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Vol 6 No 2 February 1983

Cover Illustration: Mike Brownlow

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REGULARS

'Tell me Parkhouse, just who is this Pacman who is supposed to have eaten your homework?'

In our January issue, accompanying the Benchtest of the Jupiter Ace, we published two illustrations, which were unfortunately uncredited For this oversight we are suitably shamefaced and would like to set the record straight by acknowledging the photography of Kokon Chung and graphics of Andv Martin.

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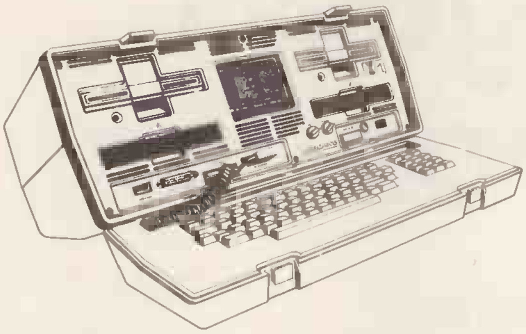

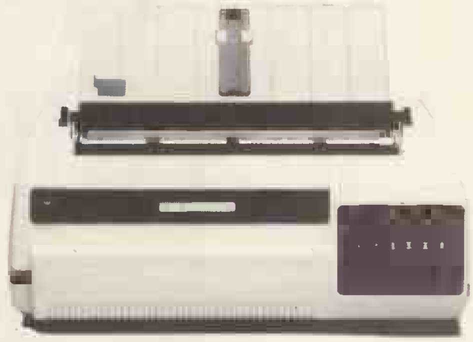

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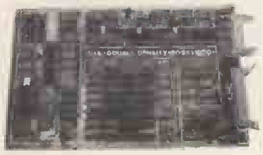

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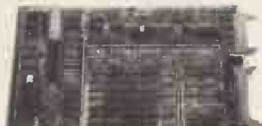

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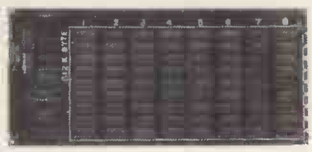

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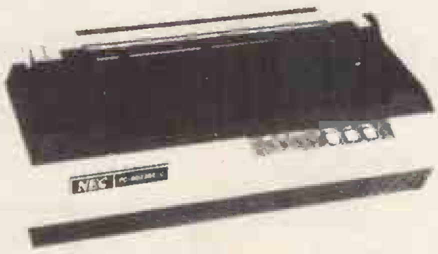

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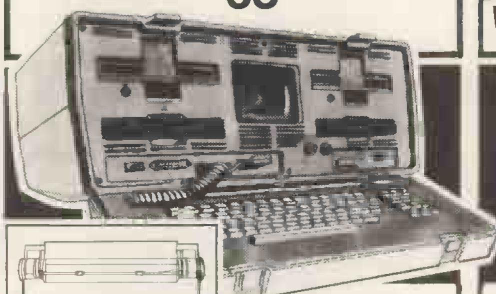

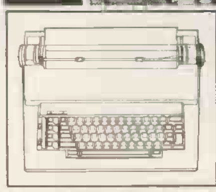

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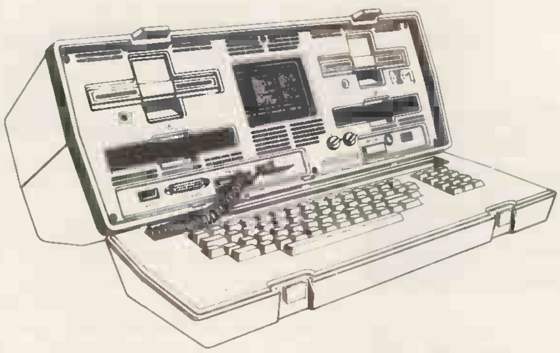

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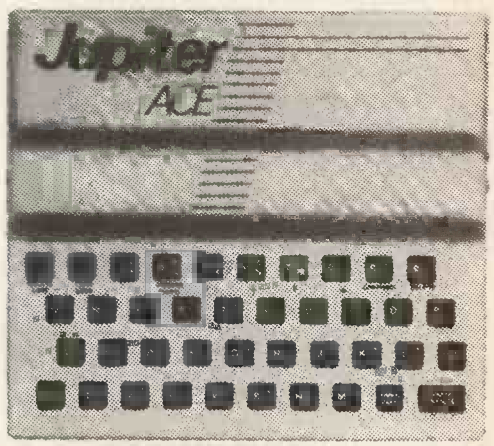

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Unbelievable value at only £173.00 from SPECTRUM! British built and designed it's one of the most impressive micros to appear for quite some time. Extensive facilities include highly advanced colour graphics. Just look at this top specification: Powerful standard 32K RAM (expandable to 64K Bytes). ■ 9 Colour, 5 resolution Display. ■ Extended Microsoft colour BASIC (as standard). ■ Advanced sound with 5 octaves – 255 tones. ■ Professional style editing, e.g. extract line, auto find reinsert. ■ Professional quality keyboard. ■ Centronics Paralled printer interface. ■ Serious programmer/user – the BASIC on this machine is similar to that found on machines costing 3 times the price! ■ Uses almost any cassette recorder. ■ Standard file handling ON TAPE.

Spectrum LOW price **£198.95** INC. VAT

(£173.00 exc. VAT)

	EX VAT	INC VAT
ACCESSORIES		
Joysticks (pair).	£17.35	£19.95
Cassette Lead..	£2.35	£2.70
CARTRIDGES		
Beserk	£17.35	£19.95
Cosmic Invaders	£17.35	£19.95
Meteroids	£17.35	£19.95
Ghost Attack...	£21.70	£24.95
Cave Hunter ...	£17.35	£19.95
Starship Chamelion ...	£17.35	£19.95
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VISCOUNT Software for **DRAGON** Teach yourself Dragon Basic **£6.95**

ATARI

ATARI 800 16K RAM

The top selling ATARI 800 at a sensational new LOW LOW price from SPECTRUM. It's the ideal home or business computer with an extensive range of EDUCATIONAL, GAMES, PERSONAL FINANCE and BUSINESS programmes and aids available. It features a typewriter keyboard, 16K memory that's easily expandable to 48K with convenient, slip-in ATARI Memory Modules. It's expandable, which means you can build the computer system you want today, knowing that it will grow to meet your needs tomorrow – making it ideal for the business man. You can add printers, programme recorders, disk drives and more.

Sensational **NEW LOW** Price

£399.99 INC. V.A.T.

(£347.82 excluding VAT)

ATARI 400

16K RAM

£198.95

INCLUDING V.A.T.
(£173 excluding V.A.T.)

THERMAL PRINTER

£198.95

INCLUDING V.A.T.
(£173 excluding V.A.T.)

ATARI DISK DRIVE

£299.00

INCLUDING V.A.T.
(£260 excluding V.A.T.)

ACCESSORIES, BOOK & GAMES for ATARI

	EX VAT	INC VAT
Accessories		
16K RAM Pack	£56.52	£65.00
Paddles (Pair)............	£12.17	£13.99
Joysticks (Pair)...........	£12.17	£13.99
I/O Cable	£11.30	£12.99
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Books & Manuals		
Wiley Manual	£5.99	No VAT
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INV. to programming 1	£17.38	£19.99
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Conversational Italian	£34.77	£39.99
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	EX VAT	INC VAT
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Macro Assembler (Disk).......	£52.17	£59.99
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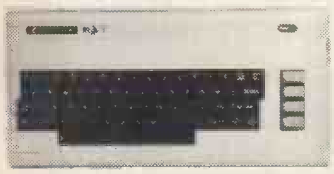
Programmer Kit (Basic Cartridge & Manuals)	£43.47	£49.99

Commodore VIC-20



Sensational **NEW LOW** price

£139.90 INCLUDING VAT

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Now a top quality home/business micro for the price of a games machine.

■ Memory expandable to 32K ■ High resolution (full PET type) graphics ■ 16 Screen colours and 8 border colours ■ Plugs in to your TV. or monitor ■ Add Disk Drive & Printer for impressive 170K Byte system ■ Can act as an intelligent terminal for a larger computer.

VISCOUNT SUPER X2

64K DYNAMIC RAM PACK for VIC-20

EXCLUSIVE TO SPECTRUM!

Unbelievable-but-true, now you can up grade your VIC-20 from 3.5K to a massive 67½ RAM. Enables you to load up to 8 games or programs at a time & still select which one you wish to use. Can be used in conjunction with other expansions to increase total memory up to 152K-using the VIC memory expansion board. The SUPER X-2 will make your VIC-20 the biggest little micro in town!

Spectrum LOW price **£114.94** INC. VAT

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New!

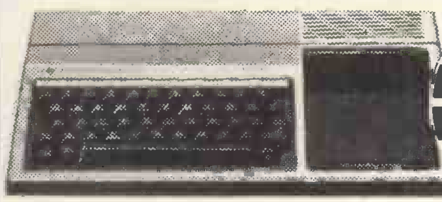
COMMODORE 64

Just Arriving

Limited stocks are just arriving of this super new micro. Just look what it offers!

■ 64K Ram ■ Z80 processor option ■ Dedicated video chip ■ Sprite graphics ■ Music synthesizer ■ Prestel link ■ High resolution graphics (320 x 200) ■ 16 colours and lots more. **£344.99** INC VAT.

TEXAS TI99/4A



Sensational
£50 CASH BACK OFFER!
£50 CASH REBATE WITH EVERY TEXAS TI99-4A PURCHASED
Please ask for full details
Offer expires 31.1.83

■ 16K RAM (expandable to 48K) ■ Built-in 14K Byte BASIC interpreter ■ 16 Bit Microprocessor ■ 16 Colour High Resolution graphics ■ Extensive range of solid state software command modules available from games to architectural aids.

Spectrum **LOW** Price **£198.95** INC VAT (£173.00 ex. VAT)

	EX. VAT	INC. VAT
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Speech Synthesizer.....	£40.50	£46.58
Peripheral Exp. System..	£122.00	£14.30
Disc Cont. Card	£124.30	£142.95
Disc. Drive...........	£234.74	£269.95
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Matrix printer	£347.78	£399.95
Software Entertainment		
TI Invaders	£16.48	£18.95
Tombstone City........	£19.96	£22.95
Attack	£19.96	£22.95

Car Wars	£23.43	£26.95
Munchman............	£23.43	£26.95
Adventure & Pirate.....	£31.26	£35.95
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Number Magic.........	£12.13	£13.95
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BASIC	£8.26	£9.50
Home Budget Management	£19.96	£22.95

. . . and many more

MORE SPECTRUM LOW PRICES ☞

Spectrum Computer Centres have no connection whatsoever with the ZX-Spectrum Computer manufactured by Sinclair Research Ltd.

spectrum

A few examples from our

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Software for Atari	Inc. VAT
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Darts	£19.49
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Cribbage & Dominoes	£14.89
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Hickory Dickory Dock/Baa Baa Black Sheep	£14.89
British Heritage Jigsaw Puzzles, Vol. 1	£14.89
British Heritage Jigsaw Puzzles, Vol. 2	£14.89
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Figure Fun	£14.89
Cupute 4 & Reversi	£14.89
Owari and Bull & Cow	£14.89
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Vic Music Composer	£25.24
Vulcan O/+	£7.95
Games Compendium DI	£7.95
Golf	£7.95

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Software for ZX81, Dragon and Spectrum	Inc. VAT
Monster Mine (for 4ZX 81)	£4.95
Monster Mine (for Spectrum)	£4.95
Monster Mine (for Dragon)	£7.95
Space Mission (for 4ZX 81)	£4.95
Space Mission (for Spectrum)	£4.95
Space Mission (for Dragon)	£7.95
Dragon Golf	£7.95
Dragon Character Generator	£9.95
Games, Pack I	£7.95
Games, Pack II	£7.95

SALAMANDA

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Wizard War	£7.95

Plus many more at your local SPECTRUM dealer — call in now and see!

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Software for Commodore VIC20	Inc. VAT
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Super Worm	£4.49
Jungle	£4.49
Cosmic Battle	£4.49
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Rabbit Functions	£4.49
Code Breaker	£4.49
Night Flight (3K)	£4.49
Rabbit Writer (16K Cassette)	£19.49
Rabbit Base (16K Cassette)	£14.49
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Skramble	£9.49
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Night Crawler	£9.49
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KUMA

Software for Sharp	
Electron 22622	£9.20
Cribbage	£12.08
Adventure	£12.08
Chess	£16.68
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Music Composer	£12.08
Junior Maths/Stepping Stones	£6.33
Home Budget	£6.33

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Programs for VIC-20	Inc. Vat
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Alien Blitz	£7.95
Golf	£7.95
Spiders of Mars	£19.95
Sattelite & Meteorites	£19.95
Bonzo	£7.95
Trashman	£19.95
Boss	£14.95
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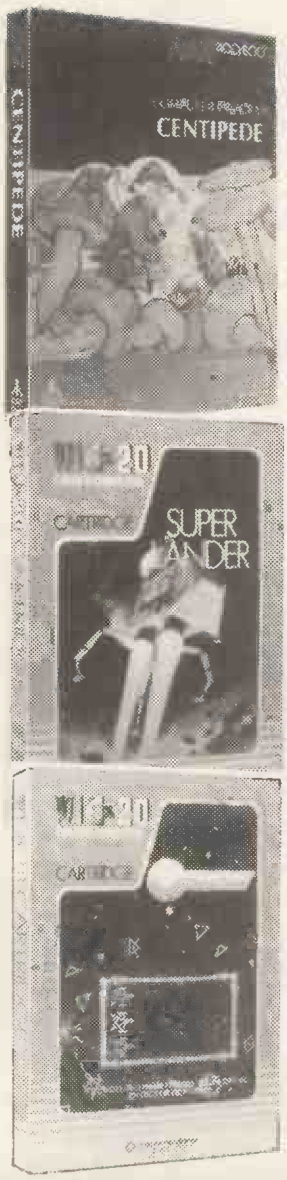

BOOKS

SELECTION FROM THE COMPUTER BOOKSHOP

30 Hour Basic for the B.B.C. Micro	£5.95
Let your B.B.C. Micro Teach You To Programme	£6.45
B.B.C. Micro Revealed	£7.95
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60 Games and Applications for the Zx Spectrum	£4.95
Programming The 6502	£9.95
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ZAP Pow Boom for the Vic 20	£7.95
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Easy Programming for the ZX Spectrum	£5.95
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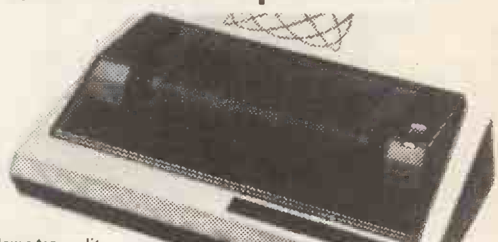
Vic Revealed	£10.00
De RE Atari	£17.00
ATARI Operating system listing	£10.43

SEIKOSHA

GP-100A Graphic Printer



Now a top quality graphic printer at a price you can afford. The **SEIKOSHA GP-100A** – Terrific value at under £200 from **SPECTRUM**. Standard Centronics compatible interface for easy link-up with most micros. ■ Full graphics capability. ■ Printing speed 30 chars/sec. ■ Double width character output under software control. ■ Graphics, character and double width character can be intermixed on same line. ■ Paper width adjustable up to 10" – tractor feed. ■ Print position addressable by character or dot.

Spectrum LOW price £229.94 (Price Ex. VAT £199.95)

Also Available	EX. VAT	INC. VAT
GP-100VC (for VIC-20)	£215.00	£247.25
GP250X 50cps	£249.90	£274.85
Optional Interfaces for GP-100A/GP-100VC		
RS232	£70.00	£80.50
MZ80-A	£60.00	£69.00
APPLE SERIAL	£45.00	£51.75
APPLE GRAPHIC	£55.00	£63.75
VIDEO GENIE	£36.00	£41.40
Cables for BBC MICRO, ACORN, DRAGON	£19.58	£22.52
DRAGON (Std.)	£12.95	£14.89
Accessories		
Data Sheets GP-100 (packet 100)	£17.00	£19.55
Data Sheets GP-250 (packet 100)	£17.00	£19.55
Ribbons GP-100 (box of 12)	£5.00	£5.75
Ribbons GP-250 (box of 12)	TBA	TBA

EPSON PRINTERS

Chosen by **SPECTRUM** for their reliability, the superb new top quality graphic printers from **EPSON**. New features include super & subscript, underlining & deletion. If you're looking for an up-market printer at a down-to-earth-price, call in and see the **EPSON** range at **SPECTRUM**.

Model	EX. VAT	INC. VAT
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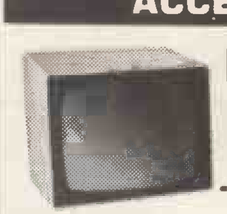
MX80 F/T Type III	£369.00	£424.35
MX100 Type III	£469.00	£539.35

Please see your SPECTRUM dealer for prices of INTERFACE/CABLE options.

ACCESSORIES



PRINCE 12" Green Monitor
ONLY
£98.90 Inc. VAT
(£86.00 ex. VAT)

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Slim 3G Cassette Recorder (for use with Nascom and Dragon)	£26.04	£29.95
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Not all stores carry every advertised item, please phone before making a journey — Prices correct at time of going to press E. & O.E.

FREE! £75 WORTH of software
with every MZ80A purchased

SHARP MZ-80A

Desk top genius! – the all-in-one SHARP MZ-80A. A personal computer designed with the serious user in mind. ready to run the moment you get it home. Built-in keyboard, CRT 9" display and cassette data storage with 48K RAM. The BASIC with extra useful additions, offers quite a powerful micro for the home or business. ■ 4K Byte ROM + 48K Byte RAM + 2K Byte Video RAM ■ ASCII profiled keyboard + numeric pad ■ 2 page Video RAM allows screen to be scrolled up or down. ■ CP/M available

Spectrum LOW Price £546.25 Inc.VAT (£475.00 ex. VAT)

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Twin Floppy Disk Unit (inc. I/O Card, Disk, Cable)	£745.00	£856.75
Single Floppy Disk Unit (inc. I/O Card, Disk, Cable)	£400.00	£460.00
Twin Disk Unit (only)	£590.00	£678.50
Single Floppy Disk Unit	£400.00	£460.00
Cable for F/D Drive	£25.90	£29.79

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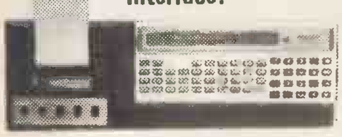
Sensational SCOOP Offer!

LESS THAN WHOLESALE PRICE!

SHARP PC-1211

Pocket Computer complete with Cassette/Printer interface.



Spectrum LOW price **£110.28** Inc. VAT

(£95.90 ex. VAT)

SHARP PC-1211

Pocket computer complete with CE-1221 Cassette Interface

Spectrum LOW price **£68.42** Inc. VAT

(£59.95 ex VAT)

SINCLAIR ZX-81

SINCLAIR ZX . £49.95
16K RAM pack £29.95
ZX Printer . . £59.95

COMPUTER BOOKSHOP SOFTWARE FOR SINCLAIR COMPUTERS	INC. VAT
BUMPER 7 1K ZX81	£5.95
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LABYRINTH 16K ZX81	£5.95
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MERGATROYDS 16K ZX81	£5.95
PROGMERGE 16K ZX81	£5.95
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MATHS. 1	£6.95
MUSIC 1	£6.95
INVENTIONS 1	£6.95
SPELLING 1 (6-11 YEAR OLDS)	£6.95
CHESS*	£6.95
BIORHYTHMS	£6.95

*Requires 16K Ram Memory Pack

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AberData at Galloways, 23 Pier St. 0970 615522 (Just Opening)

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David Saunders Computer Centre, 51 Station Rd. 0252 20130 (Just Opening)

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ASHFORD
Ashford Computer Centre, 2 Station Parade, Clarendon Rd. 07842 44955

BANBURY
Computer Plus, 2 Church Lane. (0295) 55890

BASILDON
Godfrey's, 28-32 East Walk, Town Centre. 0268 289379

BASINGSTOKE
Fisher's, 2/3 Market Place. 0256 22079

BATH
Software Plus, 12 York St. 0225 61676

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Stanad Ltd., 115 Midland Rd. 0234 49341 (Just Opening)

BIRMINGHAM
Sherwoods, Great Western Arcade. 021 236 7211

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Fotosound Computers, 19 Dolphin Lane. 0205 64781 (Just Opening)

BRADFORD
Photosave, 18 Cheapside. 0274 308598

BRIDLINGTON
Bridlington Computer Services, 8 Bridge St. 0262 75048 (Opening Soon)

BRIGHTON
Capricorn, 1 Queens Rd. 0273 29634

CAMBERLEY
Camera Arts (Micro Computer Division), 36 High St. (0276) 65848

CAMBRIDGE
KP Ltd., 12a Kings Parade. 0223 68087

CANTERBURY
Kent Micro Systems, Conquest House, 17 Palace St. 0227 50200

CARDIFF
Randall Cox, 18-22 High St. Arcade. 0222 31960

CHELMSFORD
Maxton Hayman Ltd., 5 Broomfield Rd. (0245) 354595

COVENTRY
Coventry Micro Centre, 33 Far Gosford St. (0203) 58942

DARLINGTON
McKenna & Brown, 102 Bondgate. (0325) 59744

DERBY
C T Electronics, at Camera Thorpe, The Spot. 0332 44760

DONCASTER
Briarstar Computer Centre 13 Netherhall Rd. 0302 67135

DUNSTABLE
Dormans, 7-11 Broad Walk. 0582 65515 (Opening Soon)

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Vennals, 71 English St. 0387 4547

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The Silicon Centre, 6-7 Antigua St. 031 557 4546

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The Model Shop, 79-81 Northgate St. (0452) 504691

GRIMSBY
R. C. Johnson Ltd., 22 Friargate, Riverhead Centre. 0472 42031 (Just Opening)

GUILDFORD
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HARROW
Camera Arts (Micro Computer Division), 24 St. Ann's Rd. 01-427 5469

HATFIELD
Microworld, 2 Crawford Rd. (07072) 64137

HORNCHURCH
Channel One, 174 High St. 040 24 75613

HULL
The Computer Centre (Humberside) Ltd., 26 Anlaby St. (0482) 26297

HYDE
Pase, 213-215 Market St. 061-366 5935

IPSWICH
Brainwave, 24 Crown St. 0473 50965

KILMARNOCK
Vennals, 49 Foregate 0563 32175

LEEDS
Bass & Bligh, 4 Lower Briggate. 0532 454451

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Youngs, 40-42 Belvoir St. 0533 544774

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Vic Odden's, 6 London Bdg. Walk 01-407 6833

LONDON SE9
Square Deal, 375 Footscray Rd., New Eltham. 01-859 1516

LONDON SE15
Castlehurst Ltd., 152 Rye Lane, Peckham. 01-639 2205

LONDON N1
ASP Micro Systems, 185 Upper St., Islington. 01-359 9095

LONDON N.20
Castlehurst Ltd., 1291 High Rd. 01-446 2280

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Devron, 4 Edgware Road. 01-724 2373
Computers of Wigmore Street, 87 Wigmore St. 01-486 6821 (Opening February)

LONDON W11
Electroleisure, 120 Notting Hill Gate. 01-221 7029

MACCLESFIELD
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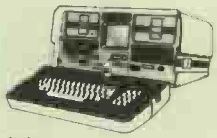

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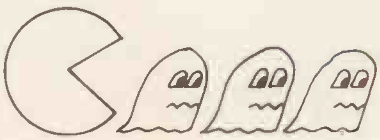

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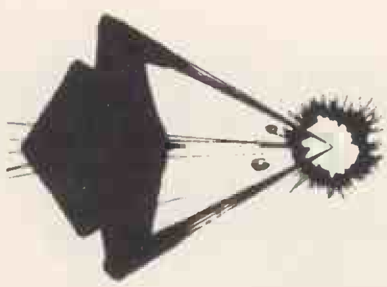

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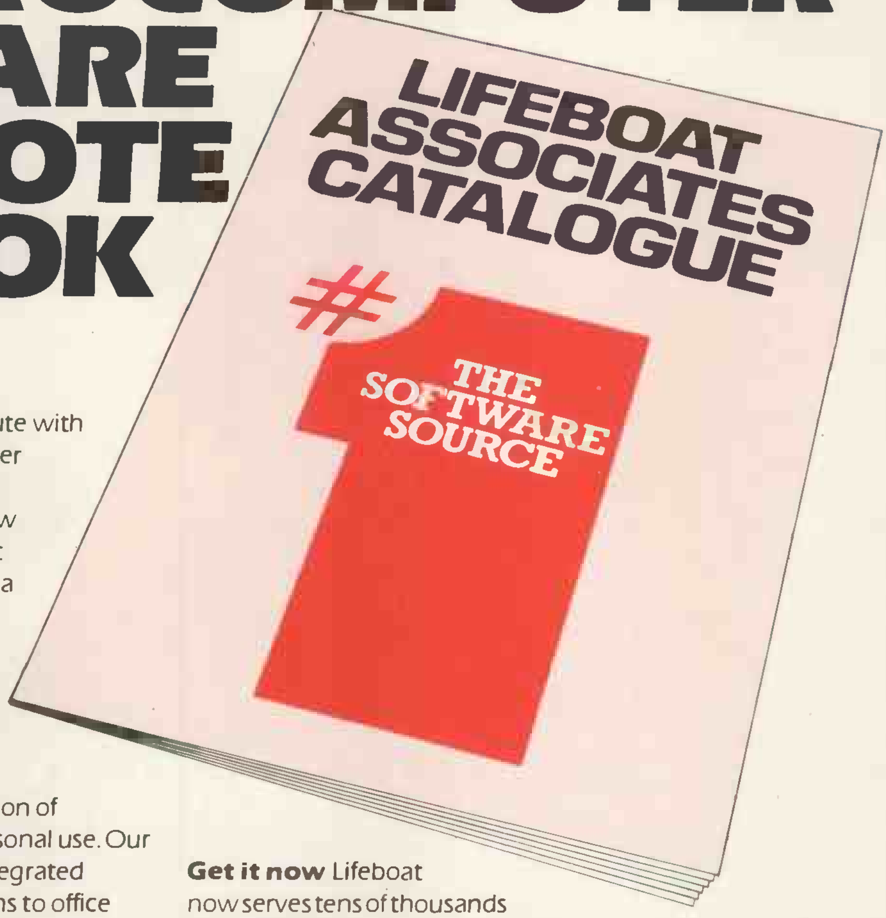

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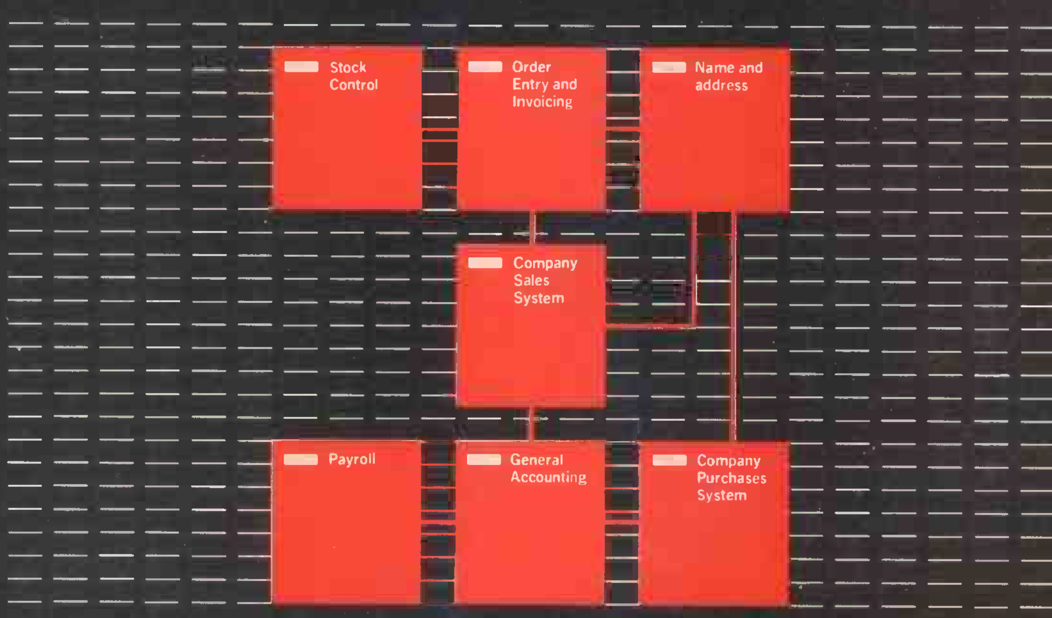

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LS90	24
LS91	60
LS92	32
LS93	23
LS125	24
LS126	25
LS138	25
LS139	28
LS148	70
LS151	40
LS153	40
LS156	36
LS157	27
LS158	30
LS175	50
LS240	55
LS241	55
LS242	55
LS243	55
LS244	55
LS245	70
LS273	54
LS373	60
LS374	55
LS393	42
LS471	629
LS640	180
LS641	180
LS645	180
LS668	125
LS669	120
LS670	100
LS673	550

CMOS

4000	40
4001	10
4002	12
4009	24
4010	24
4011	10
4012	16
4016	20
4017	32
4018	45
4023	13
4025	13
4027	20
4034	140
4040	40
4051	45
4052	60
4053	50
4066	24

4068	14
4069	13
4070	13
4076	50
4077	13
4078	15
4081	13
4093	20
4099	75
4160	95
4161	99
4162	99
4163	99
4174	99
4175	105
4411	690
4412	790
4419	350
4450	350
4451	350
4490	350
4500	675
4504	75
4505	185
4508	130
4511	46
4519	30
4528	50
4549	375
4569	175
4583	99
4584	48
4585	99
4597	330
4598	290
4599	290
40101	130
40105	115
40106	75
40108	450
40110	300
40114	240
40163	50
40244	195
40245	195
40373	240
40374	245
45106	595

DRAGON
The family Computer

6809E Microprocessor based computer 32K RAM as standard, expandable to 64K. Has nine colours, 5 resolution graphics from 16 x 32 to 256 x 192. Extended Microsoft colour Basic. Advanced graphic commands. 5 octave sound through TV speakers. Full editing-Inert, Delete, Amend QWERTY keyboard. Simple plug-in type connections for Joysticks, cartridges & cassette. Centronic printer port. 160 page 'BASIC' manual. All one requires is a colour TV or Monitor & mains supply and your Dragon is Huffing and Puffing. Up & running.

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WATFORD's own most versatile MICRO EXPANSION SYSTEM. Ideal for interfacing with APPLE, ATOM, DRAGON, PET, RESEARCH MACHINE, SPECTRUM, SUPERBOARD, UK101 VIDEO GENIE. ZX81, etc.

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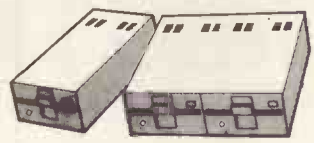

- TEAC FD-50A Single Uncased 40 track S/sided 100K £125
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	1+	25+
2532	330p	295p
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6116	390p	360p
6522	300p	280p

Just phone your order through, we do the rest.

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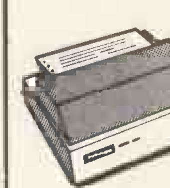

Only: £324 (carr £7)
Price includes FREE 500 sheets of paper

MX80FT/3 10" Tractor & Friction Feed 9x9 matrix, 80 column, Speed 80CPS, Bi-directional, Centronic Interface Baud Rate 110-9600 (RS232) Hi-res, Blt Image, graphics, Subscript & Superscript, Italics & Underlining facility. Fully guaranteed

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- Stack Pack the unique stackable twin drawer racking system for Computer Cassettes. 5 Drawers (10 sections) including labels. 250p
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1MHz	275	18 0MHz	180
1 6MHz	392	18 432M	150
1 8MHz	395	19 968M	150
1 843M	200	20 0MHz	200
2 0MHz	225	24 0MHz	170
3 2768M	150	24 930M	325
3 57594	98	48 0M	175
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4 0MHz	150		
4 433619	100		
5 0MHz	160		
6 0MHz	140		
6 144MHz	150		
6 5536M	200		
7 0MHz	150		
7 168MHz	160		
7 68MHz	200		
8 0MHz	150		
9 0MHz	200		
9 375M	350		
10 0MHz	175		
10 7MHz	150		
10 24MHz	200		
12 0MHz	175		
12 528M	300		
14 31818	170		

WEMON

Watford's specially designed 4K Ultimate Monitor IC for UK101 & Superboard

Only £10.

IDC Connectors:

Speed Block type	PCB Plug with latch Strt Pins	Angle Pins	Female Header Socket	Female Card-Edge Connectors
Two rows				
10 way	90p	99p	85p	120p
16 way	130p	150p	110p	-
20 way	145p	166p	125p	195p
26 way	175p	200p	150p	240p
34 way	205p	236p	160p	320p
40 way	220p	250p	190p	340p
50 way	235p	270p	200p	395p

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

IDC FEMALE RECEPTACLE JUMPER LEADS

24"	20way	26way	34way	4way
1end	160p	200p	260p	300p
2end	290	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	Colour
	Price per Foot	
10	12p	22p
16	25p	32p
20	25p	40p
26	35p	52p
34	48p	60p
40	55p	70p
60	75p	115p

DIL PLUGS (Header)

	Solder	IDC
14pin	38p	95p
16pin	42p	100p
24pin	88p	130p
40pin	195p	218p

AMPHENOL PLUGS

24way IEEEE	560p
26way Centronics Parallel	520p

ZIF DIL SOCKETS

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

VIDEO MONITORS

A choice of 5 attractively finished video monitors with a smoked antiglare display filter. Bandwidth >12MHZ; Res. >750 lines, I/P 75 Ω or high; 240V.

50HZ.	9"	12"
Black & White	£89	
Green	£95	£114
Amber	£98	£118
Zenith 12" Green Monitor		£85

EURO (DIN) CONNECTORS

	Female Strt. Pins	Female Angle Pins	Male Strt. Pins	Male Angle Pins
DIN41617 31way	170p	—	—	175p
41612 A+B 2×32way	285p	325p	220p	295p
41612 A+C 2×32way	300p	325p	240p	300p
41612 A B C 3×32way	360p	385p	260p	400p

EDGE CONNECTORS

TWO ROWS	1"	156"
2×18way	180p	145p
2×22way	199p	200p
2×23way	185p	
2×25way	225p	
2×28way	195p	
2×30way	245p	
2×36way	295p	
2×40way	315p	
2×43way	395p	

D CONNECTORS: Miniature

Male	9 way	15 way	25 way	37 way
Solder	80p	110p	160p	250p
Angle	160p	210p	250p	355p
Pins	120p	130p	195p	295p
Female				
Solder	110p	160p	210p	350p
Angle	165p	215p	290p	440p
Pins	150p	180p	240p	420p
Covers	100p	95p	100p	110p

IDC 25way 'D' plug 385p Skt 450p

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Compact home computer designed for family use that nevertheless compares favourably with far more expensive models on the market. 170.00 ex.VAT

Dragon 32 Family Computer 170.00
Dragon Joysticks (Pr).......................19.95
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Dragon Cartridges from.....................17.35
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VIC C2N Cassette Unit 39.09
VIC Printer 200.00
VIC Single Floppy Disk Drive 260.00
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VIC Superexpander High Res. Cartridge 30.39
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VIC Games Cartridges from.................17.35
VIC Games Tapes from 2.95
Commodore 64 Home Computer 299.00
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A full feature personal business computer system including software – for the price of a VDU. Also the entry point into the renowned Cromemco range. 1195.00 ex.VAT

C-10 SP Personal Computer Superpak inc. Z80A Processor, 64K Memory, Single 5¼" 390K Byte Floppy Disk, 24 × 80 Screen, CKBA Keyboard. CP/M Compatible Operating System, plus Word Processing, Financial Planning & 32K BASIC Software 1195.00
Additional 5¼" Floppy Disk Drive 450.00
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OSBORNE

Osborne Portable Computer inc. Standard Software – Wordstar, Mailmerge, Supercalc, MBASIC, CBASIC, CP/M – Plus Free Monitor 1250.00
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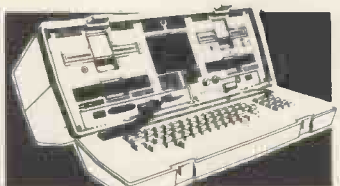
Osborne Starter Kit inc. Daisy Wheel Typewriter 'Printer' 1699.00



OSBORNE

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Inc. Free Monitor 1250.00 ex. VAT

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ZX81 Computer 43.43
ZX Printer...52.13
16K RAM Pack.......................................26.04
Learning Lab...17.35
All Sinclair Software available from..........3.43

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BBC Micro Model B.......................419.00
Games Paddles 11.30
14" Colour Monitor 250.00
12" Monochrome Monitor 90.00
Single Disk Drive 230.00
Selection of business, educational, graphics & games software available from 3.50
Available from Birmingham, Manchester & Nottingham shops only.

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Anadex DP9501A 132 Cols, 150CPS Matrix Printer 10, 12, 15, 16.4 Char/In, Low Noise.......................................1150.00
Anadex DP9620A 200CPS Printer, Low Noise, 10, 12, 15, 16.4 Char/In 100 CPS in Double Pass Enhanced Mode....................1250.00
Anadex DP6000 Dual Mode Printer 132 Cols, 150/180CPS Correspondence Quality, 300/330CPS Draft and Graphics Mode. Diablo 630 Protocol Emulation.................1950.00
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Epson MX80FT/3 Friction and Tractor ...389.00
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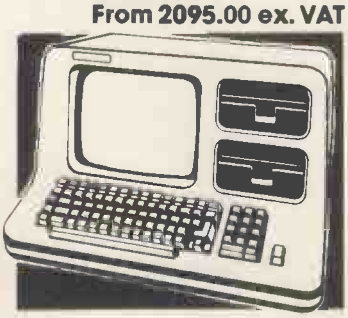

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Advantage upgrade to Intel 8088 Processor with 64KB Memory@ 320.00

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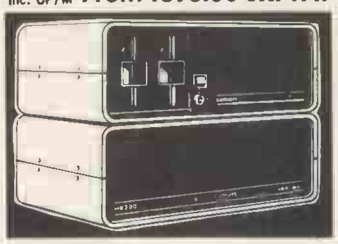

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Comart CP100 'Communicator' Micro Computer: Z80A Processor, 64K Byte Memory, Dual 5¼" Floppy Diskette Drives each storing 390K Bytes of Data. Dual Serial and Parallel Ports. 10 Slot S100 Bus. CP/M Version 2 included 1895.00
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Comart FD802 8" Floppy Dual Disk Drive Subsystem...1495.00
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Comart C-CPU Z80A system Processor Board incl. 2 Serial/1 Parallel Port...............200.00
Comart 4SIO 4 Channel Synch/Asynch Interface Board...250.00
Dual Systems CLK24 Battery Supported Real Time Calendar Disk...........................295.00
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Cromemco CS1D5E as CS1D2E but with 512 MSU...4280.00
Cromemco CS1HD2E System 1 including Single 390K 5" Floppy Disk, 5.5M Byte 5" Winchester Disk, DPU, MCU, 256MSU, 16FDC, WD12...5595.00
Cromemco CS1HD5E as CS1HD2E but with 512MSU 6255.00

PRICES EXCL. VAT

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Volkercraig 4404 ....595.00
Volkercraig 4404WS 695.00
Cromemco RGB14LP. High Resolution Colour Monitor 1395.00
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All Tapes Available For Acorn, VIC, BBC, ZX81. Spectrum. Call for availability.

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Full range of 5¼" & 8" Diskettes in stock

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ANIMATOR Microfocus Programming Tool 225.00
BASCOM Microsoft Basic Compiler 227.46
BASIC-80 Microsoft Basic Interpreter 205.27
BAZIC Micromikes Basic Language 120.00
BSTAM BYROM Software Communications Package between CP/M based machines. Both machines require BSTAM 115.00
BSTMS BYROM Software Communications Package. A commercially orientated, TTY Emulation Facility for CP/M Systems......115.00
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CALCSTAR Micropro Financial Planning/Budgeting, Electronic Spread Sheet Package..90.00
CARDBOX Caxton Fast Store and Search System 155.00
CB80 Digital Research Basic Compiler....314.00
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CBASIC/86 Digital Research Basic Language for 16 BIT Micro's (CP/M 86)..............204.00
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COBOL TRAIN Microcal Training Package for CIS COBOL 350.00
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CP/M Digital Research Operating System 94.00
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CP/M-86 DISPWR Digital Research Operating System 204.00
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FILESHARE Microfocus Utility.............250.00
FILESTAR Microsec's Disk Reformatter CP/M to IBM, DEC, Motorola and Intel Formats ...195.00
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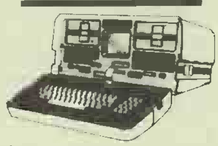

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80-BUS MULTIBOARDS

The Gemini Multiboard Microsystem provides a large and growing range of fully compatible microcomputer boards. Around these boards you can configure a solution to satisfy your own particular microprocessor needs, whether you need as many as 10 boards or as few as one. This flexibility is made possible by Gemini's adoption of a number of accepted industrial standards; especially the 80-BUS, specifically designed for the Z80A

The Z80A (the high speed version of the Z80) is now the largest selling microprocessor worldwide, and forms the heart of the MultiBoard system. The principal advantage of a Z80A based system is the abundance of software that is available, and the majority of those packages operate under the CP/M disk operating system. With CP/M software becomes machine independent; providing the user with literally the widest range of software available.

With MultiBoard an almost unlimited number of system permutations are possible. Six of the most popular boards are shown here, but there is a range of 15 available from your MicroValue dealer; together with mother boards, frames, cables, power supplies, keyboards and compatible software if required.

Your MicroValue dealer can also provide the opportunity to build on the Galaxy computer, which uses Gemini MultiBoards, but has two spare slots in a five-board frame for particular configurations.

GM813 — CPU/64K RAM Board

£225 (£258.75 inc. VAT)

* 4 MHz Z80A CPU
* 64K Dynamic RAM
* RS232 Serial Interface
* Two 8-Bit I/O Ports
* 1200 Baud Cassette Interface
* Extended and Page Addressing Modes

The Gemini GM813 is a new 80-BUS compatible CPU card incorporating 64K dynamic RAM and utilising the powerful Z80A microprocessor running at 4MHz. Extended addressing and page mode facilities allow for future memory expansion up to 2 megabytes. Input and output capabilities include both programmable serial and parallel interfaces — RS232, 1200 baud CUTS cassette interface and the Z80A PIO. When used with the GM812 video card, the GM813's unique RP/M monitor allows the creation of cassette or EPROM based programs or files which are upwards compatible with a disk based CP/M system.

GM811 — CPU Board

£125 (£143.75 inc. VAT)

* 4MHz Z80A CPU
* Four 'Bytewide' Memory Sockets
* Two 8-Bit Input/Output Ports
* 8 Bit Input Port
* RS232 Serial Interface
* 1200 Baud CUTS Cassette Interface

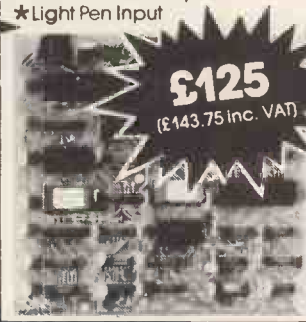
GM 829 — FDC/SASI Board

£145 (£166.75 inc. VAT)

* Single/Double density operation
* Single/Double sided drive operation
* Up to 3 mixed 3.5", 5.25" and 8" drives
* Industry Standard SASI hard-disk interface

GM812 — IVC Board

* 80x25 Display Format
* On-board Z80A Microprocessor
* Buffered Keyboard Input
* Programmable Character Generator
* 160x75 Pixel Graphics
* Light Pen Input



£125 (£143.75 inc. VAT)

GM 816 — MULTI I/O Board

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* 6 I/O Ports
* 4 Counter/Timer Channels
* Real Time Clock
* Further expansion capability

EV 814 — IEEE 488 Controller

* Cost-effective Controller
* Comprehensive software supplied

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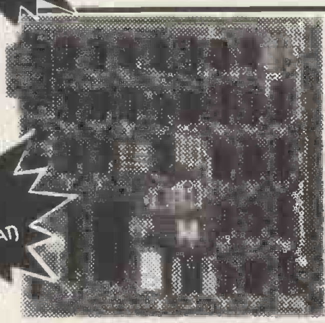

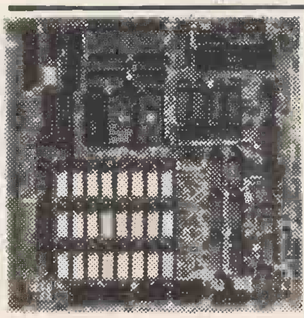

PLUTO — Colour Graphics Processor Board

* 640 x 576 Bit mapped display
* On-board 16-Bit microprocessor
* Comprehensive on-board software

IO 828 A:	IO 828 B:
192K RAM	"BABY PLUTO"
"PLUTO" £399	96K £299
(£458.85 inc. VAT)	(£343.85 inc. VAT)

Other boards available in the Multiboard range include:

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GM803	EPROM/ROM Board	£65	(£74.75 inc. VAT)
MP826	32K Static RAM Board	£185	(£212.75 inc. VAT)

All MultiBoards are Nasbus* compatible
Ask for latest catalogue for full details.

*Trademark of Nascom Microcomputers Division of Lucas Logic

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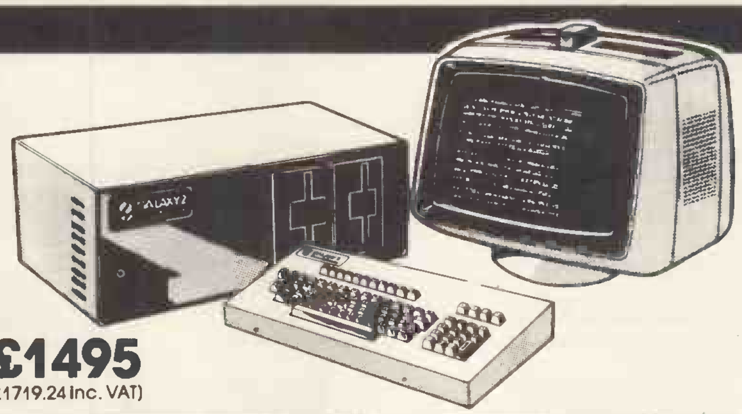
COMPUTERS

New from Gemini

Gemini Galaxy 2



- ★Twin Z80A Processors
- ★CP/M 2.2 Operating System
- ★64K Dynamic RAM
- ★800K Disk Capacity
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- ★Cassette and light pen interfaces
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- ★12" Monitor included

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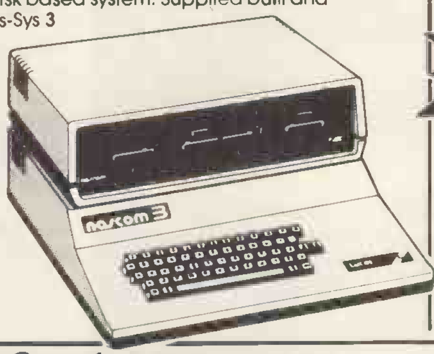
(£1719.24 Inc. VAT)

Total support for Gemini & nascom Products

nascom 3 available from MicroValue

Based around the successful Nascom 2 computer, this new system can be built up into a complete disk based system. Supplied built and tested complete with PSU, Nas-Sys 3 and Nas-Gra.



48K System
£549 (£631.35 Inc. VAT)

CP/M 2.2
£100 (£115 Inc. VAT)

NASCOM 2 KIT
£225 (£258.75 Inc. VAT)

Built & Tested
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NEW LOW PRICE

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(Inc. parts list)
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GM802 64K RAM Card
£125 (£143.75 inc. VAT)

GM802K 16K RAM Kit
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Disk System for Gemini & nascom

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An optional alternative to CP/M is available for Nascom owners wishing to support existing software. Called POLYDOS 4, it includes an editor and assembler and extends the Nascom BASIC to include disk commands.

Single Drive System
GM825-1S
£350 (£402.50 inc. VAT)

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GM825-2S
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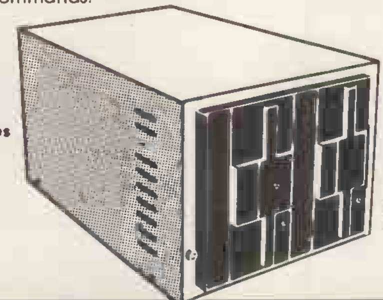

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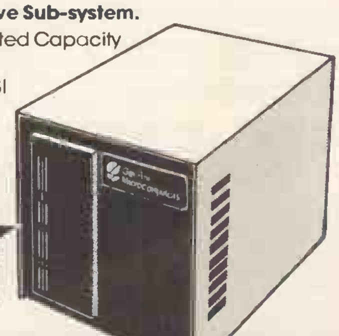

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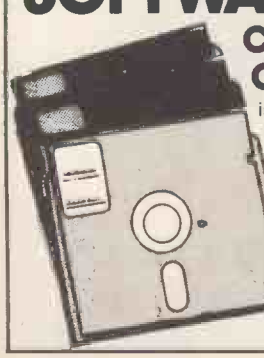
(£1667.50 inc VAT)

SOFTWARE



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is totally different from other compiler based Pascal systems, as it allows you to create, edit, run, and debug Pascal programs in a highly interactive manner.

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is used in conjunction with Microsoft's MBASIC*. No knowledge of BASIC programming is required since all input is performed using question and answer routines written in plain English.

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*MBASIC—MicroValue Price if purchased with 'The Last One –£178.95 Inc.VAT

VIZ:APL

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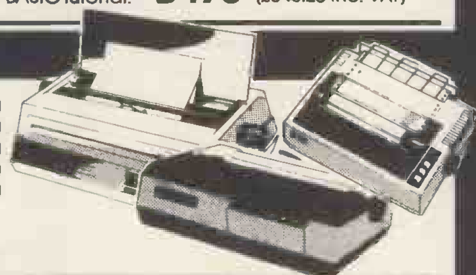

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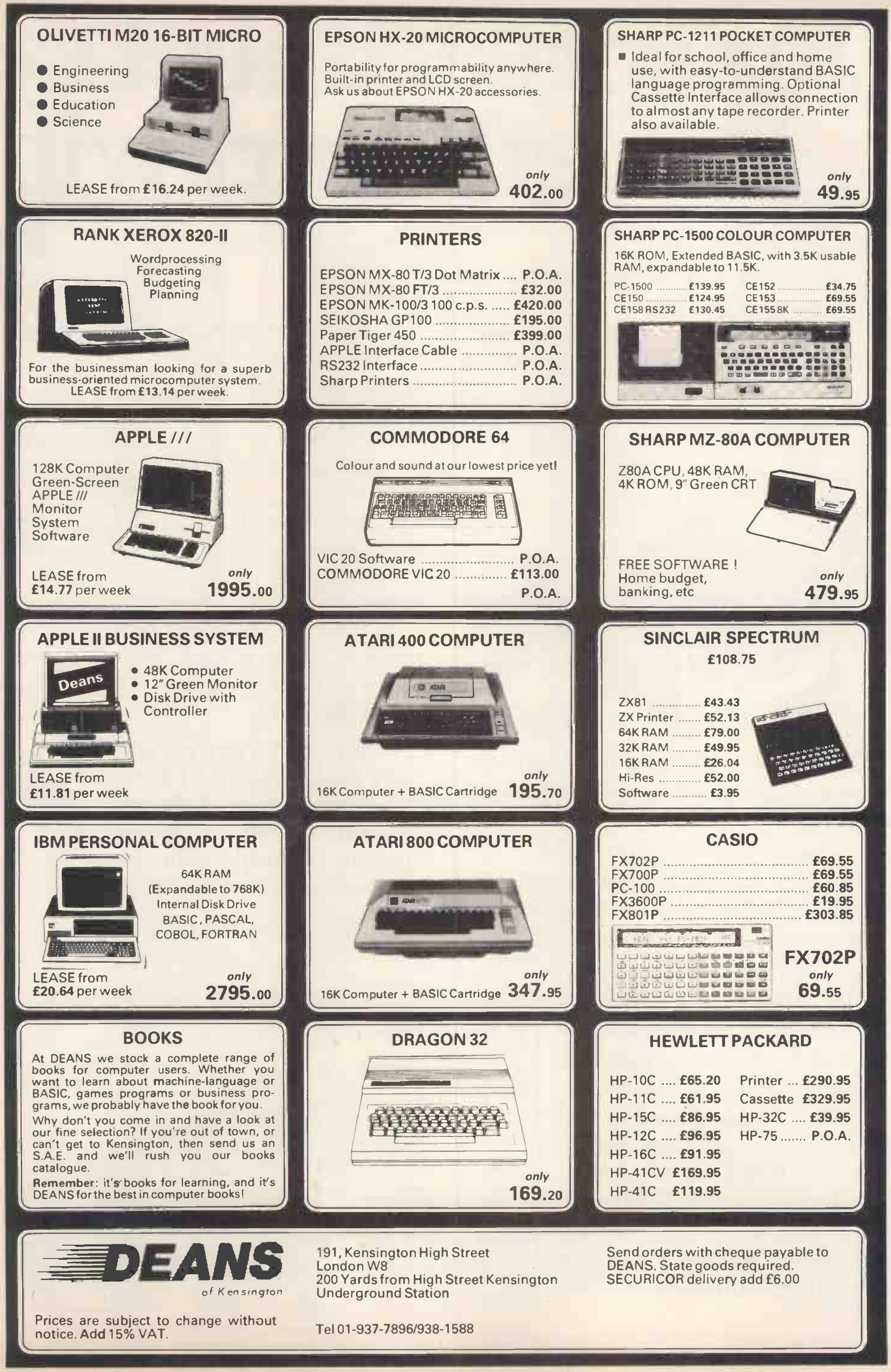
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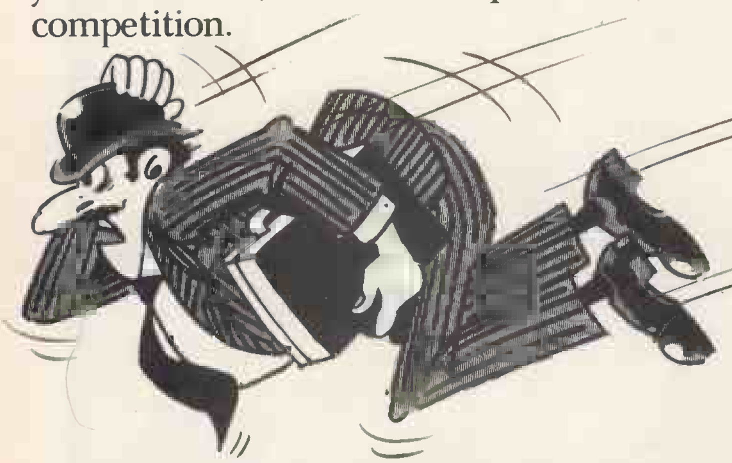

So it seems odd that most software companies still expect to solve all the problems with one system.

A "jack-of-all-trades" if you like.

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Unlike all other 'calc' products it allows you to enter calculation in a language you understand. Plain English.

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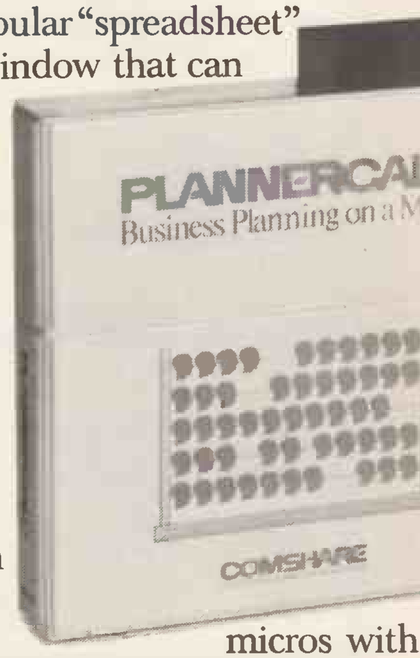
It uses the popular "spreadsheet" approach with a window that can be rolled in all directions.



Which means you can enter new figures and rules and immediately see their effect on everything else in the model.

It comes with the best manual on the market and it's suitable for most micros with a ™CP/M 2.2 operating system, 64K of memory, giving at least 900 cells, minimum screen width of 80 characters and floppy disc drives.

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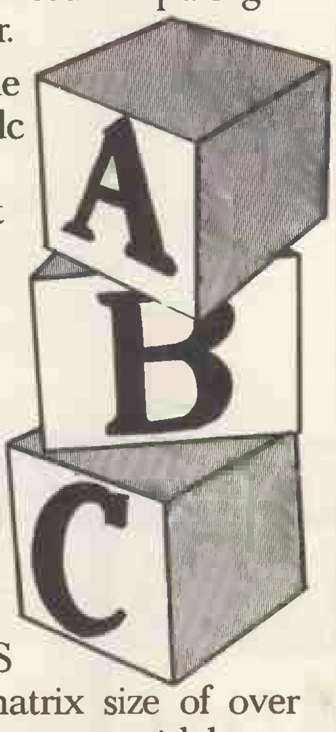

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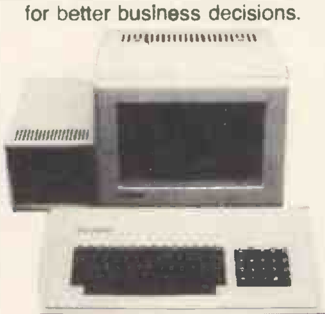

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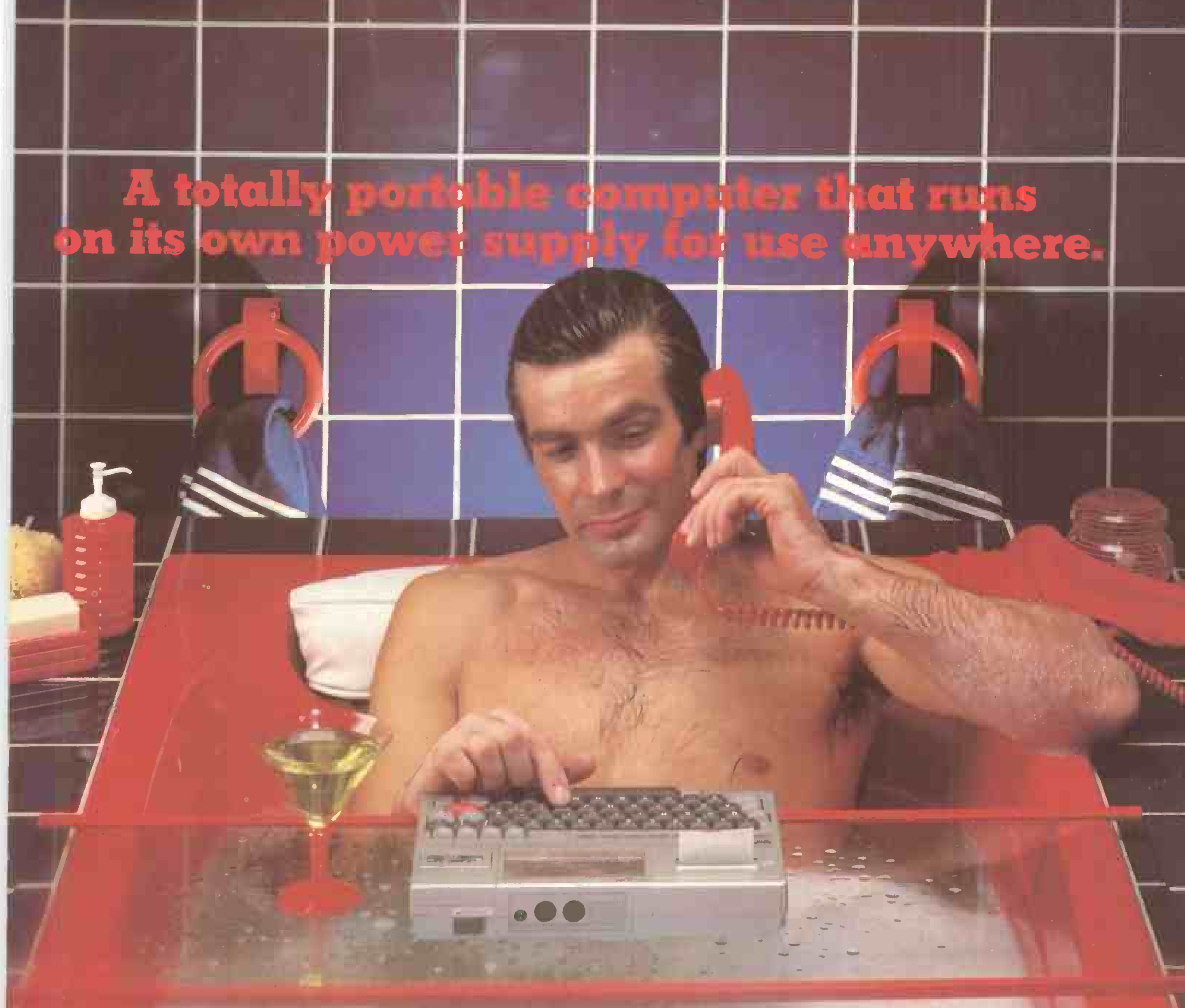

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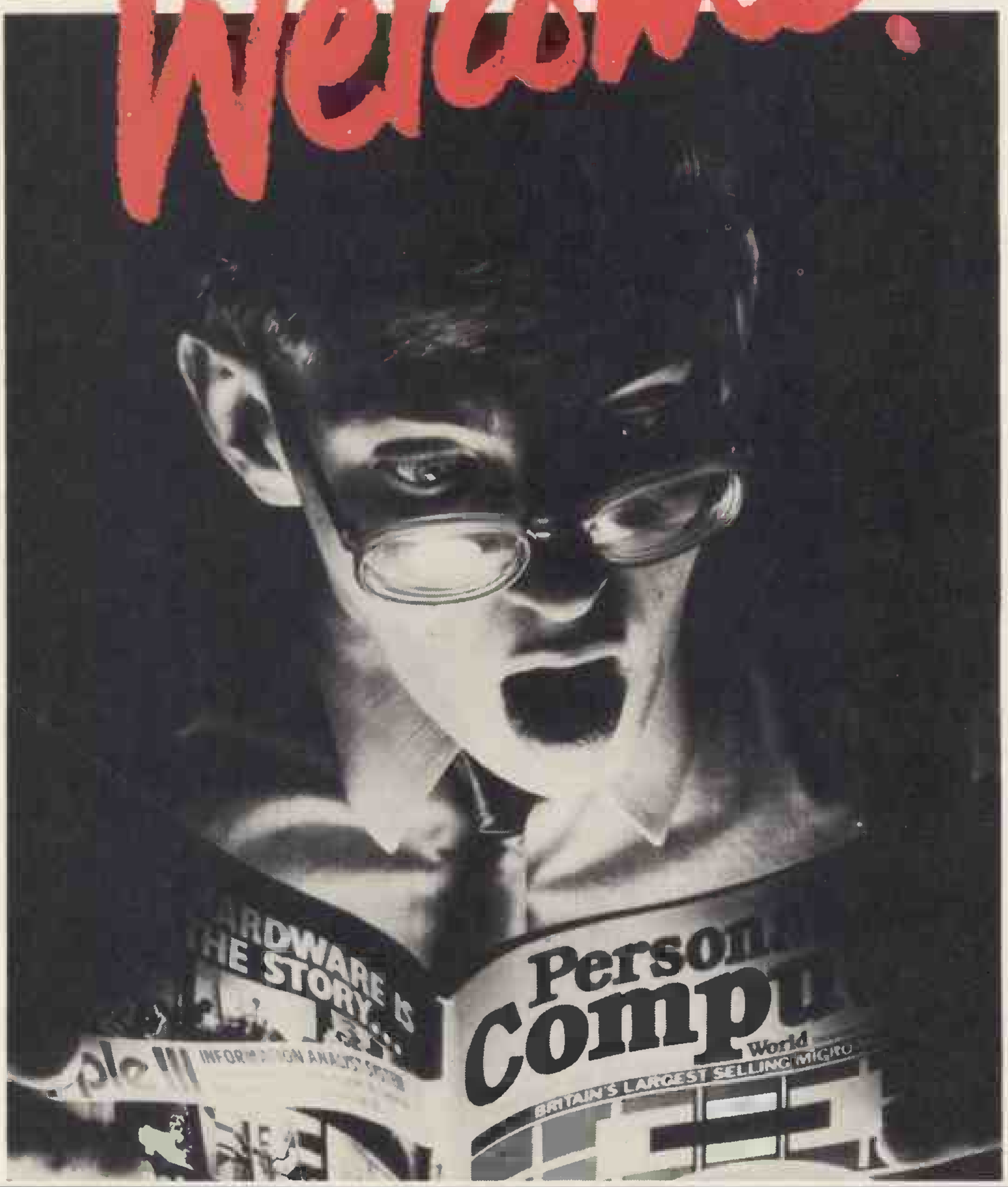

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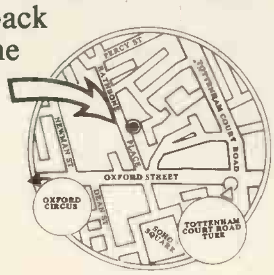

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NEW SCHIZOIDS

for any ZX SPECTRUM.
It's my own fault, I even volunteered.
I thought that with the space-dozer and its shovel and skyhook it would be easy shifting the galaxy's rubbish. Childs play. HUH!
They warned me of the weird packaging, the trays, the rods, and all the rest.
But they didn't say I'd have to stop and control not just one but two or even more garbage pods. Then prod them, push them, toward that black hole, and oh, it's so very, very black, and so lonely, so empty.
Panic, musn't panic, but they won't stop, twirling and spinning and turning, always turning, towards me, against me, at me.
And I'm alone.
No way out, nowhere to hide, on my own, my own . . own . . . .
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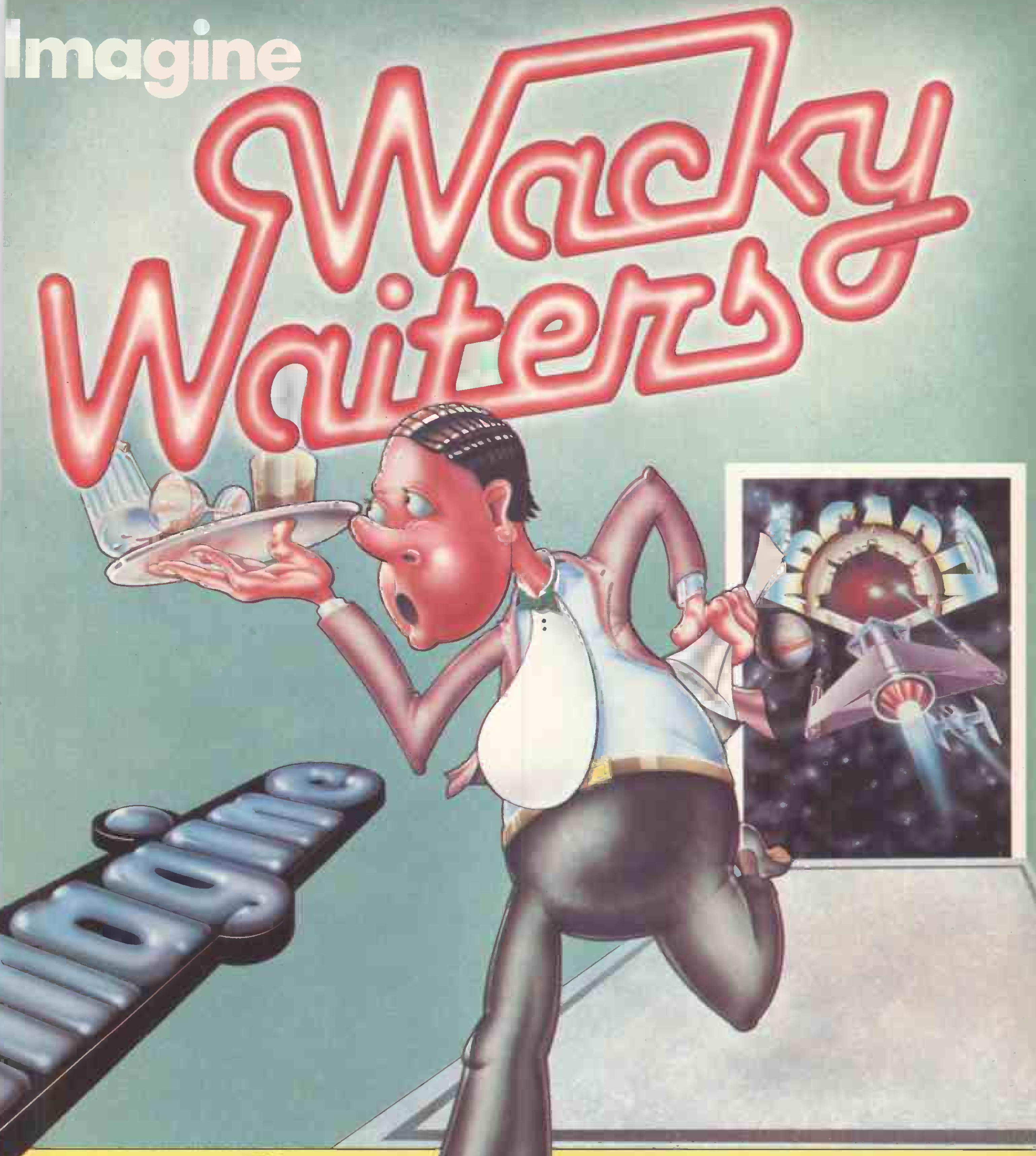

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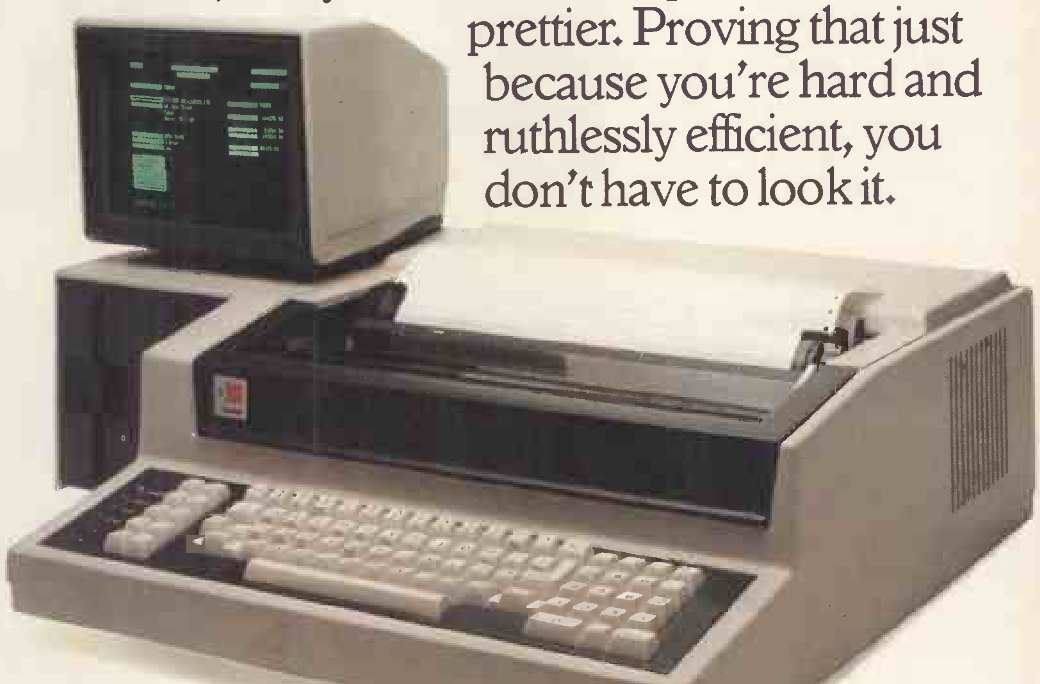

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Don't let its size fool you.

If anything NewBrain is like the Tardis.

It may look small on the outside, but inside there's an awful lot going on.

It's got the kind of features you'd expect from one of the really big business micros, but at a price of £269.95 including VAT it won't give you any sleepless nights.

However, let the facts speak for themselves.

<u>You get what you don't pay for.</u>

NewBrain comes with 24K ROM and 32K RAM, most competitors expect you to make do with 16K RAM.

What's more you can expand all the way up to 2 Mbytes, a figure that wouldn't look out of place on a machine costing ten times as much.

We've also given you the choice of 256, 320, 512 and 640 x 250 screen resolution, whereas most only offer a maximum of 256 x 192.

<u>Big enough for your business.</u>

Although NewBrain is as easy as ABC to use (and child's-play to learn to use) this doesn't mean it's a toy.

Far from it.

It comes with ENHANCED ANSI BASIC, which should give you plenty to get your teeth into.

And it'll also take CP/M® so it speaks the same language as all the big business micros, and feels perfectly at home with their software.

NO OTHER MICRO HAS THIS MUCH POWER IN THIS MUCH SIZE FOR THIS MUCH MONEY.

So as a business machine it really comes into its own.

The video allows 40 or 80 characters per line with 25 or 30 lines per page, giving a very professional 2000 or 2400 characters display in all on TV and/or monitor. And the keyboard is full-sized so even if you're all fingers and thumbs you'll still be able to get to grips with NewBrain's excellent editing capabilities.

When it comes to business graphics, things couldn't be easier. With software capabilities that can handle graphs, charts and computer drawings you'll soon be up to things that used to be strictly for the big league.

Answers a growing need.

Although NewBrain, with its optional onboard display, is a truly portable micro, that doesn't stop it becoming the basis of a very powerful system.

The Store Expansion Modules come in packages containing 64K, 128K, 256K or 512K of RAM. So, hook up four of the 512K modules to your machine and you've got 2 Mbytes to play with. Another feature that'll come as a surprise are the two onboard V24 interfaces.

With the aid of the multiple V24 module this allows you to run up to 32 machines at once, all on the same peripherals, saving you a fortune on extras.

The range of peripherals on offer include dot matrix and daisy wheel printers, 9," 12" and 24" monitors plus 5¼" floppy disk drives (100 Kbytes and 1 Mbyte) and 5¼" Winchester drive (6-18 Mbytes).

As we said, this isn't a toy.

It doesn't stop here.

Here are a couple of extras that deserve a special mention.

The first, the Battery Module, means you won't be tied to a 13 amp socket. And, even more importantly, it means you don't have to worry about mains fluctuations wreaking havoc with your programs.

The ROM buffer module gives you a freedom of another sort.

Freedom to expand in a big way. It gives you additional ROM slots, for system software upgrades such as the Z80 Assembler and COMAL, 2 additional V24 ports, analogue ports and parallel ports.

From now on the sky's the limit.

Software that's hard to beat.

A lot of features you'd expect to find on software are actually built into NewBrain so you don't need to worry about screen editing, maths, BASIC and graphics.

However, if you're feeling practical you can always tackle household management, statistics and educational packages. And because NewBrain isn't all work and no play, there's the usual range of mind-bending games to while away spare time.

Waste no more time.

To get hold of NewBrain you need go no further than the coupon at the bottom of the page.

With your order we'll include a hefty instruction manual so you'll know where to start, and a list of peripherals, expansion modules, and software so you'll know where to go next.

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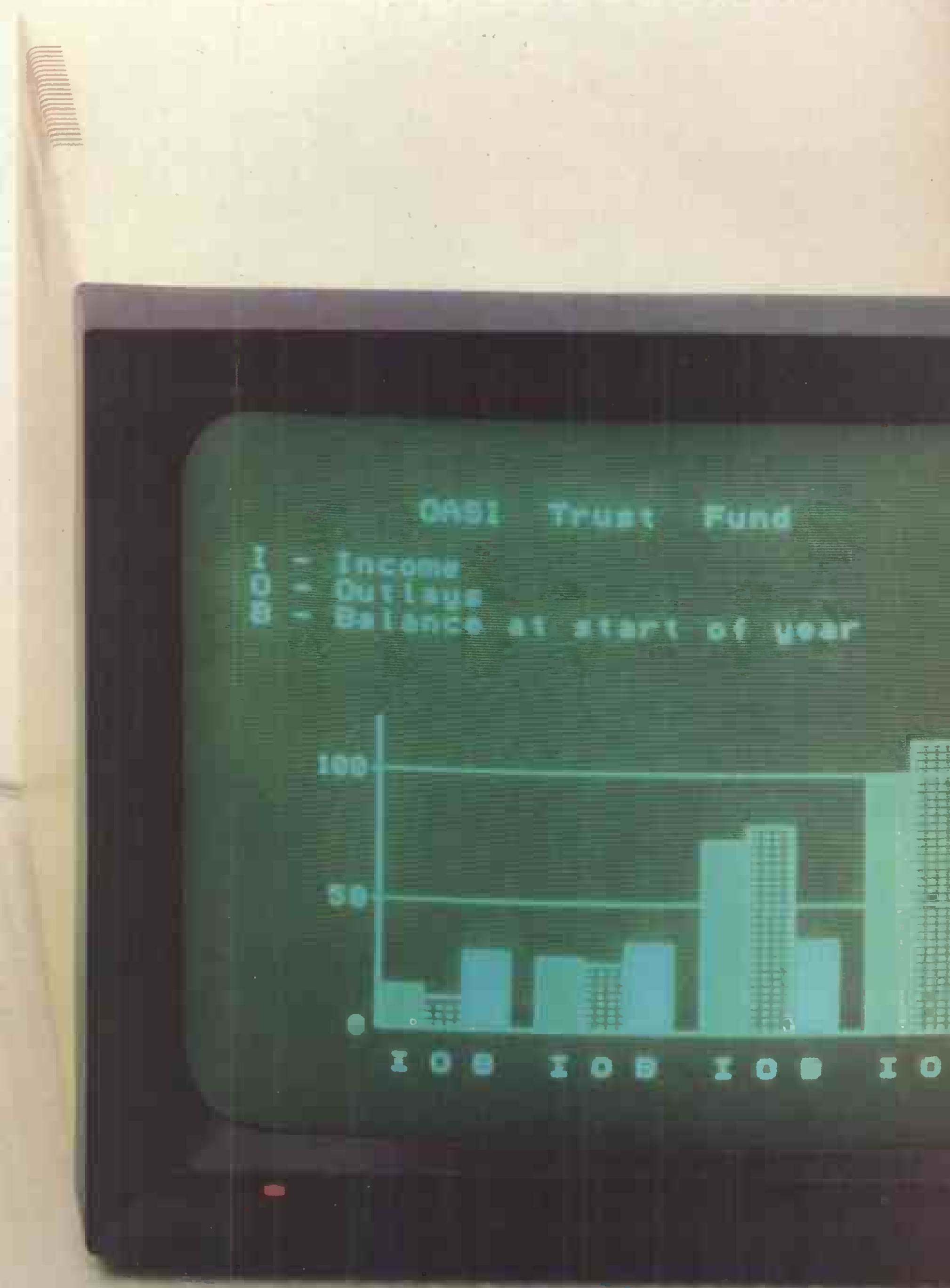

Technical Specifications

The NewBrain is a fully specified professional computer built to the highest standards of engineering and reliability. Chosen by leading OEM suppliers. Designed to facilitate easy expansion for use with the CP/M operating system, and the addition of 5¼ flexible and Winchester disks, 12 green phosphor professional standard monitor, 80 cps professional quality dot matrix printer with pin addressable graphics.

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Previous Issues showed examples of 'employees-short-list', 'garage stock re-order', 'sales analysis', 'librarian's list'. Here is an example of a hospital's patient index and some reports it might generate.

The record may look like this:
1- record number (23)
2- patient (John Smythe)
3- date of birth (1.5.45)
4- date of last visit (12.2.82)
5- symptom (epigastrium ache)
7- diagnosis (peptic ulcer)
8- test type (barium meal)
9- prescription (100mg carbenoxolone sodium 3 daily)
10- effect/other (minor improvements/test for surgical treatment)

One report might be: select??
all records where patients have had symptoms of 'epigastrium ache'
associated with nausea or vomiting
not diagnosed as peptic ulcer.
Print a list of those where there were barium tests made and the effect.

Another report might be: select??
all records in the file where the diagnosis of ailment was peptic ulcer or duodenal ulcer, and then where the treatment was carbenoxolone sodium and in the first instance list those where there was no improvement; after which list those where there was an improvement

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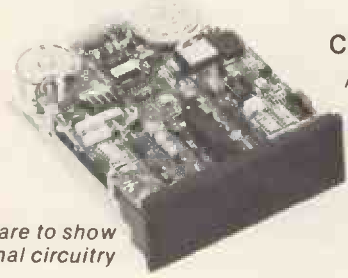

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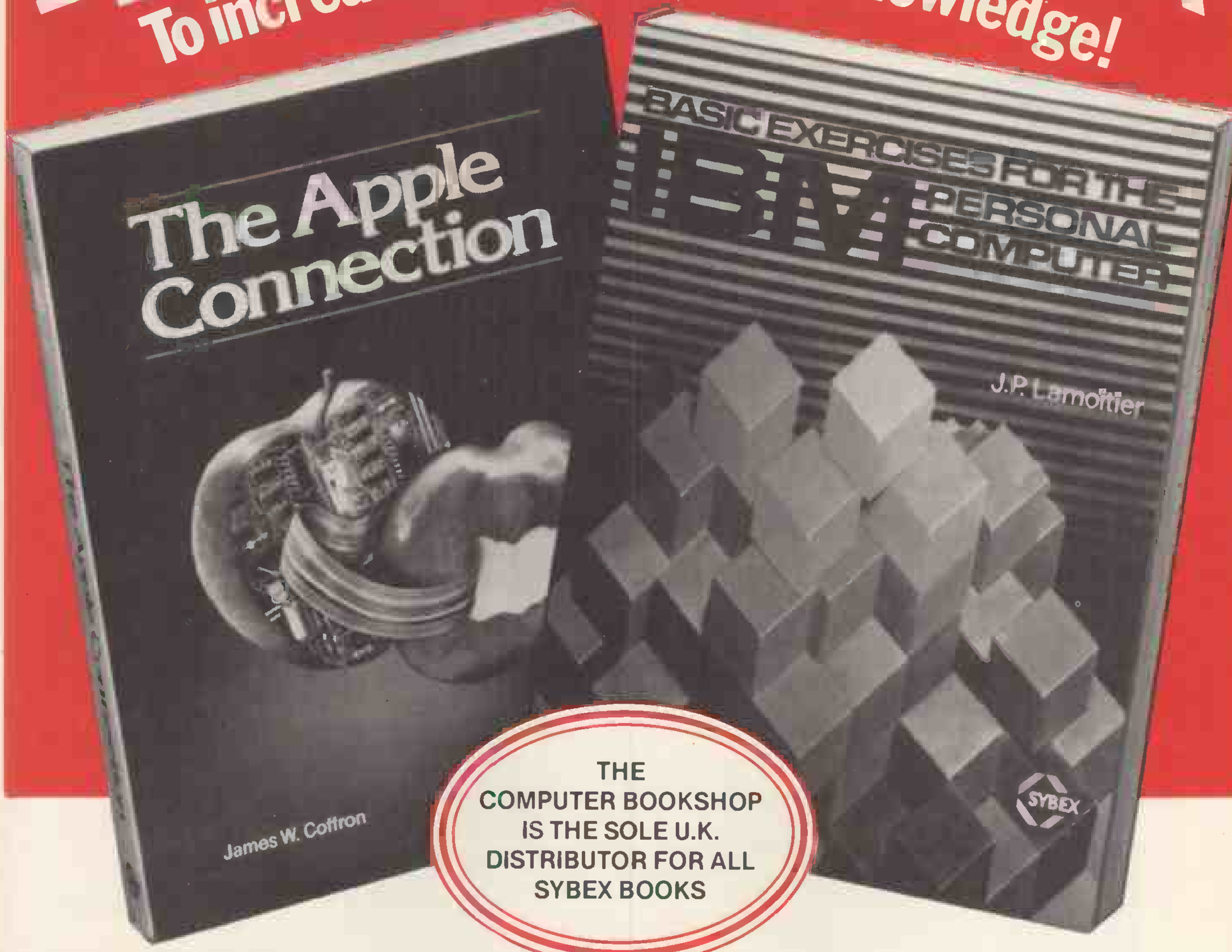

The Apple Connection
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ISBN: 0-89588-085-7
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An introduction to personal computer control of external devices. Describes hardware and software for the interfacing of an Apple to various household appliances. Also describes an I/O system developed by the author, but that is not the main focus of the book. The hardware and software are both simple. Hardware consists mainly of widely available integrated circuits; and software consists of simple BASIC control programs. There is the usual disclaimer that matters have been simplified somewhat for the purpose of instruction and that the programs and diagrams are intended simply to show what can be done. More sophisticated readers can take the book as a starting point for further, more elaborate applications. Less sophisticated readers are "taken by the hand." Elementary concepts such as Input/Output and Analog-to-Digital conversion are discussed in a reassuring manner, but in enough depth to enable the reader to understand what is being done.

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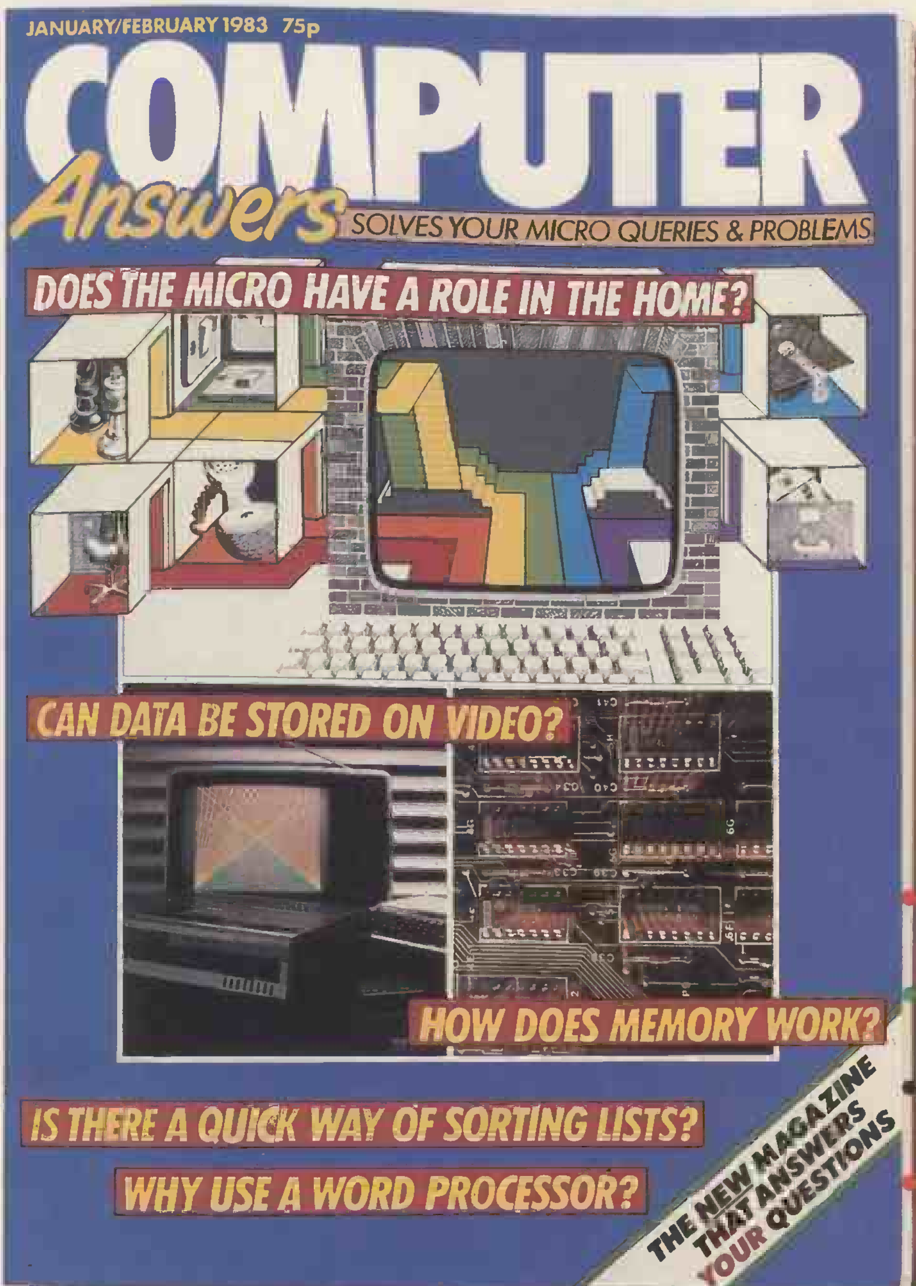

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RED CAPS LOCK 2 @ FN
MAGENTA TRUE VIDEO 3 # LINE
GREEN INV. VIDEO 4 $ OPEN #
CYAN 5 % CLOSE #
YELLOW 6 & MOVE
WHITE 7 ' ERASE
8 (POINT
GRAPHICS 9) CAT
BLACK DELETE 0 _ FORMAT
SIN Q <= PLOT ASN
COS W <> DRAW ACS
TAN E >= REM ATN
INT R < RUN VERIFY
RND T > RAND MERGE
STR$ Y AND RETURN [
CHR$ U OR IF]
CODE I AT INPUT IN
PEEK O ; POKE OUT
TAB P " PRINT ©
READ A STOP NEW ~
RESTORE S NOT SAVE |
DATA D STEP DIM \
SGN F TO FOR {
ABS G THEN GOTO }
SQR H ↑ GOSUB CIRCLE
VAL J − LOAD VAL $
LEN K + LIST SCREEN $
USR L = LET ATTR
ENTER
CAPS SHIFT
LN Z : COPY BEEP
EXP X £ CLEAR INK
LPRINT C ? CONT PAPER
LLIST V / CLS FLASH
BIN B * BORDER BRIGHT
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Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

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Key features of the Sinclair ZX Spectrum

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ZX Expansion Module

This module incorporates the three unctions of Microdrive controller, local rea network, and RS232 interface. Connect it to your Spectrum and you can control up to eight Microdrives, communicate with other computers, and drive a wide range of printers.

The potential is enormous, and the module will be available in the early part of 1983 for around £30.

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Sinclair Research Ltd, Stanhope Road, Camberley, Surrey GU15 3PS.
Tel: Camberley (0276) 685311.

The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. 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 ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.

The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing by providing mass on-line storage.

Each Microdrive can hold up to 100K bytes using a single interchangeable storage medium.

The transfer rate is 16K bytes per second, with an average access time of 3.5 seconds. And you'll be able to connect up to 8 Microdrives to your Spectrum via the ZX Expansion Module.

A remarkable breakthrough at a remarkable price. The Microdrives will be available in the early part of 1983 for around £50.

How to order your ZX Spectrum

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, Barclaycard, Access or Trustcard.

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Sinclair ZX Spectrum–technical data.

Dimensions
Width 233 mm
Depth 144 mm
Height 30 mm

CPU/ memory
Z80A microprocessor running at 3.5 MHz. 16K-byte ROM containing BASIC interpreter and operating system.
16K-byte RAM (plus optional 32K-byte RAM on internal expansion board) or 48K-byte RAM.

Keyboard
40-moving-key keyboard with full upper and lower case with capitals lock feature. All BASIC words obtained by single keys, plus 16 graphics characters, 22 colour control codes, and 21 user-definable graphics characters. All keys have auto repeat.

Display
Memory-mapped display of 256 pixels x 192 pixels; plus one attributes byte per character square, defining one of eight foreground colours, one of eight background colours, normal or extra brightness and flashing or steady. Screen border colour also settable to one of eight colours. Will drive a PAL UHF colour TV set, or black and white set (which will give a scale of grey), on channel 36.

Sound
Internal loudspeaker can be operated over more than 10 octaves (actually 130 semitones) via basic BEEP command. Jack sockets at the rear of computer allow connections to external amplifier/ speaker.

Graphics
Point, line, circle and arc drawing commands in high-resolution graphics.
16 pre-defined graphics characters plus 21 user-definable graphics characters. Also functions to yield character at a given position, attribute at a given position (colours, brightness and flash) and whether a given pixel is set. Text may be written on the screen on 24 lines of 32 characters. Text and graphics may be freely mixed.

Colours
Foreground and background colours, brightness and flashing are set by BASIC INK, PAPER, BRIGHT and FLASH commands. OVER may also be set, which performs an exclusive-or operation to overwrite any printing or plotting that is already on the screen. INVERSE will give inverse video printing. These six commands may be set globally to cover all further PRINT, PLOT, DRAW or CIRCLE commands, or locally within these commands to cover only the results of that command. They may also be set locally to cover text printed by an INPUT statement. Colour-control codes, which may be accessed from the keyboard, may be inserted into text or program listing, and when displayed will override the globally set colours until another control code is encountered. Brightness and flashing codes may be inserted into program or text, similarly. Colour-control codes in a program listing have no effect on its execution. Border colour is set by a BORDER command. The eight colours available are black, blue, red, magenta, green, cyan, yellow and white. All eight colours may be present on the screen at once, with some areas flashing and others steady, and any area may be highlighted extra bright.

Screen
The screen is divided into two sections. The top section – normally the first 22 lines – displays the program listing or the results of program or command execution. The bottom section – normally the last 2 lines – shows the command or program line currently being entered, or the program line currently being edited. It also shows the report messages. Full editing facilities of cursor left, cursor right, insert and delete (with auto-repeat facility) are available over this line. The bottom section will expand to accept a current line of up to 22 lines.

Mathematical operations and functions
Arithmetic operations of +, –, ×, ÷, and raise to a power. Mathematical functions of sine, cosine, tangent and their inverses; natural logs and exponentials; sign function, absolute value function, and integer function; square root function, random number generator, and pi.
Numbers are stored as five bytes of floating point binary – giving a range of $+3\times10^{-39}$ to $+7\times10^{38}$ accurate to 9½ decimal digits.
Binary numbers may be entered directly with the BIN function. =, >, <, >=, <= and <> may be used to compare string or arithmetic values or variables to yield 0 (false) or 1 (true). Logical operators AND, OR and NOT yield boolean results but will accept 0 (false) and any number (true).
User-definable functions are defined using DEF FN, and called using FN. They may take up to 26 numeric and 26 string arguments, and may yield string or numeric results.
There is a full DATA mechanism, using the commands READ, DATA and RESTORE.
A real-time clock is obtainable.

String operations and functions
Strings can be concatenated with +. String variables or values may be compared with =, >, <, >=, <=, <> to give boolean results. String functions are VAL, VAL$, STR$ and LEN. CHR$ and CODE convert numbers to characters and vice versa, using the ASCII code.
A very powerful string slicing mechanism exists, using the form a$ (x TO y).

Variable names
Numeric – any string starting with a letter (upper and lower case are not distinguished between, and spaces are ignored).
String – A$ to Z$.
FOR-NEXT loops – A-Z.
Numeric arrays – A-Z.
String arrays – A$ to Z$.
Simple variables and arrays with the same name are allowed and distinguished between.

Arrays
Arrays may be multi-dimensional, with subscripts starting at 1. String arrays, technically character arrays, may have their last subscript omitted, yielding a string.

Expression evaluator
A full expression evaluator is called during program execution whenever an expression, constant or variable is encountered. This allows the use of expressions as arguments to GOTO, GOSUB, etc.
It also operates on commands allowing the ZX Spectrum to operate as a calculator.

Cassette interface
The ZX Spectrum incorporates an advanced cassette interface. A tone leader is recorded before the information to overcome the automatic recording level fluctuations of some tape recorders, and a Schmitt trigger is used to remove noise on playback.
All saved information is started with a header containing information as to its type, title, length and address information. Program, screens, blocks of memory, string and character arrays may all be saved separately.
Programs, blocks of memory and arrays may be verified after saving to confirm successful saving.
Programs and arrays may be merged from tape to combine them with the existing contents of memory. Where two line numbers or variables names coincide, the old one is overwritten.
Programs may be saved with a line number, where execution will start immediately on loading.
The cassette interface runs at 1500 baud, through two 3.5 mm jack plugs.

Expansion port
This has the full data, address and control busses from the Z80A, and is used to interface to the ZX Printer, the RS232 and NET interfaces and the ZX Microdrives.
IN and OUT commands give the I/O port equivalents of PEEK and POKE.

ZX81 compatibility
ZX81 BASIC is essentially a subset of ZX Spectrum BASIC. The differences are as follows.
FAST and SLOW: the ZX Spectrum operates at the speed of the ZX81 in FAST mode with the steady display of SLOW mode, and does not include these commands.
SCROLL: the ZX Spectrum scrolls automatically, asking the operator "scroll?" every time a screen is filled.
UNPLOT: the ZX Spectrum can unplot a pixel using PLOT OVER, and thus achieves unplot.
Character set: the ZX Spectrum uses the ASCII character set, as opposed to the ZX81 non-standard set.
ZX81 programs may be typed into the ZX Spectrum with very little change, but may of course now be considerably improved. The ZX Spectrum is fully compatible with the ZX Printer, which can now print out a full upper and lower case character set, and the high resolution graphics; using LLIST, LPRINT and COPY.
ZX81 software cassettes and the ZX 16K RAM pack will not operate with the ZX Spectrum.

