Practical Computing

80p

January 1983

Volume 6 Issue 1

Special issue
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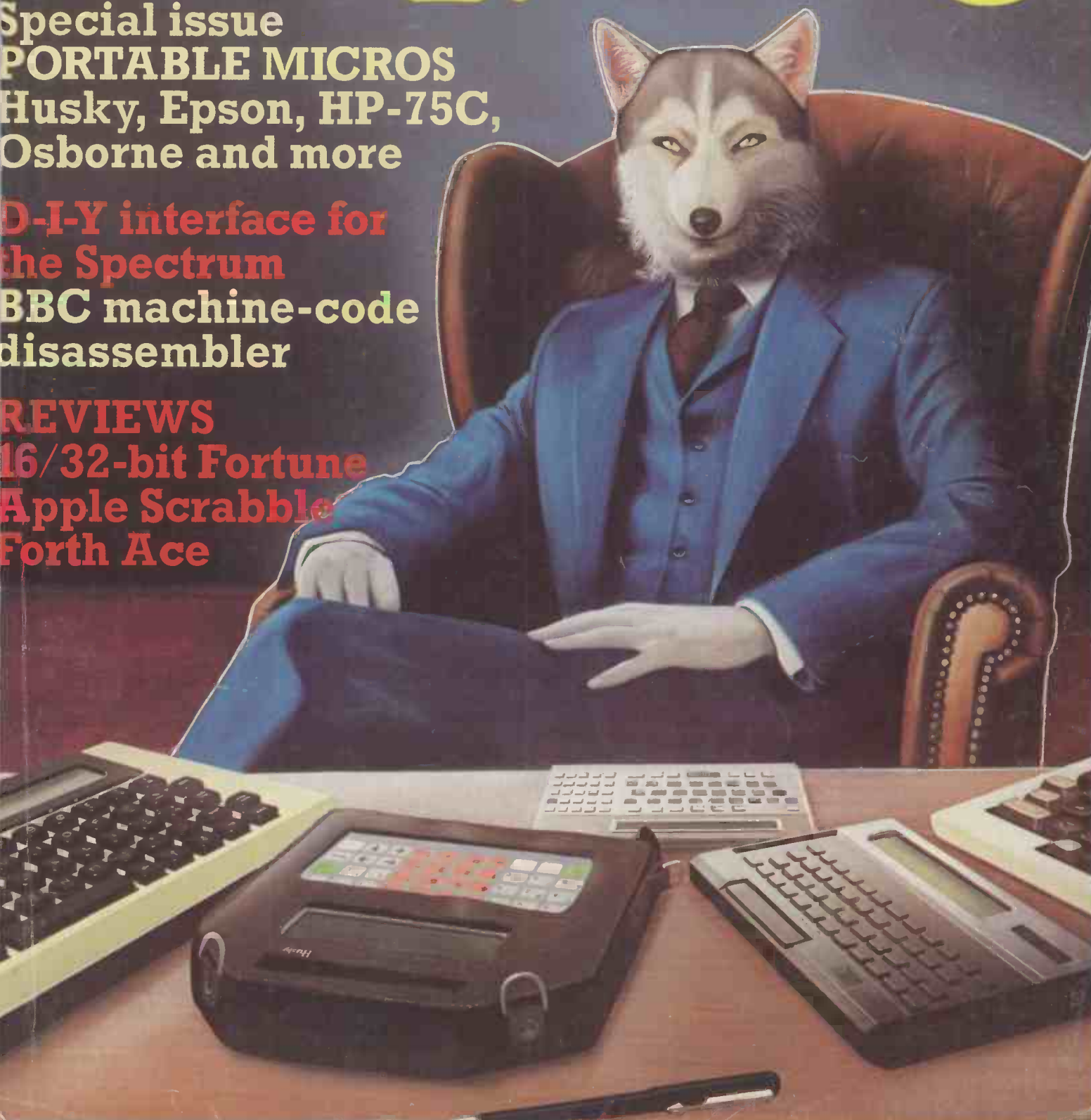

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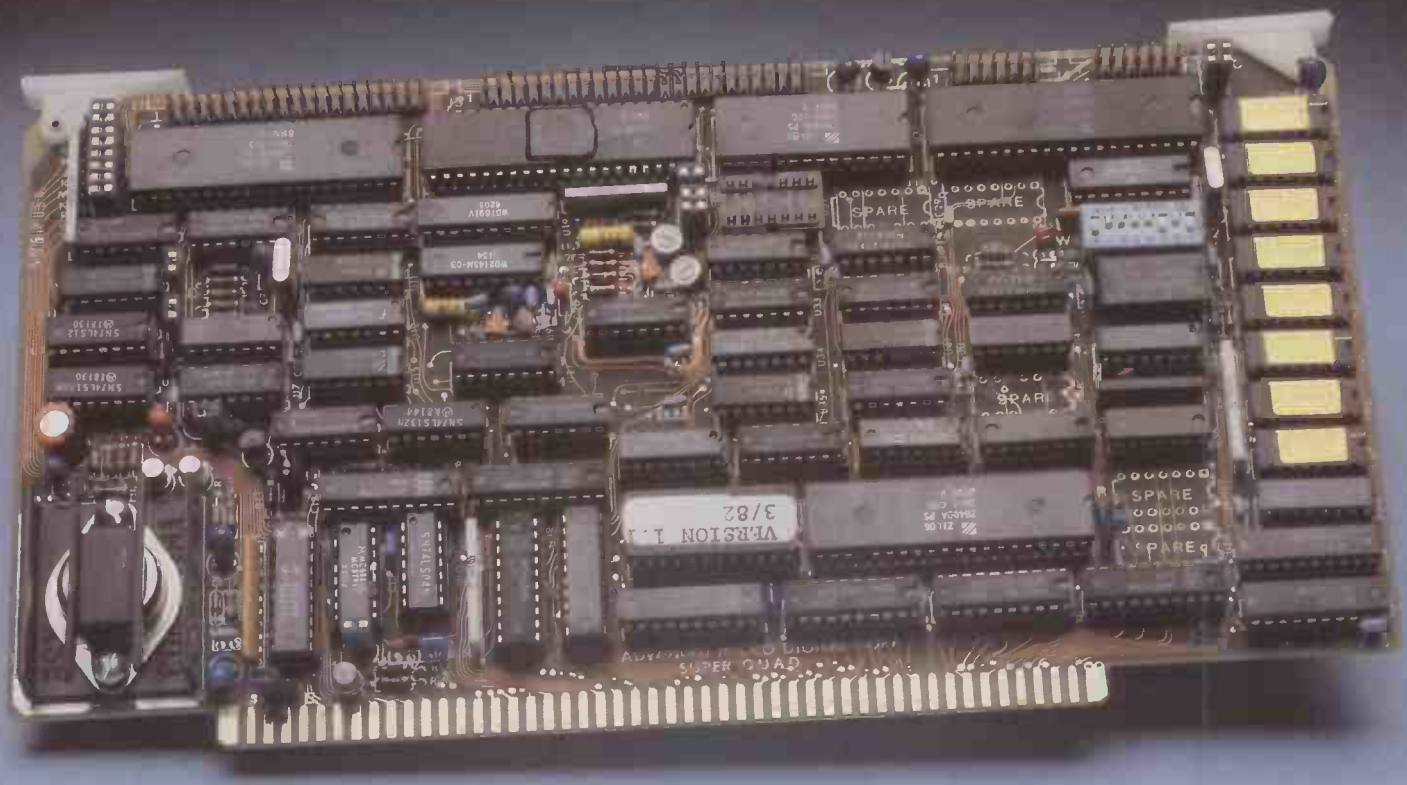

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Would-be authors are welcome to send articles to the Editor but *PC* cannot undertake to return them. Payment is at £30 per published page. Submissions should be typed or computer-printed across a 40-character width, and include a tape or disc of the program. Handwritten material is liable to delay and error.

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

Goodbye to all IT

INFORMATION TECHNOLOGY YEAR has been and gone, which presumably means most people will now forget all about it. In spite of the admirable efforts of the Minister of Information Technology, Kenneth Baker, Britain has not suddenly computerised itself.

In fact, very few of Britain's offices seem to have taken the giant step from the mechanical world of the manual typewriter to the electrical world of the IBM Golf-ball, let alone made the massive step to electronic word processing. Hotels, travel agents, shops and services are still, by and large, run using thousands of small pieces of paper and long telephone numbers which are, tediously, dialled by hand many, many times a day.

Perhaps the most memorable aspect of the whole IT year was the issuing of two special stamps, which were so extravagantly long they required two tongue-strokes. In this respect they could not be considered an improvement on the 1840 originals.

Just why are we so backwards at going forwards? There is no single answer to this question. Ignorance, fear and trade union intransigence are often mentioned as reasons, partly because all three appear together so regularly. The failure of businesses to invest is another factor, and there are few offices which could not be cited, as mentioned above, as evidence of this. But a new report from the NCC*, published by Heidrick and Struggles, finds a new scapegoat in middle management.

The enemy is male, 44 years old, married with 2.2 children, has a degree, earns £18,500 a year and is probably a member of the British Computer Society and perhaps the Rotary Club. The problem: he is slow to respond to change. The alarming conclusion of the report is that the rate of adoption of new technology is slower than senior management and the workers and — of course — the computer industry would like.

The middle manager does not want to introduce computers which would upset his organised routine. He does not want computers breaking down the boundaries between the different departments of the company, spoiling his little empire. He does not want computers because he doesn't really understand them, and it would be unbearable if that new school-leaver or junior-cum-office-dog's-body proved to be an adept. Most of all, the company gets along alright now, thank you, so why bother trying to improve things?

Meanwhile, the company chairman sees his foreign competitors adopting new technology and taking his export business. The more enlightened worker sees that with a loss of competitiveness comes an inevitable loss of jobs. "Computerise!" The cry is heard on all sides, with Kenneth Baker leading the chorus . . .

The middle manager finally bestirs himself. He spends several man-weeks agonising over the choice of micro, before finally doing nothing. "Wait!" he replies.

Don't hold your breath. Having "saved" the company some £5,000, less capital allowance, he climbs into his company car — cost: £10,000 plus petrol — and drives home. If we are lucky, his 2.2 children are monopolising the TV playing Space Invaders on a cheap home micro, thus absorbing a love for computers which is so strong that not even being taught computing at school will be able to destroy it. If we are even luckier, by the time they grow up there will still be some British Industry left for them to save.

In truth the middle manager has a point. Computers are not a panacea. Computerising Britain will not transform the nation overnight, or even over a year. The failure to adopt new technology is neither the disease nor the cure. It is, instead, a symptom of the larger failure to move with the times, and to be adventurous and take risks rather than settling for the easy way out.

Never mind. Now we can turn our attention to 1983 — the Year of Beautiful Britain, Welsh Castle Year, and the Year of Telecommunications between Governments. That should result in some even prettier stamps.

**Information Technology — the management of change in the UK.*

5 Years ago...

. . . the first Apple, basically a kit of parts for knowledgeable hobbyists, was quickly converted into a market research exercise for a properly-funded, second-generation machine.

With a new product specified by March last year, the company had the cash needed to develop it as a fully packageable product. There was no question of sticking badges on other people's boxes.

By January this year Apple could move into a proper factory, having sold around $3 million worth of the Apple II — formally announced on June 5, 1977. Sales of this machine in the U.S. are expected to reach five times that figure by the end of this year.

The U.K. Apple II is, thankfully, not the same product as sold in the States. A key factor in its appeal is the ability to drive a colour television. American television differs radically from the PAL colour television system used in Britain (and Germany) so a new colour driver circuit had to be designed for sale here. The design project was not exactly rushed, with the result that the Apple II computer is not yet truly six months old here.

Prices: Computer with 4K RAM: £995. 8K: £1,050. 16K: £1,250. 48K: £1,900.
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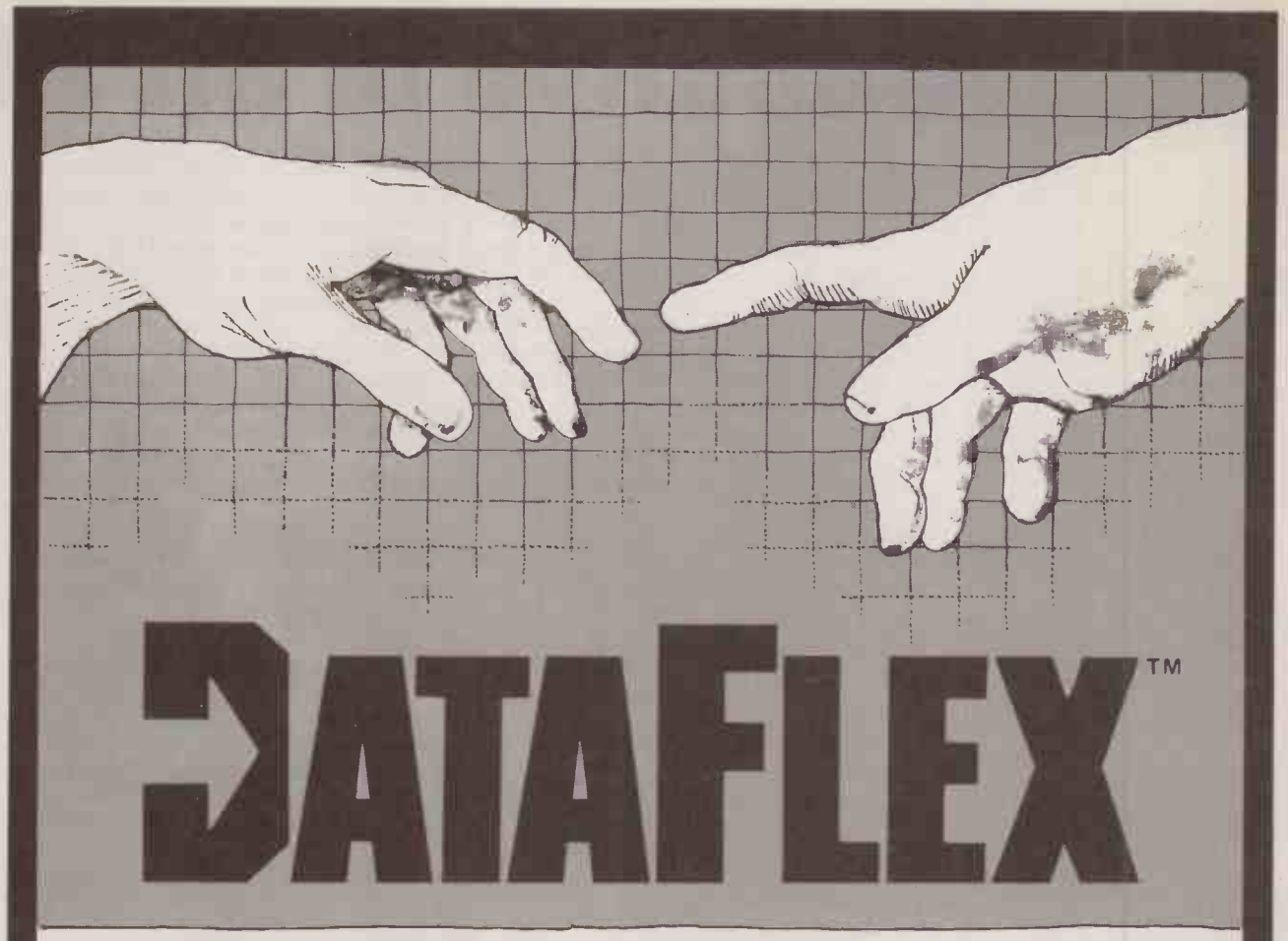

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Spaghetti pots of Gotos

BORIS ALLAN'S article on the Tower of Hanoi problem — *Practical Computing*, September 1982, — certainly shows that the problem can be solved on small, cheap, computers — but isn't the whole matter of programming languages a question of "the right tools for the job"?

If I wanted to write a payroll package, I'd probably use Cobol; for number crunching, I'd prefer Fortran; for real-time applications I use Coral-66. I do not regard any language as "the best", but each is appropriate for its task.

Good problem solving depends not only on using the appropriate tools but on using them skilfully. The "perpetrators of rubbish" who "frequently avoid Goto" generally produce programs which are easier to write, understand and debug than the spaghetti pots of Gotos which Boris Allan presumably prefers. I notice that he makes no mention of the recursive features of BBC Basic which allow a simple, elegant expression of the Tower problem — or is recursion also "rubbish"?

The key question in choosing any language or computer should be, "Can it be made to do what I want with the minimum effort on my part?" Just because no one product is "the best" overall, this does not mean that they are all equal.

Anne R Heinrichsons,
Wokingham,
Berkshire.

Induction and proofs

IN NOVEMBER'S issue of *Practical Computing*, Boris Allan replies to my letter of the previous month. Since he repeats some of the mistakes of his original article — published in August's issue, the topic was proving programs correct — I must assume that it was written before the correspondence that has taken place between myself and Dr Allan. Since Dr Allan has criticised my letter I would be grateful if you would accord me a chance to reply further.

Firstly induction: "Induction is induction," says Dr Allan. Presumably he is asserting that since "scientific" induction is not a valid method of proof, then neither is mathematical induction. This is, of course, nonsense. Simply because both are called induction, it does not imply any logical connection between the validity of the two methods. In "scientific" induction it is asserted that because something happened yesterday it will happen today. This is obviously rubbish.

In a proof by mathematical induction it is proven that if a statement or theorem is true for some n, then as a logical and necessary consequence it is true for n+1. Note that n is not an explicit value, but it is general. We can prove the assertion for some particular value. If, for example, it is obviously true if n=1, this implies it is true for 1+1=2, which implies it is true for 1+2=3, and so on for all integers. The logic is faultless.

Would Dr Allen be happy if we changed the name of the method to "mathematical inference"? His statement makes as much sense as saying that cheddar cheese is mouldy because Danish blue vein is; after all, cheese is cheese and to try and distinguish between different types of cheese seems fruitless!

Secondly Dr Allan's criticism of my trivial program is just splitting hairs. He could have run the program on the Jupiter Ace — which uses Forth, and not Basic — and it would have failed. Sinclair Basic and Atom Basic are not Microsoft Basic, and to expect a program that is correct in one version to run faultlessly in another is ridiculous. I reassert that

```
10 A = 1
```

is a correct Microsoft Basic program.

Finally, Dr Allan asks for a proof that the program is correct. I have supplied him with a proof in our correspondence, and if any reader would like a copy I would be happy to supply him or her with it. It is unfortunately too long to include here.

Carl Zetie,
Maidenhead,
Berkshire.

Lucid and succinct

I ENTIRELY AGREED with the letter from Mr Carl Zetie in the October issue which was an admirable, lucid and succinct refutation of Dr Allan's ideas. If Dr Allan — as he says in November — regards it as fruitless to distinguish between the different meanings of induction, Popper himself does not.

In his book *The Logic of Scientific Discovery* he writes of scientific induction: "Now in my view there is no such thing as induction," adding in a footnote, "I am not . . . here considering so-called mathematical induction."

In the Basic program

```
10 A = 1
```

Mr Zetie presumably wanted to concentrate on the essential element, the statement "Set A to 1". It was surely valid, in the interests of brevity, to leave out some syntactic extras. Some Basics require Let, in others it is optional. My complete program including the assertions necessary to the proof would be:

```
ASSERT:    A is undefined
10         (LET) A = 1
ASSERT:    A = 1
20         END
```

Obviously this will not run under any existing Basic because no Basic has, as yet, facilities for proving programs correct, but it does demonstrate the necessary elements.

D A H Brown,
Malvern,
Worcestershire.

Morse omission

HAVING RECEIVED a number of enquiries about our morse program in *Practical Computing*, August 1982, we ought to point out that a rather important piece of information was omitted. The program assumes that the Pet is connected to an Easicomp sound generator and that a machine-code patch provided by Easicomp Ltd, 57 Panama Court, Sprowston, Norwich NR7 8BH is loaded. Statements in the program of the type

```
POKE 950, 0: POKE 951, 54: SYS 845
```

are controlling the sound generator.

However, the program can be modified to drive a transistor oscillator directly from the user ports. A listing of this alternative program can be obtained from the authors.

D Wakelin,
C Dracup,
Newcastle upon Tyne Polytechnic.

Tax interpretation

I REGRET to note that James Fergusson, Feedback, September 1982, has completely misrepresented the function of my program Income Tax, June 1982. He refers to it as though it was intended to be a fully comprehensive treatise on taxation covering every possible circumstance, and then points out the "errors and inadequacies" compared to that interpretation.

I am aware that taxation law and practice is very complex, with numerous exceptions and variations to general rules, but most of these only apply to a minority of tax payers. As Mr Fergusson correctly surmises, to cater specifically for all of these would have expanded the program beyond the capacity of most Pets and the length of the article beyond the capacity of *Practical Computing*. Such programs can sell commercially for hundreds of pounds.

My program provides a quick, accurate and convenient ready reckoner for straightforward income tax assessments and this function was clearly stated in the final paragraph.

Incidentally I have received

(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)
many appreciative letters and orders for cassettes from practising accountants, universities and colleges of higher education, and in the three months since publication I have not received any complaints whatsoever.

E G Acraman,
Ruislip,
Middlesex.

Hanoi too basic

THE ARTICLE by Boris Allan in the September issue of *Practical Computing* appeared to be guilty of the failings it attempts to criticise. The solution offered to the Towers of Hanoi problem seems to be at too low a level to be either easily understood or easily translated into languages other than Basic.

In general my criticisms are:

- The solution is too tied to a Von-Neuman architecture.
- The solution assumes that computers will always work in binary. We should not tie ourselves to this number system just to make things easier for electrical engineers. Many numerical analysts would much prefer a base-10 system which eliminated rounding errors in base conversion.
- The structure of the problem is not evident from the programs produced.
- There is no reason why successive characters should have successive codes. We are fortunate that this is a property of the ASCII code but this need not necessarily be true of all character codes.
- The programs as they appear are hard to understand. As a programmer of some years experience I could only vaguely see how the BBC illogical version might work.

We use high-level languages to make things easier for ourselves. We use Basic not because it is the most efficient language in the world but because it is easier to understand than machine code. A higher-level approach to specify a method for solving this particular problem would aid our understanding of it and make it easier to prove that our solution is correct.

The classic solution to the Towers of Hanoi problem uses recursion. It can be found in *An Introduction to Programming* by Richard Conway and David Gries as well as numerous other books on programming practice.

The solution is arrived at by the following logic. Firstly number the towers 1,2 and 3. The problem is now rephrased as "move discs from tower 1 to tower 2 using tower 3 as temporary storage."

The largest disc is clearly a key disc since it can only be placed at the bottom of a tower; therefore we concentrate on placing it first. The first refinement of the solution for six discs is therefore:

1. Move five discs from tower 1 to tower 3 using tower 2 as temporary storage.
2. Move one disc from tower 1, the largest disc, to tower 2.
3. Move five discs from tower 3 to tower 2 using tower 1 as temporary storage.

We must now expand step 1. Clearly here the second-largest disc is important since it may only be placed in three positions. Therefore we concentrate on placing it. The steps are:

1. Move four discs from tower 1 to tower 2 using tower 3 as temporary storage.
2. Move one disc, the second largest, from tower 1 to tower 3.
3. Move four discs from tower 2 to tower 3 using tower 1 as temporary storage.

A pattern emerges and the strategy can be seen to be:

1. Move all but one disc to the spare tower.
2. Move last disc to the correct tower.
3. Move the discs on the spare tower on to the destination tower.

We can now conceive a generalised routine for moving the disc. Assume there are N discs, the source tower is numbered X, the destination tower is number Y and the spare tower is numbered Z.

The routine is then:

1. Move N – 1 discs from tower X to tower Z using tower Y as temporary storage.
2. Move one disc from tower Z to tower Y.
3. Move N – 1 discs from tower Z to tower Y using tower X as temporary storage.

The only special case is where N = 1 and the disc can be moved immediately.

Since X,Y,Z and N may take on any values the routine can call itself to perform steps 1 and 3. The program as listed is a clear representation of the algorithm and contains no low-level features. Of course it is not possible to write the program simply in most versions of Basic but that is a fault in the language design rather than in the problem solution.

The program shown is in a version of Fortran 77 which permits recursion. Pascal would be quite adequate for the implementation of this algorithm. Since the solution has a recursive nature it will obviously execute faster on a machine with stack hardware, but this is not essential. Even in the Fortran solution no unsightly contortions of the program were necessary to produce Goto-less code.

Dr Allan is correct in urging us to forget about individual machines and languages. Unfortunately he has become trapped in a bit-twiddling world of Basic compilers. We should instead seek high-level computer-independent solutions to our problems before developing a low-level answer based on the nature of the computer rather than the nature of the problem. The computer should be a useful tool rather than an obstacle to get round. If we are lucky we may find that one day the facilities for implementing our high-level solutions become available to everyone.

M S Jackson,
Wolverhampton,
West Midlands.

Hanoi too basic.

```
      PROGRAM MAIN
      INTEGER DISCS
C
C     READ NO. OF DISCS
      PRINT*,'ENTER NUMBER OF DISCS'
      READ(1,*)DISCS
C
C     CALL TOWER ROUTINE
      CALL HANOI(1,2,3,DISCS)
      CALL EXIT
      END
C
C
C     MOVE DISCS FROM X TO Y
C     USE Z AS TEMPORARY STORAGE IF REQUIRED
      SUBROUTINE HANOI(X,Y,Z,DISCS)
      INTEGER X,Y,Z,DISCS
      IF(DISCS. EQ. 1)THEN
        PRINT*,'MOVE DISC FROM ',X,' TO ',Y
      ELSE
        CALL HANOI(X,Z,Y,DISCS-1)
        PRINT*,'MOVE DISC FROM ',X,' TO ',Y
        CALL HANOI(Z,Y,X,DISC-1)
      ENDIF
      RETURN
      END


 ENTER NUMBER OF DISCS
 3
  MOVE DISC FROM          1 TO          2
  MOVE DISC FROM          1 TO          3
  MOVE DISC FROM          2 TO          3
  MOVE DISC FROM          1 TO          2
  MOVE DISC FROM          3 TO          1
  MOVE DISC FROM          3 TO          2
  MOVE DISC FROM          1 TO          2
```

Wordpro points

IN DAVID OBORNE'S perceptive article "Wordpro revisited" — October issue, page 129 — in which he uncovers some of the finer benefits of Wordpro, he says several things which are a shade misleading and should be corrected. It is Wego Computers, not Professional Software, who distributes the package in the U.K., so please write to us for information on Wordpro.

Wordpro does not favour just the NEC Spinwriter and the Ricoh. The biggest seller with Wordpro at the moment is probably the Commodore 8300 — the Diablo in CBM clothing — because of its price of £1,395. Qume is another favourite.

David Oborne explains the use of assigned ASCII characters to print subscripts

(continued on page 13)

comart communicator

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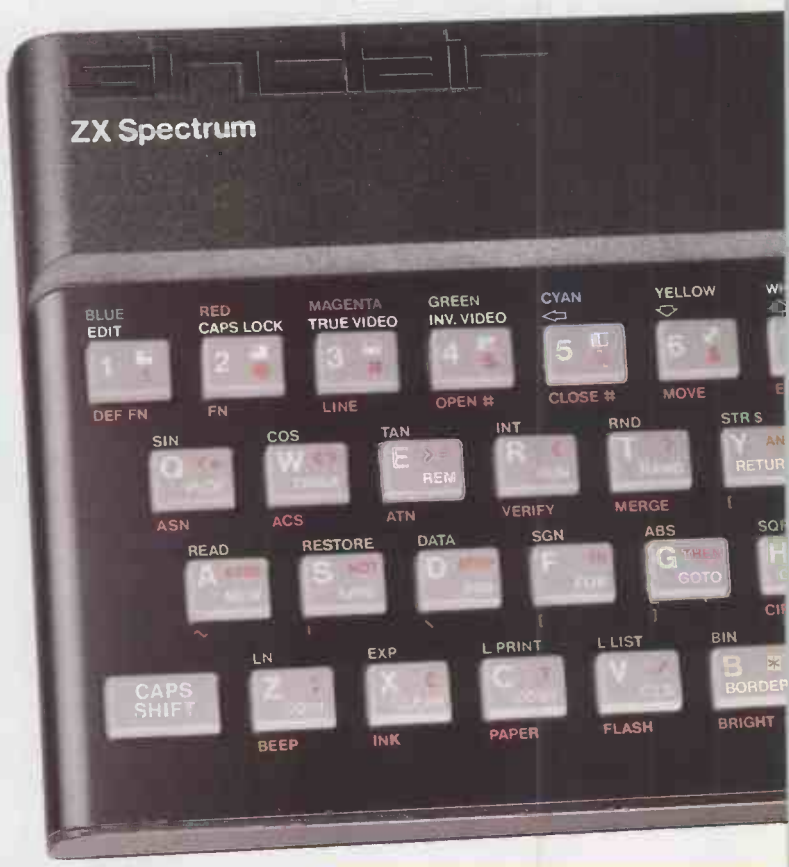

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The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can uprate later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.

Key features of the Sinclair ZX Spectrum

- Full colour – 8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound – BEEP command with variable pitch and duration.
- Massive RAM – 16K or 48K.
- Full-size moving-key keyboard – all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution – 256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set – with upper- and lower-case characters.
- Teletext-compatible – user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE – 16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC – incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

um

ZX Spectrum software on cassettes – available now

The first 21 software cassettes are ow available directly from Sinclair. roduced by ICL and Psion, subjects clude games, education, and business/ ousehold management. Galactic vasion... Flight Simulation... Chess... istory... Inventions... VU-CALC... VU-3D .47 programs in all. There's something r everyone, and they all make full use f the Spectrum's colour, sound and raphics capabilities. You'll receive a etailed catalogue with your Spectrum.

RS232 / network interface board

This interface, available later this ear, will enable you to connect your X Spectrum to a whole host of printers, erminals and other computers.

The potential is enormous. And the stonishingly low price of only £20 is ossible only because the operating ystems are already designed into the OM.

sinclair

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

The ZX Printer – available now

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

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.

The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy.

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

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.

How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Barclaycard, Access or Trustcard.

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

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

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

Please tick if you require a VAT receipt ☐

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*Please delete/complete as applicable

Signature

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Name: Mr/Mrs/Miss

Address

PRC901

FREEPOST – no stamp needed. Prices apply to UK only. Export prices on application.

(continued from page 8)
and superscripts on the Ricoh. Of course with most printers there is a standard embedded command in Wordpro: Ctrl-4 for superscripts and Ctrl-6 for subscripts.

We would be very pleased if readers could give us feedback on ways of "bending" Wordpro to their advantage. We have recently found a way of double-underlining a row of figures — something that accountants insist on for totals. It is rather long to describe here, but we would be happy to send a copy of the description to any of your readers.

Jill Hewett,
Wego Computers Ltd,
22a High Street,
Caterham,
Surrey CR3 5UA.

Apple formatter

I HAVE JUST FINISHED typing in the Apple text editor-formatter program in September's Apple Pie. While this is an excellent program, I have two problems with it:

- The program has been saved on disc. If it is called up using BRun, then the first time Ctrl-L is used, whether text has been entered or not, then the program is called up from disc and run again.
- If the last character of the input text is Ctrl-L, the program locks during coding.

If anyone has a solution I would be grateful.

Philip Colmer,
Fordingbridge,
Hampshire.

BBC Bytes back

THERE IS NO NEED to go to the lengths Mr Hill does — November issue — to achieve automatic line feed on your printer, since the micro can do it for you.

*FX6 sets the Printer Ignore character — it is ignored by the printer routine and is not set. This character defaults to the line-feed character. To send line feeds enter

*FX6, 0

For fuller details see page 423 of the user guide.

T Duffield,
Stansted,
Essex.

Sound seduction

HAVING BEEN SEDUCED by a young lady in one magazine claiming low G in the bass clef for 0 in BBC sound compared with the low A claimed by *Practical Computing* I find that my own machine blurts out a very nearly accurate B — 0.5Hz out of pitch, checked against a frequency meter.

As a musician, I find this discrepancy an irritation. Is there any way of altering this frequency, or is the division frequency derived from the main clock? I suppose it means that I can number-crunch faster than my rivals.

Douglas Tate,
Ampthill,
Bedfordshire.

Spectrum software

LOOKING THROUGH your adverts it is clear that no one has yet got his or her act together to offer much decent material for the Spectrum. Can I therefore offer potential producers some guidance:

- Warmed-up ZX-81 software will sell to 16K Spectrum owners whose machine is their first purchase.
- Most of the rest of we Spectrum owners are ZX-81 owners who have upgraded, and we are likely to be suspicious of offerings with vague descriptions. The reason for this is that some of the stuff we bought for our ZX-81s was pretty awful, and we don't Intend to get caught a second time.
- The advent of the Microdrive and the promised RS-232 interface — which will enable us to output to "proper" printers — will change the nature of the game.

Here's a list of items I'll be looking for:
Comal, Pilot, and Forth.
A graph, histogram and pie-chart plotting program.
A decent VisiCalc-type system.
An electronic card index with a good set of searching, sorting, listing and counting facilities.
A renumber program to use on my own programs in Sinclair Basic.
A text editor.
A program to reformat output to an 80-column printer.

D Simpson,
Rochdale,
Greater Manchester.

Libel laws

HOW REFRESHING to see a totally unbiased article in your October edition. I refer, of course, to P K Chilvers' article on the BBC Microcomputer and the Sinclair Spectrum. It is

(continued on page 15)

(continued from page 13)

such a shame that other magazines do not print such articles, as this would dispel many of the rumours abounding about the virtuosity of one computer compared with another.

However, I did get the impression that although the author had attempted to give an unbiased opinion of the two micros, some form of censorship had been applied to the article in order for it not to offend. This practice, although unprovable, is wrong, as it leads to false information being relayed and hence ultimately in making your magazine's views worthless.

It is obvious to those of us who have used both a Spectrum and the BBC Micro that there is no comparison at all. The BBC machine leaves the Spectrum standing in all aspects of operation. The Spectrum's advantage of price is far outweighed by the disadvantages — keyboard, Basic, speed, display, expansion, etc. I would not hesitate to say the BBC Micro is the most advanced computer in Europe, and possibly the world.

Simon Clark
Towcester,
Northants.

● We do not censor articles, but our contributors generally try to stay on the right side of the U.K.'s illiberal libel laws. Your assertion about the BBC Micro might upset the makers of the Cray 1, not to mention IBM, but it is certainly one of the best currently available home computers costing less than £400, our lawyers agree.

Spectrum deliveries

I AM WRITING in regard to your article "Spectrum's Delays", which appeared on page 48 of the November issue. You quoted the then current expected delivery date as January 1983, but I should point out that we have now completely cleared our backlog on Spectrum and all orders are now being fulfilled within 28 days of our receipt of them.

Bill Nichols,
Sinclair Research Ltd,
London SW1.

● We will take Sinclair's word for this — unless, of course, you know different.

Illegible listings

A FEW DAYS AGO I received my copy of the October issue of *Practical Computing*, and having glanced through it briefly I am prompted to complain at the legibility of some of the computer listings. A particularly bad example is that for the Apple II Graphics on page 174 but there are others almost as bad — as indeed there have been in other issues.

Surely you must be aware that the chance to try out new programs is one of the main reasons why your readers buy the magazine.

I am sure you will say that there are technical problems in obtaining a consistent print size and quality, but these problems are yours and should not be passed on to your readers who have paid money for a readable magazine.

This point aside, thank you for an excellent publication.

Hugh McDonald,
Wallsend,
Tyne and Wear.

● We are making every effort to improve the quality of our program listings as should be evident from this month's issue. Contributors can help by always supplying a cassette or disc as well as a program listing.

Wiley's books

IN THE October and November issues of *Practical Computing* you were good enough to review some of our titles. I would like to point out, however, that *Microcomputer Buyer's Guide 1981* is published by Hayden but is distributed in the U.K. by John Wiley and Sons Ltd. *Pet Graphics* is also published by Hayden and distributed by us for sale in Europe only. It is available in the U.K. and Ireland from Nick Hampshire Publications, PO Box 13, Lysander Road, Yeovil, Somerset.

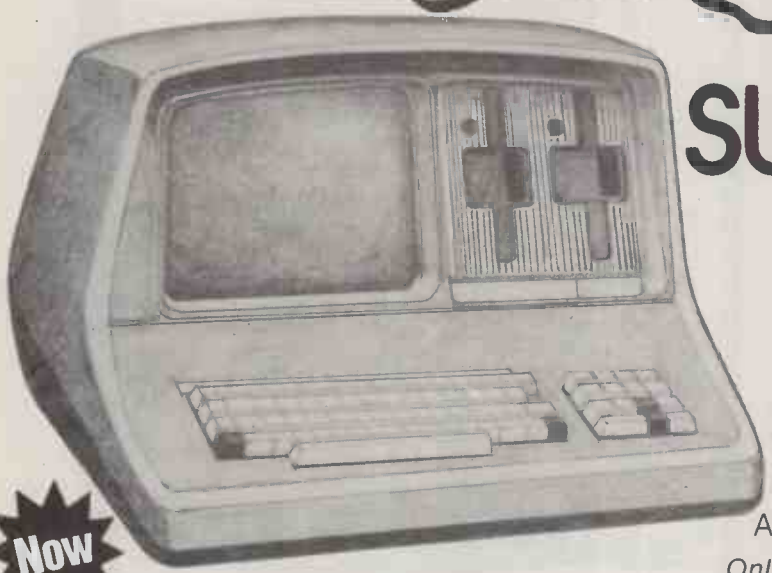
Bernice Preddy,
John Wiley & Sons Ltd,
Chichester.

Apology

"The BBC Micro as a colour graphics terminal" published in the November issue was written by John Ferguson and John Gordon, not as originally credited.

Brainless prices!

FREE membership to Micro Computer Club when you buy SUPERBRAIN. Entitles you to other special offers



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All prices are based on exchange rate at time of going to press and may be subject to change. All orders must be accompanied by a cheque for the sum due. This will not be banked until four days before despatch.
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Compec '82 report

Around 400 firms exhibited at Compec

NEW 16-BIT micros, portables, and local area networks were the main themes of Compec '82. There was little that was startling, but a lot of evidence of continuing development in these areas.

As well as the by now familiar Sirius/Victor 9000 and IBM PC there were several recent or brand-new 16-bit micros at the show.

Six interesting machines all use the powerful Motorola 68000 16/32-bit processor: the Fortune — reviewed on page 66 of this issue — the Sage II, Alpha Micro AM-1000, Wicat 150WS, Corvus Concept and the British-built IMP-68. MicroAPL showed the Scimitar, which is a version of the Sage II running APL under the custom Mirage operating system.

Range of micros

Among the many micros using the Intel 8088 chip were the Rair Business Computer, the Hitachi 16, Zenith Z-100, Televideo 1602 and the new Micro Five Series 1000.

An interesting — and good — trend is for machines to include both an eight-bit and a 16-bit processor. Both the Rair and the Zenith machines have an 8085 to go with the 8088, for example. Interam showed the North Star Advantage with both Z-80B and 8035, though an 8088 16-bit upgrade is due shortly. EuroMicro showed the new EuroMicro M8/16 with dual 8085 and 8088 processors, and also the Equinox range which now offers an 8088 upgrade. Equinox also showed a 68000-based micro in prototype form.

Buy British

Two excellent British companies taking advantage of the upgrade path offered by the S-100 bus system are Comart and Almarc. Comart's Communicator range now features an Intel 8086, of which the 8088 is a cut-down version and the Cromenco that Comart imports now offers a 68000 option. Almarc has used an 8086 to upgrade the Series 8 to a Series 16; existing Series 8 users can also take the upgrade.

Finally, Ferranti has entered the 16-bit market with the new PPC — Professional Personal Computer — which is also based on the 8086 and runs CP/M-86.

In spite of the current rage for 16 bits, eight-bit micros continue to appear. That is where the software still is, after all. Excitement can still be generated by making the hardware smaller, neater and cheaper, and three new American imports come into one or more of these categories.

The Morrow Designs Decision 1 was shown in the U.K. for the first time. This is a quite cheap, very expandable machine which runs multiple CP/M or multiple Unix level 6 packages simultaneously.

The oddly named Fox is not actually designed as a portable, but becomes so when packed in a custom case. Digital Microsystems calls it the DMS-3/F.

The third is the Cromenco C-10 personal computer which consists of a keyboard, VDU and single disc drive. Nothing special about that perhaps — except the price, which at $1,785 is cheaper than the Osborne. As with the Osborne, essential software is included in the price, so this could well be the cheapest business system on the market.

Just about every major manufacturer is now implementing some form of network system to link micros together, allowing them to share hard discs and printers. Keen Computers, for example, offers the Corvus hard discs and the Omninet to link up a network of Apples or other micros — including the Sirius, IBM PC, and even the Atari 800.

Digital Microsystems offers the HiNet local area network which is CP/M compatible. Data Logic Ltd launched the 90/10 Network Management System at the show, which includes 60Mbyte of disc storage. Research Machines Ltd's Chain network for linking 380-Z and 480-Z micros is now in production. Zynar has the Cluster/One network for Apples, and is now offering the Elf as a low-cost LAN for the same machines.

Digico's 7800 series uses a 16-bit processor to control up to 32 clusters of micro terminals, where each cluster can include three work stations based on a 5Mbyte or 10Mbyte hard disc — for example the 3800 series announced in September.

The well-known Ethernet LAN is used by a number of manufacturers. Altos showed Ethernet working on its full range of eight-bit and 16-bit micros. MicroAPL had Ethernet linking its Spectrum and Scorpion micros. Finally, Clearway showed four new versions of its standard unit, which was reviewed on page 61 of our September 1982 issue.

With around 400 firms exhibiting at Compec it is impossible to mention all the new products shown, but several caught the eye. Among these was the JP101, an ink-jet printer from Olivetti. It is to be sold at around £400, which will give dot-matrix printers a run for their money.

Newbury Data, the largest exhibitior at Compec in terms of stand space, launched four new dot-matrix printers with optional add-on keyboards, a series of VDUs and an 8in. Winchester offering 80Mbyte storage.

New at the show

ICE showed its 50Mbyte Rodime-made hard disc for Apple, Sirius, IBM PC, etc, with tape-streamer back-up. Owners of the Profile hard disc for the Apple III will be delighted to hear that the tape-streamer will back up the contents in under three minutes.

Kode Ltd was offering to add voice-recognition modules to existing terminals for less than £2,000, and Aptec had an Arabised version of the IBM PC with a bilingual Arabic/English keyboard, software and printer. Comsol had its multi-tasking Forth, knows as polyForth, running on the Sirius 1, and Atari had two new arcade games, Defender and Galaxian, on ROM cartridges. Even a show devoted to the highest forms of microcomputer life should find room for a bit of inter-galactic death. That was Compec.

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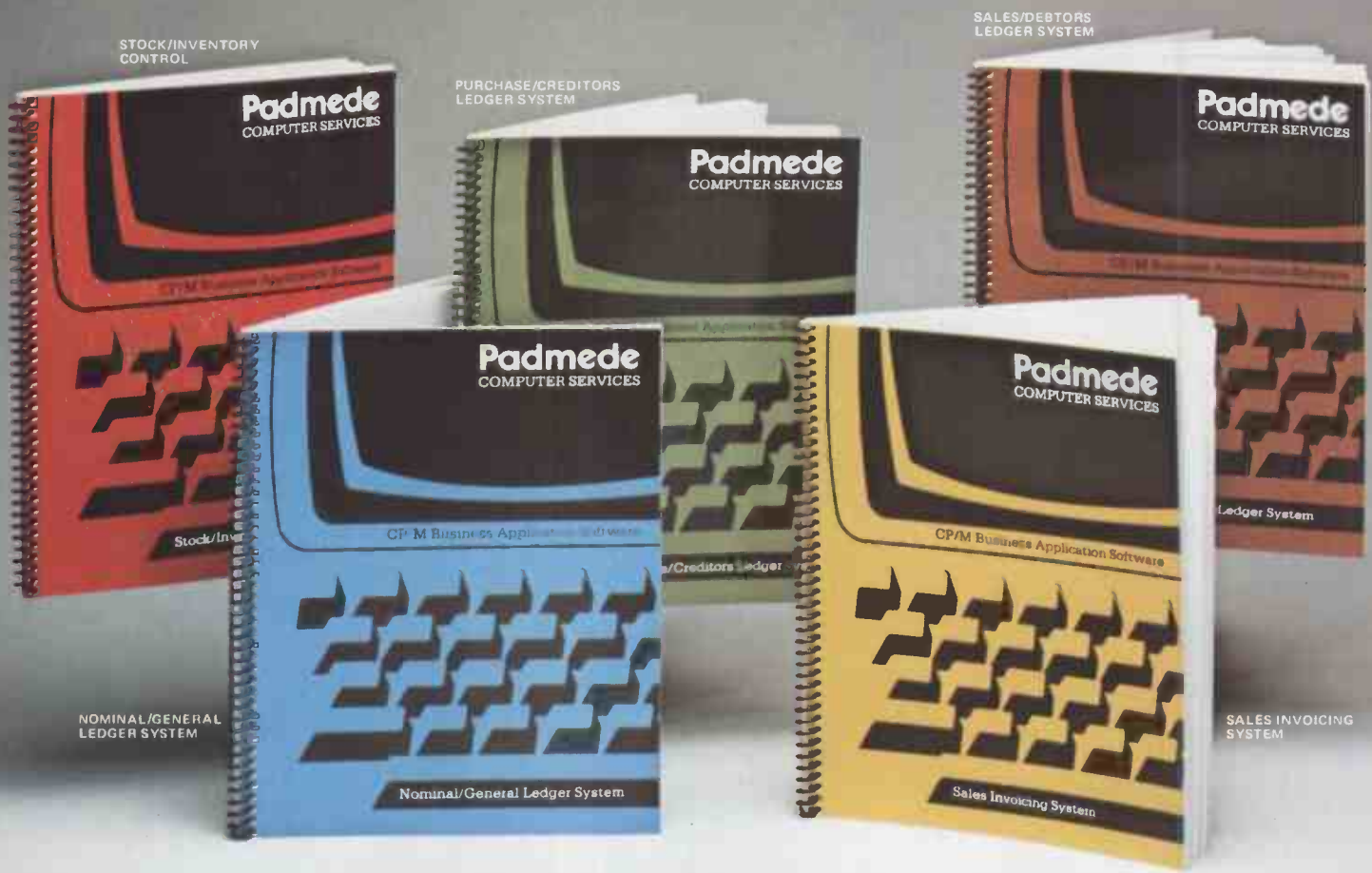

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● Circle No. 112

HP announces first 'desk-top mainframe'

HEWLETT-PACKARD has announced further developments of its NMOS-III integrated-circuit technology, which allows circuit densities 70 times greater than the NMOS-II. It has allowed them to build a package of five "superchips" which combine in a 32-bit machine to bring mainframe power to the single-user desk-top computer.

The new range is the HP-9000 Series. The smallest configuration — an integrated work station with one CPU, 912K of RAM, floppy disc and monochrome display — costs about £20,000. With a 10Mbyte hard disc, built-in printer, high-res colour display and software the cost goes up to over £45,000.

Other versions of the HP-9000 are available rack-mounted, and with multiple CPUs for those unfortunates who have to share their machine with other members of the human race.

It may be expensive, but perhaps one day all micros will be made this way!

Two new microcomputers from Hewlett-Packard are the HP-120 Office Computer and the HP-200 16-bit machine. Both are offered with 3.5in. micro-floppy discs which are based on Sony developments with HP electronics and packaging. Each floppy disc offers 270K of storage.

The HP-120 is like the HP-125, but smaller. The HP-200 is a 16-bit micro using the Motorola MC-68000.

Contact Hewlett-Packard Ltd, Nine Mile Ride, Wokingham, Berkshire RG11 3LL. Telephone: (03446) 3100.

Apple memory

BUBBLE MEMORIES could be back in fashion soon. Xcalibur has announced a 128K Bubble Memory Module for the Apple II. It is called, imaginatively, XBUB1 and costs under £500. Contact Xcalibur, Spencer House, 3 Spencer Parade, Northampton NN1 5AB. Telephone: (0604) 21051/4.

HAL computers has announced the Aquarius subsystem, also for the Apple II. It offers a choice of 5, 7.5 or 11Mbyte of formatted storage on a mini-Winchester with 20 Mbyte, 0.25in. tape for back-up. The tape does not receive an unverified dump when backing up, but is verified by read-after-write. Contact HAL Computers, Invincible Road, Farnborough, Hampshire. Telephone (0252) 517171.

A tape back-up is available for the Apple III Profile 5Mbyte drive from DNCS. It is called the Shadow III and takes about 25 minutes to back up the full drive with verify. Contact DN Computer Services, West Croft Industrial Estate, Manchester Old Road, Rhodes, Middleton, Greater Manchester. Telephone: 061-643 0016.

The World launch of Eagle's new 16-bit micro took place at Compec. The Eagle 1600 is a stylish-looking micro built round the Intel 8086 CPU, and runs MS-DOS or CP/M-86. The basic model has 128K of RAM, built-in hard disc with 10Mbyte of formatted storage, and a 5.25in. floppy. It is claimed to be fully compatible with both hardware and software for the IBM Personal Computer, and offers eight expansion slots compared to the IBM PC's five. Contact Mediatech Business Systems, Woodside Place, Alperton, Wembley, Middlesex HA0 2HA. Telephone: 01-903 4372.

Touchy input

YOUR VDU could have a sense of feel if you fitted an unpatterned glass faceplate over it. The faceplate from Interaction Systems senses impedance changes, so if you touch the screen it returns the x,y co-ordinates of the point in eight-bit numerics, 0 to 255. It would allow you to, for example, dial phone numbers by touching a picture of a phone dial on the screen, or write complex programs that do not require keyboard input.

Interaction is offering manufacturing licenses, and plans to supply components to OEMs. The price comes below $200 for quantities of 1,000 or more.

Contact Interaction Systems Inc., 24 Monroe Street, Newtonville, Massachusetts, 02160. Telephone: (617) 964 5530.

Football crazy

FOOTBALL POOLS prediction programs require data to work on, and the more the better, but keying it all in takes a lot of time and effort. Alternatively it can be purchased from Selec Software. The database is the scores and dates of all the English Football League results from 1977 to 1982.

Selec can cater for most home computers from the ZX-81 up. A tape of two years' data costs £7.50, and a disc of all five years costs £15. The data comes with some starter analysis software in Basic and UCSD Pascal to help beginners get started.

Contact Selec Software, 37 Councillor Lane, Cheadle, Cheshire. Telephone: 061-428 7425.

Rival top-end database managers

DBASE II is the top-selling full-feature database package for eight-bit CP/M systems, with possibly 20,000 copies sold worldwide. Now its creator Ashton-Tate has produced a 16-bit version which will run on the IBM PC, other CP/M-86 machines and the ACT Sirius. More details from Encotel Systems, 7 Imperial Way, Croydon Airport Industrial Estate, Croydon, Surrey CR0 4RR, telephone 01-686 9687; or for the Sirius contact Sirius dealers or ACT Microsoft, ACT House, 111 Hagley Road, Birmingham B16 8LB, telephone 021-454 8585.

dBase II is a very powerful relational-database package, and its flexibility makes it much favoured by sophisticated users as a system-building tool, much like a very high-level programming language. For example, Magnum Computers has just released a foreign-exchange management package written entirely in dBase II commands. It handles spot and forward deals in any foreign currency, producing various reports which analyse exchange risks and keeping a complete audit trail.

One advantage Magnum Computers derives from this approach compared to writing the application package in Basic is that it can more readily be modified to suit individual clients' requirements. The users pay £550 for the package, plus £430 for dBase II if they do not already have it. More details from Magnum Computers Ltd, 156 Northfield Avenue, Ealing, London W13 9SB, telephone 01-567 0154.

Dataflex is a new database package aiming to compete with dBase II in both the eight-bit CP/M-machine market and the 16-bit CP/M-86 and MS-DOS arena. It is written in Pascal and can also run on most multi-user operating systems like MP/M-86 and Turbodos.

Dataflex is a multi-file full-feature relational database. It can handle 125 files with up to 255 fields and four indexes per record. Six files, and sometimes more, can be active at any time.

An optional library of Pascal utilities is available for the system builder who wishes to incorporate Dataflex into an application package but wants to go down beneath the usual interface to Pascal language level.

Dataflex costs £450 in its CP/M version and £595 for multi-user systems. More details from Equinox, 16 Anning Street, New Inn Yard, London EC2A 3HB. Telephone: 01-739 2387.

...improved middle range

FIRST-TIME USERS who care more about what they want to use a computer for than what has got to be done to get it to happen tend to find the full-feature database package such as dBase II a little overwhelming — unless somebody else has set the whole system up for them. Into this opening come packages such as Compsoft's DMS.

DMS's great strength is its simplicity in use and the excellent training and support available from Compsoft. DMS has sold over 4,000 packages in the U.K., and it must be the leader in its class.

There tends to be a trade-off where software is concerned between power on the one hand and ease of use on the other. DMS is still very powerful in terms of data-checking, sorting, searching and reporting features, but some compromises are made to keep it relatively simple. In particular, operations are performed on one file at a time.

Now Compsoft has introduced a new version of DMS, called DMS Delta. It adds the ability to handle more complex data while still keeping to the tried and tested DMS menu-driven format. DMS Delta runs on eight-bit CP/M machines or 16-bit machines like the IBM PC and ACT Sirius under MS-DOS. It costs £495.

Users are now able to attach sub-files or related data to the main file. For instance, an order sub-file can be attached to a stock file, or borrower details appended to a file of book

(continued on page 25)

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(continued from page 23)
information. Up to eight sub-files can be attached to a file.

In effect DMS has been upgraded to a multi-file package, but compared to a true relational database like dBase II or Dataflex there is less flexibility: you have to decide what data you want to associate together at the time you define your files rather than at run time. But for many common applications the simpler DMS approach may be exactly what is required.

More details from Compsoft Ltd, Hallams Court, Shamley Green, Guildford, Surrey GU4 80Z. telephone (0483) 898545.

Rescue is an all-new database package for eight-bit CP/M systems. Although 20 files can be held per disc, Rescue can only operate on one file at a time, so it is a single-file package; it is thus comparable to the original DMS but not to DMS Delta or the more complicated relational packages like dBase II and Dataflex. Nonetheless, it has a number of interesting features. Data compression techniuqes are used extensively. As well as cramming more data per disc, Rescue has a dictionary feature which allows you to specify a permitted set of up to 256 values for a particular field, other values being rejected upon entry.

Rescue allows records up to 1K in length, containing up to 100 fields and up to 10 keys. Used in conjunction with WordStar the package can produce personalised letters or reports.

Rescue costs £295. More details from MBS (U.K.) Ltd, 5 Charterhouse Buildings, Goswell Road, London EC1M 7AN. Telephone: 01 253-3998.

...and the bare essentials

MANY PEOPLE find choosing between database packages so complex that they give up. And they may be right — if it takes that long to find out what they all do it is worth considering seriously how long it will take to learn how to use the chosen product. Hence a new wave of products which are un-ashamedly primitive but have the virtue of being easy to pick up and use.

Addressbook is a completely menu-controlled mailing-list package for use with CP/M word-processing systems like WordStar. The user initially enters information about each addressee into a standard form displayed on the screen.

Addressbook costs £90. It is available now for the Superbrain range with versions for other machines to follow. Contact Decision Technology, 7 St Johns Road, East Molesley, Surrey KT8 9JH. Telephone: 01-979 5533.

List Handler for the Apple is marginally more ambitious, handling mailing labels, lists and letters. It can store, sort and selectively retrieve, and costs £85. Details from Pete and Pam Computers, New Hall Hey Road, Rossendale, Lancashire BB4 6JG. Telephone: (0706) 227011.

The Acclaim is a British-made Apple work-alike — it runs all Apple software and accepts all Apple peripherals — but it has enhancements of its own. For a start it has upper and lower case, pressing one key will switch formats between 40 and 80 columns, and the keyboard offers programmable auto-repeat. Hardware advances on the II include a detached keyboard and built-in 6 or 12Mbyte hard disc with tape back-up. Prices run from £3,650. Contact Country Computers, Pipers Road, Park Farm Industrial Estate, Redditch B98 OHU. Telephone: 0527-29826.

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The designer's tale

Ian Sinclair — the name is right but are his designs, asks Bill Bennett.

GOOD LOOKS sell computers. System specifications are very important, but nobody wants to have a hideous monstrosity sitting on their desk, no matter how useful it might be. This is one of the most widely unrecognised truths of the microcomputer business. Designer Ian Sinclair believes that a good design is a fundamental ingredient of a successful machine.

The success of the Italian office-equipment giant Olivetti is a testament to the importance of good design. Ian Sinclair believes that the time is right to apply the same philosophy to computer products aimed at the home user. He has already designed the Chess Champion Mark V, which incorporates a number of innovatory features, and is currently working for Acorn Computers designing a new range of exciting machines.

With any project Sinclair's method of operation is simple. First he looks at existing "conventional" designs, then he throws them out and starts from scratch. With microcomputers there is a limitation, the keyboard, but then good design is all about incorporating a number of essential features into the product.

Sci-fi micros

Acorn is being pretty cagey about these new micros, but they will be aimed at the home market and will feature highly futuristic designs. "Futuristic design is essential for computer products," argues Sinclair. "People want to feel that they are living in the science-fiction future now, and in fact they are."

The mentioned of science fiction is certainly interesting. Sinclair believes that the technology is developing so fast that the turnaround time from something being science fiction to it becoming science fact is now less than 10 years, and decreasing. To this end he gets a lot of inspiration from what is, at present, merely fantasy. Science-fiction films are often showing technology that is just around the corner.

Sinclair's design for the Polybrain, a computer-based TV games machine manufactured in Hong Kong, is certainly futuristic. It has a wedge shape which suggests the lines of a spaceship. It does not require much imagination to look at the games console as a control console for a spaceship.

Sci-Sys, manufacturer of highly sophisticated chess computers, commissioned Ian Sinclair to design the range. Sinclair has to design just about everything that the user sees: the complete outside, and with it the interface between the cold, digital logic of a microprocessor and the analogue world of the chess player. It is a task which requires a lot of thought about ergonomics.

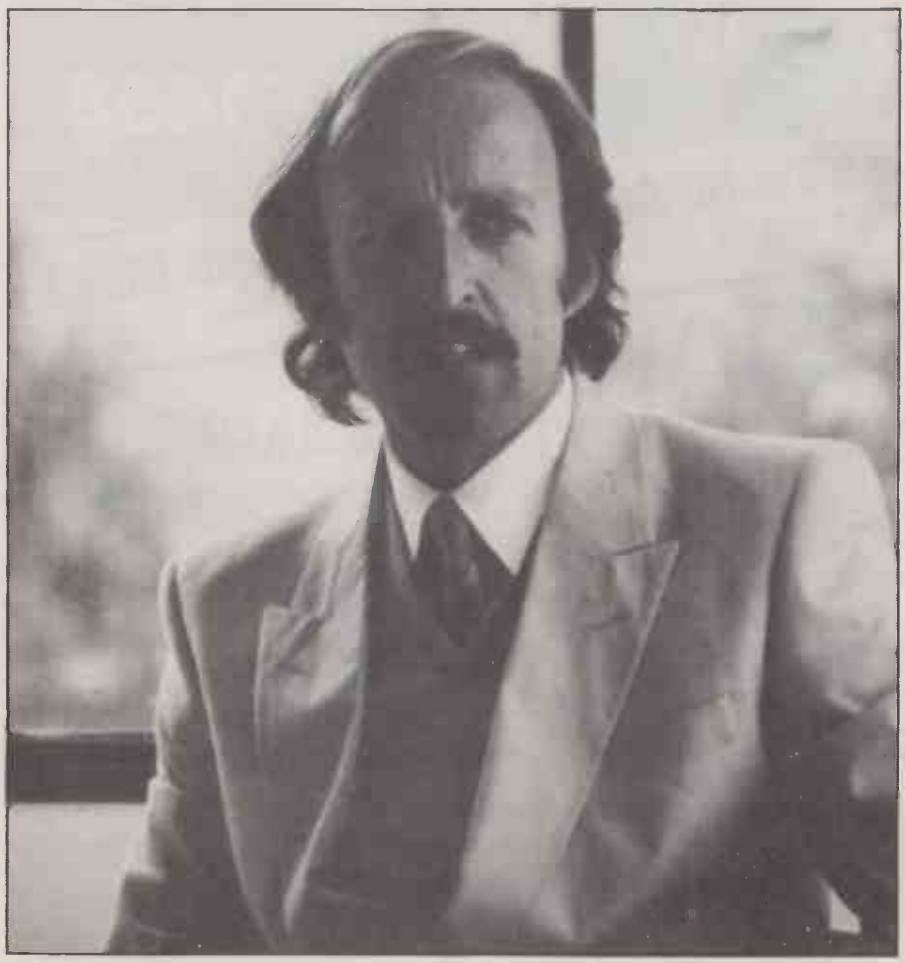
Combination of ideas

"I have to work hand-in-hand with the engineers," says Sinclair. "Sometimes what is desirable from an aesthetic point of view is not achievable in practice, the limiting factor being either technological or simple economics." The design for the Chess Champion Mark V can be seen as a real achievement, both from the aesthetic point of view and the technical.

"There is a family look to the Sci-Sys range," claims Sinclair, and all the machines do have certain common design themes. The Mark V was technically difficult, the hardest job being to get the wiring from the board across a hinge. There are two essential features to the design: chess players like to use a traditional board, with traditional pieces, but the unit also has to look modern. The final design combines both requirements, and the sensor board has been hailed as something very special.

Sinclair's other computer design was for the Torch, a British-made, desk-top micro with a heavy communications bias. His submission was only partly used in the final design, mainly because of cost. Development work in this field can be expensive, with mock-ups costing thousands of pounds to build, but the real costs are in people's time. Ian Sinclair insists on payment up front.

Other projects worked on by Sinclair include tennis rackets, hi-fi equipment, watches with removable chips and a pocket-size bridge computer to complement the Sci-Sys chess machines. He designed the first digital clock, which used the old-fashioned Nixie tubes. Recent developments inlcude a turbo version of the Austin-Morris Metro, a new sport craze that combines skate-boarding and sail-boarding, and a range of puzzles and games; he has also been working on using computers in cars. Maybe he could sell that idea to his brother, Clive.



"A good design," says Ian Sinclair, "is fundamental to a successful machine."

