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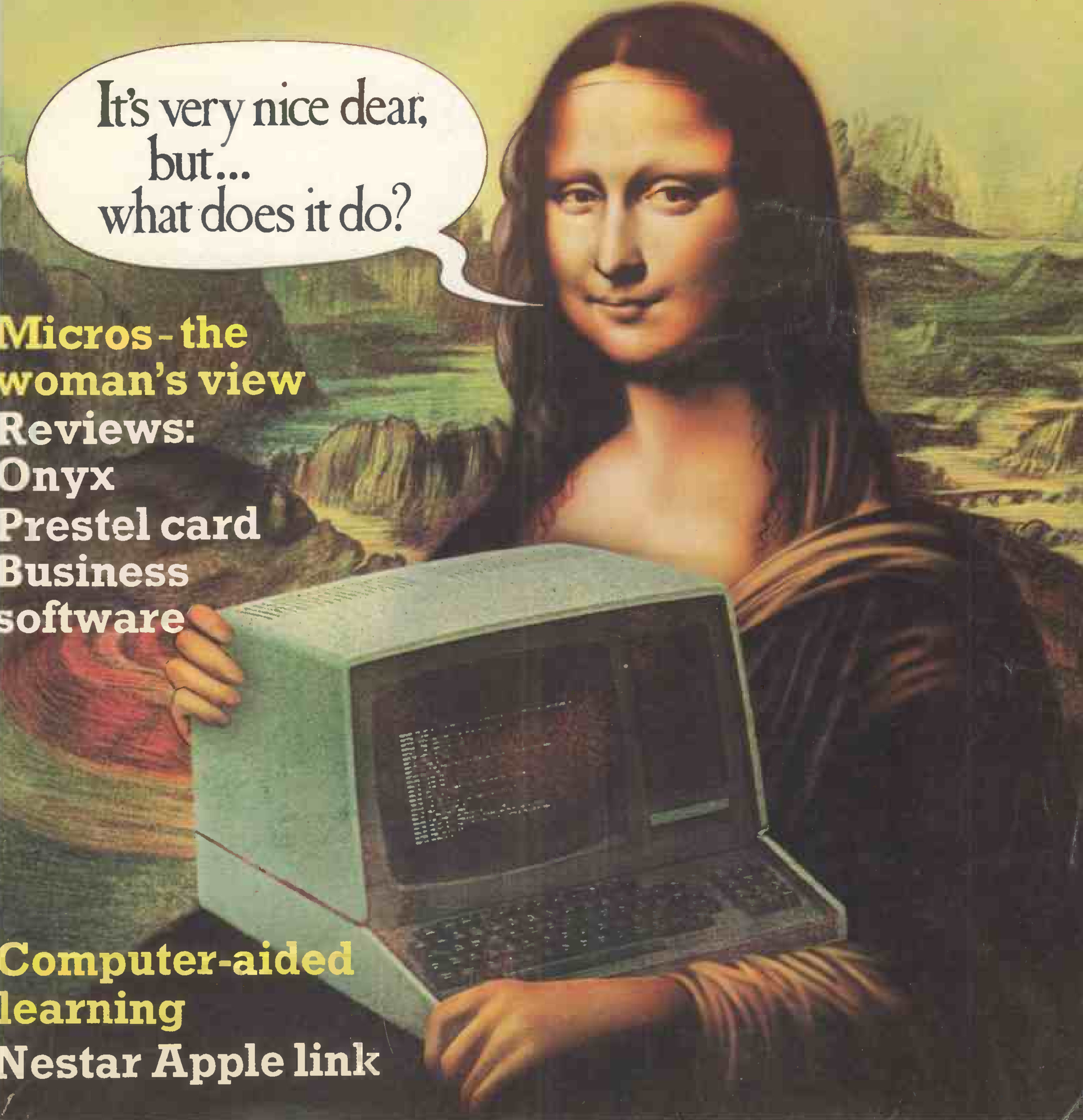


Micros - the woman's view

Reviews:
Onyx
Prestel card
Business software

Computer-aided learning

Nestar Apple link

MicroCentre introduce . . . . . . System Zero

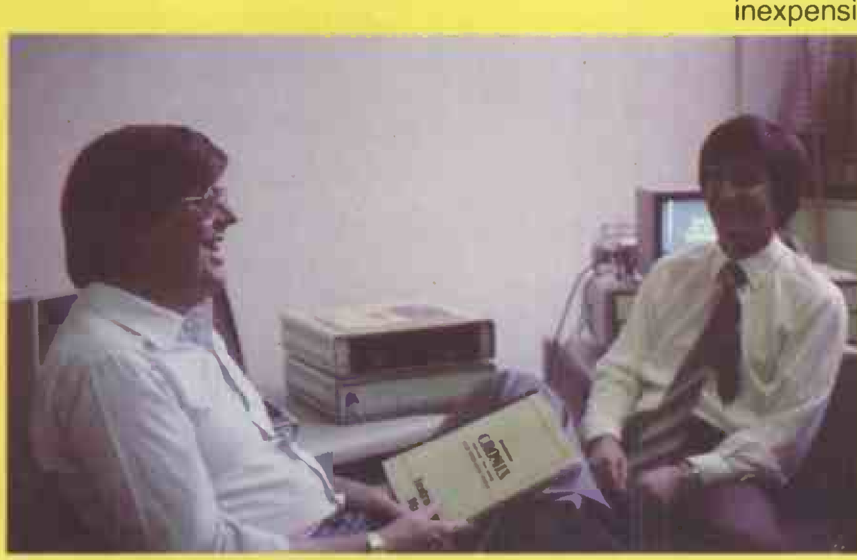
Basic System Zero £587
System Zero/D with DDF £2355

The System Zero is a small computer especially designed for dedicated applications. It is particularly useful in process control situations.
In the basic model you get Cromemco's famous Z-80A single card computer, 1k of RAM, 4k of ROM, Control Basic, and an attractive cabinet. The motherboard provides 3 extra card slots on the S-100 bus, for tailoring the system to particular applications. The basic model is designed for ROM-based programs, but it can be expanded by the addition of memory and I/O cards. It is fully compatible with all Cromemco peripherals, including floppy disks and hard disk systems. Suitably configured the System Zero can run any Cromemco operating system or software package.

New System Zero Computer with quad-capacity DDF disk drive. The system includes built-in diagnostics for a quick system test of memory, controller and disk drives

System Zero/D

This special version of the System Zero has 64k of fast RAM, and a model DDF dual disk drive. It includes two double-sided double-density 5 inch disk drives giving a total of 780k bytes storage; and RDOS-2, a new resident disk operating system with terminal and printer drivers, and self-test diagnostics.
The System Zero/D is an exceedingly inexpensive development computer ideal for setting up dedicated applications to run in the basic model. It will support Cobol, Fortran IV, Ratfor, Structured Basic, Lisp, RPG II, Word Processing, DBMS, and the full range of Cromemco's business applications software.



At the recent UK launch of the System Zero Computer, Cromemco's Technical Director Roger Melen presented a System Zero/D with 128k memory running Cromix. Here he is seen discussing the system with MicroCentre Director Andrew Smith (right).

Operating system

The System Zero/D will run any Cromemco operating system provided sufficient memory is available. The mimimun configuration of 4k ROM runs control Basic; with 64k RAM the system will run RDOS-2 or CDOS (compatible with CP/M); and with 128k the Zero/D will run the Cromix system (based on Unix).

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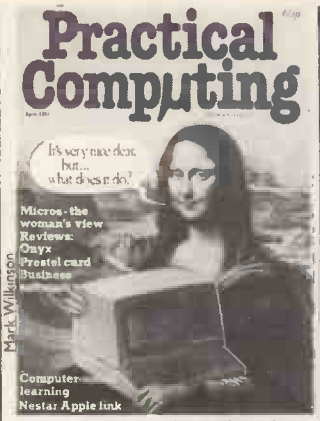

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NEW

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☐ Ⓜ **DISILOG** — As Distel to Zilog Mostek mnemonic files. Runs on Z80 only .... £35/£7

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☐ **DATEBOOK** — Program to manage time just like an office appointment book but using the speed and memory of a computer. Keeps track of three appointment schedules (three dental chairs, three attorneys, etc.) at once. Appointments consist of name, reason for the appointment, the date and time, and the length of the appointment. System can be quickly customized for the individual user. Many helpful features for making, changing, finding, and reporting appointments. Requires 48K CP/M and 180K bytes diskette storage. Not available for Apple CP/M .... £185/£15

NEW

☐ Ⓜ **POSTMASTER** — A comprehensive package for mail list maintenance that is completely menu driven. Features included keyed record extraction and label production. A form letter program is included which provides neat letters on single sheet or continuous forms. Compatible with NAD files. Requires CBASIC-2 .... £85/£10

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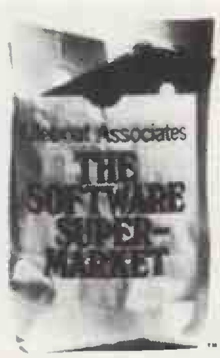

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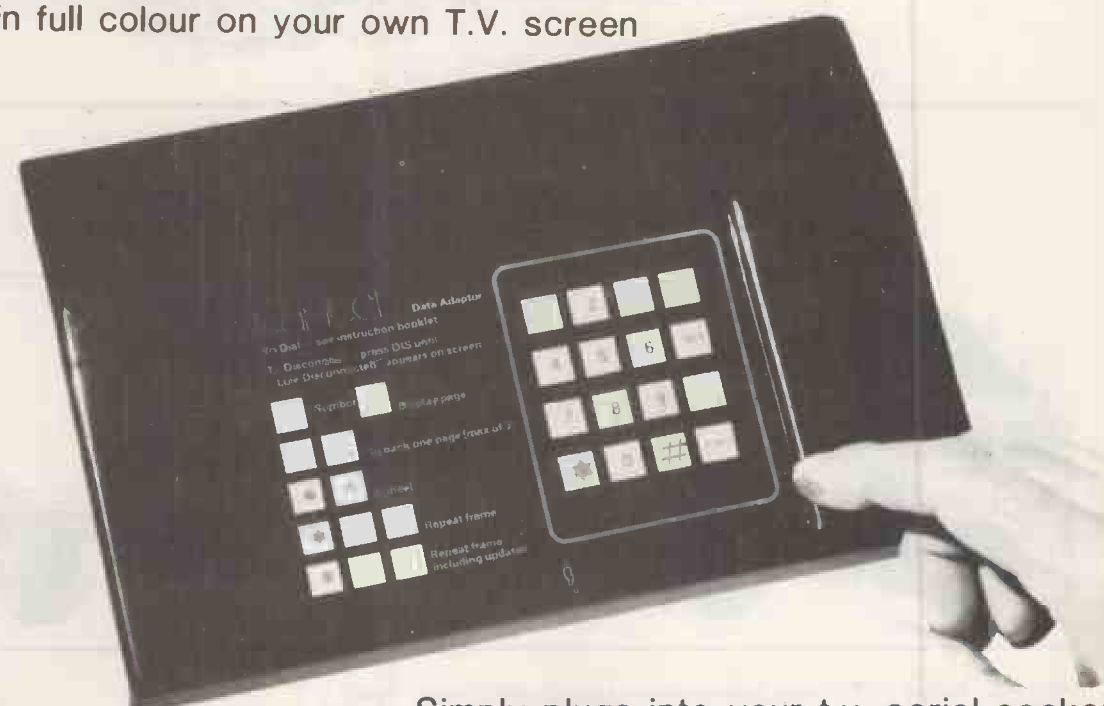

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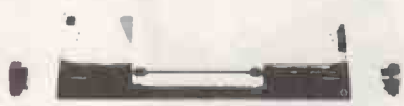

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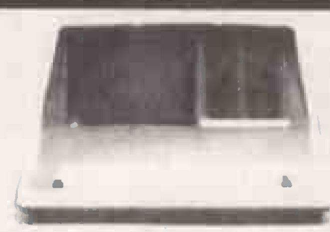

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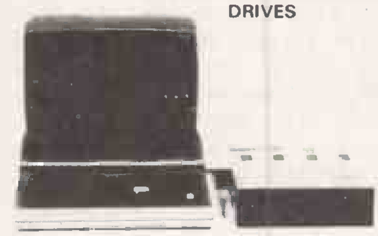

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4044	90p
4046	110p
4047	100p
4048	55p
4049	45p
4050	45p
4051	80p
4052	80p
4053	80p
4054	150p
4055	125p
4056	135p
4059	600p
4060	115p
4063	120p
4066	50p
4067	450p
4068	27p
4069	20p
4070	30p
4071	25p
4072	25p
4073	25p
4075	25p
4076	107p
4081	27p
4082	27p
4086	72p
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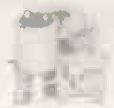

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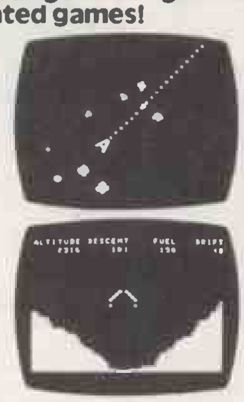

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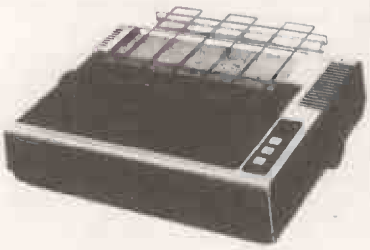

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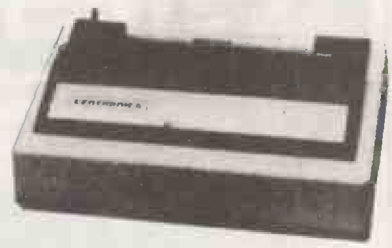

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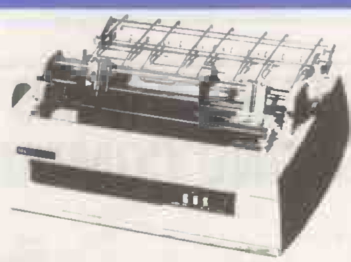

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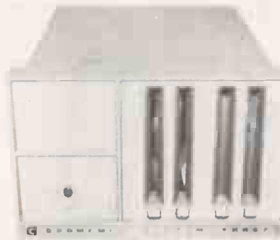

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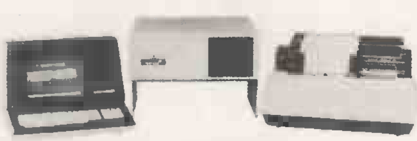

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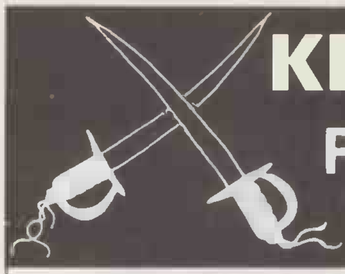

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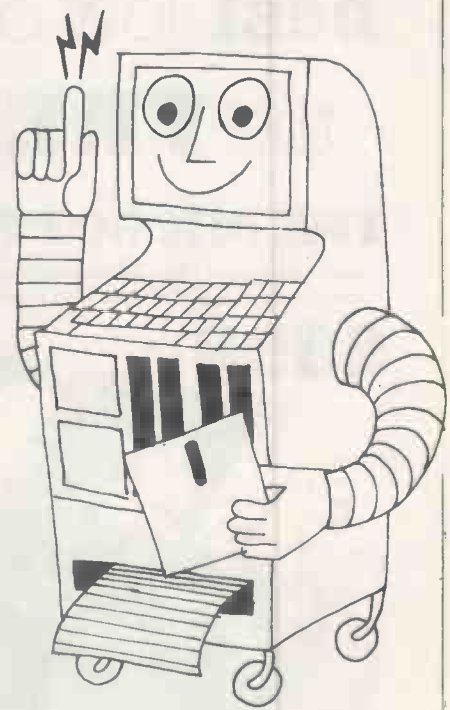

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• Circle No. 149

The business of education

MUCH FUSS IS made about the many questions created by micros in the field of education. Indeed, the whole subject makes one think. It seems that in this area, more than anywhere else, micros will first make a deep impact on the philosophy of civilisation as we know it. What, briefly are the issues? How do micros affect the business of education?

Firstly, a microcomputer can be used as a tool to reduce and standardise the teacher's work. This is nothing new. After all, a textbook is just such a tool: instead of 10,000 teachers explaining how to do long division, or relating the glories of the British Raj, the text book does it once. The pupils learn the same technique or the same political view of history, and at much reduced price. Even in these expensive times, each copy of a book costs less than a teacher/day.

Much noise was made a decade ago about programmed learning with machines that performed — rather crudely — just the function a micro might in presenting course material and testing students on their comprehension. It turned out that the television was less effective than Sir or Miss.

