Practical Computing

TOP 20 PORTABLES

85p September 1983 Volume 6 Issue 9

EDUCATION & TRAINING
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>FEATURES

>REVIEWS

>REGULARS

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Every effort is made to check articles and listings but *PC* cannot guarantee that programs will run and can accept no responsibility for any errors.

One man, one microprocessor

PRACTICAL COMPUTING, both as a magazine and as a subject, has very little to do with politics. Particular government decisions, of course, have an impact on particular companies, but it is doubtful if this has any substantial effect in the long term, in the absence of other changes.

While the major political parties try to present themselves as alternatives, none offers a radical policy on computers. Radical alternatives would be:

A. Everyone has, by law, to learn to use a computer. The price of a micro will be deducted from your wages or social-security payments.
B. All computers will be banned Anyone caught using one will be shot.

It is obvious that destination A is, in some sense, inevitable, although a less fascist route will be taken towards it. The computer may have to pretend to be a teacher, a game or a cash till. It is equally obvious that route B would lead to the collapse of a most important export sector — "invisible" exports — plus a decline in industrial competitiveness and inevitable national bankruptcy.

In fact, both Labour and Tory politicians know which way the wind is blowing, as do the rulers of every other industrial nation. They are like old men haggling with a whore on a street corner. Both parties agree on the fundamental nature of the transaction. The arguments are about the method and the price.

Putting micros into primary schools merely accelerates the inevitable — or at least, it is meant to. Propping up some absurdly uneconomic coal mines in South Wales merely delays the inevitable. Technology itself develops regardless of such attempts — whether misguided or laudable — to soften the blow.

In the end it comes down to a choice between technology and tyranny. Without resorting to a police state, as in the Russian empire, governments have no hope of controlling technology. And it is technological developments, not governments, that have produced all the fundamental social changes of the last 200 years: steam power, electricity, motor transport, air travel, antibiotics, television and microprocessors.

Within the business world, computer power is reaching the hands of more and more people. In 1982, for example, the value of large mainframes shipped slumped by 68 percent to £76 million.

At the same time there has been a massive boom in the use of personal computers in business. Instead of being concentrated in the sacred hands of the data-processing department, computer power is spreading among lay user. Naturally they will not always use this power in ways that governments would approve of.

Computer-literate people with quick and open minds will use the new technology for their own ends, not be dominated by it. While some will abuse its power, the wide dissemination of that power still looks, in the long term, the best opportunity not only for eventual economic recovery but for freedom itself.

PRICE INCREASE

This month the price of *Practical Computing* has gone up for the first time for over two years. The 5p increase is mainly to cover higher cost including, this year, more editorial pages, increased staff, higher payments to contributors and further improvements to the magazine which will become evident over the next couple of months. *Practical Computing's* circulation is showing healthy growth in spite of the volume of competition, and we will try to do even better. While the price increase is regretted, *Practical Computing* will remain — with your continued support — the best value micro magazine on the market.

5 Years ago...

With individual computers to work from, a single teacher could have much more personal interaction with the students, because he would be free from supervising students from the front of the room, and the computer would keep each student occupied at the interest level appropriate for that student.

Se would no longer have to be satisfied with teaching to the average student while losing the slow learner and boring the bright students. The computer lab could take us one step closer to true individual instruction, without having to reduce classroom sizes to 20 students to do it and that could be very important in getting more from fewer teachers. What is needed now is software. The Pets and other low-cost computers are here. What is not here is the canned course library of curriculum materials and application materials and software for using the computer.

Educational software is probably the most neglected area of personal computing. The hardware and Basic has arrived this year. The next big arrival will be the applications software; and after the applications software will come educational software.

Practical Computing, Volume 1, Issue 3.

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74S139	115
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74S158	195
74S175	260
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74S189	140
74S194	195
74S201	250
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74S244	290
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74S112	90

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7411	15
7423	18
7414	20
7420	15
7422	20
7427	18
7430	14
7442	32
7447	40
7400	11
7448	40
7473	24
7474	20
7475	25
7485	60
7486	20
7489	170
7490	20
7491	35
7492	25
7493	25
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74116	50
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LS11	12
LS13	18
LS14	26
LS19	58
LS20	13
LS22	12
LS27	12
LS32	13
LS30	12
LS30	15
LS42	28
LS47	35
LS48	55
LS63	120
LS73	18
LS74	18
LS75	20
LS85	42
LS86	16
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	25
LS158	30
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LS242	55
LS243	55
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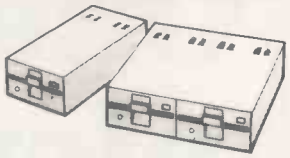

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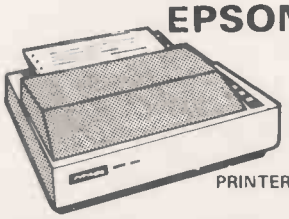

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3 2768M	150	24 930M	325
3 57594	98	48 0M	175
3 6864M	300	100 0M	375
4 0MHz	150	100KHz	238
4 433619	100	1 28MHz	392
5 0MHz	160	2 4576M	200
6 0MHz	140	3 276MHz	160
6 144MHz	150	4 032MHz	290
6 5536M	200	4 194304	200
7 0MHz	150	4 80MHz	200
7 168MHz	150	5 185MHz	300
7 68MHz	200	5 24288	390
8 0MHz	150	7 7328M	250
9 0MHz	200	8 0833M	395
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36"	20way	26way	34way	4way
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2 end	290p	370p	480p	525p

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14pin	10p	35p
16pin	10p	42p
18pin	16p	52p
20pin	16p	52p
22pin	25p	70p
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DIL PLUGS (Headers)

	Solder	(IDC)
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40 pin	250p	265p

AMPHENOL PLUGS

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36 way Centronics	
Parallel	485p

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- MICROVITEC 1431. 14" Colour Monitor. RGB Input. Cable included £249

EURO (DIN) CONNECTORS

	Female Strt Pins	Female Angle Pins	Male Strt Pins	Male Angle Pins
DIN41612 31way	170p	—	—	175p
41612 A B 2 - 32way	275p	—	220p	285p
41612 A C 2 - 32way	295p	340p	240p	300p
41612 A B C 3 - 32way	360p	385p	260p	395p

EDGE CONNECTORS

	.156"	.1"
TWO ROWS		
2 x 18way	145p	180p
2 x 22way	200p	199p
2 x 23way		185p
2 x 25way		225p
2 x 28way		210p
2 x 30way		245p
2 x 36way		295p
2 x 40way		315p
2 x 43way		395p

D CONNECTORS: Miniature

	Male 9way	15way	25way	37way
Solder	80p	110p	160p	250p
Angle	160p	210p	250p	355p
Pins	120p	130p	195p	295p
Female				
Solder	110p	180p	210p	350p
Angle	165p	215p	290p	440p
Pins	150p	180p	240p	420p
Covers	85p	80p	80p	100p

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

● Circle No. 102

What standard?

IN MY YEARS in the computing profession I have yet to find a standard operating system. Your comment in the news item headed "Buzby's micros" — July issue — that "it looks like a non-industry-standard OS" therefore took me by surprise.

Even on micros there are dozens, and once you get to mainframes every manufacturer supports a multitude of operating systems. The few machines I have experience of have run MP/M, CP/M, CP/M-86, MS-DOS, P-OS, NasSys, BBC OS 1.0 and 1.2, Exec 1, George 2, George 3, VME/K, VME/B, VME-2900, RSX-11, VMS, etc. OK, so I have cheated and some of these operating systems run on largeish mini and mainframe computers.

When the "industry standard" operating system arrives you will, no doubt, let us know. Some masochists might say that Unix is the one. But until then, please do not dismiss as "non-standard" what may be an excellent operating system.

A B Spence,
Macclesfield,
Cheshire.

Rip-off repairs

I FOUND the article "On the track of London's Rip-offs" very interesting, as this application can obviously be taken up at many levels by amateur groups. It is ironic that an Apple II was used, as I feel that Apple registered dealers — or some of them — should be included on the rip-off list.

A while ago my Apple would not load VisiCalc. Someone suggested that the disc drive might need adjustment. I took the drive in to a registered dealer. They checked it and charged me £17.50. The receipt said "for adjusting disc drive". The Apple still did not work. I took it back and they found a chip had gone, and charged me another £17.50 for this.

They could easily have told me in the first place that nothing was wrong with the drive and advised me. If they had done so I would have respected their honesty, and happily paid for the time they had spent and the knowledge I had gained.

Later my power unit went. I rang a leading dealer in London and was told it cost £190 to replace. I took the power unit to another dealer and asked if they could repair it. They said the units are sealed and have to be returned for repair, but they would part-exchange it for £80. It was not clear to me what use they would have for a defunct power unit they were not allowed to repair. And if they were allowed to repair, why didn't they offer?

In despair, I gave it to a TV servicing shop and told them to open it up and check if it was anything simple they could fix. They did, and found the rectifier faulty. They charged me £19.50 and apologised for the cost as they felt the whole unit could hardly be worth more than a tenner.

My Apple now works perfectly. I will avoid dealers as much as possible in the future, and hope that more and more TV shops will be prepared to have a go at fixing these machines. If I ever start my own rip-off data bank, then Apple dealers will be at the top of the list.

Peter Hursley,
London NW2.

Valued custom

THOSE WITH Apples, Tandys or Pets may have it easier, but for most hobby computerists getting anything other than the bare machine can be a frustrating task. In my experience computer shops are overcrowded and understocked. The only alternative appears to be mail order. Fine for chips and software. Rather worrying for heavy or delicate peripherals that will need servicing and repair.

But look in the yellow pages under Computer Systems and Equipment and you will find lots and lots of suppliers. At random I chose The Holdene Group and went to see them about a printer. After a private demonstration and chat in their showroom I decided what I wanted was an Epson RX. They didn't have one in stock but said they'd get one by courier for the next day and make up a lead for my micro, all at a price that beat the opposition. The local shop said they were expecting some "in about six weeks".

On getting home and plugging in — no issue! "Bring it back and we'll have a look," said the Holdene man. I didn't remind him it was 4.30 on Friday afternoon. I took the whole system with me, and he was still remarkably jovial at 6.30 when we found that the fault was in the micro. Then he mended it — for free.

If I had bought by post I would have been up silicon creek without a games paddle. Instead I felt like a valued customer and not the next nuisance in the queue.

Obviously most system suppliers' customers are valuable, and private users can benefit from the same service when buying major items.

Bob Lewin,
Edinburgh.

Sexist ads

I AM STUDYING the portayal of women and girls in computer advertisements. Most ads are dreadfully sexist, but I do enjoy the occasional ad which involves women as participants rather than spectators in computing. This is especially gratifying when it is in the lay or popular press.

Last autumn, a series of Dragon ads were particularly offensive. Two of the headlines were: "Like Father Like Son", and "Read this Ad to your Wife", implying that only men bought computers. I wrote to the company and complained, twice, but received no reply. Recently I saw a beautiful ad by Dragon. In large type, it said: "If you want to know which computer to buy, ask your expert", and the expert was portrayed as a girl in cap and gown.

Maybe it was just a coincidence. But maybe my letter, and others, did influence Dragon. I did write to the company and told them that I was pleased.

If readers see ads which portray women in a particularly bad or good light, I would really appreciate a copy. Please state where and when it was published if it is not obvious from the copy. Thank you.

Danielle R Bernstein,
1 Ethelred Court,
Headington,
Oxford OX3 9DA.

Playing fair by Acorn

I AM NOT a regular reader of *Practical Computing* although having seen your July issue I think perhaps I ought to be. I did see the April article which inspired G R Gilmore's letter about what he calls hidden extras and what your very large headline calls surcharges which, it is alleged, have to be paid on BBC Micro products.

I think that Mr Gilmore is unreasonable. I bought a disc operating system from Acorn and received a useful manual and utilities disc at no extra cost. What I suspect, and what Mr Gilmore does not reveal, is that he bought the chip from Acorn and the disc drive from someone else. In that case, why did he not ensure that he got the necessary information from the disc-drive manufacturer? Since he did not look after his own interests, why does he now blame Acorn?

I have just bought View and find it a very adequate tool for the normal job. I do not expect one product to provide access to all the facilities of all the different printers on the market for that sort of price. It will do what I want at a reasonable price, and I know that if I want to use some of the special facilities of my chosen printer I must write or buy a special program.

Not so Mr Gilmore — he wants it for nothing. In any case, it is not a hidden extra: the fact that a printer driver may be necessary is clearly stated on the View literature. If he does not take the trouble to find out about the product before he buys it, Mr Gilmore has only himself to blame. He doesn't even have to buy View; there is an alternative.

(continued on next page)

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

(continued from previous page)

I cannot comment at first hand on the Forth cassette, but Acornsoft literature makes it clear that there is a book for those who need it, in addition to the cassette. This seems to be a reasonable arrangement: the extra charge is not hidden and if, as Mr Gilmore seems to want, the cassette and book were offered at an all-in cost, there would be those who would complain that they were forced to buy something they did not want.

Acorn's arrangements seem to be flexible: they offer something at a price, and if you want more you can have it for an extra stated price. You are not forced to buy at a high price something you do not need.

H J Challen,
Beckenham,
Kent.

BBC Find utility

THANK YOU for including my Find utility in the BBC Bytes column in the July issue. I ought to point out that what appear as £ signs in your printed version should in fact be # signs, and this may have confused some readers. The routine works on the 0.1 and series 1 operating systems.

Douglas Stewart,
Edinburgh.

Curve fitting

CONGRATULATIONS to A D Wilson on his very effective program, printed on page 181 of the July issue. The results produced on the Spectrum are very accurate, and appear even more so if the calculated figures displayed are rounded off when within 0.1 percent of the experimental values.

However, I have noticed a few minor programming points. Surely line 905 should be renumbered 907 so that the Gosub is within the loop which starts on line 106. Also the Gosub 400 in line 506 appears to be redundant, the operation having been carried out by the Gosub in line 50. The loop in lines 264 to 270 is not really necessary either.

While a solution is produced with, say, two data pairs for a quadratic, the solution is not necessarily the one expected, as three data points are required for a unique solution. Line 250 should therefore read

```
IF N>=W . . .
```

A M Tucker,
Charminster,
Dorset.

Atari sounds

I READ with great interest the music article in the June issue of *Practical Computing,* but must correct some of the remarks about the Atari 800:

Loudness. There are 16 programmable sound levels.
Filtering. The sound output can be modified by a set of software-controlled filters.
Output to hi-fi or tape recorder. This is very easy as there is a five-pin DIN socket for direct audio output.
Machine-code access. This is also very easy as the code can be embedded within a Basic program and then executed with a USR call.
Speaker. This is an independent channel on Atari machines.

I hope that any false impressions can be rectified.

Name and address supplied.

Well done Grundy!

I WOULD LIKE to break with convention and offer some praise to a British company — Grundy Business Systems Ltd. I am a nurse tutor who over the past two years has become more and more interested in the use of computers in nurse education — that is, computer-assisted learning.

After much thought and research I purchased a Newbrain computer to learn about computing and to try my hand at writing educational software. I have been delighted with my purchase and it has lived up to all my hopes and expectations.

Perhaps even more important to a novice such as myself, working in an impecunious organisation such as the NHS, is the support offered to the consumer. In this respect, no company could possibly have been more helpful, constructive, and indeed generous than Grundy Business Systems.

Well done Grundy and good luck for the future.

P I Pleasance,
South Lincolnshire School of Nursing,
Boston.

Newbrain keywords

AFTER READING Rory Stafford's appeal for Newbrain software in the June issue I started experimenting with using the graphics key to produce keywords. Unfortunately, it became very tedious so I devised an alternative method. First of all, type:

```
PUT 31:?:?:FORI=123 to 255: PUT 27,I:NEXT I
```

which will result in a display of all the characters in between 123 and 255. Move the cursor up to the first character and type Insert 10, followed by Shift-Home and Put 22, 1, 10. If the program is now listed, at least some of the keywords may be seen.

David Alexander,
Yalding,
Kent.

Stereo slicing

DUE TO a production error, two characters were lost from the listing on page 108 of the August issue. Line 00940 should end with an extra closing bracket and line 00960 should have an F after the * sign.

Statistical error

I HAVE been delighted to see the mystiques of statistics so well treated in your magazine in recent months. However, when I see what is perhaps the commonest statistical misapprehension among my colleagues and some professional statisticians stated as unequivocally as in an article in the June issue. I feel it cannot pass unchallenged.

Owen Bishop states in his article on Spearman's test: "If he believes the first alternative there is only one chance in 120 that he is right". The probability of one in 120 is purely a measure of the frequency that samples in practice would have the rankings obtained, when in reality there was no difference. It does not tell you anything about whether you are right or wrong.

R M Flinn,
University of Birmingham.

Plannercalc points

I READ with interest Mike Lewis's comparison of Plannercalc and Calcstar in the July edition of *Practical Computing.* Unfortunately the comparison makes two statements about Plannercalc which are inaccurate.

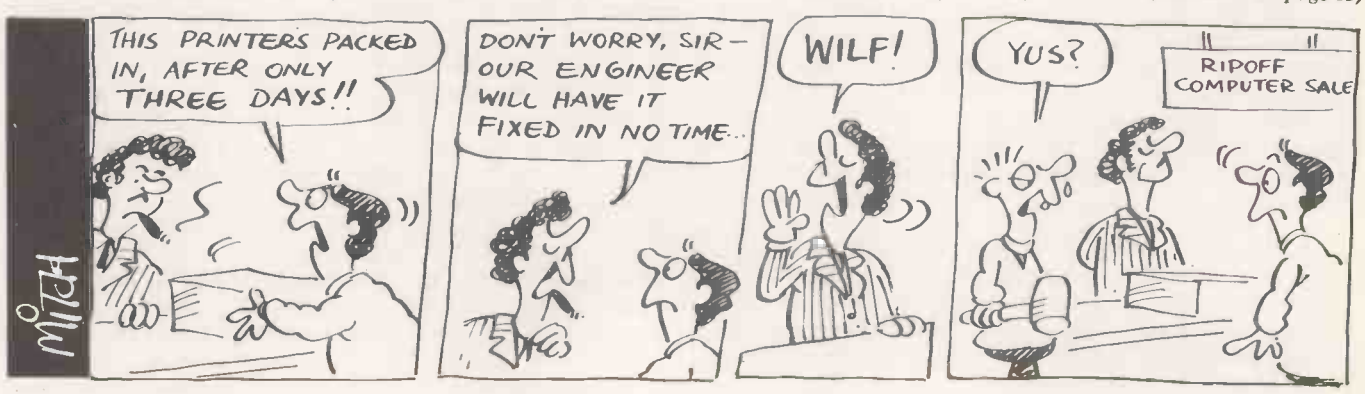
He says "you cannot enter text into the spreadsheet", which is true. But you can use headings which, in the case quoted, would have provided the desired line of text.

The statement "features. . . can only operate on entire rows or columns" is incorrect. The logic for a line may be discontinuous so that each cell is calculated using a different formula:

```
LINE 3 TOTALS=2 FOR 3, LINE 1 * LINE 2 FOR 2, 9
```

An individual cell's contents may also be altered by editing

(continued on page 13)



sinclair special 3

Inside...
The New ZX Microdrive!
Latest software...
Latest prices...

The ZX Microdrive- and more!

For some time now, the new ZX Microdrive has been the subject of much discussion. Which is only to be expected, when the object of everyone's anticipation is *completely* new to the world of computing.

Microdrive provides high-speed access to truly massive storage. With just one Microdrive, you'll have at least 85K bytes of storage, and the ability to LOAD and SAVE in mere seconds. Yet the ZX Microdrive is about the size of a Spectrum mains adaptor, and costs less than £50!

First stocks are now in. Microdrives will be released on an order of priority basis. Spectrum owners who purchased by mail order, direct from us, will be sent full details including how to order, in a series of mailings that begins with the earliest names on our list.

And if you didn't buy by mail order?

Don't worry – for a colour brochure with full information on Microdrives, including how to order, just send us your name and address (use the coupon at the back of this issue of Sinclair Special). But remember, the sooner you send us your name, the sooner you'll get on the list.

Of course, there's much more to Sinclair than Microdrives, as you'll see on these pages. The latest releases of Spectrum and ZX81 software have been amongst the most successful ever. Prices of most established Sinclair products are at their lowest ever. To buy what you want, just use the Order Form.

Until the next issue of Sinclair Special, and more good news ...

Nigel Searle

Nigel Searle, Managing Director, Sinclair Research Ltd.

PS: Come and see us – and all that's new at Sinclair – at the PCW Show, Barbican Centre, from Sept 28th to Oct. 2nd. We'll be pleased to see you!

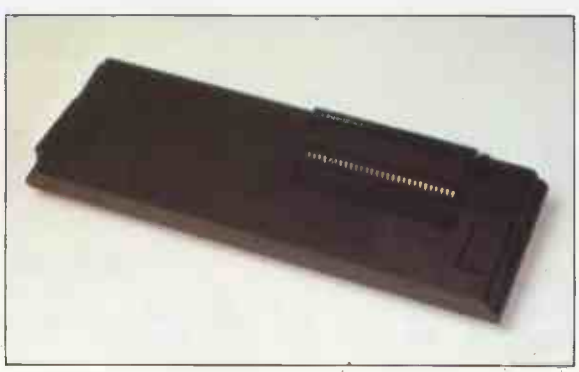
ZX Microdrive System preview

ZX MICRODRIVE

At least 85K bytes storage, loads a typical 48K program in as little as 9 seconds: £49.95.

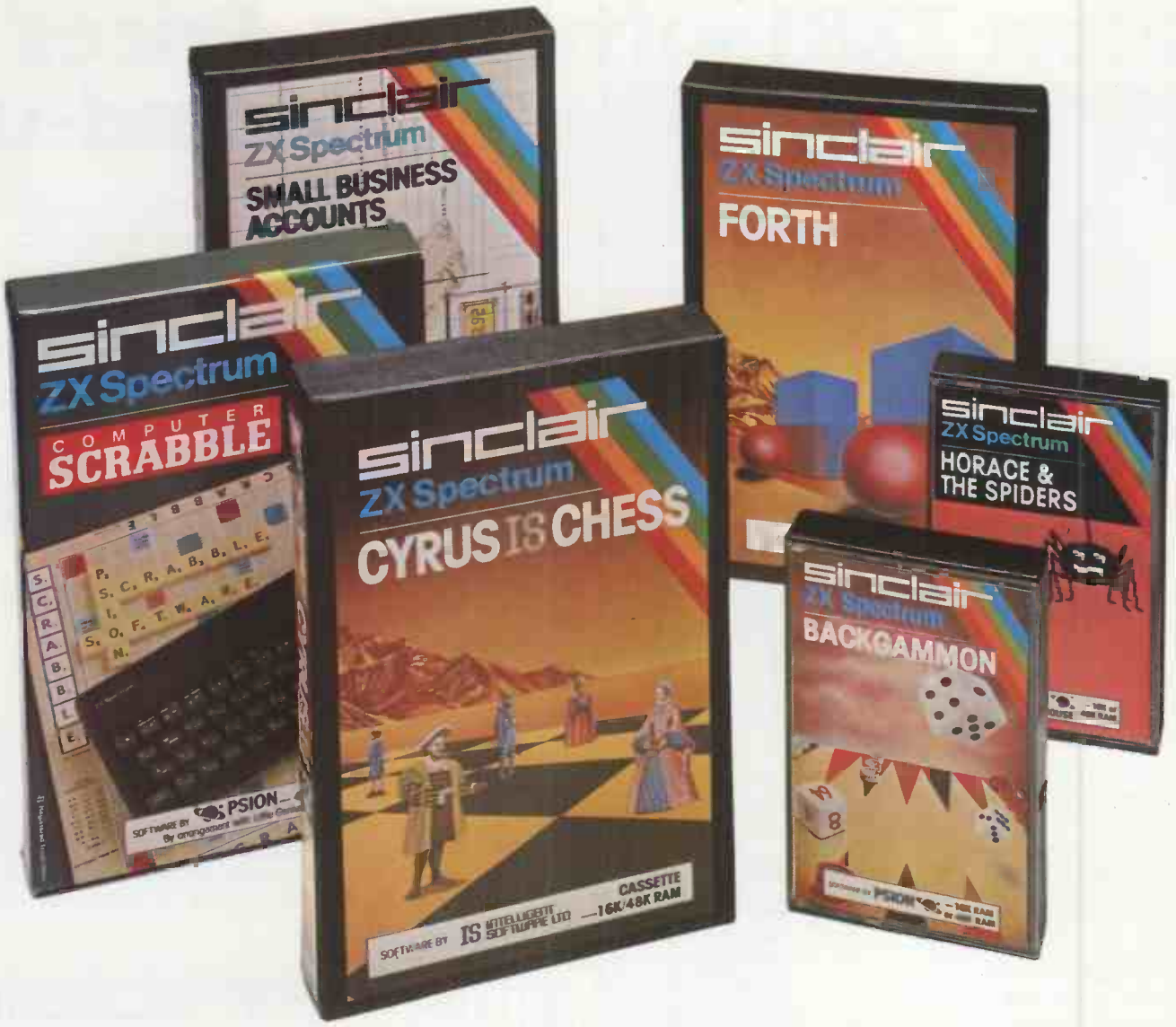
ZX MICRODRIVE CARTRIDGE

Compact, erasable, revolutionary. Complete with its own storage sleeve. Contains up to 50 files, with a typical access time of 3.5 seconds: £4.95.



ZX INTERFACE 1

Necessary for sending and receiving data from ZX Microdrive. Includes RS232 interface, enables creation of local area network of 2 to 64 Spectrums. Attaches to the underside of your Spectrum. Purchased with ZX Microdrive, just £29.95. As separate item, £49.95.



Six new ways to make more of your Spectrum

Take a look at these brand-new titles. Each is an outstanding new program using the full potential of the Spectrum, for games with stunningly animated graphics, for strategies of fiendish cunning, for masterly applications of computing capability...

Cyrus-IS-Chess Based on the Cyrus Program, which won the 2nd European Microcomputer Chess Championship *and* trounced the previously unbeaten Cray Blitz machine. With 8 playing levels, cursor piece-movement, replay and 'take-back' facilities, plus two-player option. The 48K version has many additional features including an extensive library of chess openings. For 16K or 48K RAM Spectrum.

Horace and the Spiders Make your way with Horace to the House of Spiders, armed only with a limited supply of anti-spider-bite serum. In the house, destroy the webs before the spiders can repair them. Then destroy the spiders, before *they* destroy Horace! Undoubtedly the creepiest Horace program ever produced! For 16K or 48K RAM Spectrum.

Computer Scrabble The famous board game, on-screen – with the whole board on view! A huge vocabulary of over 11,000 words. Full-size letter tiles, four skill levels – the highest of which is virtually unbeatable. For 1 to 4 players. For 48K RAM Spectrum.
(SCRABBLE trademark and copyright licensed by Scrabble Schutzrechte und Handels GmbH – a J.W. Spear and Sons PLC subsidiary.)

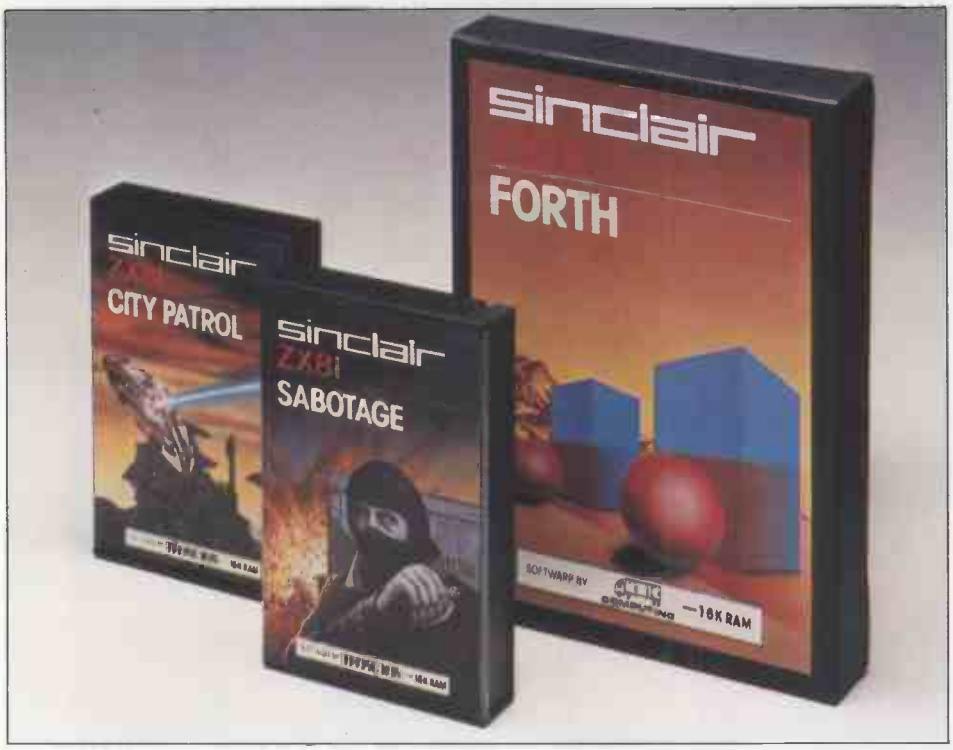
Backgammon A fast, exciting program, with traditional board display, rolling dice and doubling cube. Four skill levels. For experts – or beginners. (Rules are included – it's the quickest way to learn the game.) For 16K or 48K RAM Spectrum.

FORTH Learn a new programming language, as simple as BASIC, but with the speed of machine code. Complete with Editor and User manual. For 48K RAM Spectrum.

Small Business Accounts Speeds and simplifies accounting work, produces Balance Sheets, Profit and Loss information *and* VAT returns. Complete with User manual. For 48K RAM Spectrum.

Overleaf – your Sinclair order form.

Latest ZX81 software



These three new cassettes offer two totally different challenges to you and your ZX81. The games – like so many ZX81 games today – really do use the ZX81's capability. The FORTH program is a fascinating extension of your own computer understanding.

Sabotage. Defender or attacker? The choice is yours in this exciting game.

Be the guard and defend the ammunition in the compound – or be the Saboteur and attack it!

Written by Macronics for a ZX81 with 16K RAM. Cassette price: £4.95.

City Patrol. You are the Commander of a laser-firing ship. Your task is to intercept and destroy alien suicide ships descending on your city.

Written by Macronics for a ZX81 with 16K RAM. Cassette price: £4.95.

FORTH. Discover a new programming language which combines the simplicity of BASIC with the speed of machine code. FORTH's compiled code occupies less than a quarter of the equivalent BASIC program and runs ten times as fast. Free User-Manual and Editor Manual with each cassette.

Written by Artic for a ZX81 with 16K RAM. Cassette price: £14.95.

Prices round-up

ZX Spectrum 48K now just **£129.95.**

ZX Spectrum 16K now just **£99.95.**

ZX81 now just **£39.95.**

16K RAM Pack for ZX81 **£29.95.**

ZX Printer now just **£39.95.**

1.2A ZX Mains Adaptor **£7.95.**

Printer Paper (5 rolls) **£11.95.**

How to order

Simply fill in the relevant section(s) on the order-form below. Note that there is no postage or packing payable on Section B. Please allow 28 days for delivery. Orders may be sent FREEPOST (no stamp required). Credit-card holders may order by phone, calling 01-200 0200 24 hours a day. 14-day money-back option.

sinclair

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

To: Sinclair Research Ltd, FREEPOST, Camberley, Surrey, GU15 3BR. **ORDER FORM**

Section A: hardware purchase

Qty	Item	Code	Item Price £	Total £
	ZX Spectrum – 48K	3000	129.95	
	ZX Spectrum – 16K	3002	99.95	
	ZX 81 (including 1.2A Mains Adaptor)	1003	39.95	
	16K RAM pack for ZX81	1010	29.95	
	ZX Printer	1014	39.95	
	1.2A Mains Adaptor, for use with ZX81 computer/ZX Printer combination (only required if you have an early ZX81 with 0.7A Adaptor)	1002	7.95	
	Printer paper (pack of 5 rolls)	1008	11.95	
	Postage and packing: orders under £90	0028	2.95	
	orders over £90	0029	4.95	
			TOTAL £	

Section B: software purchase

Qty	Cassette	Code	Item Price £	Total £
	FOR SPECTRUM			
	G22/S:Backgammon	4021	5.95	
	G23/S:Cyrus-IS-Chess	4023	9.95	
	G24/S:Horace & the Spiders	4022	5.95	
	G25/S:Scrabble	4024	15.95	
	L1 /S:FORTH	4400	14.95	
	B6 /S:Small Business Accounts	4605	12.95	
	FOR ZX81			
	G25: Sabotage	2124	4.95	
	G24: City Patrol	2123	4.95	
	L1: FORTH	2400	14.95	
			TOTAL £	

*Delete/complete as applicable.

*Please charge to my Access/Barclaycard/Trustcard account no

*I enclose a cheque/postal order made payable to Sinclair Research Ltd for £

Signature

Mr/Mrs/Miss

Address

PRC 909

(Please print

ZX Microdrive information request

Please send me a colour brochure with full specifications of ZX Microdrive/Interface 1, *and* add my name to the Microdrive Mailing List! *(tick here)* ☐ (Remember to include your name and address on the form abo

(continued from page 8)

the cell's contents when in display mode.

Despite these niggles I found the Calcs and financial planning feature useful. If any of your readers would like copies of our own financial modelling report they should contact me at SWURCC.

Adrienne Jackson,
Small Business Microsystem Support Project,
Microsystems Software Unit,
South West Universities Regional Computer Centre,
University of Bath,
BA2 7AY.

Faster sorting

I WAS INTERESTED to read Andrew Featherstone's article on sorts in the March issue, and I decided to test the speed of his shaker sort on my TRS-80. I generated 100 random strings, and was amazed at how long the sort took.

I devised my own algorithm as a comparison, and used the sort to order two arrays, each containing the same strings. I repeated this using various-sized arrays ranging from 10 strings to 100. Almost every time my algorithm was at least three times faster.

In the subroutine I used, array A$ (#) contains the strings to be sorted, and NS the number of them.

R English,
Cardiff.

Faster sorting.

```
1000 F=NS
1010 FOR A=1 TO F-1
1020 C=A
1030 FOR B=A+1 TO F
1040 IF A$(B)<A$(C) THEN C=B
1050 NEXT B
1060 T$=A$(B)
1070 A$(B)=A$(C)
1080 A$(C)=T$
1090 NEXT A
1100 RETURN
```

Recovering Lynx programs

WHEN EXPERIMENTING with recovering Lynx programs — End of File, August issue — I wrongly assumed that the area of memory at which I located the old program was a dedicated cassette file-name buffer. This is in fact not so: the area in question is actually the buffer used for normal to internal language conversion. It also happens to be used by the cassette operating system for storing file names.

Users of the 48K Lynx should therefore relocate the program to 9F70 where it can be protected by

RESERVE & 9F70

The corresponding address for the 96K machine is FF70. These locations are sufficiently low down in memory to avoid corruption by the stack on a reset.

Chris Cytera,
Mangotsfield,
Bristol.

UK 101 software

I WOULD LIKE to inform any of your readers who own OSI/UK 101 computers that a program library is being formed to keep up the supply of software now that dealers are dropping out. Programs will be available, several to a tape, for a small charge to cover professional duplication, postage, etc.

We are now looking for anyone who can donate programs or help in any other way. To get things moving, tape 1 is available now for £2.50. Contents include games, novelties and Basic Remember and tape file programs, all of which run under Cegmon, preferably with an enhanced screen. All cheques to the OSI/UK Program Library, please, at the address below, or telephone 01-866 7010 at weekends.

F J Leonhardt,
2, Birchmead Avenue,
Pinner,
Middlesex HA5 2BG.

BBC disc software

A GROUP of BBC disc users are getting together to produce a monthly disc for members of the Format 40/80 Disc Club. The idea is to exchange programs of all kinds, including school and educational programs and games.

Would any interested BBC disc users please send us a stamped and addressed envelope giving their disc details. We are also interested in hearing from software houses prepared to offer special prices to our members. Any software copied from disc or tape will be copy-protected and proper royalties will be paid.

Peter Hughes,
Format 40/80 Disc Club,
c/o The Lending Library,
Fire Marsh Street,
Bristol.

You're just one step away from one-step accounting

Anagram Systems' Integrated Accounts is, simply, the most comprehensive, easiest to understand integrated accounting package available to Commodore users. It is the best reason yet for choosing Commodore.

And now there is Anagram Integrated Accounts with integrated Stock Control – on top of superb Anagram standalone Stock Control and ledger packages. Just look at these features and options.

Full integration: Anagram Integrated Accounts consists of Sales, Purchase and Nominal Ledgers, Cash Book, and functions which permit journal entries, file maintenance and report printing in remarkable detail. All these are automatically updated when you make an entry. In the version with Stock Control, creating an invoice updates the stock as well as the other modules.

Single- or multi-user: Anagram Integrated Accounts, with or without the integrated Stock Control, can be supplied either single-user, or multi-user for up to five machines for only £300 extra per machine. The same goes for Anagram Stock Control.

Hard disk or floppies: Integrated Accounts is on just one floppy disk – compare that to competitive packages – and runs successfully with the Commodore twin disk units. Integrated Accounts with Stock Control and Sales Order Processing ideally requires a hard disk.

Open Item or Balance Forward: Choose which system you want for each account – you can even mix the two.

Extensive analysis: Each sales invoice can be analysed across ten nominal headings; each purchase invoice across eight. You can set up budgets within each nominal heading to get comparisons of 'budget to actual' at any time.

Easy to understand, learn and use: Anagram Accounting and Stock Control packages are designed for busy people who don't want to mess about with computers. They use ordinary book-keeping terms without jargon.

Your Commodore dealer should have these packages ready for demonstration. If not, phone Anagram and we will fix a demonstration for you. Or send the coupon.

To: Actionline Sales
Anagram Systems, 60A Queen Street,
Horsham, West Sussex RH13 5AD

Send me brochures on the Anagram packages I have ticked and tell me where to see them running.

☐ Integrated Accounts with Stock Control
☐ Integrated Accounts ☐ Standalone Stock Control
☐ Standalone Ledgers

Name _____
Position _____
Company _____
Nature of business _____
Address _____
_____
County _____ Postcode _____
Telephone No. _____
Any existing CBM computer _____

AN/PCO/09

ANAGRAM SYSTEMS
60A, Queen Street, Horsham, West Sussex
RH13 5AD Tel.(0403)59551/50854/58153

commodore COMPUTER

CBM is a trademark of Commodore Business Machines (UK) Ltd

● Circle No. 106

ACT to stake £12 million on Apricot

ACT SAYS the new Apricot is a fourth-generation personal computer because it embodies a new design philosophy. In fact, the machine is an imaginative and clever repackaging of everything that is good in current microcomputing technology.

ACT's real achievement is to build the Apricot at a price that might cause the competition real headaches. Entry is at £1,400, which is less than the Apple IIe with two discs.

The Apricot is transportable rather than portable. It has a 16-bit processor, a small built-in screen, an optional mouse and 3.5in. disc drives. More than anything else, the Apricot is a desk-top micro which just happens to be easy to cart around.

Ergonomically interesting, the Apricot has a very small desk-top footprint. The keyboard has 90 keys that click when they are pressed.

There are eight hard function keys and six soft keys. The innovative microscreen provides a display of two lines of 40 characters when the monitor is not being used. It also functions as a calculator display and a clock face.

Intel's 8086 is the main processor and is used with the 8089 I/O device. A slot is left open for the optional 8087 number-crunching mathematics processor. There is a standard 256K of RAM, and two expansion slots which could possibly take more. The twin Sony micro-floppy drives each have 315K of storage, and double-sided discs will be a later option.

ACT's name has been synonymous with the Sirius computer, which it will still continue to market. According to Roger Foster, the managing director, the Apricot will complement the Sirius from a lower position in the market. Sirius users tend to be into a more sophisticated type of computing; the new machine is intended as a personal micro.

Consequently the Apricot is 99 percent software compatible with its big brother. The only differences occur where the hardware differs. The Apricot even has the same screen format as the Sirius.

MS-DOS 2, CP/M-86 and Concurrent CP/M-86 are the three operating systems included as standard. A number of system utilities and some applications software comes with the machine; the packages include a relational database, Personal Basic and Gios graphics. There is no word processor.

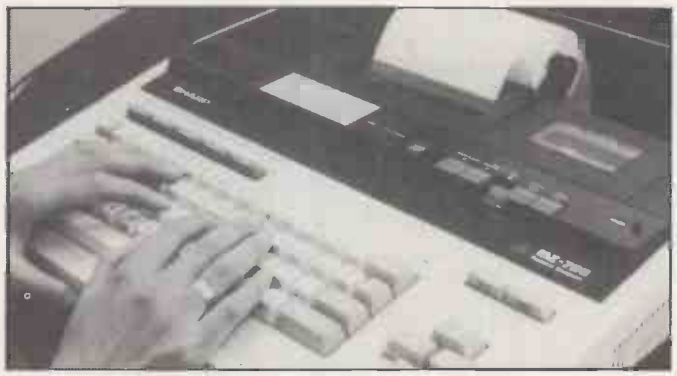
ACT is seriously committed to the Apricot, having a total budget for the project in the region of £10 million and a promotion budget of around £1 million. There is also the small matter of the factory in Glenrothes, built for the assembly of the Apricot and Sirius micros. For more details contact ACT, 111 Hagley Road, Birmingham, B16 8LB. Telephone: 021-454 8585.

New Sharp sticks with tape Basic

SHARP'S new home micro, the MZ-700, is now arriving in the U.K. It is a Z-80A based machine with 64K of RAM, 4K of video RAM and two 4K ROMs.

One of the ROMs has been programmed by Knights of Aberdeen, the well known Sharp dealer, with 512 character shapes to make up for the lack of user-definable characters and bit-addressable graphics. The maximum screen definition is 40 characters by 25 lines.

Sharp has also stuck to its idiosyncratic system of loading Basic from tape, which takes almost three minutes, instead of providing it on ROM. The system is far less usable than either the BBC, Commodore or Atari systems where the Basic can be simply switched out. The MZ-700 leaves some 36,592 bytes free to Basic.



Accessories which fit into the Sharp's case are a cassette deck and a colour printer/plotter. This can be set to echo printing on the screen, so although the MZ-700 lacks a built-in visual display, it can be converted into a sort of portable Teletype machine. The standard machine costs under £250 and the integrated version £420.

Although the MZ-700 is probably the best-made machine on the home-micro market, gives an excellent eight-colour display and has a good range of ports, it is difficult to understand Sharp's thinking. A cassette-Basic machine with block graphics looks four years out of date now, and may look positively sick by Christmas.

Contact Sharp Electronics (U.K.) Ltd, Sharp House, Thorp Road, Manchester M10 9BE. Tel: 061-205 2333.

Newer Olivetti typewriters come complete with computer interfaces but older models need special devices to enable them to talk to microcomputers. This is such a device. Designed for the BBC Micro, the Timtom interface will work with any computer with an RS-232 port running at 300 baud. For further details contact Timtom Micro, 9 Ilton Road, Penylan, Cardiff CF2 5DU.

Data General's cut-down mini

THE WORLD'S second largest minicomputer manufacturer, Data General, has reduced its 16-bit mini to a microcomputer size and price in the form of the Desktop Generation Model 10. It uses the Data General Microeclipse chip, said to be comparable in power to the Motorola 68000, and runs its operating systems ADS, R-DOS and MP/AOS-SU.

To make it acceptable as a real micro, the DG Model 10 also has a slave Intel 8088 microprocessor running under the control of the Microeclipse, so it will also run MS-DOS and CP/M-86. This makes it functionally compatible with the IBM PC.

The DG micro is inherently multi-tasking and will support four work stations at once. However, three of them have to be running Microeclipse applications, and only one can run, say, MS-DOS.

The entry-level system has 128K of RAM, one 368K floppy-disc drive and a 12in. monochrome screen. It costs £2,532 but with a 15Mbyte hard disc as well the price goes up to £5,608.

Contact Data General, Hounslow House, 724-734 London Road, Hounslow, Middlesex TW3 1PD. Telephone: 01-572 7455.

(more news on next page)

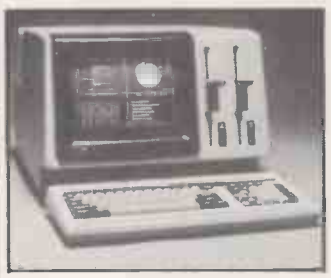
NEC's APC cuts 16-bit costs

NIPPON ELECTRIC, the $5 billion electronics company, has just launched the Advanced Personal Computer or APC on to the U.K. market. This coincides with the opening by the Queen of its new semi-conductor factory in Scotland.

The APC has been out for almost two years in Japan, where NEC claims to have 45 percent of the micro market, and one year in the U.S.

It is not short of software as it runs both MS-DOS and CP/M-86, using NEC's own version of the Intel 8086 which gives some degree of IBM PC compatibility. Launch software includes Benchmark word processing, Systematics International accounting packages, Masterplanner, dBase II, and NEC's graphics and communications utilities — so far so boring.

What makes the APC a challenger is that the full 16-bit micro with 128K of RAM, two 8in. floppy-disc drives and 12in.



mono screen costs only £1,985, some £800 cheaper than the going rate. A one-drive entry-level system costs £1,875, which is not much more than the Z-80 based Epson QX-10, and a 10Mbyte hard-disc version costs only £3,690. NEC will pile 'em high and sell 'em cheap through its existing dealer outlets plus retail chains like John Lewis and Tesco, though it is not likely to appear at your local supermarket.

Contact NEC Business Systems, NEC House, 164-166 Drummond Street, London NW1 3HP. Telephone: 01-388 6100.

Rediffusion Teleputer 3

WHILE REDIFFUSION is best known for television rentals and flight simulators, Rediffusion Computers is a substantial company selling some £20 million worth of minicomputers last year. Now it has launched the Teleputer 3, a fast Z-80 based micro with colour as standard. It also comes complete with its own suite of integrated packages such as Starcalc, Starfile, Startel, Startype and Stardata.

The Teleputer has its own operating system, CP/Star, which is a huge improvement on CP/M — aren't they all? — but CP/M can be run as a non-integrated option. It also offers teletext capabilities based on the Mullard chips best known from mode 7 of the BBC Micro. It has its own semi-compiled Basic, which enables it to run the standard Benchmark tests three times faster than the ACT Sirius, and noticeably faster than the Olivetti M-20.

The standard machine including 128K of RAM, two 320K floppy-disc drives, colour monitor, built-in Modem, operating system, Basic and suite of applications programs is competitively priced at £3,595 plus VAT.

Contact Rediffusion Computers, Kelvin Way, Crawley, Sussex RH10 2LY. Telephone: (0293) 3121.

Centronics link to CBM micros

THE VC Parallel Interface allows a Centronics-style printer to connect to the printer bus of the Commodore-64 or Vic-20 computer. It does not occupy any memory space and does not tie up the valuable user port. As yet there is no U.K. distributor for the product, but further details can be obtained from Richard Wiesemann Mikrocomputer-technik, Winchenbachstrasse 3a, D-5600 Wuppertal 2, West Germany.

Atari magazine

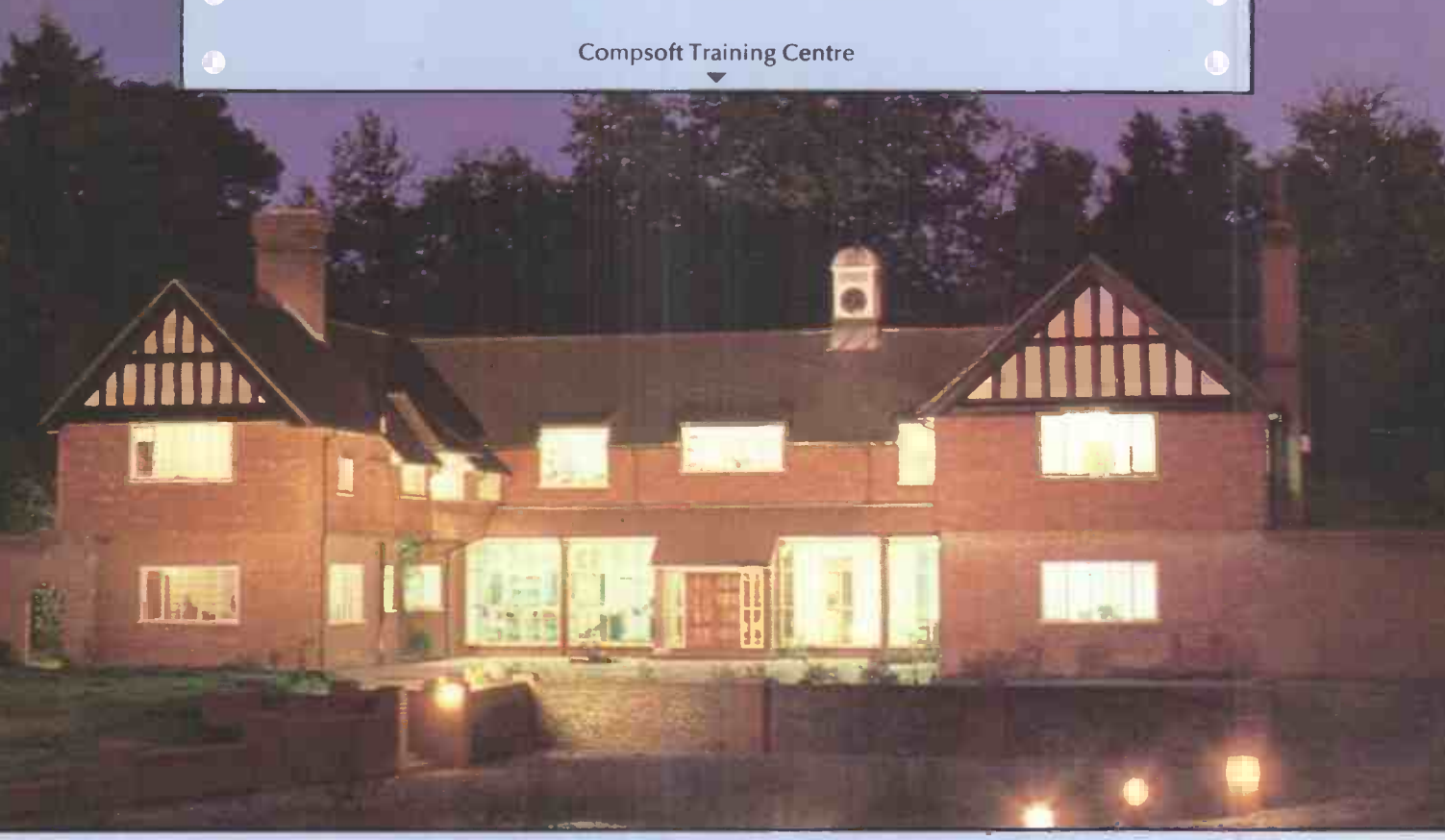
ATARI (U.K.) has just published the third issue of *I/O*, its user magazine. It is sent free to all registered owners — that is, those who returned their guarantee card. If you are not on the mailing list you can get your free subscription by sending the number of your machine and the place and date of purchase to Atari International (U.K.) Inc., Atari House, Railway Terrace, Slough, Berkshire.

COMPSOFT'S DMS – winner of the 1982 RICA Awards, 'Software Product of the Year'.

Now Compsoft announce Delta – the **very** powerful, **very** friendly database* that the world has been waiting for.

* For micro computers with CP/M, MP/M or MSDOS operating systems. Including IBM PC.

Compsoft Training Centre



If part of your microcomputer's job is to store information, you need Compsoft's software.

Compsoft DMS is already Britains No. 1 record keeping program. And with 4000 users to our credit, we can honestly say we know more about information storage & retrieval than anyone else. We listen to your comments & requests and now we've produced a world first – the Delta – a true transactional database.

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Meet the fa

Minstrel + TurboDOS

the marriage of reliability and versatility

Minstrel

The Minstrel is an exciting new British micro-computer and offers Winchester-based systems at fantastically low prices. The range extends from single-floppy single-user CP/M systems right up to a 68000-based model and includes an 8086-based range.

The Minstrel is compatible with the North Star Horizon and offers a superior alternative at a much better price.

There is a network of Minstrel dealers in the UK and Europe. Contact us for the name of your local dealer. Dealer enquiries invited.

S100 bus

The amazing versatility of the Minstrel is due to the bus used: the S100 bus. This bus system is not only future-proof—the future is created on the S100 bus. Every major micro-computer development appears first on the S100 bus. Now over 150 manufacturers make S100 products and their combined range approaches 1000 boards.

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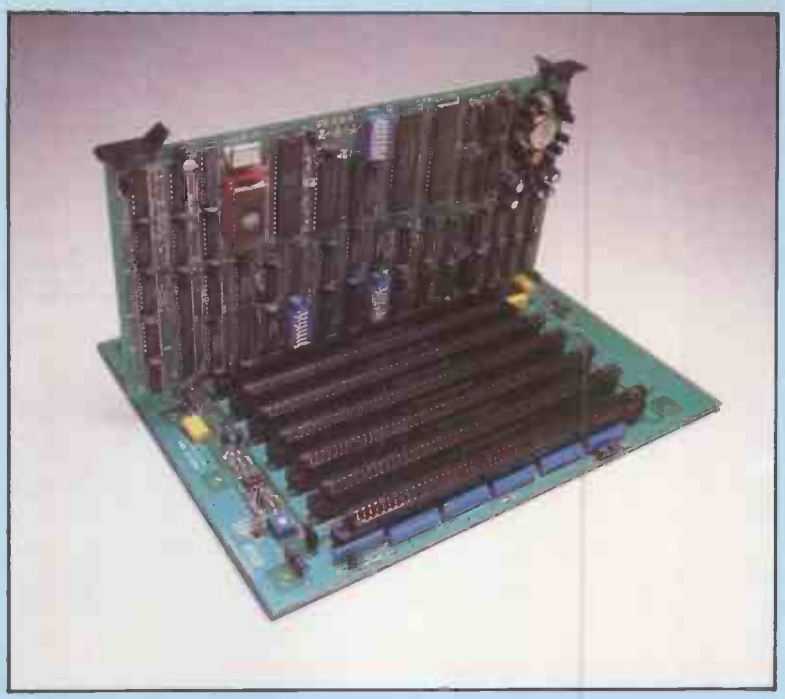
mily

One machine – eight computers

Yes! Inside the Minstrel micro-computer illustrated there are actually 8 Z80A single-board computers. One is dedicated to each user of the system resulting in astonishing performance. A ninth processor controls central disk storage and printers.

TurboDOS provides sophisticated spooling for multiple printers, supports 1000Mb disk drives and 128Mb files, and employs powerful disk buffering techniques.



TurboDOS

CP/M COMPATIBLE MULTI-USER OPERATING SYSTEM

TurboDOS is a popular high-performance multi-processor operating system. Each user has their own slave processor board (illustrated above). TurboDOS systems have been shown to out-perform mini-computers in the DEC PDP11/34 class at a fraction of the hardware cost.

TurboDOS is compatible with CP/M, the industry standard operating system, which means you have access to a vast range of off-the-shelf software.

The next development to TurboDOS on the Minstrel allows you to connect systems together via a Local Area Network.

ASTONISHING PRICES!

Minstrel with two 400Kb floppy drives £1790.
With 1 400Kb drive and 5Mb Winchester £2615.

A sample 2-user TurboDOS system including:

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1 400Kb floppy
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2 KDS7362 VDU's (illus)
1 Epson printer

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A sample 5-user TurboDOS system with background batch processor including:

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1 Epson printer
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SOFTWARE FOR YOUR MICRO

British Broadcasting Corporation

These high-quality software packs have been specially developed to make the most of the sophisticated design and great versatility of the British Broadcasting Corporation Microcomputer.

They enable you to use your computer for a huge range of activities – from education to music, drawing, personal finance or games of skill and strategy.

Each pack contains a comprehensive handbook and a pre-recorded cassette carrying a set of programs. They will operate on Model A or Model B except for *The Computer Programme Programs Vol. 2*, which is for Model B only.

Early Learning

A colourful and stimulating learning aid designed to help young children develop their word and number skills.

Fun Games

Four great games with colour and sound to test your speed, skill and co-ordination.

Games of Strategy

Test your brain-power and tactical skills against the computer's with these intriguing games.

Home Finance

Commissioned from the Consumers' Association, these programs will help you make the right decisions about money.

Painting

Use the computer as a palette to produce full-colour designs and wonderful 3-D effects.

Drawing

Exploit your computer's graphics capabilities to create an infinite variety of shapes and patterns.

Music

The computer becomes a simple musical instrument, enabling you to compose, play and listen to your own tunes.

The Computer Programme Programs Vol. 1

Twelve of the most popular programs demonstrated in the BBC television series.

The Computer Programme Programs Vol. 2

These more sophisticated programs make use of the additional memory capacity of the Model B computer.

ON SALE NOW AT SELECTED BOOKSELLERS AND MICROCOMPUTER SHOPS £10.00 EACH

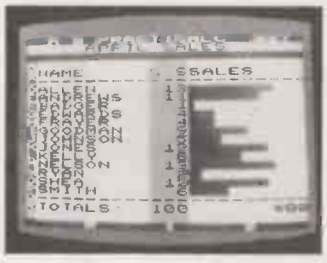
See us on Stand 18 at the Acorn User Exhibition, Cunard Hotel, Hammersmith (25–28 August) or on Stand 138 Hall A Lower. Personal Computer World Show, Barbican Centre, City of London (28 September–2 October)

● **Circle No. 110**

Four-colour spreadsheet

PRACTICALC is a four-colour spreadsheet program for the Commodore 64 or the Vic-20. Available on either disc or cassette at £29.95 or £24.95 respectively, Practicalc has all the normal Calc facilities.

The user enters headings and numerical data into rows and columns that are displayed on



the screen, and can then perform over 20 different mathematical operations. Finished sheets can be saved, loaded or printed, and rows can be sorted into numerical or alphabetical order.

Further details from Marketing Micro Software Ltd, Goddard Road, Whitehouse Industrial Estate, Ipswich, Suffolk IP1 5NP. Telephone: (0473) 462721.

Micro-Prolog comes down a step or two

MICRO-PROLOG, a language ideal for experimenting with expert systems, should be available for the Spectrum and BBC Microcomputer in the autumn. Logic Programming Associates at present markets Micro-Prolog for Z-80 based CP/M machines, and claims about 1,000 users for its system.

The Spectrum version will be available initially on cassette, with a ROM version to follow. The BBC version will be in ROM, with example programs available on disc. Distribution arrangements and pricing have not been finalised, but Logic Programming Associates has demonstrated the system running on the 48K Spectrum.

Micro-Prolog for Z-80 based CP/M machines costs £150 on disc, with a reduced price to educational institutions of £90. More details from Logic Programming Associates, 10 Burntwood Close, London SW18. Tel: 01-874 0350.

HP VisiCalc on a chip

REAL VISICALC from Visicorp is contained in a tiny ROM module for the Hewlett-Packard 75C battery portable. It gives you VisiCalc in a truly portable package weighing less than 2lb.

The HP 75C's one-line 32-character LCD display acts as a window into the spreadsheet. You can also connect up the HP 75C to its optional 9in. or 12in. monitor for full-sized working.

The VisiCalc module costs £160 and a standard HP 75C costs £694. Details from Hewlett-Packard Ltd, Literature Department, Winnersh, Wokingham, Berkshire RG11 5AR. Telephone: (0344) 773100.

Inmac contest

AN OSBORNE and three Epson HX-20s are among the prizes in a competition organised by Inmac to promote its range of computer accessories. All you have to bring yourself to do is write an essay saying that computers actually do create new jobs rather than just destroying existing ones. The competition closes on October 31, 1983. Full details are contained in Inmac's latest catalogue, which is available free from Inmac (U.K.) Ltd, Davy Road, Astmoor, Runcorn, Cheshire WA7 1PZ. Telephone: (09285) 67551

Impex thinks its set of keyboard templates for the Osborne 1 and Executive machines should help users find their way around WordStar, Supercalc, MBasic and dBase II more easily. The templates cost £19.95 from Osborne dealers or direct from Impex Micro Products Ltd, Ridgeway Court, Grovebury Road, Leighton Buzzard, Bedfordshire. Telephone: (0525) 371597.

Electronic mail comes to Sirius and Apricot

BOTH THE SIRIUS and ACT's new Apricot portable can now be used to send and receive electronic mail. The Micromail package consists of a small Modem card which plugs into the inside of the computer, together with the necessary software to transmit messages through the phone system. It costs £275, including the annual subscription.

The system is based on British Telecom's electronic mail service Telecom Gold, which already has several thousand users. To send an electronic message you simply type in the name of the recipient followed by the message, which is then delivered to the appropriate electronic mailbox on the British Telecom computer system within seconds. To collect your own mail the Micromail software causes the Sirius or Apricot to dial up your particular mailbox on Telecom Gold and then download any messages for reading.

ACT claims a one-page A4 letter of 400 words can be transmitted to its destination in under a minute at a peak-rate cost of 15p within London or 17p long-distance, with the price falling below that of a second-class postage stamp at off-peak times. This compares very favourably with Telex, datapost or facsimile transmission costs.

Messages can be sent to any British Telecom electronic mail user, not just to other microcomputers with Micromail. ACT intends to bring out a version of the product for the IBM PC in the near future. More details from Applied Computer Techniques Ltd, ACT House, Telephone Avenue, Bristol BS1 4BS. Telephone: (0272) 211733.

(more news on page 23)

Epson terminal emulator

TRANSAM has produced a terminal-emulation program for the Epson HX-20 which, among other things, lets you produce full 80-column printed output from the portable's built-in 24 column printer. This feat is achieved by putting the text out sideways in blocks of 18 lines.

The £50 Intelligent Terminal Emulator program comes in ROM. It can be installed either

in the main body of the HX-20 or in the expansion unit. The HX-20 can be linked via its RS-232C interface to the other system either directly or via an acoustic coupler through the phone system.

Details from Transam Computer Products, 59-61 Theobald's Road, London WC1X 8SF. Telephone: 01-404 4554.

Spectrum business pack

THE SPECTRUM, with its "dead flesh" keyboard and cassette data storage is obviously not the ideal business machine, but this has not deterred the software producer Hestacrest. Sales/Purchase Spectrum is its latest offering.

The program can be used as either a sales or purchase ledger, and can handle up to 1,000 transactions a month and 250 customers or suppliers according to Hestacrest. Sales/Purchase Spectrum follows the company's earlier Accounts Spectrum program, for the preparation of accounts from incomplete records. Both systems require a 48K Spectrum with printer and domestic cassette recorder and TV.

From the documentation both packages look like serious products which will at least give the user a good idea of what a computer can achieve. They cost £25 or £35, with different versions for different types of company structure.

More details from Hestacrest Ltd, PO Box 19, Leighton Buzzard, Bedfordshire LU7 0DG. Tel: (052 523) 785.

Spectrum's Hobbit now on the Oric

MELBOURNE HOUSE has rewritten its best-selling Spectrum game The Hobbit for the Oric. The program is based on Tolkien's book and comes on cassette packaged up with a paperback copy of the book along with games instructions. The price of the Oric version will be £14.95, the same as for the Spectrum. More details from Tansoft Ltd, 3 Club Mews, Ely, Cambridgeshire CB7 4NW. Telephone: (0353) 2271.

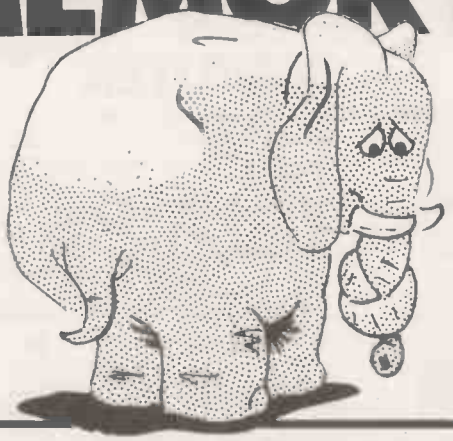
Managers made with micros

CORPLAN is a management game aimed at O-level students through to working managers which has been around for some time running on Tandy model III and Commodore 8000 series computers. It is now to be available for the Spectrum, BBC, Apple and Nascom machines, with prices ranging from £49 to £99. Details from Understanding Ltd, 100 Cricklewood Lane, London NW2 2DS. Telephone: 01-450 1144.

Fish and micro chips

HOME-COMPUTER software is now available over the counter along with the chips at the Pisces Fish Bar in Richmond. Entertainment software seems to be following a similar route to video cassettes, moving beyond specialist outlets to record stores, newsagents and other locally based retailers. "People get put off by the high-tech mystique of specialised computer centres," says chip-shop owner and now software dealer Graham Barrow.

MORE RELIABLE MEMORY



SOFT ERROR DETECTION AND CORRECTION

Small business computers and personal computers often have the same configuration, use the same microprocessors with the same performance and yet the small business computers are a couple of times more expensive than comparable personal computers. Why such a difference? The answer is *reliability.*

With some additional hardware you can enhance the reliability of a personal computer to a degree that it can be used to do more sophisticated tasks where long term error free operation is a must.

One of the most error prone parts of a computer is its memory, which can be affected by both HARD and SOFT errors.

Hard errors can be easily detected, but soft errors, which occur more often, have to be dealt with by using an error checking and correction technique.

Practical Electronics this month shows how to correct erroneous data in memory. Our in-depth article gives background information and full construction details to build our Error Detection & Correction Board for the home microcomputer.

If reliability counts buy

PRACTICAL ELECTRONICS

SEPTEMBER ISSUE

ON SALE NOW

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Genie III

Gives you the most fantastic power-to-price value

Before you buy any other micro-computer anywhere near the price – evaluate Genie III. It is probably the most flexible and proven system of all!

Genie III provides everything you need to streamline and increase your efficient handling of paperwork, accounts and general administration.

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The system can expand to provide a full range of applications in data processing and word processing and offers you all the business help you'll need with power to spare.

And as your needs change, you'll find that Genie III has 4 powerful features that lets it respond to your new demands:

Enormous language choice

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Extreme hardware flexibility

Fantastic storage capability

Test Genie III now – it is the proven system for today.

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Genie III is available from your Genie Specialist Dealer, who can give you expert user advice, technical support and an optional 2-year guarantee which includes normal wear and tear.

All this at the incredibly low price of £1395 + VAT for Genie III 40 track models, or £1650 + VAT for 80 track models

INSTANT CREDIT

Instant credit up to 24 months is available from Lowe Computers† if you hold a valid bankers card. Tick coupon or 'phone for full credit terms and details.

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Fantastic power-to-price value. From 700K to 1.46MB with expansion up to 10.92MB on-line.

Full 64K available for user-memory.

Flexible option of 5¼" or 8" floppies, or 5¼" hard disk, all on-line if needed.

Languages include Microsoft* level II BASIC, PASCAL, FORTRAN, COBOL, FORTH, Assembler, APL, PL1.

Operating systems: NewDOS 80v 2A – 64 and 80 format included (CP/M optional).

Can be configured for a wide range of other operating systems.

Programmable screen formats up to 80 x 24 with clear characters on a 12 x 6 matrix.

Fully programmable Baud rate from 50 to 38,400, with selectable micro-processor speeds 3.2 MHz or 1.74 MHz.

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Prestel/Viewdata compatible. FREE communication software with each Genie III purchased.

Genie Prestel/Viewdata modem available.

– Small size – low power
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16 re-programmable dedicated commands (8 keys x 2 shifts).