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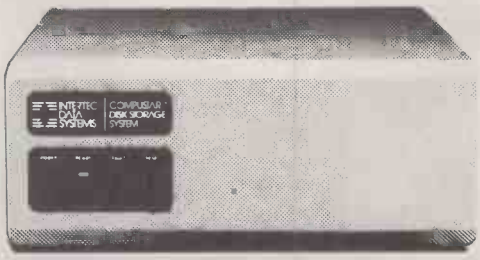

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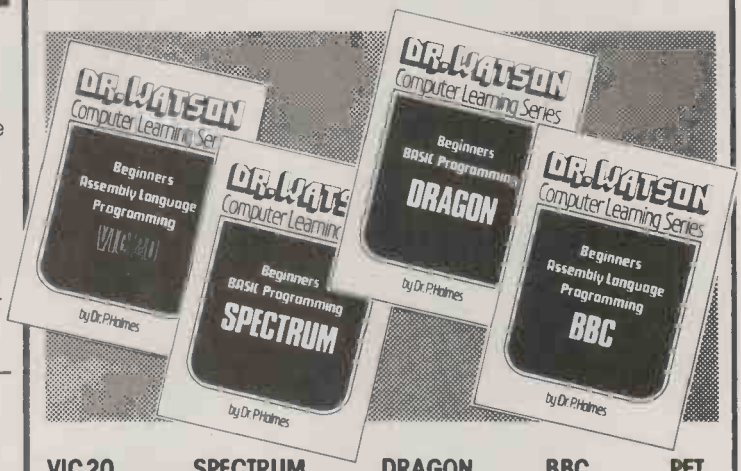

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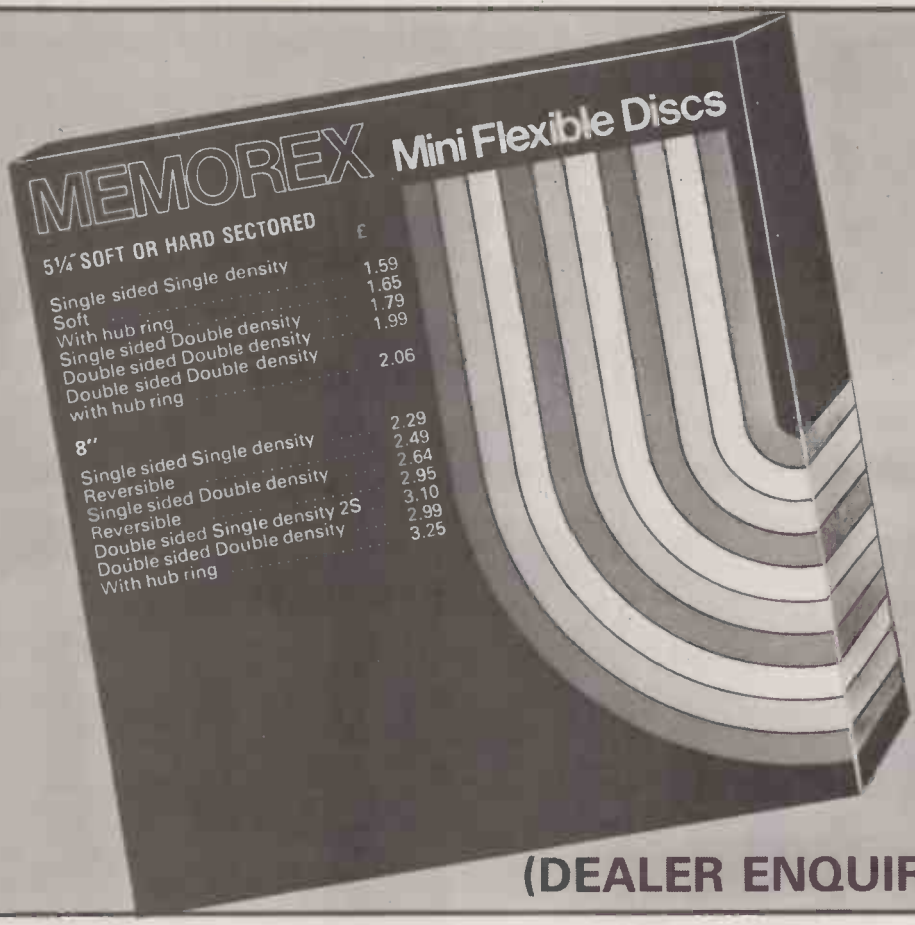

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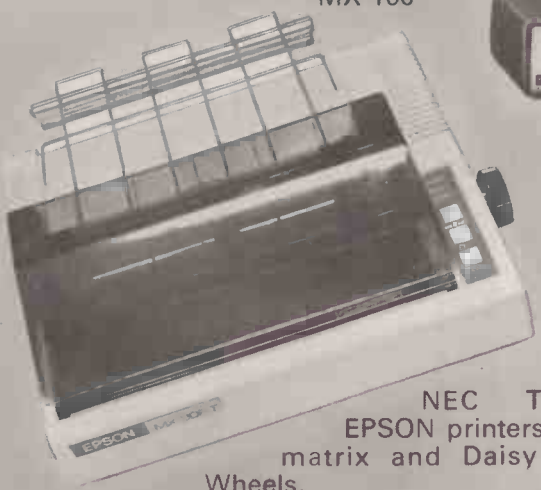

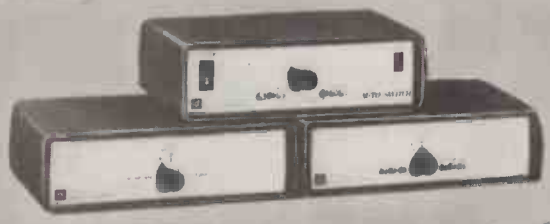

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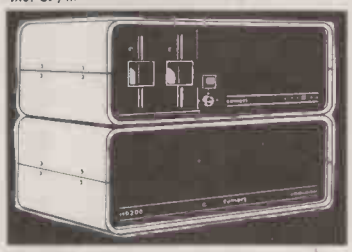

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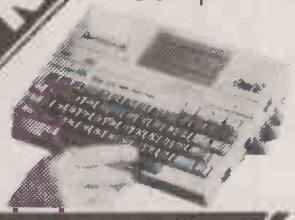

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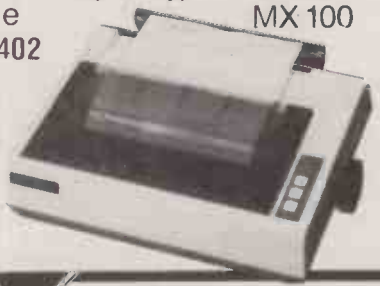

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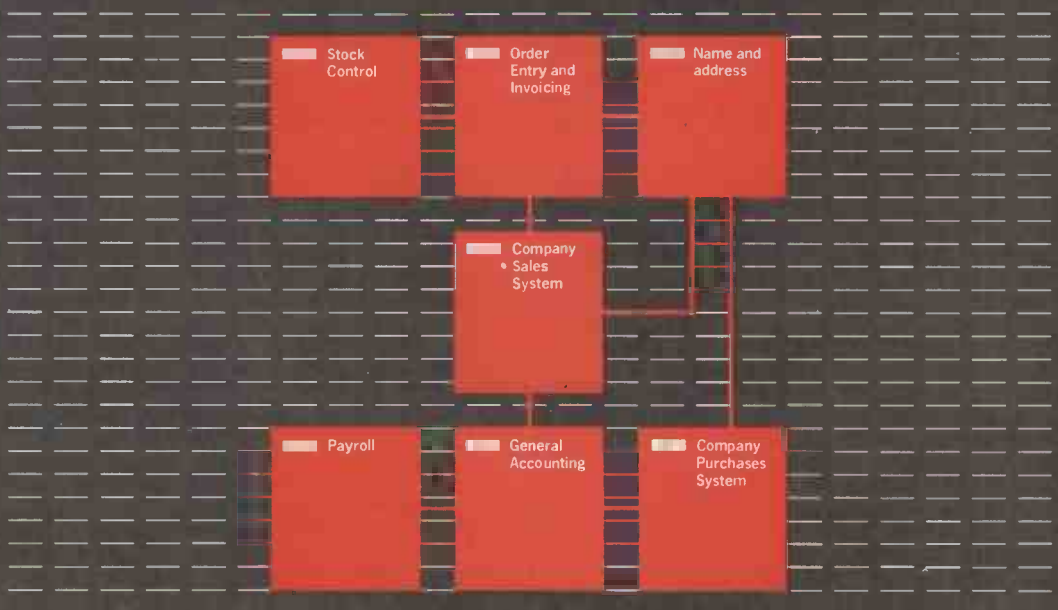

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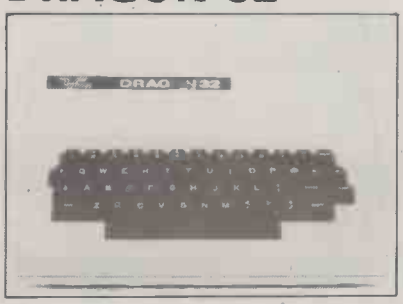

The amazing new British computer with a full-travel standard keyboard, a 16-bit microprocessor, 32K RAM fitted (expandable to 64K and later to 256K!!), 9 colours, hi-res graphics and Microsoft extended colour BASIC (the very best BASIC to learn with). It can be used with virtually any ordinary cassette recorder, it has a printer interface (Centronics-type), joysticks are available and it's incredible value for money. **(AF57M) Only £199.50**

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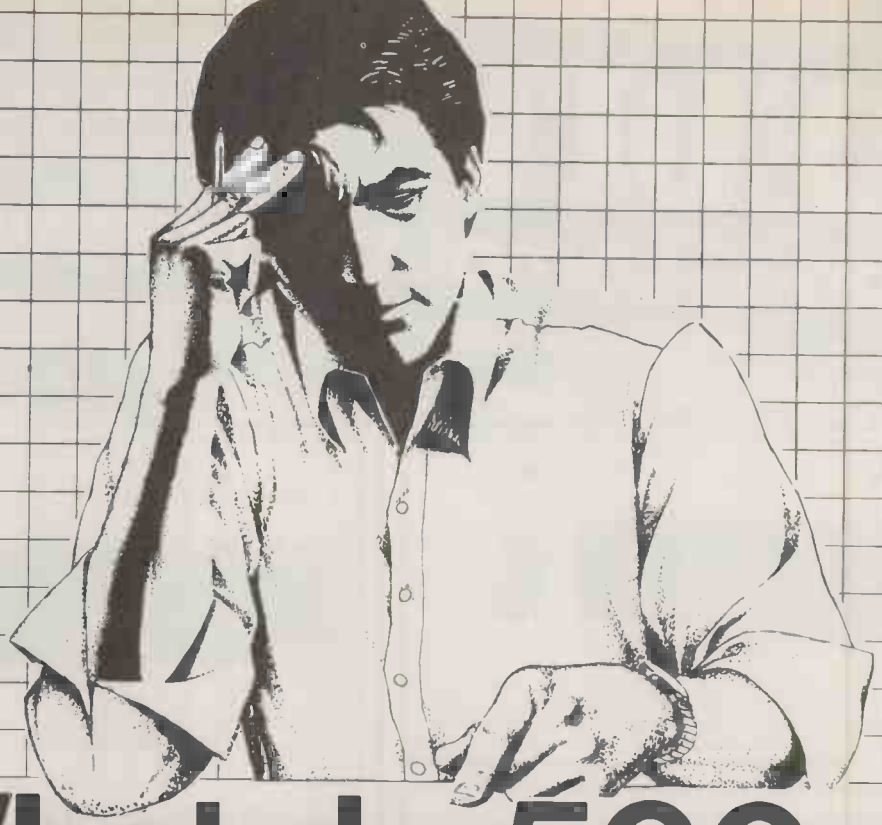

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74S139	120p
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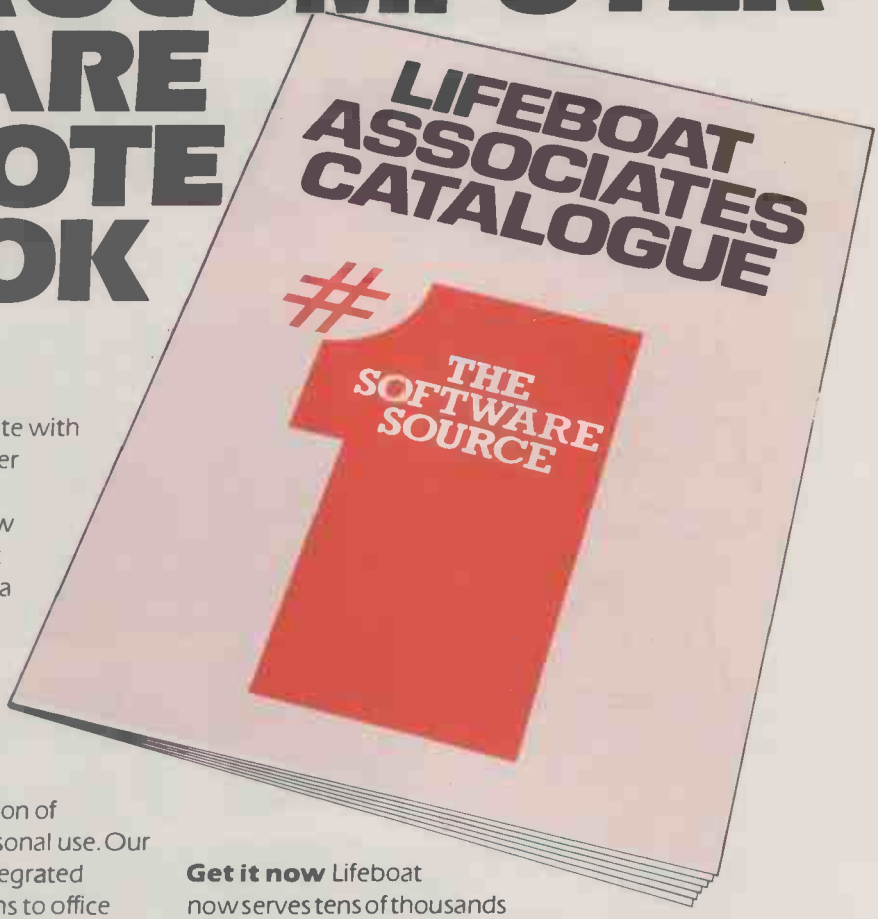

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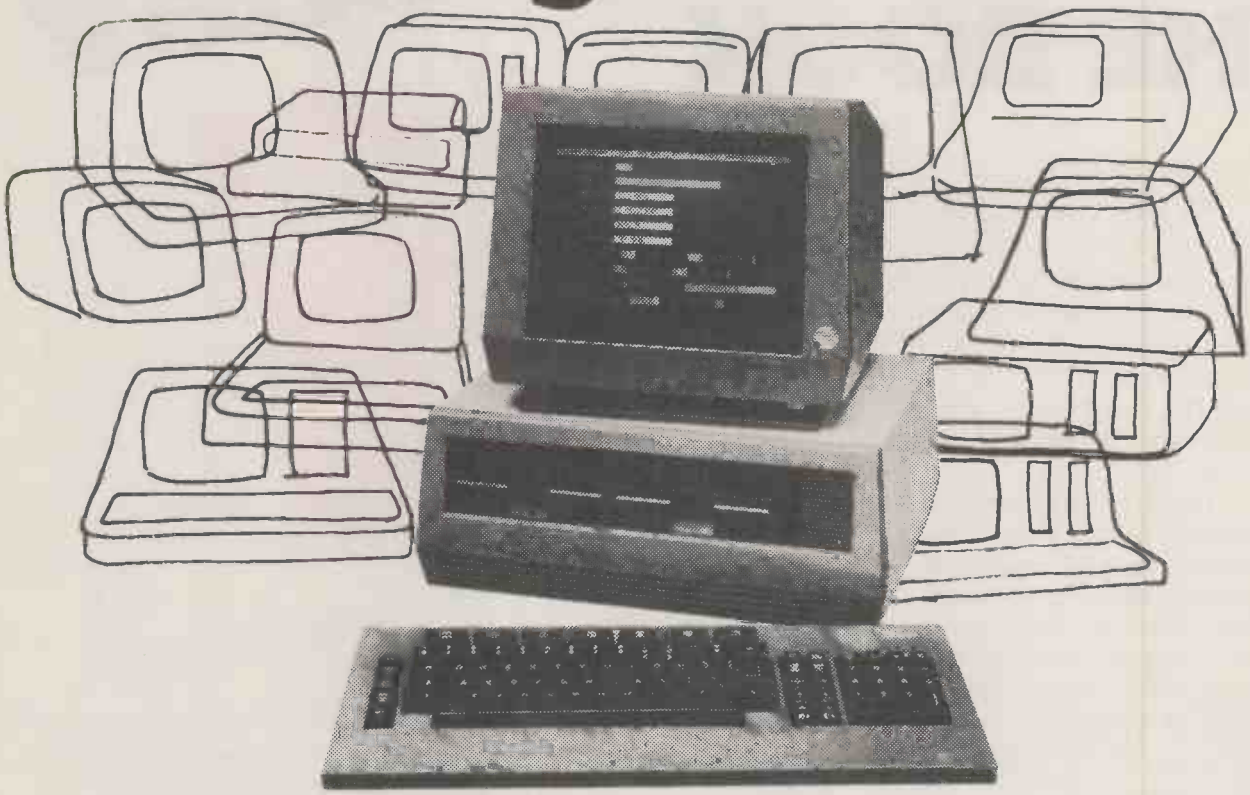

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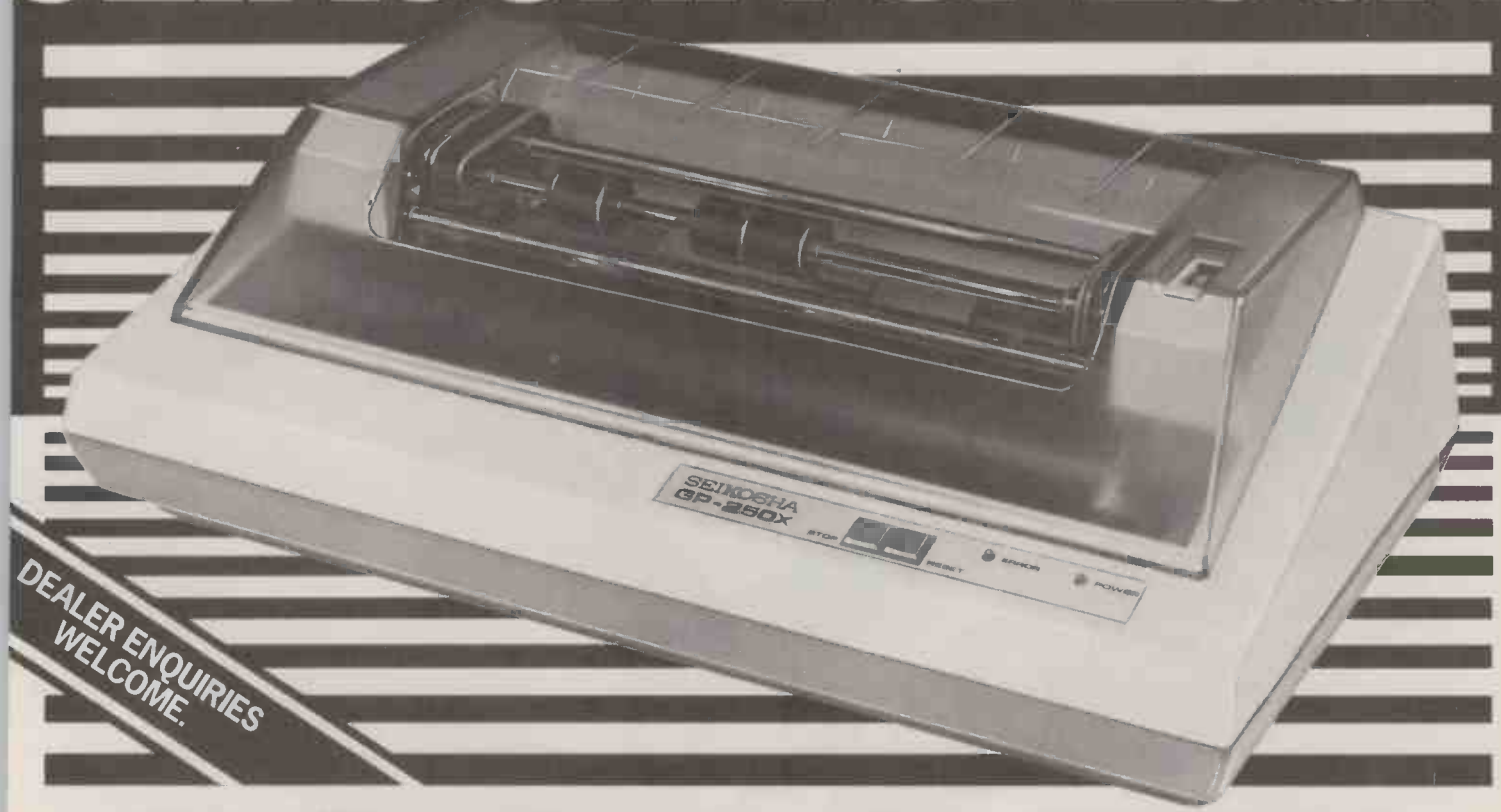

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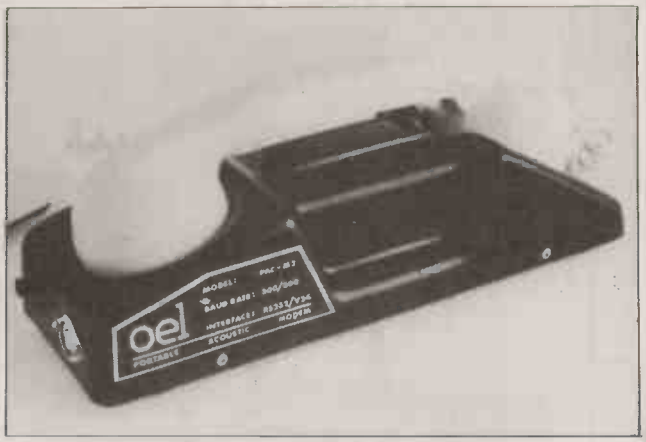

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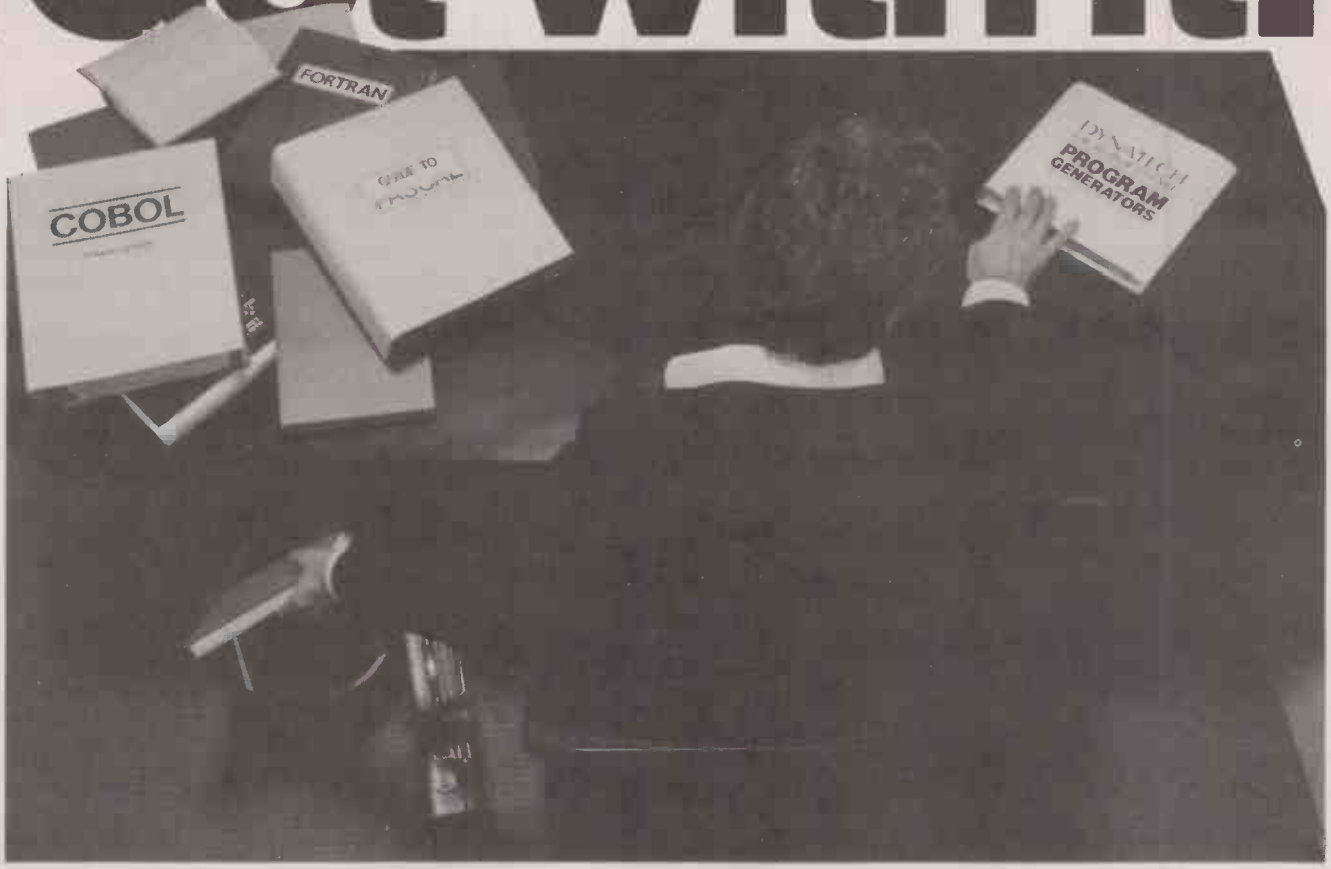

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FORTUNE

WHILE THE ARGUMENT about whether "pseudo 16-bit" machines like the Sirius 1 and IBM PC are actually better than ordinary eight-bit Z-80 machines, or if they are not actually worse, one or two companies have already taken the next leap forward to 16/32-bit machines. The Fortune 32:16 is the first of these to become generally available. The Sage II, Corvus Concept and Alpha Micro AM-1000 are the other leading contenders hot on Fortune's heels.

The Fortune 32:16 is called that because it uses the Motorola 68000 microprocessor, which offers a 16-bit data bus instead of eight-bit, and 32-bit internal registers instead of 16. Data transfer rate is 19,200 bits per second. This gives it capabilities which are more generally associated with minicomputers, and in fact the Fortune will support up to 16 intelligent work stations, but at a microcomputer price.

However, the main point of the Fortune is not that it is technologically more advanced than most micros now available or announced. It is designed to be an ultra-smart and user-friendly piece of business equipment. Typical buyers will more likely be impressed by the colour and styling than what is inside it.

There are three units in the system. First there is a fluted, oblong box containing the operating system, main memory and two floppy-disc drives — or one floppy plus a mini-Winchester. Second there is a separate tiltable VDU, which can be changed for a colour monitor. Third there is a detached keyboard which is virtually a copy of Wang's better-known Word Processor keyboard. The keys are all round-edged and finished in elegant grey and white. The system is surprisingly compact, with the main unit being only 565mm. by 353mm. in size, and less than 150mm. deep. It leaves lots of room to work on the average desk top.

Up to 80Mbyte on disc

The main processor comes with 128K main memory, expandable up to 1Mbyte. Each floppy disc provides 720K of additional storage. The mini-Winchester hard disc can be 5, 10 or 20Mbyte, with the maximum configuration of four hard discs providing 80Mbyte. The System 5 we reviewed features one floppy and one 5Mbyte hard disc, along with a standard 1Mbyte of RAM. As a result, we never came across the Out of Memory error message.

The keyboard has the standard QWERTY layout, with a 15-key numeric keypad on the right, and a cursor-control pad of nine keys in between. There are 16 programmable function keys across the top, arranged as four groups of four. Then there are a few extra dedicated system keys, including Help, making 99 keys in all. A coiled cable links the keyboard to the front of the main processor.

The VDU is a non-glare green-screen 12in. monitor with adjustable brightness. It offers vertical tilt from +15° to -5°, and 90° horizontal swivel. The screen display is 80 characters by 25 lines, with each character being made up on a nine-by-20 dot matrix. There are 128 standard characters, 256 optional characters — to give a range of international ones — 13 characters for word processing and 15 graphics symbols. It supports overstrike, underline, double underline, reverse video, blink and highlight. With a colour monitor you can have 16-colour graphics with high-resolution mixed text and graphics.

The availability of software is often a problem with new machines, but since the system's launch in the U.S. in November a number of packages have been available. The most important are improved versions — supersets — of Wang's word-processing software, which are called For:Word and For:Word Plus, and the electronic spreadsheet program Multiplan. These will cater for most of the needs of the typical user con-

32:16

Some so-called 16-bit micros have disappointed their users. Una Sheehan discovers if scepticism is still in order for this 32/16-bitter.

figuration — a business executive plus secretary.

Fortune Systems has adapted some other popular micro packages for the Fortune, and some unusual ones like Troff typesetting and EQN multilevel maths programs usually available only on larger computers. Frank Burgess Associates is currently converting its respected U.K. financial system programs, written for minicomputers, to run on the Fortune. Most packages are in the £250 to £500 price range, about one-third of the price of the minicomputer versions.

The operating system is Unix, which was originally developed as a research tool for the Digital Equipment Corporation PDP-11 minicomputer at Western & Bell Laboratories, for use by professional progammers. It supports SMC Business Basic, with other languages including Pascal, Cobol, Fortan and C either implemented or planned. On the basic Fortune system it is supplied in a single-user version. There is also a multi-user version for local networking, which supports the Xerox Ethernet network.

Unix was specially adapted for the Fortune 32:16 at a reported cost of about £1 million. Most of this was spent on constructing a user-friendly "shell" around the conventional operating core, and improving file protection, to make the system easy to operate by non-specialist staff and occasional users. It includes a hierarchical manager/user password protection system, and occupies from about 64K to 100K of memory.

SMC Business Basic is compatible with Basic IV. Additionally, Fortune's literature says a set of "filters" have been developed which automatically translate applications written in some other Basic dialects into the Fortune's Basic. Filters are said to be available for Applesoft, TRS-80 Basic, Microsoft Basic and CBasic. We were not able to test these claims. A CP/M emulator is planned.

The system supplied for review by Fortune Systems and Text 100 was the System 5 version with several applications programs loaded on the hard disc. These included For:Word and Multiplan, as well as the system-training program and the Unix system utilities. We also confess to trying the games supplied — to gain familiarity with the system, of course.

With no loading to do, the system was easy to switch on and use straight away. A global menu laid out in a grid of mini-menus shows all the system's facilities at a glance. Reading the top row from top left, they are divided into:

Business Fuctions — for business programs handling general ledgers, purchase orders, etc.

Professional Tools — which include Multi-Plan on this system, graphics and space for other applications

Electronic Office Tools — including For:Word word processing, records processing, automated calendar, and room for other choices.

The bottom row, reading from left, has menus for

Communications — for local network and dial-up links

Training/Education — which has sections on

(continued on next page)

FORTUNE 32:16

(continued from previous page)

topic introduction, a self-introduction by the system, as well as a training program and other education software including some games and System Tools which makes Unix tools available, as well as various languages, dictionaries and facilities to add new programs.

Each of the mini-menus on this main global menu has a final choice called Additional Choices where more options can be added on to the system. This illustrates the system's commitment to expandability and user choice, and as a first impression of the system's capacities, gives users a feeling of getting an instant knowledge of the system they are about to use. Programs loaded on to that particular machine are highlighted on its global menu. This overall initial view to the user is where that £1 million shell adapting Unix for business use really shows it was well spent.

To date, Fortune Systems is the only company that has spent this kind of money adapting Unix for use by the relatively unskilled. Though this operating system has been around for several years, its poor user interface and lack of help for the user did not initially endear it to a general market. But Microsoft's version, Xenix, has helped it catch on, and nearly 300-odd applications programs are listed in a recent software catalogue produced by a Unix user group.

Specification

Microprocessor: Motorola 68000; 32-bit data and address registers; 24-bit memory-address bus; 16-bit data bus; 16Mbyte linear address space
Operating system: Unix
Memory: 256K to 1Mbyte RAM; 4K to 16K ROM
Disc storage: one to four 5.25in. floppy discs with 800K formatted; one to four 5.25in. hard discs with 5, 10 or 20Mbyte; one to four 8in. discs; maximum total 80Mbyte
Keyboard: detached QWERTY with 99 keys, including cursor controls, numeric keypad, system keys and 16 function keys
Display: 12in. green-screen monochrome with 80 characters by 25 lines; optional colour monitor with 16 colours and 132 columns by 60 lines
Ports: RS-232C and floppy-disc controller
Optional I/O ports: two or four RS-232C; one or two IEEE-488 or Centronics parallel ports; Ethernet controller; bit-mapped graphics video controller; Winchester hard-disc controllers
Dimensions: height x depth x width in mm.: monitor 327 x 348 x 312; keyboard 56 x 160 x 566; processor 147 x 353 x 566.
Weight: monitor 12 lb. keyboard 6 lb, processor 30 lb.

For:Word features

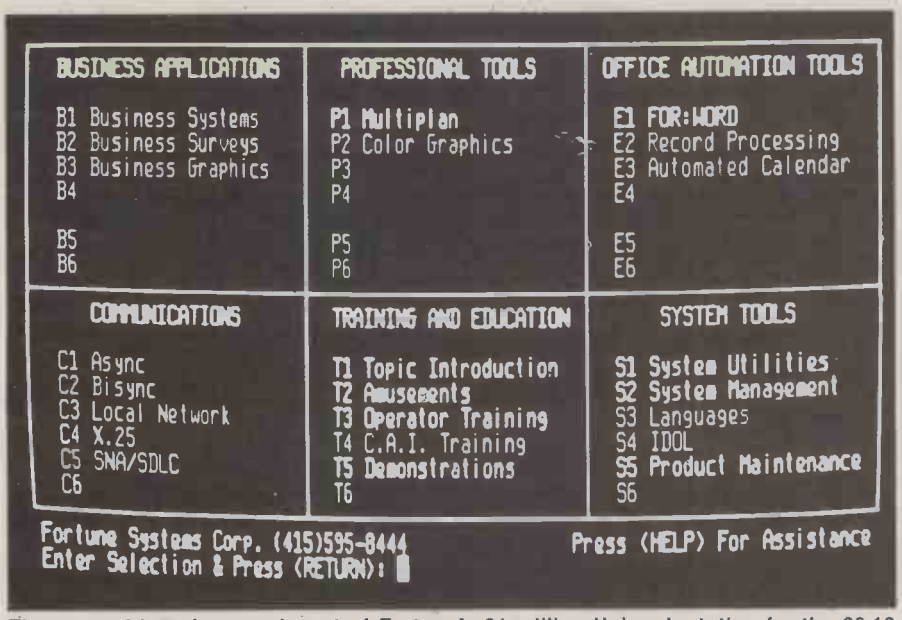
Document management
Create, edit, copy, delete, rename, archive, history and statistics, print request, index libraries, menu by-pass, Unix directories for file names
Printing
Left/right/centre justification, proportional spacing, soft and hard hyphenation, pagination, repagination, headers and footers, page numbering, fixed space, printer support, summary
Text editing
COMMAND KEYS: Return, Indent, Page, Centre, Format, Note, Search, Replace, Copy, Move, Command, Super/Subscript, Goto, Cancel, Execute, Insert, Delete, Cursor up/down/left/right, Next Screen, Previous Screen, Help. Underline, Double underline, Overstrike, Bold, Glossary, Tab and Decimal Tab, Search Backwards, Global Formats

CURSOR-MOTION MODES: by line, word, sentence, paragraph, page

GOTO: beginning/end of document, page number, top/bottom of page, right/left margin, next/previous page, bookmark, header/footer/work page.

Reread a page, copy and move between documents, file update, global search and replace

For:Word Plus offers many further facilities including Wang and IBM Series 6 communications, multiple print queues, multi-column and windowing, artwork space reservation, display of control codes, maths and sorts.



The menu-driven front end, part of Fortune's £1 million Unix adaptation for the 32:16, shows the system's facilities in an easy-to-understand way.

Using the global menu the user can select the facility needed and be transferred into a single menu opening that program. For example, the word-processing program has a menu that records when a document has last been used, how many keystrokes it has stored and how long the user spent working on that document. Also it records the date when the document was revised or printed. This helps the user keep track of system use which would be particularly helpful in any business, but especially a typing pool or agency.

At each step the system is well signposted with menus so the user will not be easily lost. To get into Unix, the main menu is cancelled "+ +UNIX" and then a code-word "root" is typed in, and the skilled user can proceed. To get out of Unix, all you have to do is type in "+ + menu", and, you are brought back to the main global menu. The System Tools section allow the average user access to Unix facilities in menu-format data processing.

The Training/Education section has two particularly interesting choices: Topic Introduction and Training. They represent two of the three levels of self explanation and help provided by Fortune's 32:16. Topic Introduction is a "this is what it is" feature which has information on all programs currently on the system. For example, the For:Word overview has two purposes — to provide information about this progam and operational facilities with the 32:16. Not only does it show you the information but it also examines the user on his grasp of each concept before it moves on.

The section on introducing word-processing concepts is succinct and enlightening: "word processing is a method of producing documents electronically on computerised equipment". The Training program builds on the user's knowledge provided by Topic Introduction and helps with procedural familiarity.

The third level of help provided to the user is the Help function activated by a dedicated, labelled Help key. This is divided into major sections — one for each screen selection — and subsection of each of the major sections. For example, when activated it comes up on a screen saying "Here's Help; note file contents on screen" which can be explained in a subsection on the next screen as you proceed through Help: "When you list file contents on screen, you'll see the file on screen exactly as it looks". The Help function explains all features on the system and does not disrupt procedures the user is engaged in. Error messages provided by the system are pretty reasonable, and the system also sounds an alarm "beep" to signal them to the user.

Anyone familiar with Wang systems will quickly be able to use the Fortune's full word-processing program. The For:Word package on the 32:16 has a row of dedicated keys on the top of the keyboard for frequently used functions like Centering, Search/Replace, Copy — for copying text within text as well as copying text to another document — and Move — for moving copy within a document and between documents. However, the Merge function is provided only with the more advanced. For:Word Plus package, along with sorting and a maths facility.

Insert and Delete, two most commonly used word-processing functions, are assigned special keys, along with Next Screen and Previous Screen, nearer to the well-designed and spaced cursor-control keys, to the right of the regular QWERTY keyboard.

The Cancel and Help functions also have dedicated keys on the right-hand side of the keyboard. The keyboard is pleasant to use and not too "springy" to the touch.

Fortune is particularly proud of the documentation provided with the system, where screens are reproduced in the manuals and are easy to recognise and follow accordingly. This is a particularly useful feature as many of even the best-designed systems are poorly documented and often let users down at this point. Documentation is also available for programming languages, for Unix itself, communications and graphics as well as the system and the popular programs.

The Fortune 32:16 offers two standard I/O controllers plus 10 slots. Five of these are for memory expansion in 128K or 256K increments. Five are for optional controllers, with a versatility that includes three types of RS-232C controller, IEEE-448, parallel printer-interface controller, etc. The ports can be asssigned very neatly from the keyboard, using a graphics screen display.

Dedicated processor

The intelligent controller has its own Z-80B and buffer memory and is capable of supporting industry protocols such as 2780/3780, HSAP, 327x and HDLC/SDLC. The standard bit-mapped graphics display controller has its own 64K memory and provides 640-by-480 resolution and 800-by-480 high resolution for monochrome. The optional colour card contains a second MC-68000, provides a choice of 16 colours from a palette of 512 and offers resolution up to 1;024 by 1,024.

Up to 16 work stations can be supported, and Fortune says that up to eight can be run for word processing without any degradation of performance. Each work station has its own Z-80 processor with 64K of RAM built in.

This represents excellent versatility, and should allow the Fortune to be configured to meet most communications and control requirements. On power-up, the Fortune goes through a self-diagnostic routine and automatically configures itself to the system in use. Again, user-friendliness overlays the technology of the system.

Conclusions

- **The Fortune 32:16 is an advanced, sophisticated microcomputer which offers considerably more power and versatility than its eight/16-bit rivals.**
- **It is very expandable. With up to 1Mbyte of RAM and 80Mbyte of hard-disc storage, and with up to 16 work stations it could well replace a minicomputer for most office purposes.**
- **It has been designed as a piece of office equipment, looks smart and does not take up much space.**
- **It is much more user-friendly than the average computer.**
- **The word-processing package is far superior to that expected on microcomputers, and as good as or better than the standards set by dedicated word processors. It can also be used with other system tools.**
- **It is very reasonably priced at about £4,000 for an average small system with applications programs. For a multi-user set-up with four work stations costing around £10,000 it becomes extremely cheap.**

JUPITER ACE

Bill Bennett analyses the attributes of the Ace.

FORTH is described as a "threaded interpretive language" and it is the native language of the Jupiter Ace. "Threaded", because small fundamental subroutines can be strung together to make more complex ones, these can in turn be strung together. At the final level, a complete Forth program—or to be precise the complete application, Forth programmers write applications not programs — is just another of these subroutines. In Forth, these subroutines are called words.

Forth is above all else a language ideal for control. It was originally developed by an astronomer, and fittingly first came to fame when it was used to control the cameras used in the shooting of the realistic space-action scenes in the film *Star Wars*.

The advantages of Forth, and therefore of the Jupiter Ace, are advantages that would only really appeal to the more sophisticated programmer. The type of computer user who is contemplating learning machine code will be attracted towards Forth. Forth is compact, a feature that is important in the Ace, because there is only 3K of user RAM. Most other micros have access to much larger memories, where compactness is not so important.

Forth is fast, working at up to 80 percent of machine-code speed. Combine this with the 3.25MHz processor speed of the Jupiter Ace and you have a very fast micro. Educationalists and teachers will like the Jupiter Ace because Forth is a structured language. However, I am not confident that it is an ideal language for a young beginner to learn as the concepts are fairly difficult. Maybe I have been prejudiced by years of Basic.

The real reason why I would not advise Forth to be thrust upon novices is that programs written in the language are so unreadable. Because each individual programmer defines his or her own words, higher-level words — that is, words using other words previously written by the programmer — are fairly meaningless. Forth programmers are no better than Basic programmers when it comes to leaving meaningful comment statements in their software.

Experienced Forth programmers tend to develop individual vocabularies of their own, frequently used, simple words. They fall into the habit of using these in a throw-away manner, just as if they were kernal words — the kernal being the fundemental set of words contained in the Ace's ROM. This is not a bad thing; however, trying to read someone else's Basic program is difficult enough, when reading someone else's Forth program even the words used will be meaningless. Maybe this is why Gary Kildall, founder of Digital Research, recently described Forth as a "write-only language".

This illegibility is not so marked on the Jupiter Ace, because when a word is listed it is broken up into lines and indented to show the structure. Words incorrectly entered or containing bugs can be edited easily using the helpful editor contained within the system. The amended word is then placed on the top of the word list. The original version of that word remains where it was before.

Any other word lying between the two definitions of the same word and containing that word will refer to the version lower down the dictionary than itself. This could lead to confusion. The Ace rather cleverly gets around this logical conundrum with the inclusion of a Redefine word which deletes the latter copy of a word, having replaced the earlier version with the latter.

This last feature is of special interest because the cassette-based Forths for other micros lack this facility. Another advantage the Ace has over these implementations is that the stack is not likely to overflow and crash the system. Readers familiar with Forth will be interested to know that the Create or Builds structure has been replaced by Definer.

The cassette-based operating system is interesting. Rather than opt for the Screen

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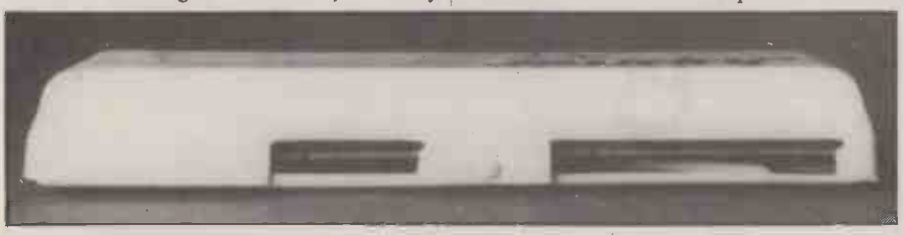


The rear showing the Z-80 bus section and video-output lines reserved for colour.

Specification

Processor: Z-80A
Speed: 3.25MHz
Memory: 8K ROM
3K RAM
Keyboard: small QWERTY moving keys
Display: memory-mapped 32 by 24 characters
chunky low-resolution graphics 64 by 46 pixels; high resolution achieved via programmable characters 256 by 192
Sound: internal speaker, accessed by Beep word
Language: Forth
Cassette: named tape files, 1,500 baud, works with most tape recorders. Verify command
Quartz timer: four-byte integral timer
Expansion port: allows connection of extra memory and control of other devices
Dimensions: 35 by 215 by 190mm.
Manufacturer: Jupiter Cantab, 22 Foxhollow, Bar Hill, Cambridge CB3 8EP

(continued on previous page)

technique of storing Forth applications, the Ace allows the user to Save all the user-defined words in the vocabulary. A Verify command allows the user to check that which has been Saved.

Physically the Ace is similar to the ZX-80, with a Spectrum-like keyboard. I found that keys did not always register when pressed, so each character has to be read as it is entered. The rear of the of the Ace has two holes cut into it. The first is the Z-80 bus section, which is similar to that of the ZX-81, except that the lines are all jumbled up. Another hole on the rear reveals the video-output lines. This will be used later to expand the system to allow colour graphics.

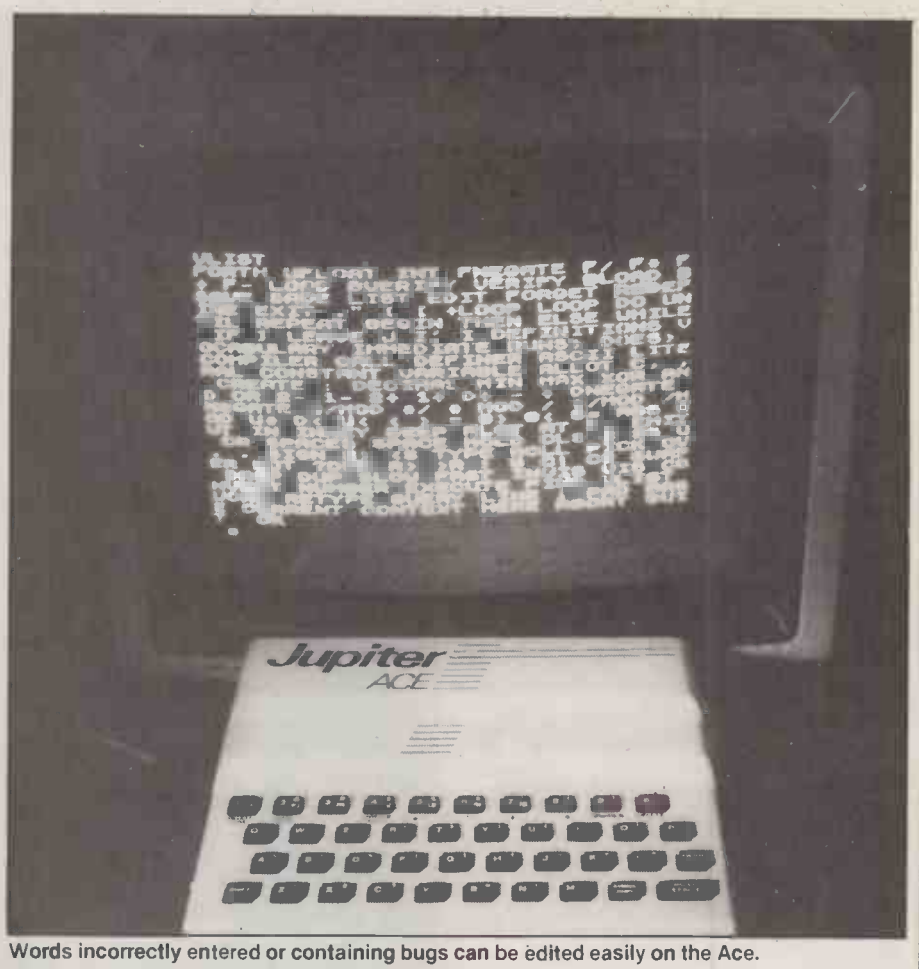
One of the particular uses of the Forth language is in the area of computer control This is easily done using the main output port. Examples are given in the manual in the final chapter. This ability makes the Ace an ideal tool for electronics enthusiasts.

Conclusions

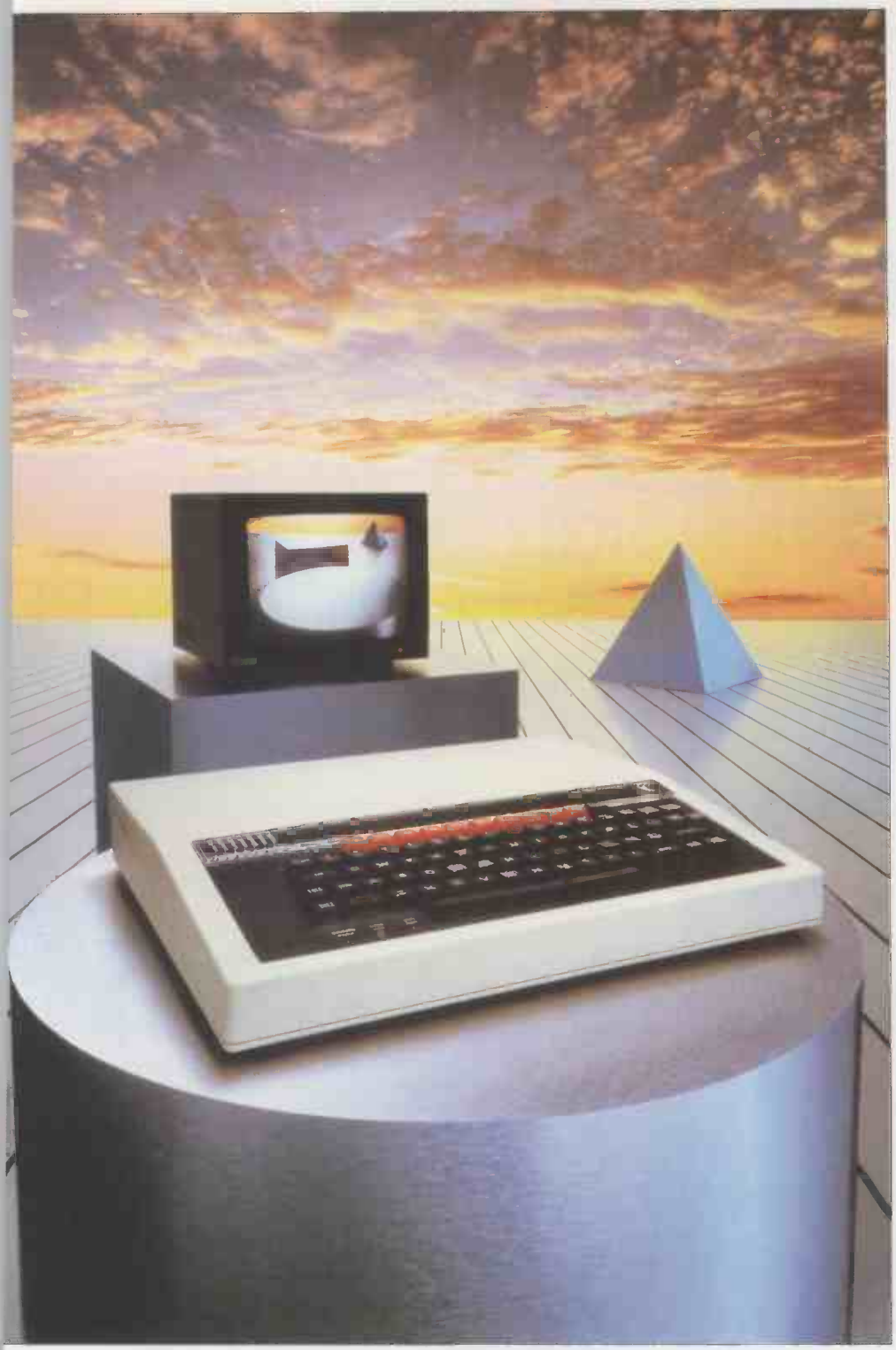
● The Jupiter Ace is an excellent training device, teaching computer users a different language

● It is certainly one of the most interesting developments in the flourishing home-computer field.

● As a tool for control it is a real winner and as a games machine it is fast, but as a real computer the keyboard and small memory let it down. At £89 it was never intended as a business machine.



Words incorrectly entered or containing bugs can be edited easily on the Ace.



'Whether your interests lie in business, educational, scientific, control or games applications, this system provides a possibility for expansion which is unparalleled in any other machine available at present', comments Paul Beverley in the July 1982 edition of *Personal Computer World*.

The BBC Microcomputer can genuinely claim to satisfy the needs of novice and expert alike. It is a fast, powerful system generating high resolution colour graphics and which can synthesise music and speech. The keyboard uses a conventional layout and electric typewriter 'feel.'

You can connect directly* to cassette recorder, domestic television, video monitor. disc drives, printers (dot matrix and daisy wheel) and paddles. Interfaces include RS423, inter-operable with RS232C equipment, and Centronics. There is an 8-bit user port and 1MHz buffered extension bus for a direct link to Prestel and Teletext adaptors and many other expansion units. The Econet system allows numerous machines to share the use of expensive disc drives and printers.

BASIC is used, but plug-in ROM options will allow instant access to other high level languages (including Pascal, FORTH and LISP) and to word processing software.

A feature of the BBC Microcomputer which has attracted widespread interest is the Tube, a design registered by Acorn Computers. The Tube is unique to the BBC Microcomputer and greatly enhances the expandability of the system by providing, via a high speed data channel for the addition of a second processor. A 3MHz 6502 with 64K of RAM will double processing speed; a Z80 extension will make it fully CP/M** compatible.

The BBC Microcomputer is also at the heart of a massive computer education programme. The government has recommended it for use in both primary and secondary schools. The BBC Computer Literacy Project includes two series of television programmes on the use and applications of computers.

There are two versions of the computer. Model A, at £299, offers 16K of RAM and Model B at £399 has 32K of RAM.

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*Model A has a limited range of interfaces but can be upgraded to meet Model B specification.
**CP/M is a registered trade mark of Digital Research..

The BBC Microcomputer is designed, produced and distributed in the UK by Acorn Computers Limited.

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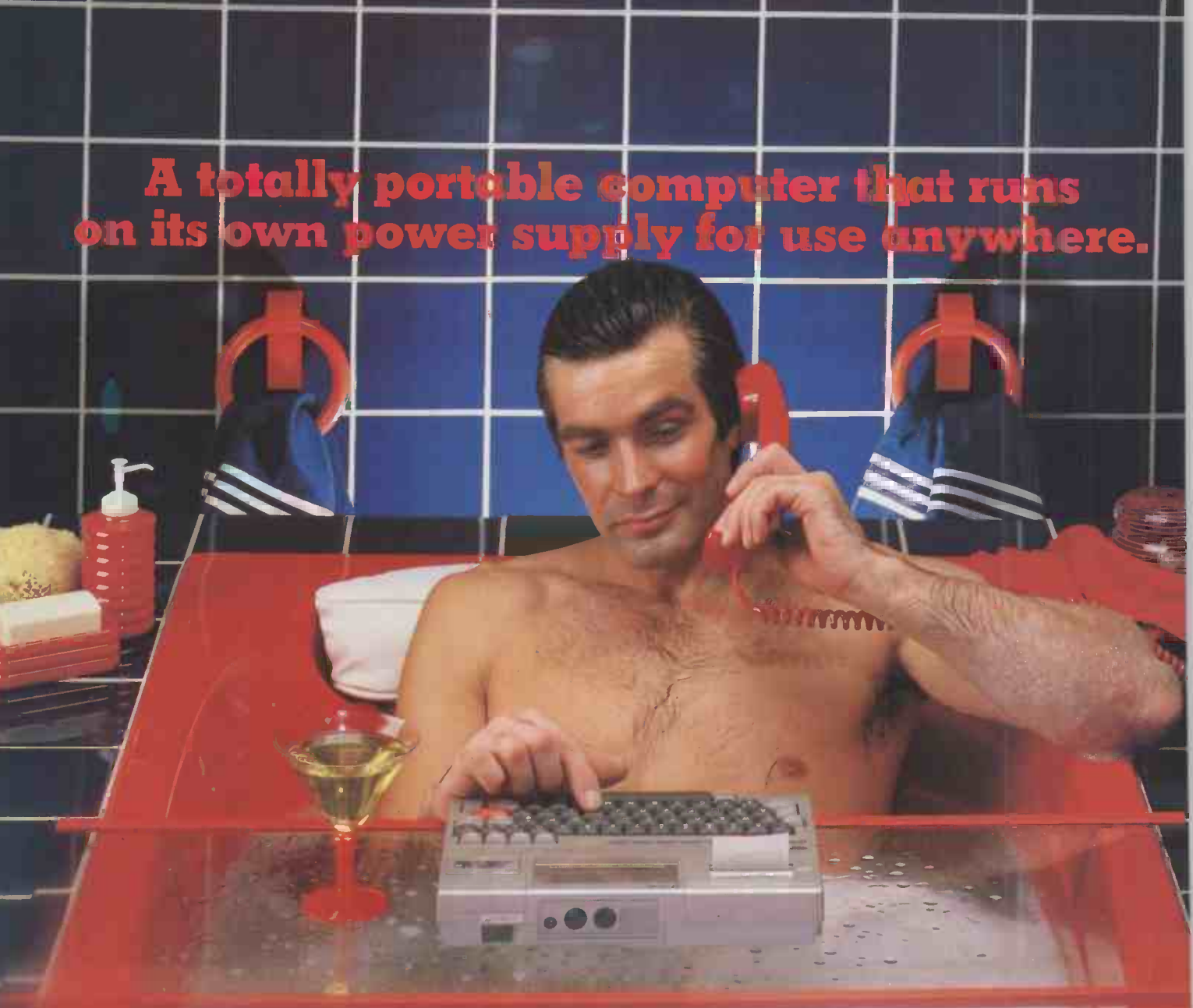

It could mean the end of the rubber duck as we know it.

The HX-20 is a portable computer with a full size typewriter keyboard, LCD Virtual Screen, printer and micro-cassette facility actually built in. A computer with a rechargeable power source that's large enough for writing programs and manipulating data virtually anywhere, yet small enough to carry in a briefcase.

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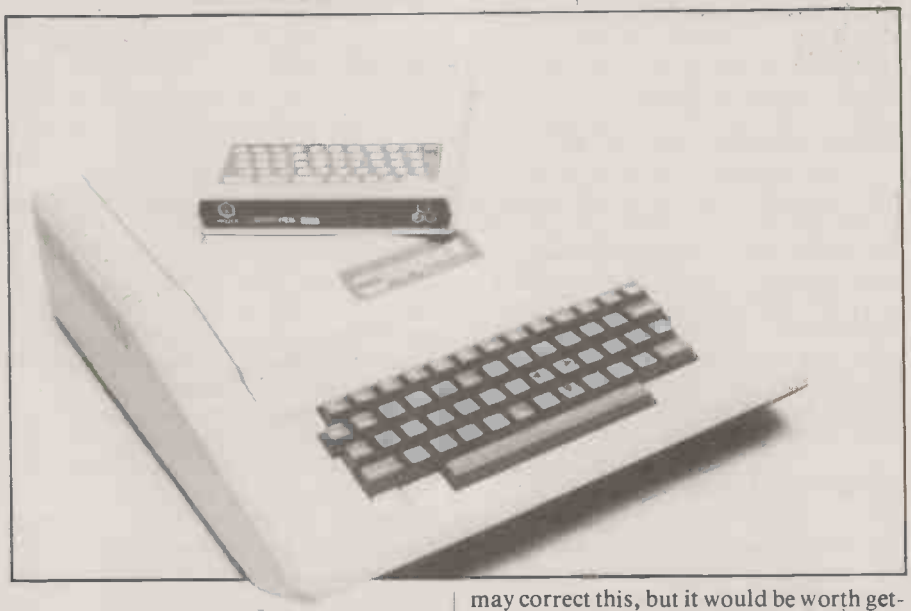
MPF-II

With Apple II capability at a reduced price this Taiwanese micro should appeal to hobbyists, says Ian Stobie.



APPLE'S VAST USER BASE has recently been under assault from manufacturers of look-alike machines. The MPF-II from the Taiwan-based Multitech Corporation can hardly be described as a look-alike in any literal sense as it is about one-eighth the size of the Apple II, but it does run Applesoft Basic programs and resembles the Apple closely when looked at through programmers' eyes.

The hardware is completely different. Mounted in a small, flat box measuring 10in. by 7in. by 1in., the MPF II has a calculator-style keyboard in a scaled-down QWERTY layout. But beneath the keyboard is 48K of RAM and a 6502 processor, like the Apple. Two ROM chips house the 16K operating system and Basic. The circuit layout bears no resemblance to Apple's, so the MPF II can in no way be called a pirate machine.

Provision for expanding the system is limited. The Apple II has eight 50-pin slots mounted on the motherboard, into which printers, video interface boards, disc controllers and the whole huge range of add-on goodies can be fitted. The MPF-II has AC power, cassette, TV and monitor connections along the back of the case. Down the side are a ROM-cartridge slot for Multitech-provided software, a non-standard printer connector and a similar connector marked RCB. The initials stand for the remote-control box which is the sole means of expanding the system. The remote-control box can be used to connect two games controllers, a Chinese character input device, a full-size keyboard or, eventually, a disc drive. The MPF-II is not plug-compatible with the Apple II.

Just like Applesoft

What the MPF-II does provide is a software environment which appears to be identical to the Apple's and a Basic which behaves exactly like Applesoft, Apple's standard floating-point Basic. Memory is organised the same way, with two text pages of 1K each and two 8K graphics pages. All system addresses tried checked out the same; the only differences appear to be in the command-line interpreter and the peripheral handling parts of the monitor. The simplest explanation for this is that the monitor ROM is different but the Applesoft is either the same or very close.

The most obvious difference is the ability the MPF-II has to accept Basic statements as single-key commands in a similar way to Sinclair Basic. This is done by holding down the Shift and Control keys simultaneously, while pressing the appropriate key — P for print, for example. A template which fits over the keyboard is provided if you prefer to enter programs this way. This is very convenient given the calculator-like nature of the keyboard, but statements are also accepted typed in full in the normal Apple way, so compatibility with Apple programs is fully preserved.

The other interesting feature of the MPF-II keyboard is the graphics character set that can be accessed by pressing Control-B followed by the appropriate character. Another keyboard overlay is provided to define these. The set is similar to the Pet's, with a range of partially blocked-out rectangles for drawing block graphics and a selection of lines, clubs, hearts and so on.

Like the Apple the MPF-II has three graphics modes for text, low-resolution graphics and high-resolution graphics. Text mode gives the user 24 lines of 40 characters in monochrome only. Cursor control uses the familiar VTab and HTab approach of the Apple. Low-resolution graphics allows plotting or line drawing on a 40-by-40 grid in 16 colours, while high-resolution graphics uses a 280-by-192 screen in six colours.

Commands are the same as for the Apple, including the powerful Shape, Draw, Rotate and Scale commands, allowing a shape to be defined and stored on tape and later read in and manipulated. The process involved is rather laborious, but many published Apple programs use the commands, and hence should run on the MPF-II.

The documentation that comes with the MPF-II is not up to the Apple standard. The Basic manual is meant to be both tutorial and reference manual, and takes some time to get started, rambling on in dubious English about generalities. The distinctive features of the MPF-II — the keyboard graphics and single-stoke keyword entry — where it has improved on the Apple, are ignored. The final version may correct this, but it would be worth getting hold of Apple documentation if at all possible.

Starting with a clean slate and today's technology the originators of the Aple II can probably come up with something to grab the consumer's attention. Meanwhile the MPF-II provides a low-cost way for more people to join the world of Apple software. It is not unreasonable to think that eventually many of them will migrate to the real thing.

Conclusions

- **The MPF-II is almost identical to the Apple from the programmer's point of view, but it is in no way a direct copy.**
- **The very limited expansion possibilities of the machine and its small calculator-size keyboard make it a home machine rather than a machine for serious use or program development.**
- **Even so, the provision of a powerful Basic like Applesoft and a good machine-language monitor make it a very suitable machine for the hobbyist or educationalist.**
- **Most cassette-based Applesoft programs should run on the machine, as well as published listings.**
- **Serious users should stick to Apple's own products, or look at machines which go beyond the Apple II specification like the Basis 108 and Country Acclaim.**
- **The MPF-II costs £235 and is available in the U.K. from Flight Electronics Ltd, Flight House, Quayside Road, Southampton, Hampshire SO2 4AD. Telephone: (0703) 34003.**

WALTERS 2000

Could the daisywheel be slipping into obsolescence? After a session with this British-made dot-matrix unit Chris Bidmead thinks that it just might.

NINE HAIR-FINE wires, fired repeatedly against a ribbon in shifting patterns, can hammer out pages of text up to four times as fast as the fastest daisywheel printer. Recent developments have produced "correspondence quality" dot-matrix printers that rival daisies in character definition without losing the ability to run off draft copy at high speed. It is beginning to look as if the days of the daisy are numbered.

Design improvements at the high end of the market filter down the line, and many of the cheaper dot-matrix printers, while still falling short of correspondence quality, have certainly cleaned up their act. The crippled character sets that used to be characteristic of the dot-matrix approach now have a very old-fashioned look. The Walters 2000 is a middle-range, medium-priced, good-quality printer, built like a tank, and just about as noisy.

Noise pollution

Our comments on noisy products in the past have failed to abate the various forms of acoustic pollution that roll into this office, so perhaps our enthusiasm for the quiet life is not shared by the various manufacturers. And as the products sell, it is obviously not particularly shared by the market either. So if you can hear us above the whine let's drop the subject and continue the tour.

The manufacturer claims a print speed for the Walter 2000 of 120 characters per second but, as usual, the conditions of testing are not defined, so the figure is a figment. The benchmark must be based on a single, straight-line burst because we were only able to attain an average speed of 84cps with our continuous-text test, a page of solid prose.

Our speed is exactly 30 percent below specification which, allowing for the turns at the end of lines, is probably about right. To put this in perspective, the Walters performed over 46 percent faster than the comparable Paper Tiger we reviewed in July 1981, and 93 percent faster than the fastest daisy.

Fast mover

The print-head certainly moves nippily, but the real edge comes from intelligent decisions about when not to move and when hopping across columns or down lines is going to be a faster strategy. The unidirectional tractor feed whips paper through pretty quickly, particularly during blank lines. Thanks to "motion minimalisation" rapid partial form feeds hurry the paper along to the next bit of business.

We were disappointed to find that the physical paper transport system was not entirely up to supporting the aspirations of the software. Early trials with the kind of vertically perforated tractor-feed paper where you can tear off the hole-punched edges came to grief when the printer tried doing the job for us, and the trimmings got wrapped round the platen.

Impact Data, the lively new firm marketing the Walters, came to the rescue with non-perforated paper of rather better quality, and the problem never re-appeared. The Walters is fast for a machine of its kind, and the fact that you cannot just bung in any old paper is a small price to pay for the advantage.

The nine-needle print-head produces a very readable basic character set with true descenders. It is expandable through software to double size, and contractable to 130 characters per line in the usual way. The typeface produced as a result of contraction is still pleasantly legible, making this option a very useful way of printing out assembler listings that normally require full-width 13in. paper.

Internal PROMs give the Walters a helpful personality. As well as providing auto-bidirectional printing, the resident software skips the paper over perforations, aligns figures around the decimal point, underlines and boldfaces, and offers a choice of whether over-long lines are to be truncated or wrapped.

Unfortunately this built-in intelligence does not extend to being able to set left-hand margins. If you are working from inside a word processor this will be taken care of by software in the host machine, but we missed being able to print assembler listings with a good margin for binding.

The full character set includes Pet-like graphics, accessible by setting the high bit, or alternatively by bracketing values inside the ASCII Shift In and Shift Out characters. ASCII 23H produces the £ sign instead of the #, which will be good news for the British business community. Computer buffs who find the hash character indispensible will have to down-line the pattern into the Walters. Up to 10 characters can be programmed like this and stored until the power is switched off.

Designing the characters and translating them into language the Walters understands needs some thought, but once that is done the loading process is as easy as printing. The short assembler listing shown here adds a ½ symbol to the character set. New additions are identified with lower-case letters in the lead-in string — "a" in this example — and recalled with

The hardware is robust, but beware — it can hand out brutal treatment too.

```
        .z80
        .comment +
*****************************************************
*  WALTERS, version 0.2: Demonstration of how to set up *
*  special characters on the Walters 2000            *
*                                                    *
*  NB: compile with M80 and run as a .COM program    *
*  before printing.  Or change the JP 0 exit and link *
*  into your printer routine.                        *
*                                                    *
*  Chris Bidmead, 22 July 82                         *
*****************************************************

bdos    equ 5           ;cp/m entry point
lstfn   equ 5           ;cp/m list device function
esc     equ 1bh         ;ascii escape character

start:  ld hl,pattern   ;get the address of our picture
        call lststr     ;and send it to the printer
        jp 0            ;back to cp/m command line

pattern:db esc, 'a'     ;character programming lead-in

        db 0100000B     ;column 1 of the pattern
        db 0000001B     ;column 2 etc
        db 1111000B     ;in fact this is a mirror-
        db 0000010B     ; image of the character laid
        db 0000100B     ; on its side, with the B's at
        db 0001000B     ; the bottom.
        db 0010101B
        db 0101000B
        db 0000011B
        db 1001100B
        db 0000001B
;up to nine other characters can be blocked out here, each
;preceded by esc and an identifier ('b', 'c', etc)

        db '$'          ;marks end of string for lststr

lststr: ld a,(hl)       ;get next char
        inc hl          ;bump the pointer
        cp '$'          ;end of string?
        ret z           ;if so, back to main
        push hl         ;save the pointer
        call lst
        pop hl          ;restore the pointer
        jr lststr       ;round again

lst:    ld c, lstfn     ;cp/m list function
        ld e,a          ;needs the char in e
        call bdos       ;call cp/m
        nop! nop! nop   ;give the usart a breather
        ret             ;and go back for more

        end start
```

an escape sequence that uses the upper-case equivalent. So to print the ½ sign as we have designed it you would send Esc "A" to the printer.