For all the enthusiasts' claims that computers can present material at the student's pace, can adapt to his strengths and failings, the software is not available to do the job, and even if it were, an eight-bit machine would not be sufficiently powerful to mimic the teacher well enough to be worth the money. Which is what is required. It is probably something we shall have to wait for until the Cray-on-a-chip is available, running a cerebral emulator — a piece of software we do not expect to review this decade.

It may be that as micros become as cheap and prevalent as people threaten — they sometimes sound like the plague of locusts in Egypt — there will be some routine teaching jobs they can do. Yet as so many people have found in computing, the job of teaching is one which is harder than it looks. The good teacher needs to be showman, clown, tyrant, philosopher and friend as well as a regurgitator of information. In fact, that, which the micro can do satisfactorily, is the least of his functions. Secondly, we obviously need to teach children to use micros. What does that involve and how should it best be done?

For all that the mainframe industry has told us for 20 years, computing is not difficult. It is merely tricky, and, as software becomes friendlier to its users, it should become increasingly less so. The only difficulty is in learning to think "computish" in the beginning. That is, to think through precisely what you want to do and to express it in terms a diligent idiot can follow. Once you learn to do that, the rest is relatively easy. The arguments about Pascal versus Basic, standardisation, portability and what have you are all fal-lals.

How should this skill be taught? In essence, it is an attitude to problem solving which is inculcated by solving a few computing problems. It is probably not something that needs to be taught formally — if computing power is available, children will teach themselves and each other the way they teach each other about sex. Adults may think they are doing something with their biology lessons and sex education classes, but really the kids learned it all in the garden shed years ago.

It is far from certain that all the apparatus we see gathering around computer education is useful, necessary or even relevant. The best way of teaching children is to give them computers and let them develop a subculture among themselves. Thirdly, what effects will the touted prevalence of microcomputers have on education as a whole, even on those who never intend to touch a machine?

It might be worth remembering that full-time schooling, for everyone up to 16 at least, is a very recent idea which only really got started during the industrial revolution. Once children had been outlawed in factories and the mines, they had to be put to school to keep them out of the machinery.

Before it started, children were regarded as small adults — charming enough in their way, but subject to disabilities of size, strength, manners, discretion and general *savoir-faire*. The sooner a child learned how to be an adult, the better for all concerned. How much of our present curriculum is routine marking time, designed to keep the little dears out of grown-ups' hair?

That is certainly how it seems to the children, and looking back on personal experience, it seems that there was a compulsory wait, agonising for everyone, between the time the child was 12, able and willing to start adult life and the time he or she was 16 and legally allowed to do so. Of course, many of the poor things go on being educated until their early or mid-twenties — a whole decade of wasted energy and enthusiasm.

What is education for? Deep down it is, as they say, to inculcate habits of honesty, sobriety, co-operation, application and all the other -ions which make life less fun than it might be. Also, the child learns a number of useful techniques such as long division, reading words of six syllables, how to say "Hullo sailor" in Latin — will our classicists accept *salve naute?* The argument no doubt goes that learning the detail of the latter in the wholesome community of the school automatically produces the good effects of the former.

Two difficulties arise. The first is purely practical, in that the techniques which used to give people so much wholesome trouble to learn are now apt to be automated before they need them. Why bother to learn how to do arithmetic when chips will do it for you; how to say hullo sailor in a foreign language, if a hand-held speaking database will say it for you? What techniques can we make children learn so they benefit from the process of learning, at least — if not of the thing learnt — which they can be persuaded are worth learning? Because, willy nilly, one must have some co-operation from them.

The second problem flows from the first: if there are no techniques which are going to stand still long enough for children to get the benefit of learning them, is there any justification for wasting many of their best years in classrooms?

Would it not be better to return to the pre-industrial system, in which children learned about life at first hand from their parents and their businesses or, if they wanted, by sitting at the feet of noted masters? "That's all very well", the educationist will reply, "and suited to a society of farmers and cottage industries, but quite inappropriate to the modern industrial state". To which we would answer that the micro will bring back cottage industries; that the modern industrial state is quite visibly crumbling before our eyes; that the most prolific programmer is an enthusiastic 16-year-old. Why waste his time with A levels when he could be earning good money and making his elders rich into the bargain?

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.

Buying the best

D MALTBY in Feedback, January 1981 makes an interesting and often-repeated point — he suggests that schools and other educational establishments should buy only U.K.-manufactured micros and peripherals. It is a point which can be heard in many industries, but it is not as simple as that.

With limited finances, among other things, you cannot afford to buy all the products you might feel you "ought" to. You should buy the best computer for the job, not just any old thing which happens to have "Made in Britain" on it.

We all know how many brilliant ideas there are in the U.K., in microcomputing and many other areas, yet can you find backing for a good idea? Is the Government pumping plenty of money into the computer industry like the Japanese and other administrations?

If we developed our computer industry as other countries have done, there would be no need to suggest that people should buy those items only if made in the U.K. — everyone would buy them simply because they were best, and made the most sense economically and technically.

If the present Government was not so interested in running things down, throwing people out of work, and cutting back essentials, and was more interested in starting things moving more sensibly by encouraging investment and the manufacture of the better products we know Britain can make, we would have not only an even more exciting British computer industry, we would not be the last country in the world to emerge from the recession.

Richard Elen,
London SW11.

Noughts and crosses

MANY THANKS to W N James for his excellent 3D noughts and crosses program in your January 1981 issue. I have made some slight changes to it which may interest other readers.

The changes add fun to the game so that on the first time through, you can beat the machine although it is still a difficult task. The second time through, however, the original program is played — I have yet to beat it.

Each subsequent turn is alternatively easy and then difficult, quite frustrating for someone watching you win and then playing the next game. I have added line 14 to clear the screen before play commences but it could be omitted if desired.

The program will now run as follows: the first time through, the first set of data, line 15, is read. When a win or a draw is encountered, the program goes to line 6000. The keyboard is set to look for key 1 to be depressed. Line 6005 sets A to 1 — A is zeroed when initial RUN is pressed — and line 6025 checks for A = 2?, i.e., the second time the game is played.

Line 6030 says GOTO 10 NOT RUN for the next game, ensuring that A is not re-set to zero and the second set of DATA, line 20, is now read. After the second game, A will equal 2 and the program will GOTO 6050 which, if key 1 is pressed, will RUN the program, zeroing A and reading the first set of DATA, line 15, again.

Although exceeding James' limit of 2K memory, the program will still run in 4K, in fact it uses about 3.25K. Many thanks for an excellent magazine.

Here are the changes to existing lines:

```
210  IF MC = 64 THEN PRINT "THE GAME
       IS DRAWN": GOTO 6000
5000  IF D = 16 THEN GOSUB 2000:PRINT:
       PRINT"I WIN": GOTO 6000
5020  IF D = 81 THEN PRINT:PRINT"YOU
       WIN": GOTO 6000
```

Re-number line 30 to become line 9, line 30 is no longer there. Add the following lines:

```
14  FOR X = 0 TO 25:PRINT:NEXT X
15  DATA 3,10,2,14,9,98,4,100,27,90,8,100,
     6,—14,10,—9,12,—10
6000  K = 57088: POKE 530,1: POKE K,127
6005  A = A + 1
6010  PRINT:PRINT"FOR ANOTHER TRY"
6020  PRINT:PRINT"PRESS 1"
6025  IF A = 2 THEN 6050
6030  IF PEEK(K) = 127 THEN GOTO 10
6040  GOTO 6030
6050  IF PEEK(K) = 127 THEN RUN
6060  GOTO 6050
```

Sgt. L R Cuff,
RAF,
BFPO 45.

Unsatisfied customer

I WAS very pleased to see your tirade, February 1981 editorial, against the ready-next-week promises which mean nothing of the kind. I, too, have had more than my share of them. Could I make some suggestions:

- You refuse adverts from companies which have a tradition of broken promises.
- You publish a list of those companies which follow the good business practice of not cashing your cheque/debiting your credit card until the goods are dispatched.

I realise you could well lose many of your advertisers by doing this. However, I feel there is very little that I, as a mere customer, can do. My letters of complaint simply go unanswered, and telephone calls bring the inevitable "ready next week"

M J Baker,
London W7.

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Basic issue exhumed

ON THE whole, I must agree with John TeSelle's comments in his letter, Basic Burial, in the January 1981 issue, but I think it only fair to point out that many people use a computer as a necessary evil in the course of some study programme, and the quicker one can obtain a working knowledge of the language, the better.

I feel that Fortran, with its rigid input and output formats and precise data descriptions, is learned more easily when one has a working knowledge of a simpler language and an appreciation why this simpler language fails in some processes.

When choosing a language for a particular task, it is very much a case of "horses for courses" and Basic is an easy-to-learn, very useful multi-purpose language. The only area in which I would criticise Basic is in its application in the personal computer where the facilities offered by the language are very much hardware-orientated, making programs less portable.

At the systems company where I work, we find that engineers explore general problems using Basic, systems analysts perform more detailed work in Fortran, and our professional programmers, as one would expect, have a favourite language, but are able to select and work with the most suitable language for the task.

G J Bell,
Haslington,
Cheshire.

TRS-80 Level 3 Basic

AS THE author of the Level IV enhancement to the Microsoft TRS-80 Level 3 Basic, whose marketing by Kansas and subsequent legal proceedings with Molimerx have attracted so much attention by the media, I would like to make a few observations.

Firstly, the extra commands I incorporated were designed to correct what I judged to be major deficiencies in Level 3 as it was marketed. When first written, most TRS-80s which had the expansion

(continued on page 44)

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(continued from page 42)
interface fitted suffered from frequent re-boots causing the loss of any Basic program in memory. It seemed ludicrous to me that a 17K interpreter could not at least recover the resident Basic program after a re-boot. That was corrected.

The Microsoft re-numbering routine in Level 3 increases the size of the resident program by always allocating room for a five-digit line number whenever they are referenced. Considering that the user has sacrificed 5K of RAM to accommodate Level 3, it seemed to be doubly wasteful, so a space-removing routine was added.

Again, with 17K of interpreter which claimed to provide all the most useful disc Basic commands a non-disc user could want, one could reasonably expect to find a program merge utility. Unfortunately, Microsoft did not include one, so that was added.

Finally, for those of us not blessed with bionic eyesight to keep up with the speed at which the TRS-80 scrolls program listings, etc., a command was provided which gave 10 speeds to the video output from flat-out to near dead-stop.

All of these routines were incorporated into Level 3 without taking any further memory by more careful use of RAM and the avoidance of duplicate sections of code. It is unfortunate to my mind, that this software, which undoubtedly was satisfying a need, has now disappeared from the market to the detriment of the TRS-80 user.

L A Shields,
Chesterfield,
Derbyshire.

British robots

THE British Amateur Robotic Association, which has been recently formed, will help those interested in all aspects of robotics to exchange and share new ideas and discoveries. Write to: BARA D Stocqueler, 66 Waterloo Rd, Penylan, Cardiff, South Glamorgan.

There is no membership fee but a nominal fee will be charged each month to cover the cost of producing a monthly newsletter.

D Stocqueler,
Cardiff.

Paragon for authors

BEFORE submitting a program to *Practical Computing* for publication, I would advise all authors to compare their documentation to that of Jonathan Dick. Apart from the usefulness of the program, his article, Incorporating a control-key function into your programs, January 1981 issue, is a lesson to all authors on how to explain a program. In particular, he tells the reader:

- The background to the program.
- How to call the program as a subroutine, and what it returns to the main program.
- A clear explanation of how the Basic program works.
- Useful references to POKE locations for Pets with old ROMs.
- Suggests an application for the program.

Having read this clear and concise explanation of the Basic version of the program, his sensible comments and mnemonic labels make the assembler version understandable — even to those who may not be familiar with 6502 assembly language.

A final point — too many listings published have the spaces left out, rendering them nearly unreadable. Apart from one line, which is very full, Dick keeps his program very readable by the plentiful use of spaces. Well done, Jonathan Dick.

Mike Bruce,
Hounslow,
Middlesex.

Lesson in schooling

WITH reference to the statement in the January 1981 editorial that schools still use punch cards for computing, I would like to point out that many universities and colleges also still use them.

It is not totally to do with lack of money, although a major reason, but because, in business computing, punch cards are still the norm. The point is that it is not just computing which needs to be taught in schools but microcomputing.

Schools are just beginning to include computer science in their curricula. Schools should be teaching pupils that computers are common objects which can be small and easy to use, rather than being something large, indistinct and far away in a university and which seem to take two weeks to run a simple program.

Unless microcomputers are used in schools, the two fields of computing, in the sense of business data processing, and personal computing will not merge.

If they succeed and we have a young generation aware of personal computers, the micro revolution will have truly arrived.

A W Black,
Coventry.

Varied reactions

MARTIN HAWKINS in December 1980's Feedback columns provoked several reactions in me. First, I was moved to tears by the negative attitude of the letter. Next followed a strong sense of incredulity and annoyance. I agree with many of the statements in Hawkins' letter: programming is an art, and many find that it is beyond them. However, he and I view the situation from completely opposite ends of the spectrum.

First, I have a bone to pick about his statement that ZX-80s, Pets, Apples, Tandys are not suitable for more than the simplest operations. Certainly, a 4K TRS-80 Level I may not run your business, but can he truthfully claim that, for instance, an Apple II with Winchester discs and 48K is "not suitable for more than the simplest of operations"? Perhaps the reason for *Practical Computing's* constant presentation of machines such as ZX-80s, Pets, Apples, Tandys, etc., is because each one outstrips by far his Digico Micro 16 in sales.

Something else which caught my eye in his offering was the statement that "most of them (programs) are unusable and irrelevant in the average office". The reason *Practical Computing* is full of games and other light-hearted programs is because they are interesting. You above all people must realise that programs written for the "average office" are anything but this. For those masochists who prefer the sales production work-scheme analysis-type program, I refer them to less riveting magazines.

In my opinion, computers were invented for *Breakout,* and not the reverse. Whoever twisted their use to invoicing and general ledgers was a maniac, and a suitable candidate to be taken out and shot at dawn. Hawkins seems to think that a computer's main use is in boring data-crunching.

The "fun market" Hawkins mentions has made many a boffin rich. I hope the cynical observation that *Practical Computing's* future may lie there turns out to comply with that painful proverb — many a true word spoken in jest. I am proud to be a part of that wonderful section of society — amateur computer boffins.

I have reservations as to whether the expansion of computer usage of which Hawkins so whimsically speaks is altogether a good thing. I support wholeheartedly increased productivity created by computerisation, but frankly, I do not want to be told how to use my hex digits, or that my floppy tape is not switched on. I much prefer to be considered as a kind of electronic freak and to be left alone.

To sum up, I think the sooner a more liberal and accepting attitude is adopted by the computer industry to enjoyment, the better protection it will be for those of us who like messing around in bytes.

Mark Wood,
Wakefield,
West Yorkshire.