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ZX Spectrum

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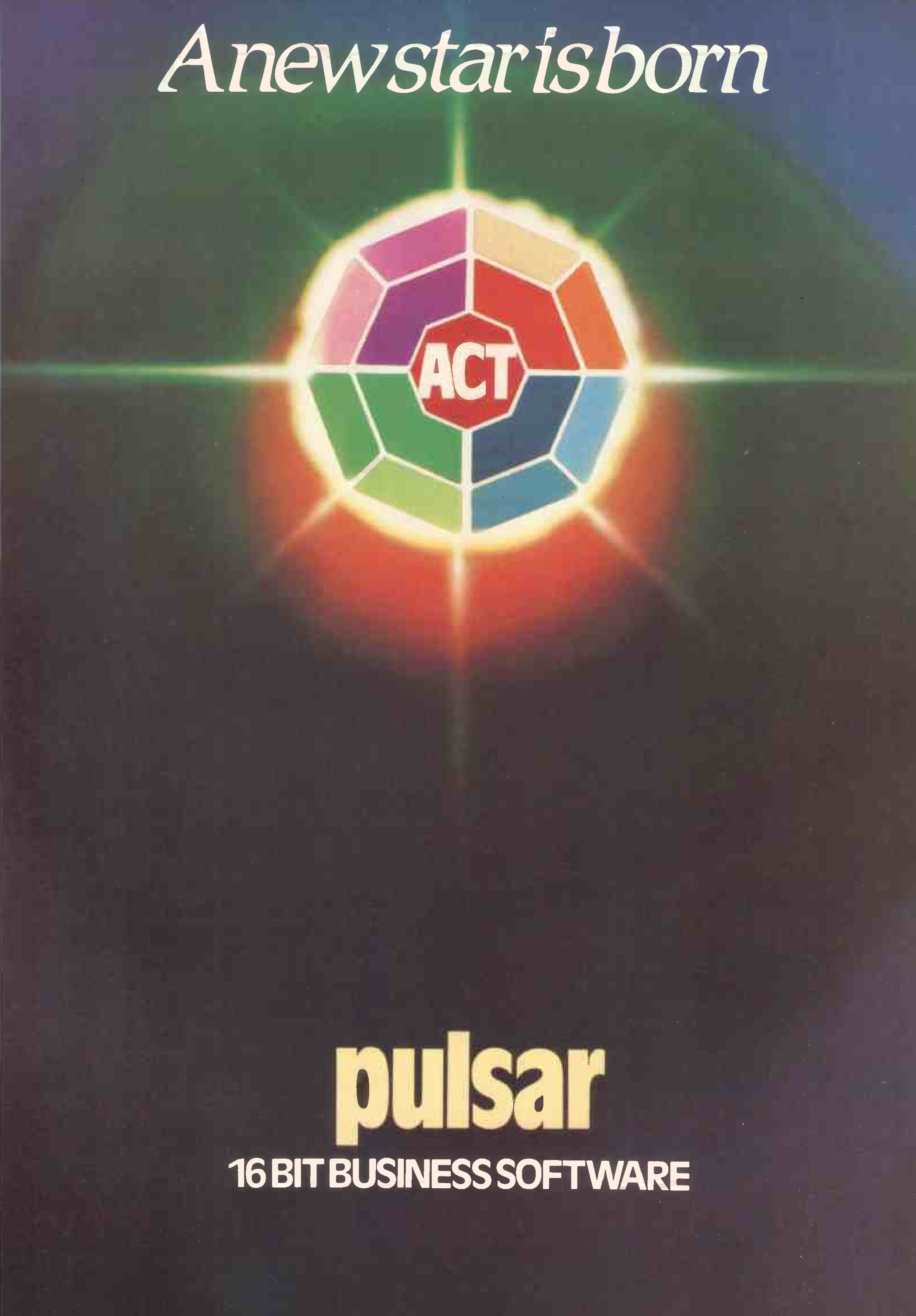
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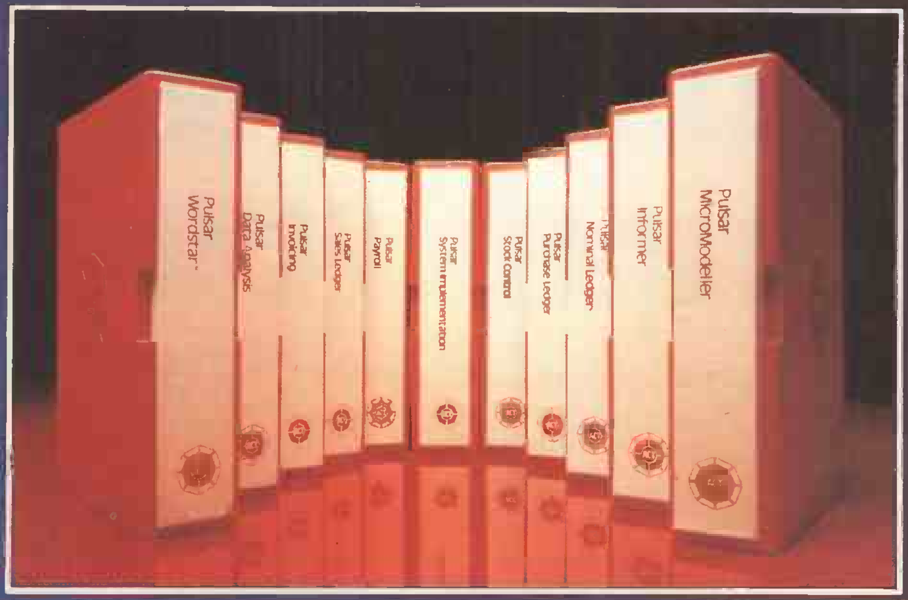

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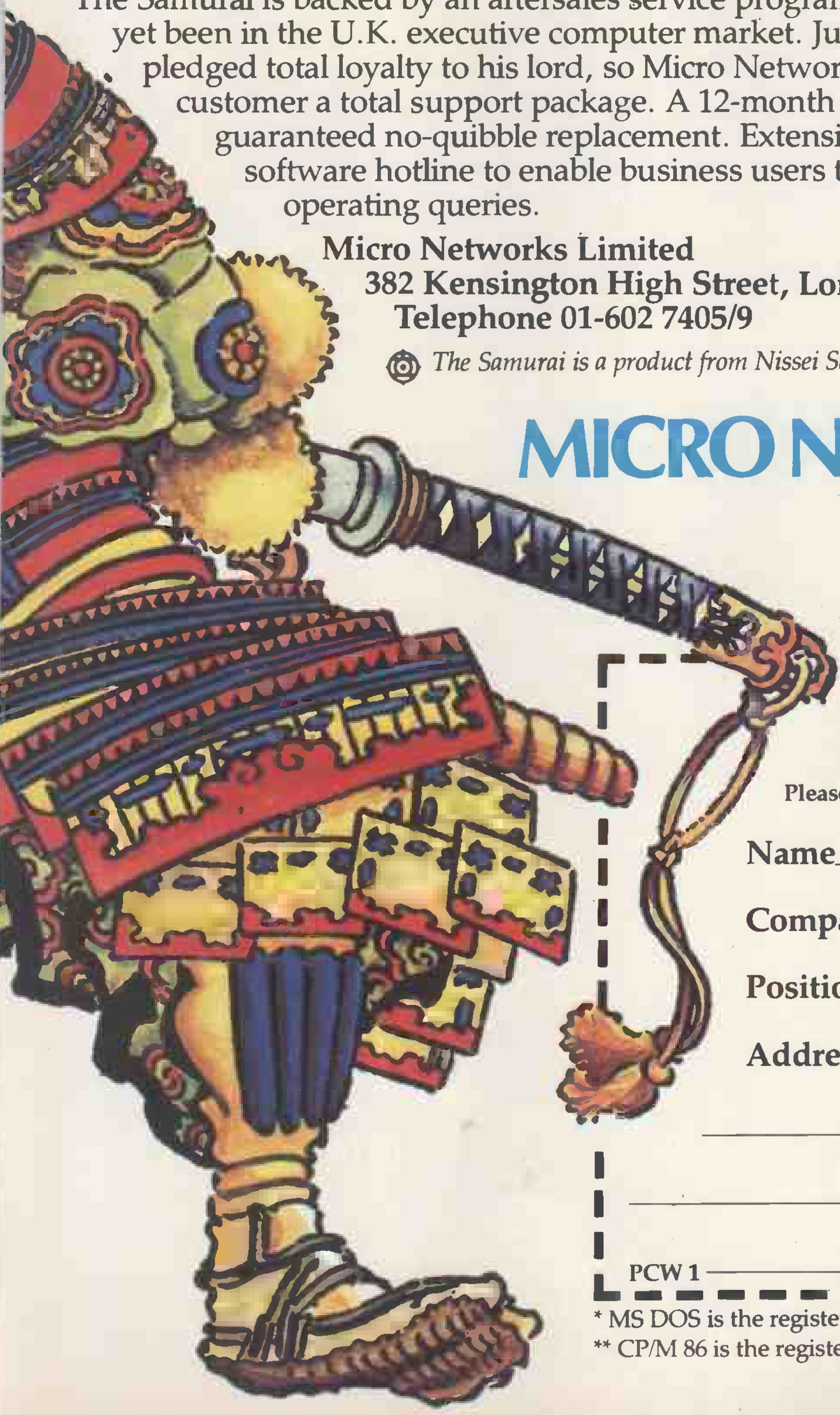

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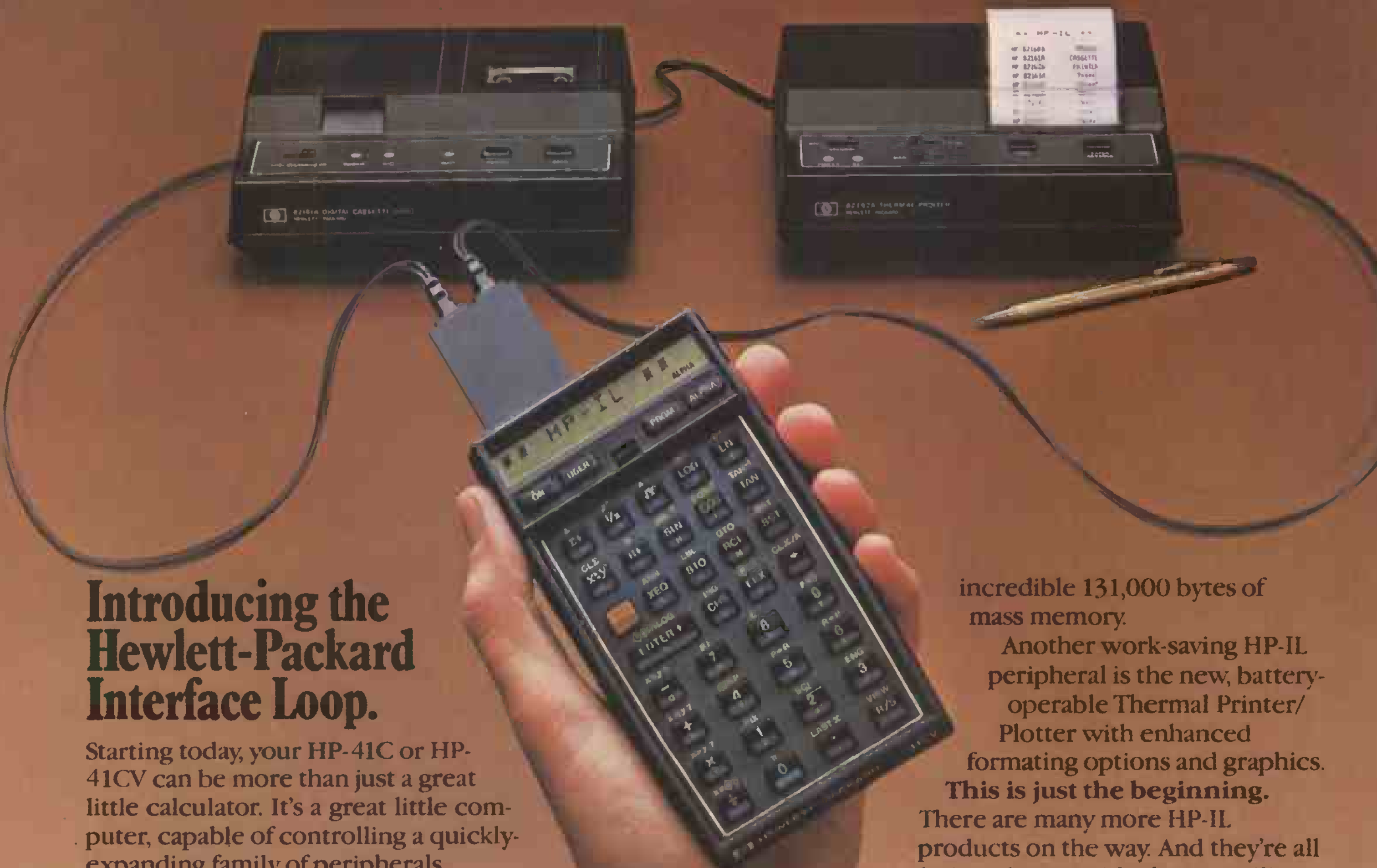

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One of the key HP-IL peripherals is the new Digital Cassette Drive. This battery-operable device provides an incredible 131,000 bytes of mass memory.

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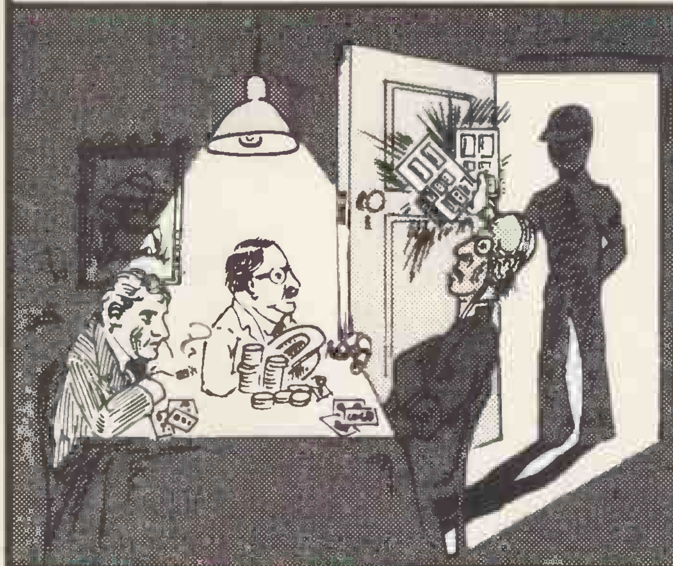

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apple II Aristocards

Parallel £69

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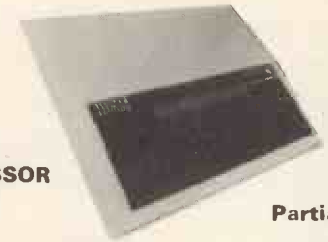

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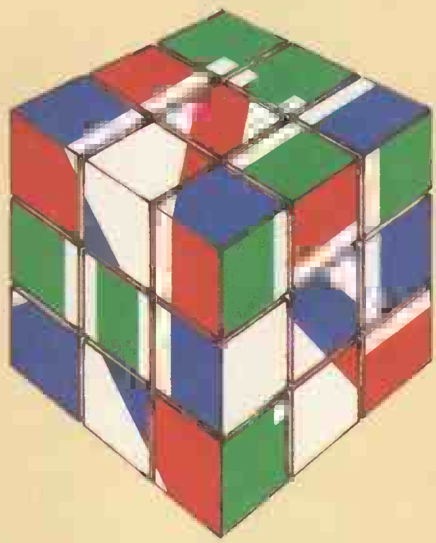

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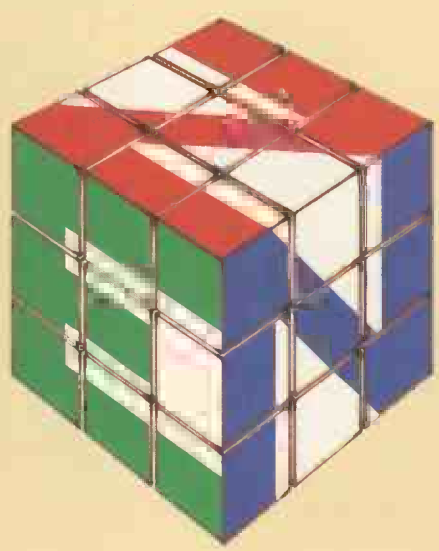

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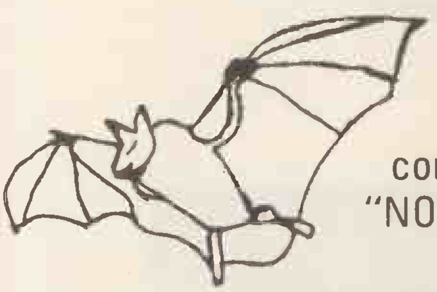

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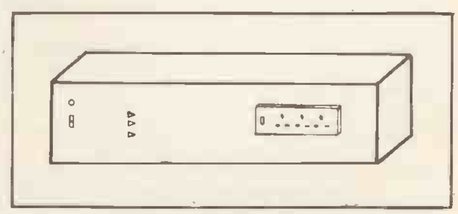

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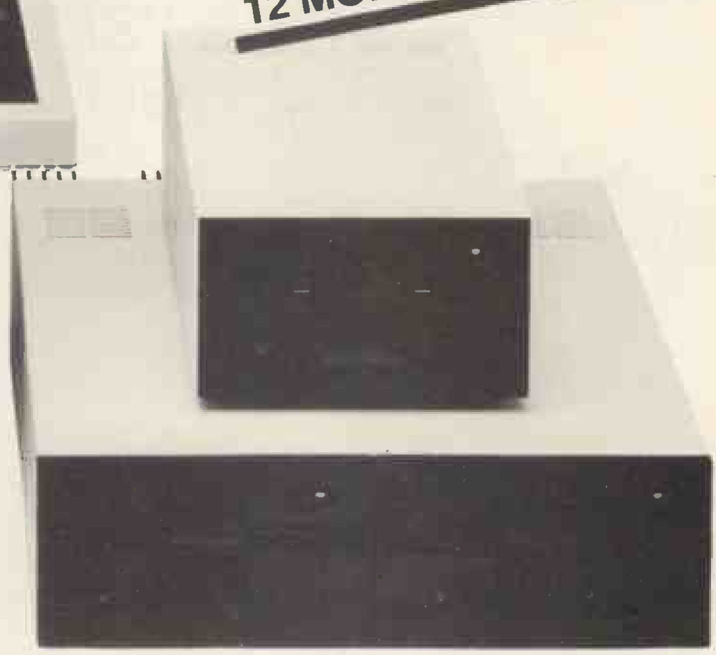

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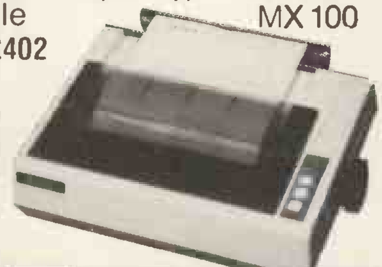

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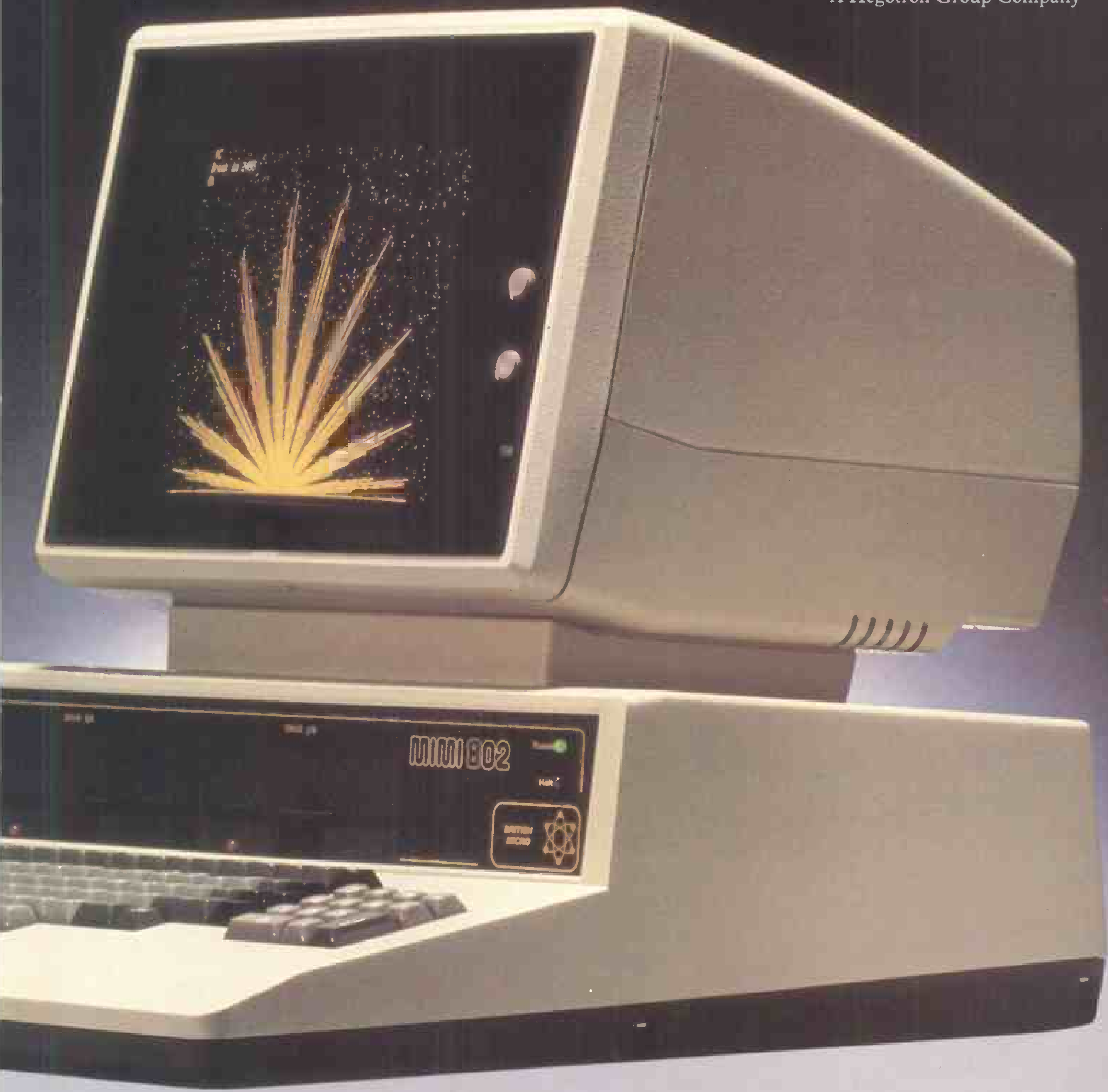

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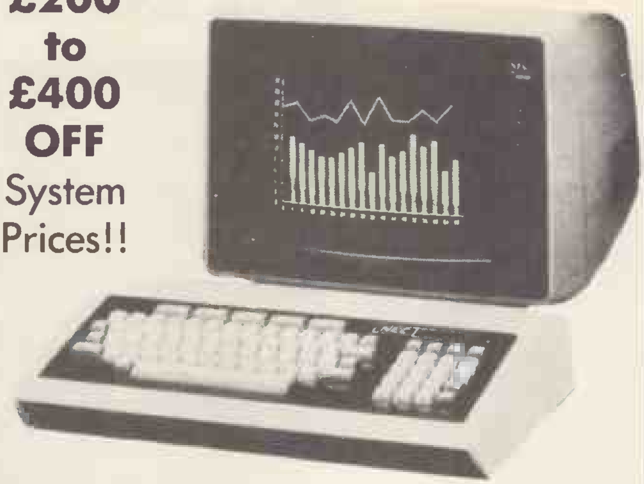

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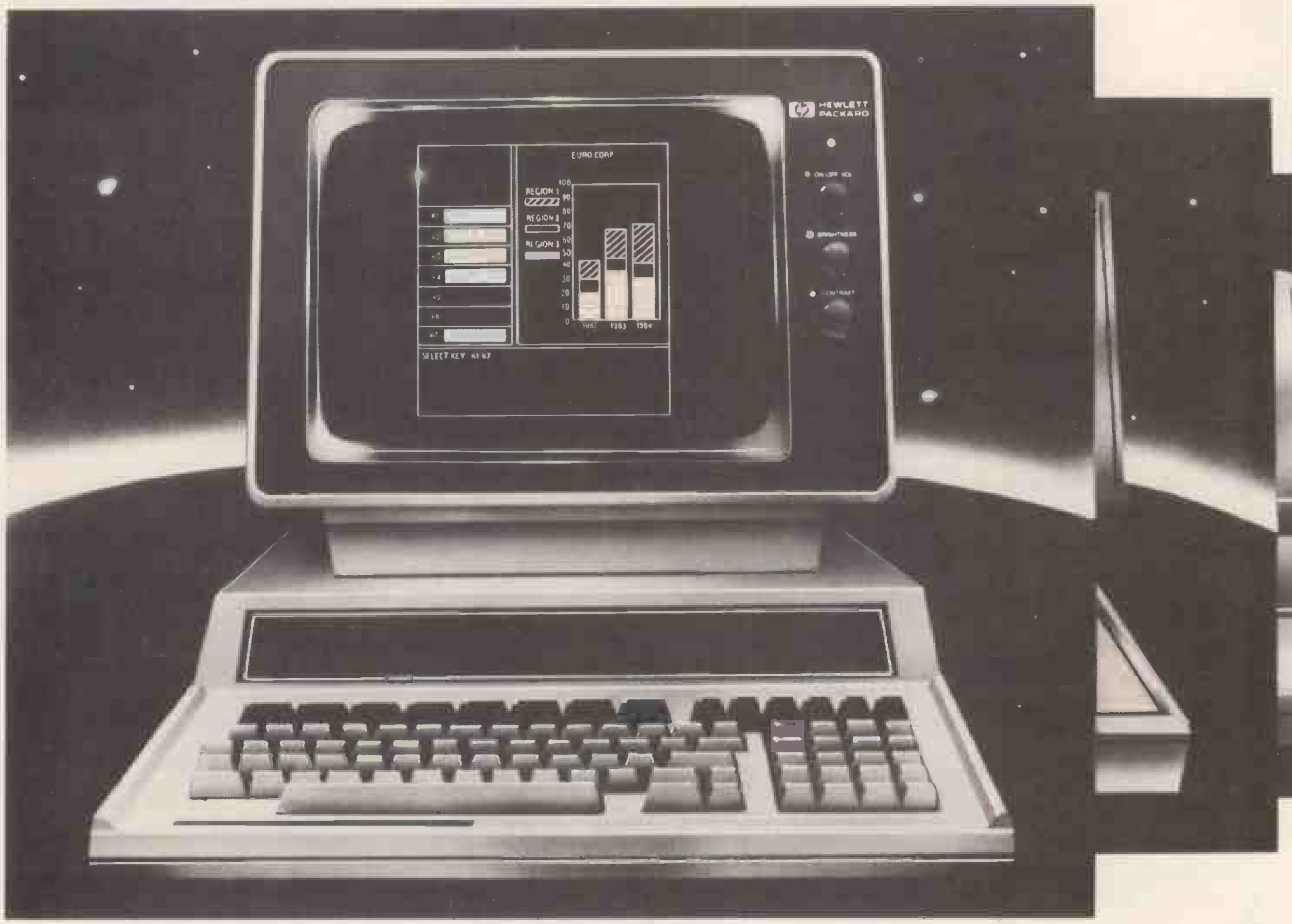
The New HP-86



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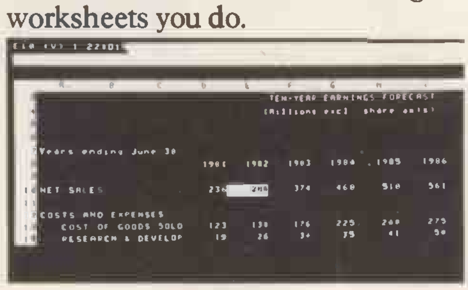

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Personal Computer

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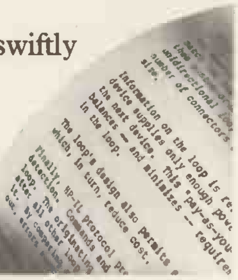

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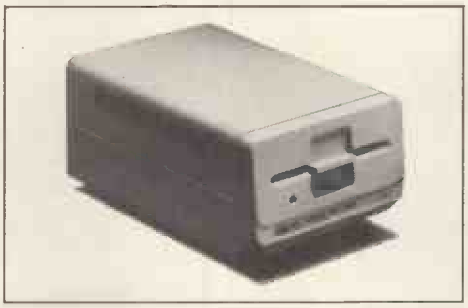

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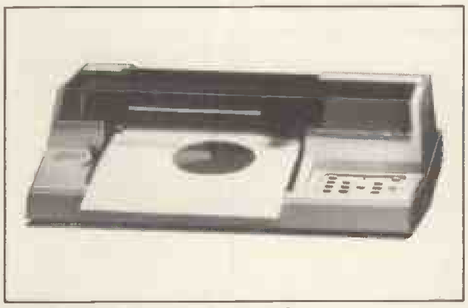
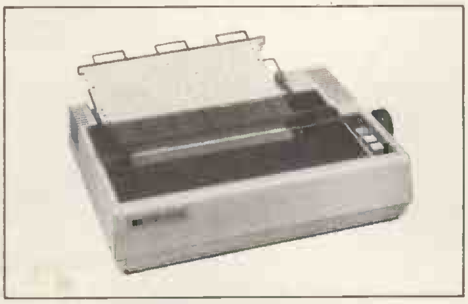


HP 7470 low-cost plotter, for full-colour hard-copy charts or overhead transparencies.



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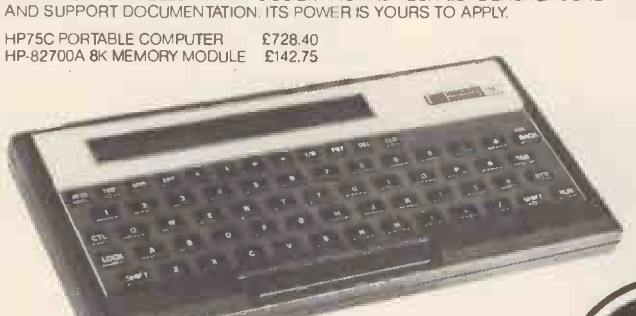

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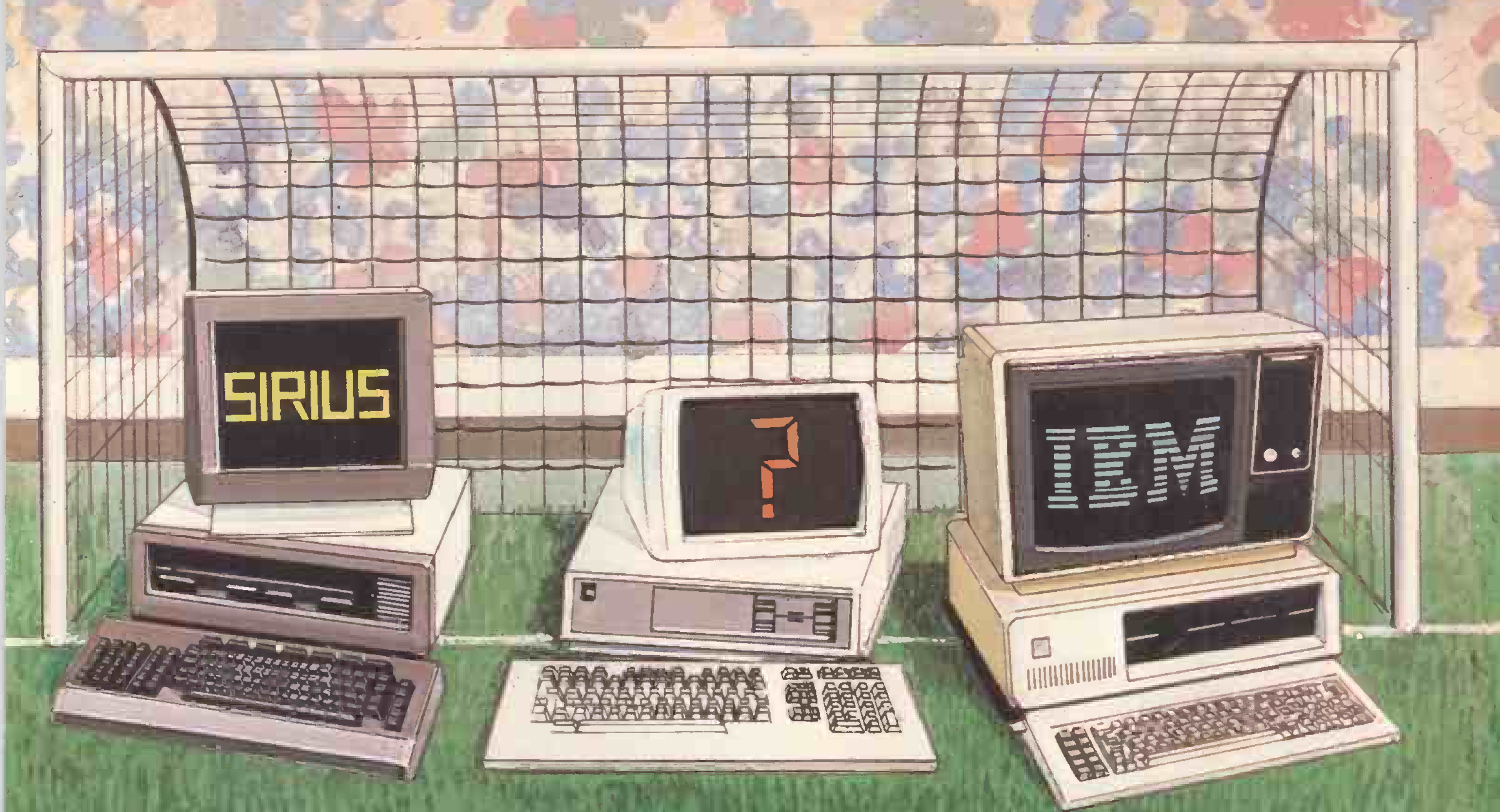

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*Model A has a limited range of interfaces but can be upgraded to meet Model B specification.
**CP/M is a registered trade mark of Digital Research.
The BBC Microcomputer is designed, produced and distributed in the UK by Acorn Computers Limited.

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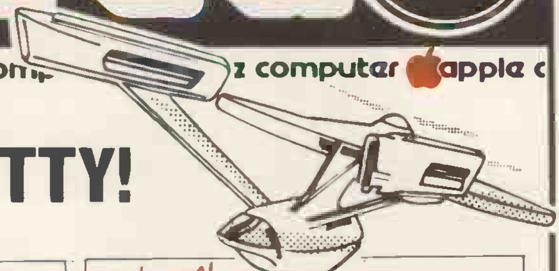

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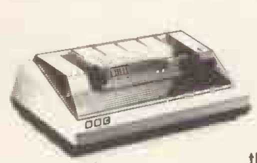

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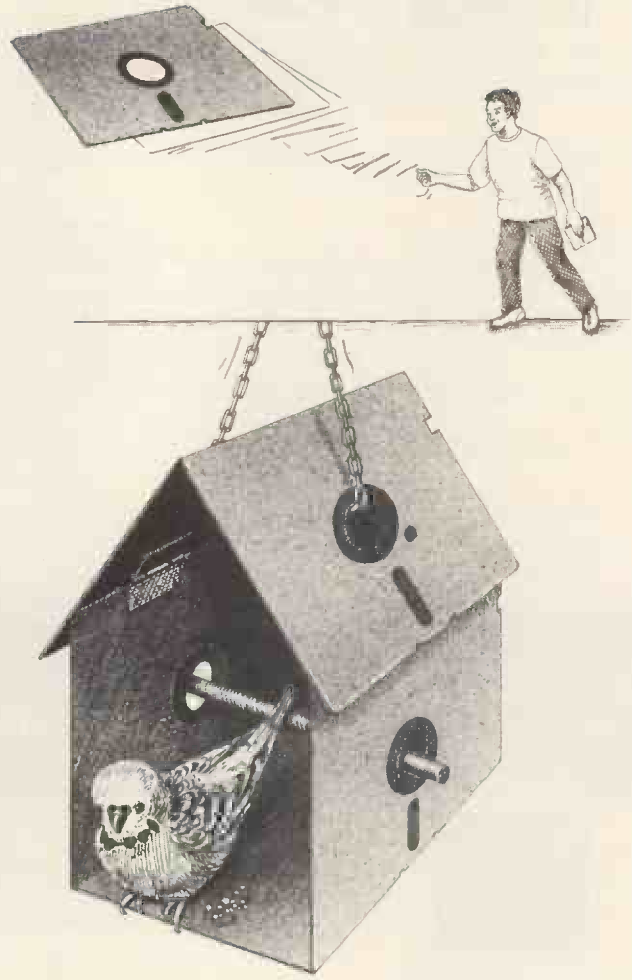

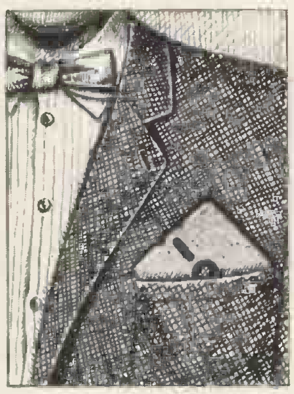

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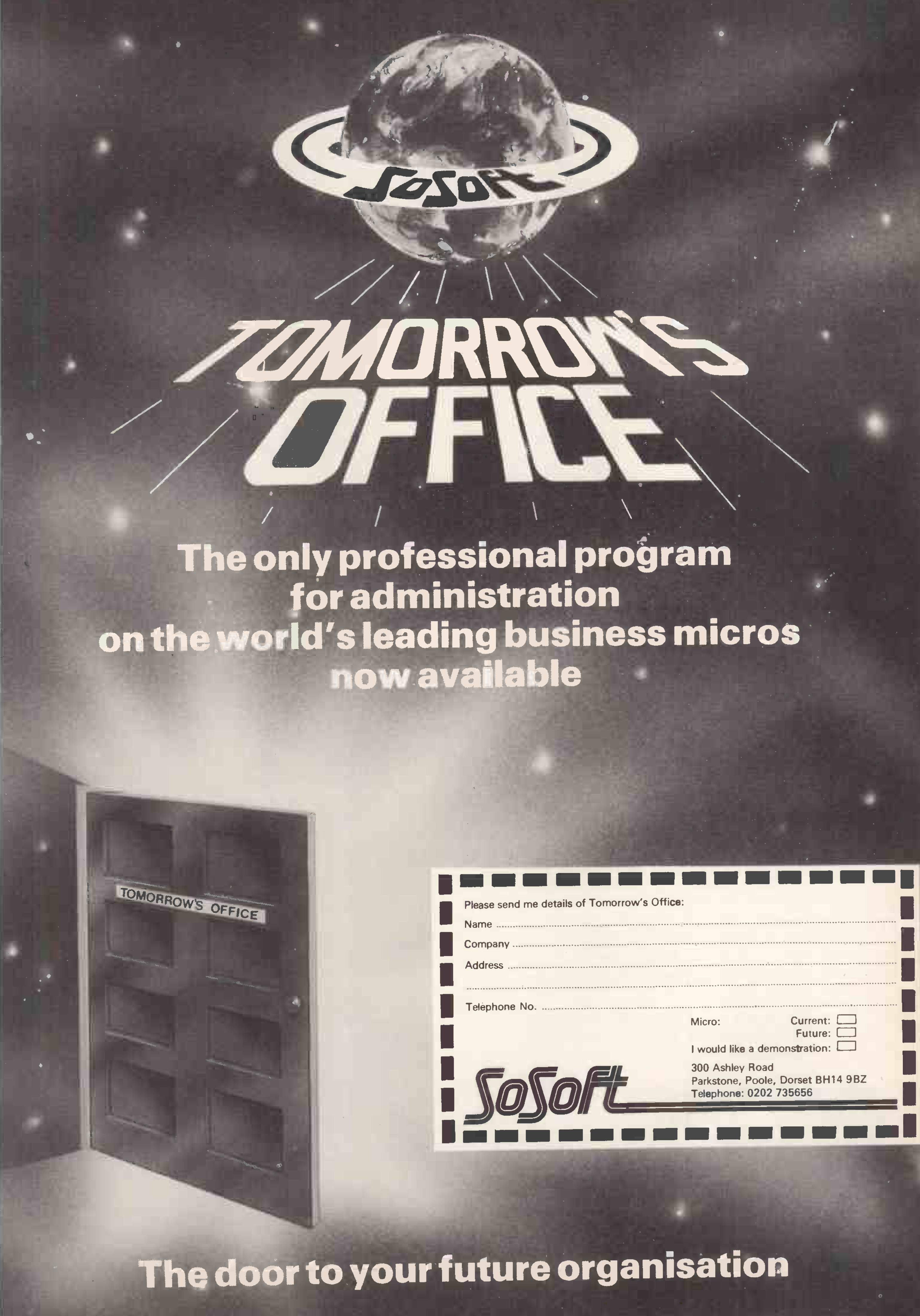
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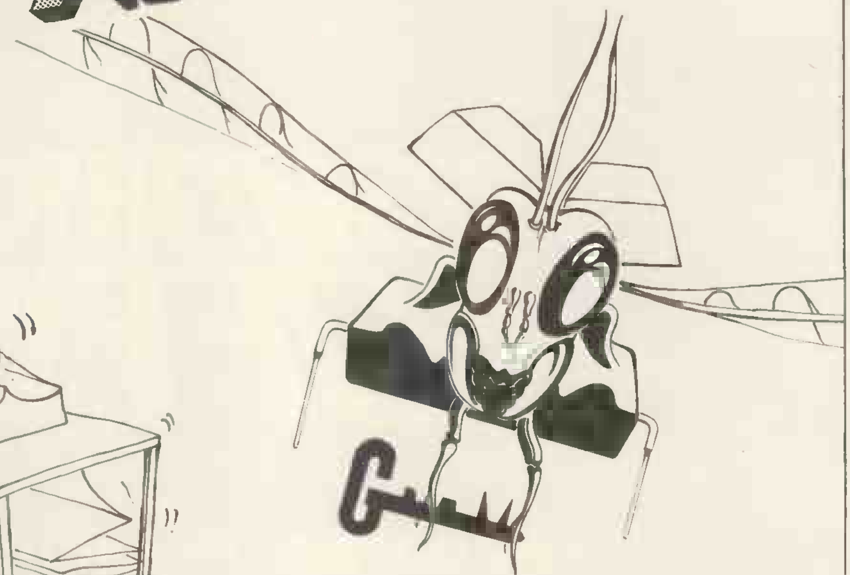

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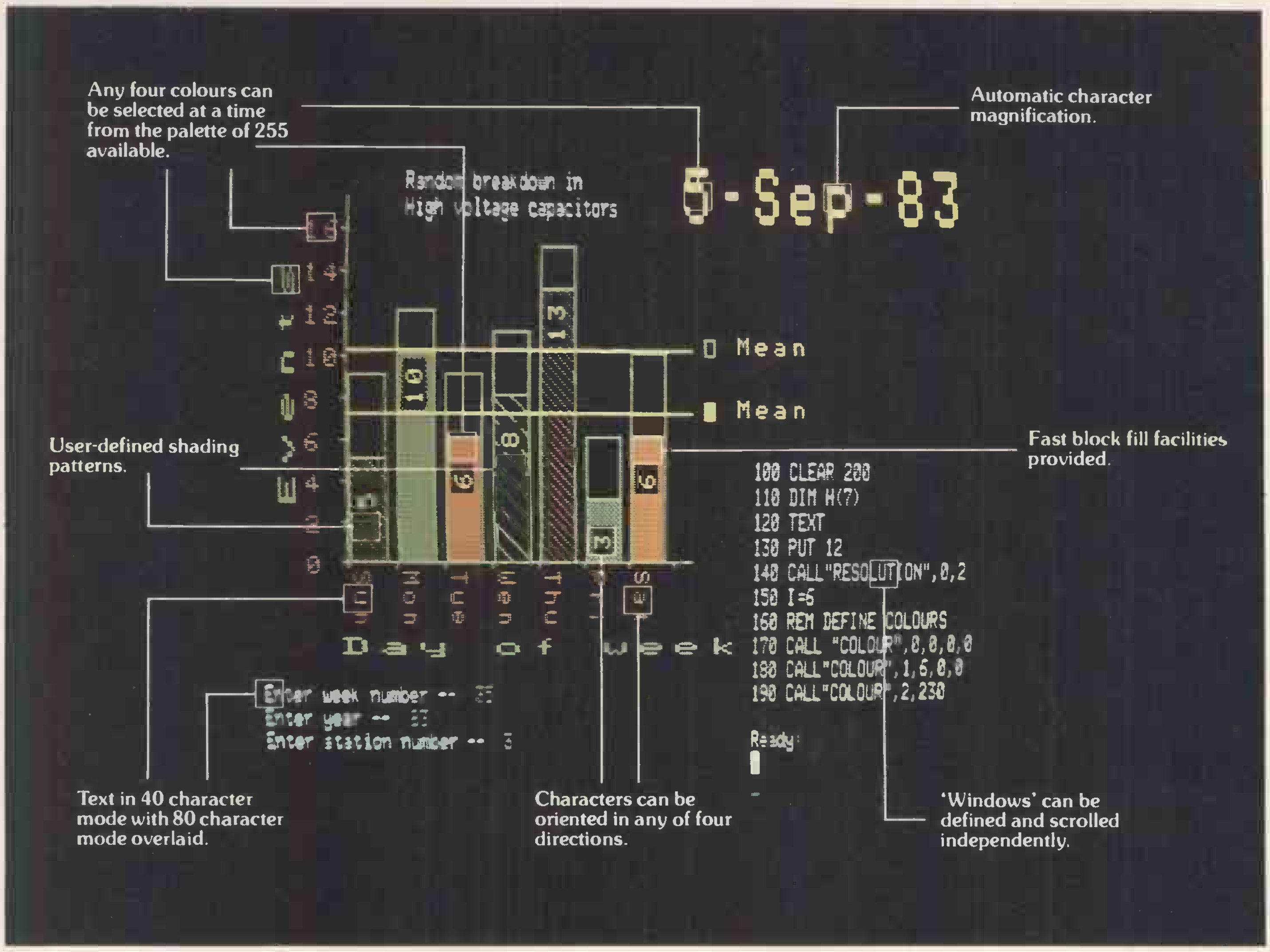

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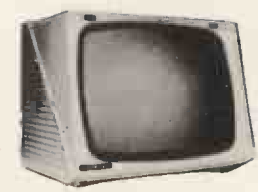

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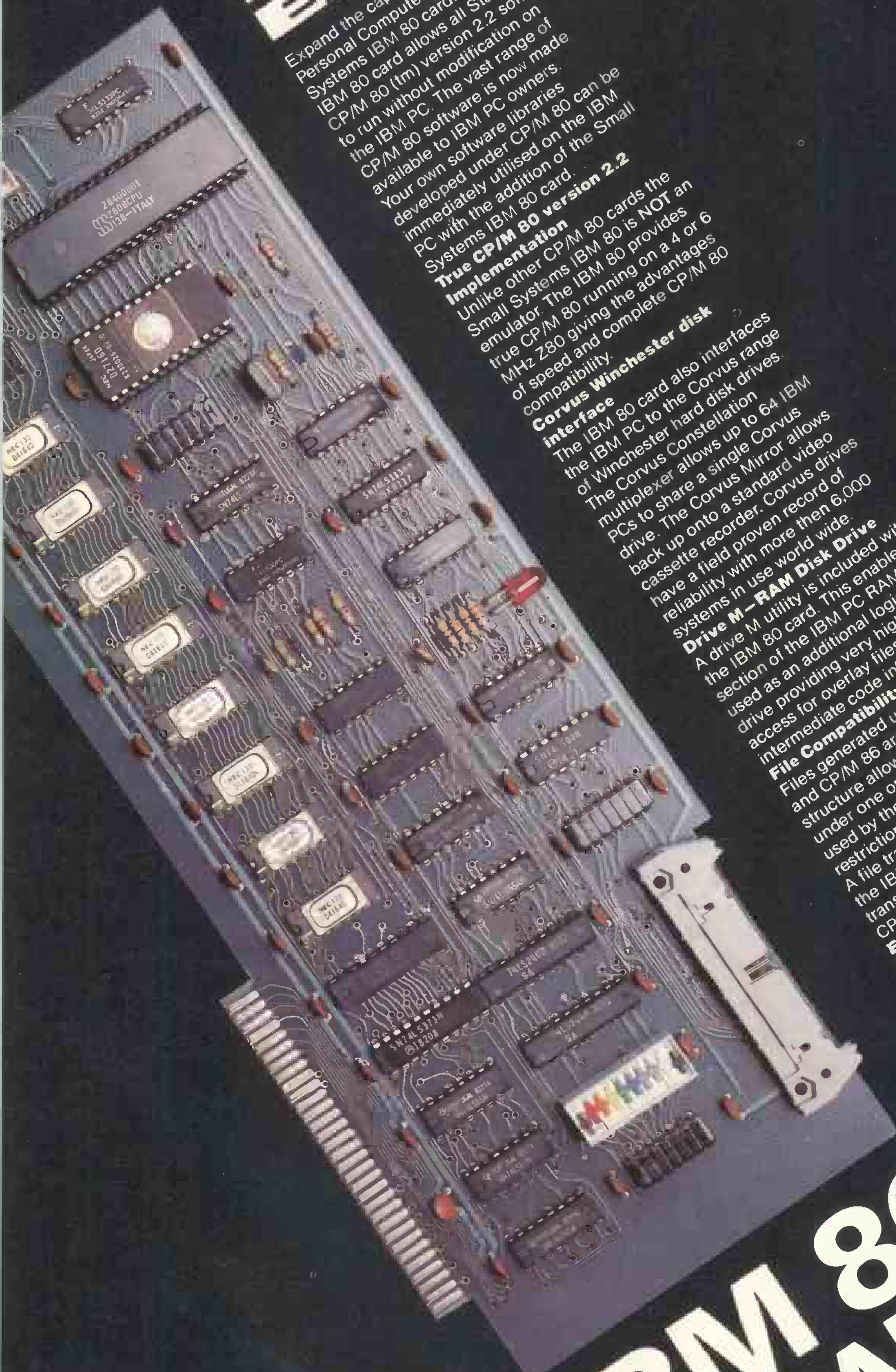

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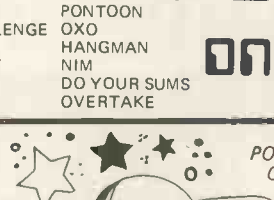

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Guy Kewney provides the latest micro news.

Fear and loathing...

A room where three people announce portable versions of the IBM Personal Computer that are in one way or another nicer and faster than the original (and cheaper); where a couple of dozen people announce brand new micro-systems with the power of one of the better known mainframes (the Vax) running Unix (an operating system popular with universities); where new printers without motors in them, new hard disk drives that can have their disks replaced, and a new form of software that can do two things at once — where all these things happen is a room which might be mistaken for the centre of the computer industry.

The computer industry doesn't have a centre — not in the way that fashion centres on Paris, or the way motor cars are supposed to be able to find their own way to Detroit.

But the biggest computer show in the world (after the computer section of the Hanover Fair, which doesn't count) is the show which is held twice a year, once in Las Vegas and once in Atlantic City, and is called Comdex.

At Comdex Fall, the one held when even Las Vegas is starting to get cold and wintry, all those things happened — and more. Let us hope that this doesn't mean that Las Vegas is the centre of the computer industry. Let us hope it is just the site of a very big exhibition hall, in a town where the hotels are normally empty in winter. Because Las Vegas is a dreadful place.

To get into Comdex, you have to be more than a masochist, however. You have to be 'trade only' — you have to be a bulk buyer or seller of micros or micro software or services.

But if you are all these vile things, then you get let into a treat. Apart from being the 'biggest single level exhibition area in the United States', and having 'more than six miles of brand new carpet laid just for this one show', Comdex is where the new minis (some of them) and the new micros get their first showings.

It is important to remember something about 'first showings', however.

First showings, almost always, are of 'non-functional' equipment.

As you read your way through this 'Newsprint' section of *PCW*, you will notice that certain news items are about things that happened at Comdex — because they were important, trend-setting, or otherwise simply newsworthy.

I haven't done one big Comdex review item — because nothing will make a CP/M user interested in PET software, whether it was announced at Comdex or not. So it has all been kept in nice, separate news items.

But all Comdex stories about new equipment printed here have one thing in common — you can't buy it in the shops, and you won't be able to for some time. And if you do, it won't work.

There may be exceptions to the rule that people announce products before they are ready, or before there are enough available to meet demand, but those exceptions don't include IBM, Digital Equipment, Commodore, Acorn, Sinclair, Comart, Canon, Osborne, Apple, and so on and so on. They don't even include several more worldly-wise Japanese companies.

Whatever you were just about to pay out a deposit on, stick with it.

Arise, 'Sir' Clive...

Around the middle of December, I was frequently distracted by people telling me that it would not just be Clive Sinclair OBE, but Sir Clive Sinclair, KCG or whatever, instead of merely Uncle Clive.

By the time you read this, of course, all the speculation will be probably wasted — until the next Honours List — because the honours will have been announced — or not.

Naturally, before attempting to print this rumour, I rang Sir Clive up, and told him what I'd heard. He laughed immoderately, and agreed at once that if such a thing were in the wind, 'They' would probably have told him of it.

But I couldn't help noticing how he signally failed to say that 'They' hadn't.

If by some strange chance the powers that be do manage to confer official approval on Clive, it will come as less surprise to a lot more people than you would think possible.

At Government dinners recently, Ministers have been hinting at 'recognition' for various micro-industry people and their 'contribution to Britain's position in the world in this area'. And, in rooms where Sinclair has been standing, Ministers have used the phrase 'for people in this room at the moment'.

Ever since Clive first pointed out that the Civil Service and the BBC (not altogether the same thing, since some Civil Servants didn't go to Oxford or Cambridge) didn't approve of him, there has been some sort of chorus of official disagreement.

There was the amusing episode, you may remember, of the educational 'approved' list, where the Spectrum (its virtue is its low cost) was included together with the RML 480Z and the BBC micro as a suitable machine for young children — providing they also bought an expensive colour video monitor.

'Proves we have nothing against him, doesn't it?' enquired one well-placed gentleman, who seemed astonished when I suggested that Sir Clive might not agree.

So, I suppose, since Sir Clive always wanted to prove to the Establishment that he was real and since the Establishment always wanted to seem fair-minded and even handed, you could say that a deal is a deal, and everybody's happy.

As long as it is really 'Sir' Clive, and not some Minor Bloody Eminence.

This is not a picture of the first tracker ball for home computer use. It is a picture of an ordinary high quality joystick for home computer users, and the joystick is made by Wico, who do actually make the tracker ball on Centipede (an arcade game from Atari) and who have now released the thing for you and me at over $70 — but couldn't find a picture for me to bring home from Comdex.

Wage security

Apparently a lot of people with computerised payroll get other people's payslips. One way of avoiding this is the ingenious scheme which PFC Business Forms has evolved, where you type the employee's name and works number (and so on) on a special 'security label' which is attached to the payslip. Then you tear the label off, and find that it has a carbonised underside, so the details are on the payslip. Then you put the label on the pay envelope, and the payslip inside it. Sounds great, except I'm sure there must be some way to put the payslip inside one envelope and the security label on a different one. Details on 021-559 3381.

Supplementing the Sirius

It is possible to upgrade your powerful 16-bit Sirius into an ordinary 8-bit CP/M machine by adding the board which Small Systems Engineering designed.

It is now possible to do it another way, and even add an interface to a hard disk (if you feel equal to the task of modifying the basic input-output system, the BIOS) on an add-on memory board from a man called Ravi Chandar.

The difference between his and the offical Sirius board is that you can use the extra 128 kbytes of memory when running 8088 (16-bit) programs, and that he doesn't use the Sirius parallel port — which, he says, means faster disk input and output of data.

He gives 'clear step-by-step instructions for installation, plus all instructions for BIOS modification required for hard disk expansion and high resolution graphics' — and the £400 price includes the CP/M 2.2 licence.

Write c/o Ozymandias, 198 Rochdale Road, Shaw, Nr Oldham.

Half-baked hard disks

They are called 'hard' disks because they are hard to afford, hard to fix, hard to use, hard to interface, and because they are not floppy.

The one thing they aren't is hard: the magnetic coating on a hard disk is so delicate that if the recording and reading head touched it for an instant it would gouge a groove in your data from which it would never recover.

Disk designers spin the soft surface fast enough for the head to 'take off' and 'fly' very, very close to the surface, and hope that nothing even as big as a particle of cigarette smoke ever comes flying along into the gap to act as a grinding agent.

There are two ways round this problem. The first is the one Sparrow Computer showed at Comdex Amsterdam, where you take a floppy disk, then spin it so fast that it looks hard but remains floppy enough to move out of the way of the head when pushed by an air cushion.

The second, more usual, way is to take the head and the disk, and enclose them in a plastic bubble, filled with the cleanest possible air — the pure air in a modern surgery just wouldn't be pure enough — so that there are no particles of anything, least of all smoke, to get in the way.

Now there is a new way, one invented by Syquest of Santa Cruz. This method takes the disk and coats it with a very tough surface magnetic material, and then bakes it in a semiconductor furnace until it doesn't matter a toss whether the head touches it or not.

This way, you can build a drive for a few hundred (not thousand) dollars. And then you can buy a five megabyte disk in a cartridge for about £30 or so. At this point, the manufacturers of floppy disks start counting the weeks, I suppose, or else rush out to see if they can buy a licence to make the Syquest drive.

The semiconductor furnace part of the story explains why the disk is 3.9 inches in diameter. Up until recently, most semiconductor chips were made on silicon circles ('wafers') four inches in diameter. Nowadays, they are made in five-inch wafers.

There is quite a lot of cheap four-inch furnace equipment on the market. Production will be readily established.

There is only one thing else you need to know: it appeared for the first time at Comdex Fall. . .

Next time somebody tells you he rang up Sir Clive (goodness, I do hope it doesn't turn out to be an Ordinary Bloody Emblem) you can show them what they've really being talking to.

This machine can answer up to 25 calls, and feed them through to the people answering queries in the right order. The really unusual part of it (apart from the identity of one of its more famous users) is the fact that it speaks a polite little piece when you phone, but doesn't use a tape recording. Instead ,the speech is digitised, and stored in semiconductor memory. The main advantage for the user is that the memory doesn't wear out like tape. For the angry customer, the advantage is that the little piece is spoken from its beginning, not just from wherever the tape loop happened to be when you got connected.

This one is used by Sinclair's distributor (mail order, that is) GSI (UK) Ltd in Camberley. Price is from £2,500 or rental from £1,000 per year. Other details from Ansamatic on 01-446 2451.

Fast Future

Britain's own response to the IBM Personal Computer is a lot cheaper than the original.

A new company called Future Computing, selling through distributor Encotel, has launched a machine costing £1,500 which runs all IBM software but runs it some 60 percent faster.

At press time, we had so few details that it was hardly worth running the item — but this is pretty unusual, so a quick mention will do no harm.

The machine will have a very comprehensive local area networking ability, says Brian Jackson, the managing director of the new company.

And to set it right apart from most IBM look-alikes, this one will be able to have an add-on processor more powerful than its own chip.

Where most users of the 8088 chip eventually plug in an ordinary Z80 to provide standard CP/M, Future Computing will offer the much beefier Motorola 68000, a favourite of those who want to write programs in C under Unix.

And in 1984, promises Jackson, there will be a 'true 32-bit processor', but he didn't want to give details.

Apple Proof

A new spelling checker for Apple II users — costing £120, called Proof — is available from Cambrian Software of Caernarfon.

I contains 44,711 words, including 1170 proper names, and has both British and American spellings — or one, or the other, whichever you specify. Details on (0286) 831072.

Approval for Torch

The Torch, a computer built around the BBC micro board but offering CP/M-like operating software, has now become 'the first microcomputer to be fully approved by British Telecom for connection to the phone network', according to Torch.

The standard Torch has been designed, the company points out, with extensive communication abilities. It actually has a built-in modem, a fast 1200 baud one, also capable of transmitting at the 75 baud rate of Prestel if necessary.

'Within the Torch, the 6502 processor chip handles all communications with other computers,' says the company in a handout. 'That works through the Econet local area link, and the RS232 interfaces, or via the modem. The Torchnet interface provides for local area networking — software — while remote traffic is handled by Torchmail, the company's own communication software system for using the BT phone network.'

The machine is now being distributed by EMG, which tells me that it plans to have 200 EMG micro centres over the next five years.

Details on (0223) 841000.

Excuses, excuses...

Suppose you had to hire a car, in the newly discovered Pacific continent of Urbania, in order to cross from the main airport on the east side of the capital city Consprawlopolis, to the heights of the western Cimmerian cliffs. Got it? Now compose a short description of your journey, after you discover that brake and accelerator are transposed and that the brake, furthermore, must be pulled, not pushed.

The description need not be as short as your journey, but it can

The Acco box — indexing made easy.

end with your regaining consciousness in the Saint Jude Hospital.

Suppose that all your life you have been an expert in the use of Unix, as the background operating system into which you hook all your programs. Your favourite masterpiece, a complex file management program, must be transposed to the Frivolous Mk III microcomputer, which has a re-write of Unix called Immunix. It runs your programs nearly all right, but one or two complex modifications, say a couple of weeks' work are needed to take account of the special display and keyboard routines.

To your horror, you find that the editing command you use as second nature doesn't work. Instead, you have to use a different procedure, which (without your realising it) actually has one or two side-effects which the designers thought were 'improvements' and which in your hands generate a whole new series of untraceable software bugs.

Describe, in your own words, which machine you choose to transfer your clever file handling program to. Do not use the phrase 'any other machine but the Frivolous III and Immunix' more than once.

The moral of this story, which became clear walking around the very, very many new Unix-based machines displayed at Comdex, is: don't take it for granted that just because 'Our operating system is an exact emulation of Unix' this means that the system will get that clever file-handling program inside the next year. If it will, can they demonstrate it? And if not, why not?

That simple test will save you from the extreme tedium of having to listen to experts explain in their own terms why what you want is not what you really want, but only what you think in your ignorance you ought to want if you what you really wanted were not available.

In the end, the only thing that matters about an operating system is: 'Will it run my software?'

If the answer is 'no' then everything else is just excuses, excuses.

Easy indexing

Within a year of starting work with your first disk-based system, you will be the owner of an untidy mess of around 50 floppy disks. You will never be able to find the one you are looking for, and when you do find it, the file you want will turn out to have been transferred to a different one, to make space.

After a little wandering around exhibitions you tend to buy a box, and stick with it. These boxes tend to be plastic, with a perspex top so you can see that the contents are really disks, and not honey or cheese (or vice versa, perhaps).

This really isn't good enough. At least two makers of boxes realise that just having them in one place is not much help unless you have some way of working out which diskette is which — and those two people are MC2, with a system of diskette indexing and envelope indexing; and Willis, with a system of displaying the labels, and indexing them.

Both these systems cost well over £30, and have the disadvantage of storing rather fewer disks than an ordinary long box —but so far, they are the best solution I've found.

Latest announcement is the Acco disk box, illustrated on this page, which has the advantage of having its own envelopes for the floppies — tear-proof — and a box for 20 5¼ in disks with envelopes costs £15.

Anybody else who had a method of storing 50 or more disks in sensible order, and a method of indexing them and their indexes, please don't be shy —get in touch.

Rooting for Unix

When getting Unix to run on a computer, you have to find somebody, first, who knows how to 'port' it on. Unisoft (mentioned above in connection with Uniplus) is based at Berkeley in California, where the people working on Unix 4.2 call themselves the Root Group.

This explains the otherwise inexplicable name of the London firm which does Unisoft's work in the UK — Root Computers.

Root has done its first 'port' — the machine announced in this column last month by Eddie Bleasdale. 'It was completed in just three days,' they claim.

Root is on 01-468 7045.

Price war looms (or does it?)

A plan to cut the price of the ZX Spectrum to under £100 after Christmas (possibly in February) could have a disastrous effect on Christmas sales or January sales, if news of it leaked out prematurely, and so it would be kept a very strict secret.

So it may be true, and it may not be true. The machine has only just been released to the retail trade, with WH Smith getting stocks in just in time for the Christmas rush, as you probably saw.

In those circumstances, cutting the price might seem premature. On the other hand, with the Oric just about to start shipping a very nice machine in large numbers, with the VIC being discounted down to £130 or lower, and with things like the Lynx very close, a pre-emptive price cut on the Spectrum would make sense.

And people I often trust insist that it will happen.

Make up your own mind.

In Smiths, you will now find, there is a range of 'own-brand' WH Smith software, together with a range of books and magazines.

Chalking up marks

After hard cheese, very different is Chalksoft — an educational software company formed by a group of teachers and programmers.

The company plans to concentrate on 5-11 year-olds, an area of great nervousness and controversy — it already has programs for the BBC B, and the VIC 20 with minimum extra memory.

Currently available is 'Metrics' at £9.95 to check knowledge of kilos and litres: 'Invisible Man' (same price) which hides a cartoon man on cartesian graph paper, and makes the children work out coordinates; 'Sequences' (cheaper at £6) which demonstrates square numbers, prime numbers, Fibonacci numbers and so on (this is apparently 'important') in a way that leads the producers to say that 'the

An American rival to the remarkable colour graphics machine that IO Research launched at the PCW Show, the Vectrix colour graphics system is a bit pricier, and a bit more packaged.

It costs $2,000, and is designed as a colour graphics terminal to a host computer. So it includes the monitor, the printer, the keyboard (not in the $2,000 price, that just covers the graphics box) with serial and parallel interfaces to 'just about any computer.'

Again like IO Research, Vectrix has a bigger, more powerful version of its basic machine. The normal box is the VX 128: the big one, the VXZ 384 costs $4,000 and is vastly more powerful, and requires a considerably more accurate colour display than the normal one.

Information is available from Michael Gold at Vectrix, 700 Battleground Avenue., Greensboro NC 27401. Phone (919) 272 3479.

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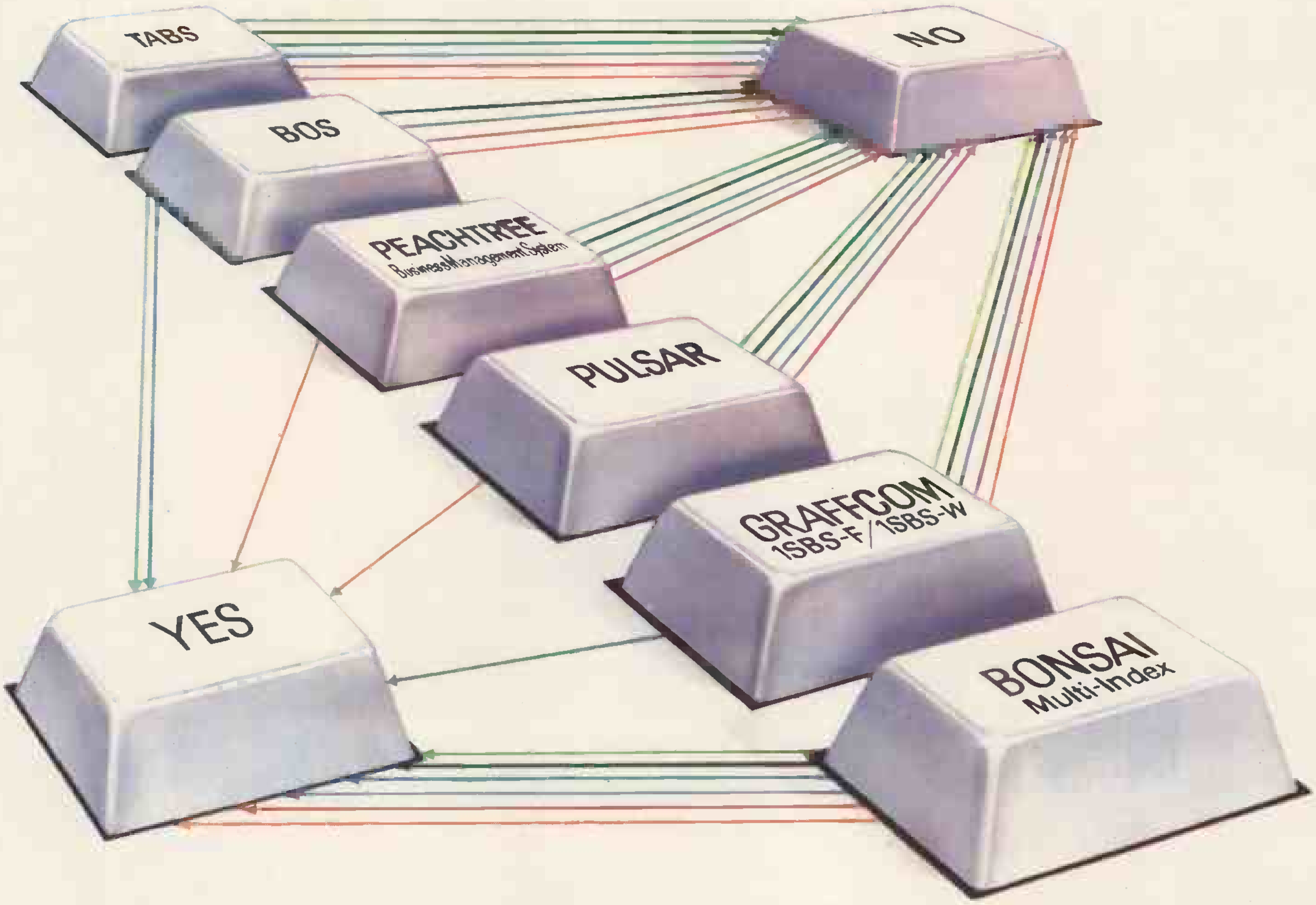

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This picture illustrations a perfectly acceptable powerful business microsystem from Micro Five — a system not noticeably inferior to any other powerful business microsystem, yet one of which you've probably never heard.

The reason is that there is a terrible battle to get enough dealers. Everybody has a factory big enough to churn equipment out fast, and equipment good enough to sell fast — if only they could get us to look at it.

Should anyone doubt that Micro Five is desperate to have us look at their equipment, consider the announcement that the company has 'added Pacific Computer Products to the company's world-wide marketing base'. This is described as 'going after the Fortune 500 base'.

Who, you ask vaguely, is Pacific? 'Pacific Computer Products is an Orange County-based manufacturer and supplier' (oh, good, an expert) 'of computer printer ribbons. . .'

See what I mean?

electronic chalkboard really has come of age!'

Apart from a vague feeling that I keep hearing educationalists saying that chalk is a silly way to teach, it all sounds fun — especially the program which has Pac-Man eating up wrong punctuation. Details on (082 347) 7117.

Nice little mover

David Levy, the man who used to play chess against humans, and now programs computers to do it for him, has been asked by toymaker Milton Bradley to produce a machine which plays like a human being.

This has nothing to do with strategy — but the way the machine moves the pieces.

What most of us hate most about chess-playing computers is their rude manners. You politely move a pawn, and instead of responding suitably, they flash an imperious light which says 'd5' or something equally cryptic.

Levy was asked to produce a machine which moved its own pieces. He has done it, and it is now a Milton Bradley product, likely to sell for under £400 in the UK (around $500 in the US).

The reason he can produce it for so little was the magnetic chess board which Milton Bradley designed.

The squares are not just marks on the board: they are a touch-sensitive keyboard. Under them, a magnet rests, capable of covering the whole board area, plus there's an area on the side of the board where the pieces can be stored.

This product really sells itself because it can play a game against itself, in a shop window — all the way from setting up the pieces, right through to putting them all away again.

It is called Grand Master, which exaggerates a bit, because its skill, according to Levy, is 'a little better than the Sargon II program on the Apple' — which at the time he was asked to design the program, was the world micro champion game.

That may not be Grandmaster standard, but it's too good for me. It has a library of openings, and it knows openings your average nerd (me) never heard of — so it plays like lightning, while its dumb opponent takes hours to try to understand what on earth is going on.

Then, when you get out of the opening, you find that it was not just waiting for you to move. It was passing the time by working out your best move — and if you choose that, it is ready with its best reply.

The machine isn't all-wise, however, and you can play foolish tricks on it. If you hold one of the pieces while it is being moved, it won't care — it will believe that it has moved the piece, and will believe it is where it was going to be. Even more fun is to ask it to set up the pieces when it already has.

As for how it works, well there's no mystery there, It works like those 'etch-a-sketch' toys, with the processor doing the wheel turning. Or, in David Levy's words: 'by magic'.

Picking and choosing

One can hear a long sermon, if one is minded, simply for the small effort of asking any minicomputer maker why the software which runs on his machine is better than the software which runs on those trivial CP/M micros.

Should one wish to terminate the sermon, it can be done for the equally small effort of repeating the words of the chief of Altos, who has just put Pick and Dibol on his CP/M micros.

Pick is an operating system much loved by certain commercial programmers of minicomputers. Dibol is a language used by programmers of something like a third of Digital Equipment's minis.

Altos has announced Pick and Dibol not because they are wonderful, however. They are available because if the machine looks the same to the program and the programmer, then the only person who cares whether it is a DEC mini or an Altos micro is the accountant — and the Altos micro costs half the DEC mini's price.

Sage that never was

Apple has always thought that its strange Apple III was a wonderful machine simply because it was bigger than the Apple II.

Bigger and more powerful than a totally different machine, the Sage II, is its successor, the Sage IV. Like the II, the IV is based on the language Pascal, and runs very fast, and allows its user to write programs in many different languages.

It also has an enormously clever replaceable disk, the Syquest drive mentioned above.

What happened, then, to the Sage III?

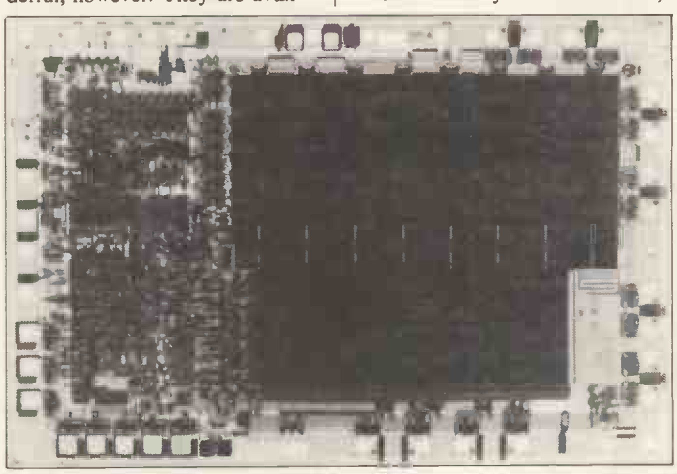
'We felt a bit superstitious about that, after the Apple III,' said the company boss, Rod Coleman. 'There never will be a Sage III.'

But does it read the news?

You have missed the first radio show to be hosted by a computer!

It happened way back in November on Radio Solent (Isle of Wight area) and all the Sinclair Spectrum did was to set quiz questions. The questions were derived from a new book, *The Working Spectrum,* authored by the Reverend David Lawrence, who is Chaplain to Southampton University.

It's a shame you missed it. No,



To you, me and most people in this business, 64 kbytes of memory isn't that much — but to the people who are automating typewriters, washing machines and burglar alarms, the new 'microcomputer' from Japanese firm Mitsubishi will indeed seem large, even with a capacity of only 256 bytes (not kbytes) of read-and-write memory, and 4 kbytes of read-only memory.

This pic shows the chip (numbered the M5M805H in order to prevent people from remembering it). It looks just like an ordinary memory chip of five years ago, and has a computer crammed onto it.

If you buy a thousand, you pay only 2,500 yen per chip.

Always nice to see two friends together. The friend on the left, Ed Sherman, is chairman of ACT, who recently fired software producer TABS for selling the rival Victor machine instead of his own Sirius. At the time, Terry Poole, of TABS, denounced the move as (amongst other things) illegal, immoral, and quite possibly fattening, and described ACT in terms of disapprobation that would probably shock your innocent soul.

And of course, the other friend, the nice bloke with the beard and the other happy smile, is Terry Poole himself.

Yes, they have made it up. I believe a certain Chuck Peddle, head of Victor, insisted.

you didn't miss out on any Confounded Binary Epithets or the like. But you might have won a free copy of the £6 book.

If you want one anyway, it's available from Sunshine Books, on 01-930 3266.

Raising the standard

'With the appearance of the IBM standard, the obsolescence of 8-bit systems will take place even more rapidly than previously predicted,' remarked Dr Robert Harp, previously boss of Vector Graphic, now boss of Corona Data Systems.

Harp was building up to announce a machine which was the same as the IBM, yet better than the IBM (for many obvious reasons) and yet was also portable, comparable in size and weight with the Osborne — but with a bigger screen and smaller disks. And the price was $2,395 (with one disk).

It was quite an announcement, spoilt only by the fact that the machine isn't going to be available until April in America, and who knows when in this country.

Actually, Harp was releasing a whole family of IBM-compatible machines. The first was a desktop machine, like the original IBM but costing $2,600 (compare that with the £3,000 or so asked for the IBM in this country today by 'grey' importers).

Because this machine has half-height floppies, you can get four, or two and a hard disk, in the desk-top box.

However the main improvements are not just how the floppies fit in the box, but more substantial — the power supply, the memory, and the graphics are all enhanced over the standard specification.

In the words of Bob Harp: 'In the past, most systems like this have been priced far too high, and too many features have been "optional" which ran the price even higher. Having so many components optional also meant that serious users had to be quite knowledgeable in order to configure a system.'

In the Corona — unlike the IBM — video controller, disk controller, extra memory, printer ports and graphics are all included in the price. Memory can be expanded from the normal 128 kbytes to 512 kbytes without expansion slots. And the power supply is 110 watts, compared with IBM's 60 watts, which will be sufficient, says Harp, to power several extra expansion boards — and the IBM's power supply, he adds, is not.

Corona offers graphics to a 640 dot by 325 dot resolution (IBM's is 640 by 200) and stores the graphics image in main memory, not on an add-on card — which makes its graphics a lot quicker and cleverer. But IBM graphics can be run on the normal IBM graphics expansion card if you like.

The portable version, with two disks, will cost $2,795. Included in that price will be 128 kbytes of memory, the display monitor, input and output ports, graphics, MS-DOS, Basic, and a spreadsheet package.

It is quite possible that adapting the Corona portable for UK use will be easy. The company engineers at Comdex couldn't think of any reason, offhand, why there should be a problem converting from American voltage and mains frequency to British.

But usually there are many problems with frequency resonances, and voltage heating effects, and if the engineers can't think of anything off the top of their heads all that proves, usually, is that they haven't done any serious thinking about it.

So don't expect to see any in Britain before July at the very earliest — because if there is one thing more annoying than a computer running off a mains converter, it is a portable computer running off a heavy mains converter.

Corona is at 31324 Via Colinas, Suite 110, Westlake Village, CA 91361; phone (213) 706 1505.

Portable Hyperion

One trick which Corona pulled seems likely to catch on — the idea of putting only one disk in a portable computer to cut down weight and price.

Independently, Canadian micro maker Dynalogic Info-Tech Corp has adapted the Hyperion, an imitation IBM computer that it launched six months ago, into a portable version — and, with one disk only it weighs in at a mere 18lb.

Price is hardly as competitive as the Corona — but compared with the IBM price, it is still keen.

The base price of $3,395 doesn't include the second 320 kbyte disk drive ($650), doesn't include an optional integral modem to link to the phone network ($500), doesn't include the Multiplan Microsoft spreadsheet ($275) nor Dynalogic's own text editor, Inscribe. All these options are included in the Hyperion Plus, at $5,000.

Details at 8 Colonnade Road, Ottawa, Canada K2E 7M6 or phone (613) 226 1383.

Guess the trips

Why we promised to print the result of the 'Guess the trips to WH Smith' competition in the December issue is one of the world's great mysteries. Still, here they are in the February issue instead,

Some readers might remember filling in little forms in WH Smith shops, telling someone or other how many different ways there are to get to Smith's from your home (theoretically speaking).

25 lucky people who got the answer right should now have ZX81s in the post to them.

The picture shows the random procedure by which winners were selected from among the thousands who had the correct solution. Editor Rodwell (left), with characteristic eccentricity, had the whole pile of forms tipped onto the floor and turned over a few times to make it all fair. Better than the old revolving drum, anyway. The other chap in the picture is John Rowlands, WH Smith's Computer Buyer. He helped pick out the winners.

Those of you with a sense of humour will appreciate knowing that one Mr Cramp of Dartford filled in 250 forms — all with the answer right — and actually managed to win. Whether or not this was due to his efforts is a point worth discussing, but one wonders if it was worth it!

The other 24 winners were: P Manning of Westcliff-On-Sea; P Escott of Norbury; Margaret Banon of Redcar; Marcus Grant of Leamington Spa; E Atwell of Loughborough; Sarah Lomax of Beaconsfield; Mrs J McCarthy of

Rodwell picks the winners — see 'Guess the trips'

Sending a picture of a version of Pascal which will process 5000 lines of code a minute (is that fast?) is a severe test of imagination.

Gemini Microcomputers was equal to the test: they called their Pascal 'Compas Pascal,' and sent in a picture of a compass.

Details from, and some kind of 'cheeky Turkey Award' to, (02403) 28321.

Wilmington; G Brown of Mannamead; S Watson of East Dulwich; Mrs C Charlton of Hertford; M Beales of Potters Bar; Louise and Liam Gardner of Marlow; D Brassington of Surbiton; Clive Evans of Taunton; Joanna Bailey of Chelmsford; M Weaver of Andover; Miss F Wroot of St Albans; H Armengi of Worcester Park; Brian Driver of Moulton Leys; G Softley of Aylesbury; F Dunford of Basingstoke; J Suffling of Cambridge; Wendy Morey of Huntingdon and Daniel Jones of Cardiff.

Maggie Burton

Oasis directory

An Oasis, most people vaguely feel sure, is probably something to do with computers. Some might know what it actually is — an operating system — without knowing much more than that. Asked to name the top-selling half dozen applications that run under it, even the best-informed will go blank.

Hence the release by Phase One Systems of an Oasis Software Directory. All the rest you might need to know is the address: Lynda Varga at Phase One is the editor of the Directory at 7700 Edgewater Drive, Suite 830, Oakland, CA94621 (415) 562 8085.

Antic-killer

The trouble with benchmarks is that everybody knows they are useless, but nobody can think of any better way of showing which computer is 'better' than another. So we use them, and play benchmark games.

That is the only possible reason for Atari's having introduced an Antic-killer. An Antic, in case you were wondering, is something like a VIC chip, and something like a character generator — it creates patterns that look like words on a TV screen.

Atari last month announced its 1200 model in America, with an Antic-killer option which does what the Sinclair ZX80 used to do — make the screen go blank when the processor is working.

There are other features which makes this machine more interesting, however. They include a much prettier box, at least 10 kbytes more useful memory capacity, and more programmable function keys instead of the four games function keys on the Atari 400 and 800.

There are also the moderately dubious benefits of having only two joystick slots instead of four, and having only one games cartridge slot instead of two (on the 800, you can have two). Nobody ever wrote a game that really needed four joysticks. And the only reason for having two cartridges was the fact that, long ago, you could only get a small amount of memory into one cartridge, and since you can get four times as much today, there seems little point.

As in the past, Atari is making sales in America its number one target, and has no plans to release the 1200 in the UK. Maybe at the end of 1983, they will have such plans. By then, perhaps, they will also have developed a new machine (I hope) which actually does a bit more than provide a prettier box and a higher price.

And maybe, by then, all the software which is currently under development will have appeared, and, even more important, maybe the UK distribution side will have developed to the point where it takes less than a week to get a printer cable out of Atari.

Delta database

The world's first 'true transactional database' is, according to its producers, Compsoft, 'the only program for microcomputers which will store any number of sub-records attached to the main record.'

It takes little imagination to think of ways in which that might be useful — and little more to think of ways in which it might become frustrating.

However the true nature of the product is probably more helpfully summed up in the company's other descriptive phrase.

'Delta (the product's name) has features which are our response to feedback from the 4,000 plus users of DMS.' That particular database program for PET computers has proved very popular, and if this one is able to include all those little things which users wanted extra, it must be worth trying out, I think.

Particularly attractive-sounding is the Delta Letter Writer, which lets the user type directly into memory, see the letter on the screen it is typed, and call up any data from the database into the letter.

Details on Guildford (0483) 898545.

Micro City 83

An exhibition at which Apple actually did appear last year was the local show called Micro City 82, in Bristol. Micro City 83 is now being planned for 10-12 May and according to the organisers, Tomorrow's World Exhibitions, 'response from companies who exhibited at the previous two shows has already been very encouraging, even before the brochures and booking forms were available.'

People like IBM, Hewlett Packard, Tandy, British Telecom, 3M and ICL were at previous shows, they add.

The venue is the Bristol Exhibition Complex, and details are available from Stephen Hybs, managing director on (0272) 292156.

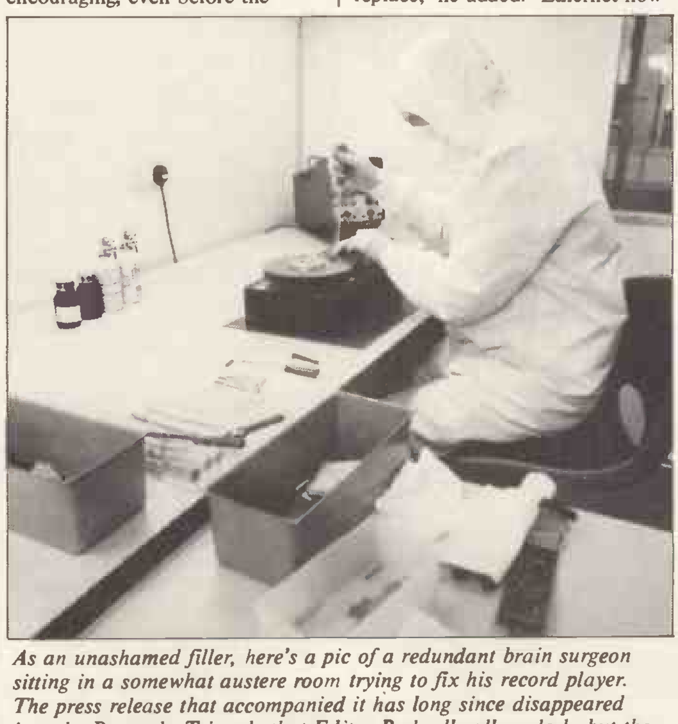
16-bit Ethernet

After the first appearance of Ethernet in a catalogue last month (from Altos and its close friend 3Com) the follow-ups inevitably come soon — first to announce is MicroAPL, with a network for connecting its 16-bit systems.

Rather than comment on Ethernet again, it is probably worth quoting MicroAPL's director Robert Bittlestone, whose opinions are that networking will save users from the manufacturers.

'We have maintained for some time that the way ahead for management information systems, production control applications and many other tasks where the users' requirements keep changing, is to use a language like APL,' he said. So far, so predictable.

'But without networking, the danger was that we would find ourselves selling bigger and bigger "centralised" microcomputers, eventually recreating the mainframe monsters we were trying to replace,' he added. 'Ethernet now



As an unashamed filler, here's a pic of a redundant brain surgeon sitting in a somewhat austere room trying to fix his record player. The press release that accompanied it has long since disappeared into the Bermuda Triangle that Editor Rodwell calls a desk, but the caption on the back tells us that he is, in fact, ensconced in Europe's first independent winchester disk repair facility at KSL headquarters, Calne, Wiltshire. We are further informed that the Class 100 clean room has been built to exceed Federal Standard 209B, which requires that the particle count does not exceed a total of 100 particles per cubic foot of air of a size 0.5 microns and larger. There, you feel better for knowing that, don't you?

This may look like a microcomputer to you just because it has a very powerful Zilog Z8001 chip inside it — but it is a terminal.

Lynwood actually makes a version of it that really is a microcomputer, but they are more interested in providing the most intelligent terminal in other people's microcomputers.

Zilog sent us a photo of this particular terminal because it is the first to use the Z8001 to go into full production.

Lynwood is in Alton Hampshire, on (0420) 84888.

allows us to offer a truly decentralised, distributed computing "facility" where expansion can be catered for by tacking on new modules of a standard type.'

MicroAPL has used hardware produced by Logic Replacement Technology (in Reading).

This particular network operates with specially written computer code written for the Motorola 68000 processor by MicroAPL, and plugs into the S100 bus — a fact which might make it a lot more sellable than most Ethernets.

Details on 01-834 2687.

Spectrum upgrade

32 kbyte RAM upgrade kits for the Sinclair ZX Spectrum are available from Fountain Computers. These will take a 16k machine up to 48k.

Fountain claims that these are the cheapest such kits around, weighing in at £24.50 including VAT, postage and packing. However, the kits are for Issue 2 machines only, which can be identified by the large chip in a socket in line with the '9' key, visible in the rear expansion cutout.

The kits consist of chips and instructions and no soldering is necessary.

'We are also providing instructions for optimising the display quality from the Spectrum, by adjusting internal controls. Such faults as yellowish whites, Venetian blind effect and wobbling characters are dealt with,' says Fountain.

The instructions cost £1 together with a stamped addressed envelope, or are sent free if you order a 32k RAM kit.

Details from Fountain Computers Ltd, Darvill Road, Ropley, Alresford, Hants, SO24 0BW.

BOS for beginners

The BOS/5 operating system from MicroProducts Software is to be made available on models in Texas Instruments' new business systems, the BS200 and BS300.

TI says that much of MPSL's BOS/5 software has been written for the same target market as the TI hardware. This includes a range of programs suitable for the small business user.

In addition to these there are suites of general business accounting packages, the Autowriter word processing and Autoindex database packages. For multi-user installations TI is providing MBOS/5. TI has already implemented BOS/5 on its DS990 minicomputers.

Adopt-a-robot

Did you know that 1983 was going to be Adopt-A-Robot Year? Well, you know now. A Manchester-based firm of consultants has come up with the idea and has persuaded the benevolent Department of Industry (DoI) to cough up funds.

Mektronic Consultants aims to promote a rapid uptake of robots in factories during 1983. It will carry out feasibility studies for installing reprogrammable Pick and Place units and mechanical handling equipment in factories. The DoI will pay for half the cost of these studies.

'We have had several years of experience as authorised consultants to the DoI under the Map and CadCam schemes.

'The aim of the campaign is to promote awareness of industrial robots,' says Mektronic and admits that 'Introducing a robot is no easy task. It can often disrupt existing practices and compel a reappraisal of many aspects of a company's operations.'

Details from Mektronic: (061-799) 7689.

Typewriter art

There's one book *PCW* can't wait to receive, having read the blurb that preceded it: *Bob Neill's Book of Typewriter Art*, published by a pastoral organisation called The Weavers Press.

Bob Neill is a hypnotherapist afrom Kent and has apparently from Kent and has apparently been composing detailed portraits nearly 20 years.

Never before, however, have his secrets been revealed. For the first time the man in the street can, by means of step-by-step instructions and 20 patterns, create a range of pictures and portraits on any typewriter keyboard.

'The instructions are simple enough for success to be achieved by people of any age — from eight to 80 — and there is also a computer program in Basic to adapt the technique for home computer use,' says the Press.

The book costs £5. Details (0622) 53600.

Cheaper megabytes

C/WP is proud to offer disks at the best prices, more or less, in Britain, and even goes so far as to quote the cost per megabyte of hard disk.

For a 432 megabyte Contour drive, the shop will charge £65 per megabyte — making a price of £2,610. That's impressive enough, since there are people who will ask that much for a three megabyte drive.

What's really interesting is the drive you can see advertised in most issues of *PCW* — the three megabyte drive, at £995. That works out at £332 per megabyte — roughly the same as the best-value floppy drives, and only its extra speed to compensate for the fact that it doesn't let you take the

A cat may look at a micro and even enthrone itself on top of an Apple. This smug creature is advertising Floppy Cat — a program which reads directories of disks running under several operating systems supported by the Apple II. These include Apple DOS 3.2, 3.3, UCSD p-System, CP/M, Forth 1.7 and Lisp.

Floppy Cat notes the operating system, displays the directory and integrates the filenames into its own retrieval system.

The retrieval system then allows alphabetical lists to be produced by filename. These can be printed in either list or label format (a trial pack of standard address-sized labels is supplied with the software). Up to 250 disks can be handled with a total of 3000 directories.

The program has been produced by DCAN. It requires at least 48 kbytes of RAM and costs £29.95. For details, telephone 01-928 1931.

Still Need Convincing?

SOFTWARE FACTSHEET

Product: CARDBOX	Type: CardIndex
Retail Price: £155	Machine: CP/M & MP/M
File Size: CP/M 8MB MP/M 16MB	Records: 65.500 maximum
Record Size: 1404 ch maximum	Fields: 26 maximum
Field Size: 1404 ch maximum	Index Limits: None

Notes: Allows complex searching using up to 99 separate criteria.
Widely available from distributors in USA, UK and Australia.

Published by Caxton Software Ltd of London.

InfoWorld
Software Report Card

Cardbox

	Poor	Fair	Good	Excellent
Performance	☐	☐	☐	☑
Documentation	☐	☐	☐	☑
Ease of Use	☐	☐	☐	☑
Error Handling	☐	☐	☐	☑

The Critics Don't....

"Cardbox is your familiar, tried and trusted card index... with most of the features you have always wanted on your manual card index but couldn't have, because of the limitations of pieces of card."

"Cardbox... succeeds extremely well. Its facilities for indexing and searching are good and very fast... the user image of the screen displays and the documentation are in the main excellent."
Personal Computer World, August 1982

"The interesting thing... is the display... Cardbox enables you to draw a form on the screen complete with headings."

"Cardbox is an excellent database manager... its versatility... and its ease of operation make it a useful program for home or business."
InfoWorld, September 13, 1982

Anyone can use Cardbox. It's a simple yet powerful electronic card indexing system. Easy to learn and easy to use, Cardbox is bringing real computer power to hundreds of new users.

Put yourself in a user's shoes:

- You wouldn't have to change your present working methods or think in computer terms. Cardbox talks to you in plain English.
- If you can do it with a card index you can do it better with Cardbox thanks to its sophisticated automatic cross-indexing.
- Up to 65,500 'cards' can be stored and they can be displayed, printed or passed to other programs in any number of alternative formats.
- Groups of 'cards' can be selected by any word in any field. Your choice can be refined by using up to 99 words in a single search.
- Information is easily added, changed, duplicated or deleted.

These are just a few of the reasons why the top British and American micro journals are convinced Cardbox is the ideal card index for CP/M users.

Cardbox ~ the ideal card index system for CP/M users

Caxton Software Ltd, 10-14 Bedford St, London WC2E 9HE. Tel: 01-379 6502. Telex: 27950. Ref: 398

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Specifications MZ 80A

CPU	Z 80
Memory	4K-byte ROM; 48K-byte RAM; + 2K-byte Video RAM.
Display	9 inch (23 cm); 40 characters x 25 lines. Green screen.
Cassette	Manual control; standard audio cassette tape. Data transfer (Sharp PWM system 1,200 bits/sec.
Keyboard	ASC11 keyboard; upper-/lower-case alphabet; graphic symbols; numeric keypad.
Other features	Built-in clock and music function. Auto repeat on all keys. 2-page video RAM (allows the screen t be scrolled up and down). *CP/M available.
Options available	Tape based Pascal Interpreter. Tape based Machine Language package. Sharp FDOS including BASIC compiler. Tape based Z-80 Assembler package.

Printer specifications	Optional Printers MZ 80P4	MZ 80P5	MZ 80P6
Printing method	Serial impact dot matrix		
Feed method	Variable sprocket; Friction	Variable sprocket	Variable sprocket; Friction
Kinds of characters	230		
Character make-up	9(W) x 8(H) dot matrix (normal-size characters)		
Number of digits	136/68 per line 160/80 per line	80/40 per line 136/68 per line	
Printing speed	150 cps (normal-size characters)	80 cps (normal-size characters)	
Head sweep direction	Bi-directional		
Other functions	• Software-controlled full graphic function • Programmable number of lines per page • Battery-operated memory of HOME position (MZ 80P4 only)		

Design and specifications subject to change without notice.

Floppy Disc Unit (MZ 80FB)
Two drives per unit; 5.25" dual-sided, double density; 70 tracks; soft-sectored; 16 sectors per track.

Memory capacity 280K bytes per diskette.

To: Sharp Electronics (UK) Ltd, Computer Division, Sharp House, Thorp Road, Newton Heath, Manchester M10 9BE. Tel: 061-205 2333.
Please send me details of the Sharp MZ 80A

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PCW4

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CP/M is a trademark of Digital Research Ltd.

This is a pad on which you write, and a screen on which you read what the computer thought you wrote.

It's not a particularly new idea, but the name is: Ferranti has chosen to call it a Handprint Recognition System. Shortsighted detectives should contact Ferranti on 061-499 3355.

disk out and put in a different one.

From that you can deduce that makers of hard disks which get sold at over £2,000 for three megabytes must be whistling in the dark.

C/WP uses these drives as the heart of its Starnet local micro network, which is therefore comparably priced. An eight-station network (one with eight micros, Apple, Osborne, Superbrain, IBM and most CP/M models) costs only £461 per station.

Operating systems which can be used on the network include Apple DOS 3.3, CP/M (of course), Pascal, BOS 5, and MS-DOS.

Theoretically, 64 different micros could use the net, but nobody is really likely to find out how well that works — long before you got to 64, you'd want something very much grander.

Details available on 01-630 7444.

Home computer sales

In 1982 an astonishing 509,000 people bought home computers in Britain. It was the year the home computer really arrived.

What's more, home computing seems to be one area where Britain is taking a lead.

A set of startling figures come from micro-analyst Robin Bradbeer who's just completed a report on the subject.

'Per head of population we have twice as many machines in the UK as the US and one and half times as many as Japan,' said Bradbeer.

'Over two-thirds of all pcs sold in Europe are sold in the UK. We also have more manufacturing than anybody else and are producing more machines. And our distribution chain is more efficient than those in the US and Japan.'

So far, most of the home computers we have been so furiously buying are UK built.

In fact over half of them come from Sinclair. In retail and mail order last year Sinclair sold 220,000 ZX81s (£50) and 75,000 Spectrums (£125 and £175). Sinclair has reached the people through a number of High Street stores including WH Smith, John Menzies, Greens, Wigfalls, Currys and Rank Xerox. Mail order has declined sharply to 10 per cent of total UK sales.

Price has a lot to do with Sinclair's success. Home computers are getting cheaper and cheaper. We have already seen this with the ZX81, which went down from £70 to £50 at the beginning of August, and several other machines are expected to follow suit early in 1983 having shipped large volumes for Christmas.

The ZX81 has kept a firm grip on the bottom end of the home computer market. It felt a drop in sales around the launch time of the Spectrum, but Sinclair claims the ZX81 is now shipping at 30,000 per month. 'It is selling stronger than it was a year ago when there was considerably less competition,' said a Sinclair spokesman.

Another machine which might have been expected to be overshadowed by a bigger brother is the VIC-20 from Commodore, 100,000 were sold in 1982, again through a wide range of retail outlets. When the Commodore Max and Commodore 64 were launched at the Hanover Fair last April the company fully expected the 20 to fade gently into obscurity. 'But in October it was decided to increase the sales of the VIC-20 and we have now sold over one million units internationally,' said Commodore.

Commodore has pledged to start UK manufacturing in Britain in 1983. This would give the company a better claim to be a 'British' company and so to to bid for lucrative government contracts with more chance of success.

The schools market is particularly prized. The theory is that if you can get children hooked on your machines at an early stage then they will want them at home, too, and are likely to be customers for life. This is certainly the fond hope nursed by the BBC with its Acorn-designed machine.

The BBC Computer was launched in July and has sold about 40,000 units in the UK home sector. Acorn is confident that the BBC banner will sell the machine in huge volume all round the world. This company also believes that the unique option to receive broadcast software places the BBC computer way ahead of the competition.

'Telesoftware makes the BBC machine the only buy,' said an Acorn spokesman. 'It is the only machine that can receive software through the air. At the same time the BBC's tutorial programs, scheduled to start in January 1983, can be recorded onto video cassette recorders for use over and over again. And this facility is free as part of your TV licence.'

Despite altruistic claims for home computers as educational aids, however, most people buy them to play games on. The great thing about home computers, though, is their versatility: when you get fed up with the games you can move on to educational packages to teach yourself chess or indeed French. You can also start learning to program.

Pundits have noticed a distinct change in the type of people buying home computers over the last year. 'The people who bought pcs changed completely during 1982,' said Irfan Salim, marketing manager of the comsumer division at Texas Instruments. 'During the first part of the year the market was still being driven by school pupils who knew Basic existed, roughly what it could do, and wanted to write programs.

'But by Christmas people were not buying through computer awareness or because they had necessarily understood anything about the machines.

'Channels in the consumer market are opening up, and some of them are very successful. Over-the-counter sales of computers are in no way related to computer expertise on the part of the buyer or the sales person who may have virtually no understanding of the machine.'

TI's 99/4A is expected to continue as the company's main pc throughout 1983. The machine, formerly priced at £199, has recently been on special offer at £149. 'The policy will be reviewed at the end of January but there is general pressure in the marketplace for prices to go down,' said Salim.

Despite all this blue sky talk from the pundits there is scepticism in the field about how successful home computers will be, especially when sold as a brain for the home. 'A diary or a thermostat will do better than their computer counterparts,' said one doubter.

He was also dubious about the potential market for pcs in the UK. 'We may have only 2.5 per cent penetration of the 17 million British households but it just depends how many households you think are potential customers. 80 per cent of homes in this country can't operate a VCR and at the same time 40 per cent of homes consist of people over the age of 55 and they're unlikely customers.'

He suggested that half the ZX80s, ZX81s and Atoms are mouldering away in cupboards.

Nevertheless, we look set to exceed the 600,000 mark from pc sales in 1983. The big question is will the UK manufacturing and distribution channels be able to cope with the volume, and how much of the market will be lost to competition from the US and Japan?

Home Computers sold in the UK in 1982

Sinclair ZX81	220,000
Commodore VIC-20	100,000
Sinclair Spectrum	75,000
BBC Computer	40,000
Dragon 32	25,000
TI 99/4A	20,000
Atari 400	12,000
Video Genie	10,000
Colour Genie	2,000
Others	5,000
TOTAL	509,000

Jane Bird

Manhunt

That pesky Manhunt Competition just refuses to go away. Numerous readers have written in to inquire why 42924 is not the answer to question number 3, rather than our larger answer of 44744.

You were given a strong hint in question 4. The question asked for a triangle in which 'only one of these digits appears in any of the sides'.

The required interpretation is that the digit which appears in one or more of the sides be unique. Given the palindromic nature of the perimeter this means that it has to be the middle digit, the only unique one. This is the case with 44744, but with 42924 it is the 4, which is not unique, which appears in a side (albeit only once!). In answer to many queries, the sides of the 44744 triangle are 12376, 13818 and 18550. This ends all correspondence on the Manhunt answers (please?).

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JUST AN EXCUSE?

The halcyon days of the British micro industry could be numbered. Japanese competition poses a new threat, and some UK manufacturers are becoming increasingly worried. Jane Bird examines the background to the conflict between two factions in the British Microcomputer Manufacturers Group.

This year the Japanese micros will start to arrive with a vengeance — and UK manufacturers are beginning to get a teensy bit nervous. They are warily casting their memories back to the demise of the UK camera, motor cycle, and television industries.

Last November the British Microcomputer Manufacturers Group (BMMG) wrote a florid and jingoistic letter to the Prime Minister warning her that drastic measures are needed against the 'acid rain of unfair foreign competition'.

The Group was seeking a total ban on micro imports for a year and exclusion of foreign manufacturers from the Central Computer and Telecommunications Agency (CCTA) list from which the government chooses its micros.

David Broad, managing director of Comart and chairman of the BMMG, told *PCW*:

'We are wholehearted and unashamed in our call for government procurement to favour British manufacturers. We see no reason why the CCTA has to bend over backwards to support foreign machines. We are pressing for all foreign machines to be excluded from the CCTA's list.'

But is it reasonable to suggest that we should protect the UK micro industry if Japanese machines prove cheaper and better than UK equivalents?

The BMMG takes the view that if you look at the overall cost to the country, importing is bound to be more expensive.

'The terms of reference of the CCTA say nothing about favouring UK industry. They are out to get the best price but this may not be the best choice when viewed from a total government point of view — thousands of new jobs could be created. And we need to ensure that the UK still has machines to offer in the future, especially for defence,' said Broad.

David Broad. . . 'We are wholehearted and unashamed in our call for government procurement.'

He complains that the government finds it necessary to be scrupulously fair to the international community whereas no other country does the same. 'Only about 10 of the companies on the CCTA shortlist of 29 are UK companies,' said Broad.

However, Martin Vlieland-Boddy, managing director of Torch Computers, thinks the request that all manufacturers on the CCTA list should be British is not acceptable.

Nor is he very optimistic about the BMMG's proposals to charge import duties.

'Even if import duties did go down I'm not sure how much it would be passed on to the computer companies, which mostly get their components from importers who could just increase their profits.'

He agreed that the CCTA should include in its review all possible products manufactured in the UK which might fulfill government requirement.

'But limiting it to UK products may not be justified.'

One of the BMMG's most illustrious members, Clive Sinclair, has dissociated himself from all the BMMG's claims apart from component imports. The current situation is certainly anomalous with duty on importing complete machines at about seven percent and duty on components at up to 17 percent — an active disincentive not to manufacture in the UK, according to Broad.

'When we try to sell abroad we experience difficulties because we cannot say we're CCTA approved,' said another BMMG member. 'It should be a quality award. UK manufacturers like Systime and LSI have not got the approval. It doesn't make sense. Systime, for example, has provided a finance and accounting system for the House of Commons.'

But Vlieland-Boddy points out that alternative signs of approval are around. 'There's the Queen's Award For Industry but I bet you'll find that none of them have even taken the trouble to apply for it.'

Torch is still selling 50 percent of its products abroad. 'I think it is just an excuse,' he said.