As an extension of this idea the Walters 2000 has a dot-graphics mode that allows up to seven of the print-head needles to be addressed directly. The manual gives an example in Basic of how this can be done, and very ugly it is too. The defining bytes have to be translated into decimal and then sent down the LList pipe wrapped in the old Chr$ envelope. The natural expression of these bit-pattern values is binary, and any ordinary assembler is happy to accept them like that, with a B tagged on to the end to define the base as 2. If you need to do programming of this kind it is well worth while learning the necessary simple assembly language. ASC.COM comes free with CP/M.

Uneven margins

Close inspection of the listing as printed shows that the vertical alignment is rather more ragged than we are used to seeing on a properly adjusted dot-matrix printer. In many applications this will not be important, and users will probably be happy to accept the speed of the printer as an adequate trade-off against precision of alignment.

In the RS-232 version we tested, transmission speed rate can be set to match the full range from 50baud to 19,200baud. Handshaking can be hard, through DTR on line 20 or soft XOn/XOff. It is a pity that ETX/ACK handshaking is not supported. Although generally passing out of fashion it is very simple to implement at the computer end and does not need continuous monitoring of the TX line.

One very nice design touch is the ease of conversion from RS-232 to Centronics or IEEE. The interface is a small printed-circuit board about the size of a cigarette packet, and changing over from one protocol to another is just a matter of pulling out one board and plugging in another.

Conclusions

- **For a machine of its price the Walters 2000 is remarkable nippy. Be sceptical about the 120cps in the real world — manufacturers generally parade ideal figures which are hard to match in practice.**
- **The polyurethane case gives the printer a good solid feel, and the internal mechanism seems to be built to take plenty of punishment.**
- **Paper handling at speed can be a touch brutal and good-quality paper is essential.**
- **The ribbon is a standard Diablo dot-matrix type, easily second-sourced.**
- **The documentation is clearly written and well laid out. Surprisingly for a new product, it seems to be accurate too.**
- **Made and supported in the U.K. — High Wycombe, to be precise — the Walters 2000 seems good value at around £400.**

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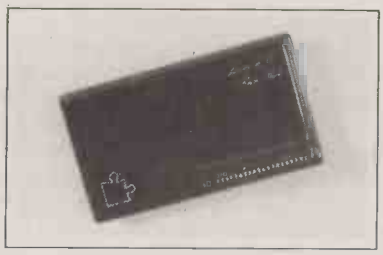

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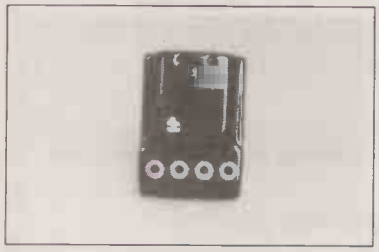

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BM. 4.	9.8	12.6	17.5
BM. 5.	10.5	13.6	19.8
BM. 6.	18.7	23.5	35.4
BM. 7.	29.6	37.4	55.9
BM. 8.	5.1	3.5	4.3

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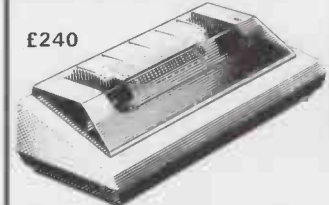

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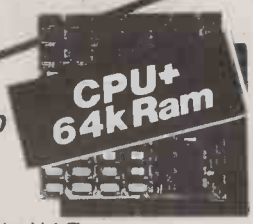

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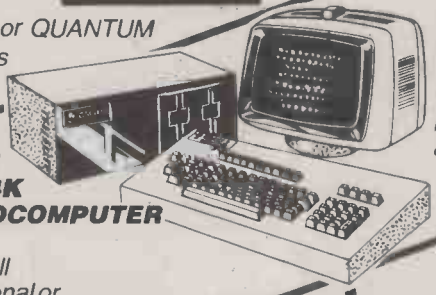

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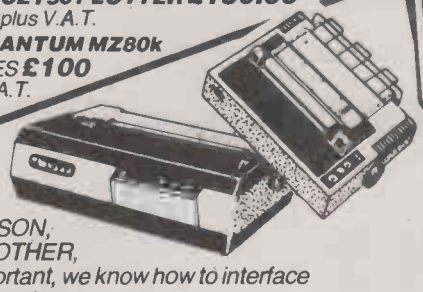

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Programming for a purpose

Taking his name-and-address program as a case study, Arnold Maughan offers further hints on writing effective applications software.

NEW PROGRAMMERS should be encouraged to write programs that are easy to understand, easy to debug and easy to maintain. To help achieve all three aims each stage of the program is broken down into modules, blocks or subroutines. Each file-creation section is headed by a meaningful name and is simple to understand, and the whole section can be run and tested even before the rest of the program has been written.

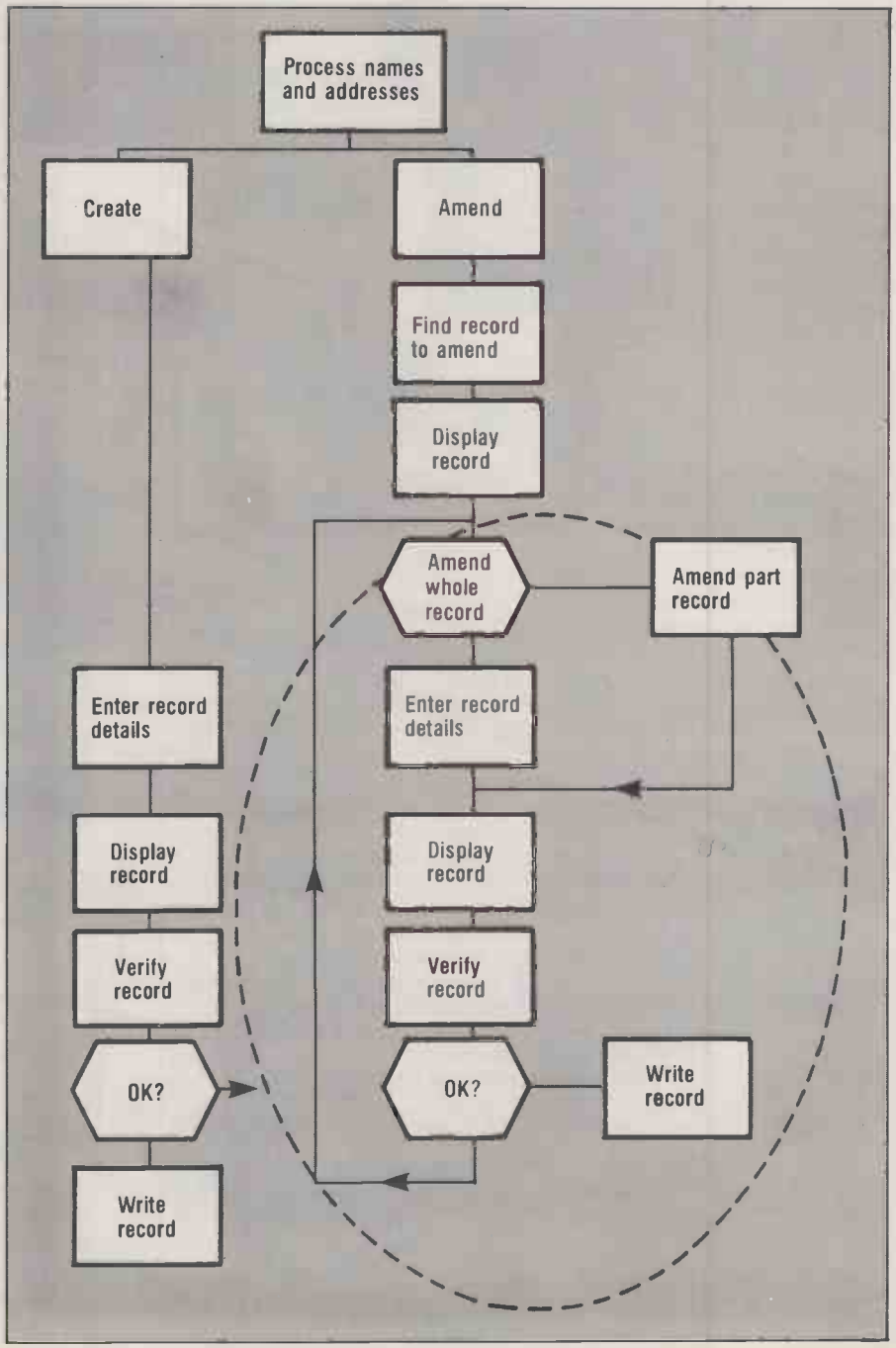
In a previous article in *Practical Computing*, October 1982, page 124, the control section of a name-and-address program called NAMADD was looked at. The next stage is planning and coding the file-creation routines.

Each section of the program has been designed, coded and tested at the same time as the article was written. It means that from time to time changes may be made to earlier sections in the light of new ideas or problems that arise at later stages.

Before starting to code the Create module — line 1000 onwards — consider what the program must do in this section. By planning this stage you can write a number of subroutines which can be used in other parts of the program. On my Comart Communicator with a VC-404 VDU and MBasic a routine is needed to clear the screen. It is written as a subroutine starting at line 60000. If your machine accepts CLS you can replace all the Gosub 60000 lines in the listing with CLS. But if you look at the 60000 subroutine it will be obvious why a simple piece of coding is better as a subroutine. Instead of repeating the three lines of coding it is only necessary to write Gosub 60000.

Obviously the subroutine Create New Records could include all the coding for entering, displaying, verifying, amending and writing away the records, but this would mean a lot of unnecessary coding and a great deal of duplication of effort at the Record section — look at the structure diagram of both sections. Apart from the control subroutines Create and Amend and the Find Record subroutines in the amendment section they share common subroutines. To write these out twice enlarges the program, apart from anything else.

To Create new records you Enter Record Details. The routine which starts at



```
10 PRINT CHR$(24)
20 DIM NA$(8),NB$(8),MX%(8),PR$(8)
30 MR% = 1001
40 FF% = 0
50 OPEN "R",1,"ADDRESS",128
60 OPEN "R",2,"INDEX",27
70 FIELD 1,22 AS NA$(1),3 AS NA$(2),4 AS NA$(3),27 AS NA$(4),
          27 AS NA$(5),27 AS NA$(6),8 AS NA$(7),10 AS NA$(8)
80 FIELD 2,25 AS KY$,2 AS RC$
90 FOR Z% = 1 TO 8
100     READ MX%(Z%)
110 NEXT Z%
120 FOR Z% = 1 TO 8
130     READ PR$(Z%)
140 NEXT Z%
150 DATA 5,4,23,28,28,28,9,11
160 DATA "Title","Initials","Surname","Line 1","Line 2","Line 3",
        "Postcode","Telephone no:"
170 GET 2,1
180 RC% = CVI(RC$)
190 IF (RC% > 0) AND (RC% < MR%) THEN 200 ELSE
    IF RC% = MR% - 1 THEN FF% = 1 ELSE
    RC% = 0
200 PRINT"Name and address program (NAMADD)"
210 PRINT TAB(20):"Select procedure required by number"
220 PRINT TAB(30);"1 to create new records"
260 PRINT TAB(30):
270 INPUT"99 to end run";TY%
280 IF TY% = 99 THEN 330
290 IF (TY% < 1) OR (TY% > 1) THEN 210
300 ON TY% GOSUB 1000
310 IF RC% = MR% - 1 THEN FF% = 1
320 GOTO 210
330 IF FF% THEN 340 ELSE 350
340 PRINT"ADDRESS file full"
350 PRINT CHR$(7);RC%;"records on file - end of NAMADD run"
360 LSET RC$ = MKI$(RC%)
370 PUT 2,1
380 CLOSE
390 END
1000 '


CREATE NEW RECORDS - 1000
1010 IF FF% THEN 1130
1020 GOSUB 10000 'ENTER RECORD DETAILS
1030 IF LEFT$(NB$(1),1) = "*" THEN 1170
1040 GOSUB 12000 'VERIFY DETAILS
1050 IF LEFT$(NB$(1),1) = "*" THEN 1170
1060 RC% = RC% + 1
1070 LSET NA$(1) = NB$(3)
1080 LSET NA$(2) = NB$(2)
1090 LSET NA$(3) = NB$(1)
1100 FOR Z1% = 4 TO 8
1110     LSET NA$(Z1%) = NB$(Z1%)
1120 NEXT Z1%
1130 PUT 1,RC%
1140 IF RC% = MR% - 1 THEN FF% = 1
1150 IF FF% THEN 1130 ELSE 1000
1160 PRINT"ADDRESS file full"
1170 RETURN

10000 '


ENTER RECORD DETAILS - 10000
10010 GOSUB 60000 'CLEAR SCREEN
10020 PRINT"Enter name and address details - or * to end input"
10030 FOR ZA% = 1 TO 8
10040   PRINT PR$(ZA%);
10050   PRINT TAB(20);
10060   LINE INPUT NB$(ZA%)
10070   IF LEFT$(NB$(1),1) = "*" THEN 10120
10080   IF LEN(NB$(ZA%)) < MX%(ZA%) THEN 10110
10090   PRINT CHR$(7):"Too many characters, only";MX%(ZA%) - 1:"allowed"
10100   GOTO 10040
10110 NEXT ZA%
10120 RETURN
11000 '


DISPLAY RECORD - 11000
11010 GOSUB 60000 'CLEAR SGREEN
11020 PRINT TAB(20);"1    2    3"
11030 PRINT TAB(20);NB$(1);TAB(25);NB$(2);TAB(29);NB$(3)
11040 FOR ZB% = 4 TO 8
11050   PRINT ZB%;
11060   PRINT TAB(20);NB$(ZB%)
11070 NEXT ZB%
11080 RETURN
12000 '


VERIFY RECORD - 12000
12010 GOSUB 60000 'CLEAR SCREEN
12020 GOSUB 11000 'DISPLAY RECORD
12030 INPUT"Enter 0 if OK - otherwise any other number";YE%
12040 IF YE% THEN 12050 ELSE 12100
12050 PRINT"Enter 0 to amend the whole record"
12060 INPUT"    or enter the number of the line to be amended":YE%
12070 IF (YE% < 0) OR (YE% > 8) THEN 12050
12080 IF YE% THEN GOSUB 13000 ELSE
      GOSUB 10000 'AMEND PART or ENTER DETAILS
12090 GOTO 12000
12100 RETURN
```

(listing continued on next page)

line 10000 will be used later to amend existing records.

To amend a record or merely to look at the records on file Display Record is needed. This can be done using the subroutine starting at line 11000. Then you will want to Verify each Record. In other words, you want to look at the display of the record just entered, or those you propose to amend, in order to decide what to alter. Another subroutine starting at line 12000 allows that to be done.

If from this Verify Record routine you decide to re-enter the whole record go to line 10000 — Enter Record Details. You may want to amend a line or two, add a post code or telephone number, or correct the spelling of a name. To do this you can utilise a subroutine called Amend Part Record which starts at line 13000.

The description of the program explains the purpose of the coding where necessary. It is easier to follow the program listing by starting each subroutine on a 1,000-line boundary, and by putting two or three line-feeds at the start of the break or heading line after the ' or Rem. If you run under CP/M take a look at the Address file you have created by entering Type Address after the CP/M A> prompt.

Variable names.
FF% — file-full indicator
KY$ — key of records for sorting purposes: NA$(1) + NA$(2)
MR% — maximum number of records allowed in the file
MX% — eight-variable array of maximum size of NB$ fields
NA$ — eight-variable array of fields in the file buffer
NB$ — eight-variable array of name/address fields in this program
PR$ — eight-variable array of prompts for NB$ fields
RC$ — Record Count, also RC%
TY% — procedure type indicator
Z?% — various loop counters

The main features of the program are as follows:

Line 20. Note that NB$(8) has been added to the arrays being dimensioned.

Line 1000 acts as a divider on the program listing. The number at the right is included to make it easier to renumber the program if insertions have been made.

Line 1010 checks the file-full indicator FF% to prevent any attempt to write records to the file when it is full.

Line 1020 calls the Enter Record subroutine.

Line 1030 checks the end-entry indicator *. There is obviously no point in verifying an end-of-entry indicator.

Line 1040 calls the Verify subroutine.

Line 1050 checks the end-entry indicator *. This has to be done after the Verify routine in case you decide not to keep this last record.

Line 1060 increments the record count RC%.

Lines 1070-1090 set the fields in the record buffer to the values in the NB$ array. The

(continued on next page)

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sequence is slightly different in order to simplify later routines.

Line 1130 writes the record to the file.

Lines 1140-1160 check the file size and print a warning message if it is full. Otherwise the program branches back to the routine to enter the next record.

The loop counter in this subroutine is Z1%, the "1" standing for the 1000; it is not used outside the 1000 subroutine.

Line 10000 prints heading.

Line 10010 clears screen; replace with CLS if this will work on your equipment.

Line 10030 sets up the count. The counter is ZA%, A being the hex equivalent of 10, and this being subroutine 10000.

Line 10040 prints the prompt message.

Line 10050 insets the input.

Line 10060. Line Input allows commas to be included. Do not use double-quote marks in the address; it would not matter in this program, but you may want to use the names and addresses with a word-processing package. Some of them, such as WordStar, use double quotes as text dividers. Though it is generally a simple matter to reformat the file for use with such packages any double quotes would have to be removed as part of the conversion routine.

Line 10070 checks for end-entry indicator *.

Lines 10080-10100 check the length of the fields, print an error message and branch back if in error. Only 10 characters have been allowed for telephone numbers, which is sufficient for U.K. STD numbers provided spaces and dashes are omitted. Only two initials have been allowed for with one space in between.

Lines 11000-11010 print heading and clear screen.

Lines 11020-11070 print the field number and content of each field of the record. ZB% is the counter in this subroutine, B being hex for 11.

Lines 12000-12010 print heading and clear screen.

Line 12020 calls display routine.

Line 12030. You could use Y and N if you prefer, but the coding of 12040 is simpler and faster using numerals.

Line 12040. The YE% statement tests YE% for a true or false condition — that is, zero or any other number.

Lines 12050-12060 use the same method but now the number entered indicates the field to be amended.

Line 12070 checks that the entry is valid.

Line 12080 selects the appropriate subroutine.

Line 12090 branches back to verify the amendment.

Lines 13000-13010 print heading and clear screen.

Lines 13020 onwards use the value of YE% to pick out the line to be amended. It is used again in lines 13070-13090 to check the length of the field.

Lines 6000-60040 are the clear-screen routine. The count in Z6% is to delay the program while the clear-screen function is being carried out. Without it the start of the next display could be lost. The size of the count must be varied to suit the equipment.

(listing continued from previous page)

```
13000 '


AMEND PART RECORD - 13000
13010 GOSUB 60000 'CLEAR SCREEN
13020 PRINT"Amend line number";YE%
13030 PRINT
13040 PRINT NB$(YE%)
13050 PRINT
13060 LINE INPUT: "should read ";NB$(YE%)
13070 IF LEN(NB$(YE%)) < MX%(YE%) THEN 13100
13080 PRINT CHR$(7):"Too many characters, only":MX%(YE%) - 1:"allowed"
13090 GOTO 13050
13100 RETURN
60000 '


CLEAR SCREEN - 60000
60010 PRINT CHR$(24)
60020 FOR Z6% = 1 TO 500
60030 NEXT Z6%
60040 RETURN
```

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SNAP

Public-opinion polls collect vast quantities of data. Phil Cole makes public his opinion of a package which ensures that none of it goes to waste.

"EXCUSE ME? Have you got a few moments? Would you mind answering a few simple questions? It won't take very long. Thank you so much." My usual response is to say No, side-step and dart away, but there must be some of us who answer the questions/questionnaires and generate the hundreds of case sheets which in turn provide the sample data from which projections are made and conclusions drawn.

If there are any organisations or people involved with the analysis of market-research surveys who do not know about Snap, then perhaps it is time they undertook some market research on their own behalf. The Survey Analysis Package, alias Snap, by Mercator Ltd does what computers still do best, which is number crunching. Moreover, it does it in a very flexible way. The suite of programs running under the CP/M operating system which make up the package is designed to handle the manipulation of the results in small to medium-sized surveys.

The suite divides neatly into the usual three program areas:

Entry of survey definition — data structuring

Entry and validation of answers — data capture

Analysis of the answers — data manipulation and reporting

with the third part obviously embodying the major function. Considerable trouble has been taken to ensure that getting the data on to file is under very extensive user control.

Bedtime reading

Before using Snap the survey must be designed, though the amendment facilities are very forgiving and allow modifications and rearrangements to be made even after entry of the survey definition. I started using the package after first jotting down on paper the rough outline of a survey, but without having read the user manual in detail. Somehow I can never bring myself to sit and read a manual from cover to cover and past experience has shown that good software generally does not need it. Within a few minutes I was setting up the survey using a question-and-answer routine to enter the questions and their associated answers.

Four possible types of answers to any of the questions are available: precoded, numeric, alphanumeric or multi-punch — the last catering for more than one answer to a single question. A range of possible answers to each question can be entered and there is also provision for routeing within the questionnaire so that certain questions are only asked or others avoided, depending on previous responses.

The system is menu driven and all the screens are clear, uncluttered and give a good indication of what is currently happening. I particularly liked the use of brackets to indicate that certain options were unavailable at certain times, but found the need to initalise repeatedly for certain operations very irritating.

Validation of entry is good, explanatory error messages being displayed when necessary. However in one or two situations after having made an error, the system informed me of the fact, displayed a plausible correct response and passed on to the next entry. I found this "hidden default" disconcerting to begin with, and inconvenient when having to "go round again" to make the correct entry. Of course, if the machine got it right I mentally applauded the presumptuous programming.

The package supports both Interview and Batch modes of operation and for this trial I had elected to go for the former. Once I had set up my survey, printed out the questions and possible responses — see figure 1 — and made a few modifications I moved on to the data-entry section. Again it is simple to use, the survey questions being displayed one at a time, but it needs a

(continued on next page)

Phil Cole is a Microcomputer software consultant with Computercraft Ltd, a software co-operative.

Figure 1.

```
S N A P  -  SURVEY  ANALYSIS  PACKAGE

SURVEY : DEMONSTRATION SURVEY
-------------------------------------------------------------
 TITLE : DEMO  6.11.82

                        FULL REPORT OF VARIABLES 1 TO 3

Variable no.: 1            Name : REGION
Type :PRECODED

Start column: 1            Field length : 1

                      Val                        Value Name
                        1                        LONDON
                        2                        SOUTH EAST
                        3                        SOUTH
                        4                        SOUTH WEST
                        5                        MIDLANDS
                        6                        NORTH EAST
                        7                        NORTH WEST
                        8                        WALES
                        9                        SCOTLAND
-------------------------------------------------------------
Variable no.: 2            Name : AGE
Type :NUMERIC  RANGE

Start column: 2            Field length : 2

        Val        Value Name          Ranges
          1        YOUTH                0-17
          2        18-25               18-25
          3        26-35               26-35
          4        36-50               36-50
          5        51-60               51-60
          6        > 60                61-99
-------------------------------------------------------------
Variable no.: 3            Name : MALE/FEMALE
Type :PRECODED

Start column: 4            Field length : 1

                      Val                        Value Name
                        1                        MALE
                        2                        FEMALE
-------------------------------------------------------------
```

SNAP

(continued from previous page)

trained user since the possible responses are not displayed with the survey questions and some idea of the expected answers is necessary. All answers are validated against the user-specified criteria and valid replies are displayed alongside a shortened form of the question. It is very easy to recall and amend any response previously given to any of the questions.

Time-consuming

Entering data using this method does take time, even with rapid response, and though this Interview mode was ideal for my small-scale trial it would not suit a larger survey. That is presumably why the Batch mode which works on a slightly different principle has been included. To begin with a similar process of entering questions and response ranges is carried out, but instead of entering the survey data one variable at a time, the data for a complete record is entered as a single string of characters.

There is two-stage validation and both are user definable. The initial stage is superficial but adequate enough to filter out most typing mistakes. The records are then stored in a file until the batch entry is complete. Termed Raw Data, these records are then validated against the more stringent limits of the survey's defined responses and translated into the appropriate variable in an automatic procedure under program control.

This produces a second file of what is referred to as Processed Data. Once again the system allows great flexibility in defining validation criteria and offers facilities to update, change and amend data that has already been entered and validated. All the facilities are easy to use, and there is also provision for double punching as a further safeguard.

Having entered all the data from a survey, output can be divided into four types. It is available either to the screen or printer in predefined formats which are not user amendable. The formats are functional and present the data clearly.

The Hole Counts option displays a table of the number of responses of each answer to each question in the survey — see figure 2. In cases where there are more elements to the table than can be accommodated on the screen a windowing technique is used. The minimum and maximum value of the answers together with the range, mode, mean, standard deviation and variance can be displayed for any of the questions. This applies to both the raw and processed data for Batch mode surveys. Histograms of the number of responses to each answer of individual questions can be generated, with the scales of the axes being adjusted under

Figure 2. S N A P – SURVEY ANALYSIS PACKAGE

SURVEY : DEMONSTRATION SURVEY

TITLE : DEMO 6.11.82

HOLE COUNT ANALYSIS TABLE OF ABSOLUTE VALUES

(PART 1)

	1	2	3	4	5	6	7	8	TOTALS
REGION	96	104	63	76	56	26	50	4	500
AGE	5	135	179	81	55	45	.	.	500
MALE/FEMALE	265	235	.	.	.	.	.	.	500
MARITAL STATUS	113	313	53	21	0	.	.	.	500
CHILDREN	135	130	135	100	0	0	0	0	500
S E GROUP	70	230	150	50	.	.	.	.	500
IRISH P.M	105	155	90	35	90	25	.	.	500

(PART 2)

	9	10	11	12	13	14	15	16	TOTALS
REGION	25	.	.	.	.	.	.	.	500
CHILDREN	0	.	.	.	.	.	.	.	500

Figure 3.

```
                S N A P   -   SURVEY  ANALYSIS  PACKAGE

SURVEY : DEMONSTRATION SURVEY
-------------------------------------------------------------------------------
 TITLE : DEMO 6.11.82

                              HISTOGRAM ANALYSIS
FOR VARIABLE NO 2 (AGE)

                    0         50        100       150       200       250       300
        VALUE !COUNT+---------+---------+---------+---------+---------+---------+
        YOUTH !     5!*
        18-25 !   135!****************************
        26-35 !   179!*************************************
        36-50 !    81!*****************
        51-60 !    55!***********
          > 60 !   45!*********
```

Figure 4.

```
                S N A P   -   SURVEY  ANALYSIS  PACKAGE                    PAGE    1

SURVEY : DEMONSTRATION SURVEY
-------------------------------------------------------------------------------
 TITLE : DEMO 6.11.82

   ROW : REGION ( 1)
COLUMN : AGE ( 2)
```

AGE / REGION	YOUTH	18-25	26-35	36-50	51-60	> 60	TOTALS
LONDON	0	0	70	20	6	0	96
SOUTH EAST	0	40	25	35	4	0	104
SOUTH	0	40	10	6	7	0	63
SOUTH WEST	5	20	20	5	1	25	76
MIDLANDS	0	35	9	10	2	0	56
NORTH EAST	0	0	20	0	6	0	26
NORTH WEST	0	0	25	5	0	20	50
WALES	0	0	0	0	4	0	4
SCOTLAND	0	0	0	0	25	0	25
TOTALS	5	135	179	81	55	45	500

automatic program or user control — see figure 3.

The most powerful facet of the package is its ability to generate cross-tabulation of the numbers of responses to the different answers to one question against a similar analysis of another question. It does this by displaying the table after first requesting question numbers for row and column — see figure 4.

The table can be built up on screen to provide the satisfying spectacle of seeing the machine at work, but cursor movement slows things down and much more rapid generation is achieved if it is completed before display. This option is under user control as is the windowing of the completed table. More sophisticated manipulations of these cross-tabulations are also possible by invoking the filtering and weighting facilities of the package.

Filtering enables the user to select out certain portions of the data sample based on the answer to specific questions before the cross-tabulation is generated. Similarly it is possible to give certain responses to questions greater value and significance or to extrapolate to a fixed population size. It is in these features that the true worth of the software becomes evident. Since all the data for the analyses and tabulation is retained in memory all the functions are very rapid. A hard copy of any display is available at any time.

Included in Snap's price of £645 is a

(continued on next page)

SNAP

(continued from previous page)

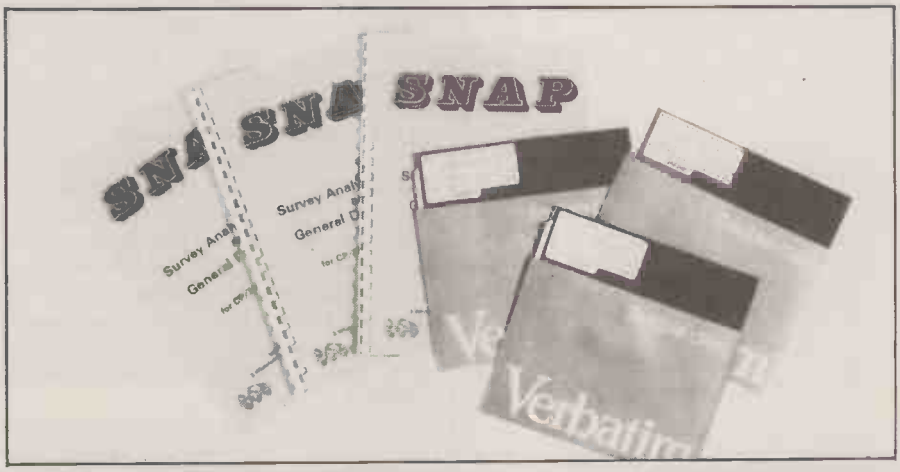
comprehensive user manual which I found a little fragmented although logical in its approach. There is also a year's warranty which includes updates released during that period.

Some of the extensions reportedly in the pipeline are a batch-processing facility for output using an instruction file, display of valid responses for the Interview data-collection mode, and an interpreted Basic program to manipulate the data in the Raw file. Mercator also claims that large parts of the package are being revised to take advantage of the recently available bigger machines in which, among other improvements, the limit on questionnaire size will be raised.

At present the package can handle up to 32,000 case sheets but is more practicable with surveys up to 2,000 on a minimum two-drive system. The maximum record size is 120 characters but the number of questions per questionnaire can be up to 192, with up to 15 multi-punch responses or 30 individual values; in practice only 64 of the questions can be active at the same time.

As an example of disc-storage requirements, 1,000 cases with 50 variables or questions would need 200K in Batch mode or 150K in Interview mode. On a floppy system operational speeds would be:

Validation of Raw data file — 15 minutes
Hold Count table generation — 3 seconds
Cross-tabulation — 40 to 45 seconds depending on filtering and weighting factors.



Conclusions

● Snap is a very solid piece of software that achieves what it sets out to do.

● In addition to its market-research applications, anyone involved in analysing data should have a serious look at Snap.

● Whatever data you enter, Snap is unlikely to crash. It is a very robust package.

● Screen layout is very consistent throughout the package, which helps make Snap quite easy to use in spite of its powerful features.

● Validation of input data is very much under user control, and data input formats can be modified easily.

● Snap can generate a wide range of reports, but the user has to live with limited control over print formats.

● Documentation is comprehensive and clear but a little fragmented. Mercator promises a quick reference section in the next rewrite.

● Snap costs £645 and is available from Mercator Computer Systems, 3 Whiteladies Road, Clifton, Bristol BS8 1NU. Telephone: Bristol (0272) 731079.

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What's portable?

Ian Stobie outlines the essentials of portable computing.

A PORTABLE COMPUTER can be conveniently lugged around without falling apart. It can be taken from room to room or from work to home in a civilised way without damage to machine or human, and then plugged in and used.

Included within the category of portable computers are a whole new wave of much lighter devices that are battery powered. These can be used out of doors and generally fit easily in a briefcase.

There is a problem of definition at both the top and bottom of the portable range. The limits are not arbitrary as they reflect judgements about the fitness of a particular expensive piece of hardware for a specific practical use.

The top limit is fairly simply set by what is easily carried — weight in other words. A machine like the Superbrain is portable in that discs, screen and keyboard are all in one unit with just one power cable coming out the back, but at 45lb. a short trip to the car would involve both hands and some staggering.

The 24lb. Osborne 1 represents a major gain in portability, which given the way it has sold has been recognised by users. It becomes possible for one person to carry the machine through doors and down long corridors in large buildings. A package of this size can accommodate a full-function CP/M computer; with portable hard-disc systems like the Zita becoming available the only compromise necessary is over the display.

By using completely different display and storage technology weight can be reduced dramatically. The 4lb. Epson has no heavy cathode-ray tube or discs, using LCDs and a micro-cassette drive instead. At the moment this does mean compromising a little on performance. The Sord M-23P is pretty much on the limit of present-day technology, with the largest commercially available LCD display and Sony 3.5in. microfloppy discs.

An irreducible weight at the moment is the keyboard. We were thinking of excluding from this survey all machines without a normal typewriter keyboard layout and spacing, but this would have meant leaving out machines that are being widely used in the field for a range of true computing tasks.

The NewBrain keyboard is very close to the typewriter standard, only being let down by its small-sized space bar. Its smaller keys but normal spacing may make it more practical to use outdoors with gloves on. The Husky keyboard is not at all standard, but is well adapted to its specific role as a rugged, outdoor data-collecting device; the membrane-covered flat, waterproof keys are normally in numeric mode; you push Shift for alphabet characters. Hewlett-Packard claims you can touch-type on the HP-75C keyboard but we found this impossible; the spacing is slightly too close although the keys click nicely.

Already available in the U.S., the 10lb. Compass has a 16-bit CPU and built-in Modem.

The Sharp keyboard is very much smaller. This is really the odd machine out in our survey, raising the question of where computers stop and pocket calculators begin. It is included because it has a full Microsoft-style Basic, a very neat printer, and it has been around for some time. It is just the thing for a heating engineer to take out to sites to prepare estimates.

Many new, calculator-style computers will be launched over the next few months. New machines are on the way from Sharp, Casio and Sanyo. Compared to a true portable computer they have a small keyboard, a small display often of one line only, limited memory, often a limited Basic or less adequate machine-oriented programming language, and a much smaller range of add-on devices. So Casio calls its new FX-801P a calculator, even though it has Basic. It looks very similar to an Epson but is smaller, has a one-line 20-character LCD display, a built-in printer, a micro-cassette drive and a scaled-down QWERTY keyboard.

Clearly there is no hard-and-fast dividing line. What matters is what applications a machine is fit for. It is a similar distinction to that between a Kodak instant camera and a versatile system camera like a Nikon or Pentax SLR. A calculator is used for immediate-mode computations, or repetitive computations if it is programmable. A computer can also be used for data logging, process control, word processing, graphic display, financial planning and entertainment. Not all the machines in our survey are suited to all these roles, but each one could sensibly be used for at least some of them.

In the United States the market is extremely active and some interesting portables are on sale. We have restricted ourselves in this survey to machines you can go out and buy now in the U.K., but it is likely that the machines that do best in the U.S. will make it here some time in 1983.

Starting with the obvious market slot, there are plenty of direct competitors to the Osborne 1. The Kaypro II, for instance, is a Z-80 based machine with a bigger, 9in. screen, larger-capactiy discs and a similar

(continued on next page)

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software deal: CP/M, MBasic, Select and Microplan are thrown in. In its attempt to put right the obvious weak points of the Osborne it is the U.S. equivalent of the Zita, and there are several more machines like it, such as the Extec 1000 and the Courier.

More innovative is the Teleram 3000, a Z-80 based machine featuring 128K or 256K of non-volatile bubble memory instead of discs, and a four-line by 80-character LCD display. It is light, under 10lb., and can run off batteries. It is aimed for use as a portable word processor, especially as it can be linked up via its RS-232 interface to a large office-based machine for detailed editing. Like many other machines, there is a strong emphasis in the promotional literature on communications. In a country with several time zones, getting hold of the person you want by phone may not be so easy, so electronic mail takes on more significance. And public-access databases like the Dow Jones Financial database and the Source are well established.

Another machine using bubble memory is the more up-market Compass manufactured by Grid Systems and designed by U.K.-based Moggridge Associates. Weighing 9.25lb. the Compass has a true 16-bit 8086 processor, 256K or 512K of RAM and a built-in Modem. The 6in. electro-luminescent high-resolution screen displays 24 lines of 53 characters and folds down to make the Compass into a neat briefcase-like package. Software for word processing, database, spreadsheet analysis, business graphics and communications is included in the price of just over £8,000.

Several U.S. manufacturers have decided that the IBM PC is the machine of the future, and have decided to go one better by offering a portable equivalent. The Compaq computer weighs 28lb. and contains an 8088 eight/16-bit processor — like the IBM machine — as well as 128K RAM, a detachable keyboard and a 9in. display. At around $3,000 it costs slightly less than the non-portable IBM.

The Dot from Computer Devices Inc. weighs 26lb., has a 9in. screen, an optional built-in Modem and uses 3.5in. microfloppies from Sony. As well as an 8088 for running MSDos it also has a Z-80 for running CP/M. But it costs more — over $4,000 for the configuration described here.

None of these machines is officially available in the U.K. Dealers over here are evaluating some models, but resistance to selling in Europe seems to be coming from the manufacturers themselves. U.S. companies are concentrating on building up production and do not appear to want the distraction of setting up a European operation when they can get rid of all they can make in their home market.

Benchmarks

A benchmark is a short Basic routine which performs a common task a convenient number of times. The routines used here first appeared in *Kilobaud Microcomputing* magazine, and we are indebted to Transam Microsystems for providing timings for the machines shown here. Transam has just refitted its London shop, turning it into a portable computer centre.

	1	2	3	4	5	6	7	8	9
PC-1500 CMOS CPU	15	70	121	122	178	293	383	51	211
HP-75C CMOS CPU	2.5	4.4	21	21	23	39	56	13	37.1
NewBrain Z-80	2.0	5.8	19.2	17.5	19.2	32.0	48.8	7.0	26.8
Epson HX-20 6301	2.6	15.2	33.4	33.2	35.2	59.6	101	13.2	51.5
Osborne 1	1.4	4.4	11.7	11.6	12.3	21.9	34.9	6.1	19.9
Sirius 8088 5MHz	2.0	7.4	17.0	17.5	19.8	35.4	55.9	4.3	24.7
IBM 8088 4.8MHz	1.5	5.2	12.1	12.6	13.6	23.5	37.4	3.5	17.6
HP-86	3.0	5.2	19.4	18.8	20.4	36.5	56.5	13.4	36.7
Olivetti M-20 Z-8001	1.3	4.0	8.1	8.5	9.6	17.4	26.7	1.6	11.5

Benchmark timings in seconds for a number of portable and non-portable micros. Timings are for standard benchmarks using default variable type.

What's available?

Portable computers are highly competitive: we compare the market leaders.

Hewlett-Packard HP-75C

THE HP-75C looks very like a large calculator, but inside is an eight-bit custom-made HP processor, 16K of CMOS RAM expandable to 24K, and 48K of ROM containing a very full Basic and an extensive operating system. It is probably no accident that from the outside, with the single-line 32-character LCD display and the slightly scaled down QWERTY keyboard as the main visible features, none of this power is apparent. Unobtrusive design is a Hewlett-Packard hallmark, as is the substantial price: at nearly £700 for the lowest-cost configuration the HP-75C is by no means cheap.

The HP-75C weighs under 2lb. (0.7kg.) and at 10in. by 5in. is about the size of a notebook. In maximum power-drain mode it can run off its own internal batteries for around 30 hours, which means in normal use data can be retained in memory for three or four weeks without having to recharge.

Backing storage is provided by hand-pulled cards, each holding 1.3K using both sides of the card. Reading or writing involves pulling the thin magnetic strip rapidly through the small slot to the right of the space bar.

For mass storage a highly reliable battery-powered digital cassette drive holding 128K per cassette is available for £393. With the addition of the HP battery-powered 24-column thermal printer costing £354 the HP-75C becomes a complete portable system. HP does not itself provide a Modem for use in Europe but is collaborating with independent suppliers to bring one out.

The built-in calendar/clock is well supported by the operating system, allowing you to enter appointments so that the machine beeps and displays reminders when they are due. More impressively, named programs can be auotmatically set running at scheduled days and times.

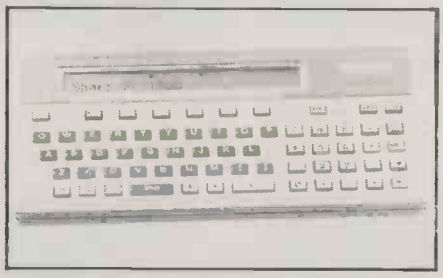
Data, programs and appointment details are all treated as named files by the HP-75C operating system, and share the same space, so there is no arbitrary limit on the number of programs or other files that can be concurrently in memory. Programs can also be stored permanently in ROM. Three slots for 16K plug-in modules are located very compactly beneath the keyboard. Tiny slots at the side of the keyboard allow keyboard overlays to be clipped in place, all keys being software redefinable. A lot of detailed thought has gone into making the machine ideal for turnkey applications.

The HP-75C is fitted with the Hewlett-Packard Interface Loop, accessible through two small sockets at the back. This is a network interface specially designed for low-power consumption devices, introduced by HP with the HP-41C calculator/computer, which has sold over 500,000 units. HP is the world's seventh-largest computer manufacturer and a huge supplier of specialist scientific and engineering instruments. So in addition to full-size monitors, plotters and printers, the HP-75C can be linked to a full range of HP instrumentation and larger HP computers.

Although the HP-75C is expensive, it is likely to appeal to people who have already come across the HP name in their work and who are prepared to pay for the reputation and flexibility it appears to offer.

For more information contact Hewlett-Packard Ltd, King Street Lane, Winnersh, Wokingham, Berkshire. Telephone: Reading (0734) 784774.

Sharp PC-1500



Although the PC-1500 is obviously descended from the humble pocket calculator its size and portability are desceptive. The slim box is smaller than a paperback and will fit in a jacket pocket, but inside is a fairly substantial Basic computer.

The Sharp is likely to inherit the pocket calculator's user base: it will be used mainly by scientists and engineers, as well as a number of businessmen. Unlike the calculator, the PC-1500 can be programmed in Basic and programs can be kept in the non-volatile RAM. The basic machine has 3.5K of user RAM which, thanks to the peculiar way the Sharp stores programs and data, can be designated as either variable-storage space or as program storage space.

High arithmetic precision is often called for in this kind of product; divide 22 by 7 and π is approximated to 10 significant digits, more than enough for most people.

The most significant feature of the Sharp pocket-computer system lies not in the computer itself but in the CE-150 expansion pack. This costs another £150 and provides the user with a surprisingly high-resolution four-colour graphics printer. Up to 220 plotting points across the width of the tally-roll printer paper are allowed. The paper is only about 2in. wide but some sophisticated graphics can be generated.

The CE-150 also provides an interface which allows two cassette recorders to be connected to the computer for file handling. There is some software available on cassette for the PC-1500, both from Sharp and from Microl. The use of the interface tends to give the batteries a bit of a hammering, especially when the printer/plotter is being used a lot.

The Sharp PC-1500 was reviewed in the August 1982 *Practical Computing*. For more information contact Sharp Electronics, Sharp House, Thorpe Road, Newton Heath, Manchester M10 9BE. Telephone: 061-205 2333.

Sord M-23P

The Sord M-23P is the most technically advanced of the portable computers covered in this survey, with two Sony 3.5in. microfloppy disc drives giving a total capacity of 580K, a Z-80 addressing 128K of RAM, a full keyboard and a very large LCD display. The display is over a foot long and can show eight lines of 80 characters.

CP/M is available now for £50, so the Sord is a full-feature machine like the Osborne or Zita, although it weighs a good deal less at 18.5lb. (8.5kg.). The only qualification to be made is that Sord is, at the moment, offering just the Lifeboat Associates version of CP/M, which opens up the Lifeboat range of software to users but is not compatible with all CP/M programs on sale.

Sord specialises in making computers, and holds the number-one slot in the Japanese

(continued on page 104)

The table on the following page is virtually self-explanatory. The figure given for the number of hours a machine can be run from its own batteries should be taken with a pinch of salt — it depends on what assumptions are made about the use of peripherals.

MACHINE	PC-1500	NewBrain AD	Epson HX-20	HP-75C
manufacturer	Sharp	Grundy	Epson	Hewlett-Packard
where made	Japan	U.K.	Japan	U.S.
PORTABILITY				
weight	0.38kg.	1.5kg.	1.75kg.	0.7kg
dimensions (mm.)	195 × 86 × 26	275 × 155 × 49	289 × 216 × 44	255 × 130 × 30
battery?	yes	option	yes	yes
hours at max. power	50	1.25	50	30
PROCESSOR/MEMORY				
CPU	custom eight-bit CMOS	Z-80A, 4MHz	twin eight-bit CMOS	custom eight-bit CMOS
standard RAM	3.5K	32K	16K	16K
maximum RAM	7.5K	2Mbyte	32K	24K
standard ROM	16K	29K	32K	48K
maximum ROM	16K	2Mbyte	64K	96K
DISPLAY				
type	LCD	vacuum fluorescent	LCD	LCD
size (mm.)	113 × 11	115 × 12	90 × 25	138 × 15
lines, characters	1, 26	1, 16	4, 20	1, 32
graphics	156 × 7 dots	optional	120 × 32 dots	graphics characters
KEYBOARD				
detachable?	no	no	no	no
layout and spacing	QWERTY, but close-spaced	almost QWERTY	QWERTY	QWERTY, but closer spaced click keys
numeric keypad?	yes	no	via shift lock	no
BUILT-IN FEATURES				
printer?	option	no	24 characters wide	no
calendar/clock?	no	no	yes	comprehensive
speaker?	yes	no	yes	yes
MASS STORAGE				
type	none	RAM	microcassette option	magnetic-card reader
capacity	—	as above	—	1.3K per card
hard disc?	—	no, but announced	no	no
INTERFACES				
RS-232	option	two	two	no
parallel	yes	option	no	no
networking facility?	no	yes	X-25	yes.
other	cassette option	cassette	bar-code reader	HP-IL
ADD-ON PERIPHERALS				
large screen	no	yes	yes	yes
Modem?	no	yes	matching CX-20 Modem	not get in U.K.
other	—	floppy drive	floppy drive	all HP-IL instruments
SOFTWARE				
operating system	PC-1500 OS	NewBrain OS	Epson OS	HP-75 OS
standard language	Basic	Basic	Basic	Basic
special features	graphics facilities	compiled, 10 sig. digits	Microsoft, 16 sig. digits	12 sig. digits, E ± 499
other software in system price	—	—	—	Money Manager and Name List
PRICE				
minimum configuration	3.5K RAM, 2.6K user RAM	32K RAM, 29K ROM with LCD	16K RAM, 32K ROM	16K RAM with card reader
price	£169	£263	£402	£694
other prices	printer & cassette I/F £149	battery unit £59, 256K RAM £285	microcassette drive £75	digital cassette drive £394
COMMENTS	Calculator size and limited memory. Will appeal to scientists and engineers for its full Basic and optional clip-on printer — really a four-colour plotter.	Can be expanded to run CP/M with floppy drive for about £450, but not then portable. Memory expansion up to 4Mbyte possible. Likely to appeal to educationalists.	Aimed at business use in the field, will also appeal to enthusiasts. Light A4-size package, printer can do graphics. Basic fast for CMOS machine.	Powerful timing functions, file handling and extended Basic. HP-IL allows networking and connection to battery-driven peripherals and instruments.

Zita	Osborne 1	Husky	M-23P	Scorpion
ITCS U.K.	Osborne U.S.	DVW Microelectronics U.K.	Sord Computer Systems Ireland	MicroAPL U.K.
13.2kg. 510 × 434 × 204 no —	10.7kg. 520 × 355 × 215 option 2	2kg. 241 × 203 × 44 yes 20	7.5-8.5kg. 438 × 392 × 131 no, but announced —	13.2kg. 510 × 408 × 204 12V DC option —
Z-80A 64K 512K 8K 128K	Z-80A 64K 64K 4K 4K	NSC-800 32K 144K 32K 64K	Z-80A, 4MHz 128K 128K 4K 4K	Motorola 68000, 16-bit 256K 1Mbyte — —
CRT 10in. diagonally 25, 80 yes	CRT 5in. diagonally 24, 52 32 graphics characters	LCD 141 × 41 4, 32 no	LCD 305 × 40 8, 80 64 × 640 dots	CRT 9in. diagonally 24, 80 option; 512 × 480 dots
yes QWERTY yes	yes QWERTY yes	no QWERTY, flat keyboard yes	no QWERTY yes	hinged QWERTY, ASCII and APL sets yes
no yes —	no — —	no yes yes	no no yes	no option —
up to three 5.25in.floppies 125K to 1Mbyte per drive 6 to 12 Mbyte	dual 5.25in. floppy 92K or 184K per drive no	CMOS RAM as above no	dual 3.5in. microfloppy 580K no	one or two 5.25in. floppie 720K or 1.2Mbyte per driv 10Mbyte
yes option no, but announced —	yes yes yes —	yes yes yes A-D converted	two yes yes three expansion slots	option option yes S-100 bus, four slots free
yes yes —	yes yes 80-column upgrade card	no yes bar-code wand	mono or colour monitor yes —	yes yes Ethernet option
CP/M Basic — Lexicom WP, Mars, Trendisc database, etc.	CP/M Basic CBasic and MBasic WordStar, Mailmerge, SuperCalc	Husky OS Basic —	Sord OS Basic Pips spreadsheet database package	Mirage OS APL, costs extra 140K workspace 68000 macro-assembler, editor
64K, 125K floppy, software	64K, two 92K floppies, software	32K RAM	128K plus dual microfloppies	256K RAM, one 720K floppy
£995	£1,250	£1,983	£2,060	£5,950
with two 1Mbyte floppies £2,895	with two 184K floppies £1,375	£3,423 with 144K CMOS RAM	without LCD £1,560	APL plus training £1,200
Strong competitor to Osborne. ITSC prefers to sell you software from an approved list and loan you the machine free, but will sell. Maintenance included.	The machine that started it all for portables. Still inexpensive compared to other CP/M systems. Battery option weighs 1.8kg. and costs £175.	Rugged machine intended for harsh environments. Waterproof keyboard is software redefinable for turnkey applications. Large, protected CMOS memory.	Very modern hardware approach gives large memory and disc capacity in light package. Good graphics with Sord-supplied colour monitor.	Primarily intended to run APL, which requires a lot of memory, hence the 16-bit processor. Hard-disc version with tape streamer costs £9,950.

(continued from page 101)
microcomputer market, where the M-23P has sold very well. Much of this success the company attributes to Pips, which comes free with the machine along with a Sord-supplied Basic.

Sord promotes Pips as a high-level language to rival Basic, but Pips is better understood by comparing it to VisiCalc. In addition to manipulating rows and columns like the spreadsheet program, Pips can handle records of plain text. It has good sorting and searching facilities and can do simple graphs.

Sord software is very well integrated with the hardware. Strings of Pips commands can be associated with one of the M-23P's seven function keys and then executed as a batch job or program with a single keystroke. Files of Pips commands can also be built up, and in this respect Pips really is like a programming language. But unlike most programming languages routines can be developed interactively by watching what happens to data on the screen when a sequence of commands is entered from the keyboard.

With a colour monitor the M-23P becomes an eight-colour machine. Pips turns out to produce colourful screens of data, which certainly gives it the edge over most spreadsheet programs. Unfortunately most colour monitors will not, at the moment, work with the M-23P, and the Sord-supplied one costs £500.

Other options available are a matching acoustic coupler and several Sord-supplied languages including Pascal, Fortran and Z-80 assembler. The word-processing program is well integrated with the hardware, using the function keys very effectively.

The Sord M-23P, like the other new Japanese machine the Epson HX-20, looks like a winner in its class. At £2,060 with the LCD it is reasonably expensive, but this is unlikely to deter people who require the features it offers. Pips is a very good package, and it is likely to become better known in February with the appearance of Sord's £99 home micro the M-5, which also offers both Pips and Basic.

For more information contact Socius Computer Systems U.K. Ltd, Samuel House, 6 St Albans Street, Haymarket, London SW1Y 4SQ. Telephone: 01-930 4214.

Husky

The Husky is substantially different from other portable microcomputers, mainly because of its application. It is a powerful Basic computer housed in a tough, metal, waterproof case. It can be supplied in a number of different ways, usually as a special dedicated machine with software in a protected area of RAM and a keypad specific to that function.

The Basic and operating system will often be opaque to the end-user, though this need not be the case. Its hefty construction makes it ideal for work in the harshest of environments, and it is even used by the services in battlefield conditions.

The Husky can be supplied in a leather case which can be slung over the shoulder. Its potentially very large internal memory of 144K means that large quantities of data can be stored in the computer at any moment. Data can be downloaded via the port on the end of the machine, and can be transferred to another computer. This can be done remotely using an optional acoustic coupler.

There are three levels of battery protection in the micro, making the data inside impossible to tinker with. The port means that it can be connected to items of equipment like meters, tills or data-loggers and read-in data. There is an internal clock, so software can be configured to make a note of what time a reading is made.

Current applications for the Husky mainly involve forms of data collection, from stock-taking in hotel bars to reading water meters and logging the movement of vehicles. The machine is equally at home on the high seas or in the middle of a desert. One possible area of application yet to be explored on the Husky is the creation of portable expert systems.

For more information contact DVW Microelectronics Ltd, Box 139, 345 Folehill Road, Coventry CV6 5RW. Telephone: (0203) 668181.

NewBrain

The NewBrain is a well-built micro, with a lot of components packed into a very small space. It comes in a number of versions all based on the same design, but adding LCD displays, battery packs and extra memory. The standard version has 32K of RAM and 29K of ROM.

The NewBrain has a real keyboard which is only slightly marred by the absence of a full-length space bar and the profusion of extra keys in that area. It is easy to type using the NewBrain, and the inclusion of batteries means that letters could be typed in on a train journey. One feature that is particularly good is the ability to use the NewBrain in conjunction with a monitor or TV.

Screen display formats allow 40 or 80 characters. The graphics package is impressive and allows high-resolution plotting with 640 by 250 pixels. Data and programs can be saved to tape at 1,200baud and standard cassette recorders can be used.

In addition to an extended version of the Basic language there is some optional ROM-based software. This will soon include CP/M, text processing, Comal, a Z-80 assembler and a statistical package. Memory can be added up to a total of 2 Mbyte.

The Grundy Newbrain was reviewed in the September 1982 *Practical Computing*. For more information contact Grundy Business Systems Ltd, Grundy House, Somerset Road, Teddington, Middlesex TW11 8TD. Telephone: 01-493 1901.

Epson HX-20

The introduction of the Epson HX-20 in 1982, a machine with a radically different specification to the Osborne 1 style of portable, has opened up a whole new sector of the portable-computer market with a different range of potential applications. The machine is only the size of three or four copies of *Practical Computing* stacked together, and weighs just under 4lb. It easily fits in a briefcase.

Into this small space Epson has managed to fit a full-size QWERTY keyboard with a good typing feel, a four line by 20 column LCD display, a 24-column plain-paper printer and an optional microcassette drive. Internally the system has twin eight-bit CMOS processors, 16K RAM expandable to 32K, and 32K of ROM containing a full high-precision Basic written by Microsoft and an extensive operating system. It also has a fully supported calandar/clock and a progammable speaker.

The machine is battery powered and can run for 50 hours without recharging in normal use. It looks substantial and could not possibly be confused with a calculator. Epson is unambiguous about aiming it at business use, but the price of £402 — £477 with the microcassette drive included — is bound to bring it to the attention of home users.

The operating system allows up to 10 programs to be simultaneously in memory. With both CMOS memory and the microcassette drive the machine is ideal for portable data capture and Epson is going for high-volume sales to field sales forces. Other obvious business applications make use of the built-in printer: Transam for instance has developed a payroll program for firms with

up to 50 employees, which prints out pay-slips and reports. The 16 significant-digit numeric precision of the Basic is very high, ensuring that the machine will also be looked at closely by scientific and engineering users.

The machine really comes into its own with the matching battery-powered CX-20 acoustic coupling Modem. Together with a fully expanded Epson it will fit into a neat briefcase, and allows field staff to transmit data back to base from any telephone. The Epson HX-20 is a potential job destroyer, for unlike a hobby machine or the executive's planning tool, a machine used in this way can eliminate jobs back at headquarters. Orders or meter readings can be typed by field staff directly into the machine and then transferred by phone or magnetic media to a larger machine. The paper stage is eliminated and with it, potentially, the jobs of the people employed to deal with it.

Epson has very rapidly established itself as the number-one supplier of dot-matrix printers worldwide, with around 60 percent of the U.S. market. A major supplier of LCD and print mechanisms to other suppliers — the Amber uses the same mechanism as the HX-20 — the ability of Epson to produce reliable equipment in high volumes is not in doubt. It looks as though 1983 will see a repetition of the Osborne 1 success story, with the Epson HX-20 getting a similar response in its own particular sector of the market.

For more information contact Epson U.K. Ltd, Dorland House, 388 High Road, Wembley, Middlesex HA9 5UM. Telephone: 01-900 0466.

Zita

Zita is a new name on the microcomputer scene. It is not so much a single machine as a range of portable microcomputers. The models in the range go from a £995 entry-level Zita-P system to a 13Mbyte portable with Winchester hard discs costing £2,895 and known as the Zita-PW.

Purchasers do not actually buy the Zita; it is "given away free". What they actually pay for is the software, and they are given the hardware to run it on. A number of interesting marketing ploys separate the Zita from other microcomputers. For example, heavy emphasis is placed on the "loan plan" designed to attract the business purchaser who might not want to tie up large amounts of capital in computers.

Other advantages of the loan plan — and incidently it is is the software that is on loan, not the hardware — include quarterly preventive maintenance and a nationwide servicing arrangement with a four-hour response. Software is updated regularly on such a scheme. The software that the user purchases or loans is chosen from a relatively long list, is all-British and runs under CP/M.

Comparisons with the Osborne micro are obvious, especially with the way the competing systems are being sold. Both companies are obviously aiming at the "fleet micro" market: large companies wishing to give every one of their managers a personal micro will buy either a Zita or an Osborne. The Osborne is sold with a standard set of software packages, while with the Zita you have a choice; the Osborne is but one machine, Zita is a range which can be upgraded.

The basic machine in the range is the Zita-P. It has an integral 10in. monitor, a QWERTY keyboard and a single 125K disc drive. Zita-Ps extend right up to a three-floppy, 3Mbyte system at £2,095 and there are nine Zita-P models in all.

Software piracy is combatted through an identifying code embedded in the ROM of each machine. It is compared with a code on the disc and will only load into the right machine. To add a greater degree of protection — or interference, depending on how you view these matters — the Zita micros will only be able to use blank discs which have been formatted with this security code. If you want to buy non-British software to run on the Zita you have to pay the full cost of the software.

For more information contact Information and Technology Computer Services, 2 Kingston Road, Staines, Middlesex TW18 4PA. Telephone: Staines (0784) 63211.

Osborne 1

The machine that started it all: other computers might have been as portable earlier, but the Osborne was the machine that captured people's imagination and was, from the outset, sold as a portable. The Osborne 1 is a Z-80 based CP/M machine with screen, two floppy discs and a full-size keyboard, all in one box weighing under 24lb. All you need to add is a printer and you have a working data-processing centre for about £1,500.

Adam Osborne's other innovation was to include popular CP/M software in the price. With WordStar, Mailmerge, SuperCalc and two versions of Basic included in the price the machine is, in effect, almost free. To keep weight down some compromises have been made. The small screen has been much criticised, but we have never heard much complaint from anyone who actually owns an Osborne. Nevertheless 5in. diagonally translates into 3.75in. by 2.75in., which is not very big.

The 24 lines of 52 characters which can be shown on the screen can be used as a window on to a larger 32-line by 128 notional display area, but many people find it simpler when using WordStar to set the right margin to the 52nd character position while editing, and then reformat to the full width required before printing. The narrow screen is more of a limitation with the Spreadsheet program SuperCalc.

The version of the Osborne currently being shipped has been upgraded in subtle but useful ways. The case is now vacuum formed so the system looks neater, and ventilation has been improved so the Osborne will perform more reliably in hot climates. New double-density discs are available, giving 184K per drive instead of 92K. The original Osborne discs were incompatible with almost all other popular CP/M systems; the new double-density ones can read data discs from other systems, including the IBM PC, the Xerox 820 and some Cromenco machines.

The cost of the new Osborne, with two 184K discs, is £1,375; a disc-upgrade kit for existing Osborne users is available for £125. After December 1982 the cheaper single-density version ceases to be available in the U.K., but to sweeten the pill further Osborne is offering dBase II free until mid-February 1983, along with the usual software. The other major enhancement to the Osborne 1 is the 80-column screen-upgrade card, available from early 1983 for approximately £150.

One day a completely new Osborne II will probably come along. Whatever it will look like, Osborne is doing a lot to correct the early difficiencies of the Osborne 1 and extend its life. As the best-selling portable in the CP/M class it will certainly be a hard act to follow.

For more information contact Osborne Computer Corporation U.K. Ltd, 38 Tanners Drive, Blakelands North, Milton Keynes, Buckinghamshire MK14 5BW. Telephone: (0908) 615274.

Scorpion

The Scorpion offers enormous power — at a starting price of around £6,000. It runs APL on the 16-bit 68000, and can support five users. For further information contact MicroAPL Ltd at 19 Catherine Place, Victoria, London SW1E 6DX. Telephone: 01-834 2687.

Stock answers

In the pub and hotel trade keeping track of valuable stock is vital. Della Bradshaw has been down in the cellars to see how a portable micro can help the publican.

ONE OF THE MANY complaints launched against software packages is that they are written by programmers and not by people who know about the job involved. No such accusation could be levelled against the Inn-Ventory package, designed to do stock-takes in bars, clubs, hotels and even greyhound tracks.

Inn-Ventory is the brainchild of Dennis Clifford who has a long history of hotel management behind him. In 1977 he gave up managing a four-star establishment in Bristol to open his own hotel, and in 1979 he opened up a second one. Up to that point, he claims, his only dealings with computers were through staff in his hotels who used them for doing things like accounts. One headache he found when he started running his own businesses was bar stock-taking.

Clifford's main gripe about manual stock-taking was the time it consumed. He was using a national firm of stock-takers, but as a general rule they took 10 days to pass the required information to him. The stock-takers also dealt with some of the big breweries and if they called them out at short notice Clifford's hotel had to wait two weeks for its information.

So Clifford decided he would be better off with a computer. He looked at micros like Apple, Pet and TRS-80, but preferred the Husky, a portable made by DVW Microelectronics.

Built for outdoors

The Husky is a hand-held computer which, if you did not know better, you would swear was Japanese. It was originally developed for the Severn-Trent Water Authority for use outdoors collecting data to track down the huge quantities of water that get lost somewhere between the resevoir and the household tap. Not surprisingly, it is completely waterproof.

The Husky seemed just what was needed in the bar stock-control line. If someone spills a pint of beer over it or if you fall down in a dark cellar the Husky is durable enough to take it.

Clifford set about specifying what he wanted the program to do. He based it on the manual stock-taking system, which means you can flick through from the bottles of lemonade to the barrels of real ale, updating stock where necessary. It is done by keying in the code number for each different kind of drink, like 100 for Bell's whisky or 129 for Gordon's gin. The machine does the rest.

Clifford was so impressed with the market potential for this kind of service that he set up his own stock-taking business, Inn-Ventory, as well as continuing to use the Husky in his own hotel. He now has 54 clients, including hotels, clubs, free houses and even a dog track, and employs four stock-takers.

He claims the benefits of a computer stock-take are numerous both for the stock-taker and the client. Firstly the stock-take can be completed on site by attaching a printer to the Husky. The publican then receives the information immediately rather than having to wait the customary 10 days or a fortnight. If anything has been left out of the stock-take, like two barrels of beer in the corner of a very dark cellar, the discrepancy will be immediately apparent and the stock can be rechecked. If the information does not arrive for another 10 days or so the stock will have changed and it will be well nigh impossible to work out where the oversight occurred. The publican can also spot customers' drinking trends and work out from that what to order.

The speed at which the stock-take can be carried out is surprising. Clifford reckons it takes only 45 seconds from the moment the information is keyed in to the moment when the Husky is ready to print out. With the manual system it takes about 2¼ hours, so more stock-takes can be fitted in. Costs can be cut by about 15 percent.

The client is also left with an accurate stock record listing what is in stock down to the last 1/10 of a bottle. The stock value of it, an account in quantity and the value of what has been sold since the last stock-take, intakes, percentages and portable stock life can all be established within a morning.

Legal requirements

The only legal requirements for this kind of information are in the annual accounts: "The printout for my hotel is for my eyes only," says Clifford. "I let the tax people see as little as possible." But it is invaluable for keeping tabs on what is in stock. As Clifford says, "With a manual system we always used to take short cuts but not with the computer. It is all so quick and easy."

Clifford is confident he has made the right decision in opting for the Husky. It is easy to operate and can be used by non-computer buffs: "When I employed stock-takers I wanted people experienced in the hotel trade, not programmers. When I say the hotel trade I don't mean experienced stock-takers. The problem with them is they know all the tricks of the trade and can do deals with the clients."

The program runs on two main menus, the first for existing clients, the second for new clients. When dealing with a new client the stock-taker has to create codes first for the client and then for all the different types of drinks in stock. The stock codes are different from customer to customer. Once this is done, all the stock-taker has to do is key in how much of each of the coded beverages is in stock.

Tax wrangles

The information is also recorded on to an ordinary cassette, which is duplicated. One copy stays with the stock-taker and one copy goes into the main office. Each month's stock-take is recorded on one side of the cassette, so the firm keeps two months' information on every client at any one time. Clifford says he wants to keep it at that, "We don't want to get involved in any sort of legal or tax wrangles."

At the next stock-take the information is transferred back on to the Husky from the cassette, so that the closing figures for the last stock-take become the opening ones for the new stock-take. Anything the bar owner or publican has bought in since the last stock-take is keyed in using the agreed codes, and the stock on the shelves and in the cellar is typed in. With the two months' information plus the purchases keyed in, the machine can speed through the calculations and tell the client how much should have been taken in, what they need to buy, and whether things have gone missing or if someone has had their fingers in the till or the cellar.