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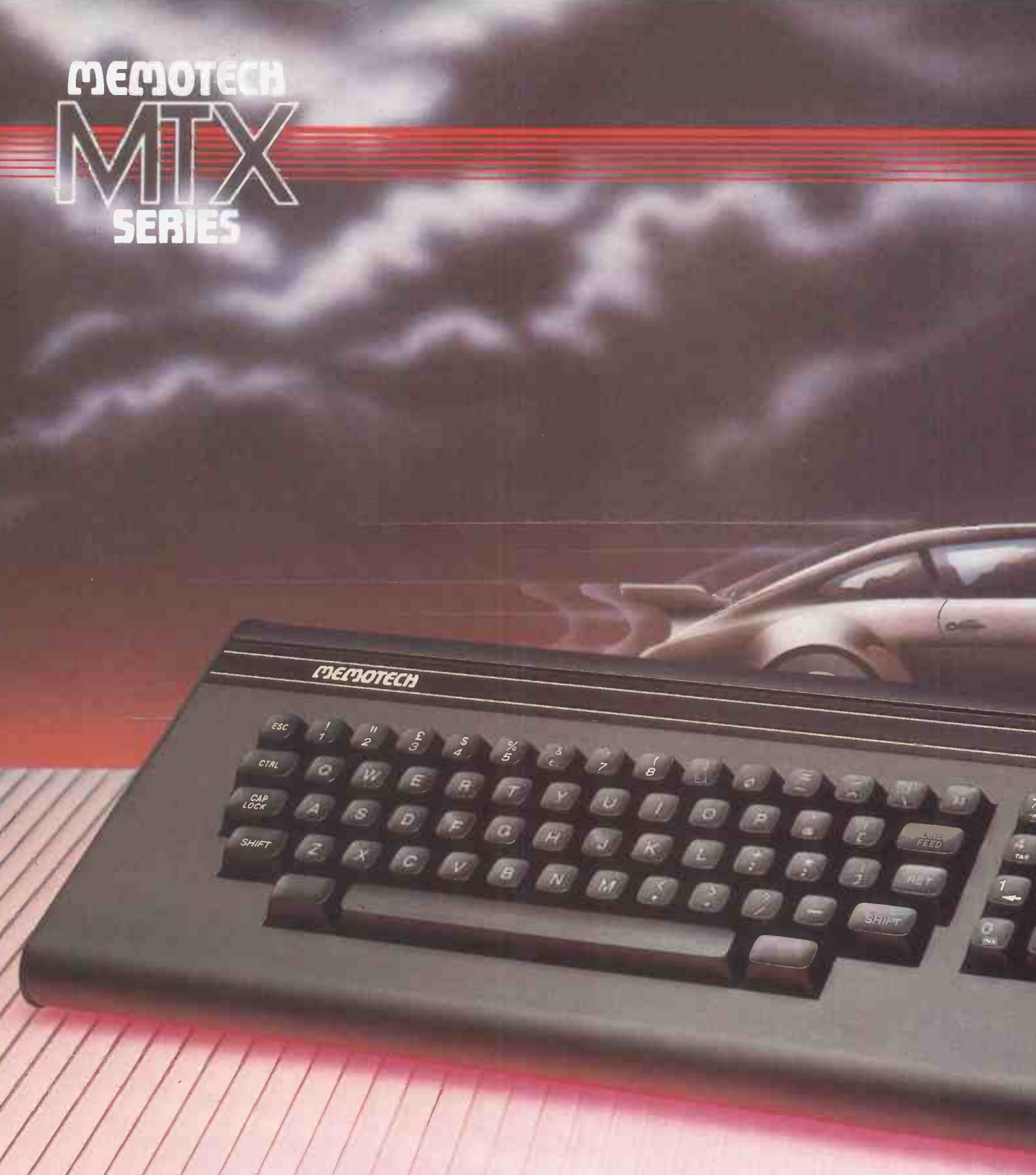
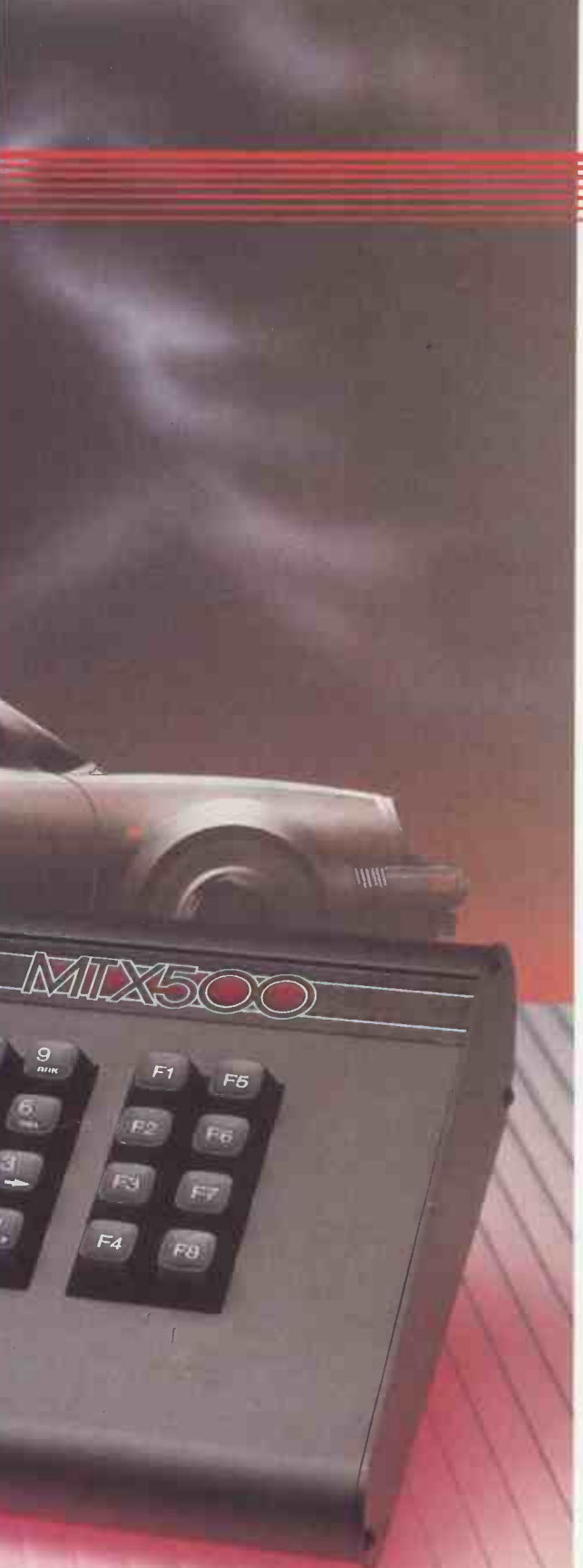
MEMOTECH

MTX SERIES



MTX500 £275 MTX512 £315

Available in September–please phone for sales information
Memotech products are designed and made in Oxford and Witney



The All-Purpose System

The MTX Series

The MTX Series is a new departure in micro-computer technology. Whether your needs as a user are for personal programming, games playing, scientific or process control, educational or business use the MTX Series is already capable or very easily adaptable to almost every application. Glance through the standard features below — you'll see what we mean.

Software

The MTX's 16k ROM contains several languages and routines which enable the novice or the experienced programmer to make full use of the machine. Standard languages are MTX BASIC, LOGO type commands, and NODDY. ROM routines include an ASSEMBLER/ DISASSEMBLER with screen display of the Z80 CPU registers, memory and program, which can be manipulated from the keyboard. Machine code programs can be stepped through one instruction at a time, and easily called from within BASIC programs. A further feature is the Virtual Screen facility which enables the programmer to define sections of the screen to work independently whilst maintaining all full screen facilities. Pascal is available as an add-on ROM pack.

Hardware

The MTX500 has 32k of user RAM as standard (64k on the 512), expandable to 512k plus 16k of dedicated video RAM. Sixteen colours, 40 column text, 256 x 192 high resolution graphics with all sixteen colours available, and easily moveable user defined graphics (Sprites) combine to make effective screen displays quick and simple to achieve. Standard outputs are centronics printer port, two joystick ports, an uncommitted I/O port, 2400 Baud Cassette port, separate TV and Video Monitor ports, 3 voice sound with hifi output plus a dedicated games cartridge port. Other standard features include the Z80A processor running at 4MHz, real time clock, full moving key keyboard with 79 keys including eight function keys and separate numeric pad.

The Disc Based System

The MTX series has been produced with performance and expandability uppermost in the design team's thoughts. When expanded to Disc level the computer supports the following facilities, which will be available in October:

- *80 column video board*
- *5¼" floppy discs*
- *5¼" hard discs*
- *CP/M 2.2, enabling the widely available range of CP/M based software*
- *Memotech Silicon discs — multiples of 256K of fast RAM expandable to 8m bytes*
- *Colour Wordstar*
- *A/D and D/A converters*
- *Networking*

MTX

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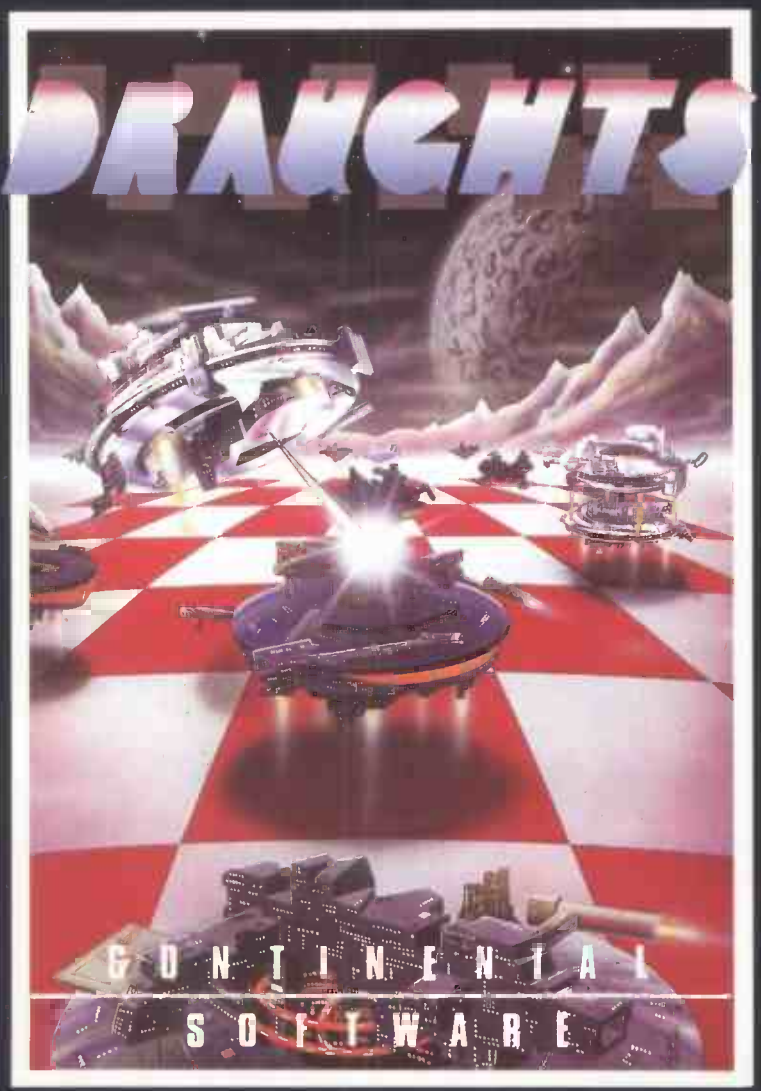

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Weaving words

Threaded interpretive languages are both powerful and flexible says Boris Allan

THE MOST POWERFUL family of languages on computers is that known as threaded interpretive languages, TIL. A TIL cannot easily be described, and R G Loeliger in his book on the subject stresses that to define a TIL it is necessary to view it in the context of language translation.

In a TIL any function — usually called a "word" — when translated by the interpreter is treated as a series of addresses to other, previously defined, words. These previously defined words are also composed of addresses to even earlier words. The threading process continues until all the addresses refer to purely machine-code routines.

TILs are essentially extensible languages, as can be seen by considering how you might implement your own, novel language. A TIL is implemented by creating what Loeliger terms "primitives", keywords which have a purely machine-code definition. When a primitive is activated, therefore, only machine code is used. Primitives thus execute swiftly as they are already "compiled". Loeliger claims that a TIL can be implemented using as few as 40 to 60 primitives.

When the primitives have been defined, or perhaps at the same time as some of the later definitions, you can start to create secondaries. The secondaries have bodies of code which are, in fact, lists of addresses pointing to the location of primitives, or a mixture of primitives and previously defined secondaries.

The most common TIL is Forth, but I will not use Forth as an example because TILs are far more general. I will, however, use the familiar colon definitional form of Forth as this form is also common to most TILs. Any secondary word will be prefixed by Sec, and any primary word will be prefixed by Prim. To define a new secondary word SecX might take the form

```
: SECX SECA SECB PRIMC ;
```

which utilises secondary SecA and SecB, as well as primary PrimC. The initial colon indicates to a TIL that the next word, SecX, is to be defined. The definition of SecX is that the word does SecA then SecB and then PrimC. The definition is terminated by the semicolon.

The other words in the definition have to be already defined, for example:

```
: SECA SECD PRIME;
: SECB PRIMF PRIMG;
: SECD PRIMH;
```

The reason a TIL is called "threaded" is shown in figure 1. When it is interpreting the various words the TIL seems to thread its way through the computer's memory. For each word there is an associated unambiguous number which says what that word actually does when activated by being used in, say, a definition.

Before you can use SecX, therefore, you have to have previously defined PrimH, PrimE, PrimF, PrimG and PrimC. In a TIL, to make an application be successful, you have to have built from the bottom up all the necessary primitives and secondaries. To build from the bottom up actually forces the programmer to develop a systematic mode of programming. Unless the programmer knows what he or she is doing, little can be achieved.

Each word has an unambiguous number which can be used instead of the word itself. Instead of activating the process which is SecX by using the name of the word you could use the number of the word, for example;

```
NUMBER.SECX
```

and execute the routine stored at that number. You could,for example, say

```
NUMBER.SECX EXECUTE
```

which would have the same effect as entering SecX. The definition of SecX could then be written as

```
:SECX NUMBER.SECA EXECUTE
  NUMBER.SECB EXECUTE
  NUMBER.PRIMC EXECUTE;
```

though the point of the exercise may not be clear.

Take any word. To be able to execute the routine stored at a certain number you need to be able to apply to any word a set of rules — an operation — which produces the number for that word. You could, for example, produce the number for SecX by

```
SECX WORDNUMBER
```

and it is worth considering what is the form of the routine stored at that number.

When the word SecX is encountered, the interpreter effectively finds Number.SecX using a routine such as Wordnumber. It then executes the routine stored from that number. The simple word SecX is thus regarded by the language interpreter as

```
SECX WORDNUMBER EXECUTE
```

because the system works with numbers, and not with names.

The routine stored at Number.SecX is merely a series of numbers, Number.SecA to Number.PrimA, which are pointers to the numbers, not names, of words necessary to the operation of the word SecX. When the system then examines the routine at Number.SecA it finds pointers to Number.SecD and Number.PrimE, and the routine at Number.SecD points to Number.PrimH.

When the number of a primary is found, the routine to which it points is a machine-code routine that actually has a meaning beyond a series of addresses. The primary is the place at which the regress stops, for no computer is infinite and so at some point finitude intrudes.

The language I have just described can do the following:

- Every word has an associated number which is solely the number of that word.
- When a word's number is given, the operation of that word is unambiguously known.
- Words defined later in the sequence cannot be used by earlier words, as a word can only be defined in terms of words which already exist.
- There is one level of word which does not refer to other words, but operates on the basis of a routine composed of the basic elements of the computer — that is, machine code.

Examine the definition:

```
: SECY SECX SECY ;
```

in which the word SecY refers to the word SecY in its description. How is this definition to be interpreted?

Case 1. Suppose that there is a word SecY to which you append (1) to show that it is the initial example of the word. It is therefore written as SecY(1), though for the TIL it will only appear as SecY. There is a number to correspond to this word, Number.SecY(1).

If there is then another example of the word SecY, which is defined in the above line, it will be distinguished by appending a (2). This assumes that the TIL translator treats all information between round parentheses as comment. The definition might then be written as

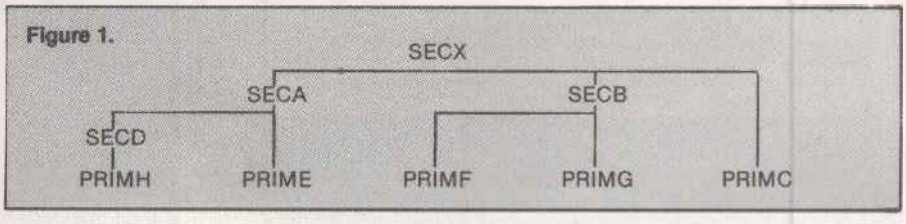
```
: SECY(2) SECX SECY(1) ;
```

where it can be clearly seen that that though the name is the same, the routine is different. Number.SecY(2) is not the same as Number.SecY(1). But how does the system know, when the definition of SecY is given in terms which include SecY, that the initial example of SecY — that is, SecY(1) — is the one which is meant, and not itself, SecY(2)?

To resolve this possible ambiguity the

(continued on next page)

Figure 1.



(continued from previous page)

TIL must be constructed in such a way that when the translator is searching through for the word SecY it does not find itself. When the word SecY, variant (2), is being defined the fact that it is called SecY is hidden from itself, and the name can only be discovered after the definition is completed successfully.

In this case, though the definition may seem self-referential or recursive it is not: SecY(1) is not the same as SecY(2), and thus Number.SecY(1) is not equal to Number.SecY(2).

Case 2. Now suppose that the number to which the word SecY refers in the body of the definition is Number.SecY. And suppose that the number of the word SecY being defined, is also Number.SecY. When the word SecY is activated, the system will execute the routine at Number.SecY. The routine will then point to Number.SecX, and onwards, to be followed by a pointer to itself, Number.SecY. Thus the routine will repeat until stopped in some way.

To be able to refer to itself, the type of definition has to be altered. When a colon definition is given, a word cannot find itself, so a new version of the colon has to be used. Let it be called SR:, for self-referencing colon:

```
SR: SECY SECX SECY SR;
```

and the SR: has to be matched by a special word to end the definition, the self-referencing semicolon.

At this stage a special procedure has to be designed to allow self-referencing. You can give two meanings to a colon definition, depending on whether you want Case 1 or Case 2. But when you actually have to perform the operation you have to be clear. Normally, however, the form of self-referencing is more controlled and there is a means to stop activation of the self-referential execution. For example,

```
SR: SECY SECX CONDITION IFTRUE
  SECY IFEND SR;
```

where Condition is just that, a condition which will vary depending on the state of computation and which, if true, activates the self-referential execution.

Case 3. Remember that it is possible to execute a word by giving the number of the word, and then using the word Execute. The definition might then be given as

```
:SECY SECX NUMBER.SECY EXECUTE;
```

though there is still the problem of how to find Number.SecY while you are still giving it a definition.

There are at least two possibilities. First, you could define a special word to perform this function called perhaps MyNumber. Or you could leave it in abeyance, to be supplied later, for example:

```
:SECY SECX INPUTNUMBER EXECUTE;
```

Later you could apply WordNumber to SecY, and assign the resulting value to InputNumber. Actually, in this way you could swap between the two — or more if needed — versions of SecY. This facility is often described as using execution vectors, and why stop at versions of SecY? This last method is obviously the most flexible of the three and it an provide great power.

TILs are powerful and flexible because of the way they can produce new words which can not only do things, but also describe how things are to be done. A TIL is equally at home bit-twiddling as it is running systems or producing super-fast graphics. No other family of languages can legitimately claim so much, particularly when you take into account that a TIL is perfectly suited to be implemented on a small computer.

One reason why TILs are so powerful is that they closely match the arithmetisation of mathematics as proposed by Gödel and others. A TIL is a finite representation of Gödel's infinite arithmetic. The problems TILs have solved will be found to have equivalents in Godel's arithmetisation, which have not been solved.

An example of the mapping between TILs and theories of the infinite in mathematics is proved by Russell's theory of types. To solve the conundrum "Is the set of all sets a member of itself?" Russell invented his rather *ad hoc* theory of types. In it there was a gradation between individuals, then properties of individuals, properties of properties of individuals, and so forth.

Essentially, the theory of types is the doctrine that any property of an entity at one level, cannot be assigned to an entity at any other logical level. I think that the resemblances begin to be clearly seen.

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Cures for a bad memory

by Ray Coles

INSIDE most microcomputers, there lives a very important memory area which never seems to feature in the glossy brochures or in the advertisements, namely the operating system read-only memory — ROM to its friends. Eight-bit microprocessors such as the Z-80 and 6502 can usually address up to 64K of memory with their 16-bit address bus, but microcomputer data sheets rarely talk of more than 48K of available memory. The remaining 16K is reserved for the operating-system ROM which normally contains all the input, output and housekeeping software and, in most cases, a Basic language interpreter.

For the owner, it is very comforting to know that just by hitting the On switch he or she can gain access to all of this lovely ROM-based software without having to perform a load from cassette or floppy disc. It is the availability of cheap ROM chips, just as much as cheap microprocessors, which has made the low-cost microcomputer a practical proposition. The operating systems of early microcomputers often consisted of four or more separate 24-pin ROM devices. Today a full 16K can be packed into a single inexpensive 28-pin package, and this causes something of a problem for the poor designers.

ROM devices are programmed during the manufacturing process by means of the final metallisation mask layer. This ensures that they never lose their stored instructions, but it also means that making modifications or applying software fixes is next to impossible. Erasable programmable ROMs are available, of course, and they are fine for prototypes. But unfortunately EPROMs are much more expensive than masked ROM, and the microcomputer business is now entering a highly competitive phase when every penny counts.

Anyone who has ever written even a 10-line Basic program already knows all about the frequency of software bugs and how difficult some of them are to track down. So put yourself in the position of the poor old microcomputer designer who has just added the last assembly-language statement to 16K of system software, and is about to post it off to the ROM manufacturer with an order for 5,000 ROMs at a tenner apiece. You will begin to see why most 30-year-old chief designers have grey hair and smoke 40 a day.

This month I have good news for all those long-suffering designers. With their best interests at heart Motorola has introduced a new ROM which is repairable. It is called the CREEM which stands for combination ROM plus EEPROM memory. Inside the CREEM device there is a 14K masked ROM array, a 2K electrically reprogrammable EEPROM array, and a separate 256-byte EEPROM page which can be used to replace any other 256-byte page in the main ROM area.

With CREEM on his side, our microcomputer designer whistles a jolly tune as he posts off his order for 5,000 with enclosed operating-system code. When the complaints roll in about an obscure bug which affects all Dim statements above a certain size, instead of reaching for the Walther PPK he locates the bug and modifies all 4,802 ROMs still in stock by overlaying the bad code with the 256-byte relocatable EEPROM page.

Even when the disc-drive manufacturer announces that it will discontinue the model originally specified by our hero, he does not flinch or bite lumps out of the carpet-tiles in his office. Because he was canny enough to route all I/O calls through the 2K EEPROM array, all future systems can have the updated code inserted and ready for the new disc drives when they arrive. The CREEM, coded MCM-6836R16 by Motorola, fits into a standard 28-pin ROM package and costs a lot less than a fully programmable EPROM. Our rejuvenated microcomputer designer will no doubt get the girl and live happily ever after.

Another problem faced by microprocessor memory designers concerns the volatility of read/write RAM. In many microprocessor-based systems — although not generally in personal computers — it is desirable that data stored in read/write memory should be retained when the power fails or even when it is deliberately switched off. Until recently there have been three main ways of ensuring non-volatility: using magnetic-core memory, EEPROM or battery-backed RAM. All have their attendant problems.

Magnetic-core memory is certainly still used, and is favoured for military applications where its ability to survive in severe environments is attractive. It is not generally applicable, however, due to its high cost and large physical size. EEPROM is very much a modern technology, but unfortunately it is very slow to write and erase, and it is not therefore a suitable replacement for conventional RAM memory.

Battery-backed RAM, in which conventional RAM chips are supported by an external battery during power-loss conditons is widely used, and is quite suitable for most systems, but it still suffers problems. What is needed is a non-volatile RAM device which can be plugged into a standard RAM socket where it will behave just like any other RAM until the power fails. At that point it will, all by itself, reliably retain its stored data without any external assistance. I am very pleased to be able to announce that such a device has now been introduced by Mostek. With any luck it will become the first of a whole new family of such devices which will feature ever-increasing capacity.

The new device, coded MK-48Z02 appears to the outside world like any other 2K CMOS static RAM. It has a 200 nanosecond access time and uses a 24-pin package compatible with the pin-outs of a wide range of existing ROM, EPROM, EEPROM and RAM devices in the so-called byte-wide format. The only difference is that the MK-48Z02 has two lithium button cells together with all the protection and change-over logic actually built into the package. Any RAM socket it is plugged into immediately becomes battery backed.

The lithium cells have a shelf life of about 10 years even at high temperatures. In the low-voltage data-retention mode the RAM chip used needs only about 5 nanoamperes — 5×10^{-9} A — at room temperature. The theoretical life of the two 35 milliampere-hour cells is over 500 years. For my money, this is the best solution yet to the problem of providing non-volatile RAM.

Maze mastery

John Billingsley reports on the 1983 British Euromouse heats at Earls Court.

YET ANOTHER cliff-hanger ended this year's Euromouse British Finals as Alan Dibley's T4 and David Woodfield's Knownaim battled in the closing minutes for the £1,000 trip to Madrid, put up as a first prize by Micro Management.

Mice had started to arrive on Friday, while the maze underwent plastic surgery to repair its accumulated knocks and blemishes. The seated arena at the Earls Court Computer Fair seemed bigger than ever, with an adjoining mouse development area which appeared to be ample at first. As more teams arrived, however, there was a scramble for space and improvised work benches were propped up on chairs.

First to take to the maze was Tony Porter's Maisey, a strange mouse with a tottering gait which seemed able to get itself out of any tricky corner. Alan Dibley started to tune up his stableful of Thezeii, while David Woodfield unveiled Knownaim the successor to Thumper.

Woodfield's mouse is extremely smooth in its operation. Built on the dodgem principle, it is a front-wheel-drive tricycle with stepper-motor steering. When exploring, its drive motor receives only a fraction of normal voltage and Knownaim seems to drift gently about the maze. But if it knows that there is a long straight ahead it puts on a startling burst of speed.

Alan Dibley's T4, on the other hand, buzzes about the maze like an angry bluebottle. Unless completely cornered it keeps going no matter what. Then with an impatient shrug it performs a three-point turn and bustles on its way. It entered its first contest last year in Finland, where it missed the European Championship by a mere two seconds.

Prominent among the newcomers were the boys from Ilford County High School with Barnacle Bill III. A kindly description of their mouse would be "alternative technology". The heap of wooden wheels, plastic lunch box body and assorted pieces of Plasticine which they spread out on the work bench certainly did not speak of technological overkill. What their mouse lacked in technology and performance, however, they made up for in enthusiasm, performing so well before the TV cameras that Clement Chambers of CRL has provided sponsorship to send them to the Euromouse Finals in Madrid in September.

Saturday's novice contest started off with David Buckley's Quester. It is no wonder that Quester has never won a major prize — in the two years since it first saw the light of day its processor has never been connected to its body. Barnacle Bill was

Alan Dibley and the victorious T4.

scooped on to the maze, then carried off again in a noisy procession in the hope of resuscitation. Transplant surgery was not enough. Gonzales, a newcomer made by Bill Urmenyi, made a valiant effort. Bill's efforts were even more valiant, if somewhat illegal, as he helped it around corner after corner. It is a mouse with potential.

Another most worthy newcomer was Anonymouse, built singlehanded by a London youngster, Guy Hills, with no help from his school. Finally Fullyautomatix took to the maze. The product of the boys of Maelor School, Bangor, this was a well developed piece of engineering marred only by stepper-motor problems and the discrepancy between an imperial mouse and a metric maze.

First prize of an Atari 800 was awarded to the Maelor schoolboys and their Fully-automatix. The boys' success also brought them sponsorship from their home town to take them on to the European Finals in Madrid. Second prize of a Dragon computer went to Bill Urmenyi while the third prize, a voucher from Computers for All, was given for a worthy effort to Guy Hills.

Sunday's final started with a short run by Elmer, a first-time mouse which really should have been among the novices. Messrs Jackson and Sweeney had been unable to arrive on Saturday and so Elmer's brief moment of glory was rapidly eclipsed. Thezeus set off for a long patient plod around a very difficult maze. Usually reliable, even if slow, Thezeus ran out of patience or luck and made a dignified retirement. The 500-strong audience were growing restive as Maisey set off, but a few minutes later burst into applause when Maisey showed that the centre could be reached in 5 minutes 42 seconds.

After Maisey, Alan Dibley's T3 disguised as a First World War fighter ace took off into the maze. But the aim of the contest is not circuits and bumps, and T3 withdrew without finding the centre. A historic interlude followed as Nick Smith brushed away the cobwebs and placed on the maze the first European champion, Stirling Mouse. Behaving almost impeccably, Stirling found the centre first in 3 minutes 2 seconds and then in 1 minute 47 seconds. Another past champion then took to the maze, and Thumper made rather heavy weather of finding the centre in 3 minutes 50 seconds.

Now we had reached the two favourites. Would Dibley's T4, an exercise in perpetual motion, reach the centre first or would the honours be taken by the ingenious Knownaim? T4 was clearly not up to its best, but after several restarts reached the centre in 1 minute 2 seconds. On a later run it proved that the maze really was not so difficult and could be solved in 47 seconds. Knownaim then sallied forth, batteries charged to the brim, but after only 15 seconds staggered askew into a wall and had to be restarted. After a while, as the batteries discharged, Knownaim became more consistent. However, its memory of the maze had become muddled and it repeatedly took a long route to the centre in 1 minute 15 seconds.

Though acknowledging the enormous potential of Knownaim the judges placed it second to win a 48K Sinclair Spectrum for David Woodfield. Alan Dibley's T4 was awarded the £1,000 first prize while Nick Smith and Stirling Mouse won the third prize of £25-worth of books from John Wiley Ltd.

Alan Dibley has generously undertaken to spend his £1,000 on a combined trip for both Dibley and Woodfield families to travel to the Euromicro Conference in Spain so that Britain can be represented in force at the European Final. They take the task of wresting the championship back from the Finns very seriously and Alan Dibley plans to have a brand-new Thezeus, T5, ready for the contest.

Next year's British finals will be held again at the Computer Fair and the European finals will take place at the 1984 Euromicro Conference in Copenhagen. In each case there will be a valuable prize for novice mice. If you can meet the challenge, write for details to Dr John Billingsley, Portsmouth Polytechnic, Anglesea Road, Portsmouth, PO1 3DJ.

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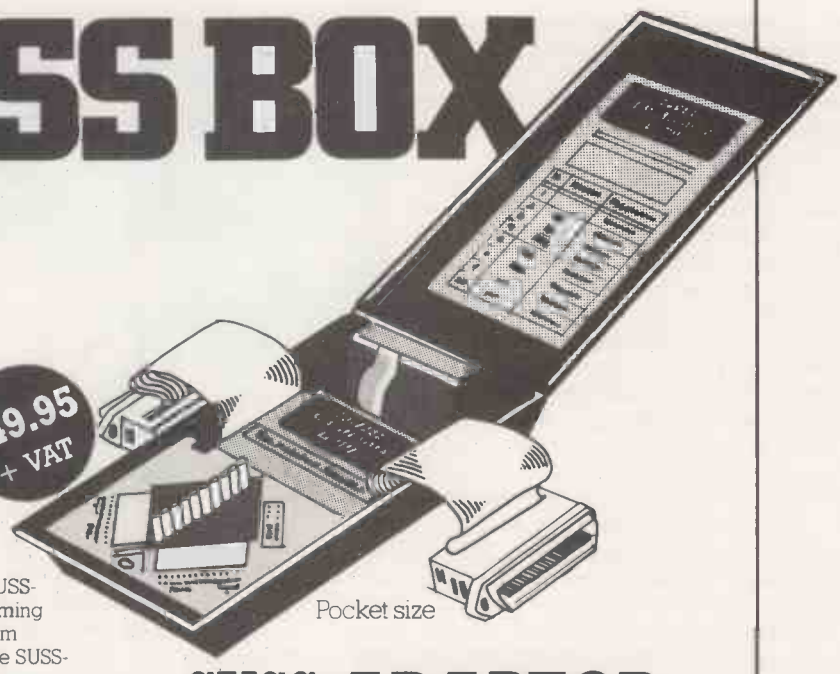


Pocket size

The DUPLEX SUSS-BOX and DUPLEX SUSS-ADAPTOR have been designed to enable the less skilled computer user to have a better understanding of the correct working connection between a computer and a peripheral, such as a printer. This is achieved by using the commonly used signals (wires) of the RS232C serial data cable specification, a matrix-block and special connector pins.

£49.95 + VAT

By inserting the connector pins into the SUSS-BOX's matrix-block at the axis of two incoming signals the user can quickly establish a firm connection. The signals are routed into the SUSS-BOX by two 25 way D type connectors; 1 x female. 1 x male. The SUSS-BOX also provides a lamp for each signal to show its condition when connected in-line, ie High or Low.

JUMPERING:

Jumpering between two or more signals is possible by using three SEPARATE jumpering lines also available on the SUSS-BOX & ADAPTOR matrix-blocks, thus each of the incoming 25 way connectors can be jumpered independently.

WIRES ROUTED THROUGH THE MATRIX-BLOCK:

On each connector, pins:– 2, 3, 4, 5, 6, 8 & 20. All remaining pins are wired through.

Lines for jumpering:– J1, JA2, JA3, & JB1, JB2, JB3. All separate lines.

SUSS BOOK

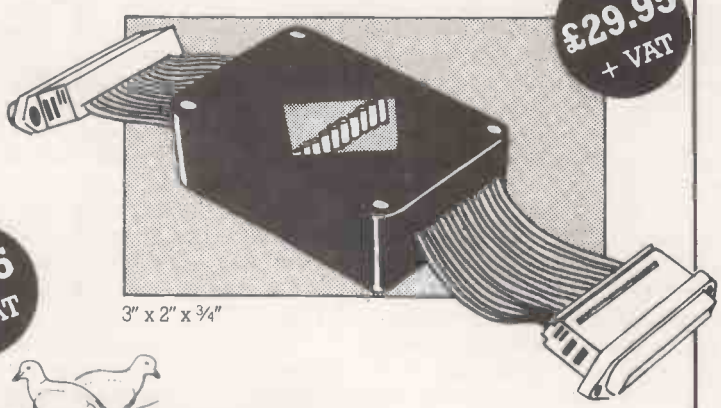
£3.75 + VAT

If the user specifically wishes to connect a microcomputer to the OCTET or HERMIT typewriter/printers then refer to DUPLEX's SUSS-BOOK for details on various microcomputer cable 'Pin-outs'.

SUSS-ADAPTOR

When the user has achieved the correct 'Pin-out' between a micro computer and a printer the DUPLEX SUSS-ADAPTOR should be used as a permanent means of connection. This is done by 'transposing' the correct matrix-block pin-layout already established with the SUSS-BOX onto the matrix-block of the SUSS-ADAPTOR, and then installing the SUSS-ADAPTOR in between the computer and printer.

£29.95 + VAT



3" x 2" x ¾"

All prices are based on cash-with-order terms

DUPLEX Communications Ltd.

The Interface People

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ASHTON·TATE

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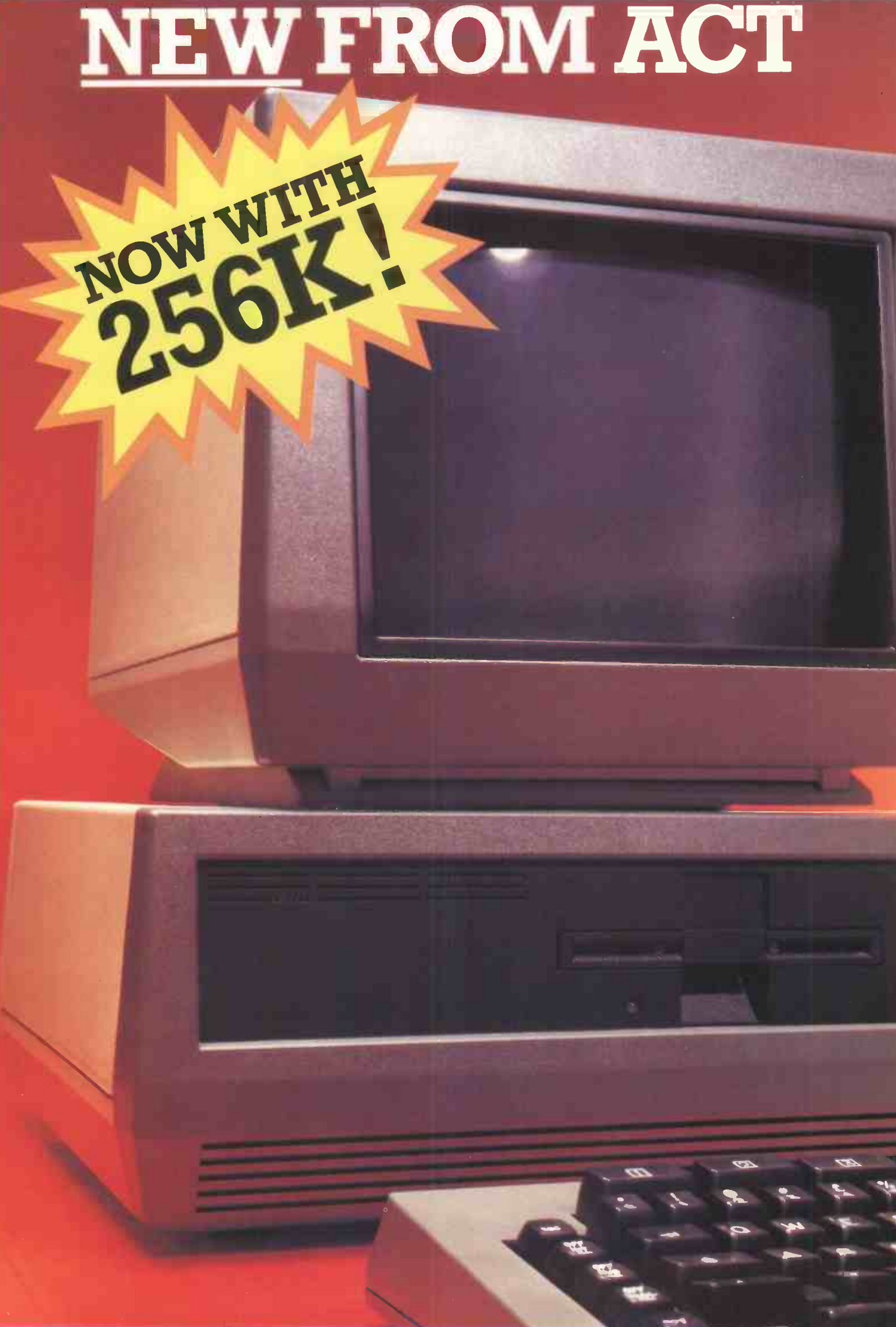
NEW FROM ACT



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General Specifications

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- 800 x 400 pixel high resolution graphics
- Multiple operating systems
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- User port

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dUTIL makes dBASE II faster

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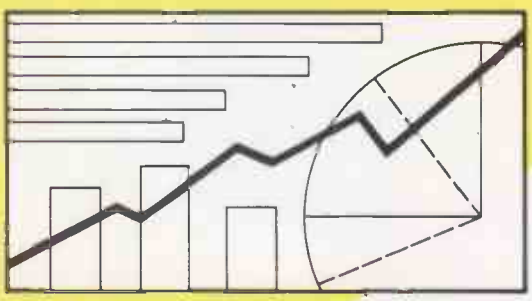

Easy to use dGRAPH makes dBASE II better to look at

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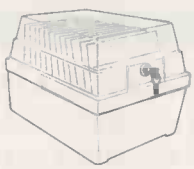

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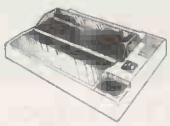

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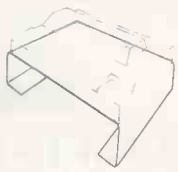

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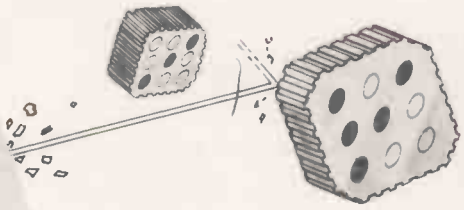

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Integral Disk Storage: 19-Mbyte Winchester drive plus 1-Mbyte floppy drive
Storage Options: Up to 4 add-on Winchester drives plus streaming tape backup
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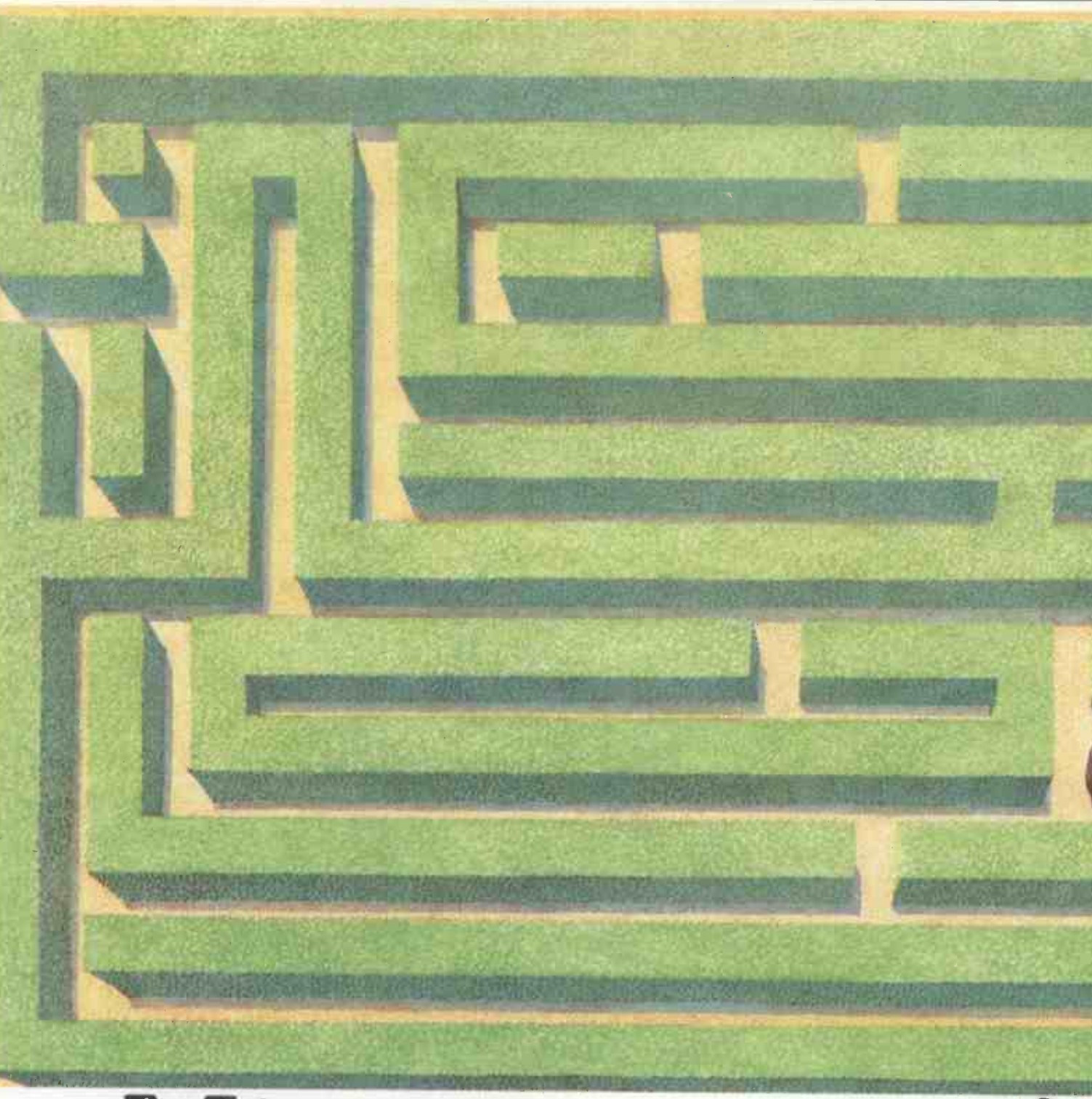

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Today, with so many systems available, it makes sense to deal with just *one* company who can supply all your microcomputing needs – the hardware, and specifically tailored software.

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Also, Rank Xerox offer you the "Helpline" service. As its name suggests, we don't just provide you with the right microcomputer system for your business, we also help you through those first vital stages of operation. Any questions, just call us and our specialists will work with you on a telephone link. No charge.

On-site servicing is another benefit of choosing Rank Xerox. And it's prompt.

Powerful microcomputers designed to help you manage your business better

Not just power, but simplicity, too. And compactness. Keyboards and controls have been more thoughtfully designed to make working with Xerox microcomputers easier and more comfortable.

The new Xerox 820 II range, for example, has all the built-in memory and operating power you could possibly need. It's CP/M* based with 8-bit or 16-bit versions. You could select the advanced 820 II HRG, with on-screen graphics for plans, graphs and so on.

For extremely powerful word processing and microcomputing together in one complete system, there's the Xerox 823.

And remember, these are *expandable* systems that grow as your business needs grow. At the same time, they're *adaptable* systems, with many disc drive and printer options to suit your requirements.

Software for every aspect of your more efficient business.

Every aspect of your business can be controlled more efficiently by you and your better designed Xerox microcomputer.

Budgetry and financial analysis, records and data management, word processing, plus specific business accounting packages that help you to calculate payroll, update sales ledgers, and monitor stock control, and more.

Suddenly, you could have instant access to all the information you need to make informed business decisions – information you can update, manipulate, and store on easy-to-file discs.

You're able to work in your choice of computer languages too, including BASIC, Pascal, Cobol and APL.

Which Xerox microcomputer system is right for you? Let us point you in the right direction right now. To the coupon below. Simply fill in and freepost it today.

Alternatively call our 24-hour enquiry service. Dial the operator and ask for Freefone 2279.

*® *CP/M is a registered trademark of Digital Research Inc.*

RANK XEROX

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FREEPOST THIS COUPON TODAY!
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Yes, I'd like to know more about the Xerox 820 II series of microcomputers. Please ask my local authorised dealer to contact me soon, to arrange a demonstration.

Name _____

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PC9/83

GALAXY 2 COMPUTER SYSTEM

WHATEVER REQUIREMENTS YOU HAVE

The cost-effective solution to your computer needs for only £1,495*

For just £1,495 the Galaxy 2 provides the basic requirements for a small business system:

- **Central Processor Unit with 64K of RAM**
- **Twin disk drives (400K storage per drive)**
- **Keyboard and 12" monitor**

But unlike many other small-business systems the Galaxy System is specially designed for expansion and flexibility to meet changing requirements. It uses the world's best selling micro processor, the Z80A, and is based on industry-standard 80-Bus boards. The business system uses only 3 boards in the 5 spaces available, so extra cards can be "plugged-in" to expand the system; for example to expand the memory, or to give a colour facility, or to develop the Galaxy for the particular requirements of education, research, software development etc.

It has a CP/M operating system which gives access to the largest range of software available for any machine. In particular, Gemini can offer QUIBS; a small-business package developed especially for the Galaxy.

The Galaxy has industry-standard interfaces (parallel and serial), and Gemini Microcomputers can supply a full range of compatible hardware including a Winchester sub-system and printer.

The Galaxy offers the most cost-effective way of obtaining a basic unit which is capable of developing to meet your particular requirements; now and tomorrow.

Features include:

- **Twin Z80 Processors**
- **64K Dynamic RAM**
- **800K Disc Based Storage**
- **80 x 25 Screen Format**
- **Dual Printer Interfaces**
- **Modular Design**
- **Extra Disc Drives Easily Added**
- **Winchester Expansion Available**
- **Net Working System Available**
- **Additional Slots for 2 Cards**
- **12" Green or Amber Monitor**

*Price is exclusive of VAT

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CLEARWAY is the Local Area Networking System with a starter kit that can be fully installed for under £500.

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*****THE NEW DBMS III (series III of the world's first 'task-robot-programs')*****

*****FEATURES*****

1400 character record sizes	32000 records per filename	12 online file architectures
mathematical scratchpad	20 main/200 sub fields per record	240 fields using cross-referencing
record relational indexes	field and record related formulae	cross-record calculations
translateable to any language	'Jump-to' any of 32000 records per file	'Jump-to' any record in 12 files
User-defineable reporting	random/binary/key/multiple field search	User-defineable files/field words/sizes
field protection/classification	'if-then' questioning	endless 'either-or' matching
either-or. same as. greater. smaller	file protection/password entry	formulate/recall on selection criteria
sorts 'alpha or numeric' any window	range match. not match. integer match	13 interrogation question types
12 online file architectures	sort speed 500 records per 20 seconds	short filing output/audit trails
		Word-star & Mbasic compatible

DBMS III.7 NEW SWITCH MODE FACILITY ENABLES YOU TO CROSS UP TO 12 DIFFERENT FILES (32000 RECORDS PER FILE) PRE-SELECTING ANY OF UP TO 20 FIELDS PER RECORD/FILE FOR DISPLAY/PRINT OUTPUT (240 FIELDS) IN ALL. ONE MASSIVE ENQUIRY CAN PASS THROUGH 384,000 RECORDS

You might have two files whose records are directly related to each other, so that the first file (say containing names and addresses) refers to the second file (say financial and other information relating to the same record numbers in the first file) directly. Then you can simply select that in file 1 you are interested in just the name and telephone numbers, whereas in file 2, you are interested in the income, trading period and number of branches, information. Your enquiry can then pass through both files highlighting that information only. Actually there doesn't need to be a strict correlation between the same record numbers in different files, and you can also on just one JUMP command go to any record in any of the 32000 records in any of the twelve files and carry on cross-referencing from there onwards.

DBMS'S MACROS WORK FROM THE MOMENT YOU INSERT THE 'TASK DISK' IN THE COMPUTER

Simply design your file, give its fields your words, setup your report mask, and then enter your records. Switch to 'automatic drive' and formulated any task you wish to program to fulfill, the task is stored as a macro. Take a copy of the program on another 'task disk' and from then on, the task disk will function without a single key-stroke. Think of a number of such 'task disks' such as "stock-re-order reports"; "stock-valuation reports"; "analysis"; "patient history analysis"; "research-analysis"; "budgetting-analysis"; "vehicle-location control"; "librarian analysis"; "plus more?"

Not only does this program surpass most of its kind that you might buy elsewhere, but if you buy the hardware from us, then you get it FREE . . . DBMS II (WITHOUT MACROS) AND DBMS III ARE FULLY IMPLEMENTED UNDER CPM-86 (tm) AND MS-DOS (tm) I.E.: SIRIUS/VICTOR/IBM DBMS II IS £395.00 (or £250.00 by mail order ex. training) . . . DBMS III is £575.000 (or £295.00 by mail order ex. training).

MICRO-COMPUTERS

INTERTEC	·Superbrain 64K RAM/320K disks	1895.00
	·Superbrain 64K RAM/700K disks	2395.00
	·Compustar 64K RAM/320K disks	2195.00
	·Compustar 64K RAM/700K disks	2595.00
NORTHSTAR	·Advantage 64K RAM/700K disks	£2195.00
(exc DOS)	·Advantage 64K RAM/5.3M disks	£3095.00
TELEVIDEO	·802 64K RAM/700K disks	2395.00
	·802H 64K RAM/7.3M disks	3950.00
	·806 64K RAM/10M disks	5195.00
	·816 256K/750K disks	*£3350.00
ACT	·Sirius 1 256K/1.2M disks	*£2195.00
	·Sirius 2 256K/2.4M disks	*£2695.00
	·Sirius 3 256K/10MEG disks	*£3995.00
VICTOR	·9000 256K/1.2M disks	*£2195.00
IBM	·PC 64K RAM/640K disks	*£2795.00
	·PC1 330K/640K disks	*£3395.00
IBM	XT (TEN MEGABYTE)	4480.00
IBM	XF (FIVE MEGABYTE)	3250.00
Ten 4480		*3995.00
Five 64K 5 Meg disk		£3250
ALTOS	ACS800-2 64K RAM/1M disks	2195.00
	ACS800-10 208K/10.5Meg disks	5695.00
NEC	APC 128K RAM/2M disks	call.00
CORVUS	Concept 16 bit pc	call.00
SANYO	G80 64K RAM/320K disks	1195.00
ABC	26 64K RAM/2.2M disks	3250.00

All computer prices include mbasic as standard.
All prices marked * are 8/16 bit machines.

WE STOCK MOST OF THE BEST KNOWN SOFTWARE ALSO MOST OF THE BEST KNOWN BRANDS OF PRINTERS & PERIPHERALS FROM 300.00 TO 2700.00 (OKI/EPSON/DRE/NEC/QUME/ANADEX/RICOH)

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OKI	·Microline 80	295.00
	·Microline 82A	395.00
	·Microline 83	695.00
	·Microline 84	895.00
EPSON	·MX80/FT-3	425.00
	·MX100/FT-3	575.00
ANADEX	·DP 9000	895.00
	·DP 9501	1045.00
	·DP 9501 (A)	1145.00
QUME	·9/45 R/O	1995.00
	·9/55 R/O	2195.00
	·9/35 R/O	1495.00
NEC	·3510 R/O	1495.00
	·7710 R/O	2195.00
	·5520 KSR	2250.00
DRE	·8820	1295.00
	·8830	1695.00
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	·825	995.00
DIABLO	·630	1995.00
RICOH	·RP1600	1095.00
OLYMPIA	·ESW 103 14 CPS	975.00

SOFTWARE

G.W.L.	·BUS V8.00 (Accounts)	275.00
	·DBMS II (Database)	*£395.00
	·DBMS II (by mail order only)	*£250.00
	·DBMS III (database)	*£575.00
	·DBMS III (by mail order only)	*£295.00
	·FORMS/TEXT/CALC/·DBMS IV	*£575.00
	·Sales Ledger	*£95.00
	·Purchase Ledger	*£95.00
	·Nominal Ledger	*£95.00
	·Stock·Control	*£95.00
	·Address·Mailer	*£95.00
	·QASort/QNSort (500 Recs/14secs)	*£95.00
MICROSOFT	·Mbasic 80	*195.00
	·Fortran 80	295.00
	·Cobol 80	395.00
	·Basic Compiler	*225.00
	·MU lisp/mu star	125.00
MICROPRO	·Word·star	*£295.00
	·Mail·merge	*£95.00
	·Spelstar	125.00
	·W·star/M·merge/Sp·Star	425.00
BYROM	·BStam (communications)	100.00
	·BStms (tele-comms')	100.00
DIGITAL	·CBasic	75.00
	·Concurrent CPM/86	*375.00
	·CBasic86	*175.00
	·Pascal MT	225.00
LIFEBOAT	·T/Maker	155.00
M'FOCUS	·CIS Cobol	420.00
	·Forms II	100.00
SORCIM	·Super Calc	195.00
PEACHTREE	Magic Wand	190.00
	·Magic Calc	175.00
VARIOUS	·Including tele-comms etc	call.00

Software formats on all micros in our hardware list.
All prices marked £ are available 8/16 bit formats.

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POPULAR BRANDS OF EQUIPMENT WE SELL
MICROS: Sirius/Victor/I.B.M./DEC
Epson/North-star/Sanyo/Superbrain
Compustar/Altos/Apple-Lisa/Televideo
PRINTERS: Nec/Qume/Diablo/Oki/Epson
Olympia/Ricoh/Texas/Dre/Anadex
OTHERS: Corvus/Compustar
Hard disks networks and multiplexors
Spoolers/Modems/Buffers
most of the best known brands of software

SYSTEM DEAL (our speciality) SAVES YOU 1500.00+

Buy any computer, any printer and 150.00 value diskettes add £85.00 for cables and testing.
add 10% for return to base warranty for 1 year (optional)
add £110.00 for delivery & installation (optional)
Training optional extra £120.00
and get completely *****FREE*****

cpm handbook	50 basic exercises	2000 sheets paper
DBMS III.7	magic wand w/proc	magic calc
mbasic 80	diagnostics	msort/dsort
recover	autoload	instant basic
library boxs	disk/games	DT/AS/NS sorts

Total Value £1525.00
Based on 8 bit hardware, 16 bit software varies.
Here's a typical example of a complete system deal

1-Sirius 128k ram/1.2 megabyte disks	2395.00
2-Oki microline 80 printer	295.00
3-Cables & testing	85.00
4-Diskettes	150.00
5-price differential on magic/wand for word-star	100.00
software described above ***** FREE *****	3025.00

We specialise in 'STANDARD MICRO-PRINTER SYSTEMS' as well as 'NETWORK SYSTEMS BASED ON A SHARED HARD DISK'.
The range of computer products (mostly ex stock) includes the most popular brands of micro-computers, printers, modems, buffers, spoolers and software.

PERIPHERALS & ACCESSORIES

CORVUS	·6 Meg hard disk	1950.00
	·11 Meg hard disk	2950.00
	·20 Meg hard disk	3950.00
	·Multiplexor 7 station	695.00
	·Mirror backup card	695.00
INTERTEC	·Compustar 10 Meg hard disk	2950.00
	·CDC 144 Meg hard disk	7950.00
N'STAR	·16 Bit u/grade	395.00
	·18 Meg hard disk	2995.00
RODIME	·6 Meg hard disk	1495.00
	·12 Meg hard disk	1950.00
GENIE	·5MG fixed/5MG removeable disk	3295.00
QUADRAM	·64K print spooler/copier	295.00
BIZCOMP	·RS232/Auto·modem 1200 baud	450.00
AST	·port expanders (4 tmnls to 1 prtr)	395.00
GIX	·port expander (switcher)	95.00

NOTE: Corvus drives with multiplexor may network sirius . . Superbrain . . Concept . . PET . . Victor . . IBM . .

SOFTWARE COMMENT!!!
INTEGRATED SOFTWARE IS PROPERLY REPRESENTED, when the degree of integration reflects the ability to refer to as many different files, as well as employ as many different functions, under as many different modes as possible in one program only. This principle not being observed, will confer upon your purchases the attribute of their being expensive as an aggregate even though individually they are cheap. "DBMS III.7" and "THE KEY" are comparably worthy of such a label.

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Please call at our showroom only by prior appointment. Unless expressly agreed, all warranties are commercial 90 days return to base for parts and labour. Annual warranties and maintenance facilities available nationwide through closely related third parties.

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G. W. COMPUTERS LTD

G80/86 SOFTWARE

Fully implemented on MS-DOS, CPM 2.2 and CPM 86 (tm)

Works on IBM, Sirius and Victor 9000 and all micro-computers in our price list
Requires the prior acquisition of DBMS 111.7

Sales ledger (95 pounds)
Purchase ledger (95 pounds)
Nominal ledger (95 pounds)
Stock control-valuation/re-order (95 pounds)
The address mailer (95 pounds)
Qasort/Qnsort (500 records/15 seconds) (95 pounds)

Each module is a set of 'task disks' designed for minimal learning curve. This software derives from modules of 'DBMS III' and runs reports without your secretary having to touch a single key

Consider the advantages in these features: The user manual is contained in FIVE pages. All reports are generated by robot functions. Reliability tested (benchtest PCW June). Works in a network multi-user environment Fast easy data entry. Files are re-organised and sorted automatically. Produced by the same people that originated 'BUSiness' 'DBMS II', 'DB-CALC', 'AUTOLOAD AND RECOVER' 'ETC' and sold successfully over the past five years.
Also see our advertisement next page.

The G80/86 networks

Based upon one hard disk and multiplexor module the G80/86 networks feature full network sharing of data resources by adding different stations that may be as various as Sirius/Victor 9000f/IBM/Superbrain/Pet/N'star/Sanyo.
We also have a special 'spooler module' as well as software controllable port expanders and modems for output to telephones, printers, and screens so that a number of terminals may share the resources of one printer, as well as be able to send files over the telephone at any time (day/night) to both store on the hard disk and print out as well.

only from G.W. Computers (the leaders in database)

Call us on 01-636-8210 or 01-631-4818 and leave your address for our standard 'infopacks'

G. W. COMPUTERS LTD — Tel: 01-631 4818

Contains the highest state of the art software available today

FORMS/TEXT/CALC/DBMS IV ALL IN ONE PROGRAM — "KEY" — at £575.00

When you budget for a complete system of software you eventually end up with a host of packages like, Sales, Purchases, Nominal, Data, Text, Calc, Mailshot, Invoice, Order, Workflow, Personnel, and so on.
The list is endless and the outlay several thousands of pounds.

Features. Design a form as wide as a window of 250 characters, long as needed. Cursor movements are 'left, right, up, down, delete left delete right, tab right-left-up-down' Paint your form as you like directly on the screen.

Text..... Write a letter as you see it on the screen, edit it then simply enter ^P to print.

Calc..... Set into the form, your data fields, "£££££" and specific file-related activities, formulae and validation checks.
Enter values and see the spreadsheet calculate itself.

Database. Search files for data to be inserted to fields specified.
All the features of DBMS III, explained elsewhere in our ad.

Here's an example of an invoice you might design for your stationery .....
You could design your own spreadsheet, order form, statement, or any other kind of form that is required to fit your existing stationery.

INVOICE <0>£££££££££££	
To £<1>£££££££££££ £<2>£££££££££££££ £<3>£££££££££££££ £<4>£££££££££ £<5>£££££££	From: G.W. Ltd 55 Bedford Court Mans. Bedford Avenue London W.C.1. Tel: 01-636 8210

Date <6>£.£ Tax point <7>£.£ Agent <8>£

Quantity	Description	Cost	Tax	Total
<9>£	<10>£££££££££££	<11>£	<12>£	<13>£
<14>£	<15>£££££££££££	<16>£	<17>£	<18>£

and so on...

Total...<19>£££££ Tax...<20>£

<??> items <1> to <5> internal command to request name input, and then search an address file for details.
<??> items <6> to <7> request date input and validate.
<??> item <8> request agent number and validate range.
<??> <9> request quantity, validate range.
<??> <10> request description, search file, accept, and calculate fields <11>, <12>, <13>, if finished invoice then calculate fields <19> and <20>

Now comes the more valuable facility, you can provide the 'FORM' with file-related instructions, not only to request a 'console' input for a file search against names, and stock, but after the invoice is finished the fields you have selected may be passed to related files.

EG: Send fields <0>, <1>, <6>, <7>, <11>, <12>, <13>, <19>, <20> to a sales ledger.
Then send fields <9>, <10>, <11>, to product analysis file.
Then send fields <0>, <1>, <7>, <19>, <20> to V.A.T. file
Then send fields <10>, <11>, <12>, <13> to Nominal ledger.

Available at present only on SIRUS/IBM PC.

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Business Computers you can afford.

At last here's a range of true business computers at realistic prices. Sanyo desk top micros give you a choice of 8-bit, 64K RAM or 16-bit 128K RAM, expandable up to 512K. Sanyo's reputation for quality products, thoroughly pre-tested for reliability, is backed up by Logitek's experience and service.

Logitek has a strong reputation for reliable products and a high level of customer support. 100 Logitek dealers are backed up by a national maintenance service, and in-house support on operating systems and applications software.

Logitek are the top distributor for Altos micros, and Peachtree software and the new Landmark multi-processor micro complete the range with full compatibility of operating systems and applications software.

Here are real business computers at an affordable price – get one on your desk now.

- Choice of 8-bit or 16-bit
- 320-640 Kbytes on floppy disc
- Expandable up to 1.2 Mb
- True 8086 16-bit processor
- Peachtree accounting software
- CP/M, CP/M-86, MS-DOS operating systems
- Price from £1195 to £2450

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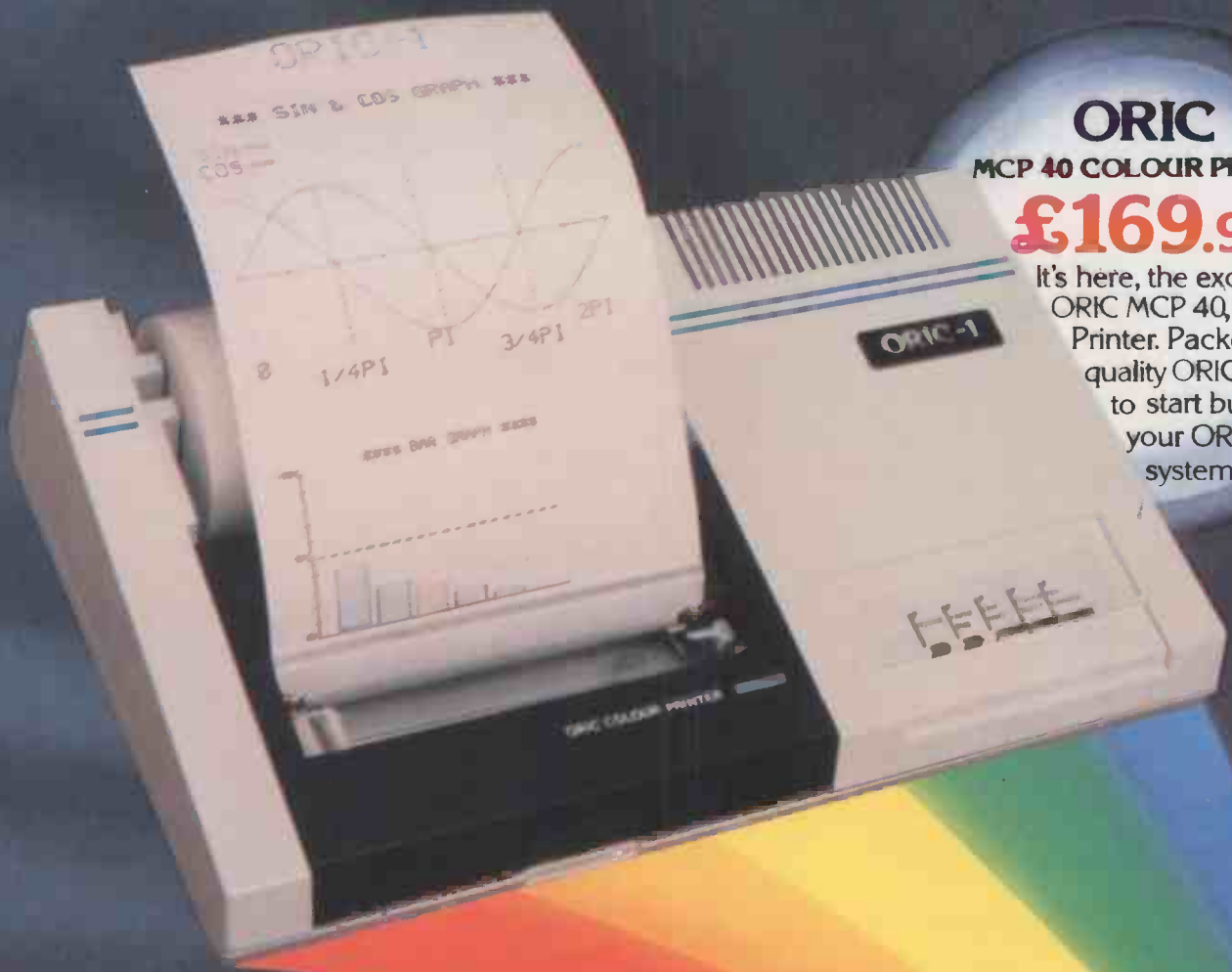
● Circle No. 146

ORIC MCP 40 COLOUR PRINTER



ORIC
MCP 40 COLOUR PRINTER
£169.95 Incl.V.A.T.
It's here, the exciting new ORIC MCP 40 Colour-Printer. Packed with quality ORIC features to start building your ORIC system.

Superbly styled and quality engineered to provide 4 colour hard copy, for home and business use.

Just look at these leading features:

- **Quality hard copy on plain paper**
- **Superb graphics and text capability**
- **Prints 4 colours – Red, Green, Blue and Black**
- **Designed to match the futuristic style of ORIC 1**
- **Plugs straight into your ORIC – printer lead supplied**

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The ORIC MCP 40 – Setting new standards in Micro Computer Printers. ORIC The Real Computer System

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- Superb Styling
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- Teletext/Viewdata compatible graphics
- 6 Octaves of real sound plus HI*FI output
- Centronics printer interface and cassette port
- Free user manual, cassette recorder lead and Driver game included.

ORIC 1 Todays best value in real computer systems.

To be launched within the next few weeks - the revolutionary ORIC 3" MICRO FLOPPY DISK DRIVES, with incredible access time and data storage capacity.

Other peripherals to be launched this year...

It is Oric's policy to continue to expand our product range, in order to offer our customers a comprehensive, professional, Micro Computer system, at a realistic price.

We believe that with the launch of our MCP 40 colour printer, and our combined computer/software value packs, we will continue to lead the small micro market in both quality and value.

*Titles may vary subject to availability but the approximate value will not.

THE BEST SELLER OF 1982

In 1982 the RICOH 1600S outsold every other comparable printer because of its speed, reliability, intelligence, flexibility and sophistication.

Because it is compatible with all known systems and software packages.

Because of the 12 month warranty that Micropute offer.

Because Micropute are a company who care, who are constantly aware of changing needs and who can fulfill any special requirements.

Not least of all, because of the price

In 1983, there will be thousands more satisfied customers.

We hope that you will be one of them.

ONLY MICROPUTE GIVE YOU SUPERCOVER

As an extra bonus Micropute Supercover will provide a 12 month on site maintenance for only £99.00 parts and labour.

DON'T FORGET THE RICOH 1300S

...a little bit slower but every bit as clever.

Please send details of the RICOH 1600S and 1300S

Name: _____

Position: _____

Company: _____

Address: _____

_____

_____ Telephone: _____

● **Circle No. 148** RP2

MICROPUTE

Micropute, Catherine Street, Macclesfield, Cheshire SK11 6QY. Tel: (0625) 615384.

APL*Plus

IBM launched APL last month, and now APL *Plus is offering its own full-feature version as an alternative. APL*Plus/PC includes a custom-character ROM where some of the IBM's little-used characters have been changed to provide APL symbols, communications software and other utilities.

APL*Plus takes up 90K of memory, after which the system disc can be removed. It requires a PC with at least 128K of RAM. APL*Plus costs £600.

Contact APL*Plus Ltd, 1-2 Henrietta Street, London WC2 8PS. Telephone: 01-240 5765.

TK!Solver

AFTER we had gone to press with a review of TK!Solver — August issue page 132 — the product was launched by a U.K. distributor, Marketing Micro Software. It costs £286.25 including VAT. Ready-to-run applications packages for mechanical engineering and financial management cost £125.95 each.

Contact Micro Marketing Software, Goddard Road, Whitehouse Industrial Estate, Ipswich, Suffolk IP1 5NP. Telephone: (0473) 462721.

Pete & Pam

WELL KNOWN IBM PC dealer Pete & Pam has expanded its range of PC offerings. Recent additions include Multimate, a powerful word processor designed to make the PC behave as much like a Wang dedicated word processor as possible. Price: £345 plus VAT.

Graph'n'Calc is a calculation and business-graphics program which is easy to use and can take DIF files from the Visi series. Price £125 plus VAT.

Three new educational packages are The Speed Reader, Math Blaster — for ages six to 12 — and Word Attack. They are all from Davidson & Associates, of California and cost from £33.50 to £49.95 plus VAT.

Contact Pete & Pam Computers, New Hall Hey Road, Rawtenstall, Rossendale, Lancashire. Telephone: (0706) 227011.

Put your feet up

ADMIRERS of the DEC Rainbow stand, which gets the system box off your desk, can imitate the style with an IBM PC using the Curtis pedestal and extension Cables. The system stand costs £24.95 and will let you stick the system box on end by the side of your desk. The VDU pedestal, which costs £79.95, provides a tilt and swivel facility. Extension cables for the system box cost £49.95, and a 3ft to 9ft coiled cable for the keyboard is £39.95. All prices include VAT and delivery. The idea seems to be to free enough space on your desk so that you can put your feet up on it — if that happens to be your style.

Contact Chell Instruments, Tudor House, Grammar School Road, North Walsham, Norfolk. Telephone: (0692) 402488.

Focus from mainframes

FOCUS is a database and information-control system which runs on IBM mainframes. PC/Focus is said to be identical in function and design, but it runs on the IBM PC.