Vlieland-Boddy added that the BMMG is also asking for £250 million to be allocated for research and development.

There is undoubtedly a problem over funding because Japanese banks work much more closely with industry, and lend at much lower interest rates.

But Vlieland-Boddy is anxious about how available funds are spent.

'I would like to see a chunk of this money allocated to promoting British products abroad. Unless, at the end of the day, we are selling products abroad the government is not benefiting from its investment.

'The way Britain presents itself at shows is a very serious comment. The whole British stand at the National Computing Conference in Houston last June was only one-tenth the size of the Motorola stand. The provisions of the British Overseas Trade Board are an embarrassment and the stands they come up with at shows allow you to display nothing much more than a few union jacks.

'As far as volumes are concerned, the UK has an ongoing problem in production,' said Vlieland-Boddy. 'We use old-fashioned methods of producing manufactured goods. It is better for government to encourage a more structured approach to production than to cut out its imports. There must be a reason why BMMG members think they can't compete. Lots of companies in the Cambridge area would still be able to compete even if prices went down 30 percent.

Clive Sinclair. . . 'The secret of success is pitching yourself accurately in the marketplace.'

'UK companies have got to be realistic about what the market place is doing. The person who pays the bill of protectionism is the consumer,' he said.

Sinclair pointed out that the secret of success is pitching yourself accurately in the marketplace. And he said there is no inherent reason why the UK can't produce in volume.

'Sinclair is the largest computer manufacturer in the world in terms of volume,' he said.

If Sinclair can do it, why can't the rest of the BMMG?

TRAINING FOR THE FUTURE

'A long-term solution for London's unemployed'? That's the plan for Covent Garden's Itec. Jane Bird reports.

Nestled between the hand-knitted jumpers and advertising agencies of Covent Garden is to be a hi-tech micro centre for training London's young unemployed.

The Centre comes under the Government's Information Technology Centres (Itecs) scheme — 49 have already been approved out of a planned 150 throughout the UK.

'Our site on Long Acre makes us a high-profile Itec. Covent Garden is an area full of small businesses run by just the sort of people who will find themselves using micros for the first time,' said Chris Sadler, manager of the Covent Garden Centre.

The Itec has already been promised £62,000 in start-up funds and £170,434 for running costs. Meanwhile, Sadler has a portfolio of schemes designed to integrate his Centre with local firms and raise cash.

One such scheme is Which Micro?, a micro consultancy aimed at people who are investing in micros for the first time. 'The thinking behind it is that nobody yet knows the theory and practice of micro maintenance. We might get taken on by a large company which previously had a mainframe and now has 60 micros. We will investigate what is required — the level of support and the skills a maintenance person might need.'

Another project Sadler envisages for the Itec is a 'milk round'. 'This will allow a naive user to remain totally naive. When somebody buys a micro to use in their business then the Itec will offer to set it up and service it.

'Afterwards an Itec student can come in on a weekly basis, or even daily, and take the back-up files. That is the sort of laborious process that small businesses often have to spend Saturday night and Sunday morning doing.'

In addition to his proposed 'milk round', Sadler plans a 'coffee trolley'.

'This service is aimed at big companies who have recently switched from a large, centralised mainframe to 63 micros across 20 storeys. Not only do they now need the whole gamut of maintenance people — the cleaners, operators, programmers — but they also need these people in a large number of different locations. The whole system becomes moribund because you won't get an operator to do all the backup on each different system. However, one of our trainees could do it.

'The students can help with file loading at the installation of a system, which is the most labour intensive part and this also gives them experience of teething problems with machines.

'The advantage of this method of teaching is that you are not standing in front of blackboards waving your arms. Instead the students are out there in the field learning.'

Sadler doesn't expect many of his trainees to be terribly entrepreneurial in setting up businesses in their garages at home, 'but they might be able to carry on with projects they began during their time at the Itec. Their work would be paid for by the customer and once the trainee leaves the Itec it is real money,' he said.

The Itec will also do some repair and refurbishment. 'Much can be done to renovate a Sinclair ZX80, simply by taking it apart and cleaning the connections, removing the oxidisation and human remains such as hair, grease, coffee and McDonalds debris. I'm planning that the kids won't be too proud to do that stuff.'

He chose the job because 'I thought if we couldn't find jobs for people with micro skills then there was no hope.'

Over the next six months Sadler is going to commission building work, buy kit and design a curriculum based on input from potential employers.

'I want to spend time contacting local businesses, software houses, retailers and distributors who are not represented in the area. Which Micro? could act as an agent or sub-dealer.'

Sadler heard recently about a printer sale that was lost because at the crucial moment the visiting salesman couldn't get the machine to work.

'For just, say, £6,000 per year we could provide an expert assistant for a printer salesman. The expert would accompany the salesman on all his visits and discreetly set up the machine in the background so that the demonstration could then work perfectly.

'In Covent Garden we are to occupy a brand new building which will have to be fitted out as training workshops — the funds don't cover that or the amount of equipment we need. We get £22,000 to provide equipment for 35 people which is a bit tight.

'We are applying for other funding. One vital area for which funds are needed is to buy magazines. In micros most of the information needed for teaching is to be found in magazines such as *PCW*. We need to purchase all the back numbers of these magazines for reference material.'

Whether Sadler will be successful in enlisting the support of local businesses remains to be seen. There could not have been more than 20 represented at the launch.

He is ready to admit that it is going to be a 'hard job' recruiting for the courses. 'We won't take people off the street, but the scheme is not for people who already have qualifications.

'From my talks with other Itecs I know there is a tendency to get white, male applicants with O-level maths. We will have to be quite stroppy to avoid this if we really want the Itec to mirror the community.'

One myth he is particularly anxious to dispel is that girls will be better at typing and boys at soldering. 'Students will learn all jobs to the same level of skill. We will sell that very idea as how you become a computer professional.'

Every Itec is different because they all service a particular community. For example, the Itec at Dundee is heavily involved with Timex which provides sponsorship. That Itec will be teaching very different skills from the Covent Garden centre where local firms are shops, advertising agencies and the like.

Sadler's optimism is very engaging but whether it will lead to the long-term solution for many of London's 'unemployed and unemployable' remains to be seen.

In his own words, 'Otherwise there isn't much hope...'

Getting to grips with the new technology — ITEC trainees at work.

WARING'S CONJECTURE AND A CERTAIN DIOPHANTINE EQUATION

Mike Mudge starts a new series of mathematical puzzles.

PCW has always prided itself on its ability to provide answers to that perennial question, 'what can I use my computer for?' Most of the answers, for hobbyist or enthusiast, have been of a recreational or educational nature. There is however an area of serious research which is open to (and well within the capabilities of) the mathematically-minded computer hobbyist. I refer to the field of Number Theory. Given that its subject matter — the natural numbers — is infinite, it's not surprising that there remain huge numbers of unsolved problems; moreover, the scope for discovering new problems of interest is limitless.

From this issue on, we will be publishing a monthly column by Mike Mudge BSc FIMA FBCS of the University of Aston, in which he sets problems in Number Theory (with explanatory background) and awards a monthly prize of £10 for the best submission. These problems will not be simple puzzles but genuine research projects in Number Theory which are capable of investigation using a personal computer; who knows, we may even arrive at some important results? Don't be discouraged from trying them if you're not a professional mathematician; if you've enjoyed our Leisure Lines puzzles or the Manhunt Competition you might find that you're a budding number theorist already! — *Dick Pountain.*

Waring's conjecture

The integers consist of 0, ±1, ±2, ±3, . . . eg, +1234 or -201379. When k denotes a positive integer, the product of k-factors each equal to x is written x^k, eg, $7^3 = 7.7.7 = 343$.

A Diophantine equation is one which is to be solved using integers only, the first writer to study such equations being Diophantus of Alexandria (c AD 250). For example $x^2 + y^2 = z^2$ regarded as a Diophantine equation has among its solutions x = 3, y = 4, z = 5 and x = 5, y = 12, z = 13 – each being the integer length sides of a Pythagorean (or right-angled) triangle.

'There sir — Your flight number, departure time and the odds against being hijacked.'

In 1770, in a text entitled *Meditationes Algebraicae*, the mathematician Edward Waring wrote (in Latin): 'Every positive integer can be expressed as the sum of at most, g(k), k^{th} powers of the positive integers, where g(k) depends only on k, not on the number being represented.'

Special Cases k = 2,3,6.

It was proved by Lagrange in 1770 that every positive integer can be expressed as the sum of at most *four squares.* Other theoretical results to date include:

i. every positive integer can be expressed as the sum of at most *nine cubes.*

ii. every positive integer can be expressed as the sum of at most 73 *sixth powers.*

Problem

Given the Diophantine equation $x^3 + y^3 + 2z^3 = k$ where k is a known positive integer, what are the (integer) solutions for x, y and z?

Historical note

In 1969 M Lal, W Russell and W J Blundon (*Math Comp* Vol 23) reported a calculation which was originally programmed in Fortran and subsequently in assembler (showing an acceleration factor of 15x) for an IBM 1620; after 1000 hours at low priority they had considered $-10^5 < x,y,z < 10^5$ and all k between 1 and 999. Their computation revealed the results

$(-133)^3$	+	$(-46)^3$	+	$2(107)^3$	=	113
$(-602)^3$	+	$(450)^3$	+	$2(309)^3$	=	190
$(-79)^3$	+	$(126)^3$	+	$2(-91)^3$	=	195

omitted by the previous writer, Makowski, in 1959.

However they failed to find any values of x,y,z corresponding to the following 19 k values less than 1000:

76	148	183	230	253
356	418	428	445	482
491	519	580	671	734
788	923	931	967	

Submit a program which generates these numbers and attempt to eliminate some of them by an extended x,y,z search or otherwise. Alternatively extend the k-range, hence possibly adding to the above list.

All submissions should include program listings, hardware description, run times and output; they will be judged for accuracy, originality and efficiency (not necessarily in that order) and I shall award a suitable prize to the 'best' entry.

Submissions to: M R Mudge BSc FIMA FBCS, Room 560/A, Department of Mathematics, The University of Aston in Birmingham, Gosta Green, Birmingham B4 7ET.

Note: Submissions will only be returned if suitable stamped addressed envelopes are included.

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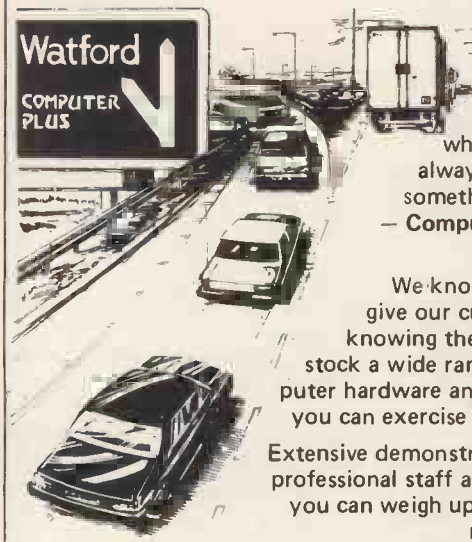

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CAN'T STOP THE BASIC!

How much time do you spend in front of your computer terminal? Having problems relating to other people? Psychic damage could ensue. . . Awful warnings from Jane Bird.

Home computing, that bright new hope for the 'eighties, may find it has a lot to answer for come the next decade. It may well be responsible for, quite literally, driving people mad.

A new disease is emerging among those who spend too much time programming computers. The illness is microholism and its sufferers are called compulsive programmers or terminal junkies. The chances are that you know somebody who's a potential victim.

There is no doubt that home computers are a chief cause of the disease.

Even psychiatrists, who deny totally that a computer in itself is enough to send somebody mad, admit that it could act as the catalyst.

'Home computers have a marvellous role to play in demystification,' said Brian Pearce, research fellow at the department of human sciences, Loughborough University.

'But unfortunately the approach we have to children at the moment is that they must be able to program. We have overemphasised the skill in programming at the expense of teaching pupils to look at a computer just as a tool.'

At the moment it is learning to program which offers all the incentives. By doing this, children can groom themselves for employment in one of the flourishing new industries.

'New career paths have opened up and young people who may not have been very good at formal education can learn computing skills. But there is a problem, and it starts at a very early age,' said Pearce.

Another expert, this time from a computer department, is also concerned about the problem. 'The big danger seems to be the bright but socially-gauche adolescent,' thinks Dr Chris Reynolds, reader in computer science at Brunel University. Some find their home computers are more friendly than their schoolmates.

And they can impress friends with clever programs. Their parents may also encourage them in this thinking it will lead to a brilliant career for little Jane. 'The relationship with the machine can take over to the point where individuals are better able and prefer to talk to computers than to people. They will log on almost before talking to anyone,' said Pearce.

The disease can spread alarmingly.

Some sit in front of the screen for hours into the night finding that their efficiency increases the longer they keep at it. When finally they go to sleep, they dream they are the program attempting to execute and awake fresh in the discover of last night's elusive bug.

One poor victim had reached such an advanced stage of the 'I am a computer' syndrome that he thought all broadcast information was personally addressed to him.

But most of these young enthusiasts are hidden from view, tucked away in cold attics and garden sheds. Hunched over their home computers are the shapers of our futures. Their impact has not yet been felt because they are too young and too dispersed. Nevertheless, a force to be reckoned with.

Next year they will be doing their computer science 'O' and 'A' levels, then there will be college, and finally, if they're still sane, a job. The job will be in one of the bright young software companies where they will design the systems of tomorrow.

But what sort of people will these be, and what sort of systems will they design?

By the time they are employed as programmers many will already be hardened computerholics.

Since first owning a home computer many will have become accustomed to a daily two-hour fix. This persists at university where computer departments each have their quota of code junkies. 'In the last decade we have had several who have become addicted to the university computer,' reports Reynolds.

The syndrome has also been noticed by Professor Joseph Weizenbaum of the Massachusetts Institute of Technology (MIT).

Weizenbaum calls addicts compulsive programmers. These are haggard and obsessed young men who work at their computer keyboards for 20 hours at a time, eating and sleeping near the console, their only reality has become the vast and ramifying system of programs and subprograms which they construct, reconstruct and try to control.

They live only to program, and have no interest at all in how their computing operations are related to the real world.

But how much impact can these individuals have on the world?

Really extreme cases, though highly regrettable, may not represent a threat beyond the passive role of martyrs to our brave new technology. These students often fail to be accepted by society and there is a limit to how much damage they can do.

'From experience we know that almost all such students fail the course. They prove to be almost unemployable because of their inability to get on well with people, and because of a marked reluctance to work with, rather than play with, computers,' says Reynolds.

It is the ones who get jobs that we should really be wary of. Those whose great skill and enthusiasm has carried them happily through the educational years. Sanctioned by society, their addiction to computers is likely to give them the inclination, as well as the power, for far-reaching destruction.

This group is more alarming because, unlike the martyrs, these 'professionals' have the power to influence society directly. They may be responsible for sending legions of innocent people mad.

'It is when computerholics become pushers as opposed to purely consumers, that they become dangerous to others,' said Pearce.

'They might try to sell their software which they think is wonderful. Or they may impose the system on to someone else who is not a junkie and who has not bought a system to twiddle around with for fun.'

The code junkie designs a system which matches his mental model of how things can work, but it bears no relation to the way the end user looks at things.

So microcomputers devour two generations of victims — those who get caught first time round, contract microholism, and cease to know what a 'normal' life is, and those who slip through the net and proceed to engineer a world based on their own warped view of the universe. In time to come, systems designed by these 'experts' will be the cogwheels of our lives.

The professionals don't do it on purpose of course. They genuinely believe that the systems they are designing are friendly and helpful. The trouble is that they've totally forgotten what it's like not to be a computer freak.

They are incapable of imagining what a technologically naive user will find difficult. And they don't really want to ask, because they've already got the answers. They are the masters of a technical solution that is desperately in search of a problem

Illustration by Mike Litherland


604
594
94

CAN'T STOP THE BASIC!

to solve.

Inevitably, the systems they design force humans to adapt rather than vice versa. And they are far too complex for mere mortals to understand.

This is not only undesirable but downright dangerous. Ada, the language that has been developed by the US Department of Defense is an example of such a system. Iann Barron, UK managing director of Inmos, has said that Ada may be the cause of World War III. This is because it is so complex and creates unintelligible systems. Unintelligibility caused near-disaster at Three Mile Island nuclear power plant when operators were unable to find out what had gone wrong with the system.

A similar problem apparently occurred when the British Navy radar systems failed to detect Exocet missiles during the Falklands conflict last year. Somehow the system was labouring under the misapprehension that the missiles were 'friendly'. Although operators realised the mistake they were unable to penetrate the convolutions of programming to discover the offending clause.

Traditional methods of programming need to be revolutionised. If this does not happen then we will come to grief at the command of a system which no human being can fathom.

Such a revolution is being planned. It has been dubbed the 'fifth generation' of computing and it follows four previous generations: valves, transistors, large scale integration and very large scale integration. The fifth generation represents a qualitative remove from its predecessors, however, because it takes into consideration non-computerate users and aims at systems capable of explaining their lines of reasoning.

So it is really not the right approach to rear the next generation on 'spaghetti' Basic. It puts the emphasis on acrobatic manipulation of the language to design clever programs. Children learn how to be efficient with machine resources because in the old days machine resources were scarce. But this will not be the problem of the future where the prospect of optical discs, for example, means that work files will never need to be deleted.

There is no reason why children should not learn programming but this should surely be taught within the context of clear and intelligible systems. And there are new languages such as Lisp and Prolog which are specifically designed to build these fifth generation programs. MicroProlog is beginning to appear in schools but it needs much more backing.

Meanwhile, unintelligible systems are creating the main problems with introducing new technology at work.

Study in this area has been carried out by David Boddy and David Buchanan at Glasgow University. Buchanan and Boddy have done a number of studies of workplaces where new technology was introduced. They found that it is not the nature of the technology which causes problems so much as the way it is introduced.

The impact of the systems on human patterns of work has not been fully thought through. They enforce a whole new regime. One effect is distancing.

'The inner workings of computers are mysterious to those of us (most of us) with no special training. So the operators of computer-based equipment often do not know how it works, how to recognise faults, or how to fix it when it breaks down. The ability of the operator to influence what is happening is drastically reduced. The operator is "pushed back" from the work,' said Buchanan.

Job satisfaction is eroded because it depends on the individual having meaningful control over the work done.

Buchanan also found that computer technology tended not to be introduced in a way that is complementary to human skills. One site was introducing word-processing. Whereas copy typists had been able to vary the pace and intensity of work, one video typist claimed 'there is now pressure to keep working'. Another said she felt like a 'zombie', constantly typing with infrequent breaks. The system was interactive, prompting responses from the typist, and the screen was always 'live'. The video typist was therefore held at the machine, and was likely to work for longer periods than a copy typist without a change of activity because of the hassle of logging off and on the system.

'The effects of screen position, flicker and glare on operators is well researched but the effects of computer work-pacing on job satisfaction and performance and stress are not well understood.'

This 'pacing' is not uncharacteristic of the way that computers are introduced at work, and there are production lines where men are interspersed with robots to keep up the pace.

Another feature of the introduction of computers at work is that mistakes become more visible, both to the person who perpetrated the mistake and to that person's supervisor. So while users find they can correct errors and learn more easily, they may feel their performance is under the critical and ever-watchful eye of Big Brother.

The final problem Buchanan highlights is isolation. 'If you can get information through a computer terminal, why bother to go and look for youself or go and talk to someone?'

'The spread of information through deliberate and chance encounters between people at work will be disrupted as computers interfere with the social life of the factory and office. What effects will this have on the work of operators who remotely control a production process through a video screen? What effects will this have on the decisions of a manager who rarely leaves his desk-top terminal to talk to anyone?'

There is evidence that advanced technology creates boring, routine, lonely and unskilled work.

'Most software people have incredibly stimulating jobs writing software and fail to realise that what they do will create a large amount of boring jobs. One powerful antidote to this will be discretionary users.

'What is needed is human pressure. The unions have taken up the case of display screens but in the past they have not really looked at software. It must be examined from the point of view of what humans need. It is up to consumer power,' said Pearce.

There are three levels of consumer to be considered. The primary user is the one who may currently be a terminal junkie. The secondary user takes the ouput of the system — a manager, for example. A tertiary user is anyone who receives, say, an electricity bill. The classic example of a tertiary user being affected by a computer system is in the old age pensioner who committed suicide on receiving a computer-generated electricity bill for thousands of pounds. Tertiary users have put up with a steady reduction in service, as in bank statement production — statements which once listed details of to whom every cheque was paid no longer have such details. In fact we should be pressing for services with the same level of pre-computerised information rather than adapting to a reduced quality of information.

Microholism is a destructive disease — for the terminal junkie himself, for those who use systems at work and for the user at several removes who may get a heart-attacking electricity bill.

There is no doubt that home computers are a chief cause of the disease.

Given the scepticism of the established medical profession, it is up to computer freaks and their friends everywhere to watch out for the signs and step in before it is too late.

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SMOOTH AND SLICK

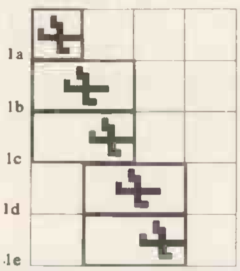
FLICKER FREE GRAPHICS FOR THE BBC MICRO

If your Beeb graphics have got the jerks, Alwen Bowker can steady them up — and give you a useful lesson in logic at the same time.

Are you dissatisfied with a jerky movement of your Space Invader/monster/snake as it moves across the screen? This article will tell you how to make your graphic display characters glide across the screen without flickering.

Most people start by implementing the easiest but least satisfactory way to simulate movement on the screen. This involves printing a character at some initial screen position; printing it at an adjacent position; and finally printing a space at the earlier character position. Repeating the last two steps results in movement around the screen, albeit very jerkily.

The approach often tried next is to create 'half characters'. Here a graphic character is written to an initial location (see diagram 1a). Next, that location and the following one are overwritten by two new characters which together show the graphic moved half a square (1b). Then the same two character positions are overwritten by a space and the original character (1c) so moving on another half square. Repeating the last two operations one square across the screen (1d and 1e) now gives a smoother movement than before, but still quite jerky.

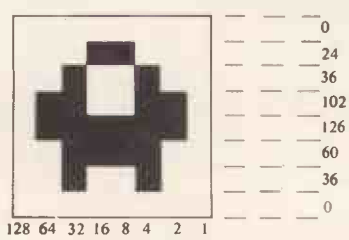


On the BBC machine, it is not necessary to print on character boundaries. It is possible to link together the text and graphics cursors, move to any graphic position on the screen and then print a character.

Now we can benefit from the higher resolution of the graphics screen compared with the character or text screen. The screen is divided into a very large number of points — 1024 from top to bottom and 1280 from left to right, although the best definition available is MODE 0 where there are 640 by 256 blocks on the screen. This means that each block is two points wide by four points high. So it should be possible to move a character one block (just two points) to the left or right, and one block (just four points) up or down.

Let's define a graphic character that we would like to move around the screen. For reasons that will become clear later on, we will leave a border one block wide all the way around the character.

Meet Cyclops, the one-eyed monster (though in some modes, he looks more like a car!).



Work out the value of each line in turn, by adding up the column value of each block which is black, and then define your character using VDU 23 (see the User Guide page 170).

```
VDU 23, 224, 0, 24, 36, 102, 126, 60, 36, 0
```

Character 224 will now be our Cyclops.

Let's print the Cyclops on the screen at 600,500. To make it easy for us to change modes we will use XLEN% and YLEN% to define the number of points contained in one block in the X and Y directions.

```
 10 MODE 1 : XLEN = 4 : YLEN% = 4
 20 VDU 23, 224, 0, 24, 36, 102, 126, 60, 36, 0
 30 X% = 600 : Y% = 500 : REM PRINT AT THESE
      CO-ORDINATES
 40 VDU 5 : REM JOIN TEXT AND GRAPHICS
      CURSORS
 50 MOVE X%, Y%
 60 VDU 224 : REM SAME AS PRINT CHR$ (224)
920 VDU 4 : REM RETURN TEXT CURSOR TO
      NORMAL
```

Let's suppose we now want to move the Cyclops to the left. The smallest amount we can move it in this mode is one block of four points (XLEN%) to the left.

```
500 DEF PROCLEFT
510 IF X% < XLEN% THEN ENDPROC : REM
      CHECK FOR EDGE OF SCREEN
520 X% = X% — XLEN% : REM NEW X
      CO-ORDINATE
530 MOVE X%, Y%
540 VDU 224 : REM NOT QUITE RIGHT
550 ENDPROC
```

This is a simple procedure to move the Cyclops one graphics block to the left. But line 540 is not correct. Although the method doesn't seem a great deal different from the first method described, if you try the program as it stands (adding 70 PROCLEFT) the character displayed will be a mess. This is because one of the effects of joining the text and graphics cursor is to cause the text characters to be superimposed upon what is already on the screen rather than erasing and replacing it. It looks as if we have to somehow erase the old character and then rewrite the new one — which is not a great improvement on the first method.

Now, the part which makes animation look jerky is the actual erasing of the old character (usually by printing a space) either before or after printing the new character. If only we could think of a way of doing it all in one operation then the movement would be much smoother.

If we look at the way characters are stored ready for printing, we might be able to find a way of doing this. Each character is made up of 8x8 dots and each dot has a colour, so a dot which is to stand out as part of a letter, for instance, is given the foreground colour, and a dot which is to blend with the background is given the background colour. Assume we are in a two-colour mode for the time being — colour 0 being the background colour and colour 1 being the foreground colour. The second line of our Cyclops is stored like this:

0	0	0	1	1	0	0	0

On moving left the pattern we want to end up with is:

0	0	1	1	0	0	0	0

Many of you will have noticed that GCOL (graphics colour) has as one of its parameters a number which allows us to AND, OR, EOR or invert the colour with the colour already on the screen.

Those of you who are familiar with the logical operations may immediately realise which one we want to use. For the others, here is an explanation.

AND, OR and EOR are logical operators, which work on two values. They work right down at the bit level (it doesn't matter to them whether the data they are working on are numbers of characters or anything else, they are just concerned with 0s and 1s).

AND takes two bit values and produces a result. The result is 1 if and only if both input values are 1.

```
So        0        0        1        1
       AND 0    AND 1    AND 0    AND 1
gives     0        0        0        1
```

AND can be applied to a string of 0s and 1s but it still takes one bit at a time from each input value and the above rules still apply.

```
So          0 0 1 1
       AND  0 1 0 1
gives       0 0 0 1
```

OR also takes two bit values and produces a result. The result is 1 if either or both of the bits in the input values are 1.

```
So        0        0        1        1
        OR 0     OR 1     OR 0     OR 1
gives     0        1        1        1
```

And, applied to a longer value:

```
          0 0 1 1
OR        0 1 0 1
gives     0 1 1 1.
```

EOR also takes two bit values and gives a result. The result is 1 if one (and only one) of the input value is 1.

```
So        0        0        1        1
       EOR 0    EOR 1    EOR 0    EOR 1
gives     0        1        1        0
```

And, applied to a longer value:

```
             0 0 1 1
        EOR  0 1 0 1
gives        0 1 1 0
```

Inversion is a funtion which works on one bit value. The result is 1 if the value was 0, and 0 if the value was 1.

```
So           0             1
     invert        invert
gives        1             0
```

And, applied to a longer value:

```
             0 0 1 1 1 0
      invert
gives        1 1 0 0 0 1
```

So, going back to out Cyclops, we start with:

1	2	3	4	5	6	7	8
0	0	0	1	1	0	0	0

We want to perform some operation and end up with:

1	2	3	4	5	6	7	8
0	0	1	1	0	0	0	0

ie, we want to find the sequence of 1s and 0s (let's call it x) and the logical operation such that
0 0 0 1 1 0 0 0 operation x = 0 0 1 1 0 0 0 0

The operation is not inversion because the inverse of
0 0 0 1 1 0 0 0 is 1 1 1 0 0 1 1 1

Looking at column 3 we start with 0 and want to end up with a 1. We can rule out AND because
0 AND x will never give us a result of 1.

Looking at column 5, we start with 1 and want to end up with a 0. We can rule out OR because
1 OR x will always give us a result of 1.

The only operation left therefore is EOR. We have to find a value so that
0 0 0 1 1 0 0 0 EOR x = 0 0 1 1 0 0 0 0

Now a funny thing happens with EOR.

```
If we start with   1
EOR it with        1
this gives         0
EOR it with        1   again
this gives         1   which is what we started with.
```

Similarly,

```
     1         0         0
  EOR 0     EOR 1     EOR 0
     1         1         0
  EOR 0     EOR 1     EOR 0
     1         0         0
```

It appears that if we apply EOR twice using the same value, then we get back to our original value.

```
        0 0 1 1
EOR     1 0 1 0
        1 0 0 1
EOR     1 0 1 0
        0 0 1 1
```

We can use this in trying to solve our equation
0 0 0 1 1 0 0 0 EOR x = 0 0 1 1 0 0 0 0.

If we apply EOR 0 0 0 1 1 0 0 0 to both sides, we get

```
00011000 EOR 00011000
      00000000

EOR x =  00011000 EOR 00110000
EOR x =        00101000
    x =00101000
```

So if we use GCOL 3 (EOR), and print 00101000 to where we currently have 00011000, we end up with 00110000 — just what we wanted. And we've calculated the value to be used by taking the original value at the location and the final value wanted there and EORed them together.

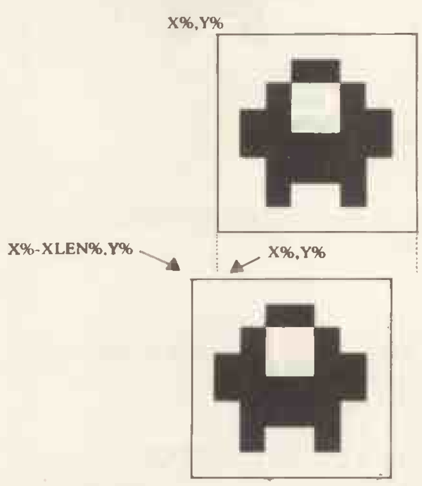
The only thing wrong with this is that since we are simulating movement to the left, we should really be printing our new character one block to the left. Since we were clever enough to leave a blank border around our Cyclops (remember?), we can shift our operation one block to the left and forget about the square on the right hand end because it is always 0.

```
      | 0 | 0 0 0 1 1 0 0 0 |
EOR   | 0 0 0 1 0 1 0 0 |
      | 0 0 0 1 1 0 0 0 | 0
```

ie, don't EOR the current square with 00101000, but move one point to the left and EOR with 0010100 .

Let's calculate the character we have to print in order to move the Cyclops to the left.

We've printed at X%,Y%.
and now we want the Cyclops to move to X%-XLEN%,Y%.



For each line, we take the old value and EOR it with the new value.
The first line is trivial

```
    00000000
EOR 00000000
    00000000
```

The second line new value is 00011000 decimal 24
The old value is the same shifted right one bit

```
EOR 00001100  decimal 12
EOR 00010100  decimal 20
```

SMOOTH AND SLICK

FLICKER FREE GRAPHICS FOR THE BBC MICRO

It gets a bit tedious to work at bit level for every line, so if we could work out a formula for doing the calculation, we can write a tiny program to do it for us.

For moving left, we need to EOR the new value and the old value (which is the new value shifted right one bit).

Since we are working in binary — ie, to the base 2, shifting right one bit when the rightmost bit is 0 is the same as dividing by 2. Compare this with a decimal value where 230 shifted right one position is 23 (ie, 230 divided by the base of 10). Similarly, shifting left one bit is the same as multiplying by 2.

So new value EOR (new value DIV2) is the value we want.

```
1000 INPUT A%
1010 PRINT (A% EOR (A% DIV 2))
1020 GOTO 1000
```

Do this for every line of the Cyclops and you will end up with a new character which you can define as character 225.

```
VDU 23,225,0,20,54,85,65,34,54,0
```

So line 540 of PROCLEFT becomes

```
540 VDU 225
```

and we will have to ensure that a GCOL 3 has been executed before PROCLEFT is called.

For moving right, we want to print one block to the right, so we need to EOR the new value and the old value (which is the new value shifted left one bit — ie, multiplied by 2). Again, we can ignore the square on the left because it is always 0.

So change line 1010 to be

```
1010 PRINT (A% EOR (A% * 2))
```

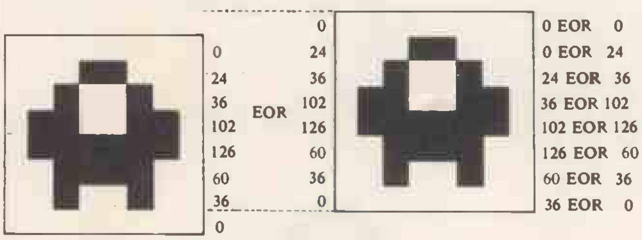
This will give us the character for movement to the right.

```
VDU 23,226,0,40,108,170,130,68,108,0
```

And we can define PROCRIGHT.

```
600 DEF PROCRIGHT
610 IF X% > 1279 — XLEN% * 9 THEN ENDPROC :
REM X% IS ON LEFT OF CHAR
620 X% = X% + XLEN%
630 MOVE X%, Y%
640 VDU 226
650 ENDPROC
```

To move up, we do the following:



This gives us

```
VDU 23,227,0,24,60,66,24,66,24,36
```

and

```
700 DEF PROCUP
710 IF Y% > 1023 — YLEN% THEN ENDPROC
720 Y% = Y% + YLEN%
730 MOVE X%, Y%
740 VDU 227
750 ENDPROC
```

To move down, we can use the same values as for moving up, but we start printing one line down.

```
VDU 23,228,24,60,66,24,66,24,36,0
800 DEF PROCDOWN
810 IF Y% < YLEN% * 9 THEN ENDPROC
820 Y% = Y% — YLEN%
830 MOVE X%, Y%
840 VDU 228
850 ENDPROC
```

Now all we need is a control loop and we can start moving Cyclops around the screen.

```
 80 REM SET AUTO REPEAT DELAYS TO MINIMUM
 90*FX 11,1
100*FX 12,1
110REPEAT
120K$=INKEY$ (0)
130REM FLUSH INPUT BUFFER
140*FX 15,1
150IF K$
160IF K$ = "M" THEN PROCDOWN
170IF K$ = "Z" THEN PROCLEFT
180IF K$ = "X" THEN PROCRIGHT
190UNTIL FALSE
```

Lines 90 and 100 make the program as responsive as possible to the keyboard, and

```
45GCOL 3, 3:GCOL 0,129:CLG:CLS
```

sets the background colour to red and the foreground colour to white (which when EORed with the red already on the screen will give us yellow).

Another useful line to put in is

```
70 ON ERROR REPORT: PRINT " AT LINE " ERL:
   GOTO 900
```

If there is an error, or you press the ESCAPE key; this gives you a chance to reset the auto-repeat delays to their normal values. If you don't, you will not be able to type anything sensible into the machine.

```
900 *FX 12, 0
910 *FX 15, 1
920 VDU 4 : REM RETURN TEXT CURSOR TO
    NORMAL
930 END
```

Expermient with moving the Cyclops around, using Z and X for left and right and K and M for up and down. You can change modes merely by changing line 10.

Try

```
10 MODE 0: XLEN% =2: YLEN% =4
```

or

```
10 MODE 5: XLEN% =8: YLEN% =4
```

If you feel that this graphics character is a bit small, don't worry. it is easy enough to move larger figures around using the same techniques.

Plan your figure, still leaving a border one block wide around the outside.

eg,

You will need four user-defined graphic symbols for the balloon and four more user-defined symbols for movement in each direction. The calculations are the same as before — EOR the old value and the new value, but watch out for the overlap between adjoining character positions — we don't have that border around *all* the edges any more.

Let's define our air balloon.

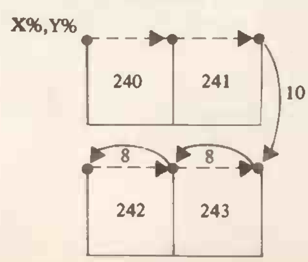
```
30 VDU 23,240,0,7,15,31,63,63,63,31
40 VDU 23,241,0,224,240,248,252,252,252,248
50 VDU 23,242,15,3,2,2,3,3,1,0
60 VDU 23,243,240,192,64,64,192,192,128,0
```

A new technique that we will have to use with larger figures is the VDU 8,9,10 and 11 commands which move the text cursor directly.

VDU 8 moves the text cursor one char position left
VDU 9 moves the text cursor one char position right
VDU 10 moves the text cursor one char position down
VDU 11 moves the text cursor one char position up.

So, to print the air balloon we use

```
MOVE X%, Y%
VDU 240,241,10,8,8,242,243
```



The full program to move the air balloon is shown in Figure 2.

This method of moving graphics is easier to understand and control when using only two colours, but interesting effects can be achieved by adding more colours. I have added some buildings to the air balloon screen and when the balloon moves in front of a building it changes colour. Try working out for yourself why this happens.

I think you will agree that this method gives very smooth movement even in Basic, but if used in a machine code program, I'm sure it could be even faster as well.

```
10MODE 1:XLEN%=4:YLEN%=4
20VDU 23,224,0,24,36,102,126,60,36,0
21VDU 23,225,0,20,54,85,65,34,54,0
22VDU 23,226,0,40,108,170,130,68,108,0
23VDU 23,227,0,24,60,66,24,66,24,36
24VDU 23,228,24,60,66,24,66,24,36,0
30X% = 600: Y% = 500: REM PRINT AT THESE
      COORDINATES
40VDU5: REM JOIN TEXT AND GRAPHICS CURSORS
50MOVE X%,Y%
60VDU 224: REM SAME AS PRINT CHR$ (224)
70ON ERROR REPORT: PRINT " AT LINE ";
      ERL: GOTO 900
80REM SET AUTO REPEAT DELAYS TO MINIMUM
90*FX 11,1
100*FX 12,1
110REPEAT
120K$ = INKEY$(0)
130REM FLUSH INPUT BUFFER
140*FX 15,1
150IF K$ = "K" THEN PROCUP
160IF K$ = "M" THEN PROCDOWN
170IF K$ = "Z" THEN PROCLEFT
180IF K$ = "X" THEN PROCRIGHT
190UNTIL FALSE
500DEF PROCLEFT
510IF X% < XLEN% THEN ENDPROC: REM CHECK
      FOR EDGE OF SCREEN
520X% = X% - XLEN%: REM NEW X COORDINATE
530MOVE X%,Y%
540VDU 225
600DEF PROCRIGHT
610IF X% > 1279 - XLEN%*9 THEN ENDPROC:
   REM X% IS ON LEFT OF CHAR
620X% = X% + XLEN%
630MOVE X%,Y%
640VDU 226
650ENDPROC
700DEF PROCUP
710IF Y% > 1023 - YLEN% THEN ENDPROC
720Y% = Y% + YLEN%
730MOVE X%,Y%
740VDU 227
750ENDPROC
800DEF PROCDOWN
810 IF Y% < YLEN%*9 THEN ENDPROC
820Y% = Y%-YLEN%
830MOVE X%,Y%
840VDU 228
850ENDPROC
900*FX 12,0
910*FX 15,1
920VDU 4: REM RETURN TEXT CURSOR TO NORMAL
930 END
```

Fig 1 Listing for Cyclops

```
10MODE1: XLEN%=4:YLEN%=4
15VDU 19,1,6,0,0,0:VDU 19,2,1,0,0:VDU
      19,3,3,0,0,0:
  VDU 19,0,4,0,0,0
20REM **BALLOON**
30VDU 23,240,0,7,15,31,63,63,63,31
40VDU 23,241,0,224,240,248,252,252,252,248
50VDU 23,242,15,3,2,2,3,3,1,0
60VDU 23,243,240,192,64,64,192,192,128,0
70REM **LEFT**
80VDU 23,224,0,4,8,16,32,32,32,16
90VDU 23,225,0,16,8,4,2,2,2,4
100VDU 23,226,8,2,3,3,2,2,1,0
110VDU 23,227,8,32,96,96,32,32,64,0
120REM **RIGHT**
130VDU 23,228,0,8,16,32,64,64,64,32
140VDU 23,229,0,32,16,8,4,4,4,8
150VDU 23,230,16,4,6,6,4,4,2,0
160VDU 23,231,16,64,192,192,64,64,128,0
170REM **UP**
180VDU 23,232,0,7,8,16,32,0,0,32
190VDU 23,233,0,224,16,8,4,0,0,4
200VDU 23,234,16,12,1,0,1,0,2,1
210VDU 23,235,8,48,128,0,128,0,64,128
220REM **DOWN**
230VDU 23,236,7,8,16,32,0,0,32,16
240VDU 23,237,224,16,8,4,0,0,4,8
250VDU 23,238,12,1,0,1,0,2,1,0
260VDU 23,239,48,128,0,128,0,64,128,0
270ON ERROR CLS:REPORT:PRINT" AT LINE
      ";ERL:GOTO9000
275GCOL 0,129:CLG:PROCBUILDINGS
280X%=600:Y%=YLEN%*16:VDU 5:GCOL 0,129:
      GCOL3,2
290MOVE X%,Y%:VDU 240,241,10,8,8,242,243
300*FX 11,1
310*FX 12,1
400REPEAT
410K$=INKEY$(0)
420*FX 15,1
430IF K$="K" THEN PROCUP
440IF K$="M" THEN PROCDOWN
450IF K$="Z" THEN PROCLEFT
460IF K$="X" THEN PROCRIGHT
470UNTIL FALSE
500DEF PROCLEFT
510IF X%<XLEN% THEN ENDPROC
520X%=X%-XLEN%
530MOVE X%,Y%
540VDU 224,225,10,8,8,226,227
550ENDPROC
600DEF PROCRIGHT
610IF X%>1279 - XLEN%*17 THEN ENDPROC
620X% = X%+XLEN%
630MOVE X%,Y%
640VDU 228,229,10,8,8,230,231
650ENDPROC
700DEF PROCUP
710IF Y%>1023 - YLEN% - YLEN% THEN ENDPROC
720Y% = Y% + YLEN%
730MOVE X%,Y%
740VDU 232,233,10,8,8,234,235
750ENDPROC
800DEF PROCDOWN
810IF Y%<YLEN%*17 THEN ENDPROC
820Y% = Y% - YLEN%
830MOVE X%,Y%
840VDU 236,237,10,8,8,238,239
850ENDPROC
900DEF PROCBUILDINGS
910MOVE 20,0
920PLOT5,20,200
930PLOT85,100,200:PLOT5,20,0
940PLOT85,100,0
950GCOL0,0
960PLOT5,100,800
970PLOT85,260,800:PLOT5,100,0
980PLOT85,260,0
990GCOL 0,2
1000PLOT5,260,600
1010PLOT85,500,600:PLOT5,260,0
1020PLOT85,500,0
1025GCOL0,3
1030PLOT5,500,200
1040PLOT85,1200,200:PLOT5,500,0
1050PLOT85,1200,0
1990ENDPROC
9000VDU4
9010*FX 12,0
9020*FX 15,1
9030END
```

Fig 2 Moving the balloon

EXPERT SYSTEMS

Robin Webster continues his investigation of expert systems. . . this time he's grappling with 'fuzzy logic'.

The problems involved in putting together an expert system are directly related to the kind of application you eventually intend for it.

But there is one thing absolutely vital to the success of any attempt to build such a system — something that is very easy to overlook. Imagine the following conversation between an expert system builder and a potential customer.

Expert system specialist: 'Yes, how can I help you?'

Army representative: 'I heard your talk about expert systems and feel that we could use something like that in my division ...'

Expert system specialist: 'Really? In what way could it help?"

Army representative: 'Well, we're wanting to set up this new computer system to handle...'

Expert system specialist: 'Ah, wait a moment — how many people are doing the job manually now?'

Army representative: 'No one, that's the problem.'

Expert system specialist: 'Yes, that *really* is your problem...'

Although not the exact words, a conversation similar to the above did in fact take place. It highlights the simple fact that to build an expert system you first need to have a human expert willing to explain how he or she goes about making decisions.

Expert systems do not feature some inspirational device capable of figuring out how humans go about their work; they simply emulate expert decision making, their judgement, and sometimes even their gut feeling.

This is where expert systems depart from the traditional mould of conventional software. Today's usual computer languages such as Basic, Fortran, Cobol and Pascal are powerful problem-solving tools if you have fully documented a problem and come up with an algorithm that will provide a solution to that one problem.

It might be quite accurate to say that a well designed expert system deals with uncertainty, or even conflicting data, in a common-sense way.

The late John Gaschnig, who headed up the Prospector mineral exploration expert system project at SRI International in the US, explained why we need expert systems rather well:

'It is an increasingly complicated world and we pay princely sums for expertise; whether it is a plumber or a consultant to help drill for oil, the job has got to get done when the stakes are high. An algorithmic system suffices for the mechanics of filling out a tax return or fixing the trajectory of a spacecraft to Jupiter — but most of the world is rather messy. If you ask a doctor or a geologist about their reasoning they'll tell you it is based on "years of experience". If we can capture those rules of thumb, as well as his textbook knowledge, we can get a computer to do the same thing.'

So let's look at how we can capture all this expert knowledge in a form that can be rendered sensible to a computer.

Typically, an expert system is made up of three distinct components: a knowledge base of rules dealing with some specific area of expertise; an inference engine, or mechanism, which interprets the rules; and an input/output system to allow humans to interact with the system via keyboard or other device.

Knowledge rules are usually coded in the form 'IF (condition) —> THEN (implication)' or 'SITUATION —> ACTION'.

On the face of it this all seems quite simple, but the hard part is making sure that the rules are correctly coded and that each rule interacts in the expected way with maybe 100 to 500 other rules in the knowledge base.

When the situation parts of the rules are satisfied, the action parts are 'fired' or activated. The expert system will then follow a 'chain of reasoning' until a particular hypothesis is proved or disproved by the data input by the user.

The rule interaction is controlled by the inference mechanism which looks for interrelationships between single rules or whole sets of them — this ensures that a user is not asked an irrelevant question or, more importantly, that the software does not generate great lists of questions which have no logical links and which cannot therefore contribute to the solution of the problem at hand.

If we are faced with many questions, it is only natural to expect that once or twice we will be unsure about the answer we should give, or will not know anything about the area under review at that time. In such an event we must be able to indicate our uncertainty by typing in the equivalent of 'I think it may be possible' or 'I don't know'.

There are many ways an expert system can be made to accept such degrees of certainty, but the most used currently is that employed on Prospector. The user can type in the number 5 to indicate 'Yes' or 'Absolutely certain', 0 to indicate 'I definitely don't know', and -5 to indicate 'No'. All numbers between 5 and -5 are used to indicate differing shades of certainty.

For straightforward Yes/No type of questions, the user can often just use those two words.

While the US has tended to stick with the Lisp programming language for its expert systems and Artificial Intelligence work, the UK has tended to be less certain about which direction to move in.

Possibly the most used alternative to Lisp is the Prolog (PROgramming with LOGic) language first implemented in Marseilles by Alain Colmerauer along the lines suggested by Imperial College's Bob Kowalski. The language does not require that the user creates conventional program statements; rather it allows programs to be built from statements of the relationships between and the attributes of objects.

Work on putting Prolog onto microcomputers has led to the microProlog system which currently runs on Z80 based micros, but will soon be made available on many more of the popular machines including the IBM Personal Computer, the Wicat, and the Sirius.

A microProlog rule, or statement, could look like the following: (Bob likes x if x likes logic). This is pretty self-explanatory. The problem with microProlog in its initial form was that it was fine so long as you didn't want an interactive session with it.

What this meant was that, although rules could be created in the language, you had to ask specific questions of the statements to find out who liked what and why, or what was X and how did it relate to Y and Z?

To add the fact 'John is a male' to a microProlog knowledge base you simple typed:

add(male(John))

and it was integrated into the list of microProlog statements already held in main memory, ready to be stored on disk. To ask who is male, you could then type:

which(x male(x))

This asks 'Find out which object held in the knowledge base is assigned the value of male and print out his name.'

So the question and answer would look like this:

which(x male(x))
Answer is John

Compare this level of interaction with the following expert systems session I went through with Dr Peter Hammond at Imperial College (user response in italics).

What is the rock type at site1?
valid
Valid rock types are given below
granite type-of strong-rock
basalt type-of strong-rock
gabbro type-of strong-rock
dolerite type-of strong-rock
quartzite type-of weak-rock
gneiss type-of weak-rock
unknown type-of weak-rock
mixed type-of weak-rock
What is the rock type at site1?
granite
Is deeply-weathered (site1)?
no
Is much-jointed (site1)?
no
Is essential-water-loss-minimised-at (site1)?
no

Illustration by George Snow (legs and idea by Phillippa).

EXPERT SYSTEMS

Is minor-water-loss-acceptable-at (site1)?
no
What is the leakage rate at site1?
list told
told ()
told ((site1 has-rock-type granite))
told ((deeply-weathered (site1)) no)
told ((much-jointed (site 1)) no)
told ((much-fractured (site1)) no)
told ((essential-water-loss-minimised-at (site1)) no)
told ((minor-water-loss-acceptable-at (site1)) no)
What is the leakage rate at site1?

The purpose of this particular expert system is to ascertain whether an area is suitable for dam-building and, if so, which type of dam construction method should be used. It took a geologist about four days to come up with sufficiently detailed rules for coding up in the microProlog system, and Peter Hammond another four days to clean them up, input and test them.

Here are a few actual rules:

```
(roller fill) optimum-dam-at X if
  (earth fill) possible-dam-type-at X and
  not (overflow-needed-at (X)) and
  clay-nearby (X) and
  earth-moving-machinery accessible-to X

(hydraulic fill) optimum-dam-at X if
  (earth fill) possible-dam-type-at X and
  not (overflow-needed-at (X)) and
  (hydraulic material) transportable-at X
  and
  (dam-height-at X) LESS 100

buttress best-at X if
  overflow-needed-at (X) and
  concrete-expensive-at (X) and
  (dam-height-at X) at-least 40
```

To attempt a full explanation of these rules and the session is probably not necessary since it is quite easy to follow the general direction of the questions and answers. It should be noticed, though, that with all microProlog examples so far, the user is not required to give varying degrees of certainty — there is no facility for indicating a 'maybe' response.

Fig 1 shows another expert system, called Apes, developed by Hammond which acts as a car fault diagnosis system. This employs what is known as 'fuzzy logic' — a method of weighting or assessing the odds of a range of possible faults. This is just one way of giving expert systems a decision-making capability.

In the first rule, we see the last line reads 'strength (20-5)'. This indicates that if the engine does have a weak fuel mixture there is a very good likelihood (20) of a blocked jet being the problem, but if there is no weak fuel mixture then it is unlikely (-5) that a blocked jet is the problem.

These 'confidence' values are set by the expert designer, otherwise they may cause an expert system to make many false conclusions when dealing with user input.

One other micro-based system is Microexpert, an expert system building package developed by Isis Systems in Redhill, Surrey. Microexpert will run on almost any micro capable of supporting the UCSD p-System and comes with a similar method of assessing possibilities.

If a particular fact has been ascertained as being true then a Logical Necessity rating (to use Microexpert jargon) of 100 makes a particular hypothesis dependent on that fact extremely likely, whereas a Logical Necessity rating of 0.01 would obviously mean that absence of the particular fact makes the hypothesis very unlikely.

To create an expert system with Microexpert you must write out the relevant rules in the Advice Language provided and then compile this text with the EXPCOMP system. Another system called RUNEXPT, which is the rule interpreter, then actually gets the Q & A session going. Microexpert is available for commercial evaluation.

Hammond has concentrated on actually building specific prototype expert systems using microProlog that demonstrate the viability of using a logic-based language approach to problem solving — none of his systems are to be made available commercially, although the microProlog system is sold by a London company called Logic Programming Associates. A full review of microProlog will appear in *PCW* soon.

END

```
&listf is-fault-in
(blocked starter jet) is-fault-in carburettor if
          noticed ((a problem starting)) and
          engine-has ((weak fuel mix))
strength  (20 -5)

(blocked starter jet) is-fault-in carburettor if
          not (fuel reaches (engine)) and
          fuel-reaches ((float chamber))
strength  (25 -5)

(blocked main jets) is-fault-in carburettor if
          noticed ((a problem revving)) and
          engine-has ((weak fuel mix))
strength  (15 -12)

(faulty needle valve) is-fault-in (float chamber) if
          engine-has ((weak fuel mix))
strength  (10 -3)

(faulty needle valve) is-fault-in (float chamber) if
          engine-has ((high fuel level in float chamber))
strength  (13 -3)

(faulty needle valve) is-fault-in (float chamber) if
          not (fuel-reaches ((float chamber))) and
          fuel-reaches ((carburettor inlet))
strength  (19 -3)

(faulty fuel pump) is-fault-in engine if
          engine-has ((weak fuel mix))
strength  (13 -3)

(faulty fuel pump) is-fault-in engine if
          not (fuel-reaches ((carburettor inlet))) and
          fuel-reaches ((fuel pump))
strength  (16 -3)

(incorrect adjustment) is-fault-in carburettor if
          engine-has ((weak fuel mix))
strength  (10 -13)

(incorrect adjustment) is-fault-in carburettor if
          engine-has ((rich fuel mix))
strength  (10 -13)

blockage is-fault-in (pipe from tank to pump) if
          fuel-reaches ((fuel pump))
strength  (-20 25)

blockage is-fault-in (pipe from pump to float chamber) if
          not (fuel-reaches ((carburettor inlet))) and
          fuel-reaches ((fuel pump))
strength  (25 -20)

(enlarged fuel jets) is-fault-in carburettor if
          car-has ((high mileage)) and
          confirmed ((jets have been cleaned with wire))
strength  (13 -13)
```

Fig 1 Car fault diagnosis using fuzzy logic.

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MAKING WAVES

TURTLE GRAPHICS AND THE HUYGENS PRINCIPLE

Martin Lesser chases chelonia. . .

It is now well known that the turtle is an animal living in the two-dimensional world of the computer monitor screen. Computer biologists even distinguish several varieties of this beast with names such as the 'dynaturtle'. As the Logo-defined microworlds expand into the lives of all we can expect a dramatic multiplication of these creatures. I would like to tell about some of my experiences with one that I found roaming around on my Apple screen. In some ways this turtle, the 'signaturtle' (for signalling turtle), has characteristics shared by its biological cousins that live in or near ponds, puddles and other bodies of water. When it wags it tail it sends waves out onto the shallow surface of its habitat. We can use Logo to control our friend's actions and learn some things about the many and varied aspects of wave motions in nature.

The basic ideas involved in using the signaturtle's tail-slapping wave to understand wave-like phenomena were formulated by Christian Huygens in the 17th century and today go under the name of the Huygens Principle. Despite an elegant simplicity the idea has both great conceptual strength and extreme usefulness for obtaining quantitative results. The range of experience that can be illuminated and experimented with concerns such diverse things as the sonic boom of a supersonic aircraft, or the transmission of guided waves in the ocean. Our main aim here is to set up a computer microworld in which the signaturtle can be manipulated by the user to discover for him/herself something about the physics of wave propagation.

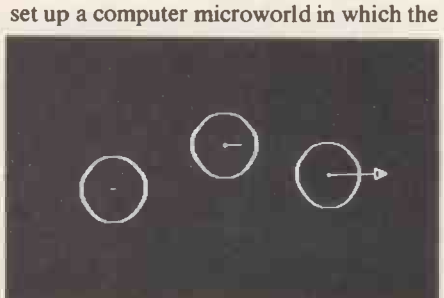


Fig 1: The wave sent out by a turtle tail slap. In the pattern at the left the turtle does not move. In the middle pattern the turtle has moved to the end position of its trace line at a speed lower than the wave speed. In the pattern at the right the turtle has moved with a speed faster than the wave speed — ie, it's a 'supersonic' turtle.

The first step in our project must be to create the signaturtle, which we will do in terms of the LCSI Apple Logo implementation. Assume that every second our friend 'slaps' the water with his tail, sending out a circular wave front. The wave so created moves out in the form of a circle, centred on the position at which the turtle was located when its tail struck the water. If the 'speed' of the wave is C then after time T the radius of the circular wave will be C*T. Thus if we look at the pattern one second after the slap the radius will be C.

If the signaturtle walks with velocity V in a straight line, then after time T it will have moved a distance V*T. This means that after one second it will have moved a distance V. This situation is illustrated in Figure 1. In this figure we see the circular wave front emitted by the tail slap that took place when the signaturtle was located at its starting position. The first part of the illustration shows what would occur if the turtle does not move. The 'tail slap' sends out a moving circular pattern centred on the animal's position.

In the second case shown, the head of the beast is located V units away from the starting position and the signal radius is C units away from the starting position. As the velocity of the turtle is lower than the wave speed it is to be found inside the circular wave.

The last part of the figure shows the situation when the turtle moves faster than the wave speed. In this case it is to be found outside of the pattern. In analogy to the motion of bodies such as aircraft we can refer to the two earlier cases as 'subsonic' and the last case as 'supersonic'. The 'transonic' case refers to the situation where the turtle's speed equals the wave speed. These considerations give us the basic property of our signaturtle — ie, at any time it will show its present location and the signals and path points from which the signals originated at one, two, etc seconds before. To keep the programming task manageable we shall assume that during the period between tail slaps the animal moves in a constant direction with a constant speed.

Three Logo procedures give us the desired properties we have just sketched and allow us to begin experimenting. These are listed in Table 1. The first one is simply a version of the CIRCLEL procedure provided in the AIDS package supplied with the system. It draws a circle, representing the emitted wave front, and for vividness we call it SIGNAL with argument DISTANCE. We also need a help procedure MARK which draws a mark at each

```
TO SIGNAL :DISTANCE
(LOCAL "SAVEPOS "SAVEHEAD)
HIDETURTLE  PENUP
MAKE "SAVEPOS POS
MAKE "SAVEHEAD HEADING
RIGHT 90
FORWARD :DISTANCE
LEFT 90
PENDOWN
CIRCLEL :DISTANCE
PENUP
SETHEADING :SAVEHEAD
SETPOS :SAVEPOS
SHOWTURTE
END

TO MARK
HT PD
RT 90 FD 1 RT 180 FD 2 RT 180 FD 1 LT 90
ST PU
END

TO SIGNA.MOVE  :C :V
MARK
SIGNAL :C
PD FD :V PU
END
```

Table 1

```
TO COAST :TIME  :C  :V
IF (OR :TIME = Ø :TIME < Ø)  [STOP]
SIGNA.MOVE :C * :TIME  :V
MAKE "TIME :TIME - 1
COAST :TIME :C  :V
END

TO COAST.TURN :ANGLE :TIME :C  :V
IF (OR :TIME = Ø :TIME < Ø)  [STOP]
RIGHT :ANGLE
SIGNA.MOVE :C * :TIME  :V
MAKE "TIME :TIME - 1
COAST.TURN :ANGLE :TIME :C  :V
END
```

Table 2

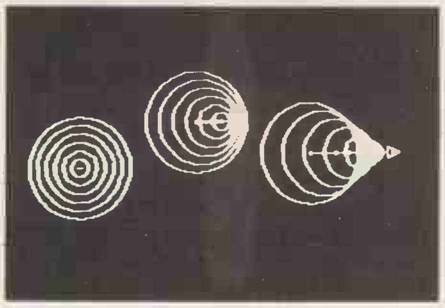


Fig 2: Wave patterns made by a turtle slapping its tail periodically six times. The wave speed is five. In the left hand pattern the turtle is at rest, the outer circle is the first emitted wave. The turtle moves with speed four and nine in the other two patterns.

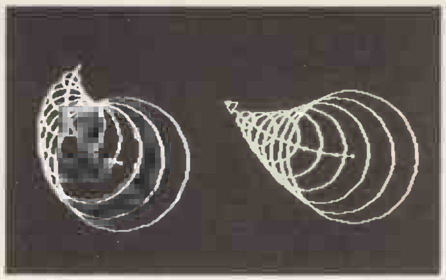


Figure 3: Wave patterns made by turning (accelerating) turtles. Both patterns are supersonic. Here we see an analogy to the 'booms' emitted by supersonic aircraft.

emission point. Using these two procedures it is a simple matter to write the procedure SIGNA.MOVE with the arguments C, the wave speed, and V, the signaturtle's velocity. Calling this procedure forces the animal to move forward a distance V, to make the initial position and to show the radiated signal front at distance C from the marked slap point. In order to get true circular patterns the reader may have to adjust the aspect ratio of his screen using the SETSCRUNCH command.

You can now try to verify the behaviour of the resting, subsonic and supersonic signaturtle. Also, see what happens for a transonic animal — ie, the one that moves at the signal velocity.

So far our turtle can only move for one second in a fixed direction at a constant velocity and send out the wave from a single tail slap. What happens if we allow it to move for say six seconds, emitting a wave at the end of each second of motion? The first tail slap wave will have a radius 6*C and be centred on the position at which the turtle started moving. The second tail slap wave will have been sent out from the position held by the animal at the end of one second. As we are looking at the picture attained after six seconds, this wave will have radius 5*C. The wave created at the end of each second of the motion will thus show a smaller radius centred on the position at which the turtle was located when the tail slap took place.

The last wave emitted in the six-second motion will be the one that originated five seconds after the first tail slap. To generate this type of picture we make use of the procedure COAST with the inputs TIME, C and V. This procedure is shown in Table 2. It first draws the wave emitted at the start of the signaturtle's motion, and uses a recursive call to itself and a stop condition to draw the remaining waves.

The first thing we can try with our COAST procedure is to let the signaturtle stay in one position and slap its tail once every second. Try it for, say, C equal to 10 and T equal to eight (V, the animal's velocity, is of course zero in this case) and see the pattern shown in the first part of Figure 2.

Now clear the screen and see what happens if the creature moves for the same period of time at the speed five and 15. The observant follower of our signaturtle may notice that the envelope curve for the emitted waves in the last case consists of two straight lines radiating out behind the animal's final position. The envelope is the 'curve' which tangents to each of the signal fronts. If the signaturtle started slapping its tail at a higher rate this envelope curve would be closer and closer to fitting the definition of the curve which separates the region of the turtle's pond where signals announcing the animal's activities have arrived from the undisturbed waters.

In some sense we can consider the limiting case of infinite slapping frequency to describe the case of the tail being constantly in the water. Do you see any similarity here with the sonic boom created by an aircraft moving faster than the speed of sound in air? Experiment and see what happens in the transonic case where the signaturtle's velocity is equal or almost equal to the wave speed. Can you modify the procedures so that more waves are emitted during the motion, and does this help you in interpreting the results? Perhaps you have heard of the Doppler effect. If so the subsonic signaturtle's movements should blow a train whistle in your mind!

With the sonic boom picture of the turtle's supersonic movements in mind, we can experiment a little to see what might happen when a fast-moving jet aircraft makes a turn. The boom is bad enough — can anything worse happen? To find out, let us make a small modification in the procedure COAST defined in Table 2. The new procedure, called COAST.TURN, has an additional input called ANGLE. The modification to COAST is simple to let the signaturtle make a right turn with the given ANGLE after each tail slap. The procedure, shown in Table 2, allows us to explore some of the things that may happen when a supersonic aircraft manoeuvres. I leave it to you to see if you can produce and explain the so called superboom or focused shock. Figure 3 shows what you might expect to find for this case.

Suppose the turtle pond has a steep and sudden bank — ie, a wall. Waves that reach such a boundary will, of course, reflect. A little experience in your bathtub might give you some idea about this. How can we create such reflections in our microworld of the signaturtle?

The answer is quite easy! We need a reflectaturtle. Thus use two parallel moving signaturtles. The line drawn halfway between them can be reconsidered as the pond boundary as a little experimentation will show. First take the simple case of two stationary signaturtles; ie, let V equal zero and use the same wave speed C for both of them. Look at the pattern, which should be like the one shown in Figure 4. Do you believe that the situation of two signaturtles is equivalent to one slapping its tail in the presence of a steep bank? In fact, this method of 'reflection' is used to solve quite difficult problems in wave motion. The second or 'reflected' turtle can be considered as a sort of convenient phantom moving in a phantom pond on the other side

```
TO COAST.WALL :HEIGHT :MACH
CS PU WINDOW RT 9Ø
SETPOS LIST  -8Ø :HEIGHT
COAST 15 5 (:MACH * 5)
PU SETH 9Ø
SETPOS LIST  -8Ø  -:HEIGHT
COAST 15 5  (:MACH * 5)
SETSCRUNCH 1
FILL.BLOCK  -14Ø 14Ø  -1ØØ Ø 1
HT
END

TO COAST.TURN.WALL :ANGLE :HEIGHT :MACH
CS PU WINDOW RT 9Ø
SETPOS LIST  -8Ø :HEIGHT
COAST.TURN :ANGLE 15 5 (:MACH * 5)
PU SETH 9Ø
SETPOS LIST  -8Ø  -:HEIGHT
COAST.TURN -:ANGLE 15 5 (:MACH * 5)
FILL.BLOCK  -14Ø 14Ø  -1ØØ Ø 1
HT
END
```

Table 3

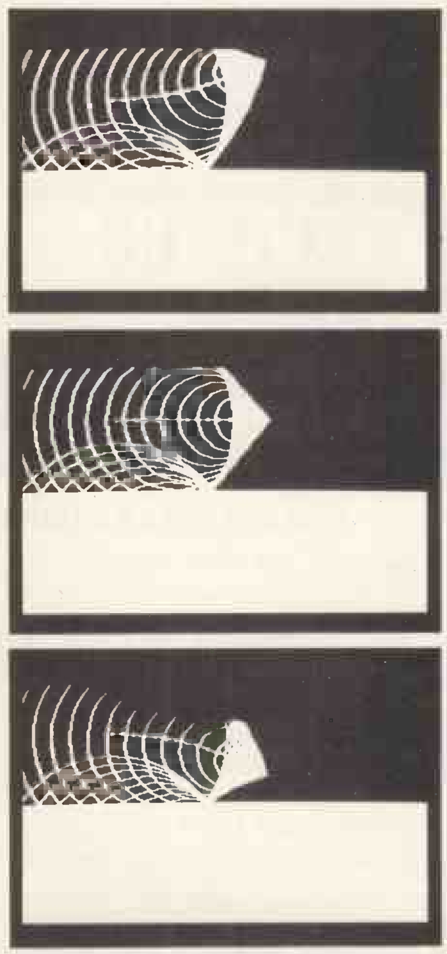


Figure 4: In these three pictures we see the use of a reflectaturtle to simulate the presence of a reflecting barrier such as the ground or the edge of a turtle pond. The three cases shown are analogous with a supersonic aircraft in straight flight and accelerating away from and toward the ground.

MAKING WAVES

of the 'barrier' between them. The pattern so created is the same one that the single turtle would create if it slapped its tail and the resulting waves reflected off such a barrier.

The procedures COAST.WALL and COAST.TURN.WALL in Table 3 can be used for examining some of the possibilities. As a slight refinement, we can use the FILL.BLOCK procedure given in Table 4 to mask the motion of the phantom 'signaturtle'. There are many variations on this theme and I leave it to the reader to explore some of them. Just a hint, though — consider how one could simulate the presence of a corner in a pond by adding three phantom signaturtles.

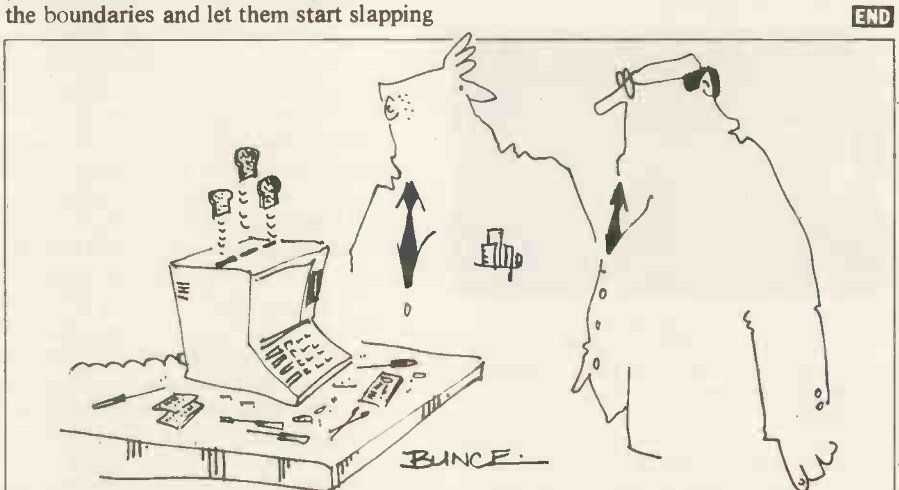
Another interesting signaturtle project can be used to see the type of wave patterns that might emerge from an antenna or an oddly shaped vibrating object. The method you could use is to distribute signaturtles on the boundaries and let them start slapping their tails. You could also use a reflected object to account for the presence of a pond wall or barrier. The possibilities are as endless as the subject of wave motion itself, and I find it difficult not to reveal many other projects using the signaturtle that come into my mind. However the philosophy of Logo that appears to be emerging is that the individual should use the microworld concept to explore and learn for himself, so in this spirit I will restrain myself, at least for the present, from further elaborations of the signaturtle theme. I also must stop because I just saw another turtle-like beast crawling up the edge of my computer screen and I would like to see what he's up to. . .

END

```
TO FILL.BLOCK :XL :XH :YL :YH :COLOR
(LOCAL "AR)
MAKE "AR SCRUNCH
SETPC  :COLOR
PU SETSCRUNCH 1
MAKE "SPOS POS
MAKE "SHEAD HEADING
SETPOS (LIST :XL :YL)
SETH 90
PD HT
PAINT :YH - :YL :XH - :XL
SETPC 1 PU
SETSCRUNCH :AR
SETPOS :SPOS
SETH :SHEAD ST
END

TO PAINT :YD :XD
IF (OR :YD < 0 :YD = 0)  [STOP]
FD :XD LT 90 FD 1 LT 90 FD :XD
RT 90 PU FD 1 RT 90 PD
PAINT :YD - 2 :XD
END
```

Table 4



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THE SMALLEST COMPUTER

Dick Pountain investigates the neat, petite PC1251.

To Sharp belongs the distinction of having introduced the first true pocket computer, the PC1211, in 1980. Having capped the achievement with the introduction of the PC1500 last year it would not be unreasonable to expect them to sit back and rest for a while; this is not, however, the Japanese way. The newest pocket computer from Sharp, the PC1251, is another triumph of miniature digital engineering. The face of the portable computer market has been changed considerably in recent months by the new introductions from Hewlett Packard and Epson; these manufacturers have worked towards cramming desk-top computer functionality into a more or less handheld package. This trend will continue as new machines from Teleram, Athena and possibly Apple arrive on the scene.

Sharp, however, has chosen not to go this route but instead to continue down to ever smaller sizes. The PC1251 is more powerful than the 1211 and not far below the 1500, but in a package which is as small as a modern programmable calculator. This makes it a true pocket computer: even a shirt pocket will hold it comfortably. When fitted with the optional printer and microcassette recorder cradle it resembles nothing so much as an Epson that has shrunk in the wash; it is about the size of a paperback book, all-included. Perhaps most remarkable, though is the very keen pricing of the 1251. At £79.95 it is cheaper than the 1211 was on launch three years ago.

PC1251 fitted with printer and microcassette cradle.

Hardware

It isn't difficult to discover the basis of the 1251's low price tag. On opening up the case one discovers that the single board contains only two minuscule chips. One of these is an 8-bit CPU and the other is presumably system ROM. Memory is provided in the form of three chips on a small removable board next to the two lithium batteries and looks as if it is designed to be replaceable in the future by upgrades; it connects to the main board by a pad of conductive rubber like that used to connect LCDs. The design of the internals is the most remarkably neat that I have seen to date; the PCB boards are quite beautiful with their gold conductors and green lacquer, nearer to jewellery than electronics (Pseuds Corner, here I come).

Computer in handy carrying case.

The case itself is the typical sandwich of plastic between brushed alloy plates and is marginally smaller than a Casio 602p in overall dimensions.

The keyboard has a QWERTY section and a numeric keypad; the keys are minute by necessity but not more difficult to use than any modern calculator. The ENTER key is double-sized but unfortunately the SPACE key is single and not centrally placed as on the 1500. The numeric keys are larger than the alphas, which makes calculator use quite convenient. Unlike the 1211 and 1500, the 1251 uses the sliding on/off switch for selection of operating modes (RUN, PROgram, and ReSerVe).

Here's a brief rundown of the vital statistics of the 1251. The total user program is 3468 bytes with a further 48 bytes of Reserve Key area and 208 bytes for the 26 predefined variables A-Z. Basic is contained in 24k of ROM.

The display is a 24 character dot-matrix LCD which scrolls to the left automatically to give a maximum line length of 80 characters. It contains small annunciators for BUSY, DEGrees, RADians or GRADient angular mode and various status indicators. A cursor may be moved left or right with the <— and —> keys; it may also be moved up and down when in program mode to scan a listing.

No lower case letters are provided; when the shift key is used with the lower two rows of alphabet keys it produces keywords assigned in Reserve mode.

Power is by two lithium cells with a life of around 300 hours; when the optional print/cassette cradle (CE 125) is attached the computer draws its power from this instead.

Arithmetic is performed to 10-digit precision (12 digits internally) with a dynamic range of 10+/−99.

Software

The Basic provided with the 1251 is almost identical to that of the 1500 and is considerably more advanced than the 1211. The only 1500 statements which are missing are ON...ERROR, LOCK/UNLOCK and all the graphics and plotter commands. The 1251 lacks the 1500's internal clock calendar and its BEEP command is programmable only for number of repetitions, not for tone or duration.

The numeric variables A-Z are predefined with their own separate memory allocation. This space can alternatively be used for string variables A$-Z$ or the numeric or string array A(26) or A$(26); it is not cleared by the RUN command. Additional arrays can be defined using the rest of the alphabet — eg, M(50) — but these will sit in ordinary user RAM and be cleared by RUN. String variables hold 7 characters, string arrays can be dimensioned to hold as many as memory allows. PEEK, POKE and CALL all seem to work and hex numbers can be entered if prefixed with &.

One thing that is noticeable about this Basic is that it is much slower than the 1500's (see Benchmarks); presumably this is one of the prices of such extreme miniaturisation. Solutions which require a lot of iteration are going to be impractical with this machine, though, unless you run them overnight.

However, looking back to my original test of the PC1211 I find that the 1251 is actually three to five times as fast as that 4-bit machine.

CE-125 Printer/ cassette unit

The optional printer/cassette unit contains a 24-character thermal printer and a 2.4 cm/s micro-cassette recorder which can be controlled from the PC1251. The unit is powered by rechargeable Ni/Cad cells which can be charged from the supplied 8.5v AC/DC adaptor. This device has a built in shaver-type two-pin mains plug, so you'll need an adaptor unless you recharge it in the bathroom. Battery life is only a couple of hours if you use the printer heavily and recharging requires 15 hours according to the manual (though overnight seemed to work). It is possible to use the machine while the charger is connected but this will lengthen the required charging time. Low battery condition is indicated by a red LED on the front panel and the printer being disabled.

The printer takes spindle-less rolls of thermal paper through a trap door in the top; threading is quite straightforward using the paper advance button. The print quality is rather mediocre compared to the 1500 plotter but is probably no worse than equivalent electrostatic printers. Fingerprints on the paper reduce the quality further so the rolls should be handled with care. Programs may be listed using LLIST, and a special PRINT mode allows direct calculations to be printed, so you can use the PC1251 as a desk calculator.

The microcassette recorder has a full set of manual controls in addition to a remote switch which puts it under program control. Fast forward and rewind are adequately fast and a 3-digit mechanical tape counter is located next to the recorder. There is no provision for fast winding under program control, however.

A mini-jack socket at the right side of the unit allows an external cassette recorder to be connected via a single lead; only reading is possible and with no remote control. The facility is provided to permit loading of programs or data from other Sharp pocket computers rather than to control two recorders for data processing.

Saving and loading were found to be very reliable and tolerably quick using the CE-125 and it is certainly much more convenient than using an external recorder and juggling with remote leads which has been the norm with previous pocket computers.

A library tape of maths and statistics routines comes with the CE-125.

The printer/cassette unit comes with a padded travelling case similar to but smaller than that for the PC1500 plotter; it even has a compartment to hold the manuals.

Documentation

Two manuals are provided: a short guide to using the printer and cassette and a 217 page instruction manual which includes a summary of the Basic. The standard of translation is rather better than previously, though far from perfect. Details of the various Basic statement are rather better too, with each one getting a page to itself with examples. Appendices cover compatibility with the 1211 and 1500, the

Computer slots neatly into cradle.

character set and error messages. Most of the information required is included but it will not be of great help to a beginner who hasn't yet learned Basic. Interestingly, as with the 1500, PEEK, POKE and CALL are not mentioned in the manual but appear to work.

Conclusions

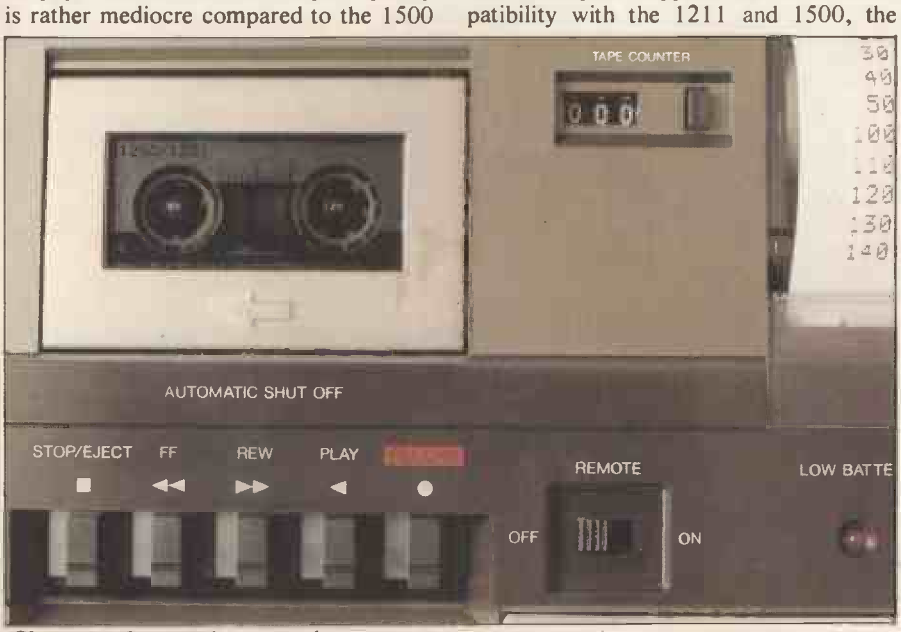
It is rather sobering to reflect that this little sliver of aluminium contains as much RAM as a Commodore VIC, and a Basic which, graphics apart, is just as complete.

At £79.95 for the PC1251 and £99.95 for the CE125 it represents very good value compared to its competitors and its own predecessors — especially as it includes a microcassette recorder which would cost at least £50 to buy separately.

Although not as fast as the 1500 it is faster than the 1211 (and that machine found plenty of users). For mathematicians, though, the 1500 is probably still a better bet.

Speed is not a problem in everyday arithmetical calculation and I prophesy a big future for the machine as a salesman's aid, allowing costing and estimating with hard copy to be done on site. While it lacks the power and communications facilities of the Epson HX20 there will be plenty of applications for which this machine is sufficient, and more cost effective (you can get nearly three for the price of an HX20).

As a scientific calculator the PC1251 offers more memory and smaller size than anything else available. It is also pretty enough to be bought as a status symbol whether you actually need it or not.



Close-up of manual cassette keys.

Benchmark timings for PC1251

BM1	42.3
BM2	70.6
BM3	162.5
BM4	165.9
BM5	197.3
BM6	427.8
BM7	581.4
BM8	980.0

All timings in seconds. For full explanation of the Benchmarks see PCW *November 1982.*

COMMUNICATIONS

PCW welcomes correspondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add 'not for publication' if your letter is to be kept private. Please note that we are unable to give advice about the purchase of computers or other hardware/software — these questions must be addressed to Sheridan Williams (see 'Computer Answers' page). Address letters to: 'Communications,' Personal Computer World, 62 Oxford Street, London W1A 2HG.

Cryptic comments

In your December edition, Dr David Fisher of Cardiff writes on the problem of factoring large numbers. He states that due to recent advances in number theory it is now possible to find the factors of 200-digit numbers. On the other hand, he appears to be confusing two problems: those of testing for primality, and factoring. In practice, though, these problems are not equivalent; it is much, much easier to show that a number is not prime than actually to find the factors.

On my Z80-based machine I can test numbers around 10^{36} for primality in a matter of minutes, but finding the actual factors might take a million times as long as estimated by extrapolation. The computing power required for factoring rises as about the fourth root of the number, but for primality testing only about as the log of the number. The higher the numbers, the greater the difference.

Nevertheless there have been reports that Adi Shamir, a co-inventor of the so-called RSA public-key cryptosystem, has made a breakthrough in this field. I am investigating and await the results with interest.

George Sassoon, Warminster, Wilts

Failed!

No, Mr Bev Mason's program (*PCW* December 1982) failed the intelligence test. Has he tried it on a series such as 3,9,27,81,_? The psychologist's preferred child gives the answer 243; Mr Mason's 'clever' child, and his program, give 195. They are wrong; the other is right. Why? Because if the sequence is a series, the fifth term should be predictable from the first three terms as well as from the first four. The standard answer meets this requirement, and shows that the child can draw conclusions from all the data but nothing more than the data. The computer hasn't been programmed to check that the solution for N-1 . . . 3 values is the same as that for N values; and the program assumes that the Y values conform to a formula Y=f(X) where f(x) is a polynomial in X. It can't cope with other functions. The computer 'knows' about explanation, but hasn't been programmed to expect it. The standard child may not know about it, but can intuit it from its knowledge of arithmetic. That, perhaps, is what intelligence is about; and perhaps the tests are less useless than Mr Mason thinks.

C Currie, London N15

Text encoding

In an article entitled 'Cramming it in' by Dennis Andrews, of Keele University, in the September edition of *PCW*, Mr Andrews expounds upon the excellence of his Program 'E40' for compressing or condensing computer text files into as little as 40% of their original size. Towards the end of the article, and under the heading 'Secrecy and patents', Mr Andrews refers to the fact that the basic ideas of E40 are the subject of a Patent Application, but laments — with some justification, I feel — that the *current* British Patents Act (the 1977 Act) requires that an application, and the specification filed therewith (which should fully describe and explain the claimed invention), shall, unless specifically withdrawn in due time, be published *before* the application is 'accepted' and a patent granted. Incidentally, under the old law (the 1949 Act), this was not the case; while specifications were indeed published before the patent was granted (so as to give third parties an opportunity to oppose the grant), this publication was *after* acceptance, meaning that it occurred only when the Patent Office itself was satisfied that the invention merited a patent.

However, returning to the present day, and the 1977 Act (with all its warts), your readers will be interested to learn that the bare details of every British patent application — the applicants' name, and the application number, date and title — are published week by week (usually four or five weeks in arrears) in the Official Journal (Patents), those for the year being collated in the form of an applicants' name index on cards, and freely available for inspection at the Patent Office in London. So far as concerns the application for E40, the one in question is No: 82/01,655, filed on the 21st January 1982 in the name of Keele Codes Ltd with the title 'Encoding Text'. If all goes well, and assuming the application is not withdrawn by about mid April 1983 (15 months after filing), the specification *will* be published, and purchasable by anyone for the fairly trivial price of £1.65, shortly after mid-July 1983 (18 months after filing). At that time anyone may see exactly what it is that Mr Andrews (and his co-inventors?) thinks he has invented, and for which he believes he is entitled to a patent.

Of course, whether he gets a patent is another matter — and in certain circumstances rather an unfair one. As he himself implies, present British patent law requires that *if* the application is to be proceeded with then, within a year of filing, there should also be filed a Request for Preliminary Examination and Search. Once this is filed, the Patent Office will then effect a search to see a) whether the application meets certain formal criteria, and b) whether the invention as claimed is in substance disclosed in any published Prior Art (usually other, earlier, patent specifications). At this stage, then, the applicant may become aware that his invention is not as inventive — as new and unobvious — as was first thought, having been described in, or rendered obvious by, the disclosure of one or more of the cited documents. Obviously, if the invention *is* clearly a non-invention, that is the moment to give up, and (if still in the right time period) perhaps to withdraw the application to prevent its publication. If, however, it seems that the invention's patentability is not in doubt, or is at least arguable, then it is necssary to proceed to the next stage, filing a Request for Substantive Examination within six months after the application is actually published, if the presentation of the application is to be continued.

Unfortunately, however, there are other reasons for an 'invention' being unpatentable, besides it being either not new or clearly obvious. Specifically (and amongst a few other reasons), the invention may fall into one of the categories listed in Section 2 of the 1977 Act as being *inherently* unpatentable no matter how ingenious, excellent, novel and unobvious. These categories are, broadly speaking:

a) discoveries, theories or mathematical methods;
b) literary or other works of an aesthetic nature;
c) schemes, rules or methods for performing mental acts; playing games or doing business, or computer programs; and
d) the presentation of information

— though it is stressed that the ban applies only when the invention is *solely* one of these things *as such*, and will not necessarily apply when the invention involves such a thing as a part of something that overall does *not* fall into one of these categories.

The problem faced by Mr Andrews and the Keele Codes application is that, though sometimes a helpful Patent Office will indicate in the Novelty Report (following the Search Request) that the invention appears to fall foul of one or more of these forbidden categories, this is not usual, and in any case it is only during Substantive Examination that the question will be properly considered and decided. And, of course, Substantive Examination can only occur after publication — by which time the unfortunate Applicant has already seen his secrets laid bare to an astonished world, and now faces the awful prospect of *not* getting a patent in return afer all!

What, then, is the situation that Keele Codes are in? Clearly, it depends to a great extent upon the wording of the Patent Claim that defines their invention. If the claim is in terms of a program *per se*, then obviously Category (c) of Section 2 nails it to the ground. But such a claim is highly unlikely, for, as can be seen from Mr Andrews' article, what has been invented is a method of compressing textual information, in which various (so far unidentified) operations are carried out upon the text in some suitable form (as binary digital electronic signals, for example), and it is in a sense purely coincidental that not only is the text itself a computer file but the most convenient way of effecting the method is using a suitably-programmed computer. Without doubt, the invention is more than a computer program as such!

A few of the other categories of unpatentable inventions give one pause for thought, but only for a moment. The invention is not merely a mathematical method, though naturally mathematics is involved in it. Equally, the invention is not merely a scheme, rule or method of performing a mental act, though no doubt one could do it by hand, using a human brain. Finally, the invention is clearly not just the presentation of information, for the invention lies not in how the information is presented but in how it is manipulated to take up less room.

It is evident, upon close and careful study, that even without any knowledge of the method the Keele Codes invention actually uses to compress text it *must* be possible to frame the idea as an invention which does not fall within any of the banned types of Section 2 of the Act. Keele Codes can, therefore, anticipate getting a British Patent in due course — in about two years' time on present form — while *we* can look forward with pleasure to being able to read all about it in the Patent Specification when it is published in August or September 1983!
JPL Hooper, Colchester, Essex

Scottish Show

Isn't the *PCW* Show exciting? I wouldn't know. I stay in Scotland. The chances of me getting to London — for a computer show — are virtually nil.

Since I became a computer user — around 9 months — I have seen *one* computer show in Scotland for microcomputers which the ordinary user could visit. That was the Edinburgh ZX Microfair. All credit to the Edinburgh ZX Club, but the range was rather limited. Now a *PCW* Show. . .

I owned a ZX81 for 7 months. my ZX Spectrum has been and gone (order fulfilled after only eight weeks, one week's use, sent back for faulty keyboard — 3 weeks so far — and if you take that as a criticism of Clive Sinclair's marketing methods he's welcome to it). I'm not just a game-player. I used my ZX81 for a multitude of uses — education, filing. . .

PCW comes near to my ideal computer magazine. The *PCW* Show sounds like my ideal computer show, where I can *see* the new micros, not just read about them. So how about a Scottish show — as near to the standard of the London one as possible — in either Glasgow or Edinburgh — *soon*.
David Allardice, Ayrshire

See page 142 — Ed

Public-key encryption

David Fisher's letter in your December edition prompts me to set the record straight for the benefit of those of your readers who have been following developments in *Science, Scientific American* and the *Daily Telegraph* (20, 30 October).

Two of the public-key encryption methods are the Knapsack which was invented by Merkle and Hellman, and the RSA which is named after Rivest, Shamir and Adleman. The first is no longer thought to be secure because of work by Shamir and Lenstra, as reported in *Science* (28 May) and *Scientific American* (August); the second, which depends on the difficulty of factorising a large number, is just as secure as it was before the publication of Lenstra's algorithm and *ZX Computing* Vol 1 No 2. In order to achieve security the large number must be the product of two 'doubly-safe' primes (*Cryptologia* Vol 6 No 3 page 229).

Testing large numbers for primality has recently taken a step forward although probably by a factor of 2 rather than 10^7. Since the result of a primality test on a composite number merely confirms that it is composite and does not provide the factors as a by-product, an improvement here actually makes the RSA method better because the calculation of a key is quicker. It is claimed in *Scientific American* (July) that an arbitrary 97-digit number was demonstrated to be prime in 78 seconds on a large computer, and that 100 years would previously have been needed, thus apparently showing a speed factor of 10^7. This is misleading because the five-year-old probabilistic test devised by Solovay and Strasssen could do the same in 160 seconds, although only to a confidence level of 0.999999 which is surely satisfactory.

In conclusion, it seems that your July correspondents are well informed because the factoring time of the 150 digit number published in your May edition is about a million years according to the classic article in *CACM* of February 1978. Perhaps a £5000 reward should be offered for the two factors.
D Hunter, Saffron Walden, Essex

The Japanese problem

Your editorial in the December issue of *PCW* drew certain conclusions with regard to the future of the British computer industry, in the wake of your recent visit to Japan, allowing myself and, I hope, others to look forward to continuing debate and increasing awareness of the problem.

I have spent the last six years travelling extensively throughout the world, mainly in the Middle East, as a sales and marketing representative for two companies manufacturing diverse industrial products. Such exposure to the world market has convinced me of two mutually supportive and inevitable future developments. The first of these is that by the turn of the centry the majority of mass-produced capital and consumer goods will be produced in the Far East and other key, currently developing countries. The second is that the future prosperity of Europe and in particular Britain must, and indeed should, by virtue of the skills peculiar to this Isle, lie in the fields of services, research and development, specialist low production quantity products and, above all, brainpower.

The threat to our industrial base from the developed and developing Far Eastern countries is unstoppable unless a total revolution in methods of financing, producing and marketing of our industrial products takes place. Anybody who has seen and/or been at the receiving end of competition from Oriental products has a healthy awareness of the problem, but at the same time feels impotent in the face of the massive market research and design efforts, and State investment, that are the prelude to any serious Oriental production venture.

Hence to the point. Your observation that there exists a ready market for high quality software in Japan hits home at one of the areas where the Japanese are still found wanting, and where productivity is substantially poorer than generally found in the UK. You point out that in spite of this British software houses are notable by their absence in Japan which, I propose, is due to the fear of an unknown market, with the attendant variance in business practice and human relations, and the lack of experience generally in your industry of grappling with the unknowns and the 'grey areas' where business ought to be obtainable but where nobody takes the initiative to go and find out.

Regrettably the computer industry generally tends to be incestuous in its employment of personnel, believing perhaps that the first priority is to know and understand the product, and only then to concern oneself with other skills. Frankly I consider this a dangerous trend as key people in the industry need to devote an excessive amount of time to keeping abreast of new developments, and generally fail, with the inevitable drift towards narrower and narrower specialisation. In any event, whether they be analyst, programmer, director, engineer or even journalist, they cannot devote the time necessary to gain experience in the finer points of carpetbagging their skills around the world.

Selling any product in a non-European or USA market is a combination of public relations, marketing skill, salesmanship and, above all, legwork and common sense. The ability to 'suss' a market and develop it is as much a matter of experience as natural ability. Britain is the most successful exporter on this planet, even today, and there is a wealth of talent available for the asking. Many of these 'street wise' travellers have a rapport with micros and the various operating systems and languages because, like myself, they spend 100 percent of their spare time working on their home based systems. With luck and a fair wind they could become competent at analysing whether a particular software requirement was within the capabilities of their company, and subsequently negotiate the way through for specialists to take over the problem, as indeed happens in many other sectors of industry.

Not being one of the cognoscenti, I may unwittingly be covering old ground and I am, of course, over-generalising. However, the fact remains that I am determined to get out of the engineering industry and into the computer industry at some stage and in whatever capacity I can. It seems to be a shame that I cannot do so in the capacity in which I perform most efficiently, and now, rather than in the future because, in your own words, the British mini and micro industry is going to hell in a basket.

Anyway please keep the pressure on in the media, as I am above all a patriot and, you never know, perhaps somebody will begin to listen.
Peter Dyer, Brackley, Northants

PCW SUBSET

Alan Tootill and David Barrow present more useful assembler-language subroutines. This is your chance to help build a library of general-purpose routines, documented to the standards we have developed together this this series. You can contribute a Datasheet, improve or develop one already printed or translate the implementation of a good idea from one processor to another. PCW *will pay for those contributions that achieve Datasheet status. Contributions (for any of the popular processors) should be sent to SUB SET,* PCW, *62 Oxford Street, London W1A 2HG.*

6502 anybase conversion

In December we had Dennis May's routine, XBIN, to convert to binary an ASCII encoded number of any base between 2 and 36. Here is Dennis's Datasheet BINX to convert the 32-bit binary number back to an ASCII encoded number in any base. In bases higher than 10, digits with values 10 to 35 are represented by the letters A to Z and the ASCII string is terminated by the carriage return (0DH) character.

Datasheet

```
;=BINX - 32-bit binary to unsigned base 2-36 number.
;/CLASS: 2
;/TIME CRITICAL?: No
;/DESCRIPTION: Converts an unsigned 32-bit binary number to
;/             an ASCII number in any base in the range 2-36.
;/ACTION: Push carriage return character onto stack.
;/        Divide number by base required.
;/        Convert remainder and put it on stack.
;/        Repeat until number is zero.
;/        Pop digit off stack and store it in RAM.
;/        Repeat until carriage return popped and stored.
;/SUBr DEPENDENCE: None
;/INTERFACES:  An area of RAM, pointed to by M4-M5, must be
;/             provided to store the result.
;/INPUT:  MO-M3, with the most significant bit in M3, contain
;/        the unsigned 32-bit number to be converted.
;/        M4 (low) and M5 (high) contain the address of the
;/        ASCII encoded result.
;/        MD contains the base that the number is to be converted to.
;/OUTPUT: The converted ASCII string, terminated by carriage return,
;/        is stored in the address specified in M4-M5.
;/        MO-M3 are zero: M4-M5 are unchanged: MD is unchanged.
;/REGs USED: A,Y,P,MO-M5,MD.
;/STACK USE: minimum 2; maximum 33.
;/LENGTH: 55
;/PROCESSOR: 6502

BINX:   LDA  £$0D      ;put carriage return            A9 0D
        PHA            ;character onto stack.          48
DIV:    LDY  £$20      ;set bit count.                 A0 20
        LDA  £0        ;clear accumulator.             A9 00
BINX1:  ASL  M0        ;shift                          06 ZZ
        ROL  M1        ;32-bit                         26 ZZ
        ROL  M2        ;number                         26 ZZ
        ROL  M3        ;left                           26 ZZ
        ROL  A         ;into accumulator.              2A
        CMP  MD        ;if acc is greater than         C5 ZZ
        BCC  BINX2     ;or equal to base number        90 04
        SBC  MD        ;then subtract base number      E5 ZZ
        INC  M0        ;and set result bit,            E6 ZZ
BINX2:  DEY            ;else next bit.                 88
        BNE  BINX1     ;all done?                      D0 EC
        CMP  £$0A      ;convert                        C9 0A
        BCC  ASCZ      ;digit                          90 02
        ADC  £6        ;to                             69 06
ASCZ:   ADC  £$30      ;and                            69 30
        PHA            ;push it onto stack.            48
        LDA  M0        ;if                             A5 ZZ
        ORA  M1        ;32-bit                         05 ZZ
        ORA  M2        ;result                         05 ZZ
        ORA  M3        ;still not zero                 05 ZZ
        BNE  DIV       ;repeat,                        D0 D5
BINX3:  PLA            ;else pop digit off stack       68
        STA  (M4),Y    ;and store it in RAM.           91 Z'
        INY            ;adjust pointer                 C8
        CMP  £$0E      ;and, until carriage return,    C9 0E
        BCS  BINX3     ;do next digit.                 B0 F8
BINX4:  RTS            ;return.                        60
```

XBIN and BINX can be used together to convert an ASCII encoded number in any base to one in any other base. If the new ASCII number may overwrite the old one, this can be done simply with the ASCII string address in zero page RAM locations M4 (low) and M5 (high), the old number base in M6, the new number base in MD and CALL to this subroutine BCNV (see Figure 1).

```
BCNV:    JSR XBIN      ; old ASCII to 32-bit binary
         BCS OVFWX     ;jump if overflow
         JMP BINX      ;binary to new ASCII;cy = 0
OVFWX:   RTS           ;exit with carry = 1
```

Fig 1

If the old number must be preserved, a separate address for the new number will have to be provided and loaded into M4-M5 before the jump to BINX.

Z80 random numbers

For Ettrick Thomson's 31-bit random number generator ('Sub Set' September 1982) Francis Clarke (Swansea) George Sasson (Isle of Mull) and Brian Ripley (Imperial College) have confirmed, with programs in Pascal, Basic and Fortran 77, that 2^9+1 is indeed a primitive element modulo $2^{31}-1$. But Brian thinks it is a bad choice (too small), leading to a generator that fails Knuth's tests. Francis has produced more primitive roots, including $2^{17}+1$, which he thinks might be useful.

In June 82 we asked for a 16-bit generator for $X_{i+1} = (1509X_i+41) \bmod 65536$ and a 32-bit generator for $X_{i+1} = (69069X_i+41) \bmod 2^{32}$ and have received both from Kevin Smith of Aberdeen and John Kerr of Glasgow respectively. Here they are in Datasheets RNDM2 and RDM32.

Datasheet

```
;=RNDM2 - 16-bit pseudo-random number generator
;/CLASS: 1
;/TIME CRITICAL?: No
;/DESCRIPTION: Generates a 16-bit number from the series
;/             Xi+ 1 = (1509Xi + 41) mod 65536
;/ACTION: Xi is multiplied by 1059, thus:
;/        1059Xi = ((32Xi + (16Xi - Xi))*8 + Xi)*4 + Xi
;/        to which is added 41 to give Xi + 1
;/SUBr DEPENDENCE: None
;/INTERFACES: None
;/INPUT: A seed or the previous random number in HL
;/OUTPUT: The new random number in HL
;/REGs USED: HL
;/STACK USE: 8
;/LENGTH: 32
;/TIME STATES: 304
;/PROCESSOR: Z80

RNDM2:  PUSH  AF       ;save                           F5
        PUSH  BC       ;                               C5
        PUSH  DE       ;registers.                     D5
        LD    D,H      ;                               54
        LD    E,L      ;DE<- HL.                       5D
        ADD   HL,HL    ;                               29
        ADD   HL,HL    ;                               29
        ADD   HL,HL    ;                               29
        ADD   HL,HL    ;HL<-HL*16                      29
        PUSH  HL       ;                               E5
        ADD   HL,HL    ;HL<-HL*32                      29
        EX    (SP),HL  ;HL<-HL*16;(SP)<-HL*32          E3
        OR    A        ;clear carry.                   B7
        SBC   HL,DE    ;HL<-HL*15                      ED 52
        POP   BC       ;BC<-HL*32                      C1
        ADD   HL,BC    ;HL<-HL*(32+15)                 09
```

```
        ADD    HL,HL    ;                                       29
        ADD    HL,HL    ;                                       29
        ADD    HL,HL    ;HL<-HL*376                             29
        ADD    HL,DE    ;HL<-HL*377                             19
        ADD    HL,HL    ;                                       29
        ADD    HL,HL    ;HL<-HL*1508                            29
        ADD    HL,DE    ;HL<-HL*1509                            19
        LD     DE,+41   ;                                       11 29 00
        ADD    HL,DE    ;HL<-HL*1509+41                         39
        POP    DE       ;restore                                D1
        POP    BC       ;                                       C1
        POP    AF       ;registers.                             F1
        RET             ;return.                                C9
;=RDM32 - 32-bit pseudorandom number generator
;/CLASS: 1
;/TIME CRITICAL?: No
;/DESCRIPTION: Generates a 32-bit number from the series:
;/
;/              r(i+1) = (69069 r(i) + 41) mod 2^32
;/ACTION: The seed, or r(i), is copied from the 32-bit accumulator
;/        HL,IX into BC,DE (H & B are Ms bytes).
;/        Initialise loop counter (A) to -11
;/
;/        .  HL,IX := 2*HL,IX    (all numbers are mod 2^32)   .
;/        .  If bit 1 of A is zero                              .
;/        .    Then let HL,IX := HL,IX + r(i)                   .
;/        .  Increment A; repeat if not equal to zero.          .
;/        HL,IX := HL,IX + (1+65536+256) r(i) + 41
;/        (The algorithm is based on the regularity of the bit
;/        pattern of 69069 = 12(256+16+1)+1+65536+256)
;/SUBr DEPENDENCE: None
;/INTERFACES: None
;/INPUT: A seed, or the previous random number, in HL,IX
;/OUTPUT: The new random number in HL,IX
;/REGs USED: HL IX
;/STACK USE:.8
;/LENGTH: 43
;/TIME STATES: 1049
;/PROCESSOR: Z80

RDM32:  PUSH   AF                ;                              F5
        PUSH   BC                ;Save registers                C5
        PUSH   DE                ;                              D5
        LD     A,?11             ;Initialise SHIFT loop counter 3E F5
        LD     B,H               ;Copy r(i) into BC,DE          44
        LD     C,L               ;                              4D
        PUSH   IX                ;                              DD E5
        POP    DE                ;                              D1
SHIFT:  ADD    IX,IX             ;HL,IX will hold 25 r(i)       DD 29
        ADC    HL,HL             ; after the first four         ED 6A
        BIT    1,A               ; passes through the loop,     CB 4F
        JR     NZ,NEXTA          ; 409 r(i) after the next      20 04
        ADD    IX,DE             ; four, and 3276 r(i) on       DD 19
        ADC    HL,BC             ; exit from the loop           ED 4A
NEXTA:  INC    A                 ;                              3C
        JR     NZ,SHIFT          ;                              20 F1
        ADD    IX,DE             ;                              DD 19
        ADC    HL,BC             ;HL,IX := 3277 r(i)            ED 4A
        ADD    HL,DE             ;HL,IX :=68813 r(i)            19
        LD     B,C               ;Multiply BC,DE (presently     41
        LD     C,D               ; holding r(i)) by 256 and     4A
        LD     D,E               ; add 'c' (=41), preparing     53
        LD     E,+41             ; to add into HL,IX            1E 29
        ADD    IX,DE             ;                              DD 19
        ADC    HL,BC             ;HL,IX := 69069 r(i)+41        ED 4A
        POP    DE                ;                              D1
        POP    BC                ;Restore registers             C1
        POP    AF                ;                              F1
        RET                      ;                              C9
```

Obscure 8085 instructions

Jonathan Marten of Swansea has written in to tell of his discovery in an obscure Intel publication (he does not say which) of no less than nine unspecified 8085 instructions.