Clifford appreciates the Husky's portability. It weighs less than 2kg. and after you have been round a greyhound stadium three or four times and in and out of all the various bars you begin to appreciate how light the machine is. It can be carried on the back or over one shoulder in the Irish leather shoulder bag which bears a remarkable resemblance to a lady's handbag.

The Husky runs on three sets of batteries. The main set are the alkaline type — much advertised by Duracell — which can be removed when the Husky is not in use. The second set are the mercury back-up batteries and the third set are the lithium batteries which are attached to the chip.

from a Husky

Clifford claims it is almost impossible for one of his stock-takers to erase any of the information by mistake, even when removing the main batteries.

Clifford is now thinking of buying an Osborne computer for use in the office — to complement the Huskies, not to replace them. "The Osborne still has to be plugged into the mains, not like the Husky which runs on batteries," he explains. "You have to leave it in the office — you cannot take it down into the cellars with you. If you wanted to use it for a stock-take you would have to write it all on a piece of paper and then go back up to the office and type it all in again.

Up to 144K memory

The Husky comes in anything from 32K to 144K versions. It can be plugged in to any kind of printer, and there are three options available for storing information picked up on site. The first of these is the cassette back-up as used by Inn-Ventory, the second is via a Modem down a telephone line to another computer, and the third is to dedicate the Husky to one site only and keep the information permanently in the machine's memory. This is the way the Husky is used by the Inn on the Park in London. It has a 144K version that keeps all the data from eight bars and a cellar, 893 stock items in all.

The Husky costs between £1,000 and £3,000 depending on the configuration, with the average sort of model costing around £2,000. The stock-taking software is additional to that. Inn-Ventory's stock-taking services come somewhat cheaper. A small bar, which takes about an hour to do, costs about £30 per stock-take, which is usually done once a month. Sales from a 40oz. bottle of whisky would bring in about the same, so if a member of your bar staff happens to be in the habit of expropriating the odd bottle of whisky the computerised stock-take really pays for itself. A two-bar pub costs about £50, a club £40 to £45 and hotels between £100 and £120, on average. Inn-Ventory also does the stock-take for a hotel with seven bars, and that costs a couple of hundred pounds.

Ballroom dancer

Having owned and managed hotels and started his own stock-taking company Clifford has now launched into the computer sales field, selling Huskies with the stock-taking program through his newest company, Inn-Ventory Computers. His clients range from Park Lane's Inn on the Park to Sid's Bar near Manchester, which was one of his first customers. Sid and his wife — who used to ballroom dance for Britain — use the Husky to keep track of things in their bar, wine bar and dance school.

The Husky's manufacturer is quick to point out that stock-taking is not its only use. So far over 70 applications have been developed for it, including several for the RAF. One of them tests airmen's reflex reactions under pressure: the Husky is programmed with several random multiple-choice questions and the unfortunate trainee is then sent off round an assault course clutching his computer. Every time the machine bleeps he has to answer one of the questions — a long-division sum, or something like that — as quickly as he can. The RAF's machines are housed in special khaki-coloured cases. If you happen to see one of these poor chaps dashing across a muddy field, responding to strange bleeps from a camouflaged box, then at least you will know what he is doing.

The Husky's rugged, go-anywhere capability was a key factor in Inn-Ventory's choice of machine.

They all laughed, but ...

The idea of a portable computer was dismissed by the industry. Who would want such a thing? Ian Stobie talks to Adam Osborne, the man who proved them wrong.

OSBORNE COMPUTER COROPRATION is one of the few new start-up companies to succeed in breaking through into the microcomputer big league. Apple, Tandy, Commodore and the other big-name companies have all been around since the earliest days of the microcomputer, and are only now being seriously challenged by the established giants of the large computer world, like IBM and DEC. As a new start-up company the scale and rapidity of Osborne's success is unique.

Only selling its first machine in June 1981, Osborne now claims 50,000 systems out with users, and a target turnover of one billion dollars by 1984 looks increasingly attainable: 1982 turnover will be around $100 million. The company is shipping 500 units a day from its two U.S. plants.

All this has been achieved on the back of a single product, the Osborne 1 portable computer. Weighing 24lb. including screen and twin disc drives, this mains-powered CP/M system costs £1,250 in the U.K. The price includes software, such as WordStar and SuperCalc, and a manual which rewrites in one compact volume all the necessary documentation.

When Adam Osborne announced his plans to set up a company to bring out the Osborne 1 he was greeted with much scepticism within the industry. Would people really want such a machine, even allowing for the low price and free software? Its runaway success in the U.S. demonstrated that they did and clearly Adam Osborne is the right person to talk to about what makes the portable computer market tick: "Portability is extremely important. Not so much because people want to hike across the country with a computer or fly around with it, but just to carry it from one room to another without having it all fall apart with wires and cables tangling up all over the place.

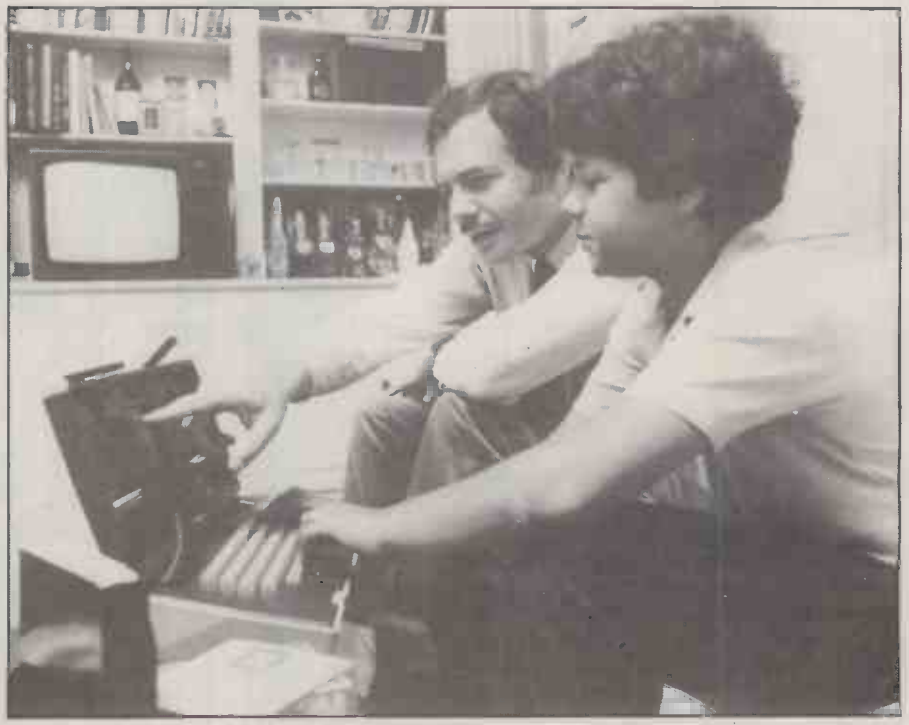
"We are going after a consumer market right now and there never really has been a consumer computer. Computers are still designed by people who are computer people. Now that can't go on for ever. If you want to sell microcomputers in the volumes that we are talking about you have got to start selling to Mr Joe in the street, who has absolutely no desire to own a computer but is buying the device for what it can do for him. They are buying a solution, they are buying a computer the way they might a typewriter, or a vacuum cleaner. That means it has got to have the level of reliability, be that easy to use, and be that easy to learn to use. They are never going to program the thing. It has got to be just solid, rugged and self-evident. We have come a long way but we have a way to go yet."

The Osborne is not everyone's idea of a portable computer: "as portable as a suitcase full of bricks" is one description. "The thing you've got to look at right now is not getting the weight of the machine down to one pound but the fact that the keyboard has to be large enough for normal fingers. And that sets one limit right there. Another limit is that you have got to have a screen that you can look at, and ours is about the bottom limit of that, you can't get much smaller than we have."

What does Osborne think of machines like the Epson, which has a liquid-crystal display of four rows of 20 columns and weighs only 4lb. "It is a different market again. You could not hope to do word processing on it or reasonably expect to do electronic spreadsheet work with that. But you could very reasonably expect to do scientific calculations — something that is computational intensive. In the days when I was a chemical engineer I would have had no trouble with a thing like that. I would have done nice little programs and watched them churn away.

"I had a Radio Shack pocket computer with a single-line display I ended up giving to a friend of mine, a civil engineer, he loves it."

Osborne prices have from the outset



Adam Osborne, son Paul and the Osborne 1.

Osborne complete with portable computer on a recent visit to London.

been pitched low. Is this some long-term strategic policy to buy a slice of the market or is it profitable anyway? "It is profitable anyway. By going in low we do expect to get a high volume, and we have achieved that. You are obviously not going in at that kind of price expecting to make a profit after you have shipped 10 machines a month as some other companies may decide to do. We are looking for reasonable volumes, but the volumes are quite easy to achieve."

Never ever

Some companies like Hewlett-Packard have a diametrically opposed approach. At the recent press-conference launching of HP's own new portable, the HP-75C, an HP executive said openly that Hewlett-Packard would never bring out an inexpensive machine. Adam Osborne can see the logic behind this. "HP sell quality and service to a market that is not particularly price sensitive. For a long time their customer base has been large corporations who want to make sure that the thing is reliable and does the job it is supposed to do. They have never been very successful in consumer products — even their calculators have not really been that successful as general run-of-the-mill consumer products. They still sell most of their calculators and everything else to large companies. And large companies, quite honestly, are not price sensitive."

Programming policy

Osborne employs very few programmers. From the beginning the Osborne philosophy has been to buy in software. Out of approximately 350 employees around the world less than a dozen are programmers. "This is not many compared to most other companies. We need them to tailor operating systems to particular configurations and to do diagnostics, that kind of very low-level engineering type of software. We don't develop our own operating systems, languages or application programs."

Instead Osborne buys in software from outside sources, choosing well-established standard software. "Occasionally where we knew that the software we needed didn't exist we went out and instigated it. SuperCalc was our invention. We went to Sorcim and said do this program for us and they did. But in most cases the software does already exist."

But will it continue to exist as the market grows? Will there ever be a software crisis? "No. I'm quite certain it will continue to exist in excess because everybody is busy writing programs, and even though most of it is junk it doesn't take but two or three percent of the people writing programs to produce something useful, and we are all in good shape."

But do they produce things that can be picked up and used readily by people new to computers? "That is the difference between the one that succeeds and the one that does not."

Obsolescence

CP/M is now getting to be an old operating system, and might be seen to be coming to the end of its life. Osborne does not think so. "I argue it is not coming to the end of its life, and the reason it is not is that it is still perfectly adequate for everything people try to do with it. The end-user can frankly see little or no difference between a program written under CP/M and a program written under a far more efficient operating system. This is the big difference from having an obsolete machine, like the Apple II, where the user will see very definitely the price/performance difference, and won't continue to put up with 40-column displays, wires all over the place or boards for this, that and the other. These are perceived differences. You can say that CP/M is an obsolete operating system but there is no perceived difference. And as for the programmers, they don't care, they are interested in what can sell. They might yell and bitch but then take Basic, which was an obsolete language in 1969, but it is adequate. The end-user doesn't see the difference so it survives."

Where does Unix fit in? "Unix is significant because in the 16-bit world there is no leader. CP/M-86 is around but it certainly hasn't dominated the 16-bit world, nor has any other operating system done so yet, and one of them is going to. Unix stands a damn good chance.

"In fact in many ways once you start getting down to these consumer computers, once you start loading it up with features you hurt yourself, you don't help yourself. I've got a couple of favourite sayings with regard to software. One of them is 'Better is the enemy of good'; the other one 'Adequacy is sufficient, everything else is irrelevant'."

The Osborne approach is to satisfy 90 percent of the users' needs rather than come unstuck trying to attain 100 percent. "Far the most important thing is making the product something the user is not intimidated by. You start telling the user to buy this machine because you can be run-

(continued on next page)

They all laughed, but ...

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ning three programs at once and you will lose the user. He doesn't want that. He is confused, he wonders if he will ever learn to use the son-of-a-bitch. He will go and get something nice and simple instead."

Adam Osborne derives his certainty about what the user wants from his experience as a journalist. His syndicated column "From the Fountainhead" appeared in many of the new magazines appearing in the United States as the micro boom began. He was widely read by people in the semiconductor and computer business as well as new users. He exposed widespread fraud in the computer-kit business, where customers were sold dud components which they would assume they themselves had damaged while assembling the kit. Osborne stopped writing the column in 1980 when he set up Osborne Computers.

How does Adam Osborne go about deciding what the user now wants from his company. "I would say it is the obvious filtered through my feel for the way the industry is going. A lot of it is obvious — I mean we want more capacity on the diskettes, we want bigger screens with larger displays, we want lower cost, we want lower weight. A lot of this stuff is very straightforward."

Osborne is not very worried by the competition the Osborne 1 is beginning to run into. "As they are following us they have to find a different niche on one side or the other, or else try to beat us on price. Beating us on price has got to be a losing proposition. In order to beat us on price they have got to be able to come in and hit the high volumes as quickly as we did or bankroll, with the assumption that they are going to have significant losses for some time."

But some companies might indeed be prepared to bankroll a new product, particularly the large Japanese companies. Is Osborne impressed with the Japanese performance so far? "Not right now. Give them time, when the new-product cycle slows down sufficiently so that if it takes you three years to develop a product and you still have a winner, then the Japanese are going to be formidable. We have that much time.

"The point is that the Japanese are as perplexed and bewildered by us in America as we are by them. We have been approached by some of the major manufacturers in Japan, wondering if there was a possibility of some kind of joint venture, because they have looked at our product and said 'My God, we are sure we can build this thing. We would not have ever done so because we would have thought anyone who did it was mad. But obviously we were wrong.' You see, it is marketing."

Apple has been predicting a major shake out soon in the microcomputer market because there are very large production capacities being brought into play, and the market is becoming reasonably defined. If this scenario is true, how will Osborne survive? "We have to achieve a large base now. The market is still in a transitional phase for a few more years. Now I am not particularly concerned about shake outs at the moment, the reason being that however large the microcomputer market may appear right now I doubt if it's 10 percent of what it potentially will be. So again for a few more years if you can build it you can sell it, as long as it has any form of viability at all. It is an extremely forgiving market still. It will get much less so within a couple of years."

Being first into a new market carries with it some risks. But Adam Osborne is not worried about pioneering a concept which other people then exploit. "I have and I am being copied and I should be. The more I am copied the more people say this is a legitimate market that we should pay a lot of attention to. I don't expect to keep 100 percent of this market."

When in two or three years time a very large base of Osborne products has been established, what is to prevent pirated copies or look-alike machines of a legitimate nature coming along and taking that user base? This is already happening with Apple to some extent. "The point is that they are always going to be somewhat behind us. If they actually directly copy our boards we can get them because the law does protect us there, but if they come up with something that is functionally equivalent we can't. It is just up to us to market better, distribute better, and manufacture more cheaply, which I think we can do."

Organisation not innovation

Osborne is not putting his trust in technical innovation, but in building up a strong organisation. "That's right. There is nothing to stop you or anyone else going into competition with General Motors if you choose to. There is nothing innovative about their cars."

There is one company that Osborne thinks can succeed at the consumer end of the market — Sinclair. "I have a deep respect for Clive Sinclair. I think that the British Establishment has been unbelievably naive and incredibly stupid in the way it has treated the man. The lot of them have less sense than Clive Sinclair has in his small finger. If they would pay a little bit more attention to the few such people who are around in this country and a lot less attention to disasters like Inmos, this country would be in far better shape in the microcomputer world."

Like Osborne, Clive Sinclair has created a company that has broken into the microcomputer market some time after the easier early days. The fact that Sinclair did this after running into problems with his innovative Black Watch product only makes it more of an achievement, according to Osborne. "His problem was that he went into it with little experience of manufacturing. There was nothing wrong with his ideas, what was wrong was that he did not have a good manufacturing team. And it is a real testimony to the tenacity of that man that he came back and did it again having learnt from his mistakes, this time letting Timex build for him."

Osborne cannot understand why

Since Osborne was born

Adam Osborne was born in Bangkok of British parents. He spent his early childhood in India and Thailand, where his father was a journalist, teacher and counter-missionary, converting Christians back to Hinduism. Adam was sent to England to be educated, and from grammar school went to Birmingham University where he studied chemical engineering.

After completing his PhD in chemical engineering at the University of Delaware he decided to stay in the U.S. and worked for six years as a chemical engineer before deciding to commit himself fully to computing.

He set up Osborne Associates in 1970 to provide programming and technical writing services to the booming computing and semiconductor industries. The writing side took off dramatically in 1975 with the success of his book series "Introduction to Microcomputers". Adam Osborne became an influential columnist in the newspapers and magazines of the new microcomputer industry.

The publishing giant McGraw-Hill bought Osborne's flourishing book empire in 1979, providing him with the money to set up his next venture, Osborne Computer Corporation, in January 1981. The first of the new Osborne 1 computers was shipped in June 1981 and the machine made it to Britain in February 1982. It is now the top-selling machine in its class on both sides of the Atlantic.

Adam Osborne is now aged 43 and a U.S. citizen. He has three children, is about to remarry and lives in the San Francisco Bay area. He was interviewed during a brief visit to Osborne Computer Corporation's U.K. base at Milton Keynes.

Sinclair has so little recognition in his own country. "I was just reading over the weekend an interview that Prince Charles gave. He was talking about how he wants to be able to instigate innovation. Prince Charles should just go and look at Clive Sinclair and see what that guy is doing. It is going on over here right under the man's nose. But because he doesn't fit the exact model — I don't know what he has done — but for some reason the British Establishment has decided that he doesn't know what he is doing. The man is going to sell half a million computers this year. And this is a guy who they wrote off a few years ago because he had a good idea but no one would give him the manufacturing backing to finish it off. As far as I am concerned the man is brilliant."

A bunch of whores

At the opposite end of the market what does Adam Osborne think is going to happen with the very large computer companies. Some, like NCR and Burroughs, have not yet established a strong base in the micro market.

"I think all of those companies are ultimately going to look for their own entry into the personal computer market, in one form or another. The market for very big computers is obviously going to be quite stagnant in comparison to the market for very small computers. These guys have a lot of cash. And it's a question of them figuring out what they want to do. A lot of us in the microcomputer world are a bunch of whores, we all have our price."

Does this mean that an offer to buy Osborne would be accepted? "We all have our price. If they came along and offered me two billion dollars for it right now — where's the contract? I think the chances are more likely that we would go public first."

Stocks and shares

Osborne is not yet a quoted company. This means that whether or not the company is bought out now, once Osborne Computer Corporation goes public Adam Osborne as a major shareholder stands to become very rich. And not just Osborne himself, some 200 out of the 350 or so employees have stock options, which would probably net them tidy sums as well. "You normally have to be in the company six months before you have a stake in it so the international employees, apart from some of the senior managers, are not very well represented as stockholders.

"The way a stock option works — it is something that has been established under American law as an incentive program — is that you are given the right at any time in the future to buy shares at some fixed price, and in a rapidly growing company by the time you get to execute that option usually the fixed price is negligable compared to the current market value. In that way you in effect get the shares free.

"Some of the kids who came in really way up at the beginning can finish up with substantial sums of money. By American law stock options have to be limited to somewhere in the region of 15 percent, and that is around where we will be by the time we go public."

McGraw-Hill bought Adam Osborne's previous company Osborne Associates which published books mainly by Osborne himself, such as the bestselling series "An Introduction to Microcomputers" and "Running Wild". Osborne now has no involvement in publishing, but is writing a novel. "I'm just proofing the manuscript. I haven't got a title for the book yet. I have a theory that history has cycles, and that we are on the way out of the present cycle of democracy into a new autocratic era of stability where nothing changes. And this will happen because, given the changes we have seen through technology in the past two decades, people are going to come to the point where they are willing to trade in their expectations and hopes for something better, in exchange for a guarantee of what they have got.

"People will rebel against technology. They will accept what exists but they will except nothing new, and there will be no more technical innovation. People will shun democracy for autocracy. They will once again accept Lords, Barons in some countries, and corporate dictators in others because that is the price of stability.

"I think the world is completely out of control now."

Diamonds are

by Brian Williams

As the rain pattered fitfully against the window of my den I decided I couldn't add any further improvements that evening to the longest program I had attempted so far. The clock insisted the time was after midnight, unaware of the passing hours since seven o'clock I had spent testing and debugging. Tomorrow, Sunday, I would run through it once more with a fresh mind. I gave my head a quick shake and sampled the coffee Dee had brought in. She had just returned home, having spent the evening with friends. For the first time I realised she had recently been out more often than usual, and getting back later.

Sipping the coffee, one of those decaffeinated brands by the taste of it, I reflected on the superb service I had received from my micro supplier. When I had decided finally to go ahead and buy a system, justifying the expense on the grounds of business, I had shopped around extensively. I must present a somewhat vague profile to a retailer, maybe because I am one myself. I did not seem to be able to impress on the people I spoke to that I really wanted more than just a good package for my trade as a jeweller. After some weeks of looking without success I went along one evening to a small exhibition held at a glossy, plasticky motel on the outskirts of town. There I met Harry.

He struck up a casual conversation as I was trying my uncertain hand at a long-established model. At first I thought he was one of the team responsible for the show, but then I noticed he had no name card pinned to his lapel. Nevertheless, within minutes he was showing me what the machine could and couldn't do. When an official demonstrator approached, Harry deftly offered to buy me a drink. Intrigued by his manner and his obviously extensive knowledge of the micro world, I agreed.

Harry Vesey operated his own little microware outfit. He openly admitted that since he was not big enough to organise a demonstration evening of his own he simply invited himself to other people's and sold from there. We both laughed. The machine I had been looking at was, Harry advised, excellent for my purposes.

During our second round of drinks Harry tactfully suggested I should take some tuition if I was to get the best out of my purchase. Not only could he supply the equipment at a good discount he could, for a reasonable fee, provide an at-home tuition package lasting for a month. Nothing would be left out.

"How can you offer both a strong discount and low-fee instruction?" I asked him. It was the first time anyone had offered me such a service.

"Because I want you to be a satisfied customer," he replied. "By pleasing retailers like yourself I am getting free advertising. Retailers see many different customers daily, and some of these customers will also be looking for a computer. You mention my name — *et voilà*!" A boyish grin spread over Harry's face. His explanation seemed plausible enough to me, and anyway I had decided I liked the man. I wrote him a cheque for the deposit while he ordered a third round.

Harry was true to his word almost to the point of being overwhelming. There was so much to work through each evening — such exciting, rewarding programs and games. Harry came three evenings a week to put me right on any difficulties and to leave a fresh batch of material for me to have a go at. He paid particular attention to my business routines and stock control but advised me to relax more with games.

I had attended evening courses at the local college so I wasn't completely computer illiterate before I met Harry, yet these classes had not shown me anything like the work he brought. Some of it he had written himself — it had a refreshing sparkle to it and a difficult-to-describe depth, a sort of extra dimension. Harry was destined to go places.

Fortunately Dee was very understanding about my new interest and she either went out or was content to watch television in the lounge at the rear of the flat. My only misgivings arose from the fact that it was the busy season, December, and I ought to be concentrating more on the business with its influx of extra stock and special orders.

I had inherited the jeweller's shop from my uncle after having worked for him since leaving school. It was an old-established business in a prime trading position and it had weathered recession well. All the same, there were times during the slack periods of the year when I had to admit to boredom. At least my new computer provided plenty of mental exercise, often until the small hours — I hated a program to get the better of me.

Earlier in the week I had been to collect some digital watches from an out-of-town wholesaler who had let me down on delivery. Next to his warehouse there was a computer-software mart, and as I had been driving for two hours on the morotway in freezing rain I felt a quick browse round was forgivable.

It was a curious place, which gave the impression that micro software had been around since the turn of the century. I was faintly reminded of those quaint little shops selling old books you sometimes squeezed into odd corners of market towns. A dusty cassette almost hidden at the back of a clutter shelf of "clearance-offers" caught my eye, mainly because of its title. It was a game called "Diamonds are for ... ". The label on the plastic cover promised the game would run on my machine so I bought it, before steeling myself for the journey home through the winter gloom.

I had completely forgotten about the cassette until a query on a customer's ring had meant a frantic search for the alterations note. Hunting through the glove compartment of the car I found the cassette. Now, as I drank Dee's awful coffee, I was giving the game a swift run through. At first I found the idea novel; a ture-to-life game — or so it said on the clever graphics — offering all the excitement of being a baddy.

"Plan your very own jeweller's raid," it announced, before a flashing display recorded that the program had been written by HVC Realware some two years previously. I duly entered the required information concerning the type of place I wished to raid. Being a little tired I simply typed in the details of my own premises, then sat back and played.

As the game proceeded I experienced an attack of *déjà vu* — paramnesia I believe it's called — or perhaps it was just too many late nights. Anyhow, I had the sensation that I'd seen it all before. Then I became distinctly uneasy and ill. Suddenly I was exhausted, my eyelids were heavy and my breathing grew laboured.

Somewhere in my intestines an oxy-acetylene cutter began to work away. Everything was at an exaggerated distance but larger than life. This was something more than too many late nights. I tried to play on. The cutter was now working its way down through my body, and I knew if I tried to stand I would collapse. The screen flashed the next question for me to answer, though I could barely make out the green text.

Then, without warning, a crystal-clear image leapt out of the increasing darkness of my brain. The shock of it provided me with a few extra moments of meagre

for...

"Plan your very own jeweller's raid," announced the display. Being a little tired I duly entered the required information, basing the details on my own shop.

strength. I had to write a message, even with arms of lead and a telegraph pole for a pen. Write before the lights went out.

Dee cautiously returned to the den half an hour after she had brought the coffee. Quietly she approached the desk where her husband lay slumped next to his keyboard. Good, the potion had had its effect. In fact the whole scheme had worked beautifully right from the start. Harry had said it would.

Harry certainly knew what he was talking about and he knew how to treat a girl. The charm behind that boyish grin. A tingle of nervous excitement passed through her. Tomorrow Harry would be seeing a man who was going to give them a good price for the contents of the jeweller's shop — and then, zoom! Out of the country, lost in the Christmas holiday bookings. New Year in the sunshine.

An unconscious habit of always switching off electrical equipment made her lean over the computer. On the desk she spotted an almost unreadable message written in felt- tip pen: Dee, for God's sake press Return. She was startled. Obviously she had not appreciated the full extend of her husband's obsession with the damn thing. All the same, she reflected, maybe she owed him this much. And anyhow, what was there to lose?

She found the Return key and jabbed at it. The screen filled up with flashy patterns. Another futile computer game, she thought impatiently, but as the title came up her interest grew. "Come away with a fortune," the screen tempted. Make all the correct decisions and give all the right reasons. One incorrect decision and you are out."

The machine told Dee that all the necessary data had already been entered, what she was watching was a summary of play so far: successful decisions accompanied by the right choices in reasoning. The questions and their responses rolled over on the screen, the first ones under a heading Method Outline.

Q: direct break-in?
R: no, security too good.
CORRECT DECISION
Q: manager manipulation?
R; no, business managed by owner.
CORRECT DECISION
Q: direct proposal to owner to falsify insurance claim?
R: no, owner honest.
Then the next question.
Q: access through owner's wife?
R: yes, bored and flirtatious.

Dee's eyes narrowed as the text continued.

Befriending the owner gaining his confidence and knowledge about the business had been covered, so had saturating him with his hobby during a trading peak. Even the early parts of the actual haul had had successful passes awarded, as had the immobilisation of the owner by the accomplice, in this case the owner's wife.

The screen then announced the conclusion of the summary and the resumption of the game proper. A flood of graphics followed. Dee felt like shaking the VDU to hurry it along.

When the new question finally arrived, Dee caught her breath.

Q: dispose of accomplice now? Type Y/N

After staring at the screen and its flashing prompt for many minutes Dee, hand trembling, gingerly pressed the N key. There was an agony of delay, followed by the blunt reply

INCORRECT DECISION — LOSE GAME

By way of consolation the machine confided that the end score suggested a well above average power of reasoning but insufficient criminal cunning. It went on to mention there would be no explanation of the incorrect decision judgement as this might spoil the player's next attempt. But Dee hardly noticed. Just at that moment she didn't need explanations.

The sun was warm , the Bacardi cool, the beach even better in reality than the brochures depicted. She decided she rather liked being alone. There were always plenty of young men falling over themselves to pay for the night life, but during the day it was far more pleasant to laze around near the swimming pool or on the beach without having to fall in with someone else's plans. Ah, the freedom.

Momentarily she recalled the look of astonishment and sheer disbelief on Harry's face as the potion took hold. Dee wondered what the early January weather was like back home, though not for very long.

School admin: let a micro take the strain

The volume of paperwork involved in running a school can be endless. T A Forber, in an effort to combat the flow of data, started experimenting on a 32K Pet. He ended up with a serious program on a 48K Apple.

IN THE LARGE secondary schools a considerable amount of information is held by people such as central administration, heads of house, year tutors and form tutors. Much of it is duplicated and a good deal of it rarely or never sees the light of day, yet still needs to be available. Updating the information may soon get out of step. A change of address, for example, might be communicated to a member of staff who may not pass on the information — indeed may not be aware of the need to do so. A good deal of storage room is needed. Confidentiality may need to be preserved.

Information stored on disc or cassette can be given some protection from prying eyes, and three or more copies can be kept in remote places so that records are unlikely to be irretrievably lost because of fire or other calamity. They take up very little space: a box rather than a room. To answer the needs of the central administration and others requires a fairly comprehensive program able to produce, say, house lists, form lists, subject lists for examination entries, pupils' lists, or lists of those living in a particular locality.

Experimental start

My school administration program began as an experiment on a 32K Pet with a cassette recorder but was completed on a 48K Apple with single disc drive and a Microline 80 printer. The availability of the printer prompted the changeover, though additional memory was also vital.

Different schools have different needs, and this program can be modified to suit them and the needs of a particular school or a particular microprocessor.

Unaltered the program will deal with about 160 pupils with 20 items of information per pupil. A school with more than this number in a year would probably be organised in, say, four houses and each house could be programmed separately. To do this it may be possible to use an append technique to attach each data list to the working part of the program which would thus have to be written only once. However, appending can itself require more memory than would be needed for an individual listing. The processor gives no indication when it has insufficient memory to merge two programs or data.

The program can, in principle, cope with a school of five years organised in four houses of 160 pupils making a total of over 3,000. With triplicate copies, up to 30 discs might be needed. Cassettes would be cheaper, and for back-up copies their slowness would be an inconvenience only at the loading stage.

A lot of memory can be saved by carefully thought-out codes for the subjects, though abbreviations need to be

School administration.

```
20  PRINT "THIS IS CODE CONTROLLE
    D"
23  PRINT "TO CONTINUE ENTER THE
    "
26  PRINT "CORRECT CODE"
29  INPUT CD$
32  GOTO 791
35  PRINT "DOYOU WANT ANY INSTRUC
    TIONS ?"
38  PRINT "ANSWER  Y  OR  N
    "
41  INPUT Z$
44  IF Z$ = "Y" THEN 65
47 D = 1
50 M = 2
53 Y = 67
56 I = Y * 10000 + M * 100 + D
59 Q = D * 10000 + M * 100 + Y
62  GOTO 122
65  PRINT "IF A CERTAIN DATE IS"
68  PRINT "OF INTEREST RELATIVE"
71  PRINT "TO THE AGES OF THE  "
74  PRINT "PUPILS  ENTER  THAT "
77  PRINT "DATE. (E.G.01,02,67) "
80  PRINT
83  PRINT "OTHERWISE TYPE IN   "
86  PRINT "   ANY  DATE        "
89  PRINT "EXACTLY AS ABOVE    "
92  PRINT
95  PRINT "   ALWAYS PRESS     "
98  PRINT "     (RETURN)       "
101  PRINT "  AFTER ANY ENTRY "
104  PRINT "      YOU MAKE    "
107  PRINT
110  PRINT "TYPE 'END' TO CLOSE D
    OWN"
113  INPUT D,M,Y
116 I = Y * 10000 + M * 100 + D
119 Q = D * 10000 + M * 100 + Y
122  PRINT "I = "I
125  PRINT "Q = "Q
128  PRINT
131  REM  CLASSLIST
134 N = 81
140  DIM S$(N): REM  SURNAME
143  DIM C$(N): REM  FORENAME
146  DIM O$(N): REM  OTHER INITIA
    LS
149  DIM F$(N): REM  YEAR FORM
152  DIM D$(N): REM  DAY OF BIRTH
155  DIM M$(N): REM  MONTH
158  DIM Y$(N): REM  YEAR
161  DIM A$(N): REM  ENGLISH
164  DIM B$(N): REM  MATHS
167  DIM G$(N): REM  OPTION 1
170  DIM H$(N): REM  OPTION 2
173  DIM P$(N): REM  OPTION 3
176  DIM Q$(N): REM  OPTION 4
179  DIM R$(N): REM  OPTION 5
182  DIM V$(N): REM  HOUSE NAME/N
    O.
185  DIM U$(N): REM  STREET
188  DIM L$(N): REM  DISTRICT(LOC
    ALE)
191  DIM T$(N): REM  BOY OR GIRL
194  DIM N$(N): REM  PARENT MR MS
197  DIM J$(N): REM  EMERGENCY TE
    L.NO.
200  DIM W(N): REM  RETRIEVAL
203  FOR K = 1 TO N
206  READ S$(K)
209  READ C$(K),O$(K)
212  READ F$(K),D$(K)
215  READ M$(K),Y$(K)
218  READ A$(K),B$(K)
221  READ G$(K),H$(K)
224  READ P$(K),Q$(K)
227  READ R$(K),V$(K)
230  READ U$(K),L$(K)
233  READ T$(K),N$(K)
236  READ J$(K)
239  NEXT K
242 X = 0
245  PRINT
248  PRINT "WHAT ITEM OF DATA ?"
251  PRINT
254  PRINT
257  INPUT X$
260  IF X$ = "ADDRESSES" THEN 671
263  IF X$ = "AGES" THEN 530
266  IF X$ = "END" THEN 9999
269  REM  SURNAME OR STREET NAME
    SEARCHES  OUT INFORMATION
272  FOR K = 1 TO N
275  IF S$(K) = X$ OR U$(K) = X$ THEN
    X = X + 1:W(X) = K
278  IF N$(K) = X$ OR C$(K) = X$ THEN
    X = X + 1:W(X) = K
280  IF L$(K) = "NLW" THEN L$(K) =
    "NEWTON-LE-WILLOWS"
281  NEXT K
284  IF X (  ) 0 THEN 290
287  GOTO 359
290  PRINT "IS PRINTOUT WANTED?"
293  PRINT "ANSWER  Y  OR  N  "
296  INPUT PR$
299  IF PR$ = "Y" THEN 308
302  IF PR$ = "N" THEN 311
305  GOTO 242
308  PR# 1
311  PRINT
314  PRINT X$
317  PRINT
320  FOR K = 1 TO X
323 L = W(K)
326  PRINT
329  PRINT S$(L); TAB( 13)C$(L);"
     ";O$(L); TAB( 28)D$(L);" ";
    M$(L);" ";Y$(L); TAB( 37)F$(
    L)
330  PRINT : PRINT : PRINT
332  PRINT A$(L); TAB( 8)B$(L); TAB(
    16)N$(L);" ";S$(L)
335  PRINT G$(L); TAB( 8)H$(L); TAB(
    16)V$(L);" ";U$(L)
338  PRINT P$(L); TAB( 8)Q$(L); TAB(
    16)L$(L)
341  PRINT R$(L); TAB( 16)J$(L)
344  PRINT
```

(continued on page 117)

S	S	C	O	F	D	M	Y	A	B	G	H	P	Q	R	V	U	L	T	N	O
	Jan 1981		Other Initial	YearHouse Form	BIRTH			English O, C, OC, N	Maths O, C, OC, N	OPTION SUBJECTS					Number or House Name	Road Street Lane etc	Locale District or Town	Boy or Girl	Mr, Mrs or Ms + Forename	Emergency Phone OR Contact
	SURNAME	FORENAME			D	M	Y	LAN	MAT	1	2	3	4	5				BO GI		
1	Lyon	James	P	AL2	02	11	66	OC	OC	ARTO	DOMC	CMPO	HISC	BILOC	18	VISTA AVE	NEWTON	BO	Mr Peter	64392
2	Lyon	June	GA	AN3	14	03	67	O	O	HBLO	TYPO	COMO	HISO	BILO	2	ACORN ST	NEWTON	GI	Mr William	64278
3	Makinson	Kevin	-	AN2	09	06	67	C	OC	DOMC	TYPC	COMC	SNDC	PHYC	144	BARTON AVE	NEWTON	BO	Ms. Enid	Home
4	Marsh	Jean	-	AN2	27	02	67	O	O	BILO	CHMO	FRNO	GOGO	PHYO	79	BARTON AVE	"	GI	Mr. PETER	64293
5	Marsh	Michael	W	AL1	24	02	67	O	O	ARTO	GRMC	GOLO	GOGO	ECNO	29	Sheffield Rd	Northington	BO	Mr. James	64721
6	Martin	David	B	AW2	03	06	67	O	O	FRNO	GRMO	LATO	GOGO	HBLO	36	Liverpool Rd	Newton	BO	MS. Elizabeth	64834
7	Mathews	Timothy	G	AN2	17	12	66	C	OC	DOMC	CHMC	COMC	HISO	BILO	14	Walton Dr	"	BO	Mr William	64196
8	Melling	Elizabeth	-	AL1	12	12	66	C	C	FRNC	GRMC	LATO	BILC	CHMC	13	Newton Rd	Melling	GI	Mr. Ernest	Home
9																				
10																				
11																				

Specimen infil to part of proforma ready for computer.

readily understood. Care is required to avoid confusion between English and engineering; German, geography and geology; and commerce, computer studies and community studies. Though English might be abbreviated at Lang or Lit, an unwary user seeing "Eng" for engineering might still read it as English. Abbreviations for Street, Road, Crescent, etc. must be those that the Post Office would recognise since they will appear in the address labels.

Consistency

It is vital that data entry is consistent in terms of the order of entry and spelling. If using an Apple, commas must be used for separating data items and for that only. Other machines may use a different delimiter. Consistency is essential, and correct spelling is helpful. To assist typists who may be involved in loading data it is useful to have a proforma which carries a key showing the permitted abbreviations, not necessarily with their meanings. Once one has been carefully drafted most large schools have facilities for duplication. The exercise is a useful one in itself and decisions made may be absolutely final. A change of mind will be very unpopular after a large amount of data has been entered.

During the long process of preparing the program and in the much longer one of loading data on a total of 286 pupils I learnt that a lone operator works much less efficiently than a pair working together. Apart from taking longer for initial entries, errors more readily creep in causing possibly huge time wastage in the ensuing search. Worse still, errors may remain hidden while users think they are being provided with correct listings. The program carries a useful protection against this possibility: the tally given at the end of each list can be used to check that a combination of lists has the correct grand total. For example, a list of those born in each month should list everyone in 12 runs. Before attaching any data to the working part of the program several copies of it should be stored so that each may be dedicated to a year or house who may then proceed independently, knowing that each master program is identical.

Names and addresses

Most strings likely to be needed for names, addresses and subjects will cause no problem although house names can be cumbersome: some have telephone numbers preceded by a town name and followed by an extension. A string like this should be entered as a continuum with the single letter E to signify that the remaining digits are the extension. Always look up the code if a town name is given. That is what an enquirer would want to know anyway, and the telephone system does not take account of any pauses you make in dialling.

Pupils' middle names are only shown as initials though you may wish to alter this; use of full names may cause difficulty when trying to produce an acceptable tabulation for address labels, and accommodating them requires modification of the workhorse part of this program. It would also apply if you want to avoid entering a long town name in string L$ for every pupil. The town name could be coded and a short subroutine inserted to modify the labelling carried out by lines 740 to 773.

Input is incorrect

Running the program causes a request for a code to be entered. Input of an incorrect code stops the program. Any string of letters can be your code. It must be fed in at line 791 to replace Tmol. If you do not wish to use this simple access protection simply delete lines 20 to 32.

Lines 47 to 53 input the default date February 1, 1967. If instructions have been asked for at the program's request, line 44, the user is asked to insert any date. The format of the response is important, and is shown on the screen. Should you renumber this program using Apple's renumber this date will be dealt with as well as the line numbers. It would be necessary to adjust lines 56, 59, 116, 119, 587 and 590 to enable the program to deal correctly with listing pupils over a certain age.

Lines 122 and 125 are not vital to the program but cause the numbers to appear on the monitor screen. The numbers should show the date as day, month, year and year, month, day. This shows that it is running and allows you to check that the date has been correctly dealt with. Even if the date is not correct the program will continue unless you key in

END

At line 134 you must have the correct value for N, which must be the number of pupils whose data has been entered. The computer uses this as a partial check that data has been entered completely. When I was building up the data file I repeatedly updated this so that I could run the program every so often to test that all was well.

Remember the day

Lines 140 to 200 allocate space in memory for the 20 pieces of information, and of course the order is important. Day, month and year must be separate strings for the Ages routine to work. In line 182 a number is preferable to a house name. In any case, do not use both for fear of producing extra commas.

Seven subjects are allowed for but this could be modified provided other consequential adjustments are made at lines 206 to 236, 275, 278, 329 to 341, 362 to 377, 437, 440, 452, 455, 509, 659, 725, and 755 to 761.

While the processor is reading in data from the disc or tape it will appear to do nothing for a minute or so and will then prompt with:

WHAT ITEM OF DATA?

The user must then key in one of the following:

Addresses — which is followed by a prompt for each form name as required. The response None closes this down and returns to What Item . . .

Ages — which is followed by a prompt to accept the data already there or to substitute another before the list of all born before the chosen date is produced

End — closes down completely.

A pupil's surname — to list all pupils of that name.

(listing continued on page 117)

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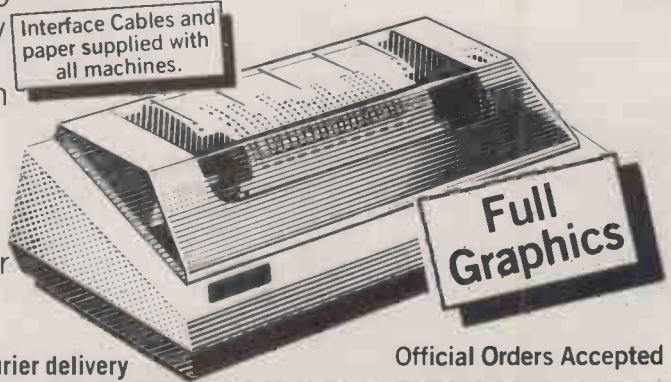

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● Circle No. 181

(listing continued from page 115)

```
347  PRINT
350  NEXT K
353  PRINT X" IN THE LIST "
356  GOTO 242
359  FOR K = 1 TO N
362  IF A$(K) = X$ OR B$(K) = X$ THEN
     X = X + 1:W(X) = K
365  IF G$(K) = X$ OR H$(K) = X$ THEN
     X = X + 1:W(X) = K
368  IF M$(K) = X$ OR F$(K) = X$ THEN
     X = X + 1:W(X) = K
371  IF L$(K) = X$ OR P$(K) = X$ THEN
     X = X + 1:W(X) = K
374  IF Q$(K) = X$ OR R$(K) = X$ THEN
     X = X + 1:W(X) = K
377  IF T$(K) = X$ THEN X = X + 1
     :W(X) = K
380  NEXT K
383  IF X <  > 0 THEN 389
386  GOTO 242
389  PRINT "DO YOU WANT PARENT'S"

392  PRINT "NAME OR TEL. NUMBER?"

395  PRINT "ANSWER  Y  OR   N   "

398  INPUT TL$
401  IF TL$ = "N" THEN 473
404  IF TL$ = "Y" THEN 413
407  GOTO 242
410  PRINT
413  PRINT "IS PRINTOUT WANTED?"
416  PRINT
419  PRINT "ANSWER  Y  OR  N   "
422  INPUT PR$
425  IF PR$ = "Y" THEN 434
428  IF PR$ = "N" THEN 437
431  GOTO 242
434  PR# 1
437  PRINT X$; TAB( 18)"EMERGENCY
     "
440  PRINT  TAB( 18)"TEL.NUMBER"
443  PRINT
446  FOR K = 1 TO X
449 L = W(K)
452  PRINT  TAB( 57)N$(L); TAB( 18
     )J$(L)
455  PRINT F$(L);" ";S$(L); TAB(
     18)C$(L);" ";0$(L); TAB( 32)
     D$(L);" ";M$(L);" ";Y$(L)
458  PRINT
461  NEXT K
462  PRINT
463  PRINT
464  PRINT X" IN THE LIST "
467  GOTO 242
470  PRINT
473  PRINT "IS PRINTOUT WANTED?"
476  PRINT
479  PRINT "ANSWER  Y  OR  N   "
482  INPUT PR$
485  IF PR$ = "Y" THEN 494
488  IF PR$ = "N" THEN 500
491  GOTO 242
494  PR# 1
497  PRINT
500  PRINT X$
501  PRINT
502  PRINT
503  FOR K = 1 TO X
506 L = W(K)
509  PRINT F$(L); TAB( 5)S$(L); TAB(
     16)C$(L);" ";0$(L); TAB( 32)
     D$(L);" ";M$(L);" ";Y$(L)
512  NEXT K
515  PRINT
518  PRINT X" IN THE LIST "
521  PRINT
524  GOTO 242
527  - 700
530  PRINT "AT PRESENT A LIST IS"

533  PRINT "READY LISTING PEOPLE"

536  PRINT "BORN BEFORE "Q
539  PRINT
542  PRINT "DO YOU WISH TO      "
545  PRINT "GO ON, USING THIS DAT
     E ?  "
548  PRINT
551  PRINT " ANSWER   YES OR NO
          "
554  PRINT
557  PRINT
560  INPUT W$
563  IF W$ = "YES" THEN 605
566  PRINT "WHAT DATE DO YOU     "
569  PRINT "WISH TO USE ? *NOTE:"
```

(continued from page 115)

A street name — to list all living in a particular street.

A parent's forename, — including Mr or Ms — to list those of same forename, along with other information.

A subject code — to list all taking that subject in whatever option

A pupil's forename — to list those with that forename.

A telephone number — to locate the person having that number.

Home — to list those having no telephone; I inserted the word "home" where no telephone number had been supplied.

Bo or Gi — to list boys or girls in alphabetical order for any particular house or year.

Declaration needed

The program will again show no signs of anything happening as it sorts out your request. It may then proceed by asking if you want printed lists. In each case it will wait for you to key in Y or N. Each listing should end with a declaration of how many are in it.

Data must be entered precisely. The exact number of items including blanks — for example, no middle name and 19 commas must be entered following the line number and the word Data not followed by a comma. No abbreviation should be less than two letters. So use Bo for boy and Gi for girl.

Asking for addresses when these are to be printed straight on to the commercially available sticky labels may need closer examination for spacing. Any necessary increase in spacing can be achieved by the adding of extra Print statements between lines 761 and 773.

Another possible snag is that some parents have different surnames from their children. In such cases courtesy demands that labels be written separately and for wrong ones which the stupid computer has printed to be removed.

This program has some advantages over bought ones. It can be stored on either tape or disc and it can be modified. The disc drive is not required after the program and data have been loaded; in any case only one disc drive is required.

Loading data

The working part of the program must be keyed in with some care, but whatever program you use and whatever its cost you still have the much bigger task of loading all the data for each pupil.

To avoid the need to update everything at the end of each school year string F$ should use a letter for the year rather than a number: this year's fourths in my listing have labels such as AN1, AL2, etc, the letter A signifying fourth year. Next year they will be fifths, but still carry the label A on the computer.

If the program is also to be used for sixth forms the number of subjects listed for each pupil may be reduced. If so it would be necessary to remove some of the Dim

(continued on page 119)

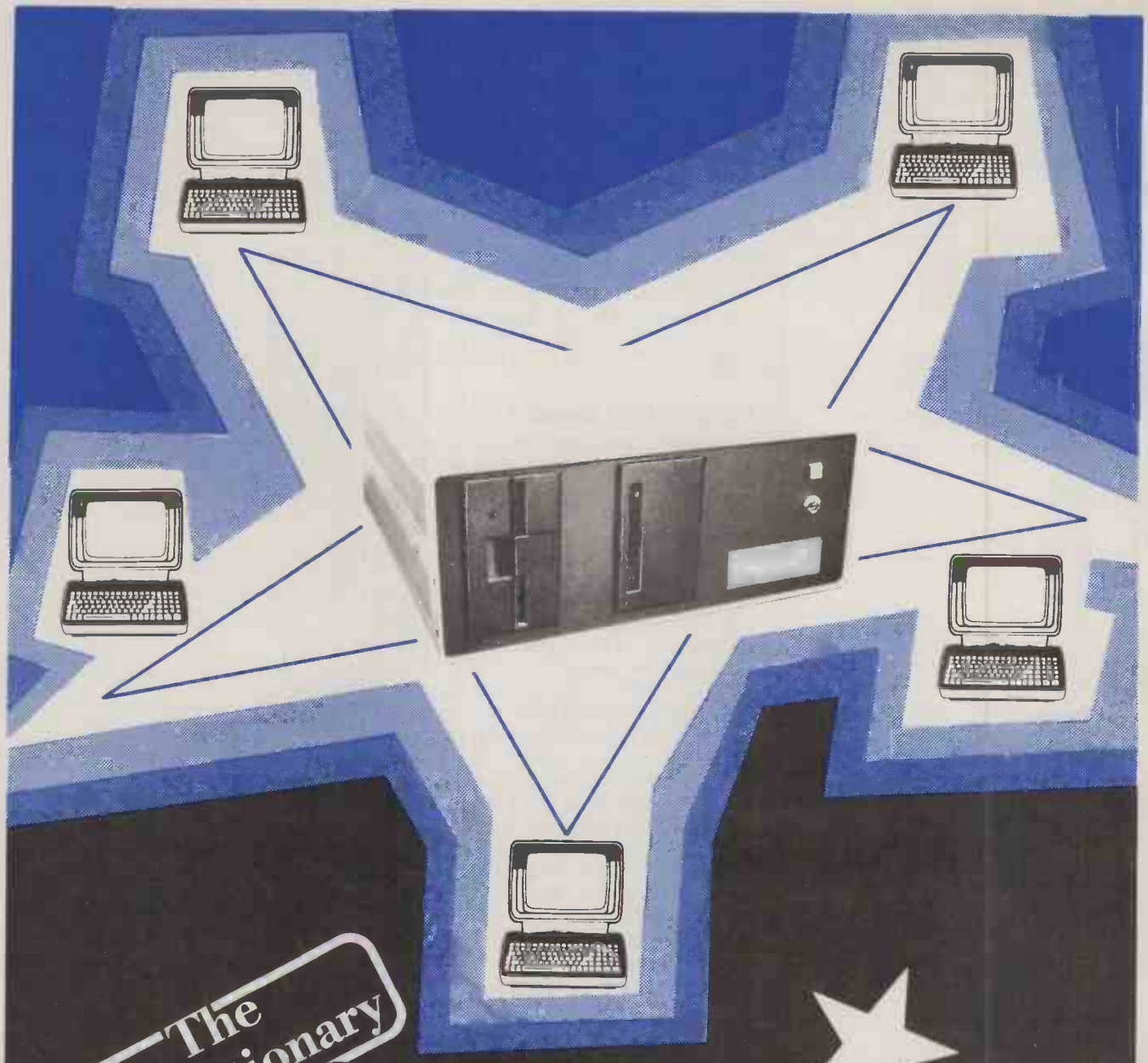
```
572  PRINT "4TH MAY 1968         "
575  PRINT "MUST BE ENTERED AS:-"
578  PRINT "  04,05,68           "
581  PRINT
584  INPUT D,M,Y
587 I = Y * 10000 + M * 100 + D
590 Q = D * 10000 + M * 100 + Y
593  PRINT " I = "I
596  PRINT " Q = "Q
599  GOTO 605
602  PRINT
605  PRINT "IS PRINTOUT WANTED? "

608  PRINT
611  PRINT "ANSWER  Y  OR  N    "

614  INPUT W$
617  IF W$ = "Y" THEN 626
620  IF W$ = "N" THEN 635
623  GOTO 242
626  PR# 1
629 X = 0
632  PRINT
635  PRINT "THESE HAVE BIRTHDAYS
     BEFORE "Q
638  FOR K = 1 TO N
641 J =  VAL (Y$(K) + M$(K) + D$(
     K))
644 A = I - J
647  IF A > 0 THEN X = X + 1:W(X)
      = K
650  NEXT K
653  FOR K = 0 TO X
656 L = W(K)
659  PRINT S$(L); TAB( 14)N$(L);"
      ";0$(L); TAB( 27)D$(L);" "M
     $(L);" ";Y$(L); TAB( 38)F$(L
     )
662  NEXT K
665  PRINT X" IN THE LIST "
668  GOTO 242
671  PRINT "IS PRINTOUT WANTED?"
674  PRINT "ANSWER  Y  OR  N    "
677  INPUT PR$
680  PRINT
683  PRINT
686  PRINT "TYPE IN A FORM NAME "

689  PRINT
692  PRINT "WHEN THE FORM HAS BEE
     N"
695  PRINT "LISTED THEN NAME ANOT
     HER"
698  PRINT "ONE.  WHEN ALL YOU WA
     NT"
701  PRINT "HAVE BEEN DONE TYPE '
     NONE' "
704  INPUT K$: IF K$ = "NONE" THEN
     242
707  IF PR$ = "Y" THEN 716
710  IF PR$ = "N" THEN 719
713  GOTO 242
716  PR# 1
719 X = 0
722  FOR K = 1 TO N
725  IF F$(K) = K$ THEN X = X + 1
     :W(X) = K
727  IF L$(K) = "NLW" THEN L$(K) =
     "NEWTON-LE-WILLOWS"
728  NEXT K
731  IF X <  > 0 THEN 740
734  PRINT "NO DATA FOUND:RE-ENTE
     R OR NONE TO LEAVE THIS REQU
     ENCE & END TO START OVER"
737  GOTO 704
740  PRINT "-------------------
     -------------------"
743  FOR K = 1 TO X
746 L = W(K)
749  PRINT
752  PRINT
755  PRINT N$(L);" ";S$(L)
758  PRINT V$(L);" ";U$(L)
761  PRINT L$(L); TAB( 36)F$(L)
762  PRINT "MERSEYSIDE"
764  PRINT
767  PRINT
770  PRINT
773  PRINT "-------------------
     ----------------"
776  NEXT K
779  PRINT
782  PRINT X" IN THE LIST "
785  PRINT
788  GOTO 704
791  IF CD$ = "TMOL" THEN 35
794  GOTO 9999

←9999 END
```



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● Circle No. 182

Make up.

```
100  REM :MAKEUP
110  LET N = 40
120  LET EE$ =  CHR$ (4): REM  CTRL-D
130  DIM S$(N): REM SURNAME
140  DIM C$(N): REM FIRST NAME
150  DIM Z$(4): REM FOR SORT
160  INPUT "NAME THE FILE";FD$
170  CALL  - 936: VTAB 8: PRINT "IF CLOSEDOWN WANTED ANSWER 999"
180  INPUT "HOW MANY ON FILE ?";Q2
190  IF Q2 = 999 THEN  END
200  INPUT "HOW MANY TO BE ADDED?";L2
210  LET M = Q2 + 1:V = Q2 + L2
220  IF V ) 40 THEN 730
230  FOR K = M TO V
240  INPUT "SURNAME     ";S$(K)
250  INPUT "FIRST NAME ";C$(K)
260  PRINT
270  NEXT K
280  CALL  - 936: VTAB 8: PRINT "HERE IS A SUMMARY OF YOUR ENTRIES
     "
290  FOR I = M TO V
300  PRINT S$(I); TAB( 12)C$(I)
310  NEXT I
320  INPUT "ARE THEY TO BE FILED";YN$
330  IF  LEFT$ (YN$,1) = "Y" THEN 360
340  CALL  - 936: VTAB 9: INPUT "THEY ARE WIPED OUT";RY$
350  GOTO 170
360  PRINT EE$;"OPEN D";FD$;",L3"
370  PRINT EE$;"WRITE D";FD$;",R1"
380  PRINT V
390  PRINT EE$;"CLOSE D";FD$
400  PRINT EE$;"OPEN";FD$;",L40"
410  FOR K = M TO V
420  PRINT EE$;"WRITE";FD$;",R";K
430  PRINT S$(K): PRINT C$(K)
440  NEXT K
450  PRINT EE$;"CLOSE";FD$
460  PRINT EE$;"OPEN";FD$;",L40"
470  FOR K = 1 TO V
480  PRINT EE$;"READ";FD$;",R";K
490  INPUT S$(K): INPUT C$(K)
500  NEXT K
510  PRINT EE$;"CLOSE";FD$
520  CALL  - 936: VTAB 8: PRINT "FILE ";FD$;"CONTAINS"
530  VTAB 12: HTAB 20: PRINT V
540  VTAB 14: HTAB 16: INPUT "RECORDS";RY$
550  LET X = 0
560  CALL  - 936: VTAB 9: HTAB 16: PRINT "SORTING"
570  FOR I = 1 TO (V - 1)
580  LET J = I + 1
590  IF S$(I) + " " + C$(I) ) S$(J) + " " + C$(J) THEN X = X + 1: GOTO
     610
600  GOTO 640
610  LET Z$(1) = S$(J):Z$(2) = C$(J)
620  LET S$(J) = S$(I):C$(J) = C$(I)
630  LET S$(I) = Z$(1):C$(I) = Z$(2)
640  NEXT I
650  IF X ) 0 THEN X = X - 1: GOTO 570
660  PRINT EE$;"OPEN";FD$;",L40"
670  FOR K = 1 TO V
680  PRINT EE$;"WRITE";FD$;",R";K
690  PRINT S$(K): PRINT C$(K)
700  NEXT K
710  PRINT EE$;"CLOSE";FD$
720  CALL  - 936: GOTO 740
730  CALL  - 936: VTAB 9: PRINT "TOO MANY"
740  INPUT "START AGAIN. PRESS (RETURN) ";RY$: GOTO 170
```

Pick up.

```
100  REM  PICKUP
110  LET EE$ =  CHR$ (4)
120  LET N = 40
130  DIM S$(N): REM  SURNAME
140  DIM C$(N): REM  FIRST NAME
150  DIM W(N): REM   RETRIEVAL
160  CALL  - 936: VTAB 8: INPUT "WHAT FILE DO YOU WANT ?";FD$
170  PRINT EE$;"OPEN D";FD$;",L3"
180  PRINT EE$;"READ D";FD$;",R1"
190  INPUT V
200  PRINT EE$;"CLOSE D";FD$
210  PRINT EE$;"OPEN";FD$;",L40"
220  FOR K = 1 TO V
230  PRINT EE$;"READ";FD$;",R";K
240  INPUT S$(K): INPUT C$(K)
250  NEXT K
260  PRINT EE$;"CLOSE";FD$
270  CALL  - 936: VTAB 9: PRINT "HERE ARE THE RECORDS"
280  FOR J = 1 TO V
290  PRINT S$(J); TAB( 12);C$(J)
300  NEXT J
310  END
```

(continued from page 117)

and corresponding Read statements along with some of the Print instructions. A simpler way is to feed blanks into the Data statements, not forgetting the comma after each blank.

The line numbers are close together to keep the working part below 1000 so that each year may have a block with an identifiable first digit. The line numbers associated with pupils are also close together for the same reason. There is still room for the insertion of data relating to any new arrival, but use a renumber routine if the gap closes.

Proforma error

The partly completed proforma shown on page 115 includes an item which is out of order. The operator entering it would enter the wrong one with a line number that would be put in correct alphabetical order, as would a new arrival. Again use renumber and start any renumber only where needed.

Where address labels are produced at lines 740 to 773 it will be necessary to put in the county name. It is presumed to be the same for everyone and is not included in the data. It appears in the program at line 762 — Merseyside in this case.

Lines 280 and 727 are important in this instance since the address of my school, is a long name which is abbreviated in the data to NLW. The program picks this out of the Data and corrects it. The position of the line within the loop is important but the technique is simple and can be used to cope with other long items in the data.

The next step in developing the program will be to add in a checking subroutine after line 800 with access available from a point early in the program to provide a high degree of self checking. It will be necessary to feed in the permitted abbreviations associated with each string to be read, and to test for oddities which would include mis-spelling or typing errors. Because the data entries under subjects will consist of three-letter codes with O,C,N or OC attached, testing will done best by extracting only the first three characters using the micro's Left string extraction technique followed by a similar If-Then statements as is used to print out an abbreviation in full.

The abbreviations used represent, in order, the following subjects: art, biology, business studies, chemistry, computer studies, commerce, cookery, domestic science, design, economics, environmental biology, environmental studies, engineering science, French, geometrical engineering drawing, geography, geology, German, history, home and child care, human biology, language (English), Latin, literature (English), metalwork, music, non-examination, needlework, physical education, physics, religious knowledge, shorthand, technical drawing, typing, woodwork. The standard abbreviations St, Rd, etc. are self-evident.

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The circuit is a comprehensive design for interfacing the Spectrum to the outside world, and is based on the Intel 8255 Programmable Peripheral Interface chip. It incorporates the following: a 100kHz A-D converter; a D-A converter; a digital output interface for controlling LEDs, etc.; a digital output interface for switches, etc.; a temperature sensor; and a music synthesiser interface.

The 8255 has 24 programmable I/O lines: for example, the user can program one port of eight bits to be an input and the other two eight-bit ports to be outputs. The three ports A, B and C can all be inputs or outputs: the port configurations are shown in figure 2. Mode 0 only is used in this interface and is simply input/output.

Two 8255s are used in this design and are configured as shown in table 1, but can be changed by software. The 8255 is set up by a control word — see figure 2 — and then ports A, B and C can be controlled by the Basic program. This can be shown more clearly by looking at the data-display program. The line

```
20 OUT 127, 139
```

sets up the 8255: 127 is the address of the control port of IC1, and 139 is the control word which sets port A to output and ports B and C to input. The line

```
170 Let a = IN 63
```

reads the A-D convertor, where 63 is the address of the convertor. Lines

```
150 OUT 31, 0
160 OUT 31, 128
```

are used to send a Start conversion pulse to the A-D convertor.

The addresses of the ports are shown in table 3, and the control words for all the simple configurations of the ports are shown in table 4. Note that port C can be used in a split mode, that is one half of the port in and the other half out.

Circuit details for connections of LEDs and switches as examples of typical digital interfacing connections are shown in figure 1. The ADC Start conversion pulse is as shown. Masking of bits D0 to D7 will be required if these bits are not to be changed when a Start conversion pulse is output. Test programs for a switch on D0, port C and LEDs on D0, D1, port A of IC1 are shown in listing 1.

A D-A converter IC7 is included. The

(continued on page 123)

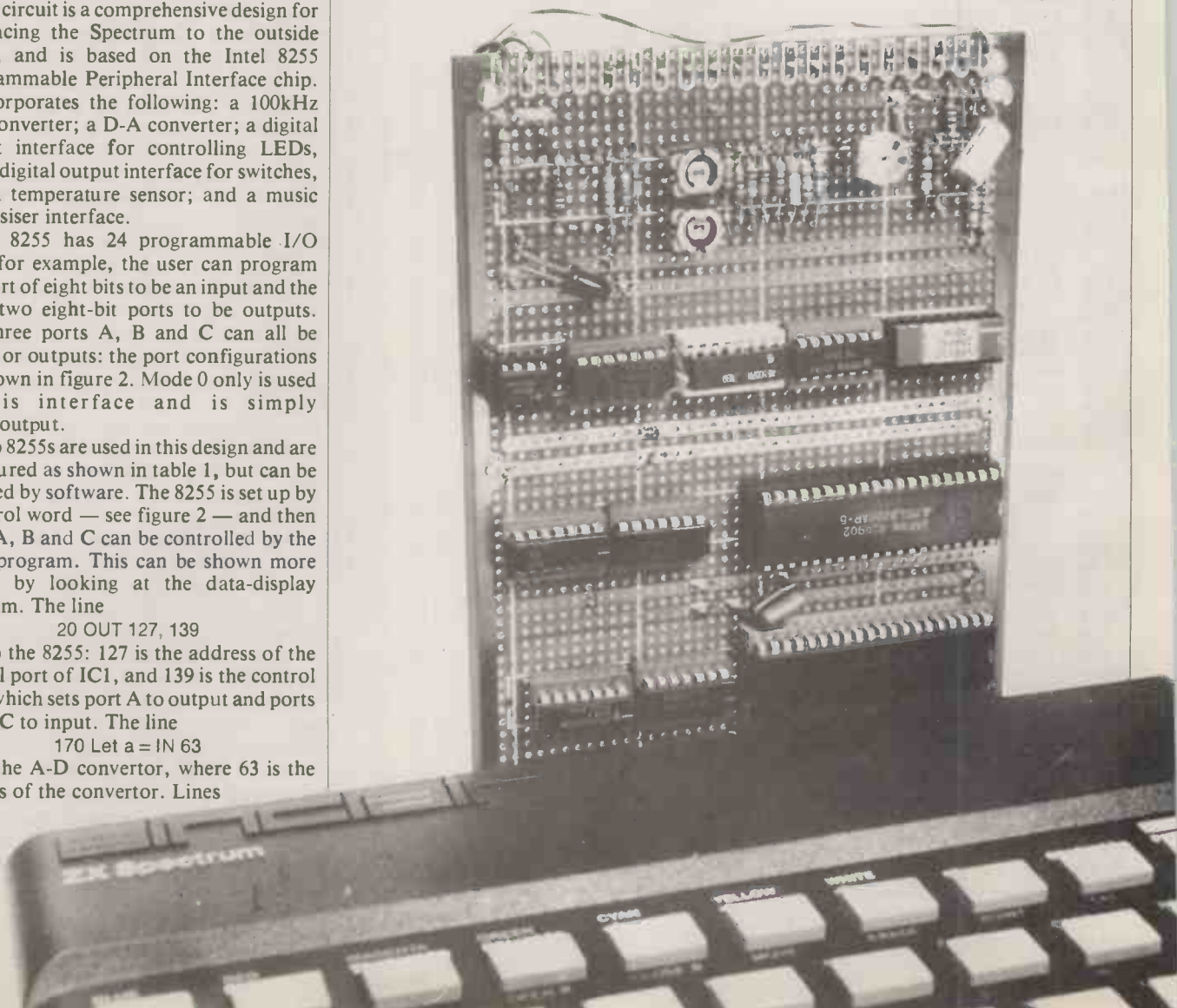


Figure 1a.