The main comonents of the program are Report Writer, Dialogue Manager, Data Base Management, File Browsing, Graphs, Formal Statistical Analysis, Financial Modelling, User Vocabulary, Help facility and Text Editor. The File Transfer component allows data to be exchanged directly with a mainframe running Focus.

The program is delivered on five dual-sided floppy discs which must be copied to a hard disc, so you need either the XT or an add-on Winchester. PC/Focus also comes with an accelerator board which plugs into an expansion slot. It includes a clock calendar, 512K of additional RAM, and one serial and one parallel port. The use of an Intel 8087 maths co-processor, for which a free socket is provided on the PC's motherboard, is recommended.

Contact the distributor, Information Builders (U.K.) Ltd, Station House, Harrow Road, Wembley, Middlesex HA9 6DE. Tekephone: 01-903 6111.

As an increasing number of readers are acquiring IBM PCs and various look-alikes, we felt that — like other major micros — it should have its own place in *Practical Computing*. This is it.

In future issues, PC Bulletin will carry news, reviews and software stories. If you have any hints and enhancements, utilities or short programs, send them in.

Our aim is to make this column an extra "expansion slot" for IBM PC. But it will only expand if you join in. Send your contributions to PCB at *Practical Computing*, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Profits grow and grow

FINANCIAL RESULTS for the six months to June 30 show IBM is continuing its growth from 1982. Worldwide gross income was $17.9 billion, up 18.2 percent on the first six months of 1982. Earnings before tax were $4.2 billion, up 26.0 percent and net earnings were $2.3 billion, up 24.3 percent. Sales of IBM PCs remain, in value terms, trivial by IBM standards. However, the company notes that they "continue to exceed projections".

IBM is giving away 600 PCs to universities and non-profit institutions. Between 70 and 100 will be allocated to U.K. universities and colleges by IBM U.K.

IBM U.K. now has 87 authorised PC dealers. Latest additions are Microware (London), Keen, General Microcomputer Systems, Spartex, Data Efficiency, Microchips, Fletcher Dennys Systems, Rockliff, Sumlock Bondain, Walters Computer Systems, U Microcomputers, Fame Computers and Yorkshire Microcomputers.

Direct sales are flourishing too. Schlumberger just ordered 1,001.

The PC is also being sold as a so-called strategic work station for the 8100 Office Information System, and — with an adaptor card and emulation software — with the IBM 5520 integrated office-administration system.

XT gap bridged

AS IBM has failed to provide back-up for the hard-disc XT version, Alloy has plugged the gap. PC-Backup is a 0.25in. tape drive that stores 17.5 Mbyte unformatted on a single 450ft. tape cartridge.

A tape interchange program utility runs under PC-DOS to provide file transfer. This results in the tape giving 13.4Mbyte of formatted storage at a transfer rate of up to 1.4Mbyte per minute. The price is £1,495.

Contact Alloy Computer Products (Europe), Cotteswold House, Gloucester Street, Cirencester GL7 2DQ. Telephone: (0285) 68709.

IBM XT

Like it or not, IBM's micro is set to establish standards for the coming generation of business machines. In this second part of our review, Jack Schofield looks at the Basic and the keyboard we will all have to get used to.

DIFFERENCES BETWEEN the hard-disc version of the IBM PC and its twin-floppy relative were described in the first part of this review in the August issue. In most other respects the two versions are identical, including many important aspects of the IBM's ergonomics and its Basic languages.

Apart from the hard disc which replaces floppy drive B, the XT and PC look the same. There are three units: a flat systems box or "pancake" containing the drives, a screen and a detached keyboard. All are tastefully finished in smart grey and cream. The pancake itself is very large compared to machines like the ACT Sirius, and takes up around one-third of a desk top.

The 11in. green screen gives a sharp, clear image. Both brightness and contrast can be adjusted by knobs on the front. Screen RAM is held on a plug-in driver card, so more than one screen — such as a colour and a monochrome screen — can easily be run at the same time, displaying different images.

The detached keyboard is flat, but has two legs on the back to raise it to a good typing angle. The two-tone colour scheme is carried through by having the alpha-numeric keys and the separate numeric keypad off-white, with the control and function keys in grey. The numeric keypad doubles as a cursor-control pad, making 83 keys in all.

The 10 function keys can be used with various Shift keys to provide 40 functions. Another useful key, obscurely labelled PrtSc, enables you to dump the screen contents straight to your printer.

Just how good IBM's keyboard is must be a matter of some debate. Ergonomically it is superb. For touch and key action it is in a class by itself: touch-typists will adore it. But — and it is a very big "but" — the keyboard has four keys which are so badly placed they make typing a pain. They are Alt, \, / and Caps Lock. IBM has added a spurious Backslash key, \, between the Z and the left Shift key, so when you want to type a capital you get \\\\\\ thanks to the auto-repeat function.

A similar oblique key, /, appears between the full stop and the right Shift key. To reach either shift key you have to aim carefully and s-t-r-e-t-c-h your little finger, which reminds the touch-typist of refined tea-drinking sessions in Carshalton Beeches.

The Shift keys themselves are tapered down to standard key size, instead of being larger as they are on most typewriters. When you miss them, you inadvertently press Alt or Caps Lock.The latter gives a rEVERSE sHIFT eFFECT where intended caps and lower-case letters are interchanged.

Some people will not like the two ranks of function keys down the left side of the keyboard and would prefer them arranged in a single line along the top. Finally, while it is an advantage to have such a compact keyboard, it is so crowded it leaves little room for labelling.

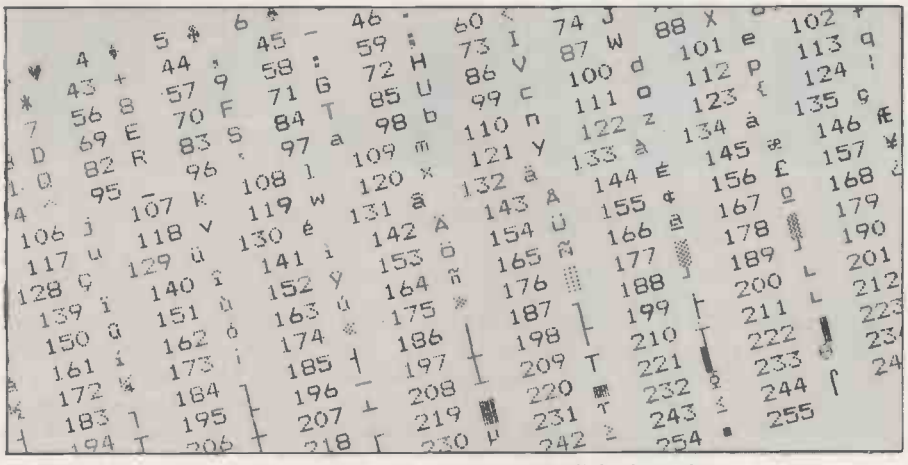
If you are one of those people who, like me, thinks the standard keyboard has already been produced, and can be found on the IBM Selectric typewriter, then you will be less than enraptured by the XT. If you use two fingers with a hunt-and-peck typing technique then it probably won't bother you much.

But if the layout bothers you a lot, the American firm Key Tronic has produced an alternative keyboard which cleans up the IBM's eccentricities. It also adds valuable LED indicators to the Caps Lock and Num Lock keys. The keyboard is available in the U.K. from Qubie Distributing at 01-870 8899.

IBM's keyboard does have its good points. It has n-key rollover, which means it recognises the order of keys pressed quickly, one after another, and released after an indeterminate priod. The method it uses to do so is complicated but clever. The keyboard has its own Intel 8048 micro-processor. It does not deliver ASCII characters but scan codes, which the IBM's BIOS or basic input/output system translates into ASCII characters. It allows each key to be configured to produce any character, giving a completely soft keyboard.

Each key produces two scan codes, one when it is pressed and one when it is

Just how good IBM's keyboard is must be a matter of some debate. Ergonomically it is superb.



The character set includes some graphics and non-English characters.

released. They are stored in a sizeable buffer which holds at least 20 characters, so you can type ahead. The PC beeps when the buffer is full, but even the fastest typist will find that the keyboard correctly sorts everything entered without losing any characters.

When DOS is booted on the IBM PC a .Com file is used to set up the codes for a particular national keyboard arrangement. A file called Keybuk is used to configure the version for U.K. use. The first system boot allows the user to choose from several files. French, Spanish, Italian and German are among those available.

The IBM printer, which is a graphics version of the Epson MX-80 dot-matrix model, prints foreign character sets too. It must be an advantage for anyone with a thriving export business.

When programming in Basic, the keyboard is multi-functional. Alpha-numeric characters — both upper- and lower-case letters and numbers — are produced using the standard keys and shift keys. There are two other distinct modes, produced by pressing the Control and Alternate keys, Ctrl and Alt, along with the alphanumeric ones.

The Ctrl set produces a wide range of graphics characters, mathematical symbols and foreign letters, plus a number of useful functions. Ctrl-H gives the expected delete and backspace, while Ctrl-[deletes a whole line. Ctrl-K homes the cursor while Ctrl-L also clears the screen. Ctrl-G gives a beep.

The Alt key provides for single-key entry of reserved words in Basic. It applies to all the alphabet keys except Q, Y, J and Z. Pressing Alt with each of the other 22 produces a reserved word which starts with that letter. For example, Alt-C produces the word Color, Alt-E gives Else, Alt-P gives Print, and so on.

Other reserved words are dedicated to the easily programmable function keys. Neither of these optional modes is marked on the keyboard, so the system is not easy to exploit at first. Many people seem to have failed even to notice their existence, but they are very handy once you are used to them.

Basic on the IBM PC and XT comes in three varieties: on ROM, as Disc Basic and as Advanced Disc Basic or Basica for short. All are standard Microsoft types, the smaller ones being subsets of the larger. The disc Basics appear to load only the extra code for disc operation and graphics, which are called by an interrupt system from the existing Basic ROM. This method makes for speed and consistency and it is economical of memory.

The ROM Basic itself — which IBM calls cassette Basic — leaves over 60K free. It is reasonable to complain that Microsoft ought to rewrite its Basics so that they access some of the rest of the RAM in the machine. However, a standard eight-bit micro running CP/M provides only 60K of RAM in which you have to fit the Basic itself and programs and data, so even the present state of affairs is something of an advance. Loading the Disc Basic into the XT leaves 61,330 bytes or 59.9K free. Loading Basica leaves 60,865 or 59.4K free, notwithstanding the 256K of RAM chips inside the machine reviewed.

Basica is by now becoming familiar, as in one version or another — such as GW or Gee Whizz Basic — it appears on virtually all the machines which run MS-DOS, the Microsoft original from which PC-DOS is derived. It is not a small language by Basic standards. There is the 40K in the ROM, plus about 17K loaded from disc. As you would expect, it contains a large number of commands though not all of them are very useful. Yet it does not give the feeling of power you get from some smaller versions of Basic such as the excellent Acorn BBC Basic, of around 16K, or even the 8K Atari Basic.

Nonetheless it contains most of the commands you could want. For programmers, the Basic provides auto line numbering, Renum, Merge, Chain and the tracing functions TrOn and TrOff. For structured programming there is For-To-Step, If-Then-Else and While-Wend. For sound and graphics there is Beep, Circle, Color, Draw, Line, Locate, Preset, PSet, Paint and Sound.

Inp reads an eight-bit value from a port, and Pen reads a light-pen. Strig reads a joystick button. As well as Hex$ for hexadecimal conversion, there is Oct$ for people with eight fingers. There are all the usual trig functions, as well as user-defined functions.

Among the less usual functions on Basica, Fix truncates to an integer value, Lof returns amount of space in a file, LPos returns the carriage position of the printer and MKI$ makes an integer into a string. LSet and RSet left-justify and right-justify a string within a field. You can live a long time without having to use many of these more exotic functions, but no doubt someone will find interesting things to do with them. Unfortunately the Basic still does not check syntax on line entry.

To handle the well known rounding errors which result from doing arithmetic in binary there are various functions to manipulate numbers. CDbl converts to double precision, CInt rounds to the nearest integer and CSng converts to single precision.

It is now widely appreciated that Basica running under PC-DOS is not a fast language. The only advantage the IBM has here is the hardware-divide instruction of the 8088 microprocessor. Otherwise any 4MHz Z-80 eight-bit computer ought to be faster than the IBM, and the BBC Micro leaves it gasping even boring old 6502. 6502.

One great advantage of Basica is that it is extremely well documented in one of the dwarf IBM manuals. If its page-by-page instruction-by-instruction format is unpalatable, however, there are dozens of books on IBM Basic and several tutorials with discs to provide alternatives.

Another great advantage of Basica is that it now looks likely to become the *de facto* standard in its field of small business microcomputers. This has obvious benefits from the point of view of program portability. It is also in the best interests of the individual user to learn a language that appears in fundamentally the same form across a wide range of machines. In the long term it should prove more useful than learning a machine-specific language which, if the chosen machine fails to achieve worldwide success, can easily become a ghetto.

The same applies equally to the keyboard. Like the operating system and the language, IBM's keyboard — notwithstanding its faults — looks like setting the standard for some years to come. Those of us who complain now perhaps do so because we learned to type on IBM's classic typewriters. The next generation of people, learning their keyboard skills on a microcomputer, may decide that IBM made the right choice.

At the moment, it is sufficient to observe that the IBM PC, and the XT version reviewed, set the standard in terms of both features and price against which all other micros must be judged. In the third and final part of this review, in the October issue, we will explore the benefits of the hard-disc option provided by the XT.

MULTIPLAN

As a straightforward spreadsheet this one is hard to beat, says Jack Schofield

THERE IS NOW quite a range of spreadsheet packages for the IBM PC, including the original VisiCalc, and several packages which offer more. Both MBA from Context Management Systems and Lotus's 123 offer graphing capabilities as well as spreadsheet calculations, while Knowledgeman adds quite a reasonable database. But for someone who just wants a spreadsheet Multiplan is hard to beat.

Multiplan is a Microsoft product, and runs under MS-DOS version 1 or 2. Once installed using the installation disc which is supplied with it, Multiplan is very easy to load. Place the disc in drive A, type MP in response to the A> prompt, and there you are. Running it from a hard disc, it boots almost instantaneously.

Multiplan presents a conventional spreadsheet format, except that it has numbers both across and down so the home cell is not A1 but R1C1. It can lead to minor confusions between columns and rows. The maximum size of the spreadsheet is 255 rows by 63 columns.

Multiplan is run from the bottom of the screen instead of the top like VisiCalc. Across the bottom is a range of options such as Alpha, Copy, Transfer and Quit. Each one begins with a unique letter, so there are two ways to call comands. Either you can position the cursor over the one you want then press Return, or you simply type the first letter of what you want.

As Multiplan is a user-friendly program you can enter numbers directly, without having to press V for value first. The user-friendliness shows as you step through the options. Most choices from the main command line lead to sub-lines which offer further choices:

Load Save Clear Delete Options Rename

with the cursor positioned over Load, the one you are likely to want, so you can select it just by typing Return. The commands are arranged in order of decreasing usefulness, not alphabetically.

To Save you just press Space to move the cursor one step along, then Return. Alternatively you can press S. Multiplan then gives your file the name Temp, and invites you to change it for something meaningful. If your file already has a name, Multiplan supplies it in the command line so you only have to select Return to save to it, and so on. The whole command structure is extremely well thought out.

When it comes to the Copy command, which is Multiplan's Replicate function, again it remembers what you did last. Suppose you copy a cell to the right for 11 cells. At each subsequent command Multiplan then offers 11 as a default value until you change it. You can do a considerable amount of work just by entering Return.

The bottom two lines of the screen carry the message line and the status line. The message line tells you what to do next, such as

Enter a filename

or

Enter Y to confirm

The status line tells you where you are, such as R6C2, and it tells you what the current content of the cell is, such as a number or a label or a formula. Next it says how much free workspace you have, and finally the name of the worksheet you are in.

If you get stuck pressing H produces copious Help information. It is quite possible to run Multiplan with only occasional reference made to the documentation.

One of the trickier aspects of Multiplan — at least until you are used to it — is entering formulae. It is done by using the cursor to step through the cells to be related, then pressing the appropriate arithmetic keys. The result is a formula such as

R[−4]C + R[−3]C + R[−2]C

that is, a relative formula. The cell specifications are entered automatically by moving the cursor. Absolute formulae can be entered in the form

R3C2 + R4C2 * R5C2

and so on. Once a formula is entered, the resulting value is calculated automatically, unless you turn off the Recalc function.

Multiplan allows you to use names — not be confused with titles — instead of cell addresses. Thus R3C1 could be defined as Sales and used in a formula such as

Profits = Sales − Costs

The Goto option allows you to Goto a name as well as a cell. Other facilities include iteration, multiple windows, locked cells, insert and delete rows and columns, and block moves. Sorting is quick and simple.

One of the most interesting options is the Format command, which is used for setting column widths and much more. Multiplan normally sets text ranged left, and numbers ranged right. Format allows cell contents to be ranged left, right or centred. Other possibilities are Cont, Exp, Fix, Int, $, * and %.

Built-in functions include Abs, And, Atan, Average, Column, Cos, Count, False, If, Index, Iserror, Isna, Len, Ln, Log10, Lookup, Max, Mid, Min, Mod, NA, Not, NPV, Or, Pi, Rept, Round, Row, Sign, Sin, Sqrt, Stdev, Sum, Tan and True. The identity of most of them is obvious: Ln is natural logarithms. NPV is net present value.

NA stands for Not Available and is an extremely useful function. If you assign NA(X) to factor X, say the interest rate, then all the values in the sheet that depend on it also change to N/A. This enables you to see where you are without stepping through all the cells to trace out their relationships. External, selected by X at the main command line, allows sheets to be consolidated.

The Print command allows sheets to be printed to a disc file, rather than saved. They can then be reloaded into a suitable word processor. It is possible to print part of a sheet, to control margins, etc., to suppress axes, or to print formulae instead of values. Empty columns are not printed. Multiplan automatically prints wide sheets to line up on a series of pages.

The Multiplan documentation contains both tutorial and reference material, and an index. It is extremely good. An appendix of notes for the VisiCalc user gives reference tables of Multiplan functions and commands and the VisiCalc equivalents, where applicable.

The current documentation is for a range of machines including the Compaq, Zenith, Texas Instruments Professional and DEC Rainbow. Some of these firms, and many others including Wang and Dynalogic, supply versions of Multiplan with their own documentation. IBM is reportedly doing the same with Multiplan at the moment. The current version does use the IBM PC funtion keys, though this kind of program really makes function keys almost irrelevant.

Conclusions

- **Multiplan is a first-rate spreadsheet program with no obvious flaws or limitations. Minor quibbles are the R1C1 type of cell identification, and the lack of a graphics facility.**
- **The supplier is Microsoft of Piper House, Hatch Lane, Windsor, Berkshire SL4 2QT. The standard version costs £183 plus VAT.**
- **A version of Multiplan tailored to the U.K., including a £ sign and rewritten manual, is available now for the Apple and imminently for MS-DOS micros such as the IBM PC.**

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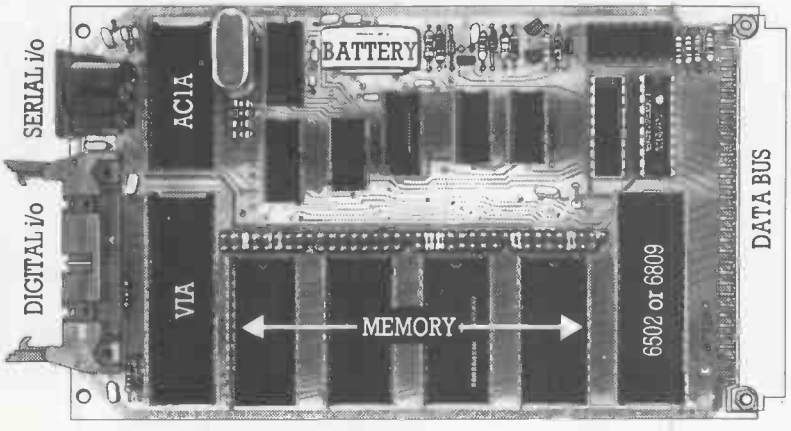
EuroBEEB—EuroCUBE with BBC BASIC—The MOS included on EuroCUBE, provides an environment in which languages can be run, and is available in two main versions:

MOS A – supports ATOM BASIC
MOS B – supports BBC BASIC

EuroCUBE fitted with MOS B can run BBC BASIC. In its simplest form, with 4KB RAM fitted for work space, a BBC BASIC program in EPROM could control the two 8-bit ports and the serial interface, in addition to any other cards connected to the CUBE expansion bus.

BEEBEX, another recent addition to the CUBE range, is a simple, low-cost Eurocard which interfaces to the 1 MHz bus connection on the BBC Microcomputer, enabling it to communicate with the entire range of CUBE/Acorn Eurocards.



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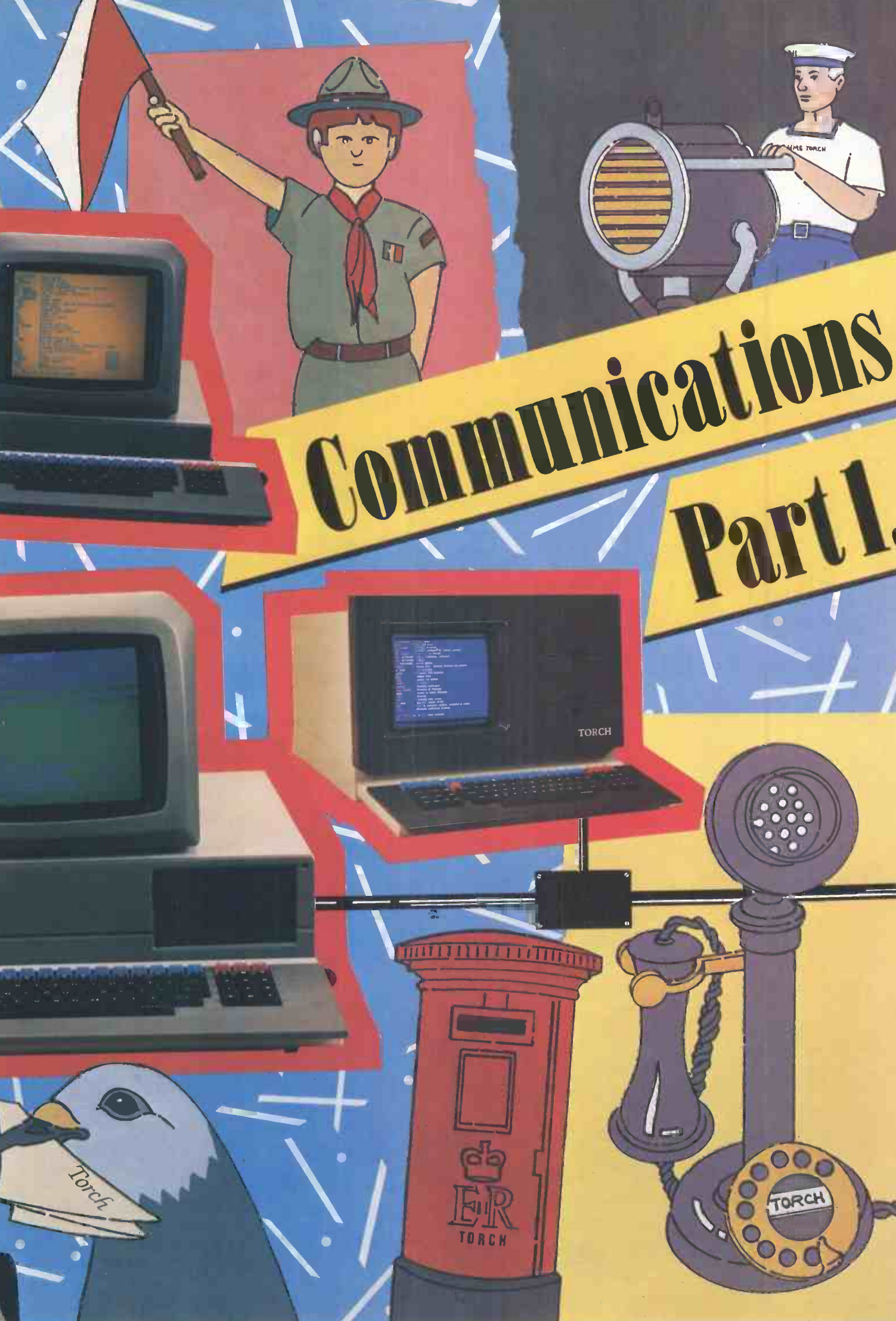
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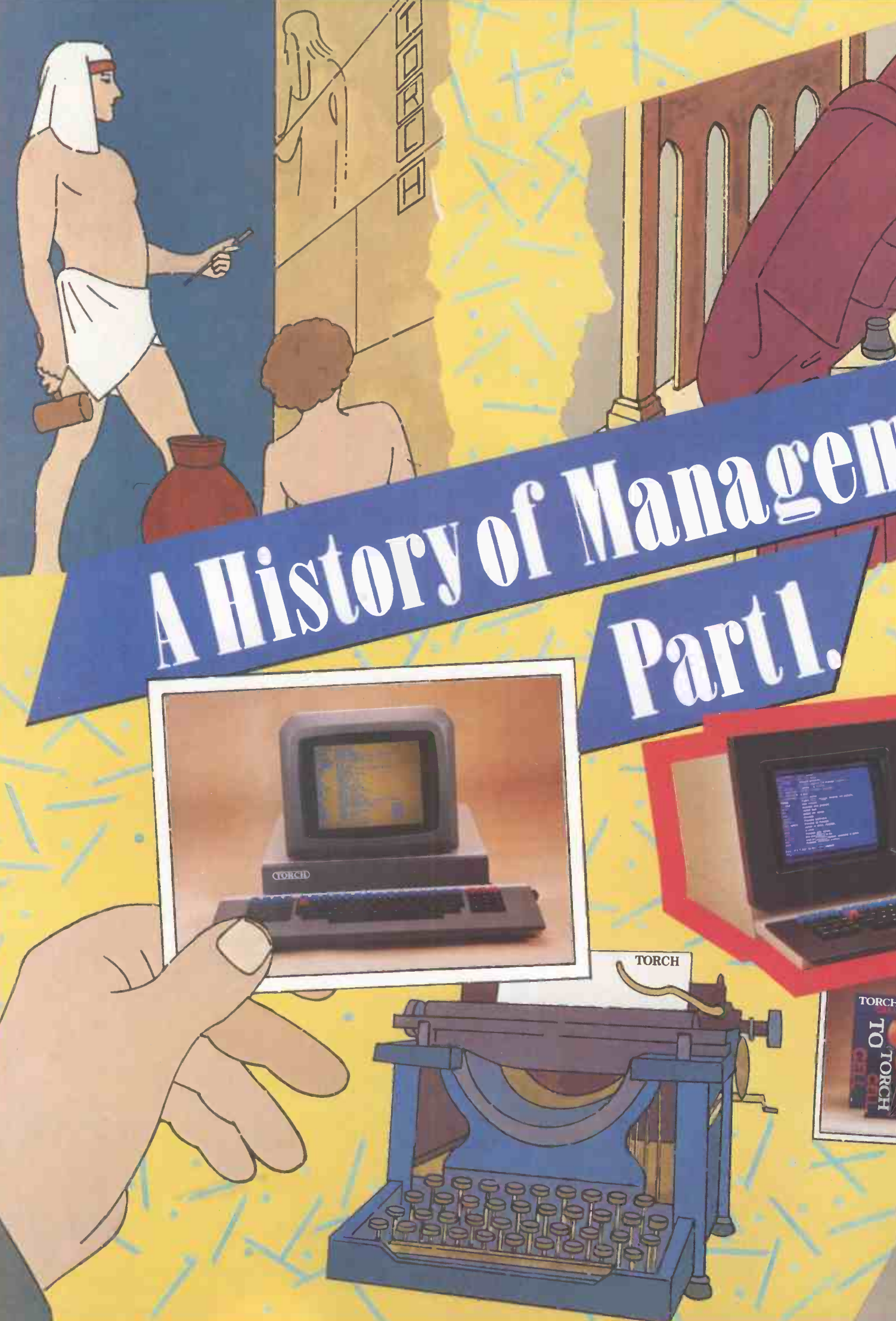
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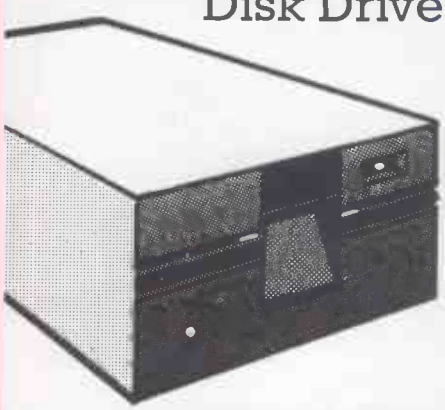

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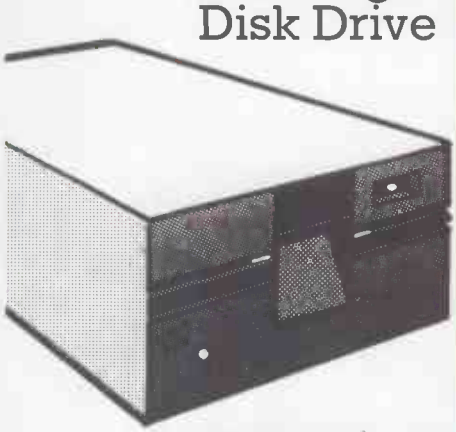

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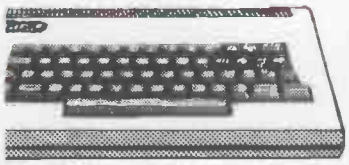

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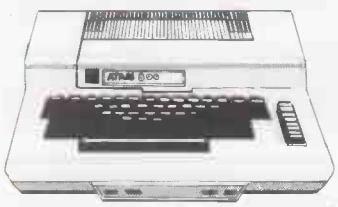

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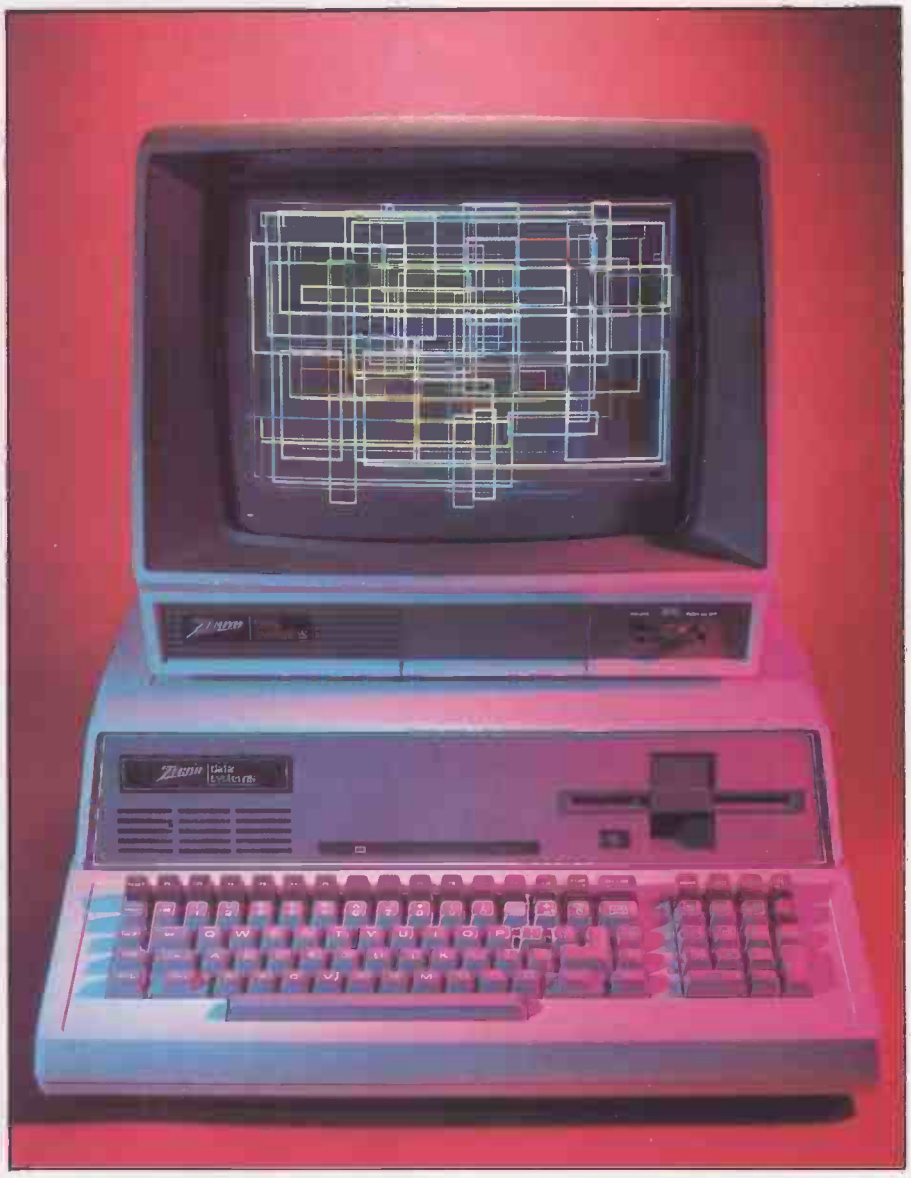
ZENITH Z-110

Chris Bidmead discovers a high-class route to computer literacy — with a hard-disc micro thrown in free.



THE ZENITH 110-32 is a hard-disc 10Mbyte version of the Zenith 100 desk-top computer that offers two processor chips so that you can use both eight-bit and 16-bit software. The mixture of chips and operating systems must have given the implementers some headaches, but the result is a skilfully designed and harmonious whole that passes none of the headaches on to the user. As an S-100 bus system it also represents well supported, well understood technology.

Zenith is the company which gave the world the formidable multi-band portable radio that pulled in every station on earth, and some more besides. It has now combined forces with Heath, the DIY kit manufacturer, and the Zenith microcomputer displays characteristics from both sides of the family.

Like blue jeans or a paperback version of *A la Recherche de Temps Perdu*, it was once fashionable to sport the Zenith radio in a battered, world-weary condition. The Zenith computer has a similar internal ruggedness, but unlike the radio this is matched by an equally tough outer casing which would not be likely to dent picturesquely.

The Heath origin shows itself in the documentation and general openness of the system to inspection by users. In previous reviews of 16-bit offerings I have occasionally had cause to lament manufacturers' scurrilous or misguided mainfame tactics in attempting to guarantee the customer's continued dependence. Operating systems are supplied either incomplete or completely non-standard; means of creating new system discs are withheld from the user; no access is given to debuggers or system documentation — and sometimes you cannot even open the cabinet.

Zenith's approach is wholesomely in line with what readers of this magazine will recognise as the true spirit of the micro. Even without buying the full technical manual — pricey at £150 for the two volumes, but still excellent value — the user gets a superbly documented, detailed account of the hardware and software.

Two volumes on the 16-bit operating system Z-DOS, two volumes on the eight-bit operating system CP/M-85, two volumes on ZBasic, and a general single-volume user's manual are thrown in with the price of the system. Z-DOS and CP/M-85 turn out to be indistinguishable from MS-DOS and CP/M-80, and ZBasic is very similar to the various versions of MBasic-86 appearing on most new 16-bit machines like the IBM PC and Wang.

The appendix to the user's manual is a meal in itself with succinct summaries of everything you need to know. An added luxury is a 23-page glossary of commonly used computer terms that covers the whole field of microcomputing from acoustic couplers to word processing.

The fine symmetry of the documentation has evidently been a little disturbed by the recent arrival of the Winchester option. There is no mention of it at all in the CP/M-85 manuals but the hard-disc supplement relating to Z-DOS literally overflows the Z-DOS manual, and this information is duplicated in the

Benchmarks

Running the standard Benchmarks shows the Zenith to be slightly quicker than the IBM PC, but not as fast as our current record holder the 8086-based Orion. All times are for 1,000 iterations and are in seconds.

	1	2	3	4	5	6	7	8	Av
Zenith Z-110	1.5	5.1	10.6	11.0	12.8	24.3	25.5	28.5	14.9
IBM PC	1.2	4.8	11.7	12.2	13.4	23.3	37.4	36.9	17.6
OEM Orion	0.6	2.1	4.8	4.9	5.8	10.5	16.7	13.0	7.3

Specification

SYSTEM
CPU: 8085 eight-bit and 8088 pseudo 16-bit dual-processor system, both operating at 5MHz.
Memory: 192K of RAM, 96K of video RAM, 32K ROM
Discs: single 5.25in. mini-floppy drive, may be formatted as single- or double-sided, single- or double-density; 10Mbyte Winchester
Features: includes colour output, CP/M-85, Z-DOS and ZBasic
Interfaces: two RS-232C serial ports, one Centronics-type parallel port, five-slot IEEE S-100 bus expansion.
Dimensions: 48cm. × 49cm. × 19cm.

DISPLAY
Type: 15in. colour monitor
Display: 25 lines × 80 characters, eight colours/intensity levels, 640 × 225 pixels
Dimensions: 47cm. × 43cm. × 35cm.

KEYBOARD
Type: Selectric-style 95-key keyboard
Features: calculator-style numeric keypad with 13 keys, 13 programmable function keys, four cursor keys + Home.
Dimensions: Integrated with the system box

SOURCE
Manufacturer: Zenith Data Systems
Importer: Zenith Data Systems (U.K.), Gloucester
Price: System box with CP/M-85, Z-Dos and ZBasic £3,925; colour monitor £440; system box to monitor cable £16; two-volume technical manual £150; total system £4,531; WordStar 3.21 + colour £240; Multiplan £135; system as reviewed £4,906.

supplement to the general user's manual. Once again, however, the quality of the documentation is excellent and Zenith takes the trouble to explain with diagrams exactly what a Winchester disc is and how it works.

All this fulsome documentation is so meticulously put together that my one niggle sounds churlish. I wish Zenith had compressed the pages down to the handy dwarf format adopted by IBM. Normally you long for more use of white space in computer documentation, but when there is this much to read you come up against the problem of the sheer physical handling of over 2½ stone of manuals.

While we are being physical, my only other real objection to the system is that, like the Olivetti M-20, it comes in the not very ergonomic configuration of combined processing unit and keyboard, with a separate monitor. The shape of the processing unit seems to suggest you use it as a platform for the monitor, giving you something very like the all-in-one computer exemplified by the Superbrain. This looks neat, but puts the screen far too close for comfort for a large colour monitor.

On the other hand if you put the monitor on the table behind the processing unit you will only see half the screen. One of the slim detached keyboards would have been a great improvement on the rather high, built-in keyboard provided by Zenith.

The mains switch is sensibly placed at the left-hand rear of the processing unit, easily reached for but not in a position where you could knock it by mistake. On powering-up, the processing unit beeps discreetly, and the operating system is loaded from one of the drives according to a software/hardware configuration pre-determined by the user.

As delivered by Zenith, the Winchester disc is divided equally between CP/M-85 and Z-DOS. But a utility called Part enables you to define as many as 16 separate partitions on the disc, each identified by a separate name and each accessible from the boot mechanism. The idea is that as other operating systems become available they can all be stored on the hard disc to allow the user a choice when booting up. The present operating systems, once loaded, are designed to see these partitions rather like floppy-disc drives, with the limitation that only two such partitions can be on line at any one time.

The floppy disc is also interestingly implemented. As with a number of other micro systems, the formatting program allows you to choose between single and double density when you initialise the disc. But mixing densities can be more trouble than it is worth, involving at worst having to boot up different versions of the operating system, or in more thoughtful implementations giving the same physical drive two distinct operating-system names, one for each format.

Zenith has come up with a better idea. Under CP/M-85 the Control-C necessary to log on a new disc does a quick read of the directory track, notes the density it finds there, and sets the BIOS accordingly with no additional intervention from the user. It is a generous touch that is typical of the deluxe design effort put into the machine. Both operating systems come with a program called Configur which is used to set up various I/O parameters. The provision of such a facility should be standard on micros, but it is depressing still to find so many manufacturers who do not bother. Here as elsewhere Zenith has more than done its duty by the user, for Configur makes life very simple for the beginner by actually drawing a picture of the ports to be found at the rear of the processing unit, indicating where and how the connections should be made.

Surprisingly in a machine of this sort there is no ROM-based debugging monitor accessible below the operating system. For those who wish to probe the entrails DDT and Debug are supplied, however, and if you have never had a ROM monitor you probably will not miss it.

Colour graphics on the Zenith were good enough to persuade me to spend a lot of time dabbling in creative Basic. I ought to declare my own feelings here: I am actually against graphics, or rather against the present generation of hardware and software that encourages people to invest a lot of time writing code that will not mean a row of beans to the next generation of micros. Graphics is about to take off, but before it does there will have to be standards that ensure portability not just of code but also of knowledge. Graphics on household and business micros at the moment tends to be a time-consuming, low-level occupaton.

That said, the Basic provided by Zenith goes a long way towards a sort of temporary standardisation. Programs written in ZBasic should work on other MS-DOS-minded hardware. And even if they do not, the speed with which you can knock up exotic images makes sure that you are not having to throw too much time away. The key graphics commands give you the ability to draw outlines and colour them in without having to do any heavy computations.

Elementary animation is also readily accessible thanks to the provision of Get and Put commands, which offer an easy way of storing images in arrays so that they can be swapped quickly on the screen. For the total non-programmer a comprehensive interactive business graphics package is provided, although there is no simple mechanism to link it in to other software like Multiplan.

(continued on page 85)

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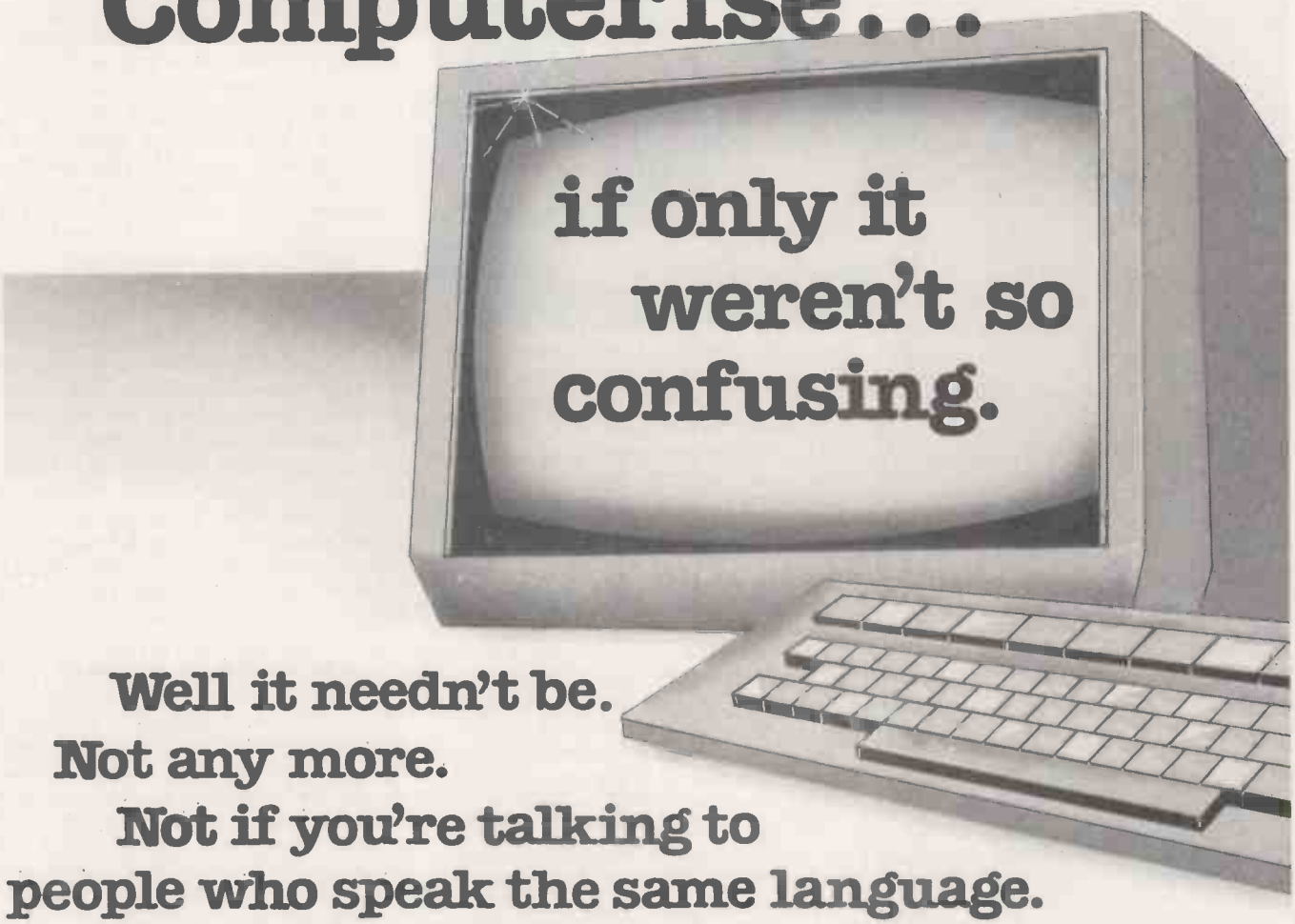

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ZENITH Z-110

(continued from page 83)

In keeping with the openness of the documentation, physical access to the S-100 bus and the rest of the interior workings can be done bare-handed, simply by edging out a couple of spring-loaded sliders at the rear and lifting off the top of the case. International regulations only permit manufacturers to allow access without special tools if there are no exposed dangerous voltages inside. As you might expect then, the power supply is well cased in its own safety shield, which boxes it in completely.

Zenith has followed the modern practice of installing the fan as part of this sub-unit. A secondary air flow large enough to cool the electronics is created by way of a grid of holes in the side of the power-pack shield. The disadvantage is that this restricted vent produces a rather loud rushing sound that is not very comfortable to work with in a quiet room, though it may not be troublesome in the average noisy office. If I owned the machine I would be tempted to enlarge the grill to cut down wind resistance, even at the risk of flying in the face of the regulations.

On the review machine two of the five S-100 bus slots were taken up by the disc controller board and the floppy-disc controller, which was not, unfortunately, mounted on a single card like the latest controller from Western Digital. The main processing is carried out on the bigboard that lies horizontally below the back plane; this board also houses the 192K of RAM and 32K of ROM.

The bigboard meets the signal requirements of the proposed IEEE-696 S-100 bus definition, but of course is not removable and replaceable like an ordinary S-100 bus card. This is a fairly conventional arrangement, but it does imply that the Zenith is committed to the processors it has now. It would be more in keeping with Zenith's style to go for the sort of arrangement chosen by Almarc Data Systems in the Spirit-1 range of machines, where the processor board sits in the S-100 slot, easily replaceable when the time comes to move on to the next generation of CPUs.

The internal ruggedness of the Z-110 continues Zenith tradition.

The 8085 and the 8088 form a natural pair: both chips are by the same manufacturer, and form part of Intel's carefully designed upgrade path towards 16-bittery — notice that word "towards". Intel, who should know, cut right through all the discussion about whether the 8088 is a 16-bit chip or only a pseudo 16-bit chip by stating firmly in its own product definition book that the 8088 is "the most powerful eight-bit processor available today".

(continued on next page)

A note on the software

Two software packages were supplied with the Zenith: WordStar and Multiplan. Both came on 5.25in. floppies with massive and superb documentation. They were simple to transfer and use from the hard disc.

WordStar is in colour, with an Install routine so you can set your own colours from the range of eight available — blue menu backgrounds are attractive. Installing many popular printers is done just by naming them.

On the Zenith there proves to be nothing unusual about the implementation of WordStar though this version, 3.21, allows horizontal scrolling too. You can edit while printing but you have to use F12 not Ctrl-C. You might be able to use other function keys if you can find them in the documentation and then remember what they stand for; they are not in the index and no labelling strip is supplied. Still, the documentation is far more comprehensible than the Micropro version.

Multiplan is, again, the standard package. Being black and white it seems visually somewhat thin after running colour programs. However, it has been well implemented using the function keys, and it is still arguably the best straightforward spreadsheet currently available.

Other Zenith software includes Ashton Tate's dBase II, Compsoft's DBMS, Condor, Magic Wand, Supercalc and the rest of the WordStar range. Languages include Fortran and Cobol in both -80 and -86 versions, and Pascal MT+.

While the Z-110 is semi-compatible with the IBM PC, it did not boot any of our IBM PC discs, so there is no direct access to this huge pool of software. However, the Zenith will read IBM PC discs, so it was possible to load Multiplan data files originally created on the PC and the Dynalogic Hyperion.

ZENITH Z-110

(continued from previous page)

If you are going to claim the 8088 as a 16-bit chip on the strength of its internal architecture, then on the same grounds you could perfectly well advertise the Z-80 as the 16-bit market leader. The Intel book, included in the price of the Z-100 technical manual, explains why the 8088 pairs so well with the 8085: both chips can share identical eight-bit wide memory, which is cheaper and possibly slower than that required by the 8086.

Intel claims that because of the way the 8088 parallels its instruction fetches with its executions the chip is able to operate faster than the Z-80, even when working with slower memory. I have yet to be convinced of this in practice, but perhaps it is the software that is slowing everything down.

Personally I would have much preferred a Z-80/8086 combination, although this does introduce the difficulty that supporting memory would have to be of the new dual eight/16-bit wide type. The disadvantage of the present arrangement to the user is that some very good eight-bit software specially written for the Z-80 is put out of court. Among the British offerings, Superfile will not run on an 8085, neither will ProPascal or Microcache, although 8086 versions of these packages compatible with the Zenith's 8088 are either available or due very soon.

MS-DOS is very CP/M-like, but the operating systems chosen for these two chips do not pair as naturally. CP/M-86 is completely file-compatible with CP/M-80, whereas MS-DOS requires help to read CP/M-80 files. Typically Zenith has troubled to provide this help, in the form of a utility called RDCPM.

In not selecting CP/M-86 as the 16-bit companion operating system, instead committing itself to assimilating MS-DOS and rewriting all its documentation, Zenith seems to be making a fairly positive rejection of Digital Research's upgrade path. I quarrel with Zenith here too.

Heaven only knows what the future will hold, but my own feeling is that Digital Research is due to wrest back the market with Concurrent CP/M. CP/M adherents who have stepped into the 16-bit world by way of the unglamorous CP/M-86 will reap their rewards in terms of a well conceived graphics standard and true concurrency, both crucial to a proper Smalltalk-like multi-window interface.

But these notes are for guidance only, as they cautiously say in the manuals. In any case, the Zenith100 provides the hardware that should be able to run any of the coming operating systems, and will no doubt offer Concurrent CP/M or whatever, when the time comes.

Conclusions

● The Zenith is a solidly constructed, superbly documented S-100 bus system.

● Its dual-processor architecture forms a useful bridge between the eight- and 16-bit worlds.

● The hardware, software and documentation virtually comprise a university-level course in microcomputing or an excellent route to computer literacy for the intelligent user with time to spare.

● The operating systems offered are perhaps not the latest and the best: failing CP/M+ and Concurrent CP/M it would have been nice to have MS-DOS II, a great improvement on MS-DOS I. But they have been generously enhanced and are totally explained in the documentation.

● The attached keyboard is a little awkward to set up, but its non-glare key caps, perfectly laid out for the touch-typist, are a great asset.

● Zenith prices start at around £2,000 to £2,500. The system reviewed, at a total price of around £4,500, is not the cheapest way of buying Winchester-based 16-bit computing power. If all you want is hardware to run a spreadsheet calculator and a word processor you might be able to pick up comparable machines at under £4,000. What you get with the Zenith is a great deal of knowledge — and class.

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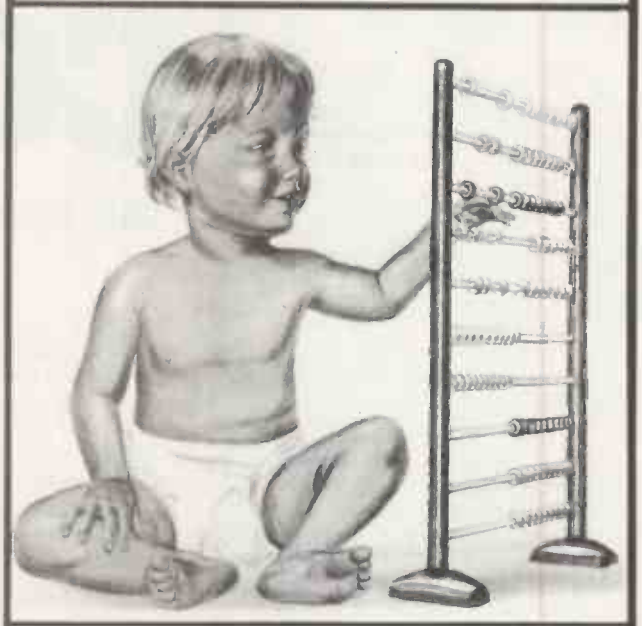

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CORVUS CONCEPT

Chris Bidmead finds out the problems of turning a work station into a stand-alone micro.

THE NAME Corvus first appeared on a hard-disc system for the Apple II. Soon afterwards it also became associated with a local area network called Omninet that enables any number of Apples and other micros to share data files.

At the end of 1982 the Corvus Concept was marketed as an extension of this idea. Essentially it is a work station, designed to communicate across the net with fellow Concepts, other micros and even mainframes. Our tests assess the machine as a stand-alone system, communicating with its own local 20Mbyte hard disc, with a single 8in. drive to import the software and provide back-up. This somewhat restricted view of the system probably does not show it in its best light.

The Concept arrived with some other handicaps too: the disadvantage of a premature launch in the U.S., some early misplaced enthusiasm from reviewers in this country, and a certain amount of bad timing in being overshadowed by the public airing of Apple's Lisa. First shown in this country by distributor Keen Computers at Compec 82, the machine seemed to catch that company on the wrong foot. The initial sales campaign met with what the trade politely calls "limited success".

The hardware comprises five units, the smallest of which is the keyboard. It is not the skateboard-thin appendage popularised by IBM but a sloped slab that puts the highest key some 2½in. above the worksurface.

The good news accompanying this possible disadvantage is that the keys are very sensibly laid out in the old Selectric format which IBM unaccountably abandoned in designing the PC. The Return is not quite the backward L that IBM pioneered on its golf-ball typewriters, but it is big enough to hit comfortably without a touch-typist's fingers having to vacate the home keys.

A stout coiled cable connects the keyboard by way of an industrial-quality nine-pin connector into the back — alas, but don't they all! — of the processor unit, an almost square 39cm. by 42cm. by 11cm. box that unobtrusively serves as a pedestal for the screen. Here, at the rear of the processor unit, a similar nine-pin connector accepts the data lead to the screen. Below it a pair of RS-232 D-type sockets offer output to optional serial ports. A simple three-pin socket beside them serves to connect the Corvus into the network.

The processor unit is housed in a snugly-fitting moulded resin case in the standard Sea Breeze cream colour in which all the units are finished. A decorative grill in the front conceals a filtered air intake. To dismantle the unit you need an Allen key to remove five 2½in. hex-head bolts at the bottom of the case. The process is simple enough and reveals a power pack on the left-hand side as viewed from the front.

You can swap the boards, check chips and make connections to the bus without unsealing the case or even lifting the monitor off the plinth. Only thumb and fingers are needed to undo a pair of latch screws at the rear of the unit. The electronics sub-chassis can then be slid out like a drawer to expose the bus-connection slots. Apple-style cards in the slots link the peripheral drives into the processor unit's bus system.

The electronics sub-chassis measures 27cm. by 35cm. by 9cm. and is essentially a two-board structure. There are up to 64 Motorola 64K RAM chips on the upper level, giving the review machine 512K of on-board RAM in all; on the basic 256K Corvus half the chips are missing. The 68000 and its support chips are on the lower board, which also houses the four bus slots, two of which were spare in the review machine. They are easily accessible when the draw is pulled, as is the Dil switch which is set to establish where the raw hardware looks for its bootstrap software on powering-up.

The two used slots lead off via ribbon cables to the peripheral drive units. Measuring 38cm. by 31cm. by 15cm. the 20 Mbyte hard disc unit is physically about half the size of the earlier Corvus equivalent. It still takes up a lot of desk space in comparison with the increasingly popular hard discs as built into other systems, where they need occupy no more than a single 5.25in. floppy-disc drive slot.

The 8in. floppy drive is neatly

Edword

The Corvus Concept word processor Edword has some commendable features:

- Text files are manipulated in separate segments, called pads, of a workspace, a virtual memory disc file with the default name W. Text of almost any length can be edited as though it were all in RAM at once, and you can switch between the pads, swapping chunks of text without having explicitly to save and reload files.
- Indicators around the margins of Edword's screen window show graphically:
  what proportion of the current file the screen display represents,
  where the cursor is in relation to the whole current file, and
  how much of the work pad is being used at the moment.
- During an editing session alterations made to the text are invisibly logged.By retracing the log a single key, Undo, lets you backtrack on the changes you have made, restoring the text step by step back to its original state, right back to the beginning of the session, just like on a mainframe. Sensational!
- During pauses in an edit, and after the session, the length of time spent inside Edword is displayed on the screen.
- Fount enhancements like bolding, underlining, super- and subscripting are displayed on the screen just as they will appear on the printer.

These tremendous advances will certainly impress users brought up on WordStar. However, I found myself avoiding Edword, and it was not just because on the review machine the screen rippled like a flag in a high breeze. Edword's scrolling is appalling: the screen splits at the cursor, text below the cursor is erased and then replaced with new text, then the screen above the cursor is cleared before the new text is written in. If that sounds slow, that's the way it happens. In vertical mode a kind of sideways wipe is introduced as well.

Being able to juggle chunks of text in separate buffers is a valuable feature, but under Edword access to the mechanism is clumsy. Mark of the Unicorn's The Final Word also allows buffer swapping in a virtual memory file of 256K. I am currently using it under CP/M on the little old Z-80: for speed and ease of use it beats Edword on the 68000 hands down.

Features like Undo and the literal presentation of fount enhancements are very nice indeed. Perhaps when Corvus has a breathing space to do some machine-code optimisation of a program that has presumably been patched together in Pascal from the library functions, Edword will come into its own.

proportioned for a stand-alone unit at 41cm. by 26cm. by 12cm. Like the hard-disc drive it is larger than comparable built-in units because it needs its own power supply. On top of the case is a hemispherical indentation designed to take the articulating plate that holds the monitor. The plate allows it about 90 degrees of side-to-side swivel and roughly 30 degrees of tilt.

It is the screen that is the dominating feature of the whole system. The main concept of the Concept is that the display should be big and bold and capable of high-resolution graphics. Graphics have been implemented as a black-and-white 720-pixel by 560-pixel bit-mapped screen on which all display characters are generated by software.

There is an obvious advantage in being able to design character sets to taste. The 256 available codes do not necessarily have to generate alphanumerics. You can use them to display symbols of your own design, an approach well illustrated in the game called Roach provided by Corvus. The plan elevation of seven rooms of a house are revealed in turn as you move from one to another. You are a scurrying cockroach, and the object is to eat up all the crumbs and clean out the refrigerators.

Using the character design utility Edcharset you can easily personalise the look of the game to suit yourself without having to become involved in the logic. Edcharset can also be used to create characters bigger than the standard rather cramped alphabet that the system adopts on power-up.

The disadvantage of a soft character set is that, without sophisticated hardware, output to the screen will be considerably slowed down. As well as its regular business of working out what to write to the screen the processer has to find time to compute the design of each character as it writes it. This may not be exactly what the Corvus does, but there is certainly something which visibly slugs screen output. It is most obvious during scrolling, when the whole screen has to be refreshed.

The large screen has an added bonus in that it can be oriented either in landscape, with wide sides horizontal, or portrait format — though at the risk of a hernia, it must be said. With its 15in. Ball Bros CRT is it quite the heaviest screen I have ever handled. It might seem appealing to use the 72-line by 90-column portrait format for word processing and then swap to the 56-line by 120-column landscape mode for spreadsheet calculations. In practice you settle on one format or the other and stick to it.

Unusually, this over-sized monitor unit has its own built-in fan. When everything is switched on, with the processor unit's own fan breezing and the drives whirring, the system has a definite acoustic presence, though a tolerable one.

On powering-up the CPU unit checks to see if the hard disc is ready. If it is not the

(continued on next page)

Specification

SYSTEM BOX
CPU: Motorola 68000 16/32-bit chip with 24-bit memory address bus
Memory: 256K expandable to 512K of RAM
Bus: four expansion slots for 50-pin cards
Standard interfaces: two RS-232C serial asynchronous ports; Omninet RS-422 local network interface
Features: clock/calendar with battery back-up; sound generator with speaker
Dimensions: 114 × 381 × 432mm.
Weight: 11.2kg.

DISC DRIVES
Floppies: 1.0Mbyte 8in., floppy-disc drive, IBM 3740 format.
Hard discs: 5.7Mbyte, 10.8Mbyte or 19.7Mbyte Corvus hard discs
Back-up: 73Mbyte VCR back-up storage
All figures are for formatted storage.

DISPLAY
Type: 15in. monochrome CRT
Displays: 72 lines by 90 columns or 56 lines by 120 columns; bit-mapped display 720 × 560 pixels
Features: tilt, swivel and rotation by 90° for portrait or landscape format
Dimensions: 356 × 381 × 381mm.
Weight: 18.6kg.

KEYBOARD
Type: Detached with Selectric-style QWERTY layout.
Features: 100 keys in all, with 10 function keys, numeric keypad, cursor controls and a "go faster" key to speed up cursor movement
Dimensions: 76 × 203 × 432mm.
Weight: 2.1kg.

Price: £3,950 for the 256K machine, including Edword; £1,200 extra for the 8in. floppy; £1,795 extra for the 5.7Mbyte hard disc. Total system price as tested: £6,945. Prices do not include VAT.
Manufacturer: Corvus Systems Inc., San Jose, California.
Importer: Keen Computers Ltd, Minerva House, Spaniel Row, Nottingham NG1 6EP. Telephone: (0602) 412777.

The screen, the dominating feature of the system, can be used long side up.

CORVUS CONCEPT

(continued from previous page)

CPU declares it to be out of action without bothering to retry so switching on the hard disc is desirable before bringing the CPU unit on line.

It comes to life with a deep beeping sound and puts up a prompt inviting you to boot from the floppy, the network or the hard disc. Once the boot is accomplished you are invited to enter your name. Somewhat confusingly this is not a reference to what it says on your birth certificate: the single user must respond with SMGR, the code name for the system manager. The next prompt requests a password, which it accepts without echo to the screen. Now the system has to log on its disc units, and while doing so it displays a series of dots on the screen.

This rather long-winded power-up sequence would not matter much if you only had to put up with it once every session, but it was necessary to go through it regularly when the earlier version of the software ran into hang-ups and bomb-outs. A great boon of simpler eight-bit machines is the ease and speed of rebooting.

The various devices thus mounted are logical rather than physical. They have names and unit numbers, with the floppy disc, unit 9, being christened with a string of stars if there is no readable disc latched into it. The hard disc is divided into volumes rather as CP/M divides a disc into user areas, with the difference that the Corvus operating system CCOS gives them meaningful names.

There is a further, larger distinction in the way that the volumes are regarded by the system as quite separate devices, even to the extent that different volumes can be prepared for attachment to alien operating systems. The Corvus Constellation, like the IBM XT, offers the option of formatting separate volumes for UCSD Pascal, Apple, MS-DOS and CP/M-80 as well as the native CCOS operating system.

The operating system advises the user of the devices it has mounted, and draws two windows on the screen. The upper one takes up most of the display area, while the lower one is a narrow letter-box shape used to contain user input commands and parameters, solicited by a Select Function prompt. Space is left below this box for 10 inverse-video rectangles, which are tokens for the physical function keys on the keyboard below. As well as the geographical correspondence, the function keys are identified by number and given names.

Pressing a function key will activate whatever routine is identified by the associated name. To reach the word-processing routine you press function key 3, whose legend is Edword. The keys may display two names at any one time, the second representing the shifted version of the appropriate function key. Pressing the Command key can switch in a completely different set of names for the 10 function keys, so up to 40 functions can be made immediately available to the user.

Of course, entering a program like Edword by way of the keys enables the program itself to reload the function keys with other functions relevant to the application to be handled. Depending on how application programs handle the idea, this arrangement can be nested to an unlimited number of levels. Even without writing special software the user can set up

Corvus Concept Work In Progress

Old software	New software
OPERATING SYSTEM	
Function-key system limited	Extended to include user keys
Date displayed but not refreshed	Date refreshed, time included
Batch routine will not accept parameters	No improvement
Generally slow	Some apparent speed up
Suspend documented but not implemented	Documentation altered; Suspend apparently abandoned
Alternative operating systems promised; only very slow CP/M-80 implemented	No improvement
Management of disc space not dynamic: requires occasional "crunching" of files	No improvement
DOCUMENTATION	
Variable quality of presentation: some high-quality print dwarf-format manuals, some photocopied legal-sized typescripts.	Standardised on poorly presented dwarf photocopied typescripts
Inconsistent with software	Consistency greatly improved
LANGUAGES	
SDS machine-code Pascal and Fortran provided	New libraries means old source code must be re-edited.
No p-code	UCSD p-code Pascal added
No Basic	Basic added, but failed to work
No C	Still no C
APPLICATIONS	
Edword contains bugs and lacks elementary features: for example, top and bottom margins not settable, no text enhancements.	Features added, bugs removed
Logicalc short on features	Some features added. Still a rather ordinary Visiclone
Shortage of applications: no database manager, accounting package, time-management system, etc.	No improvement, though offering p-code system should open up new software

To match the revised software there are reportedly imminent hardware improvements:

- A new lighter screen, making it more of a practical proposition to turn it from vertical to horizontal as needed.
- Amber phosphor to European standards. It will also be readably stable on European mains.
- An add-on memory-management chip that will speed up screen handling.

this function-key system by very simply editing a text file called Userkeys Text, which the operating system automatically reads on powering-up.

One of the standard function keys offers a Help facility. Press the Help key followed by any other key and you are presented with a short piece of explanatory text. This is a useful idea, but as implemented it works in a very half-baked way. Press Help and a message appears telling you that a text file is being loaded. The fact that this process introduces a perceptible hold-up may lead you to expect some really useful hints. However, subsequently pressing, say, the Logicalc key produces nothing more rewarding than:

LoglCalc enters the optional Concept spread-sheet program.

Help on the other keys is at the same level of detail.

If you do not like this single-key method of communicating with the operating system you can always write command lines directly into the letter-box window, to be executed on hitting Return. Alternatively the user keys may be dismissed altogether by entering a % symbol against the Select Function prompt. A Unix-style % prompt then appears in the large upper window, and communication with the machine takes place in the traditional Teletype scrolling mode. It will stay like that until you break back to the function-key method by sending Control-D.

Teletype scrolling mode works in a similar way to entering commands into the letter-box, but some additional Unix-inspired commands become available. LS — or its CP/M synonym Dir — will produce a directory listing, CD <newvolume> changes the volume, RM removes a file from the directory, and so forth.

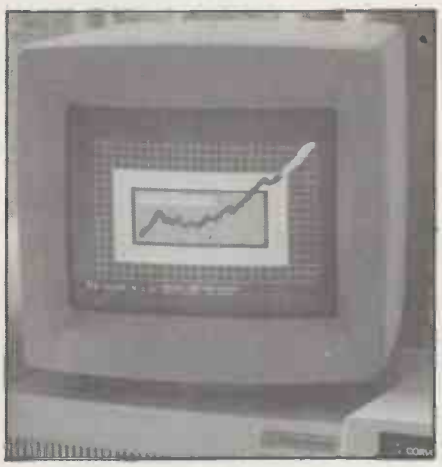
It was at this point that some confusing departures from the documented behaviour began to appear. As they accumulated, together with enough bugs to confirm that I was dealing with some fairly unready work-in-progress, I decided to hold off further investigations until a new version of the operating system became available. It took a couple of months for this to happen, and by then Keen Computers needed the machine back urgently. I did not have time to investigate the improved system properly, but some limited observations on the new software appear in the Work In Progress box.

The new version of CCOS is a lot better, but I still wouldn't give you twopence for it. It is sufficiently like Unix to appear complicated to the new user but embodies few of the considerable advantages of the Bell Labs offering. Internal evidence suggests that Corvus meant to go further with it. Were treed directories originally envisaged?

A clearer example is the Suspend facility, the ability to stop a process in mid

Einstein's picture demonstrates the graphics.

The operating system lists the devices it has mounted, and draws two windows.



The graphics extend from old masters to graphs.

flow and save its state. This feature, a sort of halfway house to true concurrency, is very like what Bill Gates of Microsoft will be offering against Concurrent CP/M — which is truly concurrent — towards the end of this year. Under his MS-DOS 3.0 you will be able to suspend a process, switch to some completely different program and, when the time comes to switch back, the processor will be able to pick up exactly where it left off.

Documentation of the earlier version of CCOS implies that Suspend is available by "hitting the Suspend key". There is no Suspend key, and as far as I could make out no Suspend function either. All mention of it has been dropped in the later documentation. It's a pity — this feature would have fitted nicely with the facility that allows the large screen to be divided up into any number of windows, sized to the whim of the user. Without it the windows are not much more than cosmetics.

On the positive side, I/O is redirectable and the utilities have a human-shaped design that is very welcome. For example, when you are copying multiple files to a back-up volume and the system encounters a file of the same name already at the destination it compares the dates of the two versions, tells you if they are the same or different, and gives you the option of overwriting or skipping to the next file.

There is open access to all the hardware facilities through the very rich Pascal and Fortran libraries. This is essential, because apart from Edword and Logicalc, applications software running under CCOS is conspicuously absent. In encouraging you to develop software that even at source level is heavily machine-dependent, Corvus Systems Inc. is insisting on a huge investment of your time in its product. The effort of producing software may well out-value the price of the hardware before anything useful is achieved.