Three of the instructions act on the condition of the K or V flags. You didn't know the 8085 had K and V flags? Well, according to Jonathan, bit 5,F is the K flag, named 'correct sign'. Unfortunately, he does not know what it represents or how it is affected by operations. Bit 1,F is the V flag, named 'overflow', and this appears identical to the overflow function of the Z80 P/V flag.

The opcodes, suggested mnemonics (not recognised by the Intellec ISIS assembler) and actions of the unspecified instructions are shown in Figure 2.

10	RRHL	:Rotate HL right. 16-bit rotation, flags unchanged.
18	RLDE	:Rotate DE left. Bit 15 to Cy. No other flags.
28bb	ADIHL bb	:Add 00bb immediate to HL, setting flags.
38bb	ADISP bb	:As above but to Stack Pointer.
CB	OVRST8	:RST 8 (to 0040) if the V flag is set.
D9	SHLDE	:16-bit move as 'LD (DE),HL'.
ED	LHLDE	:16-bit move as 'LD HL,(DE)'.
DDaaaa	JNK aaaa	:Jump to location aaaa if K flag is reset.
FDaaaa	JK aaaa	:Jump to location aaaa if K flag is set.

Fig 2

The Z80 has unspecified instructions, dealing with the separate halves of the index registers, among other things, and now we find that the 8085 also has a more extensive instruction set than we had supposed. Is this extraordinary state of affairs to be found on other popular processors? If you can discover facilities on your processor which the manufacturer never told you about then write in to 'Sub Set' and share your findings.

FOWIA returns

Not content with his discovery of the 8085 instructions, Jonathan Marten has decided that FOWIA is not pulling its weight and, in true 'Sub Set' spirit, has come up with an improvement.

For the benefit of new readers, FOWIA (Find Out Where I'm At) is a rather elegant 2-byte routine which puts into HL the address of the instruction immediately following CALL FOWIA. HL can then be used for indirect addressing in relocatable code.

Jonathan's grumble is that to be of any real use a displacement has to be added to the value in HL after the call to FOWIA. This not only eats up bytes in the program but also needs BC or DE to be free for use in the addition. FOWIA's action of POP HL; JP (HL) means that the value originally held in HL is lost. Jonathan suggests that it would be more sensible to load the displacement into HL before the CALL and make the routine effectively do an 'ADD HL,PC' instead of FOWIA's 'LD HL,PC' and his routine FOWIAD does just that.

Datasheet

```
;= FOWIAD - Find Out Where I'm At with Displacement
;/CLASS: 1
;/TIME CRITICAL?· No
;/DESCRIPTION: Adds the address of the 1st byte of the instruction
;/             following CALL FOWIAD to HL
;/ACTION: See comments
;/SUBr DEPENDENCE: None
;/INTERFACES· None
;/INPUT: Displacement in HL
;/OUTPUT: HL = HL+PC; F reflects 16-bit addition
;/REGs USED: HL F
;/STACK USE: 2
;/LENGTH: 9
;/TIME STATES: 92
;/PROCESSOR: Z80/8080/8085

FOWIAD: EX   DE,HL        ;disp to DE, DE to HL            EB
        EX   (SP),HL      ;DE on stack, ret address to HL  E3
        PUSH HL           ;save ret address                E5
        ADD  HL,DE        ;displaced address into HL       19
        POP  DE           ;ret address to DE               D1
        EX   DE,HL        ;disp addr to DE, ret addr HL    EB
        EX   (SP),HL      ;replace ret address on stack,   E3
        EX   DE,HL        ;original DE to DE and exit      EB
        RET               ;with displaced address in HL.   C9
```

6502 combination jump

Vincent Fojut of Altrincham, who put in such sterling work improving the 32-bit 6502 maths routines, has sent LONGBR, our last Datasheet this month. LONGBR was born out of Vincent's envy of the 6809's 16-bit branches and his desire to have such handy instructions on the 6502.

There are 13 different conditions resulting from the seven flags of the Status Register P. Each flag can be set or reset, except for the Break flag B which is always set to 1 as far as the programmer is concerned. Vincent questions the need to use 13 different routines to branch on those conditions. Instead, he uses just one routine which compares a bit-mask pseudo-opcode with the P register. This effects a jump only if the state of the flags indicated by the opcode match the condition also indicated by the opcode.

Figure 3 shows the position of the flags in the P register. Bit 5 is not used. The opcode passed to LONGBR uses Bit 5 to indicate whether a jump will occur if the flag to be tested is set or reset. The flag to be tested is indicated by a set bit in the corresponding position in the opcode. So, for example, the opcode value for BDC (Branch if Decimal flag Clear) is 00001000 (08H) and for BDS is 00101000 (28H).

Although Vincent does not include the possibility in his Datasheet documentation,

Bit number	7	6	5	4	3	2	1	0
Flag	S	V	B	D	I	Z	C	

Fig 3

PCW SUBSET

LONGBR is capable of performing a test on more than one flag at the same time. Eg, if the opcode is 00100011 (23H) a branch will occur only if both Z and Cy flags are set.

Datasheet

```
;=LONGBR - 16-bit long branch
;/CLASS: 2
;/TIME CRITICAL?: No
;/DESCRIPTION: Causes branch to address formed by adding the 2-byte
;/             displacement embedded at Return Address + 1 and 2 to
;/             Return Address + 3 if flag conditions match the test
;/             conditions of pseudo-opcode embedded at Return Address
;/             else returns to Return Address + 3.
;/ACTION:    Check Bit 5, opcode for 'clear' or 'set' branch
;/           Check condition of required flag
;/           Compare flag state against branch condition
;/           If match then add displacement to Return Address
;/           Add 4 to get true Return Address skipping parameters
;/           Jump to computed Return Address.
;/SUBr DEPENDENCE: None
;/INTERFACES: None
;/INPUT:  (R.A.) = pseudo-opcode, (R.A. + 1 & 2) = displacement
;/        opcodes: BCC 01; BCS 21; BNE 02; BEQ 22; BIC 04; BIS 24
;/                 BDC 08; BDS 28; BVC 40; BVS 60; BPL 80; BMI A0
;/                 BRA 30 (branch always as B flag always set to 1)
;/OUTPUT: Program Counter is set to address of next instruction if
;/        condition is false, or to next instruction + displacement
;/        if condition is true.
;/REGs USED: M0-M3
;/STACK USE: 2
;/LENGTH: 81
;/TIME STATES: no branch: 115-119; branch: 152-156
;/PROCESSOR: 6502

LONGBR: STA  M2         ;save accumulator                     85 ZZ
        PHP             ;and flags                            08
        PLA             ;in                                   68
        STA  M3         ;M2 and M3                            85 ZZ
        PLA             ;get Return Address                   68
        STA  M0         ;in M0                                85 ZZ
        PLA             ;and                                  68
        STA  M1         ;M1                                   85 ZZ
        LDA  M3         ;put copy of flags                    A5 ZZ
        PHA             ;on stack                             48
        TYA             ;save Y                               98
        PHA             ;and                                  48
        CLD             ;set binary mode                      D8
        LDY  £1         ;get pseudo-                          A0 01
        LDA  (M0),Y     ;opcode in A and                      B1 ZZ
        TAY             ;in Y                                 A8
        AND  £$20       ;check Bit 5 for 'clear' or 'set'     29 20
        PHP             ;branch, saving flag result           08
        TYA             ;opcode into A again                  98
        AND  £$DF       ;mask out Bit 5 getting flags to test 29 DF
        AND  M3         ;use opcode mask to isolate required  25 ZZ
        PHP             ;flag from copy in M3, move results   08
        PLA             ;into A and                           68
        AND  £2         ;get Zero flag result, set or reset,  29 02
        STA  M3         ;in M3                                85 ZZ
        PLA             ;recover condition flag result        68
        AND  £2         ;isolate Z result & exclusive-or with 29 02
        EOR  M3         ;test-flag Zero result to compare     45 ZZ
        BNE  NOBR       ;jump if no match                     D0 12
        LDY  £3         ;else condition is met so             A0 03
        LDA  (M0),Y     ;add displacement embedded at         B1 ZZ
        PHA             ;Return Address + 1 & 2 to Return     48
        DEY             ;Address -1 stored in M0,M1           88
        LDA  (M0),Y     ;to give branch address               B1 ZZ
        CLC             ;still needing 4 to be added to       18
        ADC  M0         ;take account of the three            65 ZZ
        STA  M0         ;embedded parameter bytes and         85 ZZ
        PLA             ;the incomplete increment of the PC   68
        ADC  M1         ;stacked as return address by         65 ZZ
        STA  M1         ;JSR                                  85 ZZ
NOBR:   CLC             ;add 4 to get true                    18
        LDA  £4         ;Return/branch Address                A9 04
        ADC  M0         ;in M0,M1                             65 ZZ
        STA  M0         ;                                     85 ZZ
        BCC  RESTOR     ;                                     90 02
        INC  M1         ;                                     E6 ZZ
RESTOR: PLA             ;restore Y A 'P                       68
        TAY             ;                                     A8
        LDA  M2         ;                                     A5 ZZ
        PLP             ;                                     28
        JMP  (M0)       ;jump to Return/branch Address.       6C ZZ 00
```

Documentation rules OK!

Most contributors to 'Sub Set' do document and test their routines but there are a few (no names, no pack-drill) who do not. It is sometimes a Herculean task to plough through lengthy undocumented code so please try and provide some documentation, especially comments, with your submissions.

SUBSET INDEX

Looking for that special Datasheet but can't remember which issue it was in? Here's a handy index to help you. . .

BANKS' STATEMENT

Martin Banks asks why anyone would want a home computer and whether it's just another passing craze.

HOME COMPUTERS–GOOD OR BAD?

The two children were squabbling again, arguing over whose turn it was next. Their mother, initially indulgent, now frowned at the sight of her children starting once again to fight over something that she secretly thought was a waste of money.

'Somehow', she said wearily, and not a little worried, 'it seems to stop them thinking.'

What could this something possibly be? What was the IT that could stop young, developing minds from automatically exercising a normally limitless supply of imagination? From an outsider's point of view it might easily be construed as an IT or something we could well do without. If it makes children fight and argue, if it stops them thinking, then maybe we should find other things for children to do, or play with.

The 'thing', of course, was a home computer, one of the new breed of machines (and not so new according to some manufacturers) that are specifically designed for use by everybody at home for fun, education, hobbies and the like. For well under £100 you too can join in on the brave new world and teach your children to become TJs.

Now at this juncture I can hear a million voices raised in horror at the mere hint of a suggestion that, just possibly, home computers might be the thin edge of a wedge that could make future generations little more than automatons. Yes, I agree that it is an overly hard judgement to make of a whole industry when it has hardly started.

Yet already the signs are there that as much, if not more, damage will be done as there is good achieved. What is more, good can usually be seen at once, while damage often shows through only after it has been done.

This is not, I hope, going to be a diatribe — but there are one or two things about the home computer, and the home computer industry, that worry me. I have said before in these pages that I am not one of the greatest 'techno-freaks' around. I can argue along with those that want to talk 8-bit versus 16-bit architectures, even know more than them sometimes, but at the end of the day I have always ended up asking myself — when confronted with the fact that a brand new company has just introduced a brand new 64-bit, 1.5 megabyte computer the size of a small paperback book at a price of £17.54 — why should I want one anyway? The answer prejudices all further thoughts on the subject.

This is the source of my concern with the home computer industry: will it actually last?

Now stop laughing, for there is some evidence to indicate the possibility that it might not. There are also some historical precedents. There have been several consumer 'boom' products in the past, and many of those that really boomed in a big way ended their lives tucked into the corners of cupboards, forgotten. It would be sad to think of the home computer as the next hula-hoop.

People in the industry, not unnaturally, feel confident the business will go on forever. After all, Sinclair sells ZX81s by the hundredweight. Texas Instruments, which claims to have started the business with the TI99/4, was pitching at an installed base in the USA of 500,000 units by Christmas. TI also claims to be outselling Commodore with its VIC-20, which makes for interesting mathematics because Commodore claims to have sold a million of them.

But all this feverish activity can be the precursor to either more feverish activity, or nothing. It could be the latter unless the products (and more specifically the software) improve. It is still an industry that is being 'bought-from', rather than one that is 'selling-to'. I saw this myself in a high street shop recently. A couple were interested in a home computer. The salesgirl smiled blandly, offered them no real help and tried to work out what her commission might be on the sale. Along comes another punter, who said, 'I wouldn't buy that, the software is no good.'

'Thank you,' said the couple and walked off. The salesgirl smiled blandly and kissed her commission goodbye.

Once the people who *want* to buy a home computer run out, will the industry be able to attract the others? And if so, what will they use to attract them? I hope to God it isn't just games.

Now I'll come clean and say that I don't really like video/computer games. I always end up thinking 'so what?' after playing

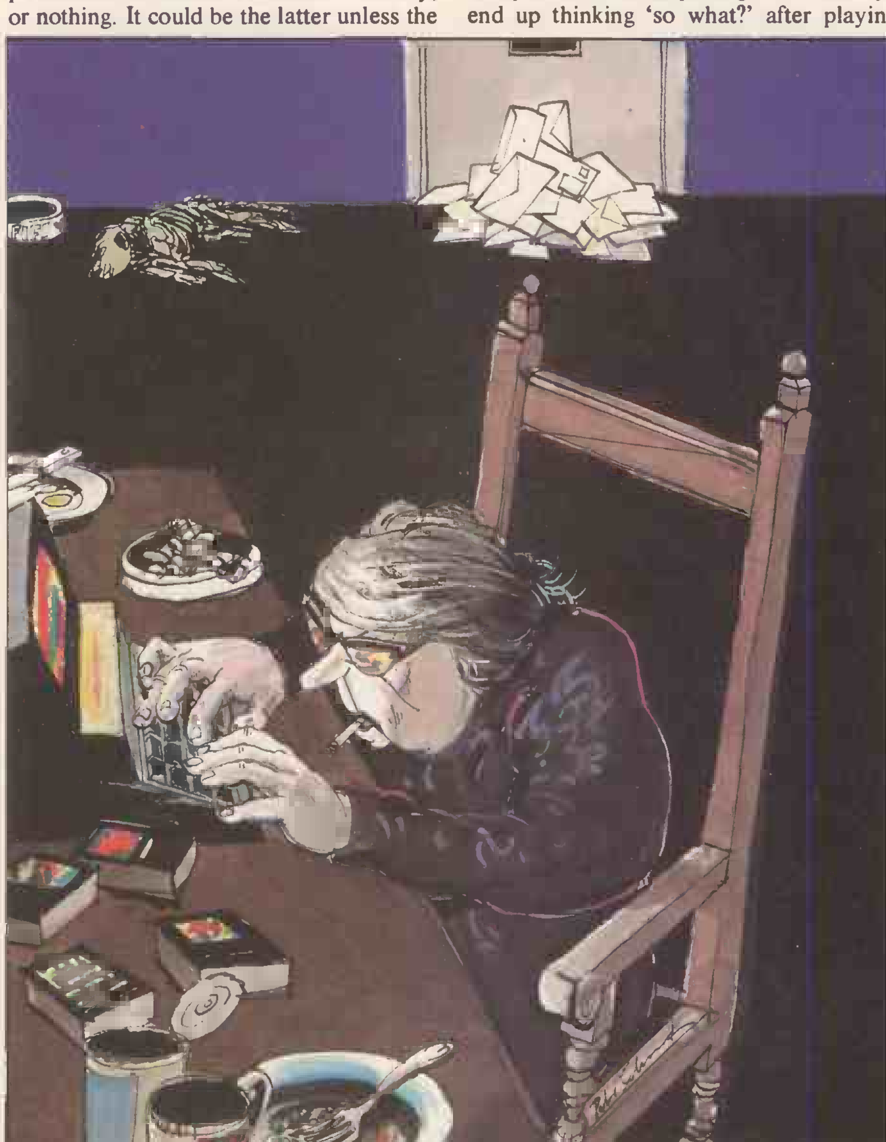


Illustration by Peter Shrank

them. (People who say that this is because I always lose may have a small point.) I always feel that there must be much more that can be done with all this technology than pretend to fire pretend rockets at pretend invaders from pretend space.

The capability of the games that are now available go well beyond the scope of Space Invaders, of course, and they will get to be even more complex. But once again I end up asking myself why? why bother? what does winning or losing actually achieve? and couldn't all that power be put to much better use?

It is here that the subject of software and its development has such a big part to play in the future well-being of the home computer industry and, perhaps more importantly, the people who use its products.

If the industry is to survive, it must have products that have a long-term future. This specifically means software, for the capabilities of the technology used make hardware essentially irrelevant — you can design what is needed. A long term future means software products that hold the interest of their users, or are of some tangible benefit to them. These can be in such areas as hobbies, or education or, even though it hasn't caught on yet, the whole area of home management.

Early research has already started to show that the typical usage pattern for a game program is almost constant use in the early days after purchase. This can last as much as a week. The amount of usage then starts to tail off until, after maybe a month, the game is consigned to a cupboard and forgotten. This can partly be explained by the fact that the majority of games programs are tolerably banal. Many are based upon restricted numbers of possible actions and reactions that, once learned, allow the player to win with ease. From this point on, interest soon wanes.

But as the capabilities of the hardware continue to improve, allowing the programs to become more complex and interactive, so these programs will take on a new and potentially dangerous role. Though computing power can be used for a wide range of purposes, there is a chance that it could be used to create games programs of immense power and complexity, allowing the player ever-greater interaction and 'control' over what appears to be happening.

What we are seeing now could be the actual, definable start-point of all those science-fiction books that have as their central theme the proposition that the whole population lives its entire life in cells, never doing anything, only playing games of fantasy that are intended to numb the brain.

We all say that such a thing will never happen in reality, but our forebears also laughed at Jules Verne. The potential for such systems to be constructed is most certainly there, and the games programs are coming. There is already one in the USA I have heard of (though not seen) called 'Millionaire'. This is, I understand, a game of fantasy which allows the player to act out in a small way the role of a millionaire. Like a cross between Visicalc and Monopoly in real time, property, things and people are bought and sold while the player tries to accumulate extra wealth.

Such games are, I feel, inherently dangerous. The greater the degree of 'real' fantasy that is possible, the greater will be the detachment of people from what is real. Now, there are many that would argue that being detached from reality is no bad thing. After all, the state reality is in at the moment there ain't too much to write home about. But unlike the case where, if there is a big enough consensus of opinion on a subject then by definition a Truth has been arrived at, detaching from reality to live inside the mind of a computer-driven game of fantasy will not change reality. Space Invaders do not eradicate bodily functions.

To live in such a way — by the machine as it were — is to become the machine. As the mother at the beginning of this piece put it, 'My children are not communicating with each other when playing with the computer, except to fight. They do not look at each other, yet the machine doesn't care who is playing, it could be anyone. Somehow, personality becomes irrelevant.'

Such fears as these concern events that are well out into the future, and pre-suppose that the home computer industry will survive. There are many reasons to suppose it will, however, and evidence to suggest that embryonic versions of such games are already with us. I would like to think that other people are aware of the potential — both for good and bad. END

FRASERS

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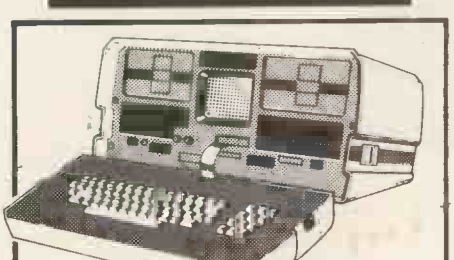

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SOFTWARE
DATABASE BENCHTEST

BusiPost

Kathy Lang tests a specialised information retrieval system for mailing lists.

And now, as they say, for something completely different — well, almost. As regular readers will know, most of the articles in this series have reviewed general-purpose data management systems, designed to take a variety of data and manipulate information in lots of different ways. The advantage of this approach is that it caters for many pretty different kinds of application, from sales ledger to job costing and from personnel records to library catalogues. The disadvantage is that the image to the user has to be in general terms, too; often, users find it hard to relate the features of a general purpose data management system to their own particular application needs.

So this month I've looked at a package designed to handle textual information of a particular kind — names and addresses — but in a flexible way so that many people who need to maintain mailing and contact lists should be able to apply it directly to their needs. The package is called BusiPost and comes from a London-based company called BusiSoft, which supplied my review copy. This was a pre-release version; the full system should have been announced well before you read this review but will have some extra features which I wasn't able to try.

The main aim of the package is to provide a flexible and powerful mailing system, which will yet be easy for an inexperienced user with limited objectives to operate. It gives the ability to set up and maintain a mailing-cum-contact list and to report on requirements for action and diary activities. BusiPost has a simple word processor as well, so you can send standard letters, or letters composed of standard paragraphs to all or just a selection of people on your mailing list. It does not aim to be a general purpose system and is, therefore, more limited in its features than many of the packages I've reviewed.

BusiPost runs under CP/M-86 and will shortly be available under MS-DOS; I tested it on a Sirius but versions for other systems using MS-DOS are planned. BusiSoft tailors the package to use the available function keys to complement the use of screen menus. The package does not interface directly with the operating system but runs under a system called Turnkey, which handles all the 'housekeeping' such as disk copying and program loading. This means that the user accesses such features through a menu rather than by commands and error handling is much more user friendly than under straight CP/M or MS-DOS. The initial Turnkey menu is shown in Figure 1.

When running BusiPost the user types a space to indicate the need to run a program and gets a second menu with all the available programs shown. These include a program to tailor BusiPost for particular printers, which dealers will be expected to do for their customers. Once BusiPost has been loaded, the main package menu is displayed, as shown in Figure 2.

Constraints

Because its aim is to provide simple and powerful name and address facilities, BusiPost uses just one screen format for entering and displaying data. This frees the user from having to decide on the structure of the records and the layout on the screen, but of course obliges him or her to keep within the BusiPost format. This format uses 800 characters per record, and the program can accommodate a maximum of 32,000 records. (Of course such a volume would exceed the capacity of a single floppy disk but I understand that the program can arrange for disks to be changed while processing the mailing list.) There are no facilities within the program for calculation on individual fields or totalling across records, nor is it at present possible to import data to or export data from BusiPost, though I understand that this should be possible soon.

Data input and updating

Data input is accomplished simply by calling up the 'Add new address' option on the menu and then typing in each address in turn. Address records are accessed through the name field, so to amend a record you just type in the appropriate name in response to a prompt. BusiPost has a range of verification features, such as checking the validity of a date, and preventing you from entering an 'action date' in the past. (I could think of some situations in which the latter might be a handicap. . .) You can have either a correct field or an empty field — you aren't allowed to leave a field until it is correct — and when amending you aren't allowed to alter parts which should remain unchanged, such as the reference name.

```
                         Master Menu

Disk Name : Wordprocessing
Disk Date : 1 AUG 1982,  1:28 p.m.


          Space  =  Select a Program

            S    =  Swap Disk in Drive A

            D    =  Display Disk Directory

            C    =  Copy Disk

            N    =  Change Disk Name

            F    =  Erase, Move or Rename Files

            X    =  Exit to CP/M "A>"-Prompt


                  Please Choose
```

Fig 1

The program allows you to input everything in lower case and capitalises for you as it thinks fit (you can override that if you want to). I expected to find the automatic capitalisation irksome, but in fact it's a great help in maintaining consistency of presentation, for instance when typing post codes, and in capitalising first letters of words. BusiPost also takes full advantage of being tailored for a particular system, using most of the special purpose keys such as cursor movement — a table showing the available functions is shown as Figure 3.

Screen display

The standard screen format used by BusiPost is shown in Figure 4, partly filled in as an example. In each position (other than Action Date) where pairs of slashes are shown, a date is inserted automatically by the program. So you have a record of each occasion when you entered comments and a note of the last date on which action was taken on that form.

Access to each record is through the name field; this can be given as loosely as you like, for instance just giving the first letter of the name — BusiPost will then allow you to browse through matching records with 'Next' and 'Previous Record' function keys. The file is kept in alphabetical order of the name field, unless you request a sort on some other field; the file is then maintained in the new order until different instructions are given.

Printed reports

BusiPost provides two main forms of printed reports. You can get a list of all the records or a selection from them, in two flavours: follow-up reports and diary reports. A follow-up report lists all those due for action according to a comparison between today's date (input by the user at the start of each BusiPost session) and the date in the Action Date field. A diary report is used to display all records with activity between two dates, so it can be used to show information about appointments, meetings, etc. In either case, BusiPost will report as many records on each page as possible and assumes continuous stationery in the printer.

You can also use the BusiPost simple word processing facilities to produce standard or one-off letters. Several standard letters are provided for you to amend, or you may create your own. You may incorporate several standard letters at specified points in the letter you are editing, thus making it possible to construct a letter from several standard paragraphs. However, the maximum length of letter is quite limited — about the equivalent of one A4 letterhead page typed in single spacing. Letters are printed on separate pages, and you can opt either to use continuous stationery or to request BusiPost to pause while you change paper.

Whether you are composing letters or reports, you can incorporate any of the fields on your address form anywhere in the text. Every field on the address form is represented by a letter is printed. Figure 5 shows the address records with the field identifiers displayed.

In the system as installed the special symbol used to show where an address field should go is an @ sign; you can change this to anything you wish, and I used ampersand (&) throughout my examples. Here is my format for a follow-up report — !&1&2&/3 &8 &Q/. Figure 6 shows the result of requesting a report on my sample data using this format.

Another example in Figure 7 shows a sample standard letter, with Figure 8 showing an example of a letter printed with that format.

BusiPost is quite flexible in its provision for regulating printing. For instance, you may use a variety of line spacings and pitches including all the most common settings if your printer has this capability. You can also use underline and bold for emphasis

```
                    Master Addressing Menu

              A   Add new Address
              V   View, Change or Delete Address
              F   Print Follow-Up List
              L   Print Letters
              P   Print Postcard Labels
              R   Print Reports
              C   Choose Addresses
              S   Sort Addresses
              X   Exit Program
                  PLEASE CHOOSE
```

Fig 2

Editing keys:

	CLR	Moves to top left of form
	DEL CHAR	Deletes a character
	LINE INS MODE	Inserts a character
Shifted	LINE INS MODE	Inserts a line
	LINE DEL EOL	Deletes from the current cursor position to the end of the line.
Shifted	LINE DEL EOL	Deletes the current line
	SCROL	Scans quickly through the form
Shifted	SCROL	Scans upwards
	CURSOR UP	Moves Cursor one line up (previous box)
	CURSOR DOWN	Moves Cursor one line down (next box)
	CURSOR RIGHT	Moves Cursor to the next box (or the next character)
	CURSOR LEFT	Moves Cursor to the previous box (or the previous character)
	TAB	Tabs 8 positions to the right, except in date or amount boxes
	BACKSPACE	Moves one character to the left
	RETURN	Moves to next box
	UNDL ON	Undesrline start symbol ($U)
	RVS OFF	Underline end symbol ($U)
	ESC	Equivalent to function key 7

Fig 3

```
Company/Ind Name          Category  ActnDate  Action
Busisoft                  X123F     01/09/82  Order BusiPost

Contact : D. A. Cooper, Esq.                    Notes
Dear....: Mr. Cooper                     15/08/82 wrote to request
Position:                                15/08/82 details of busipost
                                           /  /
Telephone: 01 381 4337                     /  /
                                           /  /
          Details of Address               /  /
Mail as:  FIRST CLASS                      /  /
Dep'mnt:                                   /  /
Company:  Business Software Services Ltd   /  /
Street :  2B Seagrave Road                 /  /
Area   :  Fulham                           /  /
Town   :  LONDON                           /  /
County :                                   /  /
PstCode:  SW6 1SF          P/O Area:       /  /
                                           /  /
Our Ref:  Order No. 9876                   /  /
Your Rf:                                   /  /
Copyright (C) 1982 BusiSoft                                ADD

1 Help  2 Next  3  4  5 Restart  6 Print  7 Finish
```

Fig 4

BusiPost

and force new lines and new page. People using the system for cheques can provide for asterisks in otherwise empty boxes.

Selection

I've already mentioned the follow-up and diary features. You can also select records according to the values of any fields. Comparisons allowed are equal and not equal, less than and greater than, less than or equal to and greater than or equal to. Where the comparison string is shorter than the field in the record, the comparison is made only up to the end of the shorter string, so a comparison string of Smith would match Smithson too. If you want exact matching you can use 'exactly equal to' instead. Comparison is left-to-right and uses the ASCII sequence, with Z being greater than A but less than a; since you are not allowed to have fields starting with spaces, you can identify empty fields by asking for the field to have a value less than zero. Comparison is cumulative, that is you can only AND selections together, not OR them. You could of course achieve OR by using several selections and sending the same letter to each set chosen.

Sorting

Address records can be sorted into alphabetical order on any one field if you need that. At the moment the smaller version of the Sirius can sort only 6000 records, but this limit is likely to be lifted before many people have managed to type that many records in. . .

Other features

BusiPost doesn't have any features for calculating. It can't read or write files in formats other than its own, and it can handle only one file of addresses at a time. No security is provided, although there are somes valuable validation features. Tailoring is very limited, but users who buy the software from a good dealer wouldn't need much as it should come ready set up for the hardware, and the software procedures are so simple and specific to the application that they don't really need further tailoring. Housekeeping (such as disk copying) is provided by Turnkey, which seemed a useful system and might be very helpful in protecting users from the nasties of the operating system — interested readers should keep their eyes open for a future article covering several of these 'supervisory programs'.

User image

I found the user image of the software by and large excellent. Menus are quite appropriate where the application is limited and well-defined, and once I got used to the sequencing I found it very easy to use; indeed quite a number of people (including some of the *PCW* editorial staff) have got to know the package with the bare minimum of documentation or none at all. On the whole I thought the implementation using function keys had been very well done, though at times I got confused because I could use either a function key or a character indicated on a menu to carry out a particular task. There was also a little inconsistency in the use of the cursor keys between the data input and letter composition phases. But these are minor quibbles about a well-designed user image. I found the Help facilities particularly well thought out, as is appropriate in a package aimed at novice users.

In the released version of the package there will be two manuals — one a tutorial introducing users to the features of BusiPost, and the other a reference manual giving more detail. I had only a draft of the tutorial, which was excellent as far as it went; but even with a specific application in mind some kind of reference manual is necessary if only to show all the features of the package.

Cost

It is expected that initially BusiPost will cost £150. This includes a disk with several sample letters and reports, so that users can experiment with those before designing their own.

Conclusions

BusiPost is designed specifically to permit easy and flexible maintaining and processing of name and address records. It does that job extremely well, with a helpful approach which should be good for novice users without boring the more experienced. If you have this kind of application then, so long as you don't expect to develop it into a full blown data management system, you should find BusiPost well worth investigating.

```
Company/Ind Name          Category  ActnDate  Action
1111111111111111111111    22222222  33/33/33  44444444444444444444444444444444

Contact   : 555555555555555555555555555555      Notes
Position  : 666666666666666666666666666666      PP/PP/PP QQQQQQQQQQQQQQQQQQQQQQQ
Dear....  : 777777777777777777777777777777      RR/RR/RR SSSSSSSSSSSSSSSSSSSSSSS
                                                TT/TT/TT UUUUUUUUUUUUUUUUUUUUUUU
Telephone: 8888888888888888888888               VV/VV/VV WWWWWWWWWWWWWWWWWWWWWWW
                                                XX/XX/XX YYYYYYYYYYYYYYYYYYYYYYY
          Details of Address                    aa/aa/aa bbbbbbbbbbbbbbbbbbbbbbb
Mail as: AAAAAAAAAAAAAAAAAAAAAAAAAA             cc/cc/cc ddddddddddddddddddddddd
Dep'mnt: BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB       ee/ee/ee fffffffffffffffffffffff
Company: CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC       gg/gg/gg hhhhhhhhhhhhhhhhhhhhhhh
Street : DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD       kk/kk/kk lllllllllllllllllllllll
Area   : EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE       mm/mm/mm nnnnnnnnnnnnnnnnnnnnnnn
Town   : FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
County : GGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGG       oo/oo/oo PPPPPPPPPPPPPPPPPPPPPPP
PstCode: KKKKKKKKKKKKKKKK Area Code: LLL         qq/qq/qq rrrr  Amount  sss,sss.ss
                                                tt/tt/tt uuuu  Letter    vvvvvvvv
Our Ref  : MMMMMMMMMMMMMMMMMMMMMMMMMMMMMM       ww/ww/ww xxxx  First entered
Your Ref : NNNNNNNNNNNNNNNNNNNNNNNNNNNNNN       yy/yy/yy zzzz  Last updated
Copyright (C) 1982 BusiSoft                                           BusiPost
```

Fig 5

Report of Follow-Up Addresses on 15 December 1982

Pixie Holidays	A	12/12/82	05036-7799	Holiday tour company
FENLAND MOUNTAINS	B	12/12/82		Top of his tree
Hills	C	10/12/82		Makes a good cuppa

Total: Follow-up Addresses

Fig 6

$0
&(&A
&5
&6
&B
&C
&D
&E
&F
&G
&H
&I
&J &K
&)

Dear &7,
Happy birthday to you, dear &7. I hope all is well in &F.
Yours sincerely,

W. U. Ever.

Fig 7

15 December 1982

FIRST CLASS
Mr V. Funny
Managing Director
Booking
Pixie Holiday Tours
Quayside
St Nicholas
PIXIETOWN
Cornwall
PL97 9HJ

Dear Vincent,
Happy birthday to you, dear Vincent.
I hope all is well in PIXIETOWN.

Yours sincerely,

W. U. Ever.

Fig 8

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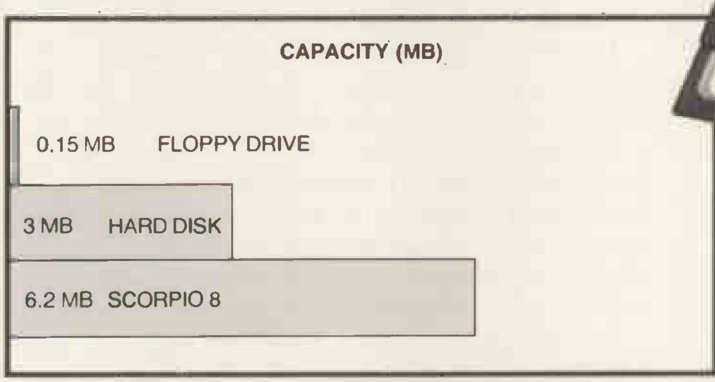

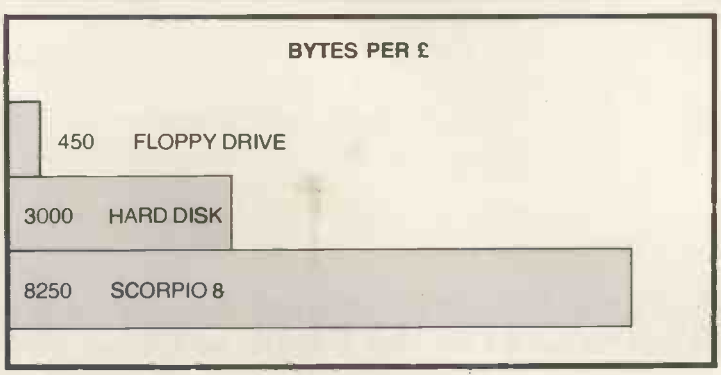

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The Scottish Personal Computer World Show

In 1982 more than 47,500 people visited the 5th *Personal Computer World* Show at London's Barbican Centre. A survey carried out at the Show revealed that 81 percent of this audience had access to a micro, and — more importantly — were planning to update or replace their machine in the near future. Inevitably, though, the majority of those at the Barbican came from the South of England.

To cater for the undoubted market in Scotland — 46 percent of the population in the Edinburgh and Lothian region are managerial or professional people (a higher level than in the UK as a whole) — Montbuild Ltd, which is responsible for the annual London Show, is organising the first Scottish *Personal Computer World* Show, over the weekend of 16-18 April 1983.

Montbuild is part of the same group as the organisers of the Scottish Ideal Home Exhibition — Scottish Industrial and Trade Exhibitions. The Ideal Home Exhibition is an established annual event in Edinburgh, attracting over 40,000 visitors, and this year it will run concurrently with the Scottish *Personal Computer World* Show.

The venue is the MacRobert Pavilion, part of the Ingliston Exhibition Complex, which offers exhibitors the finest exhibition setting outside London or Birmingham.

The MacRobert Pavilion is ideally situated: 20 minutes by car or bus from Edinburgh's West End; adjacent to Edinburgh Airport; 30 miles from Glasgow.

There is plenty of parking space nearby, there are full catering facilities available, and there is ample hotel accommodation in the area.

Facilities for exhibitors are superb, including the Exhibitors' Club inside the hall, an area for the exclusive use of exhibitors and key buyers.

Montbuild is mounting a powerful advertising and promotional campaign, directed at trade and professional publications and consumer journals. There will also be radio, TV and press previews of the event. A major feature of this publicity will be joint advertising promotions with the Ideal Home Exhibition, sponsored by the *Edinburgh Evening News,* a paper that is read by half a million people daily.

The Scottish *PCW* Show will cover both main sectors of micro applications: professional — commercial, scientific, technical and educational — and the booming home market.

The business side should be of great interest to the many local industries. Edinburgh is a major centre for insurance, banking, architecture, the professions and many light industries. With North Sea oil and its satellite manufacturers, Scotland is assuming an ever-increasing importance in many industries, and the Show will be an ideal opportunity for people in those areas to keep abreast of the latest technological advances.

So, whether you want a new spreadsheet package for your business, or you just want to see the latest range of software for your Sinclair Spectrum or VIC-20, the Scottish *Personal Computer World* Show will cater for your needs.

There is still plenty of stand space available. If you would like to exhibit, or if you just require more information, contact Timothy Collins at Montbuild Ltd, 11 Manchester Square, London W1M 5AB. Telephone 01-486 1951.

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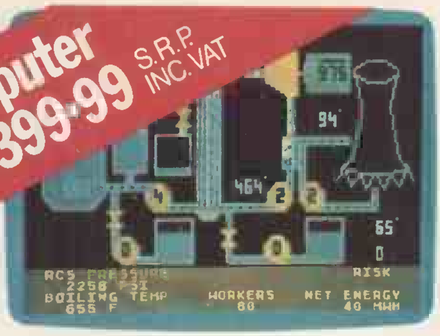

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PUTTING IT ALL TOGETHER

A social revolution in networking

Terry Lang begins an investigation into the mysteries of computer networking.

This is the first of a short series of articles which aims to explain in general terms some of the problems and some of the solutions which arise in computer networking. But first we should consider for a moment just why we should bother, since networking is hedged about with a jargon and a mystique even more dense than those which surround computing in general.

Perhaps one of the most significant benefits of microcomputers has been that each user has been able to do his or her own thing, unencumbered by the hindrances (but also the help) arising from other users and from complex operating systems. Even so, a number of networks have been developed to connect together microcomputer systems, especially in the field of education, to give economic access to shared filestore and to expensive peripherals. And for some time the microcomputer industry has been addressing (with a degree of success which might usefully form the basis of another article) the problems of the small business which needs just a few terminals to have simultaneous access to shared data. In the case of the bigger brother mainframes, networking has been more commonplace, with large corporations making heavy use of the distribution of data and of computing power. In these cases the problems have perhaps been fewest where the whole system has been under the control of one central organisation.

As for the present, all parts of the computer industry, encouraged by the success of word processing, foresee an enormous market in 'the electronic office', and are therefore hell-bent on also producing the networking mechanisms that are needed to support it. There is interest in the distribution of information which goes beyond office automation, however, and the development of bi-directional cable systems into every home would make possible social revolutions in retailing, in entertainment, and in work and travel patterns.

The control and enjoyment of these developments is of course a matter for much wider debate than just within the computing profession itself. But in so far as the speed and scope of these changes will be constrained by the practical development of computer networking, an appreciation of this field will be most valuable.

What is networking about?

We should first attempt to define in a little more detail just what is meant by 'computer networking'. Broadly speaking, it is the bringing together by the transmission of information, of users, of data, of processing hardware and of software. Specific examples would include:

— a network of terminals connected to a central computer system, to give distributed access to a central database;
— a network of computer systems some distance apart, to distribute computer power to where the bulk of the data arises (eg, systems in the branch offices and head office of a large company);
— a network of computers placed close together, to combine computing power and to share expensive filestore (eg, a cluster of microcomputers connected to a central filestore);
— a network of computer systems and peripherals, to share access to expensive peripherals (eg, printers, plotters);
— a network to move data between widely distributed users, to give fast authoritative communications (eg, 'electronic office', transfer of retail and wholesale orders).

Who is it for?

In all this, it is important not to get carried away by the technology (assuming you like that sort of thing), but to remember that the end objective is always the delivery of a computing service to people, and/or useful communication between people. Therefore the conversion of information at the interface between people and the terminal points of the network ultimately determines what can be achieved. This implies conversion (in both directions) between the human senses of sight, hearing and touch, and computer-encoded electronic signals. In this respect the input of text via a keyboard and the output of text by screen or by printer is of course the most commonplace, though even here there is a wide range of variety and subtlety.

The input and output of speech by computers has proved less easy, except where confined to a fairly restricted vocabulary. In one sense, however, the encoding of speech signals is already commonplace, and that is in the telephone network. Furthermore, while this encoding was once simply analogue in form (ie, conversion to a voltage or current proportional to the loudness of the sound), the use of digital encoding (ie, to a binary number similarly describing the loudness of the sound) is now common. (This has also been extended to the facsimile transmission of pictures.) On the other hand, the use of digital form of the speech signals is easily amenable to data processing in the conventional sense.

The tensions between this similarity in the one sense and difference in the other explains some of the love-hate relationship between computing networks and voice networks. Historically the telephone networks were developed first, and these were subsequently utilised for transmission of computer data. The next stage was the development of separate data-only networks where the computer people sought to escape the straitjacket of the old voice systems. The current stage of development however is towards a re-convergence of these forms in one network, partly because of the economics, but also because of convenience for the user, who often wants to treat both computer data and voice and facsimile as closely related information.

How far can you go?

Clearly a major factor in the transmission of information is the distance over which it has to be delivered. Distances can in fact range, as the examples given earlier imply, from the very short (eg, within a single computer cabinet) to the enormous (eg, the furthest spaceship). This range is actually a complete spectrum, but it can be convenient to divide it into four different categories where the emphasis and problems are somewhat different:

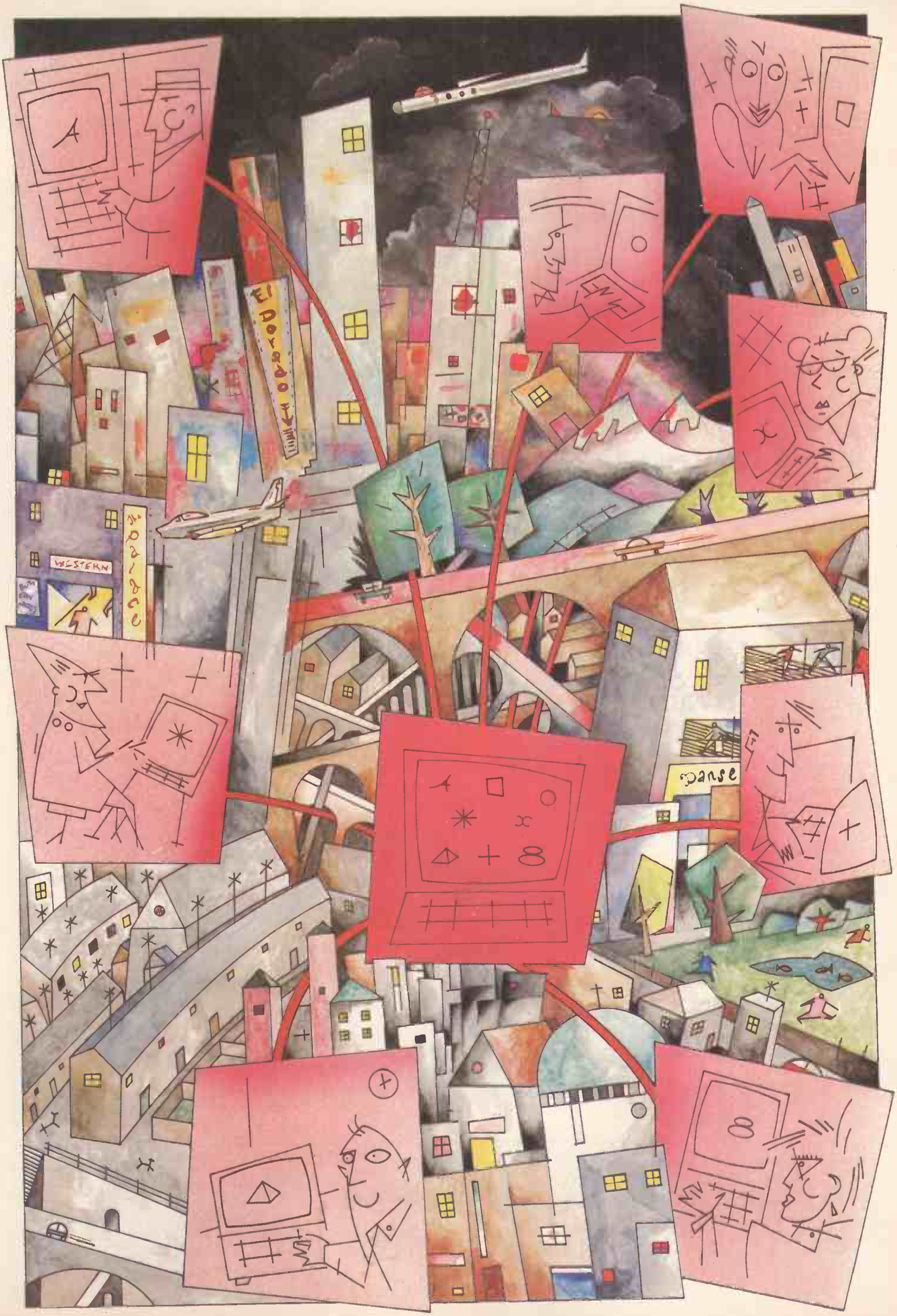
— very close: typically in the same computer system at bus level;
— in the same building or on the same site: here moderately expensive cable can be used (eg, shielded twisted pairs, coaxial cable, fibre-optic cable, etc). Furthermore, the laying of cables, the siting of repeaters and the selection of equipment is entirely under the user's control;
— between separate sites: here the services of a 'common carrier' (British Telecom in the UK) must be used for the transmission of information outside the sites themselves. In this case the user will need to work within the facilities offered by the carrier and the tariff structure under which the charges for these facilities are levied. The user must also adhere to the networking standards necessarily demanded at the connecting points to the carrier's system;
— very long distance (eg, across national boundaries) where two or more common carriers must be used in conjunction between the communicating sites.

What makes a good network?

Whether considering the use of a particular network, or studying the principles of different networking technqiues, it is important to keep in mind those characteristics which are needed to make a 'good' network.

Most users of networks require their information to be transferred quickly, usually the quicker the better. The major factor in determining the desirable speed will be the characteristics and expectations

Illustration by Kevin O'Keefe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PUTTING IT ALL TOGETHER

of the communicating parties — human beings, or computers, or systems demanding 'real-time' responses. (Voice messages would need to be delivered in 'real-time' to remain faithful to the original.)

There is little point in moving information from one point to another unless it can be recognised and trusted by the receiver when it is delivered. Sometimes a degree of corruption can be tolerated (a very poor telephone line is sometimes better than none at all). But in general near-absolute accuracy is demanded — both drawer and payee of a cheque expect the correct value to be transferred and only if it is exact can the bank be sure that neither party has genuine cause for complaint. Of course, even given every precaution, any data link must be expected to introduce errors or 'noise' on occasions, but the user will expect the network to protect against this by detecting errors when they do arise and by automatically arranging for retransmission (and possibly re-routing). Absolute continuous accuracy can never be guaranteed, but it is generally demanded that errors which do creep through are very much less frequent than those which arise in the sending and receiving systems.

If a network is used on any sort of regular basis, then it is important that it is always available, as anyone who frequently hears 'Lines from Reading are engaged, please try later' will willingly testify. Even if the network is seldom used, its reliability may still be crucial — you may not have to dial 999 very often, but when you do, correct operation will be vital.

Whilst our expectations of reliability may be high, we must still accept that in an imperfect world there will be 'hard' failures within the network system from time to time. As users we will demand that these failures can be speedily diagnosed and corrected. Nor are we concerned just with faults in the network; it is also vital that a faulty user system should not be able to degrade the performance of the network for any other user.

Just as it is vital that information is delivered to the correct receiver, it is often every bit as important that it is not delivered to the wrong receiver. There are clearly good private, corporate and national reasons for regarding the privacy of our communications as essential.

Users of a network, whether human or electronic, will require that it is easy to use — that it is easy for a caller to identify and make contact with the intended receiver, easy for the receiver to accept or reject a call or message, easy for both to exchange data. 'Easy' will thus mean simple procedures; but it also means simple electronics to connect to the network, and 'simple' will imply 'standard'. Having set up a network, we will often want to connect to it a whole range of devices, ranging from the most basic of dumb terminals to the most intelligent of computer systems. It is important that the act of connecting should be as straightforward as possible. Preferably this should be simply by the act of plugging in via a standard cable; we should certainly not be forced to have special interfaces designed and built, and special software developed and tested. Even if our network is not international (it may never extend beyond the building), it is very likely that at least some of the devices we want to plug into it will be designed and manufactured abroad, and so the standards employed must be accepted and followed internationally.

If a network will do all these things, then most of us will find it highly satisfactory. However, we still have to decide whether such excellence is worth paying for. Rarely do we get 'owt for nowt', and networking is unlikely to be an exception to the rule. If we are planning to purchase a network for 'local' use (that is, without involving the need for a common carrier), then we will be concerned with the capital cost, with the cost of keeping it running (especially maintenance), and with the cost of connecting (ie, interfacing) to it. If a common carrier is involved, then the capital costs of connection are still of concern, whilst the other costs will be met by charges which will be levied in a variety of forms:
— an installation charge;
— a 'standing charge' on a periodic basis;
— charges for calls, based on the number of calls; the duration; the time of day; the volume of information; the distance.

How these charges are levied will in practice affect the uses to which the network will be put.

In summary, a good network will be: fast, accurate, available, resilient and easy to repair, easy to use, and cheap.

What we are actually asking for is that the network should be completely transparent — ie, that systems (and hence users) should be able to communicate in exactly the same way over a network as they would if they were side-by-side.

The basic building blocks

Having examined why we need a network and what sort of characteristics it should have, we can now start to examine some of the basic building blocks, and then go on to see how these can be put together to build a network.

As a starting point, consider the problem of passing several channels of information across a single physical link. Clearly this is a basic problem of networking because we can rarely seriously consider the possibility of having one separate link (cable, microwave, etc) for every pair of connected devices that may ever wish to communicate. (Just try to imagine a telephone network working in that way.)

Figure 1 shows a situation with two different sites, connected by a single transmission link, and four devices on each site which need to be able to communicate to four devices on the other site.

A unit which will meet our basic requirements for compressing separate channels into one physical transmission link is called a mutliplexor. Figure 2 shows how one multiplexor at each site can be used to 'compress' data at one end of the link, and 'fan it out' at the other end.

There are a number of ways in which a multiplexor can work. One possibility is to inspect the connection to each device in turn, and to place the corresponding signal level onto the transmission link. In effect, what we are doing is to divide the time up into regular 'slices' and to devote successive slices to each device in turn. This is called 'time-division multiplexing'. Of course, the multiplexor at the other end of the link must use an identical clock, and make sure its own time divisions keep in step.

Another possible mutliplexing technique is to encode the signal from each device onto a different carrier frequency, just as radio and television programs are encoded before broadcasting. Then, at the other end of the link, separately tuned circuits (rather like separately tuned radio and television sets) can tune to the carrier frequencies and hence to the signals of interest. This is called 'frequency division multiplexing'. In either case, the net result is just as if we had four separate links, 1 A to 1 B, 2 A to 2 B, etc. However, we should not expect to beat the laws of physics or of information theory. We will not be able to get more total infor-

Fig 1 How to share a single transmission link

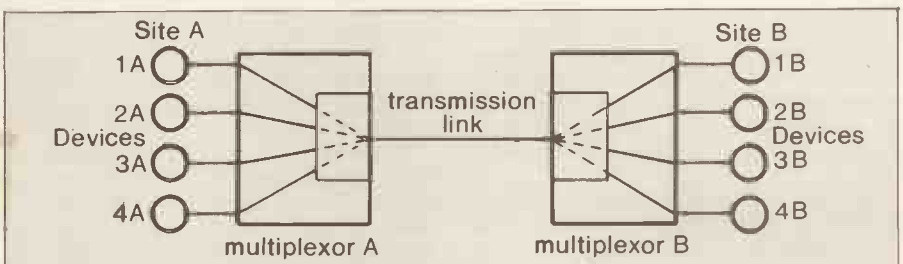


Fig 2 Using multiplexors to share a transmission link

PUTTING IT ALL TOGETHER

mation between the devices than we could get in the same time over the one physical link. The best we can do is to share the information flow between them — so that, in our example, each pair of devices can communicate at one quarter of the total rate for the whole link. In practice, of course, we will expect to do a little worse than this, if some signalling capacity is taken up with 'overheads' or 'housekeeping' of the multiplexors themselves.

As the next step, let us now imagine having two multiplexors very close together, and connected by a very short and very high speed transmission link. Then in effect we have the situation illustred in Figure 3.

It is then a natural step to provide for the modification of the linking between the A and B devices, so that, rather than the connections being 'straight through', any A device can be linked to any B device. Figure 4 shows 1A linked to 2B, 2A linked to 1B, 3A linked to 4B and devices 4A and 3B unlinked.

A mechanism will be required to direct which A devices are to be linked to which B devices. A fairly straightforward approach is to intercept the first character received on

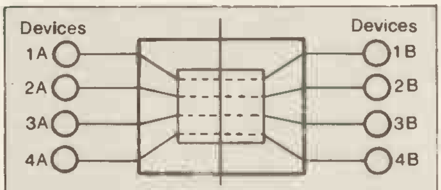


Fig 3 The two multiplexors of Figure 2, connected back-to-back

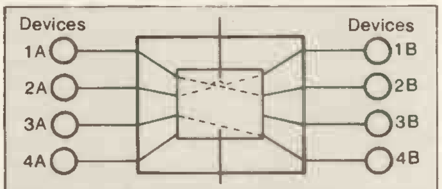


Fig 4 Switching connections between devices

the connection from any device, and to use this to specify the indentification (the 'address') of the device it is to be linked to. A similar approach — eg. the recognition of a special 'end of call' control character — can be used to break off a link when all information has been transferred. It is a further minor step to recognise that the divison of the devices into A and B groups is rather artificial, and to make connection and transfer completely symmetrical between any two devices. Thus we end up with the situation illustrated in Figure 5.

This is in effect a network. We have gone some considerable way to meeting our needs to reduce the number of cables required (here we have just one cable connecter per device) and we have also produced a central node to provide switching between them.

Remembering how we arrived at this situation by starting with two multiplexors back-to-back, we can see that the cable which we originally had separating the multiplexors has been reduced to simply the internal circuitry within the node. The maximum transfer rate over this can be extremely high and, even when apportioned between all the possible pairs of connections, very many of those connections can be maintained by just one central node.

A network of this type is called a 'star' network as the form of Figure 5 would suggest. This type of switching by a node is called 'circuit switching', because in effect it creates a direct connection or circuit between two linked devices. This circuit is available to the devices until they decide to break it. It is available for them even when they are not transferring data, for the central multiplexing action will continue transferring a signal level between them even when that level is simply quiescent. This means that the charge appropriate for a call on such a system will be proportional simply to the duration of the call, and not to the

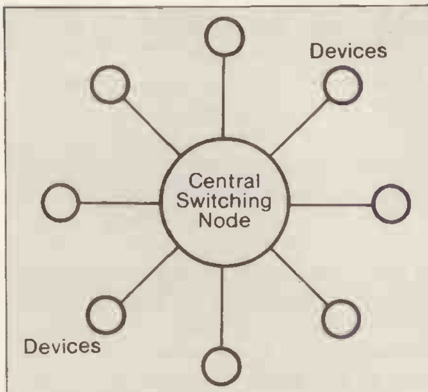


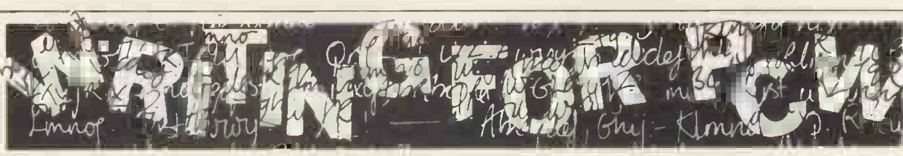
Fig 5 A star network

amount of data transported. Whether this is good news or bad news depends on your own requirements.

So, is that all there is to it?

Certainly we have got as far as a design for a network which is widely used in practice. But there are still significant problems. Clearly everything depends critically on the reliability of the central node. And while we have reduced the number of connecting cables to one per device, we may still have very long cables between each device and the node. Furthermore, we have as yet done nothing to protect against interference causing errors on the signals carried by these cables. Finally, if the capacity of the central node does become a limiting factor, then it is not sufficient simply to add another — for we must also provide the means for devices connected to the original node to link to devices connected to the new one.

So reluctantly we must conclude that we have not solved every problem, and that additional techniques will be needed. In the next article, by way of contrast, we will be examining the approach known as 'packet switching'.



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MICRO CHESS

Tony Harrington investigates Fidelity's new Prestige — an up-market machine that demonstrates just how good a dedicated chess-playing program can be.

During the course of 1982, over 15,000 UK households bought a chess computer supplied by the Miami company Fidelity. Its biggest selling machine, the Sensory Chess Challenger 9, has a US rating of 1771 and it is among the top three or four popularly available chess computers as far as playing strength is concerned.

Fidelity claims — and I haven't yet heard it disputed — to have been the first company to produce a dedicated microcomputer based chess machine for sale to the public. It released its first machine, the Chess Challenger 1, in 1977. David Morein, the managing director of Computer Games, brought it over to the UK in August of that year. 'It wasn't the first computer chess program,' he points out. 'People had been writing programs for years, but only for big computers. This was the first time a chess computer had appeared that the man in the street could afford to buy.'

According to Dr John Renaldo, Fidelity's marketing manager in the US, the company — which prior to 1977 had distributed hearing aids and had nothing to do with computers — got into computer chess via a long chain of coincidences.

Sidney Samola, one of the three brothers who run Fidelity, happened, one night in 1976, to watch an episode of Star Trek. In the episode Samola watched there was a short scene in which the Vulcan Spock took on the ship's computer at three-dimensional chess.

Whether Spock won or not I do not know. But the next day Samola mentioned the incident to his secretary. It had caught his fancy. As luck would have it, the secretary had a boyfriend who was an electronics engineer. His hobby was trying to write chess programs. She told Samola. He decided to talk to the boyfriend. The idea had substance, and Fidelity decided to boldly go where no supplier had been before.

If this tale sounds to you as if it was dreamed up by a marketing man, you are welcome to think so. I simply repeat what I was told. It's implausible enough to be true.

The fact is that, having decided to go into chess computers, Fidelity has done very well indeed. It still distributes hearing aids. But its programs, written for the most part by a husband and wife team Dan and Kathe Spracklen, have proved themselves to be among the best.

Fidelity's latest machine, the Prestige, released in October 1982, costs just under £900. But it is one of the most exciting developments in a long time. When Fidelity decides to put the Prestige program inside the popular models, instead of confining it to this rich man's toy, chess enthusiasts are going to have something to get their teeth into.

According to Dr Renaldo, Fidelity expects it to get a rating of around 1950 shortly. To qualify for a US rating, you (human or computer) have to play 20 games and the Prestige had played 15 when I spoke to Dr Renaldo. But to give you some idea of the way it plays, this week's games section features a game played by the Prestige against some unfortunate human during the US Open in August 1982. The human — and I would welcome any suggestions that would enable one to stop talking about 'humans' as against computers — had a rating of 1991. He had the misfortune to walk into a highly aggressive prepared attack against the Sicilian Dragon and came out of the opening a pawn down. You may see the results for yourself.

Dr Renaldo didn't remember where the Prestige came in the overall tournament, so clearly its final position was less than memorable. But the game shows how much computer chess programming has advanced since Fidelity first exhibited its Challenger 1 at the Chicago Electronics Fair in 1977.

In future issues I would like to give some space to readers' games against any of the commercially available chess computers. So if you think you have an interesting game, annotate it (nothing elaborate, just a comment or two) and send it to us at *PCW*. Similarly, if you have any points you'd like to make about computer chess, the suppliers or their machines, write to me at *PCW*.

White = Prestige; Black = Human (ranking 1991).

1	e4	c5	9	e6	Ne5
2	Nf3	d6	10	Bb5+	Nbc6
3	d4	cxd	11	exf+	Kxf
4	Nxd	Nf6	12	O—O+	Bf6
5	Nc3	g6	13	NxN	bxN
6	f4	Bg7	14	QxQ	RxQ
7	e5	dxe	15	Ba4	Kg7
8	fxe	Nfd7			

(According to Dr Renaldo, the Prestige begins, on move 16, to 'think' for itself. Up to now it has been playing straight out of its opening book. The pawn on c6 gets the chop on move 18 as a natural consequence of White's opening play, which has shattered Black's queen side pawn structure. As we will see, the White queen side pawns are all defensible. But turning this pawn advantage into a win needs tactical skill and technical precision.)

16	Bf4	Bf5	21	Re6	Rb4
17	Rae1	Nf7	22	Bc1	Rc5
18	Bxc	Rac8	23	Kh1	Ne5
19	Be4	BxB	24	a3	Rb6
20	RxB	Rd4	25	Na4	

(This move unleashes complexities that most club players would far rather avoid. The average mortal would have settled quite happily for the chance of exchanging off the constricted rook on e6. It goes anyway, but in a fashion that suits White better.)

25	...	RxR	27	b4	Nc4
26	NxR	Rc6			

(The 'advantage' White has gained from his knight manoeuvre is that the Black pawn on a7 is less of an impediment to the eventual march of the White pawns on a3, b4 and c2, than it would have been on b6 after 25 RxR axR. But the advance of the Black knight among the White queen-side pawns makes it look as though getting these pawns rolling will be tricky. White achieves this with admirable dexterity.)

28	g4	Bb4	30	Na5	
29	Nb3	Be3			

(On the principle that if a move is worth doing once, it is worth doing twice! Once again the computer prefers to complicate rather than simply to exchange — and quite rightly. The simple exchange BxB gives back the pawn and leaves White with a wrecked position after 30. . .NxB; 31 Rf2 (or Rc1) RxP.)

30	...	Rc7	32	RxB	RxN
31	NxN	BxB	33	g5	

(Simplest and best. It moves the pawn out of the rook's line of fire and stops Black's king advancing to join the action.)

33 ... e5

(Playing 33. . . Rc3 only speeds the White a and b pawns on their way.)

34 Rd1 Rc7

(Taking the White pawn on C2 means giving up the pawn on a7. Black's position is quite hopeless. He cannot stop the White queenside majority from rolling home. But the human player is determined to make the machine 'show' him. Prestige is happy to oblige.)

35	c4	Kf7	44	Kh1	Kb8
36	c5	Ke7	45	Ra7	Rh5
37	Kg2	a5	46	c7+	Kc8
38	Rc1	axb4	47	Ra8+	Kd7
39	axb	Kd7	48	c8(Q)+	Ke7
40	b5	Kc8	49	Ra7+	Kf6
41	b6	Rf7	50	Qd8+	Ke6
42	c6	Rf5	51	Qd7+	Resigns.
43	Ra1	Rxg+			

All those who believe that computers can't play end-games should spend a little time contemplating this game. The Prestige may be priced out of reach of most of us at the moment. But we fully expect its program to be mass-produced in the near future. It is just one more instance of competition among the manufacturers driving the quality of the programs remorselessly upward. Whether the logical end point, namely a cheap unbeatable chess computer, will be much more satisfying than the present range of machines remains to be seen. Personally, I like winning occasionally.

END

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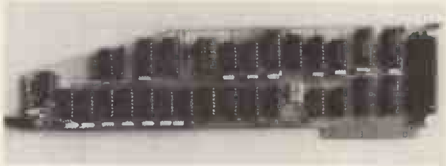

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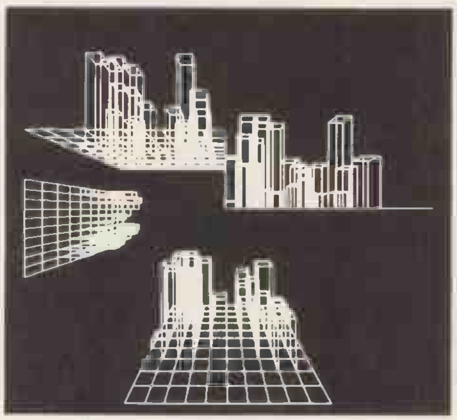

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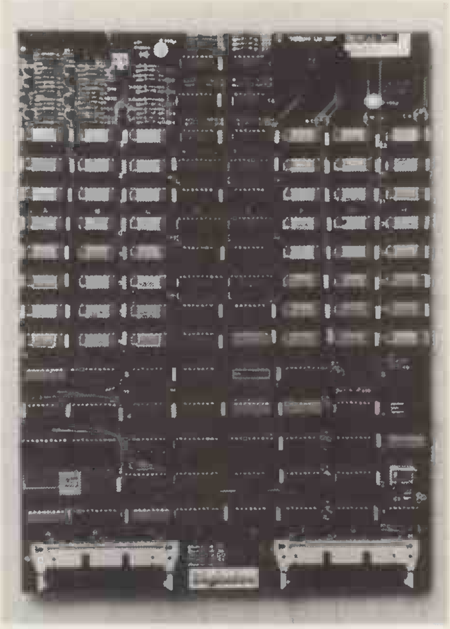

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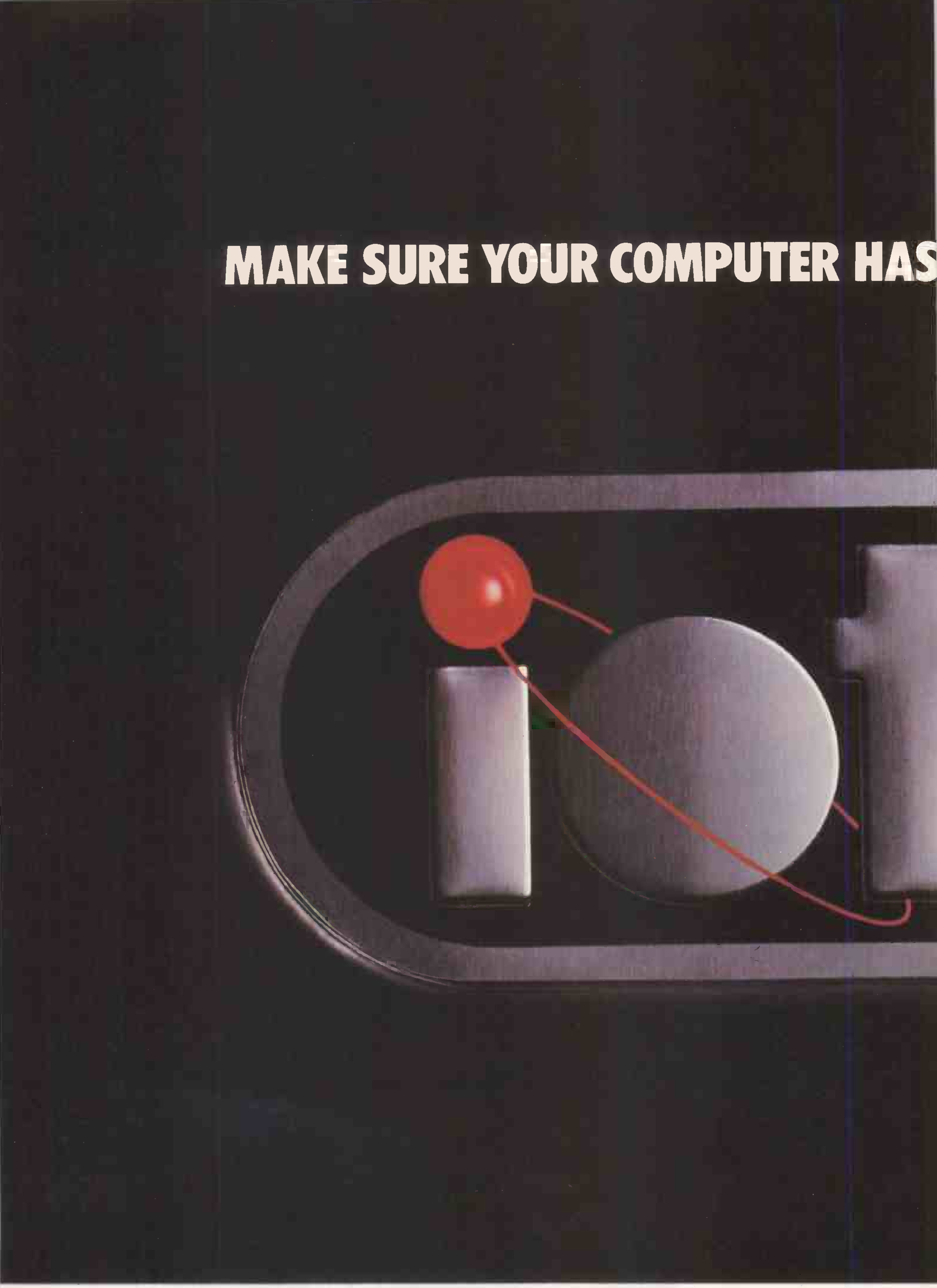

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TJ's WORKSHOP

Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to 'TJ's Workshop', PCW, 62 Oxford Street, London W1A 2HG. Please keep your contributions as concise as possible. We will pay £5-£30 for any tips we publish.
PCW can accept no responsibility for any damage caused by using these tips, and readers should be advised that any hardware modifications may render the maker's guarantee invalid.

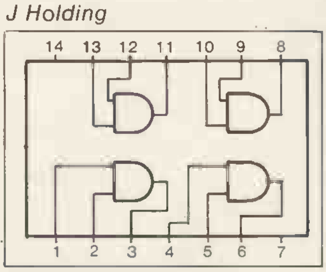
BLUDNER 1

Please refer to page 157, TJ's Workshop of the December issue of *PCW*.

Figures 1 and 2 are incorrect. Pin connections for a 74LS00 are as shown below.

Also see the Texas TTL Data Book, page 5-6.

J Holding



BLUDNER 2

In January's TJ's Workshop, under the heading 'Spectrum SCREEN$', we published a routine to enable the Spectrum SCREEN$ function to deal with user-defined graphics characters.

Unfortunately, we surpassed ourselves — the machine-code routine printed was incorrect, to the extent of not even being for the Z80 processor. Apologies to all those who may have been baffled by this — the correct routine follows (see Figure 1).

BEFORE YOUR NEXT LOOP

The only clean way to exit a FOR/NEXT loop is via the NEXT statement. Jumping out of the loop is permitted in Basic but most interpreters treat it as a provision for extending the loop to include statements which are not consecutively numbered — eg,

```
100 FOR I = 1 TO 10
110 GOTO 10000
120 NEXT I .
:
10000 REM STATEMENTS
EXECUTED AS PART OF
THE LOOP
:
:
20000 GOTO 120
```

Such interpreters, therefore, lose track of events if the loop is aborted by jumping out and an error may be signalled later in the program. With Microsoft interpreters this only only seems to happen if a subsequent loop reuses the loop counter variable name. In the case of the BBC Computer, however, there is a low limit to the allowable depth of nesting of FOR/NEXT loops and each jump out of a loop will be treated as an irreversible increase of nesting depth. This will happen with a program of the following form:

```
50 FOR I = 1 TO 20
100 X = Y
:
200 GOSUB 500
:
300 NEXT I
:
500 FOR J = 1 TO 10
:
550 IF X = Y THEN RETURN
:
600 NEXT J
650 RETURN
```

Each time the program enters the loop at line 500 the nesting level will increase by 1 and if it executes the return at 550 the matching decrease of nesting level which should have been achieved at line 600 will be omitted. The program will eventually crash with a "TOO MANY FORS" message.

The solution to this is to recast the loop in the form of

```
500 REPEAT
:
600 UNTIL X = Y
```

If the problem crops up in a new program you have only yourself to blame for using an unstructured technique when a structured alternative is available. it might, however, be encountered when running a program written for a different machine.

Ian Goddard

```
32490
      LD    HL,(23627)  /
32493 LD    BC,1        /LOAD P
32496 ADD   HL,BC       /
32497 LD    A,(HL)      /AND
32498 CP    0           /
32500 RET   NZ          /RETURN
32501 INC   HL          /
32502 LD    A,(HL)      /BC=1
32503 CP    0           /
32505 RET   NZ          /IF ERROR
32506 INC   HL          /
32507 LD    E,(HL)      /
32508 INC   HL          /
32509 LD    D,(HL)      /
32510 INC   HL          /
32511 LD    A,(HL)      /
32512 CP    0           /
32514 RET   NZ          /
32515 LD    A,D         /
32516 CP    3           /
32518 RET   NC          /
32519 LD    D,0         \
32521 LD    HL,16384    \LOAD HL
32524 LD    BC,0        \
32527 CP    2           \WITH
32529 JR    NZ,32536    \
32531 LD    BC,4096     \RAM
32534 JR    32543       \
32536 CP    1           \POSITION
32538 JR    NZ,32544    \
32540 LD    BC,2048     \OF
32543 ADD   HL,BC       \
32544 ADD   HL,DE       \CHARACTER
32545 LD    DE,(23606)  /TABLE
32549 INC   D           /START
32550 LD    BC,32       \CHAR CODE
32553 PUSH  BC          /
32554 PUSH  HL          /COMPARE
32555 LD    BC,2048     /
32558 LD    A,(DE)      /CHARACTER
32559 CP    (HL)        /
32560 JR    NZ,32569    /
32562 INC   H           /
32563 INC   DE          /
32564 DJNZ  32556       /
32566 POP   HL          \RETURN
32567 POP   BC          \IF
32568 RET               \SUCCESSFUL
32569 EX    DE,HL       /LOAD DE
32570 LD    C,B         /NEXT CHAR
32571 LD    B,0         /TABLE
32573 ADD   HL,BC       /POSITION
32574 EX    DE,HL       /
32575 POP   HL          \RAM POSIT
32576 POP   BC          /INC CHAR
32577 INC   BC          /CODE
32578 LD    A,C         \RETURN
32579 CP    165         \BC=0
32581 JR    NZ,32587    \IF ALL
32583 LD    BC,0        \CHARS
32586 RET               \
32587 CP    128         /
32589 JR    NZ,32553    /NEXT CHAR
32591 LD    BC,144      \UDG CODE
32594 LD    DE.(23675)  /UDG TABLE
32598 JR    32553

   1 CLEAR 32489
   5 LET p=0
  10 LET peek=32490
  20 LET a$="2A4B5C010100097EFE0
0C0237EFE00C0235E2356237EFE00C07
AFE03D0160021004001000OFE0220050
100101807FE012004010000809l9ED5B3
65C14012000C5E50100081ABE2007241
310F8E1C1C9EB4806000 9EBE1C10379F
EA5200401000OC9FE8020DA019000ED5
B7B5C18D1"
  25 LET A=1
  30 FOR f=peek TO peek-1+LEN A$
/2
  40 POKE f,16*(CODE (A$(A))-48-
7*(CODE a$(a)>64))+CODE a$(a+1)-
48-7*(CODE a$(a+1)>64)
  50 LET A=A+2
  60 NEXT F
```

Fig 1

SHARP RANDOM ACCESS TAPE FILES

While developing a program for quantity surveyors recently I ran out of memory using a new 24k Basic on my MZ-80K due to the need to retain a large look-up table whilst processing 49 pieces of data held in identical format for each of 20 jobs. There has never appeared, to my knowledge, any method of saving sets of data from a program in serial form, giving each set a unique title, but, for example, all 20 sets have to be prepared and saved using a blanket WOPEN "JOB DATA". This means that all data has to be held in memory while only one-twentieth of it is being used. The only other way hitherto would be to BREAK, edit "JOB DATA" in the program to say "JOB No 6 DATA" and then save the appropriate section. This is very clumsy, and of course, inadmissable for use by non-programming persons.

It occurred to me that as "JOB DATA" has the form of a string, it might be possible to compose the file title within the programme as, say, N$ and then to save data using WOPEN N$. This does indeed work and no doubt will work with other versions of Basic on other machines. If, for example, the job number is 6 (and will already be entered in the program), one can write N$= "JOB No" +STR$(N)+ " DATA " and WOPEN N$ gives the title to this data of "JOB No 6 DATA".

It is a simple matter to construct a directory at the head of the tape containing the tape counter settings for each set of data, and with this loaded at the start of operations, entering the Job No can result in the display of the appropriate counter start position. A fast wind to that position and a ROPEN N$ or just ROPEN will pick off the required data with its identifying title — the closest one is likely to get to random access files on tape!

The 24k Basic referred to above is a great improvement on all the SP-50XX versions. I would advise all MZ-80 owners to join the MZ-80 Users Club based at Yeovil College, Yeovil, Somerset, as the Basic plus a host of other software and MZ-80 info can be obtained at the cost of only the return postage on a blank cassette. An sae is appreciated when writing to them for details.

G O Hayward

ATOM CIRCLES

The following is a machine code routine for plotting circles on the Acorn Atom (my machine has 12K RAM, 12K ROM).

1) The routine is called using LINK LL0, where LL0 is the start of machine code.
2) The parameters used by the code are the BASIC variables X,Y,R and A.
X = x coordinate of centre of circle (2 bytes significant)
Y = y coordinate of centre of circle (2 bytes significant)
R = radius of circle (2 bytes significant)
A = plot type, and corresponds to the usual Atom plot type number.
Plotting points (A=8-15) and lines (A=0-7) has the same effect. Depending on A, circles can be set, inverted or cleared ,with X,Y being relative or absolute coordinates. A=0,4,8 or 12 moves the plotting coordinate as usual. If R is greater than 255 the circle will not be continuous.
3) Each point is plotted only once so that inverse circles give a sensible effect.
4) The routine takes typically 0.2 seconds and this does not vary much with R.
5) X,Y,R and A are not changed by the routine.
6) Zero page memory used is 80H to 8BH.
7) Any graphics mode may be used, but ellipses will be produced unless the pixels are square, ie, modes 0,2,4,3a.
8) The algorithm used is
C = C − S/256
S = S + C/256
which when iterated generates accurate sines and cosines.
9) The plotting coordinate is set to the centre of the circle after drawing it.

Alun Morris

```
  10 REM circle drawing for the atom
  20 REM LINK LL0 PLOTS CIRCLE  CENTRE X,Y, RADIUS R, PLOT TYPE A
  30 REM A HAS USUAL PLOT TYPE MEANING EXCEPT THAT
  40 REM PLOTTING LINE OR POINT HAS SAME EFFECT
  50 REM AFTER PLOTTING, THE COORDINATES ARE LEFT AT THE CENTRE OF
  60 REM THE CIRCLE
  70 DIM LL10;FOR I=0 TO 10;LLI=-1;N.
  80 C=#80;S=#83;T=#86;U=#88;V=#8A;REM ZERO PAGE POINTERS
  90 PRINT $21;GOSUB a;GOSUB a;PRINT $6;REM ASSEMBLE CODE
 100 REM DEMONSTRATE DRAWING
 110 A=13;REM SET
 120 CLEAR 4
 130 FOR R=0 TO 95 STEP 5
 140 X=R;Y=X;LINK LL0
 150 Y=191-X;LINK LL0
 160 X=255-R;LINK LL0
 170 Y=R;LINK LL0
 180 NEXT R
 190 END
1000a DIM P-1
1010 [:LL0 AND@3;STA#5E plot type
1020 STXU;STYV;LDA#354;STAU+1;LDA#355;STAV+1 store params x,y
1030 LDA@4;BIT#322;BNE LL8 if bit 4 of a=1 then absolute plot
1040 LDA#5A;CLC;ADCU;STAU;LDA#5B;ADCU+1;STAU+1 relative x
1050 LDA#5C;CLC;ADCV;STAV;LDA#5D;ADCV+1;STAV+1 relative y
1060 :LL8 LDA#5E;BEQ LL9 move
1070 LDA#333;STA C+1;LDA#34E;STAC+2 radius
1080 LDA@0;STAC;STAS;STAS+1;STAS+2
1090 LDA@1615&255;STAT;LDA@1615/256;STAT+1 loop 2*pi*256 times
1100 :LL1
1110 LDAC;SEC;SBCS+1;STAC;LDAC+1;TAX;SBCS+2;STAC+1
1120 LDAS+2;BPL LL6;INCC+2
1130 :LL6 BCS LL2;DEC C+2
1140 :LL2
1150 LDAS;CLC;ADCC+1;STAS;LDAS+1;TAY;ADCC+2;STAS+1
1160 LDAC+2;BPL LL7;DECS+2
1170 :LL7 BCC LL3;INC S+2
1180 :LL3
1190 CPXC+1;BNE LL4;CPYS+1;BEQ LL5
1200 :LL4
1210 \calc x and store for plotting
1220 LDAC+1;CLC;ADCU;STA#5A;LDAC+2;ADCU+1;STA#5B
1230 \calc y and store for plotting
1240 LDAS+1;CLC;ADCV;STA#5C;LDAS+2;ADCV+1;STA#5D
1250 JSR LL10 plot
1260 :LL5
1270 DECT;BNE LL1;DEC T+1;BPL LL1
1280 :LL9
1290 LDAU;STA#5A;LDAU+1;STA#5B
1300 LDAV;STA#5C;LDAV+1;STA#5D
1310 RTS
1320 :LL10 JMP(#3FE) plot
1330]
1340 RETURN
```

ATOM ALARM

PCW readers may be interested in the following routine for the Acorn Atom.

It uses the internal loudspeaker to create an alarm noise not unlike those heard on science-fiction programmes. The number 5 should be entered when the program is first run.

```
10 DIM BB(4),P(-1);
 M=#B002
20?#80=5; IN.A;
 ?#81=A;P.$21
30[
40:BB0 LDA M;LDY #81
50:BB1 LDX #80
60:BB2 DEX;BNE BB2;
 EOR@4
70 STA M;DEY;BNE
 BB1;DEC #80
80 JMP BB0
90]
100 P.$6;LINK BB0;END
```

Simon Ford

BBC SAVE AND LOAD

The BBC operating system commands *SAVE and *LOAD can also be used from inside a program to write and read a file of data.

Both commands accept addresses as parameters but demand that these are given explicitly — for example, *SAVE "file" 10000 12000 is a legal command, but rewriting it as A%=10000: B%=12000: *SAVE "file" A% B% produces an error message.

The two procedures 'save' and 'load' (see Figure 1) enable variables to be used in *SAVE and *LOAD and thus make them more versatile for file handling.

The program in Figure 1 consists of the two procedures and a few lines of coding which act as a test bed.

The method is to set aside 18 bytes as the file control block, in this example at the address &70 which is not normally used for any other purpose, and then use the ! and ? operators to place the parameters in the control block. The only required statement outside the procedures is 'DIM NAME% 11' to reserve space for storing the filename.

Procedure 'save' requires 3 parameters:
filename$ = Name of data file.
first% = Start address of area to be saved.
last% = End address of area to be saved.

Procedure 'load' requires 2 parameters:
filename$ = Name of data file.
start% = Address at which data file will start.

Lines 1030 and 1230 place the filename in an area of memory with start address NAME%.

1040-1050 and 1240-1250 set X%,Y% to the start of the file control block.

1060-1070 and 1260-1270 place the filename start address in bytes 0 and 1 of the control block.

1080 and 1090 set start and end addresses for the save operation.

1280 sets the start address for loading.

1290 determines that the file is loaded to the control block address — ie, the one given by line 1280.

Users of these procedures should incorporate their own error checking, and if you don't and find you've loaded data on top of your program don't blame me!

R Grubb

```
040  REM Testbed program for save/load procedures,  a file of
         'A'  characters is written out and then loaded to  a
         specified address. The loaded file is then checked.
050 DIM NAME% 11
070 REM Write 'A' characters to a block of memory
100 FOR N%=10000 TO 15000:?N%=65:NEXT
105 REM S% and E% should be in the range 10000 thru 15000
110 INPUT "START ADDRESS "S%'"END ADDRESS "E%
120 PROCsave("AFILE",S%,E%)
125 REM SA% should be > 15000
130 INPUT "ADDRESS TO START LOADING " SA%
150 PROCload("AFILE",SA%)
160 W%=0
165 REM check that all bytes loaded = 'A'
170 FOR N%=SA% TO E%-S%+1:IF ?N%<>65 THEN W%=W%+1
180 NEXT
185 REM W% = 0 if save/load succesful
190 PRINT W%" BYTES WRONG"
200 END

1000 DEFPROCsave(filename$,first%,last%)
1010 LOCAL A%,X%,Y%
1020 A%=0
1030 $NAME%=filename$
1040 X%=&70
1050 Y%=0
1060 ?X%=NAME%
1070 X%?1=NAME%/256
1080 X%!10=first%
1090 X%!14=last%+1
1100 CALL &FFDD
1110 ENDPROC

1200 DEFPROCload(filename$,start%)
1210 LOCAL A%,X%,Y%
1220 A%=255
1230 $NAME%=filename$
1240 X%=&70
1250 Y%=0
1260 ?X%=NAME%
1270 X%?1=NAME%/256
1280 X%!2=start%
1290 X%!6=0
1300 CALL &FFDD
1310 ENDPROC
```

Fig 1

POKEING THE MZ-80K

Here are some useful hints for Sharp MZ-80K users:

If you have ever tried to record onto the header of a program the ANTI-LIST flag by going POKE 10680,1 or POKE 4360,1 and then saving you will find that neither of these work. The solution is to enter POKE 10682, 1:
POKE 10681, 1:
POKE 4360, 1:
before saving.

A program may be saved even after entering NEW by the commands USR(33):USR(36), but when you reload it the computer will only list the first line although the whole program is in the memory. If you enter the first line again all of it will list.

All the screen messages are held from locations 4834 to 4950, so if you wish to change the message of your choice simply PEEK between these locations and at the correct address re-POKE. The changes can then be permanently put in your Basic by making a new copy using USR(33):USR(36) as long as no other program has been loaded.

The filename of a program is stored from locations 4337 to 4354 so even if you record a program by the USR calls its name can be changed. After POKEing in the ASCII codes POKE the next address with 13. This tells the computer to finish reading the title.

Commands are held between locations 5339 and 5648. These can be changed to what you want by re-POKEing. For example, you can change SAVE to RAVE by POKE 5402,82. The computer will no longer recognise SAVE and if entered the computerwill print SYNTAX ERROR. Note on keywords the last letter can not be changed.

Other useful POKEs are:
POKE 4685, any value:. This tells the computer to make a sound on printing READY.
POKE 10407,184;. This allows repeat on GET.
POKE 4498,X where X is the ASCII code for the character of the cursor.
POKE 6350,34 allows "" to be printed.

A useful USR call is USR (3494). This can be used before any POKE to the screen as it will stop the snow, but it slows down the POKE speed to PRINT speed.

Anthony Newgrosh

BEEB BEACHBALL

PROCBALL can be used to plot and fill circles with either solid colours, or with curved stripes to give a beachball effect.

X% and Y% are the coordinates of the centre of the ball, and R% is its radius. It is, however, the S% parameter which can be varied to give some unusual results. In Modes 0,1, and 2, solid colours are obtained with S% set to 2,4, and 8 respectively. Values of S% above the solid value give varying degrees of stripiness.

COL is of course the main colour plotted, but don't be surprised if during experimenting with the procedure, colours which the BEEB shouldn't have begin to appear.

Lines 20 to 60 set S% to 8 for a demonstration of high resolution plotting in Mode 0.

C R Woodings

```
 10REM BEACHBALLS
 11REM BY CALVIN WOODINGS
 12REM NOVEMBER 1982
 13REM DEMO OF STRIPED BALL PROCEDURE
 20MODE0
 22VDU19,0,3,0,0,0,19,1,4,0,0,0
 30REPEAT
 40PROCBALL(RND(1280),RND(1023),RND(200)+50,8,1)
 50UNTILFALSE
 60END
 70DEFPROCBALL(X%,Y%,R%,S%,COL)
 90 GCOL0,COL
100VDU29,X%;Y%;
110MOVE-R%,0
120FOR x%=-R% TO R% STEP S%
130y%=SQR(R%^2-x%^2)
140DRAWx%,y%
150DRAWx%,-y%
160NEXT
170ENDPROC
```

PET PROGRAM RECOVERY

Below is the listing of a routine which allows the user to recover any program that has been previously NEWed, as long as these two important factors have been observed.

1) Since NEWing the program, no further Basic program lines have been entered.

2) There *was* actually a program in memory to begin with before the routine was used in order to recover the program.

The second of these may appear obvious, but if there was no program then using the routine will leave you with an awful mess.

It is advisable to enter the routine, RUN it, and then save the machine code portion of it, either to disk or to cassette by the following method, long before you actually require it to recover a NEWed program.

After entering the routine, RUN it, then in order to save the machine code, type SYS 1024 and you will see something like the code in Fig 1.

Now type S"RENEW",xx, 033A,03AB where xx is the device number: 08 if you are saving to disk, or 01 if you are saving to cassette. You may also change the title of the routine from "RENEW" to anything you wish. Finally type X.

When a program is NEWed, accidentally or otherwise, and you wish to recover it, load the disk or cassette containing the routine "RENEW", into drive 0 or the cassette deck respectively. Disk users now type: LOAD"0:RENEW",8; or cassette users type: LOAD"RENEW"

When READY. is displayed type SYS 826 and your long-lost program will be recovered in a matter of seconds. (The routine is fast! It takes just over one second for the routine to recover an 8k program.)

```
B*

     PC   IRQ   SR   AC   XR   YR   SP
 .;  0401 E62E  32   04   5E   OO   F8
```

Fig 1

```
10 FORX=0TO113:READA$:A1$=MID$(A$,2)
20 K=16*(ASC(A$)-9*(A$>="A")AND15)+(ASC(A1$)-9*(A1$)="A")AND15)
30 POKE826+X,K:NEXTX:END
40 DATAA9,00.85.B7.A9.04,85,B2,A9,05,85.B1,A2.00,A1,B1.C9,00,F0,11.18,A9.01
50 DATA65,B1,85,B1,A9,00,65,B2,85.B2.18,4C,46,03.A9.01.65.B1.85.B1,A9.00,65
60 DATAB2,85,B2,A5.B7,C9.00.D0,0E.A5,B1,8D,01.04,A5,B2,8D.02,04,A9.01,85,B7
70 DATAA1.B1.C9.00.D0.C1,18.A9.02.65.B1,85.B1.A9.00,65,B2,85.B2.A5.B1,85.2A
80 DATA85,2C,85,2E,A5,B2,85,2B,85,2D,85.2F,CE,01,04,E6,2A.E6,2C,E6,2E.60
```

Karl Elliott

VIC20 DOWNGRADE

I have found a way of downgrading the VIC 20 to a lower memory size.

If you have a RAM expansion cartridge plugged into the back of your VIC20 and you don't want to keep on unplugging it for programs that can only be run in 3.5k, here is what to do:
POKE 642,16
POKE 644,30
POKE 648,30:SYS 64824

This downgrades the VIC to 3.5k.

Location 642 contains the start of Basic/256
Location 644 contains the end of Basic/256
Location 648 contains the start of the screen memory/256
The machine code subroutine at location 64824 cold starts the VIC.

Michael Howard

DRAGON TAPE CHECK

Despite the high reliability of the Dragon cassette interface, the lack of a tape verification facility is felt by many users to be a serious oversight. The program described here enables Basic file tapes, Basic data file tapes and machine code format tapes to be inspected for checksum errors without disturbing programs in memory.

As a machine code format tape the verification program can reside in memory alongside other programs, reducing available memory by 400 bytes.

In Figure 1 the program is in the form of decimal data within a Basic program. When this program is run the data is checked by performing a sumcheck (Lines 260-340) and then it is loaded into memory (Lines 350-410). If the DATA statements have been mistyped the program will break at Line 340.

When the data has been loaded into memory it can be saved on tape in machine code format (Line 450). Line 450 is repeated until "N" is answered to the prompt at line 430.

Once a machine code copy of the program has been obtained it can be loaded into the machine by typing:

CLEAR 200,32367
CLOADM

The CLEAR statement reserves the top 400 bytes of RAM for the program.

To use the program wind the tape to the space before the file to be checked, press "PLAY" and type

EXEC

The cassette motor will be switched on and the type of file determined from the program header.

Figure 2 shows the characters that are output by the program. Note that error codes are in 'lower case' — ie, inverse video.

Typical outputs from the program during verification are shown in Figure 3.

Figure 4 is an assembler listing of the program. The explicit subroutine jumps are calls to the cassette handling routines and text output routine in the Basic PROM. Note that the code is position independent so that the program can be made to run almost anywhere in RAM, either by producing separate copies using the Basic loader with lines 240 and 250 changed or by using the offset facility of CLOADM. The program cannot be relocated above 7E70 as the data buffer at BUFF must be 256 bytes long.

B	BASIC program
D	BASIC data file
M	Machine code format file
"	Filename delimiters
%	Data block of 255 bytes
/	Data block of less than 255 bytes
E	End of file marker (Not on M/C files0

Error Codes (inverse video):

C	Checksum Error
M	Memory Error (buffer overlaps PROM or dead memory)

Fig 2

```
EXEC

B"BASPROG1"%%%%%%%/E
OK
EXEC
D "DATA3    "%%%%/E
OK
EXEC
M"ASMO1     "%%%%%%%%%/
OK
```

Fig 3

```
5 REM VERCAS GENERATION PROGRAM
10 DATA 189.128.33.48.141.0.128
20 DATA 191.0.126.189.185.62.38
30 DATA 94,182,0.124.39.10.129
40 DATA  1,39.52.134.69.141,99
50 DATA 32.91.166.140.110.167
60 DATA 140.98.38,4.134.66.32
70 DATA 10,129,1,38,4.134,68,32
80 DATA 2.134.77,141,73,134,34
90 DATA 141.69,48.140,74.198,8
100 DATA 166,128,141.60.90.38
110 DATA 249.134.34.141.53,32
120 DATA 180.182,0.125.129.255
130 DATA 39,13,134.47.141,40
140 DATA 166.140.44.129.2.39.27
150 DATA 32,4.134.37.141.27.166
160 DATA 140.31.129.1.39.149.32
170 DATA 150.129.1.39,4.134.109
180 DATA 32,2,134.99.141.6,134
190 DATA 52.183.255,33.57,127,0
200 DATA 111.189,181,74.57.0,0
210 DATA 0,0,0.0,0,0,0.0.-1
220 REM SET TOP OF MEMORY AND
230 REM PROGRAM START ADDRESS
240 CLEAR 200,32367
250 S=32368
260 REM CHECK DATA INTEGRITY
270 RESTORE
280 C=0
290 FOR I=1 TO 500
300 READ J
310 IF J<0 THEN 340
320 C=C+J+1
330 NEXT I
340 IF C<>12215 THEN STOP
350 REM POKE PROGRAM TO MEMORY
360 RESTORE
370 FOR I=S TO S+500
380 READ J
390 IF J<0 THEN 430
400 POKE I.J
410 NEXT I
420 REM STORE M/CODE ON TAPE
430 INPUT "READY TO RECORD";A$
440 IF A$="N" THEN STOP
450 CSAVEM "VERCAS".S,S+400,S
460 GOTO 430
```

Fig 1

(Name omitted — please contact us).

ZX81 SQUARE ROOTS

The ZX81 SQR function usually has slight errors, which can be annoying in, for example, programs that include the detection of perfect squares: thus, for the ZX81, INT SQR 25 is *not* equal to SQR 25.

The most satisfactory way out is to get rid of the errors, which can be done by one extra statement, using Newton's method for improving the accuracy of an approximate square root. If a program includes, say, LET Y=SQR X then a further statement LET Y=(Y+X/Y)/2 will get rid of the errors: if there is a possibility that X=0, then use IF X<>0 THEN LET Y= (Y+X/Y)/2.

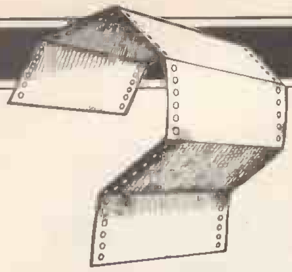
The accompanying test program allows experimentation. In this, the crude version of Y, namely Y1, and the refined version, Y2, are assigned to different variables so that their errors can be distinguished. I have not found a case where Y2-Y differs from zero.

```
1 REM SQR TEST
10 PRINT "TRUE";TAB 20;"ERRORS","VALUE";TAB 15;"Y1"; TAB 30;"Y2"
20 INPUT Y
30 LET X=Y*Y
40 LET Y1=SQR X
50 LET Y2=(Y1+X/Y1)/2
60 PRINT Y;TAB 15;Y1-Y;TAB 30;Y2-Y
70 GOTO 20
```

W E Thomson

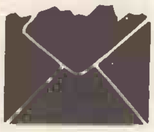
```
0000                 *VERCAS: CASSETTE
0000                 *VERIFICATION PROGRAM
0000                      ORG   7E70
7E70                 *SYNC ON LEADER
7E70  BD8021         SYNC JSR   $8021
7E73                 *GET A BLOCK
7E73  308D0080       GBL  LEAX BUFF.PCR
7E77  BF007E              STX   $007E
7E7A  BDB93E              JSR   $B93E
7E7D  265E                BNE   ERR
7E7F                 *BLOCK IS OK:
7E7F                 *CHECK BLOCK TYPE
7E7F  B6007C              LDA   $007C
7E82  270A                BEQ   HEDR
7E84  8101                CMPA £$01
7E86  2734                BEQ   DATR
7E88                 *EOF BLOCK:O/P "E"
7E88                 *AND EXIT
7E88  8645                LDA   £$45
7E8A  8D63                BSR   OUCH
7E8C  205B                BRA   SRET
7E8E                 *FILE HEADER: SAVE
7E8E                 *FILE TYPE AND O/P
7E8E                 *TYPE CODE
7E8E  A68C6E         HEDR LDA   BFLG.PCRB
7E91  A78C62              STA   FLAG.PCRB
7E94  2604                BNE   DFIL
7E96  8642                LDA   £$42
7E98  200A                BRA   OTYP
7E9A  8101           DFIL CMPA £$01
7E9C  2604                BNE   MCOD
7E9E  8644                LDA   £$44
7EA0  2002                BRA   OTYP
7EA2  864D           MCOD LDA   £$4D
7EA4  8D49           OTYP BSR   OUCH
7EA6                 *O/P FILE-NAME FROM
7EA6                 *HEADER:
7EA6  8622                LDA   £$22
7EA8  8D45                BSR   OUCH
7EAA  308C4A              LEAX BUFF.PCRB
7EAD  C608                LDB   £$08
7EAF  A680           GET  LDA   .X+
7EB1  8D3C                BSR   OUCH
7EB3  5A                  DECB
7EB4  26F9                BNE   GET
7EB6  8622                LDA   £$22
7EB8  8D35                BSR   OUCH
7EBA  20B4                BRA   SYNC
7EBC                 *DATA BLOCK: CHECK
7EBC                 *NUMBER OF BYTES
7EBC  B6007D         DATR LDA   $007D
7EBF  81FF                CMPA £$FF
7EC1  270D                BEQ   COMP
7EC3                 *INCOMPETE BLOCK:
7EC3                 *EXIT IF M/C ELSE
7EC3                 *GET ANOTHER
7EC3  862F                LDA   £$2F
7EC5  8D28                BSR   OUCH
7EC7  A68C2C              LDA   FLAG,PCRB
7ECA  8102                CMPA £$02
7ECC  271B                BEQ   SRET
7ECE  2004                BRA   GOGE
7ED0                 *COMPLETE BLOCK
7ED0  8625           COMP LDA   £$25
7ED2  8D1B                BSR   OUCH
7ED4                 *GO AND GET NEXT
7ED4                 *BLOCK: SYNC AGAIN
7ED4                 *IF BASIC DATA FILE
7ED4  A68C1F         GOGE LDA   FLAG.PCRB
7ED7  8101                CMPA £$01
7ED9  2795                BEQ   SYNC
7EDB  2096                BRA   GBL
7EDD                 *ERROR IN BLOCK:
7EDD                 *CHECK ERROR TYPE
7EDD                 *AND O/P CODE
7EDD  8101           ERR  CMPA £$01
7EDF  2704                BEQ   CSUM
7EE1  866D                LDA   £$6D
7EE3  2002                BRA   OSR
7EE5  8663           CSUM LDA   £$63
7EE7  8D06           OSR  BSR   OUCH
7EE9                 *STOP CASSETTE AND
7EE9                 *EXIT
7EE9  8634           SRET LDA   £$34
7EEB  B7FF21              STA   $FF21
7EEE  39                  RTS
7EEF                 *OUTPUT A CHARACTER
7EEF                 *TO SCREEN
7EEF  7F006F         OUCH CLR   $006F
7EF2  BDB54A              JSR   $B54A
7EF5  39                  RTS
7EF6  00             FLAG $00
7EF7  00             BUFF $00
7EF8  00                  $00
7EF9  00                  $00
7EFA  00                  $00
7EFB  00                  $00
7EFC  00                  $00
7EFD  00                  $00
7EFE  00                  $00
7EFF  00             BFLG $00
```

Fig 4



COMPUTER ANSWERS

Send your queries to: Sheridan Williams, 35 St Julian's Road, St Albans, Herts. Please note that Sheridan can no longer answer questions on an individual basis, so please don't send an SAE with your query.