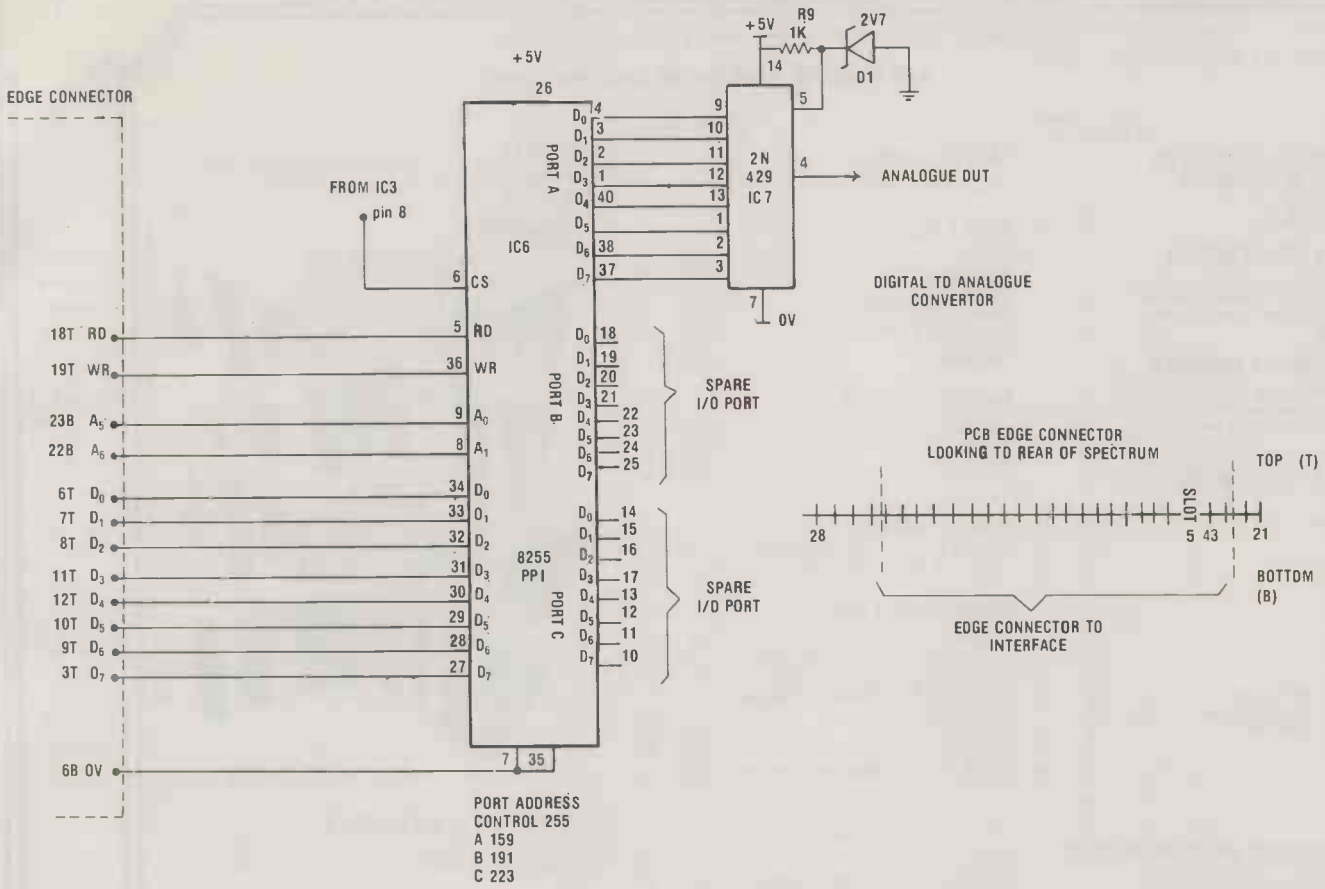
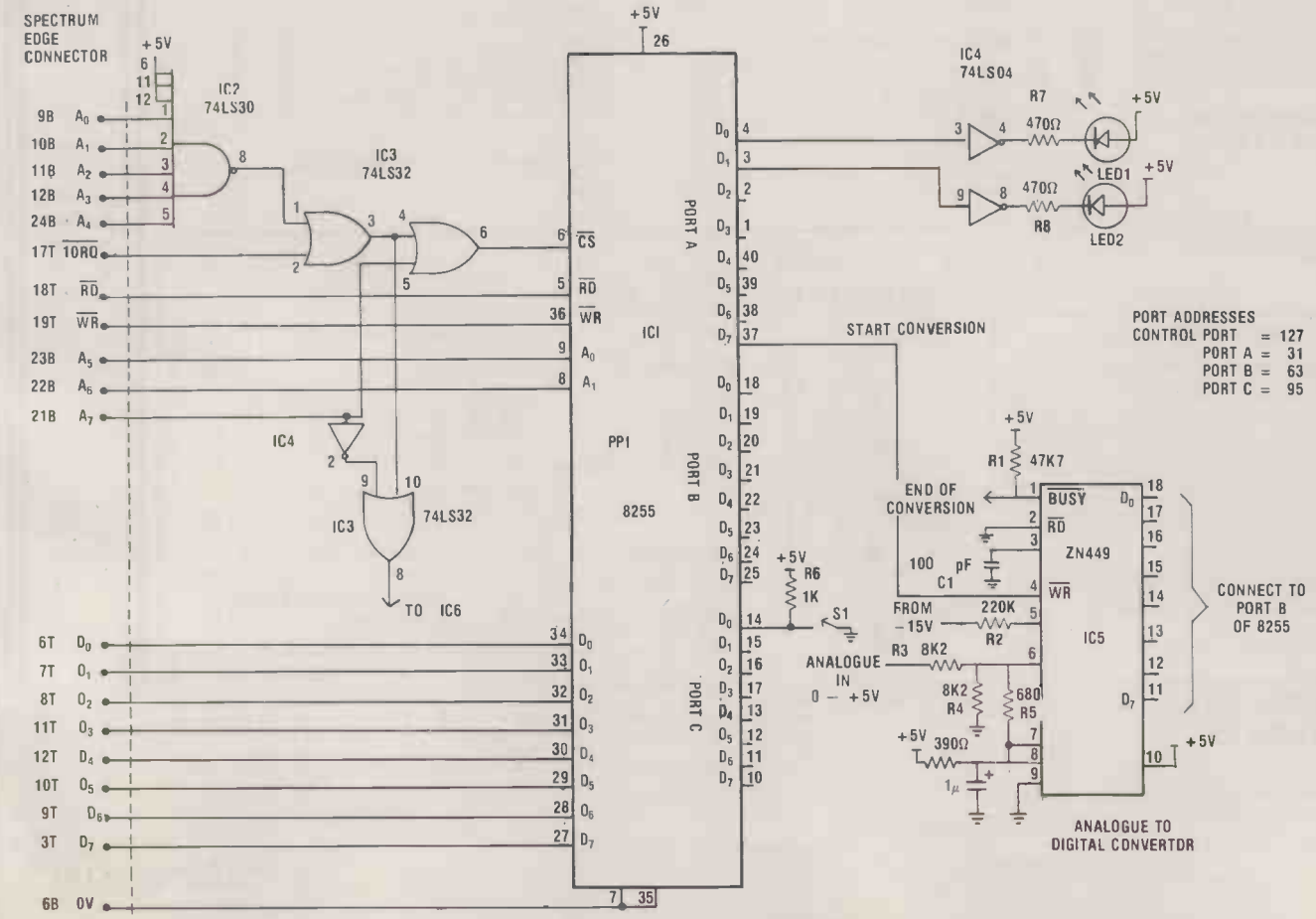


Figure 1b.



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MEDIA AND FORMATS

Altos	A1	Cromemco System 2 DD/SS	RX	IMSAI VDP-80	A1	Nascom/Lucas	N1
APPLE CP/M-80 13 Sector	RG	CSSN Backup	T1	Industrial Microsystems 5000	RA	NCR 8140/9010	A1
APPLE CP/M-80 16 Sector	RR	Cyfer 8"	A1	Industrial Microsystems 8000	A1	NNC-80	A1
Blackhawk Micropolis Mod II	Q2	Datapoint 1550/2150	A1	Intel MDS SD	A1	NNC-80W	A1
British Micros Mimi	RK	Dec VT 180 SSDD	RV	Intertec Superbrain SSDD	RK	North Star Advantage	P2
California Computer Sys 8 in	A1	Delta Systems	A1	Intertec Superbrain QD	RS	North Star Horizon SSSD	P1
CDS Versatile 4	Q2	Dynabyte DB8/4	A1	ISC Intercolor 8063/8360/8963	A1	North Star Horizon SSDD	P2
Columbia Data Products 8 in	A1	Exidy Sorcerer + CP/M-80	Q2	ITT 3030 DSDD	R1	North Star Horizon QD (MPI CP/M)	P3
Comart Communicator CP50	P2	Exidy Sorcerer + Exidy CP/M-80 8"	A1	Micromation	A1	North Star Horizon QD (Other CP/M)	P2
Comart Communicator CP100	P2	EXO	A1	Micropolis Mod II	Q2	Nytac Micropolis Mod II	Q2
Comart Communicator CP200	P2	Gemini Galaxy I	N1	Morrow Discus	A1	Osborne-I	A1
Comart Communicator CP500	P2	Heath H8 + H47	A1	Mostek	A1	Pertec PCC 2000	Q2
Compal-80	Q2	Hewlett-Packard 125.8in	A1	Multi-Tech 1	Q2	Rade 1000 SSDD	RL
CPT 8000	A1	IBM PC-DOS SSDD	C1	Multi-Tech 2	Q2	Rade 1000 DSDD	RM
Cromemco System 3	A1	IBM PC-DOS DSDD	C2	Micromation	A1	Rair Black Box	RE
Cromemco System 2 SD/SS	R6	IBM CP/M-86 SSDD	C3	Micropolis Mod II	Q2	Research Machines 5.25in	RN
		ICOM 3712	C4	Morrow Discus	A1	Research Machines 8in	A1
		ICL-PC	RE	Mostek	A1	Robotron 5"	N3
		ICL DRX Series	A1	Nascom (Gemini Drives SSDD)	R3	Robotron 8"	A1
				Nascom (Gemini Drives DSSD)	R7		

SD Systems 5.25in	R3	TRS-80 Model I + Shuffle-board 8in	RK
SD Systems 8in	A1	TRS-80 Model II	A1
Sharp MZ-80B	R7	TRS-80 Model III	A1
Sharp PC-3201	R8	TEI 8in	A1
Shelton Signet	RK	Televideo DSDD	S5
Spacebyte	A1	Torch	N2
Tarbell 8in	A1	Toshiba T200 DSDD	SF
TEI 8in	A1		
Televideo DSDD	S5		
Torch	N2		
Toshiba T200 DSDD	SF		
TRS-80 Model I + Shuffle-board 8in	A1		
TRS-80 Model II	A1		
TRS-80 Model III	A1		
TEI 8in	A1		
Televideo DSDD	S5		
Torch	N2		
Toshiba T200 DSDD	SF		
Vector MZ	Q2		
Vector Systems 2800	A1		
Vector Systems B	Q2		
Vector VIP	Q2		
Xerox 820 5.25in	S6		
Xerox 820 8in	A1		

Interface

(continued from page 120)

test program in listing 1 will output a ramp waveform. A typical use is as a control voltage for the VCO of a music synthesiser. A simple sequencer could be achieved by using the circuit as shown for this interface, with one of the output ports of the 8255 used to trigger the envelope shapers in the synthesiser and the DAC controlling the pitch of the VCO.

A circuit for an A-D convertor is included, with a conversion time of 9μs. However, when using Basic the data transfer rate — from ADC to being plotted by the Spectrum, in this case — is only about 20 samples per second. It could be used to record the keyboard-control voltage output of the synthesiser as part of the sequencer program.

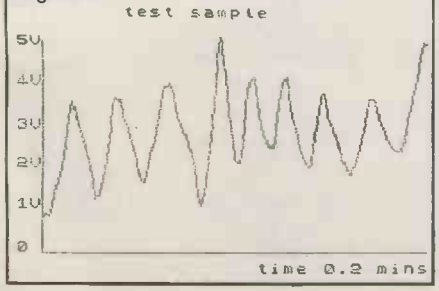
Listing 2 describes a program for the display of data from the ADC. An amplitude/time plot can be done — a plot of an instrument amplitude decay with time, for example — with the output being able to be plotted on the printer — see figure 3. Note the Beep in line 198, which outputs a sound pulse proportional to the voltage input, thought it will make the sample rate less accurate. Lines 192 to 196 draw lines between the plotted samples. The maximum time between samples is 21 minutes.

Figure 2.

D_0	Port C (lower): 1 in, 0 out	GROUP A
D_1	Port B: 1 in, 0 out	GROUP A
D_2	Mode selection: 0 Mode 0, 1 Mode 1	GROUP A
D_3	Port C upper: 1 in, 0 out	GROUP A
D_4	Port A: 1 in, 0 out	GROUP B
D_5	Mode selection: 00 Mode 0, 01 Mode 1, 1X Mode 2	GROUP B
D_6	Mode selection: 00 Mode 0, 01 Mode 1, 1X Mode 2	GROUP B
D_7	Mode set flag 1 active	GROUP B

8255 mode-definition format: X is 0 or 1. For Mode 0 D_2 and D_5,D_6 are at 0. Select In/Out for ports A,B and C as shown.

Figure 3.



The prototype interface was constructed on Veroboard with wire-wrapped connections. If the printer is not to be plugged in at the same time as the interface, ensure that enough room is left on the Veroboard to allow the edge connector to fit into the rear of the Spectrum. The edge connector plug is the same type as used for the ZX-81, but the wiring connections are different. On the Spectrum connectors 1, 2 and 25 to 28 are not connected to this interface.

A power supply will be required of +5V at about 400mA and −15V at about 10mA. The circuit for the power supply used on the prototype is shown in figure 4.

The eight-channel colour-logic monitor and analyser in listing 3 is used to monitor an eight-bit input port on the Sinclair Spectrum, for example from the analogue/digital interface circuit. The input is read in from the port and displayed as a continuously scrolling binary table. It is useful for fault finding, monitoring a port with switches on, etc. One use is for monitoring the jitter that occurs on the LSB of an A-D converter.

The program can be used with the analogue/digital interface circuit. As shown it was monitoring the digital output from the A/D convertor. Line 50 sets up the Programmable Peripheral Interface. The digital input is converted to binary and displayed, along with the decimal value and the count N which is the number of times that the port has been read. If the value just read in has changed from the previous value, a Beep from the Spectrum will notify the operator of this.

There is also a flashing * that identifies the changed value: it is useful for continuously monitoring a port where a change might only occur occasionally. Binary 0 is yellow and binary 1 is red, so pattern changes can be easily recognised. D0 to D7 is the number of the bit from the port.

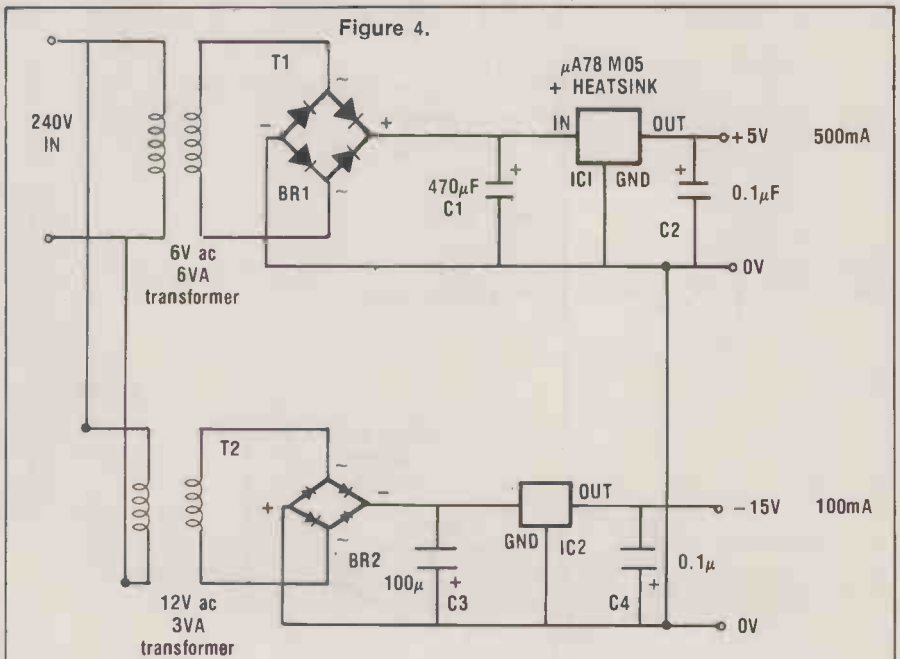
A program for a music synthesiser is shown in listing 4. It enables a sequence of musical notes to be stored by the computer and then played back. The pitch and note length stored and used to control the synthesiser VCO and envelope generator, etc. Up to 10,000 notes can be stored on a 48K Spectrum. Repeating or single sequences can be played: for example, a repeating sequence can control the synthesiser voltage-controlled filter, and with white noise as the sound it can be used as a programmable drum synthesiser. The tune can be stored digitally on cassette and loaded at a later date.

The modifications to the interface circuits in figure 1 are shown in figure 5, an amplifier for the digital-to-analogue convertor output. A Korg MS-20 music synthesiser was used with the prototype sequencer. Line 170 of the program produces the required exponential voltage output for the linear VCOs of the synthesiser.

The MS-20 has a three-octave keyboard and in this program the keys are numbered from 1 to 37 so that the programming is easy. The output from the DAC amplifier in figure 5 is scaled 1V to 8V, with a 1V offset added by R2 and the DAC output voltage amplified by 2.6. This scaling will obviously have to be changed to suit different synthesisers. The trigger for the envelope shaper is taken away from any bit

(continued on next page)

Figure 4.



PARTS LIST

T1 Transformer 240V ac/6V ac 6VA
T2 Transformer 240V ac/12V ac 3VA
C1 470μ elect 16V
C2, 4 0.1μF
C3 100μ elect 25V
IC1 μA79M05
IC2 μA79L15
BR1, 2 W01

Interface

(continued from previous page)

from port 31, IC1 port A; the output can be buffered by one of the inverters of IC4. On the MS-20 the trigger signal is from 0V to 5V, active 0V. Even though the program is in Basic, an output of up to 12 notes per second is available.

To load a sound that has been previously Saved by line 450, first load the sequencer program as normal then enter

Load "tune1"CODE

No editing facilities have been provided on this simple sequencer, but to modify just one stored note line 460 can be used to examine the stored sound — frequency value, time — and the new value Poked in. The speed of the sequence can be changed in line 270: the larger this value the slower the sequence.

The fast data logger program in listing 5 includes machine code providing a 35kHz transient recorder facility for the A-D convertor. It enables audio signals, etc. to be recorded by the interface circuit board and then displayed graphically by the Spectrum. The ZN-449 ADC can be used at up to 100kHz sampling rate, but in this case the machine code limits the frequency to about 36kHz in order that the existing hardware can be used. To speed up the data-transfer rate from the ADC to the Spectrum memory an external timer could be used instead of a software timer and a Start Conversion Signal could be decoded from A6, A7 and CS of IC1.

The program initially loads the machine code into memory — see the Z-80 assembly-language version in listing 6 which was produced with the help of the monitor program by Picturesque and Tandy's assembler-editor. It then asks the user the sampling rate — values from 2kHz to 35kHz can be selected — the trigger level for the start of conversion, and finally the name of the sound. The trigger level is set to the positive edge of the waveform.

The 239 samples of the sound are then recorded, equivalent to the number of horizontal plot positions used. The Beep indicates when the recording process has finished, which is useful for long recordings, and the waveform is then plotted. The plot points are joined up in lines 240 to 320. The circuit in figure 1 is arranged for the ADC input to be between 0V and 5V; for a bipolar input of ±2.5V, simply change R5 from 680K to 8K2. A preamplifier circuit for low-level signals can be provided by using one of the opamps — see figure 6.

A disassembled version of the transient recorder is shown in listing 7 and the corresponding flow diagram is given in figure 7. The Spectrum interrupts are first disabled so that a continuous data transfer rate of up to 35kHz can be obtained. The Spectrum interrupts 50 times per second so that the Frame count can be updated. The PPI is initialised and the ADC then has a pulse output to the WR pin to start the conversion. When the ADC has finished conversion the data is read in. This value is then compared to a trigger value that has been Poked in from the Basic program, and if the trigger threshold has been exceeded then the program will progress to

(continued on page 127)

Figure 5.

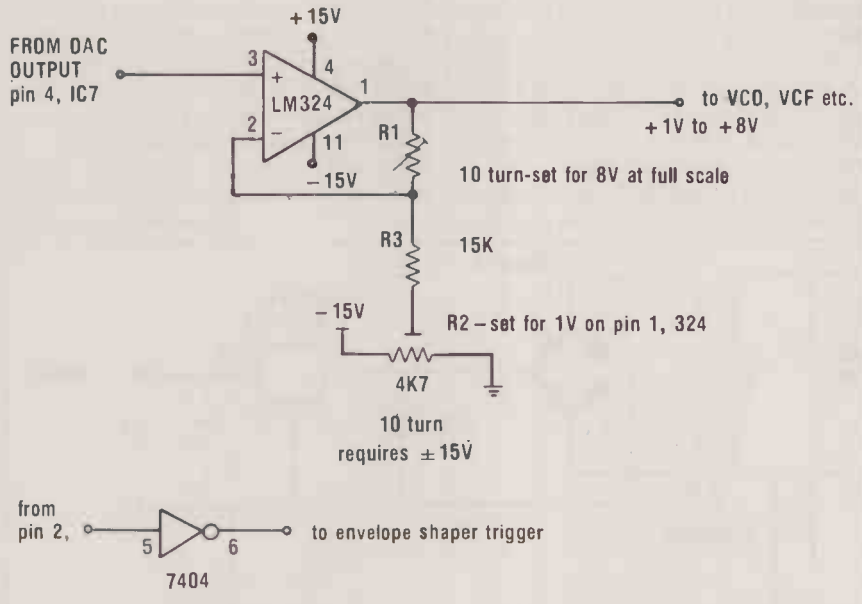


Figure 6.

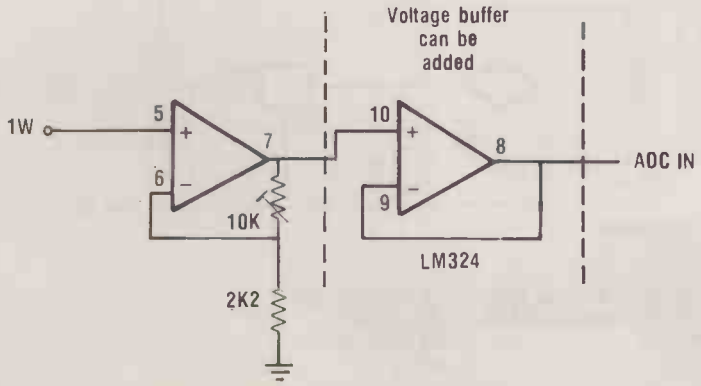
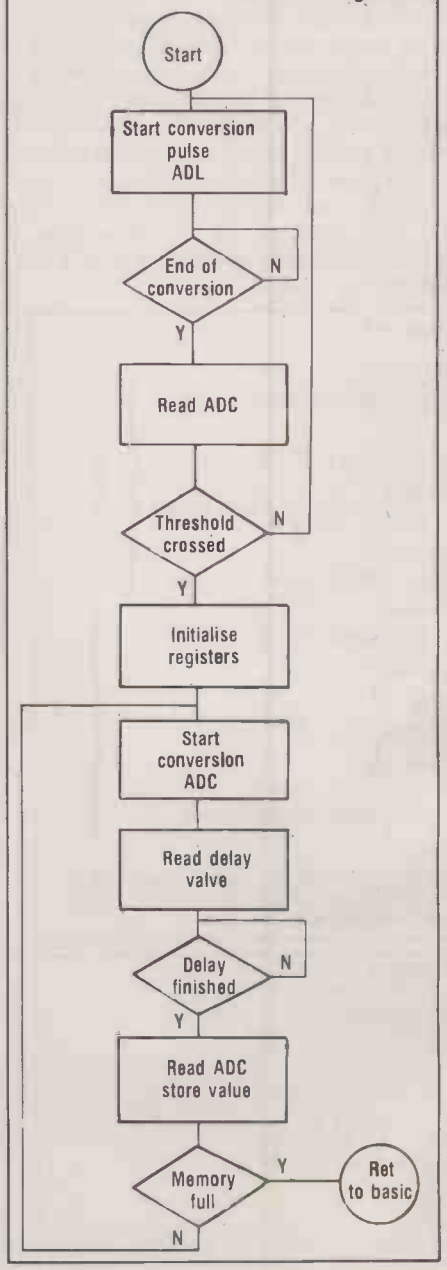


Figure 7.



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Interface

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the data-acquisition section. If not, the ADC is read again and the threshold checked again until the threshold is crossed.

The memory poiner, register pair HL, is loaded with the start of memory for the waveform storage. A software timer is used to set the sample rate for the ADC, and a 16-bit number Poked from Basic is read and converted to a time between approprimately 10μs. and 0.3s. At the end of the time delay the data from the ADC is read into memory, and after another time delay the next data byte is read in until the entire Spectrum screen width has been stored. The interrupts are enabled and a Ret instructions returns to the Basic part of the program, ready for the screen plot.

The Spectrum interface circuit board can be used with the temperature logging program of listing 8 to record temperature variations between 0°C and 100°C. The program is similar to listing 2 but scaled for temperaure. An LM-335Z is used as the temperature sensor and a basic circuit is shown in figure 8. This circuit outputs 10mV per °K, so an offset will be required for scaling to be 0V at 0°C. The amplifier in figure 6 is used for the ADC so that the full scale of the ADC range can be used. The ADC is used in the range 0V to 5V, that is as in figure 1b with R5 at 680K.

The program can be used for logging any temperature variations from 0°C to 100°C. The measured value is plotted on the graph when it is measured. If the data is to be saved it could be Poked into memory locations, so as not to be lost at the end of the program.

The graph can be Copied. Figure 9a illustrates the sensor being heated up by a 100W bulb and then cooled in free air: the exponential rise and fall can be clearly seen. Figure 9b plots the cooling of a cup of water, and figure 9c shows the heating up of the Spectrum's heat sink from approximately five minutes after powering up. The ambient temperature was 16°C so the Spectrum had already heated up by 9°C before logging the program commenced. The limit for the operating temperature for the Spectrum's voltage regulator is 70°C — it was running close to the limit even on a cool day.

The National Semiconductor LM-335Z can be used with a heat-sink clip to increase its heat conductivity, and hence speed of response. It can be calibrated against a thermometer or, alternatively, against steam and melting ice. It was found to be accurate to ±1°C. The AD-590 temperature sensor manufactured by Analog Devices and Intersil can be used over the range −55°C to +150°C.

Many additions can be made to the program shown. For example, it could Beep when certain thresholds have been crossed, or switch on or off devices connected to the rest of the PPI, such as the LEDs shown in figure 1.

The maskable interrupt is used to update the counter — see page 129 of Spectrum's manual. This three-byte value is incremented every 20ms. from when the Spectrum is powered up and is the TV frame counter. It can be used for real-time clocks, for example, as described in the Spectrum manual. The routine must be disabled for such programs as the Fast Data Logger; the ADC timing would be made inaccurate since the routine itself takes time. DI can be used to disable the interrupt the EI to encable it in time-critical applications as shown in assembly listing 6.

Listing 9 shows the disassembled Spectrum ROM from 0038H to 0072H. The address 0038H is the branch address for the MI and address 0066H the branch address for the NMI. For the MI routine, 5C78H is the address of the first byte of the Frame counter.

It appears that the NMI is available for Spectrum owners to use as required for their own purpose. Address 5CB0H, 23728 decimal, is not used and address 23728 can be loaded with the start address of the user's program. The routines after address 66 only save registers AF, HL, so if other registers will be used when the program returns these too must be saved.

A possible application for using an interrupt is wiring the End of Conversion from an A-D converter to the NMI pin on the Spectrum edge connector. The program can do other functions while the ADC is converting without continuously polling the EOC bit, listing 6, which wastes time.

The program in listings 10 and 11 is for measuing an external frequency. No hardware alteration is required to the circuit in figure 1. A TTL-compatible signal is connected to pint 15 of IC1 and its frequency can be measured up to about 20kHz with approximately 0.5 percent accuracy. The Frames counter is used as the clock reference; after every 50 increments of this counter then one second has elapsed.

The counter is used by the frequency-measurement program as the timing reference. Since the Spectrum interrupts every 20ms. the frequency program will miss some pulses from the port while the interrupt program is serviced. This can be compensated for by scaling the value k in the Basic program to account for the missing pulses; some experimentation with k will be required. With no adjustment, frequencies up to 2kHz will be accurate to about 0.1 percent. The alternative to use the Frame counter is to use an external clock to the Spectrum to provide the timing, while disabling the maskable interrupts so that time is not spent in servicing the Frame routine.

Periods other than one second can be used as the time base. Just change the value of the constant in line 180 of the assembly listing from 50 to 5, say, for 100ms. The

(continued on next page)

Figure 8.

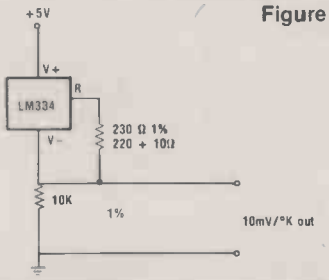


Table 1.

	IC1	IC2
Port A	Output, LEDs — ADC control	Out — DAC
Port B	Input — ADC	Out — (spare)
Port C	Input — switch	Out — (spare)

Table 3.

	IC1	IC2
port A	31	159
port B	63	191
port C	95	223
control	127	255

Table 4.

Control word	A	B	C
155	in	in	in
146	in	in	out
153	in	out	in
144	in	out	out
139	out	in	in
130	out	in	out
137	out	out	in
128	out	out	out

Table 2. Spectrum analogue/digital interface parts list

INTEGRATED CIRCUITS

IC1, 6	8255 Programmable Peripheral Interface
IC2	74LS30
IC3	74LS32
IC4	74 LS 04
IC5	ZN449 analogue-to-digital convertor
IC7	ZN429 digital-to-analogue convertor

DIODES

LED 1,2	Red LED
D1	2V7 Zener

RESISTORS
R1 4K7; R2 220K; R3, 4 8K2; R5 680K; R6, 9 1K; R7, 8 470R

CAPACITOR
C1 33pF

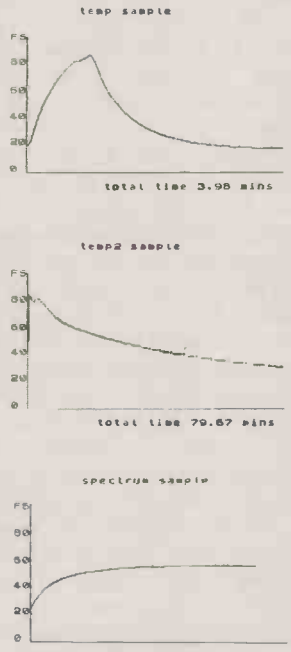
23-way edge connector, double sided, 0.1in. spacing, wire wrap or solder terminals to suit — as sold for the ZX-81
Veroboard
S1 switch spst

Interface

(continued from previous page)

program takes on second to measure a frequency and then returns to Basic. A graph plot of frequency versus time can therefore be plotted in real time. For use with signals other than TTL a voltage comparator can be used with a reference voltage to provide a suitable signal for the PPI. The frequency measurement is from 1Hz to 20kHz in 1Hz increments.

Figure 9.



Listing 1.

```
10 REM switch test
20 OUT 127,139
30 PRINT ;IN 95
40 GO TO 30

10 REM led test
20 OUT 127,139
30 OUT 31,1
40 PAUSE 25
50 OUT 31,2
60 PAUSE 25
70 GO TO 30

10 REM DAC test
20 REM outputs ramp wave
30 OUT 255,139
40 LET a=0
50 LET a=a+1
60 IF a>255 THEN GO TO 40
70 OUT 159,a
80 GO TO 50
```

Listing 2.

```
  10 REM adc display
  20 OUT 127,139
  30 INPUT "enter sample rate (H
z)";n
  40 INPUT "Enter name of sample
";a$
  50 PLOT 16,139: DRAW 0,-123
  60 DRAW 239,0
  65 PRINT AT 1,8;a$;" sample"
  70 PRINT AT 4,0;"5V"
  80 PRINT AT 7,0;"4V"
  90 PRINT AT 10,0;"3V"
 100 PRINT AT 13,0;"2V"
 110 PRINT AT 16,0;"1V"
 115 PRINT AT 19,0;"0V"
 120 PRINT AT 21,12;"total time
";INT ((239/(n*60))*100+.5)/100;
" mins"
 130 LET x1=0
 140 FOR x=16 TO 255
 150 OUT 31,0
 160 OUT 31,128
 170 LET a=IN 63
 180 PAUSE 50/n
 190 PLOT x,(a/2)+16
 192 IF x1=0 THEN GO TO 196
 194 DRAW (x1-x),(((a1/2)+16)-((
a/2)+16))
 196 LET x1=x: LET a1=a
 198 BEEP .1,a/6
 200 NEXT x
```

Listing 3.

```
  30 REM 8 channel colour logic
monitor and analyser
  40 REM © Lyndsay Robinson 29/8
/82
  50 OUT 127,139: REM set up PPI
  60 LET c=0
  70 BORDER 0: PAPER 0: INK 6
  80 CLS
  90 LET f=0
 100 DIM e(8)
 110 OUT 31,0: OUT 31,128: REM s
tart conversion
 120 PRINT INK 7;"D7 D6 D5 D4 D3
 D2 D1 D0 Dec N"
 130 POKE 23692,255: REM auto sc
roll
 140 LET n=IN 63: REM read ADC
 150 IF n<>c THEN BEEP .1,30
 160 LET a=n
 170 LET f=f+1
 180 FOR m=1 TO 8
 190 LET b=a/2-INT (a/2)
 200 IF b>0 THEN LET e(m)=1
 210 IF b=0 THEN LET e(m)=0
 220 LET a=INT (a/2)
 230 NEXT m
 240 FOR m=8 TO 1 STEP -1:
 250 IF e(m)=1 THEN PRINT INK 2;
e(m);" ";
 260 IF e(m)=0 THEN PRINT INK 6;
e(m);" ";
 270 NEXT m
 280 PRINT INK 4;n;" ";f;
 290 IF n<>c THEN PRINT FLASH 1;
"*";
 300 LET c=n
 310 PRINT : PRINT
 320 GO TO 110


D7 D6 D5 D4 D3 D2 D1 D0 Dec N
0  0  1  1  1  1  1  1  63 40

D7 D6 D5 D4 D3 D2 D1 D0 Dec N
0  0  1  1  1  1  1  1  65 41

D7 D6 D5 D4 D3 D2 D1 D0 Dec N
0  1  0  0  0  0  0  0  64 42

D7 D6 D5 D4 D3 D2 D1 D0 Dec N
0  1  0  0  0  0  0  0  64 43

D7 D6 D5 D4 D3 D2 D1 D0 Dec N
0  1  0  0  0  0  0  0  64 44

D7 D6 D5 D4 D3 D2 D1 D0 Dec N
0  1  0  0  0  0  0  0  64 45

D7 D6 D5 D4 D3 D2 D1 D0 Dec N
0  1  0  0  0  0  0  1  65 46*

D7 D6 D5 D4 D3 D2 D1 D0 Dec N
```

Listing 4.

```
  10 REM sequencer 2 Oct 82 by
Lyndsay Robinson
  20 REM a sequence of notes and
 note length can be recorded and
 played on a music synthesiser (
Korg MS20 used).
  40 OUT 127,139
  50 OUT 255,139
  60 REM set up PPI
  70 REM record
  80 GO TO 390
  90 CLS
 100 LET a=0
 110 LET b=32770
 120 PRINT "Enter key 0 for end
of record"
 130 PRINT AT 20,0;"note ";a/2+1
 140 INPUT "key (1 TO 37) ";k
 150 IF k>37 THEN GO TO 140
 160 IF k=0 THEN GO TO 260
 170 LET z=(1.0594634^(k-1))
 180 LET c=((1/z-1)*255)/7
 190 POKE (b+a),c: REM frequency
 value
 200 INPUT "time (1 TO 8)";t
 210 POKE (b+a+1),t
 220 LET a=a+2
 230 POKE 32768,a: REM number of
 notes
 240 GO TO 130
 250 REM port 31 is kybd trigger
, 159 is DAC
 260 CLS : INPUT "repeat or sing
le (r or s)";a$
 270 INPUT "speed";s
 280 CLS : PRINT "sequencer play
ing": PRINT : PRINT "Press s to
 stop"
 290 LET a=PEEK 32768
 300 LET a1=0
 310 LET b=32770
 320 OUT 159,PEEK (b+a1): OUT 31
,255: LET d=PEEK (b+a1+1): PAUSE
 (d*s+1): OUT 31,0
 330 LET a1=a1+2
 340 LET a=a-2
 350 IF INKEY$="s" THEN GO TO 39
0
 360 IF a=0 THEN GO TO 380
 370 GO TO 320
 380 IF a$="r" THEN GO TO 290
 390 CLS : PRINT "Sequencer": PR
INT : PRINT : PRINT "1 Record":
PRINT
 400 PRINT "2 Play ": PRINT
 410 PRINT "3 save on cassette"
 420 INPUT g
 430 IF g=1 THEN GO TO 90
 440 IF g=2 THEN GO TO 260
 450 IF g=3 THEN SAVE "tune1"COD
E 32768,(2*(PEEK 32768))
 455 GO TO 390
 460 FOR z=32770 TO 32900: PRINT
 PEEK z,: NEXT z
```

Listing 5.

```
   5 REM fast data logger
  10 REM 5 Oct 82
  50 FOR d=32500 TO 32559
  60 READ n: POKE d,n: NEXT d
  70 DATA 243,62,139,211,127,62,
0,211,31,58,255,0,211,31,219,95,
203,127,40,250,219,63,71,58,2,12
8,184,210,249,126,33,3,128,14,63
,6,239,62,0,211,31,62,255,211,31
,237,91,0,128,27,122,179,32,251,
237,162,32,235,251,201
 110 CLS : INPUT "Sample rate in
Hz";h
 115 LET r=1/(h*.00000925)
 120 POKE 32769,INT (r/256)
 130 POKE 32768,(r-256*INT (r/25
6))
 140 CLS : INPUT "trigger level
(0 to 5V)";b
 150 POKE 32770,INT ((b/5)*255)
 160 INPUT "name of sample";a$
 163 PRINT USR 32500: CLS
 165 BEEP .1,10
 170 PLOT 16,139: DRAW 0,-123: D
RAW 239,0
 180 PRINT AT 1,8;a$;" sample"
 190 PRINT AT 4,0;"5V"
 200 PRINT AT 7,0;"4V"
 210 PRINT AT 10,0;"3V"
 220 PRINT AT 13,0;"2v"
 230 PRINT AT 16,0;"1V"
 240 PRINT AT 19,0;"0V"
 250 PRINT AT 21,12;"sample rate
 ";h;" Hz"
 260 LET x1=0
 270 FOR x=16 TO 255
 275 LET a=PEEK (32771+x-17)
 280 PLOT x,(a/2)+16
 290 IF x1=0 THEN GO TO 310
 300 DRAW (x1-x),(((a1/2)+16)-((
a/2)+16))
 310 LET x1=x
 320 LET a1=a
 330 NEXT x
```

Listing 7.

```
7EF4 F3          DI
7EF5 3E8B        LD    A,8B
7EF7 D37F        OUT   (7F),A
7EF9 3E00        LD    A,00
7EFB D31F        OUT   (1F),A
7EFD 3AFF00      LD    A,(00FF)
7F00 D31F        OUT   (1F),A
7F02 DB5F        IN    A,(5F)
7F04 CB7F        BIT   7,A
7F06 28FA        JR    Z,7F02
7F08 DB3F        IN    A,(3F)
7F0A 47          LD    B,A
7F0B 3A0280      LD    A,(8002)
7F0E B8          CP    B
7F0F D2F97E      JP    NC,7EF9
7F12 CD0FF7      CALL  F70F
7F15 0E3F        LD    C,3F
7F17 06EF        LD    B,EF
7F19 3E00        LD    A,00
7F1B D31F        OUT   (1F),A
7F1D 3EFF        LD    A,FF
7F1F D31F        OUT   (1F),A
7F21 ED5B0080    LD    DE,(8000)
7F25 1B          DEC   DE
7F26 7A          LD    A,D
7F27 B3          OR    E
7F28 20FB        JR    NZ,7F25
7F2A EDA2        INI
7F2C 20EB        JR    NZ,7F19
7F2E FB          EI
7F2F C9          RET
```

Listing 8.

```
  10 REM adc display
  15 REM scaled for temperature
9 Oct 82
  20 OUT 127,139
  30 INPUT "enter sample rate (H
z)";n
  40 INPUT "Enter name of sample
";a$
  50 PLOT 16,141: DRAW 0,-125
  60 DRAW 239,0
  62 FOR z=0 TO 125 STEP 25: PLO
T 17,16+z: NEXT z
  65 PRINT AT 1,8;a$;" sample"
  70 PRINT AT 4,0;"FS"
  80 PRINT AT 7,0;"80"
  90 PRINT AT 10,0;"60"
 100 PRINT AT 13,0;"40"
 110 PRINT AT 16,0;"20"
 115 PRINT AT 19,0;"0"
 120 PRINT AT 21,10;"total time
";INT ((239/(n*60))*100+.5)/100;
" mins"
 130 LET x1=0
 140 FOR x=16 TO 255
 150 OUT 31,0
 160 OUT 31,128
 170 LET a=IN 63
 180 PAUSE 50/n
 190 PLOT x,(a/2)+16
 192 IF x1=0 THEN GO TO 196
 194 DRAW (x1-x),(((a1/2)+16)-((
a/2)+16))
 195 LET x1=x: LET a1=a
 198 BEEP .1,a/6
 200 NEXT x
```

Listing 9.

```
0038 F5          PUSH AF
0039 E5          PUSH HL
003A 2A785C      LD    HL,(5C78)
003D 23          INC   HL
003E 22785C      LD    (5C78),HL
0041 7C          LD    A,H
0042 B5          OR    L
0043 2003        JR    NZ,0048
0045 FD3440      INC   (IY+40)
0048 C5          PUSH  BC
0049 D5          PUSH  DE
004A CD8F02      CALL  028F
004D D1          POP   DE
004E C1          POP   BC
004F E1          POP   HL
0050 F1          POP   AF
0051 FB          EI
0052 C9          RET
0053 E1          POP   HL
0054 6E          LD    L,(HL)
0055 FD7500      LD    (IY+00),L
0058 ED7B3D5C    LD    SP,(5C3D)
005C C3C516      JP    16C5
005F FF          RST   38
0060 FF          RST   38
0061 FF          RST   38
0062 FF          RST   38
0063 FF          RST   38
0064 FF          RST   38
```

(continued on facing page)

(continued from facing page)

```
0065 FF          RST   38
0066 F5          PUSH  AF
0067 E5          PUSH  HL
0068 2A5C5C      LD    HL,(5C60)
006B 7C          LD    A,H
006C B5          OR    L
006D 2001        JR    NZ,0070
006F E9          JP    HL
0070 E1          POP   HL
0071 F1          POP   AF
0072 ED45        RETN
```

Listing 11.

```
  10 REM frequency meter 11 oct
82
  20 FOR z=32500 TO 32542
  30 READ n: POKE z,n: NEXT z
  40 DATA 62,139,211,127,58,120,
92,71,58,120,92,184,40,250,198,5
0,71,33,0,0,219,95,203,79,40,250
,35,219,95,203,79,32,250,34,0,12
5,58,120,92,184,200,24,233
  50 PRINT ;USR 32500: REM start
address
  60 CLS : LET k=1
  70 LET a=((PEEK 32768)+256*(PE
EK 32769))
  80 PRINT INT (a*k)
  90 GO TO 50
```

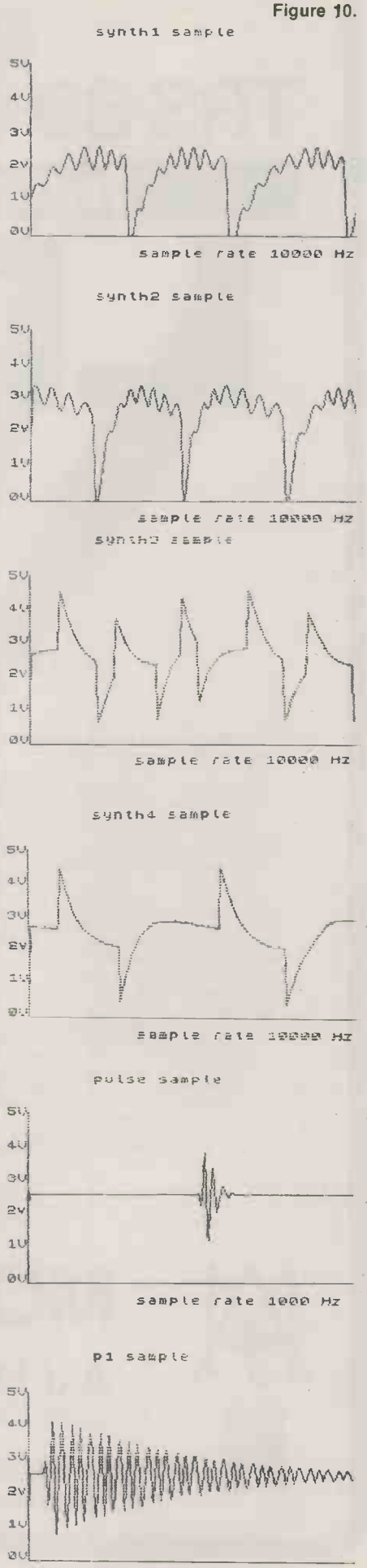
Listing 6.

```
7EF4            00100          ORG 7EF4H       ;48K SPECTRUM FAST DATA LOGGER 7 OCT 82
7EF4 F3         00110          DI              ;DISABLE INTERRUPTS
7EF5 3E8B       00120          LD A,139        ;SET UP PPI
7EF7 D37F       00130          OUT (127),A
                00140                          ;CHECK FOR THRESHOLD
7EF9 3E00       00150 TRIG     LD A,0          ;SC PULSE FOR ADC
7EFB D31F       00160          OUT (31),A
7EFD 3EFF       00170          LD A,255
7EFF 00         00175          NOP
7F00 D31F       00180          OUT (31),A
7F02 DB5F       00190 WAIT     IN A,(95)       ;EOC OF ADC
7F04 CB7F       00200          BIT 7,A
7F06 28FA       00210          JR Z,WAIT
7F08 DB3F       00220          IN A,(63)       ;READ ADC
7F0A 47         00230          LD B,A
7F0B 3A0280     00240          LD A,(8002H)    ;GET TRIG LEVEL
7F0E B8         00250          CP B
7F0F D2F97E     00260          JP NC,TRIG
                00270
                00280
                00290                          ;DATA ACQUISITION
7F12 210380     00300          LD HL,8003H     ;MEMORY POINTER - START OF STORE
7F15 0E3F       00310          LD C,63         ;ADC PORT
7F17 06EF       00320          LD B,239        ;NO OF SAMPLES - 1 SCREEN WIDTH
7F19 3E00       00330 SAMPLE   LD A,0          ;SC PULSE
7F1B D31F       00340          OUT (31),A
7F1D 3EFF       00350          LD A,255
7F1F D31F       00360          OUT (31),A
7F21 ED5B8080   00370          LD DE,(8080H)   ;DELAY  VALUE FROM BASIC
7F25 1B         00380 TIME     DEC DE          ;DELAY BETWEEN CONVERSIONS
7F26 7A         00390          LD A,D
7F27 B3         00400          OR E
7F28 20FB       00410          JR NZ,TIME
7F2A EDA2       00420          INI             ;INPUT FROM ADC,  INC HL
7F2C 20EB       00430          JR NZ,SAMPLE
7F2E FB         00440          EI              ;ENABLE INTERUPTS
7F2F C9         00450          RET             ;RETURN TO BASIC
7EF4            00470          END 7EF4H
00000 TOTAL ERRORS
```

Listing 10.

```
7EF4            00100          ORG 7EF4H       ;FREQUENCY MEASUREMENT 11 OCT 82
7EF4 3E8B       00110          LD A,139        ;SET UP PPI
7EF6 D37F       00120          OUT (127),A
7EF8 3A785C     00130          LD A,(23672)    ;TV FRAME COUNT INCREMENTS EVERY 20MS
7EFB 47         00140          LD B,A          ;START REFERENCE
7EFC 3A785C     00150 WAIT     LD A,(23672)
7EFF B8         00160          CP B
7F00 28FA       00170          JR Z,WAIT       ;IF SAME,  CHECK AGAIN
7F02 C632       00180          ADD A,50
7F04 47         00190          LD B,A
7F05 210000     00200          LD HL,0         ;CLEAR FREQ REGISTERS.
7F08 DB5F       00210 LOW      IN A,(95)       ;FREQ FLAG
7F0A CB4F       00220          BIT 1,A
7F0C 28FA       00230          JR Z,LOW
7F0E 23         00240          INC HL          ;COUNT
7F0F DB5F       00250 HIGH     IN A,(95)
7F11 CB4F       00260          BIT 1,A
7F13 20FA       00270          JR NZ,HIGH
7F15 220080     00280          LD (32768),HL   ;STORE FREQ
7F18 3A785C     00290          LD A,(23672)    ;FRAME COUNT
7F1B B8         00300          CP B            ;1 SEC TIMOUT?
7F1C C8         00310          RET Z           ;RETURN TO BASIC IF SO
7F1D 18E9       00320          JR LOW          ;OTHERWISE CONTINUE COUNT
7EF4            00330          END 7EF4H
00000 TOTAL ERRORS
```

Figure 10.



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Forth thoughts

Can Forth claim to be structured? Boris Allan scrutinises this suddenly fashionable language in search of the answer.

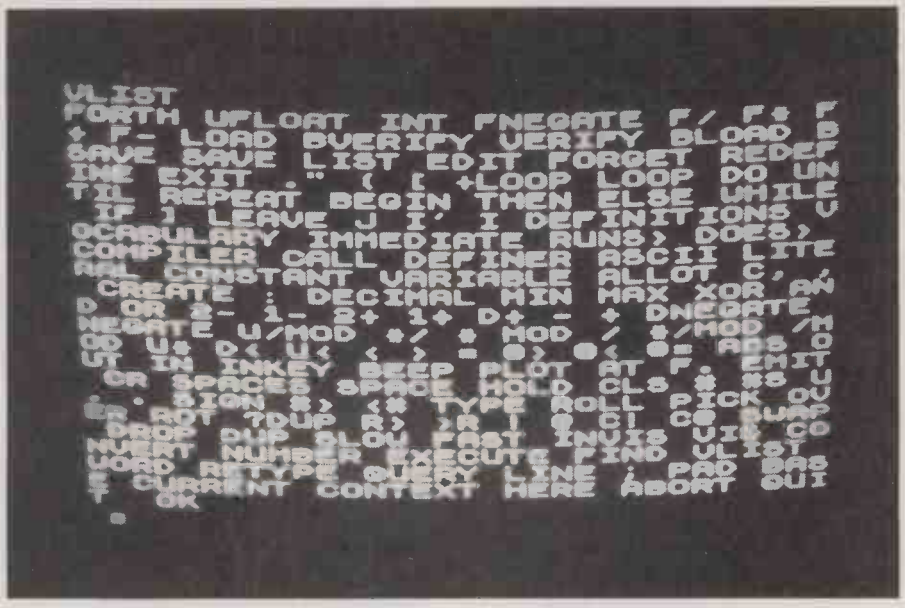
A STRUCTURED PROGRAMMING language can mean different things to different people, but on analysis it would seem to be gauged on three main criteria: The ability to use subroutines and procedures in a modular approach to programming; the ability to use powerful control structures possibly eliminating the errant Goto; and the ability to investigate a program's consistency by purely logical means — the use of correctness proofs. To call any language "structured" is to imply that it satisfies at least the first two criteria. If they are applied to Forth, can it claim to be a structured language?

Forth is an interactive language which was devised about 10 years ago as a convenient method of controlling equipment by computer. The languages then available on smaller computers were mostly too slow for such applications — though Basic compilers now available are very fast in execution — and machine code was too tedious to write at length.

Forth is supposed to solve the problem by allowing the user to write programs which are fast executing, and yet are in a high-level language. On a small system Forth uses very little memory for program storage since each part of the program is compiled as it is entered, as long as it is grammatically correct. This is why Forth is so speedy — it is a compiled language.

Forth is an extensible language too in that when a new word is defined it becomes part of the language and can be used to define other words. Forth operates at several levels:

Executing a word.
Defining what a word does.
Forming a new mode of defining words.
Generating new ways of forming modes — called meta-Forth.



The VList command lists the whole dictionary which contains defined Forth words.

Subroutines

Possibly the most common form of subroutine is that of Basic. A call is made to a section of program at line zzzz by the command Gosub zzzz. The program jumps to line zzzz and executes the code starting at zzzz until a Return is encountered, at which point control returns to the statement after Gosub zzzz. Subroutine zzzz may be used several times in a program and called from many different places, saving such repetitious coding. If you have a variable called Bill in the main program and the subroutine also uses a variable called Bill, then Bill will be the same variable in both the main program and the subroutine.

In Fortran and many other languages, including BBC Basic there is a series of parameters against the name of the subroutine. In Fortran there might be a subroutine:

Subroutine Nurdle (Bill, Ben)

Within the body of the subroutine Nurdle there are then variables called Bill and Ben, but these are not same variables as any Bill and Ben in the main program. Bill and Ben might not even be in the main program.

If within the main body of the program, or within another subroutine, a call to the subroutine is made by

CALL NURDLE(TOBY,JUG)

then the variable Toby is used in the routine whenever Bill is mentioned, and Ben is replaced by Jug. It means that other variables can be used,for instance

CALL NURDLE (MAID, MEIRION)

In BBC Basic it is possible to use parameters in this way with defined procedures — though few books which purport to teach you about the BBC Micro mention parameters. Most use procedures as if they were Gosubs.

In Fortran a subroutine can call another subroutine as long as it is not recursive — that is, the subroutine may not call itself. In Pascal, a procedure can call itself but it cannot call a procedure later in the program unless that later procedure has an earlier dummy declaration, called a forward declaration. In some Basic variants with a subroutine can call itself and any other subroutine. In Forth things are rather more complex.

Forth has a single-minded approach to life, centred on the stack. If you enter

2 3 4 + *

Forth executes the calculation

2 * (3 + 4)

which is the mysterious reverse-Polish notation. To print out the answer you enter a full point, the instruction to print the number on the top of the stack.

All procedures in Forth take their parameters off the stack, and thus do not have the ease of Fortran, Pascal, or BBC Basic. In Forth the words themselves are the subroutines. The Forth word for Print is "." though you might prefer to use the word Print as it is rather more explicit. In this case a new word might be defined by

: PRINT. ;

To calculate 3+4−5 and print out the answer you then enter

3 4 + 5− PRINT

and to calculate 4×4

4 DUP *PRINT

where Dup means duplicate the entry on top of the stack. It is now possible to define a new word to calculate squares and print out the answer by

:SQUARED DUP *PRINT ;

The word assumes there is a number already on the stack. Now to find the square of 5 you simply enter

5 SQUARED

The sequence is interesting. First Print is defined and then Squared is defined using Print. The definition of Print might then be altered, for example by executing

: PRINT DUP. ;

(continued on next page)

(continued from previous page)
so that the number on the top of stack is not removed by the operation of Printing. The word Squared remains unaware of this later definition of Print and continues to use the earlier definition. By ignoring any later changes Forth avoids some unwelcome surprises.

In Fortran and many other languages it is possible to incorporate changes in procedures by recompiling programs. With Forth it is not as simple, but by not allowing surprises Forth assures a faster-running program as fewer checks are needed. By forcing the development of procedures from the bottom-up rather than the top-down, Forth runs contrary to accepted practices in structured programming.

In Pascal and Fortran you can start with the main body of the program which merely calls procedures, and get it working before concentrating on the procedures. In Forth you have to dot the i's before you can write the word. Forth encourages bottom-up methods but it is certainly not structured in any proper sense.

Different languages use different control structures. Loops in Algol 68 take the form For-From-By-To-While-Do, where any or all parts can be ommitted. There is also If-Then-Else-Fi, where the Else can be omitted, plus Case-In . . ., . . ., . . ., . . . Out, . . . Esac, where the Out is not always necessary.

These are a powerful set of commands to control a program, against which Forth offers If- Else- Then, for which the Then is the equivalent to the Algol 68 Fi. The test is on the stack so the portion after If corresponds to the portion after Then in Algol 68, and Else is not necessary. There is a loop in Forth, but the loop index is always called I for an inner loop, J for the loop which encloses the inner loop, and then loop indices have to be given colon definitions. This is certainly not as flexible as might be hoped.

There are three forms of indefinite loop: Begin-Again, Begin-Until, and Begin-While-Repeat. In terms of control structures Forth comes out well, though you have to remember that tests are of the top of the stack.

There is no Goto in Forth because there is nowhere to go — there are no labels. In Pop 2, another stack-based language, there are no loop structures but there is a Goto.

A program may be perfectly correct yet not work on a computer, and this is especially true of Forth. It is a very standardised language, so it is easy to take programs written for one implementation and implement them on a different computer. The trouble with Forth is that it seems to be low on useful checks such as "Is my stack going to overwrite something important?" or "I think there was something wrong with the word Prune, shall I use it to see what happens?" These are both rather good ways of crashing most Forth systems.

Wishing to write a recursive word to calculate factorials, I first set an upper limit to the factorial by

```
8 VARIABLE UPPER
```

I then defined a special word to allow another word to refer to itself:

```
: RECURSIVE LATEST PFA CFA,;
  IMMEDIATE
```

And so to the factorial:

```
: FACTORIAL—DUP IF DUP ROT*SWAP
1—RECURSIVE THEN;
```

To test it I used a word Test:

```
: TEST UPPER @ 1 DO 1 I FACTORIAL I . .
  CR LOOP;
```

in this way:

```
CR TEST
```

The program works: the output is all the factorials from one to seven.

To see what happens at larger numbers I entered:

```
1000 UPPER ! CR TEST
```

which should have given factorials up to a new limit of 999. On all three computers which ran this program funny things happened after 7 factorial. After a time the system crashed and could not be revived: the stack had overwritten where it should not have written.

This only one example among many, and it seems that Forth systems are not foolproof. The lack of checks appears to be tied into a desire to make Forth run as swiftly as possible: if you ignore the checks Forth is a very simple language to implement, but not one for the novice.

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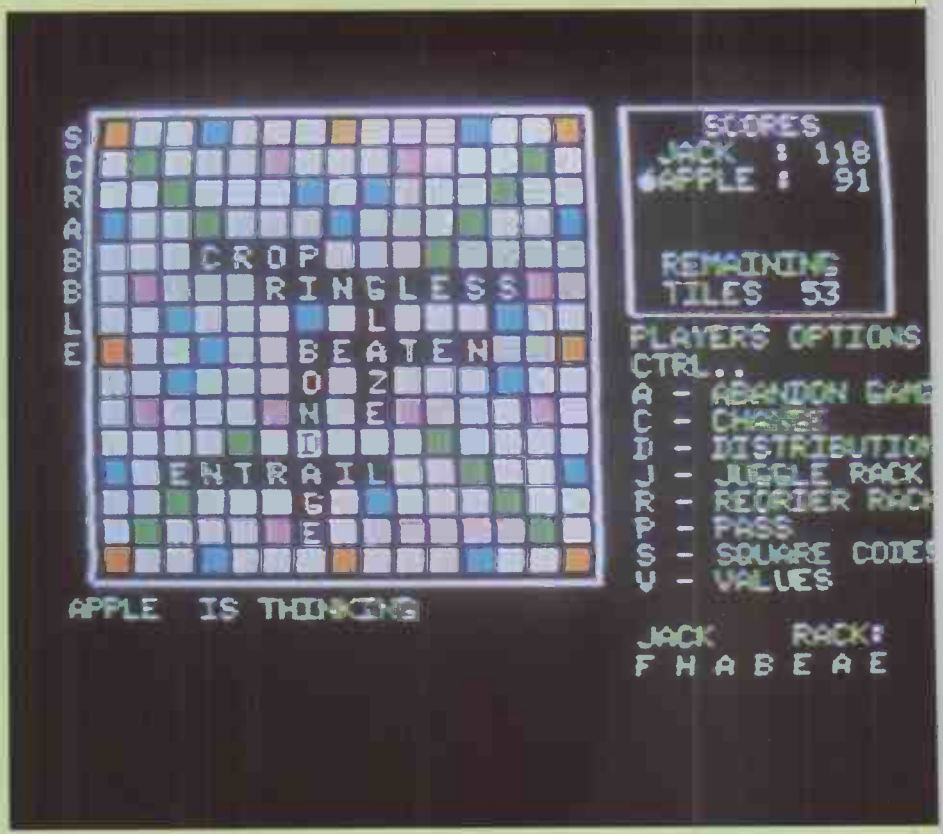
Apple games

For all addicts to this form of pastime here are three new games guaranteed to test, frustrate and perhaps even amuse, as Jack Schofield found out.



The Hitch-Hikers Guide to the Galaxy

ADVENTURE GAMES are a bit like *The Times* crossword — either you have that kind of brain or you don't. Even if you do have that kind of brain, successful adventuring depends to a great extent on practice and perseverence, and these are qualities we have not acquired. Our first venture into The Hitch-Hikers Guide soon lead us into a Total Perspective Vortex in which commands like up, down, north, south, east and west had no visible effect. Typing Help brought the response that this was no time for old Beatles hits.

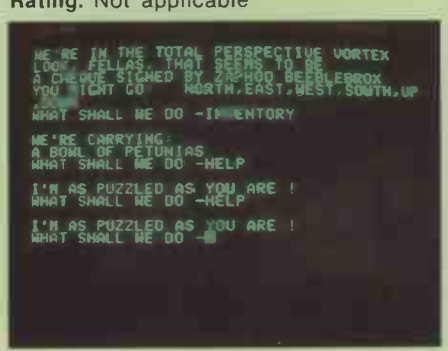
HHG is an all-text Adventure game where the text and characters are related to the popular trilogy by Douglas Adams, starring Arthur Dent, Ford Prefect and others. The disc boots up with a title page "Don't Panic!" and then asks, "Eddie, your ship-board computer needs to know if you hoopy froods have lower-case capability. (Y/N)".

Then we are off. Pausing only to pick up a bowl of petunias at the Five Artifacts Inn, we board the Heart of Gold space ship, eat an Arcturian Megadonkey steak, collect a cheque signed by Zaphod Beeblebrox and get stuck in Total Perspective Vortex. Oh well, that is fairly typical of the approach.

One good point about HHG is that it recognises single-letter abbreviations such as U, D, N, S, E, W, etc. Also the program varies its responses. Another Help produces "I'm as puzzled as you are!"

Specification

Type: Adventure game, text
Format: One 5·25in. floppy disc
Language: Compiled Basic
System: Apple with one disc drive
Minimum RAM: 32K
Manufacturer: Estuary Software Products, 261 Victoria Avenue, Southend-on-Sea, Essex
Price: £16.95
Rating: Not applicable



Computer Scrabble

SCRABBLE is the kind of game that ruins friendships and wrecks marriages because it is compulsive, and because it leads to arguments about the validity of certain words. Nothing is more frustrating than sitting with a good word on your rack waiting for the other person to play. It is these characteristics that make computer Scrabble an ideal version of the game. The micro does not stall for time, it does not cheat and it does not argue.

Computer Scrabble from Little Genius is a full and accurate version of the Spear & Sons game, written for a 48K Apple with disc drive. The program started life on an ICL mainframe as part of Peter Turcan's PhD research study into word structures and their analysis. It was eventually transported to the Apple via a Superbrain version which has not been made commercially available. The Apple version is supplied on a double-sided disc; one side contains the program and the other a 9,100-word dictionary. Booting up the program provides a title screen followed by a series of questions to establish the configuration being used — colour or monochrome; sound; the number of players, up to four; the first player's name; and other factors including the skill level.

If you want to play the Apple select a two-player game where one of the players is called "Apple" — unless you have a pet name for your computer. The Apple will happily play a one-player game by itself, or keep the board and score, and generate random letters for four human players without playing any of the hands. It is very flexible.

The screen display holds the board, a box containing the scores and the number of letter tiles left, a list of options and, while Apple is playing, your own rack. The human player can use Ctrl plus letter keys to find out the values of squares or letters — which are not marked, as they are in Scrabble — or juggle or reorder his letters.

When playing a word, this list of options changes to show the letters used to position a cursor where the word is to start, and then play it across or down. You are then told

how much the word will score, and asked if you want to accept it. Answering Y plays the word and scoring is automatic; answering N returns you to the rack to try again. Thus you can try a number of alternatives before selecting the best. Only a computer will allow you to do this.

Computer Scrabble will not accept illegal entries where the word goes over the edge of the board, does not match an existing word or includes letters not in your rack. Again, it does not deprive you of your turn.

If you play a word that is not in its dictionary — including "id", "en" and "zein" — it asks "Are you sure (Y/N)". Pressing Esc-Y plays the word, but it is not then added to the dictionary.

Designing the dictionary was a major part of programming the game. The contents were chosen with the assistance of Dr Alan Richter, a former British National Scrabble Champion, and include many words that are not exactly common in everyday speech, such as "weans" and "twex". Obviously a lot of them are short words like "qua", "eh", "ha" and "ho", which are particularly useful in Scrabble. Even so, coding had to be used to fit 40K of dictionary into the 26K available to the game.

The Apple takes about two minutes to play a word, and it plays surprisingly well. It does not exhibit much idea of strategy, except for being careful with blanks and the letter s. It happily opens up triple-word squares for its opponent if this maximises its own score on the turn. However, it scores consistently well, and this makes it hard to beat.