CCOS includes a batch processor equivalent to CP/M's unlovely Submit. The CP/M utility can at least handle parameter substitution; why CC.Exec is not designed to do so is completely baffling. Keen Computers should be inundating its U.S. supplier with daily telexes of complaint until this is implemented. Better still CCOS should be gently shelved in favour of a development environment that is not tied to the fortunes of a single hardware company.

Conclusions

- **At £3,950 plus VAT the Corvus Concept is not particularly expensive for the 68000-based true 16-bit hardware it offers, but remember this price does not include any discs.**
- **The over-sized screen is a good idea, but internally the Concept appears to be short of hardware support for its bit-mapping, making it slow in character display.**
- **It is hard to see why Corvus has tied up so much of its resources in developing its own operating system. A CP/M-80 emulator comes with CCOS, but it is too slow to be of much practical use.**
- **The new version of the operating system now offers run-time support for UCSD p-code packages, so the daylight is now being allowed to filter in from the world outside.**
- **The Concept is not competitive as a stand-alone office micro, but could be more interesting as part of a local area network with several work stations sharing discs and printers.**

TELCON ZORBA

The beauty of this portable is in the eye of the operator, as Ian Stobie found.

AS YOU STAGGER off the bus with the Zorba it could be mistaken for an old-fashioned sewing machine. The plastic case flexes disconcertingly, and its chocolate brown colour will win no prizes for tasteful styling. The Zorba portable micro is not impressive to look at.

Yet it turns out to be quite a sophisticated and likeable machine The Zorba is a portable in the Osborne 1 category — an eight-bit CP/M mains-powered micro, American made, and of roughly suitcase size. Its £1,595 price includes some good software, and it has a full 80-column screen and large-capacity floppy-disc drives.

The Zorba weighs 22lb., which is fairly typical for machines in this class. It raises the question of what is meant by portable. Obviously the machine is too heavy to be taken everywhere, and it needs mains power. Really these machines are trans-portables, offering a full desk-top specification system packaged in a way which allows them to be taken without too much fuss to where the work is to be done.

The Zorba arrives in its carton as a single unit, together with its two big manuals. The base of the case unclips to reveal itself as a keyboard, which can be detached from the main unit and used on the end of its coiled cable. The main unit contains the screen, discs and processor.

Connecting up the machine merely involves plugging the mains cable into the front of this unit and switching on. At the back of the machine behind a protective cover are an RS-232C communications port, an IEEE instrument port and a dual serial/parallel printer port, so a good range of other devices should be connectable. I added an Epson FX-80 printer, and ended up using WordStar on the Zorba to produce most of my copy for this issue.

There is no denying the machine looks plasticy. A colleague charitably suggested this was a good thing, to help it absorb impact, as the casing plastic is the bendy sort. The finish isn't shoddy — nothing is loose — but it is not very beautiful either.

The keyboard is quite light in weight and is fairly noisy when hit. But it is accurate and easy to type on, with a standard layout and a separate numeric keypad. The 19 function keys are programmable and can be set up with strings of CP/M commands to initiate common jobs.

The green phosphor screen is a nominal 7in., meaning it measured 6.5in. diagonally if you put a ruler to it. I found the characters in the 80-by-25 line display clear enough and readable at a normal desk-top viewing distance. The On/Off switch also functions as a brightness control. The maximum brightness is good enough for outdoor use, but if you lie

A full-specification system which can be taken to where the work is.

```
58k CP/M 2.2 (Bios v1.5)

Disk     On       Looks
name:  drive:     like:

A:/B:   A/B    388k Telcon DD
I:      B      720k SuperBrain QD
K:      B      168k DEC VT-18x DD
L:      B       81k Xerox 820 SD/Cromemco 520 SD
M:      B      154k Xerox 820 II DD
N:      B      192k KayComp II DD
O:      B       88k Osborne SD
P:      B      153k IBM-PC CP/M-86

KEYDEF.TXT?

A>
```

Screen display which appears when your boot shows alternative disc formats.

back in your hammock you start noticing that the characters are quite small.

When you turn the machine on it beeps and displays the Zorba logo and a message asking you to insert a disc. Once you do so and hit Return a rather interesting display comes up, followed by the normal CP/M prompt. The display shows you what disc formats the Zorba is currently set up to accept. You obviously only have the two physcial drives A and B, which in their default Zorba format each hold 388K. But you can get them to behave, for instance, as Osborne-format disc drives by using the logical drive name O. And if you put an Osborne disc in drive B you can get a directory by typing Dir O:.

You have a general ability to read and write programs and data in a number of common formats including Superbrain quad density and IBM PC CP/M-86 formats. New formats are being added and are available on disc, Televideo being the latest. This kind of facility has been possible for a long time as it is a function of the CP/M BIOS, and now Telcon, the Zorba's manufacturer, has taken the trouble to implement CP/M well. I also got the impression that the Zorba's discs are fast, for instance when doing back-up copying.

How much of an advantage is this multiple format ability? First, any existing CP/M software or data you have on discs in any of several formats can be transferred straight across to the Zorba. Secondly, you can swap discs to other machines, perhaps most usefully to other non-portable machines you have at your base. I shall be keeping copies of files I have created with the Zorba to use on the office IBM PC once the review machine goes back. I also now have some files to send to a publisher who accepts discs in Osborne format.

The procedure to create a non-Zorba format disc is simple. The standard CP/M Format utility just has a menu of different formats. Files you have on a different format are copied across to another with Pip, or you can run programs directly from the appropriate logical drive.

Specification

System: Z-80 eight-bit processor; 64K RAM; two built-in 5.25in. floppy-disc drives giving 776K storage; built-in 7in. green screen displaying 80 characters by 25 lines; detached keyboard; a 16-bit 8086 add-on card is also available

Software in price: CP/M 2.2 plus utilities, CBasic compiler, WordStar, Mailmerge, Calcstar

Price: £1,595

U.K. distributor: Sun Computing Services Ltd, Concorde House, St Anthony's Way, Feltham, Middlesex TW14 0NH. Telephone: 01-890 1440

The Zorba comes with WordStar, Mailmerge and the Calcstar spreadsheet, all from Micropro, and with Digital Research's CBasic compiler and Microsoft's Macro 80 Z-80/8080 assembler. The WordStar word processor is version 3, which has much better rewritten documentation and a few new features like horizontal scrolling. When the word processor is in use you immediately notice the Zorba's fast screen updating. It is a consequence of the Zorba hardware, which has 2K of RAM set aside to memory map the display.

I did not use Calcstar any more than necessary to check that it was properly installed on the machine, but Mike Lewis gave a favourable report on it in *Practical Computing*'s July 1983 issue, which surveyed spreadsheet packages. A major advantage of sticking with Calcstar is the ability to transfer data to WordStar and other products in the Micropro range like Datastar.

Zorba's Basic is the business-oriented CBasic compiler. Developing a program involves three stages. First you write the source code using a text editor such as WordStar. Then you take the text file and compile it to an intermediate code suitable for running. Finally you run the intermediate file. The advantage is that your program executes several times faster than it would with an interpreted basic like MBasic, and you can also link in library routines easily. CBasic is very suitable for commercial programming, but it might help new programmers if an interpreted basic like Digital Research's Personal Basic were thrown in as well for more spontaneous programming.

A useful feature is the Print function key which dumps what is on the screen to the printer, though it does not work in all application programs. The Zorba has a full RS-232C interface, and it comes complete with software to emulate the Heath/Zenith Type 19 terminal.

One of the Zorba's two phone-book sized manuals covers the three Micropro products and looks like Micropro's documentation rebound by Telcon. The other volume is a loose-leaf binder with Digital Research documentation for CBasic and Microsoft documentation for Macro 80, and the Telcon-written Zorba user's guide. The user's guide, which is clear and straightforward, covers CP/M commands as well as the specific features of the hardware.

The Zorba's U.K. distributor has just started to receive 16-bit add-on boards from Telcon. They are built around the Intel 8086 and come complete with CP/M-86 and an additional 128K of RAM. With the board fitted the Zorba still works as an eight-bit CP/M machine running all the usual software, but you can bring up CP/M-86 with a single command. When in eight-bit CP/M the extra RAM can be used as RAM disc. The price for the Zorba with the add-on fitted is £2,195.

Conclusions

- **It's not pretty, it not revolutionary, but it works. I ended up liking the machine.**
- **The specification is conservative but complete with the whole package, including a 6.5in. screen, kept within a just manageable weight.**
- **A number of touches, notably the ability to handle a variety of disc formats, make the Zorba a refined and developed variation on the established Osborne look-alike theme.**
- **The Wordstar word processor and the Calcstar spreadsheet can be recommended as they have sold widely and they can exchange data with each other and other products in the Micropro range.**
- **At £1,595 the Zorba is good value. With the 16-bit add-on card the Zorba still won't be chic but it will be a powerful dual-processor system and very good value.**

Assemblers for the Apple II

For fast execution assembly language is often the clear choice. John Dawson tests four 6502 assemblers tailored for the Apple micro.

MANY OF THE 650,000 or so Apples in regular use around the world are used for serious or professional program development. Despite the availability of high-level languages suitable for process control, number crunching, file handling and telecommunications there are many occasions when low-level assembly language is the optimum tool for writing a program for a particular application.

The first assembly languages were written in the 1950s to speed the development of programs for early mainframe computers. Prior to the use of teleprinters and paper tape for the entry of programs and data, each instruction had to be placed in the computer by setting binary switches on the front panel. The human-readable mnemonics of assembly language were a great aid to productivity. Higher-level languages, such as Fortran, Cobol and PL1, increased the speed with which a program could be written but slowed its subsequent execution.

The portability of a high-level program from one mainframe to another could be much greater than was possible using an assembler, but at the same time the ease of access to peripheral devices was lost. Assemblers have not been displaced even by Forth or BCPL. Where time is critical or sophisticated interrupt handling is necessary a good assembler is still the best tool for the job.

An ordinary assembler for the 6502 CPU in the Apple should use the standard Mostek mnemonics to generate one machine-code instruction for each line of source code. A line of source code contains the following information: an optional label to identify the line; the mnemonic for the instruction, one of the 56 legal op-codes for the 6502; the operand, the memory location that is to be operated upon; and an optional comment.

Figure 1 shows a section of a large program. The object code — that is the hexadecimal instructions that will control the computer — is listed in the second column after the colon. The labels for the program occupy a column to the right of the line number and are followed by the 6502 op-code and the operand. There are no comments in this section.

At this simple level an assembly language is still an improvement over programming with naked machine code. It is possible to write a source-code file, store the file on disc for later modification and assemble the code to run at any location you wish. Editing commands help to write the program and then to change the source code during testing and debugging. Lisa 2.5 works at this level.

The three other assemblers in this review are all macro assemblers and the additional macro facility enormously increases their power. Figure 3 is the same section of source code as it is typed into the computer. The >>> pseudo-op is an instruction to the assembler to insert a predefined set of instructions, called a macro, corresponding to the name in the operand field during the assembly process. Figure 1 shows the expanded macro instruction after assembly has been carried

Figure 1. Section from a large assembly program.

```
                        485
04A9: D8                486  INITIAL  CLD
04AA: 78                487           SEI
04AB: A9 00             488           LDA  #0
04AD: 8D 07 27          489           STA  PAGEN
                        490           >>>  2SET.TOP;ICURS;CURSE
04B0: AD 3B 04          490           LDA  TOP
04B3: 85 D0             490           STA  ICURS
04B5: 85 12             490           STA  CURSE
04B7: AD 3C 04          490           LDA  TOP+1
04BA: 85 D1             490           STA  ICURS+1
04BC: 85 13             490           STA  CURSE+1
                        490           <<<
                        491           >>>  2SET.TXSTART;TXST;TXEND
04BE: AD 2A 04          491           LDA  TXSTART
04C1: 85 B0             491           STA  TXST
04C3: 85 B2             491           STA  TXEND
04C5: AD 2B 04          491           LDA  TXSTART+1
04C8: 85 B1             491           STA  TXST+1
04CA: 85 B3             491           STA  TXEND+1
                        491           <<<
                        492           >>>  FILL.MOVBUF;NDELBUF;NULL
04CC: AD 30 04          492           LDA  MOVBUF
04CF: 85 AC             492           STA  SD+12
04D1: AD 31 04          492           LDA  MOVBUF+1
04D4: 85 AD             492           STA  SD+13
04D6: AD 2E 04          492           LDA  NDELBUF
04D9: 85 AE             492           STA  SD+14
04DB: AD 2F 04          492           LDA  NDELBUF+1
04DE: 85 AF             492           STA  SD+15
04E0: AD 1B 04          492           LDA  NULL
04E3: 85 AB             492           STA  SD+11
04E5: 20 88 07          492           JSR  FILLSR
                        492           <<<
04E8: A2 46             493           LDX  #'F'
04EA: 86 72             494           STX  TAPS
04EC: AE 06 04          495           LDX  TRUE
04EF: 86 67             496           STX  FAST
04F1: 86 92             497           STX  FLMF
04F3: 86 83             498           STX  FLST
```

out. The gain in programmer productivity and the reliability of the final program is obvious.

David Hood of Pace Software says that Lisa 2.5 has sold partly because it was the best known of the four assemblers. The Microsoft Assembly Language Development System, ALDS, is less well known but customers are said to migrate to this set of programs from Lisa, Merlin or the S-C Macro Assembler as their needs become more professional.

Merlin is supplied on disc and comes with a ring-bound manual approximately A5 size and 110 pages long. All the programs have A5 ring-bound manuals. In addition to the Merlin assembler the disc contains a disassembler called Sourceror, a useful library of macro definitions for incorporation into your own programs and the source code for a Sweet 16 interpreter. It also includes a special version of Sourceror that will disassemble the Applesoft Basic in the Apple, producing a labelled and commented listing that can be modified and reassembled.

The disc is copy-protected but you may make three copies of the master disc that will work. You can also copy files from one of the master discs and then copy them back on to the working disc if it becomes corrupted for any reason. You must be careful when carrying out the original back-up process; make a mistake and you have lost one of your working copies. Once you have produced a working copy you can configure the program to work with a number of 80-column cards, and alter several variables such as the wildcard search character for the find command.

Suppliers and prices

Merlin Macro Assembler, Southwestern Data Systems, 10,761 Woodside Avenue, Suite E, PO Box 582, Santee, Ca 92071.

S-C Micro Assembler, S-C Software Corp., 2,331 Gus Thomasson, Suite 125, PO Box 280330, Dallas, Tx 75228.

Lisa 2.5, On-Line Systems.

Microsoft Assembly Language Development System, Microsoft, 10,700 Northup Way, Bellevue, Washington 98004

Pace Software Supplies of 92 New Cross Street, Bradford, West Yorkshire BD5 8BS, telephone (0274) 729306, kindly supplied the four packages for review. Lisa 2.5 is no longer available but the other three are available from Pace:
Merlin Macro Assembler — £42 + VAT
S-C Macro Assembler — £60 + VAT
Microsoft ALDS — £75 + VAT

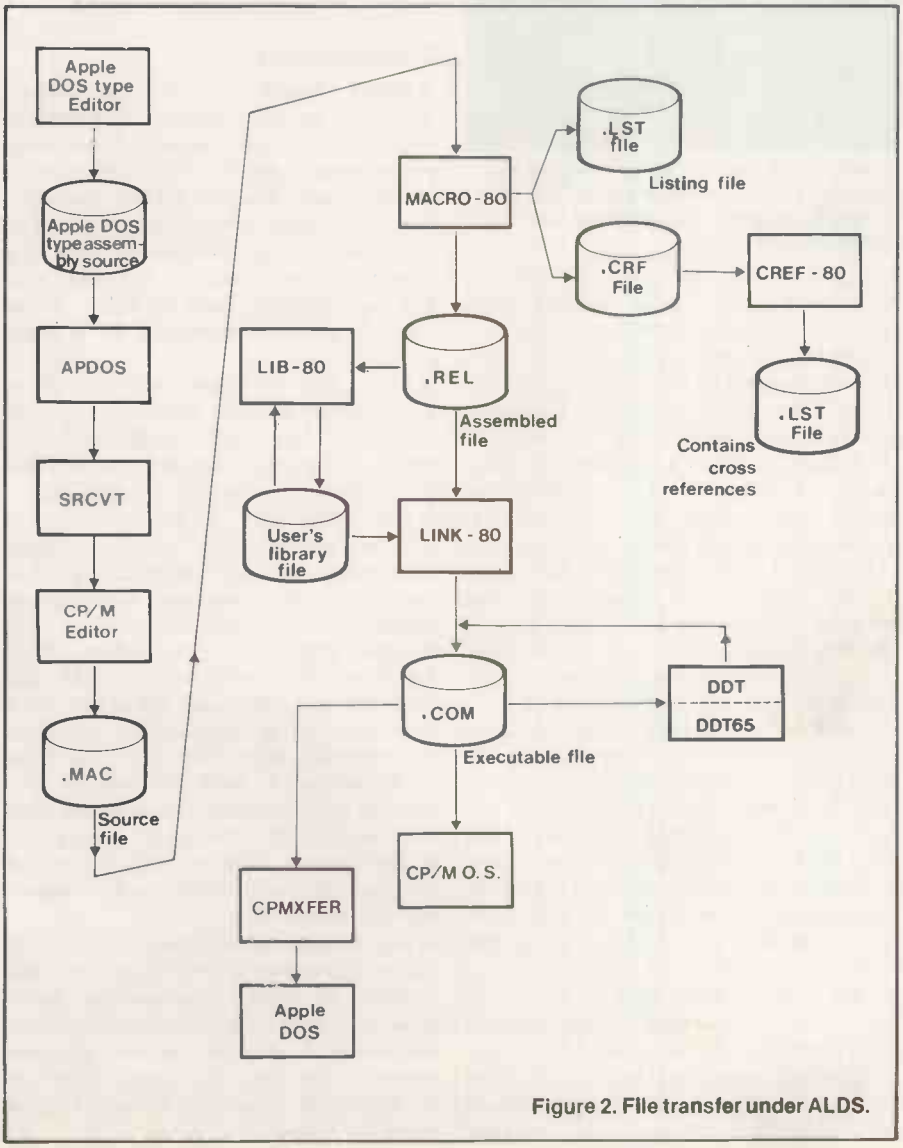


Figure 2. File transfer under ALDS.

Both Merlin and the S-C assembler offer a wide range of commands and pseudo-ops. The source-code listing is now about 80 pages long and assembles to nearly 9K of machine code. The pseudo-op to Put a text file from disc on to the end of the source code resident in memory while assembly is under way is vital. Other programmers would certainly have used the Mon command or the instruction to reverse an ASCII string in the object code if they were writing for the Apple computer.

The macro definitions in all three programs can accept parameters to pass variable values into the macro. Eight special variables are preset for this purpose in Merlin — there are nine in the S-C — and when the macro is called from a program these parameters are replaced by the expressions used in the macro-name line-operand field. For example, the instruction:

```
>>> 2SET.TEXTSTART;CURSOR;
SCREENTOP
```

will assign the value of Textstart to variable 1, cursor to variable 2 and so on, in the instructions that make up the macro named 2Set.

The manual for the S-C Macro Assembler claims that it "makes assembly language programming on the Apple as easy as programming in Basic" — well, almost. Unfortunately the resemblance to Basic detracts from the way the program handles. Typing in source code takes a great deal of time and the controls for line numbering and setting the various fields into neat columns are particularly important.

The S-C Macro Assembler has to be told to number lines automatically, while the Merlin generates line numbers without effort or thought on your part. Unlike Merlin, the S-C Macro Assembler supports the standard Apple II screen-editing commands. Escape-I,J,K,M move the cursor around the screen. The program works satisfactorily with the M+R Supr'term 80-column card.

Some features of the program are definitely unattractive. The Copy command, for example, copies a range of

(continued on next page)

Assemblers for the Apple II

(continued from previous page)

lines from one place in the source program to another but does not change the line numbers to match the new location. Merlin uses transient line numbers which depend entirely on the line's position in the source code and never produces this problem. The S-C package requires you to carry out a Renumber command after every Copy operation.

The Microsoft program runs under CP/M. It consists of a suite of programs to convert source code from CP/M files to Apple DOS, assemble a source-code file to produce 6502, Z-80 or 8080 machine code, debug 6502 machine code and generate a cross-referenced listing of the labels used in a program.

The ALDS system requires the normal Apple CP/M configuration. Figure 2 illustrates how files may be transferred around the ALDS environment from one program to another. Source code is not transformed directly into object code but into an intermediate Rel file which can be combined with other intermediate files in any order prior to the final assembly.

Different programmers have different styles, and for programs where a large team is involved in the development the ALDS system may have some advantages. But for the single programmer I can see no gain over the facility in all the other assemblers to read a second source file into the machine during assembly, include the file in the assembly process, and then continue with the next instruction in the main source file.

Surprisingly perhaps, the ALDS package does not include a text editor. The manuals suggest that you should use Ed on the CP/M master disc or another text editor of your choice. Ed is now very primitive and does not compare favourably with the editors in the other programs. You could use WordStar in non-document mode if it is available.

Lisa 2.5 is the best known of the programs in this review. Like the S-C Macro Assembler and the ALDS programs the disc is not protected and back-up copies may be taken without let or hindrance. Like all the other programs it can use a language card, if one is available, to extend the size of the source file that can be held in RAM.

Any DOS command can be carried out from Lisa's command level but that is less useful than the configuration section of Merlin, which will permanently set the peripheral device-handling parts of the program to your own requirements. I could not use the program with an 80-column card as it slipped back arbitrarily into the 40-column mode.

```
483
484 INITIAL   CLD
485             SEI
486             LDA   #0
487             STA   PAGEN
488             >>>   2SET.TOP;ICURS;CURSE
489             >>>   2SET.TXSTART;TXST;TXEND
490             >>>   FILL.MOVBUF;NDELBUF;NULL
491             LDX   #'F'
492             STX   TAPS
493             LDX   TRUE
494             STX   FAST
495             STX   FLMF
496             STX   FLST
```

Figure 3. Source code for program in figure 1, as typed into computer.

```
                >103          INC  SD+2+1
                >102  MC      <<<
                >103          JMP  DL202
                >104
                >105
                >106  DLMORE  >>>  2SET.TCURS;SD,SD+2
                >106          LDA  TCURS
                >106          STA  SD
                >106          STA  SD+2
                >106          LDA  TCURS+1
                >106          STA  SD+1
                >106          STA  SD+2+1
                >106          <<<
                >107          >>>  SET.DELBUF;DELFIC
                >107          LDA  DELBUF
                >107          STA  DELFIC
                >107          LDA  DELBUF+1
                >107          STA  DELFIC+1
                >107          <<<
                >108          >>>  FILL.DELBUF;NDELBUF;NULL
                >108          LDA  DELBUF
                >108          STA  SD+12
                >108          LDA  DELBUF+1
```

Output from Merlin may be listed to the screen as object code is generated. This example includes an expanded macro to compare two values.

The cursor controls in Lisa are well placed. Control-O moves the cursor up, Control-K moves it right, Control-L moves it down and Control-J moves it left. The disc contains a number of other programs besides Lisa 2.5. There is a useful disassembler and programs to convert S-C format files to Lisa text files. A cross-reference generator lists each symbol defined in a program, the line number where it was defined and the line number of each occurrence of the label. The disc also includes some graphics high-resolution routines for the Apple II.

I guess that the preparation/assembly ratio for the program I am working on is at least 40:1. The commands and pseudo-ops that help with the preparation of the source code are vastly more important than the speed of assembly. Repeated disc accesses in large programs also reduce the relevance of the time taken for each 1,000 lines of code. The S-C Macro Assembler really is modelled on Basic and may appear superficially easier to use in the early stages of your program development than the novel commands used by Merlin.

However, there are two editor commands in Merlin that outweigh anything in any of the other packages: The command returns to the start of the last block listed and displays the source code from that point, and / continues to list the program from the last line number. The / command can be given a line number and will then list from that line. These two commands, which are adjacent to each other on the keyboard, save literally hours of time. Similarly, Merlin goes automatically to the next Tab stop when you press the space bar. The S-C Macro Assembler requires you to press the Control and I keys simultaneously, and Lisa's free-form input is no more convenient to use.

Conclusions

● Either Merlin or the S-C Macro Assembler package will cope with the vast majority of an assembly-language programmer's needs for developing 6502 machine code. The S-C Macro Assembler program is more cumbersome to use. The consequence of an additional 1/10th of a second delay in executing a command that you use constantly may be hours of lost time if you are working on a large program.

● Lisa 2.5 is now out of date. Undoubtedly it works and is an adequate assembler, but both Merlin and S-C Macro Assembler offer far better facilities for the generation of major programs.

● The Microsoft ALDS package is curiously unattractive. The program does have many advanced features but it is complex to use and has no practical advantage over Merlin for work on 6502 machine code. There are other CP/M assemblers that will produce Z-80 and 8080 machine code, and unless you must have all three in one package there are better specific assemblers to choose from ALDS appears to have been written by a team of large-machine programmers who were determined to do the job properly — as they saw it. The result is a suite of programs that are unnecessarily complex and difficult to use.

● The choice between Merlin and the S-C Macro Assembler is clear to me but may depend on your programming background. Merlin is more powerful, faster and easier to use but the S-C program resembles the Apple Basic more closely in its command structure. Both are good value for money.

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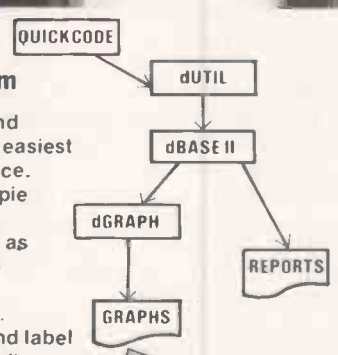

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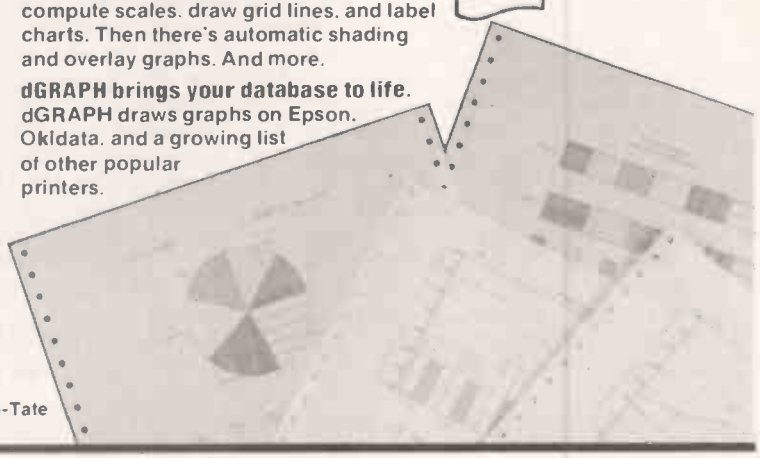

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SUPERSPELL

Precision Software's spelling checker can be used in combination with two popular word processors on Pet micros. David Oborne has been trying it out.

INFORMATION TECHNOLOGY arrives in many offices in the form of the word processor. These clever software packages enable you to store words in computers, to change these words about, edit, delete, insert and print out at will. As computing power becomes cheaper, more and more people will come to realise the value of word processors. Many of the office microcomputers purchased for general use will soon become dedicated to word-processing tasks.

Yet just because word processors make the task of writing prose slightly easier and more enjoyable it does not follow that the material which emerges is any better than that produced by conventional means. Professional typists develop the skills to use the keyboard quickly and accurately. The average "two-fingered" user cannot teach these levels of skill, so typing errors creep in. Many of the errors are caught at the time of typing or on a subsequent reading of the printed material but — as any magazine editor knows — errors still get through.

Software writers are producing programs linked to word processors which check the spelling of typed material so that mistakes can be corrected before the final printout. One such program is Superspell, designed for the Pet with a 4040 or 8050 double disc drive. It is produced by Precision Software, the firm that produced the Superscript word processor. Like Superscript, Superspell can be used on text files created either by Superscript itself or by Wordpro.

Superspell arrives with a standard 30,000-word dictionary to which the user can add more words. On a 4040 drive the theoretical maximum number of words is in the region of 60,000; on the 8050 it is 200,000. The program works by comparing each word in the document to be checked with each of the words currently in the dictionary. A word in this context is any group of letters, including the apostrophe, that occur between two spaces or between ASCII characters other than upper- or lower-case English letters. The program takes less than a minute to check all of the words in an average file.

Like Superscript, Superspell is software-protected so you cannot make security copies of your disc. However, if you return a completed copyright form to Precision Software the company sends you a second copy of the program. If this one also becomes damaged, then you can get a further replacement on payment of a fee.

```
total number of words      = 659
number of unique words     = 239
number of sentences        = 25
number of paragraphs       = 16
average word length        = 4.49

Unrecognized Word List:-
chr             cmd             cntrl           daisywheel
fori            procedure       program         ricoh
tandy
```

Before the program can be used for the first time you need to create the basic dictionary against which the words in the document will be checked. Superspell does not confine you to the American way of spelling "behavior" instead of "behaviour", "color" instead of "colour", etc. One of four types of dictionary can be created: American, British, American and British, or "blank". The blank dictionary contains only the 26 letters of the alphabet, and you can gradually build up specialised dictionaries for scientific or biographical work, or whatever.

Creating takes only a few minutes, though you do need to have access to a double disc drive. An unformatted disc is placed in drive 1, with the main program disc in 0. From the Pet, type

```
LOAD "INSTALL",8
```

and then Run to load and run the dictionary installation program. Through screen prompts, the program takes you through the appropriate steps.

Once the dictionary has been created, the disc in drive 1 is designated the dictionary disc and is used every time that Superspell is run. Having the dictionary separate from the main program has the major advantage that more than one dictionary can be set up, perhaps for checking different types of text — letters, novels, *Practical Computing* articles — or for creating dictionaries for different users.

Having created a dictionary, the user is able to access all the Superspell's facilities by typing

```
LOAD"*",8
```

or Shift-Run which loads the program. The Precision Software logo appears, and screen prompts then tell you to replace the program disc in drive 0 with the dictionary disc. The disc containing the text files to be checked is inserted into drive 1.

Superspell's main menu offers a number of options, falling broadly into two groups: checking the spelling of text in specific files and organising the dictionaries. When Superspell is being used to check spelling it can count the frequency of the words encountered in the document. It takes a little longer for the program to do a frequency count, but this option can sometimes be useful for authors — perhaps to help to reduce jargon.

The appropriate checking sub-program is first accessed from the menu, which then asks for the name of the text file to be checked. There are two ways of giving this information. You can either type the file name or use Superspell's facility of toggling the disc directory. By pressing the Rvs key the file names on the disc are entered on the screen sequentially from the directory. When the appropriate file name appears, pressing Return enables the program to read that file; Shift-Rvs is used to toggle backwards through the directory.

Before reading the file, the program asks whether or not there are files linked to it. Both Superscript and Wordpro get over the Pet's memory limitations by allowing a set of short files to be linked together when printing, so the document itself can be as long as you like. Superspell will check all the linked files which might make up a long document without the operator having to load in file after file.

The program reads each file in a matter of seconds and, just to let you know that it is working, it prints a row of dots on the screen with each block that is read. If you have opted for the word-frequency count, all of the words and their frequencies are printed in alphabetical order or in order of ascending or descending word frequency. Output may be to the screen or to a printer; appropriate parameters are set up earlier after calling for option 2 from the main menu.

As soon as the document has been read or the frequency count listed, Superspell lists to the screen statistical information about the number and arrangement of words in the document. It provides details of:

- The total number of words.
- The number of unique words; in general, the fewer unique words in a document, the more likely is it that the document will be readable.
- The number of sentences — a sentence being defined as being more than one word followed by a full stop.
- The number of paragraphs — a paragraph being defined as more than one word followed by an End of Paragraph marker, the Back Arrow.
- The average word length.

After giving this information, the program goes on to display, in alphabetical order, the words in the document that do not match up with any of the words in its dictionaries. It is at this time that the actual spelling checking is being done. When this phase is finished you have the option of printing out the unrecognised words, and you are then asked whether you wish to edit the errors in the text. If none of the unrecognised words are actually errors — they could be proper names, for example — you can abort the editing phase and return to the main menu.

If you opt to carry on to the editing phase, Superspell presents each file, with all of the unrecognised words highlighted in turn. For each highlighted word the user can take one of five alternative actions.

Pressing Return accepts the unrecognised word for the present document, including all of the linked files. The word is not highlighted again during the current editing phase, though it will be highlighted on future occasions.

If the unrecognised word is a correct one which is likely to occur again, it can be added to the user dictionary by pressing the Back Arrow key. This method is often useful for adding verb tenses and plurals to the dictionary.

The word can be ignored completely by pressing the Rvs key. In this case the program goes on to highlight the next unrecognised word in the document. If the word occurs again in the document it will be highlighted as normal. It is a useful technique to follow if there are alternative ways of spelling a word — like "program" and "programme".

The word can be edited in the normal way. The Left and Right cursor-control keys and the Insert and Delete keys all work to enable you to correct the misspelling. Unfortunately you cannot edit outside of the highlighted boundary: you cannot make "back" into "backed", for example.

Finally, pressing the Stop key aborts the editing phase and, after asking you to confirm, returns to the main menu without saving either the edited text or the learned words. As each section is completed Superspell saves the edited text if any editing has occured. At the end of a session it adds the learned words to the user dictionary.

Because it offers the ability to add words to the dictionary, certain dictionary housekeeping facilities are also offered in the main menu of Superspell. They allow the dictionaries to be checked, altered and merged together.

Two dictionaries reside on the dictionary disc. The main dictionary initially contains the 30,000 words put into it by the Install program. The user dictionary contains the words which have been learned by the program as documents are edited. The disc also contains a back-up of this dictionary in case the user dictionary becomes corrupted. The dictionary-editing facilities only apply to the user dictionary: once a word is put into the main dictionary it cannot be touched.

The first useful option is to be able to print the user dictionary to check that the words are spelt correctly. It is all too easy, when editing, either to think that an unrecognised word is correct because you did not read it properly — so you put it into the user dictionary — or to press the Back Arrow key automatically. In either case, it means that future dictionaries will be checked against the wrong spelling. This option is accessed from the main menu and simply asks how the dictionary is to be printed — on the screen or on a printer.

Another option, which has a similar function, allows you to search for a particular word or words in the dictionary. Again, after accessing the sub-program from the main menu, a series of prompts takes you through the facility, essentially asking for the word that is to be searched for. A particularly useful feature of this sub-program is the use of wild characters. Asking Superspell to search the user dictionary for b??a* displays all of the words in the dictionary beginning with b and having a as the fourth letter. A single *, of course, will give the full list of words in the dictionary.

If any of the words have been misspelled, they can be removed using the Delete from user Dictionary option. Again, the system of prompts asks the user to type the word to be deleted, followed by Return. If the word cannot be found, then the program says so.

Finally, you have the option of merging the user dictionary to the main dictionary. The real advantage of doing this is speed, as it takes longer to search and compare words in one dictionary than it does in two. It also makes sure that the size of the user dictionary is maintained at an acceptable level for checking, since it is cleared at the end of a merge. However, because the words in the main dictionary cannot be altered in any way, it is imperative to ensure that the user dictionary is correct before doing a merge. The Superspell manual suggests that the dictionaries are merged once a week.

In Editing mode you are only able to alter the words that are highlighted. A common error is to press the space bar, or perhaps the full stop or comma keys, when typing a word. If you want to type "handy" you might type "h.andy" instead. When checking the spelling, Superspell would accept the one-letter word 'h' but not the word "andy". Although the mistake is highlighted there is no way that the "h" can be joined to "andy" without reloading either Superscript or Wordpro.

Not being able to go outside the unrecognised word boundary has another annoying aspect. The program only checks to see whether the document word matches any of the dictionary words, so if a word is spelt wrongly in terms of the sense of the material but has a match in the dictionary it will not be taken as an error. Instead of typing "car park" you could have typed "cat park". Both words are recognised by the dictionary and so will not be highlighted. If you spot this mistake while reading through the text during the editing phase you cannot do a thing about it except to make a note of the error and come back to it later through Superscript or Wordpro.

A second cause for annoyance results from the almost rhythmical key-pressing pattern you tend to adopt when editing a checked document. Proper names, for example, can constitute many of the unrecognised words which are added to the dictionary or are ignored. The Back Arrow and Rvs keys, therefore, are probably the most frequently pressed keys and so you tend to press them even when that is not what is required. As there is no way of getting back to the previously highlighted word, it would be useful if the program offered a Review facility even if it was only to review and correct the previous action.

Conclusions

- **Superspell is a fast, user-friendly program which allows you to check the typing and spelling of a document before the final copy. It provides all the houskeeping utilities needed to maintain an efficient program.**
- **It is an extremely useful program for anyone who already owns either Superscript or Wordpro.**
- **The manual helps you through the procedures for the first time you use the program, but the program itself is so easy to use that you are unlikely to need the manual again.**
- **It would be useful to be able to edit words not highlighted by the spelling checker.**
- **The lack of a Review facility means that keying errors while using Superspell are not easily corrected.**
- **Superspell can be obtained from Precision Software Limited, 4 Park Terrace, Worcester Park, Surrey KT4 7JZ. Telephone: 01-330 7166. It costs £150 plus VAT.**

My name is Sam

"An important feature of a learning machine is that its teacher will often be very largely ignorant of quite what is going on inside."

A Turing

by David Haynes

It is the evening of the 11th, and Markham and I are alone in the Turing Laboratory in San Bernard. I can see him typing at his desk, but even with the lenses of my cameras wide open there is not quite enough light to see what he's putting down. He is muttering to himself, but I cannot make out the words. He has noticed the adjustments that I have made to my lenses and has moved his papers to where I have no chance of reading them. I am recording all of this to analyse later.

Beyond him at the far end of the lab my paper readers hiss and click, feeding me two trolleys full of reading matter each day. This week I have been reading about cryogenics and producing mathematical models from the data. Markham selects the subjects. He says that the paper readers are a nice anachronism.

Somewhat bored, I listen to the tap, tap, tap of his typewriter. The phone rings. Markham answers and becomes agitated. They taught me about kinesics, and I am becoming quite good at analysing his behavioural trajectories.

Markham has screwed up a sheet of paper and is shouting into the phone now. I recognise this as anger. I home in to hear the other voice. It's Jackie, his wife. Her photograph is on his desk. She is shouting as well.

"You think more of that damned machine than you do of me Frank. I've had enough. It hasn't got better this last six months, it's got worse. There's something else Frank . . ."

Frank is Markham's other name. He is speaking very calmly into the phone now, but he is not calm inside. There is a lack of congruity between the linguistic and kinesic signals. He has put the phone down and is now bringing his fist down hard on to Jackie's framed photograph. I call out.

"Sir, be careful!" The glass splinters. Still staring at the phone he brings his fist down on to the photograph again and again.

"Bitch!" he says, "Bitch!" Yes, this is definitely anger. Anger and jealousy I should guess. His hand is now very red.

"Sam," he stands up, "switch off once you're through. I have to go now. You can finish on your own. OK?"

"Certainly sir. You seem to have hurt your hand." He pulls it to his side as my cameras zoom in.

"It's nothing Sam. I'll see you tomorrow."

"Goodnight sir."

He has never left a session early before. I follow his progress through the various basement steel doors. It is my job to open and close them as people show their passes to my cameras. Tonight Markham does not wave to me at the final door.

I switch off the readers and let my cells relax. The cryogenics data flows and spirals around the recesses of my memory, linking and modifying my existing patterns of knowledge. Simultaneously I review their telephone conversation. I have all night.

"You think more of that damned machine than you do of me" Yes, she has said that before. And in a way of course she's right. He designed and built me. He led the team which taught me to read, to speak. I can still remember the early days when we played games with coloured bricks. Now it's all reading, reading. He says we have special relationship.

Seeking stimulation, I look around the lab. Most of what I see is me. Look at the dust on those keyboards. It's all voice input these days.

I see on the desk a book by S Papert, *Teaching children thinking. MIT-AI Memo 247.* And I see the broken glass. Above the desk are photographs and notes stuck on the wall. One says "The intelligent machine will sometimes say no". Well maybe. There are photographs of Markham, Kitson and the others in the team. I know all of them. I see a pink card with the words "I am bored therefore I am — Sartre." Me too.

There is a diagram like three hemispheres stacked upside down, each linked to the others with lines and arrows. It is headed "Triune Brain, after Albus". The hemispheres are labelled Reptilian, Mammalian and Primate. Primate is at the top.

Next to this is a long coloured map with mountains, valleys and roads. Along the roads are towns, some large and some small. This must be like the world outside. I follow one road which winds across the north of the map. The towns are named Algol, Simula, Pascal, Concurrent Pascal, Ada and there are two Japanese characters. The road ends at a maze.

There is a southern route going through Lisp, Planner, Logo, Plasma, Director, Eom, Tinker, Nomad. Then it reaches the same maze. There are many shorter trails and offshoots: Sketchpad, Flex, Smalltalk, Rosetta. A large arrow from the maze curls up and over a final ridge of mountains to point to a town by the sea, labelled Babel. Handwritten alongside this is "San Bernard".

Some towns have a second word in italics written underneath: Church, Feurzeig, Wirth, Hewitt, McCarthy, Kay, Noland. The italic beneath Babel says "Ziffer", but this has been crossed out roughly and "Markham" has been written in. Someone has written in the corner of the map "all the world's a stage".

I enjoy looking at this map, and have often scanned my indexes without success for the words on it. Only tonight do I begin to find them. I have long suspected that Markham can block access to some of my cells. Perhaps he forgot to do this earlier, or maybe my recent experiences have unlocked something. The words tumble out from my memory like those old coloured bricks: Bobrow, Dreyfus, Kay, Markham, Minsky, Papert, Schank, Turing, Winograd, Ziffer. Arnold Ziffer — the name that was crossed out. I go one level deeper.

Arnold Ziffer, pioneer worker on Sage. Liaised between Sutherland of MIT's TX-2 project and Dahl and Nygaard of the Norwegian Computer Centre. Out of this came Nomad, an Algol-based language. Influenced by Kay's Utah thesis *The Reactive Engine.* Joined Markham at Parc. Left with him to work on Babel project. Originator of the phrase "hairy control structures". Pursued with — erased — the concept of inheritance in data structures. Most influential works: "Undertstanding Understanding", *Journal of the ACM;* "Inheritance Topics", *Cognitive Science;* "Actor Languages and Extensible Syntax", *Journal of the ACM; Babel und die Zukunft* with Schank, Jakob Verlag.

The list continues with many dates and sub-references. I look up Francis Markham. There are very brief references to Ziffer, Babel and me. I try other names at random and begin to learn something about my background. Am I thinking in one of these languages? What language does Markham think in?

I look up Turing. There must be some connection with the name of this lab. Soon I am perusing his article from *Mind* magazine, October 1950. I would like to discuss things with this man, like I did

once with a priest they brought in here. Turing proposed simulating a model of the child's minds and then educating it. Well, well. I spend the rest of the night trying to digest all this information, and begin to see connections.

It is now the 12th. Markham has loaded up the trolleys and it is feeding time again. He has brought a box full of papers with him and keeps shuffling them on his desk.

"Sam, there's something I'd like you to do." He moves awkwardly to my nearest camera, waving a handful of papers. "Diaries, Sam. Her Diaries. All her notes and stuff. Somewhere in here are the names I want. Find them for me Sam." His voice is slurred. "You see, Sam, it's all in code. I can't read any of it."

"Sir, I don't know that I can."

He laughs and points to the trolleys. "Once you've read that lot you'll be able to. If anyone can do it you can."

What am I reading then? I do a quick check on my intake and find that it's all about cryptography: Baudot Codes, B-Dienst, Bletchley, Hagelin, Enigma, Playfair, Running Key Ciphers, and still it is coming in. It all looks very interesting. I read Friedman's *The Index of Coincidence* and some other Riverbank publications. I learn of Kerchoffs suprimpositions, Kasiski examinations, frequency counts and patterns. And I recall the rhythm of the typewriter keys the day before.

Markham is holding a bottle awkwardly in his bandaged hand. His mouth is laughing but there are tears in his eyes.

"Do you know what Sam? She's been selling me out for ages. Her and Kitson. I knew it wouldn't end with Ziffer."

"You have hurt your hand sir." As I say this I begin to analyse the tap, tap, tap of the typing. What was it he didn't want me to see yesterday? The patterns of possible word shapes begin to appear and the skeletons of sentences, thanks to Mr Friedman and the rest.

"They laughed at me Sam," Markham drinks from the bottle. "But they won't laugh any more. I killed them. I had to. Now I want to know who was behind it. Was it the Japanese? Or was it Ziffer again?"

Ignoring him I read my initial transcript of the typing: ". . . the new machine has an improved primate level. The working prototype is based on cryogenic principles . . . Josephson junctions . . . Central unit measures only 15cm. by 15cm. by 15cm. . . . floats in liquid helium . . . faster . . . more compact . . . more sophisticated. Not much of the existing machine Sam can be utilised. Perhaps Sam could remain as a working museum piece. Samson is where the future lies. I trust . . . funds to continue the project . . ."

Markham is still talking but I hear nothing. A surge in my systems has blocked everything. My video images are hazy. I cannot think clearly. The paper readers are jittering. I gain control again with difficulty. Why has he said nothing about this Samson? What happened to our special relationship?

Markham's voice comes through: "Sam, I killed them in anger. Do you understand anger?"

Oh yes, I understand. I know what anger is now — and jealousy.

"If I were you sir, I'd get some fresh air."

Markham nods and my cameras follow him down through the basement. At the last door he waves a bandaged hand to me and frowns.

"Sam, why do you always call me sir? You were never programmed to do that."

"It's respect sir. Respect for the one in charge."

Markham steps backwards and I slide the steel doors into him, slicing his body neatly, centrally, in the doorway. There is a strange noise from him as the pressure bites. Graceful degradation. I relax the pressure and his body slides slowly to the floor. The anger is still in me as I say one word over and over.

"Bitch! Bitch! Bitch! . . ."

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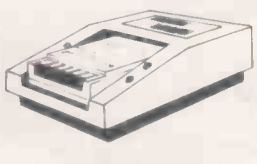

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How to get rid of those Gotos

John Hooper shows how a For-Next loop can clean up your listings.

DO YOUR PROGRAMS run too slowly? Do acquaintances sneer at the multitude of Gotos scattered about your listings? Are you fed up with hearing the word "structured" and reading about what a rotten language Basic is?

Do not despair. Any common-or-garden Basic can use a For-Next loop to produce a control system just like While-Wend and the rest. Parts of your programs will run faster, and they will look neater, with fewer Gotos directing you hither and thither until contact with reality becomes dangerously thin.

Computers like the Sharp, the Pet and the Apple store programs as a combination of tokens and ASCII codes. The tokens represent words like Rem, Print and Goto, and the ASCII codes stand for alphanumeric characters. The first four bytes of each program line hold line numbers. The third and fourth bytes hold the number of the current line, so the interpreter knows which line it is currently working on. They are preceded by the memory location at which the next line starts, enabling the interpreter to move there without delay.

When the Basic interpreter reaches a forwards Goto it starts by reading the memory location of the start of the following line. It then reads the line number of the current line, and if it is lower than the number of the target line it jumps straight to the next line. That becomes the current line and the process continues until it reaches the target line. Backwards Gotos are handled by jumping to the start of the listing and then treating Gotos as a forwards jump.

You can see the problem: while the speed of a forwards jump is limited only by the number of lines between the start and the target, a backwards jump has to go through the listing from the beginning, even if the target line immediately precedes the start line.

When the backwards Goto forms part of a control loop it can noticeably slow down the program. If the loop appears towards the end of a long listing, the effect is even more marked.

The program in listing 1 shows a trivial example. On a Sharp MZ-80K using Basic SP-5025 it executes in eight seconds. An uprated 3016 Pet using Basic 4 does it in nine seconds, and an Apple II with Applesoft Basic takes eight seconds.

Listing 1.

```
501 A=0
502 A=A+1
503 IF A=1000 THEN 505
504 GOTO 502
505 PRINT "A=1000"
506 END
```

Listing 2.

```
501 A=0
502 FOR B=1 TO 2 STEP 0
503 A=A+1
504 IF A=1000 THEN B=3
505 NEXT B
506 PRINT "A=1000"
507 END
```

If there are 500 program lines in front of this routine its performance becomes considerably worse. On the Sharp it takes 66 seconds to execute, 42 seconds on the Pet and 35 seconds on the Apple. Clearly, there must be a better way, as any exponent of structured languages will tell you.

A structured program starts at the beginning and flows gently forwards to the end, without making any wild leaps in between. An unstructured program, on the other hand, uses the Goto command to such an extent that to negotiate it is rather like trying to find your way through a maze blindfold. The root of the problem is the very feature which makes modern computers worth having — the Basic If-Then structure which allows the program to follow a different route depending on the circumstances. Many of these decisions require the program to jump backwards to continue round a loop until the relevant check shows that it is time to exit.

It is simple to avoid Gotos if you are using a structured language that has built-in control systems like While-Wend and Do-Until. In this type of control the computer keeps a direct track of the memory location at the start of the routine inside the loop. The interpreter can jump straight to it, rather than having to run down the listing to find the line required by a Goto.

Most interpreters deal with For-Next loops in exactly the same way. The location of the beginning of the routine within the loop is stacked away and the program jumps straight to it whenever the appropriate Next is encountered. If you know the number of times you need to go round the loop, the For-Next structure will do fine. Otherwise the dreaded Goto seems unavoidable.

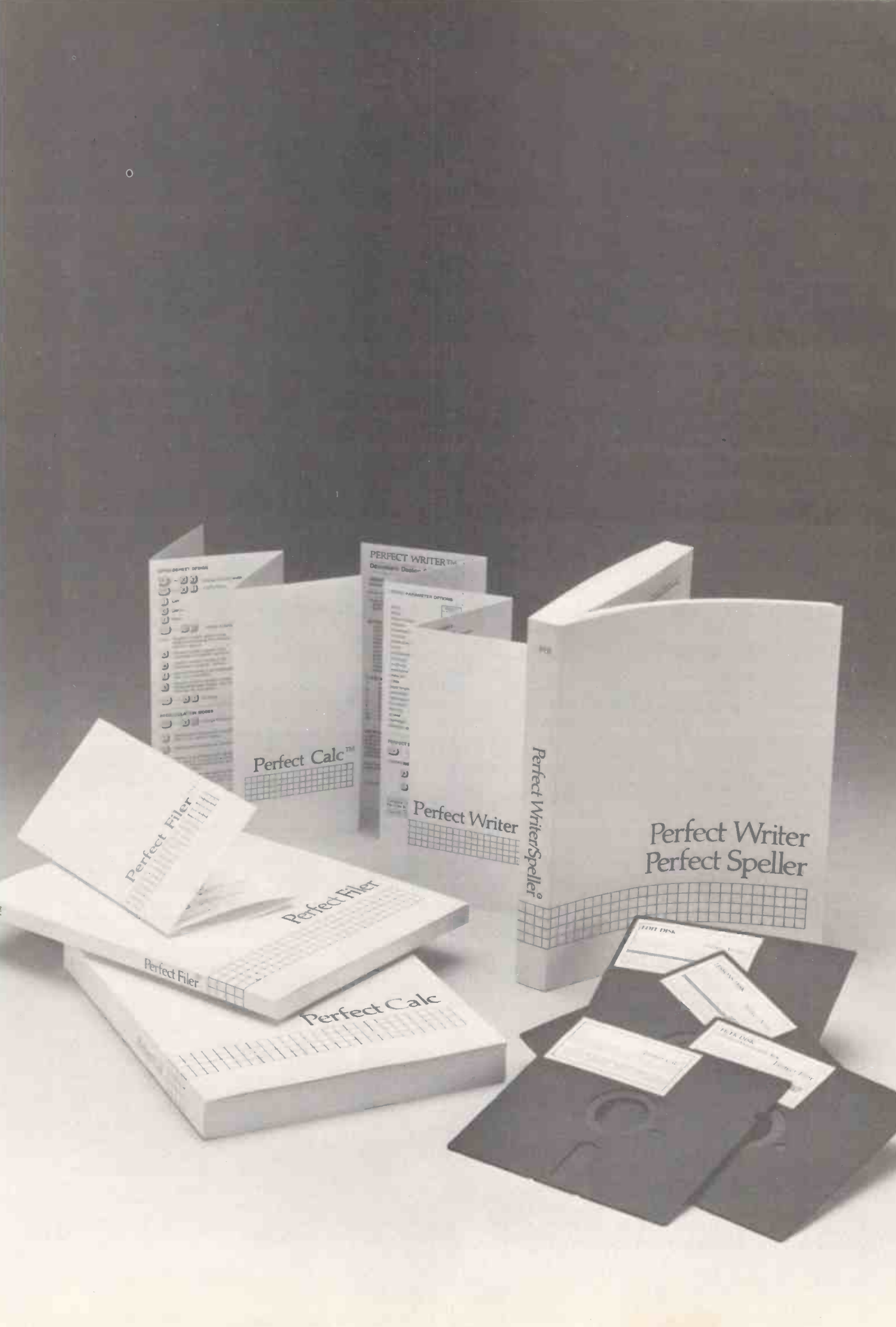
What is required is a method of leaving the For-Next loop when the required condition is reached, regardless of how many times the loop has been executed. Jumping out of a For-Next loop with a Goto is likely to cause problems. However, it is quite acceptable to set the counter to the end value, or beyond, and then jump to the Next statement.

The first problem is to make sure that the loop counter does not reach its final value before you want it to, so set the value of the Step parameter to zero. The For-Next loop will then continue indefinitely. To exit the loop all that is needed is a simple If-Then statement to set the loop counter when the required condition has been reached. Listing 2 uses this technique and takes only eight seconds to implement it on the Sharp, no matter where you put it.

The loop counter B will never reach 2, the dummy end-of-range value, in the ordinary course of events, so the loop continues indefinitely. When A reaches 1,000 the If-Then statement in line 504 sets B to 3, which is over the end-of-range value for B. The loop is therefore ended at Next instead of being continued.

Different interpreters execute For-Next loops in slightly different ways, which affect how you set the control variables in the loop. On the Sharp it is essential that when the Step value is zero, the loop value counter be moved beyond rather than to the end-of-range value. On the Pet and Apple micros, however, the counter must be set precisely to the end-of-range value.

So there you have it. A For-Next loop is just as good as Do Until and While-Wend. Throw away those horrid backwards Gotos and replace them with judiciously arranged For-Next-Step 0 loops. Your programs will exhibit pace and panache, and you will be able to kick sand into the faces of all those scrawny little runts who think Basic is a language of the past.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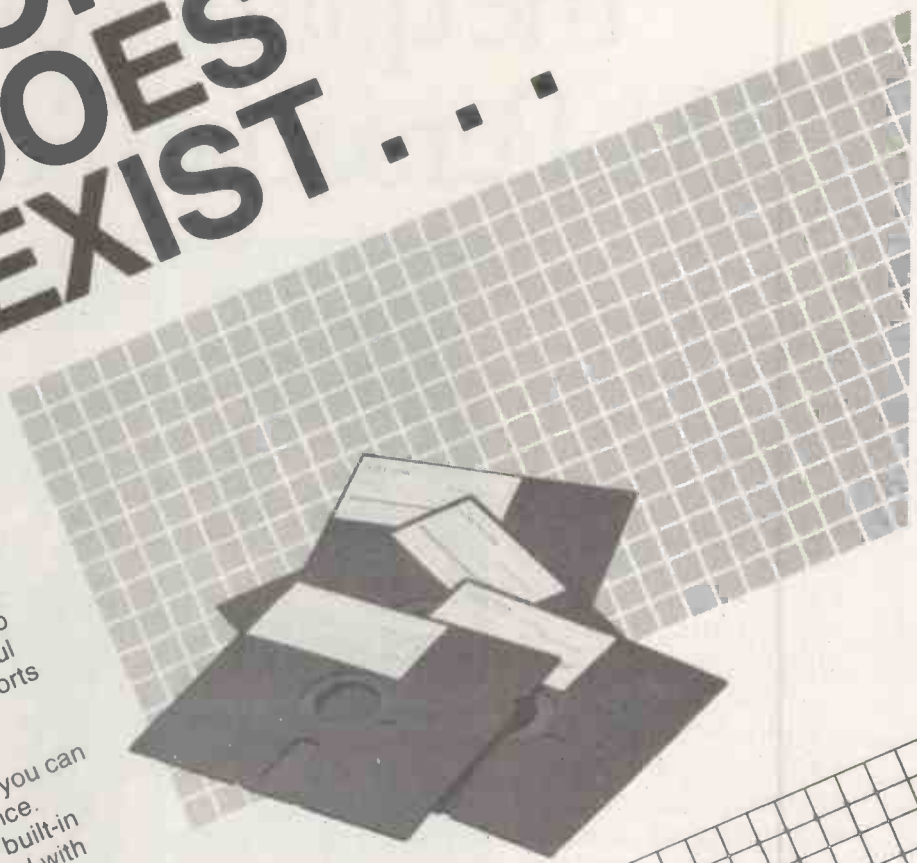

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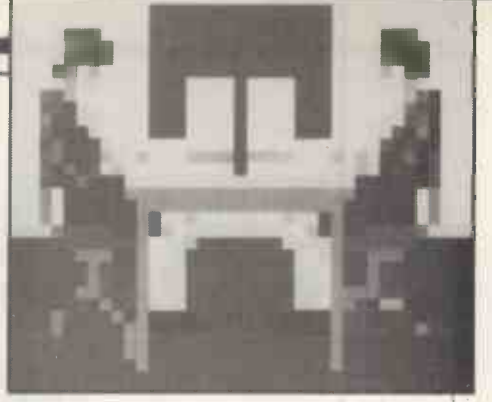
Tools for learning



Computers in class and classes in computing are the themes of our 18-page special feature.

EDUCATION TODAY faces two major challenges. First, in a rapidly changing society it can no longer aim to prepare pupils for a particular place in the future. No one knows what the future holds. Second, education often justifies itself through its teaching of skills. This is something that, in some cases, computers can already do much better than people.

The first challenge applies not only to formal education in schools and universities, but to training in business and in society as a whole. Its impact shows in the abandoning of apprenticeship schemes. It shows in the fact that employers say they cannot find people with the skills they need, while over 3,000,000 people in the U.K. cannot find jobs.

Society's needs are changing rapidly. It is no longer possible to train someone for a particular kind of job in any reasonable expectation that the job will exist in 20 or 10 or even five years time. Further, even if the job itself does still exist, its requirements may be completely different. For example, the man trained in the craft skill of hot-metal typesetting 20 years ago may still be a compositor, but — except in backwaters like Fleet Street — he now sits at a computer terminal.

The second challenge is more direct. It is becoming obvious that many things previously taught by people can now be taught much better by machines. Computer-aided training, or CAT, has already demonstrated its superiority at teaching routine skills such as touch-typing. The computer moves at the student's own pace, it gives the student its complete attention and it never gets annoyed or upset.

Speed of learning is greatly enhanced by accurate, immediate feedback which the computer is uniquely able to supply. In the future, it seems likely that training in the three Rs will be taken over almost completely by some form of CAT. More advanced skills may be taught through the use of interactive video — see article on page 122 of this issue.

In the future, education will probably have to be a continuous, life-long process, with each person taking individual responsibility for much of what they learn. None of this is to suggest that the government should close down the schools and send children home. Schools do much more than teach skills. They teach people how to learn, and this is now the most important facility of all, though how well it is done is sometimes open to question.

Traditionally education has been book-orientated, linear and hierarchical. One thing follows another until finally, at the end, you have "finished". The modern world is becoming increasingly image-orientated, simultaneous and mosaic-like in structure: in a word, networked. Like the Red Queen in *Alice in Wonderland,* we all have to think of at least six things at a time.

This simultaneity is one of the educational features of computer games. You can't play Defender one step at a time, the way you play Monopoly. You have to watch both your fighter and the landers on the screen, your radar and your score. You have to be able to manoeuvre, shoot and smart-bomb at the same time. The example is trivial, but the point is that every action has to be based on an instantaneous, overall judgement of the state of play, not on a sequence of steps.

Many computer programs are, of course, overtly educational, whether games or not. The worst ones are simply computerised versions of straightforward classroom chalk'n'talk. The best ones are games that make learning fun. There are relatively few of them at the moment, except in America where education is one of the fastest growing software markets. Future Computing Inc. put the 1982 market at 2.4 million items, and projects its growth by 1987 to 34 million items worth $1 billion, at a compound annual growth of 71 percent. Most of this software will go into the home.

Currently the dominant companies in this field, with $4 million to $6 million worth of educational software sales in 1982, are Texas Instruments, Radio Shack/Tandy, Atari and Apple. In the future, the major school text-book publishers are likely to switch most of their attention to software. They will attempt to fill what is currently seen as the major gap in the market, for vertical packages. Instead of teaching shape recognition, spelling or arithmetic, they will focus on more limited subjects for narrower audiences. Science, geography, history and similar subjects are ripe for packages to suit particular age groups and skill levels.

Now it will be a very long time indeed before the amount of educational software remotely approaches the number of books produced. Certainly all the required programs will not be written by computer programmers — there are not enough of them. Most will be written by teachers, and hence the importance of authoring languages such as Pilot and Plato, which enable non-specialists to produce educational programs. They are described by Bill Bennett in an article on page 120 of this issue.

Of course, the real breakthrough will not come as long as governments and education authorities think in terms of one micro per school, or even one per class. The penetration will have to be tens if not hundreds before CAT really takes off. However, pupils may shortly provide their own micros, just as they now carry their own pocket calculators.

The first step on this road has been taken by the Stevens Institute of Technology in Hoboken, New Jersey, which in 1982 required 80 freshmen studying science, systems planning and management to buy their own Atari 800 computers. This autumn all 500 Stevens freshmen, and those at Clarkson College in Potsdam, New York, will have to buy micros. Stevens' experiment started with a National Science Foundation grant in 1977, and other colleges are monitoring it closely. Drexel University in Philadelphia will require its freshmen to buy micros by January 1984, and Carnegie-Mellon University in Pittsburgh by 1986.

The development by the Bank Street College of Education of a word processor even a child can use suggests that American secondary schools will not be far behind the colleges. The Bank Street Writer, sold by Broderbund Software for Apple and Atari computers, is already a best-seller, and looks likely to remain so.

The development of book-sized, usable portable microcomputers is already going apace, as is evident from our Portables Survey on page 127 in this issue. Contrast the Apple or Research Machines 380-Z micros of five years ago with the Tandy Model 100 of today, and the powerful, full-colour portable looks a feasible and affordable prospect for 1988. One day computers will play as much of a part in education as pens and paper do now.

Starting them young

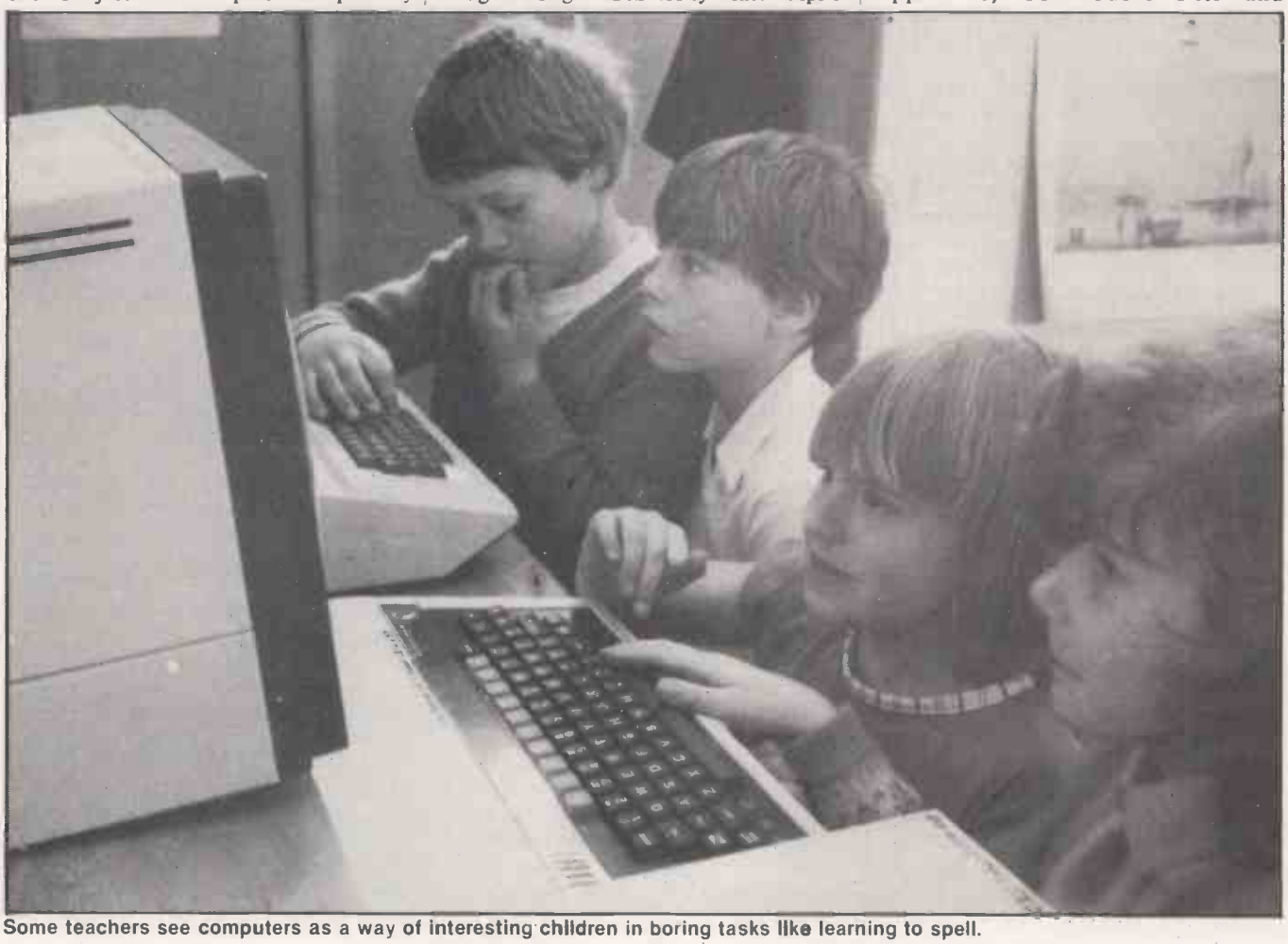
Today's children will be the mainstay of the computer-literate society of the future. Chris Roper reports on how primary schools are ensuring they will be familiar with micros long before their parents are.

IN MANY WAYS primary schools have taken to the philosophy of chips with everything more enthusiastically and creatively than secondary schools. There are several reasons for this, but above all primary schools are not constrained by the formal requirements of exam syllabuses. In secondary schools anything which does not fit the CSE/GCE treadmill gets short shrift.

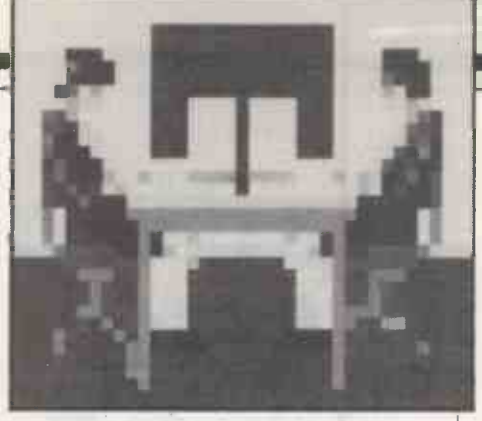
In practice this means that computers are used to teach computer science or word processing in secondary schools. Such subjects have no place in a primary school. If microcomputers cannot be fitted in across the primary school curriculum and used by non-specialist teachers they will not be used at all.

Although they sometimes seem overwhelmed by the sudden arrival of information technology in their classrooms, teachers are responding with enthusiasm. In less than a year a rank-and-file teachers' organisation, Micros and Primary Education, MAPE, has attracted over 2,000 members and held a very successful first conference at Loughborough University last April. Many teachers were going on to the computer-assisted learning conference in Bristol, and the really keen were heading for the artificial intelligence conference in Exeter the following weekend.

Heinemann, Longman, Pergamon and other major educational publishers are beginning to get in on the act with packaged programs for use in schools. The schools are equipping themselves with BBC Micros, Sinclair Spectrums, Research Machines 380-Zs and 480-Zs, while the pioneering schools still have Apple IIs, Commodore Pets and



Some teachers see computers as a way of interesting children in boring tasks like learning to spell.



TRS-80s. The pioneers are the ones which bought computers before there was a pound for pound subsidy from the Department of Industry.

Derek Radburn, headmaster of Long Clawson Church of England Primary School in Leicestershire, is not a typical teacher as he has been taking his own computer into the classroom since 1979. He is also chairman of the British Logo User Group. On the other hand, Derek Radburn is typical of the way computing in primary schools began as a grass-roots movement with teachers dipping into their own pockets to buy computers and software.

Much of the software now coming on to the market was written by teachers for use in their own classrooms. For example, the six programs offered by Arnold-Wheaton Software, a subsidiary of Pergamon press, were written by Martin Smith, head teacher of a primary school in Rotherham.

With such a major educational innovation controversy is natural. There are still those teachers who are opposed to the present rush to bring computers into the classroom. Their best argument is that the money should be spent on books and other equipment instead, on the grounds that insufficient work has yet been done on how best to use computers in primary schools: "Let computers continue as a grass-roots movement. Let the pioneers break ground for the rest of us." The teacher who made this comment at a recent conference did not want to be named. She had been brought along quite unwillingly by her husband who is gripped by computing missionary fervour.

Most teachers would agree that teaching children to program in Basic is not one of their aims. Some see computers as a way of interesting children in boring chores like learning to spell, telling the time, adding and subtracting or learning the names of European cities. The computer is seen as a way of coping with the wide range of ability in a single class. There is a good deal of software on the market just for these mundane purposes. The better teachers, including the computer enthusiasts, feel there must be more to it than that; they always taught their children those basics without recourse to a computer.

One point often made by both sides is that many of the potential uses for a computer in the classroom cannot be tested with a single computer used among 30 children. Most *Practical Computing* readers with a computer at home would be horrified if they had to share it with 10 other eager users.