BBC words

Do you know of a word processor that is available *now* for the BBC micro? I have a disk system and a printer and am raring to go.
David C Grant, Birmingham

I am writing this reply at the end of November, and the main holdup in supplying a word processor for the BBC micro has been the delay in availability of the Series 1 operating system. There are sevseral word processors around, but some of them are of dubious quality. One of the better word processors is undoubtedly 'Wordwise' which comes in EPROM. This simply plugs into your computer and remains there until needed. It is run by typing *WORDWISE or (*W.). The price is normally £39+VAT (10 percent off for BEEBUG members). Acorn has produced a word processor too but currently we haven't reviewed it.
BEEBUG (Independent User Group for the BBC Micro)

Info wanted

Could you please tell me how to obtain information on all the Zilog and Intel microprocessors and support chips and also give the titles of any books on how to build simple computers and hi-resolution colour graphic displays like the Atari or BBC computer?
D Pain, Luton, Beds

Data sheets should be obtainable by writing to the manufacturers. A very full coverage is given in the *Introduction to Microcomputers Series* by Adam Osborne. Volumes 0 to III, plus the updating supplements to vols II and III give a very thorough coverage.

I am afraid I am unable to track down books on computer and graphics card constructions.
P L McIlmoyle

16 or 8?

In the September issue of *PCW* Olivetti poses the question 'When is a 16-bit computer not a 16-bit computer?', and the answer given is: 'When it only has an 8-bit data bus, eg, the 8088 CPU.'

Yet microcomputers based on the Intel 8088 chip are widely advertised as '16-bit'. Does an 8-bit data bus significantly detract from the claim for 16-bit performance from these machines?
Dr J F Reilly, Eastleigh, Hants

The 8088 is a derivative of the 8086 16-bit chip. Internally the two are more or less the same but there's a big difference: while the 8086 has a 16-bit data bus, the 8088 has an 8-bit bus. Therefore, to fetch a 16-bit chunk of data from memory takes the 8088 longer than the 8086 takes. So yes, an 8-bit data bus for a 16-bit chip does create a bottleneck; but a system based on the 8088 is cheaper to make and provides a reasonable trade-off between performance and cost — the chances are that for many applications, the speed difference wouldn't be noticeable to most users.
Peter Rodwell

Bewildering choice

I hope to purchase a home computer but I'm bewildered by the large selection available. I would like it to be able to carry out calculations on lots of formulae such as:

$$\frac{\frac{(B+D)^2}{2A} \quad 3L(F+2.4)}{EF^3-(E-G)\ (F-2H)^3}$$

How much memory will I need and what other features should I look for?
John Park, Strathclyde

You do not indicate what else you require the computer for. In order to evaluate expressions such as the one given, you only need a simple programmable calculator. You can obtain these far more cheaply than even the cheapest computer. However, I will assume that you really *do* want a computer because you want to print or display the results in a way that a calculator cannot.

As long as you don't have more than 100 such expresions then even the smallest (8k, say) computer would do, provided that you print the results as they are calculated, and don't want all the results stored. If you want them stored then you will probably need 16k. What is perhaps more crucial is the accuracy with which the computer will carry out the calculations. You should choose a system that can work in floating point arithmetic, and has sufficient accuracy for your needs. Some versions of Basic (and you needn't necessarily use Basic) only work to six significant figures, whereas others can work in what's called 'double precision' mode with up to 14 digits' precision. As I am unaware of the use for the above expression *you* will have to be the judge on the accuracy required. Another consideration in choosing a system will probably be whether you can use a printer, or display the results graphically, but that's another story.
Sheridan Williams

Software queries

I am completing the testing of a disk utility I have written for the SuperBrain. Can you suggest how I could go about selling this to any company in the UK or USA — who would be interested in marketing it?
C Pearse, Caerphilly, Mid-Glamorgan.

An advertiser interested in buying programs for home computers sent me a submissions form bearing the following condition.

'I acknowledge that it is your policy to give thoughtful consideration to all submissions, but that because you are continually engaged in research, development and marketing of many products involving ideas, unpublished material, inventions or products of your own, which may be similar or identical to the programs or any of them, in theme, idea, format, graphics, or other respects, there is always a possibility of a conflict between the programs and your own items.'

How does this legally affect:
a) A rejected author whose program contains original ideas which crop up later in someone else's program,
and
b) An accepted author who then slightly alters his program and resells it a second time?
R Wood, Dept of Psychology, Hull University

The first of these two related questions is much the easier to answer! A close scrutiny of *PCW* (and maybe some of the other computer magazines devoted to particular hardware you may have written for) will often reveal advertisements from software publishers seeking programs. Failing this, look for firms advertising out-of-the-ordinary software for the machine of your choice, and approach them. You could also contact users clubs for the appropriate machine, who may have suitable contacts.

It could also be worthwhile contacting the manufacturers or distributors for the computer in question.

The second question does not admit of a definitive answer, as the whole question of the law relating to ownership of software is unclear, not least in this country.

I am not a legal expert, so take the following with some caution. As I understand the situation, it would be extremely difficult to claim infringement of copyright simply because the same *ideas* crop up later in someone else's program. However, if exactly the same *code* was in the other program (it would not matter a lot whether this was high level code in, say, Basic, or machine code), you would have a much stronger case for infringement. Incidently, copyright (unlike patents) is automatic, you don't have to register it.

As regards re-selling your program with slight alterations, this depends on whether in selling the first version you sold just the program, or the program and the copyright along with it. Most software publishers (as with book publishers) would expect you to sell them both together. If you have done this, the purchasers could reasonably expect you to pay them royalties on all sales of your modified program. However, if they wanted the benefits (if any!) of the modified version, they could be expected to pay for these. . . so there could be scope for a deal.
P L McIlmoyle

Spectrum typing

Has anybody yet produced an EPROM or ROM which enables you to type in the whole words on the Spectrum, rather than the keywords. Surely many people would far rather pay an

extra £15 on top of the original amount so that they can type in the commands letter by letter?

Could you please tell me what the two spare IC sockets on the PCB are for?

S Polke, Blackpool, Lancs

The answer to your first question is no. Typing in keywords in full on the Spectrum is not that difficult, it takes just a few minutes to get used to not typing them in letter by letter.

The two spare IC sockets on the PCB are where the 32k RAM expansion was fitted on the earlier models. It now has to be soldered in.

James Walsh

Spectrum queries

I am thinking of buying a ZX Spectrum.

1. As I have knowledge of 6502 assembler, how difficult is Z80 assembler?

2. In using the Spectrum, can I load machine code hexadecimal digits immediately and not via Basic?

3. I have heard about REM statements being used for machine code from Basic. Could you explain briefly about this?

4. With my current machine, the UK101, one is able to view directly the machine code hex digits via the monitor mode. Can I do so with the Spectrum or would I need an assembler/disassembler?

5. Can I access the PLOT and DRAW commands when working in machine code?

6. As the Spectrum's POKEing onto the screen is 'non-standard', ie, eight lines at a time, is it possible to write animated graphics in machine code?

7. Can I save machine code programs on the Spectrum?

8. Please could you recommend a book from which to learn machine code for the Spectrum (with no prior knowledge of Z80 presumed)?

9. Is it worth buying an assembler/disassembler if I intend to do a fair amount of machine code. If so, which one?

Graham Lord, Cheadle, Cheshire

1. The basic concept is the same though you will have to familiarise yourself with a new set of instructions. There are also many facilities within Z80 machine code which do not exist in the 6502.

2. No, it is necessary to use either a machine code or a Basic program.

3. Because we can calculate the address of the first line in the program, one can make it a REM and put a number of blank spaces after it. Then the characters that correspond to the codes for the m/c instructions can be put there and simply run via a USR command.

4. No, another program is required, such as a monitor or disassembler.

5. Yes, the addresses of these should be available in a book by Dr Ian Logan shortly.

6. Yes, quite simply by writing a short routine or using the one in the ROM.

7. Yes, easily via SAVE "Name" CODE x,y where x is the starting address and y the length.

8. Unfortunately I have yet to see any books on the subject, although there should be plenty available soon.

9. It is definitely worth your while buying one, as it makes life so much easier. The ones which I would recommend are available from: ACS Software, 7 Lidgett Crescent, Roundhay, Leeds LS8 1HN. Prices are £7.50 for the assembler and £6.75 for the disassembler.

James Walsh

Osborne diskussion

I have heard that there is a new version of the Osborne computer which has double density disks and can read disks in various formats. Can you tell me more about this, please?

(Name and address withheld by request)

I am sure you are referring to the Osborne 1 Mark 2, which is now available in this country in both single and double density versions. The Mark 2 is immediately identifiable by having a grey-blue case, as contrasted with the beige coloured case of the Mark 1.

Another noticeable external difference is that the two latches which hold the keyboard to the case in the carrying position are at the top of the keyboard, rather than being at the sides. On opening these catches you can see a further difference, in that the keyboard is connected to the rest of the computer by a helically coiled lead (like a telephone handset) rather than by a ribbon cable, thus giving more flexibility.

The double-density disk drives look very similar to the single density ones fitted to the Mark 1, but they are much quieter when reading and writing. On the machine I have tried, the keys also had a more solid feel than on a Mark 1 I have used.

As well as reading single density disks written on the Mark 1 Osborne 1, the double density version will also operate in single density mode if booted from a single density Osborne disk, or in double density mode if booted from a double density disk.

An unusual feature is, as you say, that the Mark 2 double density version of the Osborne 1 can read 5¼in floppy disks written in certain other formats. At present these are Xerox, IBM Personal Computer CP/M-86, DEC VT-180, and the original Cromemco 5¼in single-sided, single-density format. Osborne states that it intends to extend this range in due course.

It should be noted that while these disks can be read with the new double density Osborne, it cannot format disks in these other suppliers' formats, nor perform disk copy operations on them. Information, programs, etc, can be transferred to Osborne format disks using PIP.

P L McIlmoyle

Printers for Spectrum

Could you tell me what printers are directly compatible with the ZX Spectrum? Also will the Seikosha GP-100 be compatible when the RS232 interface becomes available?

Michael Walentek, Wollaton, Nottingham

The only other printer which will connect directly with the Spectrum without the RS232 interface is the Amber 2400 24-column printer. It costs just over £100 with Amber's own interface. Details are available from: Amber Controls Ltd, Central Way, Walworth Industrial Estate, Andover, Hampshire.

The Deans' model 81 and SP-42 printers will connect to the Spectrum when the RS232 interface is available. They cost £100 and £150 respectively. The Model 81 will work directly with the ZX81. Details are available from: Dean Electronics, Glendale Park, Fernbank Road, Ascot, Berks.

The Seikosha GP-100 costs £180 and will interface with the Spectrum with RS232.

James Walsh

Talking point

The new speech synthesis chips are frequently mentioned but there is a lack of hard information about them. Could you please tell me:

1. What these chips are?

2. Where they can be obtained?

3. Whether it is feasible to interface them to micros such as the Apple?

4. What sort of soft/hardware support they need?

S Brown, London N8

The two 'speech synthesis' chips most widely met in connection with microcomputers are the Vortrax SC-01 and the National Semiconductors 'Digitalker'. Texas Instruments has the TMS-5100, which is used in many of its own products such as 'Speak 'n' Spell', but I have not come across it as a separate chip.

I do not have a source for the 'Digitalker' chip, but the Vortrax SC-01 can be obtained from: Intelligent Artifacts, Orwell, Royston, Herts.

Such chips as these can certainly be interfaced to the Apple and similar computers, and complete units are commercially available for this purpose. For example, Arfon Electronics makes a speech board for the Apple (and for Nasbus as well), based on the 'Digitalker' and DCP Microdevelopments Ltd offers a 'Speechpak' for the Sinclair ZX81 based on the same chip. The Mutek 'Voxbox' is based on the Vortrax SC-01.

The software needed to interface these packaged systems is quite simple and the hardware support for the speech chips is included. The chips on their own need a lot of ROM and/or RAM (up to 128k for the 'Digitalker'), while the software can also be of the same kind of size.

P L McIlmoyle

Spectrum Forth?

A short, sharp, enquiry. Does the ZXForth software, as supplied by Artic, work on the Spectrum? I fancy having a go on this language.

Also, do you know of any other ways to run different languages on the Spectrum? The Basic on the Spectrum isn't as comprehensive and powerful as I'd like it to be, and I can't afford a flash machine that would probably be wasted on me anyway.

Angel Robert Lynas

Unfortunately the Artic ZXForth is written for the ZX81, and hence is not directly compatible with the Spectrum. But we are hoping that a Spectrum Forth will be appearing on the market in the not too distant future (take note Artic).

There are basically two ways in which an additional language such as Forth can be used on the Spectrum – either by a cassette which LOADS into RAM in the normal way, or by using an extra ROM chip which holds the language.

As far as needing a flashy computer to run Forth is concerned, this is a thing of the past because Jupiter Cantab has released the Jupiter Ace which uses Forth as standard as opposed to Basic.

It costs an incredible £89.95 – well, not so surprising when you realise that it is another creation by the boys who 'played a major part' in designing the Spectrum.

More details are available from this address: Jupiter Cantab, 22 Foxhollow, Bar Hill, Cambridge CB3 8EP.

James Walsh

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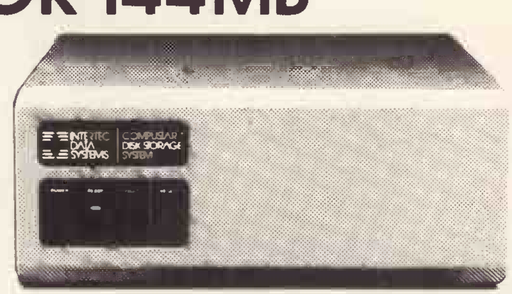

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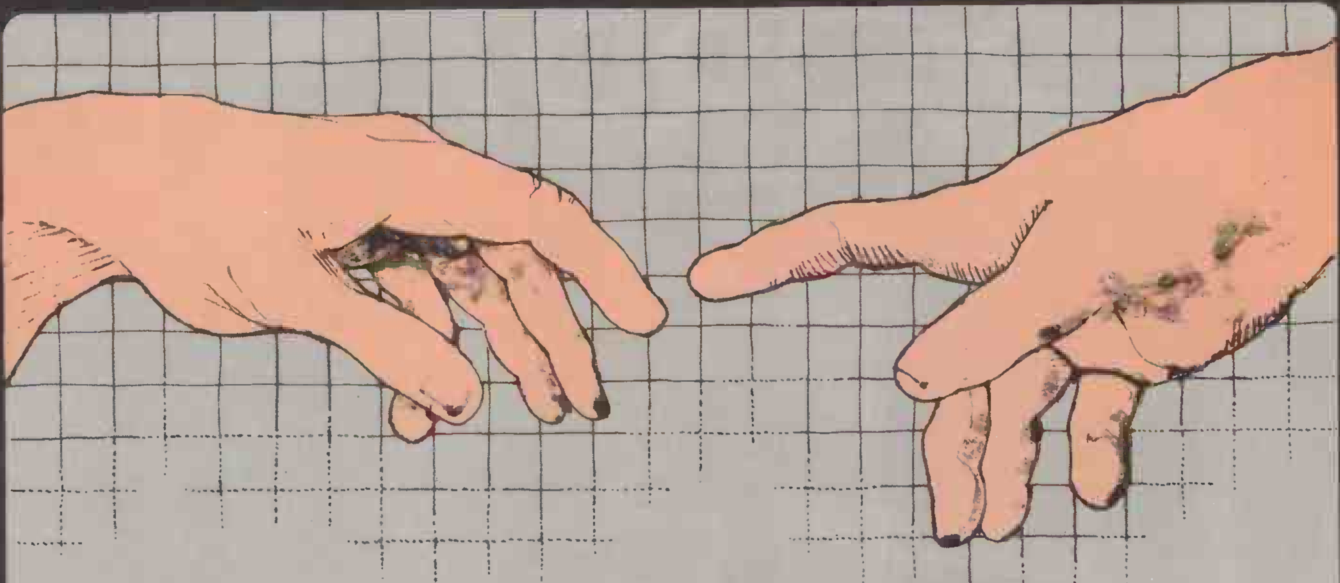

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DataFlex can change the way you do business. And at £495, (excl. VAT), with all its facilities we consider it the best value in the business. A demo package, which limits file sizes internally, is available for computer professionals.

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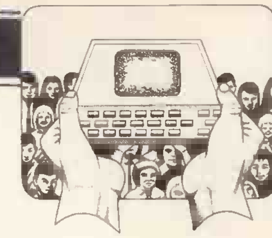
CTUK! NEWS



Maggie Burton brings you all the latest news.

ComputerTown UK! is certainly spreading. This month I've got news of two new 'Towns.

Firstly I'll mention CTEE!, or ComputerTown Eastern Enfield. Enfield is a rather prolific area for ComputerTowns. It now has three operating there and a goodly number of computer clubs as well.

CTEE! is looking out for helping hands as well as members of the public to come along and learn about micros. The venue for meetings is Ordnance Road Library, Enfield, and if you think you can help out, lend equipment and the like, the man to talk to is Peter Herring at the aforementioned library. The phone number is 9 710588.

Moving further north, there's ComputerTown Eastwood in Nottinghamshire. This one meets up on the first Wednesday of each month at the Devonshire Drive Junior School, Eastwood.

This 'Town is another one whose local library has let them down. The library is situated near the centre of the town and very convenient for public transport. However, a charge of £4 per evening is made by the library, which must be stood by the helpers at the 'Town.

Further information about CT Eastwood can be obtained from Mr E N Ryan on Langley Mill 65011 or by writing to him at 15 Queens Square, Eastwood, Notts NG16 3BJ. He is also running a computer club in that area.

Going back to Enfield again, a Mr Steve Ward wrote to us a while ago expressing interest in starting up his own club. He runs a church-based youth club at present and knows several families with micros. His idea is to make the club a general micro club rather than one devoted to a particular make. If you'd like to help him out, offer your own ideas or join the club when he starts it, write to him at 28 Brodie Road, Enfield, Middx EN2 OEU.

And in Oldham (or near Oldham, anyway), Tony Walsh is thinking seriously about running his own 'Town with the help of other like-minded souls. His address is 4 Hawkyard, Greenfield, Oldham, Lancs.

We've been hearing quite a bit from interested parties on the subject of starting up new ComputerTowns following recent publicity on ITV's computer programme Database. I mentioned a couple of issues back that John Bone of CTNE! was interviewed at the *PCW* Show in September. This interview was broadcast on Database and was later followed by a write-up by Newsprint guru Guy Kewney in Database's newsletter.

If you've been thinking on similar lines, here are two addresses from enquirers. The first is Mr D McKnight of Highdown School, Surley Row, Emmer Green, Reading, Berks. The second is Mr Richard Gates (Head of Computer Science), Reepham High School, Reepham, Norwich NR10 4JT.

If none of these addresses are near you, and you'd like to start something up in your onw locality, a letter and SAE to David Tebbutt or myself will secure you a set of our guidelines. These provide a good starting point from which your own ideas can develop. Both of us are happy to answer any queries you might have which are not covered in the guidelines.

Jay Lambert, a South London community youth worker, is looking for a group in that area who will help him provide a computer education facility within the Community Centre in Battersea. The Centre has ordered a BBC Computer but lacks expert advice and help on its use. Any individuals or groups in the south-west of London who can offer their services would be welcomed. Jay Lambert can be reached at the Battersea Project, Old Chesterton School, 110-116 Battersea Park Road, London SW11 4LY; telephone 01-622 9231.

Chris Woodford of CT Burton wrote in a while ago with some interesting news and a new idea.

More than 100 people attended their meeting on 2 December, and the room in the library was so full it broke the safety rules. This meeting featured demonstrations of the Commodore 64 and Epson HX-20 micros and a talk from Phil Phillips, the manager of Burton Job Centre on the effects of computers on employment in the area.

The team at Burton has a theory that high attendances result from talks provided for the absolute beginner. It seems their idea is right.

Remember the newsletter mentioned in the December issue? Chris has had quite some success with it. He's found a printer who will print it for a third of the price charged by their current printer — the only problem is that this printer is on the Isle of Skye, which could mean future delivery problems!

I also mentioned Burton's library hassles in the December issue. Well, all the pleading in the world wouldn't have stopped the county library from deciding to charge them £2.90 for each four hour-meeting. That, unfortunately, is now official.

CT Burton is also planning a program library for the future which is a useful idea. One problem with this, though, is that good educational and user friendly software is not too easy to find, so a project of this type could take some time to get on its feet.

The other idea they've got 'up there' (don't forget I'm sitting 'down here' in London. . .) is 'ComputerCounty Staffordshire'. Basically, this is an attempt to set up a ComputerTown in every town and city in Staffordshire. They're going about this project by making links with local papers who then publicise an appeal for volunteers.

Volunteers who come forward contact Chris Woodford who gives them details and helps with queries. So far, they've got definite plans in Stoke, Cannock and Uttoxeter, with a possibility of something starting up in Tamworth,. They've had reports published in 11 Staffordshire newspapers and Chris was interviewed on Radio Derby.

Computertown Burton almost certainly wouldn't be able to run a drive of this type if they didn't have so many willing volunteers in the first place. Among other members of the team, Chris Fox from the Tangerine User Group (TUG), Gordon Smith, deputy news editor of the *Burton Mail,* Brian Homewood, Director of Peach Data Services Ltd and Ray Threadgould and Dave Woodchurch from FBC Systems Ltd in Derby all pitch in with equipment, publicity and ideas. Certainly it's a ComputerTown to be reckoned with!

Finally, I'd like to put out a request to existing ComputerTowns to keep in touch. We can't chase you all up to find out what's going on. Your ideas and activities could help other CTs. Certainly we can't write this column without you, so I hope to be hearing plenty of news about ComputerDays, talks, demonstrations, etc, in 1983.

Computer Town UK! is an ever-growing network of computer literacy centres where members of the public are given free access to microcomputers, courtesy of those willing to volunteer their time and equipment. Computer Towns might be found anywhere — in a church hall, a library or perhaps a school after hours. The aim is to make computers enjoyable and non-threatening and, because Computer Town is entirely non-commercial, overt axe-grinding of any sort is banned. Guidelines are available for those interested in setting up their own 'Towns: Write to CTUK!, 7 Collins Drive, Eastcote, Middlesex HA4 9EL or 17 St George's Road, London NW11 0LU. Remember to enclose an A4 SAE for your reply. Please don't telephone *PCW* for information as CTUK! is entirely a spare-time activity.

WHICH SPREADSHEET?

Michael Liardet tells you what to look for in a spreadsheet system and introduces a new series on the subject.

A new year and a new series: spreadsheets. Each month we will put a different spreadsheet system on the testbench and give you a complete rundown on it. First in line for the treatment will be a relatively recent British product called Prophet II. This system is somewhat unusual in that it comes as a complete package, including hardware — but more on this next month. First, let's explain some basic concepts and outline the hows, whys, whats and wherefores of what we are going to be doing.

What is a spreadsheet system?

Some of our readers may already be using a spreadsheet system, or at least be familiar with the term. But as the word is such a recent addition to the language we had better define what we are talking about.

The word 'spreadsheet' is used to describe a range of software packages that greatly facilitate pencil/paper/calculator calculations. The underlying principle of these systems is that the VDU screen operates as a highly mobile 'window' (refer to Figure 1) on a very large (say three metres square) 'sheet' which is divided into a grid of small rectangles (known as 'cells') containing numbers, text or formulae. Each cell can be uniquely identified by a fairly obvious coordinate scheme (eg, A1 is the top left cell, Z99 the bottom right) and these identifiers are used in the formulae. For example, if it is required that cell C3 display a value double the sum of cells A1 and A2, then the formla 2*(A1+A2) is required at C3. Note that if a cell contains a formula, the formula is not (normally) displayed, but the result of the calculation is shown instead. Thus the overall display appears as a neatly tabulated array of numbers interleaved with text where required.

In most speadsheet systems one particular cell in the display is uniquely identified by flashing or highlighting, etc. This signifies the current 'cursor' position — ie, the cell at which new values or formulae can be entered. This cursor can be moved very rapidly from cell to cell, using single keystrokes — in most cases the 'arrow' keys, available on most VDUs, are used for this. Attempts to move the cursor outside the bounds of the VDU cause no problems — the display shifts to accommodate the new position. Imagine a tortoise in a box with no bottom, only a lot faster! (Incidentally 'cursor' comes from the Latin — meaning 'runner'. Perhaps I should have mentioned a hare instead, but that's another story!)

It should be remembered that neither the window nor the sheet 'really' exist — they are just simulated by the spreadsheet system controlling the VDU display — but after a few minutes working with such a system the concept is easily grasped. Anyway, with a few keystrokes the user of a spreadsheet system can position the cursor where required, make an alteration to a particular cell and then witness the effects of this change permeating through to each cell using this cell in a formula, and on to any cells that reference them in turn, and so on until the sheet is brought completely up to date.

'Is that all?' I hear you say. Well, like many brilliant and innovative ideas, spreadsheets fall into the 'so simple I could have thought of it myself' category! In fact nobody did think of it until about three years ago, when two students at Harvard Business School, Dan Bricklin and Robert Frankson, unleashed a software package called Visicalc. A hundred thousand-plus sales and a score of Visicalc imitators later and spreadsheet systems look like supplanting pencil and paper calculations in the same way that word-processing systems are taking over from the typewriter.

Who needs one?

Anybody with a problem of the 'What-if?' variety reaps enormous benefits from using a spreadsheet system. Once the basic structure of the problem has been set up (an exercise limited only by your own typing speed and your ability to formulate the calculation rules, etc), it is possible to experiment freely with different data values or modified calculation rules and instantaneously (well almost — see Benchmarks!) have the ramifications of the changes filter right through from the top to the bottom.

Perhaps the most common application area for spreadsheets is in budgeting, either personal or company budgets: if you have ever tried to draw up a budget manually you will know the massive recalculations needed to adjust it for just one small modification near the top line — just about every following line, subtotal and total seems to need recalculating!

However, use of spreadsheets is not just confined to this — for example one of the Visicalc sales leaflets lists a hundred others ranging through business, personal, scientific, financial and technical applications. All levels of decision-making right through from strategic planning in multi-nationals down (up?) to personal beer budgets can be catered for. Next time you have your pocket calculator out for more than 10 minutes ask yourself if you might be in need of a spreadsheet system. (By the way is anybody out there still using a slide-rule or even — gasp! — log tables?)

Choosing a spreadsheet

Once you have decided that you need a system, how do you go about choosing one? Well in the first instance, you should follow the same basic guidelines that would apply to the purchase of any software package:

1) Find a system that ties in comfortably with hardware and software you already (or will) have.

2) Consider your possible future needs as well.

3) Obtain an understanding of what is available in general.

4) Look for a system which satisfies the exceptions and peculiarities of your own application in particular.

5) Look for reliability, robustness and support if things go wrong.

6) Look for well-presented and clearly written manuals.

7) Look for well-presented and 'user-friendly' software.

8) Give price as low a priority as you can afford. If you can find two systems that exactly fit the bill on 1-7, then buy

the cheaper one!

9) Last, but by no means least, follow this series avidly!

Selecting the hardware

If you have not yet purchased a computer you may wish to consider the general hardware requirements to run a spreadsheet system satisfactorily. You will of course need to balance these requirements against your other needs, etc.

A high-speed VDU is a must. Since with spreadsheet systems the entire display is frequently changed by a single keystroke, the VDU must be able to respond in about the time it takes to make a key-stroke. Most modern VDUs and micros with an integral screen (like Osborne, Apple, Superbrain, Sirius, Advantage, etc) fall into this category anyway. VDU speed is measured in 'Baud', and 9600 Baud generally gives satisfactory results.

You may also look for a numeric keypad to speed data entry and a graphics display too. Make sure the spreadsheet system can in fact do graphics with the display of your choice.

Disk capacity is usually unimportant (only with respect to spreadsheets, though!), since even a 100k (ie, about the lowest capacity on the market) disk drive can be used to store several different spreadsheets.

Spreadsheet systems have a tendency to consume all the internal (RAM) memory, typically long before the 'three metres square page' mentioned above is anywhere near filled in. Until about 12 months ago, most micros had an upper limit of 64k of RAM but a new generation of micros and extension facilities for the old can provide some help if you anticipate setting up a largte application.

Spreadsheet systems certainly work very satisfactorily on a single-user desktop system, where the central processor is solely dedicated to maintaining the VDU display and performing calculations. If you intend making extensive usage of a spreadsheet system with a multi-user micro then, for the same processor, it would be reasonable to expect some degradation in responsiveness.

It is highly desirable to have a printer that can print as many characters across a line as possible, obviating the need to run off reports in sections and paste them together later. Most of the cheaper dot-matrix printers can handle at least 80 characters across, many providing 132 if switched into a smaller character font or condensed mode. Slightly more expensive printers can handle 13in wide stationery, permitting around 200 characters across a line if condensed mode is available as well.

Speed and print quality are likely to be less important for spreadsheet calculations, as most reports are fairly short anyway, and usually are just used for internal consumption. Most matrix printers are quite satisfactory in this respect but there is generally no special difficulty with using other types of printer if necessary.

Finally, if you have already been considering having graphics, then you will naturally need to select an appropriate printer or even separate plotter to cope with this.

Spreadsheet Benchtests

Having read this far, you are probably asking yourself how you are ever going to be able to assimilate enough information to make a sensible purchase decision. Obviously, most suppliers will provide information leaflets on request or a dealer may be prepared to give a short demonstration, but in neither case will you be getting wholly impartial advice, nor will you get a chance to really see if a system is exactly what you want. Enter the Spreadsheet Benchtests!

Each month, we shall take a look at a different spreadsheet system, indicating for which hardware or operating systems it is available, then giving a complete rundown on what it is like to work with, its facilities provided and its facilities not provided and finally giving the results of some Benchmark tests. Here's the checklist to be used in the forthcoming reviews.

DOCUMENTATION: No software package is complete without adequate documentation. Ideally, documentation should include both tutorial material for the out-and-out beginner and well-indexed reference material for the experienced user to get the most out of the system. Illustrations and diagrams are always of great value to all levels of user and a simple reference card can also save a great deal of page-thumbing for the expert in a hurry!

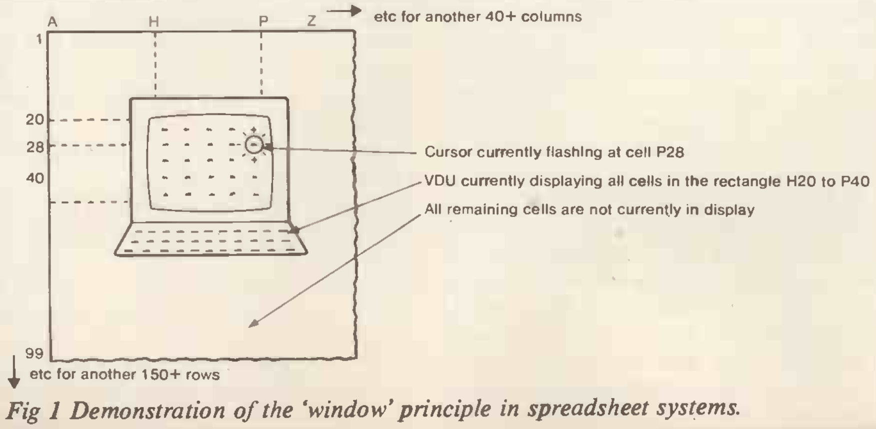


Fig 1 Demonstration of the 'window' principle in spreadsheet systems.

USER-FRIENDLINESS: It's very important that the user be able to assemble quickly, in his own mind, a 'model' of what the system can do for him, knowing what the possibilities and options are at any given moment. To achieve this, the system must at the very least outline clearly the commands available to him, warn him what is about to happen, enable him to reverse a decision if he wishes and generally behave in a consistent fashion throughout (eg, if the escape key has a special function at one point it is confusing in the extreme if it has a different function elsewhere).

ERROR HANDLING: Really this is a special aspect of user-friendliness but because it is so important we have it in a separate category. Basically, the spreadsheet systems must be able to deal correctly with erroneous keyboard input (eg, entering text instead of numbers), disk errors (eg, loading files that are not there) and printer errors (such as the facility to stop printout if there is a paper jam). In all cases, the user should be warned of the mistake and then allowed to correct it and try again as if nothing has happened. The ultimate disaster is to make a minor slip-up and be faced with a 'dead keyboard' or a garbled display and be forced to restart the system from scratch!

FACILITIES: Having defined the essence of spreadsheet systems earlier, it's obvious that a lot of other facilities need to be available to make a complete up-and-running software package. The newcomer to spreadsheets may not immediately appreciate the value of some of the extra facilities provided by some packages, so we shall suggest likely usages for them.

Arithmetic: All spreadsheets should be able to handle simple addition, subtraction, multiplication and division between cells. The better systems allow arbitrarily complex expressions to be used in a sort of 'keyboard' version of the usual mathematical notation taught at school. In addition to simple arithmetic many systems provide trigonometry, logarithms, row or column sum, minimum or maximum values and so on.

Configuration: It is important for systems which are available on a range of equipment to have a good configuration option, so that you can get the best out of them on the equipment that you, in particular, have. Configuration may relate to specifying the amount of internal memory in your computer, special features available on your VDU, or facilities provided by your printer.

Graphics: Some systems enable the results of a calculation to be plotted out as a graph, bar-graph or pie-chart. In some instances the software to achieve this may be an optional extra, or even a separate package. If you are considering the use of graphics then make sure your hardware selection matches exactly with the specified requirements for the software. Most graphics software works on only a limited range of hardware.

Interface to other software: Frequently the basic input data for the

WHICH SPREADSHEET?

spreadsheet system has already been produced by some other software on your computer (eg, current selling prices, stock-levels, sales-figures, etc). Ideally the data should not need to be re-entered direct at the keyboard, but should instead be transferred from file directly. Likewise, the results of the spreadsheet system should, if need be, be directed into other data files such as word-processing document files, etc.

Spreadsheet overlays: In general, it is very useful to be able to overlay data from one spreadsheet file onto a prepared spreadsheet in main memory, without it being completely cleared. (Of course some bits of it will be overwritten.) This enables different spreadsheet applications to inter-communicate.

Turnkey system: Systems which are completely self-sufficient and operate automatically from switch-on are the easiest to learn. All too often certain activities, particularly disk copying or initialising blank disks in preparation for use, are not provided as part of the spreadsheet system and you are forced to 'refer to your computer manufacturer's instructions' as they say in the manuals. Systems written for computers using the CP/M operating system seem to be particularly bad in this respect.

Insertions and deletions: It is quite common to have spent some considerable time setting up an application only to realise that a line has been missed out somewhere near the top, or else a row has been misplaced. Without proper row or column deletion and insertion facilities, this sort of correction can only be made by extensive retyping. It should be noted that insertion and deletion should also automatically adjust all relevant formulae.

Replication: Commonly, spreadsheet applications are built up by experimenting with just one column (the month-1 column if you are budgeting). Once this has been set up satisfactorily, it would be very tedious to retype virtually the same formulae, but shifted one column along, for all the other columns. Systems with proper replication facilities in effect do the retyping for you, adjusting all the formulae to account for the column shift as well, if you wish.

Display flexibility: Most systems allow the displayed column widths to be altered so that if you are working with small numbers you can accommodate many more columns across the screen. Some systems permit different columns to be displayed at different widths, and also various display formats for numbers — scientific notation, varying numbers of decimal places, negatives in parentheses, etc.

Another valuable display facility is the ability to have a split screen — your VDU simultaneously displaying completely separate parts of the model — thus enabling you to keep the 'grand totals' at the bottom line continually in view while you are making changes somewhere near the top.

Protected Cells: Some systems permit specified cells to be protected. This prevents them from being changed, either by accident or design. This facility is particularly useful if an application set up by an expert is to be used by inexperienced users, or even as protection from your own stupidity! Remember, though, that whatever disasters you may perpetrate at the keyboard, you will not lose a great deal if you have saved a copy of the original onto disk.

Formula printout: It is very useful to keep a hard-copy record of how the application was set up — for instance to be able to check the validity of the formulae used or as the basis for documentation on the application.

Formula editing: The adventurous user may find himself creating fairly long and complicated formulae — say 50-plus characters long. It is very irritating to have to retype from scratch to correct for a missing bracket or whatever. Many systems permit a fairly primitive but effective means for editing-in the correction without retyping the whole lot again.

Automatic/Manual recalculation: After a value has been changed, most spreadsheet systems automatically do a recalculation and amend the display 'instantly'. This is very impressive when the application is fairly small and it does really happen instantly. But as the application grows larger and it starts to take longer to recalculate for each change, it is preferable to switch this facility off, and do the recalculation only when several changes have been made.

Out of memory: It is relatively easy to generate an application which exceeds the capacity of the computer's memory. To mitigate this problem, spreadsheet systems should always keep the user informed of the remaining memory available, and should also most certainly not go haywire if this is exceeded.

Long Jumps: When moving about the spreadsheet in a fairly local region (say in a ten by ten square of cells) it is quite convenient to use the normal cursor/window move commands. Moving across longer distances, it is quicker to make use of a special 'jump' command and simply enter the cell coordinates to be jumped to.

Searching and logic facilities: Some spreadsheet systems have a 'lookup' facility for searching for a particular value and others provide logic and comparison ('and's, 'or's, 'less than's, etc) operators. If you get as far as using these, then you can call yourself a programmer.

BENCHMARK TEST AND OTHER MEASUREMENTS: Having devoured all the previous information you may still be concerned as to whether the application you have in mind will fit in, or the calculations be accurate or fast enough. With the tests and measurements here we will try and provide answers to these questions, but please be careful when comparing different times — it will not be possible to run all spreadsheet systems on the same hardware, so unavoidably we will be simultaneously Benchmarking hardware and software together.

We shall be giving details of the spreadsheet size (maximum number of rows, maximum number of columns) and numeric precision in calculations, as well as other measurements such as maximum column widths, etc.

It should be emphasised that most spreadsheet systems permit an excessive number of rows and columns, but run out of storage space long before they have all been used. The more important figure is the total area that can be filled (see Benchmarks below).

Numeric precision can be very important if you anticipate the need to handle large numbers to a high degree of accuracy — eg, if you wish to work with financial figures up to the million pound mark, but want calculations to be accurate to the nearest penny, then you will require 8-digit precision for display purposes alone (six digits before, plus two after the decimal point), and a system specified precision of nine digits at least as soon as any calculation is to be performed (at least an extra digit and preferably more to cope with round-off error).

Benchmark 1: The purpose of this test is (a) to ascertain the true capacity of a spreadsheet system and (b) to time its performance — recalculation times, etc, when it is running at full capacity. It is designed to simulate a typical 12-month financial calculation, involving 12 columns plus a 13th column as the sum of the other 12.

When the test is running, the spreadsheet displays the numbers 1 to 12 in the first row with a column sum (78) at the end, followed by 13 to 24 in the second, then its column sum, followed by 25 to 36 in the third row, and so on up to as many rows as the system can fit in before running out of memory.

This display is not generated in the simplest way possible, but by a formula which uses each of the four basic arithmetic operators just once. Assuming the spreadsheet uses letters of the alphabet to identify columns, and numbers for rows:

Cell A1 contains the number 1.
Cell B1 contains (12*(A1-1)/12)+2 (which evaluates to 2).
Cell C1 contains (12*(B1-1)/12)+2 (which evaluates to 3), etc, up to cell L1.
Cell M1 contains A1+. . .+L1 or SUM(A1 to L1) if it exists (that completes row 1).
Cell A2 contains (12*(A1-1)/12)+13 (which evaluates to 13).
Cell B2 contains (12*(B1-1)/12)+13 (which evaluates to 14), etc, up to cell L2.
Cell M2 contains A2+. . .+L2 or SUM(A2 to L2) if it exists (that completes row 2).

The remaining rows are specified in the same manner as row 2, each row per-

GOTO page 220

Moore on Kuma

Look no paper

Only last month we were extolling the virtues of the WDPRO word processing package for the Sharp range. Now it's even better.

A major enhancement to the program means that you can now see exactly what the text will look like in hard copy without using any paper. The format can be viewed, but not edited, on screen using the "window" technique. The window can move in any of four directions as required. The next page is called by simply pressing Carriage Return (CR).

A special version of the enhanced WDPRO 2.2 is available for the strongly recommended 80 column modification on the MZ80A. And an additional benefit across the range is a new non printing comment facility that allows you to embed instructions into the text without them appearing on paper. We believe this is unique among medium priced word processing programs.

WDPRO 2.2 costs only £39.50 on cassette and £79.95 on disk but if you already have the standard version, return it to us and we will update it for just £5.

Database Delight

An "electronic card index" is how Dean Software modestly describes the Solid State Database Program.

In fact the program is a low cost, highly efficient and flexible, general purpose data base management tool for the Sharp range.

It can handle 255 pages with 10 lines a page, each line having its own name, and execute a search in around 15 seconds. There are sort and summary print facilities that can be changed at anytime, and are ideal for compiling price and mailing lists.

Solid State Database Program includes a built-in calculator and a browse function for when you've forgotten exactly how you filed a particular item. Available from Kuma on cassette and disk priced £29.50 respectively.

NewBrain Software

Kuma now has a large range of software for the NewBrain. Phone 0628 71778 for a list and be pleasantly surprised by the variety.

Sharp Tools

For just £14.50 you can buy a Toolkit for the recently announced Kuma Forth for the Sharp MZ80A and K.

You can forget about spanners and screwdrivers, for this kit consists of a series of screens containing the definition of Forth words. These words provide facilities to allow programs to be written more quickly and efficiently.

This major extension to a fundamentally powerful language makes Kuma Forth the best we've seen. But we're not resting on our laurels; so if you have developed any other useful add-ons let us know.

Entertainment Stars

Although Kuma takes software publishing very seriously, there is always room in our library for good entertainment programs. This month the spotlight is on the bright stars in Sirius entertainment software.

Programs like Island of Arctuan, Maze Runner and Othello are designed for the thinking person who enjoys a real challenge. They're all under £20 each and you can find out about these and others by phoning 0628-71778 for a catalogue.

No P's in Pascal for the Sharp

Gone are the cumbersome P-codes. Here to stay is the Hisoft Pascal 4 which has the fastest overall time on the PCW Pascal Benchmark Timings of any currently available micro Pascal Compiler.

Cassette and CP/M based Pascal 4 is available for the complete Sharp range and is a very fast and powerful compiler which produces directly executable Z80 object code.

Hisoft have a long track record in Pascal compilers; so you can be sure that this one is a proven, reliable software tool.

Cassette and disk prices are £35 and £40 respectively, with the MZ80B cassette price to be announced.

Kuma adds Epson HX20

We now supply a new micro which complements our range very nicely: Epson HX20 is from the makers of those highly reliable printers. It has a built in mini-cassette tape and microprinter and 32K of user memory.

Contact John Day at Kuma for full details.

Sharp Software Catalogues

The new MZ80AK & A catalogue has details on 48 additional programs — most of them completely new. It costs just 50p. For free you can have totally revised MZ80B catalogue.

Escaping with Sharp

Kuma is now offering Sharp entertainment software by prolific writer John Wolstencroft.

The first two selected are Quest and Cursed Chambers. Quest takes you through a 130 room castle full of treasure, fires and other hazards. Cursed Chambers has a random array of hazards and up to 1500 rooms to explore and escape from the "almighty sphere".

Both cost £10.50 for the MZ80A & K and £14.50 for the MZ80B.

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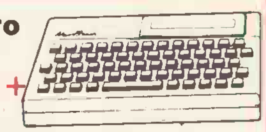
Newbrain: The only professional micro of this size: Phone us for immediate **FREE delivery + SOFTWARE CATALOGUE** Newbrain AD with onboard display £229. + VAT.



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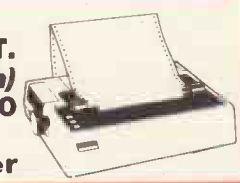

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BENCHTEST

THE SAGE II

Resident seer Robin Webster prophesies a bright future for this 68000-based system.

There's a lot of revolutionary talk going on right now about the Sage II single-user microsystem.

Listening to the claims made for this Motorola 68000-based machine it seems it could blow the socks off almost everything below the size of a Digital PDP-11: however, the manufacturer's own benchmarks suggest that the lower end PDP-11s have got something to worry about as well.

The Sage II is said to compile Pascal source code at a rate of 1800 lines a minute and load a 20k program from its floppy disk unit in about one second. Indeed, the *PCW* Benchmarks — Pascal and Basic in this case — tend to support the general impression that the Sage makes even tired-out software look good.

But, leaving pure processing speed aside for the moment, the real key to the success of a new computer system is the software it brings within reach of its users. In this sense, the Sage II is somewhat unusual. While Sage Technology sensibly avoided the mistake of producing its very own 'new and better' operating system, it did not follow the crowd by offering the single-user CP/M and MS-DOS operating systems, or the multi-user Unix.

Instead, the primary operating system on the Sage is the portable UCSD p-System marketed by Softech Microsystems. The only other system to be so intimately identified with the p-System is probably Western Digital's Microengine, which has an architecture designed specifically to run p-code.

The notion behind this decision has a lot to do with the fact that there is a large amount of p-System software around. Apple, Texas Instruments, and Digital Equipment users were bitten by the bug a long time ago. Of course, CP/M is still ahead in terms of the sheer number of users and the software packages available, but what they lack in choice p-System users make up for in terms of collective support of the product.

Both in this country and in the US, p-System users have formed a user group called USUS which puts out regular newsletters (at least, as regular as anybody else's) and tend to keep in touch with each other by electronic mail.

But rather than force customers to pick which side of the fence to stand on, Sage Technology is already making arrangements to offer the 68000-based version of CP/M — known as CP/M-68k — and the multi-user Unix operating system within the next few months, as well.

It also appears that Sage Technology intends to go through the whole alphabet of languages (APL, Basic, Cobol, etc) in an attempt to stop its machine from becoming typecast.

The 68000 chip is by no means new — all sorts of companies have been putting their own boxes around it for a couple of years. Its performance has never really been easy to estimate, however, since the majority of machines were designed as multi-user, multi-tasking systems running either Bell Labs' own Unix, or one of the other lookalikes. Good examples would be the Fortune 32:16 and the Wicat.

Sage II designer Rod Coleman told me that, as far as he was concerned, the strengths of his machine are that it had been developed from scratch to be a single-user system based on the Motorola 68000 — a 'chip that will have the biggest share of the 16-bit market'; and that it was somewhat a mixture of Apple Computer technology and Altos packaging, two successful models — to his way of thinking — to follow.

While it might be fairer to compare the Sage's performance with peer machines rather than with the Sirius or IBM Personal Computer, time did not permit a search for a truly comparable machine.

So, before we look at why the Sage is causing quite a stir in the industry, a small qualification on all comparisons. The Sirius and IBM are based on the Intel 8088 chip which has 16-bit internal processing capability. While this may qualify it as a 16-bit chip, all I/O operations must squeeze through the 8088's 8-bit data bus. Therefore, a 16-bit chunk of data has to be taken in or out of the processor in two 8-bit pieces.

The Motorola 68000, however, is a 32-bit internal and 16-bit external chip. This means that it can process twice as much data in one go (32 bits) and can send or receive data in 16-bit lots.

So there is an important distinction to be made between machines like the Sirius and IBM and the Sage — even though they are all referrred to as 16-bit computers in the literature.

Hardware

Having been told about the power of the Sage, it's surprising to see the machine itself, since there's not actually much to look at. In this sense it is a good example to other microcomputer manufacturers who expend more energy on making their machine look substantial or 'good' than they do on making the system provide sensible computing facilities.

The Sage comes in the form of an 18lb unit measuring 5.5in x 12.5in x 16.75in — roughly the same size as an Apple II box with the keyboard missing. But whereas the Apple has only its electronics within the box the Sage comes complete with main memory plus so-called Ramdisk of up to 512k total, two integral disk drives, a cooling fan, and four I/O ports.

The box is a pleasant beige colour, while the front of the disk units are painted black. Above the left-hand drive unit is a multi-colour light-emitting-diode (LED), marked 'processor', which changes colour depending on what the machine is doing: green signifies that the data bus is active; red signifies that it is inactive; other colours mean that the system is processing data. The LED's colour can be controlled by user software.

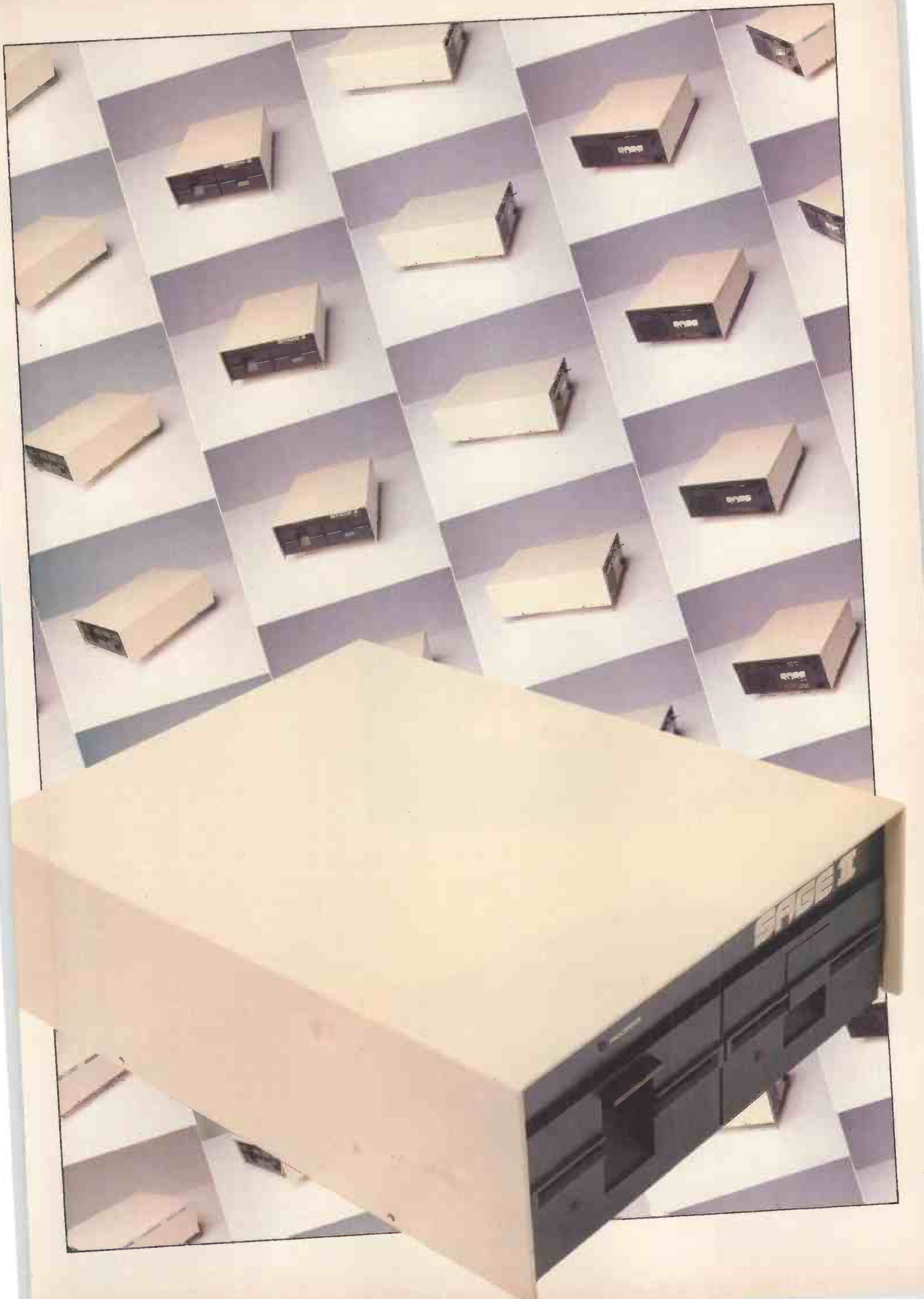
All four I/O ports are arranged at the back of the machine. They are easy to get at since they have been set next to each other at the top edge of the box. From the rear, moving from left to right, there is the reset button, the terminal port, the modem port, the printer port, two blocks of eight micro-switches marked 'Group A' and 'Group B', and an IEEE-488 interface. To the left, below the terminal and modem ports, there is the cooling fan exhaust, while to the right under the IEEE-488 interface lurk the on/off switch and the mains power socket.

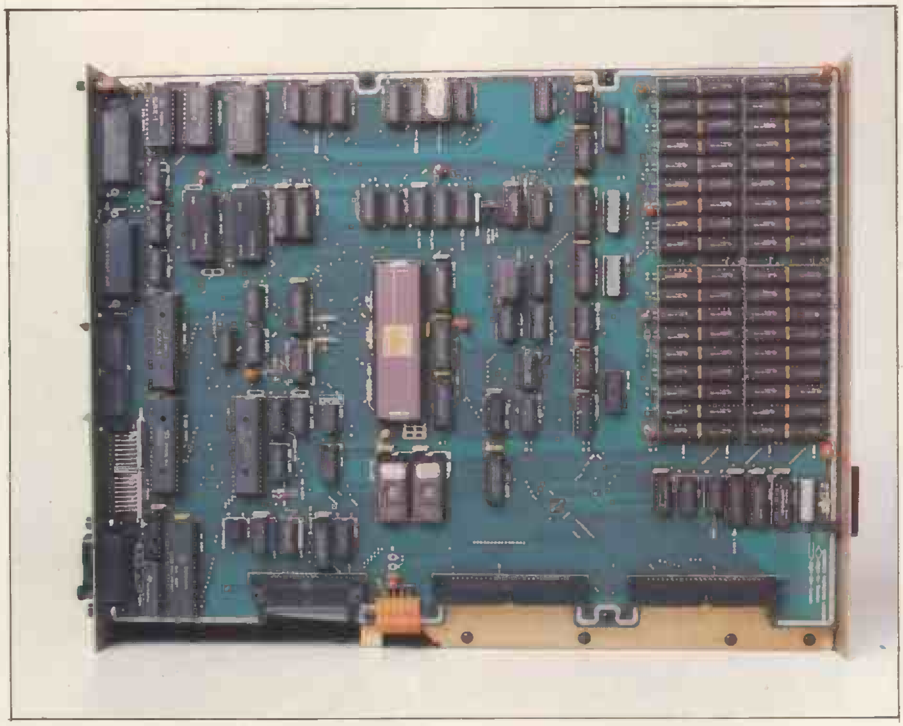
Also on the back is a printed message informing the user that although the Sage complies with FCC electronic equipment design rules there is a danger that it could cause local electrical disturbances. Further, the message points out that the user will be responsible for the disturbance and might have to take some steps to contain the problem. (There was some radio interference during review sessions.)

The terminal and modem ports are of the usual RS-232C serial type and can be software set to operate at anywhere between 50 and 19,200 baud. The printer port is a Centronics compatible parallel version and in addition to this can be used as a general-purpose I/O or control port.

If you're intending to tie up special instrumentation to the Sage, you'll use the IEEE-488 interface which, again, can be

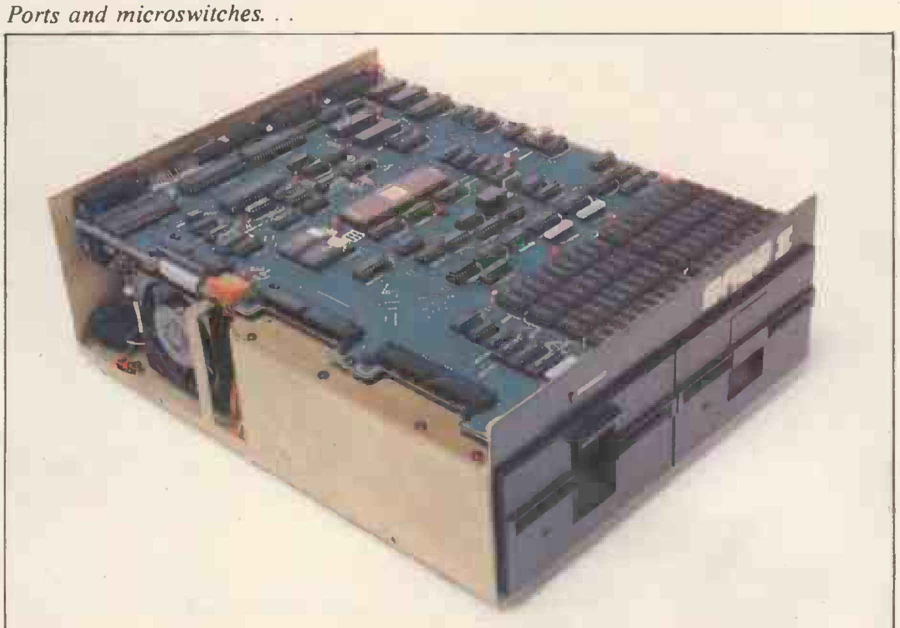
Photography by John Mason


SAGE II



Top view — packed but uncluttered. . .

Ports and microswitches. . .



Main board, sitting neatly above disk drive.

set to do more or less what you want by use of the appropriate software. At the housekeeping level, the interface is controlled by a Texas Instruments TMS9914A chip.

If you're wondering what the Group A and Group B microswitches are for, I'll explain.

The Group A block of eight switches is ostensibly there to enable the system to communicate with terminals having different baud rate capabilities, and the current set-up is always checked out by the system whenever it is switched on. Also, by following the instructions given in the owner's manual, the switches can be set so that rather than booting up in the normal way when switched on, the machine can be made to enter a debugging mode, signified by a '>' prompt.

The Sage Debugging Tool, as it is called, is a powerful program repair utility which offers commands that allow the user to display the contents of all or selected registers, dump the contents of the memory, load in data from floppy disks or other connected devices, set program break points, and modify memory contents. Other than by choice, the SDT is entered whenever errors occur on power-up, or certain system states occur.

Group B switches allow devices to be given a bus address, although this function can be taken over by software if the switches are needed for some other use.

Putting these switches (the only ones I could detect anywhere on the machine) on the outside will do a lot to endear the Sage to those users who have previously had to take the lids off other terminals or computers and search for well-hidden switches to change a baud rate or whatever.

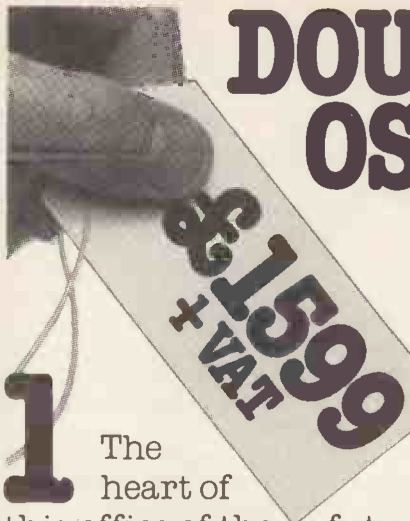
Almost everything about the Sage seems to have been designed so as to make its use and maintenance a simple job — it takes up little space, is easy to move around and requires only the removal of four screws to get inside it. Once the screws are taken out, the sheet metal casing can be lifted off without fear of snagging or stretching any cables, because there just aren't any to be seen hanging out idly.

Inside, all the chips and connecting circuitry are very neatly laid out on one board (measuring about 11.5 x 15.5 inches) which sits atop the disk drives and cooling fan, just under the sheet metal exterior. At first, the fact that the main board was given just enough room to breathe, and no more, made me wonder how extra boards and other devices might be accommodated: was it that customers would have to start hanging things on the outside, a la Tandy?

The answer turned out to be very simple. When extra boards came along, the sheet metal casing would be made a bit taller so that the new boards could stack on top of the one that was already there.

The simplicity and neat design of the Sage's electronics is to be expected, I suppose, since Rod Coleman admits to having

DOUBLE DENSITY OSBORNE AND PRAXIS



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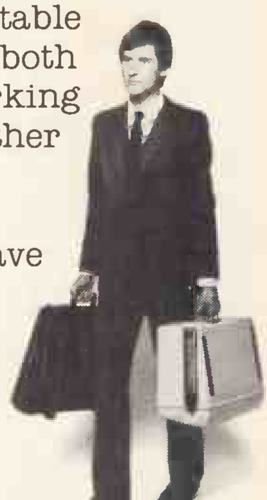

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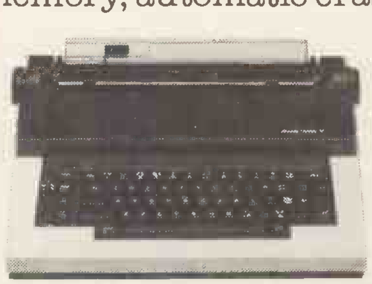

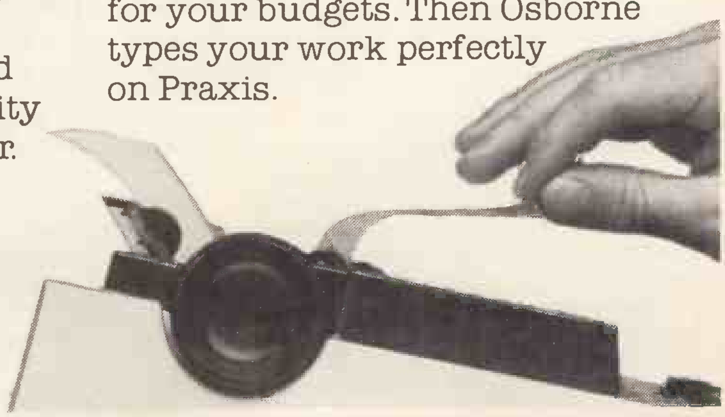

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built his first arithmetic and logic unit (ALU) out of transistor radio parts when he was in his early teens.

While his company refers to the Sage as being of 'innovative design' or as representing a 'technological and price breakthrough', all technical information, including source software files, is freely published for users wanting to keep it as documentation, or for those more expert who want to pursue their own development ideas. Obviously, this is a great idea from both the company and user point of view, and should shorten the time it will take for a generous amount of useful software (and maybe even hardware) products to appear.

The Sage is based on a 68000 chip set to run at a speed of 8MHz. Compared to this, the Sirius and IBM personals have 8088 chips running at only 5 MHz. This is yet another point in favour of the Sage performance ratings.

The 68000 has a 16-bit external data bus, and, with a 24-bit address bus, can address up to 16 Mbytes, which is nice to know although most users won't require that maximum initially.

Minimum memory on the Sage is 128k, the amount required by the p-System to operate properly. Of this 128k, 64 is allocated to the p-System itself, while the remainder is left as the user area (that's the ideal situation, but the memory areas can be played around with to a certain extent if you know what you're doing). The Sage literature claims that this 128k standard memory really signifies 'The End of the RAM Cram Era' in which 64k was the usual memory allocation.

True, most manufacturers still provide 64k as standard — only the Sirius comes to mind as competitive in that a standard machine comes with 128k memory, two 600k drives, a keyboard, a display, and Microsoft Basic for about £2395. A bottom-end Sage is provided with 128k memory, one 320k disk drive, the p-System and the Pascal, Basic, and Fortran compilers, plus one year's on-site maintenance for around £2870 (VDU and keyboard are extra).

Both machines are expandable: up to 512k of internal RAM for the Sage — more in the case of the Sirius.

Clearly there are pros and cons about buying either machine given these details — but the minimum memory argument is really quite irrelevant. The key thing about the Sage II is that it is quite a different type of machine altogether from the Sirius, offering lots of personal processing power.

And that's the important thing: to decide what level of processing power your applications will need to perform satisfactorily, ations will need to perform satisfactorily, and then to go scouting for the most suitable machine.

One of the key components of the Sage hardware, to my mind, is the combination of the powerful chip with the additional semiconductor memory which can be added, in 128k chunks, and used as Ramdisk — RAM chips configured to appear to the 68000 as if they are in fact a super-fast access disk.

The Benchtest machine came with the full 512k memory (split up into 128k main memory and 384k Ramdisk); one 80-track disk unit capable of storing 640k, and a 320k 40-track disk unit. The terminal used was a Televideo 925, although it could have been a far simpler, and cheaper, type.

The Ramdisk can be used in two ways: you can either boot a system disk directly from the left-hand disk drive into main memory only and treat the Ramdisk as if it were simply another disk drive; or you can boot to the Ramdisk. This second feature can be useful because it allows you to remove the system floppy once the relevant files are loaded. The Ramdisk then acts as if it were a bona fide disk.

This Ramdisk enable/disable ability is handled through a utility program called Sageutil, which is also used to format disks and make copies of the p-System bootstrap loader.

A really useful aspect of the disk configuration element of Sageutil is that it makes it possible for the Sage disk drives to read IBM's 5¼in disk format. Because the machine I was using had only one 80 track drive and one 40 track drive, there were some compatibility problems in copying from one to the other. This was resolved by first loading files into Ramdisk and then down onto the target disk. The only trouble here was that if the Ramdisk was nearly full with files the transient files would be rejected until some file deletions had been made.

The Ramdisk is physically located to the front-right of the circuit board and is made up of four rows of 18 8k chips. Each row of 18 is further sectioned into two lots of nine chips so that eight of them provide 64k of memory while the ninth handles parity checking.

In operation, the Sage is acceptably quiet and consumes only about 70 watts of power — less than a household light-bulb. Therefore it remains cool even when used for long periods. Indeed, the manufacturer claims that the machine could operate without a cooling fan.

UCSD p-System

Although Softech Microsystem's UCSD p-System has been covered in *PCW* before (see three-part article 'P for Perfect'), it's probably worth going over the features of the unusual environment since it currently dictates the way the Sage is used.

The p-System is great for amnesiacs who can never remember what the system command is to copy a file or list a directory. From the moment you boot it up, the p-System always does its best to provide a menu of possible commands that can be used.

The main, or Command level, menu is usually the first thing a user sees and it presents a choice of the following: E(dit, R(un, F(ile, C(omp, L(ink, X(ecute, A(ssem, D(ebug.

You have only to press the first letter of each, so that by typing in 'E' you will be asked for the filename of the file you want to edit and, if it is found on disk or in main memory, another editing-oriented menu will appear. If you want to create a new file, you simply press the return button when asked for a filename and the same editing menu will appear.

'F' for F(ile give you yet another menu which is oriented towards the manipulation of files and file names, as in G(et files from a disk, S(ave files to disk, R(em or delete files, and obtain a file directory L(dir.

Compared to the 'dir', 'pip', and 'era' commands of CP/M, this can be a bit overwhelming at first and there's always the danger of being confused by all the options. Naturally, though, the p-System has its very strong supporters, as do CP/M and Unix.

The p-System editor is very good and can be used as a reliable, if sometimes tricky, word processor when you're not programming with it. It is a full-screen editor in the conventional sense in that it lets you wander wherever you want to on the screen with the cursor. Compared with those on other operating systems, it must be somewhere very near the top of my 'best editors I have known' list.

An interesting thing to note is that Sage Technology was one of the first companies to get its hands on the latest release of the p-System, Version 4.1. The story goes that Rod Coleman contacted Softech about the fact that he was building the Sage and was interested in running the p-System on it. Softech said okay and agreed to give him 'the latest release that was ready' when he had built the hardware. In December last year, the first Sage prototype was up and running and Coleman was lucky enough to get hold of Version 4.1 ahead of virtually everyone else.

Some of the differences between Version 4.1 and the previous p-System releases is that larger files can be created and what are known as subsidiary volumes (a volume is the contents of a device such as floppy disk) became possible.

Not content with just this, Coleman and his associates at Sage Technology are now putting the final touches on what is probably the first multi-user p-System. This is described as being a 'concession' to the concept of multi-user environments and this comment presumably goes for the upcoming Unix system as well.

Having used the p-System on smaller machines like the Apple II and the Sirius, the Sage version is a delight. Because of the 68000/Ramdisk combination, response times for almost everything, except jobs like disk formatting, could be measured in fractions of a second — it's rather like being on one of those powerful timesharing systems.

This kind of performance came in very handy when typing in and compiling the 15

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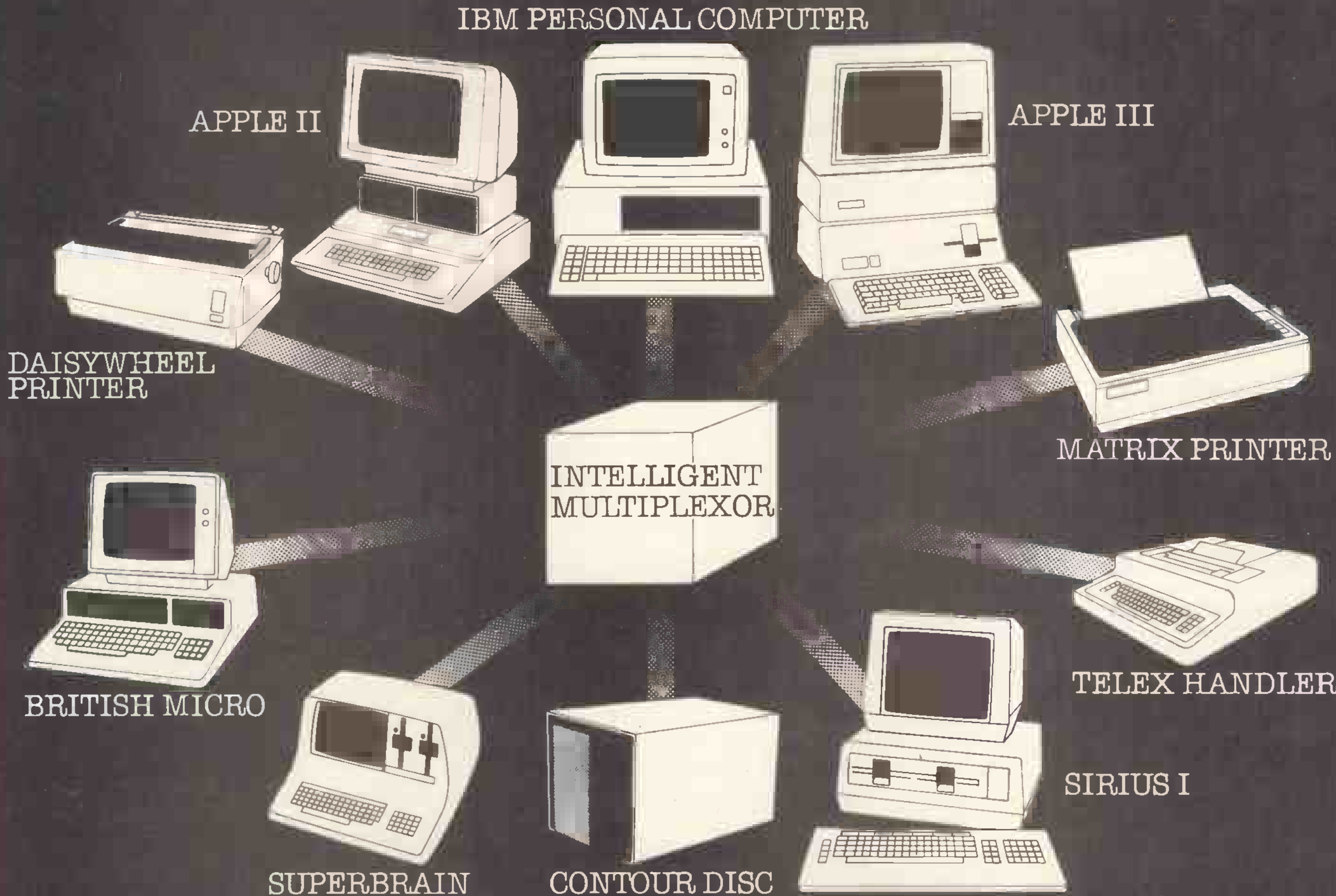

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Pascal and eight Basic Benchmarks.

Since a p-code to 68000 native code generator was provided with the Benchtest machine, I've included native code timings as well.

Documentation

All the documentation provided with the Sage was of good quality. The Sage owner's manual had each section clearly labelled, was generally well written and had a comprehensive index at the back — a rare example of a useful piece of documentation.

The p-System documentation is the Softech standard issue, and there's lots of it —system description volumes, compiler volumes, new feature sections, and a general in-depth mass of p-System possibilities. It's all clearly written, though, and is totally necessary if you want to do more than just run off-the-shelf programs.

Potential

Unfortunately, at the time of this review, few software packages were readily available and so I didn't really get a good chance to look at them in detail.

TDI of Bristol, sole UK distributors of the Sage II (the review machine was borrowed from here) has, however, made great efforts to get UK software up on the machine as quickly as possible. Available right now are the Micromodeller, Microfinesse, and Logicalc financial planning systems; the Aladdin, Logiquest and Beta database systems; the Jarman and Systematics accounting packages; communications software; and word processing software. Also there is an unusual offering from Isis Systems, which has put its Micro-expert systems builder onto the Sage. This allows users to create 'intelligent' knowledge bases about some specific field of human expertise which can be used for diagnostic or analysis purposes.

The languages to be made available include Pascal, Basic, Fortran (included in the cost of the machine), microAPL, C, Lisp, Cobol, Forth and the Pascal-like Modula 2.

In terms of operating system choice, CP/M-68K and a Unix system will soon appear, but an event to look forward to is the expected delivery of the Xerox-developed Smalltalk system on the Sage sometime next year. In the meantime, those longing for graphics capabilities will be glad to hear that by the time this issue of *PCW* comes out the Pluto graphics board should have been interfaced as well. With a colour display, this could add another £800 to the cost of the Sage, however.

For those who would rather network than share a Sage, it looks as if the Corvus Omninet local area network system has been adopted by Sage Technology — although this does not rule out other network technologies being offered as well.

Benchmark timings

Pascal Benchmarks

	p-code 4-word prec	p-code 2-word prec	Native code 2-word prec
magnifier	0.8	0.8	0.1
forloop	10.1	10.2	1.1
whileloop	9.8	9.8	1.0
repeatloop	8.6	8.6	0.9
literalassign	12.1	12.1	1.3
memoryaccess	12.2	22.2	1.3
realarithmetic	24.1	14.9	20.2
realalgebra	22.2	13.7	19.0
vector	21.0	20.9	1.9
equalif	17.2	17.2	1.7
unequalif	16.8	16.8	1.7
noparameters	23.6	24.1	10.1
value	30.9	31.9	23.9
reference	38.3	39.9	37.8
maths	15.1	7.6	7.7

Basic Benchmarks

	p-Code 2-word prec	Native Code
BM1	0.5	0.7
BM2	0.7	1.1
BM3	1.3	2.3
BM4	1.7	3.0
BM£	2.1	8.7
BM6	5.1	8.7
BM7	6.4	11.0
BM8	18.0	—

All timings in seconds. For a full explanation of Benchmark timings, see PCW *November 1982.*

Benchmarks

The Benchmarks timings given for native code versus p-code need some explanation, as there are a few different techniques which can be used to produce the native code file.

To produce a native code file, you must use a special software switch — {$N+} — to indicate the point at which native code generation would begin, and a second software switch — {$N−} — to indicate the point at which native code generation should stop.

Typically, the most satisfactory results are obtained if only selected portions of a program (those parts which are processor intensive, for example) are enclosed by these software switches. To reduce the amount of time required to do all the Benchmarks, I simply placed the {$N+} switch at the beginning of all programs to be converted to native code; this had the effect of producing files which were a mixture of native and p-code. In some cases, these files turn out to be larger than the original p-code only file because the native code generator changes only those parts of a program it can make more efficient. So, some native code timings will in fact turn out to be longer than the original p-code!

In the case of the Pascal Benchmarks where this happens, it is because the program is making procedure calls or calls to the floating-point interpreter. In the Basic Benchmarks, the problem is more a case of the Basic language not knowing whether a number is a real or an integer.

The point to bear in mind is that the native code generator is not a Philosopher's Stone to be relied on to magically turn slow, badly written programs into superfast numbercrunchers.

Used wisely, it is extremely useful — used carelessly, it is really not very helpful at all.

Conclusions

It's a little difficult to assess a machine properly without having a good selection of application software to work with, but in the time I've given desk-space to it, the Sage II has really impressed me. Its design is practical, it's easy to use, and it never gave any sort of trouble. With regards to the price, it may be a little expensive when compared with some of the mass-market machines around right now, but it's probably worth it if it's power you need.

I'm also impressed by the way Sage Technology hasn't let any grass grow under its feet — just as I was finishing this review, the Sage IV was announced at the Comdex show in Las Vegas. This new model features half a megabyte of main memory, six serial ports and a winchester controller capable of handling five winchester units. It will probably be smaller in size than the Sage II since it will use half-height floppy or winchester disk units. A graphics board is currently under development, too. This shouldn't affect the life of the Sage II, said a TDI spokesman, because the Sage IV was really just an extension to the family, and not a replacement for the II.

Prices

Smallest Sage II comes with 128k memory, one 40-track drive giving 320k storage, UCSD p-System version 4.1 operating system, Pascal, Basic and Fortran compilers, 68000 Macro Assembler, and one year's onsite service: £2870 (inc VAT).

Top of the line Sage II with 512k memory, two 80 track drives, and software as above: £4594 (inc VAT).

Our thanks to TDI (tel: 0272 742796) for the loan of the test machine.

Technical specifications

Processor	Motorola 68000, 8 MHz
ROM	8k boot ROM, expandable to 64k
RAM	Minimum 128k, expandable up to 512k (including Ramdisk).
I/O ports	Terminal, Modem, Printer ports (RS-232) and IEEE-488 interface.
O/S	UCSD p-System
Languages	Pascal, Basic, Fortran, microAPL, Lisp, Modula 2. Others, including Cobol, C, and Forth, to be added soon.

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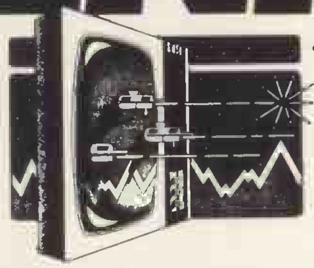
SCREENPLAY

Dick Olney casts his eagle eye over games for the BBC Computer.



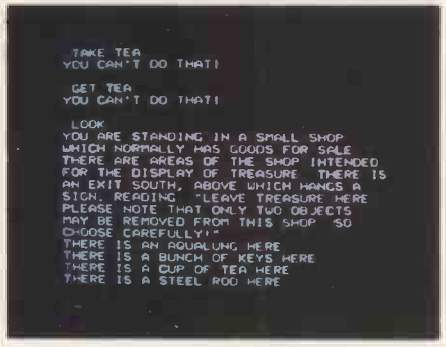
When I first approached Acorn's PR agency to get a machine for this review the indications were that I was facing a complex bureaucratic procedure so dreaded by those of us with deadlines to meet. Apparently the agency had to get permission from the BBC whereupon they would request that Acorn send me a machine. In my experience such disjointed procedures can take weeks to complete, but in this case I was delighted when, just one week later, I was told to contact Acorn and arrange delivery. Imagine my horror then when Acorn told me that the machine would be despatched 'through their normal mail order channels'! For a brief moment I had visions of weakly explaining the lack of Screenplay to an enraged editor with the by now immortal words 'well I've been waiting months for my BBC micro'. By a remarkable coincidence, however, I had planned to visit Cambridge that weekend, and was thus able to pick up the machine in person from the impressive Acorn offices housed in the shell of one of those grand old water stations.

The machine I collected was a BBC microcomputer Model B with 32k RAM, which is currently retailing at around £400 including VAT. All of the software was on cassette and I had no problems loading it from my cheap Tandy tape deck. I was hoping to review games from a larger selection of suppliers (since there seem to be plenty of companies selling games for this machine nowadays) but the Christmas post put paid to that and in the event I could cover only Acornsoft's own offerings plus a few games from the Liverpool based Bug-Byte.

The BBC micro is a truly remarkable machine with an extensive, if rather complex, Basic and superb graphics. Unfortunately I was not supplied with any joysticks, but the excellent keyboard easily lends itself to games use. Although the Model B is at the more expensive end of the home computer range, it is undoubtedly one of the most impressive machines available, competing favourably with machines such as the Atari 800 and VIC-64.

Acornsoft offers a well-balanced range of high quality software, which was a pleasure to review, especially after my experiences with the company's Atom games. None of the games are particularly original, indeed several of them run the risk of copyright infringement, but they are all professionally presented with full use made of the colourful BBC graphics.

If I were asked which microcomputer currently offered the best games potential, I would have to say the Atari 800 (see next month's Screenplay) but the BBC Model B offers a worthy challenge to that machine. The 800, of course, benefits from a flood of games from the States and it will be interesting to see what software becomes available for the BBC over the next year; certainly the potential is there. You should note, however, that the BBC is aimed mainly at the educational market, an area which is becoming increasingly important, and one in which Atari is somewhat lacking.



Name:	**Business Games**
Supplier:	**Acornsoft**
Price:	**£9.95**

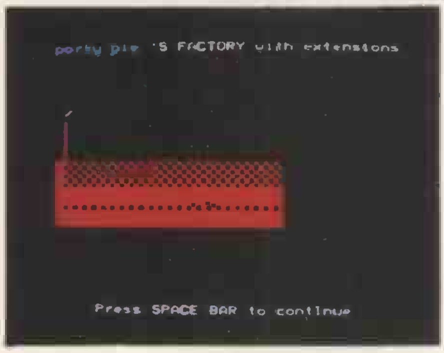
Regular readers of this column may remember a management type game called Inheritance which I reviewed last month. This duo of business games from Acornsoft is essentially very similar to that, though presented in a much more austere fashion. The first is called 'Stokmark' and, as the name suggests, involves investing money in the stock market. Up to eight players can take part, each beginning the game with £1200; and the first to gain money or shares to the value of five grand is the winner. There are four companies to invest in —Comine, Derfoods, Electrix and Fintrust. Dividends are paid yearly — in reality, every four turns.

The dividend, yield and percentage earnings are given for each company's shares — terms which are explained in the manual — but a bit of common sense and a lot of luck is needed to win the game. For some reason only one transaction per player is allowed each turn, which seemed to me rather unrealistic. Nevertheless a good game which should prove particularly interesting if you can round up a full complement of players.

The second game, Telemark, has up to four players battling for the largest market share in televisions. Each turn the players must decide whether to extend their factory, and work out how many batches of televisions to make, and at what price to sell them; as well as considering whether to spend money on improved management and/or allocate extra marketing funds. A full balance sheet and profit and loss account is available for all the companies at the end of each round.

Telemark is a fairly sophisticated business game, clearly designed for the educational market, but with a bit of practice it could prove to be an exciting family game. Some rather strange things happened from time to time, however, and I suspect the program needs a little tidying up.

Presentation: ■■■■□□□□
Addictive Quality: ■■■■□□□□
Complexity: ■■■■■□□□
Value For Money: ■■■■■□□□



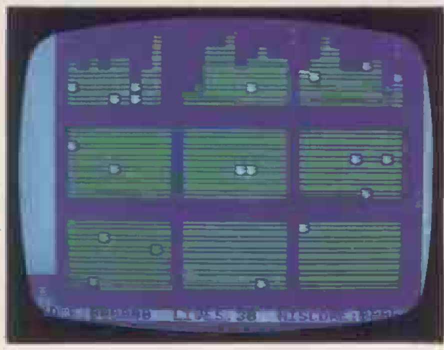
Game:	**Philosopher's Quest**
Supplier:	**Acornsoft**
Price:	**£9.99**

This is one of a pair of adventures which Acornsoft has included in its range of BBC software. The other one is called Sphinx Adventure and is I suspect the easier of the two, although I haven't yet seen it. Philosopher's Quest is an interesting and complex adventure, with a fairly standard vocabulary and a simple game save procedure.

The Ancient Mariner and his albatross make an early appearance and in one room you apparently cease to exist! The text is varied, though without the humour of some adventures, and has the advantage of not repeating the full description of a room every time you enter.

This game is one which would appeal only to the most patient adventurer, and could provide months of mental turmoil even for the most experienced. As you might have guessed, I hadn't got very far by the time this review was completed, but I haven't given up yet! If adventures are your forte then Philosopher's Quest should prove to be excellent value for money.

Presentation: ■■■□□□□□
Complexity: ■■■■■■□□
Value for money: ■■■■■□□□



Game: **Airlift**
Supplier: **Bug-Byte**
Price: **£5.50**

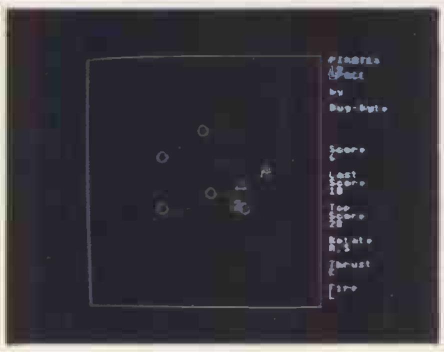
Although the insert in this cassette shows a picture of an airliner (Concorde?) the game itself involves manoeuvring a helicopter around a criss-cross network of tunnels during a meteor storm. The title picture is very impressive, using an attractive green patterned background and including a very realistic helicopter noise (though this noise is not used in the game itself). Full instructions are presented at this point, which is good since, as with most Bug-Byte games there are no written instructions in the packaging. Incidentally, this policy of minimal printed information is reflected in the absence of any identification on the cassette itself, so if you've got more than one Bug-Byte game take care to replace the cassette in its box as soon as its loaded.

Your helicopter starts off on a 'helipad' in the bottom left hand corner of the screen and the idea is to collect little white urns of treasure and return them to this home base. The urns are embedded in the rock structure and become available for pick-up when exposed by the falling meteors destroying the rock above them (these have no effect on the urns themselves). Every so often an alarm sounds, which means that a radiation storm is approaching, and at this point you must quickly take cover in the lowest tunnel.

You start off with 30 lives and lose 10 if hit by a meteor, one when ever you crash into a rock and an apparently arbitrary number if you are exposed to a radiation storm. Control is via the cursor keys, which is a pity since it is quite difficult to use these for quick manoeuvring without crushing both hands into the corner of the keyboard. I did, however, manage to overcome this after a little practice.

Though rather simple, this game is fun for a while, and the graphics are good if not particularly inspired. I found an interesting bug which involves that part of the program concerned with the helicopter's position. If you drive it up to the very top of the screen (a manoeuvre which is admittedly pointless if you're playing seriously) a whole array of helicopters appear and the program crashes. As I've said this should not normally affect the game, but it does show a lack of rigorous testing procedures — tut tut!

Presentation: ■■■■■□□□
Addictive quality: ■■■■□□□□
Use of graphics: ■■■■□□□□
Value for money: ■■■■□□□□



Game **Space Pirates**
Supplier: **Bug-Byte**
Price: **£8.00**

I was surprised that Bug-Byte sent me any more games after what I said about their Atom offerings, but the quality of those games was at least consistent with the limitations of the machine. This simple black and white Asteroids look-alike would be impressive on a ZX81, but it is an insult to the BBC micro.

You use four keys to rotate, accelerate and fire from a small triangle, just as in traditional Asteroids. The asteroids themselves, however, are replaced here with 'space pirates' represented by bug-like objects with pincers on the front. The pirates attempt to destroy your ship by exploding next to you, or by stealing your 'life-pods'. You start with six of these pods, which represent the number of lives you have left to play (if your ship is hit one of the pods metamorphoses into a new one).

Only about three-quarters of the screen is used for the playing field, with instructions and your score displayed in a full-length column on the right-hand side. This is disconcerting as it gives the impression you've never quite got past the title frame into the game itself. You are allowed unlimited repeat firing, though it is not automatic. Movement is tortuously slow, even when full thrust is applied, which becomes increasingly frustrating the better you get at the game. I have to say that if you've got a Model B and want a good version of Asteroids you'd be well advised to save up the extra money and get a copy of Acornsoft's 'Meteors' which is highly recommended, even though I have chosen not to review it this month.

Presentation: ■■■□□□□□
Addictive quality: ■□□□□□□□
Use of graphics: ■□□□□□□□
Value for money: ■□□□□□□□

Name: **Planetoid**
Supplier: **Acornsoft**
Price: **£9.95**

Almost exactly a year ago, in the very first Screenplay, the 'Arcade Ace' section featured the superb Defender. In the conclusion to that review I looked forward to the time when games of that quality could be played at home. Since then I have played many games loosely based on Defender, though none of them were up to much. Now, finally, a game worthy of the name Defender has arrived, and it's called Planetoid!

This game is *exactly* like the original. For those of you not familiar with Defender it's like this. Using up, down (A and Z) thrust and reverse (Shift and Space) you pilot a ship travelling horizontally across the surface of a planet which extends over about four or five screens in width and is in effect circular. On the surface of the planet are small humanoids, which are constantly being kidnapped by round green aliens. These aliens attempt to carry the humanoids to the top of the screen and, if successful, will mutate into a more hostile form. Your job is to stop this happening and to destroy all the other various types of alien pitted against you using a forward firing laser (Return key) and 'smart bombs' (Tab key — these destroy everything on the screen but are in short supply).

For further details of this game I will refer you to the review in the March '82 *PCW* (or your local amusement arcade!) but suffice it to say that this is generally accepted as the ultimate in games of the space battle genre. Planetoids is scrupulously faithful to the original, right down to the colour scheme and sound effects. The responses are excellent and can be made full use of with the well-designed key layout, though I've a feeling that the keyboard may begin to suffer badly after a few months of regular Defender (sorry, Planetoid) sessions.

You may have seen the recent adverts stemming from Atari's latest bout of corporate megalomania, which proclaims 'Defender — our game' and suggests that anybody planning to market a similar game should contact them immediately. So far Atari has released only the VCS (video console) version of the game, but the home computer cartridge should be in the shops early next year (I gather the only copy in the country was recently liberated from an exhibition stand). Having bought the copyright for Defender from Williams, Atari is likely to make every effort to prevent cover versions on other computers, especially if they are successful with the case pending against Commodore over Pac-Man.

Clearly Acornsoft has made some last minute changes to accommodate this possibility — albeit very superficial. An early version of the company's BBC software catalogue reads 'Defender . . . Save the humanoids from the landers. . . Complete with mutants bombers, pods, swarmers, and baiters'; and on the back of several of the games I looked at the name Defender appeared under 'also available'. Yet the actual release has a changed name and most of the alien objects have been given new titles such as 'spore' and 'megacyte'.

We have yet to see how good Atari's Defender is, though I must say I don't relish using those stiff joysticks, but let's be in no doubt — Atari would not be doing anybody any favours by getting Planetoids withdrawn.

One final word of warning: this game involves a high degree of coordination and concentration to play well, and as such is not suitable for young children (oh, and don't say I didn't warn you about the keyboard).

Presentation:
Addictive Quality:
Use of graphics:
Value for money:

Game: **Monsters**
Supplier: **Acornsoft**
Price: **£9.95**

One of my arcade favourites is a game called Space Panic.

Monsters is an exact reproduction of the original, right down to the sound effects and, as with most of Acornsoft's BBC games, is of extremely high quality.

You control a neatly drawn little man who runs around five floors which are linked together by various configurations of ladders while being chased by a selection of monsters. As you might guess, the idea is to kill all the monsters as quickly as possible. Instead of a weapon the little man is equipped with a spade (or is it a pickaxe?) with which he can dig and fill in holes. To destroy the monsters, therefore, he must dig a hole, wait until a monster falls into it, and then quickly fill the hole in again before it can crawl back out, whereupon the unfortunate creature falls crashing to the floor below and dies. The 'X' and 'Z' keys control horizontal movement, ':' and '/' vertical, and 'D' and 'F' digging and filling — which is fairly easy to master.

In the first frame there are three red monsters, which look like huge tomatoes and are the least insidious of your foes.

If you kill all the monsters, a little tune is played and a new frame appears — but this time there are five of the red tomatoes. From the second frame onwards, any monster who manages to climb out of a hole mutates into a more devastating form. A red one turns green, and a green one turns white. The green and white ones are different too, incidentally, and don't look at all like tomatoes.

Green monsters must fall through two vertically aligned holes, and whites through three, though if any monster falls on top of another they are both destroyed. In addition to this, the green and white monsters are much smarter than the red ones and will follow you around relentlessly so that it's difficult to find time to dig any holes. One feature I have yet to mention is the limited oxygen. Your oxygen level is shown by a red and yellow bar at the bottom of the screen; this gets progressively shorter throughout the frame. When it reaches red the little man begins to tire and eventually crashes to the floor and dies. This is not a real problem in the first few frames but, later on when you may find yourself tackling several green and white monsters, it becomes vital.

As I've said, Acornsoft's Monsters is high quality. The responses, graphics and sound effects are impeccable, making for one of the best games around. I spent an afternoon showing a group of five small children the BBC games and this one definitely came out of it the favourite, well ahead of 'Snapper', which is a classy Pac-Man rip off.

Presentation:
Addictive quality:
Use of graphics:
Value for money:

Game: **Arcade Action**
Supplier: **Acornsoft**
Price: **£11.90**

I must admit I am generally suspicious of multi-games packs, since they so often disguise low quality. Perhaps surprisingly, after the way it approached the Atom software, this is the only such package that Acornsoft is offering for the BBC micro, containing a selection of old favourites including Invaders and Breakout.

The Invaders is a one or two player game with nine skill levels. Each player may choose a different level of play, which is a novel feature even for stand-alone Invaders. The game itself moves smoothly and quickly with plenty of flying saucers and all the standard features. The Invaders and saucers seem very large and are quite easy to hit to begin with, though unfortunately so is your base. They speed up quite dramatically when there are only a few left, and the last remaining Invader really does move like a rocket. All in all a good version.

The Breakout is also of good quality and is attractively colourful. As well as the standard game there are three optional features: double bat, moving walls and captive balls.

Any combination of the options can be chosen, giving a set of eight different games. As in many versions of Breakout the bat moves quite slowly in normal mode and in this game pressing the shift key gives double speed, a feature that I found particularly useful.

The third game on this cassette is another early arcade original, Dodgem. This is the one where you move a car through a maze of six concentric square tracks with four crossing points between them, attempting to avoid crashing into a computer-controlled car travelling in the opposite direction and determined to get you. This version is completely standard with the favoured 'Z', 'X', ':' and '/' keys used for movement and the space bar giving acceleration.

On this one I found the keys rather unresponsive. Still, again it's a good version of a popular game.

Finally we have an interesting variation on the game where you must avoid crashing into your own tail, now immortalised in the film Tron, and somehow inevitable in a games pack of this type. Snake is a one player game in which, you must guide a small white square around the screen attempting to eat 'food' (more small white squares which appear at random around you). If you don't reach the food in time it fades away, but if you eat it your points are increased and the tail which follows the course of your dot grows a little. Eventually you end up with a long snake winding around the screen behind you, and if at any point you guide the dot (now the head of the snake) into it or into the boundary lines, a life is lost. Each game consists of the standard three lives. Snake is an interesting and surprisingly addictive variant of a stunningly trivial game.

Presentation:
Addictive quality:
Use of graphics:
Value for money:

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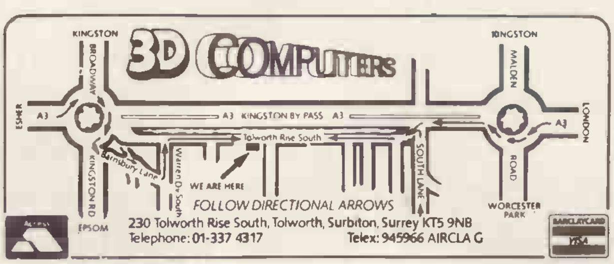

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R A M Computer Services Ltd.
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Superior Systems Ltd.
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Wharncliffe Business Systems
Tel: 0226 298501

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BORDERS
McQueen Systems Ltd.
Tel: 0896 4866/7/8

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Imex Digital Ltd.
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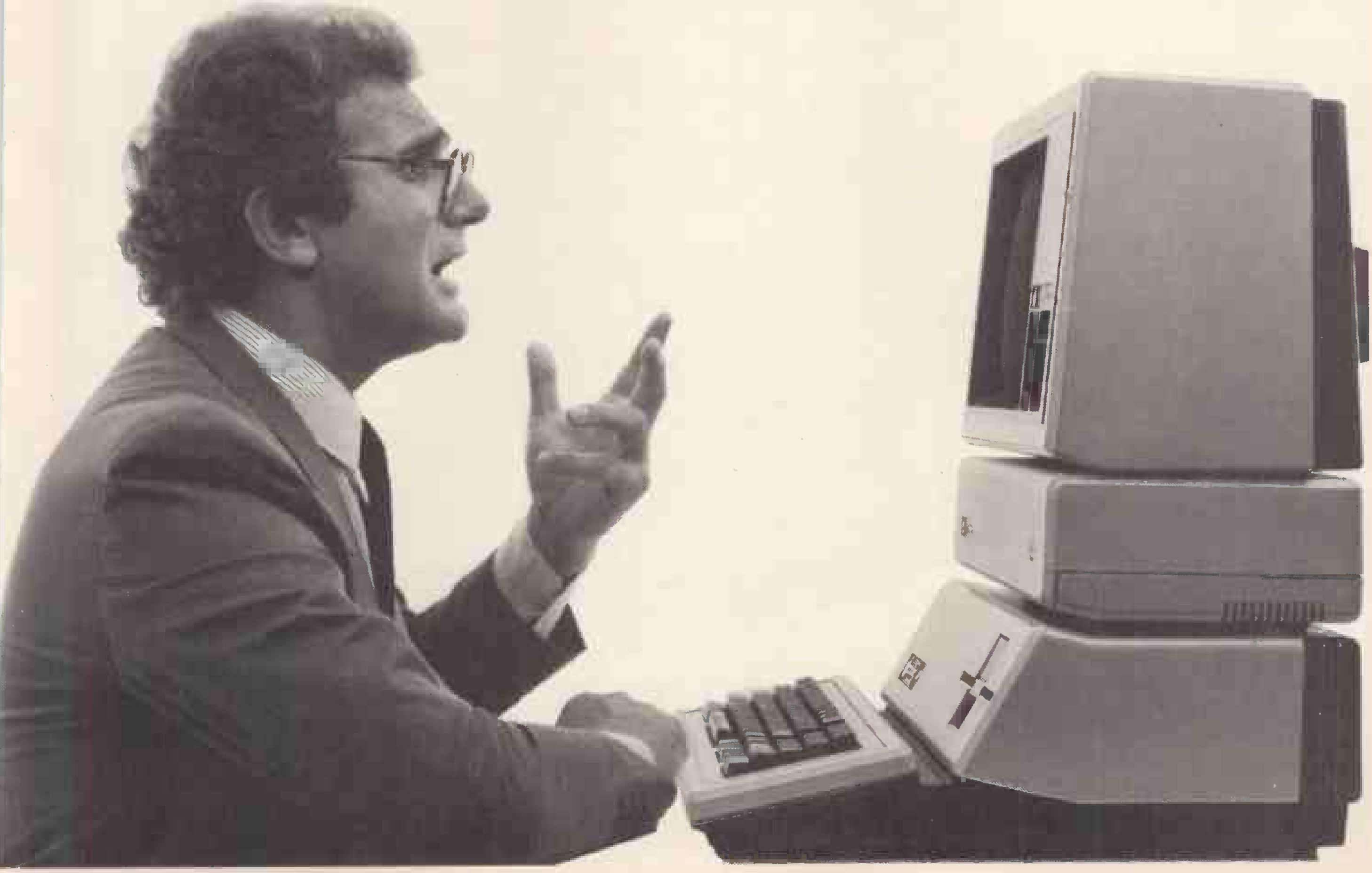
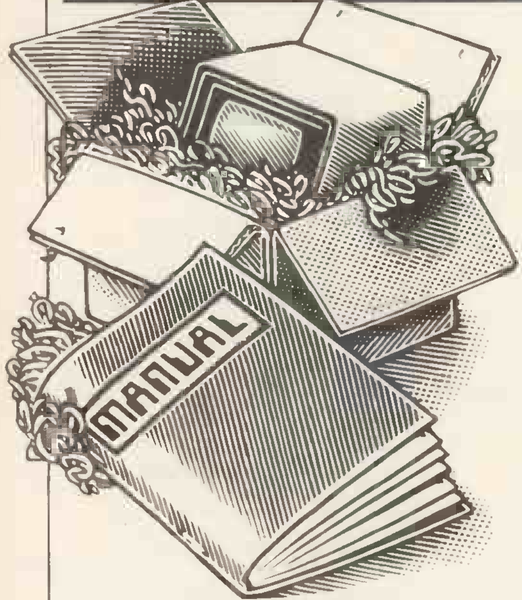
Medical & Scientific Computer Services Ltd.
Tel: 08462 77533

The Dealer list above is not a list of all authorised Apple Dealers.
For a complete list write to Apple Computer (UK) Limited, Eastman Way, Hemel Hempstead, Herts, HP2 4BR, FREEPOST.



