	O
R	O	R	L	I	G	E	A	N	A	L	G	C	N	B
G	R	O	E	C	K	R	I	D	I	S	K	L	I	O
O	N	M	T	P	E	H	D	C	I	G	O	L	A	O
R	J	E	M	I	C	R	O	S	Y	S	T	E	M	T
P	A	M	D	A	B	N	E	T	T	E	S	S	A	C
O	K	P	M	E	T	Y	B	O	L	I	K	M	L	C

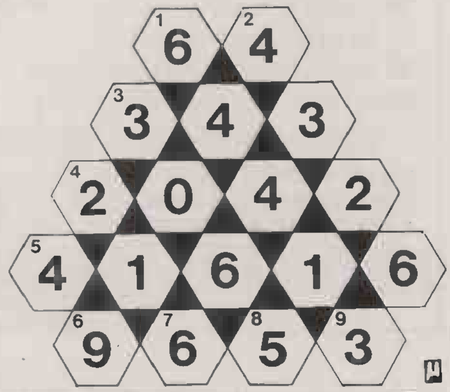
Word list

MICRO
COMPUTER
MAINFRAME
SILICON
CHIP
WORD
PROCESSOR
KILOBYTE
ROM
RAM
LOGIC
PROGRAM
HARDWARE
VDU
GRAPHIC
MONITOR
FLOPPY
DISK
CASSETTE
MACHINE CODE
FORTRAN
PASCAL
BASIC
COBOL
ALGOL
PILOT
FORTH
CPM
MEMORY
MAP
PRINTER
BOOT
MINI
SYSTEM
IEEE
BUS
BIT
COMPILE

WHEN OUT DIGGING on the island of Skye, a team of anthropologists found this rather strange and apparently random matrix of letters. One of the team, a keen computer user and academic, discovered that among the letters it was possible to find a whole list of words relating to the ultra-modern world of microcomputers.

If you wish to try and recapture the excitement of that discovery then hunt through the letters and try to find those words contained in the word list. Once you have found a word, ring it and tick it on the list.

Solution to April puzzle



What chance 1984?

In the early 1960s there were widespread fears that computers were about to take over. Boris Allan takes a close look at today's predictions of omniscient expert systems, in the light of what happened to their predecessors.

IT IS 1982 and information technology is really with us, yet some of the futurology produced today is as out of touch as it was 20 years ago.

In 1962 in *Computers and the World of the Future* C P Snow expressed misgivings that a new elite might be formed if only those who are concerned with the computers are going to be knowledgeable about decisions.

So far such elitism has not taken hold, and Snow's worst fears have been unfounded. Snow later argues: ". . . if we let the individual human judgement go by default, if we give all the power of decision to more and more esoteric groups, then both the moral and intellectual life will wither and die".

Human paradigm

E E Morison, then Professor of Industrial History at the Massachusett's Institute of Technology, suggested a test of expert systems. The computer would reconstruct a series of historical situations of increasing complexity in which men have acted most successfully.

Morison expected several benefits from this exercise. First, people would have to learn some history. Secondly, we could evaluate the machine by comparing the computer results with actualities; and, finally, the machine would become not so much a problem solver as a learning machine.

In 1962 learning machines were very fashionable. Morison hoped not only that this computer would force us to ask proper questions, but might help us sort out the things that can be thought from the things that can only be felt. In all of Morison's argument there is the assumption that the human is correct and that if the computer is to do what humans have done, it must be judged by comparison with humans.

Marvin Minsky was less impressed with humanity — especially historians — and more impressed with computers. Minsky suggested giving the computer a precise area of history about which not everything is generally known, and then having a group of professional historians study the facts and predict the outcome. He thought that historians had meticulously avoided any such experiments.

Morison agreed, saying that he had made the suggestion to see what other historians might say, and implying that neither humans nor computers could claim perfection. In the same book N Beecher noted that the training of a person in values took from 21 to 50 years — depending on the society — before that person was judged worthy to make a real decision.

In the final chapter, J R Pierce of Bell Telephone research observed that the superpower confrontation in the early sixties made it urgent to teach more people Russian. He was told, however, by a U.S. Air Force officer that the training would take too long and the Air Force could not wait.

With typical military thoroughness, six projects on the machine translation of languages had been initiated by the Air Force, four by the National Science Foundation, two by the Army, and one by the Navy. There is no evidence that any of these projects has replaced the need for Russian/English translators.

In 1962 Minsky bet that the IBM-704, if properly programmed, could read human script faster than a human. Pierce's comment on Minsky's bet has proved justified:

> These are nice bets, but how long do we have to wait? Will I live so long? I do not doubt that it will read script faster, if you do not care how well it reads it. There is a wonderful tendency to talk about things that lie in the future and that you cannot prove will not happen. This is good clean fun . . .

Failure follows fame

No wonder that Dreyfus claimed that, whereas fame in many fields only came when success was achieved. "artificial intelligence seems to be operating instead on the principle of fame until failure".

This all sets the scene for a recent piece of futurology, which makes many claims for the power of expert systems, and also seems designed to help produce a new elite.

Snow's comments about the political dimension are especially relevant because Philip Virgo's *Learning for Change* has been produced by the Conservative Party's Bow Group to coincide with Information Technology Year. The report set out to diagnose what is wrong with Britain, British education, British industry, and then suggests how we can be rescued from decline. The author is chairman of the Conservative Computer

(continued on next page)

(continued from previous page)

Forum and claims to have worked in the computer industry. On the first page we read, "Fundamental changes to the education system are necessary. Information technology makes these possible at economic cost".

The report consists of six sides of A4 priced at £2. Later we find that he really means computer-assisted learning, CAL not IT, and that he imagines "at the end of a CAL packaged course, each student has reached the same level of understanding, some more quickly than others".

Yet we all know that when all the pupils in a class can recite their tables, only a few can understand what they really mean. Understanding requires more than successfully reaching the end of a task. Real ideas, such as the concept of number, are notoriously difficult to learn by mechanical methods such as tables.

Leonardo da Vinci pointed out that there are ideas which require for their exposition experience rather than the words of others, and in the context of learning this means giving as many different experiences as possible — and not principally a CAL experience. I do not know how a machine can teach morality, or even the meaning of entrepreneurism. The author's belief that "two years and a million or so pounds to assemble quality packages which can be mass-produced on discs or transmitted over the air or down telephone lines, is a lot faster and cheaper than retraining several thousand teachers over a decade or two", has more than a passing similarity to the U.S. Air Force view about Russian/English translation, which has yet to be successfully mechanised. Why should the use of CAL be any more successful? Where are the experts to design the systems?

Logical skills

At one point the author states the unthinkable:

> . . . the complex diagnoses that elevate the Harley Street consultant above the local general practitioner, can already be done faster and more accurately by computer.

It would be interesting to know the whereabouts of this marvellous computer, and then see it in action. The report also thinks that lawyers, tax inspectors and accountants can also be easily replaced by computers, because these groups only offer "book-learning and machine-like logical skills". He forgets that judgement is an important part of all these occupations. I would rather trust my tax affairs to an accountant, or myself, than to a computer.

Virgo would have children

> ". . . associate education with reward and relevance. Forget the sport field, swimming pool and minibus . . . If you do not feed the mind and teach it how to earn a living all you've got is a physically fit, unemployable delinquent".

He has the same instrumental approach to higher education, wanting an increased emphasis on training of future employees and applied research to the detriment of academic research and the apprenticeship of future academics.

Virgo certainly would not approve of a scientist who was only playing with mathematical symbolisms because he found it fun — yet this is how Albert Einstein laid the way for nuclear power and the nuclear arms race. In the early 20th century no-one realised the potential consequences of his discovery in theoretical physics.

Trendy priorities

Virgo is forever accentuating the need to follow trends and fashions: priority should be given to retraining taxpayers or training their children for jobs in known demand.

In the field of computer software, for instance, Britain is a world leader, but the ideas in *Learning for Change* would have a deleterious effect on just the quality of those very successful ideas.

A further confusion is to take the impressive speed at which technology is changing, and assume that ideas change at the same speed, or that breakthroughs in knowledge are just around the corner. In 1962 there was argument about how long it would be before a computer became World Chess Champion; 20 years later we are still waiting.

The impressive developments in computing since 1962 have been mainly in the hardware. At present CAL is primitive and mainly used in technical areas, so to assume that in one or two years we will be able to teach languages by CAL is to fly in the face of reality.

To talk glibly, as many workers in AI now do, of the up-coming expert systems — especially an expert system to replace a Harley Street consultant — is very reminiscent of the arguments in 1962. How about an expert system to produce translations?

Once the expert system was set up, a few experts and analysts would still be needed to correct faults in the system, and this elite would make sure that their children were taught expert knowledge. For the rest of the population Virgo suggests that too much education is a dangerous thing

> Too high a qualification is really a disqualification for a contented, competent employee.

All they could expect would be spoon-fed low-grade pap, which is what CAL is best suited to assure.

The ideas contained in *Learning for Change* worry me, but, do not frighten me, because I know that our expert systems are little more expert than they ever were, or are likely to be for a long time.

References

Computers and the World of the Future edited by Martin Greenberger, MIT Press, 1962.

Learning for Change by Philip Virgo, Bow Publications, 1981.

BUYERS' GUIDE

Printers

The Peripherals Buyers' Guide is a survey of printers suitable for small computers. We have excluded any system which costs significantly more than £2,000. The printers are listed in alphabetical order. The addresses of the main suppliers are listed at the end of the guide.

Printers may be divided into several categories. The highest-quality printing is produced by the daisywheel-type which creates text in various type-faces, according to the wheel used. The quality ranges from excellent typing to rather poor book printing and generally there is a proportional-spacing facility. Those machines tend to be expensive and slow. Daisywheels can be either plastic — inexpensive, but must be replaced often — or metal — expensive but durable.

For faster printing, you must turn to dot-matrix machines. The print quality tends to be poor and the machines noisy. Older machines use a 7-by-5 matrix which puts the descenders of letters such as 'y' above the line. That makes bulk text difficult to read. Better printers use a matrix nine dots deep to give true descenders. Recently, several firms have produced dot-matrix printers which give an approximation to typewriter printing and proportional spacing. They are less expensive than daisywheel machines, work faster and could well be used for correspondence-quality work.

Some dot-matrix printers employ sensitised paper to produce printing by more direct electrical effects. They are often quiet and fast, but the paper can be expensive, unpleasant to handle and hard to obtain.

The trend is to build more processing power into printers. That means they offer increasingly varied features, so it is hard to categorise them precisely.

A printer has to be connected to the computer by a cable and a more or less standard interface. The normal interfaces are the Centronics parallel, RS232 serial port — also known as the V-24 — and 20mA current loop. IEEE is a parallel interface used by Pet; 'cpl' means characters per line, 'cps' means printing speed in characters per second. Allow five characters to the word.

The more intelligent printer prints as its head moves in both directions across the paper — bi-directional printing. Still more intelligent ones end the head movement at the ends of short lines. These two features can more then treble the working speed.

Printers use two types of paper: plain paper fed — like a

typewriter — pinch- and pin- or sprocket- or tractor-fed with holes along the margins. That paper can be supplied fan-folded or in rolls.

Pinch feeding is more expensive but is convenient for letters. Only a few machines will accept both pinch- and pin-fed paper. It is possible to obtain headed letter paper bonded lightly on to pin-fed, fan-folded computer paper for word processors.

Some printers allow direct control of the print-head to give graphics. KSR means keyboard, send and receive, ASR means automatic send and receive, RO means receive only. KSR machines can be used as electric typewriters in local mode.

Comb or line printers have a whole line's worth of dot hammers so they can print a line of text at a time. They tend to be very expensive and very noisy but produce an enormous quantity of work.

ACCESS DATA COMMUNICATIONS

ADC 1251 *£560*
Matrix printer, continuous paper, £13 per box, 80 or 132 cpl, 125 cps, 7x9 matrix. RS232, Centronics and IEEE interfaces.

ADC 2401 *£1,350*
9x9 dot-matrix printer, continuous paper, 136 cpl, 240 cps, RS232, Centronics and IEEE interfaces. Available from Access Data Communications.

ADDMASTER

400 receive only *£242*
Uses 2.5in. Tally roll paper, 16 cpl, 48 cps. Main U.K. agent Clary Ltd.

420/426 receive only *£246*
Dot matrix grade-one Tally roll paper at £5 for 20 rolls. BCD serial or 10-line serial interfaces, 12 cpl, 36 cps.

ANADEX

Main U.K. agent Anadex Ltd

DP-500 *from £367*
Dot matrix, tractor feed, parallel interfaces, 18 cpl, 45 cps.

DP-660 *from £700*
Dot matrix, pinch feed for printing labels, uses sprocket feed. Parallel interface. 19 cpl, 57 cps.

DP-750A *from £800*
Dot matrix, RS232C 20mA current loop, 21 cps, 25 cps.

FP-600 *from £65*
Dot matrix ticket or form printer, from four columns to 19 columns parallel interface, 19 cpl, 44 cps.

DP-9500 Series *£895 upwards*
Dot matrix, tractor feed, nine-wire print head, bi-directional printing, three ASCII interfaces as standard — parallel bit, RS232C, current loop — 120-200 cps, 132-220 columns, 7x9, 9x9 or 11x9 matrices depending on model. Also from: Peripheral Hardware, Kode Services, Robox, Stack Computer Services and Data Design Techniques Ltd.

DP-8000 *£550*
Dot matrix, pinch feed, bi-directional printing, fan-fold paper up to 9.5 in. up to three copies. Three ASCII interfaces — parallel bit, RS232C, current loop — 112 cps, 80 column, 9x7 matrix. Also from: Peripheral Hardware, Kode Services, Robox, Stack Computer Services and Data Design Techniques Ltd.

DP-1000 Series *from £395*
Dot matrix, tractor feed, internal data storage, roll-type paper for 40 columns at £11 for box of 10 rolls, three basic ASCII-compatible interfaces are available. 40 cpl, 50 cps, 40 columns, 5x7 matrix. Also from: Peripheral Hardware, Kode Services, Robox, Stack Computer Services.

AXION CORPORATION

Main U.K. agent Memec Systems Ltd

EX-820 receive only — *£500*

Electro-sensitive dot matrix includes plotting capability for full graphics, paper at £3 for a 240ft. roll, RS232C or 20mA serial and ASCII parallel, 20/40/80 cpl and up to 160 cps, 5x8 matrix.

EX-850 Video Printer — *£500*

Electro-sensitive dot matrix, aluminised paper at £3 for a 240ft. roll. Needs only the video signal from user's. Normal resolution 13.5 seconds per screen, high resolution 27 seconds per screen.

EX801/802 receive only — *£279*

Electro-sensitive, dot matrix, aluminised paper at £3 for a 240ft. roll, RS232C, Centronics, Apple, Pet, and Tandy interfaces, 20/40/80 cpl, 160 cps, 5x8 matrix.

BASE 2

800-MST — *from £385*

Impact dot matrix, bi-directional, tractor feed up to 9.5in., RS232C, 20mA, IEEE-488, Centronics and parallel interfaces, up to 132 cpl and 60 cps, with 5x7 matrix. Main U.K. agents Microbyte.

CENTRONICS

Main U.K. agents Bytech, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.

Model 150 — *£499*

Table-top demand document dot-matrix printer, 150 cps, bidirectional logic-seeking, using fan fold, roll and cut sheet paper up to 9.5in. wide 80 columns, RS-232 and parallel models available.

Model 152 — *£695*

As model 150, but 132 columns 15in. wide.

Model 352 — *£1,400*

Print station; advanced dot-matrix printer, 132 column 200 cps bidirectional logic seeking printer. Three-way paper-handling with built-in single-sheet feeder. Has second printing mode which at 60 cps gives very high-definition letter-quality printing, and high-quality pin addressable.

Model 353 — *£1,740*

Print Station; similar to model 352 but with liquid-crystal display for status indication and user-selectable parameter set-up.

Model 739 — *£504*

Table-top correspondence-quality mini-printer with three-way paper handling and proportional character set.

Model 6300 — *P.O.A.*

Industrial 300 line per minute band printer.

Model 6600 — *P.O.A.*

Same as 6300 but with 600 lines per minute.

Model 6080 — *£5,583*

Very quiet 600 line per minute band printer for office use. Has a variety of interfaces to suit most micro, mini or mainframe computers.

COMPUTER DEVICES INC

Miniterm 1201, 1202, 1203 — *from £936*

Thermal mechanism, uses Thermal Type B paper at £2.40 per roll, RS232 or parallel — 1201 only — interfaces, 80 or 132 cpl, 10/30 cps, 7x5 matrix. Main U.K. agent Teleprinter Equipment Ltd.

DATAC

Main U.K. agent Datac Ltd

414 free-standing assembly receive only — *£130*
Electro-sensitive, matrix printer type 245L, electro-sensitive roll paper, 59mm. wide x 30m. long at 90p per roll for 20 off, six-bit parallel ASCII, character serial interfaces, 16, 20, 32 or 40 cpl, 32 to 80 character per serial, 7x5 matrix.

DMI-40P free-standing terminal, receive only — *£350*
Impact, matrix, uses pressure-sensitive roll paper, 10mm.-wide ordinary paper version, using ink ribbon. Cost of paper £1 per roll, seven-bit parallel ASCII, character serial; RS232C or graphics, 40 or 20 cpl, up to 80 cps, 7x5 matrix.

411C compact panel mounting, receive only — *£209*
Electro-sensitive matrix type 245L or R, uses electro-sensitive roll paper, 59mm. wide x 30m. long at 90p per roll, six-bit parallel, serial interfaces, 16, 20, 32 or 40 cpl, 32 to 80 cps, 7x5 matrix.