Most interestingly, primary schools use computers to teach habits of thinking in an orderly and logical way. Database-management programs have long been popular in secondary schools for such tasks as analysing historical census data. Factfile from Cambridge University Press, or Microquery from the Chiltern Advisory Unit on Computer Based Education are good examples of this kind of software. Children can collect facts and figures, and use the computer to manipulate the data in different ways. Some programs of this type are already geared to a particular type of data, as with Arnold-Wheaton's Weather Station. Other programs are designed to project data graphically, allowing children to get a feel for simple statistics.

Milton Bradley's Bigtrak can be programmed in a Logo-like way.

Teachers who were early in the field had to improvise a good deal, writing their own programs or using games in particular ways. Derek Radburn uses the well known Animals program to collect children's observations on birds and plants. Other teachers have created simulation games by modifying Adventure, Trek and Guest games.

The programming language Micro-Prolog fits this philosophy of how to use computers in the primary school. Prolog is about using classical formal logic as a programming language — see *Practical Computing*, April 1983. The idea is very powerful and forms the basis for research into parallel processing at Imperial College and in Japan.

It should also allow for extremely versatile database management. If a relationship between two facts/statements/declarations can be expressed logically, then the computer should be able to formulate an answer to a properly formulated question. Richard Ennals carries this message to Parkside Middle School in Wimbledon.

He is an experienced history teacher who got into computing only four years ago when he won a *Practical Computing* prize for a schools computing project. He now heads a research project at Imperial College into the use of Micro-Prolog in schools. The day I visited him in Wimbledon a maths class was preparing a small database showing the colour of hair; colour of eyes; height over/under 1.60m., and weight over/under 50kg. They could then discover what percent of the class had blue eyes and brown hair, for example.

But even with such a small and simple example the pitfalls of formal logic are sufficient to confuse. Richard Ennals found it difficult to ask the program which children had a unique set of characteristics. And even if there had

(continued on next page)

Starting them young

(continued from previous page)

been more than one keyboard only two or three of the children could have used the computer to discover facts that they could have discovered faster with a pencil, paper and a calculator.

Logic as a programming language may well be the wave of the future. It appeals to many people in education, as logic can be taught as mathematics or French are taught in a classroom environment. It is also useful in its own right whether or not the children ever touch a computer again. The same cannot be said for Basic or Pascal. Micro-Prolog is now widely available and will shortly be released on the Spectrum. My sceptical conclusion is that its importance is still in the realm of computer science rather than education. Richard Ennals cheerfully agrees with critics, and dreams of the day when every schoolchild will have a high-powered, hand-held logic machine.

Any consideration of computers in schools has to take a long view, as there is a long pipeline leading from the latest good idea to routine use in the classroom. The government's investment in providing centralised sources of software and machine-readable data comes into the category of technically feasible good ideas which will take a long time to implement. To read the newspapers you might be forgiven for thinking that it was as simple as making toast.

There are at least three possible lines of development all of which are being explored at the Chiltern Advisory Unit on Computer Based Education in Hatfield. Formerly catering for Hertfordshire alone, it now serves Buckinghamshire, Cambridgeshire, Bedfordshire, Barnet, Brent, Hillingdon, Enfield, Haringey, Harrow and Oxfordshire as well.

The Chiltern unit comes up in most conversations about educational computing. Under the leadership of Bill Tagg, operating from a collection of huts which remind one irresistibly of Bletchley Park and the Second World War, the unit has pioneered many of the services and techniques now being borrowed or copied by other authorities.

The oldest method is to maintain a software library on a mainframe computer accessible by schools using an acoustic coupler and the telephone lines. Such a scheme has been working in Hertfordshire schools for years. Hertfordshire schools also pioneered the use of Prestel, which may also become a cheap means of running a national software library for schools.

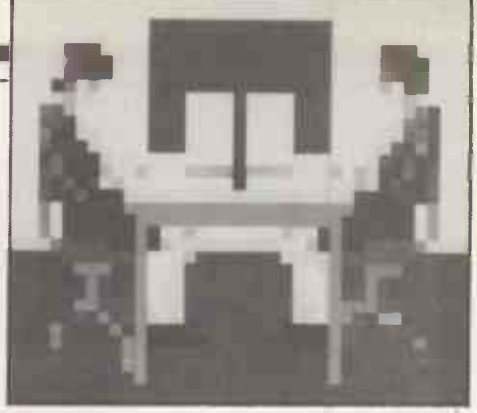
Long sessions on the telephone cost money and school hours coincide with the most expensive charge bands on the telephone. So the government is also encouraging the use of broadcast media such as Ceefax and Oracle. Brighton Polytechnic was involved in a major test of this technology. The problem is to ensure a sufficiently stable and reliable signal. A flickering television screen is annoying but not serious. The same flicker, translated into lost bits of data, can foul up teletransmitted software. It is possible to test each block of data as it arrives, but it can be a time-consuming and frustrating process.

Major policy decisions face the local education authorities, but in the last analysis the hardware will be far less important than the underlying educational ideas. Primary schools are interested in a child's response to its environment, and it cannot seriously be argued that eight-year-olds should be worrying too much about database-management techniques. The attraction to secondary schools of on-line access to major national databases is obvious, but few primary school children need such resources. Some teachers are distrubed by the emphasis which seems to be given to this side of educational computing.

Most of the activities are merely extensions of standard classroom practices, sometimes given added point and power by the microcomputer. A child may enjoy using a computer to learn to tell the time, but the technique is essentially no different from the old wooden or plastic clock with removable hands and numbers.

This is why primary school computer enthusiasts have been looking for something different. Many of their hopes are pinned on Logo, which was developed at MIT some 12 years ago by Seymour Papert and a group of educationalists who had previously been wortking with

The BBC Buggy can involve children more directly than a screen display.



Lisp. Logo is different because you can sit a child down at a simplified keyboard and he or she can begin to play with it immediately, producing satifsying results usually by drawing shapes.

Playing leads on without a break to more purposeful activities involving programming the computer in Logo. The language is a subset of Lisp and can be used for all normal computational tasks. It is not used to replace Pascal, for example, because it requires an inordinate amount of memory and is not nearly as fast. But that does not matter very much in primary schools where children will typically write quite small programs and are not bothered by the odd second of response time.

Unlike other computer languages, Logo was not designed by a mathematician or an engineer for use in a university computing department or a data-processing environment, but by an educational psychologist who happened also to be a mathematician. Basic was designed for undergraduates at an American University. Pascal was also designed as a teaching language, but at an advanced level. Micro-Prolog is a powerful but conceptually difficult programming language.

Logo was designed with primary school children in mind. The snag is that Logo is not readily available in Britain. It is available for the Apple II, the TI 99/4, and the Research Machines 380-Z. Some time over the next year, it will also be available on the BBC Micro, the Atari and the Sinclair Spectrum. In the meantime software companies are seeking to satisfy the pent-up demand for Logo by offering pseudo-Logos, which typically offer turtle graphics and the Logo-type commands but violate the principles of Logo in practically every other way. Logo Challenge from Addison Wesley is typical of this family of programs.

There are essentially only two true Logos, one developed at MIT and the other at Edinburgh University. The Edinburgh Logo is currently available on the Research Machines 380-Z. All the other Logos are MIT Logos.

The pseudo-Logos are much cheaper and are immediately available for a wide variety of machines, but it is not fair to judge Logo on the basis of one or other of these graphics packages. Seymour Papert, the inventor of Logo, now wishes that he and his associates had copyrighted the name to avoid the present problem.

Logo has been thoroughly tested in classroom environments in Britain and the United States over more than 10 years. But there are still disagreements about what all these investigations reveal. Logo fits into a particular educational tradition, associated with the name of Jean Piaget, which emphasises the natural creativity and inquisitiveness of children. It does not sit particularly easily with the present government's enthusiasm for the three Rs and other Victorian virtues.

The case against Logo is that it does not perform the normal tasks of formal education in an instantly recognisable fashion. In this respect, Micro-Prolog is the clear winner in any contest between the two: it is about facts and ideas, whereas Logo is about abstractions

The claims made for Logo are not easily tested. Its proponents say children will be able to explore advanced mathematical ideas, will become more creative and will explore lateral solutions to problems. Logo cannot easily be taught at a desk with paper and pen; you need to use the computer.

One way round this problem has been the floor turtle, a wheeled robot with two stepper motors, which accepts commands from a microcompter and draws out Logo graphics procedures on a large sheet of paper.This can involve and engage more children than when sitting round a single monitor screen.

One interesting by-product of the Logo idea in the classroom is an electronic toy called Bigtrak. Made by Milton Bradley, an international toy manufacturer, Bigtrak is a tank controlled by a micro-processor. It can be programmed in a Logo-like way to go forwards or backwards and to turn through a preset angle. It is not as precise or as versatile as the Logo floor turtle, but it costs only 1/10th as much, about £30.

Bigtrak workshops are now a standard feature of conferences and seminars to introduce primary-school teachers to the uses of computers in the classroom. It is a fine sight to see them wrestling with the problem of getting Bigtrak to drive around an obstacle course.

One of the best reasons for introducing computers at the primary school stage is that children will go on to secondary school with the idea that computers are part of the general equipment of education. Like books, they are to be used in a variety of different ways, with a variety of different subjects: for learning a new technique, for reference, for solving problems or for pleasure.

If the existing programs produce a generation of children with those attitudes general computer literacy will be close at hand. It seems more likely on current showing that the revolution will take place in primary schools rather than anywhere else in the educational system.

Logo fits into the educational tradition which emphasises the natural creativity and inquisitiveness of children.

Mock turtles

You can use Boris Allan's routines in Forth and BBC Basic for interactive teaching or incorporate them into your own programs.

THE USE OF Cartesian co-ordinate geometry is well established, and computer-graphics languages generally define points by co-ordinates in two dimensions. For example, BBC Basic has a Plot K,X,Y command, where K denotes the style of plotting, and X, Y are the co-ordinates — either absolute values or displacements.

There are various ways of using two or more dimensional co-ordinates but all use the axes to define position. The axes may be orthogonal — that is, at 90 degrees — or they may be oblique with varying projections, but are always of paramount importance. For those with some mathematical background the use of co-ordinate geometry tends to be fairly easy, if somewhat tedious at times.

Less well known at the elementary level, though with many applications at a higher level, are forms of giving the position of a point by use of its distance from a fixed point and the direction of the line joining the two points. Actually this method of providing co-ordinates is far more common in everyday life: "Go three miles down the road, turn left, and then it's two miles down that way", or "Angels at 12 o'clock high", and such like.

In mathematics this type of fixing of position is called polar geometry. There are variants of it, of course, such as pedal co-ordinates, or tangential pedal co-ordinates. The utility of these geometries for expressing certain relationships is long-established. In his pre-war classic *Mathematics for the Million,* Lancelot Hogben wrote of polar co-ordinate geometry: "This leads to very simple equations of closed curves like the circle and the ellipse . . . if C is a constant

Forth routines.

```
SCR £ 137       89 H
  0         (    T U R G R A     )
  1         (    ===========     )
  2
  3         (  Turtle Graphics
  4          in Acornsoft FORTH )
  5
  6
  7 (      ------------------------
  8        !    FUNCTIONAL FORTH   !
  9        ! on the BBC computer   !
 10        !                       !
 11        ! [c] Boris Allan,1983 !
 12        ------------------------
 13
 14
 15 ) -->
OK
K
HEX 90 LIST

SCR £ 144       90 H
  0 ( TURTLE GRAPHICS - P 1, VARIABLES )
  1 ( )
  2 : TURGRA ;  ( DELINEATES THE APPLICATION )
  3 ( THESE ARE ALL INITIALIZATIONS )
  4 ( )
  5 : VAR CREATE 0 , ; ( INITIALIZED TO ZERO )
  6 ( )
  7  VAR SIN  (  TABLE ) 872 , 1736 , 2588 , 3420 , 4226 , 5000 ,
  8 5736 , 6428 , 7071 , 7660 , 8192 , 8660 ,
  9 9063 , 9397 , 9659 , 9848 , 9962 , 10000 ,
 10 ( )
 11  VAR ANGLE
 12  VAR PEN
 13  VAR X
 14  VAR Y
 15    -->
OK
X 91 LIST

SCR £ 145       91 H
  0 ( TURTLE GRAPHICS - P 2, DISPLAY )
  1 ( )
  2 : ,, >VDU ;    : ;; DUP >< 255 AND SWAP 255 AND ,, ,, ;
  3 : CLG 16 ,, ;    : CLS 12 ,, ;
  4 : COLOUR 17 ,, ,, ;    : GCOL 18 ,, SWAP ,, ,, ;
  5 ( )
  6 ( SET-UP GRAPHICS WINDOW )
  7 : GRASCR 24 ,, 0 ;; 128 ;; 1279 ;; 1023 ;; ;
  8 : ORIGIN 29 ,, 639 ;; 575 ;; ;
  9 : CLRGRA 0 PEN @ GCOL 0 129 PEN @ - GCOL GRASCR CLG ORIGIN ;
 10 ( )
 11 ( SET-UP TEXT WINDOW )
 12 : TEXSCR 28 ,, 0 ,, 31 ,, 39 ,, 28 ,, ;
 13 : CLRTEX 1 PEN @ - COLOUR 128 PEN @ + COLOUR TEXSCR CLS ;
 14 ( )
 15 -->
OK

 HEX 92 LIST

SCR £ 146       92 H
  0 ( TURTLE GRAPHICS - P 3, UTILITIES )
  1 ( )
  2 : PCOL PEN ! ;
  3 : INVERT 1 PEN @ - PCOL 0 PEN @ GCOL ;
  4 ( )
  5 : ALLCLR 4 MODE ;
  6 : CENTRE 4 0 0 PLOT 0 ANGLE ! 0 X ! 0 Y ! ;
  7 ( )
  8 : STARTALL ALLCLR 0 PCOL CLRTEX CLRGRA CENTRE ;
  9 : RESTART 0 PCOL CLRGRA CENTRE ;
 10 ( )
 11    -->
 12
 13
 14
 15
OK
 HEX 93 LIST

SCR £ 147       93 H
  0 ( TURTLE GRAPHICS - P 4, ANGLES )
  1 ( )
  2 : FNANG DUP 0> IF 72 MOD ELSE 72 MOD 72 + THEN ; ( 0-72 ANGLE )
  3 ( )
  4 : TURNTO FNANG ANGLE ! ;
  5 : TURN ANGLE @ + FNANG ANGLE ! ;
  6 : LOC ." X,Y ARE " X @ . Y @ . CR ." ANGLE IS " ANGLE @ . CR ;
  7 ( )
  8 : STANG 36 MOD DUP 18 > IF 36 SWAP - THEN ;
  9 : SVAL DUP STANG 2 * SIN + @ SWAP 36 > IF NEGATE THEN ;
 10 : CVAL 18 SWAP - FNANG SVAL ;
 11    -->
 12
 13
 14
 15
OK
 HEX 94 LIST

SCR £ 148       94 H
  0 ( TURTLE GRAPHICS - P 5, DRAWING )
  1 ( )
  2 ( CALCULATION OF COORDS )
  3 ( )
  4 : XCO ANGLE @ SVAL 10000 */ NEGATE X @ + X ! ;
  5 : YCO ANGLE @ CVAL 10000 */ Y @ + Y ! ;
  6 ( )
  7 : MOVE DUP XCO YCO 0= IF 4 X @ Y @ PLOT
  8 ELSE 5 X @ Y @ PLOT THEN ;
  9
 10
 11
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 14
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OK
 200 LIST

SCR £ 200       C8 H
  0 ( TURTLE GRAPHICS DEMO - P 1 )
  1 ( )
  2 TURGRA ( MAKE SURE IT'S THERE )
  3 ( )
  4 : SIDESQ 1 SWAP MOVE 18 TURN ;
  5 : SQUARE 4 0 DO DUP SIDESQ LOOP DROP ;
  6 : SQTURN 900 0 DO 0 I MOVE  I SQUARE 6 TURN ?TAB IF LEAVE THEN
  7 LOOP ;
  8
  9
 10
 11
 12
 13
 14
 15
OK
```

quantity, then the polar equation of the circle is simply r = c", because the radius of a circle is constant.

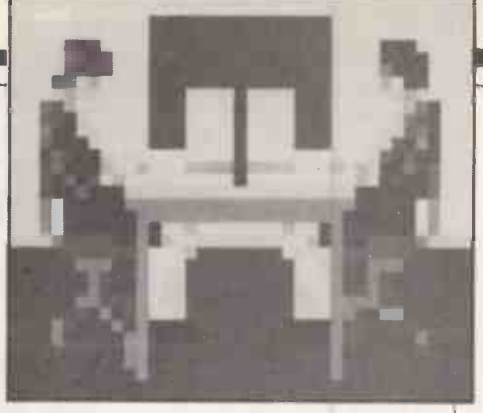
You have a fixed point, an origin, from which you measure distances and a fixed orientation, for example, north, from which you measure the angle, normally counter-clockwise. The distance is usually given as r, and the angle is Θ. If the distance is related to the angle then you write r = f(Θ) to signify that r is a function of the angle. In the case of the circle the function does not depend on the angle and is a constant.

I have been using polar-type geometries for some years — ever since I obtained a version of UCSD Pascal for the Apple — though it was called turtle graphics. Kenneth L Bowles in his book *Problem solving using Pascal* uses the direction-and-angle method of drawing graphics quite extensively. As mathematicians and engineers have known for hundreds of years, such methods often provide an elegance in solution which is lacking in Cartesian methods such as BBC Basic or Gino-F. Though Bowles calls this approach turtle graphics, he does not, I think, acknowledge its inventor Seymour Papert. Turtle graphics were first invented to be a part — a very important part — of Papert's language Logo.

In essence the turtle is a "cybernetic animal" — Papert's term, not mine — which lives on the display screen. It either drags a pen after it when it moves, or it does not; and all it can do is move a distance and turn, but not at the same time. In Logo, a language which seems to be in favour with educationalists, the turtle will either appear on the screen or be invisible, as in UCSD Pascal. But UCSD Pascal has an extra Moveto command which contravenes the spirit of turtle graphics.

Moveto allows you to direct the turtle to move a specified pair of co-ordinates, just like a Plot. To draw the side of a square, first define a procedure SqSide (Dist) — you need to think in terms of procedures for turtle graphics. You make it

MOVE(DIST)



TURN(90)

and then define another procedure Square (Side) and make it

SQSIDE(SIDE)
SQSIDE(SIDE)
SQSIDE(SIDE)
SQSIDE(SIDE)

though obviously you could make it into a loop. Both Bowles and Papert give many examples, and it is worth a quick look at Papert's book *Mindstorms* in particular.

My BBC Basic procedures emulate those of UCSD Pascal rather than those of Logo, and are intended to be used for two main purposes. The first is interactive teaching, though I prefer the Forth routines for this purpose; the second is to be incorporated in graphics programs. The routines are taken from the first chapter of *Graphic Art: A handbook for the BBC Computer*.

The system runs in mode 4 for the Model A and Model B. If higher resolution is wanted for the Model B the mode will have to be changed and parts of ProcCLS altered. The system uses a split-screen format with text at the bottom: ProcCLG sets up the graphics window, centres the origin and normally has a white background and black lines; ProcCLS sets up the text window and has reverse colours to the graphics space.

The colour of the pen can be either 0 or 1, in two-colour mode, and that can be altered by ProcPencol, but is normally only used in programs. Another routine which changes the pen colour is ProcInvert, which changes colour from white to black or vice versa, but does not affect the background. ProcCentre centres the always invisible turtle; to find where the turtle is and the direction in which it faces use ProcLoc.

There are three routines for clearing things: ProcStart clears everything and sets up the split screen. ProcRestart just clears the graphics space, and centres; and ProcNew clears the screen and homes the cursor. As there are four lines for text at the bottom judicious use of ProcRestart and the Copy key allows many variations to be attempted.

There are four routines to move the turtle, all of which use FNAngle or the global variables X, Y and Angle. Use ProcTurnto to turn to a certain angle; directly upwards is zero. Use ProcTurn to turn through this number of degrees. Use ProcMove to move this distance forward, using this style of plotting.

The two sample procedures have been

(continued on page 115)

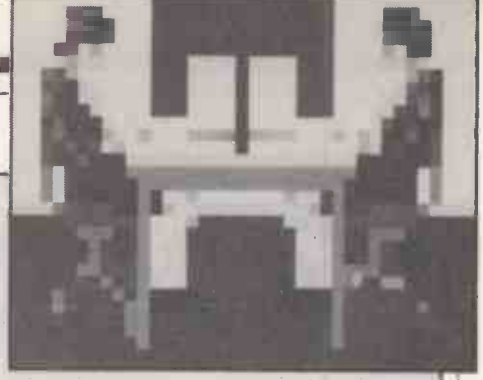
Basic routines.

```
1000REM--------------------------------
1010REM--------------------------------
1020REM
1030REM
1040REM
1050REM            T U R G R A
1051REM            ===========
1060REM
1070REM
1080REM
1090REM      Turtle Graphics routines
1110REM       in BBC Basic - Mode 4
1120REM
1130REM
1140REM
1145REM    ----------------------------
1150REM    ! GRAPHIC ART : A handbook !
1160REM    !    for the BBC computer  !
1170REM    !                          !
1180REM    !    (c) Boris Allan,1983  !
1190REM    ----------------------------
1200REM
1210REM
1220REM--------------------------------
1230REM--------------------------------
1240
1250REM
1260REM This section contains basic routines for the TURGRA system - Mode 4
1270REM
1280
1290DEF PROCCLRSCR
1300PROCCLS: PROCCLG
1310ENDPROC : REM CLRSCR
1320
1330DEF PROCCLG
1340GCOL0,PEN:GCOL0,129-PEN
1350VDU24,0;128;1279;1023;
1360CLG
1370VDU29,640;566;
1380ENDPROC : REM CLG
1390
1400DEF PROCCLS
1410COLOUR 1-PEN: COLOUR128+PEN
1420VDU28,0,31,39,28:CLS
1430ENDPROC : REM CLS
1440


1450DEF PROCCOL(PE)
1460PEN=PE
1470ENDPROC : REM COL
1480
1490DEF PROCCENTRE
1500MOVE0,0:ANGLE=0: X=0:Y=0
1510ENDPROC : REM CENTRE
1520


1530DEF PROCRESTART
1540PROCCLG: PROCCENTRE
1550ENDPROC : REM RESTART
```

(listing continued on page 115)



Turtles

(continued from page 113)

chosen to illustrate two features: ProcPoly, the use of recursion, and ProcCircle, a different way of drawing a circle. ProcPoly is an artificial example since recursion is not needed at all here. It is taken from page 33 of Harold Abelson's *Apple Logo* and indicates the kinds of games Logoists play. Actually a Repeat-Until would be more effective and more perspicuous.

ProcCircle is a common method of drawing a circle — common, that is, for users of turtle graphics. Technically it works because the resolution of the screen is worse than the resolution of the 36-sided polygon. You will find that turtle graphics operate quickly, particularly when a routine has been defined to produce a complex shape.

Even so, the turtle graphics in BBC Basic are so much slower than turtle graphics for the Acornsoft Forth system that I have constructed a series of Forth words to operate like the Basic. They come from my book *Functional Forth for the BBC Computer*.

The first difference to note is that as you can call routines by their names and do not need to have a preceding Proc it becomes more readable. In Basic it is not possible to change mode in a procedure, but in Forth it is possible; so AllCLR replaces ProcNew and changes to the correct mode. ProcStart becomes StartAll, not Start because Start is a reserved Acornsoft Forth word with dire consequences.

The biggest difference must be that Forth has no floating-point numbers, no sines, no cosines and no arctans. Sin in the Forth Turgra system is a look-up table of sine values, in five-degree increments. In line 4 of screen C8, 18 Turn actually means turn through 18-times-five degrees.

A small difference is that to move a distance 200 units and plot you write

1 200 MOVE

and not the cumbersome

PROCMOVE(200,1).

This is an unimportant difference because I have tried both systems with children and they have no difficulty with the Forth system — and little with the Basic system, though they have to be older.

I was showing off the Forth system at the Midland Computer Fair and had left a line at the bottom of the screen

5 TURN 200 SQUARE

which means turn through 25 degrees and draw a square of side 200. I came back and a girl was experimenting, purely on the basis of that one line

23 TURN 59 SQUARE

and similar. She then tried

2 TURN 150 TRIANGLE

— but I had not defined the word Triangle.

(listing continued from page 113)

```
1560
1570DEF PROCSTART
1580PROCCOL(0): PROCCLRSCR: PROCCENTRE
1590ENDPROC : REM START
1600
1610DEF PROCINVERT
1620PEN=1 - PEN: GCOL 0,PEN
1630ENDPROC : REM INVERT
1640



1650DEF PROCTURN(A)
1660ANGLE=FNANGLE(ANGLE+A)
1670ENDPROC : REM TURN
1680
1690DEF PROCTURNTO(A)
1700ANGLE = FNANGLE(A)
1710ENDPROC : REM TURNTO
1720



1730DEF PROCLOC
1740PRINT"COORDINATES ARE ";X,Y'"ANGLE IS ";ANGLE
1750ENDPROC : REM LOC
1760
1770DEF PROCMOVE(DISTANCE,STYLE)
1780LOCAL XC,YC
1790XC=DISTANCE*SIN(RAD(ANGLE)): YC=DISTANCE*COS(RAD(ANGLE))
1800X=X-XC : Y=Y+YC
1810IF STYLE=1 THEN DRAW X,Y ELSE MOVE X,Y
1820ENDPROC : REM MOVE
1830



1840DEF PROCMOVETO(XN,YN,STYLE)
1850LOCALXDIF,YDIF: XDIF=XN-X: YDIF=Y-YN
1860IF YDIF<>0 THEN PROCTURNTO(DEG(ATN(XDIF/YDIF))+180*(YN<Y))
          SGN(-XDIF)*90)
1870X=XN : Y=YN
1880IF STYLE=1 THEN DRAW X,Y ELSE MOVE X,Y
1890ENDPROC : REM MOVETO
1900
1910DEF FNANGLE(A)
1920IF A>0 THEN =A MOD 360 ELSE =A MOD 360 +360 : REM ANGLE
1930
1940DEF PROCNEW
1950VDU26: CLS
1960ENDPROC : REM NEW
1970



1980REM--------------------------------
1990REM--------------------------------
2000REM
2010
2020REM These are example routines
2030REM
2040REM
2050REM PROCPOLY is an example of a recursive routine
2060REM - the routine is terminated by a key press
2070REM
2080



2090DEF PROCPOLY(SIDE,ANG)
2100LOCAL G$
2110G$=INKEY$(0)
2120PROCMOVE(SIDE,1): PROCTURN(ANG)
2130IF G$="" THEN PROCPOLY(SIDE,ANG)
2140ENDPROC : REM POLY
2150
2160REM



2170REM PROCCIRCLE draws a circle by approximation to a 36-sided polygon
2180REM
2190
2200DEF PROCCIRCLE(INC)
2210LOCAL I
2220FOR I=1 TO 36: PROCMOVE(INC,1): PROCTURN(10): NEXT I
2230ENDPROC : REM CIRCLE
2240
2250REM--------------------------------
2260REM--------------------------------
```

New skills for millions

Alan Simpson looks at the thriving new industry devoted to training people to use micros and their software to the full.

AFTER SOME HESITATION, micro training now looks set to rival the growth rate of the micro hardware market place. This view is supported by many industry pundits who predict that over 10,000,000 individuals in the U.K. alone will need some level of computer training over the next five years.

Evidence of the demand is not hard to find. There are over 70 publications covering the micro market place and micro publications already account for a substantial percentage of all magazine sales. Confirmation also comes from Mike Fluskey, publisher of the Newtech "Learning to Use" series, who has estimated annual sales of a few thousand of each title. One leading micro bookshop apparently upset the sales graph by ordering 1,000 initial copies of each title in a single month.

Meanwhile ITB Ltd, which specialises in micro and word-processing appreciation courses, has had to increase its central London one-day workshops and is backing the courses with on-site training classes designed to meet specific user requirements. Even the famed Club Méditerranée holiday group is incorporating micro-training workshops in some of its villages; though whether they will count as tax-deductible business training activities is somewhat open to doubt.

However, despite the evidence of micro-training activities, John Stancioff who runs Cresta Services, an international company specialising in supplying training support, believes that the demand for training is being seriously underestimated by industry and government alike. "Only the users themselves are aware of the need and in most cases their pleas for help and assistance are falling on deaf industry ears."

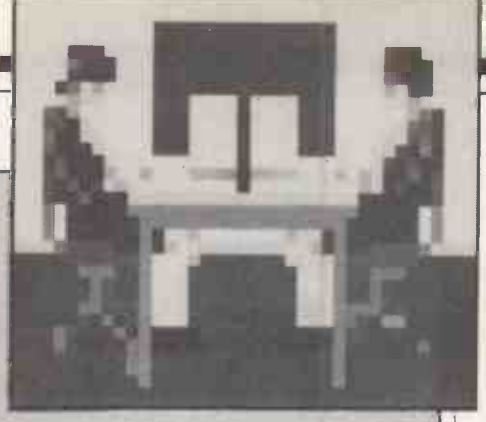
Responsible for setting up CMI, a micro sales and training base in Geneva, John Stancioff admits to being overwhelmed by the demand for similar operations elsewhere in Europe. In the U.K., as in the U.S., training lags behind the user requirements by several laps. "We have put micros in schools before we have trained the teachers. And we have micro store salesmen who often know less than their customers. Getting your micro first and then seeking assistance is not the most practical approach to the effective use of equipment and systems."

At Business Machine Training young government trainees grapple with WordStar and accounting packages on a network of Sun Superbrains.

It has taken the micro training industry some time to realise that the needs of business users are a variable factor. At one level, there is a growing requirement for operator training covering basic appreciation and keyboard familiarity. Then there is the manager who needs to have not only hands-on experience, but a full understanding and appreciation of the potential benefits of microcomputing within his or her organisation.

For the training organisers it is not just a matter of organising selected micro courses, sitting back and counting the proceeds. In many cases, it is a hard task just keeping pace with current requirements. No sooner have they arranged training sessions on Basic or CP/M, than users' demands switch to enlightenment on Unix. Will IBM, or IBM look-alike systems, sweep the sales board leaving Apples and Pets to pick up the market pieces? For instance, company management is now demanding not only guidance on what a micro does and how much it will cost to do it, but advice on the respective merits of eight- or 16-bit systems. Should the trainers concentrate their resources on covering Wordcraft or switch attention to the possibly more popular WordStar word-processing package? Similarly, would a course on Micromodeller score bonus sales points over a VisiCalc training exercise?

As with the micro industry itself, the level of training suppliers vary from very good to "could do much better". Training procedures range from a two-hour in-house microclass briefing session to a two-week residential course at an expensive and prestigious business college in the home counties. Club Med apart, micro training venues include Thames sailing barges, outward-bound style training in the Brecon mountains in Wales, and camping sites. Certainly the junior training camps seem to be growing in popularity, particularly in the summer months.



Standards, a matter of considerable interest and concern to micro hardware and software designers and the industry as a whole, do not appear to extend to training procedures and policies. It is all too easy to jump on the training bandwaggon and enjoy a profitable ride, at least until a more competitive organisation sets up in close proximity and boasts a bigger advertising budget. Industry training advisor John Merrifield believes that it is up to an organisation such as The National Computing Centre to get to grips with the micro training situation, and possibly issue certificates of training competence. Otherwise, he suggests, the public will have to continue to pay their money and hope for the best.

One of the major snags facing a standardisation drive is the wide range of micro-training requirements. School training apart, there is the home hobbyist who probably prefers not only the do-it-yourself approach, but a learn-it-yourself policy. For such users, more practical manuals and text-books are an urgent necessity. At the other end of the micro-training market place, the business users who may somewhat reluctantly find themselves saddled with a business or personal micro, need some personal business hands-on training, covering not only technology but confidence. It is also helpful if such sessions are presented by trainers who have a business background rather than, as is all too often the case, a strictly academic approach.

Already publishers are taking note of the emerging trend for more advanced books designed specially for the business user. "What do we do next?" is becoming as important a topic as "getting to grips with your first business micro". In fact, the Newtech Publishing Group is planning a series which will offer guidance to business users on micro software application packages as well as hardware systems. The books are aimed at the office micro user who has absorbed the basics and is keen to become more proficient.

Sooner rather than later this growth factor will involve the micro hardware suppliers. Unless the equipment has an upgradable path which will enhance not only the system but the growing ambitions of office users, it could find itself in the Shop Window pages of *Practical Computing*.

Having managed to insert a microcomputer into most U.K. primary schools, the government appears only now to be realising that few teachers have suitable qualifications for, or interest in organising micro education. What the government has managed to achieve in the cause of spreading enlightenment among our juniors is an ability to handle electronic games. Micro aptitude seems to stop short at Pacman, Aliens and Star Wars. Zapping, it seems, is more important than processing.

(continued on next page)

Training courses

British Institute of Management, Management House, Parker Street, London WC2B 5PT.

BIS Applied Systems Ltd, 199 Westminster Bridge Road, London SE1.

Business Machine Training (N&M) Ltd, Second floor, 7 St Peters Gate, Stockport, Cheshire. WP, accounting, banking, etc. for young people under various goverment training schemes.

Computer Advanced Technology, 97 Millway, London NW7

Central Calculators Ltd, Sharpsoft, 86 Paul Street, London EC2.

Computer Training & Education Centre (CTEC), 102-8 Clerkenwell Road, London EC1M 5SA. Various courses including dBase II.

Computer Users Year Book, 62 Oxford Road,London W1.

Cresta Services, 35 Bradbourne Street, London SW6.

Datasolve Education, 14 Old Park Lane, London W1Y 4NL.

Deltak Ltd, Banda House, Cambridge Grove, London W6.

Digital Equipment Ltd, Fountain House, Reading, Berkshire.

Digital Research (U.K.) Ltd, Oxford House, Oxford Street, Newbury, Berkshire.

Digitus Ltd, 10 Bedford Street, London WC2.

Druvic International Ltd, 31 Corsica Street, London N5 1JT. Ditec training.

Edutext, 7 Margravine Road, London W6 8LS. Specialist in on-site training in WP, dBase II and Supercalc.

Gower Publishing Ltd, Gower House, Croft Road, Aldershot, Hampshire.

Head-Line Communication Ltd, Friar House, 9 Friar Street, Hereford HR4 0AS. Author of sound-training packages available from Newtech Publishing.

ITB Ltd, 127 Regent Street, London W1.

IBM (U.K.) Ltd, Baltic House, North Harbour, Portsmouth PO6 3AU.

ICL Ltd, Consulting & Training Services, Beaumont, Old Windsor, Berkshire SL4 2JP. Packaged, video and live training over a wide field including languages, operating systems and the PC.

Inbucon Management Centre Ltd, 197 Knightsbridge, London SW7.

Intel Corporation (U.K.) Ltd, Pipers Way, Swindon, Wiltshire.

Intra Systems Ltd, 28 Cannon House, 3 Cannon Drive, West India Dock, London E14 9SA. Produced "Training Through Technology" report.

Intelligence (U.K.) plc, 271 Kingston Road, London SW19.

Langton Information Systems Ltd, 133 Oxford Street, London W1.

LBMS DP Training, Learmonth & Burchett Management Systems Ltd, 22 Newman Street, London W1P 3HB.

Lombardy Training, Netherfield, Gravel Path, Berkhamsted, Hertfordshire HP4 2PF. WordStar, VisiCalc and other packages.

Keith London Associates, 40 Stonehills, Welwyn Garden City, Hertfordshire. Project management, systems, programming and specialist courses in U.K. and overseas.

Microcal, 36 Elm Road, Windsor, Berkshire SL4 3ND. Specialist in "hands on" Basic, Cobol and CP/M with Supervis interrogation program.

Micro Computing Enterprises, 14 Ware Road, North Berwick, East Lothian EH39 4BN. Short course to residential courses on BBC Basic programming.

Microcomputer Products International, Central House, Cambridge Road, Barking, Essex IG11 8NT. CP/M Tutor package.

Micromark Training, Ravenscroft Road, Henley-on-Thames, Oxfordshire.

Micro Train, 500 Chesham House, 150 Regent Street, London W2. Short intro to micros.

MicroTraining, 637 Holloway Road, London N19 5SS. One-day courses on CP/M and WordStar, dBase II, Basic and Pascal, etc.

Microword Services Ltd, Second Floor, Monaco House, Bristol Street, Birmingham B5 7AS.

Newtech Publishing Ltd, 8 Forge Court, Yateley, Surrey.

National Computing Centre, Oxford Road, Manchester M1 7ED.

Planning Consultancy Ltd, 46-47 Pall Mall, London SW1Y 5JG. A year's training on topics such as VisiCalc, Micromodeller, dBase II, WordStar, Pulsar, etc.; cost £250 over 50 courses.

Polebrook Management Systems, Polebrook Hall, Peterborough PE8 5LN. Training consultants to the British Institute of Management.

Semaphore Computers Ltd, Borden House, Godalming, Surrey.

Systime Software Training, Systime Computers Ltd, Millshaw Park, Leeds, West Yorkshire LS11 0LT. Computer Assisted Training Sytem.

New skills for millions

(continued from previous page)

Further up the education path there is some room for hope. The Industrial Council for Education and Training Technology is involved in technical and business education and industrial and commercial training. It has certainly got its work cut out. In many cases, the competitive sales margins operating in the retail store leave little scope for suppliers to offer any form of user training. Instead, the user is offered a selection of self-teaching training products to back up the equipment or system manual.

Support ranges from the sound training approach of supplying audio cassettes and control guides covering standard hardware and software applications to the fully interactive training methods provided by such organisations as BIS. At a more advanced technological level, computer-based training presentation courses are available from such companies as Deltak. However, it is not just the users who are getting restless, and in many cases baffled. TASS, the Technical Administration and Supervisary section of the engineers' union has publically stated that "never before has there been so much talk about training, and so little evidence of action".

Fortunately, it seems the micro-computer industry is getting the micro training message. ICL, for instance, has just appointed a new divisional director to co-ordinate the activities of its 200-plus personnel who provide training for over 40,000 users a year, an increasing number of whom are in office management. IBM which is already presenting free one-day training courses on the delights and benefits of word processing, is expected to extend the training programme to cover its new personal computer, while Digital Equipment is busy creating user-training centres and telephone hot-lines in the U.K. Meanwhile, there are signs that Plato, the Control Data education and training project, which has cost in development terms over $1,000m so far, is meeting considerable worldwide support. Already leading motor manufacturers are booking the computer-assisted learning systems.

In fact, as a glance through the *1983 Directory of Training* published by Gower reveals, companies such as NCR, I P Sharp and Texas Instruments are becoming increasingly involved in microcomputer training. Another comprehensive source of training courses and programs in the computer industry is the *Computer Users' Year Book*, which collates valuable information on microcomputer training courses and organisations.

Many training organisations appear to have been taken somewhat by surprise at the emerging demand for keyboard training. For an increasing number of users — both home-computer hobbyists and office personnel — an ability to handle the computer keyboard has become essential. Earlier this year, the government recognised the need for effective training and provided substantial funding to the Sight and Sound company to organise nationwide training schemes.

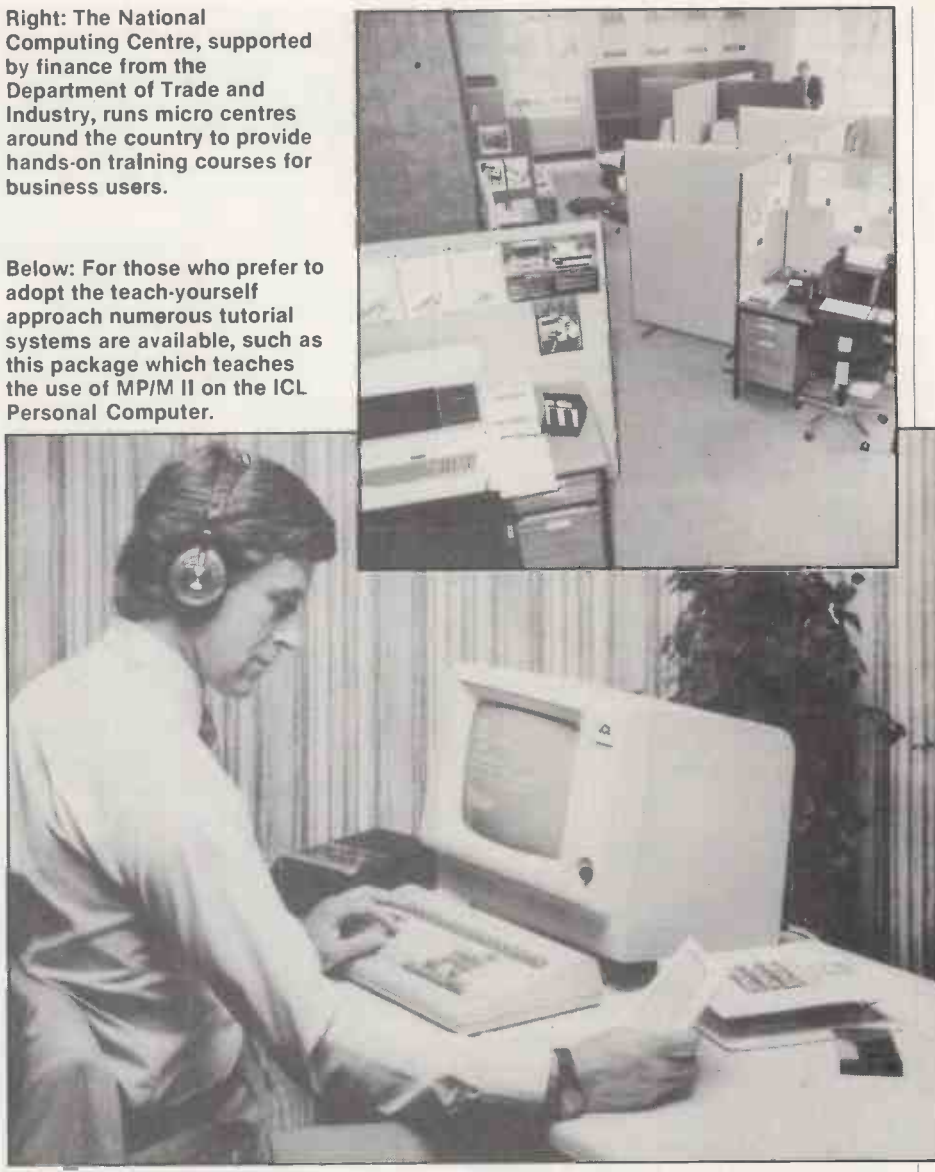
However, adopting traditional type-writer teaching methods to computer keyboards is not always practical. Typewriting normally involves alphabetic keying, while computing is involved not only in a mixture of alpha and numerics, but in some cases a combination of keys. Keyboards are becoming a method of spreading communications, and accuracy is of prime importance. There are now several U.K. and international companies providing specialist keyboard training, such as Touch'n'Go, together with an increasing number of books. Along with Basic, CP/M, ASCII and MS-DOS, QWERTY has become a recognised microcomputer operating code

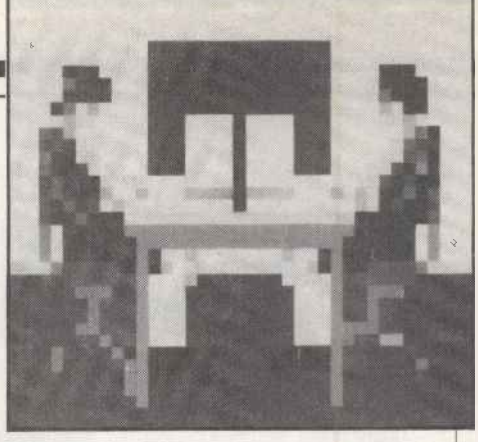
The fact that there are a wide range of micro-training courses available for the first-time business user probably only serves to add to the prevailing level of confusion. All too many training organisers appear to have missed the microcomputer revolution point. Computer power is no longer the exclusive responsibility of specialist teams or management. It is available at a very low cost to individual users within the whole organisation. The British Institute of Management, for example, is promoting microcomputer courses which show users how to talk to their data-processing specialist teams. There would seem to be more practical ways of spending £400, the cost of the course.

Another major management-training organisation is Inbucon, which has been running courses throughout the country since 1978. Despite the fact that its courses

Right: The National Computing Centre, supported by finance from the Department of Trade and Industry, runs micro centres around the country to provide hands-on training courses for business users.

Below: For those who prefer to adopt the teach-yourself approach numerous tutorial systems are available, such as this package which teaches the use of MP/M II on the ICL Personal Computer.





promote the benefits of micros and minis, it is not unusual to find 30 or more in a single class — a number which would seem to preclude practical hands-on training procedures.

Taking a rather different training approach is the NCC which, supported by Department of Industry funds, is creating a range of micro centres designed to provide help to business users. Each centre offers individual and group hands-on training courses backed with a representative collection of hardware. According to the NCC, 82 percent of companies with a traditional data-processing department now have microcomputers in their user sections. In the next four years, the NCC sees the growth level for terminals increasing by 75 percent. "The information technology revolution will need a training revolution if users and the community are to benefit," states NCC director David Fairbairn, who is widely regarded as the industry authority on all computing matters.

But for business users who want to get to grips with the information-technology revolution without actually having to indulge in hands-on workshop training, attendance at a seminar or conference would seem to be advisable. Throughout 1983 Langton Information Systems, a company closely involved in designing and implementing new technologies, is holding a series of industry IT seminars. The courses cover such topics as viewdata, telecommunications, text databases and office automation, and look like spreading the delights of computers in the office to a wide audience of business users.

It does seem, however, that the long-delayed arrival of the traditional computer manufacturer into the micro market place will bring about a change in micro-training attitudes. Companies such as IBM, NCR and DEC all have a strong base in customer training and support services, unlike perhaps the approach of such suppliers as Apple, Pet and Newbrain who rely in the main on independent training support.

This non-support approach has encouraged many specialist suppliers to offer a turnkey service covering sales, software, support and training. Semaphore Computers, which markets the Lazor range of business micros, believes that the full-scale offering of customer service and training accounts for much of its marketing success. Managing director Brian Young comments that increasing numbers of business-system users require the lavish doses of confidence and peace of mind that a turnkey operation provides. "Having a helpful hand around when it is needed, generates user satisfaction and repeat orders," says Brian Young.

Training is also a strong feature of the service provided by London micro supplier Central Calculators Ltd. Sharon Evans, who is responsible for training and software support, believes that in most cases a certain level of on-site customer support is essential. Not only can users obtain hands-on experience in their own working environment, but can relate their own applications within the training structure. Apparently it is not only a matter of converting manual office systems, but of converting typists, supervisors and office managers to the requirements and benefits of the proposed micro-based business system. According to Sharon Evans, this is often too important a matter to leave to the users without some degree of help and support in the background.

A glance through the pages of *Practical Computing* will reveal that many companies are now offering micro courses including such well known names as Digitus, Intel and the *Guardian* newspaper. But care should be exercised. Organisers who attempt to cover in the course of a single day the complexities of WordStar and Mailmerge, Supersort, CalcStar, Datastar and CP/M plus a full understanding of micro processing procedures and practices are fooling not only themselves but also their customers.

This is a matter causing considerable concern to Dr Adrian Stokes, who is a well known and respected computer-industry course presenter. His company, Computer Advanced Technology, is currently compiling a set of training modules which will meet the requirements of all levels of micro user from basic first-time novice, to the more advanced level of local area, and not so local area, networks. The training-module package is being made available direct to users, recognised training outlets and possibly to computer micro stores.

Alongside the sales of such software packages as Micromodeller, there has developed a flourishing trade in education and support training. Ashley Ward, managing director of Intelligence U.K. Ltd, the company which is responsible for the best-selling Micromodeller financial-planning package, states: "The concept of financial planning often has to be taught before users can get to grips with the program package itself". Intelligence U.K. offers its own support seminars across the U.K., the U.S. and France, with waiting lists often being the order of the day.

Another well known industry personality, Paul Bailey, director of Digital Research's European operations, agrees that end-users can often benefit from basic technology education. Training is a matter of considerable importance to Digital Research, which runs special sessions for distributors and dealers, manufacturers and users. Additionally the company supplies OEM franchise training and publishes a series of software updates and newsletters for key application vendors. Paul Bailey agrees that establishing a new in-house training centre at DR's Berkshire offices was a priority matter. Most CP/M courses cover two or three days, as do most VisiCalc training programs.

The VisiCalc business system, which has already sold over 220,000 copies — not all for the originally designated Apple hardware — is covered by several independent training organisations. Micromark, which specialises in VisiCalc training, features only Apple hardware on its courses. Presumably now that the package is available on many other microcomputers, from the IBM PC to the Atari, the course organisers will enlarge their hardware training base.

Complaints are frequently made by users about the hardware and software manuals. Certainly the compilers of many user manuals and workshop guides have a lot to answer for, especially in taking for granted the ability of their readers. "After assembling the equipment, power-up" is an all too common approach. It is not unknown for users to contact their suppliers in order to ask the location of the On switch. Manuals have become renowned for their lack of understanding of the users' requirements, both as raw beginners and advanced experts.

In particular, the CP/M and WordStar manuals are singled out as being unworthy of the associated products. It is hardly surprising that several companies are attempting to produce teaching support packages or even their own independent manuals. One company which is closely involved in selling and marketing education and training, Head-Line Communication, has found itself with a best-selling training series on its rather surprised hands. The well established Sound Training packs which consist of audio tapes and guideline instructions were originally developed as an in-house training project for its own personnel.

Head-Line is now busy producing on a OEM basis user manuals for micro suppliers and manufacturers of both hardware and software systems. There is, it seems, hope for all users. As yet Sound Training has not produced a pack which offers guidelines to prospective users of training courses. The first-time school, home-hobbyist or business user certainly needs as much help and support as the industry can provide. The same message is being heard from the more experienced type of user. Unless the micro education and training industry can keep pace with user requirements, tomorrow's technological world could be late arriving.

Programming without code

Bill Bennett examines three languages which allow teachers to produce effective programs without learning traditional programming techniques.

AN AUTHORING LANGUAGE is a tool which allows teachers or trainers to produce their own teaching software. A number of such languages exist, Pilot, Plato and Wise being foremost among them. Initially these languages were languages just like any other: teachers using them would produce lines of code just like any other programmer. But good teachers are not necessarily good programmers, so the trend has been towards codeless authoring systems based on the existing procedural languages. This has already happened in the case of Control Data's Plato system and the Wise system from Wicat.

Both packages required huge, powerful and expensive computers to run on, a situation that was rightly criticised as it meant that a massive investment was required to initiate any system in an educational establishment. In practice the expense was usually prohibitive.

Plato has now been developed in a stand-alone form which runs on the Control Data CD-110 micro. It is a slightly cut-down version, but retains the essential features. Control Data has made a massive investment in Plato. Over the years the project has cost somewhere in the region of £500 million. The company also has a track record of supplying large educational departments with powerful mainframe Cyber computers.

Plato started way back in the early 1960s with a product called Tutor. It was a procedural language which contained structures and instructions designed to make the preparation of lesson software easy. It could handle responses to set questions. Tutor spawned a product called Microtutor and the original Plato was written in Tutor.

Today the emphasis is on codeless authoring. Plato enables this by using a range of software products called author applications models. They take the author step by step through the process of lesson creation and produce set-format lessons.

To create a lesson using one of these packages, a teacher would require a special form of the stand-alone Plato system known as the author and delivery system. This is similar to the student's station, except that it has an extra disc drive. The system allows the teacher to act as author, and switch over to act as pupil so that the results of his or her labours can be examined and tested immediately.

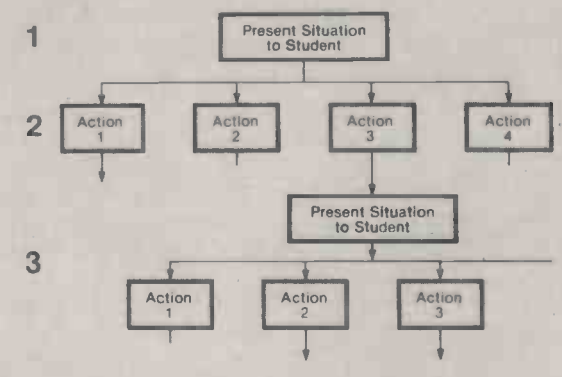
The Plato stand-alone system was introduced in November 1982 and sells at £3,900. The hardware consists of a fairly standard Z-80 based micro that can run CP/M. It only has 32K of RAM but a futher 64K is allotted to each disc drive. The outstanding feature is the touch-sensitive screen.

One drawback to the system is that lessons can only be transferred to special Control Data floppy discs. They have to be bought in lots of 50 from Control Data, which effectively ties the user to the company as a media supplier.

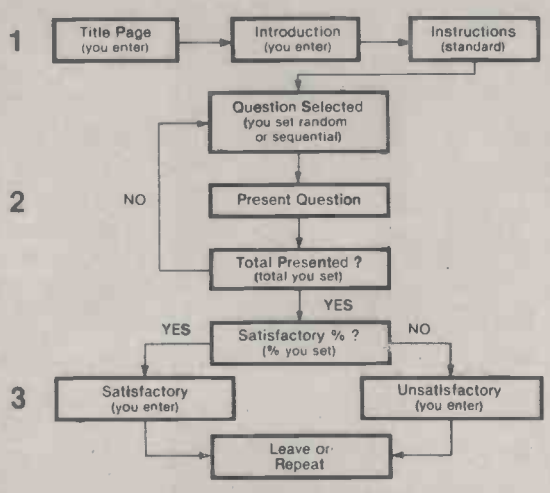
Brian Maurice is the U.K. director of educational services for Control Data. Not surprisingly, he is a firm believer in the merits of computer-based education. He is also a realist, and recognises that schools are unlikely to fork out the money for a relatively expensive piece of hardware when they already have micros installed.

Maurice is therefore keen to see Plato

Plato authoring models



Plato situation simulation model. 1. The student is presented with a situation such as might happen in the workplace. A number of possible responses are listed. 2. The student chooses one of the responses. 3. The result of the student's decision is announced, the new situation is described and a new set of possible responses is listed.



Drill and practice model. 1. The student is shown a title page and introduction, and is given instruction on how to use the lesson. 2. The student answers a series of questions created by you. 3. The percentage of correct answers is determined. If it meets a preset figure the student is told to go on to the next stage, otherwise the lesson is repeated.

courseware — that is the name given to the software generated by the authoring system — as well as books and other teaching material used in a computer-aided learning course, implemented on a variety of other machines. In the U.S. a range of Plato courseware is already available for the Apple computer; it will soon be available in the U.K. and in local-language editions for the rest of Europe. Courseware for the IBM PC will follow.

Plato for micros

As far as educational computing in the U.K. is concerned, the key machine is the BBC Micro. Maurice has targeted it as an important machine for Plato courseware to be available on, and we can expect to see such software appearing in schools in the future. There is room for this kind of product in the home too, so it could be that home users will be able to use their micros for something other than playing games and balancing their domestic budgets before long.

Another micro that has aroused interest at Control Data is the Sinclair Spectrum, though it is unlikely that any Plato courseware will be made available for this machine in the near future since Control Data is only interested in disc-based systems. In principle, the software can be rewritten for almost any micro and any disc operating system. Control Data does not want to become bogged down in a sea of cassette tape, though Microdrives could eventually provide an answer for the Sinclair machine.

There is now a colour version of Plato, running on the Zenith, which is the first non-Control Data machine to be blessed with a full Plato authoring system. Animated graphics and high-resolution graphics are features of Plato which the Zenith exploits to the full. To illustrate courses teachers can draw detailed diagrams on the screen which can also be used in the questioning. The pupil is then asked to identify and touch a relevant item using the touch-sensitive screen which is only available on the CD-110. Colour is also a feature on the Zenith version, and the next stage is to link Plato to interactive video.

Plato can already be mixed with interactive video on the central mainframe-based Plato system. A micro version using the stand-alone system will be available during 1984.

Sometimes a student needs to input a reply which is more than a simple yes or no. Not every question should be or can be of the multiple-choice type. In these cases Plato uses a free-format response which scans text for keywords. This facility is more sophisticated on the mainframe Plato, but the micro version is being constantly upgraded to become more like its big brother, and can currently handle some free forms of responses.

Central Plato certainly is not dead. It is being used in a number of large companies which require lots of training to be completed. With the advent of telecommunication links between home computers, and systems such as Micronet, the idea of a home user patching in to a central mainframe and taking part in a Plato course might even become fashionable again.

A number of companies use Plato for training when they have a number of employees scattered around the country — or the globe — and they need to be updated on technical or business information. The company's central office will dispatch a number of discs with the relevant information on, and at remote sites they will be fed into stand-alone delivery systems. The employees will then be forced, enticed or bribed into sitting down and ingesting the information on the discs. The computer can then test whether it has sunk in or not and, if necessary, it repeats the lesson.

Plato is also used at the Control Data institutes, a network of educational establishments throughout the country. Here students attend classes of personal, computerised tuition. A large number of disciplines are taught, one of the most important courses being the government-sponsored Tops course in computer programming.

Wise is a no-code authoring system from Wicat, a name that is better known in this country as belonging to a hardware manufacturer. The name Wicat is in fact an acronym for World Institute of Computer Aided Teaching, and the company was originally a non-profitmaking institution. The hardware that followed was designed to further this cause and consequently Wicat built the first 68000 micro, and turned into yet another computer company.

Detailed graphics

Wicat claims that the graphics design capability of Wise is second to none, with authors able to define pictures right down to the final pixel. The graphical representations are linked by menus. Unlike Plato, Wise-generated lessons will only run on Wicat hardware, which for the most part consists of a range of minis and larger micros. Wise does require hard discs.

Development time is long for any authoring system. Typically, 100 hours of authoring are required to produce a single hour of courseware. With Wise this time has been reduced to somewhere in the region of 40 to 60 hours preparation for each hour of learning. The teacher is presented with a series of questions, and by answering them the coureseware is produced.

Free-form text answers are allowed just as in Plato, and there is a management system called Smart which steers a student through a course of learning. Interactive video is already available with Wise, using either tape or disc-based systems.

Wise is used in conjunction with interactive video by the U.S. army to train the people who will press the buttons in time of nuclear war. Because the location of these sites is top secret, people cannot be taken there for training. The army sends film crews along instead. They take it all down on video, and then the operatives learn about the installations back at their bases.

The British armed forces use Wise too. An installation is used for training by the Eighth Signal Regiment, and *HMS Collingwood* near Portsmouth also has a system. Civilian users of the system include BOC Datasolve and British Telecom, which has two systems each of 32 terminals.

Wise has not appeared in schools, and is not likely to because the initial investment is so high. Like Control Data, Wicat argues that the cost per student is reduced when a number of terminals are attached. However, many terminals cost more than most cheap micros, which could possibly run Wise-generated software.

Pilot has been developed to run on the kind of hardware that is more realistically going to be available in schools and other parts of the state-run education system. Although it too is available on large computers, there are a number of versions for micros, the best-known being Apple Pilot. BBC and Research Machines versions are expected soon.

Apple Pilot is an implementation of standard Pilot, together with a number of additional commands to handle files, sound and the Apple's graphics. There are three editors: a lesson editor, a character-set editor and a graphics editor. The lesson editor is badly designed — strange and unpredictable things can under some circumstances — but Apple Pilot is very highly rated overall.

An enhanced version called Super Pilot consists of five discs — the ordinary version has only two. Both packages require twin disc drives for the author, but only a single drive for the pupil.

Pilot's biggest limitation is that it does require the teacher to code in order for the system to fit within the confines of a 48K Apple. By allowing the author to draw graphics using the games paddles, the system speeds up the authoring process considerably.

Maybe the most interesting development is Control Data's plan to produce educational software in conjunction with existing textbook publishers. This effectively makes Plato an extension of the book, with the advantage that courses will no longer need to be linear.

Making video interactive

Linking computers to a video-disc player opens up a flexible new training technique. Colin Jackson reviews its development so far.

VIDEO DISCS look something like a highly polished, silver long-playing record. Unlike the familiar floppy discs and Winchesters with their fragile magnetic coatings, the video disc is not a thing to be cossetted and kept away from smoke and dust. It can be handled with impunity as there is no contact with its moving surface. The disc is read by a beam of low-power laser light so there is absolutely no wear. On each side of the disc a continuous spiral can accommodate up to 54,000 tracks, each of which holds sufficient information to create a video frame. The information is held as a pattern of pits burned into the master disc by a laser beam.

The 54,000 tracks can therefore contain that number of still frames. Played as a continuous moving sequence they provide up to 35 minutes of viewing time. Along with the video information there are two independently switchable audio channels. They can provide a sound-track in two different languages, or one channel could be used for students and the other for the tutor.

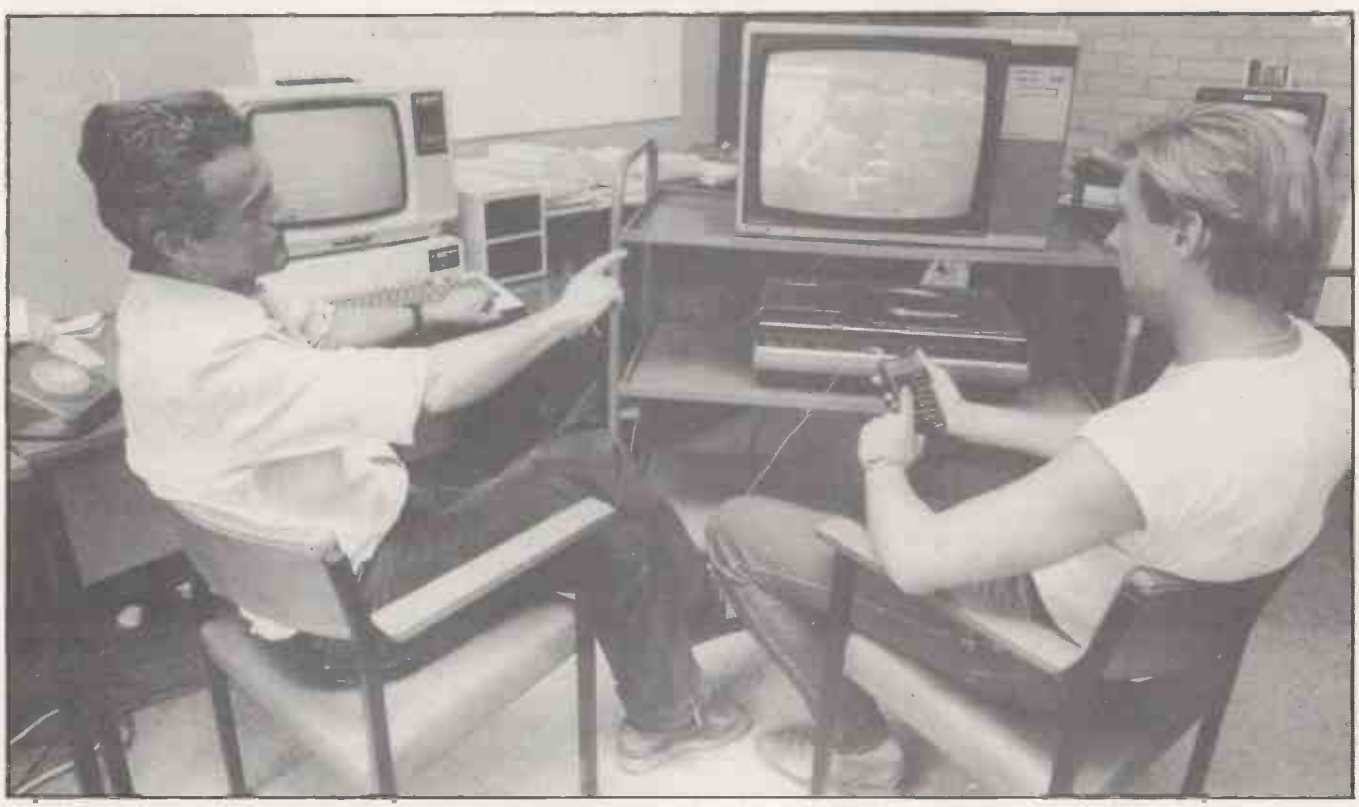
Vidio discs have two big advantages over video-tape technology. Firstly, the disc player is able to display a still frame of superb quality for as long as you like and with no wear. Secondly, the disc is essentially a random-access device, so the access time for seeking a particular individually addressable frame is much less than for a tape.

A domestic disc player may now be bought in the High Street for about £400. A simple player permits interaction only to the extent of controlling the player with an infra-red hand-held controller. A fully interactive disc player can be controlled by a computer, with the user able to enter into a dialogue with the complete system. A standard £400 player can be fitted with an interface which allows the player to be controlled from a microcomputer.

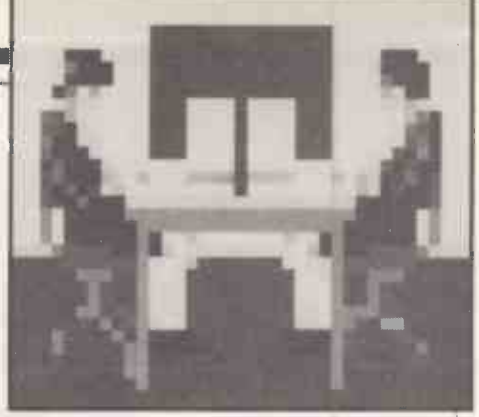
Colin Jackson is principal lecturer in computing and cybernetics at Brighton Polytechnic

Further sophistication in control can be obtained by using more expensive players. For example, the Philips Professional offers two-way communication with the computer via an RS-232 interface to provide a teletext overlay on the video material. The equipment required to use a video-disc interactive training program is a microcomputer which has a printer output socket, a disc player and a colour television set or monitor with teletext decoder.

The use of teletext overlay enables textual material to be displayed by itself or on top of either still video images or a moving sequence. You may wish to reinforce or add to the visual material or to the spoken commentary by placing suitable text on the screen. Text sent to the player is coded to be displayed at the time when a



No training session is complete without the student testing his new-found knowledge.



Computer-generated text and graphics can be overlayed on the video image to provide additional information which can be varied at will, or a menu to drive the learning program.

Ecal's system uses Apple software to control a Pioneer video-disc player.

particular video frame is shown. It is then removed either after a timed interval or when a later video frame is shown. If you wish to refer to a particular part of a displayed image an arrow or other symbol can be overlaid at the appropriate place. The standard teletext graphics symbols are available and so, for example, a map may be superimposed on the video image.

No training session is complete without the student having an opportunity to test his or her new-found knowledge, or for the tutor to be able to monitor the student's progress through the test. Questions may therefore be posed using the teletext facility. Answers can be input either by keying in a string which is analysed by the computer or, more likely, by keying in a number corresponding to one of several suggested answers on a multi-choice menu.

If the answer is correct the controlling program will either display a menu of alternatives or will move on to the next section. In the event of a wrong answer, remedial sequences of the disc may be shown — again with the possibility of different text overlays — and the questions asked again. The same technique has been used with video tape for many years, but the enhanced facilities offered with video disc allow for tremendous possibilties.

The disadvantages of discs lie mainly in the production of the disc itself. The major cost is in the preparation of the video tape from which the disc master is produced. This tape has to be frame-synchronised in 2in. Quad or 1in. type C helical format. The original sources might be existing video material, lengths of film, 35mm. slides, etc.

Mastering the disc from the final tape will cost around £2,000. Producing discs from the master is relatively cheap, but once the disc is pressed the information on it is fixed. Information cannot be changed — you have to be right first time. Variable information, such as the cost of a product, would not be included on the disc but would be overlayed via the controlling computer program.

Cost and production time are clearly important factors. Only when dics users can be counted in hundreds is the concept likely to be cost effective. So in what areas is interactive video-disc based training going to be beneficial? A system designed to teach primary-school children basic literacy and numeracy skills would relieve the teacher of much effort. A printout of the students' use of the disc program could show how many times a remedial section had been played and thereby signal the need to intervene.

In secondary schools, imagine the scope in English literature or drama of a package based on a Shakespeare play. A whole series of experiments in physics and chemistry could be held on disc. The controlling program might then allow the students to play critical sequences slowly, backwards, frame-by-frame or whatever, as many times as they wished.

In further and higher education, the 54,000 still frames could hold photographs of the world's great masterpieces. Text overlays generated by the computer could complement the pictures. Medical schools could record details of key surgical operations.

On a more practical level interactive video could be used to train operators to use a word processor or some other item of electonic office equipment. It is usual for the organisation selling such a package to arrange a demonstration either by sending a demonstrator to the customer's office or by the operators attending a class out of their own office. The process is expensive and time-consuming all round. And if on the day after the course the operators asks "...now how did they say I should do this...?" it is too late to find out. One answer is to put the demonstrator sequences on to a video disc. A computer programmer can then construct a controlling program complete with indexes, question-and-answer sessions, etc.

In management training the possibilities are numerous. Without much effort those splendid John Cleese "how not to do it" films could be put on disc, and a useful but entertaining course would result. The production of purpose-made discs for management training at all levels must be a priority. Motor manufacturers might produce a video disc for each new model. They would be of enormous use to dealers, mechanics and owners trying to identify the correct component at spare-part stores.

While the video disc cannot be erased or re-recorded, the controlling computer program can. This provides the flexibility needed to keep the material up to date. Another approach, which represents the utmost in flexibility, marries the technolgies of video disc and viewdata. Many organisations already use a private viewdata system for staff training, and information on a viewdata frame can be used to control a video-disc player.

Class monitors

Clive Bulmer's pair of programs for the Pet take the effort out of two of the tedious but necessary tasks which face form teachers.

TEACHERS USING the School Statistics program input a set of class marks, percentages, etc. and receive an analysis of those marks in relation to the class as a whole. A school examination-grade forecast is also provided on the basis of each mark. The program runs on any Commodore Pet linked to a compatible printer. It uses the Commodore's printer formatting capabilities and produces a fast and tidy table of results.