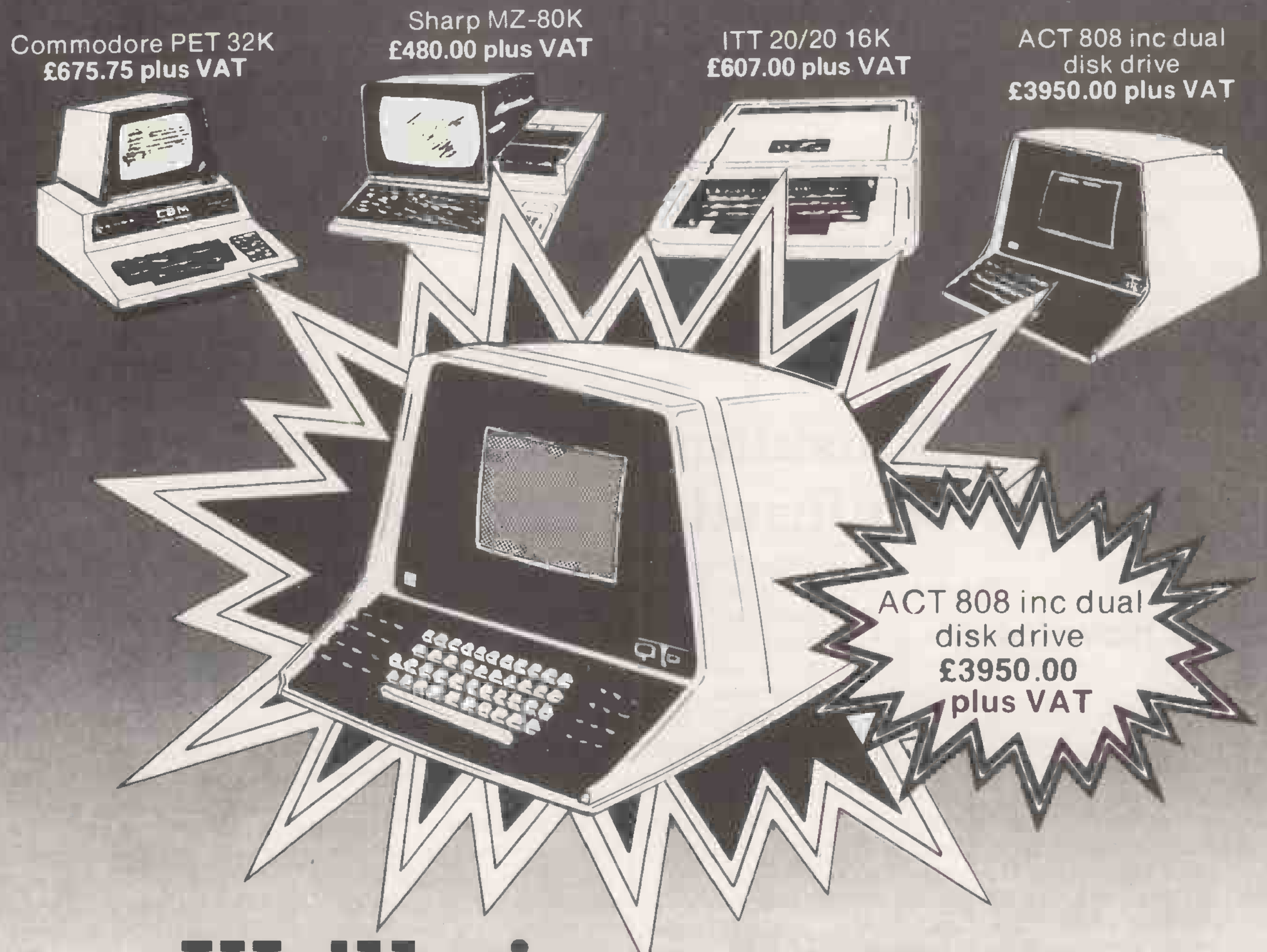
Educational game

I WAS most interested in the article concerning the quality of mathematics education packages, January 1981, by M P Thorne. In it, he describes a game, How the West was won, and states that it is not available on microcomputers — at least not from commercial sources.

We implemented a version of the game for the Pet some time ago, so it certainly is available on at least one microcomputer from at least one commercial source. Mind you, we know the game under the title, Mathstrek. Also, we have found that there has been remarkably little interest in the game. Perhaps we should rename it and try again.

Graham Browne
Pi-Lok Systems Ltd,
Heywood,
Lancashire.

Buying Computers?



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Disc-based HP-83 can run VisiCalc Plus

A NEW personal computer has been introduced by Hewlett-Packard. The computer, the HP-83 which costs £1,210, is identical to the HP-85 computer introduced in January 1980 except that the HP-83 does not have an integrated magnetic tape cartridge drive and integral thermal printer. It is aimed at those users who want a disc-based system and an external printer.

Like the HP-85, the HP-83 is a typewriter-sized computer with an integrated high-resolution CRT and keyboard, enhanced Basic and graphics capabilities. Two types of Hewlett-Packard floppy disc drives, providing storage from 270KBytes to about five megabytes, can be connected to the machines. A Hewlett-Packard printer and plotter can also be connected.

New peripherals for the Series 80 systems include a graphics tablet for £1,071. The range can also support the new Hewlett-Packard VisiCalc Plus — an enhanced version of the popular software package which lets the user produce four-colour charts and graphs from VisiCalc tables. VisiCalc Plus also features about 20 other functions not available on other VisiCalcs. These financial, statistical and maths functions include internal rate of return, standard deviation and variance.

On the software front, Hewlett-Packard has released an assembler ROM for the Series 80 for £159.

CAD82 call to authors

THE FIRST call for papers has been issued for the CAD82, the Computer-Aided Design conference and Exhibition which will be held in Brighton in March 1982.

Authors should submit four copies of full papers, in English, not more than 3,500 words long, by Friday July 31, 1981 to Alan Pipes, Conference Organisers, IPC Science and Technology Press, PO Box 63, Westbury House, Bury Street, Guildford, GU2 5BH or call (0483) 31261.

Cobol now for Z-8000s

THE FIRST Cobol for Z-8000 16-bit microcomputers has been installed on the Onyx Systems C-8002 microcomputer. It is running under Onix, the Onyx version of the Western Electric Unix operating system. The Cobol has been supplied by Ryan-McFarland which is now planning releases of Cobol for the 8086 and 68000 chips.

Consultancy centre aims to help confused business users

PUZZLED businessmen may find assistance at a new microcomputer consultancy centre, which has been opened in the heart of London under the auspices of the National Computing Centre, NCC, Manchester. The idea of the centre is to provide a stock of literature, representative machines, software and knowledgeable people who can give advice to those who need it.

The enquirer can just walk in and browse, can pay a few pounds to experiment with a micro or can have a personal consultancy with one of the Centre's staff for something like £25 per hour.

Alternatively, one can pay a £50 annual subscription in return for the same services, including microworkshops and a regular supply of information and advice about microcomputers.

The third part of the plan is designed to aid all those puzzled businessmen who do not live in London. The director of the new centre, Derek Scriven from the NCC, hopes to set-up a federation of the 40 or so existing micro-consultancy centres, mostly in colleges and polytechnics, and encourage them to share standards, information and form a pool of expertise.

The experiment was originally the idea of Ian Litterick who first proposed it to the Department of Industry in January 1979. The service was introduced by the new Minister with responsibility for information technology, Kenneth Baker. His department has provided £250,000 over three years to help the project find its feet. The Centre is eventually supposed to be self-supporting. The official opening date is April 2 and the address is 11 Fetter Lane, London EC4.

Two new business computer systems have been introduced by Olivetti, the company which claims to have a 52 percent share of the small business computer market. The two systems in the BCS 2000 range are similar to the existing Olivetti range of business computers but include a full-sized VDU. The BCS 2025 and 2030 are stand-alone units with double-density 1megabyte floppy discs. The 2025 has a 13in. cps printer and a manual ledger card feed. The 2030 has an 18in. 100cps printer and an automatic card feed. Olivetti is promoting the range as a way of preserving traditional accounting systems such as ledger cards. The two computers will cost between £7,000 and £10,000. More details from Olivetti on 01-629 8807.

Zork fantasy game

THE LATEST and biggest microcomputer fantasy game, Zork, is now being sold by Personal Software in the U.S. Zork has a vocabulary of more than 600 words including nouns, verbs, adjectives, prepositions, articles and conjunctions. That means Zork can "speak" and understand many basic English sentences.

Zork is available from Personal Software on 5¼in. diskettes for the Apple and the Tandy TRS-80 computers with 32K of memory or more. The U.S. price is $39.95.

Commercial satellite plan

BRITISH Telecom has announced its plans for an inexpensive business satellite system which will use a geo-stationary bird and dishes 10 to 13 ft. in diameter on the ground. The cost will be £250,000 for a full-feature ground station down to £20,000 for receive only. The service will be available from 1983.

Tipping the scales in favour of accurate weight records

EVER SINCE the new Weights and Measures Act was introduced at the beginning of 1980, there has been a strong market for weighing systems which automatically keep records of sample product weights from, for example, manufacturers of tinned beans. Under the requirements which are specified in the new Act, any goods which are sold by weight have to have their average weight marked on the container, whereas under the old Act the requirement was minimum weight. Although the change means savings for the suppliers, the burden of responsibility for ensuring that the goods supplied fall within the limits of the stated weight shifts away from the Government inspectors to the manufacturer.

The manufacturer now needs to take weighings of a sample of the goods leaving each production line and be able to produce the records of each weighing. Hence the market for automatic weighing and recording systems.

Many products have been designed along these lines and the latest connects the Apple II microcomputer to the Oertling electronic balances. The software for data acquisition, filing and statistical analysis is also available from the supplier, U-Microcomputers.

The company has also just received a contract to provide an Apple on-line to a Gamma counter in the pathology department of a hospital. The contract apparently involves a substantial amount of software which may be of interest to other similar users.

Further details are available from (0925) 54117.

One of the latest trends seems to be making cases for Apple and ITT microcomputers to make them easier to carry without all the usual packing and unpacking. The Apple distributor Microsense has produced two cases: one contains the Apple and two disc drives; the second one holds a monitor. They cost £39.50 and £19.50 respectively. Another case which can store an Apple, a single disc drive, a smallish printer, a cassette recorder and various bits and pieces has been released by Phoenix Management Services of Beckenham in Kent which says it is now making a case for the Sinclair ZX-80 computer.

New 8080/8085 package

A HARDWARE and software package for development work on 8080- and 8085-based systems has been designed to run in conjunction with the Commodore 32K Pet and 3040 floppy disc systems. It is a self-powered unit which plugs into the Pet and can be used to program PROMs of the 2716- or 2732-type.

The software is supplied on a disc suitable for the Commodore drive and is used with the standard Commodore editor which is part of the system for the 6502 microprocessor. The software consists of a two-pass assembler using standard Intel memories — source and object files are compatible with the Commodore 6502 development systems. Formatted listing can be produced on any IEEE-compatible printer.

The cost of the system, excluding Commodore components, is £700. Details from EDI on (0473) 211222.

Public-domain Comal to stop use of unstructured Basic in schools

COMMODORE has announced the launch of a new structured form of Basic called Comal as public-domain software. Comal is a structured language developed to satisfy educationalists unhappy about the widespread use of unstructured Basic.

The inventor of the language, Danish mathematician, Borge Christensen, is himself a noted computer educationalist who realised that Pascal was not suitable because children tend to become bogged down with its declaration statements and its sheer complexity.

Christensen claims that: "As soon as the teacher's back is turned, children start writing Basic". He saw the answer as a compromise between the two — a language with the simplicity of Basic and the structure of Pascal.

Comal has been in use in Denmark since 1976, but has been fully developed only recently. The method of development relies on the considerable amount of feedback Christensen receives from teachers and students using the language.

In the five years it took to develop, Comal has rapidly become widely used to the extent that it is the standard programming language taught in Danish schools.

Danish educational authorities have instructed that computers bought with public funds must, as a minimum requirement, have a Comal facility. Because Comal is a compiled language, this entails floppy discs. A tribute to its success is that it is in common use for business applications in Denmark and a large amount of Comal software is available.

Among the features of Comal is automatic indentation, which clearly shows not only the structure of the program but is also a powerful debugging aid. Other features include IF—THEN—ELSE—END IF, REPEAT—UNTIL — long variable names to clarify their purpose, and true parameter passing.

Multi-branching, dimensional arrays, Boolean functions, file handling, etc., are all possible in Comal. In fact, Comal's links with both Basic and Pascal are obvious to the experienced programmer.

As Commodore is to release Comal as public-domain software, that means any Pet user will be able to copy and use the program without payment of royalties. This policy is part of an attempt by Commodore to establish the Pet as the main computer for the educational sector.

Superbrain's Teletype role

THE Superbrain microcomputer can now be used as a Teletype terminal thanks to a program, TTY, which has been released by the London-based software house Systematica. TTY also permits the transfer of files to and from other computers and allows users to operate in CP/M while still linked to a host computer.

So far connections, up to 9,600 baud, have been made to IBM, ICL, CDC, DEC, Prime computers and other Superbrains. The one-off cost of TTY is £150. Details on 01-836 9379.

Recipe for success

RUNNING a bakery should be a piece of cake if a newly-released program, called Master Baker, lives up to expectations. The program has been designed for small bakery chains, with up to 10 shops, and can cope with up to 300 recipes, 250 different ingredients and sales, production and stock reports.

One item on the menu is "recipe costing" which is a system of re-calculating the cost of every recipe affected by a change in the price of an ingredient. The computer report can show the product name and number, the batch cost, the old and new retail price if the profit margin is kept the same.

The options then available are: hold at the old price; change to a new price; and change to an alternative price. When one has been selected, the computer records are updated and a price list printed-out. Master Baker was designed originally for a bureau operation but is now being made available as a complete microcomputer system for about £3,000. Details 01-368 6128.

DMS 'solves problem' for WordPro and Wordcraft

ONE OF the limitations of the WordPro and Wordcraft word-processing packages on the Commodore Pet 8000 series computers is that while allowing users to store information, such as names and addresses which are used regularly, there is no facility for selecting categories before printing.

That problem may now have been solved by Compsoft which has linked an information storage and retrieval package, DMS, to both WordPro and Wordcraft. It is designed to keep records in any format. The information can be retrieved using several search criteria and can be sorted on any field, either alphabetically or numerically.

The word-processing link allows users to select certain people to write to by asking DMS to search for all those clients who, for instance, did not buy last month, and who spent £5,000 in 1980 and/or who live in Yorkshire.

Any information in those selected records is then transferred automatically to fill in the gaps in standard letters. Costing £190, the program is available on all 32K Pets and Computhink. A CP/M version is available at £330. Details on (0483) 39665.

Fully-programmable HP-41CV has big capacity boost

THE top-of-the-line calculator from Hewlett-Packard, the HP-41CV, features five times the memory of the HP-41C and accommodates up to 2,000 program lines. The calculator is fully-programmable and has continuous memory so that programs and data are saved even while the calculator is switched-off. Other features include an alpha-numeric display and 130 functions. The price of the HP-41CV is £169.35.

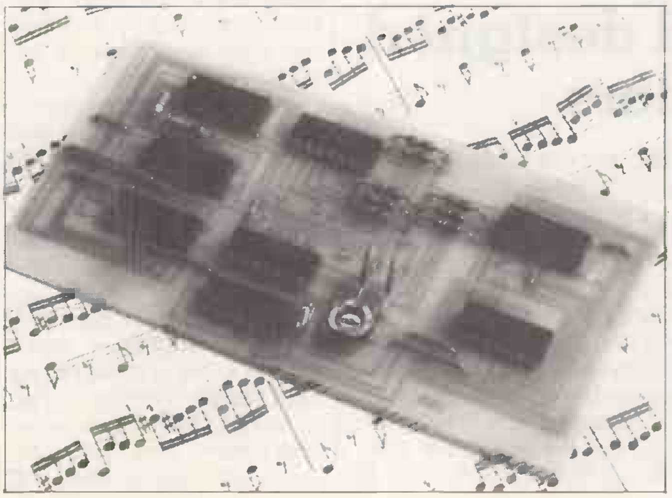
The company has also introduced a "super memory module" which plugs into the HP-41C calculator and boosts its memory to the same 2,000 program lines. The HP-41CV, like the HP-41C, has four ports to accommodate peripherals and program modules. Printer/plotters, magnetic card readers and an optical wand for reading bar code can all be added.

The new Hewlett-Packard memory module allows HP-41C owners to increase their machine's memory using only one port, leaving the three other ports free for software modules and peripherals. The memory costs £49.96 and the price of the 41C has been reduced to £130.39.

Hewlett-Packard is adding to its effort in the calculator market by offering a custom calculator program which can be plugged into the 41 calculators. One example of an application for a customised calculator is with the Beech Aircraft Corporation which has had navigation formulae built into a calculator.

It is used in-flight by the pilot to compute the best altitude for minimal flight time or minimal fuel consumption. A fully-customised calculator should cost about £150 per unit.

A music board for Nascom owners will plug directly into the PI/O of the Nascom microcomputers and play musical notes over a range of eight octaves. The BBF music-board kit has construction details, test procedures, programming notes and software examples including routines to turn the computer into a live keyboard instrument. It can be programmed in either Basic or machine code, and can be plugged into a stereo system for full sound and driven from most parallel output ports. The kit costs £18.65 and an assembled-and-tested version is £21.65. A music-entry program which includes demonstration tunes and the ability to handle multiple channels is available on cassette for £7.50. Details from BBF on Luton (0582) 35930.



Printers' system will tackle job costing

ONE WAY a computer might find its way into the printing professions is by concentrating on peripheral tasks such as estimating, costing jobs and looking after stock control. The latest effort along these lines is from Sage Systems, Newcastle upon Tyne, which is offering an estimating system based on a 64K microcomputer with dual 5¼in. disc for £4,750. A more comprehensive package including job costing, stock control and a daisywheel printer will cost £8,500.

The estimating program simulates a standard estimating document and covers more than 90 production operations from copy preparation right through to binding and delivery.

Also, there are 10 standard paper sizes stored in the program so when a job size is entered, the computer compares this to the stock sizes and shows the most economical sheet size, with percentage waste, how many flat sheets are required, the total weight and the total costs.

An ink calculator is included and there are facilities for calculating four different paper stocks for any one job. Sage, on (0632) 761669, claims productivity improvements of at least 50 percent.