NEWCOMERS START HERE



This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. *While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!*

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, **PCW** will be publishing this guide — every month.

We'll start by considering a microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, **processing** it, storing the results or sending them somewhere else. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary** — a system of numbering which uses only 0s and 1s. Thus in most micros each character, number or symbol is represented by eight binary digits or **bits** as they are called, ranging from 00000000 to 11111111.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). As an example of this standard, the number five is represented as 00110101 — complicated for humans, but easy for the computer! This collection of eight bits is called a **byte** and computer freaks who spend a lot of time messing around with bits and bytes use a half-way human representation called **hex**. The hex equivalent of a byte is obtained by giving each half a single character code (0—9, A—F): 0=0000, 1=0001, 2=0010, 3=0011, 4=0100, 5=0101 .... E=1110 and F=1111. Our example of 5 is therefore 35 in hex. This makes it easier for humans to handle complicated collections of 0s and 1s. The machine detects these 0s and 1s by recognising different voltage levels.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary or hex (**machine code** programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the programming language is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic**. Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To run such a program the computer uses an **interpreter** which picks up each English-type **instruction**, translates it into machine code and then feeds it into the **processor** for execution. It has to do this each time the same instruction has to be executed.

Two strange words you will hear in connection with Basic are **PEEK** and **POKE**. They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to **hardware**, this means the physical components of a computer system as opposed to **software** — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit (**CPU**), a single microprocessor chip with supporting devices such as **buffers**, which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board (**PCB**) or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large, PCB; in others a **bus system** is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the **S100**.

The **CPU** needs memory in which to keep programs and data. Microcomputers generally have two types of memory, **RAM** (Random Access Memory) and **ROM** (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — **static** and **dynamic**; all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called **PROMs** (Programmable ROMs) and **EPROMs** (Eraseable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of **audio tones** and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a **read/write head** across the disk's surface. The disk is divided into concentric rings called **tracks**, each of which is in turn subdivided into **sectors**. Using a program called a **disk operating system**, the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: **soft sectoring** where special signals are recorded on the surface and **hard sectoring** where holes are punched through the disk around the central hole, one per sector.

Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for micro-computers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit (**VDU**), which looks like a TV screen with a typewriter-style **keyboard**; sometimes these are built into the system, sometimes they're separate. If you want a written record (**hard copy**) of the computer's output, you'll need a **printer**.

The computer can send out and receive information in two forms — **parallel** and **serial**. Parallel input/output (**I/O**) requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the **baud rate** and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

To ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is **RS232** (or **V24**) while, for parallel interfaces to printers, the **Centronics** standard is popular.

Finally, a **modem** connects a computer, via a serial interface, to the telephone sytem allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need British Telecom's permission; instead you could use an **acoustic coupler**, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn't so uppity about the use of these.

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SUMMARY SPECIFICATION

1. Standard user memory (RAM) of 128K of which 64K is available for your BASIC program and 64K for variables and/or data. The full RAM can be used for machine code programs.

2. The user memory is expandable in 64K blocks to a total of 896K.

3. The dedicated video chip is capable of 320 by 200 pixel resolution on a bit-mapped screen. The standard display is 16 colours, 40 columns by 25 lines on a separate TV or monitor.

4. The keyboard is specially designed for comfortable, efficient use: sculptured keys, separate calculator pad, isolated critical operation keys, separate cursor controls.

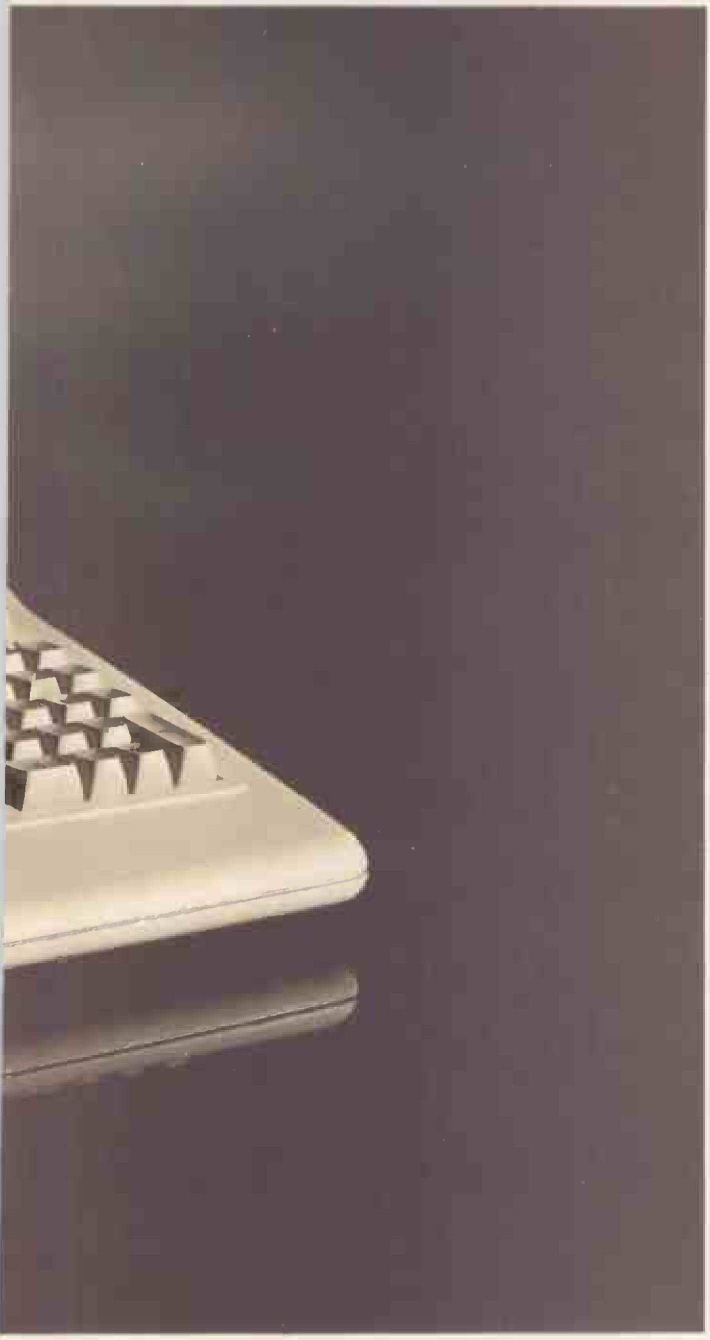
5. Ten special function keys are programmable in BASIC or machine code to execute twenty special operations.

6. The sound synthesiser chip provides the ability to produce many sound effects including simulation of musical instruments.

7. An optional dual processor, the Z80 or 8088 can operate concurrently with the standard 6509.

8. The computer has a more extensive range of interface ports than any comparable computer: IEEE-488, RS 232C, CBM cassette, 8-bit user port, direct audio/video output, cartridge slot

And that's the last reason you should buy it.



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and two control ports.

9. Other communications features include built-in networking capability, Prestel link available as standard, and easy interfacing to scientific equipment.

10. Supports a full range of peripherals including dual disk drives, hard disks, dot matrix and letter quality printers, and plotters. Works with all existing Commodore systems peripherals.

11. Standard language BASIC 4.0 plus, so existing 40-column Commodore software is easily converted.

12. Soft-loaded languages will include UCSD Pascal, Forth, Logo, COMAL.

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For more information on the Commodore 500, and the address of your nearest Commodore dealer, telephone or write to us at:
The Commodore Information Centre, 675 Ajax Avenue, Slough, Berkshire SL1 4BG. Telephone: Slough (0753) 79292.

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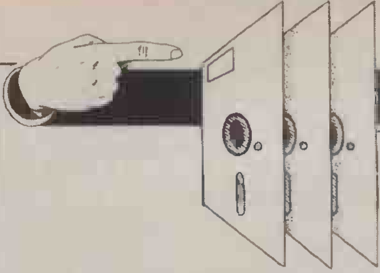

PACKAGES

PCW's 'Packages' section is produced bi-monthly, alternating with our 'In Store' hardware guide. We have confined coverage to business packages which are available and supported at national level and which have been in use for at least six months in a minimum of five sites. Producers of packages which fall within these constraints should send details or updates to: **Dick Olney, *PCW*, 62 Oxford Street, London W1.**

The layout has been designed to allow you to discover which packages are available for the application you have in mind and to show you which packages are available for your computer if you already have a machine. In either case the code enables you to look up the supplier's name and telephone number in the table below.
All details published are the latest made available — some may have changed since this issue went to press.

Code	Company	Telephone
A1	ACT	021-454 8585
A2	Arden Data Processing	0533 22255
A3	ADP Network services	01 388 1912
A4	Alamo Comp. Serv.	0642-310381
B1	B + B Computer Ltd.	0204 26644
B2	Beam Business Centre	061-831-7292
B3	Benchmark Computer Systems	07266 1000
B4	Bristol Software Factory	0272 23430
B5	Byte Soft Systems Ltd	0533 531441
B6	Business Solutions Ltd	01-554-5985
B7	Bromley Computer Consultancy	01 464 8080
C1	CAP-CPP Products Ltd.	01-404 0911
C2	Commodore	01-388 5702
C3	Compsoft	0483 39665
C4	Comput-a-crop	0507-604271
C5	Computastore Ltd.	061-832-4761
C6	Computech	01-794 0202
C7	Compass	Standish 426252
C8	CWP Computers	01-828 3127
C9	C4 Computer Services	0632-664313
C10	Caxton Software	01 379 6502
C11	CBS Consultants	021-722-8181
C12	Comp Prog & Systems Serv	0942-38831
E1	Engineering Sciences	01-437-4894
G1	Graffcom Systems Ltd.	01-727 5561
G2	Grama (Winter) Ltd.	01-636 8210
G3	Great Northern	0532 589980
G4	Alan Greenhalgh Ltd	01-520-0218
G5	Grade One	Glossop 63819
H1	A.J. Harding	0424 220391
H2	Hartford Software	0606 76265
H3	H.B. Computers	0536 83922
H4	Wordcraft Systems	0332 760127
I1	Intereurope Software Design	0734 786644
I2	Intex Datalog Ltd	0642 781193
J1	T.V. Johnson	0276 20446
K2	Keen Computers	0602 412777
L1	Lifeboat Associates	01-836 9028
L2	Liveport (Exidy Sorcerer Firmware)	0736 798157
L3	Ludhouse (Computing) Ltd.	01-679 4321
L4	Logic Comp Systems	01-222-1122
M1	Micro Computer Applications Ltd.	0734 470425
M2	Microteck.	Orpington 26803
M3	Microsys Ltd	051 426 7271
M4	Microsave	0272 737555
M5	M.A.P. Comp Systems	061-624-5662
O1	Omicron Design	0784 31809
P1	Padmede Computer Services	02514 21892
P2	Personal Computers Ltd.	01-377 1200
P3	Professional Computer Services	061 624 4065
P4	Prestige Computers	021 561 2001
Q1	Quill Computer Systems.	061 477 4960
R1	Rockliff	051-521 5830
S1	SMG Micro Computers	0474 55813
S2	The Softwarehouse	01-637 2108
S3	Stage One Software	0202 735656
S4	Systematics International	0440 61121
S5	Sumlock Bondain	01-250 0505
S6	Stemmos	01 602 6242
S7	Software Aids Int	01-904 8139
S8	SD Micros	01 836 9520
T1	Tridata Micros Ltd.	021 622 6085
T2	Templeman Software	0789 66237
T3	The Micro Solution	0608 3256
T4	Terodec Ltd	0734-664343
T5	TABS Ltd	0264-58933
T6	Tlp Data Ltd	0375-33910
V1	Vlasak Electronics Ltd.	0494-448633
W1	Wisbech Computer Services	0945 64146
W2	Westfarthing Comp Services	03265-4098
W3	Walters Computer Systems Ltd	04492 70811
X1	Xetal	061 682 7555

APPLICATIONS

Application	Machine	Price	Code
Analysis ledger	Philips P2000	£100	P4
Appointments planner	Act Sirius 1	£115	C7
	Challenger	£25	C7
Assembler dev	PET/CBM	£50	L2
Bill of materials	Apple II	£199	T5
	CP/M	£850	B5
	CP/M	£199	T5
	Cromemco	£850	B5
	PET/CBM	£199	T5
	Superbrain	£450	T3
Bookmakers package	CP/M	POR	B7
Budgeting package	Apple II	£125	P2
	Apple II	£125	T2
	CP/M	£95	B5
	Cromemco	£95	B5
	North Star Horizon	£95	B5
Building estimating	Apple II	£570	S8
Bureau de change	PET/CBM	£8	H3
Cash flow	Apple II	£125	P2
	Apple II	£80	V1
	Apple II	£100	C8
	CP/M	£250	L3
	CP/M	£95	B5
	Cromemco	£95	B5
	North Star Horizon	£95	B5
Cash register	CP/M	£300	T4
Cheque writer	CBM/8032	£90	P3
	PET/CBM	£90	P3
Company secretary	CP/M	£450	C4
Construction cashflow	Apple II	£75	S8
Construction Expenditure	Apple II	£250	S8
Construction Financial Control	Apple II	£750	S8
Construction valuations	Apple II	£500	S8
Container accounting	CP/M	£750	M5
Contract costing	Apple II	£500	P1
	CP/M	£2000	L3
CP/M & utilities	Tandy Model II	£150	M1
Credit control	Apple II	£98	P2
	PET/CBM	£650	B4
Customer file	Famos	£1000	M2
Database management/Information retrieval	ACT800	£225	H4
	Apple II	£150	A2
	Apple II	£150	K2
	Apple II	£60-140	S2
	Apple II	£150	S5
	Apple II	£75	P2
	Apple II	£100	S4
	Apple II	£100	C8
	Apple II	£125	T2
	CP/M	£150-750	C4
	CP/M	£100	G3
	CP/M	£350	B3
	CP/M	£400	C3
	CP/M	£600	G5
	Famos	£1500	M2
	North Star Horizon	£250	B3
	PET/CBM	£250	C3
	PET/CBM	£225	H4
	PET/CBM	£75	B1
	PET/CBM	£50/150	C2
	PET/CBM	£150	J1
	PET/CBM	£150	G2
	Superbrain	£300	S6
	Tandy Model 1	£25-80	M1
	Tandy Model 1	£60	S2
	Tandy Model 1	£150	J1
	Tandy Model 1	£32.50	H1
	Tandy Model 111	£270	A4
	8000 Series	POR	C2
Dental Records	Apple II	£395	M4
	CP/M	£500	T4
Disk operating system	PET/CBM	£150	B1
Double glazing costing	North Star Horizon	£750	W1
Eire payroll system	CP/M	£650	M5
Estate agent	Apple II	£850	A2
	Apple II	£850	S5
	Apple II	£850	K2
	Apple II	£175	P2
	Apple II	£130	C8
	Apple II	£750	S4
	PET/CBM	£30	H3
	CP/M	£750	C4
	CP/M	£700	B5
	PCC 2000 Simpelec Triton 3	£350	B3
	MZ-80K	£195	W1
	Superbrain	£600	S6
	Superbrain	£600	C12
Equipment lease/rent/HP	CP/M	£400	G1
Expense analysis	Philips P2000	£150	P4
File Handling	PET/CBM	£225	H4
Financial modelling	Act Sirius 1	£595	A1
	Apple II	£450	P2
	Apple II	£360	C8
	CP/M	£400	G1
	CP/M	£95	B5
	CP/M	£425-535	A1
	CP/M	£400	B6
	Cromemco	£95	B5
	North Star Horizon	£95	B5
	PET/CBM	£425-535	A1
	RAIR Black Box	POR	A3
Financial planning	Act Sirius 1	£150	A1
	Apple II	£250	S4
General ledger/NL	Apple II	£300	A2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£455	P2
	Apple II	£225	V1
	Apple II	£295	C6
	Apple II	£250P	S4
	Apple II	£600	T2
	Apple II	£490	L4
	Apple II	£199	T5
	CBM/8032	£450	C11
	CBN/8032	£350	W3
	CP/M	£500	L3
	CP/M	£375	L1
	CP/M	£500	C4
	CP/M	£400	G1
	CP/M	£400	M3
	CP/M	£400	B5
	CP/M	£275	S6
	CP/M	£390	S7
	CP/M	£350	B3
	CP/M	£300	W1
	CP/M	£425	B6
	CP/M	£500	T4
	CP/M	£400	M5
	CP/M	POR	B7
	CP/M	£199	T5
	Cromemco	£400	B5
	North Star Horizon	£250	B3
	North Star Horizon	£400	M3
	PCC 2000 North Star Horion	£400	B5
	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£200	C2
	PET/CBM	£200	H3
	PET/CBM	£199	T5
	Philips P2000	£100	P4
	Sharp PC3201	£450	P2
	Superbrain	£400	M3
	Superbrain	£400	S6
	Tandy Model 1	£90	M1
	Tandy Model II	£90	M1
	Tandy Model 1	£225	H1
	Tandy Model 1	£225/325	T1
	Tandy Model 11	£425	T1
	Vector	£400	C5
	8080/Z80	£357	L1
	8080/Z80	£275	G3
General purchase transaction proc.	CBM/8032	£495	S3
Hotel billing	Philips P2000	£500	P4
Hotel management	Apple II	£525	M4
	CP/M	£525	M4
	RAIR Black Box	POR	A3
Incomplete records	Act Sirius 1	£1200	S1
	Apple II	£250	S2
	Apple II	POR	K2
	Apple II	£425	P2
	Apple II	£450	P1
	Apple II	£490	L4
	CBM/8032	£150	W3
	CP/M	£750	M3
	CP/M	£250	B5
	CP/M	£975	B3
	CP/M	£750	W1
	CP/M	£1250	M5
	CP/M	£155	C10
	Cromemco	£250	B5
	North Star Horizon	£750	M3
	North Star Horizon	£250	B5
	North Star Horizon	£975	B3
	Philips P2000	£150	P4
	Superbrain	£750	M3
	Superbrain	£1200	S1
	Tandy Model 1	£40	M1
	Tandy Model 1	£40	H1
Industrial cleaning package	CP/M	POR	B7
Industry Factory loading	Apple II	£360	X1
	CP/M	£360	X1
	PET/CBM	£300	X1
Industry work study	Apple II	£990	X1
	CP/M	£990	X1
	PET/CBM	£750	X1
Inn Management	Act Sirius 1	£185	C7
Insurance Broker	Act Sirius 1	£450	C7
Insurance renewals	CBM/8032	£1200	S3
Integrated accts	Act Sirius 1	£795	O1
	Altos (CP/M, MP/M)	£300	B1
	Apple II	£450	P1
	Apple II	£300	P2
	Apple II	£855	V1
	Apple II	£600	T2
	Apple II	£1470	L4
	Apple II	£300	W2
	Apple II	£199	T5
	CBM/8032	£1500	P3
	CBM/8032	900	C11
	CP/M	£950	L1
	CP/M	£1500	C4
	CP/M	£1100	G1

PACKAGES

Application	Machine	Price	Code
	CP/M	£990	M3
	CP/M	£690	B5
	CP/M	£900	B5
	CP/M	£1450	B3
	CP/M	£1200	B6
	CP/M	£199	T5
	Cromemco	£690	B5
	Cromemco	£900	B5
	Famos	£2000	M2
	MZ-80K	£150	P2
	North Star Horizon	£950	B3
	North Star Horizon	£690	B5
	North Star Horizon	£900	B5
	PET/CBM	£300	B1
	PET/CBM	£800	S3
	PET/CBM	£199	T5
	North Star Horizon	£990	M3
	PET/CBM	(£50)	C2
	PET/CBM	£650	J1
	PET/CBM	£650	G2
	Philips P2000	£650	P4
	Superbrain	£990	M3
	Superbrain	£1200	S6
	Superbrain	£1000	T3
	Superbrain	£1200	S1
	Tandy Model I	£350	M1
	Tandy Model II	£350	M1
	Tandy Model I	£75	J1
	Tandy Model II	£795	O1
	Tandy Model III	£550	A4
	Vector	£1000	C5
	8000 Series	POR	C2
	8080/Z80	£950	L1
	8080/Z80	£995	G3
Investment portfolio	Tandy Model I	£20	S2
Invoicing	Act Sirius I	£95	C7
	Act Sirius I	£265	O1
	Act Sirius I	£195	A1
	Apple II	£295	S2
	Apple II	£300	P1
	Apple II	£300	P2
	Apple II	£140	V1
	Apple II	£300	T2
	Apple II	£199	T5
	Challenger	£25	C7
	CP/M	£325	L1
	CP/M	£150-350	C4
	CP/M	£250	M3
	CP/M	£250	S7
	CP/M	£100	B5
	CP/M	£200	B3
	CP/M	£300	W1
	CP/M	POR	B7
	CP/M	£199	T5
	Cromemco	£100	B5
	North Star Horizon	£100	B3
	North Star Horizon	£250	M3
	North Star Horizon	£100	B5
	PET/CBM	£350	A1
	PET/CBM	£25-50	B1
	PET/CBM	POR	J1
	PET/CBM	£199	T5
	Philips P2000	£150	P4
	Superbrain	£250	M3
	Superbrain	£150	S6
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	Tandy Model I	£25	H1
	Tandy Model I	£75	T1
	Tandy Model II	£125	T1
	Tandy Model II	£265	O1
	Tandy Model III	£280	A4
	8080/Z80	£325	L1
Jewellers System	CP/M	£1000	S7
Job costing	Act Sirius I	£350	C7
	Act Sirius I	£265	O1
	Apple II	£300	P1
	Apple II	£990	X1
	Apple II	£199	T5
	CBM/8032	£1000	C11
	CBM/8032	£350	W3
	CP/M	£700	C4
	CP/M	£350	M3
	CP/M	£990	X1
	CP/M	£500	T4
	CP/M	£650	M5
	CP/M	POR	B7
	CP/M	£199	T5
	CP/M	£1500	T6
	North Star Horizon	£350	M3
	PET/CBM	£750	X1
	PET/CBM	£199	T5
	Philips P2000	£400	P4
	Superbrain	£350	M3
	Tandy Model I	POR	M1
	Tandy Model II	POR	M1
	Tandy Model II	£265	O1
Job order control	8080/Z80	£275	G3
Legal precedents	CP/M	£1100	C4
Letter writer	Apple II	£80	V1
	Apple II	£99	T5
	CP/M	£150	M3
	CP/M	£99	T5
	North Star Horizon	£150	M3
	Superbrain	£150	M3
Local government housing maint	RAIR Black Box	POR	A3
Lotteries	PET/CBM	£45	H2
Mailing List	Altos (CP/M. MP/M)	£75	B1
	Apple II	£300	A2
	Apple II	£50-150	S2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£40	P2
	Apple II	£100	S4
	CP/M	£50-150	C4
	CP/M	£250	G1
	North Star Horizon	£195	W1
	PET/CBM	£45	H2
	PET/CBM	£15	A1
	PET/CBM	£75	B1
	PET/CBM	£35	H3
	Superbrain	£140	C9
	Tandy Model I	£40	M1
	Tandy Model II	£75	M1
	Tandy Model I	£50-150	S2
	Tandy Model I	£25/38/55	H1
Mail shot	Act Sirius I	£95	A1
	Apple II	£14	S2
	Apple II	£40	P2
	Apple II	£25	T2
	Apple II	£99	T5
	CBM/8032	£350	W3
	Challenger	£25	C7
	CP/M	£200-360	C4
	CP/M	£90	M3
	CP/M	£100	S7
	CP/M	£50/150	G5
	CP/M	£99	T5
	MCZ Zilog	£250	I1
	North Star Horizon	£90	M3
	PCC 2000 Simplec Triton 3	£450	B2
	Superbrain	£90	M3
	Tandy Model I	£75+	G4
	Tandy Model II	£75	M1
	Tandy Model II	£75+	G4
	Tandy Model III	£160	A4
Membership accting	Apple II	£75	P2
	MCZ Zilog	£250	I1
	PET/CBM	£85	H2
Motor Dealer	Act Sirius I	£345	C7
	CBM/8032	£950+	P3
	Famos	£5000	M2
NEDO price adjustment	Apple II	£200	S8
Order entry/ invoicing	Apple II	£99	T5
	CBM/8023	£750	P3
	CP/M	£350	G1
	CP/M	£500	T4
	CP/M	£550	M5
	CP/M	£550	L1
	CP/M	POR	B7
	CP/M	£99	T5
	8080/Z80	£550	L1
Order Processing	AppleII	£99	T5
	CP/M	£99	T5
	Philips P2000	£200	P4
Office admin	Apple II	£100	S4
Pad to plotter-systems	Apple II	£250	P2
	Apple II	£180	C8
Payroll	Act Sirius I	£300+	O1
	Act Sirius I	£195	A1
	Apple II	POR	A2
	Apple II	£200	S2
	Apple II	POR	S5
	Apple II	POR	K2
	Apple II	£200	P2
	Apple II	£375	V1
	Apple II	£375	C6
	Apple II	£250P	S4
	Apple II	£400	T2
	Apple II	£490	L4
	Apple II	£199	T5
	CBM/8032	£375	P3
	CBM/8032	£350	W3
	Challenger	£24	C7
	CP/M	£450	L3
	CP/M	£475	L1
	CP/M	£495	C4
	CP/M	£500	G1
	CP/M	£390	M3
	CP/M	£500	B5
	CP/M	£450	B3
	CP/M	£425	B6
	CP/M	Lease	W1
	CP/M	£500	T4
	CP/M	£450	M5
	CP/M	POR	B7
	CP/M	£199	T5
	Famos	£1500	M2
	North Star Horizon	£350	B3
	North Star Horizon	£390	M3
	North Star Horizon	Lease	W1
	PET/CBM	£200/350	C5
	PET/CBM	£50/195	I2
	PET/CBM	£150	G2
	PET/CBM	£150	J1
	PET/CBM	£150	C2
	PET/CBM	£10	H3
	PET/CBM	£199	T5
	Philips P2000	£300	P4
	Scorcerer	£250	L2
	Superbrain	£390	M3
	Superbrain	£400	S6
	Superbrain	£250+	T3
	Tandy Model I	£249	M1
	Tandy Model I	£200	H1
	Tandy Model I	£218	T1
	Tandy Model II	£375	T1
	Tandy Model II	£300+	O1
	8000 Series	£250	C2
	8080/Z80	£475	L1
	8080/Z80	£275	G3
	PET/CBM	£150	G2
	PET/CBM	£150	J1
	PET/CBM	£150	C2
	Sorcerer	£250	L2
	Tandy Model I	£249	M1
	TRS-80	£200	H1
	TRS-801	£218	K1
	TRS-801	£218	T1
	TRS-8011	£375	T1
	8000 Series	£250	C2
	8080/Z80	£475	L1
	8080/Z80	£275	G3
Perpetual Inventory	CP/M	£150	B5
	Cromemco	£150	B5
Personnel records	Apple II	£98	P2
	CP/M	£450	C4
	MCZ Zilog	£400	I1
	PET/CBM	£85	H2
Petaid report generator	PET/CBM	£250	S3
Petsoft programs	PET/CBM	£160	J1
Postal advertising response package	Apple II	£350	S2
Price lister	PET/CBM	£12	H3
Product Management	Act Sirius I	£245	C7
Production analysis	Apple II	£75	P2
	CP/M	£700	C4
	PET/CBM	£300	B1
Production control	CBM/8032	£650+	P3
	PET/CBM	£650+	P3
Prof appts groups	8080/Z80	£275	G3
Prof appts individ	8080/Z80	£220	G3
Prof client billing	8080/Z80	£330	G3
Programming aids	Apple II	£40	P2
Property management	CP/M	£450-1000	C4
	CP/M	£400	M3
	CP/M	POR	B7
	North Star Horizon	£400	M3
	Superbrain	£400	M3
Publishers System	CP/M	£1850	S7
Purchase ledger	Act Sirius I	£395	A1
	Apple II	£300	A2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£295	C6
	Apple II	£300	P1
	Apple II	£300	P2
	Apple II	£315	V1
	Apple II	£250P	S4
	Apple II	£300	T2
	Apple II	£490	L4
	Apple II	£199	T5
	Challenger	£25	C7
	CBM/8032	£500	C11
	CBM/8032	£350	W3
	CP/M	£500	C4
	CP/M	£450	G1
	CP/M	£500	L3
	CP/M	£425	L1
	CP/M	£400	M3
	CP/M	£400	B5
	CP/M	£395	S7
	CP/M	350	B3
	CP/M	£300	W1
	CP/M	£425	B6
	CP/M	£500	T4
	CP/M	£400	M5
	CP/M	POR	B7
	CP/M	£199	T5
	Cromemco	£400	B5
	North Star Horizon	£250	B3
	North Star Horizon	£400	M3
	North Star Horizon	£400	B5
	Superbrain	£400	M3
	Superbrain	£300	S6
	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£300	B4
	PET/CBM	£200	C2
	PET/CBM	POR	J1
	PET/CBM	£350	H3
	PET/CBM	£199	T5
	Philips P2000	£200	P4
	Sharp PC3201	£300	P2
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	Tandy Model I	£225	H1
	Tandy Model I	£225	T1
	Tandy Model II	£375	T1
	Vector	£400	C5
	8000 Series	£250	C2
	8080/Z80	£275	G3
	8080/Z80	£425	L1
Quotation estimating	Act Sirius I	£125	C7
	Apple II	£300	P1
	Philips P2000	£400	P4
Recruitment Agency	Act Sirius I	£345	C7
Reinforcement bar schedule	Apple II	£150	S8
Renewals ledger	Philip P2000	P4	
Resource optimiser	Apple II	£295	C10

PACKAGES

Application	Machine	Price	Code
Sales ledger	Act Sirius I	£395	A1
	Apple II	£300	A2
	Apple II	£300	S5
	Apple II	£300	K2
	Apple II	£295	C6
	Apple II	£300	P1
	Apple II	£300	P2
	Apple II	£315	V1
	Apple II	£250P	S4
	Apple II	£300	T2
	Apple II	£490	L4
	Apple II	£199	T5
	CBM/8032	£500	C11
	CBM/8032	£350	W3
	Challenger	£25	C7
	CP/M	£500	C4
	CP/M	£450	G1
	CP/M	£500	L3
	CP/M	£425	L1
	CP/M	£400	M3
	CP/M	£400	B5
	CP/M	£365	S7
	CP/M	£350	B3
	CP/M	£300	W1
	CP/M	£425	B6
	CP/M	£500	T4
	CP/M	£400	M5
	CP/M	POR	B7
	CP/M	£199	T5
	Cromemco	£400	B5
	North Star Horizon	£250	B3
	North Star Horizon	£400	M3
	North Star Horizon	£400	B5
	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£300	B4
	PET/CBM	£800	C1
	PET/CBM	POR	J1
	PET/CBM	£200	C2
	PET/CBM	£350	C7
	PET/CBM	£199	T5
	Philips P2000	£200	P4
	Sharp PC 3201	£300	P2
	Superbrain	£400	M3
	Superbrain	£300	S6
	Superbrain	£199	T5
	Tandy Model I	£90	M1
	Tandy Model II	£90	M1
	Tandy Model I	£225	H1
	Tandy Model I	£225	T1
	Tandy Model II	£375	T1
	Vector	£400	C5
	8000 Series	£250	C2
	8080/Z80	£275	G3
	8080/Z80	£425	L1
S/L, P/L & stock control	Apple II	£900	P2
	Apple II	£1000	T2
	CP/M	£1000	L3
	CP/M	£900	B5
	Cromemco	£900	B5
	North Star Horizon	£900	B5
	Philips P2000	£950	P4
Solicitor's complete record accounting	Apple II	£3000	S2
Solicitor's package	Act Sirius I	£1400	S1
	CBM/8032	£1400	S1
	Compucorp	£2000	Q1
	Superbrain	£1400	S1
	CP/M	£1250	M5
Statistics	Apple II	£150	G3
	Apple II	£100-195	P2
	Apple II	£140	C8
	Tandy Model I	£45	S2
Stock control/ recording	Altos (CP/M, MP/M)	£300	B1
	Act Sirius I	£265	O1
	Act Sirius I	£195	A1
	AppleII	POR	A2
	Apple II	POR	K2
	Apple II	POR	S5
	Apple II	£150	G3
	Apple II	£80	S2
	Apple II	£75/300	P2
	Apple II	£285	V1
	Apple II	£300	P1
	Apple II	£500	S4
	Apple II	£490	L4
	Apple II	£199	T5
	CBM/8032	£175	P3
	CBM/8032	£199	T5
	CBM/8032	£350	W3
	Challenger	£25	C7
	CP/M	£325	L1
	CP/M	£500-1500	C4
	CP/M	£350	G1
	CP/M	£900	M3
	CP/M	£700	B5
	CP/M	£550	B5
	CP/M	£550	B3
	CP/M	£300	W1
	CP/M	£500	T4
	CP/M	£550	M5
	CP/M	POR	B7
	CP/M	£199	T5
	Cromemco	£700	B5
	Famos	£1500	M2
	MZ-80K	£150	P2
	North Star Horizon	£450	B3
	North Star Horizon	£900	M3
	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£195	I2
	PET/CBM	£300	B4
	PET/CBM	£15	A2
	PET/CBM	£300	B1
	PET/CBM	£150	C2
	PET/CBM	£150	J1
	PET/CBM	£150	G2
	PET/CBM	£250	R1
	PET/CBM	£35/25	H3
	PET/CBM	£199	T5
	Philips P2000	£300	P4
	Sharp PC3201	£300	P2
	Superbrain	£900	M3
	Superbrain	£300	S6
	Superbrain	£450	T3
	Tandy Model I	£30-50	M1
	Tandy Model II	£300	M1
	Tandy Model I	£48	S2
	Tandy Model I	£200	H1
	Tandy Model I	£115	J1
	Tandy Model I	£200	T1
	Tandy Model I	£375	T1
	Tandy Model II	£265	O1
	8080/Z80	£275	G3
	8080/Z80	£325	L1
Surveying	CP/M	£500	T4
TAP business system	PET/CBM	£125	H2
Text file librarian	Apple II	£125	S4
Time/cost recording	Act Sirius I	£800	S1
	Apple II	£450	S2
	Apple II	£300	P1
	CBM/8032	£800	S1
	CP/M	£400	G1
	CP/M	£200	M3
	CP/M	£350	B3
	North Star Horizon	£250	B3
	North Star Horizon	£200	M3
	North Star Horizon	£450	W1
	PCC 2000 Simpelec Triton 3	£350	B2
	PET/CBM	£300	B1
	Philips P2000	£300	P4
	Superbrain	£200	M3
	Superbrain	£800	S1
	Tandy Model I	POR	M1
	Tandy Model II	POR	M1
Travel agency accts	Superbrain	£800	S6
	Tandy Model I	£225	G4
	Tandy Model II	£225	G4
Travel Agents Dairy	Tandy Model I	£100	G4
	Tandy Model Ii	£100	G4
Travel Ticket Sales	Tandy Model I	£225	G4
	Tandy Model II	£225	G4
Utilities	Apple II	£40	P2
	Apple II	£20	C6
	CP/M	£50	B5
	ITT 2020	£20	C6
Utility set	PET/CBM	£78	H3
Various engineering	Tektronix		E1
Various thermal insulation industry systems	CP/M	£2000 +	T6
VAT master	PET/CBM	£25	H3
VAT register	Tandy Model I	£15	H1
Video hire system	Act Sirius I	£125	C7
	Tandy Model III	£460	A4
Video message	Apple	£200	G3
Warehousing	CBM/8032	POR	S1
	CBM/8032	£375	P3
Word processing	ACT 800	£375	H4
	Act Sirius I	£295-325	A1
	Act Sirius I	£295 +	O1
	Apple II	£60	S2
	Apple II	£75	K2
	Apple II	£75	S5
	Apple II	£75	A2
	Apple II	£150-300	P2
	Apple II	£75	J1
	Apple II	£120	V1
	Apple II	£180/95	S4
	Apple II	£30	C8
	Apple II	£500	T2
	Apple II	£99	T5
	CP/M	£150-260	C4
	CP/M	£400	G1
	CP/M	£250	M3
	CP/M	£250	B6
	CP/M	POR	B7
	CP/M	£99	T5
	Famos	£500	M2
	North Star Horizon	£250	M3
	PET	£85/65/ 40/20	H2
	PET/CBM	£375	H4
	PET/CBM	£325	C5
	PET/CBM	£75/150	C2
	PET/CBM	£75/150	J1
	PET/CBM	£75/150	G2
	PET/CBM	£35	H3
	Philips P2000	£230	P4
	Superbrain	£250	M3
	Tandy Model I	£50/75	M1
	Tandy Model II	£175-240	M1
	Tandy Model I	£30/60/90	S2
	Tandy Model I	£45/95	J1
	Tandy Model I	£15	H1
	Tandy Model II	£295 +	O1
	Vector	£400	C5
	8000 Series	£250	C2
Work In Progress	CP/M	£850	B5

MACHINES

Machine	Application	Price	Code
ACT 800	Database management/	£225	H4
	Word processing	£375	H4
Act Sirius I	Appointments planner	£115	C7
	Financial modelling	£595	A1
	Financial planning	£150	A1
	Incomplete records	£1200	S1
	Inn Management	£185	C7
	Insurance Broker	£450	C7
	Integrated Accts	£495	A1
	Integrated Accts	£795	O1
	Invoicing	£95	C7
	Invoicing	£265	O1
	Invoicing	£195	A1
	Job Costing	£350	C7
	Job Costing	£265	O1
	Mailing list	£95	A1
	Motor Dealer	£345	C7
	Payroll	£300 +	O1
	Payroll	£195	A1
	Project Management	£245	C7
	Purchase ledger	£395	A1
	Quotation Estimating	£125	C7
	Recruitment agency	£345	C7
	Sales Ledger	£39[illegible]	A1
	Solicitors package	£1400	S1
	Stock control/recording	£265	O1
	Stock control/recording	£195	A1
	Time/cost recording	£800	S1
	Video hire system	£125	C7
	Word processing	£295/325	A1
	Word processing	£295 +	O1
Altos (CP/M, MP/M)	Integrated accts	£300	B1
	Mailing list	£75	B1
	Stock control/recording	£300	B1
Apple II	Bill of materials	£199	T5
	Budgeting	£125	T2
	Building estimating	£570	S8
	Cash flow	£80	V1
	Cash flow	£75	P2
	Cash flow	£100	C8
	Construction cashflow	£75	S8
	Construction expenditure	£250	S8
	Construction financial control	£750	S8
	Construction valuations	£500	S8
	Contract costing	£450	P1
	Database management/ information retrieval	£150	K2
	Database management/ information retrieval	£150	A2
	Database management/ information retrieval	£60/140	S2
	Database management/ information retrieval	£150	S5
	Database management/ information retrieval	£9[illegible]	P2
	Database management/ information retrieval	£100	S4
	Database management	£75	P2
	Database management	£100	C8
	Database management	£125	T2
	Dental records	£395	M4
	Estate agent	£850	S5
	Estate agent	£850	A2
	Estate agent	£850	K2
	Estate agent	£750	S4
	Estate agent	£130	C8
	Financial modelling	£360	C8
	Financial planning	£250	S4
	General ledger/NL	£300	K2
	General ledger/NL	£300	A2
	General ledger/N/L	£450	P2
	General ledger/NL	£300	S5
	General ledger/NL	£225	V1
	General ledger/NL	£295	C6
	General ledger/NL	£250P	S4
	General ledger/NL	£600	T2
	General ledger/NL	£490	L4
	General ledger/NL	£199	T5
	Hotel management	£525	M4
	Incomplete records	POR	K2
	Incomplete records	£250	S2
	Incomplete records	£450	P1
	Incomplete records	£450	P2
	Incomplete records	£490	L4
	Industry factory loading	£360	X1
	Industry work study	£990	X1
	Integrated accts	£885	V1
	Integrated accts	£450	P1
	Integrated accts	£300	P2
	Integrated accts	£600	T2
	Integrated accts	£300	W2
	Integrated accts	£1470	L4
	Integrated accts	£199	T5
	Invoicing	£295	S2
	Invoicing	£300	P2
	Invoicing	£140	V1
	Invoicing	£300	P1
	Invoicing	£300	T2
	Invoicing	£199	T5
	Job costing	£450	S2
	Job costing	£990	X1
	Job costing	£300	P1
	Job costing	£199	T5
	Letter writer	£99	T5
	Mailing list	£300	K2
	Mailing list	£300	A2
	Mailing list	£40	P2
	Mailing list	£50-150	S2
	Mailing list	£300	S5
	Mailing list	£100	S4
	Mailing List	£25	T2
	Mail shot	£14	S2
	Mail shot	£225	P2
	Mail shot	£99	T5

PACKAGES

Machine	Application	Price	Code
	NEDO price adjustment	£200	S8
	Order entry/invoicing	£99	T5
	Order Processing	£99	T5
	Pad to plotter system	£250	P2
	Pad to plotter system	£180	C8
	Payroll	POR	S5
	Payroll	POR	K2
	Payroll	POR	A2
	Payroll	£200	S2
	Payroll	£375	V1
	Payroll	£200	P2
	Payroll	£375	C6
	Payroll	£250P	S4
	Payroll	£400	T2
	Payroll	£490	L4
	Payroll	£199	T5
	Personal records	£75	P2
	Postal advertising response package	£350	S2
	Production analysis	£75	P2
	Programming aids	£40	P2
	Purchase ledger	£300	K2
	Purchase ledger	£300	P2
	Purchase ledger	£300	A2
	Purchase ledger	£300	S5
	Purchase ledger	£315	V1
	Purchase ledger	£300	P1
	Purchase ledger	£295	C6
	Purchase ledger	£250P	S4
	Purchase ledger	£300	T2
	Purchase ledger	£490	L4
	Purchase ledger	£199	T5
	Quotation estimating	£300	P1
	Reinforcement bar schedule	£150	S8
	Resource optimiser	£295	C10
	Sales ledger	£300	A2
	Sales ledger	£300	K2
	Sales ledger	£300	S5
	Sales ledger	£300	P2
	Sales ledger	£315	V1
	Sales ledger	£300	P1
	Sales ledger	£295	C6
	Sales ledger	£250P	S4
	Sales ledger	£300	T2
	Sales ledger	£490	L4
	Sales ledger	£199	T5
	SL, PL stock control	£1000	T2
	Solicitor's complete record accounting	£3000	S2
	Statistics	£150	G3
	Statistics	£100/195	P2
	Statistics	£100-195	P2
	Statistics	£140	C8
	Stock control/recording	£150	G3
	Stock control/recording	POR	K2
	Stock control/recording	£300	P2
	Stock control/recording	POR	A2
	Stock control/recording	£80	S2
	Stock control/recording	POR	S5
	Stock control/recording	£285	V1
	Stock control/recording	£300	P1
	Stock control/recording	£500	S4
	Stock control/recording	£490	L4
	Stock control/recording	£199	T5
	Text file librarian	£125	S4
	Time/cost recording	£450	S2
	Time/cost recording	£300	P1
	Utilities	£20	C6
	Video message	£200	G3
	Word processing	£75	K2
	Word processing	£75	A2
	Word processing	£60	S2
	Word processing	£300	P2
	Word processing	£75	S5
	Word processing	£120	V1
	Word processing	£75	J1
	Word processing	£180/95	S4
	Word processing	£30	C8
	Word processing	£500	T2
	Word processing	£99	T5
CBM/8032	Cheque writer	£90	P3
	General ledger/NL	£450	C11
	General ledger/NL	£350	W3
	General purpose transaction proc.	£495	S3
	Incomplete records	£150	W3
	Insurance renewals	£1200	S3
	Integrated accts	£1500	P3
	Integrated accts	£900	C11
	Job costing	£1000	C11
	Job costing	£350	W3
	Mailing list	£350	W3
	Motor trader	£950 +	P3
	Order entry/invoicing	£750	P3
	Payroll	£375	P3
	Payroll	£350	W3
	Production control	£650 +	P3
	Purchase ledger	£500	C11
	Purchase ledger	£350	W3
	Sales ledger	£500	C11
	Sales ledger	£350	W3
	Solicitors package	£140	S1
	Stock control/recording	£175	P3
	Stock control/recording	£250	C11
	Stock control/recording	£350	W3
	Time/cost recording	£800	S1
	Warehousing	£375	P3
Compucorp	Solicitors package	£2000	Q1
Challenger	Appointment Planner	£25	C7
	Invoicing	£25	C7
	Mail Shot	£25	C7
	Payroll	£25	C7
	Purchase Ledger	£25	C7
	Sales Ledger	£25	C7
	Stock Control	£25	C7
CP/M	Bill of materials	£500	B5
	Bill of materials	£199	T5
	Bookmakers package	POR	B7
	Budgeting package	£95	B5
	Cash flow	£250	L3
	Cash flow	£95	B5
	Cash register	£300	T4
	Company secretary	£450	C4
	Container accounting	£750	M5
	Contract costing	£2000	L3
	Database	£350	B3
	Database management/information retrieval	£150-750	C4
	Database management/information retrieval	£100	G3
	Database management/information retrieval	£400	C3
	Database management/information retrieval	£600	G5
	Dental records	£500	T4
	Eire payroll system	£650	M5
	Equipment lease/rent/HP	£400	G1
	Estate agents	£750	C4
	Estate agent	£700	B5
	Financial modelling	£400	G1
	Financial modelling	£95	B5
	Financial modelling	£400	B6
	General ledger/NL	£500	L3
	General ledger/NL	£500	C4
	General ledger/NL	£400	G1
	General ledger/NL	£375	L1
	General ledger/NL	£200	B5
	General ledger/NL	£275	S7
	General ledger/NL	£400	M3
	General ledger/NL	£350	B3
	General ledger/NL	£300	W1
	General ledger/NL	£425	B6
	General ledger/NL	£500	T4
	General ledger/NL	£400	M5
	General ledger/NL	POR	B7
	General ledger/NL	£199	T5
	Hotel management	£525	M4
	Incomplete Records	£250	B5
	Incomplete Records	£750	M3
	Incomplete Records	£975	B3
	Incomplete Records	£750	W1
	Incomplete Records	1250	M5
	Incomplete Records	£155	C10
	Industrial cleaner package	POR	B7
	Industry factory loading	£360	X1
	Industry work study	£990	X1
	Insurance brokers	£995	W1
	Integrated accts	£1500	C4
	Integrated accts	£1100	G1
	Integrated accts	£950	L1
	Integrated accts	£690	B5
	Integrated accts	£850	S7
	Integrated accts	£990	M3
	Integrated accts	£900	B5
	Integrated accts	£1450	B3
	Integrated accts	£1200	B6
	Integrated accts	£199	T5
	Invoicing	£325	L1
	Invoicing	£150-350	C4
	Invoicing	£150	S7
	Invoicing	£250	M3
	Invoicing	£100	B5
	Invoicing	£200	B3
	Invoicing	£300	W1
	Invoicing	POR	B7
	Invoicing	£199	T5
	Jewellers System	£1000	S7
	Job costing	£700	C4
	Job costing	£990	X1
	Job costing	£350	M3
	Job costing	£500	T4
	Job costing	£650	M5
	Job costing	POR	B7
	Job costing	£199	T5
	Job costing	£1500	T5
	Legal precedents	£1100	C4
	Letter writer	£150	M3
	Letter writer	£99	T5
	Mailing list	£50-150	C4
	Mailing list	£250	G1
	Mailing list	£75	S7
	Mail shot	£200-360	G4
	Mail shot	£90	M3
	Mail shot	£50/150	G5
	Mail shot	£99	T5
	Order entry/invoicing	£350	G1
	Order entry/invoicing	£500	T4
	Order entry/invoicing	£550	M5
	Order entry/invoicing	POR	B7
	Order entry/invoicing	£99	T5
	Order processing	£550	L1
	Order processing	£99	T5
	Payroll	£450	L3
	Payroll	£495	C4
	Payroll	£500	G1
	Payroll	£475	L1
	Payroll	£500	B5
	Payroll	£390	M3
	Payroll	£450	B3
	Payroll	Lease	W1
	Payroll	£425	B6
	Payroll	£500	T4
	Payroll	£450	M5
	Payroll	POR	B7
	Payroll	£199	T5
	Perpetual Inventory	£150	B5
	Personnel records	£450	C4
	Production analysis	£700	C4
	Property management	£450-1000	C4
	Property management	£400	M3
	Property management	POR	B7
	Publishers system	£1850	S7
	Purchase ledger	£500	L3
	Purchase ledger	£450	G1
	Purchase ledger	£425	L1
	Purchase ledger	£500	C4
	Purchase ledger	£200	B5
	Purchase ledger	£275	S7
	Purchase ledger	£400	M3
	Purchase ledger	£350	B3
	Purchase ledger	£300	W1
	Purchase ledger	£425	B6
	Purchase ledger	£500	T4
	Purchase ledger	£400	M5
	Purchase ledger	POR	B7
	Sales ledger	£500	L3
	Sales ledger	£500	C4
	Sales ledger	£450	G1
	Sales ledger	£425	L1
	Sales ledger	£200	B5
	Sales ledger	£275	S7
	Sales ledger	£400	M3
	Sales ledger	£350	B3
	Sales ledger	£300	W1
	Sales ledger	£425	B6
	Sales ledger	£500	T4
	Sales ledger	£400	M5
	Sales ledger	POR	B7
	Sales ledger	£199	T5
	Solicitors	£1250	M5
	S/L, P/L + stock control	£1000	L3
	S/L, P/L + stock control	£900	B5
	Stock control/recording	£325	L1
	Stock control/recording	£500-1500	C4
	Stock control/recording	£350	G1
	Stock control/recording	£500	B5
	Stock control/recording	£900	M3
	Stock control/recording	POR	B7
	Stock control	£550	B3
	Stock control	£300	W1
	Stock control	£500	T4
	Stock control	£550	M5
	Stock control	£199	T5
	Surveying	£500	T4
	Time/cost recording	£400	G1
	Time/cost recording	£200	M3
	Time ledger	£350	B3
	Utilities	£50	B5
	Various thermal insullation industry systems	£2000 +	T6
	Word processing	£400	G1
	Word processing	£150-260	C4
	Word processing	£250	M3
	Word processing	£250	B6
	Word processing	POR	B7
	Word processing	£99	T5
	Work in progress	£850	B5
Famos	Customer file	£1000	M2
	Data base	£1500	M2
	Integrated accts	£2000	M2
	Motor dealer	£5000	M2
	Payroll	£1500	M2
	Stock control	£1500	M2
	Word processing	£500	M2
MCZ Zilog	Mail shot	£250	I1
	Membership accting	£250	I1
	Personnel records	£400	I1
MZ-80K	Estate agent	£195	W1
	Integrated accounts	£150	P2
	Stock control/recording	£150	P2
North Star Horizon	Budgeting package	£95	B5
	Cash flow	£95	B5
	Database management/information retrieval	£250	B3
	Double glazing costing	£750	W1
	Estate agent	£750	B5
	Financial modelling	£95	B5
	General ledger/NL	£250	B3
	General ledger/NL	£400	M3
	General ledger/NL	£400	B5
	Incomplete records	£750	M3
	Incomplete records	£250	B5
	Incomplete records	£975	B3
	Integrated accts	£950	B3
	Integrated accts	£990	M3
	Integrated accts	£690	B5
	Integrated accts	£900	B5
	Invoicing	£100	B3
	Invoicing	£250	M3
	Invoicing	£100	B5
	Job costing	£350	M3
	Letter writer	£150	M3
	Miling List	£195	W1
	Mail shot	£90	M3
	Payroll	£350	B3
	Payroll	£390	M3
	Payroll	Lease	W1
	Property Management	£400	M3
	Purchase ledger	£250	B3
	Purchase ledger	£400	M3
	Purchase ledger	£400	B5
	Sales ledger	£250	B3
	Sales ledger	£400	M3
	Sales ledger	£400	B5
	SL, PL + stock control	£900	B5
	Stock control/recording	£450	B3
	Stock control/recordng	£900	M3
	Time/cost recording	£250	B3
	Time/cost recording	£200	M3
	Time/cost recording	£450	W1
	Word processing	£250	M3
PCC 2000 Simpelec Triton 3	Estate Agent	£350	B2
	General ledger/NL	£350	B2
	Mail Shot	£450	B2
	Purchase ledger	£350	B2
	Sales ledger	£350	B2
	Stock control/recording	£350	B2
	Time/cost recording	£350	B2
PET/CBM	Assembler dev	£50	C2
	Bill of materials	£199	T5
	Bureau de change	£8	H3
	Cheque writer	£90	P3
	Credit control	£650	B4
	Database management/information retrieval	£75	B1

PACKAGES

Machine	Application	Price	Code
	Database management/ information retrieval	£50/150	C2
	Database management/ information retrieval	£150	G2
	Database management/ information retrieval	£150	J1
	Database management/ information retrieval	POR	C1
	Database management/ information retrieval	£225	H4
	Database management/ information retrieval	£250	C3
	Disk operating system	£150	B1
	Estate agent	£30	H3
	File handling	£225	H4
	General ledger/NL	£200	C2
	General ledger/NL	£1000	C1
	General ledger/NL	£200	H3
	General ledger/NL	£199	T5
	Industry factory loading	£300	X1
	Industry work study	£750	X1
	Integrated accts	£300	B1
	Integrated accts	£(50)	C2
	Integrated accts	£650	G2
	Integrated accts	£650	J1
	Integrated accts	£800	S3
	Integrated accts	£199	T5
	Invoicing	POR	J1
	Invoicing	£25-50	B1
	Invoicing	£400	C1
	Invoicing	£199	T5
	Job costing	£750	X1
	Job costing	£199	T5
	Lotteries	£45	H2
	Mailing list	£75	B1
	Mailing list	£45	H2
	Mailing list	£35	H3
	Membership accting	£85	H2
	Payroll	£150	G2
	Payroll	£150	J1
	Payroll	£150	C2
	Payroll	£50/195 195	I2
	Payroll	POR	C1
	Payroll	£200/350	C5
	Payroll	£10	H3
	Payroll	£199	T5
	Personnel recors	£85	H2
	Petsoft programs	£160	J1
	Petaid report generator	£250	S3
	Prise lister	£12	H3
	Production analysis	£300	B1
	Production control	£650+	P3
	Purchase ledger	£200	C2
	Purchase ledger	POR	J1
	Purchase ledger	£1000	C1
	Purchase ledger	£300	B4
	Purchase ledger	£350	H3
	Purchase ledger	£199	T5
	Sales ledger	POR	J1
	Sales ledger	£200	J1
	Sales ledger	£300	B4
	Sales ledger	£800	C1
	Sales ledger	£350	H3
	Sales ledger	£199	T5
	Stock control/recording	£150	C2
	Stock control/recording	£300	B1
	Stock control/recording	£150	G2
	Stock control/recording	£150	J1
	Stock control/recording	£195	I2
	Stock control/recording	£15	A2
	Stock control/recording	£300	B4
	Stock control/recording	£35/25	H3
	Stock control	£199	T5
	TAP business system	£125	H2
	Time/cost recording	£300	B1
	Utility set	£78	H3
	VAT master	£25	H3
	Word processing	£75/150	J1
	Word processing	£75/150	G2
	Word processing	£75/150	C2
	Word processing	£85/65 £40/20	H2
	Word processing	£375	H4
	Word processing	£325	C5
	Word processing	£35	H3

Machine	Application	Price	Code
PET/ Computhink	Stock control/recording	£250	R1
Philips P2000	Analysis ledger	£100	P4
	Expense Analysis	£150	P4
	General ledger/NL	£100	P4
	Hotel billing	£500	P4
	Incomplete records	£150	P4
	Integrated accts	£650	P4
	Invoicing	£150	P4
	Job costing	£400	P4
	Order Processing	£200	P4
	Payroll	£300	P4
	Purchase ledger	£200	P4
	Quotation Estimating	£400	P4
	Renewals ledger	£200	P4
	Sales Ledger	£200	P4
	S/L, P/L stock control	£950	P4
	Stock control/recording	£300	P4
	Time/cost recording	£300	P4
	Word processing	£230	P4
RAIR Black Box	Financial modelling	POR	A3
	Hotel management	POR	A3
	Local government housing maint.	POR	A3
Sharp PC-3201	General ledger	£450	P2
	Sales ledger	£300	P2
	Purchase ledger	£300	P2
	Stock control	£300	P2
Sorcerer	Payroll	£250	L2
Superbrain	Bill of materials	£450	T3
	Database	£300	S6
	Estate agent	£800	S6
	Estate agent	£600	C12
	General ledger	£400	M3
	General ledger	£400	S6
	Incomplete Records	£750	M3
	Incomplete Records	£1200	S1
	Integrated accts	£1200	S6
	Integrated accts	£990	M3
	Integrated accts	£1000	T3
	Integrated accts	£1200	S1
	Invoicing	£250	M3
	Invoicing	£150	S6
	Job costing	£350	M3
	Letter writer	£150	M3
	Mailing list	£140	C9
	Mail shot	£90	M3
	Payroll	£400	S6
	Payroll	£390	M3
	Payroll	£250+	T3
	Property management	£400	M3
	Purchase ledger	£300	S6
	Purchase ledger	£400	M3
	Sales ledger	£300	S6
	Sales ledger	£400	M3
	Sales ledger	£199	T5
	Solicitors package	£1400	S1
	Stock control	£300	S6
	Stock control	£900	M3
	Stock control	£450	T3
	Time/cost recording	£800	S1
	Time recording	£200	M3
	Word processing	£250	M3
	Travel agency accts	£800	S6
Tandy Model I	Database management/ information retrieval	£25-80	M1
	Database management/ information retrieval	£270	A4
	Database management/ information retrieval	£60	S2
	Database management/ information retrieval	£32.50	H1
	Database management/ information retrieval	£150	J1
	General ledger/NL	£90	M1
	General ledger/NL	£90	M1
	General ledger/NL	£225	H1
	General ledger/NL	£225/325	T1
	General ledger/NL	£425	T1
	Incomplete records	£40	M1
	Incomplete records	£40	H1
	Invoicing	£90	M1
	Invoicing	£280	A4
	Invoicing	£90	M1
	Invoicing	£75	T1
	Invoicing	£125	T1
	Invoicing	£265	O1

Machine	Application	Price	Code
	Integrated accts	£350	M1
	Integrated accts	£550	A4
	Integrated accts	£350	M1
	Integrated accts	£75	J1
	Integrated accts	£795	O1
	Investment portfolio	£20	S2
	Invoicing	£25	H1
	Job costing	POR	M1
	Job costing	POR	M1
	Job costing	£265	O1
	Mailing list	£40	M1
	Mailing list	£75	M1
	Mailing list	£25/38/ 55	H1
	Mailing list	£50-150	S2
	Mail shot	£75+	G4
	Mail shot	£160	A1
	Mail shot	£75	M1
	Mail shot	£75+	G4
	Payroll	£249	M1
	Payroll	£200	H1
	Payroll	£218	T1
	Payroll	£375	T1
	Payroll	£300+	O1
	Purchase ledger	£90	M1
	Purchase ledger	£90	M1
	Purchase ledger	£225	H1
	Purchase ledger	£375	T1
	Purchase ledger	£375	T1
	Sales ledger	£90	M1
	Sales ledger	£90	M1
	Sales ledger	£225	H1
	Sales ledger	£225	T1
	Sales ledger	£375	T1
	Statistics	£45	S2
	Stock control/recording	£30-50	M1
	Stock control/recording	£300	M1
	Stock control/recording	£200	H1
	Stock control/recording	£48	S2
	Stock control/recording	£115	J1
	Stock control/recording	£200	T1
	Stock control/recording	£375	T1
	Stock control/recording	£265	O1
	Travel Agency Accts	£225	G4
	Travel Agency Accts	£225	G4
	Travel Agents Dairy	£100	G4
	Travel Agents Diary	£100	G4
	Travel Ticket Sales	£225	G4
	Travel Ticket Sales	£225	G4
	Time/cost recording	POR	M1
	Time/cost recording	POR	M1
	VAT register	£15	H1
	Video hire system	£460	A4
	Word processing	£50/75	M1
	Word processing	£175-240	M1
	Word processing	£45/95	J1
	Word processing	£15	H1
	Word processing	£30/60/ 90	S2
	Word procesing	£295+	O1
Vector	General ledger/NL	£400	C5
	Integrated accts	£1000	C5
	Purchase ledger	£400	C5
	Sales ledger	£400	C5
	Word processing	£40	C5
8000 Series	Database management/ information retrieval	POR	C2
	Integrated accts	POR	C2
	Payroll	£250	C2
	Purchase ledger	£250	C2
	Sales ledger	£250	C2
	Word processing	£250	C2
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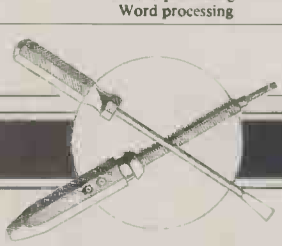

ACC NEWS

Rupert Steele presents his monthly round-up of news from the Amateur Computer Club.

So, you got a computer for Christmas? And maybe you're having one or two difficulties, or perhaps the Space Invader game on it isn't *quite* as good as the arcade version, and after the thousandth game its attraction is beginning to fade? Then you might want to meet other computer users to get a few ideas.

You can do this at your local computer club, or by joining the National User Group appropriate to your particular micro. If you want information on these clubs or groups then please write to me or telephone (address and number below), and the ACC will tell you all. You'll also get a sample copy of *ACCumulator* (the ACC's own newsletter, published six times per year), so if you do send an SAE, make it decent-sized.

Of course, the info the ACC gives out is only as good as the info that comes in (if anybody says 'GIGO', I will scream!), so if you would like people to be told of your club, write to me with the details and it will be added to the ACC Club database. Incidentally, the ACC will allow an *ACCumulator* subscription to be taken out by a club at the children's rate of £2.50 and there is also a bulk membership scheme, giving cheap ACC membership to all members of a local club. Details, as always, from me.

Suppose there isn't a club in your area? Then write to me for information on how to start one — it's not that difficult and it really doesn't take too much time. Honest!

The big news this month is the launch of Club Spot 800 on Prestel. I described the ideas for a

ACC NEWS

clubs area on *8008# some time ago, but the details of this are now sorted out and the scheme is 'live'.

As you may know, the old 'Electronic Insight' magazine on Prestel *800# has been re-styled 'Micronet 800', while the Micronet company has been selling cheap Prestel adaptors for the popular micros, on a subscription basis. Within the Micronet area lies the node 8008, which has been allocated to the amateur computing movement.

The 8008 area — Club Spot 800 — will be administered by the ACC National Prestel Committee, which includes elected representatives from the national user groups and the clubs. Also on this committee are the database managers, who are responsible for the day-to-day running of the computer hobbyist movement on Club Spot 800, and include such worthies as Len Stuart, Vernon Quaintance and Stephen Rabagliati.

Computer enthusiasts about the country will be able to experiment on Club Spot 800 via their local clubs. They will be able to edit information up on to the Prestel system as well as create telesoftware (programs stored on Prestel which can be downloaded off the system to run on a micro). There will be news pages, tips, information on clubs, 'wants and needs', and much more. What actually turns up on Club Spot 800, however, is very much up to you. The ACC don't intend to tell people what to write on Club Spot; on the contrary, we want as many people as possible to be involved and new ideas to appear. Naturally, we would retain the right to remove anything that was illegal or likely to bring the hobbyist movement into disrepute, but basically the Prestel database is there for you to play with.

So what are the mechanics for getting to be an editor on Club Spot 800? We are going to hold an inaugural Editors' Conference somewhere near (but possibly very slightly to the north of) Watford. This will be a one-day event, and will happen at the end of February or beginning of March. At this, the managers will demonstrate how to edit and describe the routing conventions that we would like Club Spot 800 to adhere to. The price is not fixed at the time of going to press, but it will only be enough to cover our expenses in mounting the conference.

We would like possible attenders to register in advance if possible, so that we know how many we will have to cater for. So please contact (either directly or via your local club) Andy Leeder at St. John's College, Oxford, OX1 3JP or telephone Oxford (0865) 512811 for more information. If you can't make the conference, it may still be possible to get you online as a Club Spot 800 editor — contact us anyway.

Of course, if you are a Prestel user (whether via Micronet or some other cause), you can have a look at Club Spot 800 on *8008#. It should make fascinating reading/viewing (can somebody suggest the correct verb?).

Various exhibitions merit a mention this month, so here goes. At the time of writing, the IPC Northern Show had just happened. They had 22,000 visitors in Manchester. Club stands were spectacularly thin on the ground. No stand. . . no new members. So if you don't want to get left out next time, contact the ACC and we'll get you some space if we can.

Also up north was Microfest (December). Held at UMIST, this show provided a chance for the various north-western groups to get together, and for a North-Western Regional Association of Computer Clubs to be formally set up. As soon as I have the chairman's details, I'll give them a plug.

There are two exhibitions coming around Easter this year. These are IPC Birmingham, at which the ACC will be organising the Amateur Stands (contact David Annal, 142 Windermere Road, London SW16 5HE for details, if your club wants a stand. Do it *today*), and the ALCC Computerfair which is now expanded with the help of IT'82 (?) and the GLC. Contact Robin Bradbeer, 13c Compton Road, London N1 2PA for more info on the ALCC fair.

The introduction of the Dragon seems to have coincided with an increase in Club activity in Wales. Two examples of this phenomenon have presented themselves in the past month.

Mr W F Jones, of 77 Millbank Road, Rhyl, Clwyd is the contact for the Abergele Computer Club, which meets on Thursdays from 7.30pm to 10pm at Abergele Council Offices. Their sub is a fiver (half for juniors) and everybody is welcome.

Also in the Principality is the Pencoed Amateur Computer Club, which has now been going about five months. Contact general sercretary Philip Williams of 38 Bryn Rhedyn, Pencoed, Mid Glam, CF35 6TL. Their subscription is also a fiver, and they meet in the Pencoed Library reference room (quietly, no doubt) from 3pm to 5pm on Saturdays.

Continuing in ethnic vein, we move to Kemnay Computer Club, contact S J Stubbs, 15 The Glebe, Kemnay, Inverurie, Aberdeenshire. This very northern group apparently finds it difficult to extract money from its members, and so has a free membership. They claim to meet approximately weekly.

Further away from the Arctic Circle, we find the Scottish Amateur Computer Society (SACS), whose contact and chairman is Mike Anthony of 46 Moredun Park Gardens, Edinburgh, EH17 7JR. This is a kind of Scottish ACC, to look after the Scottish clubs, much like the other regional associations in the country. Is your Scottish club not involved? Then contact Mike Anthony.

We terminate our round trip of computer clubs far from the playing fields of Eton, by visiting Zimbabwe. The 'Green Screen Club' lives at Box 2900, Harare, Zimbabwe. Attention: Mr Greighton; this claims to be the only computer club in Zimbabwe, so if there's anybody out there, you know who to contact when you feel the urge to compute.

Please note the new phone number for ACC business — Oxford (0865) 512811 — or write to me at: St John's College, Oxford, OX1 3JP.

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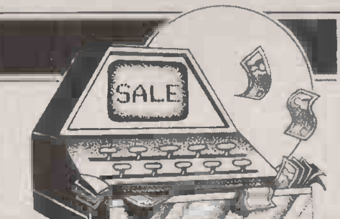

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- 40k Tangerine Microtan 65 tanex tanram 10k basic x bug tanbug V2 forth on tape home brew case power supply ASC11 keyboard £260 Tel Mr Barnes Wheathampstead 3411 after 6pm.
- Sharp MZ80k 48k RAM and manuals Sharp Basic, Xtal, Basic Pascal, Forth, Sharp Assembler, Zen Assembler, Sharp machine code games and business software good condition. £300 Cambridge 51795 ext 51. Mr Miles.
- TRS 80 16k level 2 green CRT CIR-80 deck complete with over 100 items. Software including Arcade favourites. Also manuals and books sell £395. (worth £500) Tel 01-660 1893 Eve.
- Microman 65 with power supply As new £70. 1 Dunchurch Close, Balsall Common, Nr West Midlands. Tel Berkwell 34332.
- TRS-80 16kLI with VDU and cassette, many programmes inc MONTIOR and T'Bug £200. Tel 01-387 7050 Ext 784 or call 2, East Gardens, London SW17.
- UK101 8k cased with ½MHZ switch, 300/600 band switch and number pad with compatable TV and cassette recorder £300 ono. Tel M. Leslie on Welwyn Garden City 35949.
- Ferranti keyboard and monitor with RS232 interface £100. Similar very modern programmable and versatile Ventek £250. Oscilloscope £120. Tel Crayford 529700.
- 4000 Series PET, printer, disk driven with cassette player, soundbox, books, software, cassettes, and disks. Bought recently, hardly used! Cost approx £2500. Asking price £1600 ono., Please tel 01-346 5014 eve.
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- TRS-80 16k LII — VDU lower-case modification, lineprinter VII. interface cable, manuals, software worth £100. 1yr old. Worth £1000, sell for £495 (ono) tel 0983 65742 after 6pm.
- PET 2001 green screen all manuals inc 6502 assembly and second cassette demo given. Collect. give away £150! tel Denbigh 4083 or call 34 Glasfryn Henllan Denbigh Clwyd Wales.
- Nascom 2 32k RAM NAS-SYS PITS+PC's prog aid 8k Basic Pascal, Assembler word processor, graphics, sound, lots software. 2400 baud cassette, VDU, Centronics I/F. Epson MX80 FT2 printer, paper, manuals: offers tel "David" 041-942 2402 weekends.
- Disk drive for Tandy TRS80 model 1 full history extremely little use. Supplied with TRSDOS and other software. Either drive 0 or extension drive. Brighton 0273 556184 £250 ono.
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programs. £400 or swap for BBC model B. tel 01-907 0538.

● ITT2020 Twin discs DOS 3.2 autostart language card Pascal + lots of games and other software seen working London W1. 64k ward 01-486 9893 £825 identical to Apple II.

● PET 2001 8k new ROM, small keyboard and integral cassette. Green screen, toolkit, books:- PET revealed and PET graphics. Many programs, excellent condition £350 ono tel 04895 4573 (near Southampton).

● Acorn ATOM 12k RAM 8k ROM toolkit EPROM. Acorn built boxed, 6 months old, £50+ games, software, PSU and leads upgrading soon so £150 for quick sale. Tel-01-660 6393. Eve.

● Sorcerer 48k, S100 expansion unit, Jade DD disk controller and CP/M. Dual 8in LOBO disks, IDS 460 Paper Tiger £1600. Also second S100 expansion box, Jade DD controller £400. Consider splitting. Steve (0272) 732509. Eve.

● Casio FX702-p pocket computer with printer, cassette interface, and paper: £110; UK101 8k, Cegmon: £80; Watford electronics mother board and memory PCBs: £30; technomatic I/O interface boards. £35. Tel: (0727) 53946.

● BBC 'B' boxed mint £350 Defender Monsters Snapper Peeko-computer 'Graphics' 'Graphs' £5 each 'Beebug' X6 'Acorn user' x5 £2 each lot. Cassette recorder plus cable £10. Emigration imminent 01-229 5888 must sell.

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● PET 4016 for sale 85 progs, manual, PET revealed. free £400 ono. Tel 0665 830466 eve. Mr Little.

● TRS-80 16k, L II with PSU cassette manuals and games. Used very little and want quick sale, so best offer nearest to £230. Tel: 01-902 4627.

● 8032 Software, Wordpro 4 plus £185.00. Visicalc £75.00, Petaid £145. Quick sale. Buying house, Simon, Redhill 0737 60986.

● Offers for Surplus Pertec 9 track tape-transporters model T7840/9/12.5 L/W Formatter Interface plus PSU. One unit cabinet mounted. One set of 4 items boxed. Tel: 06076 66539 day, 0602-392802 eve.

● Sharp software. MZ80A, MZ80K progs, business, games, educational from £3.00. Tape copier, extended Basic, stock control, Word Processo, invoice control, Disassembler, Physics, Maths. list SAE. 38 South Parade, Bramhall, Stockport.

● PET 32k upgraded Basic 4. Cassette, Basic 2 chips, toolkit, soundbox, reset switch. Free software cassette or disk. (4040 disk unit available). Manual, books, Visicalc inc. £400. Tel: Nuneaton 383212 (Mon-Fri).

● Sharp MZ-80k 48k with Basic extensions, manuals, s/ware (many games), dustcover, reset switch, 12 mths old. £300 ono, write: Mr Lifton, 30 Willow Ave, Catterick Garrison, North yorkshire. Sale reason: Leaving UK.

● Own a BBC computer? Add a volume control and DIN output socket. no drilling or soldering, £6.95 inc. Also quality speaker/amp. Details from P Smith, 23 Sandy Close, Petersfield, Hants GU31 4HF.

● TRS-80 LII, 16k, numerical keypad, cassette, all leads, manuals, odds and ends inc. All reasonable offers included. Tel: 0926 26633 eve. Its in very good cond.

● Atom 8k plus 8k new keyboard, via, power supply, joystick, interface, 2MHZ option. £130 Clarke. Tel: Leeds 0532 732589.

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● BBC Model A for sale, with 32k 6522 chip, completed cassette lead and full user guide. Worth £340, sell for £320, ono. Offers to Robert Erskine,, 28 Pottenhill Ave, Paisley PA2 8BA.

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● TRS80 Model I (Level II) 32k — Exp/Int, Numeric keypad, VDU, cassette recorder, lower case mod. Tandy VII printer, dust covers nd user manuals. £650 ono. Tel: Biggin Hill 21240 eve.

● Sharp MZ-80k with Quantums Hi-Res graphics (up to 64,000 dots) plus many s/ware, £400. Sharp PC-1211 and CE-121 for £80. or both still boxed and manual for £460. Tel: Mr P C Lee, 01-977 6389 w/ends only.

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● Sharp MZ80k 48k Boxed machine code and manuals plus £150 worth of s/ware eg. Cosmaid Chess Apollo Plotter etc. £300 to £325 ono. London area 01-554 9488 eve only.

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● Sharp MZ-80k, 48k £475 ono. With reset button, and over 100 programs inc business, games and languages. Tel: 01-883 1711 after 6.

● Computer magazines £17. Fantasy games. £60, model ships, tanks, figurines the lot boxed £43 unpainted. Alternatively consider lots of Atari 400 s/ware all immaculate condition call Richard 733-0090 after 5.

● ZX81 ZX80/8k cassette TDK90 minutes full to overflowing at ridiculous price. L11.95 less 50p each proram! You don't. Will find these programs anywhere. Satisfaction guaranteed. Bruno. Del Medico Torino 72 Sabaudia 0496 Italy.

● Sharp cassettes. MZ-80A and MZ-80k program collection, utility, business, educational and games. most at £3.00. Super basic and M/code editor/disassembler. SAE for list. 38 South Parade, Bramhall, stockport. SK7 3BJ.

● GENIE I 32k with sound, lower case. M/C monitor, dust cover. Boxed, manuals as new. 6 months old £50+ Kansas software computer cost £350. £220 ono tel Scunthrope (0724) 844648.

● Atari 800 micro, 810 disk drive. extra 32k memory, pilot (educators), missile command, joystick and box diskettes — £800 ono. Ring Jeremy (0244) 81489 (Deeside).

● ZX81 Sinclair built, 16k RAM pack, good condition, several software tapes, all leads etc £65 tel Ascot 22942 after 3pm.

● TRS-80 programmes: missiles, maze, survive, 3-D noughts & crosses. missiles is an adaptation of missile command & survive is of scramble. Both are very fast & addictive. Excellent value each for £5 send check to: Joao Geada, Rockwell College, Chasel, Co Tipperary, Eire.

● VIC 20 8k RAM pack, cassette unit, some software, joystick 8 books including prog ref guide and VIC reveald. 7 months old. £230 tel 903 0459.

● PET 32k 4.0 ROM 9 in screen, internal sound box, reset button, excellent condition, price £450. tel Blackburn 667060 after 6pm.

● 1k Sinclair ZX80 Sinclair built inc all leads manuals and PSU games cassette, £30. Simon 0737 64141 eve.

● Sharp MZ-80k 48k, books. manuals, newsletters over 250 progs. incl. 8 basics, asembler. machine language. fortran forth. disassembler, sargon 25 m/c games ... £460 01-834 3800 ext Frobisher 805 Central London.

● TRS-80 M1L2 16k very little used. Excellent working order. games include Chess Backgammon and Blackjack, books and manuals 11 months old all offers considered tel Kingsbridge 3413.

● 32k RAM Sinclair 2X81 with PSU etc and machine code manual £90 ono Tel: 0234 (Bedford) 67025 Dr Oswald 32 Mersey Way, Brickhill, Bedford.

● MZ80B 6 months old complete with manual's basic (+) and aplication tapes hi-res graphics 64k dust coverand leads £750 tel Biggin Hill 75038 after 7pm any eve.

● COMmodore VIC20 5 months old, + 8kRAM Super expander reference guide £185. Welwyn Garden 33485.

● PETOLD command retrieves newed programs for BASIC 3 and 4 PETS easily saved on cassette. Send £3 to David Bell 25 Westview Bedlington Northumberland NE227JX for full listing.

● Speech synthesiser (Mutek voxbox), hardly used. Suitable for ACORD ATOM (or PET). Software including game using speech and user manuals. Complete £65. tel Harrogate 0423 57464 eve. Ask for Mark.

● Sharp MZ-80K 48K RAM, year old, as new, guaranteed for further year. Instruction manual. Basic speed Basic, Forth assorted software, books and user notes included. £325. tel Rugeley (088-94) 77906.

● Sharp MZ-80K 48K RAM 4 months old, Softwarei ncludes Heads on World Cup etc Hardly used £350 ono Rob Cummings 289 Withington Road, Chorlton, Manchester tel 061-881 4534.

● VIDEO GENIE 16k boxed with all leads and manuals + sound generator worth £35. + £120 of high quality software. Total worth £400 selling for £240 ono tel 01-340 5414.

● ACORN ATOM 12 +12k 3A PSU, via buffers, printer lead, utility ROM, leads, manuals, magic book. many Atom magazine articles. £175. Tel Southampton (0703) 844051.

● PET 16k new ROM cassette recorder. £450 ovno tel Ruislip 34941.

● UK 101. cased (black) 8k RAM. Professionally built and tested. Excellent condition. Manual included. £120. tel Bristol (0272) 566519.

● 4000 Series PET. printer. disk driven with cassette player. soundbox, books, software, cassettes, and disks. Bought recently, hardly used! Cost approx £2500. Asking price £1600 ono. Please tel 01-346 5014 eve.

● VIDEO GENIE II £G 3008 16k original packaging, manuals, leads. £30 software excellent condition worth £395. Accept £299. tel Batley 475907 eve.

● VIC 20 + cassette recorder and tapes for sale. £150. Tel Peter Brunning 802 3946.

● 4 superb family games written keypad, for BBC model-B, with graphics and sound. Hangman. Bowling, Tracer and Ping-Pong. All good fun. ALL 4 only £10. tel 0702 549856 after 2pm.

● TRS-80 model 1 level 11. 16k numeric keypad. all cables and manuals, all in mint condition. £100 worth books and software. £220 ono for quick sale. Tel 01-361 8166 eve.

● Sharp 48k 1 year old some software games, utility. Manual £280. ono tel Eastbourne 21814 anytime.

● VIC 20, cassette unit, protective console, cartridges, tapes, and books. V.G.C. £200 ono. Paul O'Shea, 37 Blickling Road, off Fifers Lane, Norwich.

● Z80-card Apple II USD90 16k RAM card USD80. Epson I/F. 90USD. 3.3DISK controller USD80. All new and guaranteed 30 days limited number through M Rogers, 11 Joyeuse Entrees B1040 Brussels.

● Nascom 2 8k RAM. Gemini EPROM-ROM card. Both factory built and tested. Nascom 3A P.S.U. Basic, Zeap. Disdebug. Naspen. Nasprint 80. Hullforth, Vero instrument case. Manuals will accept £300 tel 0698 887473.

● Epson HX-20 new portable computer 16k RAM, micro cassette and programs. £400 or swap for BBC model B. tel 01-907 0538.

● S100 8080 CPU. £40 8in SSSD drives £45 5v/100A switched PSU. £40 T.E.I. S100 micro. twin mini drives, 80x24 screen, manual. £950 ASR33 (manuals) £75 wanted: S100 boards. Chelmsford 0245 360320.

● Acorn ATOM 12k + Ross toolkit 8 months old. New keyboard, excellent condition PSU+ leads + manuals+ £100 software Acornsoft packs 1.4,8,9,11, Adventures Invaders Defender. Fast-Cos. Offers above £220 tel Steve 0773 840 607 eve.

● Sharp PC1211 Still boxed. 3 manuals including over 100 programs. £55 only tel after 6 01-688 2951.

● Selectric keyboard printer, +interface to £10 port, friction pinfeed. full software for NAS-SYS Nascoms (mods for other 280 machines) previously IBM main tained, copy of manuals. excellent condition £465. Ipswich 831353.

● ITT2020 Twin discs DOS 3.2 autostart language card Pascal + lots of games and other software seen working London W1. 64k ward 01-486 9893 £825 identical to Apple II.

● PET 2001 8k new ROM, small keyboard and integral cassette. Green screen. toolkit, books:- PET revealed and PET graphics. Many programs. excellent condition £350 ono tel 04895 4573 (near Southampton).

● Acorn ATOM 28k RAM 16k ROM includes 32k RAM card with 16k RAM fitted, programmers toolbox. word-pack ROMS. Printer inter-face PSU manual, magic book, various software. £250 ono tel Cambridge 0223 870089.

● Atari 800 + cassette recorder. Basic. 16k RAm, missle command. manuals and Basic handbook. 450£ SE London tel 698 9796. Ask for John.

● TRS-80 16k LII — VDU lowercase modification. lineprinter VII, interface cable, manuals, software worth £100, 1yr old. Worth £1000, sell for £495 (ono) tel 0983 65742 after 6pm.

● PET 2001 green screen all manuals inc 6502 assembly and second cassette demo given. Collect. give away £150! tel Denbigh 4083 or call 34 Glasfryn Henllan Denbigh Clwyd Wales.

● Nascom 2 32k RAM NAS-SYS PITS+PC's prog aid 8k Basic Pascal. Assembler word processor, graphics, sound, lots software, 2400 baud cassette. VDU, Centronics 1/ F. Epson MX80 FT2 printer, paper, manuals: offers tel "David" 041-942 2402 weekends.

● Disk drive for Tandy TRS80 model 1 full history extremely little use. Supplied with TRSDOS and other software. Either drive 0 or extension drive. Brighton 0273 556184 £250 ono.

● VIDEO GENIE EG3003 with arrow keys and sound modification. with 12in Tandy monitor and 72 programs. offers required. tel 0909 476413.

● Sharp PC 1211 cassette interface, micro-recorder. user-club magazines, professional softwae, and 2 books. VGC still in box with manuals cost £180 sell for £90 ono Tel Gainsborough 4078 eve.

● PET SP9000 96k Basic 4 Assembler Pascal Fortran APL Hardly used and in mint condition cost £1,719 in January 82, First offer of £1,000 secures tel Dave Wylie 0475 704681 after 7pm.

● Wanted ZX81 64k and printer G. Cattaneo via Edison 90 20038 Seregno (MI) Italy.

● Sorcerer 32k Basic and development ROM Pacs video monitor two Micropolis Disk drives CP/M MBasic and micropolis basic Immaculate condition £525 01 552 6026 eve.

● Sinclair printer brand new, not used. Gave up waiting for SPECTRUM! £45 ono + 30in hour Basic free to buyer. tel 0602 865959 you collect, or pay postage.

● Acorn ATOM full graphics 8k + 10k includes power supply and manuals. perfect condition as only a few hours use — £120 ono 01-860 6847 Harrow.

● Professionaly built OH10 superboard 2 cased, PSU TV Cegmon. 16K RAM to board. Many programs including Assembler, ExMon, Invasion, ideal gift. 300/600 Band cassette tel 0843 45793. Will deliver £150.

● ZX80 good condition; manual; cassette connection leads; boxed urgent sale £30 ono Melanie Mason. 46 Harold Place. Leeds, W Yorks LS6 1PQ tel Leeds 0532 759808 eve

● 16k Level II TRS 80 + teleprinter with driver. some software and manuals good condition reasonable offers to Austin one Rosedene Bungalows, Methwold, Hythe. Thetford, Norfolk.

● ZX81, 16k RAM printer. all Sinclair built, manual + software all reasonable offers considered 01-947 6579 eve 01-920 7350 day.

● Complete Sharp MZ 80B system 2nd graphic RAM dfisc drives P6 printer DP Basic Pasal CPM microsoft Basic 80 cost £2997 accept £1995 ono. tel High Wycombe 0494 23786.

● Apple II Europlus 48k single disk with monitor. Ideal for fun or business. Mint condition, joystick. boxes & manuals included. Loads of business/games software. £980 ono tel 01-748 4202 after 7pm.

● ZX81 +16k RAM: all leads + manual + book of 1k progs; all in boxes: £60. Mark Tucker, 32 Heathorn Street, Maidstone. Kent ME14 5AQ.

● Olympia Scripta KSR—typewriter/printer, printwheels, ribbons. RS232, 50 baud, cable to Osborne, (requires jumper to halve baud rate), £500 ono. Richard. Nott'm 0602 585544, eve 861940.

● Microtan 65, Mini motherboard, expanded tanex, 8kRAM Basic. XBug Danbug ASC11 keyboard, All cased includes manual cost £440 all for £175 tel 01-647 8597.

● Accoustically silenced ASR33 teletype. Excellent condition with papertape punch and reader, 2 rolls of paper, and 3 rolls of paper tape,, ideal for letter quality printing. £250 ono col ok tel St Helens 812608.

● Apple II(48k) Europlus, Digitek colour card. disk. manuals etc. Bought late September A1 condition. Offers over £900 to Steve on 01-397 5100 x1445 or swop for Atari 800 similar condition.

● Hewlett Packard HP83 as new (boxed) genuine private sale. Will sell for considerably less than currentp rice, All offers eriously considered tel Ian on 01-903 431Γ (Wembley) eve and at weekends.

● Centronics 779 printer — 60 cps dot matrix with parallel interface +manuals +5 spare ribbons, any offers tel 0628 24454.

● PET programs —Wordprocessor, database pacman also IEEE interface for Epson and cable *PCW* from Sept '81 to Sept '82. tel 431-2040.

● Sharp MZ80K —48k RAM Basic + 4 game cassettes and dust cover with interfaced seikosha GP100A matrix printer and paper, both 6 months old. Bargain £550 Bristol 0272 674570.

● Microwriter, ideal for word processing in train, car, or home. Unused, complete with TV interface unit, printer cable and power adaptor. Value £700 what offers? tel Collins, Watford 0923 42966.

● Acorn ATOM. Acorn built – 12k RAM + 12k ROM user manual, 3 books, leads. PSU only 1 year old. £140. Open University computing course units £35. Ascot 26740 eve.

● ZX81, 16k RAM Sinclair built. mains adaptor and leads. manual, 2 books, 2 Sinclair cassettes £80 ono. Tel 01-958 5610 after 7pm –Kelvin.

● GENIE 3003 immaculate £200 worth of s/ware + feature ROM B. + sound + books and mags. All for £250 tel Juan Weybridge 53851 EVE Upgrade forces sale.

● Superboard II + screen enhangement (20 formats) + Basics: 1. 3. 4. 5. x Assembler in EPROM. +programmable character generator +16k ORAM + EPROM programmer + 8 amp PSU + ITT 2020 case, + 1200 baud cassette. Offers? 0727 59397 eve

● CBM 16k Basic 4 12in screen cassette deck Arrow ChIP Cosmic Jailbreak Cosmic Aliens Cosmaids Breakout and lots more manuels and magazine perfect condition can deliver £575. tel 01-852 3504.

● Centronics P1 microprinter with Genie interface with 5 rolls paper £100. Also aculab floppy tape system for VIDEO GENIE with 20 tapes £120. tel eve or weekends V.J. Day 068-45 4930 (Malvern)

● VIC 20 with cassette £150. VIDEO GENIE 3003 £195. ZX-81 £25 +Protos keyboard £35 + sound box £15 + printer £40 + 16k RAM £20. Gemini multiboard 64k with disc controller £295. Bracknell 84423.

● UK101 8k 16/32x48 screen new Basics ,3,4 Cegmon 300/600 Baud. P.E. interface boards (no I.C.S.) perfect working order £100 ono Somerton (Som) 72663.

● 16k VIDEO GENIE EG3003 + many programs including Space Invaders Flight Simulation £200 write to Mr Deman Apple Treet Cottage, Rockland. St. Mary. Norwich, Norfolk.

● TI 99/4A + extended Basic version 110, still under guarantee. 8 months old, sensible offers in writing. Mr Deman, Apple Tree Cottage, Rockland St Mary, Norwich, Norfolk.

● ZX81 +16k RAM, manual, mains adaptor leads 3 cassette programs. virtually unused £60 will deliver reasonable distance. Chelmsford (0245) 60312.

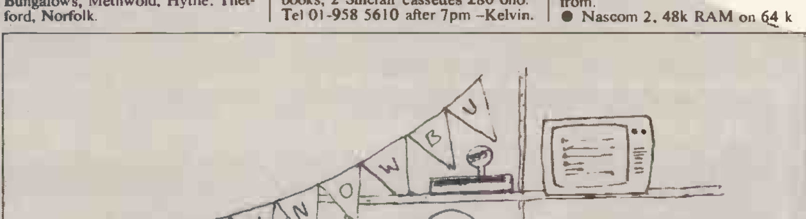
● VIDGO GENIE 16k, EG3003 leads manuals + software books, little used: tel 0634 220077.

● VIDEO GENIE E3003 Tandy green VDU and over £150 software inc Adventures and Deathmaze. Total cost £590 for quick sale for £395 ono may split. tel 0268 411576 eve.

● PET-32k new ROM, large keyboard, superchip, tookit, & mikro assembler, reset switch, cassette with sound & tape counter. 20 tapes: Asteroids, Cosmiads, S/ Glooper. 3-D Startrek, Microchess etc. manuals + dustcover. VGC £395 wuick sale. tel Burley 2294.

● Used Apple discs. Arcade games andcompleted Adventures from £9 each. guaranteed. tel Guy, eve on 01-505 4470 for detailed list. Demonstration possible, Buckhurst Hill area, many titles to choose from.

● Nascom 2, 48k RAM on 64 k

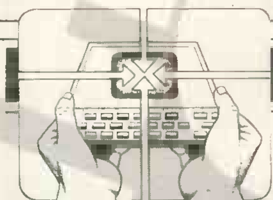


'. . . and the Grand Master level uses thought transference and mud-slinging in the popular press.'

TRANSACTION FILE

RAM board. Nas-sys 3, Zeap, disdebug, ext Basic 2400 cassette speed. Professionally built & cased, lots of software & documentation £320 tel 061-973 1487.

- AIM-65 8k monitor 8k Basic 4k RAM 16 I/O lines. 2 timers, onboard printer/display additional VDU board. Many programs (some in EPROM) and mags. offers tel Chelmsford 351704.
- VIDEO GENIE 16k mint condition withcursor keys, VU meter, inegral cassette, + manuals, carrying case, leads, and over 100 of software £220 ono. tel 01-841 5704 North West London.
- Acorn ATOM 14kRAM BBC Basic + Lisp, Forth and Adventures 5amp external power supply and TV £300 ono. Tel Northallerton 0609 2147.
- Acorn ATOM 12k RAM + 12k AOM (inc floating point) PSU and all leads, manuals, software including invaders, Asteroids 747 full working order £165 ono tel Telford 0952 592973.
- TRS 80 mod 1 level 2 with lower case.Green screen monitor with sound with CTR80 cassette, plastic covers and manuals + some software £300 o.v.n.o. tel 01-751 2262 after 6.0pm.
- Tangerine TANEX and '65' in minirack/PSU: 10k Basic, 8k RAM; RS232C, parallel I/Os superb M/code support. Takes definable hi-res graphics card, games, utilities. cased keyboard £195 ono. Washington 460093.
- MZ80K 48k green screen 4 Basics, Pascal, Forth, Assembler boxed with manuals 50+ games £375 Also sharp printer, interface, expansion box, wordprocessor and covers £350 tel 0463 40088 after 6pm.
- Tangerine home computer system. Microtan 65, Tannex 10k basic, PGM, graphics processor. 19in system rack, high quality keyboard. Full software library, including games. Cost over £600, quick sale offers around £350. tel 0665 602732
- 32k PET with 3032 disk drive and tractor printer, lots of software including business programs only used at home £700 Andy 0483 898545.
- TRS80 16k level II with TV cable lower case CTR80 cassette recorder and £150+ software including Edtasm and IBug: £300 ono S. Bayley, King's College Hall, Champion Hill, London SE5 8AN.
- Atari 800, 410 recorder, joysticks, missile command, star raiders, beta fighter + other games. Full documentation, numerous books, magazines eg. Compute. First offer over £400 secures. tel Ashwell 2474 eve w/e.
- Second hand business software for 8032/8050 Commodore systems. Wordprocessing, Data management + Visicalc. tel Pam Taylor 01-404 5011 business hours.
- Printer AP-80A £180 suite BBC/Aton etc only 5 weeks old boxed complete interface cable owners manual seen working near Sevenoaks tel West Kingsdown 2344 any time.
- Apple II 48k RAM, Applesoft basic, disk drive, disc controller, 12in green screen montiro. All cables and manuals. Chess programme, 10 blank diskettes. Perfect condition. Offers to £850 tel-Martin 01-390 1834.
- Burroughs L-6000 business computer complete with golfball printer and ceramic disc. £100 or will consider splitting up. tel Sunderland 213556. J. Potts 22 Houlsyke Close Tunstall Bank Est Sunderland Tyne-Wear.
- Video Genie 16k sound perfect £200 only, with £400 software including arcade and adventure games (Scarfman, Temple etc) and utilities, books and manuals. Only £250. tel Amersham 02403 4789 eve.
- 48k Spectrum complete, 3 months old, + £40 worth of software (games). Also book by Tim Hartnell, alternative cassette leads and magazines £180 tel 01-653 6825 after 5pm or weekends.
- Atom 12k,12k, (F.P. ROM) via 6522 modified 1 or 2 megahertz with manual, leads. Gasteroids Galaxians & other software £110 ono tel Locks Heath 5761.
- Tandy pocket computer and cassette interface ... 3 months old as new. Boxed all manuals, batteries, overlays and book of programs. Quick sale £50 ono tel 04948 24999 after 8pm.
- ZX81 + 16k RAM and £35 worth high quality cassettes. QS J.K. Greye etc. Also £10 Sinclair magazines. All leads, packing including. £85.00 ono 6 months old. tel Nick 998 0438 eve.
- Atari video computer + joysticks paddles keyboard and steerers. 9 cartridges including Missile Command, Space Invaders Dodgem, Adventures and Indy 500. total value £280+ only aksing £180. Tel 01-992 6887 after 6pm.
- 32k PET 3032 board in 2001 case. Integral cassetteand full screen hi-res graphics. Recently overhauled and in excellent condition £400 ono must sell, Worksop 771526 after 6pm.
- ZX81 + 16kRAM perfect condition many games inc: Invaders, Scramble, Guns. Adventure games, Flight simulation manual + extra book all cables plotter paper original packing £90.00 ono. tel Walsall 0922 36956. After 6pm.
- Wanted TRS80 VDU manuals etc reasonable price paid. Write Peter Ingham 114 Elizabeth Way, Seaton Carew, Hartlepool, Cleveland tel 0429 221702 after 6.30.
- Acorn ATOM 12k+12k, colour 4k Ross EPROM (as advertised) all leads + PSU games pack 9, introducory package, Magic book, manuals, magazine features, booklets, hardly used, bargain at £250 ono. Tel Ilkley 601184.
- Acorn A70M 70k RAM, FP 4 toolkits with selector, needs attention (graphics to mode 2 only) bargain £200 Kneeling 75B Broadwalk, London E18 2DN.
- Sharp PC1211 and CE121 cassette interface, instruction and application manuals, excellent condition. £0.00 tel Aldershot 24461, ext 2668 office hours.
- S100 cards RAM Z80CPU I/O boards versa floppy controller 8in simens drives, 22 port mother boards, IQ120 soroc VDUs. etc. Most of these are new. Tel: Leighton Buzzard 384233 after 6pm.
- NEC green screen montior 12in arudio channel, best available, brand new, boxed. List £172, sell for £95. Hitachi micro compatible cassette recorder, unused, boxed £20 Burgh Heath 50318 Surrey.
- TRS80 L2 16k with VDU cassette, lightpen and lower case. Loads of software, books and manuals, total cost over £450 sell for £350 ono tel Bedford 750111 Ext 2511 or 214497.
- Wanted Texas TI59 programmable calculator and/or printer, reasonable price. G.W. Wood, 1 Dean Head Cottages, Scotland Lane, Horsforth Nr Leeds LS18 5HU 0532 673411 ext 248 (work) 0532 587073 home.
- RADE card configures for CPM includes Z80A +64k +CRT +DSDD Floppy +Centronix printer +keyboard interface. Manuals, system +utility software costs £485, accept £325 ono tel 01-624 5681 late evenings, w/ends.
- HP41C 1½yrs old, 1 memory module, manuals, and cases etc. +user mags, not used much, £100 ono good conto tel: Ash Green 874592 after 4.30, selling to buy disk drive.
- VIDEO GENIE 16k level II basic, including microsoft efitor assembler plus, manuals and various books, assorted software and excellent 9in green screen monitor £275 021-745 5684.
- HP 41-C calculator with financial and games packs, hardly used. £120 ono Phone 061-928 8507.
- TRS-80 level II 16k numeric keypad, leads, manuals, books, plus over £90 software including T80-FS1 flight simulator, editor assembler plus, Startrek, Asteroids, Galaxian, Morse-Code Communicator etc. £195 Tel: Fleet (02514) 7962.
- Superbrain QD 600k disks 64k RAM 6 months old as new £1100 Tel: 061 431 9390 eve or w/ends.
- Sharp MZ80k 48k original packing 8 months old hardly used with basic + TK and some games including Chess, Bridge. Tel: 052285 293.
- BBC software model A or B. Ghost Munch + Alien attack £5.00. Zombie island + Lunar lander £5.00. Dalek attack + Road Race + Breakout + Music + Hangman + 3D graphics. £6.00. P. Thomas 3 Pear Tree Close, Barlaston SOT ST11 9EG.



CTUK! CONTACTS

*For further information on ComputerTown UK! see 'CTUK News' or Prestel page *800803 #*

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Bradford BD3 8HG

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Bury BL8 3HS

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Gloucester GL3 3JF

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New Addington
Croydon CR0 0RT

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22 Downham Court
South Shields
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Alan Sutcliffe
4 Binfield Road
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Berks RG11 1SL

Allan Porten
14 Foxmede
Rivenhall End
Witham
Essex

E N Ryan
15 Queens Square
Eastwood
Nottingham
NG16 3BJ

Bill Gibbings
2 Longholme Road
Retford
Notts DN22 6TU

NETWORK NEWS

These are all the European networks of which we're aware. Most are free — but phone them for details.

Forum-80 Hull ... (Forum-80 HQ) Tel: 0482 859169, System operator: Frederick Brown. International electronic mail, library for up/down loading software. Forum-80 Users Group, Pet Users section shopping list system hours, 7 days a week midnight to 8.00am, Tues/Thurs 7.00pm to 10.00pm Sat/Sun 1.00pm tp 10.00pm.

Forum-80 London ... Tel: 01-747 3191. System operator: Leon Jay. Electric Mail, library for downloading. System hours: Tues/Fri/Sun 7.00pm to 11.00pm.

Forum-80 Milton ... (TRS-80 Users Group 80-Nett) Tel: 0908 566660. System operators: Leon Heller and Brian Pain. Electronic mail, library, newsletter, TRS-80 information system hours: 7 days a week 7.00pm to 10.00pm.

Forum-80 Holland ... Operator: Nico Karssemeyer, Tel: 01 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours; Tues-Sat 1800-0700 nightly, continuous from 1800 Sat-0700 Tues.

CBBS London ... Operator: Peter Goldman, Tel: 01-399 2136. Facilities: electronic mail, program downloading. Hours: Wed 0700-0930 & 1900-2200, Fri 1900-2200, Sun 1600-2200.

Mailbox-80 Liverpool ... 051-220 9733. System operator: Peter Toothill, Electronic mail, downloading TRS-80 information.

ACC ... members bulletin board, Peter Whittle (0908 44262).

ABC-80 ... Stockholm (Sweden). Tel: 010-468 190522.

University Research Computer ... Sweden. Tel: 010-468 23660, guests use password "66,66" for access.

Elfa ... Sweden 010-468 7300 706.

Tree Tradet ... Sweden 010-468 190522.

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements to avoid wasted journeys due to cancellations, printer's errors, etc.