Little Genius says that on Level 4 it will score, on average, 300 points in a two-player game. The first time we played it made a seven-letter word, "devious", for 50 bonus, then plonked "jaws" on a triple-word square to emerge with 376 points and a crushing victory. Something around 340 is more usual, but this is enough to beat perhaps 80 percent of Scrabble players. At the lowest level, Computer Scrabble averages about 160 points, which should be enough to challenge beginners wthout overwhelming them.

In terms of screen display, word entry and general user friendliness Computer Scrabble is outstanding. Possibly the only criticism to be made is that the cursor movement for placing words does not offer auto-repeat, but the cursor always starts in the top left-hand corner. It takes many key presses to reach some squares. Apart from that, Computer Scrabble is an excellent version of the game and highly recommended.

Specification

Type: Real-time board game on screen, with colour graphics and sound optional
Format: Single 5·25in. floppy disc, two sides
Language: Machine code
System: Apple with disc drive
Minimum RAM: 48K
Manufacturer: Little Genius, 203 Kilburn High Road, London NW6 7HY
Price: £24.95
Rating: 18/20

Choplifter

MOST ARCADE-TYPE games are based on killing things, and even if they are "aliens", and even if the destruction is only symbolic, this worries people. Some recent games are more happily devoted to saving lives. Defender is the most important of the genre, and Choplifter another example.

Choplifter, by Dan Gorlin, is a high-resolution colour arcade game from Broderbund Software of San Rafael, California. It requires an Apple II or II Plus with 48K RAM, a disc drive with DOS 3.2 or 3.3, and either a joystick with two button or two games paddles. As with most good American games nowadays, an Atari version is also available.

The game seems to be based on the American hostages who were held by the tyrannical Iranian regime, and the helicopter rescue mission which turned into a fiasco. The game itself takes place in "Bungeling" which is "to the south of Kurdistan" — near enough Iran as makes no difference. To play you fly your "chopper" to a series of four barracks, land, and rescue the 16 occupants of each. That means you have to rescue 64 people in all.

Meanwhile the Bungelings are, of course, trying to prevent you. Your helicopter can only hold 16 people, so you have to make several trips. During the first sortie you are attacked by tanks. Then you have to cope with enemy fighters and, last of all, intelligent "space mines".

Your helicopter can either drop bombs or fire forwards. The bombs are used to break open three of the barracks and perhaps against tanks. The canon is used against fighters and space mines. You must be careful not to kill hostages by shooting them, landing on top of them, or hitting them with a rotor blade. The game ends when every hostage is either rescued or dead, or before that if you use up the three choppers allowed.

The game is played in a long horizontal landscape which is quite realistically drawn with good use of perspective. It scrolls past as you fly. The helicopter is good, but the tiny people are best of all: though really little more than stick figures, they rush to your helicopter very realistically and climb aboard, while those left behind actually wave at you as you take off. It is really quite touching.

The colour is also good on a colour TV or monitor, but the game becomes very hard to play in monochrome as the tanks blend into the landscape almost completely. The sound is mainly blips — not very exciting. It would be interesting to know if good use has been made of the excellent sound facilities of the Atari in the version available for that machine.

Also, the game is very difficult to play using two paddles. A good joystick is virtually essential. Though one person in our office did manage to rescue all the hostages using paddle controllers, for most of us just controlling the helicopter was difficult. Perhaps this is part of the realism which adds to the game — though it must be said that the realism is spoiled at the end by the space mines.

At any rate, Choplifter is an original, challenging and exciting game, and recommended.

Specification

Type: Real-time arcade game with colour graphics and sound
Format: One 5·25in. floppy disc, Atari version also available
System: Apple II with disc drive and joystick or two paddle controllers
Minimum RAM: 48K
Manufacturer: Broderbund Software, 1,938 Fourth Street, San Raphael, California. Review sample supplied by SBD Software, 15 Jocelyn Road, Richmond, Surrey TW9 2TJ
Price: £19.95
Rating: 16/20

Disassembler for BBC Micro

THE BBC MICRO contains a very powerful machine-code assembler built into the basic system, but lacks a disassembler which allows the user to read code in memory in a comprehensible format. This program, written in BBC Basic, decodes at about nine lines per second and, as a simple option, highlights certain machine-code instructions in colour. The concepts used in the program could easily be adapted to other machines using the 6502 chip.

The key to the fast decoding lies in the use of a hash table, a technique rarely used in programs published in *Practical Computing* — but see page 127 of the September 1982 issue. Simple disassemblers have been published in the past, but these have all relied on a

Use of a hash table, unusual perhaps, has enabled John Leach to devise a program which will read machine code quickly and comprehensibly.

relatively lengthy look-up of a series of data statements. The use of a hash table means that a second or two is taken up at the beginning of the program in building up the table, but after that it only takes a few microseconds to locate each new machine-code instruction.

Examination of the 6502 instruction set reveals that there are 56 separate instruction types, some of which contain up to eight addressing modes, of which there are 13 in all. However, the characteristics of the addressing mode are constant for every instruction that uses it, that is the number of bytes following the instruction — zero, one or two — and the addressing mode — zero page, absolute, X, relative branch, etc.

All the disassembler program needs to know after reading a machine-code instruction byte is the corresponding mnemonic — Add, And, Asl, etc. — and the addressing mode. By implication they will tell the program how many further bytes, if any, will have to be read to decode the instruction fully. This, after all, is what the 6502 chip itself has to do when instructions are decoded, although

Machine-code disassembler.

```
   10 REM Fast 6502 Disassembler for BBC
 Microcomputer
   20 REM J.M. Leach, June 1982
   30 REM
   40 ON ERROR GOTO 800
   50 MODE 7:@%=1:NLINES=0:TSTART%=TIME
   60 DIM MOSHOW% 7:$MOSHOW%="        ":R
EM Instruction mode display
   70 DIM HASH%(255):REM 6502 code hash
table for mode and mnemonic position
   80 DIM MOTYPE$(13):REM Holds text cha
racters for mode display
   90 DIM NBYTES(13):REM Holds number of
 bytes for each mode
  100 DIM PCGET%(3):REM Hold 1, 2 or 3 b
ytes of memory
  110 REM Get mode descriptors into arra
ys
  120 REM the order is :
  130 REM  1) Accumulator    2) Immediate

  140 REM  3) Zero Page      4) Zero Page
,X
  150 REM  5) Zero Page,Y    6) Absolute
  160 REM  7) Absolute,X     8) Absolute,
Y
  170 REM  9) Implied       10) Relative

  180 REM 11) (Indirect,X) 12) (Indirect
),Y
  190 REM 13) Absolute Indirect Jump
  200 REM
  210 FOR I=1 TO 13:READ N: NBYTES(I)=N:
NEXT
  220 FOR I=1 TO 13:READ Q$:.MOTYPE$(I)=
Q$:NEXT
  230 REM Number of bytes for each mode
  240 DATA 1,2,2,2,2,3,3,3,1,2,2,2,3
  250 REM Display format for each mode
  260 DATA"A       ","£&..    ","&..     ",
"&..,X   ","&..,Y   ","&....   ","&....,X",
"&....,Y","        ","&..
"(&..),Y","(&....)"
  270 REM
  280 REM Build Mnemonic string, in alph
abetical order
  290 REM
  300 MNE$=""
  310MNE$=MNE$+"ADC AND ASL BCC BCS "
  320MNE$=MNE$+"BEQ BIT BMI BNE BPL "
  330MNE$=MNE$+"BRK BVC BVS CLC CLD "
  340MNE$=MNE$+"CLI CLV CMP CPX CPY "
  350MNE$=MNE$+"DEC DEX DEY EOR INC "
  360MNE$=MNE$+"INX INY JMP JSR LDA "
  370MNE$=MNE$+"LDX LDY LSR NOP ORA "
  380MNE$=MNE$+"PHA PHP PLA PLP ROL "
  390MNE$=MNE$+"ROR RTI RTS SBC SEC "
  400MNE$=MNE$+"SED SEI STA STX STY "
  410MNE$=MNE$+"TAX TAY TYA TSX TXA TXS"

  420 REM
  430 REM Build Hash table to hold chara
cteristics for each 6502 code
  440 REM In the following DATA statemen
ts a negative number gives the position
  450 REM of the associated Mnemonic in
the MNE$ string
  460 REM the following (Hexadecimal) nu
mbers give the Instruction Mode (1 digit
)
  470 REM and the instruction code of 2
digits, which direct the position in the
  480 REM Hash table
  490 REM
  500 READ Q$:IF LEFT$(Q$,1)="-" THEN NM
NE%=ABS(EVAL(Q$)):GOTO 500
  510 REM Encode Hash table entries
  520 Q%=EVAL("&"+Q$):I%=(Q% AND &FF):HA
SH%(I%)=(Q% AND &FF00) + NMNE%:GOTO 500

  530DATA -1,269,365,475,66D,77D,879,B61
,C71
```

the chip's logic works differently from the way this program is written.

The idea of hashing is that the subscript for an array or the index to a record in a file is generated by the data itself. In practice this can be a complicated process for open-ended data input because an index number has to be generated from whatever is read in. Unless you define a very large hash table, which will have many empty slots, different input data can generate the same index number, which has to be dealt by the program.

However, in the case of the 6502 disassembler a very simple situation exists, because a maximum of 256 index numbers can be generated, that is, all the possible values derived from reading a single byte. All that is required, therefore, is a singly dimensioned array of 256 words, subscripted 0 to 255. In the program this is called Hash%.

The data for the disassembler is built up in four separate sections:

MNE$ — A long string containing all the 6502 mnemonics in alphabetical order, separated by a space.

MOTYPE$ — This dimensioned string array contains the 13 formats for display of the 6502 addressing modes.

NBYTES — An array of 13 words giving the number of bytes for each addressing mode, that is one, two or three.

HASH% — Dimensioned at 255, contains information for each valid 6502 code, Indexed by code number; otherwise contains zero.

The data for building up the Hash% array is structured in the following manner. If a negative number is read, this is taken as the position of the mnemonic in alphabetical order, starting from 1, assigned to MNE% in line 500. If a – sign is not found, a three-digit hexadecimal number is assumed, the first digit of which, 1 to D, is decoded as the addressing mode, while the second and third hex digits taken together are the 6502 instruction code, and form the subscript to the Hash% array, calculated in Line 520. The Eval function is used in the program to interpret the hexadecimal number: if Q$ is the hex number read from the Data list, the decimal equivalent is given by

Q% = EVAL("&" + Q$)

The word saved in the Hash% array is built up from the numerical value of the mnemonic position, determined by the negative number previously read, and the addressing mode read from the hexadecimal numbers following. In the Data list, the number of hexadecimal numbers ranges from one for implied instructions such as NOP, INX, etc., to eight for ADC, AND, etc.

Once the disassembler data is set up, the rest of the program is quite straightforward. After enquiring if you want a colour-coded list, you are asked to enter the hex values of the Start and End memory locations for the disassembly, the Start number corresponding to the program counter. Checks for valid entry are, of course, made before the listing commences. Lines 1050 to 1080 show the colour coding if this is requested.

Peeks and loops

The listing loop starts at line 1100, with a Repeat-Until construct. This line reads the next byte from memory with ?PC%, the BBC equivalent to Peek, and this forms the subscript for the Hash% array. The number in Hash% is retrieved, with

B% = HASH%(Q%)

and decoded to give the mnemonic number and addressing mode, the converse of the process used to set up Hash%. PCGet%(1) retains the instruction byte.

If the code is invalid — where, for example, a text string is being read — B% will be zero. Line 1110 deals with this situation. However, if it is valid, line 1120 decodes B%, giving the mnemonic index,

(continued on next page)

```
  540DATA -2,229,325,435,62D,73D,839,B21
,C31
  550DATA -3,10A,306,416,60E,71E
  560DATA -4,A90,-5,AB0,-6,AF0
  570DATA -7,324,62C
  580DATA -8,A30,-9,AD0,-10,A10
  590DATA -11,900
  600DATA -12,A50,-13,A70
  610DATA -14,918,-15,9D8,-16,958,-17,9B
8
  620DATA -18,2C9,3C5,4D5,6CD,7DD,8D9,BC
1,CD1
  630DATA -19,2E0,3E4,6EC
  640DATA -20,2C0,3C4,6CC
  650DATA -21,3C6,4D6,6CE,7DE
  660DATA -22,9CA,-23,988
  670DATA -24,249,345,455,64D,75D,859,B4
1,C51
  680DATA -25,3E6,4F6,6EE,7FE
  690DATA -26,9E8,-27,9C8
  700DATA -28,64C,D6C
  710DATA -29,620
  720DATA -30,2A9,3A5,4B5,6AD,7BD,8B9,BA
1,CB1
  730DATA -31,2A2,3A6,5B6,6AE,8BE
  740DATA -32,2A0,3A4,4B4,6AC,7BC
  750DATA -33,14A,346,456,64E,75E
  760DATA -34,9EA
  770DATA -35,209,305,415,60D,71D,819,B0
1,C11
  780DATA -36,948,-37,908,-38,968,-39,92
8
  790DATA -40,12A,326,436,62E,73E
  800DATA -41,16A,366,476,66E,67E
  810DATA -42,940,-43,960
  820DATA -44,2E9,3E5,4F5,6ED,7FD,8F9,BE
1,CF1
  830DATA -45,938,-46,9F8,-47,978
  840DATA -48,385,495,68D,79D,899,B81,C9
1
  850DATA -49,386,596,68E
  860DATA -50,384,494,68C
  870DATA -51,9AA,-52,9A8,-53,998,-54,9B
A,-55,98A,-56,99A
  880 ON ERROR OFF
  890 CLS:PRINT TAB(7,2);CHR$141;"6 5 0
2  Disassembler":PRINTTAB(7,3);CHR$141;"
6 5 0 2  Disassembler";:PRINT TAB(5,5);"
Do you want Colour codes ?";:PROCYN:CFLA
G=Y%
  900 ON ERROR GOTO 1020
  910 PRINT TAB(30,8);"       ":PRINT TAB
(30,10);"       "
  920 PRINT TAB(5,10);"Enter END to stop
      ";
  930 PRINT TAB(5,8);:INPUT "Disassemble
 from (Hex.) )"Q$
  940 PRINT TAB(0,14);STRING$(39," ");
  950 IF Q$="END" THEN PRINTTAB(0,14);"E
nd of run:  ";NLINES;"  lines listed":PR
INT TAB(0,16);:PROCTIME:END
  960 PC%=EVAL("&"+Q$)
  970  PRINT TAB(5,10);:INPUT "
   to   (Hex.) )"Q$
  980 PCEND%=EVAL("&"+Q$)
  990 IF PC%>PCEND% THEN PRINT CHR$(7);:
PRINT TAB(0,14);CHR$133;"Start address h
igher than end address": GOTO 910
 1000 ON ERROR GOTO 890
 1010 GOTO 1030
 1020 PRINT CHR$(7);:PRINT TAB(5,14);CHR
$(131);"Bad Hex. entry: start again":GOT
O 910
 1030 PRINT TAB(7,12);"When listing use
:-";TAB(2,14);"SPACE BAR to Pause: ESCAP
E to Stop"
 1040 IF CFLAG=0 GOTO 1090
 1050 PRINT TAB(7,16);"Colour codes are:
"
 1060 PRINT TAB(6,18);CHR$130;"Branches
and Jumps"
```

(listing continued on next page)

(continued from previous page)

MNE%, and the mode index, MoIndex%.

The variable MoShow% has eight bytes allocated to it by a Dim statement, without parentheses, in line 60. In line 1120 the format for the mode is assigned to it with the statement

$MOSHOW% = MOTYPE$(MOINDEX%)

which will be modified later.

Branching out

Lines 1130 to 1150 deal with the branch instruction set, reading the next byte to get the branch range, and then calculating the destination address from the current program counter and the branch offset. This is more meaningful than simply displaying as

B.. + 15 or -23

Line 1180 deals with all the other situations where one or two following bytes have to be read in. ProCnum is the procedure that inserts the instruction address into MoShow%. Line 1190 retrieves the mnemonic, and at line 1200 ProChex prints the program counter as a four-digit hex number, and displays the hex code, using ProCode for formatting. Lines 1220 to 1240 put in the colour coding if requested.

The rest of the disassembled line is printed in Line 1250, which also increments the program counter PC%. Finally ProcASCII puts in the printable equivalent of the code. Line 1260 allows the program to be halted by pressing any key except Escape which causes the program to go back to ask for a new listing.

ProcNum at lines 1290 to 1340 modifies MoShow% by inserting the ASCII characters representing the hex instruction address. ProcHex at lines 1370 to 1430 shows how the four-digit hex number is printed with leading zeros, the hex digit being output with the Print ~N% format. ProcASCII at lines 1490 to 1520 displays the printable code, but if the byte is outside the range of ASCII characters a "." is displayed. This part of the display shows any text messages within the disassembled code. Try starting the listing at &0E00 to see what Basic looks like, but ignore the mnemonics.

A byte of code

The disassembled listing is quite conventional, showing the program address as four hex digits, the hex code as one, two or three bytes, the 6502 mnemonic, and the instruction address, if any, in the appropriate addressing mode, followed by the ASCII equivalent of the code. Any invalid code, usually manifested when an area of text information is being accessed, is displayed as ???. A little refinement for the BBC Micro, which is very simple to implement, consists of showing all branches and jumps in green, JSRs and RTSs in yellow, and errors in red.

The listing scrolls up rather quickly, at nine lines per second. It can be halted at any time by pressing the space bar, and resumed by pressing it again. To abort a listing press Escape. The colour coding of branches and JSRs is helpful as they are highlighted on display.

No particular effort has been made to diminish the size of the program as listed, as there are at least 5,000 free bytes when the program is loaded in mode 7. Space can, of course, be saved by omitting remarks, and a further 512 bytes could be saved by juggling with the Hash% array. Each BBC word occupies four bytes, while the information stored in Hash% corresponds to two bytes only, so each word in Hash% could have information on 6502 codes. This development would complicate the logic of the program and make it run a little slower, but readers are welcome to experiment. Even better would be to rewrite everything in machine code, but this hardly seems necessary as the program runs quite fast enough in Basic.

(listing continued from previous page)

```
 1070 PRINT TAB(6,19);CHR$131;"JSR's and
 RTS's"
 1080 PRINT TAB(6,20);CHR$129;"Invalid c
odes"
 1090 PRINTTAB(1,22);CHR$131;"Press";CHR
$136;"SPACE BAR";CHR$137;"to continue":X
=GET:CLS
 1100 REPEAT  Q%=?PC%:B%=HASH%(Q%):PCGET
%(1)=Q%
 1110 IF B%=0 THEN $MOSHOW%="        ":M$
="???":NBYTE%=1:MOINDEX%=0:GOTO 1200
 1120NMNE%=(B% AND &FF):MOINDEX%=B% DIV
256:$MOSHOW%=MOTYPE$(MOINDEX%):NBYTE%=NB
YTES(MOINDEX%)
 1130 IF MOINDEX%<>10 GOTO 1160
 1140 K%=?(PC%+1):PCGET%(2)=K%:IF K%>127
 THEN K%=K%-256
 1150 PROCNUM(PC%+K%+2):GOTO 1190
 1160 IF NBYTE%=1 GOTO 1190 ELSE FOR I%=
2 TO 3:PCGET%(I%)=?(PC%+I%-1):NEXT I%
 1170 REM Display next 1 or 2 bytes
 1180 IF NBYTE%=2 THEN PROCNUM(PCGET%(2)
) ELSE PROCNUM(PCGET%(3)*256 + PCGET%(2)
)
 1190 M$=MID$(MNE$,(NMNE%-1)*4+1,3)
 1200 PROCHEX(PC%):PRINT "  ";:FOR I%=1
TO NBYTE%:PROCODE(PCGET%(I%)):NEXT I%
 1210 IF CFLAG=0 GOTO 1250
 1220 IF MOINDEX%=0 THEN PRINT CHR$129;:
GOTO 1250:REM Errors in Red
 1230 IF MOINDEX%=10 OR M$="JMP" THEN PR
INT CHR$130;:GOTO 1250:REM Branches and
Jumps in Green
 1240 IF M$="JSR" OR M$="RTS" THEN PRINT
 CHR$131;:GOTO 1250:REM Subroutine calls
 in Yellow
 1250 PRINT TAB(20);M$;" ";$MOSHOW%;:PRO
CASCII::PC%=PC%+NBYTE%:NLINES=NLINES+1
 1260 X=INKEY(0):IF X=-1 GOTO 1270 ELSE
X=GET
 1270 UNTIL PC%>=PCEND%
 1280 PRINT'"      RETURN to continue":X=
GET:GOTO 890
 1290 DEF PROCNUM(N%):REM Insert Hex num
ber into mode display
 1300 NN%=N%
 1310 N$="":N1=INSTR($MOSHOW%,".."):N2=I
NSTR($MOSHOW%,"....")
 1320 IF N2=0 GOTO 1340
 1330 FOR I%=N2+2 TO N2-1 STEP -1:Z%=(NN
% AND &F):Z%=Z%+48-7*(Z%>9):MOSHOW%?I%=Z
%:NN%=NN%/16:NEXT I%:ENDPROC
 1340 FOR I%=N1 TO N1-1 STEP -1:Z%=(NN%
AND &F):Z%=Z%+48-7*(Z%>9):MOSHOW%?I%=Z%:
NN%=NN%/16:NEXT I%:ENDPROC
 1350 DEF PROCYN
 1360 Y%=0:X$=GET$:IF X$="Y" OR X$="y" T
HEN Y%=1:ENDPROC ELSE IF X$="N" OR X$="n
" THEN ENDPROC ELSE GOTO 1360
 1370 DEF PROCHEX(N%):REM Print Program
Counter in Hex
 1380 PRINT TAB(5);"&";
 1390 IF N%>&FFF GOTO 1430
 1400 IF N%<=&FFF THEN PRINT "0";
 1410 IF N%<=&FF THEN PRINT "0";
 1420 IF N%<=&F THEN PRINT"0";
 1430 PRINT~N%;:ENDPROC
 1440 DEF PROCODE(N%)
 1450 IF N%<=&F THEN PRINT "0";
 1460 PRINT ~N%;:ENDPROC
 1470 DEF PROCTIME
 1480 T=TIME-TSTART%:PRINT "Time was  ";
(T DIV 3600000) MOD 12;" hrs ";(T DIV 600
00)MOD 60;" mins ";(T DIV 100)MOD 60;" se
cs":ENDPROC
 1490 DEF PROCASCII
 1500 PRINT CHR$135;TAB(32);"'";
 1510 FOR I%=1 TO NBYTE%:Q%=PCGET%(I%):I
F Q%>=&20 AND Q%<&7F THEN PRINTCHR$Q%; E
LSE PRINT".";
 1520 NEXT I%:PRINT"'":ENDPROC
```

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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.

We can accept material for the Pet, Vic and Sharp MZ-80K on cassette, and material for the larger machines can be sent on IBM-format 8in. floppy discs.

Security codes

THE PROGRAM Security Codes by Gary Nugent of Dublin was designed to keep prying eyes away from private or confidential files. It is used with programs which run automatically upon loading. A five-digit alphanumeric code is entered. If the code matches that stored within the program, the main file/program is run. If the code does not match then the whole program is destroyed. Incidentally, RAMtop is reset to 32768, that is address 16389 contains the value 128. So if you have any machine-code routines above RAMtop, these also will be destroyed.

The routine is written entirely in machine code, being 207 bytes long. It should be placed in a line 1 Rem statement, with 207 Xs after the Rem, using any hex loader. Once the program is entered into the Rem statement it should not be edited. This is because the listing contains some hidden bytes which will be lost if the line is edited, and consequently the program will not work.

Addresses 16514 to 16518 hold the code, each character of which being Poked into these addresses. Addresses 16519 to 16523 hold the code you input when the main program is loaded. The routine is called by

```
RAND USR 16609.
```

It is used in the following way:

```
1 REM (containing machine code routine)
        :
        :
(main program)
        :
        :
9000 SAVE "X"
9010 RAND USR 16609
9020 CLS
9030 RUN
```

When a program is loaded, the code is entered one character at a time, without the need to press Newline after each character. Keys should not be held down too long or the key will repeat, causing an incorrect entry code. If you find that you

(continued on page 145)

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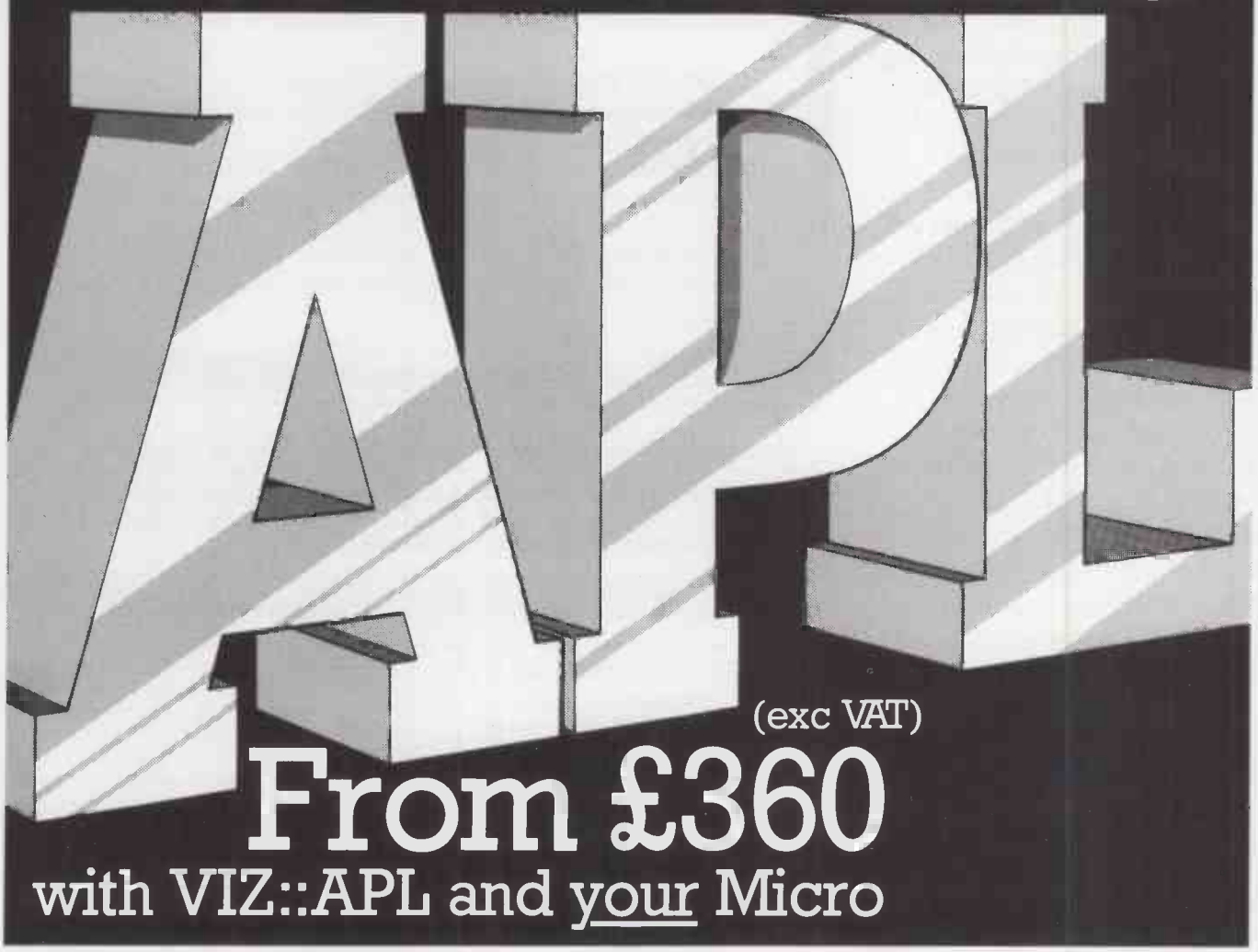

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(continued from page 141)

cannot enter the entry code fast enough — that is, keys repeat — try altering the pause between keystrokes by Poking 16646 with a value between 0 and 255. The larger the value the longer the pause.

One word of warning though: do not forget the codes you use. If you do you will not be able to gain access to the file/program. Break has no effect on machine-code programs.

Security codes.

```
** (C) GARY NUGENT **

"SECURITY CODES" HEX DUMP:

00  00  00  00  00  00  00  00
00  00  35  31  2A  26  36  2A
00  2A  33  39  2A  37  00  38
2A  26  3A  37  2E  39  3E  00
28  34  20  2A  0E  FF  00  85
AE  B3  A8  B4  B7  B7  AA  A8
B9  80  B8  AA  A8  BA  B7  AE
B9  BE  80  A8  B4  A9  AA  05
FF  35  37  34  2C  37  26  32
00  29  2A  38  39  37  3A  28
39  00  3E  33  00  1F  00  38
2A  28  34  33  29  38  FF  CD
49  41  11  8C  40  CD  40  41
3E  05  01  87  40  F5  C5  CD
B8  02  44  4D  51  14  3E  00
26  F5  CD  BD  07  7E  C1  02
03  C5  01  00  0C  08  78  81
20  F6  C1  F1  3D  20  DE  11
82  40  21  87  40  06  05  1A
BE  20  05  13  23  10  F8  C9
CD  49  41  11  A6  40  CD  40
41  11  28  00  19  11  C3  40
CD  40  41  01  FF  FF  05  78
81  20  F6  CD  00  00  1A  FE
FF  C8  77  13  23  18  F7  2A
0C  40  11  4D  01  19  C9

CALL WITH "RAND USR 16609"
```

Graph plotter.

```
  1 REM GRAPH PLOTTER
  2 REM J LOWE MAY 82
  3 REM **********
 10 IF INKEY$="" THEN GOTO 10
 11 IF INKEY$="S" THEN STOP
 12 IF INKEY$="C" THEN GOSUB 20
00
 15 CLS
 19 PRINT "EQUATION OF X?"
 20 INPUT A$
 30 PRINT "MIN. X VALUE?"
 40 INPUT XMIN
 50 PRINT "MAX. X VALUE?"
 60 INPUT XMAX
 70 PRINT "NO. POINTS?"
 80 INPUT NP
100 LET YMIN=10E10
110 LET YMAX=-10E10
120 LET XR=ABS (XMAX-XMIN)
130 FOR X=XMIN TO XMAX STEP XR/
NP
135 IF X=0 THEN NEXT X
140 LET YC=VAL A$
150 IF YC>YMAX THEN LET YMAX=YC
160 IF YC<YMIN THEN LET YMIN=YC
170 NEXT X
180 LET YR=ABS (YMAX-YMIN)
200 LET XO=ABS (XMIN)*63/XR*(XM
IN<0 AND XMAX>0)+63*(XMIN<0 AND
XMAX<0)
210 LET YO=ABS (YMIN)*43/YR*(YM
IN<0 AND YMAX>0)+43*(YMIN<0 AND
YMAX<0)
220 PRINT "PLOT OVER RANGE OR S
P. POINTS?"
230 PRINT "(""R"" OR ""P"")"
240 INPUT B$
245 CLS
250 IF B$="R" THEN GOTO 280
260 IF B$="P" THEN GOTO 500
270 GOTO 240
280 GOSUB 1000
290 FOR P=XMIN TO XMAX STEP XR/
NP
293 IF P=0 THEN NEXT P
294 LET X=P
295 LET Y=VAL A$
300 LET X=(P-XMIN)*63/XR
310 LET Y=(Y-YMIN)*43/YR
320 PLOT X,Y
330 NEXT P
340 GOTO 10
500 GOSUB 1000
510 FOR N=1 TO NP
520 INPUT X
530 LET Y=VAL A$
540 PLOT (X-XMIN)*63/XR,(Y-YMIN
)*43/YR
550 NEXT N
560 GOTO 10
1000 FOR N=0 TO 43
1010 PLOT XO,N
1020 NEXT N
1030 FOR N=0 TO 63
1040 PLOT N,YO
1050 NEXT N
1060 RETURN
2000 LPRINT "EQUATION OF :"
2010 LPRINT "Y=";A$
2020 LPRINT "FOR X=";XMIN;" TO
 ";XMAX
2030 LPRINT "(";NP;" POINTS)"
2040 LPRINT
2050 COPY
2060 RETURN
```

Graph plotter

THE MAIN DISADVANTAGES suffered by the graph-plotting routines I have seen for the ZX-81 are that the axes and scale are fixed in the program thus making them inflexible and not utilising screen space to the full, writes Jason Lowe of Hyndburn, Lancashire.

The program listed, after accepting the equation to be plotted, the minimum and maximum values of X and the number of desired points, will first adjust the position of the axes to suit the spread of points — negative and positive values of X and Y. You will then be asked if you want to intput the values of X individually or if the computer is to plot the graph over the range specified.

The points are then scaled to fit on to the screen and axes and plotted. After plotting another input is awaited — pressing "C" will produce hard copy from the printer, "S" will stop the program and any other key will clear the screen to start the next cycle.

This removes the chore of calculating scale factors and constants for each equation to be plotted and makes experimentation with different functions fun.

Lines 15-80 accept the input for initlal data.

100-210 position the axes — XO is the X origin, YO the Y origin.

220-270 directs the program to the appropriate plotting routine

290-340 plots the whole rangeof X values

500-560 plots single points specified by the user

1000-1060 draws the axes

2000-2060 handles output to the printer. The origins are set at zero unless minimum values of X or Y are negative in which case the origin is positioned according to the ratio of the negative range to the whole range — lines 200 and 210. Take care of this.

Lines 135 and 293 will skip an X value if it is zero so that, for example, if Y = 1/X is the equation an error code is not returned.

Alphabetical list

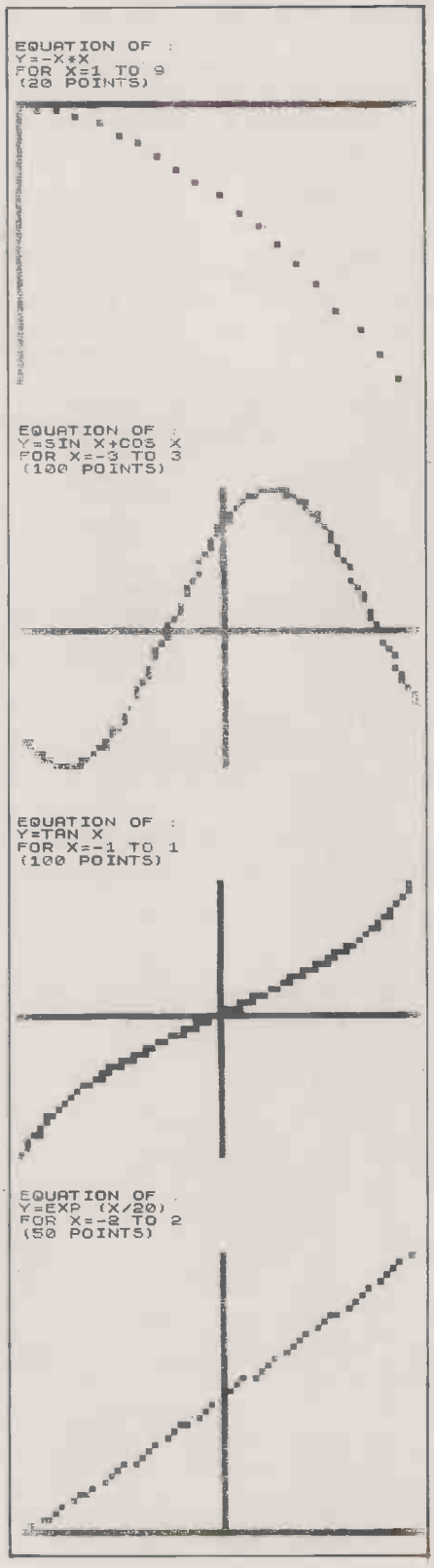
THIS PROGRAM by John Loncaster of Hornsea, East Yorkshire is designed to enable a list of items, together with two sets of figures — the amount and cost of each item — to be entered in any order, sorted into alphabetical order, listed on the screen and altered. It runs on a ZX-81 with 16K RAM.

The program as written allows for a list of up to 60 items, printed 20 at a time on the screen, the remaining lines being required for operating instructions, and with easy access back and forth. The names of the items can contain up to 15 characters, including spaces. In fact, by amendment of the arrays in lines 13, 15, 17, 19 and 21 the capacity can be increased up to 300 items.

Also of course the maximum length of the item names can be increased or decreased by altering the figure 15 in the string array at line 13. If this figure is increased, then it will decrease the total number of items which could be entered to something less than 300. Also it is important to ensure that each item with its attendant figures does not occupy more than one line when printed on the screen, otherwise the program would have to be modified to print less than 20 items at a time.

To ensure that a list entered and stored on tape is not deleted when the program is loaded, Save "Alphabetical Listing" is

(continued on next page)



(continued from previous page)

provided in line 150 and line 151 then directs the computer to go to line 132 to print out the existing list.

If, however, a list of items has not yet been entered, then the code 2/133 will appear. The list can then be commenced by using the command Run. This will then ask you to enter the number of items you want to put initially in the list. This requires the Input Z in line 24; Z is an important number throughout the program, because it keeps track of the amount of items in the list and is automatically amended whenever an item is added or deleted.

However, while it is necessary to enter some number for Z at the commencement, it does not matter if you subsequently find that you have entered too large or too small a number. If you have entered just the right number, say 30, then as soon as you have entered 30 items the screen will blank — assuming, as the program is written, that a ZX-81 is in East mode — for some time as the computer gets busily down to the task of sorting the list into alphabetical order. It will then display the first 20 items.

However if you allowed too many when entering Z, and you find, say, that you have only 25 items to list instead of 30, then after entering the 25 items, press Newline by itself when the next item is called for: Z is automatically amended to 25, and the computer starts sorting.

On the other hand, if you find you have more than 30 items, then after entering the initial 30 and allowing the computer to sort and display you can add as many as you like (up to 60, or whatever the Arrays have been set at) by using the "Add" operation. Items can only be added one at a time and the computer will sort and display after each addition. Again Z is automatically amended.

Likewise, having entered your initial complete list, you can not only add to it, but also substitute one item for another, or delete an item. Remember that the larger the number of items entered, the longer the time it will take the computer to sort.

Once the list is sorted the first page of 20 items will be displayed on the screen. To move forward to the next page press 5 and Newline, and then Cont and Newline. To move back to page 1, press 4 and Newline.

When considering what length of string to allow in the string array at line 13 it is necessary to ensure that it allows sufficient room for the maximum length of name (including any spaces) of any item. It does not of course matter if you allow more than sufficient for the longest name. This means that most, if not all, the names of items are shorter than the length allowed in the string array. This would therefore cause the computer to print a lot of spaces at the end of each item name before printing the cost. To prevent this the array L is used to measure and store the length of each name or string as it is entered. Then in the list-printing section — lines 134 and 135 — the computer is instructed to print only up to the length of each name plus one, for a space before the £ sign.

As it stands this program simply lists items in alphabetical order, together with the amount and cost of each item. However it can readily be adapted for various different uses. For example, names and addresses and telephone numbers; contents of a freezer; Christmas card list — linked with ZX Printer to address your cards. Likewise it can, as I have done, be included as a subroutine in some calculating program — for example to list a portfolio of investments, and then provide valuations.

Alphabetical list.

```
  10 REM "ALPHABETICAL LISTING"
  20 REM BY J.M. LONCASTER. JAN
     1982
  30 REM TO SAVE GOTO 1370
  40 DIM A$(60,15)
  50 REM A$ PRRAY CONTAINS THE
     ITEMS
  60 DIM A(60)
  70 REM A ARRAY CONTAINS AMOUNT
  80 DIM C(60)
  90 REM C PRRAY CONTAINS COST
 100 DIM N(60)
 110 REM N   NUMBERS THE ITEMS
 120 DIM L(60)
 130 REM L MEASURES LENGTH OF A$
 140 PRINT "HOW MANY ITEMS DO YO
U WISH TO   ENTER INITIALLY ?"
 150 INPUT Z
 160 REM Z KEEPS TRACK OF NUMBER
     OF ITEMS ENTERED AND
     CONTROLS LOOPS
 170 CLS
 180 LET N1=0
 190 FOR H=1 TO Z
 200 PRINT "ENTER NAME OF ITEM.
IF YOUR LISTIS LESS THAN THE NUM
BER SET      INITIALLY, PRESS NEW
LINE WHEN    YOU HAVE COMPLETED L
IST."
 210 INPUT X$
 220 CLS
 230 IF X$="" THEN LET Z=H-1
 240 IF X$="" THEN GOTO 410
 250 LET L1=LEN X$
 260 PRINT "ENTER AMOUNT OF ITEM
"
 270 INPUT A1
 280 CLS
 290 PRINT "ENTER COST OF ITEM"
 300 INPUT C1
 310 CLS
 320 PRINT N1+1;". ";A1;" ";X$;"
£";C1
 330 LET N1=N1+1
 340 LET A$(H)=X$
 350 LET A(H)=A1
 360 LET C(H)=C1
 370 LET N(H)=N1
 380 LET L(H)=L1
 390 NEXT H
 400 CLS
 410 FOR K=1 TO Z
 420 LET D=0
 430 FOR J=1 TO Z
 440 IF A$(J)<=A$(J+1) THEN GOTO
 580
 450 LET T$=A$(J)
 460 LET A$(J)=A$(J+1)
 470 LET A$(J+1)=T$
 480 LET T1=A(J)
 490 LET A(J)=A(J+1)
 500 LET A(J+1)=T1
 510 LET T2=C(J)
 520 LET C(J)=C(J+1)
 530 LET C(J+1)=T2
 540 LET T3=L(J)
 550 LET L(J)=L(J+1)
 560 LET L(J+1)=T3
 570 LET D=1
 580 NEXT J
 590 IF D=0 THEN GOTO 610
 600 NEXT K
 610 GOTO 1190
 620 PRINT AT 20,0;"ADD 1, SUBST
 2, DELETE 3, RETURN 4, CONT 5 T
HEN CONT"
 640 INPUT Y
 660 IF Y=2 THEN GOTO 860
 670 IF Y=3 THEN GOTO 1040
 680 IF Y=4 THEN GOTO 1190
 690 PRINT AT 20,0;"
 700 PRINT AT 21,0;"ENTER NAME O
F NEW ITEM"
 710 INPUT X$
 720 LET A$(1)=X$
 740 LET L(1)=LEN X$
 745 PRINT AT 21,0;"
 750 PRINT AT 21,0;"ENTER AMOUNT
 OF NEW ITEM"
 760 INPUT A1
 770 LET A(1)=A1
 780 PRINT AT 21,0;"
 790 PRINT AT 21,0;"ENTER COST O
F NEW ITEM"
 800 INPUT C1
 810 LET C(1)=C1
 820 LET N(Z+1)=Z+1
 830 LET Z=Z+1
 850 GOTO 410
 860 PRINT AT 21,0;"
 870 PRINT AT 21,0;"ENTER NUMBER
 OF ITEM TO BE SUBST"
 880 INPUT X
 885 PRINT AT 20,0;"
 890 PRINT AT 21,0;"
 900 PRINT AT 21,0;"ENTER NAME O
F NEW ITEM"
 910 INPUT X$
 920 LET A$(X+1)=X$
 930 PRINT AT 21,0;"
 940 PRINT AT 21,0;"ENTER AMOUNT
 OF NEW ITEM"
 950 INPUT A1
 960 LET A(X+1)=A1
 970 PRINT AT 21,0;"
 980 PRINT AT 21,0;"ENTER COST O
F NEW ITEM"
 990 INPUT C1
1000 LET C(X+1)=C1
1010 LET L(X+1)=LEN X$
1030 GOTO 410
1035 PRINT AT 20,0;"
1040 PRINT AT 20,0;"
1045 PRINT AT 21,0;"
1050 PRINT AT 21,0;"ENTER NUMBER
 OF ITEM TO DELETE"
1060 INPUT Y
1070 LET N(Z)=Z-1
1080 FOR P=(Y+1) TO Z
1090 LET A$(P)=A$(P+1)
1100 LET A(P)=A(P+1)
1110 LET L(P)=L(P+1)
1120 NEXT P
1130 LET Z=Z-1
1140 LET A$(P)=""
1150 LET A(P)=0
1160 LET C(P)=0
1180 GOTO 410
1190 CLS
1200 LET U=1
1210 FOR Q=1 TO Z
1220 IF N(Q)<=9 THEN PRINT " ";N
(Q);". ";A(Q+1);" ";A$(Q+1)(1 TO
 L(Q+1)+1);" £";C(Q+1)
1230 IF N(Q)>=10 THEN PRINT N(Q)
;". ";A(Q+1);" ";A$(Q+1)(1 TO L(
Q+1)+1);" £";C(Q+1)
1240 IF N(Q)=U+20 THEN GOSUB 128
0
1250 NEXT Q
1260 GOTO 620
1270 STOP
1280 PRINT AT 20,0;"
1290 PRINT AT 20,0;"ADD 1, SUBST
 2 DELETE 3, RETURN 4, CONT 5 TH
EN CONT"
1300 INPUT Y
1310 IF Y=1 THEN GOTO 690
1320 IF Y=2 THEN GOTO 860
1330 IF Y=3 THEN GOTO 1040
1340 IF Y=4 THEN GOTO 1190
1350 LET U=U+1
1360 RETURN
1370 SAVE "ALPHABETICAL LISTING"
1380 GOTO 1200
1385 STOP
```

Family tree

MR A N LITTLE asked for a family tree program for the ZX-81 — see March 1982 issue page 45. I have written such a program for a 16K computer, which might be useful to him, writes H A A Cabot.

I have traced my family back to AD1010, which involves 26 generations and around 280 names. This was too much for my computer and I have cut it down to 143 names. I have gone down in a direct line to my father — member number 100, see line 155 in printout section and line 220 in input section.

If you want to spread out from the beginning, lines 220 to 235 Input and 155 to 170 will be omitted. You start by writing all the family names down, generation by generation, and number them. Heir does not mean heir but the following person in the descending line.

I have dimensioned the names of the person to a length of 28, but the names must not be longer than 26. If you want to save memory you dimension to the longest name plus 2. The name of the marriage partner can be the same length as the dimension, but the main person requires a minimum of blank spaces after the name — see search section 100.

Printout section Input. Run enter all information, taking note of the cue. You can enter small cues. If you made a wrong

entry you can correct them at the end of the program: make a note of the wrong entries. If, however, you have made a big mistake, you can get out of the input program by entering a letter, when the computer asks for a figure.

You change the number 1 in line 60 to the number where you went wrong — X stands for the number of descendants, not husbands/wives — and restart the program by entering the Goto 60. On no account use Run or go through the Dim section, for you lose all entries. After entering all information, you can do any corrections as follows: for example, you made a spelling mistake in the name of main person (A$) number 55, you enter, no line number

LET A$(55)=" (enter correct name)".

This way you can correct all entries.

If you want to check a certain entry enter

PRINT A$(55)

no line number. You can also put a little program at the end:

```
500 for N=1 TO X
505 PRINT AT 21,0;A$(N)
510 SCROLL
515 NEXT N
```

Note that I do not use CLS in the Input program, but cover up with blank spaces. While entering you can check your program regularly to see whether the cover-ups are big enough. Do not enter Next N till you are satisfied. Line 105: If the person is not married enter 0.

In my family tree there are no married people without children, but you can include them by inserting

in INPUT 201 IF C(N)=0 THEN GOTO 240
PRINTOUT 261 PRINT AT 9,0;"no children"
262 GOTO 300
240-250 clear the screen
255-300 print out all entries for final check

You can save the program now. To clear the screen for the Printout program, you enter the line numbers followed by Newline. Do not use New, you will lose all the entries. Alternatively you can type the new program over the old, but I always get lost this way.

Search and printout section:

Lines 40-80 speed up the search program about 10 times but can be omitted.
85-100 cut the length of A$ from 28 to the actual length of the name and compares it with the requested name U$3 It shows why A$ has to be at least two spaces longer than the name
110-125 inform you that the name is not found and asks you to re-enter, U$ is used here as in line 30.
130-145 select the type of printout.
150-170 find the father, grandfather, etc. of the requested person.
173-325 and 415-430 print out the generations in turn, starting at the first generation, giving the name of person N, birthday, whether son or daughter, parents, married, children's names and generation.
180-225 print the name of person N in the middle at the top of the screen and underline it.
330-410 give the three different running methods.

(continued on page 149)

Family tree.

```
                RENAUD
                                DIED 1476
SON OF:-
    LOUIS 2
AND M. DE CRAON

MARRIED I. DE ROCHECHOUART

CHILDREN:-
    MARGUERITE 2
    AGNES
    LOUIS 4
    ANTOIN
    FRANCOIS 1
  ■ JACQUES 1
    MARGUERITE 3
    FRANCOISE 1
    JEANNE 5
    ANTOINNE
    ROBERT
          11TH GENERATION
              JACQUES 1
                          CA. 1425
SON OF:-
    RENAUD
AND I. DE ROCHECHOUART

MARRIED M. DE LUXEMBOURG

CHILDREN:-
  ■ CHARLES 1
    PHILIPPE
    CATHERINE 2




          12TH GENERATION
              CHARLES 1
                          CA. 1465
SON OF:-
    JACQUES 1
AND M. DE LUXEMBOURG

MARRIED J. DE ST.GELAIS

CHILDREN:-
    LOUIS 5
  ■ GUY 1
    CATHERINE 3
    JEANNE 6
    CHARLES 2




          13TH GENERATION
```

```
  1 REM "FAMILY TREE"
  2 REM INPUT SECTION
  3 REM M.A.A. CHABOT
  4 REM HEMINGFORD GREY
  5 REM 820.225
 10 LET X=142
 15 DIM A$(X,28)
 20 DIM U$(X,23)
 25 DIM D$(X,10)
 30 DIM S$(X,1)
 35 DIM C(X)
 40 DIM G(X)
 45 DIM H(X)
 50 DIM P(X)
 55 DIM T(X)
 60 FOR N=1 TO X
 65 PRINT AT 18,0;N;AT 20,13;"■
ENE"
 70 INPUT B$
 75 IF LEN B$<=28 THEN GOTO 90
 80 PRINT AT 20,10;" TOO LONG "
 85 GOTO 70
 90 LET A$(N)=B$
 95 PRINT AT 18,4;A$(N);AT 20,1
0;"
                "
100 SCROLL
105 PRINT AT 20,10;" MARRIED   "
110 INPUT B$
115 IF LEN B$<=23 THEN GOTO 130
120 PRINT AT 20,10;" TOO LONG "
125 GOTO 110
130 LET U$(N)=B$
135 PRINT AT 18,4;U$(N);AT 20,1
0;"
    SET"
140 INPUT S$(N)
145 PRINT AT 18,27;S$(N);AT 20,
10;"PRESENT DG."
150 INPUT P(N)
155 PRINT AT 18,29;P(N);AT 20,1
0;"
    LETB  "
160 INPUT D$(N)
165 SCROLL
170 PRINT AT 19,10;"                "
;AT 18,4;D$(N);AT 20,10;"GENERAT
ION"
180 INPUT G(N)
185 PRINT AT 18,15;G(N);AT 20,3
;"
190 IF U$(N,1)="0" THEN GOTO 24
0
195 PRINT AT 20,10;"N CHILDREN"
200 INPUT C(N)
205 PRINT AT 18,18;C(N);AT 20,1
0;" 1ST CHILD "
210 INPUT T(N)
215 PRINT AT 18,22;T(N);AT 20,1
0;"
                "
220 IF N>99 THEN GOTO 240
225 PRINT AT 20,10;"   HEIR    "
230 INPUT H(N)
235 PRINT AT 18,26;H(N);AT 20,1
0;"
                "
240 SCROLL
245 NEXT N
249 REM CLEARING THE SCREEN
250 SLOW
255 FOR S=1 TO 22
260 SCROLL
265 NEXT S
269 REM CHECK LIST
270 FOR N=1 TO X
275 PRINT AT 18,0;N;TAB 4;A$(N)
;TAB 36;U$(N);TAB 27;S$(N);TAB 2
9;P(N);TAB 36;D$(N);" ";G(N);
280 IF U$(N,1)="0" THEN GOTO 30
0
285 PRINT TAB 18;C(N);TAB 21;T(
N);
290 IF N>99 THEN GOTO 300
295 PRINT TAB 25;H(N)
300 FOR S=1 TO 4
305 SCROLL
310 NEXT S
315 NEXT N
```

```
  1 REM "FAMILY TREE"
  2 REM SEARCH/PRINT SECTION
  3 REM M.A.A. CHABOT
  4 REM HEMINGFORD GREY
  5 REM 820.225
 10 SAVE "FAMILY TREE"
```

```
  1 REM "FAMILY TREE"
  2 REM SEARCH/PRINT SECTION
  3 REM M.A.A. CHABOT
  4 REM HEMINGFORD GREY
  5 REM 820.225
 10 SAVE "FAMILY TREE"
 15 REM SEARCH SECTION
 20 PRINT "ENTER NAME TO BE FOU
ND"
 30 INPUT U$
 35 FOR N=1 TO X
 40 IF A$(N,1)<>U$(1) THEN GOTO
105
 45 IF A$(N,2)<>U$(2) THEN GOTO
105
 50 IF A$(N,3)<>U$(3) THEN GOTO
105
 55 IF LEN U$<4 THEN GOTO 85
 60 IF A$(N,4)<>U$(4) THEN GOTO
105
 65 IF LEN U$<5 THEN GOTO 85
 70 IF A$(N,5)<>U$(5) THEN GOTO
105
 75 IF LEN U$<6 THEN GOTO 85
 80 IF A$(N,6)<>U$(6) THEN GOTO
105
 85 FOR L=1 TO 28
 90 IF A$(N,L)=" " AND A$(N,L+1
)=" " THEN GOTO 100
 95 NEXT L
100 IF U$=A$(N, TO L-1) THEN GO
TO 130
105 NEXT N
110 PRINT U$;" NOT FOUND.";TAB
32;"IF YOU WANT TO TRY AGAIN, RE
-EN-TER NAME, IF NOT ENTER ""0""
"
115 INPUT U$
120 IF U$="0" THEN STOP
125 GOTO 35

130 REM PRINT SECTION
135 PRINT AT 10,0;"STATE WHICH
RUNNING METHOD:-";AT 12,2;"0) MA
NUALLY";TAB 8;"1) AUTOMATIC ( SL
OW )";TAB 8;"2)                ( FAST
)"
140 INPUT A
145 CLS
150 LET J=0
155 IF N=100 THEN GOTO 175
160 LET M(P(N))=N
165 LET M=P(N)
170 GOTO 155
175 LET M=1
180 FOR D=1 TO 28
185 IF A$(N,D)=" " AND A$(N,D+1
)=" " THEN GOTO 195
190 NEXT D
195 LET C$=A$(N, TO D-1)
200 LET CA=LEN C$
205 LET CB=INT (32-CA)/2-1
210 PRINT AT 0,CB;C$
215 FOR L=1 TO CA
220 PRINT AT 1,CB-1+L;"▬";
225 NEXT L
230 PRINT AT 2,22;D$(N)
235 IF S$(N)="M" THEN PRINT AT
3,0;"SON OF:-"
240 IF S$(N)="F" THEN PRINT AT
3,0;"DAUGHTER OF:-"
245 IF N=1 THEN PRINT AT 4,4;"P
ARENTS NOT KNOWN"
250 IF N>1 THEN PRINT AT 4,4;A$
(P(N));TAB 32;"AND ";U$(P(N))
255 IF U$(N,1)="0" THEN GOTO 30
0
260 PRINT AT 7,0;"MARRIED ";U$(
N)
265 PRINT AT 9,0;"CHILD";
270 IF C(N)>1 THEN PRINT "REN";
275 PRINT ":-"
280 FOR B=T(N) TO T(N)+C(N)-1
285 IF B=H(N) THEN PRINT TAB 2;
"■";
290 PRINT TAB 4;A$(B)
295 NEXT B
300 PRINT AT 21,8;G(N);
305 IF G(N)=1 THEN PRINT "ST";
310 IF G(N)=2 THEN PRINT "ND";
315 IF G(N)=3 THEN PRINT "RD";
320 IF G(N)>3 THEN PRINT "TH";
325 PRINT " GENERATION"

330 IF A THEN GOTO 355
335 SLOW
340 PRINT AT 21,22;"PRESS ■ ■"
345 IF INKEY$="" THEN GOTO 345
350 GOTO 375
355 IF A<>1 THEN GOTO 390
360 SLOW
365 FOR W=1 TO 50
370 NEXT W
375 FOR S=1 TO 22
380 SCROLL
385 NEXT S
390 IF A<>2 THEN GOTO 415
395 FAST
400 PAUSE 500
405 POKE 16437,255
410 CLS

415 IF N=Y THEN GOTO 435
420 LET N=M(N)
425 SLOW
430 GOTO 180

435 PRINT AT 12,0;"THIS IS THE
END. ENTER:-";TAB 10;"0) STOP ";
TAB 10;"1) RE-RUN"
440 INPUT I
441 GOTO 442+I
442 STOP
443 CLS
444 GOTO 20
```

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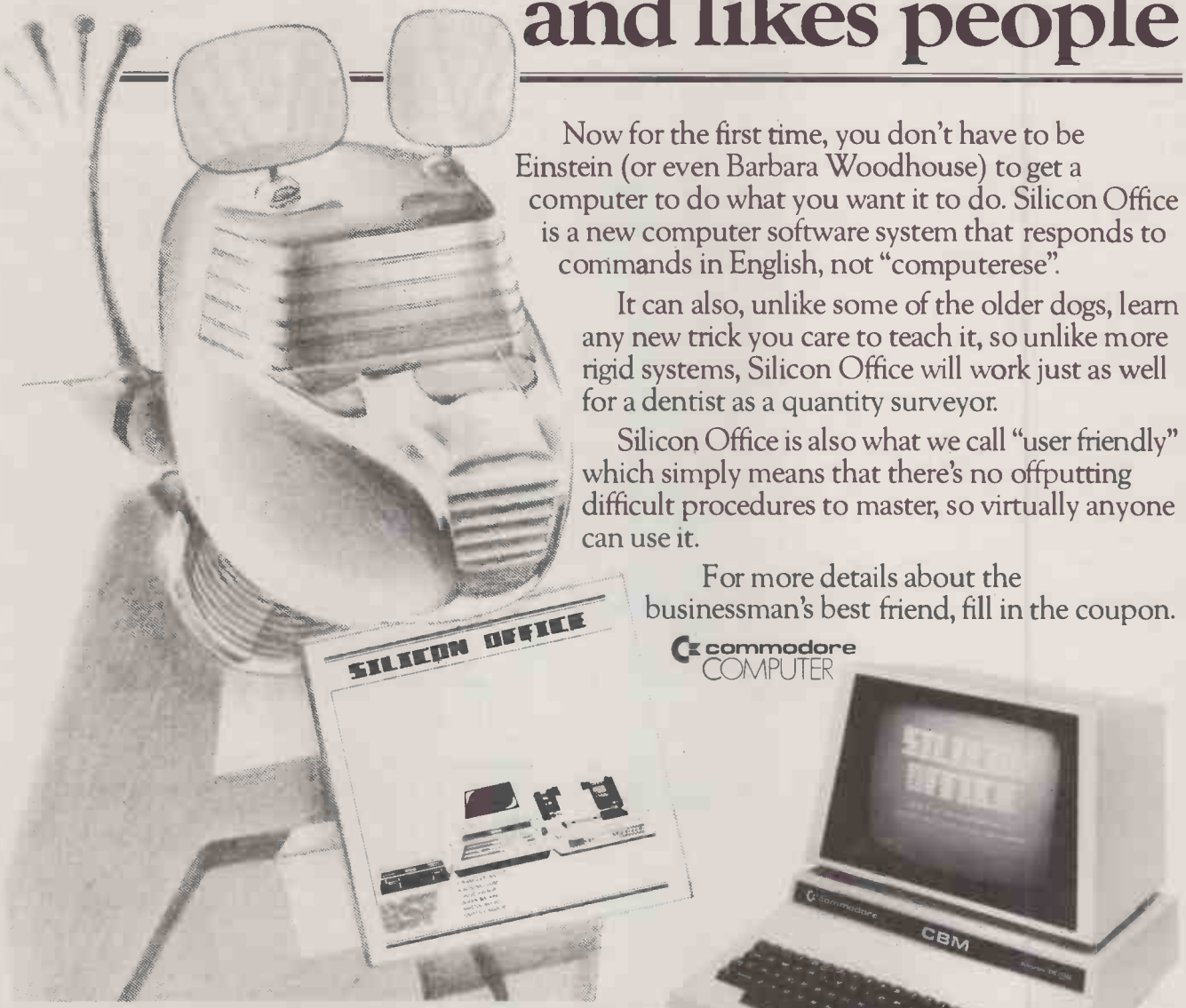

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● Circle No. 195

Car diagnosis — sample run.

```
ZX81 CAR DIAGNOSIS PROGRAM

PRESS THE REQUIRED NUMBER,
 DEPENDING ON WHERE THE FAULT
 LIES.

1.ENGINE/STARTER
2.ELECTRICAL/WARNING LIGHTS
3.BRAKES
4.STEERING
5.GEARS/CLUTCH
6.SUSPENSION

ZX81 CAR DIAGNOSIS
THE FOLLOWING MAY BE WRONG...

1.FLAT BATTERY
2.LOOSE OR DIRTY BATTERY
  CONNECTIONS
3.STARTER MOTOR PINION NOT
  ENGAGING OR JAMMED
4.SEIZED ENGINE

PRESS NEWLINE TO RUN AGAIN.
```

Main menu.

```
   10 REM ****CAR DIAGNOSIS****
   20 CLS
   30 PRINT
   35 PRINT
   40 PRINT ,,"  ZX81 CAR DIAGNOS
IS PROGRAM"
   50 PRINT
   60 PRINT ,, "PRESS THE REQUIRED
 NUMBER,"
   65 PRINT " DEPENDING ON WHERE
THE FAULT "
   70 PRINT "  LIES."
  210 PRINT ,,"1.ENGINE/STARTER",
"2.ELECTRICAL/WARNING LIGHTS"
  220 PRINT "3.BRAKES"
  230 PRINT "4.STEERING"
  240 PRINT "5.GEARS/CLUTCH",,"6.
SUSPENSION"
  260 PRINT
  270 PRINT
  300 INPUT A
  310 IF A<1 OR A>6 OR A<>INT A T
HEN GOTO 300
  315 CLS
  320 GOTO A*1000
  500 IF INKEY$<>"Y" AND INKEY$<>
"N" THEN GOTO 500
  510 PRINT ("YES" AND INKEY$="Y"
)+("NO" AND INKEY$="N")
  520 RETURN
```

Engine and starter.

```
1000 REM **ENGINE/STARTER**
1010 PRINT ,,,"DOES THE ENGINE ST
ART ? (Y/N)"
1020 GOSUB 500
1040 IF INKEY$="Y" THEN GOTO 150
0
1050 PRINT ,,,"DOES THE STARTER T
URN ? (Y/N)"
1060 GOSUB 500
1070 IF INKEY$="Y" THEN GOTO 125
0
1080 CLS
1090 PRINT ,,"1.HEADLIGHTS DO NO
T COME ON"
1100 PRINT ,,"2.HEADLIGHTS DIM"
1110 PRINT ,,"3.HEADLIGHTS ARE B
RIGHT"
1120 INPUT A
1130 IF A<1 OR A>3 THEN GOTO 112
0
1135 CLS
1140 IF A=2 THEN GOTO 1190
1145 IF A=3 THEN GOTO 1220
1150 PRINT AT 10,0;"1.FLAT BATTE
RY",,"2.LOOSE OR DIRTY BATTERY
     CONNECTIONS"
1160 GOTO 9000
1190 PRINT AT 10,0;"1.FLAT BATTE
RY",,"2.LOOSE OR DIRTY BATTERY
     CONNECTIONS"
1195 PRINT "3.STARTER MOTOR PINI
ON NOT     ENGAGING OR JAMMED
"
1200 PRINT "4.SEIZED ENGINE"
1210 GOTO 9000
1220 PRINT AT 10,0;"1.LOOSE,DIRT
Y OR DETACHED     CONNECTION
S IN STARTING     CIRCUIT"
1225 PRINT "2.STARTER MOTOR JAMM
ED IN MESH"
1230 PRINT "3.DEFECTIVE STARTER,
STARTER     SOLENIOD OR IGNITI
ON SWITCH"
1240 GOTO 9000
1250 CLS
1260 PRINT AT 10,0;"1.LOOSE,DIRT
Y OR CORRODED     BATTERYTER
MINALS OR ENGINE     EARTH STRA
P."
1270 PRINT "2.DEFECTIVE STARTER
OR STARTER  SOLENOID."
1280 GOTO 9000
```

Electrical system.

```
2000 REM **ELECTRICAL**
2010 CLS
2020 PRINT ,,"DOES IT CONCERN...
"
2030 PRINT ,,"1.WARNING LIGHTS"
2040 PRINT "2.EXTERIOR LIGHTS"
2050 PRINT "3.ALL ELECTRICAL SYS
TEMS"
2060 INPUT A
2070 IF A<1 OR A>3 THEN GOTO 206
0
2080 IF A=2 THEN GOTO 2400
2090 IF A=3 THEN GOTO 2700
2100 CLS
2110 PRINT ,,"1.IGITION WARNING
LIGHT",,"2.OIL PRESSURE WARNING L
IGHT"

2120 INPUT A
2130 IF A<1 AND A>3 THEN GOTO 21
20
2140 IF A=2 THEN GOTO 2200

2145 CLS
2150 PRINT AT 10,0;"1.THE ALTERN
ATOR DRIVE BELT IS     LOOSE OR B
ROKEN"
2160 PRINT "2.A FUSE IS BLOWN"
2170 PRINT ,,"     (THE ALTERNATOR
 IS NOT     CHARGING)"
2180 GOTO 9000
2200 CLS
2210 PRINT AT 10,0;"1.LOW OIL LE
VEL-CHECK DIPSTICK"
2220 PRINT "2.DEFECTIVE OIL PRES
SURE SWITCH"
2230 GOTO 9000

2400 CLS
2410 PRINT ,,"1.MAIN LIGHTS FAUL
TY IN SOME WAY",,"2.INDICATORS D
O NOT WORK"
2420 INPUT A
2430 IF A<1 AND A>2 THEN GOTO 22
0
2440 IF A=2 THEN GOTO 2600
2450 CLS
2460 PRINT ,,"1.BULBS BURN OUT R
EPEATDLY"
2470 PRINT "2.LIGHTS DIM WHEN EN
GINE SPEED     DROPS"
2480 INPUT A
2490 IF A=2 THEN GOTO 2550
2500 CLS
2510 PRINT AT 10,0;"1.FAULTY CON
NECTIONS AT LIGHT     SOCKET"
2520 PRINT "2.OVERLOADED CICIUT"
2530 PRINT "3.ALTERNATOR REGULAT
OR DEFECTIVE"
2540 GOTO 9000
2550 CLS
2560 PRINT AT 10,0;"1.LOOSE OR B
ROKEN ALTERNATOR     DRIVE BELT
"
2570 PRINT "2.LOW BATTERY"
2580 GOTO 9000
2600 CLS
2610 PRINT AT 10,0;"1.FUSE BLOWN
"

2620 PRINT "2.INDICATOR RELAY IN
OPERATIVE"
2630 PRINT "3.DEFECTIVE INICATOR
 SWITCH"
2640 GOTO 9000
2700 CLS
2710 PRINT AT 10,0;"1.FLAT BATTE
RY",,"2.LOOSE OR DIRTY BATTERY
     CONNECTIONS"
2720 PRINT "3.FUSE BLOWN",,"4.FU
SE LINK FROM BATTERY TO MAIN  LO
OM BLOWN"
2730 GOTO 9000
```

Brakes.

```
3000 REM **BRAKES**
3010 CLS
3020 PRINT ,,"1.PEDAL",,"2.NOISE
"
3030 INPUT A
3035 IF A<1 OR A>2 THEN GOTO 303
0
3040 PRINT ,,A
3050 IF A=2 THEN GOTO 3500
3060 PRINT ,,"1.SPONGY FEEL OR E
XCESSIVE     TRAVEL"
3070 PRINT "2.HEAVY PRESSURE"
3080 INPUT A
3090 IF A<1 OR A>2 THEN GOTO 306
0
3100 IF A=2 THEN GOTO 3200
3110 CLS
3120 PRINT AT 10,0;"1.AIR IN SYS
TEM"
3130 PRINT "2.LEAKS IN SYSTEM"
3140 PRINT "3.REAR BRAKE SELF-AD
JUSTING     MECHANISM DEFECTIV
E"
3150 GOTO 9000
3200 CLS
3210 PRINT AT 10,0;"1.WATER ON B
AKE LININGS"
3220 PRINT "2.SEIZED WHEEL CYLIN
DERS"
3230 PRINT "3.SERVO INOPERATIVE"
3240 GOTO 9000
3500 PRINT ,,"1.BRAKES ARE NOISI
ER THAN NORMAL"
3510 PRINT "2.BRAKES JUDDER"
3520 INPUT A
3530 IF A<>1 AND A<>2 THEN GOTO
3520
3540 IF A=2 THEN GOTO 3800
3550 CLS
3560 PRINT AT 10,0;"THE FRONT BR
AKE PADS OR REAR     BRAKE LINING
S HAVE WORN OUT."
3570 GOTO 9000
3800 CLS
3810 PRINT AT 10,0;"1.BADLY WORN
 BRAKE SHOES OR PADS"
3820 PRINT "2.INCORRECT WHEEL BE
ARING     ADJUSTMENT"
3830 PRINT "3.INCORRECTLY ASSEMB
LED BRAKE     PLATE COMPONENTS"
3840 PRINT "4.OIL OR FLUID CONTA
MINATION ON     LININGS"
3850 GOTO 9000
```

Steering.

```
4000 REM **STEERING**
4010 PRINT ,,"1.CAR PULLS TO ONE
 SIDE"
4020 PRINT "2.STEERING HEAVY"
4030 PRINT "3.CAR WANDERS"
4040 IF INKEY$="1" THEN GOTO 420
0
4050 IF INKEY$="2" THEN GOTO 440
0
4060 IF INKEY$="3" THEN GOTO 460
0
4070 GOTO 4040
4200 CLS
4210 PRINT AT 10,0;"1.TYRE PRESS
URES OR UNEVEN TYRE     WEAR"
4220 PRINT "2.BRAKES NEED ATTENT
ION"
4230 PRINT "3.OIL,WATER OR BRAKE
 FLUID ON     LININGS"
4240 PRINT "4.SEIZED WHEEL CYLIN
DERS"
4350 GOTO 9000
4400 CLS
4410 PRINT AT 10,0;"1.TYRE PRESS
URES"
4420 PRINT "2.WHEEL ALIGNMENT"
4430 PRINT "3.STEERING RACK ADJU
STMENT"
4440 GOTO 9000
4500 CLS
4601 PRINT AT 10,0;"1.TYRE PRESS
URES"
4610 PRINT "2.UNEVEN LOADING"
4620 PRINT "3.REAR WHEEL BEARING
 NEEDS     ADJUSTMENT"
4630 GOTO 9000
```

Gears.

```
5000 REM **GEARS**
5010 PRINT ,,"1.DIFFICULTY IN EN
GAGING GEAR"
5020 PRINT "2.CLUTCH SLIPS,(CAR
DOES NOT     ACCELERATE WHEN EN
GINE REVS     INCREASE"
5030 INPUT A
5040 IF A<1 OR A>2 THEN GOTO 502
0
5050 CLS
5060 IF A=2 THEN GOTO 5500
5100 PRINT AT 10,0;"1.IDLE SPEED
 TOO HIGH"
5110 PRINT "2.CLUTCH NEEDS ADJUS
TMENT"
5120 PRINT "3.DEFECTIVE GEAR BOX
 OR CLUTCH."
5130 GOTO 9000
5500 PRINT AT 10,0;"1.CLUTCH NEE
DS ADJUSTMENT"
5510 PRINT "2.OIL ON CLUTCH DISC
 LININGS     REQUIRED"
5520 GOTO 9000
```

Suspension.

```
6000 REM **SUSPENSION**
6010 PRINT ,,"1.CAR VIBRATES WHE
N DRIVING"
6020 PRINT "2.CAR LEANS EXCESSIV
ELY WHEN     CORNERING"
6030 PRINT "3.HARD OR CHOPPY RID
E"
6040 INPUT A
6050 IF A<1 OR A>3 THEN GOTO 604
0
6060 IF A=2 THEN GOTO 6300
6070 IF A=3 THEN GOTO 6600
6080 CLS
6090 PRINT AT 10,0;"1.WHEEL BOLT
S LOOSE"
6100 PRINT "2.WHEELS OUT OF BALA
NCE"
6110 PRINT "3.INOPERATIVE SHOCK
ABSORBERS"
6120 GOTO 9000
6300 CLS
6310 PRINT AT 10,0;"1.EXCESSIVE
LOAD ON ROOF RACK"
6320 PRINT "2.UNEVEN LOADING"
6330 PRINT "3.WEAK/BROKEN SPRING
S"
6340 PRINT "4.DEFECTIVE SHOCK AB
SOBERS"
6350 GOTO 9000
6600 CLS
6610 PRINT AT 10,0;"1.TYRE PRESS
URES"
6620 PRINT "2.DEFECTIVE SHOCK AB
ORBERS"
```

Final results.

```
9000 PRINT
9001 PRINT
9005 PRINT ,,"PRESS NEWLINE TO R
UN AGAIN."
9010 PRINT AT 0,0;
9015 PRINT
9020 PRINT
9027 PRINT
9030 PRINT     ZX81 CAR DIAG
NOSIS
9031 PRINT
9040 PRINT
9050 PRINT " THE FOLLOWING MAY B
E WRONG..."
9060 IF CODE INKEY$<>118 THEN GO
TO 9060
9070 RUN
```

(continued from page 147)

365-400 are pauses and can be altered.
Some input instructions are:
Married — if married enter name or N.N; if not enter 0.
Sex — enter M or F.
Parent number — enter number of parent.
Number of children — enter the number of children.
First child — enter number of oldest child.
Heir — enter number of child, which carries on the "direct" line.