411 panel mounting, receive only — *£189*
Electro-sensitive matrix printer type 245L or R, uses electro-sensitive roll paper, 59mm. wide x 30m. long at 90p per roll. Interfaces include six-bit parallel ASCII, character serial, four-bit parallel BCD, character parallel EIA/RS232C, CCITT/V24 and 20mA current loop, under development 40 cpl, 32 to 80 cps, 7x5 matrix.

313 panel-mounting, receive only and 312 free-standing, receive only — *£269*
Impact matrix type PU-1100, Tally roll paper, 59mm. wide x 36m. long at 60p per roll, CCITT/V24 or EIA RS232C or 20mA current loop interfaces, up to 20 cpl and up to 36 cps, 7x5 matrix.

412/1 and 412/5 receive only — *£255*
Electro-sensitive dot matrix type 245L, uses electro-sensitive aluminium-coated paper, 59mm. x 30m. at 90p per roll, six-bit parallel, ASCII, character serial and four-bit parallel BCD, character parallel, RS232C/V24 interfaces, 20mA current loop under development, 16, 20, 32 or 40 cpl, 32-80 cps, 7x5 matrix.

522/1 and 522/4 receive only — *£499 (522/1) £535 (522/4)*
Impact matrix type, roll paper, 114mm. x 75m. up to three copies plus original, cost of paper £1.10 per roll. Parallel interface and RS232C, 20mA current loop and parallel buttered, asynchronous interfaces — (522/4). 40 cpl, 100 cps instantaneous rate, 33 cps average rate — including CR and LF. 7x5, 7x10.

DATA DYNAMICS

Main U.K. agent Data Dynamics Ltd

303 Printer — *£980*
Dot matrix, up to six-part stationery width from 3m to 15.375in., V24/RS232C, 20mA current loop, 132 cpl, 30 or 60 cps, 7x7 matrix.

ZIP ASR/K7 twin cassette — *£2,000*
Dot matrix format, uses standard Teletype roll paper, V24, RS232C, or 20mA current loop operating at half or full duplex, 80 cpl, 10 or 30 cps switch selected, 5x7 matrix.

ZIP 30 keyboard printer, RO, ASR, or KSR — *ASR £1,800; RO & KSR £950*
Dot matrix, standard roll paper, 20mA half or full duplex current loop or V24 RS232C, 80 cpl, 10 or 30 cps — switch selected, 5x7 matrix.

390 eight-level and 392 five-level — *ASR from £1,250; LSR from £900; RO from £800*
ASR, KSR and read-only versions. Impact printers, friction or sprocket feed, 8.5in. paper with roll diameter 5in. 74 or 86 cpl, 6.6 or 10 cps.

Models 32 and 33 page printers — *ASR from £1,100; KSR from £800; RO from £700*
Available in ASR, KSR and receive-only versions. Friction or sprocket feed, 20mA or 60mA parallel, up to 86 cpl, 6.6 or 10 cps.

DATA GENERAL CORPORATION

Dasher TP1 Printer models 6040 and 6041 — *From £1,598*
6040 standard keyboard and can be used as a typewriter. 6041 is a receive-only terminal printer without keyboard, 30 or 60 cps, switch selectable, EIA-RS232C interfaces, 5x7 dot matrix. Main U.K. agent Data General.

DATAPLUS

400 series receive-only Model 480 — *£475*
Impact dot matrix, uses standard Tally roll, up to 3.75in. side, from 80p per roll, RS232C, V24, 20mA current loop, but parallel IEEE, Pet and Apple interfaces, 30/40 cpl, 110 cps, 7x5 and 7x10 matrices. Main U.K. agent Dataplus Ltd.

DATASOUTH CORPORATION

DS-180 — *£1,360*
Impact, matrix printer, uses fan-fold paper, RS232C, current loop, and parallel interfaces, 132 cpl, 180 cps, 9x7 matrix. Main U.K. agent Datatrade Ltd.

DIABLO

HY type II receive only — *P.O.A.*
Impact daisywheel plastic or metal print wheel, parallel, interface, 132 10-pitch cpl or 158 12-pitch cpl, 40/45/55 cps. Main U.K. agent Diablo Systems Ltd.

630 receive only — *£1,725*
Daisywheel, metal/plastic printwheels, standard listing or single sheet paper, RS232C, V24 with optional bus interface, 132 cpl at 10 pitch, 158 cpl at 12, 198 cpl at 15, up to 40 cps with automatic bi-directional printing. Main U.K. agent Geveke Electronics.

DIGITAL EQUIPMENT

DecWriter LA34 KSR — *£824*
Dot matrix, uses roll or fan-fold paper, friction-feed, up to five copies, RS-232 or 20mA interfaces, adjustable up to 256 cpl, 30 cps, 7x9 matrix. Main U.K. agent Bytech.

A120 — *from £1,645*
7x7 dot matrix, EIA or 20mA option, up to 217 cpl, 180 cps. Main U.K. agent Bytech.

DIGITRONIX

Mini-Printer — *£195*
32 column electro-sensitive, 110-4,800 baud, ASCII Serial inputs at RS232C, 20mA, 64 font at 64 cps. Main U.K. agent Digitronix.

DRG

Starwriter FP1500-25 — *£923*
96-character daisywheel printer. Up to 136 cpl, 25 cps, RS232 interface, compatible with sheet feeders. Self-testing, programmable vertical format unit. Available from DRG Business Machines.

SHOPWINDOW

ELECTROGRAPHIC AV

EG-800 receive only — *from £450*

Impact, matrix printer, uses any type of paper, parallel, RS232C, TRS-80, Apple interfaces, 80 cpl, 150 cps, 7x5 or 7x6 matrices. Main U.K. agent Electrographic AV Ltd.

500 series receive only — *from £175 for mechanism only*

Impact, matrix printer, uses 3.5in. Tally roll paper and flat documents, serial or parallel interfaces, 40 cpl, 120 cps, 7x5 or 7x6 matrices. Main U.K. agent Electrographic AV Ltd.

EPSON

TX-80 — *£395*

Impact, dot matrix, friction pin-feed RS232C, V24, 20mA current loop, bit parallel, Centronics, IEEE, Pet, Apple and TRS-80 interfaces, 80 cpl, 150 cps, 7x5 or 7x10 matrices and graphics. Optional PROM chips for high-resolution graphics. Main U.K. agent Dataplus Ltd.

MX-80 — *£425*

Impact, dot matrix, accepts any type of paper, Centronics parallel interface, optional serial and IEEE 488 interfaces, 44, 66, 80, 132 cpl, 80 cps, 9x9 matrix — 2.1 x 3.1mm. High resolution graphics.

EXTEL CORPORATION

M30 receive only keyboard send/receive and automatic send/receive — *£895*

Impact, dot matrix printer, uses roll or fan-fold paper, V24 or 20mA interfaces, 80 cpl, 30 cps (50 with buffer) 5x7 matrix, 5- or 8-level operation. Main U.K. agent Extel.

M30 B208L keyboard send/receive — *£1,270*

Dot matrix, uses roll paper, V24 or 20mA interfaces, 80 cpl, 30 cps, 5x7 matrix, 5- or 8-level operation. Main U.K. agent Extel.

FACIT

4520 and 4521 — *£583*

Seven-wire print head, uses roll paper Telex type (Facit 4520), friction feed, fan-fold (Facit 4521) pin feed, serial, V24/RS323C, Centronics parallel interfaces, both fitted as standard, 80 cpl, 100 cps at 12 characters per inch, 9x7 matrix. Main U.K. agent Facit Ltd.

GENERAL ELECTRIC, U.S.A.

ITT 3330 — *£1,496*

Impact dot matrix, pin feed, V24 interface, 132 cpl, 10, 20 or 30 cps, 7x9 matrix. Main U.K. distributor ITT Business Systems U.K.

HEATH ELECTRONICS

WH14 — *£510*

Dot matrix, uses edge-punched fan-fold paper, 20mA, RS232C interfaces, 80, 96, 132 cpl, 132 cps, 5x7 matrix. Main U.K. agent Heath Electronics U.K. Ltd. (OEM sales).

INTEGRAL DATA SYSTEMS

Paper Tiger Model 460 — *from £700*

Dot Matrix, impact printer, pin-feed fan-fold paper, parallel, RS232C, 150 cps, 24x9 matrix. Main U.K. agent Teleprinter Equipment Ltd.

LEAR SIEGLER INC

300 series *from £965*
Dot matrix, uses standard paper, RS232C, 20mA parallel interfaces, Centronics 701/703 type 132 cpl, 180 cps, 9x7 or 9x9 matrices. Main U.K. agent Penny & Giles Data Recorders Ltd.

LOGABAX

LX-213 *£1,590*
Dot matrix printer, plain paper, fan-fold or cut up to six-ply, RS232C or V24 interfaces, 132 cpl, 218 cpl, 180 cps, 9x7 matrix, optimised bi-directional printing. Main U.K. agent Brospa Data Ltd.

LRC EATON

7000+ *£250*
Dot matrix printer, uses roll paper, RS232, IEEE, current loop and parallel interfaces, 20, 32, 40 and 64 cpl software selectable by option, 40 cps, 7x7 matrix. Main U.K. agent Russet Instruments.

MALIBU ELECTRONICS CORPORATION

Masterprint 165 *£1,400*
Dot matrix, fan-fold paper, RS232C, current loop and parallel interfaces, 132 cpl, 165 cps, 10x9 matrix with 18x9 matrix character set which approaches word-processing quality, graphics. Main U.K. agent MBS Terminals Ltd.

MANNESMAN TALLY

Main U.K. agent Data Design Techniques Ltd

M-80 MC *from £875*
Dot matrix, 9.5in. pin feed paper, all interfaces, 80/132 cpl, 200 cps, 7x9 or 9x9 matrices.

T1612 keyboard send/receive *£1,612*
Dot matrix, single or multi-part paper, pin feed, RS232C or 20mA interfaces, 132/218 cpl, 160 cps, 7x9 or 9x9 matrices.

T1612 receive only *£1,475*

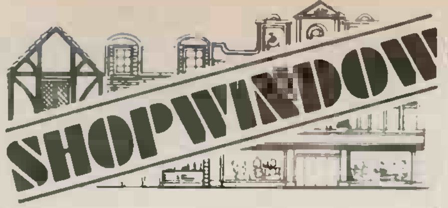
T1602 *£1,395*
Dot matrix single- or multi-part paper, pin feed, Data Products, Centronics and serial interfaces, 132 cpl, 160 cps, 7x9 matrix.

MICRO PERIPHERALS INC

MPI-88T *£535*
Dot matrix printer, uses fan-fold, roll and cut-sheet paper, RS232C, current loop and parallel interfaces, 80/96/120/132 cpl, all software-selectable, 120 cps, 7x7 matrix. Main U.K. agent Russet Instruments.

NEWBURY LABORATORIES

Model 8300 *from £475*
Dot matrix, pin-feed paper up to 9.5in., eight-bit parallel interface or CCITT V24, RS232C interfaces, 10 characters per inch, 125 cps, 7x9 matrix. Main U.K. agent Newbear Computing Store.



NIPPON ELECTRIC COMPANY

Spinwriter *£1,500*
Combines golf-ball daisywheel and thimble mechanism, uses continuous or single-sheet computer paper, RS232C serial (RO and KSR), Centronics-compatible and Diablo-compatible interfaces, 8080 input bus line, current loop, 55 cps, solid-font matrix. Main U.K. agent Memec Systems Ltd.

OKI

Microline 80A *£299*
Dot matrix, 9x7, 80 cps, 80 or 132 cpl, pin, traction or friction feed, RS232, 20mA Centronics. Main U.K. agent X-Data.

Microline 82A *£399*
Dot matrix, impact printer, 80 cps, bi-directional logic-seeking, 40, 66, 80 or 132 cpl, pin, friction or tractor feed, serial and parallel interface, 160 characters. Main U.K. agent X-Data.

QUME

Sprint 5/45 receive only *£1,795*
Daisywheel mechanism, uses plain paper, fan-fold or cut appear A4 up to six-ply, RS232C or V24 interfaces, 156 cpl at 12 pitch, 45 cps. Main U.K. agents, Access Data Communications and ISG Data Sales.

Sprint 9/35 KSR **£1,400**
35 cps daisywheel printer, exceptionally quiet operation, integral keyboard.

Sprint 9/45 RO and Sprint 9/55 RO **£1,650**
Similar to the 9/35 KSR but with no keyboard, 45 or 55 cps. Main U.K. distributor Bytech, ISG Data Sales.

RAIR

Main U.K. agent Rair Ltd

820/825 Desk-top printer *£1,090*
Dot matrix, RS232C interface, 132 cpl, 75 or 150 cps, 7x7 matrix.

DecWriter IV keyboard printer, KSR and read only *£795*
Dot matrix, uses standard listing paper, RS232C current loop interface, 215 cpl, 30 or 180 cps, 9x7 matrix.

M200 *£1,995*
Dot matrix, uses continuous paper, parallel or serial interface, 132 cpl, 340 cps, double 7x9 matrix.

DecWriter III *£1,550*
Dot matrix, uses continuous listing paper, RS232C or 20mA, current loop interfaces, 132-215 cpl, 180 cps, 7x7 matrix.

RICOH

RP-1600 *£1,295*
Daisywheel, uses single-sheet or continuous paper, Centronics and compatible interfaces, 132 cpl, 60 cps. Main U.K. agent Nexos (U.K.) Ltd.

ROXBURGH PRINTERS

X80 SP printer/plotter *from £896*
Dot matrix, impact printer/plotter, pin-feed, fan-fold paper, RS232C, IEEE488, CBM, Centronics, HP85, 20mA, Tektronix, 80/96 cpl, 100 cps bi-directional, 8x8 matrix, three character generators, various other generators. U.K. dealer Roxburgh Printers Ltd.

RP 8021 — *from £176*
Dot matrix, impact printer, Tally roll, parallel, RS232C, 20mA, 21 cpl, 150 lpm, 5x7 matrix, sprocket-feed option for labels. U.K. dealer Roxburgh Printers Ltd.

RP 8040 — *from £197*
Dot matrix, impact printer, Tally roll, parallel, RS232C, 20mA, 40 cpl, 72 lpm, 5x7 matrix, sprocket-feed option for labels. U.K. dealer Roxburgh Printers Ltd.

RX 8000 — *from £228*
Dot-matrix impact printer, friction or tractor/friction feed versions. Centronics, RS-232/20mA loop, 80, 96 or 132 cpl, 80 lpm bidirectional logic seeking, 9x7 matrix, double-width characters.

RX40 — Apple — *£152*
Dot-matrix thermal printer, tally roll, direct Apple II connection, 40 cpl, 120 lpm, high-resolution graphics printing, 10 seconds for 1 page. U.K. dealer Roxburgh Printers.

S FARID (SPECTRONICS) MANUFACTURING

TP-40 and TP-65 receive only — *from £660*
Thermal, matrix, uses thermal paper, cost of paper £1.80 each roll, seven-bit parallel interface, push-button control and self-test, 40 or 64 cpl, 13 or 18 cps, 7x5 dot matrix. Main U.K. agent S Farid (Spectronics) Manufacturing Ltd.

TALLY

Main U.K. agent Data Design Techniques Ltd
T1612 keyboard send/receive — *£1,612*
Dot matrix, pin-feed, single- or multi-part paper, RS232C or 20mA interfaces, 132-218 cpl, 160 cps, 7x9 or 9x9 matrices.

T1612 receive only — *£1,475*
T1602
Dot matrix, pin-feed, single- or multi-part paper, Data Products, Centronics and serial interfaces, 132 cpl, 160 cps, 7x9 matrix.

TELETYPE CORPORATION

Model 43 keyboard send/receive — *£800*
Impact matrix printer, uses pin-feed or friction-feed, dual RS232C and 20mA current loop interfaces, 132 cpl, 30 cps, 4x7 matrix on nine-wire printhead. Main U.K. agent Geveke Electronics Ltd.

TEXAS INSTRUMENTS

Main U.K. agents Texas Instruments and Rair Ltd
OMNI 800 series
Models 810, 820 and 825 — *from £1,090 to £1,650*
Dot matrix printers, uses paper, EIA, current loop, parallel interfaces, 132-216 cpl compressed print (models 820 and 825), 132 cpl (model 810), 75 cps (model 825), 150 cps (models 810 and 820), 9x7 matrix.

Silent 700, model and 745 portable — *£1,250*
Thermal mechanism, uses thermal paper at £1.50 per 100ft. roll, integral acoustic coupler, EIA interfaces, 80 cpl, 30 cps, 5x7 matrix.

Silent 700, 743 Keyboard send/receive version — *£1,105*
Thermal mechanism, uses thermal paper at £1.50 per 100ft. roll, EIA, 20mA current loop interfaces, 80 cpl, 30 cps, 5x7 matrix.

TRANSDATA

313 Receive only — *£790*
Dot matrix mechanism, uses thermal paper at £60 per box of 24 rolls x 150ft. RS232C and parallel interfaces, designed for use as VDU hard copy, 80/132 cpl, 30 to 45 cps, 7x5 matrix. Main U.K. agent Transdata Ltd.

TRANSTEL COMMUNICATIONS

AR receive only — *P.O.A.*
Dot matrix, uses standard teleprinter paper, V24, current loop interface, 80 cpl, 30 cps, 7x5 matrix. Main U.K. agent Transtel Communications Ltd.