Dot-matrix colour printer at a competitive price

THE LOWEST-COST colour dot-matrix printer in the U.K. has just been released by Integrex, of Burton on Trent. The CX-80 prints in seven colours, with simple code controls, and with 96 ASCII plus 64 graphics characters in ROM.

The CX-80 is fully dot-addressable, has 15 user-programmable characters together with double-length, elongated, and reverse-character printing. Line feed and form feed are also programmable.

Normal tractor-feed plain paper, up to 10in. wide, is used in this 80-column 60 dots/in., 125 cps printer.

The colours are selected by sending one of seven control codes. All the data sent after the code being printed is the same colour. The control codes are terminated by carriage return or line feed. There is a tricolour striped ribbon and the printer decides which stripes are printed to produce the required colour.

The end-user price of the printer is £895. Details from Integrex on (0283) 215432.

Intel's 16K static RAM

A 16K static RAM, with deliveries to begin in the fourth quarter of this year, has been introduced by Intel. The new RAM is the first of the Intel chips to be manufactured using redundant designs to try and increase reliability in manufacturing.

New S-100 clock works in real time

A REAL-TIME clock/calendar board for use with S-100 bus microcomputers is now being offered by Digital Devices. Known as the CLK-24, the board employs a new LSI CMOS device to provide day of week, date — day/month/year — hours, minutes, and seconds output in either a 12- or 24-hour format.

The board will maintain its time-keeping function even when the main power supply is switched-off since it reverts automatically to a standby mode and draws only 9μW from the on-board batteries. The board is delivered running on standby power with the time and date pre-set at the factory. Accuracy is better than 50 seconds per month and the batteries are guaranteed for a year.

Programming the board can be done in either Basic or assembler and standard I/O instructions can be used to re-set and read the time and date.

The board could be used in a variety of applications ranging from an automatic event timer in an industrial installation to data logging at pre-set times in a laboratory. In addition, it adds a real-time clock facility to any small business based on the S-100 microcomputers. Details on (0892) 37977.

Every microprocessor and microcomputer family can be supported on a new microprocessor development system announced by VSI Electronics of Harlow. The Phoenix I development station, a product of AMI Microsystems, includes a 12in. VDU, keyboard, integral single mini-disc drives and two RS232 ports and a free-standing external dual mini disc drive. There are 48KBytes of RAM, numeric scratchpad, eight user-definable keys and 48KBytes of RAM and 2KBytes of ROM. Price £3,500, details (0279) 35477.

Versatile measurement system suits most control applications

ANALOG Devices has launched a single-board, micro-based measurement and control system designed for use in almost any measurement, control or monitoring application.

The versatile μ mac-4000 is pre-calibrated and includes complete on-board signal conditioning, multiplexing, analog-to-digital conversion, input and output ports, power supply and serial communication to the host processor.

The master board has its own 8085A processor with 6K ROM and 1K RAM, which relieves the host computer of work by performing all linearisation, alarm checking and scaling the measurements into the relevant engineering units. Plug-in modules are available for measuring using different types of thermocouples, flow metering, pressure sensing and they can be mixed on one board.

There is also an extension board and several can be clustered so that up to 48 inputs may exist at one remote location.

The power consumption is only 12 watts, so the board could be run from a car battery — making it an excellent choice for remote monitoring in situations where mains supply is not available.

The serial interface can communicate with any host processor via RS232 or 20mA TTY, at a cost of about £80 per input channel. Applications are expected to be found in industrial control and laboratory data-logging among others.

Speech-synthesis board designed for development engineers

ANOTHER speech synthesis board has been released, although the VSM from General Instruments is aimed primarily at designers and engineers planning the use of speech synthesis devices in future products.

The VSN printed-circuit assembly is pre-programmed to generate up to 32 standard words in any sequences and can be interfaced to any digital systems. Eight TTL-compatible input signals are required to select the phrase to be spoken. Although the unit has been designed for development work, it can be replaced by a single-speed synthesiser chip for volume production.

The module card contains three main MOS—LSI devices, a pre-programmed single-chip microcomputer, a speech synthesiser and a 32K ROM. The card is interfaced via a 15-pin edge connector.

The present standard vocabulary consists of words and syllables which can pronounce any number up to one billion and a few other phrases such as "It is", "Error" and the mathematical signs. Other vocabularies will be available for volume orders. The cost is £50 and the details are available on 01-439 1891.

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SPECIAL PRINTER OFFER £375 VAT EXCL

STANDARD FEATURES

10 CPI	16.5 CPI
• 100 characters/second	• 165 characters/second
• 80 characters/line	• 132 characters/line

10 CPI or 16.5 CPI selectable by software command.
Expanded character selection for both 10 and 16.5 CPI.

- 3-way paper handling: A4 cut sheet, paper roll and fanfold.
- 7 x 7 dot matrix
- 96 character ASCII plus five selectable European character sets
- Microprocessor electronics
- Undirectional print at 10 IPS
- 6 LPI vertical
- Centronics colours and logo

INTERFACES

- Centronics Parallel (Standard)
- RS 232/V24 Serial (Option)

RIBBON SYSTEM

Continuous ribbon 9/16" (14mm) wide, 20 yards (18.3 meters) long Mobius loop allows printing on upper and lower portion on alternate passes.

OPERATOR CONTROLS

Power on/of
Reset switch — allows disabling of printer without dropping AC

DATA INPUT

7 or 8 bit ASCII parallel, TTL levels with strobe
Acknowledge pulse indicates that data was received.

ELECTRICAL REQUIREMENTS

60 Hz; 115VAC, + 10%/—10% of Nominal
50 Hz; 230VAC, + 10%/—10% of Nominal

PHYSICAL DIMENSIONS

Weight:	less than 10 lbs./5 kg
Width:	14.5 inches/37cm
Depth:	11.0 inches/28cm
Height:	4.89 inches/13cm

Dimensions exclusive of roll paper holder.

TEMPERATURE

Operating:	40° to 100°F (4.4° to 37.7°C)
Storage:	—35° to 140°F (—37.2° to 60°C)

HUMIDITY

Operating:	20% to 90% (No Condensation)
Storage:	5% to 95% (No Condensation)

FORMS HANDLING

Roll Paper:	8.5 in. × 5.0 dia. with 1 in. core maximum dimension. 3.5 in. wide with .38 in. core minimum dimension
Fan Fold:	9.0 in./22.9cm wide pin to pin 9.5 in./24.1cm wide overall

Up to 3 ply paper with 2 carbons (total thickness not to exceed .012 inches)

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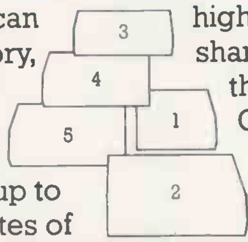

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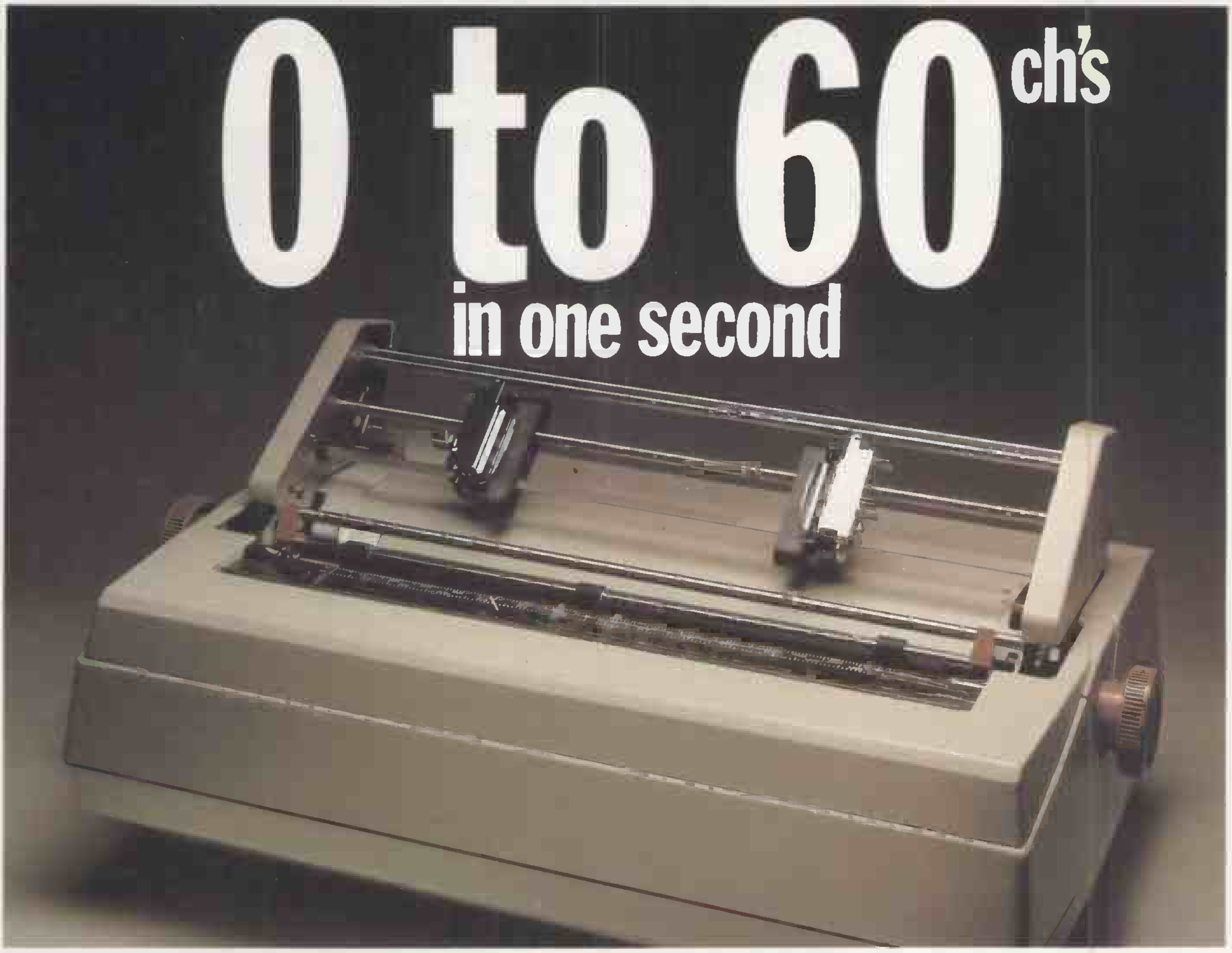

THE RICOH 1600S

If it's high performance your're looking for, the Ricoh 1600S is for you, offering an amazing 60 characters in just 1 second. An updated version of the tried-and-tested 1600, the new S model has been re-designed and fitted with all sorts of extras. Yet one thing hasn't changed — the price, making the 1600S cheaper than any equivalent model on the market. This superb performer incorporates the Z80 microprocessor, auto bidirectional printing and look-ahead logic, increasing speed and efficiency. Other capabilities include proportional spacing, graph plotting and word processing enhancements. The printer includes a standard centronics interface, and RS232 and IEEE options are available.

The Ricoh 1600S is available only from Micropute and their authorised dealers, all backed up with a nationwide service network. If you're interested in the 1600S either as a customer or as a dealer, send the coupon now.

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FEATURES	COMPETITORS				
	DIABLO 630	QUME SPRINT 5	SPIN-WRITER	RICOH RP.1600 (10 DATA)	RICOH RP.1600S
PRINT SPEED (CPS)	40	45/55	55	60	60
PRINT ELEMENT	DAISY-WHEEL	DAISY-WHEEL	THIMBLE	DOUBLE DAISY-WHEEL	DOUBLE DAISY-WHEEL
AUTO BIDIRECTIONAL	Yes	No	Yes	No	Yes
AUTO LOGIC SEEKING	Yes	No	Yes	No	Yes
PROPORTIONAL PRINT CAPABILITY	Yes	Yes	Yes	No	Yes
EXTENDED CHARACTER SET	No	No	Yes	Yes	Yes
LETTER QUALITY PRINT	Yes	Yes	Yes	Yes	Yes
CUSTOM INTER-FACE OPTION	No	No	No	No	Yes
PRICE	£1675	£1950	£1950	£1450	£1450

The above information was gathered from distributors and abstracted from their current literature. Prices shown are those advertised at the present time.

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London Computer Fair preview

THE SECOND London Computer Fair is being held at the Polytechnic of North London from April 14-16, 1981. The Fair is sponsored jointly by *Practical Computing* and *Educational Computing*. When first held last July, the event was a great success — it attracted more than 3,500 visitors in its two-day duration.

The Fair is organised by the Association of London Computer Clubs, ALCC, a regional co-ordinating group of 10 clubs in the London area. Because of the obvious demand, the Fair is open for three days this year and also is to have one late evening, Wednesday April 15.

There are 45 commercial stands, and exhibitors include Sinclair, Research Machines, Acorn, Diskdean, Computercraft, Wego Computers, Mine of Information, Central Calculators (Sharp), Chromasonic Electronics and TJ Brine Associates. A variety of user groups have taken stands and counted among their number are ZX-80 and British Apple Systems. Several computer press publications are also taking part in the Fair.

One area of the exhibition is devoted to club stands, and the participating clubs in the ALCC are demonstrating their activities. That proved very popular in 1980 and this year, the club stands are incorporated into the main exhibition area. On Thursday, April 16, we are organising another "bring and buy" sale of computer equipment — public demand requires a repeat performance.

Running parallel to the exhibition are two conferences. The first, on Wednesday, April 15, is for teachers who use or would like to use, computers in their lessons. It will be a practically-orientated meeting with several well-known speakers. Topics under discussion include: How to start and where to find the money; a possible new language for first-time users; computers and education; Schools Council computers in the curriculum project and there will also be practical demonstrations.

On Thursday, the ALCC is putting on a day's seminar/conference for hobbyists and subjects include: CP/M — what is it?; S-100 bus and the future; producing moving graphic displays on a computer.

Details and booking forms for the seminars are obtainable from Dr NB Cryer, Physics Department, Chelsea College, Pulton Place, London SW6 9PR. The cost will be £10 per day and tea and coffee are included. Part of the exhibition complex will be devoted to the new Islington Community Computer Centre and there will be a continuous demonstration of small computer systems for local businessmen. We have decided not to operate a specific seminar this year for business interests, but instead, to have experts on hand to answer questions in a specific area.

Unlike other computer fairs, the London Computer Fair is aimed at personal or hobby computers users and those businessmen and teachers who want to investigate how computing might be used in their professions. Consequently, the exhibitors tend to be smaller companies of a local nature and not distributors.

All in all, that means the Fair is more intimate than other exhibitions held during the year. That was proved by the number of exhibitors from last year who wished to book a stand again for the 1981 Fair.

The vast majority of people who attended last year indicated that they would like to return because the entrance fee is 75p and includes a free show guide aimed at those members of the public who would not normally go to a computer exhibition.

Transport to and from the Fair is also very easy — the Polytechnic is in the centre of London just north of Kings Cross and is well served by buses and trains.

Homeline cuts costs in property market

A FORMER civil engineer who designed the water distribution system for Istanbul, Turkey on a computer has turned his programming skills to an altogether different area and now claims to have grabbed more than one percent of the estate agency business in the U.K. with his Apple-based system.

Anthony Pearce, 31, uses a pair of Apples at his Kensington, London office to operate the do-it-yourself Homeline estate agency system. In its current configuration, Pearce uses the two Apples multiplexed with a variety of memories ranging from 5¼in. floppies to 10MB Corvus hard discs to handle a list of 2,000 properties and 1,500 buyers — with software which he wrote himself.

Pearce claims considerably reduced costs over the traditional estate agent. The Homeline fee for registration is 0.2 percent of the asking price up to a maximum of £90, and there is no time limit on the seller's registration. A conventional estate agent would normally expect to charge up to 3 percent of the selling price at completion. Cost to the seller, he says, is comparable with that of several advertisements in newspapers.

Part of the reason for the new low Homeline price is that it can dispense with large numbers of expensive staff and reduce the size of business premises — most estate agents operate from prestigious addresses.

Pearce's Apples, along with the Data Recording printer, have been used continuously for more than a year and so far, there have been no breakdowns. Now he is ordering two more for the London operation, and is going national with a Homeline franchise operation.

The most interesting part of the latest development is his co-operation with Liverpool's Stack Computers, which is to supply him with a Lobo peripheral memory with 5MB fixed, 5MB removable, which is due to be installed at the Nottingham office and which he expects, along with one Apple, to be capable of handling all the business in Nottingham's 1.2 million catchment area.

Anthony Pearce originally conceived the Homeline scheme when at the Cranfield School of Management. Personal experience led him to believe that many sellers of houses were dissatisfied with the service from estate agents and would prefer to sell their homes themselves if they could. Pearce's software essentially sorts and matches details of properties with buyers' requirements and leaves the parties to organise the conveyancing — although Homeline offers some extra traditional services such as surveys.