Car diagnosis

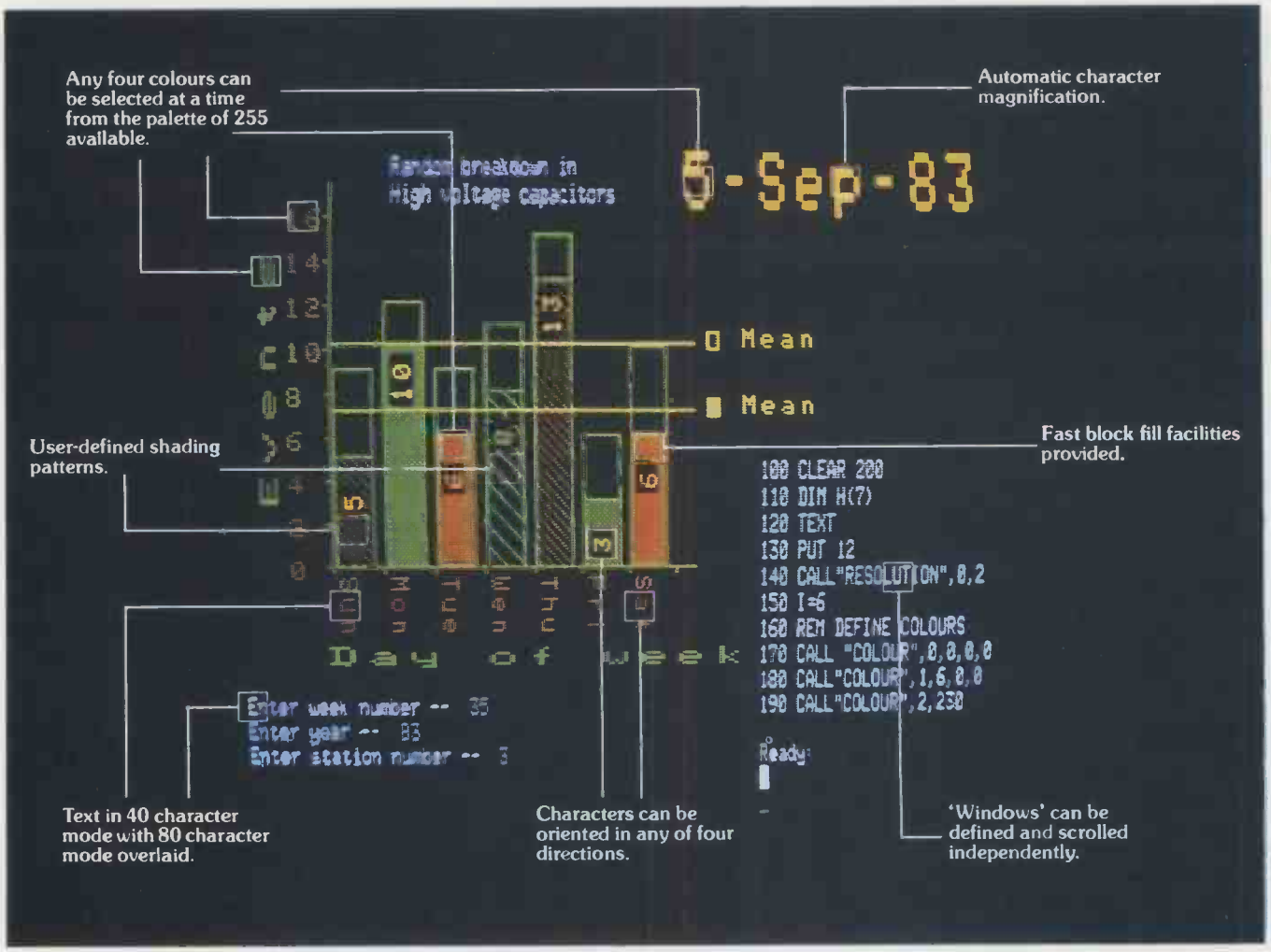
THIS PROGRAM by Geoffrey Harmon of Solihull, West Midlands was written for the 16K Sinclair ZX-81, but can easily be adapted for other computers. The program is menu driven and analyses the possible faults with a car by the user answering questions in order to identify symptons.

Two sample screen displays are shown on sheet number 1, while sheets 2 to 7 go through the various sections of the program. I will provide the program on cassette for £2 for the ZX-81 for people not wishing to type it in who write to me at 38 Heaton Road, Solihull, West Midlands B91 2DX.

In diagnosing the problem to a car, the program goes through a series of menus until enough information is known to tell fault or faults. A list of possible is usually given.

There are six areas, called from the main menu:

- The engine and starter
- The electrical system
- The brakes
- The steering
- The gears and clutch
- The suspension



GRAPHICS MACHINE

A picture may be worth a thousand words but it still tells only half the story about graphics on the 380Z.

For a start, our standard graphics functions include point plotting, line drawing, instant block fill, block copying, offsetting, and Exclusive Or Plotting.

Then there is the important fact that our Level 2 High Resolution Graphics is supported by Basic, Algol, and Fortran. And since it is contained in an additional 16K of RAM, every byte of user memory remains available for applications programs.

It is also worth noting that 380Z graphics are equally effective in monochrome — for 'colour' just read 'shades of grey'. Again there are 255 shades available, and there's also a very useful facility for fading up and down throughout the grey scale.

There are also the special effects — such as moving between graphics 'pages' for pseudo-animation, or the ability to produce 'instant' graphics by drawing them with the colour 'switched' off and then 'switching' on.

Next, not only can 380Z graphics pictures be saved on and retrieved from disc, they can also be output to one of a range of popular dot matrix printers.

Remember, too, that HRG is not a third-party add-on but designed, developed, and supported by Research Machines itself as an integral part of the 380Z.

And finally, we've now implemented GINO. So for the first time this well-established, professional suite of flexible, device-independent graphics software from the CAD Centre is available on a micro.

If you are interested in graphics — for scientific, technical, and industrial research; or in secondary or higher education; or for design, engineering, or control, then you will be interested in the 380Z.

RESEARCH MACHINES
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● **Circle No. 198**

APPLE PIE

by John Harris

Noughts and crosses in 3-D

Once upon a time, I am told — though I certainly can't remember it — the hula-hoop held sway through the classrooms of the land. Subsequently it was marbles. Of late it has been scoopy-loos and the cube. But for a brief space the four-by-four-by-four board reigned supreme, and had there been Apples in those far-off days this implementation from Kieron Leech of Warrington, Cheshire would have kept me happy.

It plays a far better middle game than I ever did, and if it survives the first 10 moves it will probably beat you too. It is coded with a nice attention to detail, and carefully avoids shape tables to play on any high-resolution configuration, disc-based or no, without the need to load machine-code files. The odd-looking lines from 1500 on allow the body of the program to sketch elegant cue- and playing-boards with positions numbered 1 to 64, and one- or two-player selection is built in with the program acting as opponent or checker.

I think a slight juggling of the order in the winning ways table — the first 64 by four codes from line 800, stored in T — would preclude the "forcing win" available at the start of the game, which is the one weak point in its play, and you may find tuning the fighting ability of the program as much fun as actually playing against it.

Noughts and crosses.

```
10  LOMEM: 16384: TEXT : HOME : VTAB
    10: HTAB 5: PRINT "THREE D N
    OUGHTS AND CROSSES": VTAB 20
    : HTAB 3: PRINT "PLEASE WAI
    T WHILE I READ IN DATA"
30  DIM T(76,4),U(64,7),C(76),B(7
    6),K(64,1): FOR P = 1 TO 76:
     FOR I = 1 TO 4: READ T(P,I)
    : NEXT I,P: FOR S = 1 TO 64:
     FOR J = 1 TO 7: READ U(S,J)
    : NEXT J,S
60  FOR I = 1 TO 16: READ K(I,1),
    K(I,0): FOR J = 1 TO 3:K(15 *
    J + I,1) = K((I,1):K(16 * J +
    I,0) = K(I,0) + 40 * J: NEXT
    J,I
70  N = 0: FOR S = 1 TO 76:C(S) =
    N:B(S) = N: NEXT
80  VTAB 20: HTAB 3: PRINT "DO YO
    U WANT TO PLAY THE COMPUTER.
    .?";: GET A$: PRINT A$: IF A
    $ = "Y" THEN PL$(1) = "THE C
    OMPUTER": INPUT "YOUR NAME..
    ?";PL$(2):PL = 1: GOTO 110
100 PL$(1) = "PLAYER 1":PL$(2) =
    "PLAYER 2":PL = 2
110 HOME : HGR :X = 0: HCOLOR= 3
    : GOSUB 1500:X = 140: GOSUB
    1500
120 FOR I = 1 TO 64:X = 140 + K(
    I,1):Y = K(I,0):HI =  INT (I
     / 10):LO = I - HI * 10: IF
    HI ( ) 0 THEN  ON HI GOSUB
    1520,1530,1540,1550,1560,157
    0,1580,1590,1600
130 X = X + 10: ON LO + 1 GOSUB 1
    510,1520,1530,1540,1550,1560
    ,1570,1580,1590,1600: HPLOT
    K(I,1),K(I,0): NEXT
140 IF  RND (1) ( .5 THEN  HTAB
    1: VTAB 21: PRINT PL$(1)" WI
    LL MOVE FIRST": FOR I = 1 TO
    1000: NEXT : GOTO 380
150 HTAB 1: VTAB 21: PRINT PL$(2
    )" WILL MOVE FIRST": FOR I =
    1 TO 1000: NEXT
160 HOME : VTAB 23: HTAB 5: PRINT
    "YOUR MOVE "PL$(2);: INPUT M
    :F =  - 1
170 IF M =  INT (M) AND M ) 0 AND
    M ( 65 THEN 210
180 HTAB 2: VTAB 21: PRINT "ILLE
    GAL:TRY AGAIN" FOR I = 1 TO
    1000: NEXT
190 IF M = 1 THEN 380
200 GOTO 160
210 IF B(M) ( ) 0 THEN  HTAB 2:
     VTAB 21: PRINT "ILLEGAL:SPA
    CE TAKEN:TRY AGAIN": FOR I =
    1 TO 1000: NEXT : GOTO 190
220 X = K(M,1):Y = K(M,0): HTAB 5
    : VTAB 24: PRINT "DO YOU WAN
    T HERE ?";
230 ZZ = 1: HCOLOR= 3
240 IF F =  - 1 THEN  GOSUB 1510
    : GOTO 250
243 IF ZZ = 0 THEN  GOSUB 2010: GOTO
    250
245 GOSUB 2000
250 FOR I = 1 TO 25: IF  PEEK ( -
    16384) ( 128 THEN 280
260 GET A$: IF A$ = "Y" THEN  HCOLOR=
    3: GOTO 300
270 IF A$ = "N" THEN  HCOLOR= 0:
     GOSUB 1610: HCOLOR= 3: HPLOT
    K(M,1),K(M,0): GOTO 190
280 NEXT : IF ZZ = 1 THEN ZZ = 0
    : HCOLOR= 0: GOTO 240
290 GOTO 230
300 X = K(M,1):Y = K(M,0): IF F =
    - 1 THEN  GOSUB 1610: GOTO
    320
310 GOSUB 2000
320 B(M) = F: FOR J = 1 TO 7:P =
    U(M,J): IF P = 0 THEN 360
330 C(P) = C(P) + F: IF C(P) =  -
    4 THEN 460
340 IF C(P) = 4 THEN 420
350 NEXT
360 N = N + 1: IF N = 64 THEN 480

370 IF F = 1 THEN 160
380 F = 1: HOME : IF PL = 1 THEN
     HTAB 5: VTAB 23: PRINT PL$(
    1)" WILL MOVE NOW": GOSUB 50
    0
390 HOME : VTAB 23: HTAB 5: IF P
    L = 2 THEN  PRINT "YOUR MOVE
     "PL$(1);: INPUT M:MO = 1: GOTO
    170
400 HTAB 5: VTAB 23: PRINT "THE
    COMPUTER MOVES AT "M; SPC( 6
    )
410 FOR I = 1 TO 1000: NEXT : GOTO
    300
420 HOME : VTAB 21: PRINT " AND
    "PL$(1)" WINS"
430 PRINT
440 FOR I = 1 TO 3:M1 = T(P,I):M
    2 = T(P,I + 1): HPLOT K(M1,1
    ),K(M1,0) TO K(M2,1),K(M2,0)
    : NEXT : PRINT "DO YOU WANT
    ANOTHER GAME ?";: GET A$: IF
    A$ = "N" THEN  TEXT : HOME :
     END
450 TEXT : HOME : GOTO 70
460 HOME : VTAB 21: PRINT "CONGR
    ATULATIONS , "PL$(2)" WON !"

470 GOTO 430
480 HOME : VTAB 21: PRINT "THE G
    AME IS A DRAW"
490 GOTO 430
500 IF N ( 5 THEN 550
505 FOR P = 1 TO 76: IF C(P) (
    3 THEN  NEXT : FOR P = 1 TO
    76: IF C(P) ( ) - 3 THEN  NEXT
    : GOTO 530
510 FOR I = 1 TO 4:M = T(P,I): IF
    B(M) = 0 THEN  RETURN
520 NEXT
530 G = 2: GOSUB 590:G =  - G: GOSUB
    590:G =  - G: GOSUB 650:G =
     - G: GOSUB 650
540 G = 1: GOSUB 740:G =  - G: GOSUB
    740
550 V = 0: FOR S = 1 TO 64: IF B(
    S) ( ) 0 THEN  NEXT S: RETURN

560 A = 0: FOR J = 1 TO 7:P = U(S
    ,J): IF P ( ) 0 THEN A = A +
    1 +  ABS (C(P)): NEXT J
570 IF A ) V THEN V = A:M = S
580 NEXT S: RETURN
590 FOR P = 1 TO 76: IF C(P) (
    G THEN  NEXT P: RETURN
600 FOR I = 1 TO 4:M = T(P,I): IF
    B(M) =  - G / 2 THEN  NEXT P
    : RETURN
610 IF B(M) ( ) 0 THEN  NEXT I,
    P: RETURN
620 FOR K = 1 TO 7:B = U(M,K): IF
    B = 0 THEN  NEXT I,P: RETURN

630 IF C(B) ( ) G OR P = B THEN
     NEXT K,I,P: RETURN
640 POP : RETURN
650 FOR P = 1 TO 76: IF C(P) (
    G THEN  NEXT P: RETURN
660 FOR I = 1 TO 4:M = T(P,I): IF
    B(M) =  - G / 2 THEN  NEXT P
    : RETURN
670 IF B(M) ( ) 0 THEN  NEXT I,
    P: RETURN
680 FOR K = 1 TO 7:B = U(M,K): IF
    B = 0 THEN  NEXT I,P: RETURN

690 IF C(B) ( ) G / 2 THEN  NEXT
    K,I,P: RETURN
700 FOR J = 1 TO 4: IF B(T(B,J))
     =  - G / 2 THEN  NEXT K,I,P
    : RETURN
710 NEXT J:M = T(B,2): IF B(M) =
    0 THEN  POP : RETURN
720 M = T(B,3): IF B(M) = 0 THEN
     POP : RETURN
730 NEXT K,I,P: RETURN
740 FOR P = 1 TO 76: IF C(P) (
    G THEN  NEXT : RETURN
750 IF B(T(P,1)) =  - G OR B(T(P
    ,2)) =  - G OR B(T(P,3)) =  -
    G OR B(T(P,4)) =  - G THEN  NEXT
    P: RETURN
760 FOR I = 1 TO 4:M = T(P,I): IF
    B(M) ( ) 0 THEN  NEXT I,P: RETURN
770 TA = 0: FOR J = 1 TO 7:B = U(
    M,J): IF C(B) = G AND B(T(B,
    1)) ( )  - G AND B(T(B,2)) (
    )  - G AND B(T(B,3)) ( )  -
    G AND B(T(B,4)) ( )  - G THEN
    TA = TA + 1
780 NEXT : IF TA ) 1 THEN  POP :
     RETURN
790 NEXT I,P: RETURN
800 DATA  1,2,3,4,5,6,7,8,9,10,1
    1,12,13,14,15,16,17,18,19,20
    ,21,22,23,24,25,26,27,28,29,
    30,31,32,33,34,35,36,37,38,3
    9,40,41,42,43,44,45,46,47,48
    ,49,50,51,52,53,54,55,56,57,
    58,59,60,61,62,63,64
810 DATA  1,5,9,13,2,6,10,14,3,7
    ,11,15,4,8,12,16,17,21,25,29
    ,18,22,26,30,19,23,27,31,20,
    24,28,32,33,37,41,45,34,38,4
    2,46,35,39,43,47,36,40,44,48
    ,49,53,57,61,50,54,58,62,51,
    55,59,63,52,56,60,64,1,6,11,
    16,4,7,10,13,17,22,27,32,20,
    23,26,29
820 DATA  33,38,43,48,36,39,42,4
    5,49,54,59,64,52,55,58,61,1,
    17,33,49,2,18,34,50,3,19,35,
    51,4,20,36,52,5,21,37,53,6,2
    2,38,54,7,23,39,55,8,24,40,5
    6,9,25,41,57,10,26,42,58,11,
    27,43,59,12,28,44,60,13,29,4
    5,61,14,30,46,62,15,31,47,63

830 DATA  16,32,48,64,1,21,41,61
    ,2,22,42,62,3,23,43,63,4,24,
    44,64,8,23,38,53,12,27,42,57
    ,16,28,40,52,15,27,39,51,14,
    26,38,50,13,25,37,49,9,26,43
    ,60,5,22,39,56,1,18,35,52,4,
    19,34,49,16,31,46,61,13,30,4
    7,64,1,22,43,64,4,23,42,61,1
    3,26,39,52
840 DATA  16,27,38,49,1,17,33,41
    ,57,69,73,1,18,42,58,0,0,0,1
    ,19,43,59,0,0,0,1,20,34,44,6
    0,70,74,2,17,45,68,0,0,0,2,1
    8,33,46,0,0,0
910 DATA  2,19,34,47,0,0,0
920 DATA  2,20,48,61,0,0,0
```

Space voyage

I have played a lot of arcade-style games over the years and many are the showers of meteors I have eventually successfully learnt to avoid. It is a long time, however, since I came across an implementation the speed, style, difficulty, duration and visual clarity of which have kept me stuck to the screen for so long as the program sent to me by Andrew Finnemore of Trentham, Stoke on Trent.

It does not, like so many, require the physical and mental response times of a Russian gymnast; neither does it flicker, flash, disappear or jump about in the way so many games programs do. The screen layout and internal loop times match to give an effect that is easy on the eye, allowing the mind to concentrate on getting through the full voyage.

The run starts with an asteroid dodge. Left and right arrows vector the ship, while Esc freezes it and fires a laser battery into the oncoming asteroid stream — which includes both discrete masses and broad belts — clearing a path and scoring points in the process. Surviving the asteroid dodge, enter the maze. This section requires avoidance of both walls and blocks, and uses the same keys as above. The game hots up here firstly because the laser battery is now dead and secondly because the maze inexorably narrows the further you progress. The final phase of the run crosses a blazing asteroid storm, where points are won by picking up survival capsules from an exploded transporter.

Having given you the program, I shall now give you the puzzle it raised in my mind. It is a puzzle with a solution, and the solution is not difficult to find, the whole thing being really one of those paradoxes which exist only because of a contradiction in the original statement. Still, here goes.

Andrew Finnemore may have written the program in its current unreadable form so as to bury a trick or two, knowledge of which helps in getting through the maze — one such trick I have found, and the game is indeed more difficult if you are unaware of its presence. Discounting that possibility you are left with a listing which all the good books tell you is wrong; it has no structure, no control loops, no procedures, no input-output modules: it is in

(continued on next page)

```
930  DATA  3,17,33,51,0,0,0
940  DATA  3,18,34,50,0,0,0
950  DATA  3,19,33,51,0,0,0
960  DATA  3,20,52,62,0,0,0
970  DATA  4,17,34,53,66,72,75
980  DATA  4,18,54,65,0,0,0
990  DATA  4,19,55,64,0,0,0
1000  DATA  4,20,33,56,63,71,76
1010  DATA  5,21,35,41,0,0,0
1020  DATA  5,22,42,69,0,0,0
1030  DATA  5,23,43,70,0,0,0
1040  DATA  5,24,36,44,0,0,0
1050  DATA  6,21,45,57,0,0,0
1060  DATA  6,22,35,46,58,68,73
1070  DATA  6,23,36,47,59,61,74
1080  DATA  6,24,48,60,0,0,0
1090  DATA  7,21,49,66,0,0,0
1100  DATA  7,22,36,50,65,67,75
1110  DATA  7,23,35,51,62,64,76
1120  DATA  7,24,52,63,0,0,0
1130  DATA  8,21,36,53,0,0,0
1140  DATA  8,22,54,72,0,0,0
1150  DATA  8,23,55,71,0,0,0
1160  DATA  8,24,35,56,0,0,0
1170  DATA  9,25,37,41,0,0,0
1180  DATA  9,26,42,70,0,0,0
1190  DATA  9,27,43,69,0,0,0
1200  DATA  9,28,38,44,0,0,0
1210  DATA  10,25,45,66,0,0,0
1220  DATA  10,26,37,46,61,65,76
1230  DATA  10,27,38,47,64,68,75
1240  DATA  10,28,48,63,0,0,0
1250  DATA  11,25,49,57,0,0,0
1260  DATA  11,26,38,50,58,62,74
1270  DATA  11,27,37,51,59,67,73
1280  DATA  11,28,52,60,0,0,0
1290  DATA  12,25,38,53,0,0,0
1300  DATA  12,26,54,71,0,0,0
1310  DATA  12,27,55,72,0,0,0
1320  DATA  12,28,37,56,0,0,0
1330  DATA  13,29,39,41,66,70,76
1340  DATA  13,30,42,65,0,0,0
1350  DATA  13,31,43,64,0,0,0
1360  DATA  13,32,40,44,63,69,75
1370  DATA  14,29,45,61,0,0,0
1380  DATA  14,29,45,61,0,0,0
1390  DATA  14,31,40,47,0,0,0
1400  DATA  14,32,48,68,0,0,0
1410  DATA  15,29,49,62,0,0,0
1420  DATA  15,30,40,50,0,0,0
1430  DATA  15,31,39,51,0,0,0
1440  DATA  15,32,52,67,0,0,0
1450  DATA  16,29,40,53,57,71,74
1460  DATA  16,30,54,58,0,0,0
1470  DATA  16,31,55,59,0,0,0
1480  DATA  16,32,39,56,60,72,73
1490  DATA  22,32,47,32,72,32,97
      ,32,27,23,52,23,77,23,102,23
      ,32,14,57,14,82,14,107,14,37
      ,5,62,5,87,5,112,5
1500  FOR I = 1 TO 121 STEP 40: HPLOT
      X + 30,I TO X + 130,I: HPLOT
      TO X + 110,I + 38: HPLOT TO
      X + 10,I + 38: HPLOT TO X +
      10,I: NEXT : HPLOT X + 10,39
      TO X + 10,159: HPLOT X + 13
      0,1 TO X + 130,121: RETURN
1510  HPLOT X - 2,Y - 3 TO X + 2,
      Y - 3: HPLOT TO X + 2,Y + 3
      : HPLOT TO X - 2,Y + 3: HPLOT
      TO X - 2,Y - 3: RETURN
1520  HPLOT X,Y - 3 TO X,Y + 3: RETURN

1530  HPLOT X - 2,Y - 3 TO X + 2,
      Y - 3: HPLOT TO X + 2,Y: HPLOT
      TO X - 2,Y: HPLOT TO X - 2
      ,Y + 3: HPLOT TO X + 2,Y +
      3: RETURN
1540  HPLOT X - 2,Y - 3 TO X + 2,
      Y - 3: HPLOT TO X + 2,Y + 3
      : HPLOT TO X - 2,Y + 3: HPLOT
      X + 2,Y TO X - 2,Y: RETURN
1550  HPLOT X - 2,Y - 3 TO X - 2,
      Y: HPLOT TO X + 2,Y: HPLOT
      X + 2,Y - 3 TO X + 2,Y + 3: RETURN
1560  HPLOT X + 2,Y - 3 TO X - 2,
      Y - 3: HPLOT TO X - 2,Y: HPLOT
      TO X + 2,Y: HPLOT TO X + 2
      ,Y + 3: HPLOT TO X - 2,Y +
      3: RETURN
1570  HPLOT X + 2,Y - 3 TO X - 2,
      Y - 3: HPLOT TO X - 2,Y + 3
      : HPLOT TO X + 2,Y + 3: HPLOT
      TO X + 2,Y: HPLOT TO X - 2
      ,Y: RETURN
1580  HPLOT X - 2,Y - 3 TO X + 2,
      Y - 3: HPLOT TO X + 2,Y + 3
      : RETURN
1590  HPLOT X - 2,Y - 3 TO X + 2,
      Y - 3: HPLOT TO X + 2,Y + 3
      : HPLOT TO X - 2,Y + 3: HPLOT
      TO X - 2,Y - 3: HPLOT X - 2
      ,Y TO X + 2,Y: RETURN
1600  HPLOT X + 2,Y TO X - 2,Y: HPLOT
      TO X - 2,Y - 3: HPLOT TO X
      + 2,Y - 3: HPLOT TO X + 2,
      Y + 3: HPLOT TO X - 1,Y + 3
      : RETURN
1610  HPLOT X - 3,Y TO X + 3,Y: HPLOT
      X,Y + 3 TO X,Y - 3: RETURN
1630  HGR : HCOLOR= 3:X = 10:Y =
      10: GOSUB 1510:X = X + 10: GOSUB
      1520:X = X + 10: GOSUB 402
2000  HCOLOR= 0: HPLOT K(M,1),K(M
      ,0): HCOLOR= 3: HPLOT X - 3,
      Y - 3 TO X + 3,Y - 3: HPLOT
      TO X + 3,Y + 3: HPLOT TO X
      - 3,Y + 3: HPLOT TO X - 3,
      Y - 3: RETURN
2010  HCOLOR= 3: HPLOT K(M,1),K(M
      ,0): HCOLOR= 0: HPLOT X - 3,
      Y - 3 TO X + 3,Y - 3: HPLOT
      TO X + 3,Y + 3: HPLOT TO X
      - 3
```

Space voyage.

```
9  REM  INSTRUCTIONS
10 I$ = "..............USING THE
     LEFT AND RIGHT ARROW KEYS Y
     OU ARE TO TRAVEL THROUGH SPA
     CE SHOOTING THE ASTEROIDS IN
      YOUR SPACE SECTOR, THROUGH
     THE MAZE AND OUT THROUGH THE
      OTHER SIDE!....."
11 I$ = "....HERE WE GO"
20  TEXT : HOME : NOTRACE : FOR I
     = 1 TO  LEN (I$) - 20: VTAB
     12: PRINT  TAB( 10) MID$ (I$
     ,I,20): FOR J = 1 TO 100: NEXT
     J,I: VTAB 12: HTAB 31: GET Q
     $
29  REM  START OF GAME 1
                ASTEROID DODGE
30 D = 0:T = 0:S = 0: HOME : FOR
     L = 1 TO 5 STEP 2
40  COLOR= 2: FOR I = 1 TO 47 STEP
     2: HLIN 0,39 AT I: NEXT I
50  COLOR= 14:Y =  INT ( RND (1) *
     40): PLOT Y,47
60  FOR I = 1 TO 5 STEP L
70 M =  SCRN( X,1):N =  SCRN( X,2
     ): IF M = 14 OR M = 10 OR N =
     14 OR N = 10 THEN  GOTO 210
80 D = D + 1: IF D ) 300 OR S ) 5
     0 THEN  GOTO 220
90 Q =  PEEK ( - 16384)
100  IF Q = 149 THEN X = X + 1: IF
     X ) 39 THEN X = 39
110  IF Q = 136 THEN X = X - 1: IF
     X ( 0 THEN X = 0
120  COLOR= 3: PLOT X,2
130  IF Q = 155 THEN  GOTO 180
140  CALL  - 912
150  COLOR= 2: HLIN 0,39 AT 47
160  IF  RND (1) ( .01 THEN  COLOR=
     10: HLIN 0,39 AT 47
170  NEXT : GOTO 50
180 P =  INT ( RND (1) * 17 + 30)
     : FOR J = 2 TO P: IF  SCRN(
     X,J) = 14 THEN S = S + 4 - L
     : PRINT  CHR$ (7): COLOR= 2:
     PLOT X,J: GOTO 200
190  COLOR= 2: PLOT X,J: NEXT J
200  POKE  - 16368,0: COLOR= 0: FOR
     K = 2 TO J STEP 2: PLOT X,K:
     NEXT K: GOTO 50
210  NEXT : GOTO 540
219  REM  START OF GAME 2

     MAZE
220 A = 12:B = 28:C = 1:LE =  INT
     ( RND (1) * 50)
230  FOR I = 1 TO LE
240  CALL  - 912: COLOR= 2: HLIN
     0,39 AT 47: COLOR= 14: HLIN
     0,A AT 47: HLIN B,39 AT 47:A
     = A + C:B = B + C: IF A = 2
     OR B = 37 THEN C =  - C
250  IF  RND (1) ( .25 THEN  PLOT
     X,47
260  IF  SCRN( X,3) = 14 THEN  GOTO
     540
270 D = D + 1:T = T + 1: IF T = 5
     THEN T = 0:S = S + 1
280 Q =  PEEK ( - 16384)
290  IF Q = 149 THEN X = X + 1: IF
     X ) 39 THEN X = 39
300  IF Q = 136 THEN X = X - 1: IF
     X =  - 1 THEN X = 0
310  COLOR= 3: PLOT X,2: IF D / 5
     0 =  INT (D / 50) THEN A = A
     + 1:B = B - 1
320  NEXT : IF D ) 600 OR S ) 100
     THEN  GOTO 370
330 LE =  INT ( RND (1) * 31)
340  IF  ABS (C) = 1 THEN C = 0: GOTO
     230
350  IF A ( 21 THEN C = 1: GOTO 2
     30
360 C =  - 1: GOTO 230
369  REM  START OF GAME 3
                STAR VOYAGE
370  COLOR= 2: HLIN 0,39 AT 47: COLOR=
     10: PLOT  INT ( RND (1) * 40
     ),47
380 Q =  PEEK ( - 16384)
390  IF Q = 149 THEN X = X + 1: IF
     X ) 39 THEN X = 0
400  IF Q = 136 THEN X = X - 1: IF
     X ( 0 THEN X = 39
410  IF  SCRN( X,3) = 10 THEN  GOTO
     540
420  IF  SCRN( X,2) = 7 THEN S =
     S + 10: PRINT  CHR$ (7)
430  IF  RND (1) ( .5 THEN  COLOR=
     7: PLOT  INT ( RND (1) * 40)
     ,46
440  COLOR= 3: PLOT X,2
450  CALL  - 912: GOTO 370
```

(listing continued on next page)

(continued from previous page)

its own small way a plate of spaghetti. Had it conformed to the good book techniques, however, its timings might have been different, thereby introducing all manner of hideous flickerings, flashings, disappearings and jumpings which would have kept it from this page, and from your machines.

Think about it — but more importantly key the program up; it is well worth the effort.

Sounds brief

JOHN MARR of Middlesborough, Cleveland has sent a code for a USR call sound routine, which I print because it provides the games coder with sound for the fewest keystrokes. Include the Basic initialisation shown, and beeps are yours for each use of

var = USR(n)

where

n = (255 * h + d)
d = 1 to 255 and indicates duration
h = 1 to 128

You will find that h is related to that curious attribute of sound, wavelength, and that h = 1 gives an almost inaudible squeal while h = 128 gives a subsonic string of clicks, so covering the spectrum.

Pretty pictures

Have you ever wondered about Lissajous figures? Well, neither have I, but a program sent by Martin Roberts of Dewsbury not only draws representative samples on the screen but provides the basis for experimenting with others. At least now I know the how of it, though the what and why still elude me.

Paged lister

A routine to page listings when taking a hard copy is a good way to avoid printing over the perforations. The routine is even more of a good thing if it cates for LF as well as CR characters in the print output. Such a routine has been sent to me by Mr A Hourd to handle 11in. paper and initialise the printer to condensed mode with 132 characters per line maximum. Mr Hourd uses a parallel interface card to an Epson MX-80F/T on his Apple II, which pleasantly coincides with what sits on my own desk.

I print his solution in assembler to allow other initialisations or page-length patches to be worked in, and a monitor listing to enable you to BSave your tailored version for actual use.

Loaded at decimal 768 and started with a Call 768, the routine initialises the printer and waits for a command. Typing List will give the required output and at the end of the listing typing PR # 0 will return output to the screen.

(listing continued from previous page)

```
460  COLOR= 2: HLIN 0,39 AT 47
470 Q =  PEEK ( - 16384)
480  IF Q = 149 THEN X = X + 1: IF
     X ) 39 THEN X = 39
490  IF Q = 136 THEN X = X - 1: IF
     X ( 0 THEN X = 0
500  IF  SCRN( X,3) = 14 THEN  GOTO
     540
510 P = @ + 1: IF P ) 50 THEN  GOTO
     530
520  CALL  - 912: GOTO 460
530 A$ = "MISSION SAFELY COMPLETE
     D!"
540  HOME : VTAB 5: PRINT A$:A$ =
     ""
550  VTAB 9: PRINT  TAB( 18)"SCOR
     E -)";S;: PRINT  TAB( 13)"HI
     GHEST SCORE -)";HS;: IF S )
     HS THEN HS = S: PRINT  TAB(
     9)"NEW HIGH SCORE -)";HS
560  VTAB 20: PRINT "ANOTHER GAME
       (Y/N) ?";: GET A$: IF A$ =
     "Y" THEN  GOTO 30
570  IF A$ (  ) "N" THEN  PRINT :
      GOTO 560
580  END
```

Sound brief.

```
]LIST
10   REM  *** ADD LINES FOR SOUND
12   REM  *** EFFECTS, WITH USR
14   REM  *** ROUTINE
16   REM
18   REM
30   FOR I = 768 TO 786: READ C: POKE
      I,C: NEXT
40   DATA  32,12,225,172,161,0,173
     ,160,0,32,168,252,173,48,192
     ,136,208,244,96
45   POKE 10,76: POKE 11,0: POKE 1
     2,3
```

Pretty picture.

```
]LIST
10   FOR R = 1 TO 11
20   READ P,Q,K,S,B
30   HGR2
40 H =  RND (1) * 6 + 1
50   IF H ) 3 AND H ( 5 THEN 40
60   HCOLOR=  INT (H)
70   FOR A = 1 TO B
80 X = K *  SIN (P * A):Y = K *  COS
     (Q * A)
90   HPLOT  TO X + 135,Y + 90
100  HPLOT X + 135,Y + 90
110  NEXT : GET A$: NEXT
111  TEXT : HOME : END
120  DATA  7,30,90,1,200,20,10,80
     ,1,72,2,4,90,1,100,3,4,90,1,
     200,4,3,90,0.5,200,4,3,90,0.
     4,200,27.8,139,80,0.208,31,3
     0,20,80,1,78,40,20,80,1,100,
     30,40,80,1,100,10,30,80,1,10
     0
```

Paged lister.

```
*300.392
0300- A9 00 85 36 A9 C1 85 37
0308- 20 8E FD A9 8E 20 ED FD
0310- 20 8E FD A9 89 20 ED FD
0318- A9 B1 20 ED FD A9 B3 20
0320- ED FD A9 B2 20 ED FD A9
0328- CE 20 ED FD 20 8E FD A9
0330- 40 85 36 A9 03 85 37 A9
0338- 00 85 06 85 07 4C EA 03
0340- 48 20 02 C1 68 C9 8D F0
0348- 05 C9 8A F0 01 60 E6 06
0350- A5 06 C9 3A D0 F7 A5 06
0358- C9 42 F0 0A E6 06 A9 8A
0360- 20 02 C1 38 B0 F0 A9 00
0368- 85 06 E6 07 A9 D0 20 ED
0370- FD A9 C1 20 ED FD A9 C7
0378- 20 ED FD A9 C5 20 ED FD
0380- A9 BA 20 ED FD A5 07 69
0388- B0 20 ED FD 20 8E FD 20
0390- 8E FD 60
```

```
SOURCE FILE: PAGER XI
----- NEXT OBJECT FILE NAME IS PAGER XXX
0300:           1        ORG  $300
0300:           2 *
0300:           3 *
0006:           4 COUNT  EQU  $06
0007:           5 COUNT2 EQU  $07
0036:           6 CSWL   EQU  $36
0037:           7 CSWH   EQU  $37
03EA:           8 DOS    EQU  $3EA
C100:           9 PRINT  EQU  $C100    ; PRINTER IN SLOT 1
FD8E:          10 CROUT  EQU  $FD8E
FDED:          11 COUT   EQU  $FDED
0300:          12 *
0300:          13 *
0300:          14 *
0300:          15 *
0300:          16 *INITIALISE PRINTER TO COND CHAR AND
                   132 CHAR PER LINE
0300:          17 *
0300:          18 *
0300:A9 00     19       LDA  #)PRINT
0302:85 36     20       STA  CSWL
0304:A9 C1     21       LDA  #(PRINT
0306:85 37     22       STA  CSWH
0308:20 8E FD  23       JSR  CROUT
0308:          24 *
0308:A9 8F     25       LDA  #$8F     ;CHR(15)
030D:20 ED FD  26       JSR  COUT
0310:20 8E FD  27       JSR  CROUT
0313:          28 *
0313:A9 89     29       LDA  #$89
0315:20 ED FD  30       JSR  COUT     ;CTRL I
0318:A9 B1     31       LDA  #$B1
031A:20 ED FD  32       JSR  COUT     ; 1
031D:A9 B3     33       LDA  #$B3
031F:20 ED FD  34       JSR  COUT     ; 3
0322:A9 B2     35       LDA  #$B2
0324:20 ED FD  36       JSR  COUT     ; 2
0327:A9 CE     37       LDA  #$CE
0329:20 ED FD  38       JSR  COUT     ; N
032C:20 8E FD  39       JSR  CROUT
032F:          40 *
032F:          41 *
032F:          42 *END OF INITIALISATION
032F:          43 *
032F:          44 *NOW BACK TO ROUTINE
032F:A9 40     45       LDA  #)START
0331:85 36     46       STA  CSWL
0333:A9 03     47       LDA  #(START
0335:85 37     48       STA  CSWH
0337:A9 00     49       LDA  #$00
0339:85 06     50       STA  COUNT
033B:85 07     51       STA  COUNT2
033D:4C EA 03  52       JMP  DOS      ;WAIT FOR A COMMAND NOW
0340:          53 *
0340:          54 *
0340:48        55 START  PHA          ;ROUTINE STARTS HERE
0341:20 00 C1  56       JSR  PRINT    ;SEND CHAR TO PRINTER
0344:68        57       PLA
0345:C9 8D     58       CMP  #$8D     ;CARRIAGE RETN?
0347:F0 05     59       BEQ  LINE     ;BRANCH IF SO
0349:C9 8A     60       CMP  #$8A     ;LINE FEED?
034B:F0 01     61       BEQ  LINE     ;ALSO BRANCH IF SO
034D:60        62 NEXT  RTS
034E:E6 06     63 LINE  INC  COUNT    ;INCREMENT LINE COUNT
0350:A5 06     64       LDA  COUNT
0352:C9 3A     65       CMP  #$3A     ;LINE COUNT =58?
0354:D0 F7     66       BNE  NEXT     ;IF NOT RETURN
0356:A5 06     67 BLANK LDA  COUNT
0358:C9 42     68       CMP  #$42     ;PAGE LENGTH MET?
035A:F0 0A     69       BEQ  LOOP
035C:E6 06     70       INC  COUNT    ;INCREMENT LINE CNTR
035E:A9 8A     71       LDA  #$8A     ;LOAD LINE FEED
0360:20 00 C1  72       JSR  PRINT    ;SEND IT TO PRINTER
0363:38        73       SEC
0364:B0 F0     74       BCS  BLANK
0366:A9 00     75 LOOP  LDA  #$00     ;ZERO THE COUNTER
0368:85 06     76       STA  COUNT
036A:E6 07     77       INC  COUNT2
036C:A9 D0     78       LDA  #$D0
036E:20 ED FD  79       JSR  COUT     ; P
0371:A9 C1     80       LDA  #$C1
0373:20 ED FD  81       JSR  COUT     ; A
0376:A9 C7     82       LDA  #$C7
0378:20 ED FD  83       JSR  COUT     ; G
037B:A9 C5     84       LDA  #$C5
037D:20 ED FD  85       JSR  COUT     ; E
0380:A9 BA     86       LDA  #$BA
0382:20 ED FD  87       JSR  COUT     ; SPACE
0385:A5 07     88       LDA  COUNT2
0387:69 B0     89       ADC  #$B0
0389:20 ED FD  90       JSR  COUT     ; COUNT2 DECIMAL UP TO 9
038C:20 8E FD  91       JSR  CROUT
038F:20 8E FD  92       JSR  CROUT
0392:60        93 DONE  RTS
0393:00        94       BRK

### SUCCESSFUL ASSEMBLY: NO ERRORS
```

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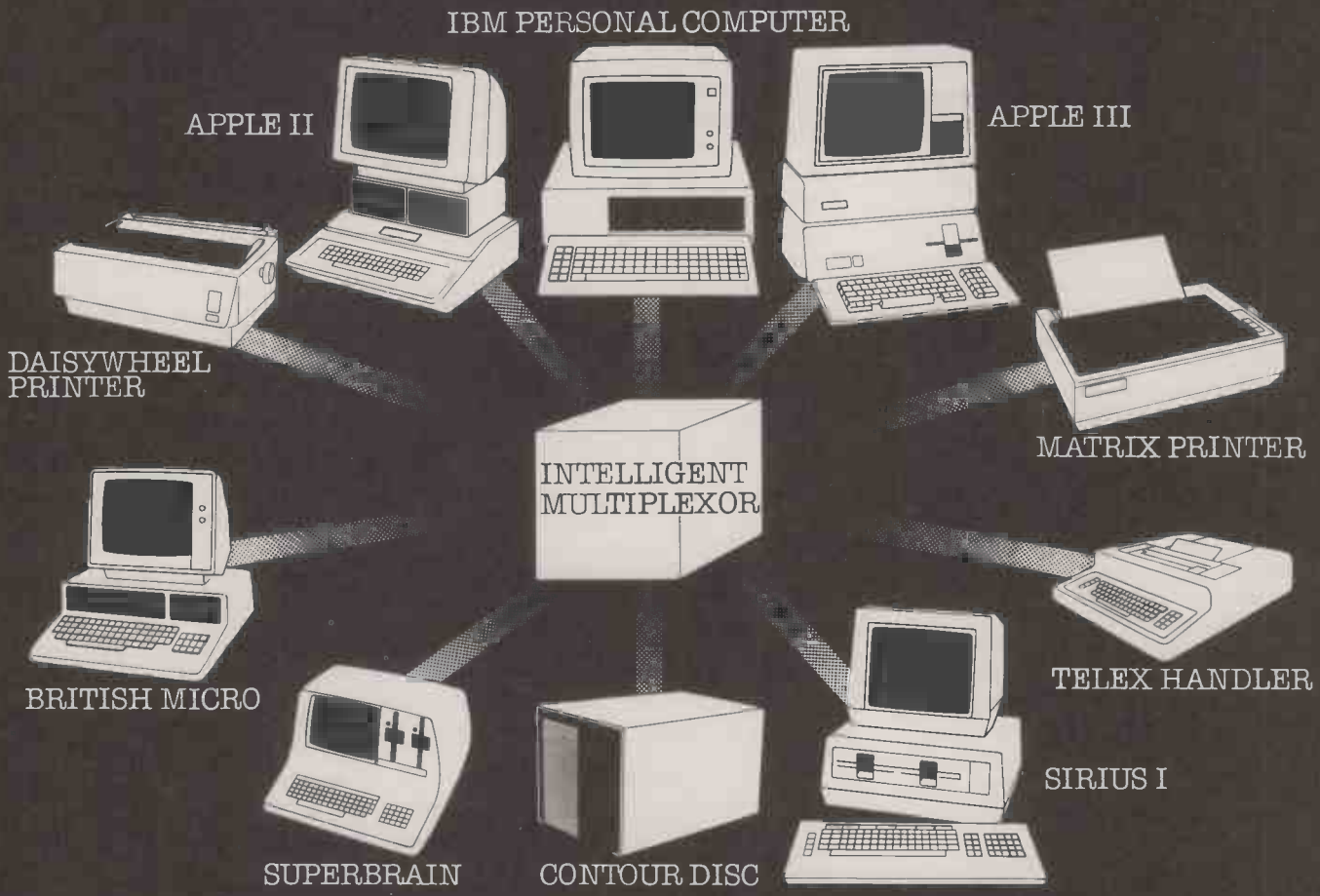

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ISS

ATARI ACCENT

by Jack Schofield

ATARI HAS NOT previously featured in Open File for one very good reason: no one has submitted any programs. Either this means none of you own Ataris, or else you do not send them in because there is no place for them in Open File. For this column to appear again, the latter will have to be the correct explanation. Take a break from Star Raiders and send in your favourite progams or subroutines on cassette or disc.

Atari has come a long way in the last year, with the setting up of Atari U.K. and the cutting of prices. The £345 Atari 400 is down to £245, including Basic, and the £645 Atari 800 down to £449. This, and television and press advertising, should help sales. However, in the U.S. the 400 can be obtained for $269 and the 800 for $649, so we can live in hope of further price reductions as sales pick up.

American sales remain massive. It is impossible to get separate figures for the home-computer division, but Atari's total turnover for 1982 is passing $2 billion, which is quite a lot. Computer sales have been large enough to generate massive independent software support. A recent catalogue from Sidcup's Silica Shop includes over 350 programs from over 60 firms. Atari has also greatly increased the number of programs in its APX scheme, and the current catalogue lists over 130, which are in addition to the programs in the "main line", now approaching 50.

Recent add-ons now include an 80-column card from Bit 3, a typewriter keyboard for the 400 from Softcell, a ROM toolkit for the right-hand cartridge slot (Monkey Wrench) from Eastern House, independent disc drives from Percom, and double-density drives that bring CP/M capability. Languages now include a third Basic by Microsoft, a third Forth by Valpar and, for the first time APX's Pascal, Datasoft's Lisp 2.0, and Tiny C by Optimized Systems Software.

Unfortunately all these cost money. At least the following tips are free.

Input routines

WHEN YOU HAVE a list of instructions it is useful to be able to hold up a program until the user presses a key to continue. In the Atari location 764 holds the internal code of the last key pressed, which makes it possible to read a key without an input statement. The idea is to Poke 764 with a value of 255 to clear it, then Peek the same location as long as that value remains unchanged — see listing 1.

The technique is very rugged. While a prompt can suggest "Press space bar to contiue", in fact any input except Break or System Reset will continue the program. And, if required,

```
POKE 53774,64:POKE 16,64
```

will disable the Break key.

In this case you are not interested in what the input is. However, if you do want the input but again without upsetting the screen display, you can use Get to collect a single byte from the keyboard, To do this, open a file, #1 for input only — the code for this is 4 — give the device number, 0, and the name. The name must start with a letter and can be up to eight characters long, but for the keyboard K: is used. Thus the command is

```
OPEN #1,4,0,"K:"
```

Then

```
GET #1, LETTER
```

will collect one letter, which can then be checked for suitability. Note that after files have been opened they must be closed, so it is sometimes convenient to issue a Close before you issue the Open — see listing 2.

For many inputs you can use Atari's useful error-trapping routine, which works as "on error Goto line XXX", and which is called simply Trap. For example, Trap 100 sends the program to line 100 on an input error. Each time the trap is used it must be cleared with a number from 32767 to 65535. Normally Trap 40000 is used as being easy to remember.

Rather than filling the program with Trap 65, Trap 80, Trap 100, etc. it is better to use a small routine to handle all the errors. This can be done because locations 186 and 187 hold the line number at which the error occurred. By Peeking these locations you can dispose of the error and return the program to the input line for the user to try again. It's as simple as

```
GOTO 256*PEEK(187)+PEEK(186)
```

I often use Poke 703,0 to create a Graphics 0 screen with a four-line text window. The window is used for inputs, then #6; is used to print accepted entries on the main screen. It is well worth paying attention to the minor details of handling inputs. All your clever programming counts for nothing if the user keeps being dropped out of the program.

By the way, has anyone found a way to use Input without getting the ? prompt?

Input routines.

Listing 1.

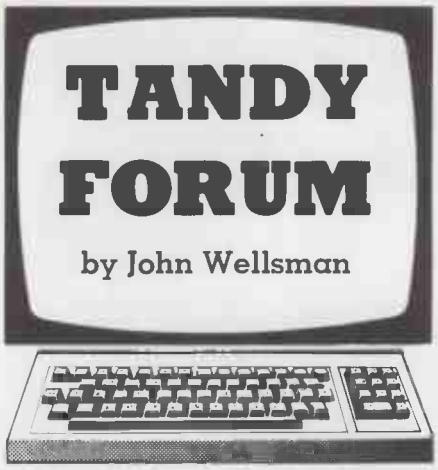
```
10 REM *** LISTING 1 ***
15 GRAPHICS 0:REM CLEAR SCREEN
20 POKE 752,1:REM SUPPRESS CURSOR
25 PRINT "HELLO":REM DO SOMETHING
30 PRINT "Press space bar to continue"
35 POKE 764,255
40 IF PEEK(764)=255 THEN 40
50 PRINT "HELLO AGAIN":REM CONTINUATION
55 GOTO 30:REM LOOP FOREVER
```

Listing 2.

```
10 REM *** LISTING 2 ***
15 GRAPHICS 0:POKE 752,1
20 PRINT "Type in some letters"
25 CLOSE #1:OPEN #1,4,0,"K:"
30 GET #1,LETTER
35 POKE 702,64:REM DISABLES CAPS LOWR
40 POKE 694,0:REM DISABLES INVERSE KEY
45 IF LETTER<65 OR LETTER>90 THEN 30
50 REM CHECK IT'S A CAPITAL
55 PRINT CHR$(LETTER);
60 GOTO 25:REM LOOP FOR ANOTHER LETTER
```

Listing 3.

```
10 REM *** LISTING 3 ***
15 REM (Accepts numbers only)
20 GRAPHICS 0:POKE 752,1
25 PRINT "Type in a NUMBER"
30 PRINT "and press RETURN"
35 PRINT
40 TRAP 85:PRINT "ENTER ONE":INPUT N1
45 PRINT
50 TRAP 85:PRINT "ANOTHER":INPUT N2
55 PRINT
60 TRAP 85:PRINT "& A THIRD":INPUT N3
65 PRINT
70 PRINT "THANKYOU!"
75 POKE 752,0:END
80 REM TRAP ROUTINE
85 TRAP 40000:PRINT "THAT'S NOT A NUMBER"
90 GOTO 256*PEEK(187)+PEEK(186)
```



I HAVE BEEN READING this column ever since it started and it has been in some very good hands, but I have been surprised that there has been so little about the Model II. Are the users of this first-class analytical engine shy? Are they bashful about confessing that they use a machine costing more than £50, or a disc bigger than a saucer? Please let me hear from you — I know you are out there somewhere. And let's not neglect the Colour and Pocket buffs; Genie users are very welcome too.

I would like these pages to be a source of help and ideas to all Tandy computer users, no matter what machine they use, what their degree of progress is or what they use their machines for, and look forward to your interesting programs and letters.

Ticker tape.

```
10 CLEAR 1000: ON ERROR GOTO 310:CLS
20 PRINTTAB(25);"TICKER TAPE"
30 PRINT@400,CHR$(191):PRINT@430,
   CHR$(191)
40 FOR I=464 TO 494: PRINT@I,CHR$(143);:
   NEXT
50 FOR I=336 TO 366: PRINT@I,CHR$(188);:
   NEXT
60 PRINT@901,CHR$(143)
70 PRINT@576,""
80 PRINT"ENTER MESSAGE NO COMMAS PLEASE
   UP TO THE '"CHR$(143)"' "
90 INPUT"*";M$
100 PRINT@576,STRING$(62,32)
110 PRINT@640,STRING$(255,32)
120 M$=STRING$(30,32)+M$:
    M$=M$+STRING$(30,32)
130 GOTO 230
140 FOR T=1 TO 2
150 IF T=1 THEN PRINT@192,"MESSAGE
    READS:          ";
160 FOR I= 1 TO (LEN(M$)-29)
170 PRINT@401,MID$(M$,I,29)
180 FOR D=1 TO 20
190 NEXT D
200 NEXT I
210 FOR X = 1 TO 200:NEXT X:
    PRINT@192,"REPEATING:          ";
220 NEXT T
230 PRINT@192,"HOLD DOWN (ENTER)";
240 PRINT@153,"* MESSAGE *";
250 FOR D=1 TO 100: NEXT D
260 IF PEEK(14400)=1 THEN 140
270 PRINT@153,CHR$(143); STRING$(3,32);
    CHR$(143);
280 FOR D=1 TO 100: NEXT D
290 IF PEEK(14400)=1 THEN 140
300 GOTO 240
310 PRINT"YOU WENT PAST THE
    '"CHR$(143)"' TRY AGAIN"
320 PRINT"PRESS ANY KEY"
330 IF INKEY$="" THEN 330
340 RESUME 10
```

Ticker tape

The first program that I would like to present to you this month comes from Mark Lawson of Stonehouse, Gloucestershire. It is a neat little program which steps a message through a frame after the style of illuminated newscasts on the front of buildings. It is intended as a subroutine and has obvious applications to games. Except for renumbering I have made only one alteration, but it is an important one if you are writing programs which others have to copy. In line 270, you will see String$(9,32) which, as you know, specifies a nine-character space. In the coresponding position in Mark Lawson's program were two "quotes" with a blank space between them. This might be acceptable in some contexts, but in this case the space had to fit line 240. So if you expect others to read your programs, indicate the size of significant spaces with a String$.

Line 170 produces the illusion of movement. All that happens is that the first 29 characters are printed @ 401, then the next 29 characters begining with the second character of the string and so on, but all are printed @ 401. It is, of course, the same effect that is produced with cine films.

In line 80, the user is instructed to avoid commas. Disc Basic users can avoid this restriction by using LineInput in line 90, while level II users might like to use the following little subroutine which will enable them to input any printable character. Substitute the Input in line 90 with Gosub 500 and add:

```
500 I$ = INKEY$: IF I$ = "" THEN 500 ELSE IF
    I$ = CHR$(13) THEN RETURN ELSE PRINT
    I$
510 M$ = M$ + I$: GOTO 500
```

As with a normal Input it is terminated by pressing Enter: but do not forget the semicolon at the end of line 500.

This is quite a useful routine in other respects. A normal Input is always followed by a Carriage-return. The VDU display will be corrupted if you have two Inputs on the same line, but when using the subroutine no Carriage-return is produced.

Comma separator

The following is a tip passed to me by Douglas Boote of Bramhall, Cheshire, Though it is a small point, it has never occurred to me or to most other programmers whose programs I have seen. It concern the use of Then and/or Goto. The Tandy Level II manual is rather vague on the subject of how optional these two words are; their main use is as separators when ambiguity would result from their absence. To quote two examples:

```
20 IF A = B THEN (or GOTO) 100
```

or

```
20 IF A = 30 THEN 100
```

If Then or Goto were omitted the computer would read the first example as

```
IF A = B1 00
```

regarding B1 as a variable, and in the second example, it would read

```
IF A = 30100
```

(continued on page 161)

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(continued from page 158)

This is probably obvious to you, but have you realised that a simple comma will substitute for Then or Goto? Its only function is to inform the computer when the definition of the conditional statement has ended.

Printer/screen switch

Here is another subroutine which switches the video and printer addresses. It was sent by Gordon Grant of Radcliffe, Manchester. Have a look at page D/1 of the Level II Basic reference manual which gives the Level II memory map if you want to understand how it works.

If you type it in and Run it just as it stands — making sure that your printer is on-line — the printer will type out

READY

and nothing will happen on the screen. In fact, you may well think that it has hung up. But all is well, except that every key that you press on the keyboard will go to the printer and not to the screen. If you type a command such as List or Print, whose effect should appear on the screen, it will go to the printer and, conversely, if you type a command such as LPrint the effect will appear on the screen and not go to the printer.

The result of running the routine is permanent and remains in effect in Dos and probably for System tapes, though I have not tried it. Script is not affected; if you return to Dos without rebooting, the switch is still present.

There are two ways out of the switch-round. One is to boot or reset, the other — well, look hard at the listing and figure it out for yourself. If you are really stuck, drop me a line — with an SAE please — and I will send you the three-word solution.

I must confess that I cannot think of many uses for this routine. The only one that comes to mind is to implement it before using a program whose output is normally to the screen and you want hard copy. Even then, remember that every bit of screen display will go to the printer.

Advice for all

I have just come back from attending a day-long meeting of the National TRS-80 Users' Group in Southall in West London. The group regularly holds meetings in all parts of the country at which members can bring their own systems and display their latest creations or acquisitions and chew the fat with all and sundry. It also arranges lectures, and dealers are often provided with display space. This meeting was unusual in that it was jointly shared with the British Apple Users' Group.

Model II buffs, where are you? We welcome programs, tips and advice from all Tandy users.

Computer enthusiasts are usually fiercely loyal to their brand and regard anything else as rubbish, but on this occasion not a drop of blood was spilt — in fact, the Apple people are quite nice guys really, when you get to know them.

The great value of these meetings is that you meet people, get new ideas and always learn something new. I would strongly recommend everyone, especially beginners, to join their respective group, whatever machine they have. Most national groups have their own local monthly meetings. TRS-80 uses should contact Brian Pain, 40a High Street, Stony Stratford, Milton Keynes, Buckinghamshire for further details.

The TRS-80 Users' Group is holding a weekend seminar at Milton Keynes on Saturday and Sunday, 29-30 January. There will be instruction on machine code, Dos, word processing, compilers and hard discs. The fee for the Saturday will be £5.50 and for Sunday £3.50. Brain Pain has full details.

On the subject of giving help, I would like to offer my support to any beginners who cannot find a solution to their particular problems. This offer must be confined to beginners with simple problems; sadly it cannot become a general consultancy offer. Please enclose an SAE.

We shall not usually be reviewing hardware in this column, but I was very interested in seeing the new little colour printer that Tandy has just brought out. It uses ordinary 4.5in. paper rolls and will print in four colours. It can be used for ordinary text of 40 or 80 characters per line, or graphics. It uses replaceable ink cartridges with a resolution of five steps per millimetre. Although I have yet to use it, it strikes me as being very good value at £149 including VAT.