UNITED SYSTEMS CORPORATION

Main U.K. agent Aviquipo Ltd

DigiTec 6320 — *£483*
Electro-sensitive dot matrix, electro-sensitive line roll paper at £1.80 per roll, RS232C or isolated 20mA current loop, 21 or 32 cpl, prints two lines per second, 1,200 Baud receive, 5x7 matrix.

DigiTec 6330 — *£421*
Dot matrix, electro-sensitive paper at £1.80 per roll, 8-bit parallel/character serial, 21 or 32 cpl, 5x7 matrix.

DigiTec 6410 — *£237*
Dot matrix, electro-sensitive paper at £1.80 per roll, RS232C or 20mA current loop, 21 or 32 cpl, two lines per second, 5x7 matrix.

DigiTec 6420 — *£237*
Dot matrix, electro-sensitive paper at £1.80 per roll, 8-bit parallel serial, 21 or 32 cpl, prints two lines per second, 1,200 Baud receive, 5x7 matrix.

DigiTec 6450 — *£266*
Dot matrix, thermal paper at £1.80 per roll, RS232C 20mA current loop, 21 cpl, prints two lines per second, 110 or 300 Baud receive, 5x7 matrix.

DigiTec 6460 — *£266*
Dot matrix, thermal paper at £1.80 per roll, eight-bit parallel serial 21 cpl, two lines per second, up to 1,000 Baud receive, 5x7 matrix.

DigiTec 6550 — *£289*
Dot matrix, thermal paper at £1.80 per roll, RS232C or 20mA current loop, 21 or 32 cpl, prints two lines per second, 110 or 300 Baud receive, 5x7 matrix.

VECTOR GRAPHIC

MP printer — *£599*
Uni-directional seven-wire x five-column dot matrix, original and one copy, maximum paper thickness 0.2mm., uses pin-wheel paper feed, 70 lines per minute, 150 cps, TTL level interface, two parallel output ports and one-parallel input port. Main U.K. agent Almarc Data Systems Ltd.

WALTERS MICROSYSTEMS

Dolphin BD-80P — *£525*
Impact, dot matrix, adjustable sprocket feed, any one of three interface choices, 10 characters per inch, 80 cpl, full ASCII character set, self-testing, 64 graphics characters, 9x7 and 11x7 matrices, double-width characters, bi-directional printing. Main U.K. dealers Texas Instruments or Walters Microsystems.

Dolphin BD-136 — *£1,200*
Impact, dot matrix, forms tractor, fully interfaceable, 136-226 column width, full graphics capability, 7x9, 9x9 matrices, 32 user-definable characters plus full ASCII set, data-formatting functions, fully logic seeking, self-testing. U.K. dealers Nexos.

WENGER DATENTECHNIK

Sole U.K. distributor Access Data Communications Ltd

Print Swiss Matrix Printer — *from £700*
Dot matrix RS232C, 20mA, 60mA and parallel interfaces, Centronics-compatible, 80 cpl, constant throughout 80 cps, 55-1000 lines per minute, 7x7 matrix. KSR version also available.

Penny & Giles hard copies — *from £365*
Electro-static RMP paper 127mm. x 70m. at £3.50 per roll, RS232C, current loop option, 80/40/20 cpl, 80 columns, 110 lines per minute, 8x5 line printer, 5x7 message printer matrix.

WHYMARK INSTRUMENTS

Main U.K. agent Whymark Instruments Ltd

Model 201 *£440*
Dot matrix, Tally-roll paper printer, IEEE, RS232C, serial, and parallel interfaces, 40 cpl, 40 cps, 52 character set with four-character sizes.

Model 204 label printer *£515*
Dot matrix, impact printer for self-adhesive labels, IEEE, RS232C, serial and parallel interfaces, 40 cpl, 40 cps, 52 character set with four-character sizes.

Model 3011 ticket/form printer *£690*
Dot matrix, plain paper, options automatic date and time, IEEE, RS232C, 40 cpl, 40 cps, 52 character set with four character sizes.

Model 501 rack-mounting printer *£625*
Dot matrix plain paper, options automatic date and time, IEEE, RS232C, 40 cps, 40 cpl, 52 character set with four character sizes.

Model 801 80/120 column printer *£750*
Dot matrix, plain or fan-fold paper, proportional spacing up to 120 cpl, 120 cps, bi-directional printing, user-definable character set, up to 4K selectable character fonts, graphics, and user-definable characters, also available; very large characters seven lines high.

Alphabetical list of suppliers

Supplier	Address
Access Data Communications Ltd, 0895-30831	Unit 17, Eskdale Road, Uxbridge Industrial Estate, Uxbridge, Middlesex UB8 2RT.
Almarc Data Systems Ltd, 0602-52657	Great Freeman Street, Nottingham NG3 1FK
Anadex Ltd, 025672-3401	Weaver House, Station Road, Hook, Hampshire RG27 9HU
Aviquipo of Britain Ltd, 0628-34555	St. Peter's Road, Maidenhead, Berkshire SL6 7QU
Bytech Ltd, 0734-61031	Suttons Industrial Park, London Road, Earley, Reading, Berkshire RG6 1AZ
Cable and Wireless 01-928 0261	83 Blackfriars Road, London SE1 8HQ
Cifer Systems Ltd, 0225-704502	Avro Way, Bowerhill, Melksham, Wiltshire SN12 6TP
Clary Ltd, 01-680 2222	12-14 Lower Addiscombe Road, Croydon, Surrey CR9 6AG
Comma Computers, 0277-811 131	West Horndon Ind Park, West Horndon, Essex CM13 3MJ
Dacoll Engineering Services Ltd, 0438-4381/0506-56565	Gardners Lane, Bathgate, West Lothian
Datac Ltd, 061-941 236/2	Tudor Road, Broadheath, Altrincham WA14 5TN
Data Design Techniques Ltd, 01-207 1717	12 Leeming Road, Borehamwood, Hertfordshire WD6 4DU
Data Dynamics, 01-848 9781	Data House, Springfield Road, Hayes, Middlesex
Data General Ltd, 01-572 7455	3rd and 4th Floors, Hounslow House, 724-734 London Road, Hounslow, Middlesex TW3 1PD
Dataplus Ltd, 0242-30030/37373	39-49 Roman Road, Cheltenham GL51 8QQ
Datatrade Ltd, 0604-22289	17 Billing Road, Northampton NN1 5AW
Davinci Computers Ltd, 01-952 0526	65 High Street, Edgware
Diablo Systems Ltd, 04862-71991	Regent House, 20 The Broadway, Woking, Surrey GU21 5AP
Digitronix Ltd, 0908-566888	10 Burners Lane, Kiln Farm Industrial Estate, Milton Keynes

VIC 20 GAMES TAPE. Six super games for only £3 incl p&p). Each game features graphics, colour and sound. Four in a row, Mean Maze, Pontoon, Bustabrick, Higher or Lower and Fruit Machine. All run on standard machine, hours of fun. Send now to: M. Gardiner, 103 Holmes Chapel Road, Congleton, Cheshire.

PET 32K (new ROMs), with cassette deck, £450. Tel: Worcester 52108.

ZX80, 8K ROM with 16K RAM plus motherboard, soundboard, Sinclair manuals, software cassettes and books. £120. Tel: 041-763 1624.

SARACEN COMPLETE S100 System. 64K Z80 4 serial, 4 parallel ports. 2 x 8 inch double sided single density drives. CP/M 2.2, Steel cabinet Lyme 4003 VDU. DRI 6320 132 column printer with stand. £4,000. Mr. M. R. Wilson, Selborne (042-050) 344.

BBC/TRS-80/ZX81 Educational Software by professionally qualified teacher. Over 16 Language and Mathematical programs from £3.50 as reviewed EDUCATIONAL COMPUTING magazine. S.A.E., Bryants, 1 The Hollies, Chalcraft Lane, North Bersted, Bognor Regis PO21 5SX. Tel: Bognor 829478.

INCREASE YOUR INCOME using "Midas", a successful inflation beating user friendly program written for a 3032/4032 (32K) PET. Test this £55 program for only £2.99, and confirm that MIDAS & PET make MONEY. All we ask is that within 21 days, you either pay the balance of £52, or simply return the original cassette and owe nothing more. Amron, 21, Grosvenor Road, Southport PR8 2JG.

TRS-80 MACHINE CODE games cassette featuring "Breakout", "Invaders" & "Submarine Battle" — £5 inclusive. Money with order, delivery by return. A. Moseley, 59 Plymstock Road, Plymstock, Plymouth, Devon PL9 7NX.

ZX80. Both ROMs, manuals, leads, software. As new £55. Phone 059-581 202.

ZX81 TOPPIX. Detailed DIY graphics update £2. 16K M/C easyloaders, load REMs without spaces anywhere in listing. HEX and Decimal £4, or £2.50 each. All plus S.A.E, N. J. Petry, 3 Lester Drive, Worle, W.S.M. BS22 0NG.

PET 'MINI BASIC COMPILER' on cassette with 20 page manual. All ROMs, all maths functions supported, with up to 15 x speed of interpreter. £16.50. PET machine language guide — details over 30 built in ROM routines. £6. S.A.E. for further details: Adamsoft, 18 Norwich Avenue, Rochdale, Lancs OL11 5JZ.

DRG Business Machines, 0934-416392	13-14 Lynx Crescent, Winterstoke Road, Weston-super-Mare, Avon.
Electrographic AV Ltd, 01-573 1826	Printinghouse Lane, Hayes, Middlesex UB3 1AP
Extel, 01-739 2041	Engineering Division, The Exchange Telegraph Company Ltd, 73-75 Scrutton Street, London EC2 4TA
Facit Ltd, 0634-40172/7	Maidstone Road, Rochester, Kent
Fortronic Ltd, 0383-823121	Donibristle Industrial Estate, Dunfermline
Geveke Electronics Ltd, 04862-71337	RMC House, Vale Farm Road, Woking, Surrey
Heath Electronics (U.K.) Ltd, 0452-29451	Bristol Road, Gloucester GL2 6EE
ISG Data Sales Ltd, 95-57955	Unit 9, Fairacre Industrial Estate, Dedworth Road, Windsor, Berkshire
ITT Electronic Services, 0279-26777	Edinburgh Way, Harlow, Essex
ITT Business Systems, 0273-507111	Crowhurst Road, Hollingbury, Brighton BN1 8AN
Kode Services, 0249-813771	Station Road, Calne, Wiltshire SN11 0JR
MBS Terminals Ltd, 09323-53151	Aldwych House, Madeira Road, West Byfleet, Surrey KT14 6BA
Memec Systems Ltd, 084421-3149	Park Industrial Estate, Thame, Oxon
MIBF 0734-415191	Barclays Bank Chambers, Pegg Lane, Kirkgate, Tadcaster, North Yorkshire
Microbyte, 01-278 7369	Unit 9-10, 1st Floor, 38 Mount Pleasant, London WC1X 0AD
Microsense Computers Ltd, 0442-48151/41191	Finway Road, Hemel Hempstead, Hertfordshire HP2 7PS
Newbear Computing Store, 0635-30505	49 Bartholomew Street, Newbury, Berkshire
Nexos U.K. Ltd, 084421-3151	3 Jefferson Way, Thame, Oxfordshire OX9 3FU
Penny & Giles Data Recorders Ltd, 042-5271 511	Mudeford, Christchurch, Dorset BH23 4AT
Peripheral Hardware Ltd, 01-941 4806	Armfield Close, West Molesey, Surrey
Rair Ltd, 01-836 4663	30-32 Neal Street, London WC2H 9PS
Robox Office Equipment Ltd, 041-776 4388	84 Townhead, Kirk in Tiloch, Glasgow, Scotland
Roxburgh Printers Ltd, 07973-3777	22 Winchelsea Road, Rye, E. Sussex TN31 7BR
Russet Instruments Ltd, 0734-868147	Unit 1, Nimrod Way, Nimrod Industrial Estate, Reading, Berkshire RG2 0EB
S. Farid (Spectronics) Manufacturing Ltd, 02013-77337	Dawkins Road, Industrial Estate, Poole, Dorset BH15 4JY
SEN Electronics 09328-66744	5 London Street, Chertsey, Surrey
Stack Computer Services Ltd, 051-933 5511	290-298 Derby Road, Bootle, Liverpool L20 8LN
Teleprinter Equipment Ltd, 044282-4011/9	70 Akeman Street, Tring, Hertfordshire HP23 6AJ
Terminal Display Systems Ltd, 0254-662244	Hillside, Whitbrik Estate, Blackburn, Lancashire BB1 5SN
Texas Instruments Ltd, 0234-67466	Manton Lane, Bedford MK41 7PA
Transdata Ltd, 01-403 5115	Battlebridge House, 87-95 Tooley Street, London SE1 2RA
Wilkes Computing Ltd, 0272-25921	Bush House, 72 Prince Street, Bristol BS1 4HU
Whymark Instruments Ltd, 07372-21753	6 Holmsdale Road, Reigate, Surrey RH2 0BQ
X-Data 0753 49117	Marish Wharf, St Mary's Road, Langley, Slough, Berkshire SL4 1HE

SHOPWINDOW

COMPLETE SYSTEM HEATH/ZENITH for sale. Comprises: H8 Computer with 56K RAM; H19 "Intelligent" VDU with graphics; 2-H17 5½" disk drives and H14 dot matrix printer. Includes all software (CP/M Compatible), manuals and 30 discs. Current cost would be in excess of £3,000. Will accept £1,300 or nearest. Telephone Burscough 0704 89 3260.

RTTY RTTY RTTY. See the world of teletype with our Computer Interface unit. PC boards — Wired Modules — Boxed units. SAE for details. Mr. J. Melvin, 2 Salters Court, Gosforth, Newcastle-upon-Tyne. Tel: 843028.

48K EXIDY SORCERER, as new, all manuals and leads, UHF modulator, basic rom. Offers over £350 secures. Tel: Winchester (0962) 66720 evenings.

CBM ACOUSTIC MODEMS (2). Connect directly to IEEE bus for communication with other CBM or remote mainframe. £300 the pair or £175 each. Woking 61082.

ACORN ATOM 12K x 12K. Software including Chess, Dodgems and Breakout. £200. Tel: 01-659 2002.

TRS-80 MOD1 16KL2, keyboard unit £350, 32K expansion interface £200, (TEAC) disk-drive & sys disk £200. All very little used. Tel: (0443) 690174 night or (0685) 74397 day.

WANTED — PET 8032/8096 business system. Separates considered. Tel: 0270-67889 after 7.00 p.m.

ITT 2020 (Apple II) 48K micro-computer with Intecer basic Rom card. RTTY/CW software, £550 ono. Tel: 0276 25040.

6502 Line by line assembler and disassembler program in 2K bytes. Adaptable to most 6502 machines with alphanumeric keyboard and memory-mapped VDU. £3 plus transportation costs. For details telephone 0574 4530 weekdays 7.30 p.m. to 11.30 p.m. or S.A.E. to E. Blackburne, 32 Newington Avenue, Larne, Co. Antrim, BT40 1NN.

NORWEGIAN usergroup seeking used ZX81s. Will pay well. Contact Jan Otto Reberg, Bjerkelundveien 15, 1400 Ski, NORWAY.

COMMODORE 32K — 3032 Series PET CPU plus Computhink 800K disc drive units and Commodore Tractor Printer 3022 Series ideal machine for development work, very clean, very little used, £800 the lot. Contact Mike Sibley, Tel: 01-739 3158.

ZX81 Personal Computer, as new, £60 o.n.o. Tel: 051-339 8203

VIC 20 ASTRO PILOT 5K. Cassette £2. Rom Software, Stanhope House, Soames Walk, New Malden, Surrey, KT3 4RZ.

APPLE II PLUS 32K, with Colour Card, Modulator, Paddles, Manuals etc. As new £600. Tel. 03294 43821, Fareham (Hants).

APPLE II PLUS. 48K. £540 incl. software, Apple magazines. Telephone Bedford 856716.

DRI 4000 top loading FED hard disk drive. Unused, tested, suit S100 system. £850 o.n.o. (includes power supply). Phone Bristol 791799 or Winterbourne (Bristol) 772545.

POWER chip £42. COMMANDO-O chip £51. (75% cost price). Manuals included. Both C.B.M. 8032 slot UD12. Tel: 041-639 6626 after 6pm.

PET 2001 16K. New ROM. Large keyboard. Commodore cassette. Phillips mini digital cassette. Printer interface. Assembler, toolkit, superchip ROMs. Software. Books. £600. P. Novis, 108a Milton Road, Clapham, Bedford, MK41 6AS.

ZX81 16K+ printer + extras, vgc, (3 months old) — £175 ono. Call Redhill 61612 after 6pm.

TRS-80 Quick Printer II. Good as new, £75. Tel: 061-973 9877.

VIDEO GENIE. 16K with sound, little used — £225. Tel: 0590 22744.

TRS-80 4K Level 2 VDU, Cassette recorder, manuals, etc. £265 ono. Tel: 01-890 6627.

APPLE II PLUS, 48K, £450. Microhush 100 thermal printer for Apple £75. Tel: Chard (04606) 3814 evenings.

S-100: Morrows 16K S/Ram Boards £71; IMS 8K S/Ram Boards £50; North Star 16K D/Ram Boards £80, Z80 CPU Board £105; Cromemco 2708 Eprom (16K capacity) Boards £35. APPLE M/Softcard CP/M/Basic £165; SSM I/O Card £92. 15in Green Screen D/Drive Monitor £60. Phone Crawley 515201.

FIRST ELECTRONIC CROSSWORD. For ZX81 16K. Graphic display. Tests knowledge of Basic. Also ANAGRAM. Three levels. Two games for £4.95. W. Newman, 3 Thalia Close, Greenwich, SE10 9NA.