In total, there are about 60 programs written in Applesoft which are available for a price of £750 and include many additional monitoring routines which are for the agent's own purposes — for example, to check the best areas in which to solicit business.

Pearce has also been consulted by the National Association of Estate Agents, AEA, which has been examining means of adapting its business to the micro age. The AEA are interested in the possibility of a national register of properties for sale and buyers, possibly to be held on a mainframe owned by Services in Informatics and Analysis.

The Homeline Apples could be interfaced to the IBM machine via a Stack card and an acoustic coupler, over the telephone network, thus giving instant access to a national homes' register. A similar system already exists for commercial properties but Pearce believes it would be a first for residential properties. Homeline — whose total investment in hardware so far is a paltry £8,500 — can be found at 01-221 3838.

COS from Interface avoids the portability pitfalls

ONE OF THE failures of the mainframe world has been the lack of an operating system which allows true portability of programs and data. The most successful attempt for programs is, of course, Cobol. By and large, a program written on one machine in Cobol will run on another machine with few changes outside the environment division.

The transfer of data in computer form, e.g., disc or tape, has, however, proved a much bigger problem. With the exception of a few specialised bureaux, the IBM user wishing to transfer data to an ICL machine has to buy extra equipment.

The effect of all that has been two-fold. Firstly, it means virtually no information, etc., has been passed between the user of one type of computer and another. Secondly, the cost of changing from one computer to another has meant that a company has to be unbelievably upset with its current computer supplier to involve itself with the cost of changing.

It is arguable whether that situation is good or bad. It obviously locks you into a particular computer supplier but, on the other hand, stops you changing to another computer which, when the chips are down, will probably be just as bad as your present one.

Accent altered

Now that the accent in computing has changed to communications, machine-to-machine transfers are becoming more common. Even so, if you wish to communicate with another type of computer, you will almost certainly have to go to a third-party soft/hardware house for the required equipment.

I think the main reason for the reluctance of large computer manufacturers to provide methods of communicating with other computers is reasonably obvious. With true portability of data and programs, the ability of the user to compare the performance of two or more machines is greatly increased. That leads to the fear that perhaps the computer you manufacture is not quite as good as the opposition's, and you will lose sales.

Benefits of CP/M

What the mainframe user has been seeking and the manufacturer avoiding, for a good number of years, has existed for more than two years on microcomputers. Thanks to a U.S. company, Digital Research, the majority of micro users can now benefit from a software product called CP/M.

In short, that means any programs or data created on a machine using CP/M are — with a few fiddles such as converting discs to single density — usable on any other CP/M-compatible micro. The number of micros using CP/M is vast, and increases every day. For example, the Apple now supports it, and I wonder how long it will be before other major manufacturers also provide some form of CP/M-compatibility.

When buying a computer which will run CP/M, the user has three main advantages:

- There is a large amount of software.
- The system is very flexible regarding I/O.
- The system is provided with a large number of utilities.

Of course, as soon as a piece of software is written it attracts vast quantities of criticism, most of which is either trivial or concerns bugs which any competent technical user could easily avoid. CP/M is no exception to that rule, but I would like to concentrate on one particular aspect of it which can cause a great deal of problems to sellers and users of CP/M-based micros.

Most operating systems for micros are designed with the software writer in mind rather than the end-user. Obviously, that is reasonable, but what is a very useful feature for a programmer can be deadly when used by an end-user in the middle of a payroll run.

Certain problems are obvious. One of the most frequent is where a user removes

by Nick Horgan

a floppy disc, either in the middle of a run or at the end of a run before the directory is created. On most decent machines, that has been solved by putting a latch on the disc drive which can only be released by the system.

There are, however, a number — or should I say any number — of more subtle ways a user can commit data-processing suicide. I think a good example of how much trouble can be caused by that kind of problem is captured in the following sad tale.

A well-constructed sales-control program, written in Basic, had been running for more than a year when it started to give odd results. As the software had been thoroughly tested, suspicion fell on the hardware, but repeated checking suggested all was well.

Nothing could be found in the software but matters were brought to a head, when a chance meeting with one of the two operators found the cause. The operator complained that when inputting an invoice number to the cash posting program nothing happened. When asked to demonstrate the fault, the operator, instead of going through the master menu, loaded the cash posting program straight from disc.

A question and answer session soon revealed that, prior to typing Run, the operator mistakenly typed an invoice number. Unfortunately, the invoice number was the same as one of the Basic I/O statements in the program and the effect was to delete that program statement. The operator then typed Run and the system appeared to work.

Problems like that cause hours and hours of wasted time. Among the most common mistakes are:

- Stopping programs in mid-run with CTL/C.
- Incorrect running of system copies, etc.
- Incorrect disc mounts.
- Running programs out of order.

Several companies have started to write special versions, or add-ons to CP/M to avoid some or all of these problems. Interface Computer Services Ltd has obviated almost all of the pitfalls with its Commercial Operating System. In addition to providing a secure user environment, COS can also be used as a powerful development tool. It includes improved screen, disc and printer controls a Cobol compiler and an excellent interactive debugging package.

The system arrives with a Cobol compiler conforming to ANSI Level 1 standards. The display and accept verbs have been modified to give the programmer greater control of the VDU. As well as the normal facilities found in Cobol for screen inputting, the user can:

- Set tabs within an input field.
- Insert into the middle of an input field.
- Move the cursor to the start or end of an input field.
- Move the cursor left or right.
- Clear the input field, to re-enter data.

There is a two-pass compiler which uses, as input, a Cobol source file created with the system editor. The first pass is primarily a syntax checker, and, if errors are detected, the user can stop the compiler for corrections. The second pass of the compiler generates an object file for input to the linkage editor.

Cobol, being a compiler, does not of course allow the fast program debugging of interpretive systems such as Basic. To assist the programmer in running and correcting his code it is necessary to have a good interactive debugging tool. Most compilers allow three basic debugging commands:

- TRACE — print the sequence of operations the program is going through.
- STOP — stops the program at a given point to allow the user to examine various locations.
- DISPLAY — print the contents of a variable each time the statement is processed.

Interface Computer Services has provided some excellent additions to the normal commands via its program Debug. The method most systems use to include debug facilities is to include them in the source module; changing the debug requirements requires a re-compilation.

With the Interface Computer Services system, however, debugging is truly interactive. The compiler program actually runs under the control of Debug, allowing operation modes to be changed without recompilation. Facilities provided are:

- Single-step mode.
- Automatic mode with reversion to single-step at the press of a key. In this mode, statement trace may be on or off.
- Breakpoints may be entered.
- Breakpoint and display the contents of a variable when the contents change.
- Sleeptime sets a delay time between execution of steps when automatic mode is in operation.

At the end of a session COS can be made to perform automatic security copying. All diskettes running under COS are allocated a serial number when you first initialise them for the system. The serial number is written to the diskette as a null-length file. That file also informs COS whether the diskette is a prime data disc or a back-up disc, and also indicates if the last back-up was successful.

After checking to see if any updates were done to the data, in this case in drive B, COS returns with the following messages to prompt the user to take a backup.

DRIVE A: Remove diskette 001
DRIVE A: Insert diskette 2051
Press 'return' when ready
COPYING STOCKFILE — 50 records, 005K
COPYING TRANSACT — 10 records, 002K
DRIVE B: Remove diskette 2050
DRIVE A: Remove diskette 2051
SYSTEM IDLE

If an incorrect disc is mounted, DOS will ask the user to insert the correct one. You can tell COS how many back-up generations there are, and it will automatically ask for the oldest copy to be overwritten. That feature, more than any other, will ensure that the user takes back-ups at the correct time and on the correct diskettes.

COS will monitor printer operation and inform the user of the status of the printer. The same function is, of course, provided for in CP/M, but in a less sophisticated form. Printed output may be directed to a system spool file for later printing. It is not possible to print the spool file while processing another program, as happens when one is normally using a spooling system.

The sequence of operations is to create one or more spool files and then print them at a later date. That system allows you to print multiple copies of reports, ask the operator to mount special stationery, and to schedule similar types of print to follow one another.

The spool file should be used only where it is really necessary, because: most modern printers are buffered, sometimes up to 10K characters, and that allows the printer to store a large amount of information away from the main processor; printers are slow, programs and data transfer are very fast. A carefully-written program can arrange to print lines in bursts, and where there is a buffered printer it can appear that program and printer are working at the same time.

Stand-alone basis

However, with the type of spooling used by COS, you do not gain any advantage from using a buffered printer because the print run is done on a stand-alone basis.

Of course, if you are printing directly from a program and the printer malfunctions, your chances of recovering without a re-run of the program/system are very low. So, in a real commercial environment, you may well see an improved through-put due to the lack of print re-starts needed.

CP/M provides a basic batch command system which allows a number of jobs to be run in a set sequence. COS has improved that in two ways. Firstly, it is sensitive to three types of file which can contain Cobol programs to control the sequence of execution within a system. The three file types are:

- SIGNON — used for obtaining the system date, password, etc.
- JCL — controls the normal flow of the system.
- $RERUN — contains recovery routines.

Each of these files is, in fact, a user-written Cobol program which will ask the user what action to take at various points in the system. A further extension to Cobol has been provided to interact with the job control system. The following two functions are provided for use in a Cobol program.

- JSCHED — allows up to 14 programs to be scheduled for operation in sequence.
- JCHAIN — used to override a JSCHED by interposing a specific job to be run.

The recovery routine is entered when one of the following happens:

- A previous incomplete job schedule is detected at start-up.
- A corrupt disc is loaded.
- A job abort call is issued by the JCL.

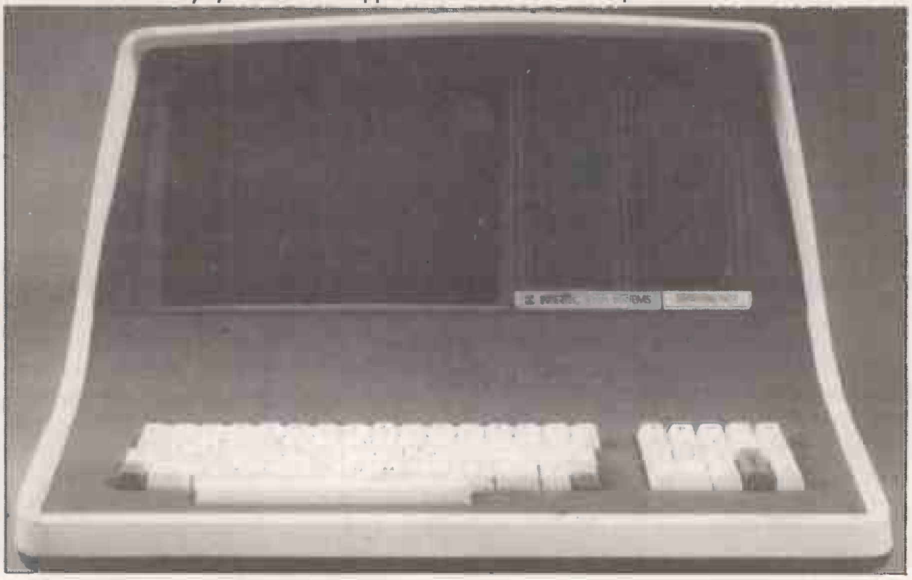
A recent addition to the system is an ISAM package. It is a standard Cobol-type ISAM system with the ability to read the file sequentially, randomly, or to obtain the next record after a random read; no read-previous exists. Where an exact key-match is not found the program can request the next higher key. Unfortunately, the index requires re-organisation at set periods. A utility has been provided to create a reorganisation program for a specific file, but the system writer has to ensure the correct reorganisation frequency. That situation is not as bad as it seems because the reorganisation program will run only if the ISAM overflow areas have been used.

The system is well documented with a large number of examples both in the manual, and on the diskette supplied with the system. Although most of the programs would obviously be best written in Cobol, there is nothing to stop any compiled program, e.g., a sort, being included in a job stream.

Conclusions

- **The system is a serious and successful attempt to bring a real commercial operating environment into the micro field.**
- **Having a controlled environment installed on a micro used by non-computer staff will relieve untold problems for the average software house.**
- **Not being a Cobol fan, and in view of the power of the new compiled Basics, it would be useful to have this system supporting one of the common Basics.**
- **All in all, from the compiler, through the I/O control and job control structure, Interface Computer Services Commercial Operating System is a well-thought-out and valuable piece of software.**

COS will run on any system which supports CP/M such as the Superbrain.



Controller takes account of small-business finances

FOR THE more popular microcomputers on the market, there are many standard commercial/business packages with generally-accepted names such as payroll and stock control. Although the names are descriptive in a general sense, expectations of what constitutes, say, a stock-control package will vary.

The situation is further complicated by the fact that many potential buyers of a package are first-time computer users and, therefore, may not have seen some of the larger or better packages in operation.

Hardware restrictions

It is not generally known that some packages have to be compromises because of the restrictions imposed by hardware configurations. Microcomputers pose problems but at the same time present new opportunities, because of the advantages of versatility they offer over traditional computer installations.

Much packaged software appears to be modified or simplified standard mainframe or minicomputer packages. Yet what is done in a certain way on a mainframe is not automatically suitable for a micro. So it was refreshing to find a package, the Creamwood Business Controller, which seemed to take into account the needs of a small business and relate them to the way a dedicated and personal microcomputer can be used.

In running a business, one of the most basic requirements is a record of customers, and in a small organisation, some basic accounting ability. Traditionally, that is done by manual means, through filing pieces of paper with an index for cross-referencing. This system, although satisfactory for years, suffers from a number of disadvantages.

Information retrieval

For example, it is tedious to update and maintain, and information retrieval tends to be slow. With the availability of cheap and easily-obtainable microcomputers, it becomes a typical application for the computer, and that is what the Creamwood Business Controller attempts to do.

The software package is delivered on three 5¼in. floppy diskettes, and has been configured for a Commodore 8032 with 3040 disc drives and a serial printer — attached via an appropriate adaptor — or the standard Commodore tractor printer. The software has been configured for other systems as well, for example for the Apple and its use has been planned for the new 8050 Commodore disc drives.

The review package was in fact, a dealers' demonstration version — the commercially-available package is supplied on one 5¼in. floppy disc and generates the transaction file on a scratch disc the first time the system is used. The three discs of the review package were: program/controller disc, transaction disc, and a history disc. A users' manual was also supplied, produced as seems to be the fashion by a line printer and therefore, I assume, using a word processor.

The controller diskette is inserted into drive 0, the systems disc drive and the transaction diskette into drive 1. On pressing shift Run on the Commodore 8032, the discs are booted-up. When the discs were working satisfactorily, after a few seconds, a prompt will appear on the screen asking for the date which is to be entered as DDMMYY. This means leading zeros are required to conform to the defined format. A useful check is that should the date entered be less than that of a previous run, the system will return to make sure you wish to proceed.

Once the date is accepted a menu of the operations available is displayed. There

by Vincent Tseng

are 15 options available selected by entering the appropriate number, 1 to 9 and A to E, as in hexadecimal, upper- or lower-case. The date entry, although simple, is indicative of how the rest of the program works — it is interactive and does not allow entries in incorrect format. It also checks for operational errors.

One of the first tasks a new user might want to perform with the package is the creation of a new account on file. This appropriately is the first item on the main menu.

The screen on all the pages in the program has a surrounding border and is laid-out as if it were a blank form. The bottom lines on the page are used to show the prompt line and the field where data could be entered between two squared brackets.

Under option 1, the first prompt asked for an account number of account name. The number is rejected unless it is the next consecutive one — there is no quick way under this option to discover how many accounts already exist on file. On entry of a customer name — the other option — an automatic customer number is given which is the next consecutive one in the file.

As the screen is like a form, the initial temptation is to move the cursor on the Commodore 8032 to the appropriate lines and fill them with the information. In fact, there is a prompt line at the bottom of the display and the entry field is between two squared brackets. That format of data entry is the same for all the options listed in the menu and, once you are used to it, makes operating a reasonably simple operation.

The first item prompted is the account name — unless, of course, a name was used for entry into the option. Once the name is entered, duplication checking takes place, and should a match be found, the program checks to see if it may proceed. N causes the program to exit back to the main menu, Y allows the program to continue, where further checking and confirmation will take place, should another match exist. When this stage is passed, the account name is entered on the form displayed on the screen.

Further details

The other details requested are address, three lines, contact name, telephone number, up to 12 characters, credit limit, opening balance, and total to date. All the entries accept a zero-character field, and the number of characters each field is allowed to accept seemed sensible in length, except for the telephone number, where some times it may be useful to be able to enter both the STD code as well as the exchange name.