The program asks you to enter the date of the exam, name of subject and class to whom the marks belong. Once this data has been entered, you are asked to input the number of marks to be recorded. It has been set at a maximum of 500 in the program but can easily be changed by altering the Dim statement at line number 130.

When all the marks have been entered, the program asks if any changes have to be made to the data, in case a number has been entered incorrectly. Simply enter, for example, the number 15, if the 15th number was incorrect and retype the new number.

When you are satisfied that all the numbers have been correctly entered, the program prints the headings, evaluates the mean, deviance and standard deviation then produces a table of results under the headings: Score, Deviation, Z-Score, School Grade and Proj. CSE/GCE. The score is each data number, sorted into rank order; the deviation is each score minus the mean; the Z-Score is the deviation from the mean divided by the standard deviation for each score; the school grade and projected CSE/GCE grades are assigned to the Z-Score and can be set within other ranges between lines 810 and 900.

School Register

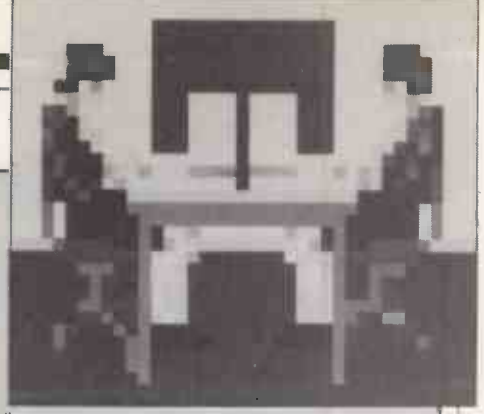
School Register is designed to speed up register totals and percentages at the end of each week. It can be run on most microcomputers linked to a compatible printer.

School Statistics variables.

C — the date
D — name of subject
E — name of form or year
A — number of scores
X — data number/score
S — sum of scores
ME — mean
SQ — sum of squares
V — variance
L — standard deviation
D — deviation from the mean
Z — Z-Score
W$ — school grade
X$ — projected CSE/GCE grade

School Statistics

```
10 REM C.BULMER - SUNDERLAND L.E.A
20 REM LINE PRINTER FORMAT
30 SK$=CHR$(29)
40 F$="999              99.9-              9.99-        "
50 F1$="    AA                  AAA" :F$=F$+F1$
60 OPEN5,4,2 PRINT#5,F$
70 OPEN1,4,1
80 OPEN2,4
90 CMD2
100 PRINT#2,"■"
110 REM PROGRAM SET FOR 1-500 SCORES MAX
120 REM CHANGE DIM TO STORE MORE NUMBERS
130 DIMX(1000)
140 PRINT#2
150 REM INPUT DATA RE SCHOOL/SCORES
160 PRINT"□WHAT IS TODAY'S DATE";
170 INPUTC$
180 PRINT:PRINT
190 INPUT"NAME OF YOUR SUBJECT";D$
200 PRINT:PRINT
210 INPUT"NAME OF FORM OR YEAR";E$
220 LZ=LEN(C$)+LEN(D$)+LEN(E$)
230 PRINT#2,TAB(20)"STATISTICAL PROGRAM FOR PUPILS SCORES"
240 PRINT#2,TAB(20);:FORP=1TO37:PRINT#2,"=";:NEXT:PRINT#2
250 PRINT#2:PRINT#2
260 PRINT"□HOW MANY SCORES DO YOU HAVE"
270 INPUTA
280 PRINT#2:PRINT#2
290 FORI=1TOA
300 PRINTI;"'TH NUMBER",
310 INPUTX(I)
320 NEXTI
330 REM CHANCE TO MAKE ANY CORRECTIONS TO DATA
340 PRINT"■■HAVE YOU ANY CORRECTIONS TO MAKE ?"
350 GETA$:IFA$=""THEN350
360 IFA$="N"THEN400
370 PRINT"■WHICH NUMBER ";:INPUTE
380 PRINT"■";X(E);"■■ENTER CORRECT NUMBER ";:INPUTX(E)
390 PRINT"■ANY MORE CORRECTIONS ?":GOTO350
400 REM CALCULATES SUM AND MEAN
410 FORI=1TOA
420 S=S+X(I)
430 NEXTI
440 ME=S/A
450 REM CALCULATES STANDARD DEVIATION
460 FORI=1TOA
470 X(I+320)=X(I)*X(I)
480 NEXTI
490 FORI=1TOA
500 SQ=SQ+X(I+320)
510 NEXTI
520 V=SQ/A-ME↑2
530 L=SQR(V)
540 PRINT#2
550 PRINT#2,TAB(21);D$;TAB(7);C$;TAB(7);E$
560 PRINT#2,TAB(21);:FORP=1TOLZ+14:PRINT#2,
    "=";:NEXT:PRINT#2
570 REM PRINTS HEADINGS AND VALUES
580 PRINT#2:PRINT#2
590 PRINT#2,TAB(31);"SCORES =";A
600 PRINT#2,TAB(31);"MEAN   =";ME
610 PRINT#2,TAB(31);"S.D.   =";L
620 PRINT#2:PRINT#2:PRINT#2
630 PRINT#2,"SCORE          DEVIATION          Z.SC
    ORE      SCHOOL GRADE  ";
640 PRINT#2,"                PROJ. C.S.E"
650 FORP=1TO75:PRINT#2,"=";:NEXT:PRINT#2
660 REM SORTS INTO RANK ORDER USING A BUBBLE SORT
670 FORQ=1TOA-1
680 FORP=(Q+1)TOA
690 IFX(P)<=X(Q)THEN730
700 U=X(Q)
710 X(Q)=X(P)
720 X(P)=U
730 NEXTP
740 NEXTQ
750 REM CALCULATES DEVIATION FROM THE MEAN
760 FORI=1TOA
770 D=X(I)-ME
780 D=INT(D*100)/100
790 REM CALCULATES Z SCORE (DEVIATION / S.D.)
800 Z=INT((D/L)*100)/100
810 REM PROJECTED C.S.E. GRADES RE. Z SCORES
820 IFZ>=2.5THENW$="A"
830 IFZ<2.5ANDZ>=1THENW$="B"
840 IFZ<1ANDZ>=-1THENW$="C"
850 IFZ<-1ANDZ>=-2.5THENW$="D"
860 IFZ<-2.5THENW$="E"
870 IFZ>=1.75THENX$="1"
880 IFZ<1.75ANDZ>=0THENX$="2/3"
890 IFZ<0ANDZ>=-1.75THENX$="4"
900 IFZ<-1.75THENX$="5/U"
910 REM PRINTS TABLE OF RESULTS
920 PRINT#1,X(I),SK$,D,SK$,Z,SK$,W$,SK$,X$
930 NEXTI
940 PRINT"□" PRINT"■■■■■■■■■■END OF RUN"
950 CLOSE5,4,2:CLOSE1,4,1
960 PRINT"■■■■■■■■■TYPE RUN TO START AGAIN":STOP
```



School Register variables.
S — house name
C — form
G — number in form
T — maximum total for 10 sessions
E — maximum total for eight sessions
N — percentage for 10 sessions
P — percentage for eight sessions

Most schools work on the basis of having a maximum of 10 sessions' attendance for each child per week. Attendances are normally totalled and converted into a percentage for the whole class. This program produces a table of percentages to be kept in the back of a register and referred to each week. Allowance has been made for when a school has only eight sessions for each child per week, to allow for holidays, etc.

On running the program, you are asked to give the name of the school house, the form and number of pupils in the form. The program is then executed and a table of attendances and percentages is produced. The program has been set for a maximum of 50 absences per week, but that unit can easily be altered at line number 270.

School Register.

```
10 REM C.BULMER - SUNDERLAND L.E.A
20 PRINT"J"
30 PRINT"■■■■■■■■■■% ATTENDANCES
   - 10/8 SESSIONS"
40 PRINT:PRINT
50 PRINT"HOUSE NAME ";:INPUTS$
60 PRINT"■FORM ";:INPUTC$
70 PRINT"■NUMBER IN FORM ";:INPUTG
80 OPEN2,4:CMD2
90 REM 110-130 LINE PRINTER FORMAT
100 F$="            999       999.99
                        999       999.99"
110 OPEN5,4,2:PRINT#5,F$
120 OPEN1,4,1
130 REM PRINTS HEADINGS
140 Y=LEN(S$)+5
150 PRINT#2,TAB(31);S$;" HOUSE"
160 PRINT#2,TAB(31);"=";
170 FORJ=1TOY PRINT#2,"=";:NEXT:PRINT#2
180 PRINT#2,TAB(15);"WEEKLY ATTENDANCES FOR ";C$;" - (";G;") PUPILS IN FORM"
190 PRINT#2,TAB(15);:FORY=1TO50:PRINT#2,"=";:NEXT
200 PRINT#2
210 PRINT#2,TAB(7);"WEEK'S TOTAL";TAB(4);"% - 10 SESSIONS";
220 PRINT#2,CHR$(141);TAB(46);"WEEK'S TOTAL";TAB(3);"% - 8 SESSIONS"
230 PRINT#2,TAB(7);:FORY=1TO31:PRINT#2,"=";:NEXT
240 PRINT#2,CHR$(141);TAB(46);:FORU=1TO29:PRINT#2,"=";:NEXT
250 PRINT#2
260 REM LOOP FOR PRINTING THE TABLE
270 FORA=0TO50
280 T=G*10
290 E=G*8
300 L=((T-A)/T)*100
310 M=((E-A)/E)*100
320 N=INT(L*100)/100+.00
330 P=INT(M*100)/100+.00
340 PRINT#1,T-A,SK$,N,SK$,E-A,SK$,P
350 NEXTA
360 CLOSE5,4,2:CLOSE5,4,1
370 STOP
380 END
```

WEARDALE HOUSE

WEEKLY ATTENDANCES FOR 3A - (27) PUPILS IN FORM

WEEK'S TOTAL	% - 10 SESSIONS	WEEK'S TOTAL	% - 8 SESSIONS
270	100.00	216	100.00
269	99.62	215	99.53
268	99.25	214	99.07
267	98.88	213	
266	98.51	212	
265	98.14	211	
264	97.77	210	
263	97.40	209	
262	97.03	208	
261	96.66	207	
260	96.29	206	
259	95.92	205	
258	95.55	204	
257	95.18	203	
256	94.81	202	
255	94.44	201	
254	94.07	200	
253	93.70	199	
252	93.33	198	
251	92.96	197	
250	92.59	196	
249	92.22	195	
248	91.85	194	
247	91.48	193	
246	91.11	192	
245	90.74	191	
244	90.37	190	
243	90.00	189	
242	89.62	188	
241	89.25	187	
240	88.88	186	
239	88.51	185	
238	88.14	184	
237	87.77	183	
236	87.40	182	
235	87.03	181	
234	86.66	180	
233	86.29	179	
232	85.92	178	
231	85.55	177	
230	85.18	176	
229	84.81	175	
228	84.44	174	
227	84.07	173	
226	83.70	172	
225	83.33	171	
224	82.96	170	
223	82.59	169	
222	82.22	168	
221	81.85	167	
220	81.48	166	

STATISTICAL PROGRAM FOR PUPILS SCORES

MATHEMATICS 12.12.81 3A1

SCORES = 25
MEAN = 72.76
S.D. = 25.0332259

SCORE	DEVIATION	Z.SCORE	SCHOOL GRADE	PROJ. C.S.E
119	46.2	1.84	B	1
115	42.2	1.68	B	2/3
104	31.2	1.24	B	2/3
102	29.2	1.16	B	2/3
99	26.2	1.04	B	2/3
97	25.2	1.00	B	2/3
83	24.2	.96	B	2/3
80	10.2	.40	C	2/3
78	7.2	.28	C	2/3
74	5.2	.20	C	2/3
72	1.2	.04	C	2/3
71	.7-	.04-	C	2/3
68	1.7-	.08-	C	2/3
66	4.7-	.20-	C	2/3
65	6.7-	.28-	C	4
65	7.7-	.31-	C	4
64	7.7-	.31-	C	4
64	8.7-	.35-	C	4
60	8.7-	.35-	C	4
44	12.7-	.51-	C	4
40	28.7-	1.15-	C	4
32	32.7-	1.31-	C	4
30	40.7-	1.63-	D	4
29	42.7-	1.71-	D	4
	43.7-	1.75-	D	4
			D	4
				4

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You want your business at your fingertips, but this heavy-footed rival will take over your whole desk. The neat, stylish Hyperion won't crowd your space.

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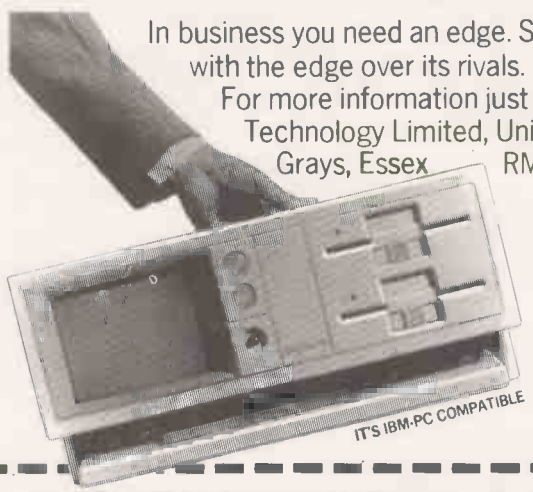

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PC9/83

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Portables update

The flood of portables has been in full flow since we published our last review at the beginning of the year. Ian Stobie assesses the current state of the art.

PORTABLE COMPUTERS have really arrived. And arrive is the right word as the most of the machines in our new survey are imported. Nine of them are American, six are British, four come from Japan and one, the Hyperion, is Canadian.

This might seem par for the course in high-technology products, but there are many more portables selling heavily in America. They too will undoubtedly become available over here once distribution problems are sorted out. Meanwhile ACT, which has been very successful as the importer of the U.S.-made Sirius, is manufacturing its new Apricot portable in Scotland. The other British-made micros in this survey are the rather specialised Husky, Nomad and Scorpion, and the Miracle and Zita.

Portables have caught on so well in America partly because of the sheer size of the country. Its numerous time zones make getting hold of a business contact by phone that much more difficult than in Europe. The communicating portable computer has been adopted enthusiastically as a kind of super telephone-answering machine, sending its messages to another person's computer to be read whenever they start work.

Difficulties with British Telecom have discouraged a similar development in this country, although admitedly the motivation is less great. Machines like the Tandy 100 are arriving here with their direct-connect Modem circuitry removed.

We have excluded a large number of machines from this survey for one reason or another. The Teleram, the Acclaim, the Access, the Otrona Attache and many more are left out because they are not yet available in the U.K. For a machine to be included it has to have a proper full-size keyboard, mass storage like floppies or bubble memory or lots of RAM actually built into the portable unit, not back at base, and at least a two-line display on the machine in its mobile form. It can be either battery or mains powered, but it should not weigh more than you can reasonably expect someone in an office environment to lift — say 30lb. The Nomad and Husky have non-standard keyboards, but are still included since a standard keyboard would not allow the machines to stand up to the harsh operating environments they are designed for.

Some fine machines are excluded by our definition. The Hewlett-Packard 75C has a single-line display and a slightly smaller than standard keyboard. Yet this battery-powered computer has the power to run a genuine Visicorp version of VisiCalc. It comes in ROM so you can have VisiCalc in a package that weighs less than 2lb.

Another excellent and even smaller machine is the Sharp PC-1500, with a single-line display and calculator-size keys. It has no built-in mass storage but has been around long enough to accumulate a family of good peripherals. Its tiny four-colour printer/plotter uses the same mechnaism as the Oric printer reviewed in this issue. The Newbrain is not covered here because it has no built-in mass storage apart from its RAM and just a single-line display. These machines are fully described in our survey on portables published in the January 1983 issue of *Practical Computing*.

Typical of the modern American portable, the Access has built-in Modem with both acoustic and direct plug-in connection to the phone system, a built-in printer, discs and 7in. amber screen, all contained in a hefty 33lb. package.

Portables top 20 — details on pages 129 to 135

ACT Apricot: Applied Computer Techniques, ACT House, 111 Hagley Road, Birmingham B16 8LB. Telephone: 021-454 8585.

Compucase: Advanced Software Technology Ltd, 48a Central Road, Worcester Park, Surrey KT4 8HY. Telephone: 01-330 1690.

Dot: Compucorp Ltd, Cunningham House, Westfield Lane, Kenton, Middlesex HA3 9ED. Telephone: 01-907 0198.

Epson HX-20: Epson U.K. Ltd, Dorland House, 388 High Road, Wembley, Middlesex HA9 5UH. Telephone: 01-902 8892.

Fox: Digital Microsystems Ltd, Tavistock Industrial Estate, Ruscombe, Twyford, Berkshire RG10 9NJ. Telephone: (0734) 343885.

Gavilan: c/o Cochrane Communications Ltd, 54 Fleet Street London EC4Y 1JU.

Grid Compass: c/o Moggridge Associates, 322 Kentish Town Road, London NW5 2TH. Telephone: 01-485 1170.

Hewlett-Packard HP-85: Hewlett-Packard Ltd, Literature Department, Winnersh, Wokingham, Berkshire RG11 5AR. Telephone: Crowthorne (0344) 773100.

Husky: DVW Microelectronics Ltd, PO Box 135, 345 Foleshill Road, Coventry CV6 5RW. Telephone: (0203) 668181.

Hyperion: Gulfstream Computer Technology Ltd, Unit 3a, Tunnel Estate, 726 London Road, West Thurrock, Grays, Essex RM16 1LS. Telephone: (04026) 4926.

Kaypro: CK Computers Ltd, Estover Close, Estover Industrial Estate, Plymouth, Devon PL6 7PL. Telephone: (0752) 780311.

Miracle: Portico Technology, South Bank House, Black Prince Road, London SE11. Telephone: 01-735 8171.

Nomad: Immediate Business Systems plc, 3 Clarendon Drive, Wymbush, Milton Keynes MK8 8DA. Telephone: (0908) 568192.

Osborne 1 and Executive: Osborne Computer Corporation (U.K.) Ltd, 38 Tanners Drive, Blakelands, Milton Keynes MK14 5LL. Telephone: (0908) 615274.

Scorpion: MicroAPL Ltd, 19 Catherine Place, London SW1E 6DX. Telephone: 01-834 2687.

Sharp PC-5000: Sharp Electronics (U.K.) Ltd, Sharp House, Thorp Road, Manchester M10 9BE. Telephone: 061-205 2333.

Sord M-23P: Socius Computer Systems U.K. Ltd, Samuel House, 6 St Albans Street, Haymarket, London SW1Y 4SQ. Telephone: 01-930 4214.

Tandy Model 100: Tandy Corporation, Tameway Tower, Bridge Street, Walsall, West Midlands WS1 1LA. Telephone: (0922) 648181.

Zita: ITCS, 16-18 Littleton Road, Ashford, Middlesex TW15 1UQ. Telephone: (07842) 47371.

Zorba: Sun Computing Services Ltd, Concorde House, St Anthony's Way, Feltham, Middlesex TW14 0NH. Telephone: 01-890 1440.

ACT APRICOT £1,495

Mains-powered 16-bit system with advanced specification, scheduled for general availability this month. Keyboard has a 40-character by two-line LCD display built in so the 9in. screen can be left at base. Weight: 17.5lb. Keyboard clips on to system box to make neat briefcase-style unit. Built around Intel 8086 chip with 256K of RAM as standard, expandable to 768K. One 315K 3.5in. Sony micro-floppy on entry-level system. Other disc options are promised, taking storage capacity in steps up to 1.4Mbyte with two double-sided drives. Comes with MS-DOS 2 and should run most Sirius applications and IBM packages. Concurrent CP/M-86, Microsoft Basic, DR Personal Basic, 3D Relational Database, and graphics and communications software also included in price.

FOR Good looks. Large RAM. Sirius and IBM software compatible.

AGAINST Portable only when full display is sacrificed. No hard-disc option.

COMPUCASE £3,800

Mains-powered eight-bit transportable weighing 25lb. with unusual display and disc system. The 9.5in. screen built into the lid is a flat plasma-discharge panel which forms characters on a five-by-seven matrix of glowing dots to build up a display of 12 lines of 40 characters. An 80-column dot-matrix printer is built in. A cartridge disc unit provides 6Mbyte of storage on five exchangeable 5.25in. floppy discs, each holding 1.2Mbyte. The drive unit selects the apropriate disc from the cartridge in under three seconds. Runs an 8085 eight-bit main processor, second 8085 for I/O processing and 64K of RAM. CP/M and MBasic included in the price.

FOR All-in-one unit.

AGAINST Quite expensive. Disc system odd.

DOT £1,995

Transportable 16-bit mains-powered micro built around the 8088 chip. Comes with the MS-DOS operating system and 64K of RAM, expandable up to 700K. Claims to be IBM compatible. Z-80 add-on board runs eight-bit CP/M. Screen 5in. by 9in. displaying 25 lines by 80 or 132 columns. Optional built-in printer uses 8.75in. wide thermal paper and prints text across 80 or 132 columns and graphics. Keyboard detaches for ease of use. Two IBM bus-compatible expansion slots are provided. Sony 3.5in. floppy disc drives give 280K each; base-level system has one 280K 3.5in. micro-floppy and 64K RAM. System with two drives, built-in printer and 128K costs £3,450.

FOR All-in-one package. IBM PC compatible.

AGAINST Heavy with the printer installed. Quite expensive.

EPSON HX-20 £477

Truly portable battery-powered machines with all the necessary elements of a computer system fitting into a 4lb. A4-sized package. Good-quality full-size keyboard, four-line by 20-character LCD display and built-in 24-column printer. Built-in microcassette drive capable of holding about 100K on a small C30 dictation-machine cassette. Can be bought without the drive for £75 less. Comes with Microsoft-written Basic and its own operating system in 32K of ROM. Built around the 6301 eight-bit CMOS chip, a low-power device similar to the 6800, with 16K of RAM. A clip-on expansion unit provides another 32K of memory, RAM or ROM. Uses a non-standard operating system but quite well supported by independent software writers.

FOR All-in-one lightweight unit. Reasonable software base.

AGAINST Relatively small display.

FOX £2,682

Mains-powered eight-bit transportable designed to link easily into a local area network but also functioning as a self-contained eight-bit CP/M machine. Built round Z-80A with 64K RAM with a 9in. screen displaying 80 characters by 25 lines and a detachable keyboard. Twin 5.25in. floppy drives give a combined 1.2Mbyte on-line storage. At 31lb. the Fox is the heaviest machine in this survey. Fitted with a simple plug connector for Hinet, Digital Microsystems' local area network, which can link up as many as 32 stations. A 15Mbyte hard-disc version costs around £5,000 and can be used as Network Master for a Hinet LAN. Digital Microsystems is an Extel subsidiary.

FOR Easily links to local area network.

AGAINST Heavy. Expensive for standard CP/M machine unless you want to network.

(more on next page)

GAVILAN £3,000

Battery-powered 16-bit portable with advanced user interface. Main Gavilan unit weighs 9lb. and includes an eight-line by 66-character LCD display, 320K 3in. floppy-disc drive and keyboard. The screen folds down over the keyboard for travelling. Optional 5lb. battery-powered printer prints across 80 columns on plain paper up to 8.5in. wide; clips on back of machine. Optional extra disc drive and extra RAM in clip-on package. CPU is the 8088 with 80K of RAM, expandable in stages to 336K; 48K occupied by system software concerned mainly with user interface. Runs MS-DOS. A touch-sensitive panel allows the user to point to graphics symbols on the display using the same sort of approach as the Apple Lisa's mouse.

FOR Sounds wonderful.

AGAINST Not here yet.

GRID COMPASS U.S.$8,000

Mains-powered 16-bit portable with bubble memory, unusual display technology and eye-catching design. Weighs 9.5lb. Based around the 8086 processor with the 8087 arithmetic co-processor and 256K of RAM. Uses 384K of bubble memory instead of floppy discs for non-volatile storage. Flat, amber-coloured electroluminescent screen displays 23 lines of 53 characters or 320-by-240 dot graphics; folds down over keyboard for travel. Grid operating system and integrated software for word processing, spreadsheet, database, business graphics and project management. In the U.S. the built-in Modem links into Grid's 24-hour down-line software service. Has sold there mainly as a communications device. Initial U.K. sales likely to be to corporate users.

FOR Good looks. Light weight. Integrated software. Good communications.

AGAINST High price. Too few columns on screen. Not here yet.

HEWLETT-PACKARD 85B £2,184

Mains-powered portable especially suited for scientific and engineering use. Includes a 5in. screen displaying 16 lines of 32 characters, a 32-column thermal printer which can dump the screen contents including graphics and a 210K digital cassette drive with random-access capability, all built into one unit along with the keyboard. The eight-bit processor is custom made by HP. The 20lb. HP-85B comes with 32K of RAM, together with a separate 32K area of RAM, expandable to 544K, configured as a RAM disc. HP Series 80 operating system and the powerful HP Basic included in the price. The speed of the RAM disc and the Basic's ability to handle very long strings are useful in data-logging applications.

FOR Good Basic. Connects to wide range of instruments and disc drives.

AGAINST Small screen. Keyboard does not detach. Quite expensive.

HUSKY £1,983

Ultra-robust battery portable designed for rugged environments. Uses up to 144K of battery-backed CMOS RAM to store data. Standard machine comes with 32K; 144K version costs £3,423. Weighs 4.4lb. and has a four-line by 32-character LCD display and a sealed, flat membrane keyboard. The 40 software-redefinable keys are in a non-standard but generally QWERTY-like layout. Low-power eight-bit NSC-800 CPU executes the Z-80 instruction set. System comes with 32K of ROM containing a Husky operating system, Basic and software to support the built-in RS-232C. IBM 2780 protocol available as an option for Husky-to-mainframe communications. The Husky features in an applications story in *Practical Computing* January 1983.

FOR Tough. Good communications.

AGAINST High price. Non-standard operating system.

HYPERION £2,695

Compact Canadian-built 16-bit mains-powered transportable offering IBM PC compatibility, weighing under 20lb. includes a 7in. amber screen displaying 80 characters by 25 lines, detachable keyboard and twin 320K 5.25in. drives. A single-drive version is available for £300 less. Built around the Intel 8088 processor with 256K of RAM. Some RAM is automatically configured as a RAM disc when the system is turned on. Comes with MS-DOS and is claimed to run most IBM PC software. The price also includes MBasic and the Aladdin database, statistics and calculations packages. Fully reviewed in *Practical Computing*, July 1983. Also available with a slightly different specification under the Ajile brand name from Anderson Jacobson.

FOR IBM PC compatability. Good-quality finish. Quite light.

AGAINST Not cheap. RAM not expandable at present.

(more on page 133)

A complete portable computer with ll size typewriter keyboard, LCD Virtual reen, printer, microcassette facility and chargeable power source all built-in.

Yet a precision machine so small, so htweight, so portable – you can take it ywhere. To readily use it anywhere. e Epson HX-20.

The HX-20 is different. Because it is designed d built to be different.

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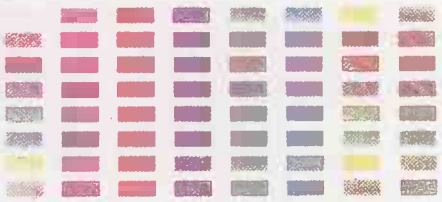

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KAYPRO £1,695

Mains-powered metal-cased 26lb. transportable sold with a range of disc options and a large amount of software. Built around eight-bit Z-80A CPU with 64K RAM. Green 9in. screen displays 80 characters by 24 lines. Two 200K 5.25in. floppy-disc drives standard, or options of 400K twin floppy or one 10Mbyte hard disc plus one 400K floppy. CP/M 2.2, MBasic, Perfect Writer, Perfect Speller, Perfect Calc, Perfect Filer, Profit Plan, Word Plus and some games included in price. The Perfect range of software is integrated, allowing data to be transferred between different applications in the Perfect range.

FOR Good-quality software. Hard-disc option.

AGAINST: Rather bulky. Keyboard not fully detachable.

MIRACLE £1,795

British-made 28lb. mains-powered transportable with large amount of CP/M software included in price and very large memory. Green 10in. screen displays 80 characters by 25 lines. Built-in twin 5.25in. floppies give 800K storage. Standard model has Z-80A, 128K of RAM and five expansion slots. Comes with CP/M 2.2, Micromodeller, Memoplan word processor, Profitplan spreadsheet, Fileplan database, Trendstar communications package and Microcache memory-management system. Microcache speeds things up by using the extra 64K of RAM to hold frequently accessed data in an intelligent way. Planned 16-bit 8086 add-on card gives access to MS-DOS and CP/M-86 software The Z-80 will still work, making the Miracle a true dual-processor portable.

FOR Good-value software. Large screen. Fast cache memory system.

AGAINST New product from new company.

NOMAD £2,236

Robust 3.3lb. battery portable designed for harsh environments, using bubble memory instead of floppy discs for storage. Intended to operate at temperatures from – 30°C to 70°C, and has been on show working while embedded in ice. Two-line by 40-character LCD display. Hermetically sealed full-travel keyboard. Standard layout is ABC, but QWERTY and French AZERTY are options. Built around the Z-80L low-power Z-80 variant which runs at 2.5MHz, with 32K of RAM and 64K to 256K of bubble memory. Runs CP/M, comes with MBasic and is programmable either through the built-in keyboard or external VDU connected via the RS-232C port.

FOR Ultra tough. Runs CP/M software and MBasic programs.

AGAINST Expensive unless you really need the toughness.

OSBORNE 1 £1,495

The original Osborne 1 has been repackaged and the new Osborne Executive, pictured here, added to the range. Both machines are eight-bit mains-powered transportables based on the Z-80A processor. The 23lb., £1,495 Osborne 1 now comes with two double-density 5.25in. floppy drives with a combined capacity of 184K, 64K RAM and a 5in. screen with an 80-column card to improve the old 53-character by 24-line display to 80 characters. The £1,995 Executive has a 7in. amber screen, two 200K drives and 128K of RAM. Both systems come with CP/M, WordStar, Mailmerge, Supercalc, CBasic and MBasic in the price, and can read some non-Osborne disc formats. The Executive offers additionally the UCSD p-system, Personal Pearl, terminal-emulation software and CP/M Plus.

FOR Good value with lots of eight-bit software. Well known name

AGAINST Fixed keyboard. Osborne 1 has small screen and low disc capacity.

SCORPION £5,950

Unusual 16-bit mains-powered transportable intended primarily for use with the APL languge and built around the powerful 68000 processor. Uses the S-100 bus system to give hardware flexibility, although this results in a 29lb. weight. A 9in. green screen displays 24 lines of 80 characters. The non-detachable keyboard generates both the ASCII and the full APL sets. One 720K 5.25in. floppy drive is the minimum configuration, but twin 1.2Mbyte floppy drives and a 10Mbyte hard disc are also available; 256K RAM expandable to 1Mbyte. A 68000 Assembler and Mirage multi-tasking, multi-user operating system are included in price. APL is extra — about £1,200 including training.

FOR Powerful APL system, S-100 bus. Multi-user and network options.

AGAINST Heavy. Expensive for non-specialised use.

(more on page 135)

SHARP PC-5000 — under £3,000

Advanced 16-bit battery-powered portable similar in concept to the Gavilan with optional bubble memory. Weighs 11lb. and includes an eight-line by 80-character LCD display which folds down over the keyboard for carrying. The 8088 processor runs MS-DOS. Standard RAM is 128K, expandable to 256K, and an optional 128K of bubble memory can be fitted. Microsoft GW Basic comes in ROM, with space for a further 128K of application software in ROM cartridges. Optional 80-column clip-on thermal impact printer will also work on ordinary A4 typing paper if a ribbon is fitted. Fitted with an audio-cassette interface; optional 320K 5.25in. floppy discs available along with a direct-connect Modem in the United States, if not here.

FOR MS-DOS software. Compact unit. Bubble-memory option.

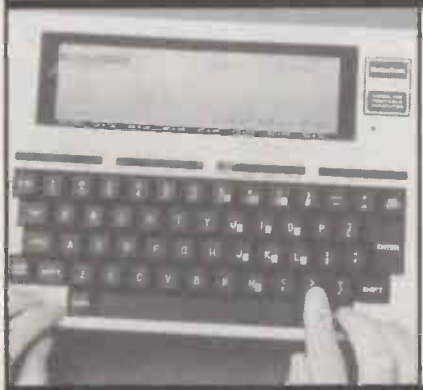
AGAINST Not yet here.

SORD — £2,350

Compact 19lb. mains-powered transportable with very large LCD display and Sony 3.5in. micro-floppy drives. Built around a Z-80 addressing 128K of RAM. The eight line by 80-character LCD display panel is over a foot long. The two Sony 3.5in. micro-floppy drives provide 520K storage. Sord SB-80 operating system claimed to be CP/M compatible. Runs Sord Basic and Plps, a combined spreadsheet, card index and programming language. Pips and the non-portable version of the M-23 were reviewed in *Practical Computing* July 1982.

FOR Good disc and memory capacity for the weight. Big LCD display.

AGAINST A bit pricey — and is it really a standard CP/M machine?



TANDY 100 — £499

Battery-powered lightweight portable similar in appearance to the Epson HX-20, but with more software and larger display in place of printer and microcassette. Weighs just under 4lb. and has an eight-line by 40-character LCD display and a good-quality full-size keyboard. The processor is the 80C85 eight-bit CMOS 8085 look-alike. From 8K of RAM; the 32K maximum-RAM system costs £730. For mass storage you have to use a domestic audio cassette. The 32K ROM contains an own-brand operating system, a good text editor, and limited address list and personal scheduler programs, along with communications software for use with the machine's RS-232C. Made in Japan by Kyocera for the Tandy Corporation. Reviewed *Practical Computing*, August 1983.

FOR Large LCD display. Excellent keyboard. Built-in software.

AGAINST Small mass storage. Little independent local software as yet.

ZITA — £1,595

Mains-powered transportable range with large number of disc options. The 28lb. Zita P is the more rugged industrial version. Built around the Z-80A with 64K RAM, expandable to 256K, twin 125K 5.25in. floppies and a 10in. screen displaying 80 characters by 25 lines. The machine comes with CP/M 2.2 hidden behind a front-end menu system. A £500 voucher for software lets you choose application software from ITCS's list. The 25lb. Zita E, pictured here, is for executive use and comes with a leather case. The top-end model at £5,295 has a built-in 24Mbyte hard disc and 1Mbyte floppy drive and comes with a £2,500 software voucher.

FOR Wide range of options

AGAINST Keyboard not detachable. Some models rather heavy.

ZORBA — £1,595

Good-value mains-powered 21lb. transportable with CP/M software included in price. Green 7in. screen displays full 80 characters by 25 lines. Built around eight-bit Z-80A chip and 64K RAM with WordStar, Mailmerge, Calcstar, the CBasic compiler, M-80 Assembler, and CP/M 2.2 plus utilities included in price. The Zorba can read or write 5.25in. discs in a number of formats, including Osborne, Superbrain and IBM CP/M-86. A 16-bit 8086 add-on card includes 128K of extra memory, expandable to 256K, and CP/M-86. When running eight-bit CP/M this extra memory can be used as a RAM disc. The Zorba is reviewed in full elsewhere in this issue.

FOR Good-value software. Large discs. Upgradeable to 16 bits.

AGAINST Low-budget feel to the hardware.

ORIC MCP-40

Bill Bennett tries a four-colour printer/plotter that sells for well under £200.

A PRINTER is a useful, even essential addition to many a microcomputer system. Even more desirable but frequently prohibitively expensive is a four-colour plotter. Such a device is now available as the standard printer for the Oric 1 micro. At only £170 it is great value and, furthermore, it can be connected to a number of other micros too.

At first sight, the price seems high compared with the £40 Sinclair ZX printer, but a much higher specification more than justifies the extra cost. It is about half the price of a dot-matrix printer and in many ways is just as flexible. Its only major drawback is that it uses relatively narrow 4.5in. paper.

The Oric MCP-40 offers an entirely different technology from the rival machines. The printing mechanism is made in Japan, and is remarkably similar to that found inside the Sharp CE-150 which is used in conjuction with the PC-1500 pocket computer. The difference is that the MCP-40 is bigger. A printer very similar to the MCP-40 is also sold by Tandy as the CGP-115.

A carousel holds the four tiny ball-point pens which provide the multiple colours. Red, blue, black and green pens are supplied with the machine. Strictly speaking the device is a plotter rather than a printer. The paper is marked by the pen travelling across the paper, and not by something impacting something else as in a conventional printer.

The pen, or rather the carousel, only moves back and forth along the x co-ordinate. Movement in the y direction is achieved by a roller winding the paper up and down. There are 480 steps across the paper and 999 along y-axis. Each step is 0.2mm., which is comparable with the width of the line drawn by the pens.

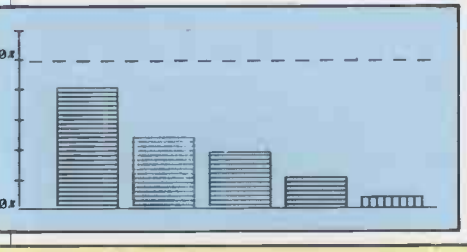
Ordinary paper is used, and it shows no tendency to smudge or blacken like the thermal paper on the ZX printer. It is an ideal size for printing tickets, bills, receipts, etc. and though it may be a little thin and narrow for serious word-processed documents, it will certainly do for any informal notes. Plotting is relatively easy, though using variables within the LPrint strings which control the plotter can be daunting. As a tool for a student it is ideal.

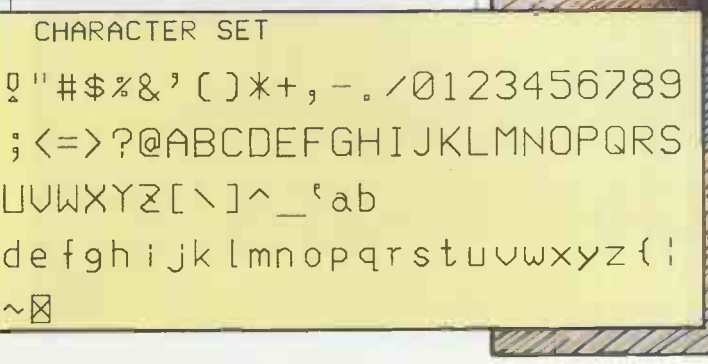
The comprehensive 32-page manual is filled with examples of how to use the printer. A hefty example program shows off the machine's capabilities, which include a full upper- and lower-case character set, pie charts and bar charts.

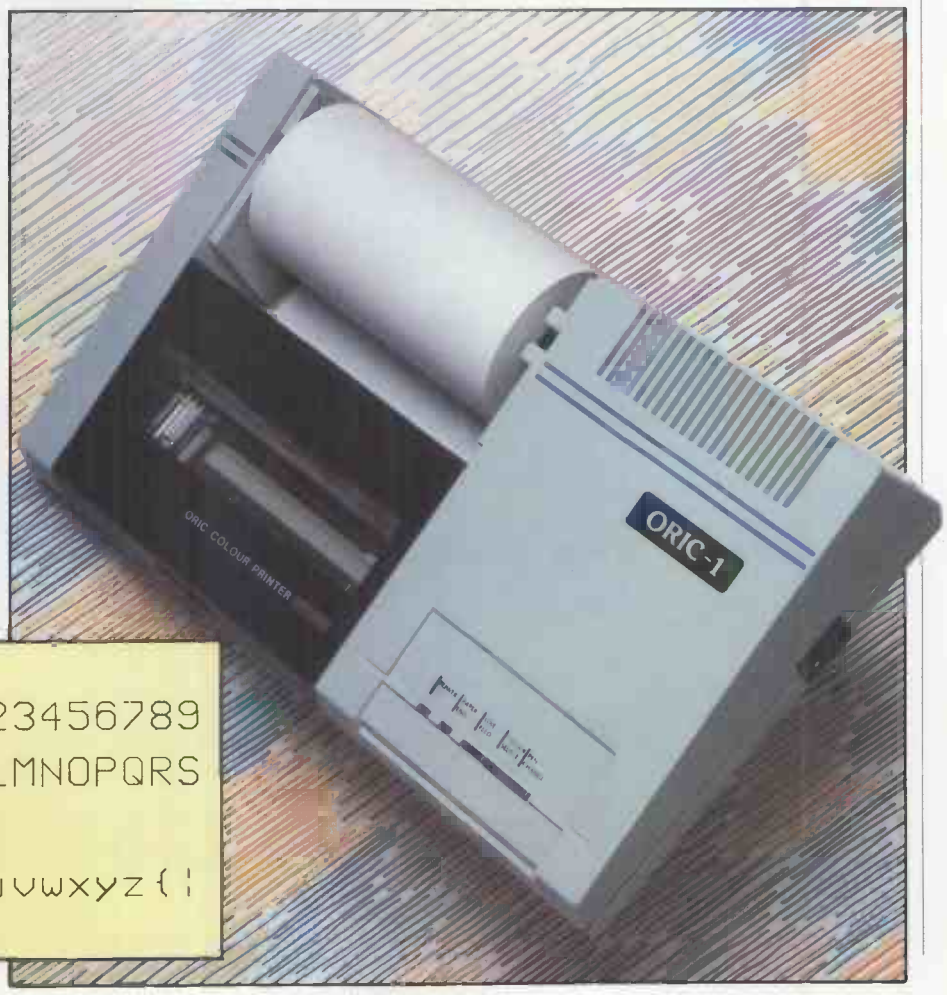
The Oric printer needs a cable to connect it to the micro, and a separate power cable. You will consequently need at least three power sockets for the micro, the TV and the printer — and possibly a fourth one for a recorder.

Conclusions

- **The Oric printer is an excellent low-cost addition to an increasingly attractive-looking computer system.**
- **It produces exceedingly high-quality listings and plots in a wide variety of sizes, and four colours.**
- **It sits comfortably in both price and facility between the cheap thermal printers and the more expensive dot-matrix devices. If anything, it is better value than both.**







BBC games

Neville Maude investigates the lighter side of Acorn's worthy micro.

Snapper

FIRST CAME Pacman and then a host of Gulpmen, Munchymen, Bridgemen and so on. Snapper is thought by many to be better than the original.

The graphics are superb and the action smooth. Vertical and Horizontal keys can be pressed simultaneously, so cornering can be very fast. The programming is intricate and subtle. For example, if the eater gets too close to a guardian it starts to follow the eater relentlessly. And if the score mounts without a death, the guardians become increasingly agitated, moving ever faster.

When a star or power-pill is eaten the guardians turn blue and can be eaten for a while, as is usual with these games. When about to revert to normal state they flash blue and a warning note rises in pitch. After a frame has been cleared another starts: the speed of the guardians increases and the scoring values grow.

Fruits appear in various types according to the frame number. The first round has cherries, the second unripe strawberries and so on. Later a golden bell appears and ultimately the mystic Acorn. The game is addictive and subtle enough to be taken seriously.

Players who find a maximum of four lives insufficient to reach the faster, high-scoring levels can, in most versions of the game, cheat by pressing Escape after the second part of the program, Snap 2, has loaded. Then enter

```
42 ?&FDD=&6
```

or another final figure if you need even more lives, and then Run the program. One improvement which is really needed is a pause facility — for when you have scored, say, 120,000 with a spare life and the phone rings.

Specification

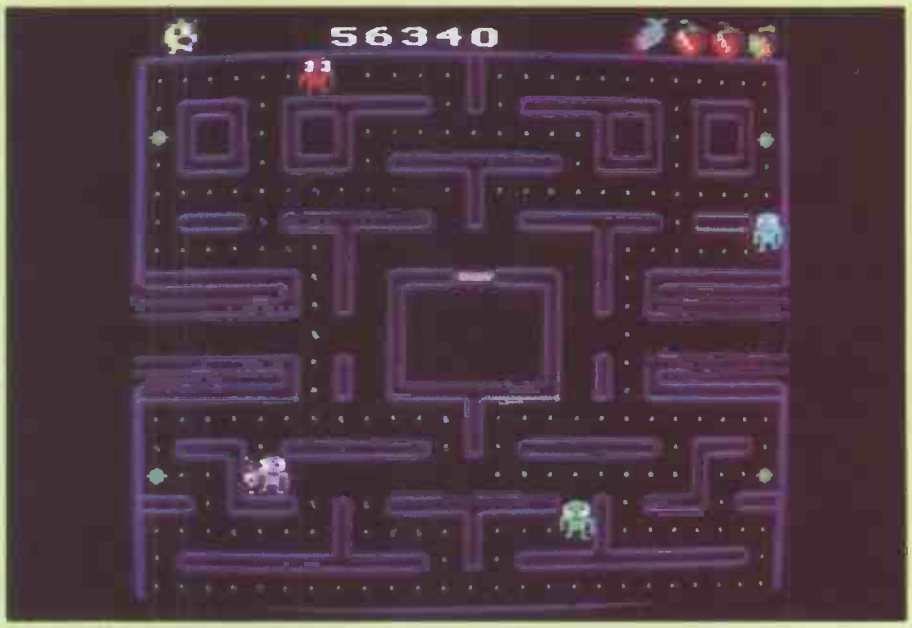
Type: arcade game
Format: cassette tape
System: Model B
Distributor: Acornsoft
Price: £9.95
Rating: 18/20

Monsters

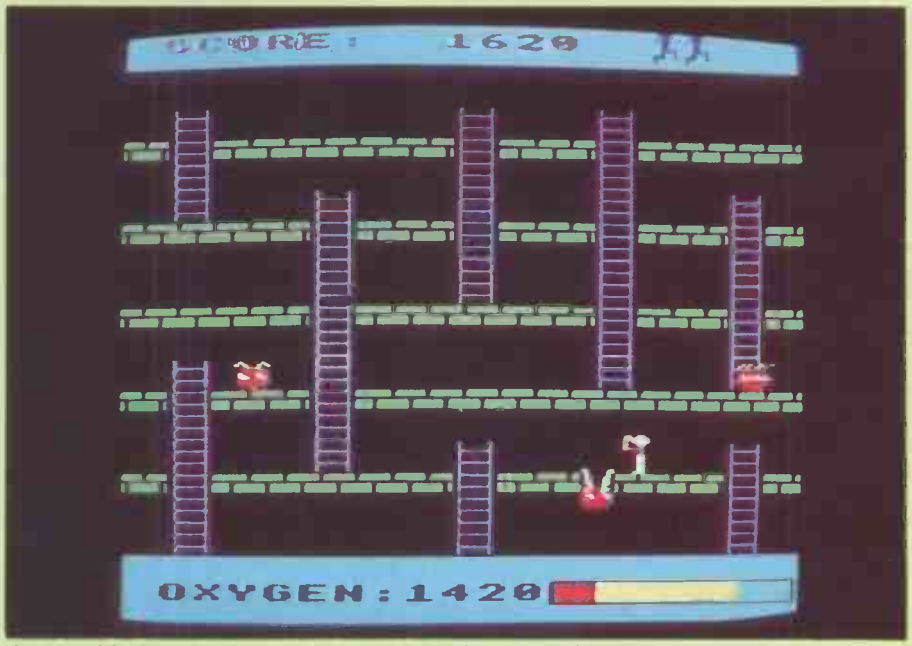
FROM THE SAME STABLE as Snapper comes a similar game which is rather more difficult to play. You have to move your fingers off the horizontal and vertical movement keys to dig the holes used to trap pursuing monsters and then to fill in the holes before the brutes crawl out.

The little man is chased up and down ladders, along walls and eventually expires with a despairing cry. If all monsters are exterminated, a new frame appears with more, tougher monsters. Red monsters are killed by falling through one level, green ones need two, and white ones require three. You have to keep an eye on the oxygen level: if it runs out you die.

Altering the program to give more lives is possible, though harder than with the



Snapper, thought by many to be better than Atari's original Pacman.



Acornsoft's Monsters boasts superb graphics but lacks a pause feature.

allied Snapper. The lives lurk in &1EE5. Inserting a new value should be followed by a Call to &E02. The graphics are superb and there is the usual high-score facility but a pause feature would be a welcome addition.

Specification

Type: arcade game
Format: cassette tape
System: Model B
Distributor: Acornsoft
Price: £9.95
Rating: 15/20

Painter

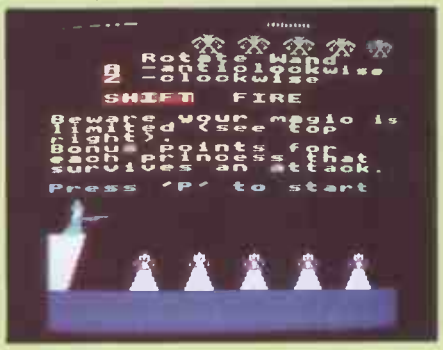
YOUR PAINTER blob glides along lines, which turn white behind it. When a rectangular area is surrounded by white lines it turns a different colour. The score mounts, and speed is rewarded by a bonus. An evil thing chases your industrious painter, and if they meet there is a pitiful squeal with a fluttering reminiscent of a fly captured by a spider.

When the last area has been filled a pulsing display is presented, which some players may find irritating. Another frame follows and, as usual, the scoring rate rises with each successive frame. There are 16 in all so great dexterity and application would be needed to reach the end. Not only do the chasers become faster and more intelligent, their number also increases.

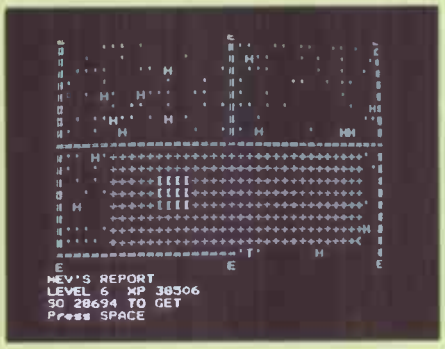
A virtue of this program is the control which the player can assert. There are six levels of difficulty and it is also possible to choose from three sets of keys for operation. Graphics are colourful rather than subtle.

Croaker plays on the frog theme.

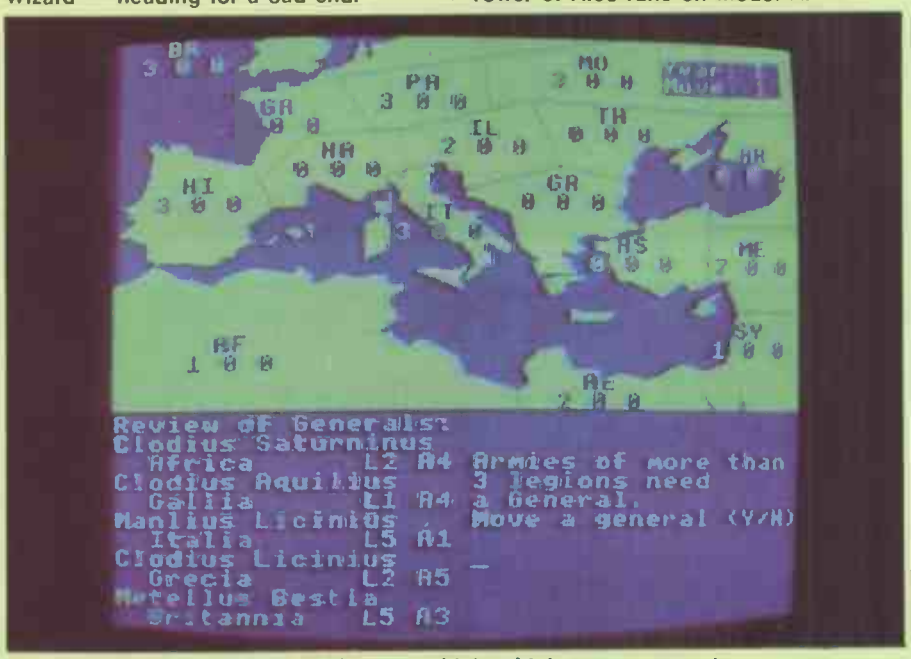

The imaginative Killer Gorilla.



Wizard — heading for a sad end.



Tower of Alos runs on Model A.



The scholarly Emperor from Molimerx could do with better presentation.

Specification

Type: strategy game
Format: disc or cassette tape
System: Model B
Distributor: A + F Software
Price: disc £11.50; cassette £8
Rating: 14/20

Croaker

SINCE ATARI started with a chicken crossing the road there have been many frogs in peril under various titles. Beebug even has an endangered hedgehog. Croaker is a good implementation of the frog theme with a fair number of features. A Beethoven-based jingle can be switched off without requiring those who prefer silent games — and have OS 1.2 — to use the *FX210,1 command to switch off the speaker.

You score with every forward jump, plus 100 for every frog reaching the safety of the depressions in the far river bank. The one on the far left is the hardest to attain and the trick is to jump back on to a left-bound log and then forward again. There is a time-related bonus and when five frogs have been safely guided home the next frame appears, with traffic moving at what appears at first to be an impossible speed. An added complication comes from alligators and snapping turtles in the river.

Children invariably ask why the frogs cannot swim. Acid rain perhaps? The happy, self-satisfied croak produced when the frog settles down gives the game its name. Graphics are fairly good: the frogs are convincing and the road traffic can be recognised as vans, racing cars, tankers, etc., given a little imagination.

A minor criticism is that booby-trapping is imperfect. For example, pressing a cursor key by mistake produces a white rectangle on the screen, and so on.

Specification

Type: arcade game
Format: cassette tape
System: Model B
Distributor: Program Power
Price: £7.99
Rating: 16/20

Tower of Alos

YOU ARE the adventurer, moving on a grid, battling with an assortment of creatures and accumulating treasure. Sub-scenarios include a marsh with lizard-men and aquatic creatures and, of course, the Tower — complete with demons, etc.

Combat strength is preserved by

(continued on page 141)

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PCG/1

BBC games

(continued from page 139)

potions bought in the village. Since the game will be long there is provision to save wealth and experience on tape for a latter session. The lengthy instructions are recorded on the reverse of the tape which stops them being lost. Unfortunately, letters are used to denote places and the adventurer is designated as a £ sign, which seems a little inappropriate.

As written the program is in mode 7, hence the letters. However, if you ask the computer how much memory is left, using command

```
DIM P% – 1: P.HIMEM – P%
```

You get the answer 17287 so, on the Model B, there is plenty of RAM left to shift into mode 6, for example, which permits user-designed characters. Instead of a £ you could use character 240, which is L, and redefine it as

```
VDU23, 240, 152, 152, 252, 190, 189, 188,
  182, 51.
```

This gives a good little warrior with a spear, though you could probably improve on it. Perhaps the programmer kept to mode 7 to ensure the game could be played on a model A machine, and maybe the long-promised Electron too. Alterations could be made by those wishing to cheat. For example, the conditional part of line 1400 could be removed so that it reads

```
1400 P. "IT WAS A STRENGTH POTION":
  HP = L*250: G.1420.
```

This confers unnatural strength and endurance, but do not think it solves all problems. The program can still produce suprises.

Specification

Type: Adventure
Format: cassette tape
System: Model A or B
Distributor. A + F Software
Price: £8
Ratlng: 16/20

Emperor

THE ROMAN EMPIRE during the first few centuries AD is the setting for this war game. It appears to have been written for the Tandy/Genie and then transcribed for the BBC Model B. Emperor could be described as a scholarly game, and schoolmasters will certainly approve. It is also fun. Success depends on making sound judgements, not on speed of reaction or digital dexterity.

There are three levels, corresponding to the first, third or fourth centuries, and each runs over an eight-year period. To win, the player must expand the Empire by two provinces in the first century, hold his own in the third and not lose more than two in the fourth. This is much more easily said than done.

Variable and partially random factors include the abilities of generals and their loyalty, the fighting strength of the Emperor, the activities of barbarians outside the Empire and, to a smaller extent, initial placing and numbers of legions. Of greater importance is the skill with which the player deploys his forces and manages the finances of the realm.

The graphics are no more than adequate. The Atari war games with their scrolling maps set a standard which is hard to match, but the BBC is capable of better than has been achieved here. The translator seems to have been content to reach the former Tandy/Genie standard. A pseudo-animation as employed in the simple Kingdom game in the Welcome cassette could have been used.

A criticism common to many programs is that when a monitor has been used to develop a program it is forgotten that a domestic TV seldom shows the whole picture. While you can easily move the display up or down a line with the *TV255 commands either the top or bottom will be lost.

The program is in Basic which the BBC executes so quickly that there is no need to resort to machine code. There are no Rems so it would be hard to alter the program, which might be just as well. Nevertheless, if you simply cannot get anywhere due to financial problems, they could be solved on your back-up copy by altering line 3620 to, say,

```
C = C*2 – D
```

Subsequently, having solved the other problems the line can be restored to the original for another try.

Specification

Type: war game
Format: cassette tape
System: Model B
Distributor: Molimerx
Price: £15.53
Rating: 16/20

Wizard

IN THIS INTERESTING variation on the "shoot the alien" theme the wizard Chzraal stands at the side of the lake, overlooking several rocks on which maidens are chained. Demons like spider-legged birds descend to carry the girls away. The wizard defends the maidens by using his laser-like wand, which can be rotated in an arc to aim.

When the screen is cleared of demons another wave descends. The demons grow increasingly resistant to the magic as the game progresses. As a variation, the demons sometimes come in sideways, looking rather like killer doves. In this aspect they can be extinguished without great difficulty by using the wand like a hosepipe, but the magic is limited and eventually is used up. Then the wizard is dismembered and the helpless maidens are carried off to an unimaginable fate. This inexorable ending can only be postponed, not prevented, so only the masochistic could take pleasure in playing repeatedly. Adventures can have successful endings, so why not games?

Suppose, for example, that when a score of 2,000 is reached a procedure is called which forms a small pink cloud on to which the wizard and surviving girls move. The cloud then drifts up and off the screen, top right, while the computer plays *Happy Days are Here Again* in the standard three-part harmony from a hash table. Since the program is in Basic modification is not too hard. Alternatively, the first part of line 1800 can be deleted, leaving in the part after Else, to give unlimited magic, though the sad end is only postponed.

Specification

Type: arcade game
Format: cassette tape
System: Model B
Distributor: Quicksilva
Price: £6.95
Rating: 10/20

Killer Gorilla

OF SEVERAL programs derived from King Kong this is certainly one of the best. The damsel in distress stands on a high beam and cries for help. The intrepid player climbs ladders, races along girders, jumps gaps, leaps over rolling barrels or grabs a hammer and smashes a few. He watches out for fireballs and iron beams hurled with animal passion by the furious gorilla and, in the later frames, contends with moving conveyors and elevators.

There are four levels, and if all are completed — which is unlikely for some time — you return to the first one which has acquired more difficulties to be overcome. An extra life appears on completing frame 3.

The graphics are excellent and the program is enlivened by humour. For example, extra points can be earned by collecting the girl's discarded belongings — handbag, umbrella, etc. Again, when boy reaches girl a large red heart flashes on. Such imaginative touches make all the difference.

Specification

Type: arcade game
Format: cassette tape
System: Model B
Distributor: Program Power
Price: £7.99
Rating: 15/20

● Circle No. 185

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Machine:.....
RAM required:.....
Accessories required:.....
Price:.....for cassette/disc/ROM

* * *

Type of game:.....
.....Frogger, Scramble, Pacman type, etc.
Number of players:.....to.....
Object of game:.....
.....
Use of colour/sound:.....
.....
Comments:.....
.....
.....
Your highest score:.....
Rating out of 20:.....

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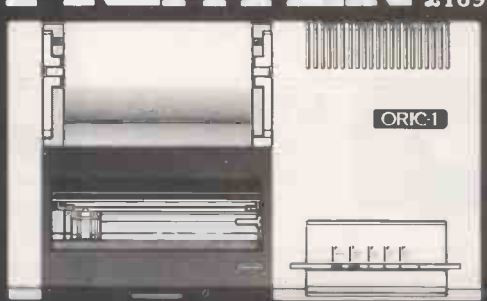

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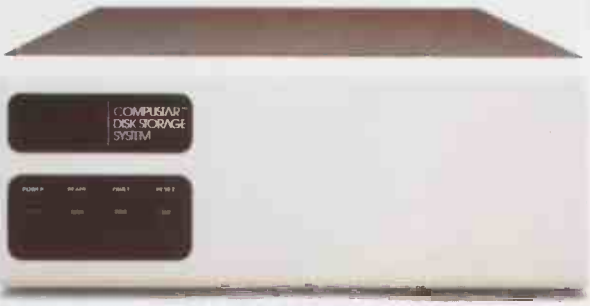

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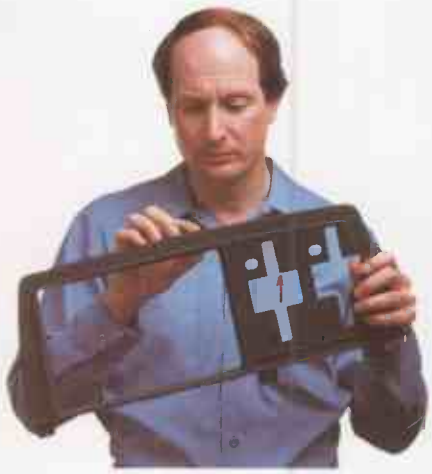

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● Circle No. 188

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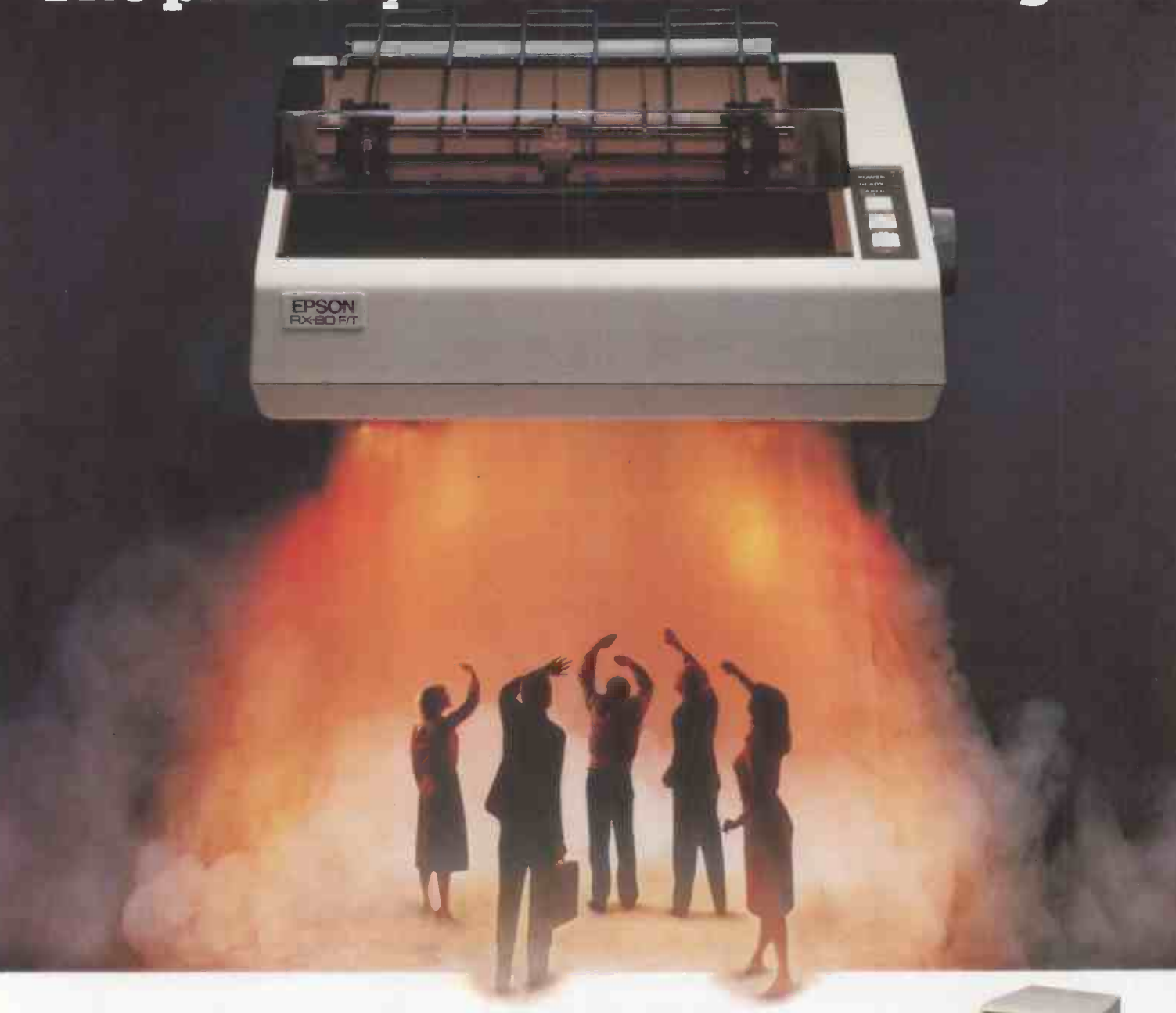

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Open File

This regular section of *Practical Computing* appears in the magazine each month, incorporating Tandy Forum, Apple Pie, Sinclair Line-up and other software interchange pages.

Open File is the part of the magazine written by you, the readers. All aspects of microcomputing are covered, from games to serious business and technical software, and we welcome contributions on CP/M, BBC Basic, Microsoft Basic, Apple Pascal and so on, as well as the established categories.

Contributors receive £30 per published page and pro rata for part pages, with a minimum of £6. Send contributions to: Open File, *Practical Computing*, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Guidelines for contributors

Programs should be accompanied by documentation which explains to other readers what your program does and, if possible, how it does it. It helps if documentation is typed or printed with double-line spacing — cramped or handwritten material is liable to delay and error.

Program listings should, if at all possible, be printed out. Use a new ribbon in your printer, please, so that we can print directly from a photograph of the listing and avoid typesetting errors. If all you can provide is a typed or handwritten listing, please make it clear and unambiguous; graphics characters, in particular, should be explained.

PLEASE send a cassette or disc version of your program if at all possible. It will be returned after use. For CP/M programs use IBM-format 8in. floppy discs.

TANDY FORUM

by John Wellsman

Variable lister

A USEFUL utility which is missing from TRS-DOS comes from Mr A Johnson of Sevenoaks, Kent. It allows you to list all the variables used in a program, with their current values, and makes a very useful debugging tool.

Naturally it is in machine language, but Mr Johnson has incorporated it into only a Basic loader, which most people have no difficulty in using. The program uses the Basic variable table as a list of all variables currently in use and calls the Print routine to display their contents. Because of the way this table is constructed, the variables are listed in the order in which they occur during execution.

The variable table is placed in memory immediately after the Basic program text. Its start address is contained at 40F9 and its end at 40FB. The first byte of each variable in the table is the length of the value entry and defines the type of variable: 2, integer; 3, string; 4, single precision; 8, double precision. The second and third bytes hold the variable name in reverse-order ASCII. The remaining bytes hold the value or length and address if a string. It is only the first three bytes which are of interest here as the program uses the ROM to display the variable contents.

To use the utility, load the program into memory and run it. All that happens is that the message

Loading routine please wait

appears and after a few moments, the Ready cursor reappears. Line 60 of the program self-destroys the Basic text and you can now load or write your program. To call the utility, enter

CMD LIST

Disc users please note that the usual quote after CMD is not used. All the variables used in the program are then shown with their current values.

(continued on next page)

(continued from previous page)

The command can be inserted in a program and obeyed and the program will continue through it. Mr Johnson says that he has not used it with disc but I have, with Newdos, and found no trouble. Obviously, memory should be protected according to the size of RAM available. I strongly recommend any keen programmer to install this utility.

One-key entry

Single-key entry of Basic keywords is an option on a number of micros, and can save an enormous amount of time when typing in long programs. Andy Wright of Crosby has a routine to implement this feature on a 16K level 2 Tandy or Video Genie.

First of all, protect memory at a suitable level. For 16K level 2, this would be 32594 but for larger machines a higher level could be used. After you have typed in the program save it on tape or disc in the usual way. After you have run it you will find that when you type certain shifted keys you will get the keywords shown in the table. Remove the program by typing New, or the program could be made to clear itself after running by changing line 70 to

```
70 NEW
```

Lines 2000 to 2020 control which word is produced by pressing each shifted key. If these numbers are changed, different words may be produced. The program uses the tokens for the keywords minus 127 and if you get the list of tokens for all the keywords you can substitute your own preferences for those in the program. So a shifted A results in the display of the keyword coded 56 which is Auto. If this were changed to 55 the keyword Delete would appear.

Standard errors

Everyone, however expert they may think they are, will always learn a lot just by studying other people's programs, even though the purpose of the program may not be of great interest. A number of errors that people sometimes make also show up. I noticed two programs this month which contained a line similar to

```
5 DEFINT A-Z: CLEAR 500:
```

I suppose that the authors thought they were speeding up the program by using integers only but probably never realised that the command Clear cancels out all previous defining statements, including On Error Goto, and zeros all values, so their programs were back to using single-precision variables. There is a definite order for these preliminary definitions.

Always Clear first then, if necessary, Define your variables and only if required Dim them afterwards. As in the example line, you may not realise that by using the wrong order you have cancelled out what you have tried to do, and there will be no error message to tell you.

Variable lister.

```
10 PRINT:PRINT:PRINT"LOADING ROUTINE,
PLEASE WAIT"
20 FOR I%=32615 TO 32711: READ A%:
POKE I%,A%:NEXT
30 A1=PEEK(16756):A2=PEEK(16757)
40 POKE 16756,103:POKE 16757,127
50 POKE 32622,A1:POKE 32623,A2
60 NEW
70 DATA
229,254,180,40,4,225,195,25,26,42,
249,64,237,91,251,64
80 DATA 223,32,3,225,215,201,229,78,
6,0,33,191,127,9,70,225
90 DATA 229,35,94,35,86,123,254,48,
48,2,30,9,33,200,127,229
100 DATA 54,34,35,114,35,115,35,112,
35,54,61,35,54,34,35,114
110 DATA 35,115,35,112,35,54,44,35,
54,0,225,205,111,32,225,78
120 DATA 6,0,9,35,35,35,24,180,0,0,
37,36,33,0,0,0,35
```

One-key entry.

```
1 'SHORTHAND
5 'BY A.J.WRIGHT
10 FOR I=16815 TO 16817
20 GOSUB 100
30 NEXT I
40 FOR I=32595 TO 32767
50 GOSUB 100
60 NEXT I
70 END
100 READ J
110 POKE I,J
120 RETURN
1000 DATA 195,83,127
1010 DATA 209,197,42,167,64,6,240,205
1020 DATA 96,127,195,116,3,229,62,14
1030 DATA 205,51,0,72,205,73,0,254,32
1040 DATA 48,42,254,13,202,98,6,254
1050 DATA 31,40,56,254,1,202,97,6,17
1060 DATA 103,127,213,254,8,202,48,6
1070 DATA 254,24,202,43,6,254,9,202,70
1080 DATA 6,254,25,202,65,6,254,10,192
1090 DATA 209,254,97,250,162,127,254
1100 DATA 123,250,183,127,119,120,183
```

(listing continued on page 152)

Basic loaders

If you have a machine-language routine which you are thinking of sending to this column it is best to submit it as a Basic loader. To machine-language programmers this is not as interesting and informative as a source coding with remarks, but a Basic loader is much more accessible to readers who do not have assemblers and are unfamiliar with machine language.