SHARP MZ80K software: excellent games programmes available at a fraction of the usual prices. Also cassette Base business systems. SAE. for full details. C. Trevena, 20 Rhosleigh Ave, Sharples, Bolton, BL1 6PP.

ZX81 users, build your own 16K RAM extension. For full circuit information and instructions to build this digital masterpiece, send cheque or postal order for £1 only to MICROTEX, FREEPOST, HULL.

EMDAS Z80 ASSEMBLER/OPERATING system for NASCOMS with Nas-sys1. Written with a 'BASIC' approach to assembler language. An ideal aid for beginners or experienced programmers who wish to learn to write in machine code. 16 page documentation included. On tape (4·2K) £8.50. An assembler program: COSMIC INVADERS (gives a 2K object machine code program) on same tape £5. State if required. Richard Daykin, 7 Holcombe View, Moorside, Oldham OL4 2QD. Telephone (061) 6523969.

PET 2001 32K, green screen, little used, external cassette, large keyboard, manual and games. Telephone John on Stevenage 55421.

UK 101 GAMES SOFTWARE. Details from M. Leslie, 5 Baldwins, Welwyn Garden City, Herts AL7 2BD or phone 35949.

TANDY MODEL 1, 16K, green screen, £100 software, £410 ono 0752663219

ZX81 8K/16K ARCADE GAMES: Fantastic flicker-free moving graphics! Pack 1: Defender, Scramble, U-boat. Pack 2: Missile Control, Air Raid, Monaco. £1.50 per pack (listings). 16K games — s.a.e. for catalogue, free game. Jega Software, 27 Hallcroft Avenue, Countesthorpe, Leicester LE8 3SL.

NASCOM 2 (64K+8K PAGED) using 8in disk drive, >2400 baud tape, RS232, lots of software, system in verocase, 20 diskettes included, fully working, £680. Swanley 67083.

GOING ABROAD TO WORK. Must sell my disk based Exidy word processor. Cost over £3,000 new. Full system includes daisywheel printer. Giveaway price for quick sale, £1,500. No VAT. Phone 01-979 4370.

TRS-80 LII 16K + PSU and CTR/41. Also £50 of software. As new. Offers around £250. Phone (0535) 34402. J. D. Hopcroft.

ZX81. Tape A: 10 1K games, cassette £2.50, listings £3.00. Basic — Connection, Hangman, Defender, Destroyer, Simon, Invasion, M/c Canyon, Galaxians, Shuttle, Asteroids. (SAE details) I. Morrison, 17 Winton Circus, Saltcoats, KA21 5DA.

MZ80K. Games and utility programs. Write 38 South Parade, Bramhall, Stockport, SK7 3BJ.

PR40 (40-col) printer for Pet. £140 plus p&p. Tel 0304 617209.

UK101 8K including many programs such as: Invaders, Assembler, Startrek, £90. 051-228 7971.

ZX81 16K chess on cassette. 6 levels, graphic display. Send £3.90 to W. Hanratty, 15 Forth Court, Port Seton, East Lothian.

48K Apple II Plus, 2 drives, controller board, b&w monitor, paddles, floppies. VGC only £850. Tel Purfleet 4431 office hours.

ACULAB FLOPPY TAPE (TRS80 or Genie) with many programs e.g. Edtasm, Tbug chess, Backgammon, Adventures, Aculab extended Basic and Database etc £150. 01-693 8975.

THE REAL ADVENTURE BEGINS HERE — for Nascom owners with NAS-SYS. Send SAE for details on our versions of the classic mainframe Adventure (Nascom approved product) in machine code to: Syrtis Software, 23 Quantock Road, BRIDGWATER, Somerset.

VIDEO GENIE, eight months old, many books, some tapes, quick sale, £230. Ring 859 4780.

PET GAMES FOR SALE on cassette. 1) Mountain Attack (8K) £7 (Defender type space game). 2) Asteroids (space game) (8K) £7. 3) Carnivorous Caves (16K) £9 (Adventure game). 4) Educational space invaders (8K). (Learn to + − × ÷ the fun way). More available. Cheques and PO made payable to: 36 Highgate Avenue, Fulwood, Preston, Lancs. PR2 4LN.

32K PET SYSTEM comprising 3032 Pet, 3040 dual floppy, 3022 tractor printer and cables. As new condition, £1,800 the lot with 3 month guarantee, or could split. Tel: 09662 4104.

FOR SALE ZX81 1K RAM £45 wanted VIC-20. Alderley Edge 582146.

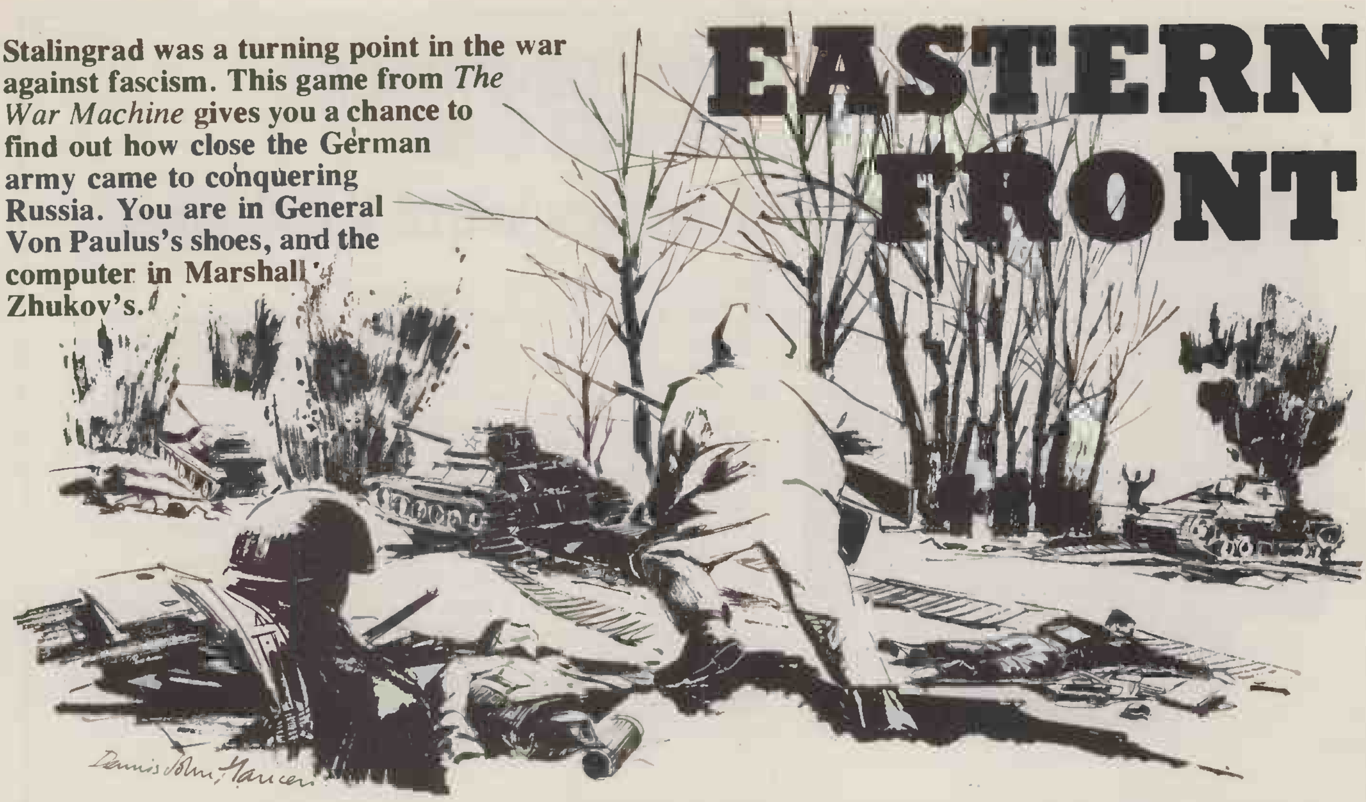
SHARP MZ80K 48K as new inc. manual, books, software, £375. Phone Hartlepool 74085.

ACORN BUILT 12K + 12K ATOM, PSU, leads, manual, £200 ono. Tel: (0283) 701142.

NORTH STAR HORIZON 32K; twin DD disk units. TTY43 pln feed terminal/printer. Hazeltine 1410 terminal. Disks and some software. All in first class condition. Offers over £2,000. 031-229 0874 (evenings).

EASTERN FRONT

Stalingrad was a turning point in the war against fascism. This game from *The War Machine* gives you a chance to find out how close the German army came to conquering Russia. You are in General Von Paulus's shoes, and the computer in Marshall Zhukov's.



EASTERN FRONT is written in machine code to run in 16K memory on the Atari 800 or 400. It is a simulation of Hitler's Operation Barbarossa in 1941, and runs from June 1941 to March 1942 in weekly turns. You play the Germans while the computer controls the Russians.

When the program is loaded a map of Russia appears, taking up two-thirds of the screen. The rest is occupied by the date of the action and two information panels. The map terrain includes rivers, mountains, swamp, forest and towns. The base colour of the map changes with the seasons, from brown in summer to grey in autumn and white in winter. The rivers change colour if they are frozen.

Screen information

On top of the map is a large hollowed-out square cursor which is controlled by the ubiquitous Atari joystick. If it is moved to the edge of the screen the map scrolls smoothly in the direction of cursor movement. The map stretches across an area of 10 screens.

Units are shown on the map as squares with different notations inside, depending on whether they are infantry or armour. When the cursor is positioned over the unit marker and the red trigger button is pressed, the unit designation, muster and strength are shown in the information panel at the bottom of the screen. Simultaneously with this an Iron Cross appears over the unit marker and this is the key to movement.

With the trigger pressed to show the cross, each movement of the joystick, up, down or sideways, will move the cross one step in that direction. The computer allows you to take eight steps. Releasing the joystick will make a green arrow emanate from the unit to the cross to show the path of movement. This is a necessary feature as traffic jams of units can quite easily build up and slow down your unit's progress.

The arrow can be used to check the possible build-up of jams by positioning the cursor and pushing the trigger. The arrow and the unit's cross are then displayed to show the unit's movement.

With the moves sorted out, pressing the start button at the side of the Atari's keyboard will start the computer resolving combat, and moving units. After each turn a number between 0 and 255 appears on the information panel to tell you how well you are doing. If you are a beginner you can press the option key on the keyboard and the muster of German units is increased.

The game plays superbly. All the normal war-game rules are in force, including zones of control, logistics, terrain and combat. Although the computer does all the work resolving combat and movement, it is possible to see how your units are doing on the screen. Combat is shown by the aggressors flashing on and off, and by the sound of machine-gun fire. Movement is shown as if it were a normal map board.

The tactics that have to be used are similar to those in the real battle. The Germans must use their tanks to break the line and speed towards Moscow and Stalingrad, while using the infantry as support and for mopping-up operations. When the Russian counter-offensive starts you feel like Canute trying to stem the tide.

Stalingrad crucial

The Germans must not spend too much time finishing off any Russian units behind their lines. It is better to stop them with one unit and starve them out through lack of supply.

To score highly Moscow and Stalingrad must be taken and held, and the Russians pushed as far east as possible. The computer will be planning its own moves while you are inputting yours. It does this by a system known as multi-tasking. It starts with a basic move and gradually refines it.

You can forget about rushing your move; the computer is fast, and will not be caught out by a rapid response from the player. The computer plays an extremely good game and after two months of play I can now score 50 points a game.

According to the excellent manual supplied with the game this rates as good. Apparently it is possible to achieve over 200 points — I must try harder.

The War Machine is published monthly by Emjay, 17 Langbank Ave, Rise Park, Nottingham, NG5 5BU. £1.25 an issue, £13 for an annual subscription, postage and packing included.

Conclusions

- The computer will recognise weak spots, danger, and the use of differing terrain.
- It does not react to the player's strategy, but takes every turn as it sees it.
- A remarkable feat to have fitted so much into 16K.
- Ratings:

Physical quality	Good
Perceived complexity	Fair
Subject complexity	High
Realism	Good
Play balance	Demanding
Overall	Very good

CU-GRAPH

ACORN COMPATIBLE GRAPHICS CARD

8 colours in 512 x 256 pixels

- Uses EF9366 graphics processor chip.
- Each plane of colour (red, green, blue) displays 16kB of memory, giving 512 x 256 resolution; each pixel can be red, blue, green, white, yellow, cyan, magenta or black.
- Only 256 bytes of the host computer memory are used, all 48k bytes of screen memory being on the memory map of the EF9366 only.
- Text display can be superimposed on graphics, and can be up to 85 columns by 32 rows, using an on board character generator. Each character can be scaled for height, width, slope and orientation, all independently.
- Driver software for use on Acorn and Cubit systems is available now, and a high resolution graphics extension to Acorn BASIC will follow later.

£180 Single Eurocard monochrome 16k bytes RAM £360 Eurocard with Piggyback Extension; 48k bytes RAM 8 colours centronics printer interface.

Send to: **CONTROL UNIVERSAL LTD**
Unit 2, Andersons Ct, Newnham Rd, Cambridge, Tel 0223 358757.

For free catalogue on Cubit, Acorn and Rockwell computers and Associated Peripherals

● Circle No. 259

THE REVOLUTIONARY TWOSOME

SDM Computer Services are major distributors of the Intertec Superbrain micro computer. This machine has established itself as *the* micro for the serious business user . . . it is not an upgraded hobby system.

Running, as it does, under the CP/M operating system, there is a wealth of readily available commercial software and SDM have their own tried and tested suite of packages covering:

Invoicing ● Stock ● Sales ledger ●
Purchase & Nominal ledgers ● Payroll

All models are available from double density through the 1.5MB system to the (shortly to be announced) Superbrain W6 which includes a 5MB Winchester.

Full software and engineering support when you buy from SDM.

SUPERBRAIN — built for commerce

MPI-88G — everything you need

This printer has more standard facilities than any other at a similar price:

- **RS232 serial** *and* **Centronics type parallel, 1K byte buffer**
- **Upper and lower case 96 character ASCII set, 100 cps maximum**
- **10, 12, 16.5 cpl and correspondence font**
- **High resolution graphics (vertical 72 dots/inch, horizontal 82 dots/inch)**
- **6 or 8 lines per inch paper feed**
- **Full forms control**

All the above list and others are *standard* at no additional cost.

Whether it is for your Superbrain business system or any other computer with RS232 or Centronics interfaces you cannot find a better printer.

Supplied ex stock for the amazing price of £475 plus VAT and P & P

S.D.M. COMPUTER SERVICES
BROADWAY, BEBINGTON, WIRRAL,
MERSEYSIDE L63 5ND. Tel: 051-608 9365.

SDM

● Circle No. 260

Duplex Communications

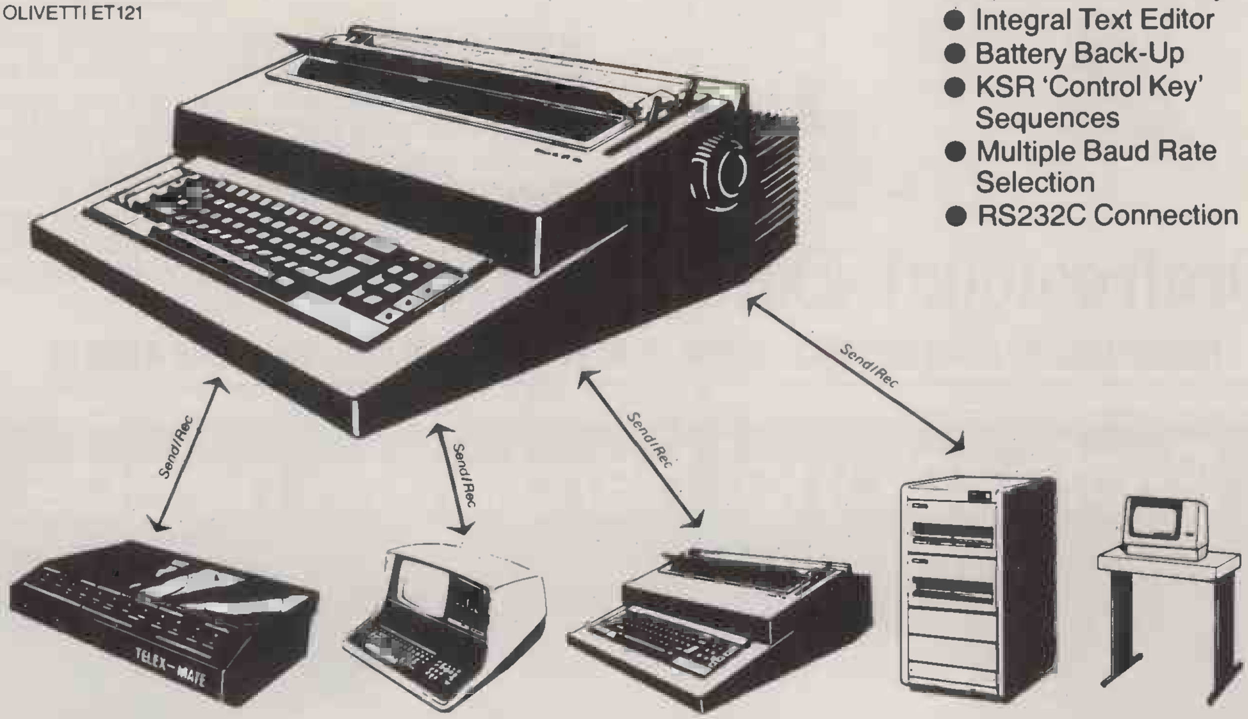
Northern Office: Dean House · Dean Hall Lane · Shaw Green · Euxton · Nr. Chorley · Lancs. Tel: 0257 453360
Midlands Office: 2 Leire Lane · Dunton Bassett · Nr. Lutterworth · Leicestershire. Tel: 0455 209131

● Computer Interfacing ● Equipment Design ● Systems Analysis ● Software Development ●

PRESENTS
The OCTET 121™ a multi-use communicating terminal and electronic typewriter

- 4,000 char. memory
- Integral Text Editor
- Battery Back-Up
- KSR 'Control Key' Sequences
- Multiple Baud Rate Selection
- RS232C Connection

OLIVETTI ET121



Telex-tape preparation | **Micro-computer** | **OCTET 121** | **Mini/Mainframe computer**

The OCTET 121 is capable of punching man-readable 'headers'. The full 4K of memory can be text-edited prior to punching. The OCTET 121 will also read in tapes where fast telex tape handling is required. Multiple OCTETs to one tape punch station is also available.