When the last line of information has been entered, the program gives you a chance to correct any errors by asking: Are the details entered correct? If the answer is N, the whole sequence of entry is run through again, where the operator uses the return key to confirm that an entry is correct, or re-enters a full line when the prompt for that line is reached.

Message displayed

Again, after the last line, the same chance to correct is given; that can be repeated as often as required. When the answer Y is given to the check, the account will be written to disc, with a message displayed on the screen indicating that it is doing so. However, the use of a return key to the checking prompt will abort the entry and the data is not recoverable. It is a minor point worth attention since it is easy to correct an entry early in the form, keep hitting the return key for the rest of the prompts, including the checking prompt, and to lose the laboriously-entered and checked file.

Option 2 on the menu concerns post transactions for customer files already set-up. It allows for entry of invoices, credit notes, cash received/discounts and payments. A sub-menu is displayed to select these transactions. The account name or number is then entered and the program checks with the user if the correct account has been retrieved from the disc files.

The details requested in all the cases are: the date — checks that it is not greater than the date entered at the very start of the program — reference, analysis code — this allows for any type of transaction which is frequently used to be stored as an analysis code number — description — if an unknown analysis code or 0 is used — amount, VAT rate — S for standard, Z for zero, E for exempt and X for not relevant such as for export — and the VAT amount.

Table 1. Options available.

1. Set-up new account on file.
2. Post transactional data.
3. Account enquiries.
4. End-of-month procedures.
5. Print sales ledger control accounts.
6. Print customer statements.
7. Print journal postings and aged debtors' list.
8. Maintain analysis code descriptions.
9. Client history transaction listings.

A. Prepare client invoice/quote.
B. Mailing list.
C. Re-set today's date.
D. Change user's details.
E. System shut-down.

Useful technique

Account enquiries, option 3, search for an account or change some of the details. Entry is by account number or name. A useful technique is to enter an initial letter and to have the program search through the files for it. The program confirms the retrieved entry on the screen.

This feature is useful if the initial letter of the customer name was known, so that one can scan through the files, but it does not give a directory of all the account names and numbers which would seem an obvious facility to include.

End-of-month procedures are selected as option 4 which activates a printout of all the accounts held on file — a lengthy process. It clears the sales-ledger control account and it can zero on request all the total-to-date figures for the year end. The outstanding balances are aged and a transfer of the current month's postings is made to the third disc — the history disc. We had disc problems with the first set of discs delivered and the history disc was one of the ones corrupted. The second set of discs were demonstration discs where the last two features of the option were not available, so I was not able to test it fully.

Sales ledger

Option 5 printed the sales ledger control account for all the accounts on the file. Option 6 prints customer statements by requesting the account number or name as in the previously described options. Option 7 prints journal postings and aged-debtors' lists, the printing is selected by a sub-menu as:

A. Sales Invoice journal
B. Sales ledger credit note journal
C. Cash and discount received journal
D. Sales ledger cash paid
E. Aged balance list.

or by entering ALL, all the journals are printed.

Analysis codes, as mentioned, are set-up and maintained in option 8. It allows a 20-character description for an analysis-code number between 1 and 99 — a convenient way of being able to describe items which are used often. Option 9, client history transaction listings, seems to be a mystery. When tested, it did not do anything. I deduce from the documentation, which did not list the option by either title or correct option number, that it will print from the history disc, either all or selected transactions.

Option A prepares a client invoice or quotation, where the user is again guided through the entry of data by prompts, as described. However, a slight inconsistency occurs — the dreaded VAT ratings are entered as in the initial letters as in option 2. This time, however, the VAT percentage is required and the VAT amount calculated automatically. This seems a sensible approach and option 2 should be brought into line.

Inconsistencies

The other options are straightforward: B prints a mailing list selected by a range of account numbers; C is used to re-set the day's date — not a very good feature, perhaps useful for pre-or post-dating statements or invoices, but it is bad practice to change the date so easily. D allows the user's details to be set-up or changed and E is used to close-down the system. The options are listed in table 1.

Using the package reveals certain inconsistencies. Sometimes it seemed as if it were written for another programmer rather than for a businessman, although I found the interactive usage and prompting was helpful.

A further point of inconsistency occurs on one of the most often-used parts of the package. For this version of the package for the Commodore 8032 business computer, it has been recently modified to allow lower-case alphabetics. This means that when using the main menu, the numeric options are chosen by the normal unshifted number keys, whereas the letter options expect upper-cased alphabetics, i.e., shifted keys.

This makes the operation slightly awkward and I feel the letter options' perhaps could be made to accept both upper- and lower-cased alphabetics for operational convenience. One can always use the shift-lock key and type the numerics on the separate numeric keypad on the 8032, but that seems to defeat the object of having the lower-case.

Another important point to bear in mind is that the package assumes working knowledge of accounting. In both the documentation and on the program screen displays, accounting terminology is used.

The manual supplied was reasonably well and clearly written, but, as mentioned, assumes the user knows the purpose of the options. It is more of an operations guide and does not teach accounting. However, what is more serious, some of the documentation did not correspond to what was on disc, and I had to deduce some of the information. Lastly, the manual was printed using a dot-matrix printer and one complaint is that the printer used had lower-case alphabetics, but did not have true descenders. Creamwood Products Ltd is an associate company of Greenwood Associates Software Ltd and Cream.

Conclusions

- **Overall, the package was easy to use — once one had grown used to its quirks.**
- **Potential users should already be familiar with the accounting methods used in the package or be prepared to study some aspects of accounting.**
- **The documentation should be checked and updated to ensure that it at least agrees with the software supplied.**
- **There are some inconsistencies in the package and the aborting of information by the use of return on the checking prompt should be altered.**
- **A directory of clients would also be helpful.**
- **The Creamwood Business Controller has been written specifically for a micro-computer, taking advantage of interactive usage and accessibility of the micro.**
- **The package has had Commodore approval.**

Access to CP/M packages adds to Onyx's popular appeal

The C-8001 is a Z-80-based central processor designed to be the nucleus of a small system. It is manufactured by Onyx Systems Inc of California and the system for review was supplied by Graham-Dorian Software Systems. To constitute a useful office system the C-8001 requires a serial, RS232, terminal incorporating a video display and keyboard together with a suitable printer. The last two items can be of the end-user's own choice.

To avoid any confusion, you should be clear that Onyx Systems has two central processors which look very similar but, in terms of internal hardware and ultimate versatility, are very different. The 8001, which is the subject of this review, is a Z-80-based system while its bigger brother, the 8002, uses the 16-bit Z-8000 as the main processing element. The Z-80 system can be upgraded to a Z-8000 by changing the single CPU board and adding a second board to house the extra memory which the Z-8000 has capacity to address.

The C-8001 is a single-board computer containing 64K of dynamic memory together with 4K of read-only memory which is used for bootstrap — initialisation — and self-test operations. Once the system is initialised, the read-only memory is removed from the address space which then becomes totally read/write.

Sealed enclosure

The CPU board is housed in a cabinet measuring 43.2cm. by 20.3cm. by 55.9cm. but occupies a minute portion of this volume. The bulk of the cabinet holds an 8in. fixed disc drive which has the capacity of storing either 10 or 20 megabytes of data. All the disc components operate in a sealed enclosure which needs to be good when used in a typical office environment.

As well as the disc drive, the cabinet also holds a cassette — not musicassette — tape transport as a high-capacity data storage medium which can be used to back-up the disc.

All software is supplied on tape cassettes which are then spooled into the disc. This is quite a lengthy process, even though high-speed digital recording techniques are used to drive the tape system. Once the software is on disc, the problem no longer exists, but in an office environment it would always be prudent to take a back-up copy of the disc data at the end of a day's transactions.

To test the system, which purports to be an office system, we thought it would be a good idea to try it in a real office environment so we arranged for Graham-Dorian Software to deliver it to our reviewer's office where it would be tried and used by a wide range of people — both technical and non-technical.

In preparation for its arrival, and on the advice of Graham-Dorian Software, we had ready a small desk and a three-outlet 13amp extension lead. At the appointed hour, the van arrived from which three large packing cases and an installation engineer emerged. In half an hour, the C-8001 together with the display terminal and keyboard were sitting neatly on the 4ft.-by-2ft.-by-6in. desk-top — with space to spare.

Unfortunately, the space left was not sufficient for the printer which was as large again as the rest of the system. We had been under the misapprehension that the printer would be a free-standing unit. It is a point worth noting that so-called desk-top systems sometimes fill more space than bargained for.

Before connection, the engineer asked whether we intended keeping the unit in the same place. We were rather surprised by the questions as the system seemed so compact and easy to handle that we had assumed that — once familiar with its *modus operandi* — we would be able to re-position it ourselves.

We asked why he needed to know. The answer was simple. The fixed disc has a floating head which is particularly vulnerable to knocks and bangs. For that reason, it is locked by a screw when in transit and once unlocked, any unnecessary disturbance must be avoided. We assured him that we would not move it, so he agreed to slacken the screw.

The printer and terminal units were switched-on and the key turned in the CPU box — a key prevents unauthorised use of the system. In a few seconds, the screen announced that the system had carried-out a satisfactory self-test and was ready to go. No more than an hour had elapsed from the arrival of the van to having the system up and running.

The engineer very thoughtfully loaded the software from the cassette tape on to the disc and, while it was running in, explained that he was leaving us with an accounting package containing programs for handling sales ledger, purchasing ledger and nominal ledger together with supporting programs which would handle order entry, invoicing and stock control.

This suite of programs was fully interactive — keeping all the books in order and leaving adequate audit trails. He added that he thought we might like to have a word-processing package called WordStar and a Basic compiler called CBasic-2 which can both support CP/M.

Control program

CP/M is a very widely-used disc-based control program with an internationally-standard set of commands. It means that it is comparatively straightforward for someone, familiar with the language, to communicate with any computer system that operates under CP/M — irrespective of its manufacturer.

Before describing the technical qualities of the C-8001, it is worth considering its appearance. It is neat, compact and attractive. Although it is fan-cooled, there was very little noise and what little there was seemed insignificant compared to the noisy goings-on of a busy office.

One could not say the same about the printer — it was big, heavy, cumbersome and rather noisy. Perhaps it was only to be expected and, to be fair, it accepted standard 120-column fan-fold computer stationery as well as being an impact matrix printer. We could have had any printer capable of RS232 interconnection — the choice is vast.

On completion of its self-test and initialisation routine — which needed no human intervention after turning the key — we were left with a rather unhelpful message which said that we were operating with CP/M version 2.2 followed by "A<".

Having located STAT.COM, it becomes clear that the disc holds 10 megabytes of data — equivalent to 1,000 sheets of closely-typed A4 pages. It is logically divided into three parts labelled A, B and C — each part pretends that it is a separate disc independent from the others. Their respective storage capacities are 1.327, 4.091 and 4.091 megabytes.

Much of the software for the accounting packages is written using CBasic-2 and — it was menu-driven — thus presenting us with a simple accounting system to operate. Because the packages are written in this comparatively-simple language, coupled with the facilities that the operating system offered, it would be a practical proposition for anyone to carry-out minor modifications to the programs or, even, write one's own.

Silent operation

When continuously accessing the disc and carrying-out logical disc-to-disc transfers, one of the benefits of the 10megabyte fixed disc becomes very apparent — its almost silent operation. There are none of the clunks and whirrs normally associated with 8in. floppy drives.

The C-8001 seems a potentially very powerful machine and with little one could fault in the behaviour of the hardware. There were, however, a few misgivings about whether or not it could be handled by a non-technical clerical assistant. Our concern still remained when we sat down to study the sales ledger users' manual. The first 25 pages are devoted to comprehensive documentation of how the package is implemented within the CP/M operating system. The wording and jargon used are enough to floor even the most dedicated of specialists. After ploughing through the first 10 pages or so, one is inclined to throw the book away and shout help.

That would be a shame because, hidden in the middle — on page 26 to be precise — is the simple statement that all one has to do after getting the CP/M prompt is type "CRUN2 MENU" followed by a carriage return. After doing that, everything becomes remarkably simple.

The screen clears and asks for today's date and when it has checked you have not put February 30, or something equally stupid, it puts up a self-explanatory list of options with reference numbers 1 to 7.

It remains only to type in the number, e.g., 2 will print a list of customers while 4 allows one to enter any payments received, and follow the instructions from there on. If any difficulties are encountered, the remaining 30 or so pages of the manual are very straightforward and could be followed by anyone.

We felt it a shame that we had the wrong impression because of the order of pages in the manual. Of course, one should not carp too much since many manufacturers and suppliers go too far the other way and do not tell the user enough. Our suggestion to Graham-Dorian Software is to leave all the material there but make the layman's language section more obvious.

Once we were into the swing of it we found the accounting package comparatively easy to use and certainly it provided a wealth of statistical information which would have been impracticable to obtain without the use of a computer.

Like any off-the-shelf program, it would not have lent itself to our existing accounts management or stock control system without considerable modification. That, of course, is the problem which has caused more headaches on the part of software developers — and heartaches on the part of potential users — than any other.

It needs a very brave accounts manager to throw overboard a pen-and-paper system which has worked well for many years in favour of a more efficient but different style of computer-based accounting procedure.

To buy the programs we were using would have cost anything between £2,000 and £3,000. To develop our own from scratch would probably take up to two man-years — with the possibility of disastrous bugs.

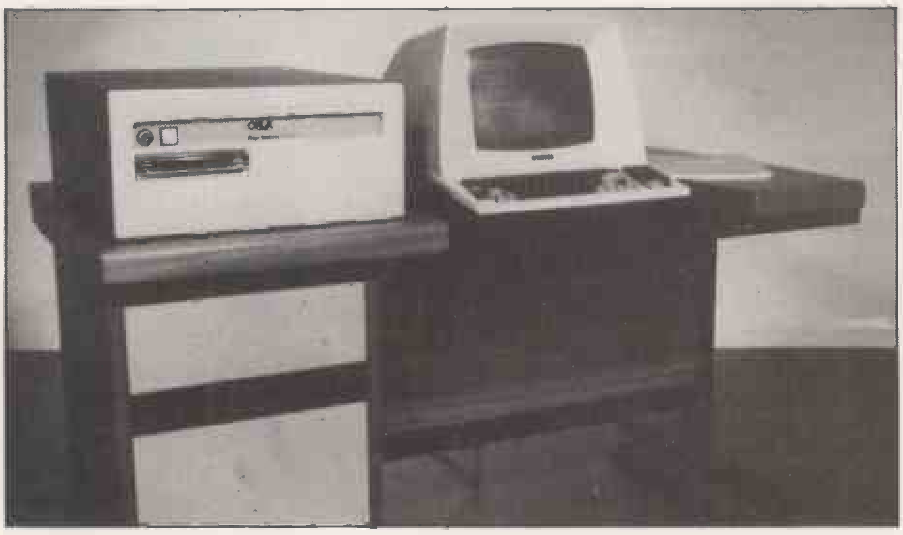
For a small new company without too much inertia, the Graham-Dorian standard software would certainly be an economic way of starting with a computer-based accounting system. Graham-Dorian Software is prepared to offer software support to its programs and, if its consultancy prices are acceptable, it might be a practical proposition to have it modify the procedures to match existing ones within the user's organisation.

It is impossible to review software and give an objective opinion which will be of any real value because the final desirability of a program is essentially subjective. To say that it works is of little benefit to the reader.

Certainly, the programs we had worked well and in two weeks' use, we did not encounter any problems.

Conclusions

- **Anyone considering a change to computers would be well-advised to consider the C-8001/GDS combination.**
- **The computer is a beautiful piece of equipment by any standard and is a joy to use whether you are a programmer or an end-user.**
- **The CP/M operating system allows access to a massive range of very reasonably-priced software including compilers and interpreters of just about every conceivable language.**
- **The Graham-Dorian software price list already contains programs like WordStar — a powerful and proven word-processing package — Datastar — a general-purpose database system — and Mailmerge.**
- **There are also programs for estate agents, retailers, surveyors and even medical records and accounting programs for doctors and dentists.**
- **The latter, however, are of U.S. origin and have not yet been converted for use in the U.K.**



S-100 video card opens teletext to more micro users

There are now many makes of computer available in the U.K. which support the S-100 busbar and several manufacturers are taking full advantage of the large potential market for peripheral devices. Hi-Tech Electronics of Southampton has developed two versions of a colour, memory-mapped video card which operate in teletext format. That means the character font and range of graphics — together with other effects — match those used by the Ceefax, Oracle and Prestel systems.

THE TWO versions differ in that one interfaces directly to a domestic colour television set via an on-board modulator and the television aerial socket, while the other outputs red, green and blue signals on separate lines with synchronisation on a fourth line for connection to the more professional types of RGB monitors. The

by Mike Hughes

company also offers an attractively-styled RGB monitor to match the latter version.