A little tip for Disc Basic users which will allow them to use a Tab value on the printer above 64. First define

DEFFNX$(Y) = STRING$(Y – PEEK(16539), 32)

Then instead of Tab(70) use

FNX$(70)

Another little tip about the very valuable Print Using function. If you want to list percentages, define a Using string as

££.££%

to put the % symbol at the end of the value without you having to tack it on every time. You could also use p or c to indicate pence or cents.

Micro word processor

The Inkey$ function can be put to a wide range of uses. E R Hill of Keighley, West Yorkshire has sent this little program which can be described as a micro word processor. But if you have a Model I, then you must have a disc version with Newdos or LDos. Again do not miss the semicolons at the end of lines 40 and 60 or you will end up in a mess.

The instructions are:

BACKSPACE — backspaces and erases
TAB — moves forward eight spaces
DOWN — moves to start of next line and erases
ENTER — has same effect
SHIFT DOWN O — cursor off
SHIFT DOWN N — cursor on
SHIFT BACKSPACE — backspaces without erasing
SHIFT DOWN Y — advances cursor without erasing
SHIFT DOWN Z — moves cursor down without erasing
SHIFT UP — moves cursor up without erasing
SHIFT DOWN — moves cursor to upper-left corner; it does not work with Model I

E R Hill reminds us not to fill the screen, otherwise scrolling problems will occur. To print with Model III use

SHIFT DOWN *

with Model I, use JKL.

Printer screen switch.

```
10 K=16413: REM VIDEO DCB
20 L=16421: rem PRINTER DCB
30 FOR M=0 TO 7
40 N=PEEK(K+M)
50 POKE K+M, PEEK(L+M)
60 POKE L+M,N
70 NEXT
```

Micro word processor.

```
10 CLS
20 PRINTCHR$(14)
30 A$=INKEY$
40 IF A$=CHR$(9) THEN PRINT"
50 IF A$=CHR$(31) THEN 10
60 PRINTA$;
70 GOTO 30
```

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BBC BYTES

by John Harris

Circuit diagrams

TOM WORSTER of Glasgow has sent me a listing which, if your interests include designing electronic schematic diagrams, may save you quite a bit of effort. For the rest of you the listing is well worth a browse for the quality of the program design and the useful code techniques employed.

The listing as shown uses the ADC but alterations are given at the end of the listing for keyboard control. If you use these the controls become:

@ — move cross-hair up
] — move cross-hair right
/ — move cross-hair down
; — move cross-hair left

though previously steady cross-hairs will flicker a little.

The procedure ProcPrint is hardware dependent and you will probably need to amend it for your specific printer control character set. If anyone sends me an enhancement to the listing to permit the saving and reloading of the screen contents to tape or disc with rescaling and positioning on retrieval, to allow the construction of a circuit library, I shall be very happy to print it.

Single-character commands are:

Q — foreground white, for drawing
A — foreground black, for erasure
O — remove cursor for 30 seconds or until key depression

Circuit design.

```
  10MODE 4
  20PROCint
  25GCOL0,1
  30 PROCnos
  40IF X1%()X% THENPROCx:X1%=X%:PROCx
  50IF Y1%()Y% THENPROCy:Y1%=Y%:PROCy
  60 I=INKEY(1)
  70IF I=32 THENPROCst
  75IF I=78 THENPROCint
  80IF I=76 THENPROCline
  85IF I=82 THENPROCrect
  86IF I=67 THENPROCcir
  90IF I=79 THENPROCcurs:A=INKEY(3000):PROCcurs
  95IF ADVAL(3)(50000 THENPROCcurs ELSE100
  97IF ADVAL(3))50000 THENPROCcurs ELSE97
 100IF I=87 THENPROCletter
 104IF I)47 AND I(58 THEN ON I-47 GOSUB 6500,2000,2500,3000,3500,4000,4500,5000
,5500,6000
 105IF I=81 THEN GCOL0,1
 106IF I=65 THEN GCOL0,0
 110IF I=80 THEN PROCprint
 120GOTO30
 150DEFPROCcurs:PROCx:PROCy:ENDPROC
 200 DEFPROCnos:Y%=960-20*INT(ADVAL(1)/(2.5*536)):X%=20*INT(ADVAL(2)/(2.5*412))
:ENDPROC
 300DEFPROCx:MOVE X1%,0:PLOT2,0,1024:ENDPROC
 400DEFPROCy:MOVE 0,Y1%:PLOT2,1280,0:ENDPROC
 500DEFPROCline:PROCcurs:MOVEA%,B%:DRAW X1%,Y1%:PROCcurs:ENDPROC
 600DEFPROCint:CLG:X1%=-1:Y1%=-1:ENDPROC
 700DEFPROCst:A%=X1%:B%=Y1%:ENDPROC
 800DEFPROCrect:PROCcurs:MOVEA%,B%:DRAW A%,Y1%:DRAW X1%,Y1%:DRAW X1%,B%:DRAW A%
,B%:PROCcurs:ENDPROC
 900DEFPROCcir:LOCALA,Z,P,J,R
 910INPUTTAB(0,0)Z,A:Z=2*PI/Z
 920R=SQR((X1%-A%)^2+(Y1%-B%)^2)
 930P=ASN((Y1%-B%)/R):IFX1%(A% THEN P=PI-P
 935PROCcurs
 940MOVE X1%,Y1%:FORJ=P+Z TO 2*PI+P STEP Z
 950IFA=1 THEN DRAW A%+R*COS(J),B%+R*SIN(J):GOTO960
 955MOVE A%,B%:PLOT85,A%+R*COS(J),B%+R*SIN(J)
 960NEXT:PROCcurs:ENDPROC
1000DEFPROCletter:LOCAL A$,C,D:C=40*A%/1280:D=32-(32*B%/1024):INPUTTAB(0,0)A$:P
ROCcurs:PRINTTAB(C,D)A$:PRINTTAB(0,0)"";:PROCcurs:ENDPROC
1100DEFPROCprint
1110PROCcurs:LOCAL I,J,K,Z%,X%
1112*FX5,2
1113*FX8,7
1114VDU2
1115PRINTCHR$(28)
1120FORI=0TO1280STEP4
1130FORJ=0TO1024STEP4
1135X%=1
1140FORK=0TO5
1150IFPOINT(J,I+K)=1THENZ%=1 ELSEZ%=0
1160X%=2*X%+Z%
1170NEXT
1180PRINTTAB(0,0);CHR$(X%);:NEXT
1190PRINT"6"
1200NEXT
1210PRINTCHR$(29)
1215VDU3
1217PROCcurs
1220ENDPROC
2000PROCcurs
```

(listing continued on next page)

Map generator

D C McMillan of Belfast has sent me a routine which may be made part of either a games or educational program requiring a map of Great Britain and/or Ireland to be displayed on the screen. The resolution in mode 4 is as fine as possible for that mode, and should you ever get a second processor would be even finer in mode 0.

He includes a control around the routine to input Size and Offset parameters; sizes of 3, 3 and 8 respectively fill the screens with options BI, GB and IR, and while smaller or larger sizes are selectable definition falls off either way. To increase the definition of the outline the map may be redrawn with one of the co-ordinates offset by one point.

Circuit-diagram command set.

Function	Press spacebar at	then	at
straight line	start of line	L	end of line
rectangle	one corner	R	diagonal corner
polygon	centre	C	one vertex, see note 1
text inclusion	first letter	W	immediately, then type text and Return
diode	anode	1	cathode
non-polar capacitor	centre first plate	2	centre second plate
resistor	beginning	3	end
dot	centre	4	immediately
arrowhead	base	5	point
earth	where wire comes in	6	immediately
chassis	where wire comes in	7	immediately
electrolytic capacitor	centre of +ve	8	centre of -ve
transistor	centre of base	9	emitter quadrant, see note 2
loudspeaker	centre of top	0	immediately

Note 1 — then enter n, m where n is the number of vertices, and m = 1 for empty, m = 2 for filled.
Note 2 — then enter 1 for inward-pointing arrow.

Gladiator 83

Different people will describe a given program in different ways. I thank Mark Beerling of Margate, Kent for the following games program, even though my wife monopolised the machine all weekend with it, and give you his own description unabridged, being incapable of bettering it myself.

You have control of a tank in an arena. You are in gladiatorial-style combat with invisible crabs that move randomly towards your tank to crush it. The crabs can only be seen in a radar pulse and can be destroyed via a plasma bolt fired from the tank.

The screen folds round on itself at the bottom and far left only; this makes a good

(continued on next page)

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escape route. As you destroy them the speed of the crabs increases and a new sheet of crabs is released when you destroy the last crab in the old sheet.

The edit keys are used to control the tanks as follows:

↑ — move up
→ — move right
↓ — move down
← — move left
Copy — fire plasma bolt
Space bar — radar pulse

The program may be changed as follows to make the game different:

25 VDU 19,1,0,0,0,0,

will make the crabs visible and the game becomes a simple crab shoot. But to even things up you might like to increase the speed of the crabs by

140 IF TIME>400 PROCatmove:TIME=350 + SC

Making the Crabs move randomly increases the difficulty of the game, done by

185 M% = RND (NT + 1)-1

Consider also taking A% = 5 out of 790 and removing C% = 1 from 860.

(listing continued from previous page)

```
 2005IF X1%-A%=0 THEN P%=(Y1%-B%)/2 ELSE P%=(X1%-A%)/2
 2010IF A%=X1% THEN MOVE X1%-3%,Y1%:DRAW X1%-P%,Y1%:MOVE X1%,Y1%:MOVE A%-P%,B%:P
LOT85,A%+P%,B%:GOTO2030
 2020MOVE X1%,Y1%-P%:DRAW X1%,Y1%+P%:MOVE X1%,Y1%:MOVE A%,Y1%-P%:PLOT85,A%,B%+P%
 2030PROCcurs
 2040RETURN
 2500PROCcurs
 2520IF X1%-A%=0 THENMOVE A%-32,B%:DRAW A%-32,B%:MOVE X1%-32,Y1%:DRAWX1%+32,Y1%:
GOTO2540
 2530MOVE A%,B%-32:DRAW A%,B%-32:MOVE X1%,Y1%-32:DRAWX1%,Y1%+32
 2540PROCcurs:RETURN
 3000PROCcurs
 3010IF X1%-A%()0 THEN 3035
 3012MOVE A%-16,B%
 3015FOR I%=0 TO Y1%-B% STEP 32*SGN(Y1%-B%)
 3020DRAW A%-16,B%+I%:DRAW A%+16,B%+I%+16*SGN(Y1%-B%)
 3030NEXT:GOTO3060
 3035MOVE A%,B%-16
 3040FOR I%=0 TO X1%-A% STEP 32*SGN(X1%-A%)
 3050DRAW A%+I%,B%-16:DRAW A%+I%+16*SGN(X1%-A%),B%+16
 3055NEXT
 3060PROCcurs:RETURN
 3500PROCcurs
 3510MOVE A%+4,B%+4:DRAW A%+4,B%-4:DRAW A%-4,B%-4:DRAW A%-4,B%+4
 3520PROCcurs:RETURN
 4000PROCcurs
 4010MOVE A%,B%+16:MOVE A%,B%-16:PLOT85,X1%,Y1%
 4020PROCcurs:RETURN
 4500PROCcurs
 4510MOVE A%-36,B%:DRAW A%+36,B%
 4520MOVE A%-20,B%-8:DRAW A%+20,B%-8
 4530MOVE A%-8,B%-16:DRAW A%+8,B%-16
 4540PROCcurs:RETURN
 5000PROCcurs
 5010MOVE A%-40,B%:DRAW A%+40,B%
 5020FORI%=A%-40 TO A%+40 STEP 16
 5030MOVE I%,B%:DRAW I%-16,B%-16
 5040NEXT:PROCcurs:RETURN
 5500PROCcurs
 5520IF X1%-A%=0 THEN MOVEX1%-32,Y1%:DRAWX1%+32,Y1%:MOVEA%-32,B%:DRAWA%+32,B%:DR
AWA%+32,B%-12:DRAWA%-32,B%-12:DRAWA%-32,B%:GOTO5540
 5530MOVEA%,B%-32:DRAWA%,B%+32:DRAWA%+12,B%+32:DRAWA%+12,B%-32:DRAWA%,B%-32:MOVE
X1%,Y1%-32:DRAWX1%,Y1%+32
 5540PROCcurs:RETURN
 6000PROCcurs
 6010MOVEA%,B%+32:DRAWA%,B%-32:DRAWA%+4,B%-32:DRAWA%+4,B%+32
 6020MOVEA%,B%
 6030IF X1%)A% THEN P%=60 ELSE P%=-60
 6040DRAWA%+P%,B%-P%:MOVEA%,B%:DRAWA%+P%,B%+P%
 6050IF GET$="I" THEN P%=20:O%=0 ELSE P%=0:O%=20
 6060P%=P%*SGN(A%-X1%):O%=O%*SGN(Y1%-B%)
 6070IF A%(X1% THEN 6075 ELSE IF B%(Y1% THEN MOVEA%-32,B%+12:GOTO 6080 ELSE MOVE
A%-32,B%-12:GOTO6080
 6075IF B%(Y1% THEN MOVEA%+32,B%+12 ELSE MOVEA%+32,B%-12
 6080PLOT 1,P%,O%
 6100PROCcurs:RETURN
 6500PROCcurs
 6510MOVE C%-16,B%
 6520DRAW A%+16,B%
 6530DRAW A%+16,B%-60
 6540DRAW A%-16,B%-60
 6550DRAW A%-16,B%
 6560MOVE A%+16,B%-20
 6570DRAW A%+50,B%
 6580DRAW A%+60,B%-60
 6590DRAW A%+16,B%-40
 6600PROCcurs :RETURN
```

```
   4 *FX 11,0
   5 *FX 12,12
   7 ON ERROR GOTO 10000
  30 I=INKEY(1)
  35 IF I=64 OR I=59 OR I=47 OR I=93 THEN PROCcos
  60 REM
 200 DEFPROCcos
 210 IF I=59 AND X%)15 THEN X%=X%-16
 220 IF I=93 AND X%(1265 THEN X%=X%+16
 230 IF I=47 AND Y%)15 THEN Y%=Y%-16
 240 IF I=64 AND Y%(1024 THEN Y%=Y%+16
 250 ENDPROC
10000 *FX 11,0
10001 *FX 12,0
```

Map generator.

```
 10REM          BITMAP
 20REM          D C McMillan
 30REM          10/8/82
 40MODE4
 50DIM X%(380),Y%(380)
 60INPUT TAB(0,0)"SIZE "SIZE
 70FOR L%=1 TO 379
 80READ X%(L%)
 90X%(L%)=X%(L%)*SIZE
100NEXT L%
110FOR L%=1 TO 379
120READ Y%(L%)
130Y%(L%)=Y%(L%)*SIZE
140NEXT L%
150INPUT TAB(0,1)"START CO-ORDS "X1%,Y1%
160INPUT TAB(0,2)"BI,GB OR IR "A$
170MOVE X1%,Y1%
180IF A$="IR" PROCir:GOTO 220
190IF A$="GB" PROCgb:GOTO 220
200IF A$()"BI" THEN PRINT TAB(0,3) STRING$
(15," "):GOTO160
210PROCbi
220PRINT TAB(0,1) STRING$(25," ")
230INPUT TAB(0,1)"NEXT CO-ORDS "X1%,Y1%
240GOTO170
250DEFPROCgb
260FOR L%=1 TO 261
270PLOT 1,X%(L%),Y%(L%)
280NEXT L%
290ENDPROC
300DEFPROCbi
310PROCgb
320PLOT 0,-85*SIZE,62*SIZE
330PROCir
340ENDPROC
350DEFPROCir
360FOR L%=262 TO 379
370PLOT 1,X%(L%),Y%(L%)
380NEXT L%
390ENDPROC
400REM       X CO-ORDINATES
410REM             G B
420DATA5,1,5,2,9,10,6,2,9,7,12,-1,3
430DATA10,-1,4,5,2,11,10,6,3,2,5,1
440DATA9,-2,-8,-1,-4,-2,-6,-2,-7,7
450DATA5,4,5,-1,-3,4,2,4,-2,4,4,2,0
460DATA-5,-10,-8,-3,-3,-2,4,2,-7,-3
470DATA-3,-11,0,11,2,6,-6,3,-6,-6,-4
480DATA-6,0,-1,-5,-3,-2,-7,-3,-9,-4
490DATA-8,8,3,3,-6,-3,-5,5,7,6,2,5,3
500DATA-1,3,4,-3,-7,-1,-3,-13,-4,-1,3
510DATA-4,8,2,-6,-2,5,14,1,-7,-16,-5
520DATA-5,-5,0,-4,1,-3,3,-4,1,-3
530DATA-2,2,0,-2,0,3
540DATA-3,0,-2,-1,2,-2,-5,-1,4,-1,5
550DATA5,-5,-2,1,-3,1,-3,-1,6,-1,3,0
560DATA8,-5,-1,3,4,4,-3,-3,5,0,-8,0
570DATA-2,-3,3,4,1,2,2,5,0,2,9,4,10
580DATA-4,-3,-5,-2,-1,3,3,-1,3,2,3,2
590DATA-3,1,-3,-1,4,-5,-1,4,-4,-2,0,-3
600DATA-6,-1,-10,-1,-9,5,7,1,-1,-2,-5
610DATA-10,-2,-7,0,3,-2,1,4,0,5,1,5
620DATA3,-3,0,6,4,2,2,1,8,0,3,1,4,6,1
630DATA-5,-7,-1,-7,-8,-8,-1,2,-9,-1
640DATA-5,-5,-2,-7,-6,-1,5,1,2,0,2
650REM             I R
660DATA7,2,11,2,1,5,2,1,5,8,4,9,3
670DATA8,0,5,-1,6,-2,2,-1,1,-1,1,-2
680DATA2,4,3,2,4,-1,1,1,2,-1,-4,-4,5
690DATA0,-1,0,-1,1,-1,-1,-2,0,-7,-6,-3,
-3,-2,4,-3
700DATA-5,-1,-1,-6,-4,-5,1,-4,-3,-2
710DATA3,7,-3,-6,-1,2,-1,-6,-3,-2,0
720DATA-10,-5,-4,3,6,-1,-4,-2,-5,-1
730DATA4,3,4,1,10,-6,-4,2,-4,-7,8,9
740DATA-2,-8,-7,-1,-4,0,-4,-1,-7,0,7
750DATA-7,0,4,1,6,-6,1,10,-4,0
760REM             Y  CO-ORDINATES
770REM               G B
780DATA3,3,1,4,1,-5,6,7,2,-5,0,3,-1
790DATA2,3,-3,0,-3,3,-4,4,0,2,-1,5,3
800DATA9,-1,1,1,2,0,2,-1,1,1,0,4,3,0
810DATA3,-1,3,2,0,4,9,10,7,3,0,-2,1
820DATA3,4,6,9,0,4,-1,2,1,-4,0,14,3,3
830DATA12,0,2,5,9,15,7,0,12,0,4,-3,3
840DATA4,0,4,3,-1,0,0,3,7,0,4,7,1,5,5
850DATA7,0,-1,2,-4,-4,2,3,1,3,3,0,3,0
860DATA15,7,1,-4,1,4,-5,-4,-1,-4,-2,-3
870DATA-2,1,-1,-5,-2,-3,-1,-6,0,-8,-2
880DATA0,-5,-1,-2,0,-4,-2,-2,-3,2,-8
890DATA-6,-1,-3,-8,-7,-7,0,4,7,10,8
900DATA-7,-7,-4,8,-2,-1,-6,-6,-4,-11
910DATA-8,4,-1,-12,0,4,-1,-4,0,6,-3
920DATA2,6,0,-3,0,-10,0,-2,-7,-5,-3
930DATA-2,3,1,-1,-3,-3,-1,-5,-1,-3
940DATA-5,-4,3,-1,-2,2,-1,1,-3,-4
950DATA-7,-2,2,-6,-5,-6,-4,-3,1,-5
960DATA-2,0,-3,-2,0,-3,0,2,1,-1,-1
970DATA-5,0,1,-3,-1,-3,0,2,2,-1,1,7,-1
980DATA-9,-4,-4,0,2,-1,-3,-1,0,-8,-5
990DATA-2,-4,-6,-1,-6,0,1,-1,-2,-1
1000REM                I R
1010DATA2,-1,2.1,-1,3,2,-1,2,4,3,-1
1020DATA2,-2,4,9,2,12,12,1,3,3,3,2,6
1030DATA5,-2,2,3,0,8,1,-8,2,8,1,-2,5
1040DATA4,0,-3,0,5,3,4,2,4,3,-2,2,-4,-1,
5,5,-4
1050DATA-6,5,1,-1,-7,-3,-4,-1,-3,-3
1060DATA-1,-3,-2,-3,-1,-1,3,-3,2,4
1070DATA1,-2,-6,-4,-1,-3,0,-3,-2,-3
1080DATA-3,-5,1,-1,-3,0,-4,-3,-3,-8
1090DATA0,2,-2,-4,1,-1,0,-4,-1,1,0
1100DATA-5,0,-3,-6,0,-2,0,-4,-4,2
1110DATA-2,-8
```

Gladiator.

```
10MODE5
20VDU23,0,10,39,0;0;0;
30VDU19,0,1,0,0,0,19,2,6,0,0,0,19,3,4,0,0,0
40VDU23,251,254,48,120,127,127,120,48,254,23,250,127,12,30,254,254,30,12,127
50VDU23,252,129,189,255,255,189,153,153,24,23,253,24,153,153,189,255,255,189,
129,23,255,66,60,153,126,24,126,129,0
60ENVELOPE1,2,2,-2,2,5,5,5,30,-5,-2,-1,100,60
70ENVELOPE2,4,0,0,0,5,2,3,10,-5,0,-1,100,70
80MOVE0,60:PLOT6,1280,60:A=136:*FX4,1
90DIM T%(9):SC=0:M%=0:X%=15:Y%=15:*FX11,15
100PRINT TAB(1,31)"SCORE" "SC;:NT=1:CH%=250:PROCmove
110PROCsetup
120REPEAT
130A=INKEY(0)
140IF TIME)400 PROCatmove:TIME=250+SC
150PROCinput
160UNTIL D%=NT+1
170GOTO110
180DEFPROCatmove
190REPEAT
200M%=M%+1:IF M%)NT M%=0
210UNTIL T%(M%)(4000
220H%=T%(M%)DIV100:V%=T%(M%)-H%*100
230TX%=H%+SGN(X%-RND(3)+2-H%):TY%=V%+SGN(Y%-RND(3)+2-V%)
240TX%=FNSB(TX%,19):TY%=FNSB(TY%,29)
250A%=POINT(FNX(TX%),FNY(TY%))
260IF A%=1 ENDPROC
270IF A%=2 PROCdead
280VDU17,1,31,H%,V%,32,31,TX%,TY%,255
290T%(M%)=100*TX%+TY%:SOUND0,2,150,2
300ENDPROC
310DEFPROCdead
320SOUND&10,-15,100,2:SOUND0,2,100,2
330VDU17,2,3,1,TX%,TY%,129,30,19,19,0,0,0:*FX4,0
340END
350ENDPROC
360DEFPROCinput
370 IF A=-1 ENDPROC
380 IF A=32 PROCrd
390IF A=135 PROCfire
400PROCmove:*FX15,1
410ENDPROC
420DEFPROCmove
430IF A(136 OR A)139 ENDPROC
440COLOUR2
450IF CH%()A+114 CH%=A+114:VDU31,X%,Y%,CH%:ENDPROC
460TX%=X%:TY%=Y%
470X%=X%- (A=137) + (A=136):X%=FNSB(X%,19)
480Y%=Y%- (A=138) + (A=139):Y%=FNSB(Y%,29)
490IF POINT(FNX(X%),FNY(Y%))=1 PROCdead
500VDU31,TX%,TY%,32,31,X%,Y%,CH%
510ENDPROC
520DEFPROCrd
530PROCang:SOUND1,1,190,3
540MOVE FNX(X%),FNY(Y%)
550PLOT 0,FNRX(ANG+30),FNRY(ANG+30)
560PLOT82,FNRX(ANG-90),FNRY(ANG-90)
570PLOT86,FNX(X%),FNY(Y%):SOUND&11,0,0,0
580ENDPROC
590DEFFNX(B%)=B%*64+32
600DEFFNY(B%)=(32-B%)*32-16
610DEFFNRX(B%)=1280*COS(RAD(B%))
620DEFFNRY(B%)=1024*SIN(RAD(B%))
630DEFPROCang
640IF CH%=251 ANG=0
650IF CH%=250 ANG=180
660IF CH%=252 ANG=-90
670IF CH%=253 ANG=90
680ENDPROC
690DEFPROCfire
700PROCang:SOUND1,1,10,10
710TX%=X%:TY%=Y%:A%=0
720REPEAT
730B%=COS(RAD(ANG)):TX%=TX%+B%
740B%=SIN(RAD(ANG)):TY%=TY%-B%
750A%=A%+1:TX%=FNSB(TX%,19):TY%=FNSB(TY%,29)
760D%=0:VDU17,3,31,TX%,TY%,42
770B%=100*TX%+TY%
780FOR C%=0 TO NT
790IF T%(C%)=B% VDU 31,TX%,TY%,255:T%(C%)=5000:SC=SC+1:PRINT TAB(8,31)SC;:A%=5
:SOUND &10,-10,100,8
800IF T%(C%)=5000 D%=D%+1
810NEXT
820VDU 31,TX%,TY%,32
830UNTIL A%=5
840ENDPROC
850DEFFNSB(B%,C%)
860IF (B%)C%) OR (B%(1) C%=1 ELSE C%=B%
870=C%
880DEFPROCsetup
890FOR B%=0 TO 29:VDU 17,3,31,0,B%,240,31,B%/1.5,0,240:NEXT
900NT=NT+2:D%=0:TIME=0:IF NT)9 NT=9
910FOR C%=1 TO NT STEP 2
920T%(C%)=3*C%:T%(C%-1)=200*C%
930NEXT
940ENDPROC
```

Match routine.

```
 1000 K=LEN(B$):FORI=0TOLEN(A$)-J+1
 1010 IFMID$(A$,I+J,1)<>MID$(B$,J,1)THENNEXT:L=0:RETURN
 1020 J=J+1:IFJ>KTHENL=I+1:RETURN
 1030 GOTO1010
READY.
```

Line counter.

```
1 B=4^5+1

2 B=256*PEEK(B+1)+PEEK(B) :C=C+1 :IF B<>0
  THEN PRINT CHR$(145) C : GOTO 2
```

Fast machine code

PROGRAMS THAT INTERACT with the user through screen displays are required to do several things extremely quickly, writes Mike Lake. They should go to a particular location on the screen ready to output a value or message in that position; they should also get input from the user in such a way that the user is typing information into a particular part of the screen just as if he/she was entering information on a preprinted form. If they are accessing files, they need to be able to read records from disc quickly, and this presents two further problems; being able to read data at high speed, and being able to do quick record searches.

While some micros at least have built-in Basic commands for printing to a particular screen location, the Commodore Pet range of micros do not have instructions to deal with any of these problems. The screen position is normally selected through a Basic subroutine that prints a number of cursor-downs followed by a number of cursor-rights.

The input problem is particularly awkward since using the normal Basic Input statment causes a return to Ready mode if the user merely presses Return. When inputting data from disc the Basic Input # command has several major limitations. In particular, it can only input a maximum of 80 bytes each time it is used and it will terminate on a carriage-return. The Get # command can be used but is extremely slow.

Basic is painfully slow when it comes to searching strings for other strings, for example when looking up someone's name in a string containing many names, as would be the case in an index file.

The four small assembler routines will solve these problems. They occupy 218 bytes and can be placed wherever convenient providing the addresses on lines 38, 40, 51, 79 and 83 are changed. If you do not have the Commodore Assembler Develoment Package then the hex listing may be used to enter the code through the monitor.

The Basic program in listing 999 demonstrates the use of the routines. The use of the variable names LC, IN, GT and FI means that any progams that use the routines can be quickly changed if you relocate the machine code elsewhere in RAM.

The command

SYS LC,X,Y,

will locate the cursor on line X in column Y. If immediately followed by a Print then the output will occur at this position.

The command

SYS IN,X,Y,A$

will locate the cursor on line X column Y and will wait for input. The value input will be placed in the variable used, in this case A$. If Return is pressed immediately, the value of ST will be set to 1, otherwise it will be 0.

The command

SYS GT,1fno,A$,length

will input from the file whose logical file number is supplied. A string of the length specified will be placed in the named variable. If end-of-file occurs then ST will be set and location zero will contain the number of valid characters in the string — the Left$ function will extract the correct characters.

The command

SYS FI,A$,B$

will find the first occurrence of the string B$ in the strings A$. The position of the B$ within A$ — the offset — will be returned in location zero.

A combination of the last two commands makes it extremely easy to build index files on disc. Each entry in the index would contain a key field followed by a record numbr in the data file. Each block of the index may be read using the SYS GT command and then searched using the SYS FI command for the required key.

Line counter

A QUICK TWO-LINER from David Barratt of Blackpool, Lancashire, counts the number of lines in a Basic program.

Match routine

ONE COMMAND available on the larger Basic compilers but absent on micro Basics is the Match command, writes Quentin King of Horsham, West Sussex. It is used to find if one string is present within another; if it is, its position is returned. Match is particularly useful for Adventure games where the command string must be compared with a vocabulary of words.

This compact Basic subroutine performs the same task. It tests if B$ is part of A$ and if so, L returns its position; if not so, L is set to zero. The routine uses I,J,K and L.

Though written for the Pet, this program should adapt to most micro Basics.

Fast machine code listing 1.

```
5   POKE 52,0: POKE 53,120: CLR: RUN10:      REM *** PROTECT CODE. ***
10  DIM A$(10) : LC=30720: IN=LC+20: GT=LC+67: FI=LC+132
20  FOR X = 5 TO 14
30  SYS LC,X,10 : PRINT "ENTER STRING";X-4
40  SYS IN,X,30,A$
50  IF ST <> 0 THEN 40
60  A$(X-4) = A$
70  NEXT
80  FOR I = 1 TO 10
90  PRINT A$(I)
100 NEXT
110 DOPEN#1,"TEST",D0,W:          REM *** CREATE TEST FILE ***
120 FOR I = 1 TO 50
130 PRINT#1,"THIS IS TEST RECORD NUMBER";I
140 NEXT
150 DCLOSE
160 DOPEN#1,"TEST":                REM *** READ BACK FILE ***
170 SYS GT,1,A$,100
180 IF ST = 0 THEN PRINT A$; : GOTO 170
190 PRINT LEFT$(A$,PEEK(0))
200 DCLOSE
210 A$="THE RUNAWAY TRAIN CAME OVER THE HILL AND SHE BLEW"
220 B$="TRAIN"
230 SYS FI,A$,B$
240 PRINT PEEK(0)
```

(continued on page 169)

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● **Circle No. 205**

(continued from page 167)

Fast machine code listing 2.

```
LINE# LOC   CODE        LINE
00001 0000              ;*******************************************************
00002 0000              ;*   LOCATE, INPUT, FIND AND GET ROUTINES FOR CBM 8032   *
00003 0000              ;*                    MIKE LAKE 1982                     *
00004 0000              ;*******************************************************
00005 0000              ;
00006 0000              CHKCOM = $BEF5          ;CHECK FOR COMMA IN BASIC STATEMENT
00007 0000              FRMEVL = $BD98          ;FORMULA EVALUATION ROUTINE
00008 0000              GETADR = $C92D          ;PRODUCE VALUE IN RANGE 0 - 65536
00009 0000              CURPOS = $E067          ;POSITION CURSOR
00010 0000              INLIN  = $B4E2          ;INPUT A LINE TO INPUT BUFFER
00011 0000              PTRGET = $C12B          ;FIND VARIABLE ROUTINE
00012 0000              INPCON = $BC09          ;ASSIGN INPUT TO A VARIABLE
00013 0000              SPACE  = $C59E          ;GENERATE SPACE FOR A STRING
00014 0000              STRPTS = $C7B5          ;RETURNS LENGTH AND ADDRESS OF STRING
00015 0000              SETIO  = $FFC6          ;SET I/O DEVICE
00016 0000              RSTIO  = $FFCC          ;RESET NORMAL I/O DEVICES
00017 0000              GETIO  = $FFE4          ;GET BYTE ROUTINE
00018 0000              RETADD = $1F            ;RETURN STRING ADDRESS
00019 0000              STATUS = $96            ;STATUS BYTE
00020 0000              INTADD = $11            ;INTEGER VALUE RETURN AREA
00021 0000              TEMSTR = $D9            ;TEMPORARY STORE
00022 0000              CURCOL = $C6            ;COLUMN POSITION OF CURSOR
00023 0000              CURLIN = $D8            ;SCREEN LINE OF CURSOR
00024 0000              LENGTH = $5E            ;LENGTH OF STRING RETURNED HERE
00025 0000              ADD    = $5F            ;STRING ADDRESS RETURNED HERE
00026 0000              POINT  = $44            ;POINTER TO STRING DESCRIPTOR
00027 0000              COMMA  = $2C            ;COMMA
00028 0000              BUFFER = $0200          ;INPUT BUFFER
00029 0000              WORK   = $00            ;WORK AREA - THREE BYTES
00030 0000              OK     = 0              ;GOOD RESULT FLAG
00031 0000              FAIL   = 1              ;BAD RESULT FLAG
00032 0000              ;
00033 0000              BEGIN  = $7800          ;START OF CODE
00035 0000              ;***** LOCATE THE CURSOR ROUTINE - CALL:  SYS LOC,X,Y *****
00036 0000              ;
00037 0000                      * = BEGIN
00038 7800  20 37 78    LOC     JSR VALIN       ;GET FIRST COORDINATE
00039 7803  85 D9               STA TEMSTR      ;PUT INTO TEMPORARY STORAGE AREA
00040 7805  20 37 78            JSR VALIN       ;GET SECOND COORDINATE
00041 7808  85 C6               STA CURCOL      ;PUT INTO CURSOR COLUMN VALUE
00042 780A  78                  SEI             ;MASK OFF INTERRUPTS
00043 780B  A5 D9               LDA TEMSTR      ;RETRIEVE LINE VALUE
00044 780D  85 D8               STA CURLIN      ;PLACE IN CURSOR LINE VALUE
00045 780F  20 67 E0            JSR CURPOS      ;POSITION CURSOR
00046 7812  58                  CLI             ;ALLOW INTERRUPTS
00047 7813  60                  RTS
00048 7814              ;
00049 7814              ;***** INPUT A STRING ROUTINE - CALL:  SYS IN,X,Y,A$ *****
00050 7814              ;
00051 7814  20 00 78    IN      JSR LOC         ;FIRST POSITION CURSOR
00052 7817  20 F5 BE            JSR CHKCOM      ;FIND COMMA
00053 781A  A9 2C               LDA #COMMA      ;STORE A COMMA
00054 781C  8D FF 01            STA BUFFER-1    ;IMMEDIATELY IN FRONT OF INPUT BUFFER
00055 781F  20 E2 B4            JSR INLIN       ;GET A LINE OF INPUT INTO THE BASIC BUFFER
00056 7822  AD 00 02            LDA BUFFER      ;GET FIRST CHARACTER FROM BUFFER
00057 7825  F0 08               BEQ EMPTY       ;NO CHARACTERS ENTERED
00058 7827              ;
00059 7827  20 09 BC            JSR INPCON      ;PLACE CHARACTERS INTO CORRECT VARIABLE
00060 782A  A9 00               LDA #OK         ;INDICATE VALUE PRESENT
00061 782C  85 96               STA STATUS      ;PLACE IN STATUS BYTE
00062 782E  60                  RTS
00063 782F              ;
00064 782F  A9 01       EMPTY   LDA #FAIL       ;NO VALUE PRESENT
00065 7831  85 96               STA STATUS      ;PLACE IN STATUS BYTE
00066 7833  20 2B C1            JSR PTRGET      ;PUSH THE TEXT POINTER BEYOND THE VARIABLE NAME
00067 7836  60                  RTS
00068 7837              ;
00069 7837              ;***** GET A VALUE FROM THE BASIC STATEMENT AND PLACE IN ACCUMULATOR *****
00070 7837              ;
00071 7837  20 F5 BE    VALIN   JSR CHKCOM      ;FIND COMMA
00072 783A  20 98 BD            JSR FRMEVL      ;EVALUATE EXPRESSION FOUND THERE
00073 783D  20 2D C9            JSR GETADR      ;CONVERT TO INTEGER
00074 7840  A5 11               LDA INTADD      ;LOAD ACCUMULATOR WITH LOW ORDER BYTE
00075 7842  60                  RTS
00077 7843              ;***** READ DATA FROM FILE - CALL:  SYS GET,LFNO,A$,LENGTH
00078 7843              ;
00079 7843  20 37 78    GET     JSR VALIN       ;GET LFNO FROM BASIC STATEMENT
00080 7846  48                  PHA             ;BUFFER IT
00081 7847  20 F5 BE            JSR CHKCOM      ;FIND COMMA
00082 784A  20 2B C1            JSR PTRGET      ;SET POINTER TO STRING NAMED IN BASIC STATEMENT
00083 784D  20 37 78            JSR VALIN       ;GET LENGTH FROM BASIC STATEMENT
00084 7850  20 9E C5            JSR SPACE       ;SET UP SPACE FOR THE NEW STRING
00085 7853              ;
00086 7853  A0 00               LDY #0          ;FOR INDEXING
00087 7855  A5 5E               LDA LENGTH      ;GET LENGTH OF STRING TO BE READ IN
00088 7857  85 00               STA WORK        ;BUFFER IT FOR CHECKING ON INPUT
00089 7859  91 44               STA (POINT),Y   ;STORE IT IN STRING DESCRIPTOR
00090 785B  C8                  INY
00091 785C  A5 5F               LDA ADD         ;GET POINTER TO RAM AREA FOR STRING
00092 785E  91 44               STA (POINT),Y   ;PUT ADDRESS INTO STRING DESCRIPTOR
00093 7860  85 01               STA WORK+1      ;STORE POINTER FOR INDIRECT INDEXING
00094 7862  C8                  INY
00095 7863  A5 60               LDA ADD+1       ;SAME FOR HIGH BYTE OF ADDRESS
00096 7865  91 44               STA (POINT),Y
00097 7867  85 02               STA WORK+2
00098 7869              ;
00099 7869  68                  PLA             ;RETRIEVE LOGICAL FILE NUMBER
00100 786A  AA                  TAX
00101 786B  20 C6 FF            JSR SETIO       ;SET FILE READY FOR INPUT
00102 786E              ;
00103 786E  A0 00               LDY #0          ;FOR INDEXING
00104 7870  A5 96       GETIT   LDA STATUS      ;CHECK STATUS: NON ZERO FOR END OF FILE
00105 7872  D0 0A               BNE GETFIN
00106 7874  20 E4 FF            JSR GETIO       ;GET A BYTE FROM FILE
00107 7877  91 01               STA (WORK+1),Y  ;STORE IN RAM AREA
00108 7879  C8                  INY
```

(listing continued on page 171)

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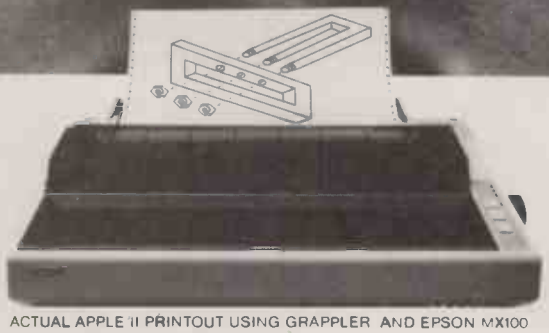

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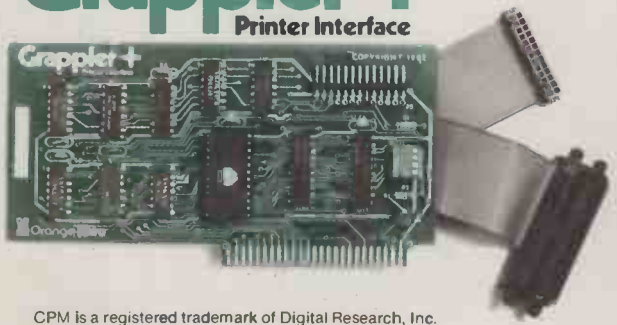

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● Circle No. 206

(listing continued from page 169)

```
00109  787A  C4 00          CPY WORK        ;FINISHED
00110  787C  D0 F2          BNE GETIT
00111  787E                ;
00112  787E  84 00       GETFIN STY WORK     ;PUT LENGTH READ INTO WORK AREA
00113  7880  20 CC FF       JSR RSTIO       ;RESET NORMAL I/O DEVICES
00114  7883  60             RTS

00116  7884             ;***** FIND ONE STRING IN ANOTHER - CALL: SYS FIND,F1$,F2$ *****
00117  7884             ;
00118  7884  20 F5 BE    FIND   JSR CHKCOM    ;PASS COMMA
00119  7887  20 98 BD           JSR FRMEVL    ;EVALUATE EXPRESSION
00120  788A  20 B5 C7           JSR STRPTS    ;GET STRING ADDRESS AND LENGTH
00121  788D  85 D9              STA TEMSTR    ;STORE LENGTH
00122  788F  A5 1F              LDA RETADD    ;LOW BYTE OF ADDRESS
00123  7891  85 01              STA WORK+1
00124  7893  A5 20              LDA RETADD+1  ; HIGH BYTE OF ADDRESS
00125  7895  85 02              STA WORK+2
00126  7897                ;
00127  7897  20 F5 BE           JSR CHKCOM    ;PASS COMMA
00128  789A  20 98 BD           JSR FRMEVL    ;EVALUATE FORMULA
00129  789D  20 B5 C7           JSR STRPTS    ;GET STRING ADDRESS AND LENGTH
00130  78A0                ;
00131  78A0  C5 D9              CMP TEMSTR    ;COMPARE STRING LENGTHS
00132  78A2  F0 02              BEQ SAVEIT    ;SAME
00133  78A4  B0 2D              BCS NOGO      ;SECOND SHORTER THAN FIRST
00134  78A6                ;
00135  78A6  85 DA       SAVEIT STA TEMSTR+1  ;SAVE LENGTH OF SECOND STRING
00136  78A8  38                SEC
00137  78A9  A5 D9              LDA TEMSTR    ;GET FIRST STRING LENGTH
00138  78AB  E5 DA              SBC TEMSTR+1  ;SUBTRACT LENGTH OF SECOND STRING
00139  78AD  85 D9              STA TEMSTR    ;STORE THE DIFFERENCE
00140  78AF  E6 D9              INC TEMSTR    ;BUMP IT UP BY ONE
00141  78B1                ;
00142  78B1  A9 00              LDA #0
00143  78B3  85 00              STA WORK      ;THIS WILL CONTAIN THE OFFSET IF FOUND
00144  78B5                ;
00145  78B5  A6 DA       CMPSTR LDX TEMSTR+1  ;LENGTH OF SECOND STRING
00146  78B7  A0 00              LDY #0        ;FOR INDEXING
00147  78B9  B1 01       CMPCHR LDA (WORK+1),Y ;CHARACTER FROM FIRST STRING
00148  78BB  D1 1F              CMP (RETADD),Y ;COMPARED WITH CHARACTER FROM SECOND STRING
00149  78BD  D0 06              BNE NOMACH    ;NOT EQUAL
00150  78BF  CA                 DEX
00151  78C0  F0 15              BEQ MATCH     ;END OF COMPARES - MATCH FOUND
00152  78C2  C8                 INY
00153  78C3  D0 F4              BNE CMPCHR    ;BRANCH ALWAYS
00154  78C5                ;
00155  78C5  C6 D9       NOMACH DEC TEMSTR    ;DECREMENT DIFFERENCE
00156  78C7  F0 0A              BEQ NOGO      ;NO MORE COMPARISONS NEEDED
00157  78C9  E6 00              INC WORK      ;INCREMENT THE OFFSET
00158  78CB  E6 01              INC WORK+1    ;INCREMENT THE INDEX INTO THE FIRST STRING
00159  78CD  D0 E6              BNE CMPSTR
00160  78CF  E6 02              INC WORK+2
00161  78D1  D0 E2              BNE CMPSTR    ;BRANCH ALWAYS
00162  78D3                ;
00163  78D3  A9 FF       NOGO   LDA #255      ;SET THE OFFSET TO ZERO TO SHOW FAILURE
00164  78D5  85 00              STA WORK
00165  78D7  E6 00       MATCH  INC WORK      ;BUMP UP OFFSET BY ONE
00166  78D9  60                 RTS
00168  78DA                    .END

ERRORS = 00000

SYMBOL TABLE

SYMBOL VALUE
 ADD      005F    BEGIN    7800    BUFFER   0200    CHKCOM   BEF5
 CMPCHR   78B9    CMPSTR   78B5    COMMA    002C    CURCOL   00C6
 CURLIN   00D8    CURPOS   E067    EMPTY    782F    FAIL     0001
 FIND     7884    FRMEVL   BD98    GET      7843    GETADR   C92D
 GETFIN   787E    GETIO    FFE4    GETIT    7870    IN       7814
 INLIN    B4E2    INPCON   BC09    INTADD   0011    LENGTH   005E
 LOC      7800    MATCH    78D7    NOGO     78D3    NOMACH   78C5
 OK       0000    POINT    0044    PTRGET   C12B    RETADD   001F
 RSTIO    FFCC    SAVEIT   78A6    SETIO    FFC6    SPACE    C59E
 STATUS   0096    STRPTS   C7B5    TEMSTR   00D9    VALIN    7837
 WORK     0000
END OF ASSEMBLY
```

```
.m 7800 7880
.:  7800 20 37 78 85 d9 20 37 78
.:  7808 85 c6 78 a5 d9 85 d8 20
.:  7810 67 e0 58 60 20 00 78 20
.:  7818 f5 be a9 2c 8d ff 01 20
.:  7820 e2 b4 ad 00 02 f0 08 20
.:  7828 09 bc a9 00 85 96 60 a9
.:  7830 01 85 96 20 2b c1 60 20
.:  7838 f5 be 20 98 bd 20 2d c9
.:  7840 a5 11 60 20 37 78 48 20
.:  7848 f5 be 20 2b c1 20 37 78
.:  7850 20 9e c5 a0 00 a5 5e 85
.:  7858 00 91 44 c8 a5 5f 91 44
.:  7860 85 01 c8 a5 60 91 44 85
.:  7868 02 68 aa 20 c6 ff a0 00
.:  7870 a5 96 d0 0a 20 e4 ff 91
.:  7878 01 c8 c4 00 d0 f2 84 00
.:  7880 20 cc ff 60 20 f5 be 20
.
.:  7880 20 cc ff 60 20 f5 be 20
.:  7888 98 bd 20 b5 c7 85 d9 a5
.:  7890 1f 85 01 a5 20 85 02 20
.:  7898 f5 be 20 98 bd 20 b5 c7
.:  78a0 c5 d9 f0 02 b0 2d 85 da
.:  78a8 38 a5 d9 e5 da 85 d9 e6
.:  78b0 d9 a9 00 85 00 a6 da a0
.:  78b8 00 b1 01 d1 1f d0 06 ca
.:  78c0 f0 15 c8 d0 f4 c6 d9 f0
.:  78c8 0a e6 00 e6 01 d0 e6 e6
.:  78d0 02 d0 e2 a9 ff 85 00 e6
.:  78d8 00 60 aa aa aa aa aa aa
```

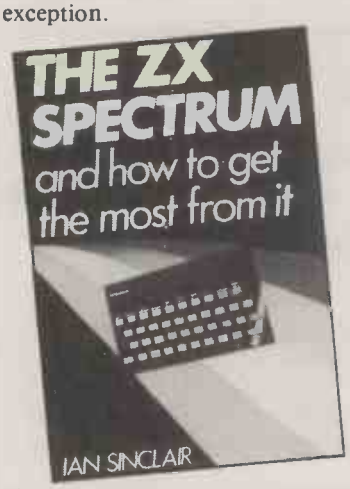
The Spectrum overlap

PUBLISHING BOOKS about home computers is one of the few remaining growth industries. About a year ago a number of publishers discovered that books on home computing can be very profitable — only one percent of ZX-81 owners needs to buy a copy for it to be a big seller.

As a consequence, a number of publishers were eagerly waiting for the launch of the ZX Spectrum. To publish the definitive Spectrum book would mean big money. As the launch of the machine grew closer a number of hopefuls were lined up on the starting grid with engines roaring, ready to go.

This end of publishing has never been known for producing a high-quality product. There is a definate "never mind the quality, feel the width" approach. Readers want information, not pretty books — or so runs the philosophy of the market.

One publishing house that subscribes firmly to these principles is Interface. There are a large number of Interface books which mainly back up the National ZX Users' Club. On the whole Interface books are rather scruffy items, the Spectrum book *Programming your ZX Spectrum* by Tim Hartnell and Dilwyn Jones is no exception.

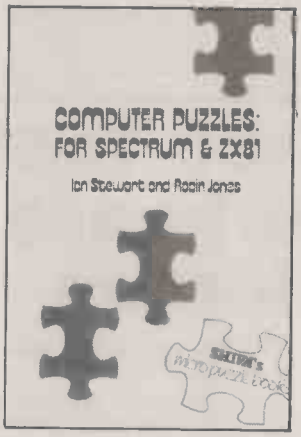


The listings are reproduced directly from a Sinclair printer, making them tatty and difficult to read. At times they do not even line up down the page. However, at least you are guaranteed that the software has been tried on a real machine. The £6.95 price does seem expensive for such a poorly presented book, but Spectrum fans will find it of use. One thing that would improve the look of the book, and actually make it more useful, would be a contents list.

Easy Programming for the ZX Spectrum is the latest offering from Shiva. Written by Ian Stewart and Robin Jones, this book is one of the Shiva "friendly micro" series. The book is presented in a slightly more tempting manner than Interface's, complete with some highly unfunny

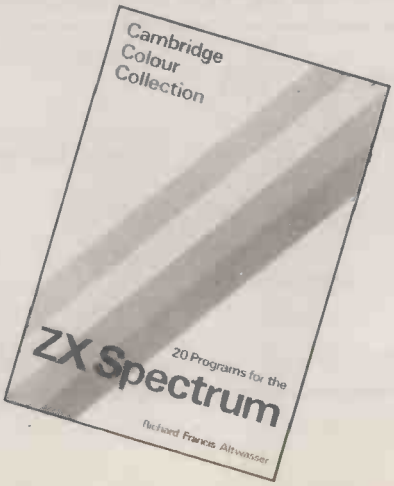
cartoons. My main complaint is that the book has been written in a style that makes the language in the Ladybird children's books look sophisticated. If you are an idiot with an odd sense of humour, then this is the book for you.

Computer Puzzles for Spectrum and ZX-81 comes from the same stable. As an idea it is fascinating, and also represents the best value of all the books I looked at.



In reality it is no more than a book of programs, 19 in all. Apart from the fact that the programs appear to have been written for the ZX-81 with changes for the Spectrum dropped in as an afterthought, I have no complaints.

The Cambridge Colour Collection is a thin volume of not very good programs from Richard Francis Altwasser.



Although Altwasser was responsible for the design of the Spectrum this book reveals nothing a reasonably bright person could not discover for themselves. If you want the programs, buying the cassette offered instead would be better.

Over the Spectrum from Melbourne House has the most imaginative name and design of any of these books. It scores points with me because of the colour photographs which show what a program should like when it is run. It had a few more programs that the other books and did include some serious software which will enable you to justify owning a micro in the first place.

The Spectrum Handbook by Tim Langdell is the best value all-round book. At £4.95 it contains a large number of useful hints and some utilities. It is especially good for people interested in graphics

Again the book uses Sinclair listings and there are sections at the end which deal with both serious programming and games. The only nagging doubt I have about this book applies equally to most of the others: Does it replace the manual? The justification is that some people will find the official manual difficult, but will understand the same information in a different format.

(continued on next page)

(continued from previous page)

Three rather disappointing books finish the survey, all from Granada Books. In *ZX Spectrum and How to Get the Most from it* by Ian Sinclair there is little that could not be found elsewhere. *The Spectrum Programmer* by S M Gee and *The Spectrum Book of Games* by Mike James, S M Gee and Kay Ewbank complete the list. Both of them are rather unremarkable works and warrant little mention. I was disappointed to realise that the final game in the second of these books, Spectrum Smalltalk, is remarkably like the Doctor program in John Krutch's *Experiments in Artificial Intelligence*.

None of the books in the survey is remarkably original and there is a great deal of overlap throughout. Three books have versions of Space Invaders, and there are at least two versions each of Galaxians, Othello, Nim, Maze and Life.

Bill Bennett

The ZX Spectrum and how to get the most from it by Ian Sinclair. Published by Granada, 130 pages, paperback, £5.95. ISBN 0 246 120185

The Cambridge Colour Collection, 20 programs for the ZX Spectrum by Richard Francis Altwasser. Published by Richard Francis Altwasser, 64 pages, paperback, £6.95. ISBN 0 9507658 2 1.

Computer Puzzles For Spectrum and ZX-81, by Ian Stewart and Robin Jones. Published by Shiva, 60 pages, paperback, £2.50. ISBN 0 9068 12 27 5.

Easy programming for the ZX Spectrum by Ian Stewart and Robin Jones. Published by Shiva, 140 pages, paperback, £5.95. ISBN 0 906812 23 2.

The Spectrum Programmer by S M Gee. Published by Granada, 140 pages, paperback, £5.95. ISBN 0 246 12025 8.

Programming your ZX Spectrum by Tim Hartnell and Dilwyn Jones. Published by Interface Books, 232 pages, paperback, £4.95. ISBN 0 907563 19 8.

Over The Spectrum. Published by Melbourne House books, 164 pages, paperback, £6.95. ISBN 0 86161 109 8.

The Spectrum book of Games by Mike James, S M Gee and Kay Ewbank. Published by Granada, 150 pages, paperback, £5.95. ISBN 0 246 12047 9.

The Spectrum Handbook by Tim Langdell. Published by Century, 216 pages, paperback, £4.95. ISBN 0 7126 0152 X.

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● Circle No. 212

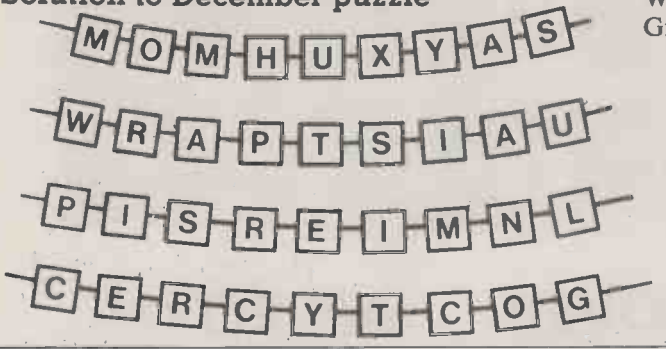
Unexpected responsibility

by Nigel Bateman

OWING TO the unexpected illness of his boss, the organisation of six stall at the 1983 Microcomputing Exhibition is left to Peabrain. There are to be five salesmen demonstrating five computers, each with a certain memory rating; four of them have appropriate printers. Additionally there is to be a hot-dog salesman plus wares.

Peabrain does have his boss's notes: how does he position them?
Salesmen: Dave, Fred, Jeff, Joe, John, Steve.
Computers: Axion, Furvon, Govon, Jincon, Zincon.
Memory: 1K, 5K, 10K, 16K, 48K.
Printers: Letta, Linka, Spella, Writa.
Notes — John is four from Dave. Letta is next to Gobon. Axion is next to John who is next to Furvon. Steve is two from 16K. Spella is other end from 10K. Hot-dog stand is as close to middle as possible. Largest K is next to smallest K. Fred is at one end. Joe is next to man whose name begins with J. Steve is next to hot-dogs. Gobon is next to a machine with double its memory. Jeff has the cheapest products — cash only. Furvon memory is one of the two smallest and has no printer. Linka is next stall after hot-dogs.

Solution to December puzzle



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● Circle No. 217

Annual index, 1982

compiled by Nigel Martin

ENTRIES refer to articles published in *Practical Computing* during the year by page number, issue number; an asterisk signifies a correction to an earlier entry. A cumulative index for volumes 1-4 appeared on page 153 of the January 1982 issue of *Practical Computing*.

(continued on next page)

(continued from previous page)

MAKE YOUR SMART TERMINAL SMARTER.

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

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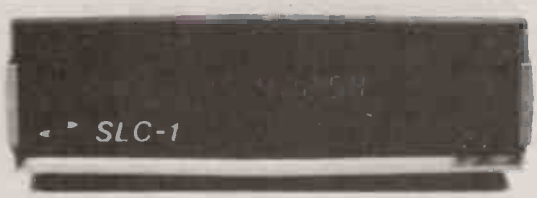
But the SLC-1 is more than a clock. It constantly monitors the output from any computer and provides instant responses to a number of user-defined key phrases. This makes it ideal for use with unattended process control or data acquisition systems. And since the Time Machine is a 6502 microprocessor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

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

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



GET INTO THE TIME MACHINE.

DIGITAL PATHWAYS

● Circle No. 220

>NEXT MONTH

>WORD PROCESSING

While many people have special uses for computers, almost everyone can profit from one feature — word processing. In the February issue of *Practical Computing* we'll be looking at the advantages and disadvantages of various approaches and the merits of particular products.
One of the in-depth reviews will compare eight different WP programs — including WordStar, Format 80 and Letter Perfect — running on the Apple II.

>REVIEWS

Amont the equipment on the test bench this month:

- Victor 9000; a 16-bit micro better known in its Sirius 1 form
- LVL disc drives for the BBC micro
- Adcomp X-80P; a low-cost dot-matrix printer which can draw graphs

>AND MUCH MORE!

With special features on eight-colour graphics in Teletext mode on the BBC micro, and "Computing for Accidents", plus all the regular departments, you will not want to miss the February issue of

Practical Computing

On sale at W H Smith and all leading newsagents after January 19.

Hic, hic, hurrah

by Peter Laurie

IMPATIENT PEOPLE in our odd trade often complain of the difficulty of selling microcomputers to otherwise conspicuous consumers. "Why", they ask plaintively, "will people buy cars and central heating and holidays abroad — which all cost as much as or more than a nice computer and are not nearly as much fun — and yet they won't buy micros?" It is a reasonable question, bearing in mind that everyone in the civilised world knows that microchips are the best thing since sliced cotton wool.

Well, we are happy to bring you a brand-new economic concept that explains this and, possibly, much more. The name of this concept — write it large — is HIDDEN INTELLECTUAL COST, otherwise known as Hic for the hiccup it causes in potentially prosperous industries.

The essence of the matter is that everything you buy has a cost in cash and a second hidden cost in the time it takes you to get used to it. The cost depends very much on your previous experience, reaching right back into your childhood education. A clothes peg takes a negligible amount of time to understand for a nicely brought-up 20th-century westerner, but it might have presented a considerable Hic to a Stone Age tramp whose laundry day consisted of falling in the river.

A motor car has a considerable Hic, but it is one that we are brought up to accept and we are willing to pay for the pleasure and convenience of being licensed killers on the road. Many things have much lower Hics than they otherwise might because they conform to general rules that we are taught in school. Say you need a manual on 68000 machine code. Imagine that there are two versions available, one in English and one in Russian. For us non-Russian speakers, the second has a quite unacceptable Hic — we would have to spend two or three years learning Russian before it was of any use. The cost of learning English we paid, without being able to argue about it, at an early age.

How much does a Hic cost? A simple way of calculating it is to take the time spent in getting over it multiplied by the Hiccer's hourly rate. The cost of getting to grips with a new gramophone might be half an hour. The cost of a video recorder, if you have never seen one before, might be a couple of hours.

We ought to charge Hic time at our potential customer's hourly income, plus overheads, plus profits he would have been earning had he not embroiled himself with our little delight. In the micro business, trying to sell systems to professional people, we ought to allow something like £10,000 a year salary, plus another £15,000 for overheads and profits.

This ingredient puts a very different complexion on the cost of a micro. Suppose it takes our man a month, full time, before he has the thing mastered and working. It puts the cost up by about £2,000, and makes quite a difference to a machine that costs, say, £3,000.

This extra cost is in retrospect. What matters is what the poor fellow thinks it is going to cost him before he buys. If he is sensible he allows a 50 percent risk that none of it will work. That puts the Hic up to £3,000, effectively doubling the cost of the machine. This is bad enough for vendors of hardware. Their prices are at least comparable with the hidden costs. The seller of software is in a much worse position because his products are cheaper but not less complicated. The Hic in his case can be not just double the cost of his product, but multiplied to such stratospheric heights that its cash price tag becomes almost negligible by comparison.

Take, as a horrible example, a word-processing package costing £300. Although its proud owners claim that it can be mastered in a matter of hours — and they'll produce some smiling lady who conceals a Nobel Prize mind beneath a Fawcett-Majors hairdo to prove it — in real life it may take several weeks to get the full benefit of the thing. The cash cost of the package is then only 10 percent of the total cost. It is not surprising that people hum and ha about buying software. If they were realistic they would often not "buy" the product even it it were given away.

What can be done about Hics? One obvious solution is for buyers to shape up and learn some basic ideas. I well remember the two or three months of agony it took me back in the summer of '79 — ah, those long, green-phosphor days! — to understand what a file was and what might go wrong with it. The trouble was one had to learn in the dark by making it go wrong and then laboriously trying to find an answer. It was rather like the blind men touching up the elephant and arguing about what they had found.

Imagine if the motor industry had to educate its customers about cars in the same way. You put them into an invisible but very expensive sort of something that you cannot really explain, and send them off to the M1 to deduce from the wounds left on other customers' carcases what makes it go and stop, and what other beasts inhabit this invisible world.

The difficulty of selling cars under those conditions would make BL's troubles seem like a holiday. Cars would not become a marketable item until people developed second sight, and that is rather the position we are in now. We are waiting for the spread of computer literacy to bring people at large an understanding of the invisible concepts inside micros. Until they have, it is going to be hiccy and sticky selling micros.

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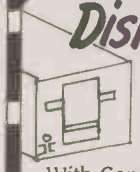

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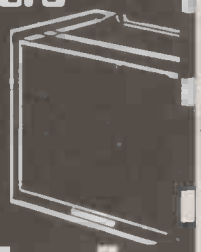

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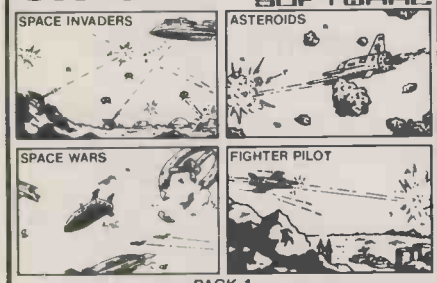

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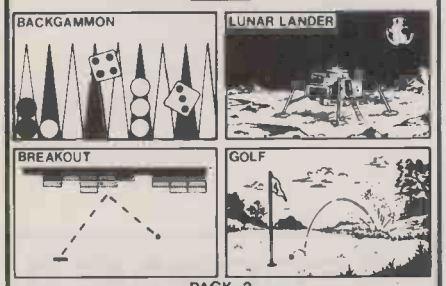

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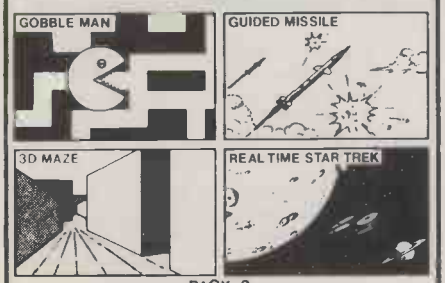

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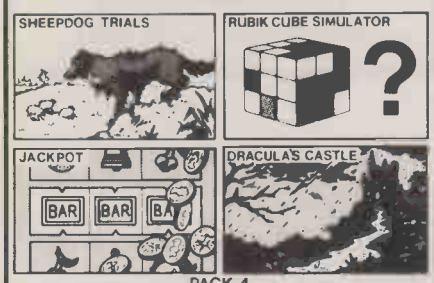

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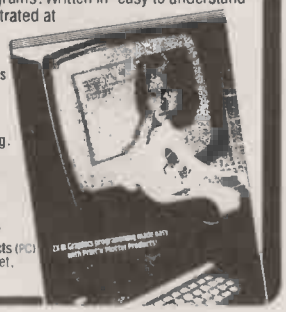

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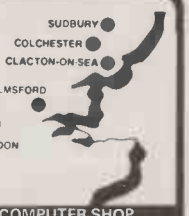

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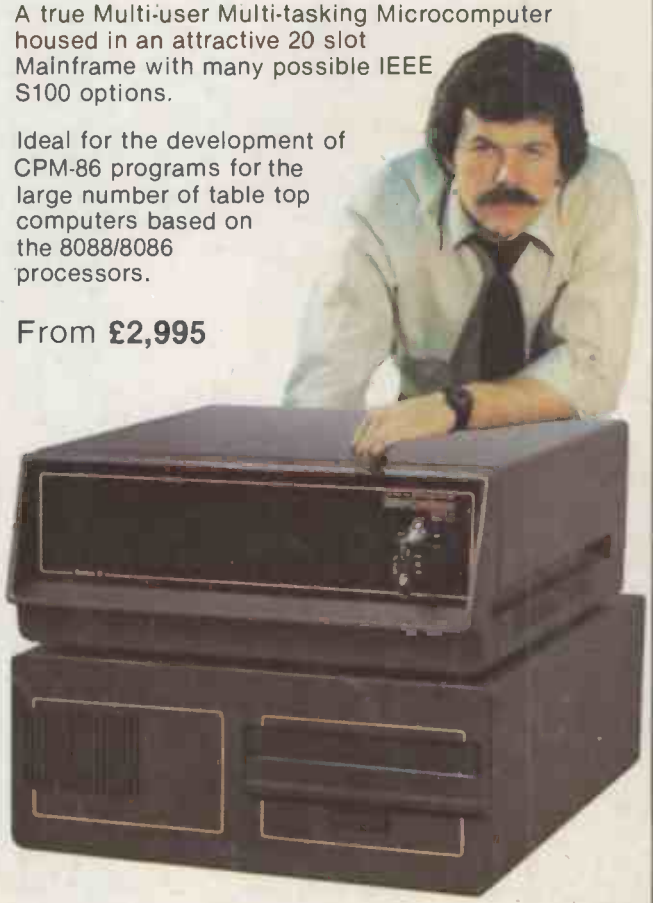

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