Nottingham	**(Albany Hotel) Computer Open Day Exbn. Contact: Couchmead Communications Ltd., 01-778 1102**	**27 Jan**
London	**(Cunard Hotel, Hammersmith) Peripheral Suppliers' Exbn. Contact: IPC Exbns Ltd., 01-643 8040**	**2-4 Feb**
Prestatyn	**(Pontin's Holiday Village) Business Technology & Communications Exbn. Contact: Gift Fairs Ltd., 0223 21061**	**4-6 Feb**
Bournemouth	**(Pavilion) Business Equipment & Services Exbn. Contact: Douglas Temple Design Group, 0202 20533**	**9-10 Feb**
Tokyo	**Data & Telecommunications Exbn. Contact: Cahners Exbn Group, 0483 38085**	**16-19 Feb**
Bristol	**(Draganora Hotel) Computer Open Day Exbn. Contact: Couchmead Communications, 01-778 1102**	**17 Feb**
London	**(Barbican Centre) INFO '83. Contact: BED Exbns Ltd., 01-647 1011**	**22-25 Feb**
London	**(West Centre Hotel, Fulham) Microsystems Exbn. Contact: IPC Exbns Ltd., 01-643 8040**	**23-25 Feb**

USER GROUP INDEX

INTERNATIONAL

Apple Users' Group Europe. President: K Giese, Hackstucker 11, D-4320 Hartingen 15, West Germany. Tel: 02324 52240.

Central Program Exchange. Full membership (£25 Europe, £40 overseas) provides 30 free programs pa. Small user service (£10 Europe, £20 overseas) provide 10 free programs pa. Contact: Mrs Judith Brown, The Polytechnic, Wulfruma St, Wolverhampton WV1 1LY.

Comp 80 User Group. Monthly newsletter. Annual subscription £6.50 UK, £8.00 overseas. Contact: Philip Probetts, 50 Cromwell Road, Wimbledon, London SW19 8IZ.

CP/M. IRL. Irish CP/M Users' Group. Meets monthly in Dublin area, membership IR £5 pa. Newsletter: CP/M.MAG. Contact: Doug Notley, Gardner House, Ballsbridge, Dublin 4. Tel: 01-686411.

DENSPET: group specifically for exchange or original programs for MTU 200x320 dot matrix hi-res PET add-on. Send sample of your work or £2.50 ($2.50) & receive sample in return plus newsletter sub & lists of available program. Contact: DENSPET, Rock House, Ballycroy, Westport, Co Mayo, Eire.

DA Inamic: European DAI personal computer users' club. Has over 500 members, publishes a bi-monthly newsletter with most articles in English. Contact: DA Inamic, Heide 98, 3171 Westmeerbeek, Belgium.

European Sorcerer Club. For sample newsletter contact Colin Morle at 32 Watchyard Lane, Formby, Nr Liverpool L37 3JU. Annual sub UK £5, overseas £12.00.

Group/380. Recently established for information interchange on microsystems equivalent to IBM 360/370 main frames, newsletter, access to a computerised database listing relevant software. Annual sub: $10 for individuals, $25 for organisations. Contact Mokurai Cherlin, PO Box 111, Mokurai Cherlin, PO Box 1131, Mount Shasta. CA96067. USA.

International Sharp User Group. 1400 members in 31 countries £3 sub includes MZ-80K Space Invaders cassette and newsletters. Contact: Graham Knight, 108 Rosemount Place, Aberdeen. Tel: 0224 630526.

Irish ZX80/81 Users' Club, the first club in Ireland. Open for all owners of Sinclairs. For info send two 22p stams (six counties 40p). Users Club, c/o M Cronsten, 73, Cnoc Crionain, Baile Atha, Cliath 1.

Ithaca Intersystems and S100 Bus Users Club. Formed to 'organise the construction and design of software and hardware based on Ithaca or other S100 systems.' Contact: George Brooke, Sebastian Baverstrasse 20c, 8000 Munich 83, W Germany.

KAOS — the official 6502 Users' Group of Australia. Has a range of projects within special interest groups: hardware, software, amateur radio, Pascal, education, Publishes monthly newsletter. Contact: Mr Ian Eyles, 10 Forbes St, Essondon, Victoria, Australia 3040.

Microcomputer Users' Club. Recently established for program writing and exchange, emphasis on 6502/Z80 users. Contact: c/o Synthetronics Microcomputers PO Box 151, 1322 Hoevik Norway.

Norsk Data Samfunn — User Groups for HP41C and ZX81. Both groups publish bimonthly magazines, offer technical services and arrange meetings and courses. Contact: Christopher Solheim, Norsk Data Samfunn, Tuengen Alle 11, Oslo 3, Norway. Tel: (02) 147110.

Pascal Z User Group (Europe) Affiliated with Pascal Z USA. 12 user disks available plus newsletter. Contact: George Brooke, Sebattian Bauerstrasse 20c, 8000 Munich 83m West Germany.

Post Sharp: International exchange and contact club on the Sharp MZ-80K. Has over 100 members. Contact: Mr Daniel Joly, 207, Rue sur les Thiers, B-4400 Herstal, Belgium.

Powertran Users' Club. Annual sub. £6.50 UK, £8.00 overseas which includes monthly newsletter. Contact: Philip Robetts, 50 Cromwell Road, Wimbledon, London SW19 8LZ. Tel: 01-540 3713.

Spanish ZX81 User Group. Quarterly magazine/newsletter, hardware and software advice, program library and exchange, courses. Contact: Josep-Oriol Tomas Jr, Club Nacional Userios Del ZX81. Avda de Madrid, No. 203-207, 10, 3a, esc. A, Barcelona-14, Spain.

Tangerine Users' Group (International), recently formed for users of the Microtan 65, the TUG will act as a central information clearing house, including exchange of programs, etc. Annual membership £5.00. Details from TUG AT 16 Iddesleigh Rd, Charminster, Bournemouth, Dorset BH3 7JR.

UCSD System User Society. Existing special interest groups include industrial application word processing, real time, business applications and forward planning. UK contact: John Ash, Dicoll Data Systems Ltd, Bond Close, Kingsland Estate, Basingstoke, Hants RG24 0QB.

ZX80/81 Users' Club. Low cost software. Technical support, newsletter. Subscription £6.00 UK, £10.00 overseas. Contact: D Blagen, PO Box 159, Kingston-Upon-Thames, Surrey KT2 5UQ (sae for further information).

The 1800 User's Group of Finland. Est. 1978, about 500 members. Software and hardware projects, competitions, meetings, newsletters, magazines. Some programs adaptable to Elf and other 1802 micros. Contact: Richard Eller, foreign correspondence, 1800 Users' Club, PO Box 559, SF 00101, Helsinki 10, Finland.

NATIONAL

Program Power. Contact R G Simpson, 5 Wensley Rd, Leeds, LS7 2LX. Tel: 0532 683186.

Ohio Scientific UK User Group. Contact Tom Graves, 19a West End Street, Somerset, BA 16 0LQ. Tel: 0458 45359.

MK14 SCMP Users Group. Contact Geoff Phillips, 8 Poolsford Rd, London NW9 6HP. Tel: 01-200 6209.

Ithaca Audio S100 Users Group. Contact Dave Weater, 41 Dore Ave, North Kykeham, Lincoln, LN6 8LN.

UK Intel MDS Users Group. Contact: Lewis Hard, c/o SPACE Limited, The Old Coach House, Court Row, Upton-on-Severn, Worcs, WR8 0NS. Tel: 06846 3626.

HeathKit User Group. Contact: John Smithson, Heath (Gloucester) Ltd. Bristol Rd, Gloucester, GL2 6EE. Tel: 0452 29451.

PDP11 Users Group. Contact Pete Harris, 119 Carpenter Way, Potters Bar, Hertfordshire, EN6 5QB. Tel: 0707 52091.

PDP8 Users Group, Contact Nigel Dunn, 21 Campion Road, Wimer End, High Wycombe, Buckinghamshire. Tel: 0494 714483.

CP/M User Group (UK). Contact David Powys-Lybbe, 11 Sun St, Finsbury Square, London EC2M 2QD. Tel: 01-247 0691.

Cosmac Users Club, Contact: James Cunningham, 7 Harrowden Court, Harrowden Rd, Luton, Bedfordshire, LU2 0SR. Tel: 0582 423934.

COMP-80 Users Group. Contact: Philip Probetts, 50 Cromwell Road, Wimbledon, London SW19 8LZ. Tel: 01-540 3713.

British Apple Systems User Group (BASUG). Contact: John Sharp, BASUG, PO Box 174, Watford, WD2 6NF. Tel: 09273 75093.

ACC. Contact: Rupert Steele, St John's College, Oxford, OX1 3JP. Tel: Oxford 0865 47671.

Compukit User Club. Contact, S H Grisvenor, 11 Bernard Rd, Oldbury, Warley, West Midlands, Tel: 021-422 3298.

UCSD Pascal UK Users Group. Contact: Malcolm Harper, Oxford University Computing Laboratory Programing Research Group, 45 Banbury Rd, Oxford, OX2 6PE.

68XX Special Interest Group. Contact: Tim Turner, 63 Millais Rd, London E11 4HB Tel: 01-558 3681.

Sharp MZ-80K User Group. Contact Joe Seet, 16 Elmurst Drive, Hornchurch, Essex RM11 1PE. Tel: 04024 42905.

Compucolor Users' Group (UK), Bill Donkin, 19 Harwood Avenue, Bromley, Kent BR1 3DX. Tel: 01-460 2626.

FX500-P User Association. Contact Max Francis, 38 Crymsdyke, Great Missenden, Bucks, HP16 0LP.

Central Program Exchange. Contact Judieth Brown, The Polytechnic, Wilfruma St, Wolverhampton, WV1 1LY. Tel: Wolverhampton 28521/27.

TRS-80 Medical and Laboratory Users. Contact Dr N Robinson, The Residency, Northwick Park Hospital, Harrow, Middlesex.

Mattel Intellivision TV Game Group. Tel: Warrington 62215 after 4pm.

British Apple Users and Dabblers (BAUD). Contact Geoff Smythe, Datalink Microcomputer Systems Ltd, 10 Waring House, Redcliffe Hill, Bristol BSI 6TB. Tel: 0272 213427.

Commodore PET User Club. Contact Brian Jones, Slough College of Higher Education, Wellington St, Slough, Berkshire. Tel: Slough 34585 ext 81.

Silica Atari 400/800 Users Club. Contact Richard Hawes, 1-4 The Mews, Hatherley Rd, Sidcup, Kent DA14 4DX. Tel: 01-301 1111.

OSI UK User Group, Richard Elen, 12 Bennerley Rd, London SW11 6DS.

Educational ZX80/81 Users Group (EZUG). Contact, Eric Deeson, Highgate School, Balsall Heath Rd, Highgate, Birmingham, B12 9DS.

Educational User's Group for TRS-80 and Video Genie. Contact Dave Futcher, Head Teacher, Beaconsfield First and Middle School, Beaconsfield Rd, Southall, Middx. Tel: 01-574 3506.

Sharp MZ80 Users Club. Contact: Tim Powell, Computer Centre, Yeovil College, Yeovil, Somerset, BA21 4AE. Tel: 0935 23921 ext 296.

UCSD System Users Society, Contact: John Ash, Dicoll Data Systems Ltd, Bond Close, Kingsland Estate, Basingstoke, Hants, RG24 0QB.

Apple Music Synthesis Group. Contact: Dr David Ellis, 22 Lennox Gardens, London SW1.

National Acorn Atom User Group. Contact Alan Carr, 105 Fairhole Avenue, Gidea Park, Romford, Essex.

Transducer Club. Contact D Stokqueler, 66 Waterloo Road, Penlan, Cardiff. Tel: 0222 495374.

TI 99/4 TIHOME (User Group), P M Dicks, 157 Bishipsford Rd, Morden, Surrey. Tel: 01-640 7503.

PET Users Educational Group. Contact: Dr Chris Smith, Dept of Physiology, Queen Elizabeth College, Campden Hill Rd, London W8 7AH.

USER GROUP INDEX

UK PET Users Club. 360 Euston Road, London NW1 3BL.

Independent PET Users Group. 57 Clough Hall Road, Kidsgrove, Stoke-on-Trent, Staffordshire.

Laserbug (BBC National Group). 4 Station Bridge, Woodgrange Rd, Forest Gate, London E7 0NF. Tel: 02812 3064.

Research Machines National User Group. Contact c/o Clare Moat, RML, Mill St, Osney, Oxford, OX2 0BW, 380-Z. Tel: 0865 49866.

UK Pilot User Group. Contact, Alec Wood, Wirral Grammer School for Boys, Crosslane, Bebington, Wirral, merseyside, LG3 3AQ.

Sharp PC1211 Users Club. Contact Jonathan Dakeyne, 281 Lidgett Lane, Leeds LS17 3AQ.

Small Processor User Group. Contact Roger Knight, Dept of Meteorology, University of Reading, Earley Gate, Whitenights, Reading, RG6 2AY.

Exidy Sorcerer User Group. Contact: Andy Marshall, 44 Arthurs Bridge Rd, Woking, Surrey, GU21 4NT. Tel: 04862 66084.

Tangerine Users Group. Contact, Bob Green, 16 Iddesleigh Rd, Charminster, Bournemouth, Dorset, BH3 7JR.

British TI Users Club. Contact: Philip Rowley, 2 Woodside Crescent, Clayton, Newcastle-Under-Lyme, Staffordshire, ST5 4BW.

Triton User Group. Contact: Nigel Stride, Transam Ltd, 12 Chapel St, London NW1. Tel: 01-402 8137.

Powertran Users Club. Contact, Mr P L Probetts, 50 Cromwell Rd, Wimbledon, London, SW19 8LZ. Tel: 01-540 3713.

National TRS-80 Users Group. Contact: Brian Pain, 10a High St, Stony Stratford, Milton Keynes. Tel: 0908 566660/564271.

National Personal Computer Users Ass. Contact Eric Keeley, (G8XWM) The Secretary, NPCUA, 11 Spratling St, Manston, Ramsgate, Kent.

6502 Users Group. Contact Walter Wallenborn, 21 Argyll Ave, Luton, Bedfordshire, LU3 1EG. Tel: 0582 2697.

BEEBUG (BBC Users Group). Contact David Graham or S Williams, Dept 1, PO Box 50, St Albans, Herts. Tel: St Albans 54213.

77/68 Users Group. 40 Bartholomew St, Newbury, Berkshire. Tel: 0635 30505.

9900 Users Group (TIMUG). Contact Chris Cadogan, Dept of Computer Science, University of Manchester, Manchester M13 9PL.

ZX80/ZX81 Users Club. Contact: David Blagden, PO Box 159, Kingston-Upon-Thames, Surrey, KT2 5UG.

Mini and Microcomputer Users in Education (MUSE). Contact: R Trigger, 48 Chadcote Way, Catshill, Bromsgrove, Worcestershire, B61 0JT.

Medical Micro Users Group. Contact P J V Dixon, Meicom, 1-2 Hanover Street, London W1.

Acorn Atom User Group. Contact: Peter Frost, 18 Frankwell Drive, Coventry, CV2 2FB.

TRS-80 Level 1 User Group. Contact: N Rushton, 123 Roughwood Drive, Northwood, Kirby, Merseyside, L33 9UG.

Amateur Radio Special Interest Group. Contact: Peter Whittle, G4BBU.

Forth Interest Group UK. Contact K C Goldie-Morrison, 15 St Albans Mansion, Kensington Court Place, London W8 5QH. Tel: 01-937 3231.

Pascal User Group (PUG). Contact Nick Hughes, PO Box 52, Pinner, Middx, HA5 3FE. Tel: 01-866 3816.

ZX Amateur Radio User Group. Contact Paul Newman G4INP, 4 Red House Lane, Leiston, Suffolk, IP16 4JZ.

Tangerine Homebrew. Contact: ACL Coates, 35 Mogg Street, St Werburghs, Bristol BS2 9UB.

National TI 58/59 User Group. Contact R M Murphy, Dept of Electronic Engineering, University College, Singleton Park, Swansea, South Wales.

Sharp User Group. Contact: Graham Knight, 108 Rosemount Place, Aberdeen, Scotland. Tel: 0224 630 526.

REGIONAL

AVON
Compukit User Club. Contact P Crabb, 21 Jones Close, Yatton, Avon. Tel: 0934 834808.

Brunel Technical College Computing Club. Contact S W Rabone, 18 nCastle Rd, Worle, Weston-Super-Mare, Avon, BS22 GJW. Tel: 0934 513068.

BEDFORDSHIRE
Bedford Amateur Computer Club. Contact R Bird, 7a High St, Gt Barford, Bedford MK44 3LB. Tel: 0234 870763.

Luton Computer Club. Contact J P Fletcher, 1 Trowbridger Gardens, Luton, Beds LU2 7JY.

BERKSHIRE
NAS-TUG (Nascom Thames Valley UG). Contact Mike Rothery, 37 Eton Wick Rd, Eton Wick, Windsor, Berks. Tel: Windsor 56106.

BIRMINGHAM
Birmingham and West Midlands TRS-80 User Group. Contact: Michael Gibbons, 1 New Street, Castle Bromwich, Birmingham B36 9AP. Tel: 021-747 2260.

West Midlands RML User Group. C/O BECC, The Bordesley Centre, Stratford Rd, Birmingham, West Midlands, B11 1AR.

BUCKINGHAMSHIRE
Buckinghamshire/Berkshire Area. Contact Steve Proffitt, The Granary, Hill Farm Road, Marlow Bottom, Bucks. Tel: 01-759 5511 ext 7298. (day).

Aylesbury Computer Club. Contact Ken Knight, 22 Mount St, Aylesbury, Bucks, HP20 2SE. Tel: 0296 5181.

CAMBRIDGE
Cambridge Microcomputer Club, Contact Derek Tripp, 3 Spurgeons Avenue, Waterbeach, Cambridge, BC5 9HN. Tel: Cambridge 861804.

Bottisham Acorn Users Group. Contact P M Rank, 27 Bell Road, Bottisham, Cambridge, CB5 9DF.

CHESHIRE
Crewe Computer Users Club. Contact Bram Knight, Tel: Nantwich 623375.

Holmes Chapel Computer Club. Contact NR Bruce-King, 3 Jodrell Close, Holmes Chapel, Crewe, Cheshire, CW4 8BU. Tel: 0477 32754.

Altrincham Computer Enthusiasts. Contact: Martin Hickling, 39 Barrington Rd, Altrincham, Cheshire WA14 1HZ. Tel: 061 941 4547.

Northwest Computer Club. Contact: John Lightfoot, 13 Ashton Drive, Frodsham, Warrington, Cheshire WA6 7PU. Tel: 0278 31519.

CLEVELAND
Cleveland Micro Computer Users Group. Contact J Telford, 13 Weston Crescent, Norton, Cleveland.

CORNWALL
Cornwall Area Computer Club. Contact: M F Grove, 35 Causeway Head, Penzance, Cornwall.

St Austell Computer Club and ComputerTown. Contact: N G Day, 2 Glendale Close, St Austell, Cornwall, PL25 3DD.

DERBY
Derby and District Branch of IPUG. Contact Raymond Davies, 105 Normanton Road, Derby DE1 2GG. Tel: 0332 41025 — day 0332 514016.

Derby Microcomputer Society. Contact Mike Riordan, 172 Blagreaves Rd, Littleover, Derby. Tel: 0332 769440.

DEVON
Totnes and South Devon

USER GROUP INDEX

Computer Club. Contact Frank Watson and A Page, Dart Inst Community Studies, Dart, Totnes, Devon TQ9 6JE. Tel: 0803 862271.

Exeter and District Amateur Computer Club. Contact Doug Bates, 2 Station Road, Pinhoe, Exeter, EX1 3SA.

Plymouth and District Amateur Computer Club. Contact Stuart Bell, 31 Victoria Place, Plymouth, Devon PL2 1BY. Tel: 0752 559192.

DORSET
Purpeck Computer Users Club. 31 North St, Wareham, Dorset, BH20 1AD.

Bournemouth Area Computer Club. Contact Peter Hibbs, 54 Runnymede Ave, Bournemouth, Dorset, BH11 9SE. Tel: 02016 6547.

Bournemouth BBC User's Group. Contact: Norman Carey, 26 Felton Road, Parkstone, Poole, Dorset. Tel: Poole 749612.

DURHAM
Darlington Computer Club. Contact L Boxell, 8 Vane Terrace, Darlington, DL3 7AT. Tel: 0325 67766.

Durham Computer Club. Contact L Boxell, 8 Vane Terrace, Darlington. Tel: 0325 67766.

Northeast PETs and IPUG. Contact Jim Cocallis, 20 Worcester Rd, Newton Hall Estate, Durham. Tel: 0385 67045.

EAST ANGLIA
Peterborough Computer Club. Contact Chris Mabbutt, c/o Brown St, Education Centre, Brook St, Peterborough. Tel: Peterboro 75923.

ESSEX
Compukit User Club. Contact Adrian Waters, 117 Haynes Road, Hornchurch, Essex, RM11 2HX. Tel: Hornchurch 40490.

Romford Club. Contact Mr D Norden, 138c Church Road, Harrow Wood, Romford, Essex.

Colchester Computer Society. Contact P T Shaw, 15 St Vincent Rd, Clacton-on-Sea, Essex, C)15 1NA. Tel: 0255 25156.

South East Essex Computer Society. Contact: Robin Knight, 128 Little Wakering Rd, Little Wakering, Southend-on-Sea, Esssex. Tel: 0702 218456.

Springfield Computer Club. Contact Stephen Cousins, 1 Aldeburgh Way, Springfield, Chelmsford, Essex, CM1 5PB. Tel: 0245 50155

Compukit User Club. Contact: Adrian Waters, 117 Haynes Road, Hornchurch, Essex, RM11 2HX. Tel: Hornchurch 40490.

Colchester Microprocessor Group. Information Centre, University of Essex, Nr Colchester.

TRS-80 User Club (Chelmsford). Contact Michael Dean, 22 Roughtons, Galleywood, Chelmsford Essex. Tel: 0245 76127.

ICPUG (Essex). Contact: Carol Taylor, 101 Courtlands Avenue, Cranbrook, Ilford, Essex. Tel: 01-554 5246.

Stanway School Computing Club. Contact G Floyd, c/o Physics Dept, Stanway School, Stanway, Colchester, Essex.

GLOUCESTERSHIRE
ICPUG Gloucester and Bristol Area. Contact Mrs Janet Rich, 23 Sheppard Leaze, Wotton-under-Edge, Gloucester. Tel: Wotton-under-Edge 2498.

Cheltenham Amateur Computer Club. Contact M Hughes, 36 Riverview Way, Cheltenham, Gloucs. Tel: 0240 75213.

GUERNSEY
Guernsey Microcomputer Users Club. Contact Tony Thorne, Summerfield House, Vale, Guernsey. Tel: 0481 44955.

HAMPSHIRE
ICPUG Hampshire Area. Contact Ron Geere, 109 York Rd, Farnborough, Hants.

Southampton Amateur Computer Club. Contact P D Maddison 'Gardenways', Chilworth Towers, Chilworth, Southampton, SO1 7JH. Tel: 0703 766161.

6502 Users Club (Southern Region). Contact Steve Cole, 70 Sydney Rd, Gosport, Hants.

Isle of Wight TRS80 Club. Contact: M Collins, 11 Star Street, Ryde, Isle of Wight. Tel: 0983 614589.

Fareham and Portsmouth Amateur Computer Club. Contact Alan J Smith, c/o 7 Francis Close, Lee-on-the-Solent, Gosport, Hants PO13 8HB. Tel: 0705 550907.

HERTFORDSHIRE
Harpenden Microcomputer Group. Contact: David M James, 5 Ox Lane, Harpenden, Hertfordshire AL5 4HH. Tel: 05827 5366 (eve).

CBM/PET/VIC Users Group (ICPUG N Herts). Contact B Grainger, 73 Minehead Way, Stevenage, Herts SG1 2HZ. Tel: 0438 727925.

ICPUG (Watford). Contact Stephen Rabaglitati. c/o Institute of Grocery Distribution, Grange Lane, Letchmore Heath, Watford, Herts.

HUMBER
Scunthorpe and District Microprocessor Society. Contact G Hinch, 21 Old Crosby, Scunthorpe, South Humberside, DN15 8PU. Tel: 0724 61076.

KENT
ICPUG South East. Contact Mick Ryan, 164 Chesterfield Drive, Sevenoaks, Kent, TN13 2EH. Tel: 0732 53530.

Medway Amateur Computer and Robotics Organisation, Contact Ms C Webster, 13 Ladywood Rd, Cuxton, Rochester, Kent. Tel: 0634 78517.

North Kent Amateur Computer Club. Contact Kevin Viney, 95 Crofton Rd, Orpington, Kent BR6 8HU. Tel: Orpington 22443.

Tonbridge and Tunbridge Wells ACC. Contact Ray Szatkowski, 1 Cromer St, Tonbridge, Kent. Tel: 0732 355960.

Orpington Computer User Club. Contact R A Pyatt, 23 Arundel Drive, Orpington, Kent, BR6 9JF. Tel: Orpington 20281.

Medway Acorn User Group. Contact Clem Rutter, c/o St John Fisher School, Ordnance St, Chatham, Kent. Tel: 0634 42811 (day) 0634 373459.

Sevenoaks School Computer Club. Contact G Sommerhoff, Technical Centre, Sevenoaks School, Sevenoaks, Kent. Tel: Sevenoaks 456490.

ICPUG SE- Canterbury. Contact J Bickerstaff, 48 Martin Down Lane, Whitstable, Kent CT5 4PR. Tel: 0227 272702.

Canterbury ACC. Contact L S Fisher, 21 Manwood Ave, St Stephens, Canterbury, Kent CT2 7AH. Tel: Cant 65948.

LANCASHIRE
TRS-80 Northwest Group, Contact Melvyn Franklin, 40 Cowlees, Westhoughton, Bolton, BL5 3EG. Tel: 0942 812843.

Chorley Computer Club. Contact Chris Hicks, 131 Market St, Chorley, Lancashire. Tel: 025 72 78376.

North Lancashire User Group. Contact John Robinson, 12 Harold Ave, Blackpool.

West Lancashire PET Users Club. Contact D W Jowett, 197 Victoria Rd, East Thornton, Blackpool, FY5 3ST. Tel: 0253 896108.

VIC (Burnley). Contact John Ingham, 72 Ardwick St, Burnley, Lancashire.

LEICESTERSHIRE
East Leake Computer Club. Contact Andrew Jones, 59 Bateman Road, East Leake, Loughborough, Leics, LE12 6NN.

LINCOLNSHIRE
Lincolnshire Microprocessor Society. Contact Eric Booth, Senior Common Room, Bishop Grosseteste College, Newport, Lincoln. Tel: 0522 27347.

Grimsby Computer Club, Contact Jenson Lee, 29 Park View, Cleethorpes. Tel: 0472 42559 (day).

USER GROUP INDEX

Lincoln Computer Club. Contact John Clifford, 448 Newark Road, Lincoln, LN6 8RX. Tel: 0522 2160.

LONDON
68 Microgroup. Contact Jim Anderson, 47 Pebworth Rd, Harrow, Middx. Tel: 01-422 4724.

Southgate Tech College Computer Club. Contact Kevin Pretorius, Tel: 01-882 2282.

East London Computer Club. Contact John Grieve, North East London Polytechnic. Tel: 01-553 4761.

Sunbury Computer Club. Contact S Taylor, 8 Priory Close, Sunbury-on-Thames, Middx TW16 5AB. Tel: Sunbury 86649.

Teddington Independent PET Users' Group. Contact: G Squibb. 108 Teddington Park Road, Teddington, Middx.

Association of London Computer Clubs. Contact Len Stuart, Secretary ALCC, 89 Mayfair Ave, Worcester Park, Surrey, KT4 7SJ. Tel: 01-337 3747.

Brent/Barnet Users Group. Contact Joseph Fox, 4 Harman Close, London NW2 2EA.

HP-85 User Group, Contact Margaret Corbett, 10 Nichols Green, Montpelier Rd, Ealing, London W5 2QU.

Southgate Computer Club. Contact Panos Koumi, 33 Chandos Ave, London N14.

PET User Group (Crawley). Contact Richard Dyer, 33 Parham Rd, Ilfield, Crawley, RH11 0ET.

The SOBAT Computer Club (Leyton). Contact T Kayani, 12 Calderon Rd, London E11 4EU. Tel: 01-556 5423.

Croydon Microcomputer Club. Contact Eleanor Granstoun, Flat 7, 10 Lancaster Road, South Norwood, London SE25 4AQ. Tel: 01-771 3525.

Harrow Computer Club. Contact Bazyle Butcher, 16 St Peter's Close, Bushey Heath, Watford, Herts WD2 3LG. Tel: 01-950 7068.

Richmond Computer Club. Contact Bob Forster, 18a The Barons, St Margarets, Twickenham, Middx. Tel: 01-892 1873 (eve).

Imperial College Microcomputer Club. Contact Tim Panton, c/o IC Union Office, Prince Consort Road, London SW7 2BB.

Post Office HQ Microcomputer Club. Contact Vernon Quaintance, British Telecom HQ, ME/PDI 2.2, Room 346, Procter House, 100-110 High Holborn, London WC1V 6LD.

TRS-80 Users' Group, London Branch, Contact J Wellsman, 292 Caledonian Road, London N1. Tel: 01-607 0157.

380Z User Group, Northern Home Counties. Contact Sheridan Williams. 35 St Julians Road, St Albans, Herts AL1 2AZ.

North London Hobby Computer Club. Contact Robin Bradbeer, Polytechnic of North London, Holloway Road, London N7 8DB. Tel: 01-607 8344.

West London Personal Computer Club. Contact Graham Pain, 81 Rydal Crescent, Perivale, Middx UB6 8DZ. Tel: 01-997 8986.

South East London Microcomputer Club. Contact Peter Phillips, 61 Craigerne Road, London SE3. Tel: 01-853 5829.

London School Computer Users' Club. Burlington Danes School, Dane Building, DuCane Road, Hammersmith, London W12 0TY.

East London Amateur Computer Club. Contact Fred Linger, 82 The Drive, Ilford, Essex IG1 3JA. Tel: 01-554 3288.

MANCHESTER
Manchester Acorn User Group, Contact J Ashurst, 20 Verdure Close, Failsworth. Tel: 061-681 4962.

Manchester Computer Club. Contact David Wade, 28 Hazel Rd, Altrincham, Cheshire WA14 1JL. Tel: 061-941 2486.

MERSEY
Wirral Microcomputer Users Group. Contact J Phillips, 14 Helton Close, Nocturum, Birkenhead, Merseyside, L43 9HP. Tel: 051-652 0268.

Merseyside Nascom Users Group. Contact T Searle, 14 Hawkeshead Close, Maghull, Liverpool L31 9BT.

Merseyside TRS-80/Video Genie Users Group. Contact Peter Tootill, 101 Swanside Rd, Liverpool, L14 7NL. Tel: 051-220 9733.

Merseyside 3807 and BBC Atom Users Group. Contact Alan Pope, Paal Enterprise, 37 Stuart Rd, Crosby, Liverpool L23 0QE.

ICPUG Liverpool. Contact Tony Bond, 27 Ince Rd, Liverpool L23 4UE, Lancs. Tel: 051 924 1505.

ICPUG (Liverpool). Contact Tony bond, 27 Ince Rd, Liverpool, Lancashire. Tel: 051-924 1505.

Liverpool ZX User's Club. Contact Keith Archer, 17 Sweeting St, Liverpool, L2 4TE. Tel: 051 236 6109

BBC Microgroup Liverpool. Contact Nick Kelly, 56 Queens Drive, Walton, Liverpool, L4. Tel: 051-525 2934.

MILTON KEYNES
Milton Keynes Microcomputer User's Group (MKMUG). Contact Brian Pain. Tel: 0908 564271.

ICPUG (Kings Lynn). Contact Peter Petts, Bramley Hale, Wretton, Kings Lynn, Norfolk, PE33 9QS. Tel: Stoke Ferry 500692.

VIC-20 (Cromer). Contact J Blair, 7 Beach Rd, Cromer, Norfolk.

East Anglia Computer User Group. Contact Jan Rejzl, 88 St Benedicts St, Norwich, NR2 4AB. Tel: 0603 29652.

NORTHAMPTONSHIRE
ICPUG (Northampton). Contact Peter Ashby, 215 Lincoln Way, Corby, Northamptonshire. Tel: Corby 4442.

NORTHUMBERLAND
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As all programs in PCW are checked either by a referee or by one of the editorial staff, it can take some time for a program to actually appear. If you don't hear from us within two months or so, it usually means your contribution is in the referee pipeline. It's essential to ensure that your program is fully debugged before you send it in — get a friend to try it out first — and all programs we publish are paid for at a regular rate. Send contributions to: Maggie Burton PCW Programs, 62 Oxford Street, London W1A 2HG — and please enclose an SAE if you want material returned.

UK 101 Vocabulary Test

by John Rawcliffe

Using a versatile, simple idea, this program provides a vocabulary/spelling test for children.

It will output a word with one letter missing. The child then has to type in as many letters as he/she thinks will complete the word correctly. When all the right letters have been typed in, the computer presents the next word. At the end of the test the child is told how many letter choices were made and how many of those were wrong.

The information on each word is contained within DATA statements at the end of the program. it consists of two numbers — the length of the word and how many letters will complete it — the incomplete word and the missing, correct, letters. To set a spelling test, add the appropriate data to the end of the program. It's also possible to save several groups of data lines on tape and then to load them onto the program if you want to set several tests in succession.

The use of the DATA statements here could be applied to other educational programs such as multi-choice tests. This program was tested on a 16k UK101 with the Cegmon monitor.

```
5 DIM A$(26)
10 POKE 11,0:POKE 12,253
20 P=16:GOSUB 990
30 PRINT"THE CHILD IS GIVEN AN INCOMPLETE WORD AND"
40 PRINT"HE OR SHE MUST PRESS A LETTER WHICH WOULD"
50 PRINT"MAKE A COMPLETE WORD. FOR EXAMPLE:"
60 PRINT"THE COMPUTER PRINTS C-T"
70 PRINT"AND THE POSSIBLE LETTERS ARE, THEREFORE,"
80 PRINT"A,O AND U GIVING CAT, COT AND CUT."
90 PRINT
100 PRINT"A CORRECT CHOICE OF LETTER IS INDICATED BY"
110 PRINT"A 'TICK' WHICH APPEARS ON THE SCREEN."
130 PRINT"A 'CROSS' MEANS THE CHOSEN LETTER IS NOT"
140 PRINT"VALID AND A BAR ON THE SCREEN MEANS THAT"
150 PRINT"THE LETTER IS VALID BUT HAS ALREADY BEEN USED."
160 PRINT
170 GOSUB 960:P=16:GOSUB 990
200 PRINT"TO ACTUALLY USE THE COMPUTER IT IS NECESSARY"
210 PRINT"TO PREPARE DATA STATEMENTS AS FOLLOWS:"
230 PRINT"1)THE LINE NUMBER MUST BE GREATER THAN 999"
240 PRINT"2)THE NUMBER OF CORRECT ANSWERS THE CHILD"
250 PRINT"  MUST GET BEFORE GOING TO THE NEXT WORD."
```

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```
255 PRINT"3)THE NUMBER OF CORRECT ANSWERS FOR THE WORD."
260 PRINT"4)THE INCOMPLETE WORD WITH THE HYPHEN WHERE"
270 PRINT"  THE VALID LETTERS SHOULD GO."
275 PRINT"5) THE ACTUAL CORRECT LETTERS."
280 PRINT"TO TELL THE COMPUTER WHERE TO STOP TYPE 'DATA 0'"
285 PRINT
290 PRINT"FOR EXAMPLE: 1000 DATA 2,3,C-T,A,O,U"
295 PRINT"THE COMPUTER WILL PRINT C-T ON THE SCREEN"
300 PRINT"AND WILL ONLY ACCEPT A,O AND U AS CORRECT."
310 GOSUB 960: P=16: GOSUB 990
315 PRINT"IN THIS CASE THE 2 MEANS THAT 2 CORRECT"
320 PRINT"ANSWERS MUST BE GIVEN BEFORE GOING TO THE"
325 PRINT"NEXT WORD. THIS CAN BE VARIED ACCORDING TO THE"
330 PRINT"ABILITY OF THE CHILD, IE IT WILL BE"
335 PRINT"NEARER TO THE MAXIMUM NUMBER THE MORE ADVANCED"
340 PRINT"THE CHILD."
345 PRINT"IF THIS IS GREATER THAN THE MAXIMUM THE"
350 PRINT"COMPUTER WILL SAY THAT THERE IS AN ERROR."
355 PRINT"FINALLY THE COMPUTER ONLY READS THE DATA AND"
357 PRINT"CANNOT DECIDE WHETHER A SLANG WORD IS VALID."
358 PRINT"THIS IS UP TO THE PERSON WHO WRITES THE DATA!"
359 PRINT:PRINT
360 GOSUB 960:P=16:GOSUB 990:WR=0:NG=0
365 T=0
370 READ CN:IF CN=0 THEN 900
375 READ N:PRINT"THIS IS A NEW WORD."
380 READ X$:IF N<CN THEN 940
385 FOR D=1 TO N:READ A$(D):NEXT
390 PRINT TAB(0);X$
400 PRINT"WHICH LETTER FITS IN TO MAKE A PROPER WORD?"
410 X=USR(X):O=PEEK(531)
420 IF O<65 OR O>90 THEN 410
425 PRINT:B$=CHR$(O):PRINT TAB(10);B$
430 NG=NG+1
435 P=4:GOSUB 990
440 FOR D=1 TO N
460 IF A$(D)=B$ THEN 600
470 IF A$(D)=B$+B$ THEN 550
480 NEXT
500 C=53986
505 FOR I=-2 TO 2:POKE C+(63*I),161
510 POKE C+(65*I),161:NEXT
520 WR=WR+1
530 P=5:GOSUB 990
540 GOTO 390
550 C=53986
560 FOR I=-2 TO 2:POKE C+I,161:NEXT
570 P=5:GOSUB 990
590 GOTO 390
600 G=54114
605 POKE G-65,161
610 FOR I=0 TO 4:POKE G-(63*I),161:NEXT
615 PRINT"THE WORD IS:"
620 PRINT
625 L=LEN(X$)
630 FOR W=1 TO L
640 D$=MID$(X$,W,1)
650 IF D$="-" THEN D$=B$
660 PRINT TAB(15);D$;
670 NEXT
680 P=2:GOSUB 990
690 A$(D)=B$+B$
700 T=T+1
710 IF T<CN THEN 390
720 GOTO 365
900 PRINT"THAT IS ALL THE WORDS DONE."
905 PRINT"OVERALL THERE WERE";NG;"ATTEMPTS AND"
910 PRINT"THERE WERE";WR;"INCORRECT CHOICES."
915 PRINT
```


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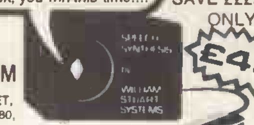

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PROGRAMS

```
920 PRINT"IF YOU WOULD LIKE TO USE THIS PROGRAM"
925 PRINT"AGAIN PLEASE LOAD ANOTHER TAPE WHICH"
930 PRINT"CONTAINS MORE DATA OR RERUN THESE.":GOTO 950
940 PRINT"THE DATA FOR THE WORD";X$;"IS INCORRECT!"
950 END
960 PRINT"PRESS A KEY TO CONTINUE"
970 X=USR(X):O=PEEK(531):IF O<>48 THEN 970
980 RETURN
990 FOR I=1 TO P:PRINT:NEXT:RETURN
999 REM*******FOLLOWING IS EXAMPLE DATA*******
1000 DATA 3,3,C-T,A,O,U
1010 DATA 4,6,-OLE,H,M,P,R,S,V
1020 DATA 5,6,-OSE,D,H,L,N,P,R
1030 DATA 7,9,-IP,D,H,L,N,P,R,S,T,Z
1040 DATA 3,5,-ASTE,B,H,P,T,W
1050 DATA 2,4,ROO-,F,K,M,T
1060 DATA 0
```

PET Race Chase II

An adaptation by Simon Palmer

Some readers may remember MZ-80K Race Chase, which was published in *PCW* March 1982. This arcade-style game has now been adapted for the PET — with one or two little changes.

The listing below is for the 32k new ROM PET. when the writer first made his adaptations to the program, it worked much more slowly than the MZ-80K version did. For this reason, the changes mentioned above have been made to the program.

The game starts in exactly the same way as the MZ-80K version does. But once you've been hurtling round the track for a while (see the instructions) the speed of your blob becomes subject to random variations in speed. The ballistic missile which chases you can now, unlike in the original version, change direction suddenly.

If any other readers have adapted other *PCW* programs to run on different micros, I'd be very interested to hear from them.

```
200 REM   * RACE CHASE        *
210 REM   * BY D.DENHOLM      *
220 REM   * ADAPTED FOR       *
230 REM   * 32K (NEW-ROM) PET *
240 REM   * S.JAMES/S.PALMER  *
250 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒RACE CHASE":PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒----------"
260 PRINT"▒▒▒IN THIS GAME, YOU (◆) HURTLE ROUND"
270 PRINT"▒A TRACK TRYING TO HIT AS MANY TARGETS "
280 PRINT"▒(.) AS YOU CAN BEFORE YOU ARE HIT BY A"
290 PRINT"▒BALLISTIC MISSILE (+) WHICH IS RACING"
300 PRINT"▒ROUND THE TRACK TRYING TO HIT YOU."
320 PRINT"▒▒▒▒▒KEY 'Z' WILL MOVE YOU IN ONE LANE"
330 PRINT"▒▒▒KEY 'M' WILL MOVE YOU OUT ONE LANE"
340 PRINT"▒▒▒▒▒▒▒▒PRESS ANY KEY TO PLAY"
350 GET K$:IF K$="" THEN 350
360 PRINT"▒":GOSUB 940
370 P1=33588:B1=33586:POKE P1,90:POKE B1,43:P2=1:B2=-1:P3=-40:B3=-40
380 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒ON YOUR MARKS!"
390 FOR X=1 TO 1000:NEXT
400 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒    GET SET !"
410 FOR X=1 TO 1000:NEXT
420 PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒    GO !!!!!!"
430 FOR X=1 TO 200:NEXT:PRINT"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒RACE CHASE"
470 XX=2
490 POKE B1,32
500 B1=B1+B2
510 IFPEEK(B1)=93 OR PEEK(B1)=64 THEN 720
520 IFPEEK(B1+B3)=32 AND PEEK(B1+B2)=32 THEN 730
525 IFPEEK(B1-B3)=32 AND PEEK(B1+B2)=32 THEN 730
530 IF PEEK(B1)=90 THEN 820
540 IF B4<>32 THEN POKE B4,46:B4=32
550 IF PEEK(B1)=46 THEN B4=B1
```


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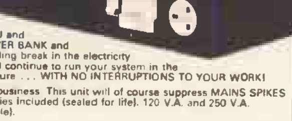

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```
560 POKE B1,43
590 IF B2=1 AND XX=2 THEN XX=1:GOTO490
600 POKE P1,32
610 AA=PEEK(158):IFAA=0THEN630
615 PM$=CHR$(PEEK(622+AA))
620 IF(PM$="M"ANDPEEK(P1-P3)=32)OR(PM$="Z"ANDPEEK(P1+P3)=32 THEN 910
630 P1=P1+P2
640 IFPEEK(P1)=64ORPEEK(P1)=93 THEN 800
650 IF PEEK(P1)=46 THEN NT=NT+10
660 IF NT>1400 THEN GOSUB 970:TN=NT+TN:NT=0
670 IF PEEK(P1)=43 THEN 810
680 POKE P1,90
690 GOTO 470
720 B1=B1-B2:SB=B2:B2=B3:B3=-SB:B1=B1+B2:GOTO 530
730 R=INT(RND(1)*5)+1:ON R GOTO 540,540,740,770,540
740 IF PEEK(B1+B3)<>32 THEN 540
745 IF RND(1)<.5THENB2=-B2
750 POKE B1,32
760 B1=B1+B2+B3+B3:GOTO 540
770 IF PEEK(B1-B3)<>32 THEN 540
775 IF RND(1)<.5THENB2=-B2
780 POKE B1,32
790 B1=B1+B2-B3-B3:GOTO 540
800 P1=P1-P2:SB=P2:P2=P3:P3=-SB:GOTO 630
820 POKE B1,42:PRINT"██████████████████████████████  CRASH !   "
830 FOR X=1 TO 1000:NEXT
840 PRINT"█████████████YOU SCORED ";NT+TN;" POINTS BY HITTING"
850 PRINT"█████";(NT+TN)/10;" TARGETS "
860 PRINT"████████WANT ANOTHER GO ?"
870 GET AG$:IF AG$="" THEN 870
880 IF AG$="Y" THEN CLR:RUN 340
890 IF AG$<>"N"THEN 870
900 END
910 IF PM$="M" THEN 930
920 P1=P1+P3+P3:POKE158,0:GOTO 630
930 P1=P1-P3-P3:POKE158,0:GOTO 630
940 REM ---+  RACE TRACK +---
950 PRINT"█Z...in            RACE CHASE        M...out"
960 PRINT"------            ----------        -------"
970 PRINT"████┌──────────────────────────────────────┐"
980 PRINT"│ . . . . . . . . .     . . . . . . . . │"
990 PRINT"│.┌─────────────────  ────────────────┐.│"
1000 PRINT"│ │ . . . . . . . .     . . . . . . . │ │"
1010 PRINT"│.│.┌─────────────  ─────────────┐.│.│"
1020 PRINT"│ │ │ . . . . . . .     . . . . . . │ │ │"
1030 PRINT"│.│.│.┌──────────  ──────────┐.│.│.│"
1040 PRINT"│ │ │ │ . . . . . .     . . . . . │ │ │ │"
1050 PRINT"│.│.│.│.┌──────────────────┐.│.│.│.│"
1060 PRINT"│        │    RACE CHASE    │        │"
1070 PRINT"│.│.│.│.└──────────────────┘.│.│.│.│"
1080 PRINT"│ │ │ │ . . . . . .     . . . . . │ │ │ │"
1090 PRINT"│.│.│.└──────────  ──────────┘.│.│.│"
1100 PRINT"│ │ │ . . . . . . .     . . . . . . │ │ │"
1110 PRINT"│.│.└─────────────  ─────────────┘.│.│"
1120 PRINT"│ │ . . . . . . . .     . . . . . . . │ │"
1130 PRINT"│.└─────────────────  ────────────────┘.│"
1140 PRINT"│ . . . . . . . . .     . . . . . . . . │"
1150 PRINT"└──────────────────────────────────────┘"
1160 RETURN
```

Program of the Month

Apple Character Plotter

by R Hornby

PCW's £25 prize this month goes to Dr R P Hornby of Merseyside. I shall use his instructions verbatim (well, almost) as the use and understanding of this program is a little complicated.

'Characters can be plotted on the Apple II hi-res graphics page (thus allowing graphs to be labelled, etc) by using shape tables. These are described in detail in chapter 9 of the Apple II Basic Program-

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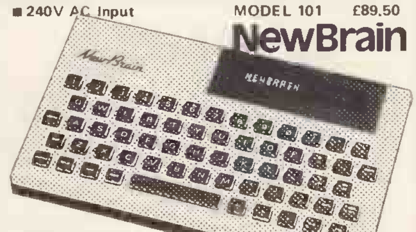

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PROGRAMS

ming Reference manual. In brief, a shape is defined as a series of plotting vectors which are stored in a set of bytes in the Apple's memory. Each byte is divided into three sections and each section can specify a plotting vector:

	SECTION 3		SECTION 2			SECTION 1		
BIT NO	7	6	5	4	3	2	1	0
	D	D	P	D	D	P	D	D

Each bit pair DD specifies the vector direction while the bits marked P indicate whether or not to plot a point before moving. The meaning attatched to the bit pair DD and bit P is as follows. For DD: 00 — move up; 01 — move right; 10 — move down; 11 — move left. For P: 0 — no point plotted; 1 — point plotted.

'There is further restriction in that section three of the byte cannot be used as a plotting vector (since it cannot define a P bit) or a move up. Also a zero byte is used to terminate a shape table and the leftmost sections of a byte containing only zeros are ignored. For example, line 1792 of the program Charload gives the decimal byte values of a shape table defining the character "O".

'The above gives some background for the programs Charplot and Charload listed below. Program Charload is run first and loads up shape tables for characters with decimal ASCII codes in the range 32 to 94 inclusive. For convenience, @ and & have been represented by a "+". Once the shape tables have been loaded the plotting subroutine (subroutine 1500) in charplot will plot out any character string assigned to Z$ (note: use CHR$(34) for "). The character string may be placed anywhere on the screen (coordinates XS,YS) and scaled using SS (SS=1 gives the smallest scaling, SS=2 gives twice the smallest scaling and so on). The character string may be plotted horizontally (RS=0) or vertically (RS=48). Further details on the setting of RS and SS may be found on page 99 of the Applesoft Basic Reference Manual.

'Three pages, (9200, 9300, 9400) of Apple memory have been assigned for storing shape tables and associated data. The shape tables themselves are stored from 9300 (Charload, line 1216). The base page address (9200) may be changed by modifying lines 18 and 1208 of Charload and line 18 of Charplot. Further shape tables may be added to the end of the data block in charload. Then in Charplot, NS (line 32) must be changed to the new number of shape tables and the character representing the new shape table must be decoded to yield the correct shape table number (IS). The decoding section for the current set of shape tables is contained in lines 1514 to 1520 of Charplot.'

```
10  REM ************************
     **
12  REM *  PROGRAM TO LOAD
     *
14  REM *   SHAPE TABLES
     *
16  REM ************************
     **
18  HIMEM: 9 * 16 ↑ 3 + 2 * 16 ↑
     2
20  REM  LOAD SHAPE TABLE
22  GOSUB 1200
24  PRINT "**SHAPE TABLES LOADED*
     *"
26  END
1200  REM  SHAPE TABLE SETUP SUB*
     ***
1202  REM  CONSTANTS
1204 C = 256
1206  REM  START ADDRESS
1208 A0 = 9 * 16 ↑ 3 + 2 * 16 ↑ 2

1210  REM  SHAPE POINTER ADDRESS
1212 A1 = A0 + 2
1214  REM  START OF SHAPE TABLES
1216 A2 = A0 + C
1218  REM  SETUP FIRST POINTER
1220 A3 = A2 - A0
1222 A4 =  INT (A3 / C)
1224  POKE A1,A3 - C * A4: POKE A
     1 + 1,A4
1226 A1 = A1 + 2
1228  REM  NUMBER OF SHAPES
1230 NS = 0
1232  REM  READ IN SHAPE TABLES
1234  READ D
1236  IF D < 0 THEN 1258
1238  POKE A2,D
1240 A2 = A2 + 1
1242  IF D <  > 0 THEN 1256
1244 NS = NS + 1
1246 A3 = A2 - A0
1248 A4 =  INT (A3 / C)
1250  POKE A1,A3 - C * A4
1252  POKE A1 + 1,A4
1254 A1 = A1 + 2
1256  GOTO 1234
1258  REM  POKE START ADDRESS INT
     O SYSTEM
1260 A4 =  INT (A0 / C)
1262  POKE 14 * 16 + 8,A0 - C * A
     4: POKE 14 * 16 + 9,A4
1264  REM  POKE NUMBER OF SHAPES
1266  POKE A0,NS
1268  RETURN
1600  REM  DATA BLOCK FOR SHAPE T
     ABLES**
1602  REM  CHARACTERS IN ASCII SE
     QUENCE
1604  REM  SHAPE TABLE FOR SPACE
1606  DATA  0
1608  REM  SHAPE TABLE FOR !
1610  DATA  36,22,18,4,0
1612  REM  SHAPE TABLE FOR "
1614  DATA  33,30,35,6,0
1616  REM  SHAPE TABLE FOR #
1618  DATA  33,52,61,63,52,47,54,
     47,38,45,20,61,38,0
```


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```
1620  REM  SHAPE TABLE FOR $
1622  DATA  63,4,45,48,45,7,51,54
      ,60,47,41,37,63,0
1624  REM  SHAPE TABLE FOR %
1626  DATA  9,128,184,23,18,27,69
      ,107,10,44,62,27,57,27,128,3
      2,5,62,0
1628  REM  SHAPE TABLE FOR &(USE
      +)
1630  DATA  36,22,54,68,3,45,31,6
      3,5,0
1632  REM  SHAPE TABLE FOR '
1634  DATA  128,32,0
1636  REM  SHAPE TABLE FOR (
1638  DATA  192,30,22,20,10,4,0
1640  REM  SHAPE TABLE FOR )
1642  DATA  64,14,22,20,26,4,0
1644  REM  SHAPE TABLE FOR *
1646  DATA  36,198,3,14,30,45,64,
      49,51,57,55,38,26,35,33,17,1
      0,33,35,0
1648  REM  SHAPE TABLE FOR +
1650  DATA  36,22,54,68,3,45,31,6
      3,5,0
1652  REM  SHAPE TABLE FOR ,
1654  DATA  18,53,49,30,7,0
1656  REM  SHAPE TABLE FOR -
1658  DATA  45,31,63,5,0
1660  REM  SHAPE TABLE FOR .
1662  DATA  18,4,0
1664  REM  SHAPE TABLE FOR /
1666  DATA  18,27,12,12,12,12,4,0

1668  REM  SHAPE TABLE FOR 0
1670  DATA  18,63,36,36,45,45,54,
      54,63,0
1672  REM  SHAPE TABLE FOR 1
1674  DATA  54,36,36,5,0
1676  REM  SHAPE TABLE FOR 2
1678  DATA  18,1,57,63,39,44,45,3
      7,60,63,47,0
1680  REM  SHAPE TABLE FOR 3
1682  DATA  210,43,45,37,60,47,33
      ,60,63,47,0
1684  REM  SHAPE TABLE FOR 4
1686  DATA  54,36,48,41,31,63,36,
      6,0
1688  REM  SHAPE TABLE FOR 5
1690  DATA  45,54,63,63,77,33,216
      ,63,36,45,45,7,0
1692  REM  SHAPE TABLE FOR 6
1694  DATA  45,54,63,63,36,9,63,3
      6,6,0
1696  DATA  137,34,36,60,63,47,0
1698  REM  SHAPE TABLE FOR 8
1700  DATA  63,54,45,45,228,43,37
      ,60,63,55,6,0
1702  REM  SHAPE TABLE FOR 9
1704  DATA  63,36,45,45,54,27,45,
      54,4,0
1706  REM  SHAPE TABLE FOR :
1708  DATA  48,18,4,0
1710  REM  SHAPE TABLE FOR ;
1712  DATA  20,18,53,49,30,7,0
1714  REM  SHAPE TABLE FOR <
1716  DATA  27,5,40,40,27,3,18,17
      ,21,5,0
1718  REM  SHAPE TABLE FOR =
1720  DATA  24,43,45,29,27,19,42,
      45,5,0
1722  REM  SHAPE TABLE FOR >
1724  DATA  9,7,56,56,9,17,24,58,
      58,0
1726  REM  SHAPE TABLE FOR ?
1728  DATA  45,36,63,23,10,54,34,
      0
1730  REM  SHAPE TABLE FOR @(USE
      +)
1732  DATA  36,22,54,68,3,45,31,6
      3,5,0
1734  REM  SHAPE TABLE FOR A
1736  DATA  63,36,41,45,50,63,9,5
      4,20,27,27,36,0
1746  REM  SHAPE TABLE FOR D
1748  DATA  9,36,59,63,54,54,45,4
      5,32,0
1750  REM  SHAPE TABLE FOR E
1752  DATA  63,36,45,45,15,18,18,
      63,63,36,0
1754  REM  SHAPE TABLE FOR F
1756  DATA  3,5,45,24,9,56,63,55,
      54,38,0
1758  REM  SHAPE TABLE FOR G
1760  DATA  45,55,62,63,36,36,45,
      45,0
1762  REM  SHAPE TABLE FOR H
1764  DATA  45,36,22,54,4,24,59,3
      9,52,50,38,0
1766  REM  SHAPE TABLE FOR I
1768  DATA  36,45,27,63,9,18,54,4
      5,27,63,0
1770  REM  SHAPE TABLE FOR J
1772  DATA  36,63,13,45,15,18,27,
      54,59,5,0
1774  REM  SHAPE TABLE FOR K
1776  DATA  234,74,31,32,40,8,223
      ,51,54,38,0
1778  REM  SHAPE TABLE FOR L
1780  DATA  27,36,22,54,45,45,7,0

1782  REM  SHAPE TABLE FOR M
1784  DATA  36,63,54,54,12,1,32,4
      4,53,54,38,0
1786  REM  SHAPE TABLE FOR N
1788  DATA  7,56,48,54,38,74,9,28
      ,37,36,6,0
1790  REM  SHAPE TABLE FOR O
1792  DATA  18,63,36,36,45,45,54,
      54,63,0
1794  REM  SHAPE TABLE FOR P
1796  DATA  45,36,63,63,54,45,27,
      54,4,0
1798  REM  SHAPE TABLE FOR Q
1800  DATA  22,63,32,36,41,45,50,
      54,63,1,48,10,6,0
1802  REM  SHAPE TABLE FOR R
1804  DATA  45,36,63,63,54,45,27,
      54,84,65,21,4,0
1806  REM  SHAPE TABLE FOR S
1808  DATA  57,63,32,41,45,23,2,1
      7,30,63,47,0
1810  REM  SHAPE TABLE FOR T
1812  DATA  18,36,36,45,31,63,5,0

1814  REM  SHAPE TABLE FOR U
1816  DATA  18,63,32,36,14,17,18,
      45,36,36,22,18,0
1818  REM  SHAPE TABLE FOR V
1820  DATA  2,34,33,33,52,27,18,3
      5,35,52,0
1822  REM  SHAPE TABLE FOR W
1824  DATA  54,41,32,36,30,19,18,
      59,32,36,6,0
1826  REM  SHAPE TABLE FOR X
1828  DATA  18,27,12,12,12,12,20,
      18,18,28,28,24,28,4,0
1830  REM  SHAPE TABLE FOR Y
1832  DATA  18,36,12,12,20,26,27,
      28,4,0
1834  REM  SHAPE TABLE FOR Z
1836  DATA  18,9,63,63,12,12,12,1
      2,20,59,63,5,0
1838  REM  SHAPE TABLE FOR LEFT S
      QUARE BRACKET
1840  DATA  18,63,36,36,45,7,0
1842  REM  SHAPE TABLE FOR /
1844  DATA  18,9,28,28,28,28,4,0
1846  REM  SHAPE TABLE FOR ]
1848  DATA  18,45,36,36,63,5,0
1850  REM  SHAPE TABLE FOR ↑
1852  DATA  18,36,36,20,18,9,28,2
      8,18,27,12,4,0
1854  REM  TERMINATOR
1856  DATA  -1
```


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PROGRAMS

```
1738  REM  SHAPE TABLE FOR B
1740  DATA  63,54,45,45,32,27,45,
   36,59,63,54,0
1742  REM  SHAPE TABLE FOR C
1744  DATA  73,24,56,63,55,54,46,
   45,61,0

10  REM ***************************
     ****
12  REM *    PROGRAM TO PLOT
         *
14  REM *  A CHARACTER STRING
         *
16  REM ***************************
     ****
18  HIMEM: 9 * 16 ↑ 3 + 2 * 16 ↑
     2
20  REM  XS,YS ARE SCREEN COORDIN
     ATES OF CENTRE OF FIRST CHAR
     ACTER OF STRING
22  REM  RS=0 FOR PLOTTING HORIZO
     NTALLY(LEFT TO RIGHT),RS=48
     FOR PLOTTING VERTICALLY(SCRE
     EN BOTTOM TO SCREEN TOP)
24  REM  SS(1->255) IS A CHARACTE
     R SCALE FACTOR
26  REM  Z$ CONTAINS STRING TO BE
      PLOTTED
28  REM  NS IS THE NUMBER OF SHAP
     E TABLES LOADED
30  HGR
32 NS = 63
34  REM  PLOT SHAPE
36  INPUT "CHARACTER STRING?";Z$
38  INPUT "XS,YS SCREEN COORDINAT
     ES?";XS,YS
40  INPUT "RS-0=HORIZONTAL,48=VER
     TICAL?";RS
42  INPUT "SCALE(1->255)?";SS
44  GOSUB 1500
46  END
1500  REM  CHAR PLOT SUB*******
1502  REM   SUB USES C1,C2,I,A$,I
   S,NS,Z$,SS,RS,XS,YS,XR,YB
1504  REM  CONSTANTS
1506 C1 = 31:C2 = 8:XR = 280:YB =
   160
1508  SCALE= SS
1510  ROT= RS
1512  FOR I = 1 TO  LEN (Z$)
1514 A$ =  MID$ (Z$,I,1)
1516  IF A$ = " " THEN 1530
1518  IF A$ =  CHR$ (34) THEN IS =
   3: GOTO 1522
1520 IS =  ASC (A$) - C1
1522  IF IS < 1 OR IS > NS THEN 1
   530
1524  IF XS < 0 OR XS >  = XR THEN
   XS = 0
1526  IF YS < 0 OR YS >  = YB THEN
   YS = 0
1528  DRAW IS AT XS,YS
1530  IF RS = 0 THEN XS = XS + C2
   * SS
1532  IF RS = 48 THEN YS = YS - C
   2 * SS
1534  NEXT I
1536  RETURN
```

Variable Checkchart Generation

by Anthony Mead

If you're writing complicated programs with a hundred and one variables in them, this program could help you keep track of what you're doing.

It generates two grids, one representing all possible string variable names and one representing all numeric ones. These follow the Microsoft standard of one alpha character followed by another alpha character or digit.

Reading the charts is quite simple. The horizontal letters are the first letter in a variable name. The top row is for variables with single-letter names. The vertical row is for the second letter (or digit).

There are two basic uses for these charts. The first is simply to mark off the variable names with a tick or whatever as they are used. The second is to use your own key to provide a more comprehensive guide to each variable — such as marking which ones are loops, which ones are input variables and the like.

This program was written on an Ohio C2-4P originally and has since been run on a Nascom 2. As it only uses ASCII characters it should run on most micros provided the printer control statements are changed as necessary. It occupies about 1k and should be run with all output going to a printer.

```
10 REM VARIABLE CHECK CHART GENERATOR
20 A$="" : B$="--" : C$=" "
30 FOR I=1 TO 27
40 A$=A$+"! "
50 B$=B$+"---"
60 NEXT I
70 PRINT "NUMERIC VARIABLES -"
80 GOSUB 130
90 PRINT "STRING VARIABLES -"
```

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```
100 C$="$"
110 GOSUB 130
120 END
130 PRINT
140 PRINT B$
150 PRINT "    !";
160 FOR I=65 TO 90
170 PRINT CHR$(I)"!";
180 NEXT I
190 PRINT
200 PRINT B$
210 PRINT ".  "C$A$
220 FOR I=65 TO 90
230 PRINT B$
240 PRINT "."CHR$(I)C$A$
250 NEXT I
260 FOR I=48 TO 57
270 PRINT B$
280 PRINT "."CHR$(I)C$A$
290 NEXT I
300 PRINT B$
310 PRINT : PRINT : PRINT
320 RETURN
```

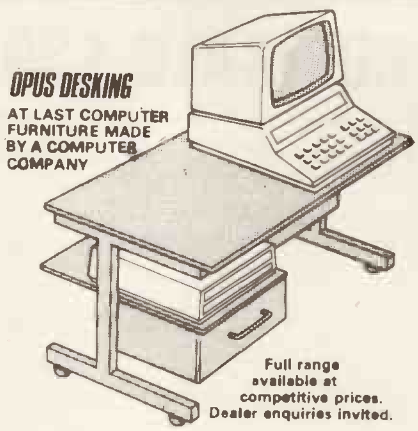
ZX81 Hexadecimal Calculator

by S Tongue

Machine Code experts will find this program rather useful. It allows a 1k ZX81 to evaulate a hexadecimal expression in the form "10FF+3AB*2;; and give the result as a hex number. Input must be written without spaces and the expression is evaluated from left to right.

```
 10 DIM X(2)
 20 LET E$="X(1) X(2)"
 30 LET X(1)=0
 40 LET X(2)=0
 50 LET K=1
 60 INPUT A$
 70 CLS
 80 FOR J=1 TO LEN(A$)
 90 IF A$(J)<"0" THEN GOTO 270
100 LET X(K)=16*X(K)+CODE A$(J)-28
110 NEXT J
120 GOSUB 400
130 PRINT A$;" ";
140 LET V=X(1)
150 LET J=1
```


MICROMART



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```
160 LET Z=INT(V/16)
170 LET Y=V-16*Z
180 LET A$(J)=CHR$(28+Y)
190 IF V<16 THEN GOTO 230
200 LET V=Z
210 LET J=J+1
220 GOTO 160
230 FOR K=J TO 1 STEP -1
240 PRINT A$(K);
250 NEXT K
260 GOTO 20
270 IF K=2 THEN GOSUB 400
280 LET K=K+1
290 LET E$(5)=A$(J)
300 GOTO 110
400 LET X(1)=VAL E$
410 LET K=1
420 LET X(")=0
430 RETURN
```

Atom Backgammon

by Peter Robinson

Backgammon players should appreciate this game. It's nicely crash-proofed and makes good use of the Atom's high resolution graphics.

An assumption is made that the user knows how to play backgammon. This means that if you don't know how to play already you'll need a set of rules with you when you use this program.

It requires the full memory expansion on the Atom — ie, 12k RAM. All play is against the computer, which plays the black pieces. You are allowed to make the first move, but if you'd rather give your micro a chance you only need to press the zero key when the prompt of 'your turn' appears on the screen. Pressing this key at any other time when it is your turn lets the computer know you can't move.

To move, you use numbers in accordance with a pair of white dice which are displayed on the screen. Illegal moves are indicated by a tone from the speaker. You have to position the cursor (which appears under the bottom right triangle) under the piece you want to move using the '[' and ']' keys. You then press the number key corresponding to the dice value you wish to move. This moves the piece the required number of points.

If one of your pieces is 'hit' it will appear on the bar. You will then be unable to move the cursor until all your pieces have been moved from the bar. You can remove your pieces simply by pressing the key with the required number on it. Bearing-off is performed in the same manner as for any other move except that the piece is actually moved off the board.

Our thanks to the Anglia Computer Centre for this listing.

```
 0REM ********************
 1REM *****BACKGAMMON*****
 2REM ***BY P.ROBINSON****
 3REM ******MCMLXXXI******
 4REM ********************
 5REM
 9P=£81;P.$21;[JSR£FFE3;STA£80;RTS;];P.$6
10CLEAR4;O=£8000
20F.A=10TO182S.2;MOVE10,A;DRAW222,A;N.
```


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 25F.A=11TO221S.2;MOVEA,10;PLOT6,A,182;N.
 30F.A=1TO12;Z=0;F.B=-16TO0;IFA>6Z=16
 40MOVE(A*16+3+Z),112;PLOT(7-(1-(A%2))*2),(A*16+11+B+Z),182
 50MOVE(A*16+3+Z),80;PLOT(7-(A%2)*2),(A*16+11+B+Z),10;N.;N.
 60MOVE9,10;DRAW9,182;DRAW220,182;DRAW220,10;DRAW9,10
 70MOVE8,9;DRAW8,183;DRAW221,183;DRAW221,9;DRAW8,9
 80MOVE7,8;DRAW7,184;DRAW222,184;DRAW222,8;DRAW7,8
 90F.A=1TO11;MOVE(109+A),10;DRAW(109+A),182;N.
100DIMPP26;F.A=0TO26;PPA=0;N.;PP1=20;PP6=5;PP8=3;PP12=50;PP13=5
110PP17=30;PP19=50;PP24=2
115DIMWW4,BB4;V=£2800
120!V=£FFFF7E3C;V!4=£3C7EFFFF;V!8=£8181423C;V!12=£3C428181
122V!16=£10284444;V!20=£00101010;V!24=£44444438;V!28=£00384444
124V!32=£44444444;V!36=V!28;V!40=£78444478;V!44=£00444444
126V!48=£44546C44;V!52=V!44;V!56=V!24;V!60=V!28;V!64=V!32
127V!68=£00102828;V!72=£7840407C;V!76=£007C4040
150F.B=1TO24;IFPPB<>0 GOS.c;GOS.d
170N.
200GOS.w;X=£8B1C;F.A=0TO3;F.B=0TO7;?(X+A+B*32)=0
220X?(A+B*32)=(X?(A+B*32)):(V?(B+16+A*8));N.;N.;X=£8C5C
230F.A=0TO3;F.B=0TO7;?(X+A+B*32)=0
240X?(A+B*32)=(X?(A+B*32)):(V?(B+48+A*8));N.;N.
245B=1
250IFB=25 B=1
254X=(12-B)*16+18;Y=10;IFB<7X=X+16
255IFB>12 X=(B-13)*16+18;Y=184;IFB>18X=X+16
260L=O+(192-Y)*32+X/8;?L=0;F=L
270LINK£81;E=?£80
276IFPP25<>0B=25;G.290
280IFE=91B=B+1;B=B%25;?L=255;IFB=0B=1
285IFE=93B=B-1;B=B%25;?L=255;IFB=0B=24
290D=0;N=0;F.A=7TO24;IFPPA<9 N=N+PPA
296N.;IF N=0 D=1
300E=E-48;IFE<>WW1 IFE<>WW2 IFE<>WW3 IFE<>WW4 IFE<>0 G.250
310IFE=0;?F=255;G.400
320IFPPB>9ORPPB=0 P.$7;G.250
325IF(B-E)>0 ORD=0;G.330
326GOS.c;GOS.m;PPB=PPB-1
327N=0;F.A=1TO6;IFPPA<9 N=N+PPA
328N.;IFN=0 A=0;G.6000
329G.365
330IF(B-E)<1 P.$7;G.250
335IFPP(B-E)=5 P.$7;G.250
340IFPP(B-E)>19 P.$7;G.250
342IFPP(B-E)<>10;G.360
343B=B-E
344GOS.c;GOS.m;PPB=0;PP0=PP0+10;X=115;Y=108+(PP0/10)*9;B=B+E
346C=Q;S=0;GOS.m
360IFB<>25 GOS.c;GOS.m
361IFB=25 X=115;Y=92-PP25*9;C=Q
362PPB=PPB-1;B=B-E;PPB=PPB+1;GOS.c;GOS.m;B=B+E
365IFE=WW1 WW1=0;G.390
370IFE=WW2 WW2=0;G.390
375IFE=WW3 WW3=0;G.390
380IFE=WW4 WW4=0
390IFWW1<>0 ORWW2<>0 ORWW3<>0 ORWW4<>0;G.250
399IFB<>25;?F=255
400X=£8B1C;F.A=0TO3;F.B=0TO7;?(X+A+B*32)=0
410?(£8B1D+B*32)=V?(B+48);?(£8B1E+B*32)=V?(B+16);N.;N.;GOS.b
420IFPP0=0;G. 495
425M=0;F=0;D=0
430F.A=1TO4;S=1;E=BBA;IFE=0G.475
440P=PPE;IFP=10 S=S+3
445 IF P=50 S=0;G.475
450IFP<10 AND P>1G.475
460IFP=1 S=S+2
470B=0;IF S>M F=A;M=S
475N.;E=BBF;BBF=0;IFF=0;G.200
476G.542
495D=0;N=0;F.A=1TO18;N=N+PPA/10
496N.;IF N=0 D=1
500M=0;I=0;DO I=I+1;P=PPI;IF P<10G.524
501F.A=1TO4;S=0;E=BBA;IFE=0G.520
503IFI+E=25AND D=1 S=200;G.516
504IFI+E>24 AND D=0G.520
```


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PROGRAMS

```
505IFI+E>24AND D=1 S=20;IF I>25-E;S=1;G.516
506P=PP(I+E);Q=PPI;IFD=1G.516
508IF P=50 S=0;G.520
509IFP<10 AND P>1G.520
511S=(24-I)/6;IFQ=20 AND I>17 S=1
512IFP=1 S=S+2
513IFP=10 S=S+2+I/4
514IF Q=10 AND P=10;S=S+3+I/3
515IF Q>20 AND P=10;S=S+5+I/3
516IF S=M S=S+R.%2;G.516
518IF S>M B=I ;F=A;M=S
520N.
524UNTIL I=24;E=BBF;BBF=0;IF M=0 G.200
525IF(B+E)<25 OR D=0;G.542
526GOS.c;GOS.m;PPB=PPB-10
527N=0;F.A=19TO24;N=N+(PPA)/10;N.
528IFN=0 A=1;G.6000
530G.595
542IFPP(B+E)<>1;G.560
543B=B+E
544GOS.c;GOS.m;PPB=0;PP25=PP25+1;X=115;Y=92-PP25*9;B=B-E
546C=-Q;S=0;GOS.m
560IFB<>0 GOS.c;GOS.m
561IFB=0 X=115;Y=108+(PP0/10)*9;C=Q;S=0;P=PP0/10;GOS.m
562PPB=PPB-10;B=B+E;PPB=PPB+10;GOS.c;GOS.m;B=B-E
595IFBB1+BB2+BB3+BB4<>0G.420
600G.200
4998E.
5000cP=PPB;Q=0
5010IFP<10 Q=1
5015IFP>9P=P/10
5020X=(12-B)*16+18;Y=20;S=-£120;IFB<7X=X+16
5030IFB>12 X=(B-13)*16+18;Y=181;S=£120;IFB>18X=X+16
5035C=B%2;R.
5040dL=(192-Y)*32+X/8+0;Z=8;IFC=Q Z=0
5050F.A=1TO P;F.K=0TO7
5060;?(L+K*32)=(?(L+K*32)):(V?(K+Z));N.;L=L+S;N.;R.
5100mIFP=0 R.
5110L=(192-Y)*32+X/8+0;L=L+(P-1)*S;Z=8;IF C=Q Z=0
5120F.K=0TO7;?(L+K*32)=(?(L+K*32)):(V?(K+Z));N.;R.
5200wF.A=34TO54;MOVEA,86;DRAWA,106;MOVE(A+30),86;DRAW(A+30),106
5210N.;WW1=A.R.%6+1;WW2=A.R.%6+1;WW3=0;WW4=0;IFWW2<>WW1G.5220
5215WW3=WW1;WW4=WW1
5220Z=0;GOS.((WW1*20)+5230);Z=30;GOS.((WW2*20)+5230);R.
5225bF.A=145TO167;MOVEA,86;PLOT7,A,106;MOVE(A+30),86
5230PLOT7,(A+30),106;N.;BB1=A.R.%6+1;BB2=A.R.%6+1;BB3=0;BB4=0
5231IFBB1=BB2;BB3=BB2;BB4=BB2
5240Z=112;GOS.((BB1*20)+5230);Z=142;GOS.((BB2*20)+5230);R.
5250X=44;Y=96;GOS.s;R.
5270X=39;Y=101;GOS.s;X=49;Y=91;GOS.s;R.
5290X=39;Y=101;GOS.s;X=49;Y=91;GOS.s;X=44;Y=96;GOS.s;R.
5310X=39;Y=101;GOS.s;Y=91;GOS.s;X=49;GOS.s;Y=101;GOS.s;R.
5330X=39;Y=101;GOS.s;Y=91;GOS.s;X=49;GOS.s;Y=101;GOS.s;X=44
5340Y=96;GOS.s;R.
5350F.X=39TO49S.10;F.Y=91TO101S.5;GOS.s;N.;N.;R.
5400sF.A=-2TO2;K=2-A.A;MOVE(X+K+Z),(Y+A);PLOT6,(X+Z-K),(Y+A)
5410N.;R.
6000P.$12;IFA=0G.6100
6010P."           I WIN!"''"COMPUTERS REIGN SUPREME!!"''
6020G.6200
6100P."CONGRATULATIONS ON A SKILFUL WIN"''''''
6200P."DO YOU WANT ANOTHER GAME?";LINK£81;IF?£80=89 RUN
6210E.
```

Video Genie Aircraft Lander

by P Bailey

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it can be a bit unnerving to play as the

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responses to your controls are intentionally delayed. Small corrections or small cross-winds can cause dramatic effects. The instructions contained within the program are clear and well set out but it may be worth making a separate note of these as they are rather a lot to remember in one go.

You can select the strength of wind against which you wish to fly. A zero cross-wind will make the landing easier as you will not have to use the 'roll' controls. Apart from roll, you control pitch and throttle. You can only land safely within certain control limits. Once you have landed you have to straighten up the aircraft and apply the brakes — if you run out of runway you crash!

```
EEEE1 REM *** AIRCRAFT LANDING SIMULATOR ***
2 REM *** BY P.D.BAILEY ***
3 REM *** DATE 3/7/82 ***
10 GOTO 8000
90 REM *** UTILITY SUBROUTINES ***
100 REM *** SHORT DELAY ***
110 FOR J = 1 TO 50 : NEXT J : RETURN
200 REM  *** LONG DELAY ***
210 FOR J = 1 TO 500 : NEXT J : RETURN
300 REM *** END OF PAGE ***
310 PRINT : PRINT "PRESS <NEW LINE> TO CONTINUE";
320 X$ = "" : X$ = INKEY$ : IF X$ = "" THEN 320
330 IF ASC(X$) <> 13 THEN 320
340 CLS
350 RETURN
400 REM ***  CALCULATE COMPONENTS OF VELOCITY ***
410 RA = AD * C1
420 VX = AS * SIN(RA)
430 VY = AS * COS(RA)
440 RETURN
1000 REM *** APPROACH TO AIRFIELD ***
1010 GOSUB 5000
1020 GOSUB 2000
1030 IF PZ <= 0 THEN GOTO 1200
1040 GOSUB 4000
1050 GOSUB 5000
1060 GOTO 1010
1200 REM *** AFTER TOUCHDOWN ***
1210 GOSUB 3000
1220 IF LF =  1 THEN 1400
1230 PRINT @ 128, "TOUCHDOWN";
1240 GOSUB 5500
1250 GOSUB 6000
1260 GOSUB 4000
1270 IF LF = 2 THEN 1600
1280 IF LF = 3 THEN 1800
1290 GOTO 1250
1400 REM *** FATAL CRASH ***
1410 CLS
1420 X$ = "" : X$ = INKEY$ : IF X$ <> "" THEN 1480
1430 PRINT @ 475, "FATAL CRASH";
1440 GOSUB 110
1450 PRINT @ 475, STRING$(12,32);
1460 GOSUB 110
1470 GOTO  1420
1480 CLS :
     PRINT "THE FLIGHT RECORDER HAS BEEN RECOVERED"
1490 PRINT "THE FINAL FLIGHT DETAILS WERE AS FOLLOWS"
1500 GOTO 9000
1600 REM *** OFF RUNWAY AFTER GOOD LANDING ***
1610 CLS
1620 IF PY > 0 THEN
      PRINT "YOU HAVE GONE OFF THE END OF THE RUNWAY." :
      PRINT "TRY USING  YOUR BRAKES NEXT TIME."
1630 IF ABS(PX) > WR THEN
      PRINT "YOU ARE OFF THE SIDE OF THE RUNWAY." :
      PRINT "ISN'T IT WIDE ENOUGH FOR YOU?"
1640 IF AS <= 10 THEN
      PRINT "LUCKILY THERE IS ONLY MINOR DAMAGE AT THIS SPEED"
1650 IF AS > 10 AND AS <= 25 THEN
      PRINT "SERIOUS DAMAGE TO YOUR AIRCRAFT, BUT YOU SURVIVE" :
      PRINT "TO SCARE YOUR PASSENGERS TO DEATH AGAIN"
1660 IF AS > 25 THEN
      PRINT "DISASTER - FATAL CRASH"
1670 PRINT
1680 PRINT "DETAILS OF THE FLIGHT WHEN YOU LEFT THE RUNWAY:-"
1690 GOTO 9000
1800 REM *** GOOD LANDING ***
1810 PRINT @ 128, "CONGRATULATIONS CAPTAIN - A SAFE LANDING";
1820 GOTO 9080
2000 REM *** UPDATE POSITION & SPEED IN THE AIR ***
2010 PZ = PZ + GZ
2020 PY = PY + GY
2030 PX = PX + GX
2040 PT = PT + NC
```


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PROGRAMS

```
2050 RL = RL + BC
2060 AS = AS + 2 * SGN( TS(TC) - AS )
2070 AD = AD + RL
2080 VZ = 1 * (TC - 5) +AS * SIN( PT * C1 )
2090 GOSUB 400
2100 GZ = VZ
2110 GY = VY + WY
2120 GX = VX + WX
2130 GD = - ATN( VX/VY) * C2
2140 RETURN
3000 REM *** CHECK FOR CRASH ***
3010 IF ABS(RL) > RT
        OR PT > TP OR PT < 0
        OR ABS(AD) > YT
        OR AS < 45 OR AS > 55
     THEN LF = 1 :
        PRINT @ 128, "CRASH ON LANDING";
3020 IF ABS(PX) > WR OR PY > 0 OR PY < - LR
     THEN LF = 1 :
        PRINT @ 160, " OFF RUNWAY";
3030 GOSUB 200
3040 RETURN
4000  REM *** UPDATE DISPLAY ***
4010 HT = -PZ-5 : LD = -PX-WR : RD = -PX+WR
4020 HD = HT*7 : IF HD < -PY THEN HD = -PY
4030 IF HD < 3000 THEN HD = 3000
4040 FOR I = 0 TO 4
4050 YD = -PY-I*500
4060  Q(I,1) = LD : Q(I+5,1) = RD
4070  Q(I,2) = YD : Q(I+5,2) = YD
4080  Q(i,3) = HT : Q(I+5,3) = HT
4090 NEXTI
4100 Q(10,1) = -PX : Q(10,2) = -PY : Q(10,3) = HT
4110 Q(11,1) = -PX : Q(11,2) = -PY-LR : Q(11,3) = HT
4120 A1 = 64/WR : A2 = 64.5 : A3 = 15.5 : A4 = 31
4130 FOR I = 0 TO 11
4140  AO = (HD-Q(I,2))/HD
4150  R(I,1) = INT(Q(I,1)*AO*A1+A2)
4160  R(I,2) = INT(A3+AO*A4)
4170 NEXT I
4180 ON ERROR GOTO 4250
4190 FOR I = 320 TO 896 STEP 64
4192  PRINT @ I, CHR$(30);
4194 NEXT I
4196 PRINT @ 960, STRING$(63,128);
4200 FOR I = 0 TO 11
4210  SET(R(I,1),R(I,2))
4220 NEXT I
4230 ON ERROR GOTO 0
4240 GOTO 4260
4250 RESUME NEXT
4260 PRINT @ 64, INT(AS+C5);
          TAB(9); INT(AD+C5);
          TAB(18);INT(PT+C5);
          TAB(27);INT(RL+C5);
          TAB(36);INT(PZ+C5);
          TAB(45);INT(ABS(PY)+C5);
          TAB(54);INT(PX+C5);
4270 RETURN
5000 REM *** CHECK CONTROLS ***
5010 X$ = ""
5020 X$ = INKEY$
5030 IF X$ = "" THEN RETURN
5040 IF ASC(X$) > 47 AND ASC(X$) < 58 THEN TC = VAL(X$) : RETURN
5050 IF X$ = "F" THEN BC = -1
5060 IF X$ = "G" THEN BC = 0
5070 IF X$ = "H" THEN BC = 1
5080 IF X$ = "M" THEN NC = 1
5090 IF X$ = "K" THEN NC = 0
5100 IF X$ = "O" THEN NC = -1
5110 RETURN
5500 REM *** CONTROLS AFTER LANDING ***
5510 X$ = ""
5520 X$ = INKEY$
5530 IF X$ = "" THEN RETURN
5540 IF X$ = "R" THEN RC = 1
5550 IF X$ = "E" THEN RC = -1
5560 IF X$ = "C" THEN RC = 0
5570 IF X$ = "B" THEN FD = 2
5580 RETURN
6000 REM *** AFTER TOUCHDOWN ***
6010 PT = 0 : RL = 0 : PZ = 0
6020 GOSUB 5500
6030 PX = PX + VX
6040 PY = PY + VY
6050 IF ABS(PX) > WR OR PY > 0 THEN LF = 2
6060 AD =  AD + AD * (SGN(AD)*SGN(RC))
6070 AS = AS - FD : IF AS <= 0 THEN LF = 3
6080 GOSUB 400
```


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```
6090 RETURN
8000 REM *** INITIALISATION ***
8010 CLEAR 100 : DEFINT I-K
8020 DIM Q(11,3) , R(11,2)
8030 CLS : PRINT TAB(20); "AIRCRAFT LANDING SIMULATOR" : PRINT
8040 INPUT "DO YOU REQUIRE INSTRUCTIONS (Y/N)"; X$
8050 PRINT
8060 IF X$ = "N" THEN 8290 ELSE IF X$ = "Y" THEN 8080
8070 INPUT "PLEASE TYPE Y OR N"; X$ : GOTO 8060
8080 CLS
8090 PRINT
"IT IS DARK AND RAINING. YOU ARE APPROACHING THE AIRPORT WITH
300 PASSENGERS ON BOARD AND YOUR CO-PILOT HAS JUST BECOME
UNCONSCIOUS, SO YOU MUST LAND THE AIRCRAFT ALONE. TO BE HONEST"
8100 PRINT
"HE WAS NOT DOING A GREAT JOB BEFORE HE PASSED OUT.

YOU ARE IN LEVEL FLIGHT AT AN ALTITUDE OF 3000 M BUT ONLY 20 KM
FROM THE FAR END OF THE RUNWAY. YOUR AIRCRAFT IS POINTING IN"
8110 PRINT
"THE CORRECT DIRECTION BUT ANY CROSSWIND WILL CAUSE A DEVIATION
FROM THIS PATH."
8120 GOSUB 310
8130 PRINT
"YOU MUST LAND WITH AN AIRSPEED OF ABOUT 50 M/S WITH NO
APPRECIABLE ROLL OR PITCH. ROLL MUST BE LESS THAN 3 DEGREES
AND PITCH BETWEEN 0 AND 5 DEGREES. SINCE THE RUNWAY IS 2000 M"
8140 PRINT
"LONG THE DISTANCE INDICATOR MUST SHOW LESS THAN THIS FIGURE ON
TOUCHDOWN. SIMILARLY THE RUNWAY IS 100 M WIDE SO THAT IF THE
DEVIATION IS GREATER THAN 50 M ON TOUCHDOWN YOU WILL MISS THE
RUNWAY."
8150 PRINT:PRINT
"AFTER TOUCHDOWN YOU MUST USE THE RUDDER TO CORRECT THE
DIRECTION OF TRAVEL AND THE BRAKES TO STOP BEFORE YOU REACH
THE END OF THE RUNWAY (THIS IS INDICATED BY A DISTANCE READING "
8160 PRINT
"OF 0). IF YOU FAIL TO STOP OR TO CORRECT YOUR DIRECTION (WHICH
MAY NOT BE 0 WHEN LANDING IN A CROSSWIND) YOU WILL CRASH."
8170 PRINT : GOSUB 310
8180 PRINT
"YOU CAN SEE THE RUNWAY LIGHTS AHEAD AND IN THE DISTANCE THE
LIGHTS OF THE CITY YOU HOPE TO AVOID.
YOUR INSTRUMENTS GIVE THE FOLLOWING INFORMATION:

"
8190 PRINT
"AIRSPEED  SPEED IN M/S
BEARING   DIRECTION IN WHICH AIRCRAFT IS POINTING. 0 IS
          STRAIGHT AHEAD. POSITIVE VALUES TO THE RIGHT
PITCH     POSITIVE VALUES WHEN THE AIRCRAFT'S NOSE IS UP"
8200 PRINT
"ROLL      POSITIVE VALUES CLOCKWISE. ROLL CAUSES BANKING WHICH
          CHANGES THE AIRCRAFT'S BEARING.
ALT       HEIGHT ABOVE GROUND IN M.
DISTANCE  FROM FAR END OF RUNWAY IN M.
DEV       SIDEWAYS DEVIATION FROM CENTRE OF RUNWAY"
8210 GOSUB 310
8220 PRINT
"IN FLIGHT YOU HAVE THE FOLLOWING CONTROLS:

F   ROLL TO LEFT
G   MAINTAIN ROLL AT THIS LEVEL
H   ROLL TO RIGHT
M   NOSE UP (INCREASE PITCH)
K   MAINTAIN PITCH AT THIS LEVEL
O   NOSE DOWN (DECREASE PITCH)

"
8230 PRINT
"0-9 THROTTLE CONTROL
     EACH SETTING HAS A TERMINAL VALUE OF SPEED WHICH IS
     REACHED EVENTUALLY. E.G. 5 - 150  M/S, 2 - 50 M/S.
     LANDING IS USUALLY ACHIEVED ON SETTING 2."
8240 GOSUB 310
8250 PRINT
"AFTER TOUCHDOWN ONLY THE FOLLOWING HAVE EFFECT:

E   RUDDER LEFT
R   RUDDER RIGHT
B   APPLY BRAKES

N.B. ALL CONTROLS HAVE A DELAYED EFFECT ON A LARGE AIRCRAFT."
8260 PRINT
"     IN GENERAL THEY HAVE AN EFFECT ON THE SECOND DISPLAY AFTER
     PRESSING A KEY

GOOD LUCK.
"
```


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PROGRAMS

```
8270 INPUT "DO YOU WANT TO SEE THESE INSTRUCTIONS  AGAIN";X$
8280 GOTO 8060
8290 PI = 3.14159
8300 C1 = PI / 180 : C2 = 180 / PI
8310 C5 = .5
8320 LF = 0 : 'LANDING FLAG
8330 PZ = 3000 : 'ALTITUDE
8340 PY = -2E4 : 'DISTANCE FROM AIRFIELD (TO FAR END OF RUNWAY)
8350 PX = 0 : 'LATERAL DEVIATION FROM GLIDE PATH
8360 RL = 0 : 'ROLL
8370 PT = 0 : 'PITCH
8380 AS = 150 : 'AIRSPEED
8390 AD = 0 : 'AIR DIRECTION
8400 GOSUB 400
8410 CLS
8420 PRINT
"PLEASE SELECT WIND SPEED AND DIRECTION. A DIRECTION OF 0 MEANS
THAT THE WIND IS BLOWING STRAIGHT AT YOU AND THIS GIVES THE
EASIEST LANDING SINCE YOU DO NOT NEED TO ALTER ROLL OR BEARING."
8430 PRINT
"THE DIRECTION SHOULD BE BETWEEN -90 (FROM THE LEFT) AND +90
(FROM THE RIGHT).A WIND SPEED OF 5 IS A LIGHT BREEZE, A SPEED
OF 30 A GALE.
"
8440 INPUT "WIND SPEED (M/S)";X0
8450 INPUT "WIND DIRECTION (DEG)"; X1
8460 WY = -X0 * COS( X1 * C1 )
8470 WX = -X0 * SIN( X1 * C1 )
8480 GZ = VZ : GY = VY + WY : GX = VX + WX
8490 TC = 5 : 'THROTTLE CONTROL
8500 BC = 0 : 'BANKING CONTROL
8510 NC = 0 : 'NOSE UP/DOWN CONTROL
8520 RC = 0 : 'RUDDER CONTROL
8530 FOR I = 0 TO 9 : READ TS(I) : NEXT I
8540 DATA 0,25,50,75,100,150,200,250,275,300
8550 YT = 20 : 'YAW TOLERANCE
8560 RT = 3 : 'ROLL TOLERANCE
8570 TP = 5 : 'PITCH TOLERANCE
8580 LR = 2000 : 'RUNWAY LENGTH
8590 WR = 50 : 'RUNWAY WIDTH
8600 HD = 3E4 : 'DISTANCE TO HORIZON
8610 CLS
8620 PRINT@0, "AIRSPEED BEARING  PITCH    ROLL     ALT      DIST      DEV";
8630 PRINT@256,
     "..:.!...:.:!.....:....!.:...:..:..!..!.!...:...:.:.:....:...";
8640 GOTO 1000
9000 REM *** FINAL DETAILS ***
9010 PRINT
9020 PRINT "SPEED =  "; AS; "M/S"
9030 PRINT "DIRECTION = "; AD; "DEG"
9040 PRINT "DISTANCE FROM END OF RUNWAY =  "; ABS(PY); "M"
9050 PRINT "DISTANCE FROM CENTRE OF RUNWAY = "; ABS(PX); "M"
9060 PRINT "PITCH = "; PT; "DEG"
9070 PRINT "ROLL = "; RL; "DEG"
9080 X$ = "" : X$ = INKEY$ : IF X$ = "" THEN 9080
9090 END
```

Atari Flashback

by G Cheung

This game is rather like the well known 'Simon' game. It uses good colour and sound and provides a full range of difficulty levels.

As it will runs in under 16k it is ideal for either Atari 400 or 800. Depending on the level of difficulty, between four and eight numbers are displayed in coloured rectangles.

These flash in a random sequence, together with a sound of characteristic pitch. The player then has to follow the sequence by pressing the right numeric keys. As the game goes on, of course, the sequences get longer. A high score of number sequences remembered is kept.

As a program it's nicely written, and it uses machine code to speed up responses to input. The flashing numbers are produced by POKEing directly into screen RAM.

```
10 REM **FLASHBACK BY GNK CHEUNG
20 REM
30 DIM A$(1),P$(19),Z$(19),N(18),P(8),NB
(8),NW(8),NT(8):GOTO 90
40 REM
50 REM **SR FOR RANDOM NUMBERS
60 FOR J=1 TO N:N(J)=INT(RND(0)*L+1):NEX
T J:RETURN
70 REM
80 REM **SETTING UP MUSIC NOTES
```

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```
90 FOR J=1 TO 8:READ F1:NT(J)=F1:NEXT J:
DATA 31,63,95,127,159,191,223,255
100 REM
110 REM **M/C TO SET UP PLAYERS
120 FOR J=1 TO 19:READ P8:P$(J,J)=CHR$(P
9):NEXT J:Z$=P$:Z$(9,9)=CHR$(255):Z$(16,
16)=CHR$(60)
130 DATA 104,104,133,204,104,133,203,169
,0,160,0,145,203,200,192,255,208,249,96
140 HS=0:REM **RESET HIGH SCORE
150 GOSUB 620
160 L=LEV+2:N=LEV*3:GOSUB 60
170 REM
180 REM **SET UP DISPLAY FOR GAME
190 GRAPHICS 18:POKE 710,0:POKE 711,15
200 REM
210 REM **NB(J)=NUMBERS IN BLACK
        NW(J)=NUMBERS IN WHITE
220 FOR J=1 TO 8:NB(J)=144+J:NW(J)=208+J
:NEXT J
230 REM
240 REM **POSITION OF NUMBERS ON THE
        SCREEN
250 S=PEEK(560)+256*PEEK(561)+4:S=PEEK(S
)+256*PEEK(S+1)
260 FOR J=1 TO 4:P(J)=S+60+4*J:P(4+J)=S+
140+4*J:NEXT J
270 FOR J=1 TO L:POKE P(J),NB(J):NEXT J
280 POSITION 6,0:? #6;"flashback":POSITI
ON 2,10:? #6;"HIGHSCORE=";HS
290 REM
300 REM **SOUND VIBRATIONS
310 GOSUB 1000:SOUND 0,0,0,0:POKE 53768,
4:POKE 53761,168:POKE 53765,168:POKE 537
60,254:POKE 53764,123
320 REM
330 REM **MOVING PLAYERS
340 FOR I=0 TO X4:POKE 53251,I:NEXT I
350 FOR I=0 TO X3:POKE 53250,I:NEXT I
360 FOR I=0 TO X2:POKE 53249,I:NEXT I
370 FOR I=0 TO X1:POKE 53248,I:NEXT I
380 SOUND 0,0,0,0:FOR I=70 TO 0 STEP -1:
SOUND 2,I,10,10:NEXT I
390 GOSUB 1160
400 K=1
410 REM
420 REM **COMPUTER SEQUENCE DISPLAY
430 FOR J=1 TO K
440 POKE P(N(J)),NW(N(J)):JJ=N(J):GOSUB
1190:POKE P(N(J)),NB(N(J)):GOSUB 1230:NE
XT J
450 REM
460 REM **PLAYER SEQUENCE INPUT
470 OPEN #1,4,0,"K:":POKE 764,255:FOR J=
1 TO K
480 GET #1,X:IF X<49 OR X>L+48 THEN 480
490 Y=X-48:POKE P(Y),NW(Y):JJ=N(J):GOSUB
 1190:POKE P(Y),NB(Y)
500 IF Y<>N(J) THEN CLOSE #1:GOTO 800:RE
M **CHECK FOR PLAYER ERROR
510 NEXT J:CLOSE #1
520 REM
530 REM **CHECK FOR END OF SEQUENCE
540 K=K+1:IF K>N THEN GOTO 560
550 GOSUB 1160:GOTO 430
560 LEV=LEV+1:IF LEV>6 THEN 880
570 L=LEV+2:N=LEV*3:GOSUB 60
580 FOR I=1 TO L:POKE P(L),NW(L):FOR D=1
 TO 10:SOUND 0,NT(L),10,10:NEXT D:SOUND
0,0,0,0
590 POKE P(L),NB(L):FOR D=1 TO 10:NEXT D
:NEXT I:T=T+K-1:FOR D=1 TO 500:NEXT D:GO
TO 400
600 REM
610 REM **INITIAL DISPLAY
620 GRAPHICS 0:POKE 710,146:POKE 712,146
:POKE 752,1:LEV=1
630 BE=PEEK(560)+PEEK(561)*256+4
640 POSITION 1,1:? "FLASHBACK
by  g w k cheung"
650 POKE BE+2,7:POKE BE+3,6
660 POSITION 2,3:? "FOLLOW THE COMPUTER
BY HITTING         KEYS 1-8 (DIRECT INPUT
)."
670 ? :? "THE GAME WILL BEGIN WHEN 4 REC
TANGLES ARE DISPLAYED ON THE SCREEN."
680 ? :? "THE GAME IS OVER WHEN THE PLAY
ER      MAKES AN ERROR OR HAS SUCESSFULL
Y    REPEATED THE SERIES OF ";
690 ? "NUMBERS AT      THE FINAL LEVEL."
700 ? :? :? "SELECT INITIAL LEVEL:"
710 POSITION 1,16:? "LEVEL":POSITION 1,1
7:? "press start"
720 POKE BE+18,6:POKE BE+19,6:POKE BE+20
,6
730 IF PEEK(53279)=5 THEN LEV=LEV+1:REM
**CHECK SELECT KEY
740 IF LEV>6 THEN LEV=1
750 POSITION 7,16:? LEV:N=6*LEV
760 IF PEEK(53279)=6 THEN RETURN :REM **
CHECK START KEY
770 FOR D=1 TO 50:NEXT D:GOTO 730
780 REM
790 REM **SCORE DISPLAYS
800 GRAPHICS 18:POKE 53277,0
810 POSITION 5,3:? #6;"AAAHHHH!!!":GOSUB
 1100
820 POSITION 2,7:? #6;"SCORE ";T+K-1
830 POSITION 2,9:? #6;"rats !!"
840 GOSUB 1130:GOSUB 1160:FOR I=53248 TO
 53251:POKE I,0:NEXT I
850 T=0:GOTO 150
860 REM
870 REM **REMOVE PLAYERS
880 FOR I=0 TO X1:POKE 53248,X1-I:SOUND
0,X1-I,10,10:NEXT I
890 FOR I=0 TO X2:POKE 53249,X2-I:SOUND
0,X2-I,10,10:NEXT I
900 FOR I=0 TO X3:POKE 53250,X3-I:SOUND
0,X3-I,10,10:NEXT I
910 FOR I=0 TO X4:POKE 53251,X4-I:SOUND
0,X4-I,10,10:NEXT I
920 REM
930 REM **CONGRATULATE PLAYER
940 GRAPHICS 18:POKE 710,146:POKE 712,14
6:POKE 53277,0
950 POSITION 2,5:? #6;"WELLDONE!!!"
960 POSITION 2,7:? #6;"SCORE ";T+K-1
970 GOSUB 1130:GOSUB 1160:GOTO 150
980 REM
990 REM **P/M GRAPHICS SUBROUTINE FOR 4
RECTANGLES
1000 X1=67:X2=100:X3=133:X4=166
1010 A6=PEEK(106)-16:POKE 54279,A6:PMB=2
56*A6
1020 POKE 623,4:FOR I=53256 TO 53259:POK
E I,3:NEXT I
1030 POKE 559,46:POKE 53277,3
1040 FOR I=53248 TO 53251:POKE I,0:NEXT
I
1050 D=USR(ADR(P$),PMB+512):D=USR(ADR(P$
),PMB+768)
1060 POKE 704,98:POKE 705,22:POKE 706,18
2:POKE 707,70:REM **COLORS OF RECTANGLES
1070 D=USR(ADR(Z$),PMB+542):D=USR(ADR(Z$
),PMB+670):D=USR(ADR(Z$),PMB+798):D=USR(
ADR(Z$),PMB+926):RETURN
1080 REM
1090 REM **ERROR SOUND EFFECTS
1100 FOR I=70 TO 196:SOUND 0,I,12,15:POK
E 712,I:POKE 710,I:NEXT I:SOUND 0,0,0,0:
RETURN
1110 REM
1120 REM **UPDATE HIGHSCORE
1130 IF T+K-1>HS THEN HS=T+K-1:RETURN
1140 REM
1150 REM **DELAY
1160 FOR D=1 TO 300:NEXT D:RETURN
1170 REM
1180 REM **MUSICAL NOTES
1190 FOR D=1 TO 16:SOUND 0,NT(JJ),10,15:
NEXT D:SOUND 0,0,0,0:RETURN
1200 FOR I6=1 TO 6:SOUND 0,NT(JJ),10,15:
NEXT I6:RETURN
1210 REM
1220 REM **FLASH DELAYS
1230 FOR D=1 TO 10:NEXT D:RETURN
```

MZ-80K Test Analysis

by P Morrison

If you don't know how to split and sort strings, a look at this program should at least give you some idea how it's done.