The RGB output board is slightly more expensive than that having the modulator and a dedicated RGB monitor can be a costly item. Nevertheless, the bonus for an RGB system is the spectacular picture quality, high-colour saturation and resolution. For the purposes of the review, we looked at the RGB system plugged into a Tuscan S-100 microcomputer.

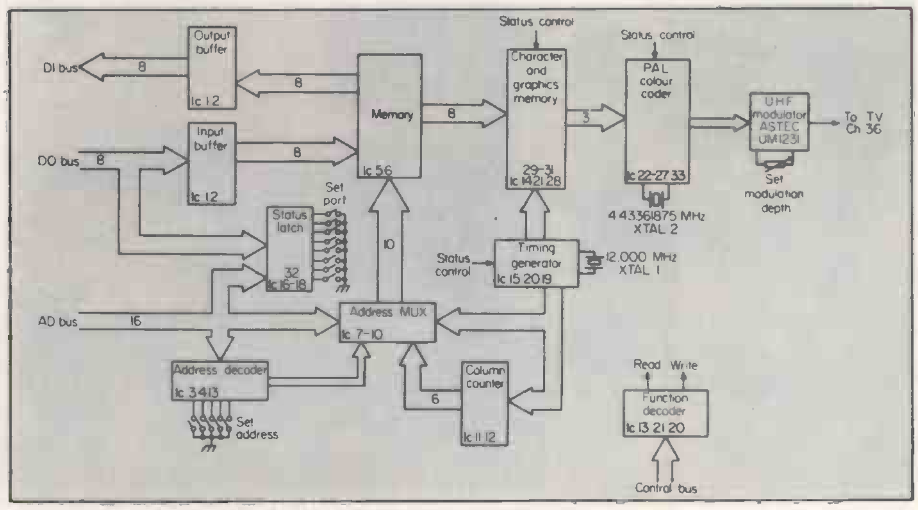
Although the S-100 busbar is now supposed to meet the IEEE specifications there are a number of older machines which do not adhere rigidly to the pinning and signal details. The Hi-Tech card should not, however, present any particular problems in that respect. It is very modest in the signals it expects to see on the busbar. In summary, they are:

- All 16 address bits
- All eight data-out bits
- All eight data-in bits
- SMEMR
- MWRITE
- PDBIN
- PWR
- SOUT
- The normal power rails

The board is conventional S-100 size, 10in. by 5in., and plugs straight into the Tuscan bus. It has a standard DIL socket on the top edge of the board into which a pin header can be inserted to extract the necessary RGB and synchronisation signals to feed a monitor direct. The board's display memory occupies 2K of the computer's memory map and a DIL switch can set its base address on any 2K boundary within 64K. A second DIL switch sets the address of a single output port which can be any available value between 0 and 255. That port is used to produce some special effects.

Having set the addresses, plugged in the board and connected it to its monitor, it remained only to power-up the system. It worked first time without any fuss or bother. The only problem was how to use it properly.

Block diagram of the Hi-Tech card.



At initial power-on, the VDU memory is, of course, in a random state of confusion and the colour display reflects that with a glorious jumble of graphics, letters and numbers in a miriad of different colours — some flashing, others double size, some on black backgrounds and others on bars of colour. Without going any further, one could see immediately the superb clarity and resolution of the display which is fully interlaced with character rounding.

The manual suggests the first experiment should be the use of the output port. Only bits one to six are used to convey data to the board and whatever is done through the port does not alter the contents of the display's memory. The instructions fed via the port affect only the general mode of operation. Once an instruction has been sent to the port, it is latched and held until the instruction is countermanded by another and each of the six bits has the following significance:

- Bit 1 when high, 1, inhibits the red gun of the display.
- Bit 2 when high, 1, inhibits the green gun of the display.
- Bit 3 when high, 1, inhibits the blue gun of the display.
- Bit 4 and bit 5 between them select either the top 12 lines or the bottom 12 lines and make all characters double-height.
- Bit 6 enables an extra range of colour options over and above the standard six colours plus white.

We set our output port to address 211 and using this simple program, produced a wonderful display of changing colours based on the scramble of random characters:

```
10 FOR A = 0 TO 7
```

20 OUT 211,A REM TCL BASIC PORT OUTPUT STATEMENT
30 FOR B = 1 TO 500: NEXT B REM SHORT DELAY
40 NEXT A
50 GOTO 10

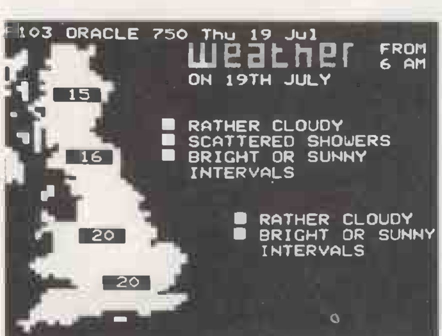
As the variable "A" changed value, so the respective display guns were switched on or off. At the value seven, the screen went blank as they were all switched-off. A similar play on data bits four and five did what was expected and we obtained double-sized characters on the top and bottom halves of the display. The manual gives a word of warning that after playing with the port, it is wise to output a zero on all bits to set things back to normal.

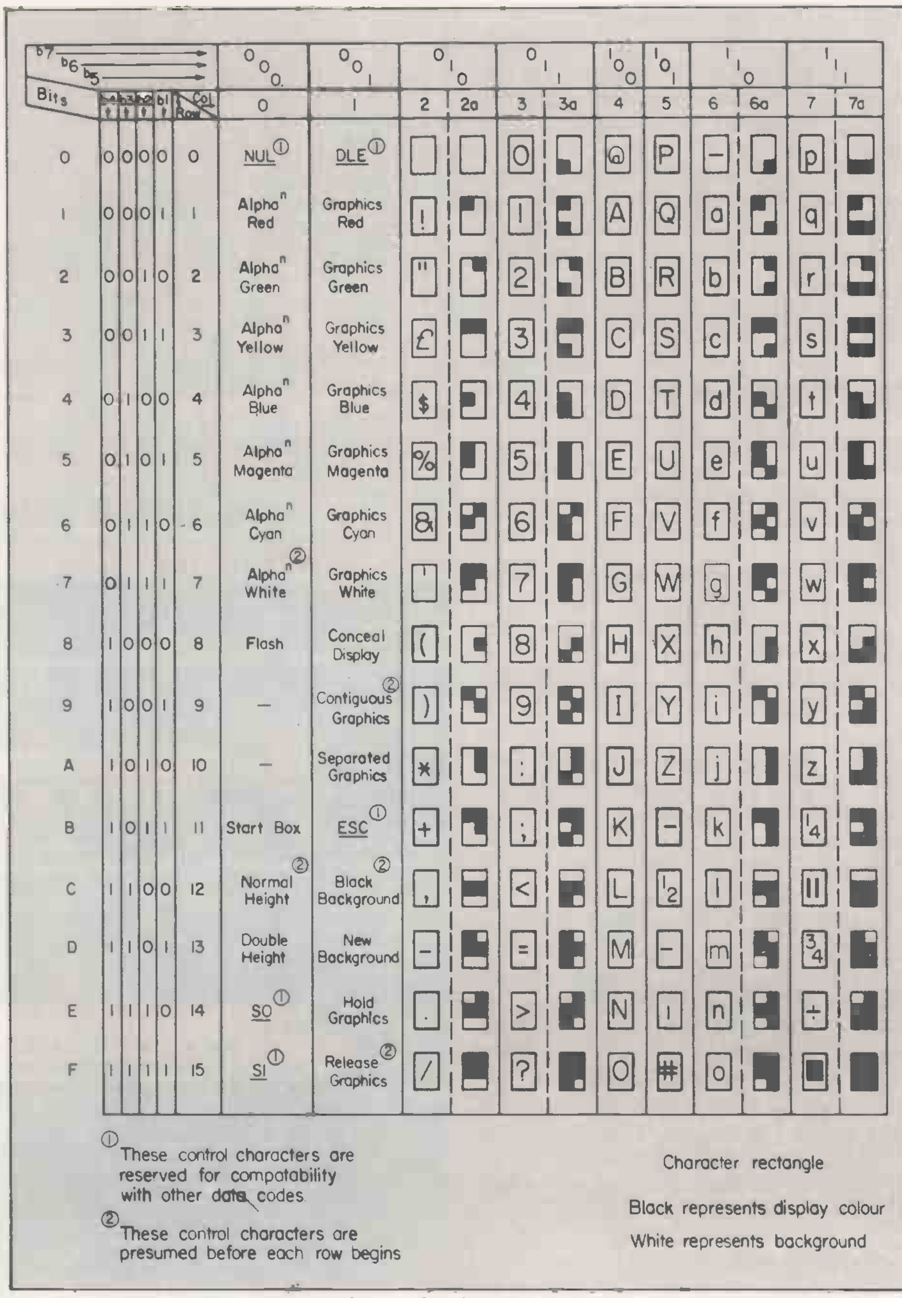
To change the contents of the display memory — hence the picture on the screen — you need either software which allows the Poke or similar statement or operate in machine code. Clearly, if you consider using this display as a supervising VDU, you must have some suitable driver software in your system and Hi-Tech Electronics has thoughtfully provided an assembled source listing for such a routine called Screen Driver 7.0. It is written in 8080 mnemonics and code and is located to origin at 100H to be compatible with CP/M disc operating system. We did not use the software but chose to use our own via the TCL Basic Poke and VDU statements.

To clear the display, it is necessary to write the code for space, 32 decimal or 20 Hex, into every location and, thinking we knew best, we patched-up a simple program to do just that — assuming that the run of the display memory map was contiguous from line to line.

Certainly, the top line cleared but, following from that, about half of a line half way down the display cleared followed by the second full line from the top, and so on. We had forgotten that the teletext screen format is 40 characters per line with 24 lines on the screen. A further scan through the manual revealed that we had overlooked the clear Hi-Tech drawing showing the on-board memory architecture.

The only problem with this convenient map is that one needs a function written in Basic to keep track of the virtual cursor. TCL Basic rushed to our aid with its VDU A,B,C statement. Once the base address for the display has been set, the variable A defines the row, B the column and C the value of the character





The full set of character and control codes for the card.

to be Poked into memory. So long as we kept A within the bounds 0 to 23 and B within 0 to 39, everything became child's play.

Once the screen is totally cleared with space codes, any normal alpha-numeric ASCII codes produce the expected characters when poked into memory. The board translates ASCII codes into characters defined by the IS07 code which is very similar but one can obtain the more typically British characters like £, ¼, ½, and ¾ at the expense of square brackets, curly braces and reverse slash etc. Provided the output port has been set to all zeros, the characters will be displayed in white against a black background.

By preceding any character on a particular line with one of a number of hidden control codes — falling in the ASCII range 00H to 1FH — one can make all following characters take up one of six colours — red, green, yellow, blue, magenta or cyan — until another colour change code is encountered on the line. A similar set of codes will make following characters take the form of the 64 teletext pixel graphics in the same range of colours, plus white.

A colour code followed by a new-background code changes the background from black to the pre-selected colour and coloured alpha-numerics or graphics can be superimposed on the new background. Further hidden codes will cause following characters or graphics to flash, be double-height, be contiguous, i.e., the graphics join up with each other to produce solid blocks of colour, or separated graphics which reduce the intensity of the display.

Care has to be taken in the use of those hidden control codes because they occupy space in memory and as a result create a space on the screen. That is fine if they occur between words, but can be a nuis-

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ance in the middle of a complicated multi-coloured graphic picture. For that reason, there is another control code which allows graphic characters to be repeated over hidden codes.

Each line on the display is, to all intents and purposes, a separate entity. Any control codes which exist on one line do not carry on their effect to subsequent lines. The benefit, or problem depends very much on your application but is fundamental to the teletext display format.

Producing custom-designed pictures with the graphics is an extremely time-consuming job — particularly if a wide variety of colours are involved — but the results are well worth the trouble and, although there are limitations with pixels, very reasonable resolution can be obtained.

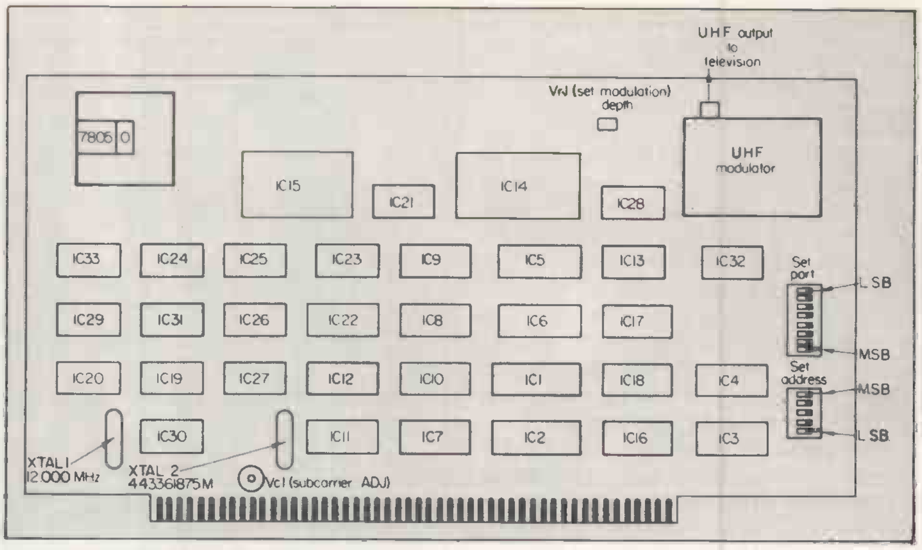
In theory, it is possible to produce coloured animated displays but in practice, it would be a very brave programmer who embarked on such an expedition and, furthermore, there are the usual flashes on the screen as the display memory is accessed.

An obvious application of the Hi-Tech board is to convert existing S-100 computers to Prestel terminals to interface with the main Prestel computer and, to that end, Hi-Tech Electronics has now produced a Prestel-compatible S-100 MODEM card. That, together with the display, would upgrade any disc operating system to an incredibly powerful machine with access to what must be one of the world's largest and most fascinating data banks of information.

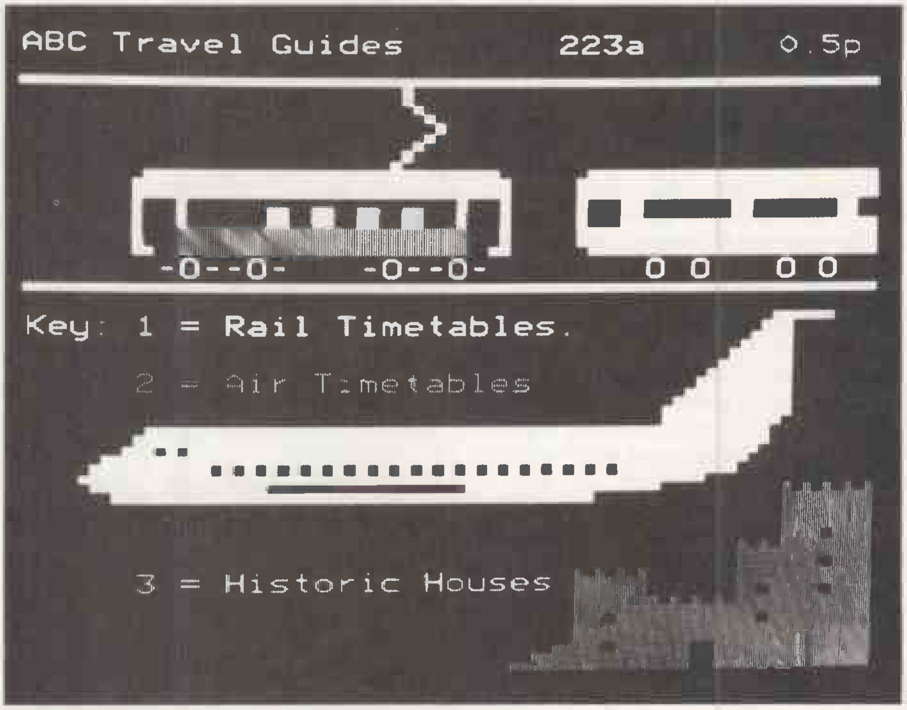
By hooking-up the board with the MODEM and one of the recently available S-100 10megabyte disc drives, the mind boggles at what might be in store for the field of information handling — not least that of information copyright.