Use the OCTET 121 as a letter quality printer. A wide selection of Daisy Wheel typefaces are available. Terminal protocols to control the buffer are standard features.

OCTET 121 communication is achieved by simple cable connection or through an acoustic modem. Ideal for remote offices who would like to use the main office telex facilities. Prepare text at the remote office and transmit to main office to cut tape for forward transmission.

The OCTET 121 is a true KSR with all standard control sequences for operating system use. Ideal for the user who requires 'letter quality' print at all times. Use as a standard typewriter or telex prep. when not in KSR mode.

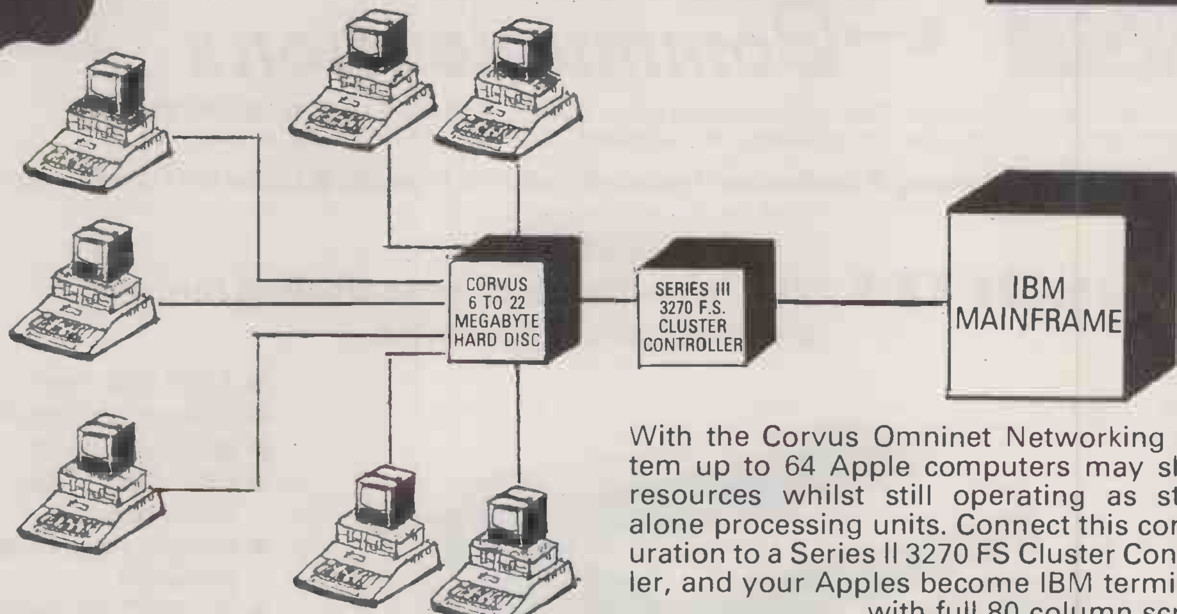
ICARUS
SUPERBRAIN DEALER

OCTET 121 has many uses and can be installed very easily in your office.
Call Duplex Communications Ltd. for more details. Telephone: Leire (0455) 209131 (Leicestershire)

™ OCTET 121 is a trade mark of Duplex Communications

● Circle No. 261

apple NETWORKING & COMMUNICATIONS



With the Corvus Omninet Networking system up to 64 Apple computers may share resources whilst still operating as stand alone processing units. Connect this configuration to a Series II 3270 FS Cluster Controller, and your Apples become IBM terminals with full 80 column screen facilities. To find out the date of our next seminar ring now!

Professional Data Systems.

CARNE HOUSE, MARLAND HILL, CHORLEY NEW ROAD, BOLTON. Tel: 0204 493816

● Circle No. 262

Professional hardware needs...

WHY YOU NEED LOCKSMITH.

You've invested some money and a lot of time in a commercial software program for your Apple. It works well, to the point that you are *dependent* on its day-to-day functioning. But the disks are copy-protected. So you are also dependent on the vendor's back-up (if furnished), on his living up to vague promises of support, even on his ability to stay in business.

No computer user can live with that. So until the situation changes (and it will), you need Locksmith.

Locksmith (new 4.0 version) will copy almost all "protected" diskettes for the Apple. It is the most reliable nibble-copy program you can buy. ***Locksmith is suitable only for backups,*** because the copies include all serial numbers, codes and protection features of the original (under the new copyright law, you'd have to be pretty foolish to try bootlegging software that is traceable back to the purchaser).

Locksmith includes nine other utilities, of which these five are vital to the integrity of your system: 1. Media surface check — Never commit data to a flawed diskette again. 2. Disk-drive speed calibration — the most frequent cause of communication bugs between Apples. 3. Degauss and Erase — Make sure no stray data is left over. 4. Nibble-Editor — sophisticated read/write tool for repairing blown disks. 5. Quickscan — Check for unreliable data, find used and unused tracks.

All for just £65.00 at your local dealer or direct. You don't just need Locksmith. You can't afford to be without it. Access or Visa accepted. Add £1.50 P & P. VAT excluded.

VERGECOURT LTD
17 NOBEL SQ., BASILDON
ESSEX SS13 1LP
TEL (0268) 728484

Apple is a registered trademark of Apple Computer, Inc.

● Circle No. 263

professional software for business

ISBS-F – the totally integrated business software system for microcomputers. Designed to perform day to day accounting and administrative functions in most business environments.

A few examples of the key business benefits from using ISBS-F are:

- optimum stock holding to keep costs to a minimum
- speedy invoice productions with stock release and posting to the sales ledger
- statements produced quickly at month end
- VAT analysis at the touch of a button
- improved credit control
- monitor performance easily using budgets and financial reports.

With over 3000 program modules already being used in many different types of industries and professions, ISBS-F offers reliability, backed-up by support, and at reasonable cost.

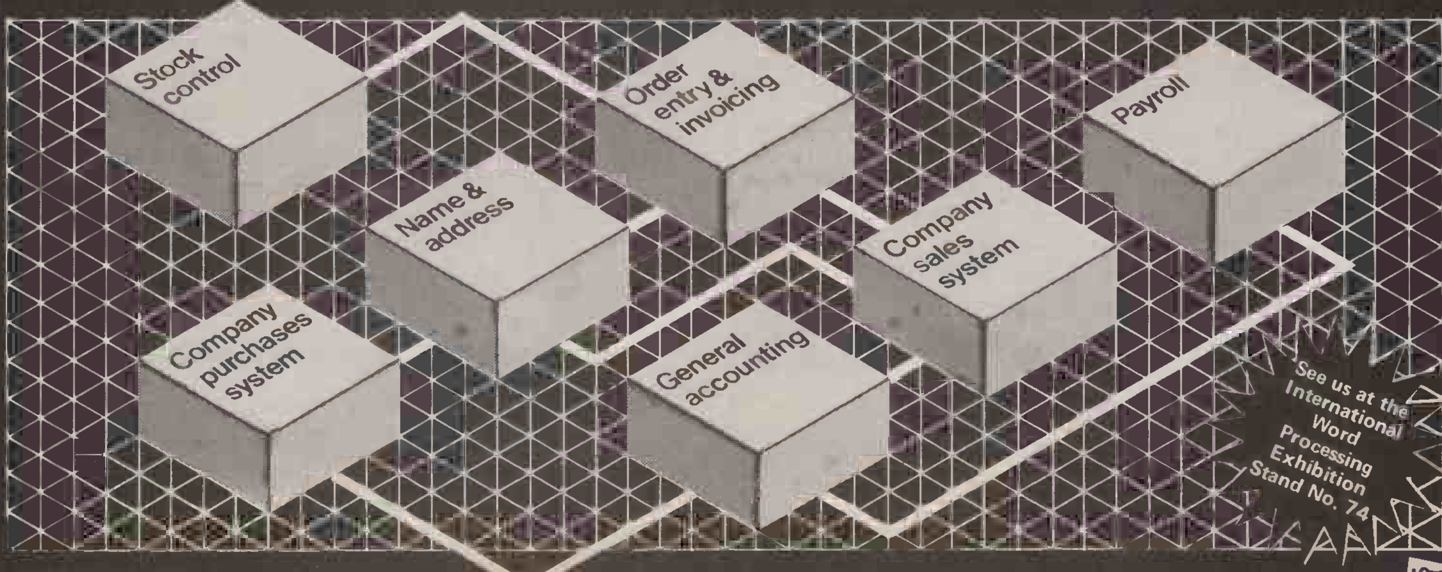
ISBS-F is available as individual modules or bundles so that configurations can fit the exact business environment. Each module is supplied on floppy disk with comprehensive documentation.

ISBS-F is designed for most popular 8080/Z80 based microcomputer systems running under CP/M*. A minimum of 48k memory is required, dual floppy disks and 132 column printer. Versions are also available for the 16 bit-microcomputers 8088/8086 running under CP/M 86.

In addition to ISBS-F, we complete our software product range with two other systems – the 2020 series and ISBS-W. The 2020 series includes WP2020 – Word Processor, CM2020 – Configurable Manager and the FP2020 – Financial Planner. ISBS-W is the advanced integrated business system for Hard disk microcomputers running in a single or multiuser environment.

For further details or a demonstration of any of our software products call us today or contact your nearest dealer.

GRAFFCOM SYSTEMS GROUP
102 PORTLAND ROAD LONDON W11 4LX 01-727 5561



● Circle No. 264

*CP/M registered trademark of Digital Research

WHY BUY FROM CAMDEN?

★ WE SUPPLY : THE **HARDWARE** — MAIN DISTRIBUTORS FOR ALL THE LEADING MAKES OF MICROCOMPUTERS AND PERIPHERALS.

★ WE SUPPLY : THE **SOFTWARE** — OFF THE SHELF PROGRAMS TO SUIT MOST APPLICATIONS FROM THE LEADING SOFTWARE HOUSES — WITH PROVEN RELIABILITY.

★ WE SUPPLY : THE **BACK-UP** — FROM OUR OWN ENGINEERING WORKSHOPS WITH FULLY QUALIFIED TECHNICIANS OR ON-SITE SERVICE — YOUR CHOICE.

★ WE SUPPLY : THE **EXPERIENCE** — AS ONE OF THE COUNTRY'S LEADING DISTRIBUTORS WITH PROVEN SALES RECORDS — AND ONE OF THE PIONEERS OF THE MICROCHIP.

★ WE SUPPLY : THE **KNOWLEDGE** — OUR FULLY TRAINED STAFF WILL ADVISE ON YOUR REQUIREMENTS TO SUIT YOUR NEEDS AND IMPROVE YOUR BUSINESS.

Superbrain

64K QD MODEL
PLUS EPSON MX80FT
PLUS FULLY INTEGRATED
ACCOUNTS PACKAGE
£21 *PER WEEK LEASE OR PURCHASE*

Apple III

128K MODEL
INCLUDES MONITOR
VISICALC III — SOS
MAIL LIST MANAGER
AND APPLE BUSINESS BASIC
PLUS SILENTYPE PRINTER
PLUS ADDITIONAL DISK DRIVE
£21 *PER WEEK LEASE OR PURCHASE*

CAMDEN COMPUTER SYSTEMS LTD

462 COVENTRY ROAD, SMALL HEATH, BIRMINGHAM B10 0UG
PHONE: 021-771 3636 (10 lines)
TELEX: 335909 (CAMDEN G)

CRA MEMBER

● Circle No. 269

ARE YOU A ZX81 USER WHO'S NOT PLAYING GAMES?

£47.50
Including VAT.
complete

ECR 81 DATA RECORDER SAVES AND LOADS YOUR PROGRAMS EVERY TIME!

The ECR81 Enhanced Certified Recorder from MONOLITH is a major advancement in cassette recorder technology which minimises the problems associated with standard audio recorders. The unit is a high reliability program store for ZX computers based on a modified, proven cassette mechanism. The two sections of data recording circuitry automatically ensure precise levels are written onto the tape and that optimised signals are received by the computer.

THE ECR81 IS NOT SUITABLE FOR AUDIO REPRODUCTION
NO MANUAL VOLUME OR TONE CONTROL ADJUSTMENT PROVIDED

- Each ECR81 comes complete with its own individual certification tape, tested and serial numbered to prove your machine reliability.
- Mains Operation only.
- Mains & DIN connector leads provided.
- Certification of tape head alignment - height and azimuth.
- Certified tape tension, torque and speed.
- Fast forward and rewind tape search controls.

The ECR81 is also suitable for Sinclair ZX80

● Please allow up to 28 days delivery. ● The ECR81 is backed by our 14 day money-back option.

MONOLITH
electronic products
Telephone: Crewkerne 0460 74321 Telex: 46306

To: MONOLITH ELECTRONICS CO. LTD., 5/7 CHURCH STREET, CREWKERNE, SOMERSET

Please supply me with:	Price	Total
____________(Qty.) Monolith ECR 81 Enhanced Certified Recorder(s) to be used with my ZX81	£47.50 (Each)	
I also enclose postage & packing per recorder	£2.50	
Prices include VAT	£	

Please print

Name: Mr/Mrs/Miss.

Address

● Circle No. 270

5MB WINCHESTER FOR APPLE II

- LOWEST COST/MBYTE FROM ANY SUPPLIER
- SINGLE APPLE CONTROLLER
- PASCAL COMPATIBLE "DROP IN" BIOS
- LICENSABLE "PROTECTED SOFTWARE" OPERATING SYSTEM (only available to bona-fide software suppliers)
- DEDICATED APPLE II
- FAST DELIVERY

SUBSYSTEM DOES NOT INCLUDE APPLE DRIVE

SYMBFILE

LOWEST UK PRICES

apple computer Sales and Service

R.R.P. **£1450**

TO PLACE YOUR ORDER, OR TO MAKE FURTHER ENQUIRIES, CONTACT:-

symbiotic computer systems

85/87 STATION ROAD, WEST CROYDON, SURREY CR0 2RD

01-680 8606

● Circle No. 271

MORE FROM MICROSOURCE

MICROSOURCE sells mainly APPLE software, peripherals and books. We cannot list all our products in a short space, so look in back issues and other magazines. We can get hold of most of your wants quickly, and at a competitive price. We specialise in the specials, what you need but cannot get elsewhere. Write or ring for a quote or more information — you can't lose!

EPSON OWNERS

Are you an APPLE owner with an MX-80 or MX-100 printer?
Are you having trouble using VISICALC, GENERAL MASTER or other such software which conflicts with your EPSON TYPE II interface card?

Then we can help you with a replacement ROM to go on your card which now allows the standard APPLE parallel interface commands to set up your printer correctly. For example CTRL-I 80N will set the column width.
There is no need to POKE numbers into odd locations. The card supports graphics and uses simple commands such as CTRL-I 6 for default printing of page 1, or CTRL-I GD2 for a double size print of page 2.

Replacement ROM for EPSON TYPE II APPLE INTERFACE CARD £18

COMING SOON, A BOOK TO TEACH YOU HOW TO USE THE EPSON.

OMNIDOS

OMNIDOS is a disk which when booted allows you to make access to either 13 or 16 sector disks using EITHER or BOTH formats SIMULTANEOUSLY.
** This means there is no need to use Muffin, etc. You do not need to know which format the disk is in. YOU DO NOT HAVE TO SWITCH in any way (software or hardware); the DOS does everything for you.
**Takes up NO EXTRA MEMORY SPACE.

OMNIDOS also has a utility program on the disk which allows you to customise your DOS to:
** Create disks which will boot on either 3.2 or 3.3 systems leaving you in a 3.2 environment.
**CHANGE DOS commands, error messages, in memory or on slave or master disks. Gives some program protection.
**RELOCATE DOS for example low down to leave space for a routine at the top of memory.
**Prepare DATA DISKS with all the tracks available to the user.
** PART INIT disks to restore DOS to a disk you have corrupted by starting to INIT the wrong disk.
** MOVE DIRECTORY to make copying difficult.
** 22 MENU OPTIONS in all.
OMNIDOS DISK + DOCUMENTATION £22

TREE SORT

TREE SORT is a high-speed utility to allow you to add fast sorting to your programs from data in APPLESOFT arrays.
FAST means 1000 items in 5 seconds; 1000 words in 8 seconds.
SORTING can be Ascending or Descending. On whole or part of an array. Rewritten or stored as sorted in another array. Zero values may be included or excluded. Can be on single or multiple dimension arrays.

In string arrays fixed fields may be specified and the sort specified by field and field order. Each field can carry its own specification of ascending or descending sort.
Numeric valuers in the specification may be defined using simple variable names.
A second array can be specified for referal when two (or more) data are equal: The second array data will then be sorted to determine the actual final order.