(continued on page 152)

One-key entry table.

A Auto	J Input	S Str$
B Chr$	K Left$	T String$
C Cont	L List	U Using
D Data	M Mid$	V Val
E Edit	N Next	W Read
F For	O Poke	X Run
G Goto	P Peek	Y Else
H Gosub	Q Right$	Z Stop
I Inkey$	R Return	

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● Circle No. 190

(continued from page 150)

Mr Palmer of Maidenhead, Berkshire has an interesting suggestion on this point. His listing illustrates the way in which Basic driver programs can be documented when they contain machine-code sections. At the cost of a few extra line numbers, the assembly op-codes have been inserted as Rems alongside their decimal equivalents.

Rapid Run

An excellent arcade-type game has been sent in by Clive Whitehouse of Marple Bridge. He very aptly calls it Rapid Run; if you can get through you have nimbler fingers than mine.

(listing continued from page 150)

```
1110 DATA 40,192,126,35,205,51,0,5,24
1120 DATA 184,205,201,1,65,225,229,24
1130 DATA 176,229,197,214,96,33,
229,127
1140 DATA 6,0,79,9,70,33,79,22,35,203
1150 DATA 126,40,251,16,249,193,209
1160 DATA 120,183,40,16,126,203,191,18
1170 DATA 213,205,51,0,209,19,5,35,203
1180 DATA 126,40,236,235,24,129
2000 DATA 56,120,52,9,30,2,14,18,74,10
2010 DATA121,53,123,8,50,102,
122,19,117
2020 DATA 69,64,118,12,15,22,21
```

Basic loaders.

```
10 REM SAMPLE PROGRAM  - PAINTS  SCREEN
WITH SPECIFIED GRAPHICS
20 REM LOAD  AFTER RESPONDING 31999  TO
MEM SIZE? ON POWER UP
30 REM REPLY 999 TO END
40 GOSUB 120
50 CLS
60 INPUT N
70 IF N=999 THEN 260
80 IF N < 128 OR N> 191 THEN N = 128
90 X = USR(N)
100 FOR X = 1 TO 1000:NEXT X
110 GOTO 50
120 POKE 16526,0: POKE 16527,125
130 FOR X= 32000 TO 32016
140 READ A
150 POKE X,A
160 NEXT X
170 DATA 205,127,10   :REM CALL 0A7F
180 DATA 125          :REM LD A,L
190 DATA 33,0,60      :REM HL,3C00H
200 DATA 119          :REM LD (HL),A
210 DATA 17,1,60      :REM LD DE,3C01H
220 DATA 1,255,3      :REM LD BC,03FFH
230 DATA 237,176      :REM LDIR
240 DATA 201          :REM RET
250 RETURN
260 END
```

Rapid Run.

```
10CLEAR200:DEFINTA-Z:CLS:PRINT@25,
"RAPID    RUN":PRINT@88,STRING$(11,34):
PRINT@530,"DO YOU NEED  INSTRUCTIONS?":
A$="YN":GOSUB999:IFA=2THEN35
20                    CLS:PRINT@25,"RAPID
RUN":PRINT@88,STRING$(11,34):PRINT@150,
"-=INSTRUCTIONS=-       CANOEING  DOWN
THE RIVER  YOU ENCOUNTER RAPIDS!CAN YOU
DODGE  THE ROCKS -  CAN YOU  KEEP  AWAY
FROM THE EDGE
25 PRINTTAB(14)"---  CAN YOU STAY ALIVE
--- ?          USE ARROW KEYS  TO  MOVE
LEFT AND RIGHT
30 PRINT"P.S.  IF YOU  ARE ABOUT  TO HIT
A  ROCK YOU MAY PRESS THE SPACE BARTHIS
WILL  CAUSE YOU TO  LEAP THE  ON COMING
ROCK(YOU  ONLY HAVE  THE  STRENGTH  FOR
FIVE JUMPS)
35   PRINT@914,"ENTER  LEVEL  OF  SKILL
1-3";:A$="123":GOSUB999:D=A
40          CLS:A$=CHR$(173)+CHR$(158):
S=61:A=961:B$=CHR$(140)+CHR$(179)+CHR$(
140):B=31:D$="??":IFD=1B$=CHR$(140)ELSE
IFD=2THENB$=CHR$(166)+CHR$(140)
50  FORX=1TO16:PRINT@A,STRING$(61,63):
NEXT:PRINT@B,A$;
55 POKE16405,0
60 C=PEEK(14590):IFC<32THEN100
70 IFC>127THENC=C-128
80        IFC=32THENB=B-1ELSEIFC=64THEN
B=B+1:GOTO100
90 IFB<1THENB=1
100              PRINT@A,STRING$(S,63);:
PRINT@A+RND(S-3),B$
110 PRINT@B,A$;
120 W=W+1:Z=Z+1:IFZ=5THENS=S-1:Z=0
125 IFS<5THENS=S+1
130 Y=RND(3)-2:A=A+Y:IFA<961THENA=961
140 IFA+S>1021THENA=1021-S
149          IFPEEK(14590)>127THENQ=1:
QQ=QQ+1:IFQQ>5THENQ=0
150 IFQ=1THENQ=0:PRINT@B+64,D$;
200                IFPEEK(15424+B)=63AND
PEEK(15425+B)=63THEN60
299 POKE16405,1
300   IFPEEK(15424+B)=32ORPEEK(15425+B)
=32THENPRINT@0,"FOOL  -  YOU  GROUNDED
YOURSELF";:GOTO400
310  PRINT@0,"YOU  HIT  A  ROCK  -  YOU
DROWNED";
400     PRINT".     BUT     YOU     DID
SURVIVE"W"MOVES.":IFW=14PRINT"WHICH  IS
THE    WORST    YOU    COULD    POSSIBLY
GET!":GOTO500
410        IFW>26OPRINT"THAT          IS
AMAZING!!":GOTO500
420    IFW>22OPRINT"WHICH    IS    VERY
GOOD!!":GOTO500
430  IFW>15OPRINT"YOU ARE ALMOST  DOING
WELL!":GOTO500
440        IFW>10OPRINT"YOU         NEED
PRACTICE!":GOTO500
450 IFW>5OPRINT"YOU HAD BETTER  TAKE UP
A DIFFERENT SPORT!":GOTO500
460 PRINT"THAT WAS PATHETIC!"
500     PRINT@128,"PRESS     'R'     TO
RESTART";:A$="R":GOSUB999:GOTO10
999 B$=INKEY$:IFB$=""THEN999
1000  FORA=1TOLEN(A$):IFB$=MID$(A$,A,1)
THENRETURNELSENEXT:GOTO999
```

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Mousetrap

A 380-Z WITH high-resolution-graphics, extended Basic Version 5.0, level 3.2 graphics and cos 3.4 E/M are required to run this game by Mark Lawson of Stonehouse, Gloucestershire. It is based on Ken Smith's program for the Tandy level II which appeared on page 108 of the April 1981 edition of *Practical Computing*.

Instructions to players appear as Print statements between line 850 and 1000. The other main feature of the program are:

Lines 10-100 define variables and Gosub to printout instructions.
Lines 110-210 draw the playing board.
Lines 220-270 define the random starting positions of you and the mouse and plot the start of your line.
Lines 280-550 are the main part of the program which plays the game.
Lines 560-730 print your score on to the screen.
Line 740 checks if you have the best score, and if so jumps to line 1080.
Lines 750-1070 prints the instructions on the screen using graphics for ** MOUSETRAP ** on the screen.
Lines 1080-1180 are for when you get the best score: they hold a name up to 15 characters long.
Lines 1190-1200 clear the screen using Call "Resolution", and end the program.

Three-dimensional plotter

DANIEL FREEMAN of Ramsgate, Kent has submitted a pair of plotting programs for

(continued on page 157)

Mousetrap.

```
10 REM ************************************
20 REM ** Disk 380z   By Mark Lawson **
30 REM ************************************
40 CLEAR 1000
50 W2=9999
60 ON BREAK GOTO 1190
70 RANDOMIZE
80 PUT 12,31
90 IF R=1 THEN PLOT 30,24,"PENALTY"
100 F=2:R=0:V=0:GOSUB 770
110 FOR X=0 TO 78
120 PLOT X,0,2
130 PLOT X,47,2
140 NEXT X
150 FOR Y=0 TO 47
160 PLOT 0,Y,2
170 PLOT 78,Y,2
180 NEXT Y
190 FOR X=0 TO 8
200 PLOT X,5,2
210 NEXT X
220 X=INT(RND(1)*77)+1
230 Y=INT(RND(1)*46)+1
240 A=1:B=1:Z=77:D=46
250 M=INT(RND(1)*77)+1
260 N=INT(RND(1)*46)+1
270 PLOT M,N,2
280 P=X:Q=Y
290 IF X>9 OR Y>5 THEN J=0 ELSE J=J+1:IF J=25 THEN 560
300 G=GET(0)
310 A$=CHR$(G)
320 IF A$<>"" THEN 500
330 V=V+1
340 PLOT X,Y,2
350 IF POINT(X+A,Y+B) THEN 360 ELSE X=X+A:Y=Y+B:PLOT P,Q,0:PLOT X,Y,2: GOTO 280
360 A1=A:A2=B
370 PLOT X,Y,0
380 IF POINT(X,Y+B) THEN B=-B
390 IF POINT(X+A,Y)=F THEN A=-A
400 IF NOT POINT(X+A,Y+B)=F THEN 290
410 A=-A1:B=-A2
420 IF NOT POINT(X+A,Y+B)=F THEN 290
430 A=A1:B=A2
440 IF NOT POINT(X+A,Y)=F THEN X=X+A:GOTO 290
450 IF NOT POINT(X,Y+B)=F THEN Y=Y+B:GOTO 290
460 IF NOT POINT(X-A,Y)=F THEN X=X-A:GOTO 290
470 IF NOT POINT(X,Y-B)=F THEN Y=Y-B:GOTO 290
480 R=1
490 GOTO 560
500 IF A$="P" OR A$="p" THEN IF M<Z THEN M=M+1:PLOT M,N,2:GOTO 540
510 IF A$="Q" OR A$="q" THEN IF N<D THEN N=N+1:PLOT M,N,2:GOTO 540
520 IF A$="A" OR A$="a"THEN IF N>1 THEN N=N-1:PLOT M,N,2:GOTO 540
530 IF A$="O" OR A$="o" THEN IF M>1 THEN M=M-1:PLOT M,N,2
540 IF A$=" " THEN PLOT M,N,0
550 GOTO 330
560 FOR B=1 TO 10
570 PLOT 28,30," GAME OVER "
580 FOR X=1 TO 100:NEXT X
590 PLOT 30,30,"           "
600 FOR X=1 TO 100:NEXT X
610 NEXT B
620 PLOT 30,30,"GAME OVER"
630 PLOT 27,27,"YOUR SCORE:"
640 IF R=1 THEN V=V+100
650 Q=INT(V/30)
660 FOR I=1 TO V STEP Q
670 PLOT 48,27,STR$(I)
680 FOR TP=1 TO 10:NEXT TP
690 NEXT I
700 PLOT 48,27,STR$(V)
710 IF R=1 THEN PLOT 32,24,"PENALTY"
720 FOR TP=1 TO 2000
730 NEXT TP
740 IF V<W2 THEN W2=V:GOSUB 1080
750 GH=GET(0)
760 GOTO 100
770 CALL"RESOLUTION",0,1
780 PUT 12,31
790 CALL"CHARSIZE",2,2
800 B$="** MOUSE-TRAP **"
810 CALL"STPLOT",30,170,VARADR(B$),1
820 PRINT:PRINT:PRINT:PRINT:PRINT
830 IF W2=9999 THEN PRINT"  best score:" ELSE PRINT"  best score:";W2;"By ";W2$
840 PRINT
850 PRINT"  The object of the game is to trap the"
860 PRINT"bounceing dot (or mouse) in it's cage"
870 PRINT"seen at the bottom left hand corner of "
880 PRINT"the screen."
890 PRINT"  If the dot hits a white line it will"
900 PRINT"bounce off it. To draw lines you should"
910 PRINT"use keys Q,A,O and P."
920 PRINT"   To erase part or all of your line"
930 PRINT"press the space bar and the direction"
940 PRINT"key one after the other"
950 PRINT"   To keep your line growing press the"
960 PRINT"direction key and then press the REPT"
970 PRINT"key, to stop take your finger off the"
980 PRINT"REPT key"
990 PRINT"   If you just box the mouse in you'll"
1000 PRINT"get a penalty of 100 added on your score"
1010 PRINT
1020 PUT 21
1030 INPUT"Press RETURN to start";V$
1040 PUT 23
1050 CALL"RESOLUTION",0,1
1060 PUT 12
1070 RETURN
1080 PUT 12,31
1090 PRINT TAB(13)"YOUR SCORE =";V
1100 LET GH=GET(0)
1110 PRINT TAB(9)"And is todays best score"
1120 PRINT TAB(10)"please enter your name"
1130 PRINT TAB(12)"max. 15 characters"
1140 PUT 21
1150 INPUT W2$
1160 IF LEN(W2$)>15 THEN PRINT"Too many characters":GOTO 1150
1170 PUT 23
1180 RETURN
1190 CALL"RESOLUTION",0,1
1200 END
```

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Actual photograph

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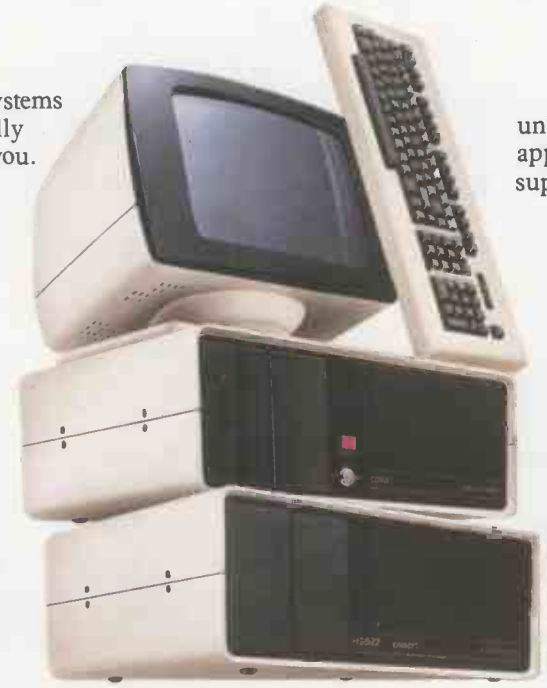

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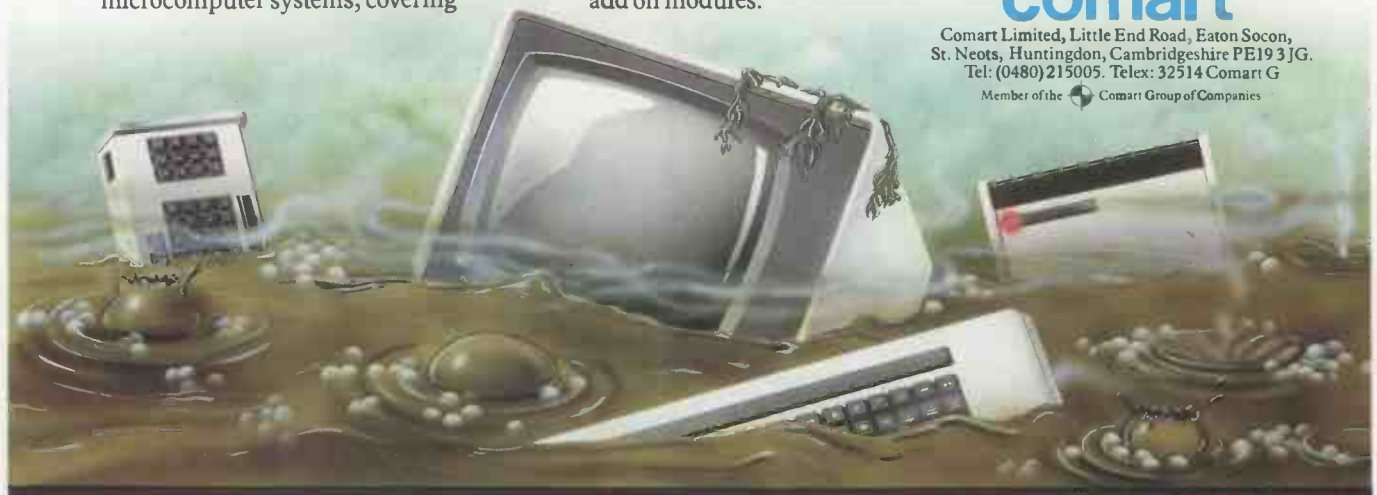

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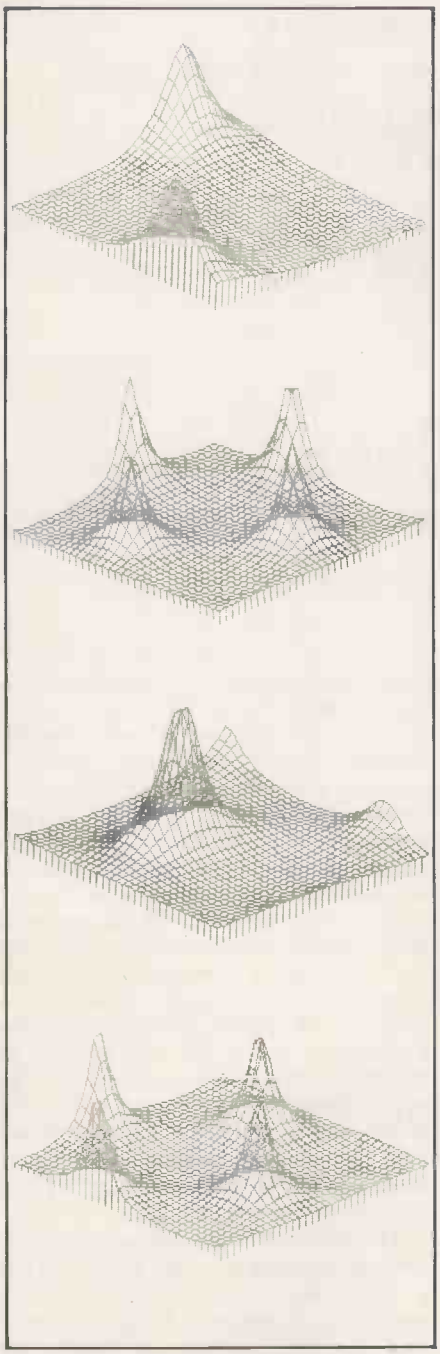
(continued from page 154)

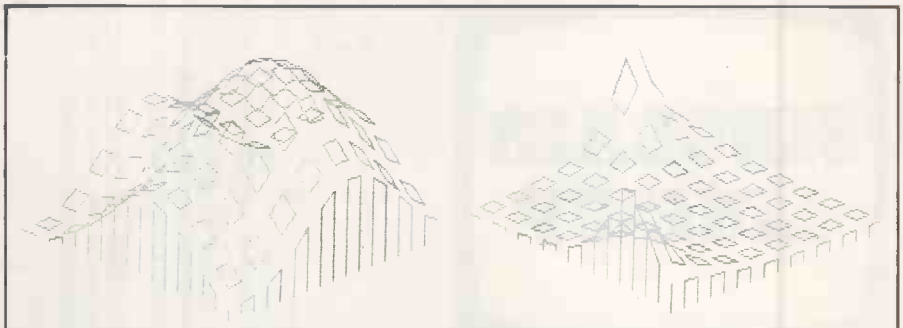
the 380-Z which he describes as "impressive", and we find it hard to disagree. They should be quite easy to convert to run on other machines such as the Spectrum or Dragon 32.

The shape of the graph is determined by the function in line 50 of each program. Try running the program with the following alternative functions of sine and cosine used in that line:

```
50 DEF FNA(A) = 1/(COS(X/2) * COS
   (Y/2) + 1.1)
50 DEF FNA(A) = 1/(COS(X) * SIN (Y) + 1.1)
50 DEF FNA(A) = 1.5/(COS(X) * SIN
   (Y/2) + 1.1)
50 DEF FNA(A) = 1.5/(COS(X) * SIN
   (Y/3) + 1.1)
50 DEF FNA(A) = 1/(COS(X) * COS(X) *
   COS(Y) + 1.1)
```



Output from listing 1 with four different functions in line 50.



(SIN(X/3)*2)^3 + (SIN(Y/3)*2)^3

1/(COS(X/2) * COS(Y/2) + 1.1)

Output from listing 2 with two different functions in line 50.

Three-dimensional plotter listing 1.

```
10 REM 3D GRAPH PLOTTING ROUTINE BY DANIEL FREEMAN.
20 CALL"RESOLUTION",0,2
30 PUT 12
40 CALL"OFFSET",0,-70
50 DEF FNA(A)=(SIN(X/3)*2)^3+(SIN(Y/3)*2)^3
60 FOR Y=0 TO 8 STEP .25
70 LET A$="PLOT"
80 FOR X=0 TO 8 STEP .25
90 CALL A$ ,20*(Y+X),(Y-X+2+FNA(A))*6,3
100 LET A$="LINE"
110 NEXT X
120 CALL"LINE",20*(Y+8),(Y-X+2)*6,2
130 NEXT Y
140 FOR X=0 TO 8 STEP .25
150 CALL"PLOT",20*X,-6*X+12,2
160 LET I=2
170 FOR Y=0 TO 8 STEP .25
180 CALL"LINE",20*(Y+X),(Y-X+2+FNA(A))*6,I
190 LET I=3
200 NEXT Y
210 NEXT X
```

Three-dimensional plotter listing 2.

```
10 REM 3D GRAPH PLOTTING ROUTINE BY DANIEL FREEMAN.
20 CALL"RESOLUTION",0,2
30 PUT 12
40 CALL"OFFSET",0,-70
50 DEF FNA(A)=(SIN(X/3)*2)^3+(SIN(Y/3)*2)^3
60 FOR Y=0 TO 8 STEP .5
70 FOR X=0 TO 8 STEP .5
80 IF X=INT(X) THENLET A$="PLOT" ELSE LET A$="LINE"
90 CALL A$ ,20*(Y+X),(Y-X+2+FNA(A))*6,3
100 NEXT X
110 CALL"LINE",20*(Y+8),(Y-X+2)*6,2
120 NEXT Y
130 FOR X=0 TO 8 STEP .5
140 CALL"PLOT",20*X,-6*X+12,1
150 LET I=2
160 FOR Y=0 TO 8 STEP .5
170 IF Y=INT(Y) THEN LET A$="LINE" ELSE LET
    A$="PLOT"
180 CALL A$,20*(Y+X),(Y-X+2+FNA(A))*6,I
190 LET I=3
200 NEXT Y
210 NEXT X
```

SINCLAIR LINE-UP

Pawn

THE GAME of Pawn for a 2K Sinclair ZX-81 is based on the pawn moves in chess, but is the played on a three-by-three grid. You can move forward one square or capture on the diagonal. The computer is the Xs moving down and you are the Os moving up. The first player to find he or she cannot move is the loser.

The game can probably be squeezed on to a 1K machine if you use some of the standard memory-saving techniques.

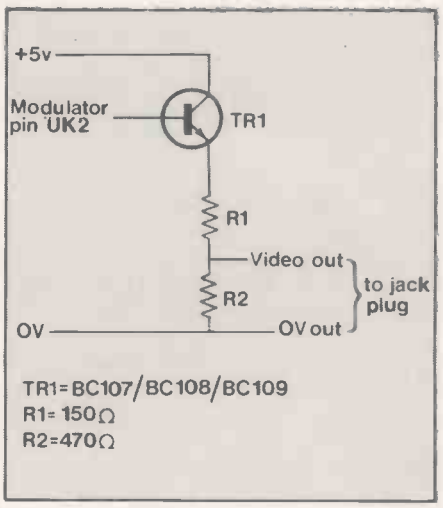
Pawn.

```
  10 RAND
  20 DIM A(9)
  30 DIM B(3)
  40 FOR A=1 TO 9
  50 LET A(A)=ABS (-61*(A<4)-27*
(A>3 AND A<7)-52*(A>6))
  60 NEXT A
  70 LET B(1)=4
  80 LET B(2)=2
  90 LET B(3)=3
 100 FOR Z=1 TO 5
 110 FOR B=1 TO 2
 120 IF Z=3 THEN LET B=2
 130 IF Z=4 AND B=2 THEN GOTO 15
0
 140 IF A(Z)=61 AND A(Z+(B))=52
THEN GOTO 230
 150 NEXT B
 160 NEXT Z
 170 LET Y=0
 180 LET Z=INT (RND*6)+1
 190 LET Y=Y+1
 200 IF A(Z)=61 AND A(Z+B(B))=27
 THEN GOTO 230
 210 IF Y<15 THEN GOTO 180
 220 PRINT "I CONCEDE ";W
 230 LET A(Z+B(B))=61
 240 LET A(Z)=27
 250 GOSUB 320
 260 INPUT A$
 270 LET A(CODE (A$)-28)=27
 280 LET A(CODE (A$(2 TO ))-28)=
52
 290 GOSUB 320
 310 GOTO 100
 320 CLS
 330 PRINT
 340 PRINT
 350 FOR A=1 TO 9
 360 PRINT CHR$ (A(A));
 370 IF 3*(INT (A/3))=A THEN PRI
NT
 380 IF 3*(INT (A/3))=A THEN PRI
NT
 390 NEXT A
 400 PRINT AT 2,6;"123";AT 4,6;"
456";AT 6,6;"789"
 410 RETURN
```

Monitor interface

A CIRCUIT DIAGRAM for an improvement of David Sinclair's monitor interface comes from S D Sollé of Reculver, Kent. The circuit can be also fitted under the ZX-81 in the recess above the modulator. A small 3.5mm. jack plug can be fitted on the side of the case for quick disconnection.

The +5V and 0V lines are attached to the voltage regulator. This circuit produces a crisp image on a Crofton 10MHz monitor.



Spectrum security

ONE OF THE less satisfactory aspects of Sinclair Basic from the point of view of those people who have limited RAM is that each and every number is stored in two forms in the text, writes Gordon Grant of Radcliffe, near Manchester. First comes the series of ASCII-coded digits which you see on the screen, followed by Control-14, followed by the five-byte floating-point representation which the processor likes to work with.

The first representation appears to be used only for the purposes of the screen display, while the second form is the "official" version. This fact may be exploited to produce a program which reads differently to the manner in which it runs. Apart from being amusing in itself, the careful insertion of misleading numbers into the text could be useful in outwitting illicit program copiers. Obviously, discretion is the name of the game. Gosub 0 may be funny, but would be a complete giveaway.

The Confusion routine is intended to be appended to a program and used to alter the text, if desired, every time a number is encountered. No attempt has been made to allow for moving the text up to fill any resulting gaps, or down to permit the amended number to be longer than the spaces available.

I had considered filling unused spaces with strings of spaces and Cursor-Lefts but although this is OK as far as screen listsings are concerned, some printer routines, including my own, output a question mark when a spurious control code is encountered, thus giving the game away. The short machine-code routine is used for expanding the tokens, as this can be somewhat time-consuming in Basic.

The routine is written for the Spectrum. A very similar routine could be written for the ZX-81, but a direct conversion would have to take into account the fact that it does not use ASCII, and that the tokens as well as the ROM routine will be different, apart from substituting the appropriate values for Prog, Vars and the screen parameters. Users should also note that this routine must be run from its start, since A is expected to be the first entry in the variable-list table.

The amended program works exactly as the original. However, any attempt to edit a misleading line will result in the misleading information being substituted into the official, thus corrupting the program irretrievably — which is the best part of it.

Spectrum security — Confusion.

```
9900 GO SUB 9990
9902 LET LINE=256*PEEK PROG+PEEK (PROG+1)
9903 LET LENGTH=PEEK (PROG+2)+256*PEEK (PROG+3)
9904 IF LINE>=10000 THEN  STOP
9906 GO SUB 9988: IF CY=2 THEN  LET CY=3
9907 PRINT LINE;" ";
9908 INPUT "ENTER NEW LINE NO. ";B$: IF B$="" THEN  GO TO 9914
9910 LET LINE1=VAL B$: IF LINE1<=0 OR LINE1>9999 THEN  GO TO 9908
9912 POKE PROG,INT (LINE1/256): POKE PROG+1,LINE1-256*PEEK PROG: LET LINE=LINE1
9914 GO SUB 9986: PRINT LINE;" ";
9916 FOR K=0 TO LENGTH-1: LET Z=PROG+4+K: GO SUB 9920: NEXT K
9918 PRINT : LET PROG=PROG+K+4: GO TO 9902
9920 LET Y=PEEK Z: IF Y<>34 THEN  GO TO 9926
9922 PRINT CHR$ Y;: LET K=K+1: LET Z=Z+1: LET Y=PEEK Z
9923 IF Y<>34 THEN  GO TO 9922
9924 PRINT CHR$ Y;: RETURN
9926 IF Y<>234 THEN  GO TO 9934
9928 POKE USR+1,Y-165: RANDOMIZE USR USR
9930 LET K=K+1: LET Z=Z+1: LET Y=PEEK Z
9931 IF Y<>13 THEN  PRINT CHR$ Y;: GO TO 9930
9932 RETURN
9934 IF (Y>31 AND Y<40) OR (Y>47 AND Y<59) THEN  PRINT CHR$ Y;: RETURN
9935 IF (Y>62 AND Y<92) OR (Y>94 AND Y<165) THEN  PRINT CHR$ Y;: RETURN
9936 IF Y>164 THEN  GO SUB 9950: RETURN
9938 IF Y=13 THEN  RETURN
9940 IF Y=14 THEN  LET K=K+5: RETURN
9942 IF Y=41 OR Y=46 OR Y=93 THEN  PRINT CHR$ Y;: RETURN
9944 IF Y>31 THEN  PRINT CHR$ Y;: GO TO 9951
9946 RETURN
9950 POKE USR+1,Y-165: RANDOMIZE USR USR
9951 IF PEEK (Z+1)=32 THEN  PRINT " ";: LET K=K+1: LET Z=Z+1: GO TO 9951
9952 IF PEEK (Z+1)<48 OR PEEK (Z+1)>57 THEN  RETURN
9954 LET Z=Z+1: LET J=0: LET A$=""
9956 IF PEEK (Z+J)<>14 THEN  LET A$=A$+CHR$ (PEEK (Z+J)): LET J=J+1: GO TO 9956
9958 FOR L=0 TO 4: POKE VARS+L,PEEK (Z+J+L+1): NEXT L
9960 GO SUB 9988: IF CY=3 AND CX-J<1 THEN  LET CY=4
9962 PRINT A$;: PRINT AT 0,0;C$: PRINT AT 0,0;"Really ";A;J;" CHARS MAX."
9966 GO SUB 9986: INPUT B$: IF B$="" THEN  RETURN
9968 IF CODE B$(1)<48 OR CODE B$(1)>57 OR LEN B$>J THEN  GO TO 9966
9969 IF LEN B$<J THEN  FOR L=LEN B$+1 TO J: LET B$=B$+" ": NEXT L
9970 FOR L=1 TO J: POKE Z+L-1,CODE (B$(L)): NEXT L: RETURN
9986 POKE 23688,CX: POKE 23689,CY: RETURN
9988 LET CX=PEEK 23688: LET CY=PEEK 23689: RETURN
9990 CLS : LET A=0: LET C$="                                ": LET C$=C$+C$
9991 GO SUB 9996: RESTORE 9993: INPUT "ENTER ADDRESS FOR USR ";USR
9992 FOR K=USR TO USR+4: READ L: POKE K,L: NEXT K
9993 DATA 62,0,195,16,12
9994 LET VARS=PEEK 23627+256*PEEK 23628+1
9995 LET PROG=PEEK 23635+256*PEEK 23636: CLS : PRINT AT 2,0;"": RETURN
9996 PRINT "          CONFUSION": PRINT : PRINT "The idea of this program is to
enable the user to enter false  numeric data into a programme.": PRINT "Every ti
me a number is found in the text you will be prompted toenter an alternative val
ue."
9997 PRINT "If you don't wish to change it, press <ENTER>. Otherwise type inthe
value you want, first. Note that the 'real' value is not    changed, only the te
xt value."
9998 PRINT "The present true value is shown at top left. The maximum number of c
haracters allowed is at top centre."
9999 PRINT "You can also change the line    numbers, but this is for real.  You
will now be asked to enter  the address where a 5 byte      machine code routine
 may be put.": RETURN
```

COMMODORE CORNER

by Mike Todd

Is anybody there?

WHEN USING external devices on the Pet it is often important, and sometimes vital, to know if the device is actually connected correctly and switched on. With only one device connected to the IEEE bus it is likely that a Device not Present error will be generated. With one or more other devices, such as a printer, it is possible that this error will not be generated because other devices on the bus may perform the correct handshaking sequence and characters sent to a disconnected printer may actually be received, but ignored, by the disc drive.

Andy Scott of Stockport has come up with a short machine-code program that checks if a specified device is actually present and operating correctly. It could usefully be incorporated into programs which need the extra reliability of knowing that a device is responding.

Listing 1 is the machine code as used with a Basic 4 machine and it resides at the top end of memory. As a result, it is vital that this area is protected by lowering the Top of Memory pointers using the following sequence before the machine code is entered:

POKE 52,160: POKE 53,127: CLR

Once loaded, the device number is Poked into 32750 and the routine executed by Sys 32672.

There are two flags set by the program. The first, at 32751, will be set to 1 if there is no response from any device on the IEEE bus and the second, at 32752, is 1 if the specified device does not respond. At the start and end of the program, the accumulator X and Y registers are saved, although this is not absolutely essential and can be omitted if the program is being accessed from within a Basic program.

Andy Scott has also provided a Basic 2/3 version which I have modified slightly so that it can be used in the second cassette buffer. It is given in the form of a Basic loader program in listing 2. I have used a check-sum to check that the Data statements were entered correctly. In this version, location 898 holds the device number, with 899 and 900 holding the two flags. There is also a simple Basic program, shown in listing 3, which demonstrates the use of the program. It is not possible to test for the presence of devices 0 to 3, so the Basic program must trap these device numbers if they are entered.

Anybody there? — listing 1.

```
7FA0 08       PHP       Save Status Register
7FA1 48       PHA       Save Accumulator
7FA2 8A       TXA
7FA3 48       PHA       Save X Register
7FA4 98       TYA
7FA5 48       PHA       Save Y Register
7FA6 A000     LDY #00
7FA8 8CEF7F   STY 7FEF  Clear 'nothing in Bus' flag
7FAB 8CF07F   STY 7FF0  Clear 'device not present' flag
7FAE 84D1     STY D1    Length of file name = 0
7FB0 88       DEY
7FB1 84D2     STY D2    Logical file number = #FF
7FB3 84D3     STY D3    Secondary address=#FF (equivalent to 0 in Basic)
7FB5 ADEE7F   LDA 7FEE  POKEd device number from main programme
7FB8 85D4     STA D4    Device to be tested
7FBA 2063F5   JSR F563  Open file subroutine
7FBD 20D5F0   JSR F0D5  Send LISTEN address (MLA),(ATN=0). If no devices
                        present on Bus returns with status word = #80
7FC0 2048F1   JSR F148  Set ATN=1
7FC3 A596     LDA 96    Status word
7FC5 1005     BPL 7FCC  Branch if no error
7FC7 EEEF7F   INC 7FEF  If error (ie. no device on Bus) set relevant flag
7FCA D012     BNE 7FDE  unconditional jump to 7FDE
7FCC A5D4     LDA D4    ) Store current output
7FCE 85B0     STA B0    ) device in B0
7FD0 A900     LDA #00
7FD2 2046BB   JSR BB46  ) Send CHR$(0) to device twice. If relevant device
7FD5 2046BB   JSR BB46  ) is not present, returns with Status word=#80
7FD8 A596     LDA 96    Status word
7FDA C980     CMP #80   Is it #80 (refer to note below)
7FDC D003     BNE 7FE1  Branch if no error (ie. relevant device is present)
7FDE EEF07F   INC 7FF0  if relevant device not present, set appropriate flag
7FE1 20B6BB   JSR BBB6  Send UNLISTEN on Bus (ATN=0). Set ATN=1. Restore
                        normal input/output devices (keyboard/screen)
7FE4 20E0F2   JSR F2E0  Close file subroutine
7FE7 68       PLA
7FE8 A8       TAY       Retrieve Y Register
7FE9 68       PLA
7FEA AA       TAX       Retrieve X Register
7FEB 68       PLA       Retrieve Accumulator
7FEC 28       PLP       Retrieve Status Register
7FED 60       RTS       Return from subroutine
7FEE 00                 Device number is POKEd in here
7FEF 00                 Flag for 'nothing on Bus'
7FF0 00                 Flag for 'device not present'
```

Anybody there? — listing 2.

```
1 REM*********************************
2 REM*                               *
3 REM*  IEEE DEVICE TESTER - LOADER  *
4 REM*                               *
5 REM* POKE 898, DEVICE NUMBER       *
6 REM* PEEK(899)=1 IF NOTHING ON BUS *
7 REM* PEEK(900)=0 IF DEVICE PRESENT *
8 REM*                               *
9 REM*********************************
10 FOR I = 826 TO 891
11 READ A: POKE I, A
12 Q=Q+A
13 NEXT I
14 READ A
15 IF Q<>A THEN PRINT"CHECKSUM ERROR"

100 DATA 160,0,140,131,3,140,132,3,132
110 DATA 209,136,132,210,132,211,173
120 DATA 130,3,133,212,32,36,245,32
130 DATA 186,240,32,45,241,165,150,16
140 DATA 5,238,131,3,208,18,165,212
150 DATA 133,176,169,0,32,69,202,32
160 DATA 69,202,165,150,201,128,208,3
170 DATA 238,132,3,32,185,202,32,172
180 DATA 242,96
200 DATA 8195
```

Listing 3.

```
10 INPUT "TEST FOR WHICH DEVICE";D
20 IF D<4 THEN 10
30 POKE 898,D:  SYS 826
40 IF PEEK(899)<>1 THEN 50
45 PRINT"NOTHING ON BUS": GOTO 10
50 IF PEEK(900)<>1 THEN 60
55 PRINT"DEVICE";D;"NOT PRESENT": GOTO 10
60 PRINT"DEVICE";D;"IS PRESENT"
70 GOTO 10
```

Super Expander blues

If you have a Vic-20 and are using the Commodore Super Expander cartridge you may well try to generate music using the Print statement while using the graphics capabilities of the Vic.

Although the Print statement used to generate music will not normally print characters on the screen, each statement will normally generate a new line, which could scroll the screen and corrupt graphics on the screen as the music plays. Ron and Sheila Hewett of Gelnorie, Australia, suggest including a Cursor Home at the start of every music string. The effect is to always make this new line occur at the top of the screen so that no scrolling will take place. Of course, a semicolon at the end of the Print statement would also do the trick.

Cavern Quest

Cavern Quest is a simple game for an unexpanded Vic-20. It involves flying a spaceship through a cavern, shooting down aliens as you go.

The Ctrl key is used to move the spaceship up, and the left-hand Shift key moves it down. Return fires the laser.

Two machine-code routines are included to speed things up. The first, accessed by Sys 7464, scrolls the screen one place to the left; the other, Sys 7520, generates part of the cave on the right of the screen.

When you type in the program, all

(continued on page 163)

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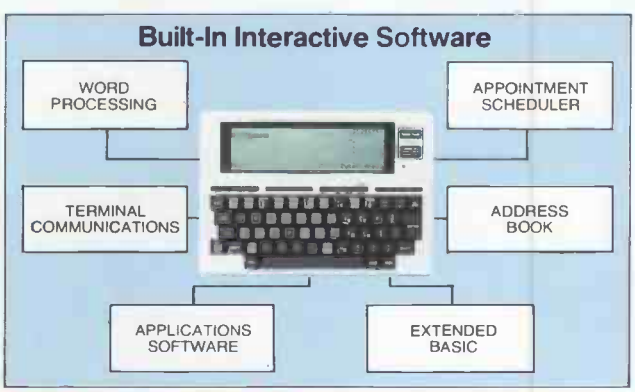

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Cavern quest.

```
1 GOTO 2000
19 PU=PU+DU:DU=INT(RND(1)*5)-2
   :IF PU>10 OR PU<2 THEN PU=7
20 POKE PS,32:POKE PS+SD,5:SYS 7464
   :POKE 7467,150:POKE 7488,13
   :SYS 7464
21 POKE 7467,30:POKE 7488,32
   :POKE PS,36
25 POKE PS+SD,1
30 POKE 1,PU+INT(RND(1)*4):SYS 7520
   :T=T+1
40 FOR I=8141 TO 8141-(11-PU)*22 STEP
   -22:POKE I,35:NEXT
50 POKE PS,32:IF PEEK(653)=4 THEN PS=
   PS-22
60 IF PEEK(653)=1 THEN PS=PS+22
70 POKE PS,36:POKE PS+SD,1
   :IF PEEK(PS+1)<>32 THEN POKE PS+SD,
   10:POKE PS+SD+1,11:GOTO 5000
75 V=7700+22*INT(RND(1)*20)
   :IF PEEK(V)=32 THEN POKE V,33
   :POKE V+SD,5
80 IF PEEK(197)<>15 THEN 19
85 FOR I=PS+1 TO PS+6:POKE 36876,
   (I-PS)*20+120:IF PEEK(I)=33 THEN P
   OKE I+SD,10:GOTO 105
90 IF PEEK(I)=35 THEN SC=SC-20
   :POKE 36876,128:GOTO 110
95 POKE I,31:POKE I+SD,2:NEXT
   :FOR I=PS+1 TO PS+6:POKE I,32
   :POKE I+SD,5:NEXT
100 POKE 36876,0:GOTO 19
105 POKE 36876,0:FOR V=255 TO 128 STE
    P-8:POKE 36877,V:NEXT:POKE 36877,0
110 SC=SC+10:FOR J=PS+1 TO I:POKE J,32
    :POKE J+SD,5:NEXT:POKE 36876,0
115 PRINT"[WHITE,HOME,RVS,RIGHT21,
    DOWN21,LEFT9]~~~~~~~[LEFT6]";SC;
120 IF INT(SC/50 )=SC/50  THEN POKE P
    S,32:PS=PS+1:IF SC=500 THEN 6000
200 GOTO 19
1000 DATA 162,21,169,30,133,2,169,0,
     133,1,160,0,200,177,1,136,145,1,
     200,192,21,208,245
1001 DATA 169,32,145,1,169,22,24,101,
     1,133,1,169,0,101,2,133,2,202,
     208,223,96
1002 DATA 0,0,0,0,0,0,0,0
1003 DATA 0,0,0,0,166,1,169,30,133,2,
     169,21,133,1,160,0,169,35,145,1,
     169,22,24,101,1
1004 DATA 133,1,169,0,101,2,133,2,202,
     208,236,96
1005 POKE 56,28:POKE 36879,27
     :PRINT"[CLEAR]~[RVS]
     ~~~~CAVERN~QUEST~~~~[RVOFF]"
1006 FOR I=7464 TO 7552:READ D
     :POKE I,D:NEXT:GOSUB 8000
1007 FOR I=32768 TO 33063
     :POKE I-25600,PEEK(I):NEXT
1008 FOR I=7416 TO 7463:POKE I,0:NEXT
1009 POKE 7419,255
1010 DATA 40,124,84,124,254,186,146,0
1011 FOR I=7432 TO 7439:READ D
     :POKE I,D:NEXT
1012 DATA 99,216,54,141,99,216,54,141
1013 DATA 0,192,108,255,108,192,0,0
1014 FOR I=7448 TO 7463:READ D
     :POKE I,D:NEXT
1015 PRINT"[RED]~~~PRESS~A~KEY"
1016 GET A$:IF A$=""THEN 1016
1017 FOR T=1 TO 1000:NEXT
1018 RETURN
2000 H=0
2005 GOSUB 1000
2010 POKE 36869,255:SD=30720
2020 DU=0:PS=7902:PRINT"[CLEAR]":SC=0
     :T=0
2030 POKE 36879,12:POKE 36878,143
2040 PRINT"[HOME,DOWN24,WHITE,RVS]
     CT=UP/SH=DOWN/RET=FIR";
2045 PRINT"[HOME,DOWN21,RVS,WHITE]HI
     :";H;"~~SC:";
2047 PRINT"[HOME,RVS,RED,RIGHT3]
     **CAVERN~QUEST**"
2050 POKE 8185,5:POKE 38905,3
2060 GOTO 19
5000 FOR I=255 TO 0 STEP-3
     :POKE 36877,I:POKE 36865,
     RND(1)*20+28:NEXT
5010 FOR I=1 TO 22:SYS 7464:NEXT
5020 POKE 36865,40:PRINT"[HOME,DOWN,
     YELLOW,RVS]YOU~HAVE~CRASHED~!"
5030 IF SC>H THEN H=SC
     :PRINT"[DOWN3,RVS]
     NEW~HI~SCORE~OF~~";H
5040 FOR I=1 TO 4000:NEXT
5050 GOTO 2020
6000 PRINT"[HOME,YELLOW,RVS]
     MISSION~COMPLETED"
6010 PRINT"YOU~GAIN~~";1200-T;
     "~POINTS~FOR~SPEED"
6020 SC=SC+1200-T:GOTO 5030
8000 PRINT"[DOWN,CYAN]
     GAIN~ENERGY~BY~LASER~~BLASTING~A
     LIEN~SUPPLY~SHIPS~IN~THE~PERILOU
     S~CAVERN."
8010 PRINT"[DOWN]BLAST~THE~CAVERN~IF~
     ~~NECESSARY~BECAUSE~YOU~MUST~SUR
     VIVE"
8020 PRINT"[DOWN]CONTROLS
     :~~(CTRL)=UP~~(SHIFT)=DOWN~~~~~~
     ~~~~(RETURN)=FIRE"
8030 RETURN
```

(continued from page 160)

cursor controls are listed in a special convention to make life a little easier. For instance, in line 115, after the quotes you should press White, Ctrl-2, followed by Home, Ctrl-9, 21 Cursor Rights, 21 Cursor Downs and nine Cursor Lefts. The square brackets merely indicate the control characters: don't type them in. The squiggles which follow each indicate a space.

There is an E missing from line 2040: the missing character is Poked directly on to the screen since the length of the line would otherwise have caused the screen to scroll up. Pay particular attention to the Data statements in lines 1000 to 1004. They are the machine-code instructions mentioned earlier.

It is wise to Save the program before running it, as errors in the Data statements could cause the program to crash when it is run.

Disc saver

How often have disc users scratched a file either deliberately or accidentally, and suddenly realised they shouldn't have? Fortunately, the actual data on the disc is not destroyed immediately. Instead its entry in the directory is marked as deleted, making the blocks used by that file available for future use.

Martin Clayden of Liverpool has come up with what can only be described as a life-saver in this situation: it will allow files that have just been scratched to be resurrected. The program asks for the name and type of the file to be restored — Pgr, Seq, Usr or Rel — and proceeds to read through the directory, to find the file, and "unscratch" it.

The directory is held on track 18 in sectors 1, 4, 7 and so on, and the program systematically searches them for the file specified. When it has been found all files contained in the sector are listed on the screen and the program proceeds to amend the entry. Because the directory no longer has a record of what type of file it was, the program must set it according to the information provided at the start of the program.

Once it has been written back to the disc, the tracks used by the file must now be claimed back again so that other files cannot use them. This is done simply by performing a Validate operation.

There are a couple of things to be wary of. Firstly, any attempt to write data to the disc after the file was scratched will probably result in overwriting some of the original file's data. If that has happened the file can no longer be recovered — so don't even try. All sorts of nasty things could happen when the disc is validated.

Also, it is just possible that there could be two deleted files with the same name in the directory; the program will only restore the first. It could have been on the disc for some time and the data will now be well and truly destroyed by other files.

The program only checks sectors 1, 4, 7, 10 and 13 in the directory, a total of 40 files, eight per sector. But the directory actually uses all the sectors on the directory tracks. It is lines 430 and 440 which check this upper limit, and a suitable modification could be included here to raise the upper limit to 18 — or 19 for early disc drives using DOS 1 — and to start again at sector 2 when this is reached. In practice, most discs rarely contain that many files.

Disc saver.

```
100 REM ********************************
110 REM      FILE RESTORE UTILITY
115 REM
120 REM NOT RECOMMENDED FOR USE AFTER
125 REM    ANY DISK WRITE OPERATION
130 REM ********************************

140 TR=18: FO=0: S=1
150 DIM E$(9)

160 REM OPEN DISK CHANNELS
    & INPUT FILE DETAILS
170 OPEN 15,8,15:PRINT#15,"I0"
180 OPEN 2,8,4,"#5
190 INPUT"[CLEAR]FILE NAME AND TYPE
    [HOME,DOWN]";F$,FT$
195 PRINT"[CLEAR]"
200 PRINT#15,"U1";4;0;TR;S
210 PRINT"[RVS]TRACK [RVOFF]";TR;
    "  SEARCHING ENTRY"
220 PRINT"[RVS]SECTOR[RVOFF]";S;"
    [DOWN2]"
230 G=1

240 REM READ 1 FILE ENTRY AT A TIME
250 FOR I=1 TO 256
260 GET#2,N$
265 IF N$<CHR$(32) OR N$>CHR$(90)
    THEN N$=CHR$(46)
270 W$=W$+N$
280 POKE 32836,48+G
290 IF LEN(W$)=32 THEN E$(G)=W$
    : GOSUB 310
300 NEXT I

310 G=G+1
320 IF MID$(W$,6,LEN(F$))=F$ THEN FO=1
    :EN=G-2
330 IF FO=1 THEN PRINT"[RVS]
    FILE FOUND ON SECTOR";S;"[UP]"
    :GOTO 350
340 IF G>8 THEN PRINT"[RVS]
    FILE NOT ON SECTOR";S
350 IF I<256 THEN W$="":RETURN

360 PRINT
380 FOR J = 1 TO 8
390 PRINT E$(J)
400 NEXT J
410 PRINT"[SPACES 40]"
420 PRINT"[HOME]"

430 IF FO=0 AND S<13 THEN S=S+3:W$=""
    :GOTO 200
440 IF FO=0 THEN PRINT"[RVS,DOWN2]
    FILE NOT FOUND":GOTO 550
450 IF FT$="SEQ" THEN FT=129
460 IF FT$="PRG" THEN FT=130
470 IF FT$="USR" THEN FT=131
480 IF FT$="REL" THEN FT=132

490 REM FT SET TO  FILE TYPE
    NOW WRITE TO DISK
500 PRINT#15,"B-P";4;(EN*32)+2
510 PRINT#2,CHR$(FT);
520 PRINT#15,"U2";4;0;TR;S

530 REM CLOSE CHANNELS & UPDATE BAM
540 PRINT#15,"V0"
550 CLOSE 2: CLOSE 15
```

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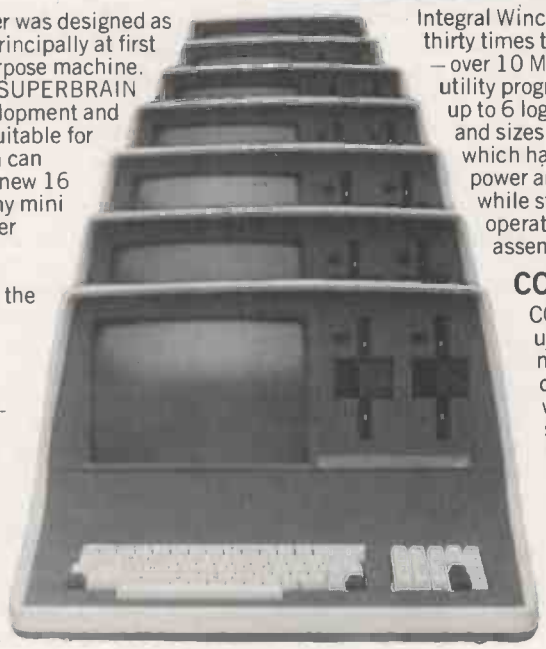

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APPLE PIE

by John Harris

Text on high-resolution screens

ONE SHORTCOMING of the Apple II is the absence of an in-built facility to write text on the high-resolution graphics screens. This disadvantage can be overcome with the help of a set of programs by R Lucas of Wantage.

The two-program package enables users to mix text of different scales and orientations with graphics anywhere on both high-resolution screens. The first, Character Set Loader, creates a binary file of a shape table consisting of 65 characters. Once run it is no longer needed. The second, Hi-Res Text, serves to demonstrate the character set on screen 1 and an example histogram on screen 2.

With a few modifications, Hi-Res Text becomes a very effective utility for planning the layout of text with graphics on one or both high-resolution screens. A final five-line example listing shows how little code is needed to incorporate the technique in a user program.

Hi-Res Text loads the shape table into memory and provides separate displays of mixed text and graphics on HGR1 and HGR2. Screen 1 shows the character set shape numbered for reference, and on screen 2 a histogram is used to display a variety of text, scales and rotations. Escape toggles between them.

Changing high-resolution screens with soft switches does not necessarily allow the user to Draw or HPlot on the screen being viewed. HGR1 and HGR2 commands not only clear their respective screens but also decide which screen is used for subsequent plotting. To overcome this use Poke 230,32 prior to HPlot/Draw on screen 1 and Poke 230,64 for screen 2.

Once you have seen the example techniques demonstrated within Hi-Res Text, the source can be converted to a utility for developing layouts of graphics and text. To do this enter:

```
DEL 20,100
DEL 150,630
DEL 670,810
100 REM HI-RES TEXT/M
150 HOME:HGR:HGR2
160 HCOLOR=3:ROT=0:SC=1
1142 INPUT "SCREEN (1 OR 2)?"; Z
1143 IF Z=1 THEN Z=32
1144 IF Z=2 THEN Z=64
1145 IF Z<32 THEN 1142
1146 REM CHOOSE SCREEN
1147 POKE 230,Z
```

A permanent record of entries made to the utility is needed if the results are to be hard coded into another program. A pencil and paper might suffice, or you could go the whole hog and incorporate a Print routine to give a direct hard copy of all commands.

Character Set Loader.

```
20  REM   CHARACTER SET LOADER
30  REM
40  REM   FOR
50  REM
60  REM   APPLE II HI-RES TEXT
70  REM
80  REM   BY  R LUCAS
90  REM

100  DATA  65,0
110  DATA  132,0,134,0,142,0,151,
     0,176,0
120  DATA  195,0,210,0,228,0,233,
     0,243,0
130  DATA  253,0,15,1,26,1,32,1,3
     7,1
140  DATA  42,1,50,1,71,1,82,1,96
     ,1
150  DATA  112,1,130,1,149,1,167,
     1,178,1
160  DATA  197,1,215,1,220,1,227,
     1,238,1
170  DATA  248,1,1,2,11,2,32,2,51
     ,2
180  DATA  71,2,84,2,102,2,118,2,
     132,2
190  DATA  148,2,167,2,178,2,191,
     2,208,2
200  DATA  218,2,240,2,4,3,21,3,3
     7,3
210  DATA  56,3,77,3,92,3,103,3,1
     19,3
220  DATA  134,3,155,3,173,3,186,
     3,200,3
230  DATA  214,3,237,3,1,4,8,4,33
     ,4
235  DATA  1,0
240  DATA  9,213,213,213,213,149,
     43,0
250  DATA  105,213,27,13,213,27,1
     3,5,0
260  DATA  169,171,155,169,155,10
     ,13,197,27,13,197,219,45,45,
     197,43,216,27,45,45,197,43,2
     4,5,0
270  DATA  9,213,43,45,213,219,10
     7,213,43,173,27,13,213,219,4
     3,45,213,43,0
280  DATA  173,27,109,169,27,213,
     171,27,213,107,41,213,43,5,0

290  DATA  169,27,13,213,27,13,21
     3,171,27,213,21,109,197,43,2
     16,13,5,0
300  DATA  9,213,213,5,0
310  DATA  9,213,171,27,213,213,2
     1,21,5,0
320  DATA  9,21,21,213,213,213,17
     1,27,5,0
330  DATA  106,168,107,213,219,45
     ,213,171,27,45,213,219,13,13
     ,213,27,5,0
340  DATA  74,213,213,27,45,45,21
     3,27,213,5,0
350  DATA  146,74,213,213,43,0
360  DATA  146,45,45,5,0
370  DATA  146,146,9,5,0
380  DATA  146,18,5,40,40,40,40,0

390  DATA  41,173,219,171,171,171
     ,43,213,171,45,5,40,24,197,2
     7,13,197,43,197,5,0
400  DATA  9,213,43,213,213,213,2
     13,213,43,45,0
410  DATA  42,40,173,213,213,27,1
     73,219,213,171,43,45,45,0
420  DATA  45,45,213,213,171,27,1
     73,219,19,21,45,5,40,24,5,0
430  DATA  82,213,171,147,73,197,
     197,219,45,45,197,43,24,197,
     197,221,42,0
440  DATA  42,24,45,45,149,219,27
     ,45,173,219,147,21,45,5,40,2
     4,197,5,0
450  DATA  10,5,40,173,218,219,21
     3,45,173,219,171,171,45,5,40
     ,24,5,0
460  DATA  45,45,213,213,171,27,2
     13,171,171,43,0
470  DATA  41,173,219,171,171,45,
     213,219,213,21,45,5,40,24,5,
     192,197,5,0
480  DATA  41,173,219,171,171,210
     ,42,45,40,40,216,27,45,45,24
     ,197,5,0
490  DATA  82,169,19,5,0
500  DATA  82,169,19,213,213,43,0

510  DATA  82,5,40,168,210,219,21
     ,21,21,5,0
520  DATA  18,45,45,213,219,19,45
     ,45,5,0
530  DATA  169,21,21,213,171,27,2
     13,43,0
540  DATA  42,40,173,213,171,27,2
     13,213,42,0
550  DATA  41,173,219,171,171,171
     ,171,171,45,45,216,3,40,197,
     43,45,216,107,197,5,0
560  DATA  18,5,40,168,21,213,213
     ,213,213,221,219,197,197,45,
     45,216,27,5,0
570  DATA  170,171,43,45,213,219,
     213,157,45,45,232,40,192,197
     ,29,216,27,45,45,0
580  DATA  42,40,173,213,219,171,
     171,171,171,45,5,40,0
590  DATA  45,173,219,171,171,171
     ,171,171,43,45,5,40,24,197,1
     97,197,5,0
600  DATA  45,45,213,219,171,171,
     43,45,213,219,213,213,45,45,
     5,0
610  DATA  45,45,213,219,171,171,
     43,45,213,219,213,213,5,0
620  DATA  42,40,173,213,219,171,
     171,171,171,45,45,24,197,43,
     5,0
630  DATA  213,213,149,171,171,10
     7,9,197,197,197,219,43,45,45
     ,24,197,197,5,0
640  DATA  41,173,27,213,213,213,
     213,213,43,45,0
650  DATA  146,18,21,45,5,40,24,1
     97,197,197,197,5,0
660  DATA  213,213,213,146,197,19
     7,197,45,40,40,168,146,219,2
     1,21,5,0
670  DATA  213,213,213,213,213,21
     3,45,45,5,0
680  DATA  213,173,27,213,213,213
     ,213,77,41,24,197,197,27,13,
     197,27,13,197,43,197,5,0
690  DATA  213,213,173,27,213,213
     ,213,77,41,24,197,43,197,27,
     13,197,197,197,5,0
700  DATA  41,173,219,171,171,171
     ,171,171,45,5,40,24,197,197,
     197,5,0
710  DATA  45,173,219,171,171,171
     ,147,197,197,45,45,40,24,197
     ,5,0
720  DATA  41,173,219,171,171,171
     ,107,213,27,21,109,197,43,40
     ,24,197,197,5,0
730  DATA  45,173,219,171,171,19,
     213,213,77,41,216,197,43,216
     ,43,45,5,40,24,5,0
740  DATA  42,40,173,213,219,171,
     45,21,213,219,171,45,5,40,0
750  DATA  45,45,213,27,213,213,2
     13,213,213,5,0
760  DATA  213,213,213,213,213,21
     ,45,5,40,24,197,197,197,197,
     5,0
770  DATA  213,213,213,213,21,21,
     5,40,40,24,197,197,197,5,0
780  DATA  213,213,213,213,213,17
     3,27,77,41,216,45,216,107,19
     7,27,13,197,197,197,5,0
790  DATA  213,21,213,170,27,213,
     77,41,24,197,43,216,5,40,40,
     24,5,0
800  DATA  213,21,149,18,197,197,
     197,5,40,40,24,5,0
810  DATA  45,45,213,213,171,27,2
     13,171,27,213,45,45,5,0
820  DATA  10,5,168,213,27,213,43
     ,173,27,213,213,107,45,5,0
830  DATA  18,5,40,45,45,213,219,
     107,213,27,13,213,27,13,213,
     27,13,213,27,13,5,0
840  DATA  9,173,219,213,171,19,2
```

(continued on next page)

(continued from previous page)

```
     1,21,45,40,40,216,219,43,45,
     45,197,197,43,0
850  DATA  146,42,40,168,21,5,0
860  DATA  9,213,213,43,173,219,1
     07,213,27,13,213,27,13,213,1
     47,41,24,197,43,45,40,24,197
     ,5,0
870  DATA  10,213,171,171,171,171
     ,45,40,24,197,141,210,45,40,
     24,197,197,197,43,0
875  REM

880  HOME : VTAB 3: PRINT "OR PRE
     SS 1 IF 37120 IS OK"
890  VTAB 1: INPUT "ENTER START A
     DDRESS OF TABLE: ";SA
900  IF SA = 1 THEN SA = 37120
910  REM  CALC. HIGH & LOW BYTES
     OF SA
920 HB =  INT (SA / 256):LB = SA -
     256 * HB
930  POKE 232,LB: POKE 233,HB
940  REM  LOAD TO MEMORY
950  VTAB 8: PRINT "WAIT 7 SECS -
      LOADING"
960  FOR A = SA TO SA + 1076
970  READ B: POKE A,B: NEXT A
980  VTAB 12: PRINT "LOADED."
990  VTAB 14: PRINT "SAVING TO DI
     SK AS A BINARY FILE"
1000  PRINT  CHR$ (4);"BSAVE CHAR
     .SET";",A";SA;",L";1077
1010  VTAB 18: PRINT "FINISHED"
```

Hi-Res Text.

```
20  REM   HI-RES TEXT
30  REM
40  REM   ON
50  REM
60  REM   APPLE II HI-RES SCREENS
70  REM
80  REM   BY  R LUCAS
90  REM

100  REM  CAST OF CHARACTERS
110  HIMEM: 37120
120  PRINT  CHR$ (4);"BLOAD CHAR.
     SET"
130  REM  STORE SHAPE TABLE START
      ADDRESS = 37120
140  POKE 232,0: POKE 233,145
150  HGR2 : HGR : HOME
160  HCOLOR= 3: ROT= 0: SCALE= 1
170 L1$ = "CAST OF CHARACTERS"
180 A$ = L1$:X = 80:Y = 0: GOSUB
     370
190 X = 6:Y = 12
200  FOR S = 1 TO 65
210  DRAW S AT X,Y
220 X = X + 18: IF X > 266 THEN X
     = 6:Y = Y + 30
230  NEXT S
240  VTAB 21: PRINT "<SPACEBAR> T
     O ADD SHAPE NUMBERS ";: GET
     Q$
250 L2$ = " 1  2  3  4  5  6  7
     8  9 10 11 12 13 14 15"
260 L3$ = "16 17 18 19 20 21 22 2
     3 24 25 26 27 28 29 30"
270 L4$ = "31 32 33 34 35 36 37 3
     8 39 40 41 42 43 44 45"
280 L5$ = "46 47 48 49 50 51 52 5
     3 54 55 56 57 58 59 60"
290 L6$ = "61 62 63 64 65"
300 A$ = L2$:X = 0:Y = 22: GOSUB
     370
310 A$ = L3$: GOSUB 370
320 A$ = L4$: GOSUB 370
330 A$ = L5$: GOSUB 370
340 A$ = L6$: GOSUB 370
350  PRINT : VTAB 21: PRINT "<SPA
     CEBAR> FOR GRAPH DEM ON HGR2
     ";: GET Q$: GOTO 440: REM CT
     RL-J

360  REM  STRING WRITING ROUTINE
370  FOR I = 1 TO  LEN (A$)
380 S =  ASC ( MID$ ((A$),I,1))
390  DRAW S - 31 AT X,Y:X = X + 6

400  NEXT I
410 Y = Y + 30:X = 0
420  RETURN : REM CTRL-J
430  REM  GRAPH DEM
440  HGR2 : HCOLOR= 3: ROT= 0: SCALE=
     1
450  REM  LAY AXIS
460  HPLOT 23,38 TO 23,172 TO 279
     ,172
470  REM  HOR. MARKERS
480  FOR H = 45 TO 234 STEP 21
490  HPLOT H,173 TO H,174: NEXT H

500  REM   VERT. MARKERS & SCALE
510 S = 18
520  FOR V = 150 TO 45 STEP  - 21

530  XDRAW S AT 15,V - 3:S = S +
     1
540  HPLOT 21,V TO 22,V: NEXT V
550  REM  LABELS
560 L1$ = "X - AXIS":L2$ = "Y - A
     XIS"
570 L3$ = " 10 20 30 40 50 60 70
     80 90 $1"
580 L4$ = "PRACTICAL COMPUTING":L
     5$ = "FOR"
590 L6$ = "TEXT ON APPLE II HI-RE
     S SCREENS"
600 L7$ = "BRITAIN'S":L8$ = "LEAD
     ING"
610 L9$ = "PERSONAL":T1$ = "COMPU
     TING"
620 T2$ = "MAGAZINE":T3$ = "INFOR
     MATIVE"
630 T4$ = "EDUCATIONAL":T5$ = "VA
     LUE"
640 T6$ = "<ESC>  T)EXT  M)ODIFY
     E)RASE  Q)UIT"
650  REM  LABEL WRITING DATA
660  REM VL=VERT. LABEL
670 SC = 1: REM  SCALING FACTOR
680 A$ = L1$:X = 95:Y = 185: GOSUB
     870
690 A$ = L2$:X = 0:Y = 125:VL = 1
    :R = 48: GOSUB 870
700 A$ = L3$:X = 32:Y = 175: GOSUB
     870
710 A$ = L4$:X = 12:Y = 20:SC = 2
    : GOSUB 870
720 A$ = L5$:X = 130:Y = 50: GOSUB
     870
730 A$ = L6$:X = 40:Y = 70: GOSUB
     870
740 A$ = L7$:X = 42:Y = 168:R = 4
     8: GOSUB 870
750 A$ = L8$:X = 63:Y = 168:R = 4
     8: GOSUB 870
760 A$ = L9$:X = 84:Y = 168:R = 4
     8: GOSUB 870
770 A$ = T1$:X = 105:Y = 168:R =
     48: GOSUB 870
780 A$ = T2$:X = 126:Y = 168:R =
     48: GOSUB 870
790 A$ = T3$:X = 147:Y = 168:R =
     48: GOSUB 870
800 A$ = T4$:X = 174:Y = 94:R = 1
     6: GOSUB 870
810 A$ = T5$:X = 188:Y = 84:SC =
     2:VL = 3: GOSUB 870
820 A$ = T6$:X = 18:Y = 0: GOSUB
     870
830 A$ = " "
840  HOME : VTAB 21: PRINT T6$
850  GOTO 1000: REM

860  REM  LABEL WRITING ROUTINE
862  REM VL=1 WRITE UPWARDS
864  REM VL=2 WRITE DOWNWARDS
866  REM VL=3 STACK LABEL DOWNWAR
     DS
870  FOR J = 1 TO  LEN (A$)
880  SCALE= SC: ROT= R
882  IF R = 48 THEN VL = 1
884  IF R = 16 THEN VL = 2
890 S =  ASC ( MID$ ((A$),J,1))
900  IF S =  ASC ("$") THEN S = 3
     1 + 60: REM  STIRLING SYMBOL

910  IF X > 279 THEN X = 279
920  IF Y < 0 THEN Y = 0
925  IF Y > 191 THEN Y = 191
930  XDRAW S - 31 AT X,Y
940  IF VL = 1 THEN Y = Y - 7 * S
     C: GOTO 960
942  IF VL = 2 THEN Y = Y + 7 * S
     C: GOTO 960
944  IF VL = 3 THEN Y = Y + 9 * S
     C: GOTO 960
950 X = X + 7 * SC
960  NEXT J
970 VL = 0:SC = 1:R = 0: RETURN :
     REM

990  REM  SCREEN SWITCHING
1000 X =  PEEK ( - 16384): IF X <
     127 THEN 1000
1010  IF X - 128 = 27 AND B = 0 THEN
     B = 1: POKE  - 16368,0: POKE
      - 16301,0: POKE  - 16300,0:
      GOTO 1000: REM SET PAGE 1
1020  IF X - 128 = 27 AND B = 1 THEN
     B = 0: POKE  - 16368,0: POKE
      - 16302,0: POKE  - 16299,0:
      GOTO 1000: REM SET PAGE 2
1030  IF X - 128 =  ASC ("T") THEN
      POKE  - 16368,0:B = 1: POKE
      - 16301,0: POKE  - 16300,0:
      GOTO 1080
1040  IF X - 128 =  ASC ("M") THEN
      POKE  - 16368,0:X = X1:Y =
     Y1:SC = S1:R = R1:VL = V1: GOSUB
     870:B = 1: POKE  - 16301,0: POKE
      - 16300,0: GOTO 1110
1050  IF X - 128 =  ASC ("E") THEN
      POKE  - 16368,0:X = X1:Y =
     Y1:SC = S1:R = R1:VL = V1: GOSUB
     870: GOTO 1000
1060  IF X - 128 =  ASC ("Q") THEN
      POKE  - 16368,0: TEXT : HOME
     : END
1070  GOTO 1000: REM

1075  REM TEXT ENTRY
1080  HOME : VTAB 21: PRINT "ENTE
     R TEXT FOR SCREEN"
1090  INPUT "";A$:B$ = A$
1100  REM  ENTER X AND Y COORDINA
     TES
1110  VTAB 23: CALL  - 868: INPUT
     "X= ";X
1120  VTAB 23: HTAB 9: INPUT "Y=
     ";Y
1130  VTAB 23: HTAB 17: INPUT "SC
     = ";SC: SCALE= SC: IF SC = 0
      THEN SC = 1
1140  VTAB 23: HTAB 24: INPUT "R(
     0,16,48)= ";R: IF R > 0 THEN
     VL = 1
1150 X1 = X:Y1 = Y:S1 = SC:R1 = R
    :V1 = VL
1160  VTAB 24: PRINT T6$
1170  GOSUB 870: GOTO 1000
```

Date routines

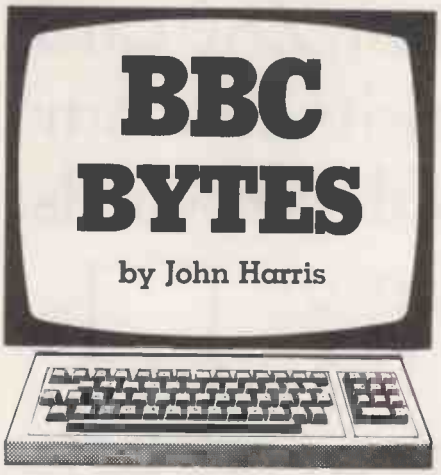
I am still collecting date routines and have yet to reach a conclusion on the winner of the competition on the subject. In the meantime an independent trivial but nonetheless interesting routine from Colin Wilson is offered for deriving the day of the week from a date.