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PROGRAMS

SP-5060 or SP-5074 (it ran under both of those). If your MZ-80K only uses one of these interpreters, modifications are as follows:

Add a line: 925 PRINT"C":GOTO 30 (the "C" is the clear screen symbol). Amend line 920 to read: IF A$<>"Y" THEN 930

Text Analysis requests input of up to 76 characters (including spaces). It then sorts out the string, gives the number of characters, and tells which different letters are contained within it, how many vowels, consonants and how many special characters there are.

It will not accept lower case or numbers, and some special characters, such as quotation marks, are not allowed. In spite of its limitations it only uses up about 4½ of memory which leaves plenty of room for expansion, both in capacity and in the number of different characters it can handle.

The author has taken care to ensure that output makes grammatical sense, eg, it won't tell you there are '1 full stops' of '3 letter A'. It sounds fussy, but these little trimmings make a lot of difference. One wonders what imaginitive uses PCW readers will make of this program!

```
5 PRINT"C"
10 PRINTTAB(12);"TEXT ANALYSIS"
15 PRINTTAB(12);"_____________"
20 GOTO 30
25 PRINT"C":PRINT"TEXT INVALID!  TRY AGAIN PLEASE":GOTO35
30 PRINT:PRINT"TYPE IN YOUR TEXT "
35 PRINT: PRINT"(CAPS ONLY:Max length 76 inc spaces)"
40 PRINT:PRINT"(No quotation marks or commas, but & ? ! .
   and -  are OK)"
45 PRINT:INPUT X$:PRINT"C"
50 IFX$="" THEN 25
55 PRINT "GIVE ME TIME TO SORT IT OUT"
60 L1=LEN(X$)
65 DIM A(26)
70 FOR X=1TO26:A(X)=0:NEXT X
75 V1=0:EM=0:AM=0:HM=0:QM=0:SP=0:FS=0
80 FOR X1 = 1 TO LEN(X$)
85 A$ =LEFT$(X$,X1):B$=RIGHT$(A$,1)
90 IF (ASC(B$)>32)*(ASC(B$)<65)+(ASC(B$)>90)THEN 100
95 GOTO135
100 IFASC(B$)= 32 THEN 135
105 IFASC(B$)= 33 THEN 135
110 IFASC(B$)= 38 THEN 135
115 IFASC(B$)= 45 THEN 135
120 IFASC(B$)= 46 THEN 135
125 IF ASC(B$)=63 THEN 135
130 GOTO25
135 IF ASC(B$)=32 THEN L1=L1-1
140 IF ASC(B$)=33 THEN L1=L1-1
145 IF ASC(B$)=38 THEN L1=L1-1
150 IF ASC(B$)=45 THEN L1=L1-1
155 IF ASC(B$)=46 THEN L1=L1-1
160 IF ASC(B$)=63 THEN L1=L1-1
165 GOSUB 940
170 NEXTX1
175 PRINT"C":PRINTX$:PRINT
180 IF L1=1 THENPRINT"This has";L1;" letter with":PRINT:GOTO190
185 PRINT"This has";L1;" letters with":PRINT
190 C1=L1-V1
195 IFQM=0THEN 215
200 IFQM=1 THEN 210
205 PRINTQM;" Question marks":PRINT:GOTO215
210 PRINT" 1 Question mark":PRINT
215 IFEM=0 THEN 235
220 IF EM=1 THEN 230
225 PRINTEM;" Exclamation marks":PRINT:GOTO235
230 PRINT" 1 Exclamation mark":PRINT
235 IF AM=0 THEN 255
240 IF AM=1 THEN 250
245 PRINTAM;" '&' Signs":PRINT:GOTO255
250 PRINT" 1 '&' Sign":PRINT
255 IF HM=0 THEN 275
260 IF HM=1 THEN 270
265 PRINTHM;" Hyphens":PRINT:GOTO275
270 PRINT" 1 Hyphen":PRINT
```


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```
275 IF FS=0 THEN 295
280 IF FS=1 THEN 290
285 PRINTFS;" Full stops":PRINT:GOTO 295
290 PRINT" 1 Full stop":PRINT
295 IF(V1=0)*(C1=0)THEN 385
300 IF(V1=1)*(C1=0)THEN 345
305 IF(V1=1)*(C1=1)THEN 350
310 IF(V1=1)*(C1>1)THEN 355
315 IF(V1>1)*(C1=0)THEN 360
320 IF(V1=0)*(C1=1)THEN 365
325 IF(V1=0)*(C1>1)THEN 370
330 IF(V1>1)*(C1>1)THEN 375
335 IF(V1>1)*(C1=1)THEN 380
340 PRINTV1;" Vowels &";C1;" Consonants":PRINT:GOTO 385
345 PRINT" 1 Vowel":PRINT:GOTO385
350 PRINT" 1 Vowel & 1 Consonant":PRINT:GOTO385
355 PRINT" 1 Vowel &";C1;" Consonants":PRINT:GOTO 385
360 PRINT V1;" Vowels":PRINT:GOTO 385
365 PRINT" 1 Consonant":PRINT:GOTO385
370 PRINTC1;" Consonants":PRINT:GOTO 385
375 PRINTV1;" Vowels &";C1;" Consonants":PRINT:GOTO 385
380 PRINTV1;" Vowels & 1 Consonant":PRINT:GOTO385
385 IFA(1)=0 THEN 405
390 IFA(1)=1 THEN 400
395 PRINTA(1);" A's",:GOTO405
400 PRINTA(1);" A",
405 IFA(2)=0 THEN  425
410 IFA(2)=1 THEN  420
415 PRINTA(2);" B's",:GOTO425
420 PRINTA(2);" B",
425 IFA(3)=0 THEN  445
430 IFA(3)=1 THEN  440
435 PRINTA(3);" C's ",:GOTO445
440 PRINTA(3);" C",
445 IFA(4)=0 THEN  465
450 IFA(4)=1 THEN  460
455 PRINTA(4);" D's ",:GOTO465
460 PRINTA(4);" D",
465 IFA(5)=0 THEN  485
470 IFA(5)=1 THEN  480
475 PRINTA(5);" E's ",:GOTO485
480 PRINTA(5);" E",
485 IFA(6)=0 THEN  505
490 IFA(6)=1 THEN  500
495 PRINTA(6);" F's ",:GOTO505
500 PRINTA(6);" F",
505 IFA(7)=0 THEN  525
510 IFA(7)=1 THEN  520
515 PRINTA(7);" G's ",:GOTO525
520 PRINTA(7);" G",
525 IFA(8)=0 THEN  545
530 IFA(8)=1 THEN  540
535 PRINTA(8);" H's ",:GOTO 545
540 PRINTA(8);" H",
545 IFA(9)=0 THEN  565
550 IFA(9)=1 THEN  560
555 PRINTA(9);" I's ",:GOTO565
560 PRINTA(9);" I",
565 IFA(10)=0 THEN 585
570 IFA(10)=1 THEN 580
575 PRINTA(10);" J's ",:GOTO 585
580 PRINTA(10);" J",
585 IFA(11)=0 THEN  605
590 IFA(11)=1 THEN  600
595 PRINTA(11);" K's ",:GOTO605
600 PRINTA(11);" K",
605 IFA(12)=0 THEN  625
610 IFA(12)=1 THEN  620
615 PRINTA(12);" L's ",:GOTO625
620 PRINTA(12);" L",
625 IFA(13)=0 THEN  645
630 IFA(13)=1 THEN  640
635 PRINTA(13);" M's ",:GOTO645
640 PRINTA(13);" M",
645 IFA(14)=0 THEN  665
```


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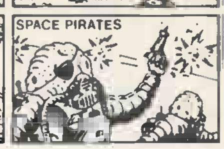

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650 IFA(14)=1 THEN  660
655 PRINTA(14);" N's ",:GOTO665
660 PRINTA(14);" N",
665 IFA(15)=0 THEN  685
670 IFA(15)=1 THEN  680
675 PRINTA(15);" O's ",:GOTO 685
680 PRINTA(15);" O",
685 IFA(16)=0 THEN  705
690 IFA(16)=1 THEN  700
695 PRINTA(16);" P's ",:GOTO705
700 PRINTA(16);" P",
705 IFA(17)=0 THEN  725
710 IFA(17)=1 THEN  720
715 PRINTA(17);" Q's ",:GOTO725
720 PRINTA(17);" Q",
725 IFA(18)=0 THEN  745
730 IFA(18)=1 THEN  740
735 PRINTA(18);" R's " ,:GOTO 745
740 PRINTA(18);" R",
745 IFA(19)=0 THEN  765
750 IFA(19)=1 THEN  760
755 PRINTA(19);" S's " ,:GOTO 765
760 PRINTA(19);" S",
765 IFA(20)=0 THEN  785
770 IFA(20)=1 THEN  780
775 PRINTA(20);" T's ",:GOTO785
780 PRINTA(20);" T",
785 IFA(21)=0 THEN  805
790 IFA(21)=1 THEN  800
795 PRINTA(21);" U's ",:GOTO 805
800 PRINTA(21);" U",
805 IFA(22)=0 THEN  825
810 IFA(22)=1 THEN  820
815 PRINTA(22);" V's ",:GOTO 825
820 PRINTA(22);" V",
825 IFA(23)=0 THEN  845
830 IFA(23)=1 THEN  840
835 PRINTA(23);" W's ",:GOTO845
840 PRINTA(23);" W",
845 IFA(24)=0 THEN  865
850 IFA(24)=1 THEN  860
855 PRINTA(24);" X's ",:GOTO 865
860 PRINTA(24);" X",
865 IFA(25)=0 THEN  885
870 IFA(25)=1 THEN  880
875 PRINTA(25);" Y's ",:GOTO 885
880 PRINTA(25);" Y",
885 IFA(26)=0 THEN  905
890 IFA(26)=1 THEN  900
895 PRINTA(26);" Z's ",:GOTO 905
900 PRINTA(26);" Z"
905 PRINT:PRINT
910 PRINT"TO TRY ANOTHER - Type Y"
915 GET A$:IFA$=""THEN915
920 IF A$="Y" THEN PRINT"C":GOTO30
930 PRINT"C":PRINTTAB(15);"'BYE FOR NOW":END
935 ** REM SUBROUTINE***********
940 FOR X= 1TO 26
945 IF ASC(B$)=X+64 THEN A(X)=A(X)+1
950 NEXT X
955 IF ASC(B$)=33 THEN EM=EM+1
960 IF ASC(B$)=38 THEN AM=AM+1
965 IF ASC(B$)=45 THEN HM=HM+1
970 IF ASC(B$)=46 THEN FS=FS+1
975 IF ASC(B$)=63 THEN QM=QM+1
980 IF ASC(B$)=65 THEN V1=V1+1
985 IF ASC(B$)=69 THEN V1=V1+1
990 IF ASC(B$)=73 THEN V1=V1+1
995 IF ASC(B$)=79 THEN V1=V1+1
1000 IF ASC(B$)=85 THEN V1=V1+1
1005 RETURN
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WHICH SPREADSHEET?

Continued from page 166

forming its calculations on the back of the previous row. The measurements for this Benchmark will be:
a) Maximum number of rows accommodated.
b) Recalculation time after changing A1 from 1 to 2 (tests integer, ie, whole number, calculation speed).
c) Recalculation time after changing A1 from 1 to 1.5 (tests floating point — ie, decimal or fractional number — calculation speed).
d) Vertical and horizontal window scrolling speed (by timing cursor move from A1 cell to bottom left, then from bottom left to bottom right).

Benchmark 2: This tests the capacity of the system with respect to textual information only. Most users of spreadsheets will set up only a few cells with text — for row and column headings, comments, etc.

Basically the test involves setting up the first row of the spreadsheet with 13 cells each containing the same eight character text 'ABCDEFGH', then repeating this row for as many other rows as possible. We shall simply measure the maximum number of rows accommodated by the system.

Benchmark 3: Just as Benchmarks 1 and 2 test the formula, and text capacity for the system, this will test the numeric capacity of the system. We shall record the maximum number of 13 column rows, with each cell containing the number '123456.78'.

LEISURE LINES

I must own up to some ambiguity in November's Prize Puzzle. Two solutions were possible — each using the rectangular type of pyramid — and both were acceptable.
a) 43 layers, 22 balls on top, covering 2279 square inches.
b) 26 layers, 594 balls on top, covering 2444 square inches.

The winner, chosen by random selection, was Graham Deaves of Dunstable.

Quickie

If you could fold a sheet of rice paper one thousandth of an inch thick 50 times, how high would the resulting wad be?

Prize Puzzle

This month's puzzle is similar to one we published about 2½ years ago. It should certainly stretch your micro. There are ten parts:
a) Which 10-digit prime number contains the most zeros?
b) Which 10-digit prime number contains the most ones?
c) Which 10-digit prime number contains the most twos? etc, etc. Carry on for all digits up to and including nine — leading zeros are not permitted.

Answers on postcards only, please, to Prize Puzzle, *PCW*, 62 Oxford Street, London W1. Closing date is 28 February.

J J Clessa

BLUDNERS

Two errors sneaked their way into December's Leisure Lines.

The answer given for September's Prize Puzzle should have read $-5 + 6^7$ (not $-5 * 6^7$), and the example given for the December puzzle showed 321 equal to $19 + 2.1^2$. This should have read "$21 = 19 + 2.1^2$".

Our attention has also been drawn to a couple of errors in September's TJ's Workshop, in a piece entitled 'Microtan Improved USR'. The first line of the routine should read:
1FFA 20 F5 D5 JSR $D5F5
and the POKEs should be reversed — ie, POKE 34,250: POKE 35,31.

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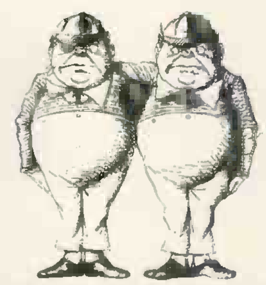

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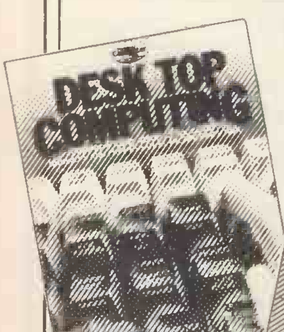

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Benctest: OKI if-800/Checkouts: Heuristics speech link, Softy 2/Calc Corner: Texas T151-111/ Jeff Taylor on computer literacy projects/Introducing TJ's Workshop/ Control your own Substation pt 1/ Programs: TRS-80 Sailing.

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Benchtests: Osborne 01, IBM Personal Computer. Checkout: Sharp IQ3100 Microtranslator. Calc Corner: Casio fx702p. PCW Show report, Benchmark Summary, Euro Micro Chess Championship report. programs: TRS-80 Sheepdog trial, ZX81 Sun and Planets.

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Benchtests: Sharp MZ-80B Philips P2000/School network/BBC Micro inside story/'Turtle' Graphics for Apple/Forth language/Curve fitting/

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Packard Interface Loop/Programs: TRS-80 Solitaire, TRS-80 Ducks, Nascom Business Documents, MZ-80K Race Chase, ZX81 Graphplot.

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benchtest; Monroe OC8820/DB Benchtest: FMS-80/Checkout: Sid 1/Generating screen forms/Comal/Logo/Brain Dump-New series/Calc Corner: Casio FP-10 printer/ Programs: TRS-80 Maths & Trig, PET Boot the Cat, ZX81 Resistor & Res code.

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Benchtests: Apple III, Hitachi Peach/Database Benchtest: dBase II/3D Graphics made easy/ Equation solving/Calc Corner: fx602 quirks/Programs: PET Mini-Animate, MZ-80K Catch, Apple Maze, Atari Sums for kids, ZX81 Book Index, PET Stockmarke, microtan 3D Rotation, Extra for MZ-80K, UK101 Crossword Notepad. With free Word Processing Supplement containing a summary of all *PCW*'s WP Benchtests.

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Benchtests: Sharp MZ-80A/ZX Spectrum/Database Benchtest: DBMS2/West Coast Fire Report/ Lisp/VIC 20 games/Calc Corner: Sharp PC1500/Programs: RML Altered Basic/VIC-20 Large Characters/BBC Breakout/VIC20 Trailblazer/MZ-80K Next-to-Last-One/MZ-80K Tarot.

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Benchtests: Sort M23/Dragon 32/ Database Benchtest: Cardbox/ Preview: Sony SMC-70/UCSD p-System/RS232 Interface/Sirius graphics/NCC Show report/ZX81 Speech Checkout/Calc Corner: Casio fx602p/Programs: TRS-80 Quadrangle/UK101 Conversion of units/PET Mopup/Apple Lifespan/ Apple Trees/Nascom Snail Racing/ UK101 Long Multipliction & addition.

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Benchtests: HP-86; Positron 9000/ Database Benchtest; Personal Pearl/ 3D Graphics for BBC Computer/Hashing Techniques/ Designing your own Database/CP/M-86 v MSDOS/Clock-Calendar Card for Apple II/Calc Corner: hints for Sharp PC122/Programs: ZX81 Star Trek; PET Knockout; PET Trains.

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Benchtests: Jupiter Ace/Torch/ Database Benchtest: Superfile/ Warnier-Orr programming tecniques/Expert systems/Tokyo Data Show report/Forth Benchmarks/Digital Video/The Nearly Man — Charles Babbage/ Portable Computer World — Continued Fractions/Micro Chess/Screenplay — Spectrum/ Programs: VIC Connect-4/ VICMon/Atari character set mover/VIC UFO/PET Forth Teacher/VIC Doppler/BBC Gomoku.

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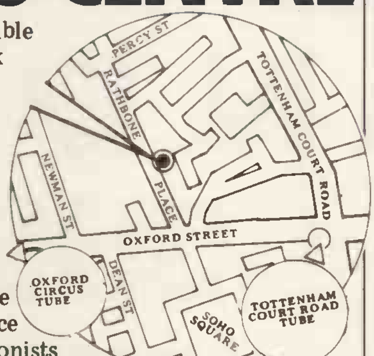

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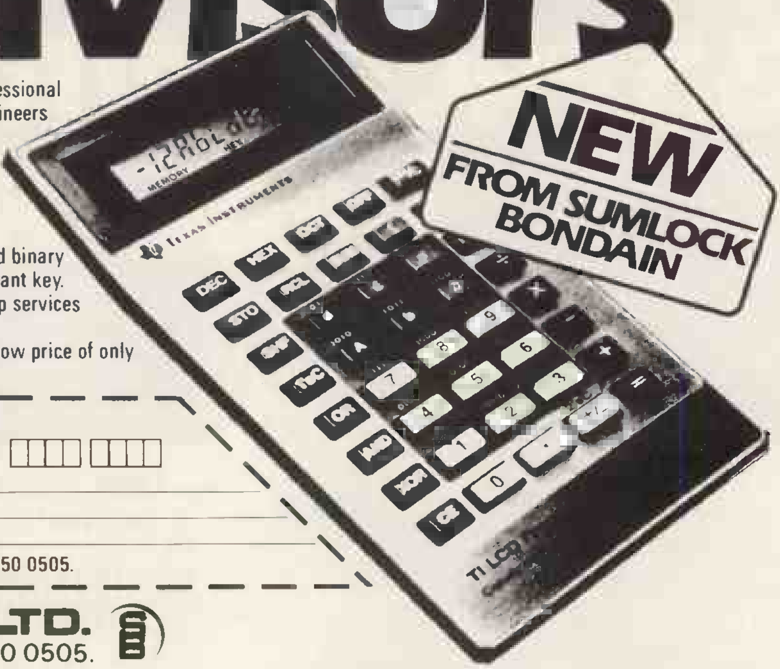

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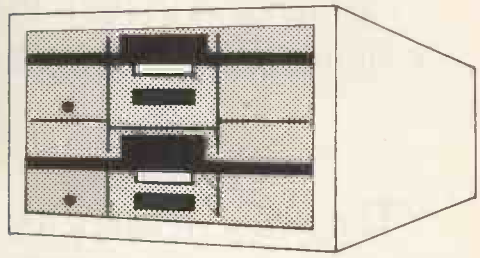

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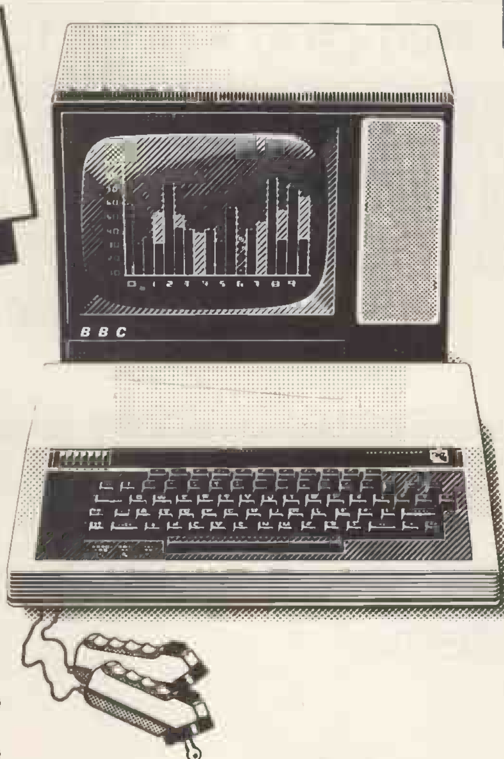

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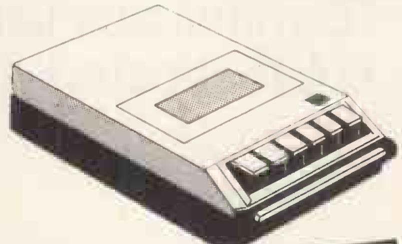

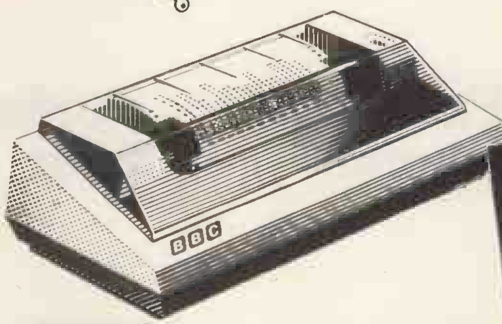

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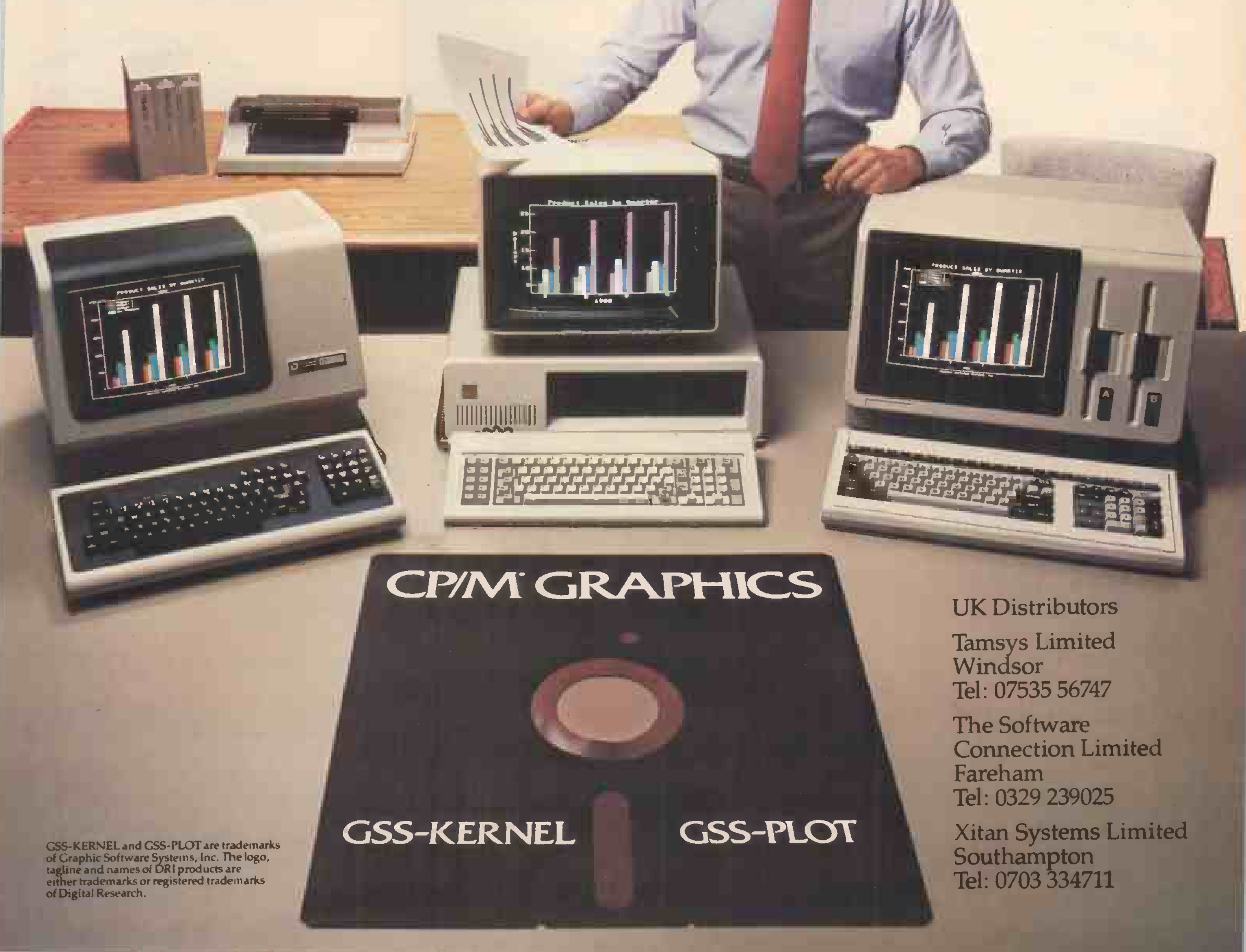

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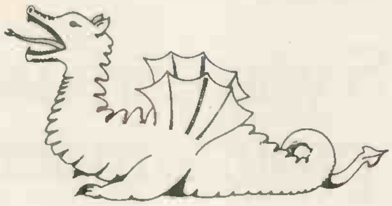

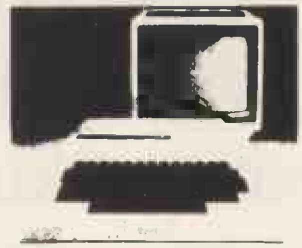

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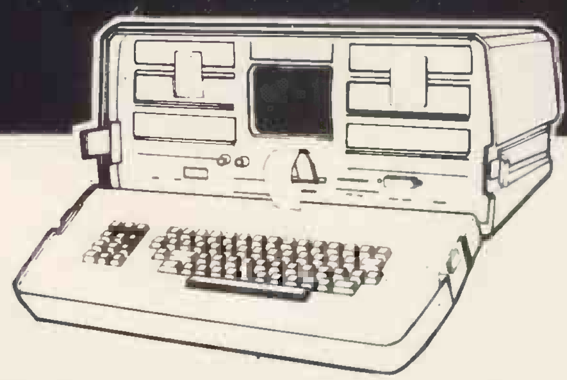

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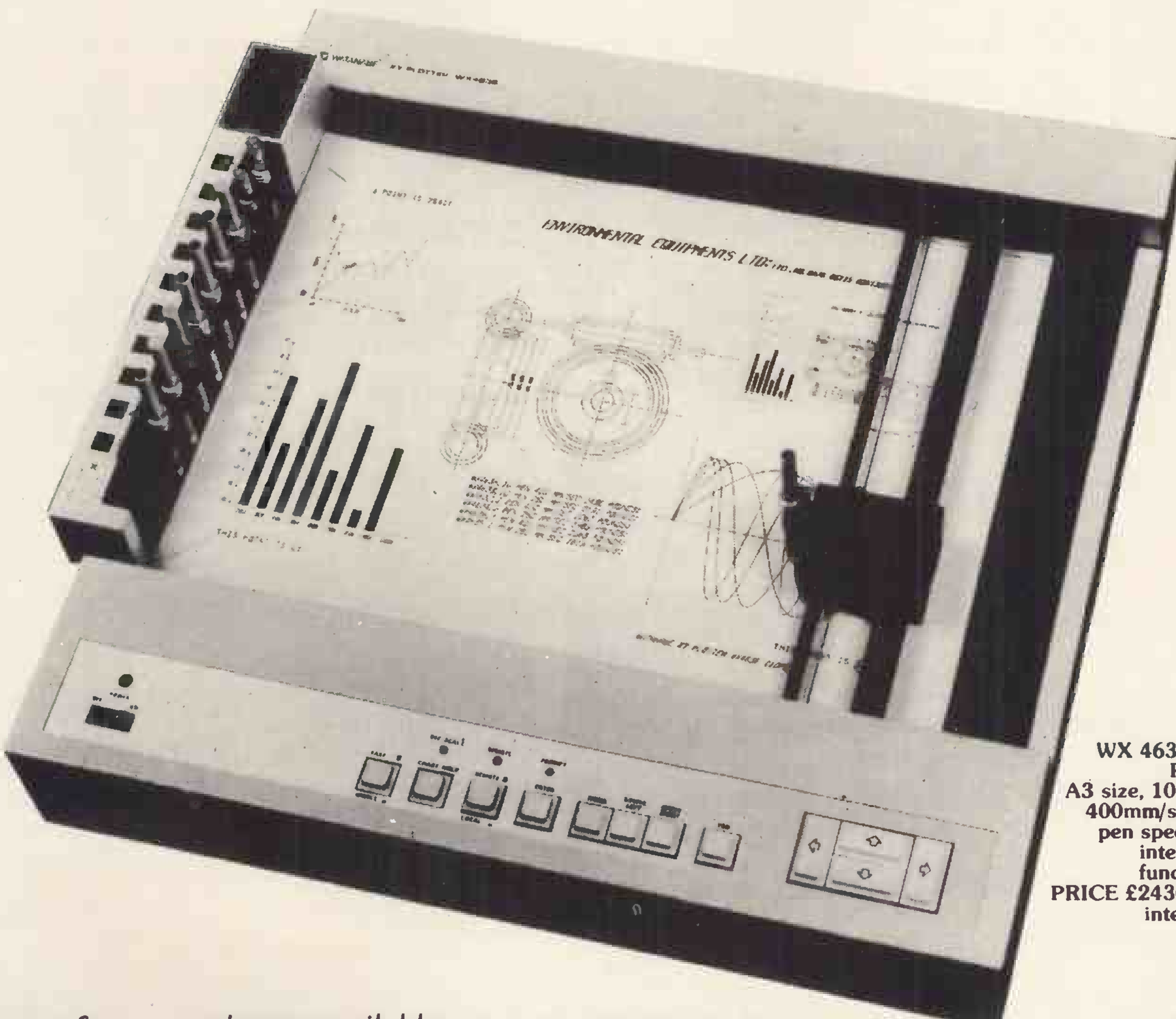

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Obviously it is also complex. This is why it is accompanied by some four hundred pages of manual. It is not the best system for beginners.

On the other hand, LDOS contains so many important features that if a person is just starting out with disks he should be aware of them and, if you like, raised in the right habits. Presently available lower cost disk operating systems are all "first generation" and are primitive. Indeed, they tend to train a person in the wrong direction.

For those people who are either just starting with disks or who wish to get an insight into a full scale first quality disk operating system, smal-LDOS has been produced. It is a sub-set of LDOS and has a manual of 160 pages. It is not an exaggeration to say that it contains most of the advantages of LDOS but still maintains an utter simplicity in use. It is, if you will, a sampler for the main system.

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DATA-WRITER

Data-Writer is, for most microcomputers, a new concept in Database Management. It adapts techniques which have been known and used on mainframe computers for quite a long time. A "normal" microcomputer Database Management program constructs its file in a single plane and is probably more accurately described as a file handling system. All of the data written into each record is filed away on disk in the same place, and it is all recalled and acted upon by the computer as one chunk of data.

Data-Writer approaches Database Management in an entirely different manner in that, subject to one or two requirements, it is not concerned as to how the database came about or the form of it. Indeed, one of the most attractive features of the program is that the data itself can even be written on a word processor — not by Data-Writer at all. So far as we have been able to ascertain, any word processor may be used that writes a plain ASCII file. Certainly AJEDIT and Scripsit are supported. If you do not have a word processor, or do not wish to use it for the manufacture of your database, then there are sections in Data-Writer which in themselves constitute mini word processors and enable the user to manufacture a database very easily.

In the foregoing paragraph we use the words "word processors" in the plural, and this gives a clue to a rather important feature of Data-Writer. The whole concept of the software is that it is a Management program. A number of earlier databases have suffered very seriously from what the author no doubt thought was economic writing, in that if a section of a program (for instance the word processing section) is used by a number of sections, only one is included and is accessed by various sections. At first sight this might indeed appear to be economic writing and we suppose in fact it is, but the result is that the disks are continually thrashing around as access is made to them. Disk access is probably the slowest task that the CPU carries out and if it is done frequently it slows the program down very considerably. Many past Database Management programs have suffered from this deficiency. Data-Writer on the other hand has a mini word processor in each section of the program where it is needed. This has the great advantage of obviating the necessity for the drives to be thrashing around, but almost as importantly means that the format of the mini word processor can be changed for the various sections of the program, so that the best advantage can be made of it in each. Thus every section is entirely separate and gives a very high degree of efficiency and user friendliness.

There are very few restrictions with Data-Writer. The number of records which one can handle in any given database is, essentially, unrestricted although any that span disks would have to have different names. In any event as the Sort section of the program does have a restriction of sorting 4,500 records at a time, this effectively imposes a restriction on the length of the file if one intends to be able to sort it all at one time. The maximum number of fields permitted to a record is 20 and the maximum number of characters per field depends on whether you use the Entry section of Data-Writer to enter your data or whether you use a word processor. In the latter case the maximum number of characters per field is 240. In the former it is 35. The maximum number of characters per field label or title is 20.

Data-Writer has a very powerful mathematical section whereby many complex mathematical functions can be carried out on your data. Up to 20 equations may be defined per run. The section will have available 10 scratch pad memories for use and as the calculations are carried out in double precision they will be carried to 16 decimal places.

Data-Writer also contains a very powerful "Mail Merge" section. Almost any personalisation can be added to a letter or report, and once again the letter or report may be constructed either on the mini word processor provided in Data-Writer or by way of an external one. Indeed we should make it clear that this remark applies to all data manipulation in Data-Writer. In other words, a word processor may be used at any time when its functions would be helpful in Data-Writer. To return to the Mail Merge feature, Data-Writer supports up to 20 different insertions per letter or report and the form letter may be of any length up to 6,000 characters, which we believe is about two and a half A4 sheets.

The Sort is a two level one and supports the extraction of stipulated data from a field. It is what might be called of fair speed. The two key levels make it powerful but as the Select section is so good, the Sort does not get used as often as would be the case in other Databases.

Data-Writer is made up of 10 sections or sub-programs as follows:

Entry	Manage	Maths	Sort	Letters
Edit	Statistics	Select	Labels	Reports

We have aleady mentioned many of them, others such as Edit are self-explanatory. The Labels section enables you to create pretty well any form of label required, including the ability to have them printed up in a from one to four across format. The Letters section enables you to create a form letter in Data-Writer if you do not wish to use an external word processor. Statistics is a method for searching the database for errors, and as the title suggests, extracting essential statistics from it.

The important sections not yet touched upon are Manage and Select. Taking the latter first, this section enables you to create a sub-set of the database by selecting from the file contents. It is immensely powerful and supports nine equivalency relationships, such as "less than" or "greater than" etc. Furthermore, the two logical relationships AND and OR may be used freely. In this way one can Select from the database to pretty well any specification required. The Management section of the program enables the user to completely re-structure his database without having to Edit it manually. New fields may be added or old ones deleted. They may be re-arranged or even appended one field to another. Indeed, this can be taken even further in that the whole database may be merged or split as required.

The Reports section enables the user to write reports such as inventories, accounts, bibliographies, insurance coverage report, in fact an endless list of applications. Because the Report section contains its own Text Editor, the report contents and format can be controlled at will and literally an infinite number of formats may be adapted.

Data-Writer is one of the most powerful Database Management systems that we have seen available for a microcomputer and certainly is the most powerful that we have seen for the TRS-80 and Video Genie machines. Once the database has been manufactured, either by Data-Writer or a word processor, one has complete and utter control over it and the ability to manipulate any part of it; not only the ones mentioned above, but many others which we have not had the space to list. Data-Writer is compatible with the Model I and Model III Tandy machine, the original Video Genie, together with the Genie I and II. A version for the Model III Genie will be available shortly.

Data-Writer is Compiled Basic, hence its DOS compatibility is dependent upon the compatibility of the Microsoft Compiler. Due to Microsoft's disinterest in supporting any other DOS apart from TRSDOS and the non availability of a Tandy Model III Compiler, we recommend customers to use Data-Writer with TRSDOS or LDOS on the Model I and the proprietary DOS supplied on Data-Writer for the Model III. Other DOS's may well be compatible after patching and as we have said the criteria is whether they are compatible with the Microsoft Compiler.

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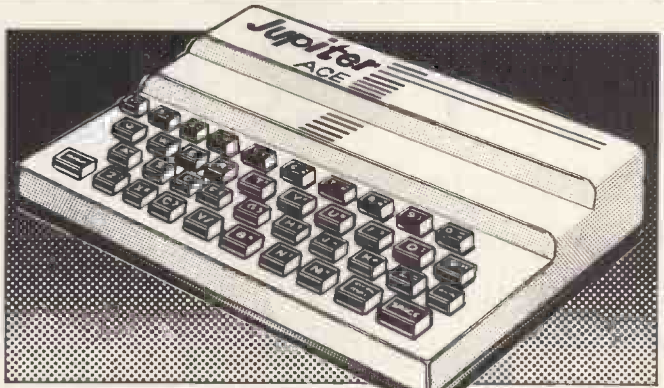

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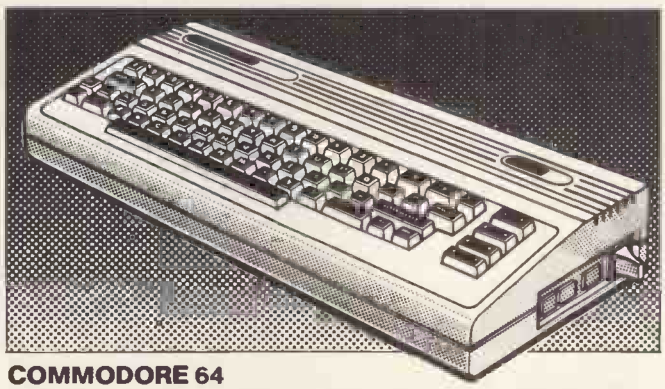

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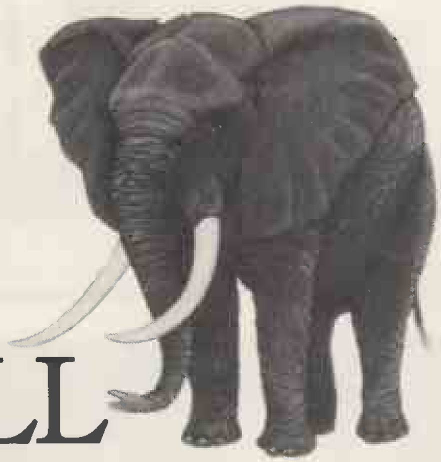

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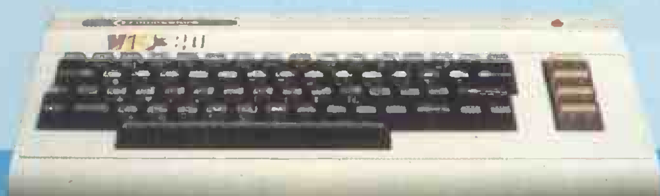

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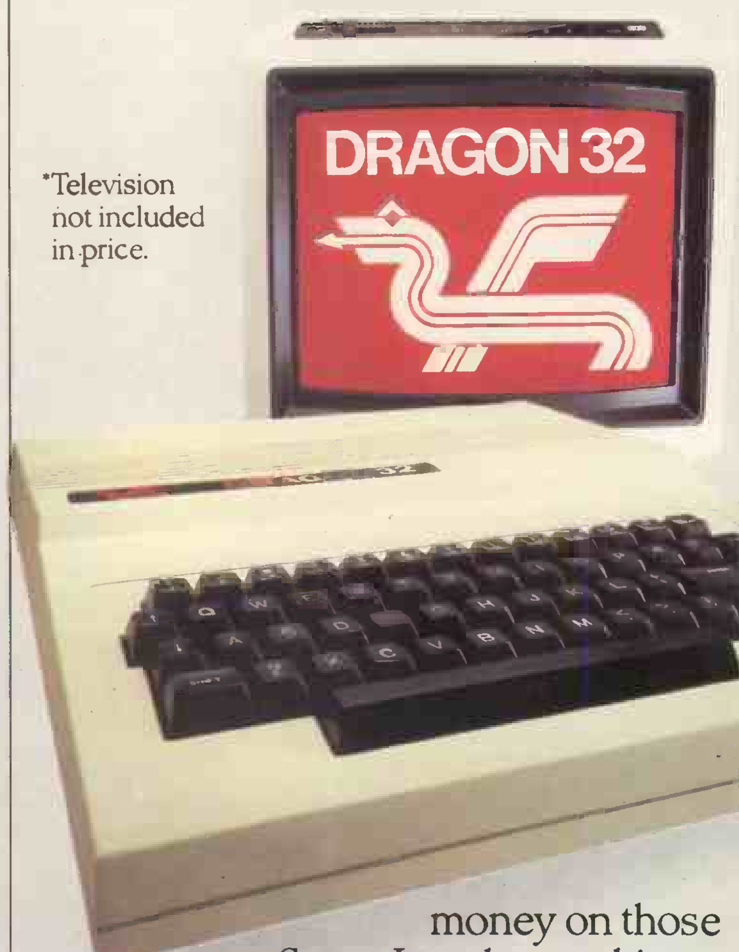

*Television not included in price.

money on those Space Invader machines. How it will magically translate simple typed instructions into beautiful drawings and designs using set, line, circle, draw, scale, rotate and paint features, in up to 9 colours - and play and compose

to your wife.

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with 5 octaves of music. How it will engross your children in mind-boggling adventures in dungeons and caves without even getting their knees dirty. And the Dragon works with any U.H.F. TV.

THEY'LL LEARN AS THEY PLAY.

And then you can casually point out that although the kids are having fun, they're also learning. And within a very short space of time, the whole family will be completely at home with programming - with computer language - with every aspect of how computers work. Which can't do their future prospects any harm at all.

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The Dragon is made in Britain, designed with the help of British Universities. And it's also worth remembering that the Dragon's instruction manual is clearer and easier to understand than any other home computers.

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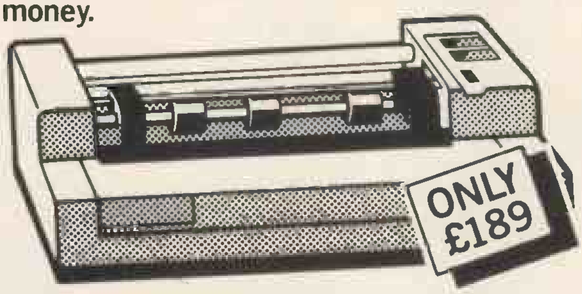

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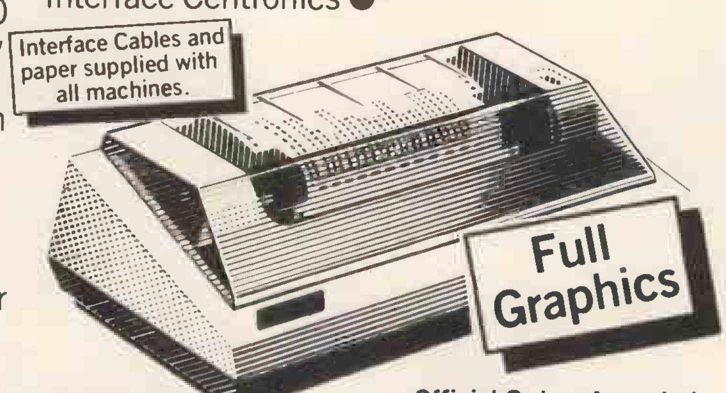

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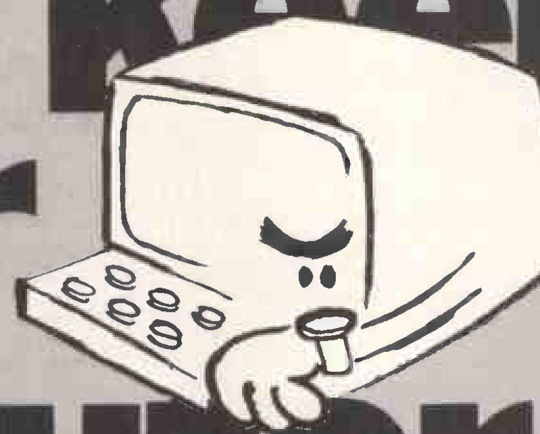

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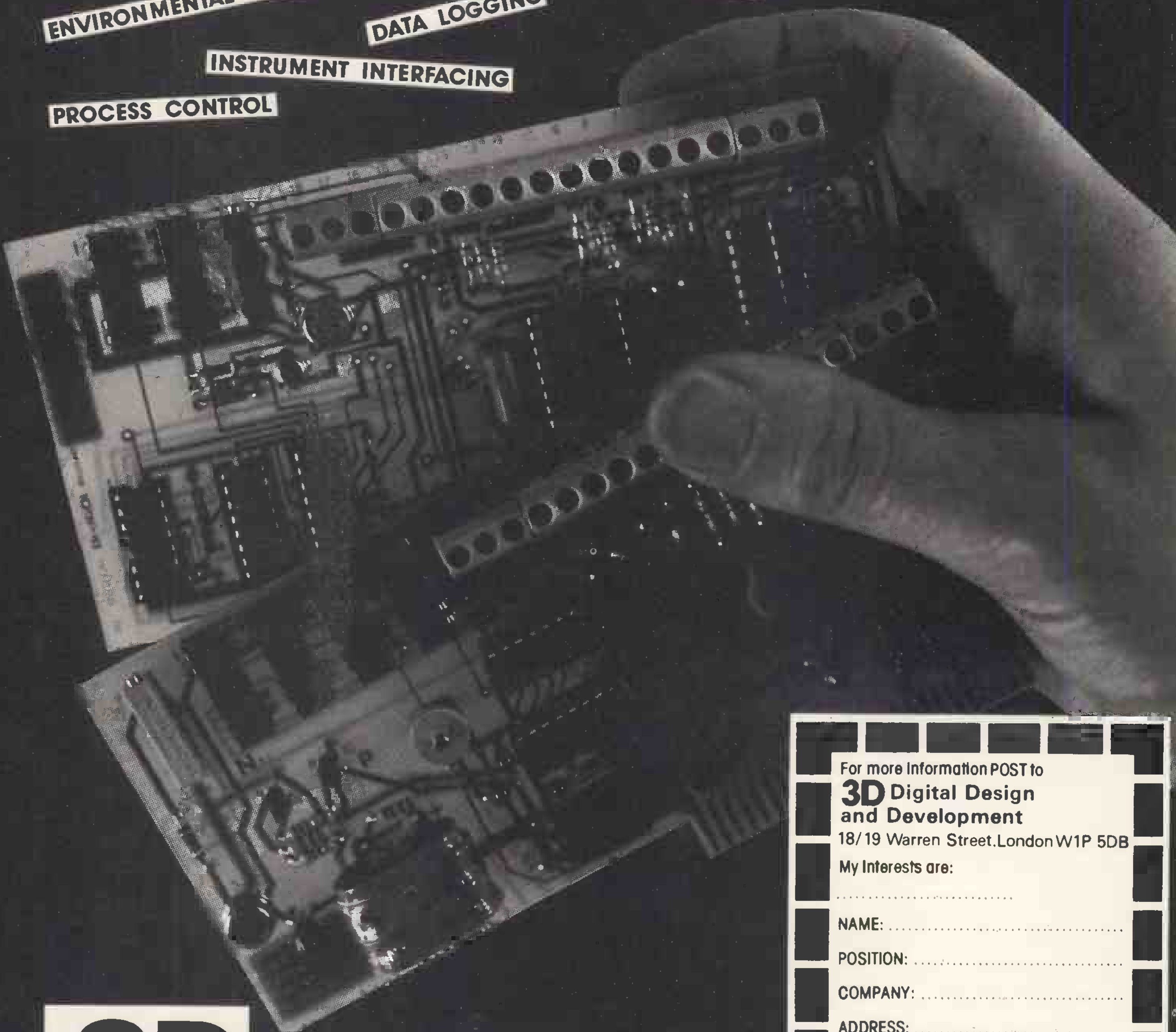

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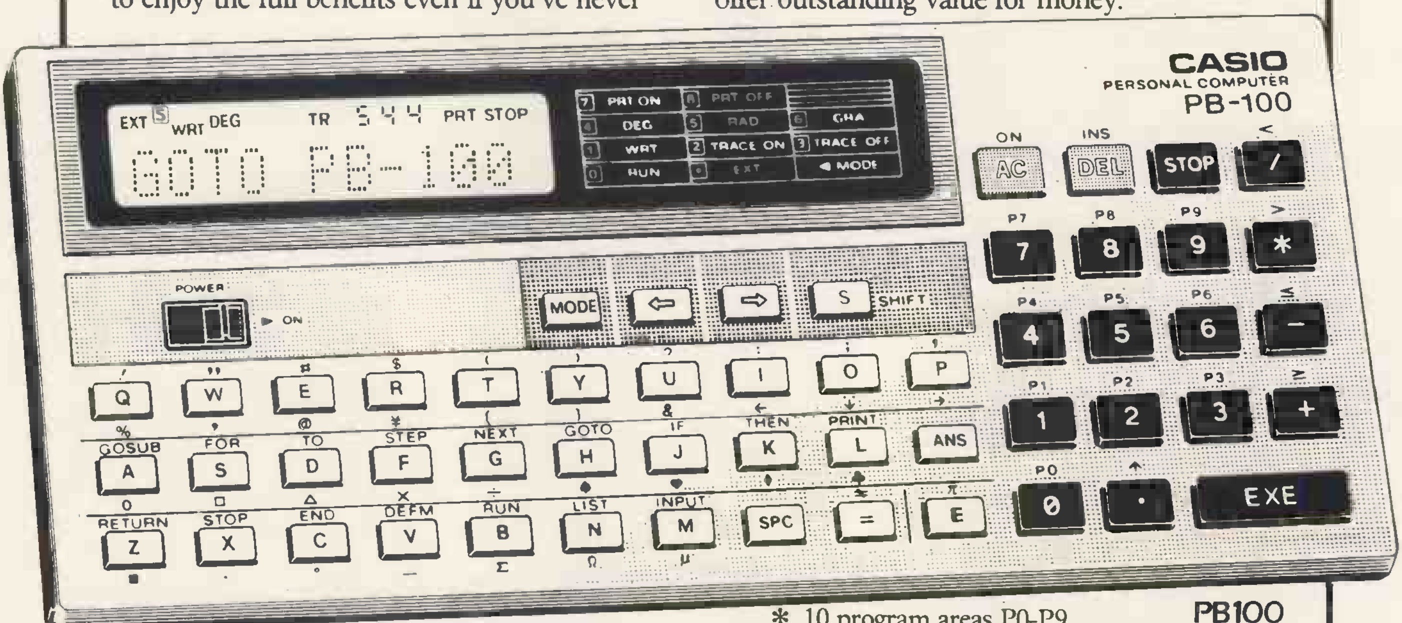

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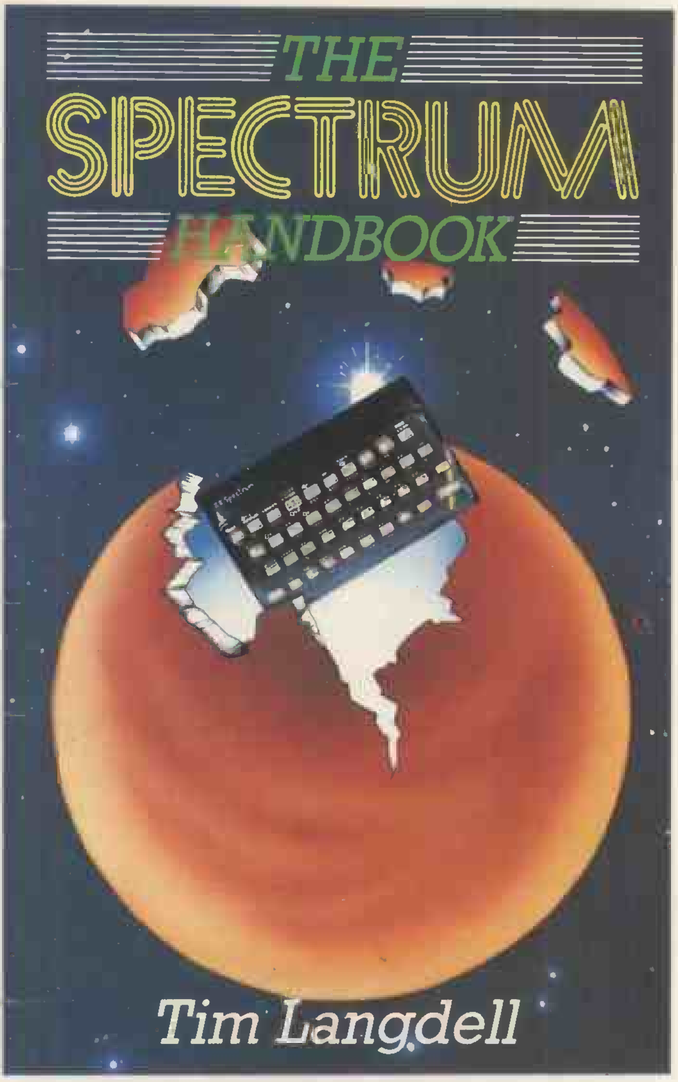

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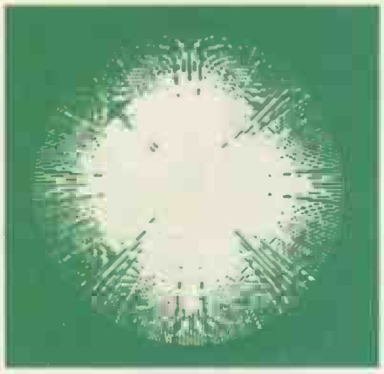

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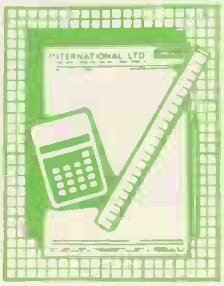

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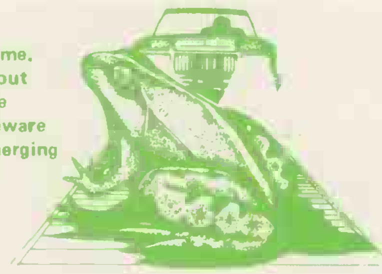

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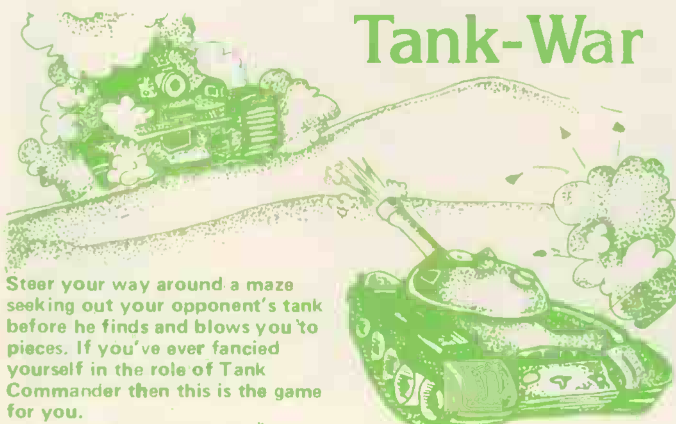

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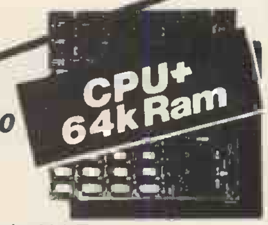

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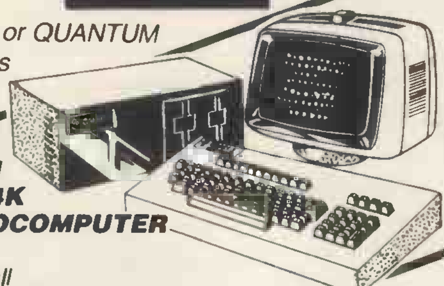

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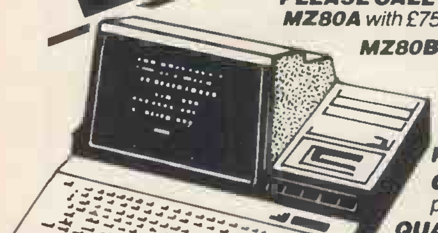

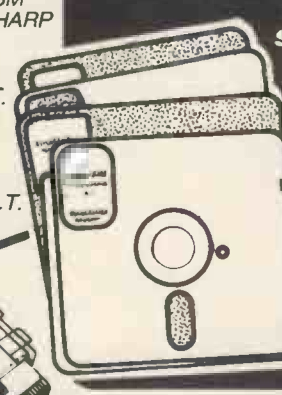

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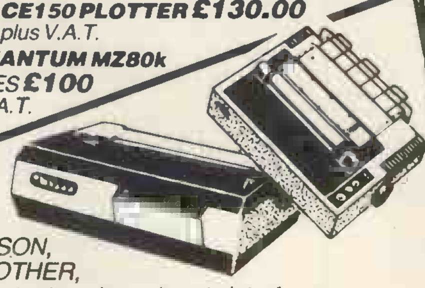

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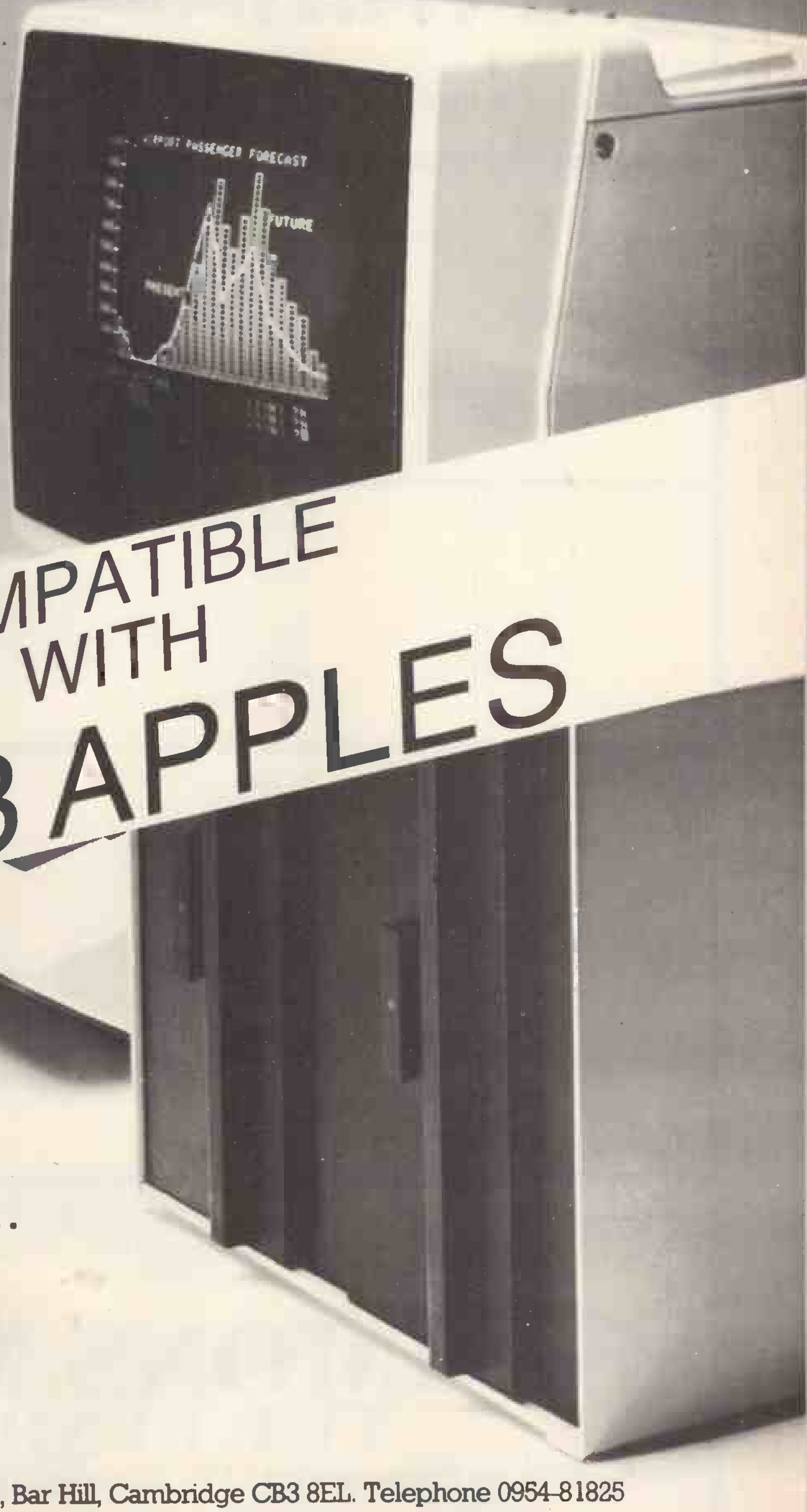

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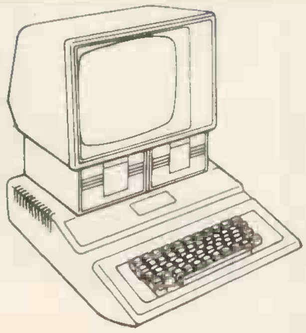

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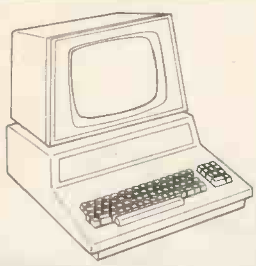

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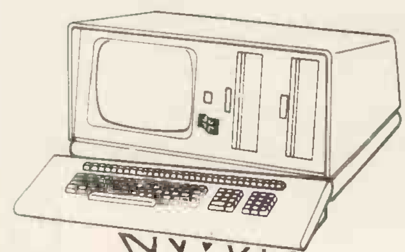

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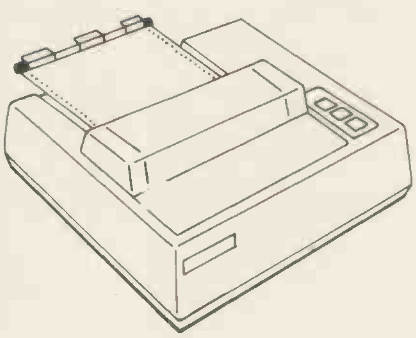

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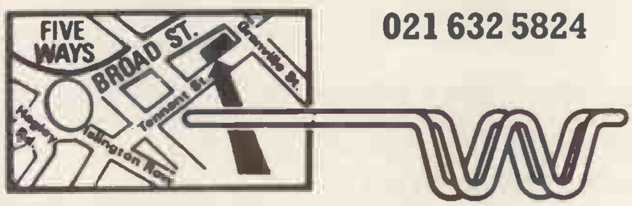

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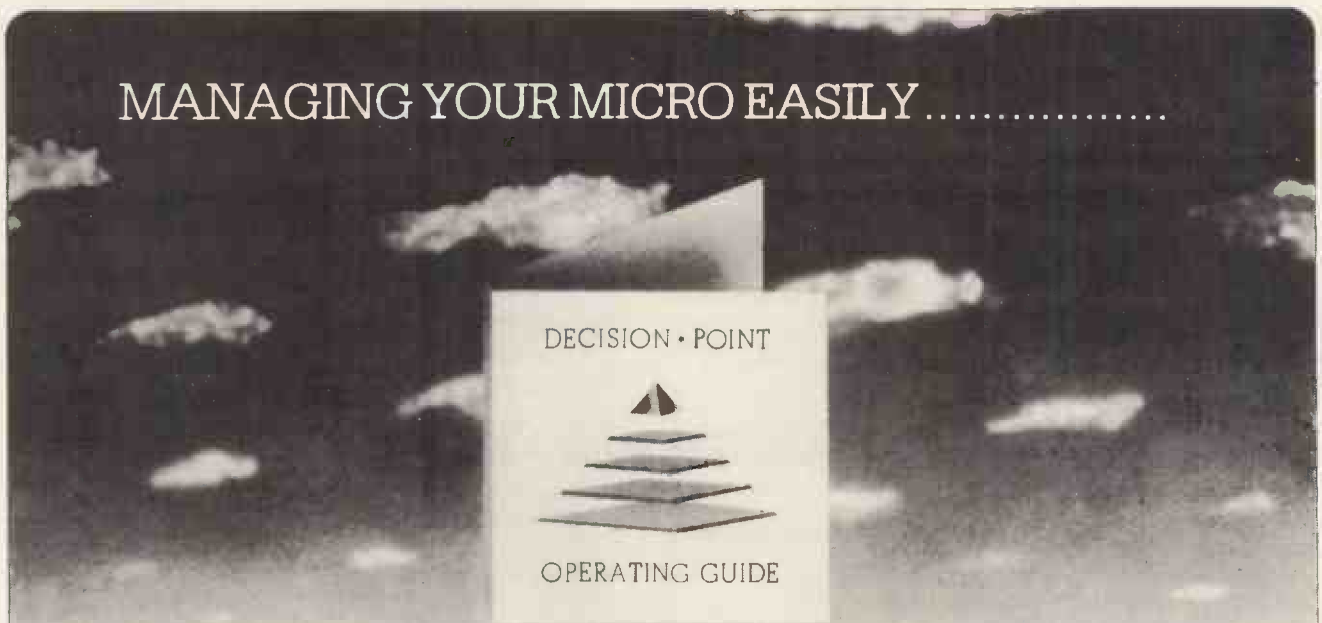

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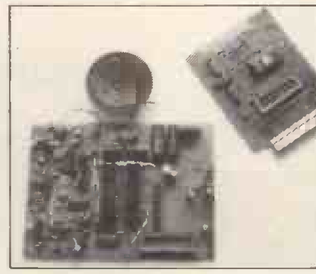

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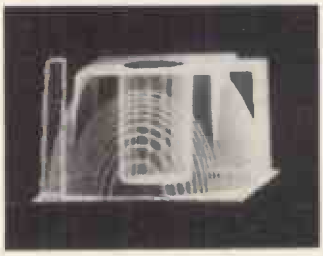

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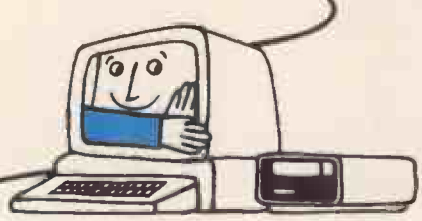

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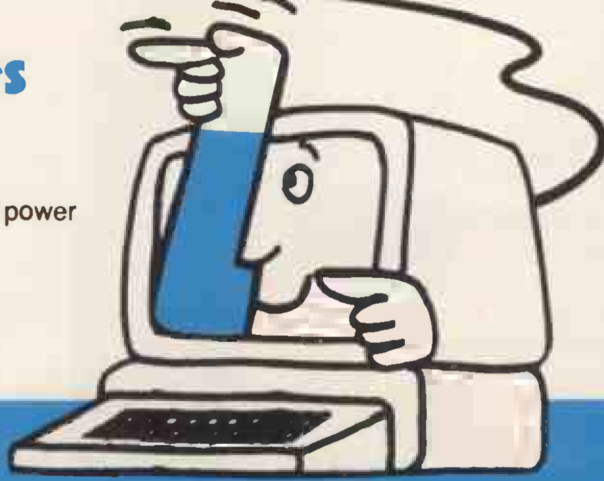

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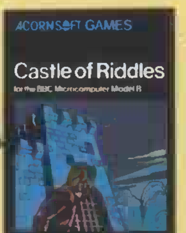

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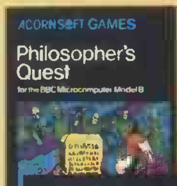

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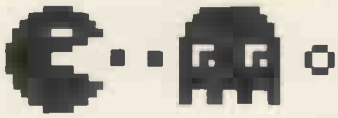

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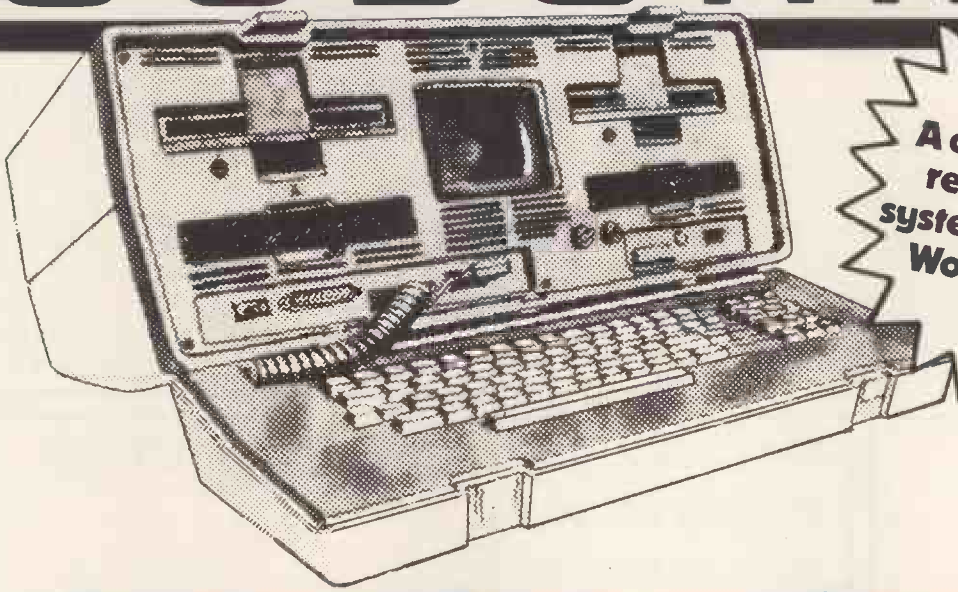

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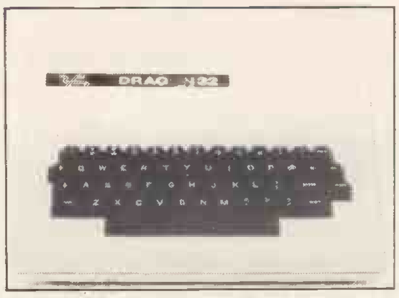

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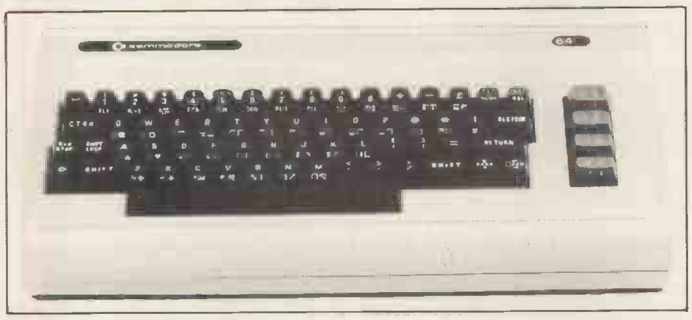

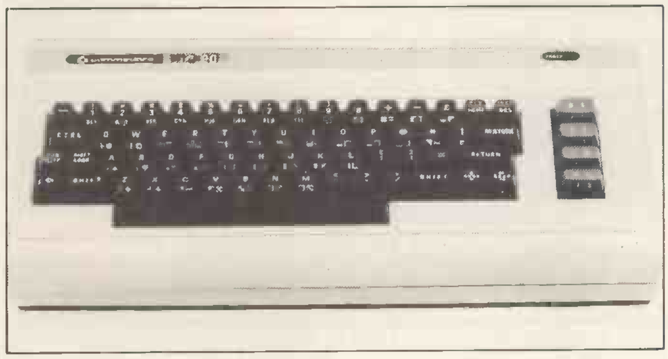

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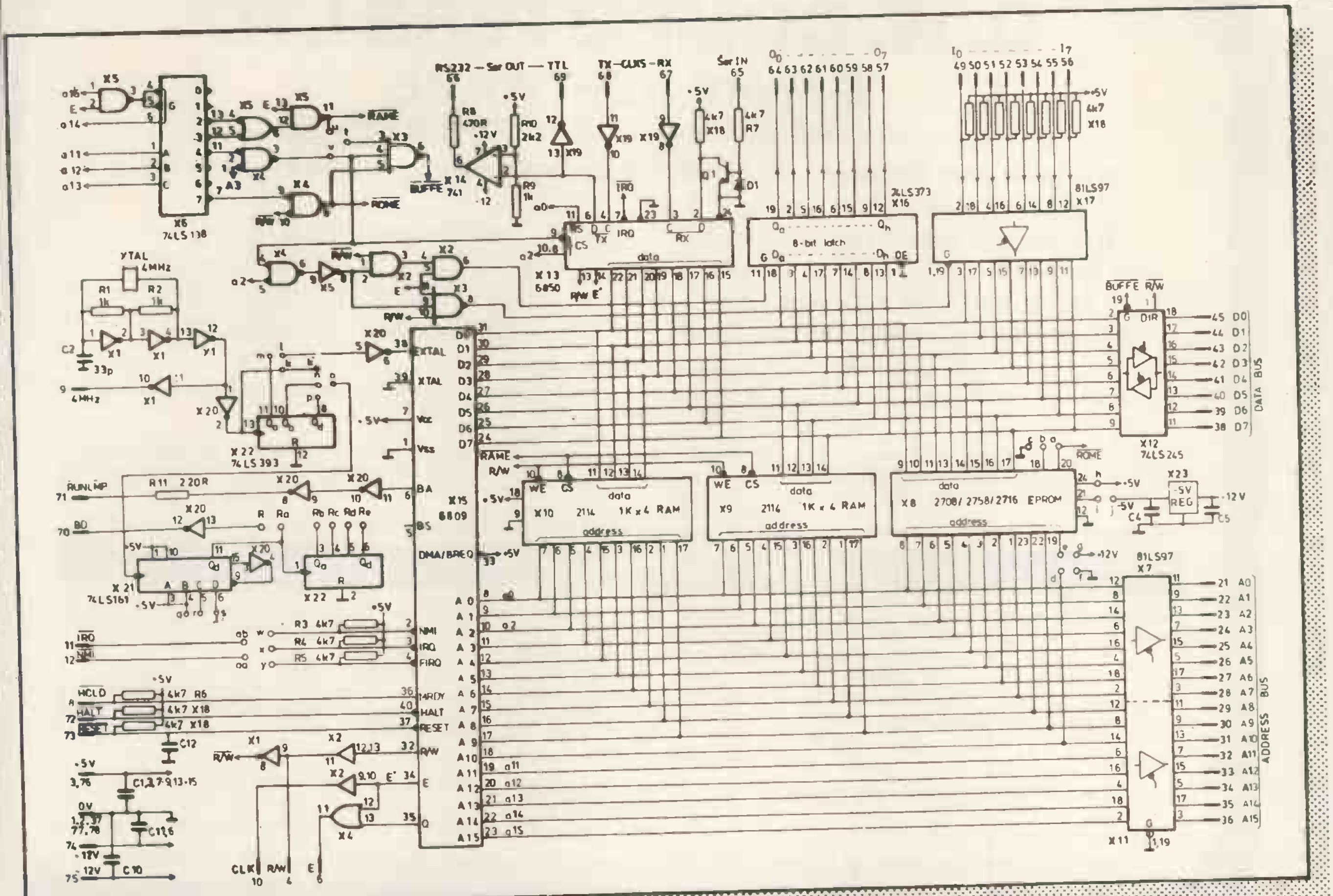

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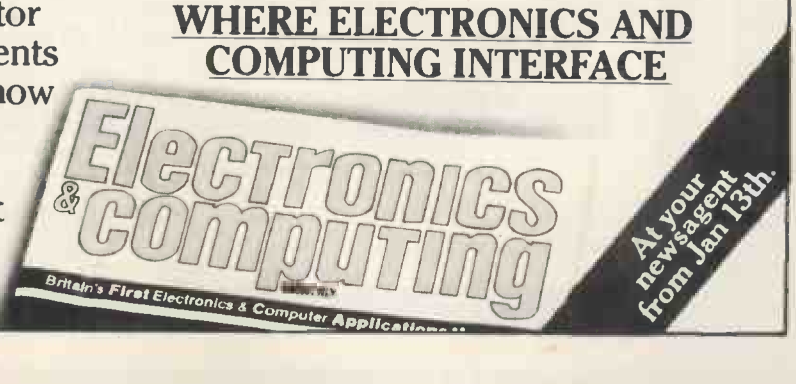

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[1] For comparison purposes, typical professional configurations consists of 16-Bit 8088 Processor, 128K RAM with Parity, Dual 320K 5-inch Floppies, DMA and Interrupt Controller, Dual RS-232 Serial Ports, Centronics Parallel Port and Dumb Computer Terminal or Equivalent.

[2] Columbia Data Products also supports CP/M 80 with an optionally available Z-80 CP/M Expansion Board.

*As advertised in BYTE Magazine, August 1982

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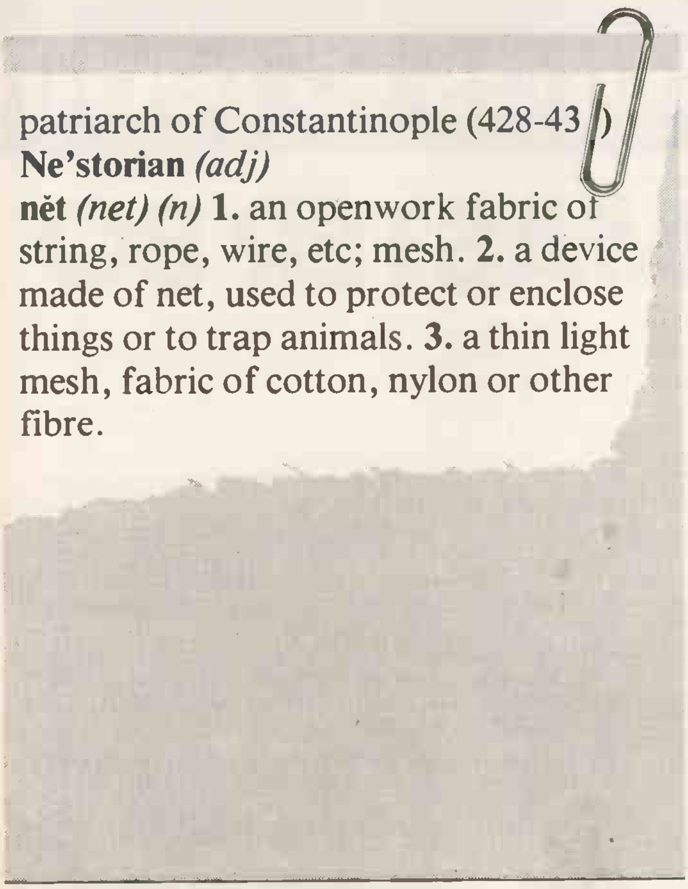

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nĕt'work *(n)* **1.** chain of interconnected persons, operations, or electrical conductors, group of broadcasting stations connected for simultaneous broadcast. **2.** *electronics.* a system of interconnected components or circuits.

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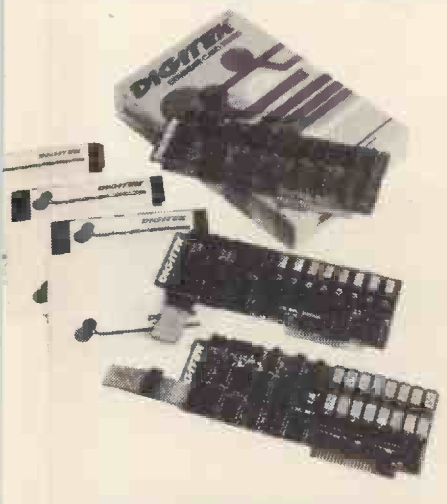

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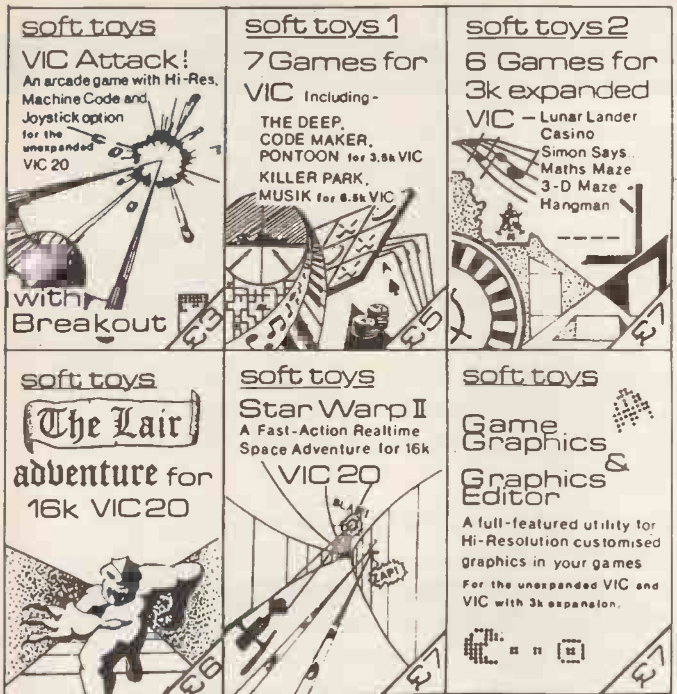

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sy̆mbiosis *(n)* **1.** living together in harmony of two organisms of different kinds *esp* to their mutual benefit.
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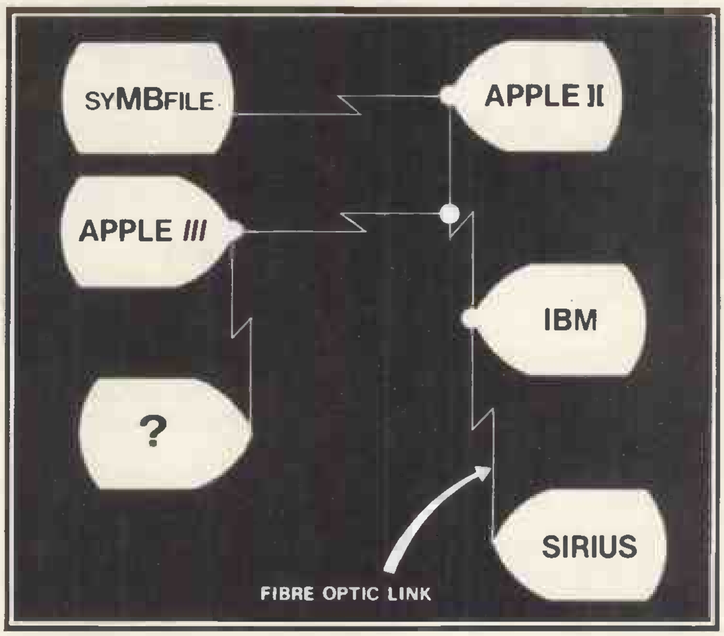

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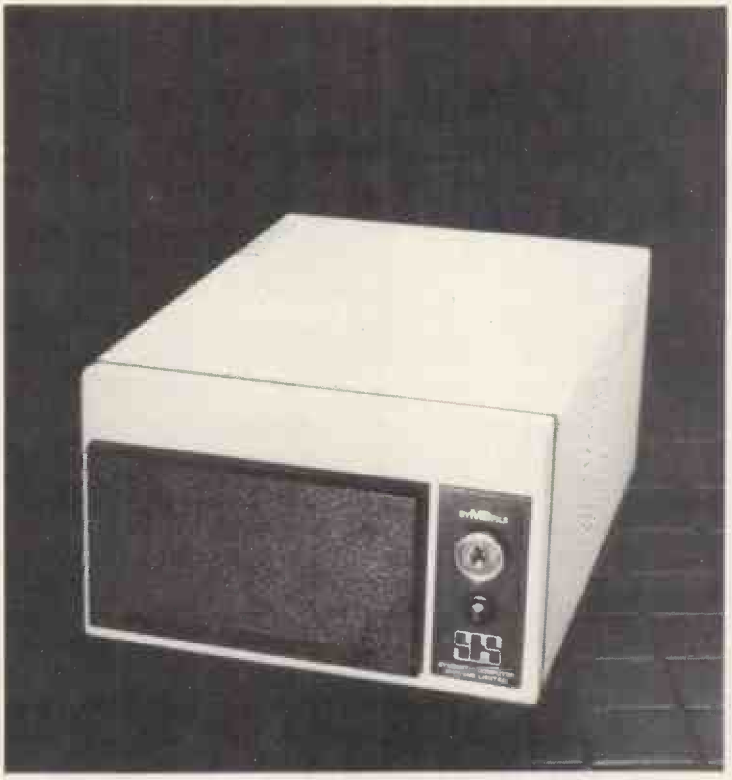

fig II **symb/file**

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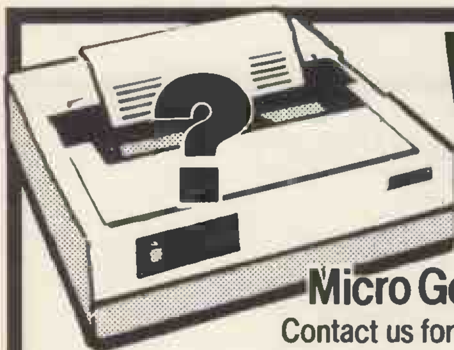

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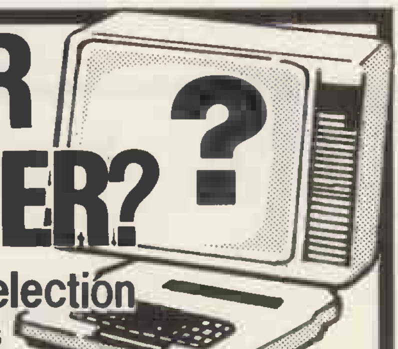

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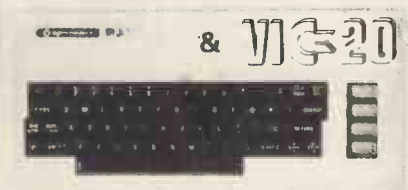

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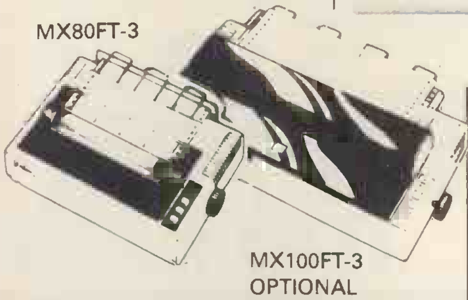

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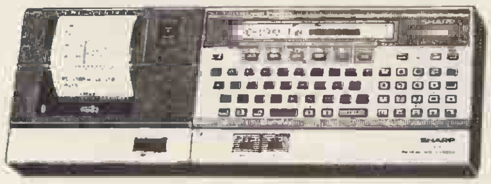

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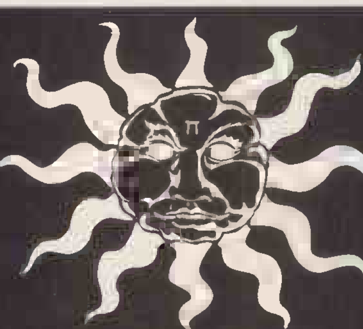

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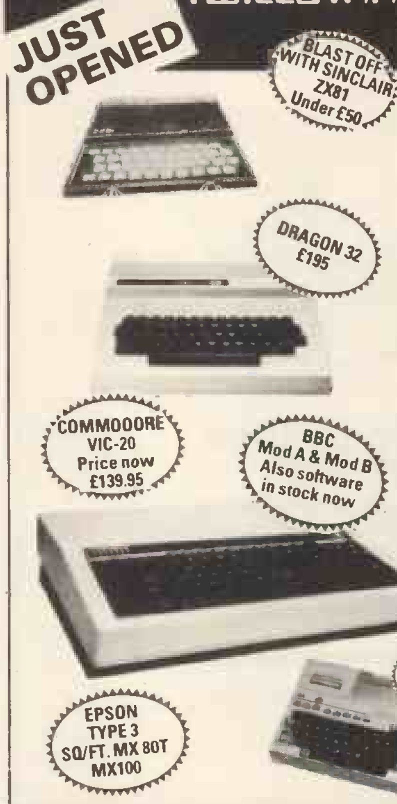

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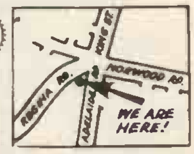

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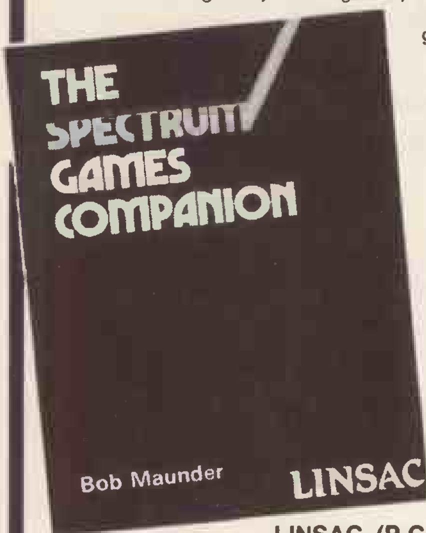

Bob Maunder is co-author of 'The ZX80 Companion' and author of 'The ZX81 Companion'. He is a Senior Lecturer in Computer Science at Teesside Polytechnic, holds an MSc degree in Computer Science, and is a Member of the British Computer Society.

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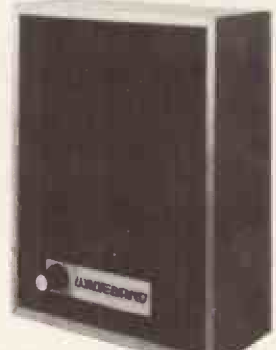

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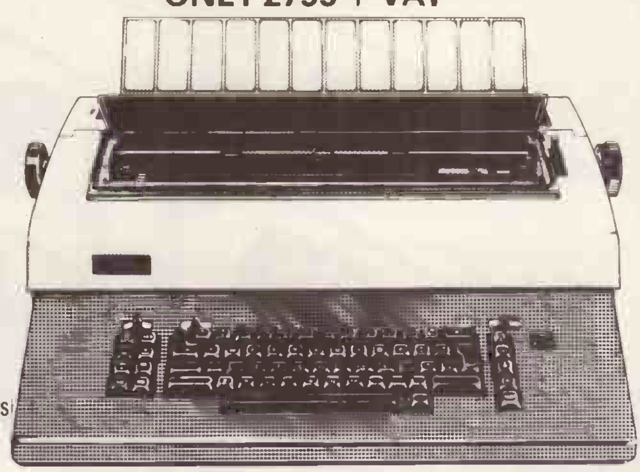

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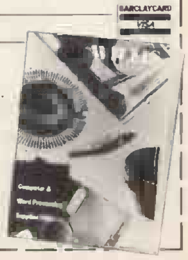

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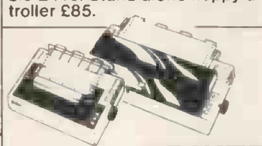

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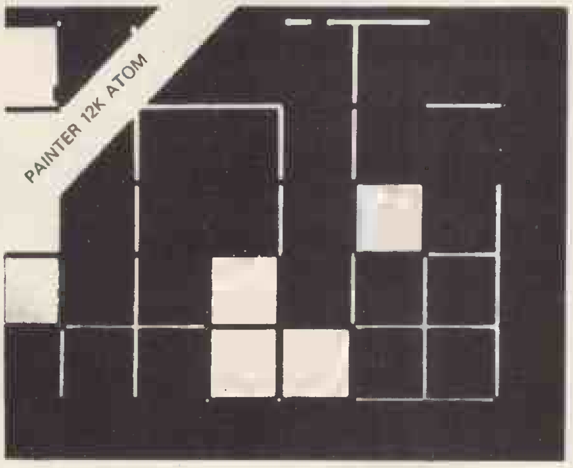

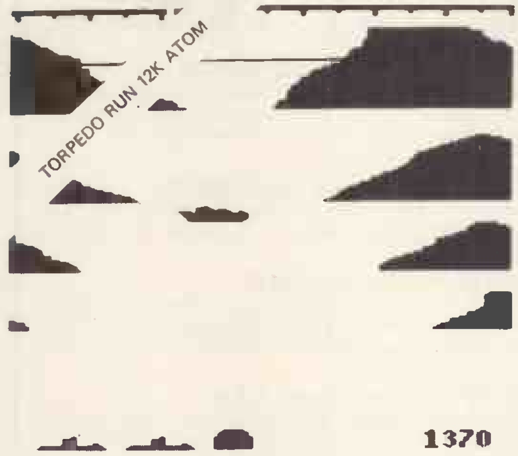

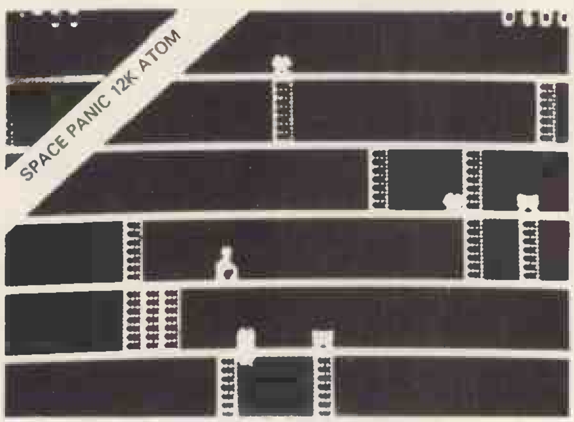

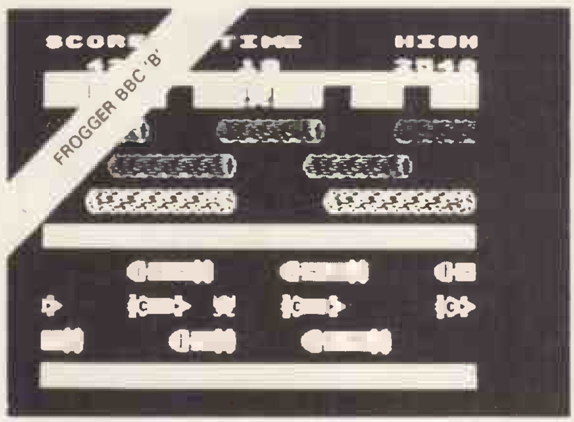

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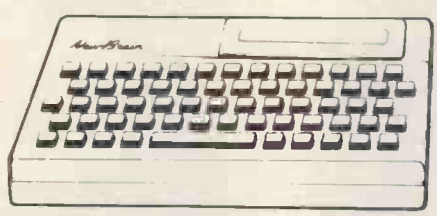

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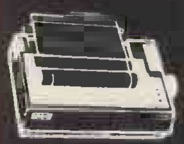

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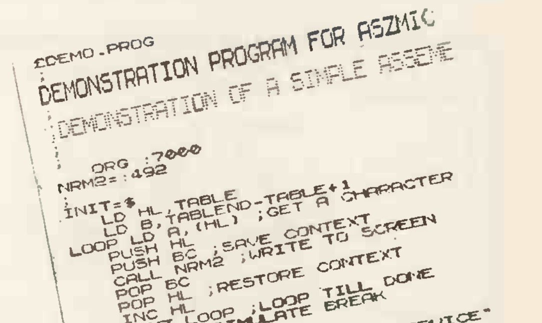
```
£DEMO.PROG
DEMONSTRATION PROGRAM FOR ASZMIC
;DEMONSTRATION OF A SIMPLE ASSEMB

 ORG :7000
NRM2=:492

INIT=$
 LD HL,TABLE
 LD B,TABLEND-TABLE+1
LOOP LD A,(HL) ;GET A CHARACTER
 PUSH HL
 PUSH BC ;SAVE CONTEXT
 CALL NRM2 ;WRITE TO SCREEN
 POP BC
 POP HL ;RESTORE CONTEXT
 INC HL
 DJNZ LOOP ;LOOP TILL DONE
 RST 0 ;SIMULATE BREAK

TABLE=$
 DEFM "ASZMIC AT YOUR SERVICE"
TABLEND DEFB :76;NEWLINE
```

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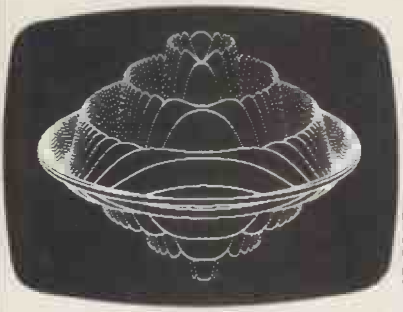
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October Issue: Program Features: Alien Attack; Calendar Generator; Union Jack; Memory display utility. Plus articles on Beebugging; Improving Key Detection; Acorn Press Release on O.S.H.2.; and Issue II Basic; The Tube and Second Processor Options; or New Series for less experienced users; and Software Reviews.

November Issue: Program Features: Racer (excellent 16K racing car game), Mini Text Editor (Mk2), Transparent Loader, Music with Memory, Harmonograph Emulator, New Character set for Modes 2 & 5; and cassette block-zero – bug retrieve. Plus articles on sound and envelope design – includes indispensable envelope editor program; Debugging Part 3, BBC Basics – Memory Maps and addressing explained; Serial Printer Port (RS423) and RGB upgrade. Plus a large number of Hints & Tips, and a guide to our past issues and their contents.

December/January Issue: Program Features: Space City (invader-type game), Breakout, Artist (Joystick painting program); Rescue (miraculously retrieves programs after bad loading or 'Bad Program' message); and Pack – a program to compact Basic programs. PLUS Disc System Review, Software reviews – including Wordwise, Book reviews, Adding Joystick interface to model A; How to access the video controller chip; and ideas for the newcomer; plus a new crop of Hints and Tips.

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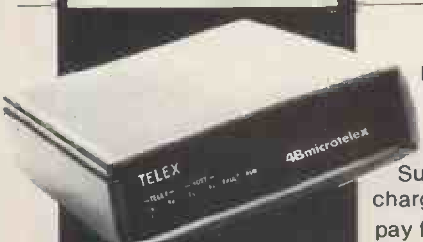

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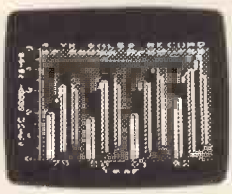

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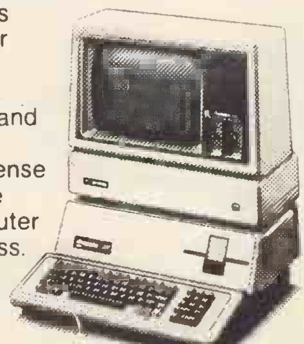

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ADVERTISERS INDEX

CHIP CHAT

Erstwhile *PCW* Editor 'Tebbo' was helpless with laughter recently in the gents' in Atari HQ. Each, er, location sported an Apple logo 'right where you aim'. We've heard of toilet battleships but this is ridiculous. . . Ex-*PCW* publishers Bunch Books held its annual orgy (sorry — Christmas party) early in December. Editor Rodwell and Programs Editor Maggie Burton arrived sporting hats with a row of flashing lights on them. We are told the flashing lights were morse code for something very rude in Albanian. The party was held in a very posh restaurant in Soho, and publisher Felix Dennis is taking everyone back in January to apologise.

Commodore now seems to have chosen the Hanover Trade Fair as *the* place to launch new products. Before some of the machines launched at the '82 Fair were even available in shops, rumours were already circulating about the '83 launch — top favourite is for a 16-bit machine of some sort, but cynics are muttering about this being no more than the 8088 plug-in board for the 700 series

Prospective buyers of the Atari 800 computer will be pleased to know they can get it for £100 less than they would have previously. Advertising blurb says '*Now, save £100 on the one you were going to buy anyway*'.

Readers' attention must be drawn to the comical little chart reproduced elsewhere here which appears in the middles of the Oric brochure. Note references to 'pedigree' (from a new company which has never brought out a computer before), 'driveability' (*what that? — Ed*) and to 'Japanese imitations'. You have to laugh, you know — you'll go nuts if you don't. . .

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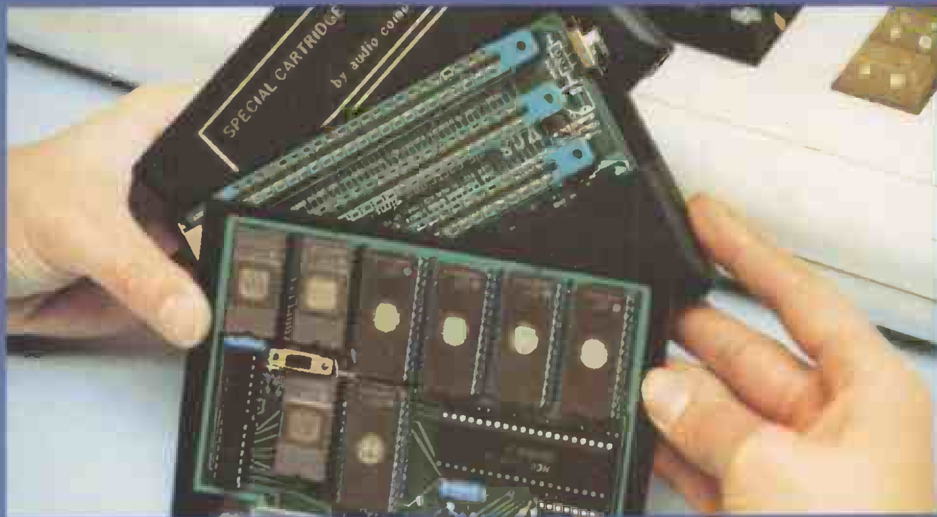

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