COMES WITH EXTENSIVE DOCUMENTATION DEMONSTRATION PROGRAMS complete with explanation in the manual. £22

APPLE SPELLER

APPLE SPELLER is the bridge between the many word processing programs for the APPLE and the large word processors.
APPLE SPELLER works with APPLEWRITER, APPLE PIE, EXECUTIVE SECRETARY, LETTER PERFECT, MAGIC WINDOW, and SUPERSCRIBE II, to name just a few, to verify the spelling of your files.

APPLE SPELLER comes with a 30,000+ dictionary with additional space to add 8,000 of your own words. You can add words, delete words, and create an unlimited number of modified and/or new dictionaries for specific applications. There is thus no need to worry about the problems of the ENGLISH vs American languages.
APPLE SPELLER is unbelievably fast. A 10-page document is proof-read in 1 minute if there are no mistakes and 2 minutes 15 secs if there are an unlimited number of errors.

There are many other features.
There are other such programs. THIS ONE CAME OUT THE TOP IN THE SOFTALK reviews, which is why we recommend it.
SPECIAL OFFER £48.50

THE ENHANCER

THE ENHANCER, is a board which fits under your REVISION 7 or later APPLE keyboard, to give you upper and lower case with shift-key ability, besides many more attractive features.
**REDEFINE THE KEYBOARD
**DEFINE WORDS OR PHRASES USING SINGLE KEYSTOKES
**TYPEAHEAD DUFFER allows you to type in 64 characters whilst the APPLE is working on something else.
**COMES WITH MANUAL AND DISK OF SUPPORTING SOFTWARE. £100

ALL PRICES INCLUDE VAT UNLESS SPECIFIC MENTION IS MADE. ALL PRICES INCLUDE P&P

MICROSOURCE
Tel: Park Street (0727) 72917

1 Branch Road,
Park Street
St. Albans.

● Circle No. 272

CRYSTAL ELECTRONICS
CC ELECTRONICS

FOR YOUR SHARP MZ80K CP/M 2.21 (XTAL)

BASIC CP/M FACILITIES INCLUDE:

- Dynamic file management Fast assembler
- General purpose editor • Advanced debugging utility

YOUR SHARP CP/M 2.21 (XTAL) PACKAGE INCLUDES:

• Hardware modification (if fitted by a SHARP dealer does NOT break the guarantee) • SHARP CP/M 2.21 (latest version) on disc • XTAL Monitor and Operating system • 7 Digital Research manuals • 12 months guarantee and up-dates (on all our products)

CP/M 2.21 (XTAL) FROM £150 + VAT

Ask your SHARP dealer for further details or contact CRYSTAL ELECTRONICS

CP/M SOFTWARE HOUSES—XTAL CAN HELP YOU ESTABLISH YOUR SOFTWARE ON THE SHARP.

XTAL BASIC (SHARP)

Takes 5K less memory, has all the features of SHARP BASIC PLUS Multi dim strings, error trapping, logical operators, machine code monitor, more flexible peripheral handling, improved screen control, increased list control, auto run, If..then..else—and it doesn't stop there—it grows. You can extend the commands and functions at will—10K, 12K, 16K, BASIC?. SHARP to XTAL BASIC conversion program is included. **£40 plus VAT.**

Bi-directional serial board for your SHARP RS232 compatible 150 Baud to 2400 Baud adjustable. <5,6,7,8 Bit words, plugs into MZ80I/O **£99.50 plus VAT.** Includes software for bi-directional use in XTAL BASIC, software for using SHARP BASIC with serial printer and self-diagnostic software for testing Baud rate etc.

Members of Computer Retailers Association & Apple Dealers Association
Shop open 0930—1730 except Saturday & Sunday
40 Magdalene Road, Torquay, Devon, England. Tel: 0803 22699

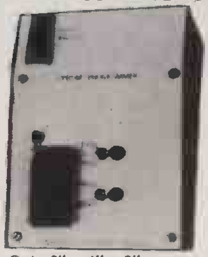
Access and Barclaycard welcome

COMPUTERS AND COMPONENTS

● Circle No. 273

PET EPROM PROGRAMMER
ACORN EPROM PROGRAMMERS

SUITABLE FOR ALL PET OR ACORN COMPUTERS



THE 2716/2532 MODEL **£46.00** PLEASE ADD £2.00 P&P

The programmer includes the software tape for reading/programming the 2716/2532 EPROMS. Plus a FREE programme for making your own Pet graphics on a 2716 EPROM.

Only 6" x 4" x 2"

- Pet IEEE Port Connector and Cable.
- Acorn expansion Port Connector and Cable.
- Independently powered.
- Mains switch with neon indicator light, anti surge fuse at rear.
- Zero force insertion socket.
- Indicator light for read and programme.
- Switch select for read and programme.
- Switch select for 2716/2532 Eproms.
- The programmer can read and programme 2716 and 2532 EPROMS. And read any 2716/2532 pin compatable ROMS, i.e. any Pet ROM/EPROMS.
- Software control programme supplied on tape.
- Instantaneous read of EPROM/ROMS verification of data.
- Total price inc p&p £47.50
- Remittance with order.

2532 compatible EPROMS £10.50
2716 compatible EPROMS £4.50 incl P&P

PET SUPERBOARD 32 NEW

ONLY **£45.50** + £1.50 P&P

PLEASE STATE TYPE OF PET

- This board can be plugged into any ROM socket from \$9000 to \$F000.
- You can plug up to 8 ROM/EPROMS into the board in any combination of 1K or 4K 2716/2532.
- Simply slots onto the expansion port, no soldering or wires required.
- Each chip is programme selectable at a speed of 4μs.
- You can now have viscal, toolkit, etc plugged into one socket.
- It is possible to run a 32K m/c programme from any single ROM location.
- The board plugs onto the expansion port and is compatible with any other add on board.
- Up to 7 boards could be used simultaneously giving a maximum of 244K of on board ROM/EPROM.
- These boards could be used to have several languages residing in the Pet permanently.
- Can also be plugged into the character generator socket to run 8 different character sets.
- SAE for further details

IEEE connectors and cover £6.00 inc p&p

COMPUTER INTERFACE DESIGNS

4 Albert Road, Margate, Kent CT9 5AN. Tel: (0843) 294648.

● Circle No. 274

LONDON COMPUTER CENTRE

TOMORROW'S COMPUTING TODAY!

SUPERBRAIN TRS80 MODEL II — TRS DOS & CPM

APPLE OWNERS!

NEW!-Maxi-Byte Hard Disk

Model 6. M6 £185
Model 12. 11.5 M6 formated £2,295

- **Specially designed hybrid**
- **(linea/switching) power supply**
- **Data error recovery**

DEMONSTRATIONS

ALL PRICES ARE EXCLUSIVE OF VAT AND DELIVERY
DEALER ENQUIRIES INVITED ON ALL PRODUCTS

43 GRAFTON WAY, LONDON W1P 5LA (Opposite Maples)
OPENING HOURS: 11-7 MON-FRI 12-4 SAT Tel: 388 6991/2
24 hour answer phone: 01-388 5721

● Circle No. 275

STOP HERE

APPLE SYSTEMS

WANT TO BUY AN APPLE][?

£550.00

HERE'S HOW!!!

PURCHASE OUR HARDWARE PACKAGE

HARDWARE

* 48K APPLE][
* DISK W/CONTROLLER
* DISK W/OUT CONTROLLER
* BMC 12" GREEN SCREEN 1+1 RES MONITOR
* M x 80 F/T2 1+1 RES PRINTER
* PRINTER INTERFACE

HARDWARE PACKAGE PRICE **£1699**

SOFTWARE AVAILABLE

INVOICING
PURCHASE/SALES LEDGER
STOCK CONTROL
PAYROLL
VISICALC
VISIDEX
VISITREND/VISPLOT
WORD PROCESSING

PET SYSTEMS

Ideal For Your Business, Education, Word Processing

8032 32K Computer 80 column	755.00
8096 96K Computer 80 Column	1040.00
8050 950K Dual Drive	755.00
8023 Tractor Feed Printer	785.00
New products now available	
8422 22 Megabyte Winchester Disk	P.O.A.
9000 SuperPet 134K Multilanguage	P.O.A.

4016 16K Computer	445.00
4032 32K Computer	560.00
2031 171K Single Drive	349.00
4040 343K Dual Drive	560.00
4022 Tractor Feed Printer	350.00

CHOICE OF SOFTWARE PACKAGES AVAILABLE SUCH AS:-
Wordprocessing, Integrated Accounts with Stock, Invoicing & Financial Planning, and many other applications.

LONDON'S MAIN EPSON DISTRIBUTOR

PRINTERS

EPSON M.×100 £575
15½" carriage, 254 columns, 1+1 RES graphics, true descenders, B1 directional

EPSON MX80 £359
Dot-matrix printer Pet and Apple compatible. True bidirectional, 80 cps.

EP80 MX82 £399
As MX80 plus high Resolution Graphics, parallel and serial interfaces.

EPSON MX80 FT-1 £399
Dual single sheet friction and tractor feed, 9 wire head, true descenders.

EPSON-MX80 FT/2 £399
An FT/1 with high resolution graphics.

SEIKOSHA GP100 £215
Dot matrix 5 × 7, 80 columns, 30 cps graphics, double width characters.

JUST PHONE FOR FURTHER DETAILS

TERMS

ALL ITEMS CARRY 1 YEAR GUARANTEE PARTS & LABOUR. DELIVERY AT COST, ALL PRICES EXCLUSIVE OF V.A.T. TELEX 22568 OFFICIAL ORDERS WELCOME

Buy it with Access — BARCLAYCARD VISA

CHROMASONIC electronics

DEPT PC 48 JUNCTION ROAD, ARCHWAY, LONDON N19 5RD 100yds FROM ARCHWAY STATION & 9 BUS ROUTES
TELEPHONE 01-263 9493/263 9495 TELEX 22568

● Circle No. 276

ZENITH | data systems

WHETHER YOU'RE A DEALER OR OEM–

Zenith can offer a product capability that includes:
- Microcomputers, CP/M based with storage to 10 Megabytes
- Systems that start from £1795*
- Word processing, including letter quality printer from £2985* (or lease from only £14 per week)
- A comprehensive range of Printers, VDU's, systems and applications software
- 12"green screen Monitor– in Apple colours. (Dealer/OEM's only)

Equally important Zenith is a company that:
- Is supported by the multi million dollar Zenith Radio Corporation of America
- Is committed to holding comprehensive UK stock
- Offers Country-wide service support
- Offers Dealer support including National Advertising Campaign
- Offers Realistic Discount Structures

*Prices correct at time of going to press.

PC/6/82

NEW DEALER ENQUIRIES WELCOME

☐ I could be interested in a Dealership ☐ I would like to receive details of your OEM terms

Name ____________ Position ____________

Company ____________ Address ____________

Telephone ____________

ZENITH | data systems

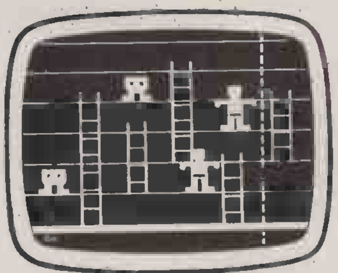
The quality goes in before the name goes on.

Or call Dave Taylor or Jim Detheridge at:-
Zenith Data Systems Bristol Road, Gloucester. GL2 6EE. Telephone 0452 29451.

● Circle No. 280

sbd Software

BEER RUN



Disk

£19.95

PEGASUS II

Disk

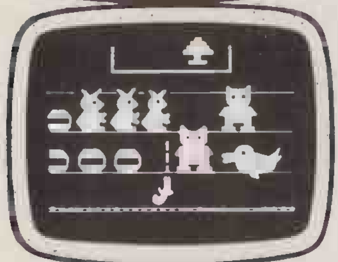
£17.95

MUMMYS CURSE

Disk

£18.00

COUNTY FAIR



Disk

£16.95

SABOTAGE

Disk

£12.95

SBD SOFTWARE
15 Jocelyn Road, Richmond TW9 2TJ
Telephone 01-948 0461
Telex 22861

Please telephone for a full catalogue, or use the coupon provided.
Dealer enquiries are welcome. All prices are plus VAT, postage & packing free.

Name ____________________

Company ____________________

Address ____________________

● Circle No. 281

Buy our £475* Daisy Wheel Printer for your computer and you have an Electronic Typewriter absolutely FREE

The T/Printer 35 is the lightest weight and lowest cost daisy wheel printer you can buy for your computer. So it will fit within your budget and you can carry it wherever you take your micro. Yet it is tough enough to give years of reliable service. Interchangeable typefaces (standard Olivetti 100 character daisy wheels), variable pitch, multiple copies—all the features you would expect of more expensive word processing printers.

Yet the T/Printer 35 costs only £475 with parallel interface. Operating speed under computer control is approximately 120 words per minute of letter perfect output. What typist can equal that?

Then when you're finished using it as a computer printer, the T/Printer 35 is ready to go right on working as an electronic typewriter.

That's the dual-purpose T/Printer 35—the versatile computer printer that fits your budget.

Orders are shipped within the UK carriage-free. To order or for more information about the T/Printer 35:

**The T/Printer 35 costs £475 with Centronics compatible parallel interface. With RS-232C interface it costs £535. Prices listed are exclusive of VAT.*

DATARITE

Datarite Terminals Ltd
Caldare House
144-146 High Road
Chadwell Heath, Essex RM6 6NT

Tel: 01-590 1155 ● Circle No. 282

DISK DRIVE DEALS

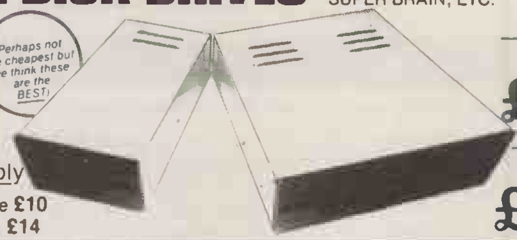
From KRAM electronics, Victoria House, 17 Highcross Street, Leicester LE1 4PF
Telephone (0533) 27556

40 TRACK DISK DRIVES

COMPATIBLE WITH TANDY, GENIE, NASCOM, GEMINI, SUPER BRAIN, ETC.

The latest OLIVETTI Disk Drives fully cased and complete with Toroidal power supply

(Perhaps not the cheapest but we think these are the BEST!)



— SINGLE — £179

— DUAL — £349

DISK DRIVE CABLES Single drive £10 Dual drive £14

KRAM ELECTRONICS

ORDERING

You may post your order with a cheque payable to KRAM electronics, or you may telephone your order day or night, any day, giving your ACCESS card number, a full description of the item and your name and address.

VAT

All the above prices exclude VAT. Please add VAT at the current rate.

CARRIAGE

Order over £100 ADD £6.
Orders over £10 ADD £3.
Orders under £10 ADD .50p

Post to: KRAM Electronics, FREEPOST, Leicester or Tel: (0533) 27556

GENIE I & II

BOTH INCLUDING *SOUND *LOWER CASE *MODULATOR *MACHINE CODE MONITOR

Choose either for only

£299

FREE EXTRA 16K RAM

GENIE I & II EXPANSION BOX INCLUDING DISK CONTROLLER AND LINE PRINTER INTERFACE AND 32 K RAM £199

PARALLEL PRINTER INTERFACE CARD £33

FREE INTERFACES WITH EPSON PRINTERS*

*for RS232, PET, GENIE or ATOM

MX 80T	MX 80F/T	MX 100
£349	£399	£569

SEIKOSHA GP 100A

NEW

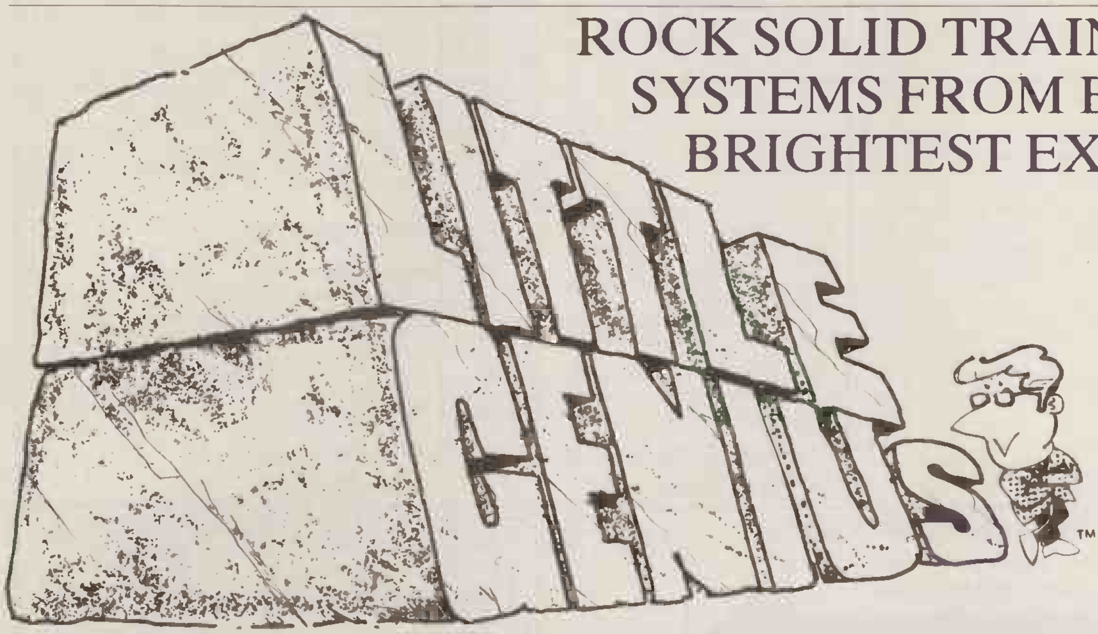
£199

CONTINUOUS PAPER

8" for GP80A 2000 sheets	£12
9½" for EPSON & GP100A 2000 sheets	£12
5¼" floppy disks	£1·70
4116 RAM CHIPS	·69p
2114 RAM CHIPS	·89p

● Circle No. 288

ROCK SOLID TRAINING SYSTEMS FROM BRITAIN'S BRIGHTEST EXPERTS



Teach yourself BASIC in 12 hours. Our LITTLE GENIUS self-instruction courses on floppy disk will teach you to master your Micro in 3 easy stages.
Each course consists of well-structured fully interactive lessons and is available in 3 separate disk modules.
1. Beginners 2. Advanced 3. Disk operating system at £19.95 each + VAT
OR take advantage of our SPECIAL OFFER–3-in-one pack price £49.95 + VAT

BE A LITTLE GENIUS YOURSELF

Courses in BASIC for Apple, ITT 2020, PET and RML 380Z.
Also PASCAL for Apple.
Available from most computer retailers or direct

In the U.K. write to:
Little Genius, Suite 504, Albany House,
324, Regent Street, London W1R 5AA.
England. Tel: 01-580 6361

In the US write to:
Little Genius, 34-38 83rd Street,
Jackson Heights, New York, U.S.A.