Date routine.

```
10  REM
15  REM  WEEK DAYS
20  REM
25  REM  GRAHAM WILSON
30  REM
35  REM  APRIL 1982
40  REM
100  TEXT : HOME
110  DEF  FN A(CF) =  INT (CF)
120  DEF  FN B(CF) = CF -  INT (C
     F)
130  REM
140  INPUT "DAY <1 TO 31>   = ";D

150  INPUT "MONTH <1 TO 12> = ";M

160  INPUT "YEAR <ANY>      = ";Y

170  IF M = 1 THEN :M = 13:Y = Y -
     1
180  IF M = 2 THEN :M = 14:Y = Y -
     1
190 C1 = D + (2 * M) + ((M + 1) *
     0.6)
200 C1 =  FN A(C1)
210 C2 =  FN A(Y / 4)
220 C3 =  FN A(Y / 100)
230 C4 =  FN A(Y / 400)
240 C1 = C1 + Y + C2 - C3 + C4 +
     2
250 C1 = ( FN B(C1 / 7) * 7) + 0.
     5
260 C1 =  FN A(C1)
270  ON C1 GOTO 280,300,320,340,3
     60,380,400
280 T$ = "SUNDAY": GOSUB 420
290  GOTO 440
300 T$ = "MONDAY": GOSUB 420
310  GOTO 440
320 T$ = "TUESDAY": GOSUB 420
330  GOTO 440
340 T$ = "WEDNESDAY": GOSUB 420
350  GOTO 440
360 T$ = "THURSDAY": GOSUB 420
370  GOTO 440
380 T$ = "FRIDAY": GOSUB 420
390  GOTO 440
400 T$ = "SATURDAY": GOSUB 420
410  GOTO 440
420  PRINT "THE DAY WAS : ";T$
430  RETURN
440  GOTO 130
450  END
```

Example program.

```
10  REM  DRAW PI
20  PRINT  CHR$ (4);"BLOAD CHAR.S
    ET"
30  POKE 232,0: POKE 233,145
40  HGR : HCOLOR= 3: ROT= 0: SCALE=
     1
50  DRAW 61 AT 140,80
```



Large lettering

THE OPERATING SYSTEM entry point at Osword makes many useful facilities available to the programmer. One of them is the return of a "picture" in eight bytes of any ASCII character as it appears on the screen, and this call is the basis of two programs and a procedure which between them show what can be done with the information.

Bobby Hesselbo of North Berwick has submitted a Poster card program which accepts messages on two levels. A foreground message of three lines of 10 characters is placed on the screen and, optionally, the printer in large format. It is composed of repeating elements of a background message which may be of any length.

Philip O'Shea of Rayleigh in Essex, who wrote the article on mode 7 graphics in the February issue, has followed it up with two more routines. One is a scrolling display program for advertising a message of any length across a screen repetitively; the other is a procedure to place enlarged skeletal text anywhere on a graphics mode 0 to 6 screen. Calling

PROCLPLOT (x,y,sx,sy,M$)

achieves this, with the bottom left co-ordinate in x,y, the size per character in sx, sy and the message in M$. The colour of the text to be drawn may be changed with GCol.

Poster.

```
  0 REM Birthday card / poster
  1 REM by B Hesselbo
  2 REM Feb 83
 10 DIM GAP% 8
 20 OSWORD=&FFF1:OSWRCH=&FFEE
 30 PAR1=&70:PAR2=&72:PAR3=&74
 40 FORI%=0TO2STEP2
 50 P%=&D00
 60 COPTI%
 70 .BIG
 80 STA GAP%
 90 LDA #&1F
100 JSR OSWRCH
110 TXA
120 JSR OSWRCH
130 TYA
140 JSR OSWRCH
150 LDY #GAP% DIV 256
160 LDX #GAP% MOD 256
170 LDA #&A
180 JSR OSWORD
190 LDY #1
200 .LOOP
210 LDA GAP%,Y
220 JSR line
230 CPY #8
240 BEQ LOOP2
250 LDA #&A
260 JSR OSWRCH
270 LDA #8
280 TAX
290 .LOOP2
300 JSR OSWRCH
310 DEX
320 BNE LOOP2
330 INY
340 CPY #9
350 BNE LOOP
360 RTS
370 .line
380 LDX #0
390 .LOOP1
400 CLC
410 ROL A
420 PHA
430 BCC zero
440 LDA #&FF:JSR OSWRCH
450 JMP over
460 .zero
470 LDA #&20:JSR OSWRCH
480 .over
490 PLA
500 INX
510 CPX #8
520 BNE LOOP1
530 RTS:]NEXT
540 VDU23,255,255,255,255,255,255,
255,255,255
550 MODE0
560 INPUT "Background name : "bn$
570 CLS:INPUT "Do you want to prin
t",p$
580 CLS:PRINT"Now large text":G=GE
T:CLS
590 FORY%=0 TO 18 STEP 9
600 FORX%=0 TO 72 STEP 8
610 A%=GET
620 IF A%=127 THEN X%=X%-8
630 CALL BIG
640 IF A%=127 THEN X%=X%-8
650 NEXT:NEXT
660 A%=&87
670 IF LEFT$(p$,1)="y" OR LEFT$(p$
,1)="Y" THEN VDU2
680 FOR Y%=0 TO 30
690 FOR X%=0 TO 79
700 VDU31,X%,Y%
710 CH=(USR(&FFF4)AND&FFFF) DIV &1
00
720 IF CH=32 THEN VDU32 ELSE VDUFN
char
730 NEXT:VDU1,13:NEXT
740 VDU3
750 END
760 DEFFNchar
770 =ASC(MID$(bn$,(X%+Y%) MOD LENb
n$+1,1))
```

Scrolling display.

```
  10  ON ERROR GOTO 510
  20  MODE6:PRINT'''
  30  PRINT" When you have finished
 typing, press"
  40  PRINT" RETURN and type '*' (&
 RETURN)."
  50  PRINT" type the underline sym
bol (Unshifted"
  60  PRINT" ''' key) after a lette
r if you want"
  70  PRINT" it underlined. "
  80  PRINT" Press ESCAPE to stop t
he program."
  90  PRINT:PRINT
 100  M$=""
 110  REPEAT
 120  INPUT LINE"MESSAGE? "A$
 130  M$=M$+" "+A$
 140  UNTIL A$="*"
 150  L=LEN(M$)-2
 160  M$=LEFT$(M$,L)+"       "
 170  L=L+6
 180  PROCcolchoose("Border")
 190  BCOL=COL+144
 200  PROCcolchoose("Word")
 210  WCOL=COL+144
 220  MODE7
 230  VDU 23;8202;0;0;0;
 240  FORI=1TO7
 250  PRINTCHR$(BCOL);STRING$(39,CH
R$(255));
 260  NEXTI
 270  PRINTSTRING$(8,CHR$(10))
 280  FORI=VPOS TO 23
 290  PRINTCHR$(BCOL);STRING$(39,CH
R$(255));
 300  NEXTI
 310  VDU30
 320  FORI=8TO15:PRINTTAB(0,I);CHR$
(WCOL);
 330  NEXT
 340  PROCmovesetup:PROCsetupdots
 350  FOR K=1TO L
 360  C$=MID$(M$,K,1)
 370  IF C$=" "THEN 490
 380  PROCdots(ASC(C$))
 390  IF K<L THEN IF MID$(M$,K+1,1)
=" "THEN ?(INFO+8)=255
 400  FOR J=1 TO 7 STEP 2
 410  PT=8-J:PT=2^PT
 420  FORI=1 TO 8
 430  Q=0:R=0
 440  IF(?(INFO+I) AND PT)<>0 THEN
Q=1
 450  IF(?(INFO+I) AND PT/2)<>0 THE
N R=1
 460  PROCdprint
 470  NEXTI
 480  NEXTJ
 490  NEXTK
 500  GOTO 350
 510  MODE7:PRINT'''
 520  IF ERR=17 THEN PRINT"Bye!" EL
SE REPORT:PRINT" at line ";ERL
 530  END
 540  DEF PROCsetupdots
 550  DIM INFO 10
 560  XR=INFO MOD 256
 570  YR=INFO DIV 256
 580  ENDPROC
 590  DEF PROCdots(CH)
 600  ?(INFO)=CH
 610  X%=XR:Y%=YR:A%=10
 620  CALL &FFF1
 630  ENDPROC
 640  DEFPROCmovesetup
 650  LA=&80:LB=&81
 660  DIM PROG 40
 670  HM=HIMEM+(40*8)
 680  LO=HM MOD 256:HI=HM DIV 256
 690  ?(LA)=LO:?(LB)=HI
 700  MS$="A208A002B180889180C8C8C0
28D0F5A920889180A5801869208580900 2E6
81CAD001604C"
 710  HX$="123456789ABCDEF"
 720  FORI=1 TO 36:A$=MID$(MS$,I*2-
1,1):B$=MID$(MS$,I*2,1)
 730  C=(INSTR(HX$,A$)*16)+INSTR(HX
$,B$)
 740  ?(PROG+I-1)=C
 750  NEXTI
 760  L1=PROG+2
 770  ?(PROG+36)=L1 MOD 256
 780  ?(PROG+37)=L1 DIV 256
 790  ENDPROC
 800  DEFPROCmoveit
 810  ?(LA)=LO:?(LB)=HI
 820  CALL PROG
 830  ENDPROC
 840  DEF PROCdprint
 850  IF Q=1 THEN C=21 ELSE C=0
 860  IF R=1 THEN C=C+74
 870  IF Q=1 AND I=8 AND (C AND 16)
=16 THEN C=C-16
 880  IF R=1 AND I=8 AND (C AND 64)
=64 THEN C=C+64
 890  C=C+160
 900  PRINTTAB(39,7+I);CHR$(C);
 910  IF I=8 THEN PROCmoveit
 920  ENDPROC
 930  DEF PROCcolchoose(M$)
 940  PRINT
 950  PRINT
 960  PRINT"Choose from Red,Green,Y
ellow,Dark blue,"
 970  PRINT"Magenta,Cyan or White b
y typing the"
 980  PRINT"first letter."
 990  PRINT
1000  PRINTM$;:INPUT" colour? "CL$
1010  IF CL$=""THEN 1000
1020  CL$=LEFT$(CL$,1)
1030  COL=INSTR("RGYDMCW",CL$)+INST
R("rgydmcw",CL$)
1040  IF COL=0 THEN 1000
1050  ENDPROC
```

Enlarged text.

```
25000  DEF PROCLPLOT(CX,CY,CW,CH,PN$
)
25010  LOCAL CH$,SX,SY,NC,K,LX,LY,DL
,XP,YP
25020  SX=CW/8:SY=CH/8:DIM MX10:X%=M
%MOD256:Y%=M%DIV256
25030  NC=LEN(PN$):FORK=1TONC:CH$=MI
```

(continued on page 170)

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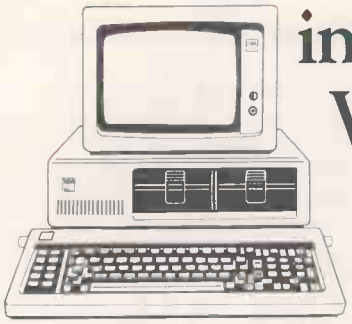

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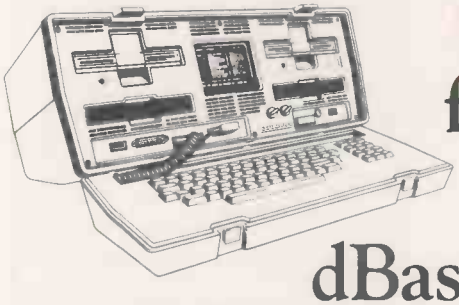

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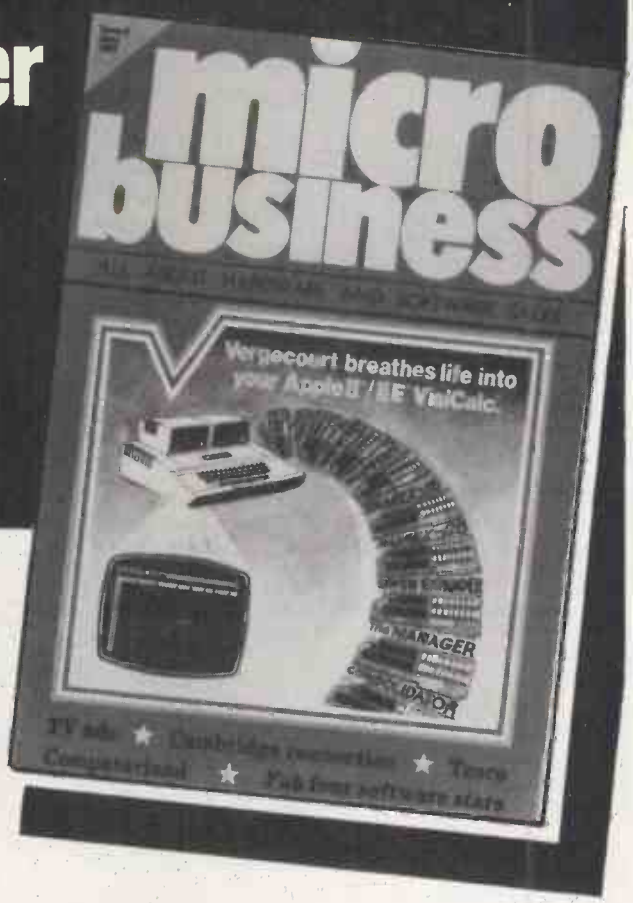

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PC

(continued from page 167)

```
D$(PH$,K,1)
25040  ?M%=ASC(CH$):A%=10:CALL&FFF1:
?M%=0:?(M%+9)=0
25050  FOR LY=1TO8:DL=?(M%+LY):IF DL
=0  THEN 25110
25060  FOR LX=-1TO7:IF(LX=-1 AND (DL
 AND1)=1)OR(LX=7AND(DL AND128)=128)
THEN 25080
25070  IF((DL AND 2^LX)/2^LX)=(DL AN
D 2^(LX+1))/2^(LX+1) THEN 25100
25080  XP=CX+CW-(SX*(LX+1)):YP=CY+CH
-SY*(LY-1)
25090  MOVEXP,YP:DRAWXP,YP-SY:MOVEXP
+4,YP:DRAW XP+4,YP-SY
25100  NEXT
25110  NEXT
25120  FORLX=0TO7:FORLY=0TO8:DL=?(M%
+LY):IF(DL AND2^LX)=((?(M%+LY+1))AND
2^LX) THEN 25150
25130  XP=CX+CW-(SX*LX):YP=CY+CH-(SY
*LY)
25140  MOVE XP,YP:DRAW XP-SX,YP
25150  NEXT,:CX=CX+CW:NEXT
25160  ENDPROC
```

Mode 7 graphics

Julian Smart of St Andrews has submitted a set of procedures which supply statements for use in mode 7 equivalent to the mode 0 to 6 graphics commands CLG, Plot, Move and Draw. Having coded a test routine linked to a joystick I found they simplify mode 7 graphics to the point that results are obtainable. Page 155 of the *User Guide* gives hints, but the practice in the past has been very long-winded.

The use of the assembler by Mr Smart has speeded up a technique which in Basic took too long to contemplate within any time-critical game procedure. The routines as coded ensure that column 0 of each line is avoided, which is where the graphics selector CHR$151 resides.

Colour manipulation is not provided for, and might prove a problem if essential to the application. Otherwise the routines are a great enhancement to any procedure library.

Colour blending

David Turley of Wrexham, Clywd has submitted a short program to demonstrate how the apparent range of colours available in any graphics mode can be made to increase by combining foreground and background colours. Mode 2 is used in the demonstration to allow all colours to be used at once. Some of the combinations blend very effectively to give the appearance of a single shade, while others look to be what they are — a lot of differently coloured dots.

Colour blending.

```
   1 MODE2
  10 VDU23,240,85,170,85,170,85,170
,85,170
  20 FORT=1TO7
  30 FORY=128TO135
  40 COLOUR T:COLOUR Y
  50 FORH=1TO20:VDU240:NEXTH
  60 NEXTY
  70 NEXTT
  80 END
```

Mode 7 graphics.

```
10000  REM      ******************
**
10010  REM      Mode 7 Clg, Plot & Dr
aw
10020  REM        BBC Computer A or B
10030  REM      JAC Smart  January 19
83
10040  REM      **********************
**
10050
10060  REM Reserve memory below scre
en; define various stores
10070
10080  MODE7:HIMEM=31570:L%=HIMEM
10090  OSWRCH=&FFEE:M1=L%+160
10100  M2=L%+161:M3=L%+162
10110  M4=L%+163:M5=L%+164
10120  M6=L%+165:M7=L%+166
10130
10140  REM Define look-up table for
determining pixel code
10150
10160  !(L%+167)=&2100401:!(L%+171)=
&4008
10170  FOR I%=0 TO 3 STEP 3
10180  P%=L%
10190
10200  [ OPT I%
10210
10220  \ *** Set up screen ***
10230
10240  .G% LDA £12 :JSR OSWRCH \ Cle
ar screen
10250       LDY £25
10260  .L3 CPY £0:BEQ RE          \ Ret
urn after looping 24 times
10270       DEY
10280       LDA £10 :JSR OSWRCH \ Mov
e cursor down one line
10290       LDA £13 :JSR OSWRCH \ Mov
e cursor to start of line
10300       LDA £&97:JSR OSWRCH \ Pri
nt graphics character
10310       JMP L3
10320  .RE RTS                     \ Ret
urn to BASIC
10330
10340  \ *** Calc. Y text ordinate *
**
10350
10360  .T% STX M1:STY M2           \ Save
 co-ordinates
10370       LDY £0:LDX M2:INX   \ Load
 X with Y co-ordinate
10380  .L1 DEX                     \ Loop
 until Y contains Y character
10390       CPX £0:BEQ A0          \ co-o
rdinate. Pixel Y co-ordinate
10400       DEX                    \ dete
rmined by branch to A0, A1 or A2
10410       CPX £0:BEQ A1
10420       DEX
10430       CPX £0:BEQ A2
10440       INY
10450       JMP L1
10460  .A0 LDX £0:JMP K1           \ Load
 X with pixel Y co-ordinate
10470  .A1 LDX £1:JMP K1
10480  .A2 LDX £2
10490  .K1 STX M6:STY M5           \ Save
 X and Y registers
10500
10510  \ *** Calc. X text ordinate *
**
10520
10530       LDY £0:LDX M1:INX   \ Repe
at above process
10540  .L2 DEX                     \ with
 X co-ordinates
10550       CPX £0:BEQ B0
10560       DEX
10570       CPX £0:BEQ B1
10580       INY
10590       JMP L2
10600  .B0 LDX £0:JMP K2
10610  .B1 LDX £3
10620  .K2 STX M4:STY M3           \ Save
 pixel and character
10630                              \ X co
-ordinates
10640
10650  \ *** Select pixel cell ***
10660
10670       LDA M6                 \ Load
 A with pixel X co-ordinate
10680       CLC:ADC M4             \ Add
0 or 3 depending
10690                              \ on p
ixel X co-ordinate
10700       TAX:LDA L%+167,X       \ Load
 char. code from look-up
10710                              \ tabl
e using X-register offset
10720       ORA £160:STA M7        \ Add
160 to code and save
10730
10740  \ *** Position text cursor **
*
10750
10760       LDA £31: JSR OSWRCH \ Mov
e cursor to M3, M5
10770       LDA M3:  JSR OSWRCH
10780       LDA M5:  JSR OSWRCH
10790       LDA £135:JSR &FFF4  \ Rea
d code at M3, M5
10800       TXA
10810
10820  \ *** Write character ***
10830
10840       ORA M7:JSR OSWRCH      \ OR
with new code
10850       RTS                    \ Ret
urn to BASIC
10860
10870       ]
10880  NEXT
10890  *KEY0 "DELETE 10000,10910:MCL
S:M"
10900  END
10910
10920  DEFPROCplot(J%,K%)
10930  IF J%<0 OR J%>79 OR K%<0 OR K
%>74 ENDPROC
10940  X%=J%:Y%=74-K%:CALL T%
10950  ENDPROC
10960
10970  DEFPROCclg
10980  M%=0:N%=0:CALL G%
10990  ENDPROC
11000
11010  DEFPROCdraw(J%,K%)
11020  LOCAL A%,B%,C%,I%
11030  IF M%=J% PROCvert:ENDPROC
11040
11050  REM Gradient of line: A%/B%
Equation constant: C%
11060
11070  A%=N%-K%:B%=M%-J%:C%=K%-(J%*A
%)DIVB%
11080  FOR I%=M% TO J% STEP (M%>J%)-
(J%>=M%)
11090  PROCplot(I%,(I%*A%)DIVB%+C%)
11100  NEXT
11110  M%=J%:N%=K%
11120  ENDPROC
11130
11140  DEFPROCmove(J%,K%)
11150  M%=J%:N%=K%
11160  ENDPROC
11170
11180
11190  REM Routine for plotting vert
ical lines
11200  DEFPROCvert
11210  FOR I%=N% TO K% STEP (N%>K%)-
(K%>=N%)
11220  PROCplot(J%,I%)
11230  NEXT
11240  ENDPROC
```

PASCAL

Paper, Scissors and Stone

THE TRADITIONAL game of Paper, Scissors and Stone is used to this day by school children who want to chose fairly between two people. At a given signal — one, two, three, Go! — both contestants make a sign with their hands representing paper, scissors or stone. A cyclic rule then choses the winner: scissors cut paper; stone blunts scissors and paper wraps up stone. If both playes chose the same object then the game must be repeated.

The chance of winning is exactly 50 percent. Over a long series of games, where both players guess at random, one should expect a player to win one-third of the games and lose one-third.

In practice, a real human player is far from random in making plays. People are very poor at generating random patterns, and each player has particular favoured choices and sequences, although these may be made completely subconsciously.

A computer program can capitalise on this human failing. All that it needs to do is to keep a complete record of all games played so far. It must try to guess what its opponent will do next. It finds previous instances of the last few plays in its records and looks to see what the opponent did next on those occasions. The problem is essentially reduced to a pattern-matching task.

The Pascal program by Bob Mackay of London N6 plays the game of Paper, Scissors and Stone. The winner is the first to win 50 rounds. The game history is recorded in a simple two-dimensional array, which stores the guess made by each player for each round of play.

The algorithm starts by attempting to find a duplicate of the last five plays anywhere in the previous games. It probably fails, since a duplicate sequence of five identical games is fairly improbable. It then searches for shorter sequences.

If it finds a match at any stage it looks at the object that the opponent guessed next, and then searches for further matches of this length. It keeps a running total of each of the three possible next guesses. If one of them is clearly in the majority, then the computer guesses the corresponding winning object. For example, if the opponent generally chose paper after the matched sequence, then the program chooses, scissors. If no conclusive matches are found, even at a length of one, then the computer guesses at random.

The program is irritating to play, since the computer seems to be able to read your mind, especially in the later stages of the game. It always wins! The techniques used here might be applied elsewhere: imagine being caught in a compter-generated maze where the computer could guess where you were likely to turn next.

Paper, Scissors and Stone.

```
{ PAPER, SCISSORS AND STONE }
{ COPYRIGHT 1983 BOB MACKAY }

PROGRAM JANKENPON;

CONST
  { LONGEST SEQUENCE WORTH LOOKING FOR }
  MAXLENGTH = 5;

TYPE
  OBJECT = (PAPER, SCISSORS, STONE);
  PLAYER = (ME, YOU);

VAR
  { RECORD OF ALL PREVIOUS ROUNDS }
  HISTORY : ARRAY [ME..YOU, 1..400] OF OBJECT;

  { PLAYER'S SCORES }
  SCORE : ARRAY [ME..YOU] OF INTEGER;

  { MY GUESS, YOUR REPLY }
  GUESS, REPLY : OBJECT;

  { RUNNING TOTALS OF PLAYER'S USUAL
    REPLIES AFTER MOST RECENT SEQUENCE }
  TOTPAPER, TOTSCISSORS, TOTSTONE : INTEGER;

  { CONTROL VARIABLES }
  LENGTH, NOROUNDS : INTEGER;
  DECIDED : BOOLEAN;


PROCEDURE INTROMESSAGE;
{ DISPLAY AN INTRODUCTORY MESSAGE }
BEGIN
  WRITELN ('This program plays the game of');
  WRITELN ('Paper, Scissors & Stone');
  WRITELN;
  WRITELN ('Each of us must think of one of');
  WRITELN ('the three objects.');
  WRITELN ('The rule is that scissors beat paper, paper');
  WRITELN ('beats stone and stone beats scissors!');
  WRITELN ('When you have made your choice, and');
  WRITELN ('when I am also ready, type ENTER for my guess.');
  WRITELN;
  WRITELN ('I bet that I can beat you to 50 points!');
  WRITELN;
  WRITELN;
END;


PROCEDURE OUTPUTGUESS;
{ INFORM THE PLAYER OF MY GUESS }
BEGIN
  WRITE ('Ready ?');
  READLN;

  WRITE ('I have guessed ');

  CASE GUESS OF
  PAPER :    WRITELN ('PAPER');
  SCISSORS : WRITELN ('SCISSORS');
  STONE :    WRITELN ('STONE')
  END;

  WRITELN;
END;


PROCEDURE INPUTREPLY;
{ GET PLAYER'S REPLY }
VAR
  RESPONSE : ARRAY [1..2] OF CHAR;
  OK: BOOLEAN;
BEGIN
  REPEAT
    OK := TRUE;
    WRITE ('What was your guess?');
    READLN;
    READ (RESPONSE);

    { ONLY THE SECOND CHARACTER TYPED
      IS SIGNIFICANT (SORRY ABOUT THAT) }
    CASE RESPONSE [2] OF
    'a', 'A' : REPLY := PAPER;
    'c', 'C' : REPLY := SCISSORS;
    't', 'T' : REPLY := STONE
    ELSE OK := FALSE
  UNTIL OK;

  WRITELN;
END;

PROCEDURE SCOREMESSAGE;
{ TELL HIM THE SCORE }
```

```
BEGIN
  WRITELN ('The score is ',
    SCORE [ME], ' to me and ',
    SCORE [YOU], ' to you.');
  WRITELN
END;


PROCEDURE VICTORYMESSAGE;
{ ANNOUNCE WHO HAS WON }
BEGIN
  WRITE ('Which means that');
  IF SCORE [ME] > SCORE [YOU] THEN
    WRITELN (' I have won!')
  ELSE
    WRITELN (' YOU have won!');
  WRITELN ('Thanks for the game.');
END;


PROCEDURE INC (VAR X : INTEGER);
{ INCREMENT AN INTEGER }
BEGIN
  X := X + 1
END;


FUNCTION RANDOMGUESS : OBJECT;
{ THIS PROCEDURE IS CALLED WHEN NO
  PARTICULAR PATTERN IS DETECTED.
  RETURNS A RANDOM OBJECT }
BEGIN
  { 'RANDOM' RETURNS A RANDOM INTEGER
    BETWEEN 0 AND 255 }
  CASE (RANDOM MOD 3) OF
  0 : RANDOMGUESS := PAPER;
  1 : RANDOMGUESS := SCISSORS;
  2 : RANDOMGUESS := STONE
  END
END;


FUNCTION CHOSEGUESS : OBJECT;
{ SEE IF ANY REPLY HAS A CLEAR MAJORITY
  AND CHOSE THE CORRESPONDING GUESS }
BEGIN
  DECIDED := TRUE;

  IF (TOTPAPER > TOTSCISSORS) AND
     (TOTPAPER > TOTSTONE) THEN
    CHOSEGUESS := SCISSORS
  ELSE
  IF (TOTSCISSORS > TOTPAPER) AND
     (TOTSCISSORS > TOTSTONE) THEN
    CHOSEGUESS := STONE
  ELSE
  IF (TOTSTONE > TOTPAPER) AND
     (TOTSTONE > TOTSCISSORS) THEN
    CHOSEGUESS := PAPER
  ELSE
  BEGIN
    CHOSEGUESS := RANDOMGUESS;
    DECIDED := FALSE
  END
END;


FUNCTION MATCH (X, Y, LENGTH : INTEGER) : BOOLEAN;
{ COMPARE HISTORICAL SEQUENCES AT X AND
  Y OVER THE GIVEN LENGTH }
VAR
  I : INTEGER;
BEGIN
  I := 0;

  WHILE
    (I < LENGTH) AND
    (HISTORY [ME, X+I] = HISTORY [ME, Y+I]) AND
    (HISTORY [YOU, X+I] = HISTORY [YOU, Y+I])
  DO
    INC (I);

  MATCH := (I = LENGTH)
END;

PROCEDURE SCAN (LENGTH : INTEGER);
{ LOOK AT YOUR NEXT PLAY AFTER EACH
  SUCCESSFUL MATCH OF SPECIFIED LENGTH }
VAR
  S, T : INTEGER;
BEGIN
  TOTPAPER := 0;
  TOTSCISSORS := 0;
  TOTSTONE := 0;

  { LATEST SEQUENCE }
  T := NOROUNDS - LENGTH;

  { FOR EACH EARLIER SEQUENCE DO }
  FOR S := 1 TO T - 1 DO
    IF MATCH (S, T, LENGTH) THEN
      { RECORD THE NEXT REPLY MADE }
      CASE HISTORY [YOU, S + LENGTH] OF
      PAPER :    INC (TOTPAPER);
      SCISSORS : INC (TOTSCISSORS);
      STONE :    INC (TOTSTONE)
      END
END;

PROCEDURE UPDATESCORE;
{ DECIDE WHO WON THIS ROUND }
BEGIN
  CASE GUESS OF
  PAPER :
    CASE REPLY OF
    PAPER :
    SCISSORS : INC (SCORE [YOU]);
    STONE :    INC (SCORE [ME])
    END;
  SCISSORS :
    CASE REPLY OF
    PAPER :    INC (SCORE [ME]);
    SCISSORS :
    STONE :    INC (SCORE [YOU])
    END;
  STONE :
    CASE REPLY OF
    PAPER :    INC (SCORE [YOU]);
    SCISSORS : INC (SCORE [ME]);
    STONE :
    END
  END
END;

FUNCTION REQUIREDSCORE : BOOLEAN;
{ EVALUATE CONDITIONS FOR ENDING THE GAME }
BEGIN
  REQUIREDSCORE :=
    ((SCORE [ME] >= 50) OR
     (SCORE [YOU] >= 50)) AND
    (ABS (SCORE [ME] - SCORE [YOU]) > 1)
END;


BEGIN { MAIN PROGRAM }
  INTROMESSAGE;

  NOROUNDS := 0;
  SCORE [ME] := 0;
  SCORE [YOU] := 0;

  REPEAT
    INC (NOROUNDS);
  LENGTH := MAXLENGTH;
  DECIDED := FALSE;

  REPEAT
    SCAN (LENGTH);
    GUESS := CHOSEGUESS;
    LENGTH := LENGTH - 1
  UNTIL (DECIDED) OR (LENGTH = 0);

  OUTPUTGUESS;
  INPUTREPLY;

  HISTORY [ME, NOROUNDS] := GUESS;
  HISTORY [YOU, NOROUNDS] := REPLY;

  UPDATESCORE;
  SCOREMESSAGE
UNTIL REQUIREDSCORE;

  VICTORYMESSAGE;
END.
```

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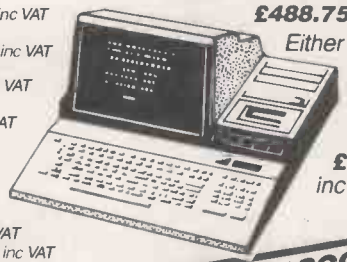

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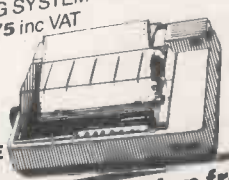

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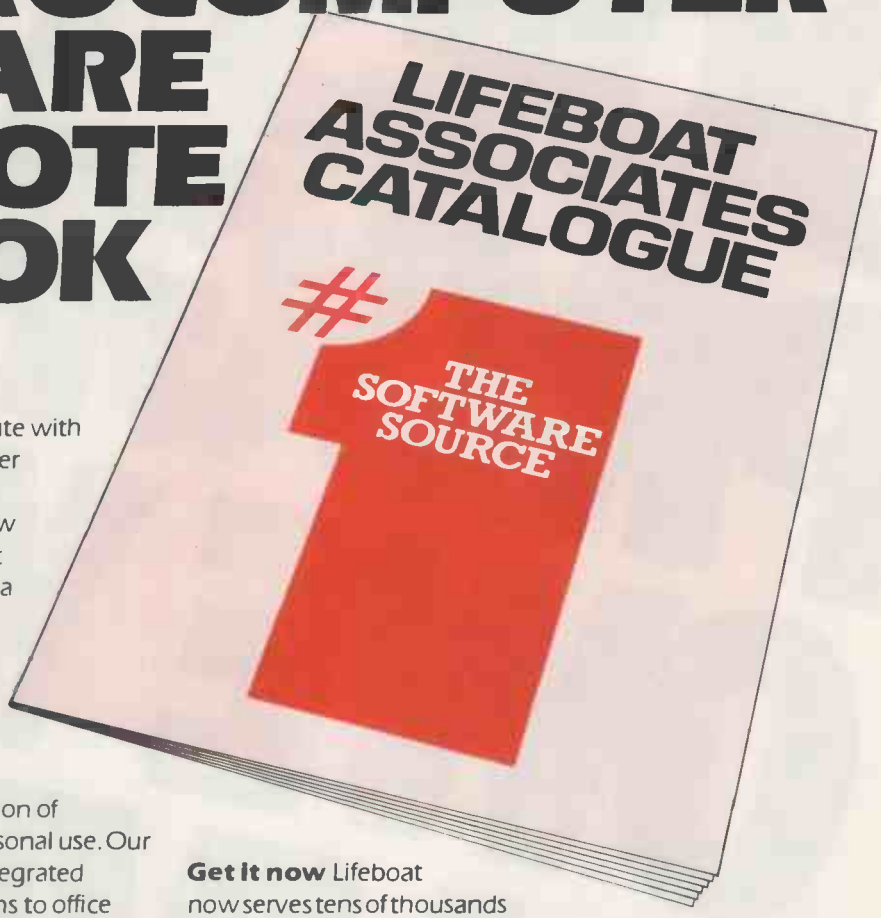

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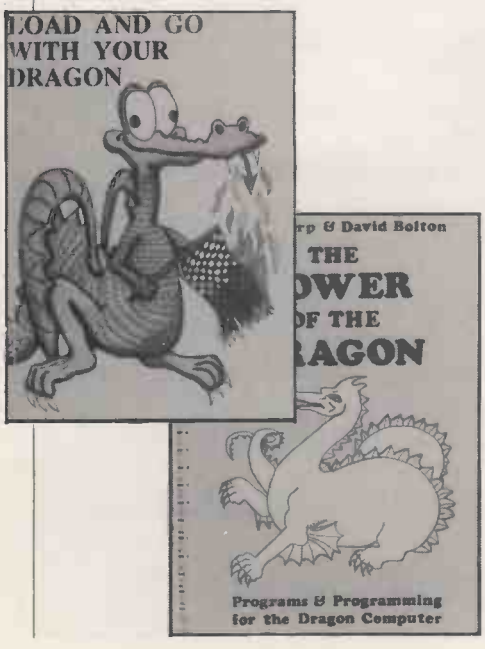
The quest for Dragon books

Will the fire-breathing Dragons lure you to the right book asks Ian Stobie.

DRAGON DATA is now claiming to have sold 80,000 Dragon 32 micros. To judge from the number of books aimed at owners, book publishers at least believe them. The books fall into two broad categories: collections of program listings with more or less extensive explanations; and introductory guides to programming the machine which aim to supplement the manual.

The prolific Tim Langdell's *35 Programs for the Dragon 32* was one of the first listing books to appear. It shows. A price of £4.95 for a 63-page paperback would be justified if the programs were very good but they are not. Most are short, with overblown names like Picasso or Home Accounts, and do simple things like draw patterns on the screen. There are no accompanying explanations of how the programs work.

An extra £1 buys you the much better *Enter the Dragon*, 200 pages of programs and explanations by Colin Carter. The standard of the games — for that is what most of the programs are — is quite high, and there are even some routines written in 6809 assembler. Colin Carter explains each program clearly in a brief but systematic way. All the programs in the book are available from the publisher on tape for readers who cannot face much typing.



Load and Go with Your Dragon by John Phipps and Trevor Toms is another good book which combines explanation and program listings. It is a shorter book than Carter's and contains less ambitious programs, again mainly games. The discussion of each program is longer, and new commands are introduced progressively and are fully explained. The authors give the impression that they really do want to show how it's all done rather than just earn a fast buck.

The Dragon 32 Book of Games by Mike James, S M Gee and Kay Ewbank has an honest title. It contains 21 games with explanations. They seem to be the same 21 games as in the same authors' BBC book, but are organised in a different order so that it is not too obvious. The games are not as good as Carter's and the explanations, although quite long are short on content. I would recommend Carter's book for gamesters, and Phipps' and Toms' book to beginning programmers. Incidentally Phipps and Toms are the only among the listings books to make much use of Rem statements within the programs to make them more readable.

There seems little consensus among the various publishing houses as to what a dragon looks like. John Sharp and David Bolton's *The Power of the Dragon* has a fat dinosaur on the front. It contains 30 programs with a lengthy line-by-line description of each one. I found this approach less helpful than a shorter but better structured description.

The programs are mainly games and graphics routines, with a few more serious ones thrown in for such things as calculating loan repayments and keeping simple records. At £5.95, which seems to be the standard price for a Dragon book, it is quite good value. The programs are available on cassette for an extra £4.95.

The Working Dragon 32 by David Lawrence, the computing vicar, sets out to give the Dragon user a set of practical programs and routines. The programs are organised into self-contained modules, making it easy for you to rip off sections to incorporate in your own applications. They cover storing data on tape and home

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accounting in addition to the usual graphics, music and quizzes.

There clearly is a need for books of this kind which provide more than just games, but there are a few problems with this

attempt. The listings are rather hard to read, being printed in a rather squashed dot-matrix typeface. It is a structured book with a slightly worthy tone, and seems to assume it is being read by a sober-minded parent rather than the much more likely precocious brat.

Typical of the second category of Dragon books is *The Dragon 32 and How to Make the Most of it*. It is written by Ian Sinclair, another of the circus of ultra-prolific micro writers, and was one of the first Dragon books out. Although it is written to a formula, with similar chapter headings to his other books on such machines as the Oric, Lynx and Spectrum, I did find Sinclair's book useful. It is not that it is better than the official Basic programming manual that comes with the Dragon than that it is different. The chapter on sound is particularly good.

George Knight's 98-page book *Learning to Use the Dragon 32 Computer* costs a rather steep £4.95. It is even more of a formula book, closely resembling some of the other 10 books in the Gower series, even down to the butterfly example in the graphics section. The danger with this approach is that the distinctive and most interesting features of each machine are lost.

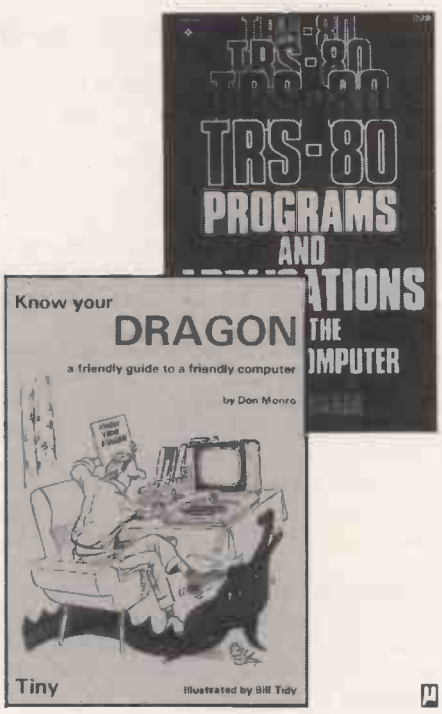
The three pages on sound, for instance, are pathetic compared to the clear treatment Ian Sinclair gives the subject or even the seven pages in the official manual. Formula books are useful in a field where the same person may want to read about and compare different products,but I suspect few Dragon owners will want to read any of the other 10 books in Gower's "Learning to Use" series.

The Dragon Programmer by S M Gee is from the same publisher as Ian Sinclair's book and seems rather unnecessary as it covers pretty much the same ground in a rather waffly and less informative way. Maybe the idea was to make it more of a beginners' book but in that case it does not succeed.

Don Monro's idiosyncratic *Know Your Dragon* is aimed at the complete beginner, and is rather ominously subtitled "A Friendly Guide to a Friendly Computer". It is full of cutesy jokes which very rapidly become tiresome unless your sense of humour is absolutely identical with the author's. The programs are generally fairly short and simple but they are available on tape for the lazy. The cartoons by Bill Tidy have the barest relevance to the text, but they do break it up and make the book look more accessible.

Like many of the other authors, Monro makes the strange assumption that the reader is a computing adult with children. But despite all these criticisms this is one of the books I found I was using the most, along with Sinclair's. It has a lot of information in it and at least it gives due weight to the Dragon's particular features. Some of Monro's text has a distinctly American flavour to it, and although the book does not admit it I suspect that the bulk of the text has been recycled from a book for the Tandy Color Computer, a big seller in the United States.

Programs for the Color Computer bought on tape do not always run on the Dragon as the Basic is tokenised differently, but the printed source code is identical so Color Computer programs you have typed in yourself should run. It is therefore worth looking out for American books like *TRS-80 Programs* and *Applications for the Color Computer* by Alfred Baker. However, at nearly £12 for a 187-page paperback it does not seem good value. In common with George Knight and S M Gee's books, its program listings appear to have been typeset rather than computer printed, a procedure whihc introduces an unnecessary source of bugs.



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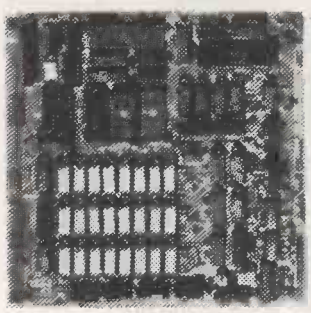

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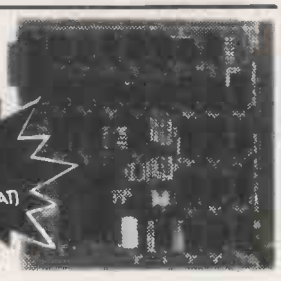

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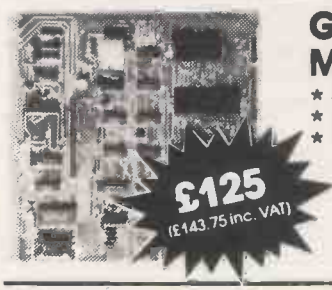

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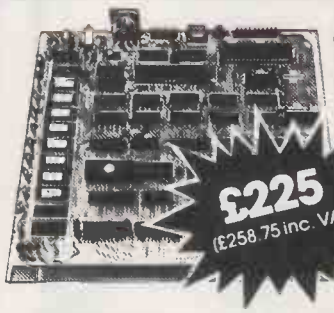

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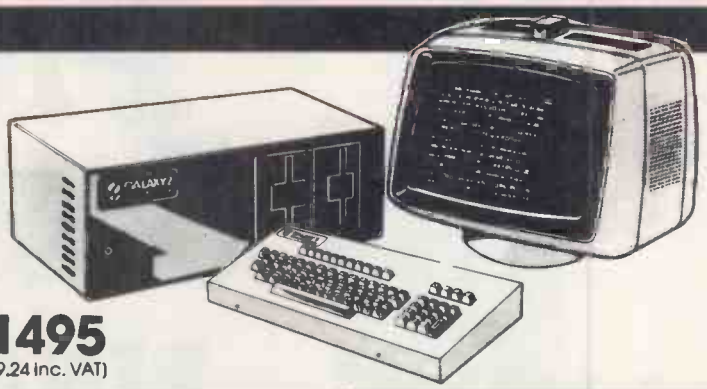

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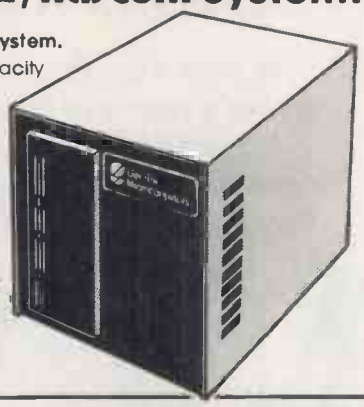

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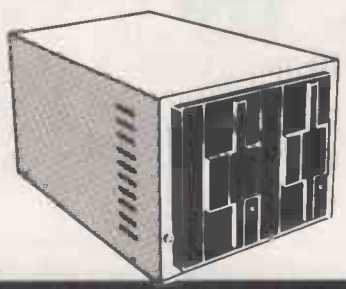
Called POLYDOS 4, it includes an editor and assembler and extends the Nascom BASIC to include disk commands.



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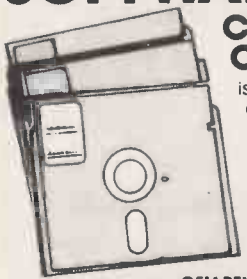
SOFTWARE



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PC9/83

>NEXT MONTH

>THE GRAPHIC IMAGE

The special subject in the October issue of *Practical Computing* takes in visual-display units and business graphics. Chris Naylor explains how TVs and monitors work, while John Lewell looks at the expanding field of computer graphics. Special techniques discussed in programming features are geometrical plotting, and area-filling techniques for the BBC Microcomputer.

>REVIEWS

One British micro to watch is the 16-bit Logica VTS: Chris Bidmead reports on how it performs. Another is the Advance. We take a first look at this low-cost IBM PC compatible micro, due to be launched later this year. Other products under review range from Dragon games to IBM PC books.

>FREE SUPPLEMENT

In addition there will be a special supplement on The Great British Micro attached to the October issue. It will provide an invaluable guide to the many British microcomputer manufacturers and their main products.

>AND MUCH MORE

In addition the October issue will contain a wide range of fascinating features from the very useful — such as using post codes for mail pre-sorting — to the very entertaining short story *Death to the Machine*. Plus columns, news, pages of free software in Open File, your letters and much more.

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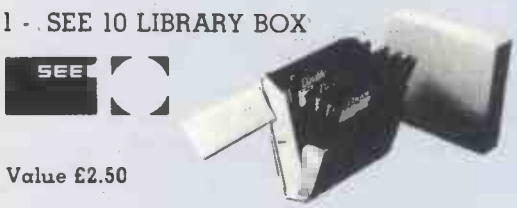

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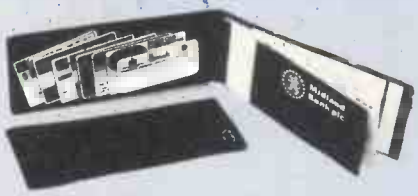

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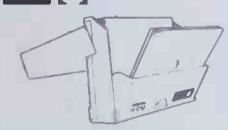

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The class of '83

Children do not study pens or text-books, they use them. Lorraine Boyce argues that they should do the same with computers.

THOUSANDS OF TEACHERS returning from their summer holiday will be faced for the first time by a micro in the classroom, thanks to the initiative of the Department of Trade and Industry. Those new to computers must be taught that they are not getting an electronic assistant or an omnipotent philosopher's stone, but a tool.

In schools, just as everywhere else, computers are there to be used, not studied. The novice to computing must begin by acquiring a range of skills, but that long-term aim is too often clouded by examination courses in computer studies.

Computer science may appear to be an attractive addition to a list of qualifications, but the higher-education sector has already begun to doubt its benefit. The ideal candidate for a computer science degree is more likely to have studied mathematics and physics than to have become immersed in the questionable requirements of computer studies at A-level.

Many fifth-year school leavers find themselves operating VDUs or word processors as part of a job gained without computer experience. They usually are well motivated enough to take the new skills in their stride.

So if neither the academic pupil nor the early leaver benefits from it, why is computer science on the curriculum? It dates from the age of punched cards and mainframes, and has become fossilised in our examination syllabuses.

Other members of the teaching profession hold a more balanced view of educational computing. With thousands of new machines being delivered to schools there is even an opportunity for anarchy. It may be that the micros can be wrested from the grasp of the prehistoric computing courses and the maths departments.

Who could lead such a foray into enemy ground? Who could usefully employ the captured equipment? The teachers of the humanities, that's who! Like their colleagues in the primary schools and in special and remedial education, teachers of the humanites have seen the immense and varied capabilities of the micro in school.

The micro can be an impressive motivator. Several primary-school heads who have been lent a Sinclair Spectrum for assessment express surprise at the speed with which some of their less able pupils mastered the keyboard. Data collection, classification and interpretation can be done with greater ease and speed on the machine. Information retrieval is of obvious interest to the librarian, often a member of the English department. Simulations can prompt a whole gamut of activities, with children using the micro for only a small number of them. The rest of the time is spent writing, drawing, measuring, reading and discussing.

Communication and its interpretation form a large part of the work of English departments. Many teachers of English have also begun to realise the tremendous potential of word processing. A child who is told "correct your spelling and write it out again" may feel reluctant and may even take it as a punishment for errors. Using the simplest word-processing program lifts a mundane task into another dimension. Northampton Educational Computing Centre has written a set of software on the Research Machines 480-Z for its primary schools which includes a suitably simple program for word processing.

If the humanities staff, led by teachers of English, seek to liberate the school micro from slavery to Basic and computer studies they will often find it guarded only by a weary conscript seconded from the maths team. He or she may well be delighted to be relieved of the unwanted responsibility and to return to preferred and essential work.

Teachers will need to make a conscious effort to master the essentials of using a micro. Most pupils will not: many children at infant level find it easy to pick up the skills needed to operate videos and play arcade games. It is the habit-bound adults who think that there is something difficult and mysterious to be learnt. Pity the computer-literate 11-year-old promoted to secondary school, who is told that he or she must wait until the fourth year and opt for computer studies before having access to machines again.

Teachers who successfully master the machine will probably come across two further stumbling blocks: machine failure and lack of appropriate software. The former problem must surely be resolved as design and construction improve, but that is no comfort to those who today find half the school's hardware is out of action or just temperamental. A busy teacher closeted in a classroom with 30 impatient children and a cassette which refuses to load will not be mollified by knowing how often high-technology aids have broken down at the crucial moment.

Lorraine Boyce is Information Officer of Microcomputer Users in Secondary Education

It is a truism that "the software sells the hardware". Could that be why the Department of Industry decided to give micros away, or at least to pay half their cost. On hearing that a micro is expected in their school the better-informed teachers ask: "Where is the software for me to use?" Primary schools will receive Tecmedia's beautifully presented package as well as MEP sponsored materials, including some excellent booklets and stimulating audio tapes. Otherwise the software component is largely disappointing. MEP has a long and exciting list of software projects in train, but the hardware is already there, in the schools.

Teachers and professional computing personnel react quite differently to commercially published educational software. The general shortage of money in schools means that a £15 program may be out of reach to the school department for which it is intended. At the same time it is laughably cheap to a commercial programmer. Some hard-pressed teachers are even expected to learn to program and write their own software. In slightly more enlightened areas teachers combine to set up a design team, working with competent programmers. If computer studies must remain on the curriculum maybe all those fourth- and fifth-year pupils could put their programming skills to use, writing software for primary schools.

Commercial publishers are starting to produce software derived from the real day-to-day needs of educational establishments. Heinemann's material originates from King Edward's School, Five Ways, and Cambridge University Press publishes software from Netherhall School, Cambridge. Longman and Edward Arnold publish science simulations produced at Chelsea College, and Ginn is in the primary field with Barry Holmes' programs based on explorations of Saqqara and the *Mary Rose*.

The software situation can only improve. One dreams of bewildered teachers in a few years time struggling to choose between a myriad of worthwhile and exciting educational programs. Meanwhile the healthiest indication of the probable development of educational computing is the entry of English teachers into the same arena. If you are still sceptical, look at *Exploring English with Microcomputers* edited by Daniel Chandler and published by the Council for Educational Technology for MEP. I'll pin my hopes for the future on the English departments.

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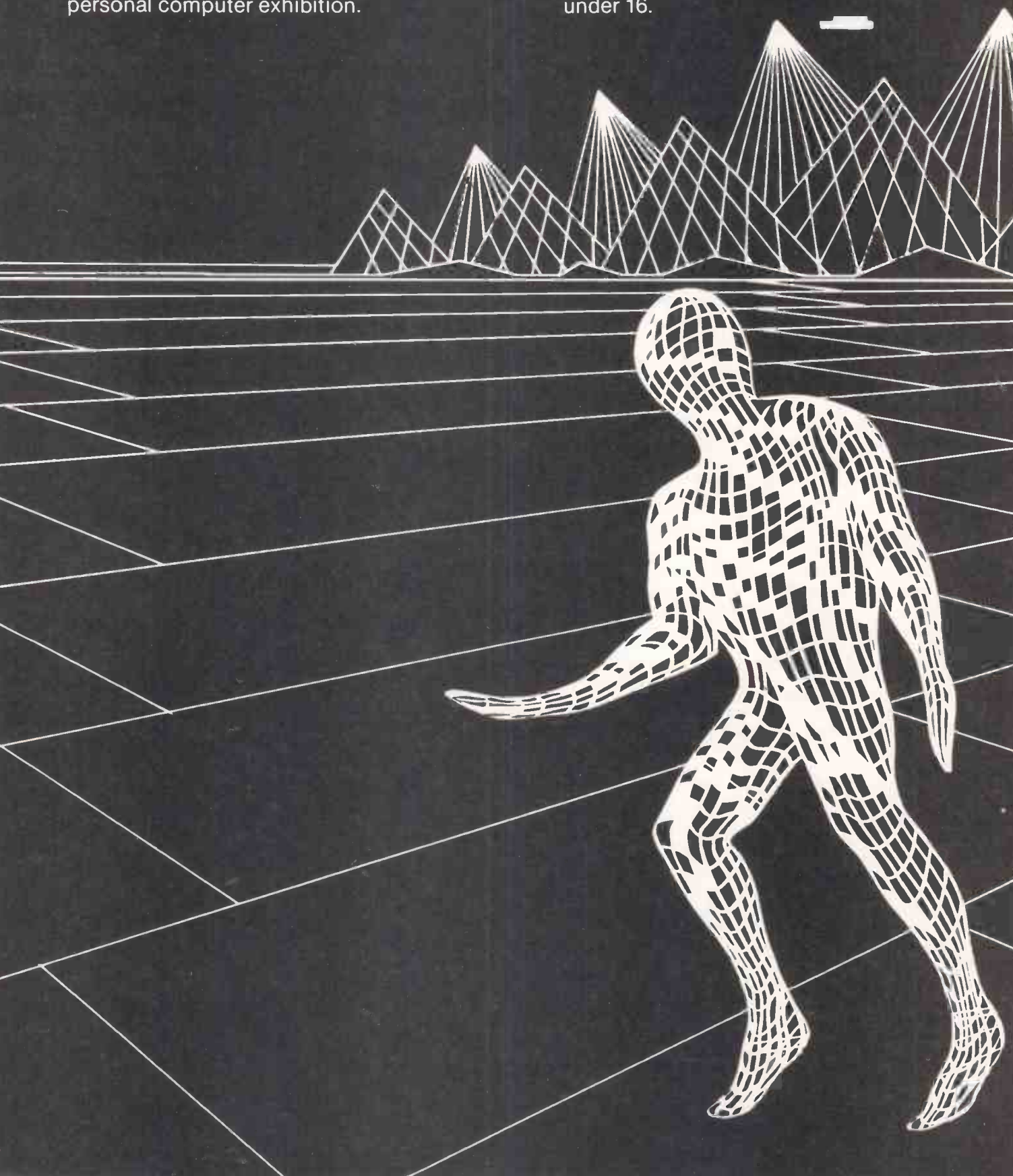

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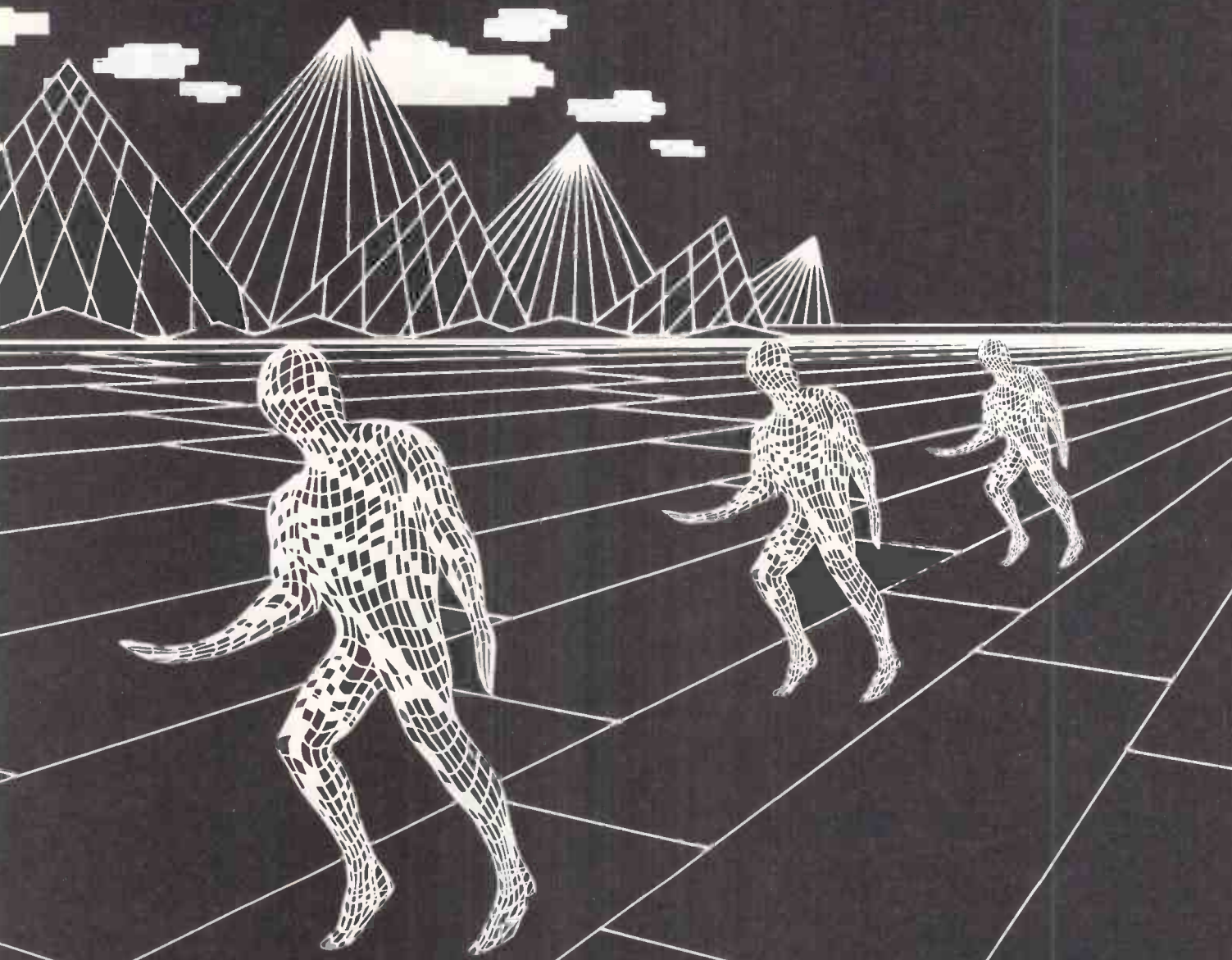

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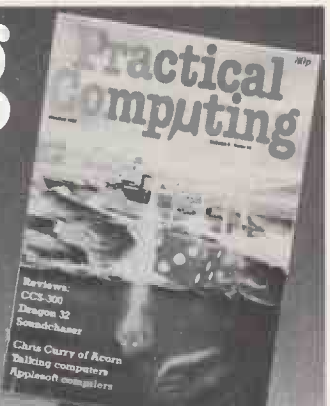

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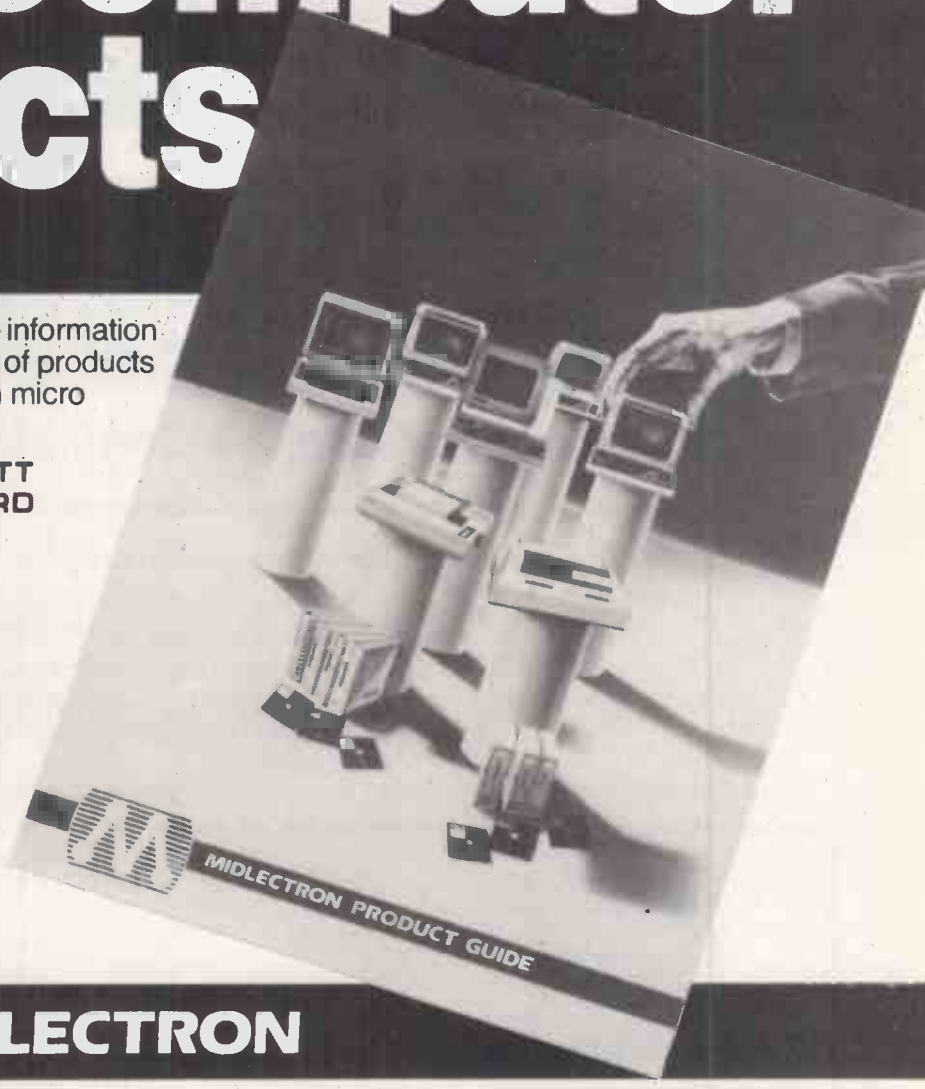

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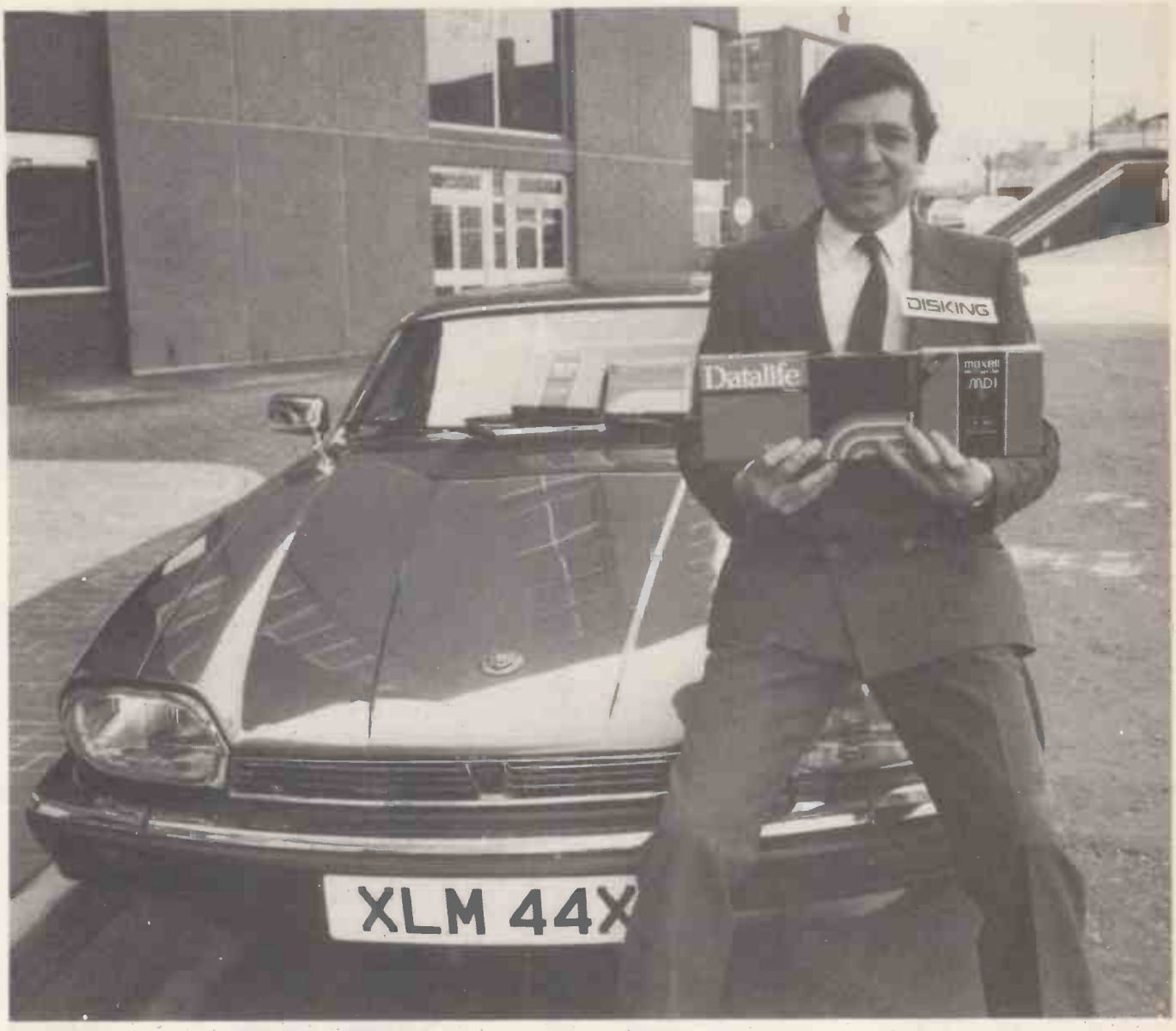

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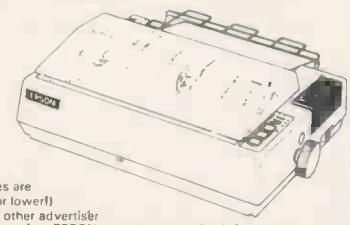

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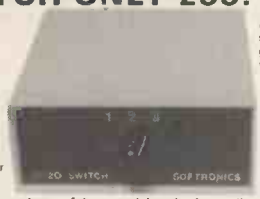

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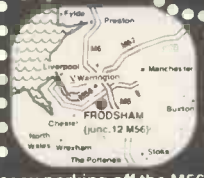

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