Rush me my order for/send information on:
*BASIC/PASCAL for Machine . . . .
Stage Nos. 1, 2, 3 or 3-in-One (Ring as Required)

Name . . . .
Address . . . .
. . . .

Cheque enclosed/Purchase Order Enclosed/Send C.O.D.*
*Delete as required

● Circle No. 289

If we can satisfy the offshore oil industry - we can satisfy you

Our level of professionalism has to be that demanded by North Sea Oil companies. We offer that same level of microcomputer expertise and service to your business.

WE SPECIALISE:
In Business, Process Control, Engineering Database and communication applications.

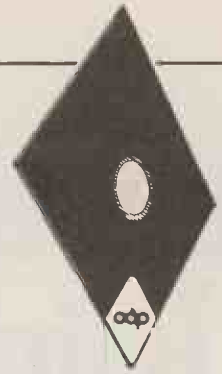
WE SELL:
Acorns, Apples, C.A.D.O. Cat, Cromemco, and now the amazing ACT SIRIUS 16 – BIT microcomputer designed by Chuck Peddle.

WE OFFER:
On-site engineering maintenance contracts for any microsystem in the Grampian Area.

WE ARE:
Sole distributors for the highly acclaimed CONDOR database management system.

GRANITE CHIPS
MICROCOMPUTERS
21 Bon Accord Street, Aberdeen.
TEL: (0224) 22520 TELEX: 739740

● Circle No. 291



OUR FLOPPY DISKS STAND UP ON THEIR OWN!

odp

We at Copyrite Computer Supplies know that our reputation stands on our choice of the best supplies for your computer system. With each of our ODP floppy disks you can be sure of:-
Quality control: Each ODP diskette is thoroughly tested before it reaches you, and is certified 100% error free.
Reliability: ODP diskettes are made by the world's largest diskette manufacturer, and are approved by the majority of the world's leading equipment suppliers.

And there's the Copyrite bonus of technical advice to ensure the best products for your system, and same-day delivery as stocks are always on our premises. Our range of computer supplies includes diskettes, tapes, cassettes, listing paper and printer ribbons. Our technical staff have 17 years experience in computer products and we know how essential an error-free system is to you – so we take your business very seriously.

COPYRITE COMPUTER SUPPLIES LTD.
505 London Road
West Croydon Surrey CR4 6AR
Tel: 01-684 6940

● Circle No. 292

MICRO-80 UK Subscription Dept.

24 Woodhill Park Pembury Tunbridge Wells Kent TN2 4NW

GET THIS free software offer when you subscribe to MICRO-80 — The specialist magazine for TRS-80 and VIDEO GENIE.
LOOK AT the programs you get FREE when you subscribe . . .
★ **Level I in Level II** — Convert your Level II TRS-80 to operate as a Level I machine. Opens a whole new library of software for your use.
★ **Copier** — Copies Level II System tapes, irrespective of where they load in memory. Copes with multiple ORG programs.
★ **Z80 MON** — A low memory, machine language monitor which enables you to insert OP codes, edit memory, punch system tapes etc.
★ **Improved Household Accounts** — Powerful enough to be used by a small business.
★ **80 Composer** — A music generating program which enables you to play music via your cassette cord.
★ **Plus Two Games** — Poker and Cube (a version of the Rubiks cube for Disk users)
and don't forget MICRO-80 is now available in monthly cassette edition as well — all the published programs each month ready to load on cassette.

Please enrol me for an annual subscription and send me my FREE cassette program. I enclose £16.00 ☐ (magazine only) or £43.60 ☐ (magazine and cassette edition).
(enclose your cheque/P.O. made payable to MICRO-80 and send to the above address)
Software offer, and cassette edition prices applies to U.K. residents only. Overseas subscription rates on application.

Name. . . . .
BLOCK CAPITALS PLEASE

Address . . . .

. . . .

PC/6/82

● Circle No. 293

Pete & Pam Computers

The APPLE Computer Specialists

Hardware & software distribution is our business — WORLDWIDE

Payment in sterling or dollars
other currencies by arrangement

SATURN SYSTEMS

128K and 32K doards and VC— Expand

The 32K BOARD
Comes with utilities to allow the movement of DOS and the use of Integer together with the ability to store subroutines on the board to be called from a main program. The final utility allows the board or multiple of boards to be used as a fast disk drive
£149.00

128K BOARD
Can be used as above with the additional facility to use the card as a fast disk drive in C/PM and PASCAL in addition to BASIC
£359.00

VC EXPAND
Is a utility that can be used with either the above two boards to give additional memory for VISICALC models, up to 146K with the 128 board—and more with additional boards
£55.00

COMING SOON
A version of VC EXPAND to allow use of VISICALC with the VIDEX 80 column board
(VIDEX 80 column board—£185.00)
(VISICALC—£105.00)

MICROSOFT PRODUCTS

MICROSOFT have written most of the BASICS for the World's Micros. As MICROSOFT'S biggest UK distributor we carry a wide range of MICROSOFT products for APPLE

TASC the Applesoft computer
True machine code programs for your APPLESOFT BASIC
£109.00

Z—80 SOFTCARD
THE C/PM System for APPLE. Over 35,000 sold to Apple users world-wide, making APPLE the most popular C/PM system
£189.00

A.L.D.S.—Assembly Language Development
System can handle 6502, Z-80 or 8080
£79.00

FORTRAN 80 £109.00
COBOL 80 £359.00

THE ENHANCER II

The dawn of a new era for the APPLE II
Introducing the ENHANCER II—a new standard which is improving the relationship between Humans and Apples. The Enhancer II can help your Apple II's keyboard become more sociable by remembering words or phrases which can be entered into the Apple by the mere touch of a key. Life can become even easier because the Enhancer II can remember what you typed while your Apple was busy talking to your disk (or doing other things). Naturally, it knows the difference between upper and lower case letters and what shift keys are supposed to do. It even knows to auto repeat any key held down. The Enhancer II replaces the encoder board making installation simple.
£99.00

apple® computer

Over 600 items for APPLE

From business to scientific, from education to pleasure. It's here NOW, make sure you get YOUR Copy—write or telex either of our offices now. If you're interested in Apple computers, you can't afford to be without it.

D BASE II—from Ashton Tate
For Apple II with Z-80 softcard
A true relational database able to work on multiple files—gives you the power to use your Apple for jobs that were previously reserved for main frames.
£395.00

MICROSOFT Z-80 SOFTCARD £189.00

WORD PROCESSING

The Wordstar Family (requires Z-80)

WORDSTAR £145.00
MAILMERGE £69.00
SUPERSOFT £85.00
DATASTAR £140.00
SPELLSTAR £89.00
WORDSTAR Training Manual £19.00

MACHINE COVERS—only the best material used

Apple only	£5.95
Single Disk	£2.95
2 stacked disks	£4.45
Apple, 2 disks and 9" monitor or Apple and 12" monitor	£8.95
Apple and 2 disk	£7.95
Epson MX 70/80	£5.45
Paper Tiger 445—460	£5.45

NEW ADDITIONS

KEYPLUS from Aids Data
A Visicalc compatible keypad with left and right arrows, space bar and escape key in addition to numbers
£99.00

CLIP-ON APPLE FAN
With forward facing Apple power switch neon lit
£49.00

COOL-STACK
A colour compatible shelf arrangement with integral fan to sit over Apple to accommodate disk drives, act as a stand for a monitor plus allow easy access to the inside of your Apple
£69.00

NEW VISISCHEDULE
from the publishers of Visicalc
A powerful project planner. Allocates all costs, specifies earliest and latest start dates prerequisites and deadlines for each task, automatic calculation and display of critical path. Can link with other Visi programs
£189.00

MATHSMAGIC
A unique number processing system designed for linear sequential calculations using a threaded interpretive language. Make your Apple a very powerful programmable calculator
£59.00

Authorised Apple Sales and Service

LONDON RETAIL
98 Moyser Road, London SW16 6SH
Telephone 01-677 2052/7341

MAIL ORDER AND DISTRIBUTION
Waingate Lodge, Waingate Close, Rossendale, Lanc. BB4 7SQ
Telephone (0706) 227011

Prices do not include VAT please add 15% to your remmittance
Postage and packing FREE

Telex No. 635740
Orders welcome by phone or telex
PETPAM G

BARCLAYCARD VISA   Access

● Circle No. 297

FULLY INTEGRATED ACCOUNTS SYSTEM

***SALES & PURCHASE LEDGERS**
Open item statements and remittance advices. Payments automatically or manually allocated. Aged Debtors and Creditors listings. Account detail reports etc.

***NOMINAL LEDGER**
Immediate trial balance. Detailed profit and loss and balance sheet. Print detailed Nominal listings etc.

***STOCK CONTROL**
Stock movement and value reports. Monitoring stock levels and usage. Price lists, Profit projections etc.

***JOB COSTING**
Estimate & actual cost comparisons. Display individual Jobs in detail. Full integration with all ledgers.

***SALES INVOICING**
Maximum automation for repetitive inputs. Discounts, credit limits, audit listings. Immediate posting.

Available on THE 16 BIT SIRIUS I SUPERBRAIN, TANDY MODEL II etc.

- All ledgers are truly integrated and do not require disk changes to facilitate inter-ledger posting.
- We understand what we are selling, can support our products and are prepared to demonstrate free.
- The above system, configured for 128k SIRIUS I microcomputer, EPSON MX80 printer — £4120 + VAT

Dealer enquiries welcome

THE OMICRON DESIGN COMPANY LTD
22 Bridge Street, Walton on Thames, Surrey. KT12 1AQ
TELEPHONE: WALTON ON THAMES 23002
24 hr Answering service

● Circle No. 298

odp

Extended Performance Flexible Diskettes

FLEXIBLE DISKS HAVE ALWAYS BEEN YOUR BEST CHOICE FOR VALUE AND PERFORMANCE.... NOW THEY'RE EVEN BETTER!!

EXTENDED PERFORMANCE
with reinforcing Hub rings supplied as standard on minidisks.

EXTENDED PERFORMANCE
ODP flexible disks exceed all ANSI and ECMA standards.

EXTENDED PERFORMANCE
that is certified 100% error-free.

EXTENDED PERFORMANCE
through R & D advances that deliver better protection against data-destroying head-to-disk contact, enhance signal resolution and assure unequalled performance.

D.N.C.S. Ltd., dept PC, West Croft Industrial Estate, Manchester Old Road, Middleton, Manchester. M24 4PJ.

DNCS WE'RE ALL YOUR COMPUTER NEEDS.

061-643 0016

● Circle No. 299

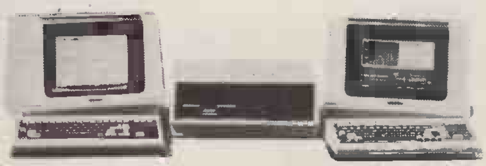
CITY MICROSYSTEMS LIMITED

65 LONDON WALL, LONDON EC2M 5TU
01-588 7272

SUPERBRAIN

320K, 680K and 1.5MB Diskdrives.
Full graphics available.
Wide range of standard packages.

TELEVIDEO SYSTEMS



Multi-user, multi-task, multi-processor, televideo reliability with complete expandability.
One to sixteen users.

VIDEO GENIE
with VISICALC

Complete system £1275, inc. Computer, Monitor, Expander, 1-disk drive printer and Software.
Vast library of standard software.

Complete business accounting systems from £2000. Word processors from £1420

ADVICE, TRAINING AND MAINTENANCE

ALL YOUR COMPUTER REQUIREMENTS READILY AVAILABLE

IN THE CENTRE OF THE CITY — LONDON EC2

VISITORS TO OUR OFFICES MOST WELCOME 10.30am-4.30pm

● Circle No. 300

ADLER

TAKING CARE OF BUSINESS

64K P2 Alphatronic includes
CP/M
Basic interpreter
90 days warranty

WORD PROCESSING

WordStar™
MailMerge™

WORDSTAR
The screen-oriented, integrated word processing system offering unequalled convenience with exceptional capabilities.

MAIL MERGE A powerful file merging tool.

FINANCIAL PLANNING

SuperCalc

SUPERCALC
A planning tool you need to make better use of your time and energy having a direct positive effect on your business profits.

ACCOUNTING

OCSC

OCSC
Accounts and payroll system offers incomplete records accounting for the practising accountant, and book-keeping financial accounting and payroll for the needs of the businessman.

A typical business environment comprising computer power with functional software tools at the untypical price of **£2095** + VAT. A choice of printers is also available — dot matrix/daisy wheel, prices on application.

WORDSTAR, MAILMERGE are trade marks of Micropro International Corporation.
SUPERCALC is a trade mark of Sorcim Corporation.
CP/M is a trade mark of Digital Research Corporation.

Adler Alphatronic is distributed and fully supported by

Plus Business Systems

Plus Business Systems Limited, Ashton Lodge, Ashton Road, Dunstable, Bedfordshire LU6 1NP.
Telephone Dunstable (0582) 666661

● **Circle No. 301**

Flexible Relational Database System

CONDOR

from M.O.M. (Systems)

For Business People Who Use English

User Friendly	Business English commands like ENTER, LIST, DISPLAY, SORT, COMPUTE etc.
Advanced	Uses relational commands like:- COMBINE, PROJECT, & JOIN to connect two or more datasets
Screen Formats	Create your own screen formats rapidly
Processing	Calculations of totals, subtotals on many keys. Sorting and selection on one or more keys
Compatible	For use on any Z80 based Micro operating under CPM 2.2 eg: SUPERBRAIN, CROMEMCO, NORTH STAR, TRS etc. or A.C.T. SIRIUS (INTEL 8088)
Flexible	For use by Doctors, Dentists, QS, Estate Agents, Lawyers, Librarians, Engineers, etc, etc. Requires no special programming knowledge to implement systems

CONDOR is a product of Condor Computer Systems Inc. It is now available in the U.K. after extensive testing by MOM.

For prices and consultancy call or write to the main U.K. Distributor:-

M.O.M. Systems Ltd.
40/41 Windmill Street, Gravesend,
Kent DA12 1BA (0474) 57746

Granite Chips Ltd.
21 Bon Accord Street, Aberdeen AB1 2EA
(0224) 22863

(Dealer enquiries also welcome)

● **Circle No. 302**

Dealer Enquiries Welcome

British SPELLGUARD™

THE PROFESSIONAL SPELLING CHECKER

- TOTALLY BRITISH SPELLING
- SOFTWARE PRODUCT of the YEAR 1981
- Recommended by OSBORNE for the *OSBORNE 1 Personal, Portable Computer*
- Over 3,000 Licensed Users
- 20,000+ Word dictionary
- Legal, Medical & Financial dictionaries

BRITISH SPELLGUARD

- The *VERY BEST* Spelling Checker
- The *PERFECT PARTNER* to Wordstar, Magic Wand, Electric Pencil and many more
- The *BRITISH* version of America's top product

VISION ASSOCIATES
57 Woodham Lane,
New Haw,
Weybridge,
Surrey KT15 3ND.

Tel: Weybridge (0932) 55932

● **Circle No. 303**

CIDER CARDS FOR THE APPLE

NEW **EPROM PROGRAMMER/VIA BOARD — 2 in 1**
Save your important BASIC and MACHINE CODE programs on EPROMS. Programs any pin compatible *2716/2532* eproms. Easy to use — just follow *VDU* instructions.* It is also a powerful *VIA* interface card — see *VIA BOARD* below. *ZIF* sockets. Just plug into any Apple slot and go. To store *BASIC* programs must use *CIDERSOFT-BASIC MANAGER* and *32K MEMORY BOARD*. *Please specify diskette (*3·3* or *3·2·1*) or cassettes for programs.
£58.00

NEW **32K MEMORY BOARD — can R/W to RAMS too!**
Reads *EPROMS/ROMS/RAMS* in any combination. *8* socket to store up to *32K bytes* of *BASIC* and *MACHINE CODE* programs. Sockets are software selected by *ONE* instruction. Reads *2716/2532* pin compatible *EPROMS/ROMS/RAMS.*
£38.00

NEW **VIA BOARD — Parallel/Serial/Timers all in 1**
Single *VIA 6522* has 2×8 bit programmable *bi-directional ports, 4 control lines, 2 programmable timers* and 8 bit *shift register.*
£29.50

NEW **DOUBLE VIA BOARD**
As above but with *2 VIA* chips giving *TWICE* the power.
£45.00

WIRE WRAP PROTOTYPE BOARD
Plugs into Apple sockets for prototype design.
£10.50

CIDERSOFT — BASIC MANAGER ROM
Contains programs for the *32K MEMORY BOARD* which *LOAD/CATALOGUE/MANAGE* Applesoft Basic programs from memory board.
£25.00

We also program BASIC (Applesoft) or MACHINE CODE programs on 2K/4K EPROMS. Please send program(s) on diskette(s)/cassette(s).
PROGRAMMING 2K — **£4** *4K* — **£5**

I.C. and MEMORIES
2716 — £4.50; 2532 — £9.50; VIA 6522 — £9.50; 6116 LP — £10.50

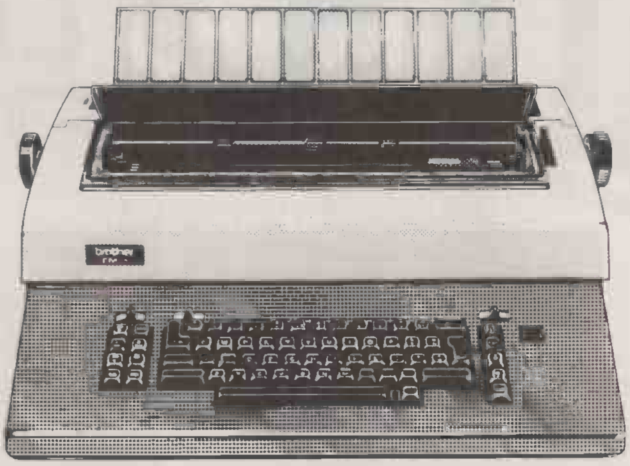
SPECIAL OFFER of 10% DISCOUNT for EDUCATIONAL INSTITUTIONS
All prices are inclusive of VAT and P&P. Cheques are payable to CIDER LTD.
Please send SAE for details.

CIDER
COMPUTER INTERFACE DESIGN ELECTRONIC RETAIL LIMITED
5 King Street, Margate, Kent. Tel: (0843) 23210

● **Circle No. 304**

THE FINEST PRINTER/TYPEWRITER MONEY CAN BUY.

THE CROWN RANIER
ONLY £795 + VAT



We offer a heavy duty daisy wheel printer/typewriter at the flick of a switch. This machine has the very latest linear motor — no cables or belts to break, stretch or wear. Beware of light weight, low cost machines, these can never give long term reliable service. THIS MACHINE WILL!!
Centronics or IEEE interface. Interchangeable daisy wheels — variable pitch — whole line memory. Uses standard type IBM ribbons and lift off correctors. Perfection as a typewriter (used by local authorities). Perfection as a printer.

Ask your local computer or office equipment dealer for furthyer information. EXSTOCK DELIVERY

SOLE UK AGENT. TRADE ENQUIRIES INVITED.

CROWN BUSINESS CENTRE
EASTBOURNE, 56-58 SOUTH ST.,
SUSSEX. (0323) 639983.

● Circle No. 307

RAVEN COMPUTERS

THE NORTH'S LEADING MICRO SUPPLIER

PRESENTS

SIRIUS I AND SOFTWARE

PLUS THE SYSTEM THAT DOES WHAT THE "LAST ONE" SHOULD HAVE DONE

FMS-80
THE WORLD'S PREMIER DATABASE AND APPLICATION GENERATOR

PROVEN PACKAGES FOR:
SALES/PURCHASE/NOMINAL LEDGERS
ORDER PROCESSING
STOCK CONTROL
JOB COSTING
BILL OF MATERIALS
FINANCIAL MODELLING
WORD-PROCESSING
CRITICAL PATH ANALYSIS

PAYROLL
FIXED ASSETS
STATISTICS

RAVEN COMPUTERS LTD.
VICTORIA MILL, MANCHESTER RD,
DROYLSDEN, MANCHESTER M35 6EP
TELEPHONE 061-370 0900 ALSO IN LEEDS AND SHEFFIELD

PLEASE SEND DETAILS OF SIRIUS & SOFTWARE
NAME
POSITION
COMPANY
ADDRESS
TEL No.

● Circle No. 308

FOR APPLE USERS, THE WAIT IS OVER!!!

Question: What's faster than a Winchester, and cheaper than a floppy Disc drive?

Answer: A 128K Disk emulator card.

If your software crawls along because it accesses the disk drives frequently, a disk emulator will speed your system enormously. The Disk Emulator consists of 128K of bank-switched RAM plus software to fool DOS into believing that the card is a disk. Once the software is installed, the card behaves exactly like a disk, except that it operates like lightning. Random access to data files appears instantaneous. Programs are LOADED and SAVED in far less time than with a floppy.

The software provides new commands to load from a floppy onto the Disk Emulator, and from the Disk Emulator to a floppy for backup. Instructions are provided to enable the creation of turnkey systems utilising Disk Emulator cards.

The Disk Emulator is fully compatible with all software which uses the DOS 3.3 commands. It will not function correctly with programs that bypass DOS.

PASCAL and CP/M disk emulation is also supported. The Pascal implementation follows the protocol defined in Apple's ATTACH BIOS specification.

VC-PLUS is a software package included in the 128KDE system which allows VisiCalc to use memory on one of the 128KDE cards to give 82K for the VisiCalc model. If two 128KDE cards are installed, 145K becomes available.

Up to four 128K cards may be installed, giving an incredible 512K of instant-access disk space!!!

The cost of a 128K DOS 3.3 Disk Emulator system and VC-PLUS software is less than the price of a floppy drive and controller. Pascal and CP/M emulation software are low-cost optional extras.

Please contact us for further details.

Special printer offers for this month:

EPSON MX80 FT/2 printer	only £345 + VAT
QUME Sprint 9/35	only £1250 + VAT
Silentype and interface	only £165 + VAT
Stylafont daisywheel and interface	only £425 + VAT

BROMLEY COMPUTER SHOP 01-460 2580
49 BECKENHAM LANE 01-464 0541
SHORTLANDS, BROMLEY, KENT BR1 ODA

● Circle No. 309

pet set 1 plus £	pet set 2 plus £	greek alphabet math set	electronic symbols and games set
french set	german set	russian set	hebrew set
apl set	medium density plotting set	printer matching sets	BBC RM380Z teletext keymatch set

4 DIFFERENT SETS OF CHARACTERS ON SCREEN TOGETHER

FOR 2-3-4-8000 PET/CBM COMPUTERS

ALPHA PLUS

Avon Computer Rentals

FREEPOST 4 THORNBURY BRISTOL BS12 1BR
TELEPHONE (0454) 415460

● Circle No. 310

YOU'LL FIND NO JOKERS IN OUR DEAL

This DEAL beats all others HANDS down

We give up to 45% discount on these systems to our registered DEALERS

Demonstration systems available on request

We can guarantee you will find no JOKERS in this PACKAGE

All systems are CP/M based

core international

92 Wolverhampton Road, Stafford ST17 4AH. England. Tel: 0785 42611

● Circle No. 311

WHAT'S the CATCH?

HOW COME THESE PRICES ARE SO LOW?
There is no catch except — you always catch a good deal at DEANS

apple

SHARP

Apple II + 48K	£639.00
Disk Drive + controller	£329.95
Disk Drive	£289.00
16K Ram Card	£60.00
Pascal System	£239.95
APPLE SOFTWARE	
Visicalc (3.3)	£99.00
Visiplot	£95.00
Visidex	£99.00
Visitrend/plot	£135.00
Apple World	£29.95
Apple Writer	£34.95
Desk Top plan II	£105.00
DOS plus	£19.95
Aplus	£19.95
Apple guard	£19.95
WORD PROCESSING	
Apple writer (I)	£34.95
Apple writer II (80 col)	P.O.A.
Magic window	£59.95
Mailmerge (80 col)	£60.95
Wordstar	P.O.A.
MONITORS	
12" green screen	£115.95
9" b/w monitor	
9" b/w Hi-Resul	£115.95
COLOUR MONITOR	
14" JVC PAL/SECAM/MTSC	£299.95
Eurocolour Card	£69.00
Integer Card	£95.00
Language card	£97.50
Parallel Interface card	£87.00
Communication card	£99.00
Centronic card	£99.00
High speed serial card	£94.50
PRINTERS	
Silentype	£190.00
Centronic 737	£345.00
Paper Tiger 445	£490.00
Epson	
MX80 T2	£399.00
MX80 FT/1	£395.00
EPSON/Sharp	£65.00
EPSON/Sharp Disk	P.O.A.
GAMES	
Space Warrior, Alien Rain	All
Snoggle, Galaxy Wars,	at
Alien Typhoon, Cribbage	
Galactic Empire	£12.95
Star Mines, Apple Panic	All
Tarturian, Tawala's	at
Creature Venture	£14.95
Star Thief, Missile Defence	All
Epoch, Soft Porn Adven.	at
The Wizard & the Princess	
Threshold,	£17.95
Sneakers,	
Oldofo Revenge	
Pegasus II	

PC 1500	P.O.A.
PC 1211 Pocket Computer	£59.95
CE121 cassette interface	£10.95
CE122 printer	£54.95
CSR700 paper roll (40)	P.O.A.
MZ80K	
MZ80A (New arrival)	P.O.A.
MZ80B	P.O.A.
MZ80K computer 48k	£329.00
MZ80 FD dual disk	£550.00
MZ80 P3 dot printer	£350.00
MZ80 F1/0 disk interface	£49.95
MZ80 F15 disk cable	£8.00
MZ80 1/0 expansion box	£94.00
MZ80T20C machine language	£18.00
MZ80TU Assembler	£35.00
400 16k computer	£295.00
800 16k computer	£549.00
16k Ram Upgrade	£49.95
DISK DRIVE	£295.00
VIDEO RECORDERS	
Sony SLC5	£390.95
Sony SLC7	£548.10
JVC HR7200	£451.53
JVC HR7300	£477.95
AKAI VS5	
FLOPPY DISK	
5¼" Verbatim SS/DD	£2.30
5¼" Verbatim SS/DDX10	£19.95
5¼" Verbatim OS/DD	£2.60
BOOKS	
Apple	
Apple II Ref Manual	£11.00
6502 assembly language	£12.10
DOS 3.2 manual	£6.00
Apple II basic tutorial	
Pascal reference manual	£8.50
ZX81	
Getting Acquainted with your ZX81	£5.95
Mastering machine code on your ZX81 or 80	£5.95
The Gateway Guide to the ZX81 and ZX80	£5.95
49 Explosive Games for the ZX81	£5.25

Most of our prices are heavily discounted therefore please send cheques payable to DEANS Credit-card Sales add 3%
Add 15% VAT Postage and Packing free on books + Software.

DEANS of Kensington
191 KENSINGTON HIGH STREET, LONDON W8
Tel: 01-937 7896 ext 8.
Open MON to SAT (9.30am — 6.30pm)

● Circle No. 326

CROYDON COMPUTER CENTRE

PROUDLY ANNOUNCE

★ ★ ★ Z-ROM 1 ★ ★ ★

A new user aid for all Commodore New Rom & BASIC 4 machines featuring a series of additional BASIC commands, all written in machine code and including:—

KINPUT	— Outlined window for string/numeric input, curser cannot escape, no return on null string.
DEFPARAM	— Set user defined or default parameters for KINPUT.
HOLD	— Waits for space bar to be pressed.
GETCHAR	— Gets one character from keyboard if in a user defined list and returns variable equal to position in list.
PRINT at	— Print at column/row specified.
D/ESTOP	— Disable and enable run/stop key with clock left on.
FORMAT	— Formats string variable for finance use.
SORT	— Alphanumeric sort on single or two dimension string array.
WSET	— Set up window on 80 column machines.
H/VPRINT	— Print horizontal/vertical line(s) of user defined characters.
PRINTUSE	— Print numeric variable(s) from user defined image string.

PRICE ONLY £34.50 + VAT

Specify machine, BASIC and socket location (9000 or A000H)
Send for data sheet and free price list. Dealer enquiries welcome.

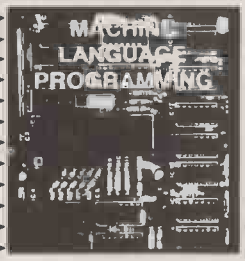
29a Brigstock Road, Thornton Heath, Surrey CR4 7JJ.
Tel: 01-689 1280

● Circle No. 325

MACHINE LANGUAGE MADE SIMPLE ZX80 AND ZX81

This new book is a must for any **SINCLAIR** user who wants to make full use of his **SINCLAIR ZX80** and **ZX81.** Go beyond Basic into the world of **MACHINE LANGUAGE PROGRAMMING** and open computer horizons you never thought possible! Learn how to use the **SINCLAIR** computer's own language and finally find out what PEEK and POKE is all about!

MORE COMPUTING POWER IN LESS SPACE! FASTER RUNNING PROGRAMS!



Written for the complete beginner as well as for the experienced **SINCLAIR** user, **MACHINE LANGUAGE MADE SIMPLE** has over 120 pages packed with programming techniques, hints and tips.

WRITE YOUR OWN MACHINE LANGUAGE PROGRAMS...

* USEFUL BASIC PROGRAM TO EDIT MACHINE LANGUAGE * COMPLETE DESCRIPTION OF THE INSTRUCTIONS GROUPED BY SUBJECT AND BY USEFULNESS * NUMEROUS SAMPLE MACHINE LANGUAGE ROUTINES DESIGNED SPECIFICALLY FOR THE SINCLAIR 80 & 81 * SIMPLE EASY TO USE LOOK UP TABLES.

£8.95 (plus 50P p&p)

Please send me .... copies **MACHINE LANGUAGE MADE SIMPLE FOR YOUR ZX80 & ZX 81.**
Orders to: Melbourne House Publishers, 131 Trafalgar Rd, London SE10
Correspondence: Glebe Cottage, Glebe House, Station Rd, Cheddington, Leighton Buzzard, Bedfordshire LU7.
Please enclose cheque or P.O. for £9.45 per copy. Orders outside the UK £9.95.
NAME ....
ADDRESS PC6/82

● Circle No. 327

Advertisement Index

comart communicator

Efficiency you'll never outgrow

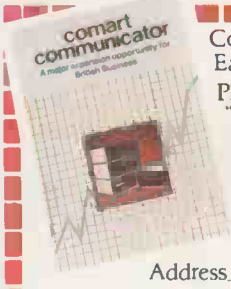
Microcomputer based business systems provide management and operational information quickly and accurately. Microcomputers put computer power in the hands of your existing staff to improve their efficiency and cost effectiveness whilst increasing your control and flexibility.

Comart Communicator microcomputer systems are British designed and British made. Systems for Management, Sales, Accounting, Production Control, Word and Data Processing are just a few of the applications available. You can select from a range of single or multi-user systems with the option of adding extra data storage and communications facilities at a later date. So you can choose a Communicator system, for today, with the confidence that it can expand to meet the needs of tomorrow.

Comart is the complete microcomputer group. From system development to after sales service. Together with our nationwide network of dealers, Comart assures you of national support–locally.

For your copy of our business brochure fill in the coupon today or call us on 0480-215005. NOW!

● Circle No. 332



Comart Limited, Little End Road, Eaton Socon, St Neots, Cambs. PE19 3JG.

Please send me a copy of your brochure "A major expansion opportunity for British business."

Name ____________

Company ____________

Position ____________

Address ____________

PC/6 ____________ Tel. No. ____________

A member of the Comart group of companies

Main Dealers

Birmingham
Byteshop Computerland
94/96 Hurst Street
Tel 021-622 7149

Dublin
Lendac Data Systems
8 Dawson Street
Tel 0001 372052

Glasgow
Byteshop Computerland
Magnet House
61 Waterloo Street
Tel 041-221 7409

Leeds
Holdene
Manchester Unity House
11/12 Rampart Road
Tel 0532 459459

London
Byteshop Computerland
324 Euston Road NW1
Tel 01-387 0505

Digitus
Lading House
10/14 Bedford Street
Covent Garden WC2
Tel 01-379 6968

Jarogate
197/213 Lyham Road
Brixton SW2
Tel 01-671 6321

Manchester
Byteshop Computerland
11 Gateway House
Piccadilly Station Approach
Tel 061-236 4737

Nottingham
Byteshop Computerland
92a Upper Parliament Street
Tel 0602 40576

Southampton
Xitan Systems
23 Cumberland Place
Tel 0703 38740

Dealers

Bristol
Senton
27 St. Nicholas Street
Tel 0272 276132

Cambridge
Cambridge Computer Store
1 Emmanuel Street
Tel 0223 65334

Cheshire
Holdene
82a Water Lane
Wilmslow
Tel 0625 529486

Edinburgh
Holdene Microsystems
48 Great King Street
Tel 031-557 4060

Manchester
NSC Computers
29 Hanging Ditch
Tel 061-832 2269

Norwich
Anglia Computer Centre
88 St. Benedict's Street
Tel 0603 29652

Sheffield
Hallam Computer Systems
1 Berkeley Precinct
451 Ecclesall Road
Tel 0742 663125

Warwickshire
Business and Leisure Microcomputers
16 The Square
Kenilworth
Tel 0926 512127

Watford
Lux Computer Services
108 The Parade
High Street
Tel 0923 29513

Comart Limited
St. Neots Cambs PE19 3JG
Tel (0480) 215005
Telex 32514 Comart G