Conclusions

- **We were unable to fault the quality and reliability of the RGB board.**
- **It more than matches the standard format for teletext.**
- **Quite clearly, the one more likely to attract users would be the modulated version — which we did not see — and it is bound to have impaired resolution but, judging from the way Hi-Tech has fulfilled its specification on the review board, it has to be good value for money at £295 plus VAT.**
- **Although it could be used as the main supervising monitor display for a system, its 40-character width would be limiting for some applications and it could consume a good deal of software space if full use was made of its colour-effects potential.**
- **It is more likely to be useful as a peripheral accessory and, to that end, in what better form could it come than an S-100 board?**
- **Full marks Hi-Tech Electronics on a first-class device.**



The chips on the Hi-Tech card.



The Hi-Tech card interfaced to the Tuscan S-100 bus.

Very nice dear, . . . but what does it do?

WHEN MY husband first announced a desire for a home computer, I reacted with a blend of amusement and bemusement.

"What on Earth for"? I asked, "what possible use would a computer be to you"?

"They do all kinds of things", he replied vaguely.

"What kind of things"? I insisted.

"Well — you know". I didn't, but let the matter drop.

After months of poking around in the minds of friends and colleagues, some of whom either already owned computers or were exploring the various possibilities, he finally decided on a Video Genie EG3003. We went to our nearest dealer who not only had one in stock but could also provide a demonstration.

Reservations

The program we sampled was Biorhythms, and although my interest perked up a bit, I still had reservations: "Seems an expensive way to find out what mood you'll be in next week". But his mind was made up.

There was, however, one small problem — money. The price including VAT was £425 and he was, he admitted, £100 short of being able to buy. He also pointed out that had it not been for his generosity concerning my birthday present, there would have been no problem. Only later did it dawn on me that he was actually attempting bribery and blackmail.

Unknown to him, for some time I had been filching from the housekeeping with the intention of throwing a surprise party for his looming 50th birthday.

by Tina Billett

By juggling the figures, I decided instead I could give him £100 and at the same time save myself a considerable amount of work in cooking and organising.

The great day dawned and he left to buy his new toy. I suppose that most of my scepticism stemmed from past experiences of gadgets eagerly acquired, played with for a while, then stashed away in the spare room never to see the light of day again. As I had taken over the spare room, using it as an office for my own work, I was alarmed at the thought of losing more precious space. Had I foreseen the consequences of the micro, I would have been horrified.

Innocent start

It all started innocently enough. A colleague at his work, who was possessed by a TRS-80, had adapted a Pet program, which had appeared in a U.S. magazine called *Quest* written by Roger Chaffee. My husband had been enthusing about that for some time and finally obtained a taped copy. "Here", he said, "you try it". I did — and was hooked.

The trouble with that kind of game is that once you understand it, the only excitement to be gained is in shortening the length of time it takes to remove the treasure from the caves. We were to return to treasure hunting later, but in the meantime, we decided to try our hand at book programs. When I say we, I really mean I, for by some freak coincidence I am a faster typist than he.

I spent hours typing programs from *Basic Computer Games* and *More Basic Computer Games* only to discover at the end of the day that they did not work. Not

Background

The two ladies who star in this month's distaff special could scarcely be more different; they are alike only in their consuming passion for the micro. Rose Deakin, pictured here with her Transam Triton, discovered the micro after a frustrating stint with an official mainframe which she was using to process data from her social services research project.

After the turgid protocol of the punch cards and the municipal pecking order, she found it a great relief to be able to edit so fluently and so easily. Before, she had had to wait to have anything run and if, as sometimes happened, even one punch card had been reversed — back in the queue, madam.

She comments favourably on the excellent service that Transam have given her even when the problems were software bugs rather than hardware malfunctions. This surely argues patience on the part of the supplier, who must have heard that story before.

Tina Billett is a wiry and energetic spirit whose two youngsters, quarantined with chickenpox, looked on with curiosity as the pictures were taken. By contrast with Rose, whose micro operation is a freelance extension of an existing career, her passion for the Video Genie is an all-family fun operation and has to a large extent dislocated her occasional career as a writer.

By the looks of it, the Genie has seen a good deal of "open sesame". Not even a year old yet, it has been in use all day every day since it arrived in their Claygate, Surrey home, except when the family went away on holiday.

After three days of rain, they all by common consent headed for home and the micro — they had even considered taking it with them but this was precluded on grounds of car space. Games like Battleships are still very much the order of the day, and many well-leafed tomes of practical programs lay around the computing room.

She complained that many of them would not run as listed, but agreed that the real fun lies in making them work rather than using them. She still manages to run her spiritualist foundation, The Chalice Foundation, when not at the keyboard and uses the Video Genie for filing.

Her sect promises answers to such intriguing questions as: Is there a God? and: Is there life after death? though her controversial views on the spiritualist movement appear less frequently than formerly in the pages of the *Spiritualist Gazette*. After that, mastering the micro must seem easy.

knowing the first thing about computers in general and ours in particular, how was I supposed to know what was going wrong?

Commands appeared in the listings which did not appear in the users' manual supplied with the Video Genie for very good reason — the Video Genie does not know about things like:
"DEF FNA(X) = INT(RND(1)*X) + 1" or
"H1 = FNA(N)"
and
"H2 = FNA(C(H1))"

So programs like Nomad seemed a useless waste of time. Then I discovered that by omitting the initial DEF FNA and inserting RND(n) wherever FNA appeared the problem should be solved — except that it was not. Only a line by line scrutiny finally revealed a comma, lurking on the end of a Data line, turning a vital positive constant into a zero and making a nonsense of the whole thing.

A similar problem arose with Seabattle except that in that case a semicolon omitted from a "PRINT A$;" statement turned what should have been a map into a stream of full-stops shooting up the edge of the VDU. There were many hitches besides typographical ones in this program. Some statements, such as

"S3 = INT(RND(1)*20) + 1"

could be simplified into

"S3 = RND(20)

but lines such as "RESTORE 6300" just do not work.

Perseverance

When I explained our difficulty to the man in the shop, he told me positively that I was wasting my time — the program was written on and for a computer with teleprinter rather than VDU so not only was the map larger than the screen, but it shot off the top at a great rate of knots, making strategic planning quite impossible.

Undeterred by the expert's opinion, we persevered, and after weeks of sporadic twiddling, we achieved a game not only with static map but also with the added advantage of seeing torpedoes on route to their target and which create a satisfying explosion on impact, but we have not yet managed to display a completely animated version. In any case, we have learned one thing — experts don't know it all.

During this time, I also toyed with Quest to the extent that on each run, the treasure is placed at different locations. Then we encountered the Adventureland programs, which made Quest seem kids' stuff by comparison. Pirates' Treasure took two weeks to find, but I still have not been able to elude the Adventureland bear without giving him honey.

The Tandy Pyramid 2000 insists on keeping the whereabouts of the last two treasures to itself, and I have now embarked on Ghost Town and Mystery Fun House. I am determined that the one-eyed monster who sits permanently on the dining table is not going to out-do me.

As you can probably guess by now, I am no longer merely hooked, but severely addicted, and so frequently burning the midnight oil. As well as playing ready-made games, I have typed-in and de-bugged many published listings, learning about programming into the bargain.

Whether it is a peculiarity in me, or symptomatic of the disease computer-mania, I do not know, but one thing I have discovered is that once the program has been debugged and runs to plan, I lose interest in it, turning my attention to yet more intricate and complicated plots.

When I thought I knew enough about the basics of programming I set about devising a simple reference system for my own work, which involves researching, and writing on, a totally unrelated subject. I frequently need to refer either to something written by myself, or contained in other works and can rarely find what I want without a great deal of scrabbling through papers or books.

The program I wrote, although short, is very effective and could be adapted easily to suit the needs of anyone in a similar position. In my case, I have entered under Data, file/book letter, A-Z, followed by page number, up to 999, then three factors of three letters each.

If, for example, I thought I may want to refer back to the article in the November issue of *Practical Computing* on, say, Micromouse I would enter "P 50ARTMICMOU". By entering on request ART,MIC,MOU the computer would sort through the DATA and print up "P 50".

If, on the other hand, I had by that time forgotten exactly how it had been entered, but knew it was connected with a mouse, by choosing the appropriate option, I would enter MOU I would then receive the entire entry. If by some remote chance I also had an entry MOU, meaning something quite different, all references would be printed leaving me to decide which one was the correct one.

Tina Billett, self-confessed micro addict.

To save unnecessary explanation I have inserted a few REMs in the listing, so that anyone will be able to understand it.

Obviously any individual wanting to adapt the program for their own purposes would need to devise their own coding system, adapting the listing accordingly.

Having spent so long tinkering with Adventure-type games, I allowed myself to be talked into devising something similar. Not yet conversant with machine code, I am limited to the use of Basic, but with 16K at my disposal there had to be something original worth trying. Not being of the class of people like Scott Adams, what I really wanted to try was something totally different.

Board-games

I have always enjoyed board-games, so after considerable thought, I chose Cluedo as the basis of the experiment. In the computer version, Computaclue, there are 30 locations, including a hazard-ridden garden, 10 suspects and 10 possible murder weapons.

Every run produces a different combination of location, murderer and weapon. The suspects and weapons are strewn at random about the three-storey mansion and can be taken, dropped or released at will. Solving the crime is, as in the board-game, by a process of elimination.

There are two versions; the first enables the player to move through the house at will, while the other moves one at random. The second takes longer in terms of finding the solution but has distinct advantages for those whose typing ability is questionable.

I am contemplating converting 'Monopoly' to the keyboard but have some doubts as to my ability to teach the machine to play intelligently enough to provide stiff opposition. My other half is, meanwhile, writing a program concerning the shooting of a certain well-known and much-hated soap opera character.

We each jockey for position at the keyboard with our 10-year-old son who has all the hallmarks of a budding genius. He has discovered the knack of Peeking and Poking, pointing and setting all over the place, sending the poor machine into apparent convulsions. If ever I decide to use graphics I shall know who to ask for advice.

We have had some technical difficulties with the Video Genie which may be worth a mention to prospective buyers. Having a built-in cassette recorder has distinct disadvantages, particularly when the head tends to be off-centre, and while CSAVEing and CLOADing our own efforts is straightforward enough, there are problems in loading bought System tapes.

I think I have spent as much time watching the left-hand asterisk change into a C as in actually playing the games. Also, those TRS-80 owners to whom we have given copies of our programs have

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constantly complained about not being able to load the tapes easily or effectively.

Loading reciprocal material is achieved through the second recorder input and if someone can devise an idea for loading machine-code programs in this manner, we would be thankful.

Substandard tapes

We have tweaked the head to make it compatible with other machines, but then had to spend hours transferring all the tapes from one system to the other. That involved dislocating the head of a standard cassette recorder to load the program, then re-record them on to the corrected built-in model.

We have also had trouble with sub-standard tapes. The inexpensive ones are not the bargain they seem to be. Anything longer than a C-30 jogs up and down on the spindles like a thing possessed and only the judicial placing of a block of wood prevents it from happening. The metal spring on the underside of the cassette lid is as good as useless, for at regular intervals it falls off, leaving the cassette to its own devices and sometimes allowing the tape free access to the works.

Life with Genie is totally different from our prior existence. He — and I use the word with female intuition — has wrought havoc with a household which once ran smoothly and predictably.

Meals which used to appear on the table like clockwork are now haphazard and rushed; clothes are dragged reluctantly from the laundry basket, washed, and frequently reworn in an unironed state; dust thickens on the furniture and even the dog has to remind me when it is time for walkies.

As I write this there is a sink full of un-washed dishes and I really ought to go and to them — well, perhaps just a short dibble at Ghost Town.

References

Quest: Written by Roger Chaffee, inspired by Will Crowther's Adventure. Published in July 1979 by Byte Publications Inc.

Basic Computer Games and More Basic Computer Games published by Creative Computing Press, Morristown, New Jersey.

Nomad: written by Steve Trapp and published by Creative Computing Press September/October 1977, reproduced in More Basic Computer Games.

Seabattle: Originally written by Vincent Erickson, converted by Steve North and published in More Basic Computer Games.

Ghost Town and Mystery Fun House written by Scott Adams.

Pyramid 2000 Tandy Corp.

Pirates Treasure and Adventureland by Scott Adams.


```
10 Z$="    ":GOTO90
20 A$=LEFT$(R$,4):C$=MID$(R$,5,3):D$=MID$(R$,8,3):E$=MID$(R$,11,3)
25 RETURN
90 CLS:PRINTTAB(17);"INDEX REFERENCE"
95 PRINT:PRINTTAB(5);"ENTER 1, 2  OR  3 THREE LETTER FACTORS, AS REQUESTED, FOR
 REFERENCES PERTAINING TO THE CHOSEN OPTION."
100 PRINT "OPTIONS:
            1) THREE FACTORS AS ENTERED.
            2) THREE FACTORS ANY POSITION.
            3) TWO FACTORS AS ENTERED.
            4) TWO FACTORS ANY POSITION.
            5) ONE FACTOR AS ENTERED."
101 PRINTTAB(12);"6) ONE FACTOR ANY POSITION
            7) ENTER NEW DATA.
            8) END OF SEARCH.
            9) OPTIONS."
110 PRINT"ENTER OPTION"
112 O$=INKEY$:IFO$=""THEN112
115 O=VAL(O$)
120 ONOGOTO140,200,250,300,350,400,450,990
130 IFO=>9THEN100
140 CLS:PRINT"THREE FACTORS AS ENTERED. ENTER THREE FACTORS.";:INPUTF$,G$,H$:PRI
NT
160 READR$:GOSUB20:ON ERRORGOTO175
165 IFF$=C$ANDG$=D$ANDH$=E$THENPRINTA$;Z$;
170 GOTO160
175 RESUME180
180 RESTORE:PRINT:PRINT:PRINT"THAT IS ALL":GOTO110
200 CLS:PRINT"THREE FACTORS ANY POSITION, ENTER THREE FACTORS.";:INPUTF$,G$,H$:P
RINT
210 READR$:GOSUB20:ON ERROR GOTO175
220 IFF$=C$ANDG$=D$ANDH$=E$THENPRINTA$;Z$;:GOTO210
221 IFF$=C$ANDG$=E$ANDH$=D$THENPRINTA$;Z$;:GOTO210
222 IFF$=D$ANDG$=C$ANDH$=E$THENPRINTA$;Z$;:GOTO210
223 IFF$=D$ANDG$=E$ANDH$=C$THENPRINTA$;Z$;:GOTO210
224 IFF$=E$ANDG$=C$ANDH$=D$THENPRINTA$;Z$;:GOTO210
225 IFF$=E$ANDG$=D$ANDH$=C$THENPRINTA$;Z$;:GOTO210
226 GOTO210
250 CLS:PRINT"FIRST TWO FACTORS AS ENTERED. ENTER TWO FACTORS.";:INPUT F$,G$:PRI
NT
255 READR$:GOSUB20:ON ERRORGOTO175
260 IFF$=C$ANDG$=D$THENPRINTA$;Z$;E$;Z$;
265 GOTO255
300 CLS:PRINT"TWO FACTORS ANY POSITION. ENTER TWO FACTORS.";:INPUTF$,G$:PRINT
310 READR$:GOSUB20:ONERRORGOTO175
315 IFF$=C$ANDG$=D$THENPRINTA$;Z$;E$;Z$;:GOTO310
320 IFF$=C$ANDG$=E$THENPRINTA$;Z$;D$;Z$;:GOTO310
321 IFF$=D$ANDG$=E$THENPRINTA$;Z$;C$;Z$;:GOTO310
322 IFF$=D$ANDG$=C$THENPRINTA$;Z$;E$;Z$;:GOTO310
325 IFF$=E$ANDG$=C$THENPRINTA$;Z$;D$;Z$;:GOTO310
```

```
330 IFF$=E$ANDG$=D$THENPRINTA$;Z$;C$;Z$;
335 GOTO310
350 CLS:PRINT"FIRST FACTOR IN FIRST POSITION. ENTER ONE FACTOR.";:INPUTF$:PRINT
355 READR$:GOSUB20:ONERRORGOTO175
360 IFF$=C$THENPRINTA$;Z$;D$;E$;Z$;
365 GOTO355
400 CLS:PRINT"ONE FACTOR ANY POSITION. ENTER ONE FACTOR.";:INPUTF$:PRINT
405 READR$:GOSUB20:ON ERRORGOTO175
410 IFF$=C$THENPRINTR$;Z$;:GOTO405
411 IFF$=D$THENPRINTR$;Z$;:GOTO405
412 IFF$=E$THENPRINTR$;Z$;
415 GOTO405
450 LIST1000-
990 END
1000 REM   DATA EXCLUDED. USER SHOULD DEVISE AND IMPLEMENT
1010 REM   METHOD BEST SUITED TO OWN PURPOSES.
1020 REM   EXAMPLE -   DATA A123ABCDEFGHI,B 21DEVOWNMET,   ETC
```

Bleak moments spent with an unsympathetic machine

A YEAR AGO I decided to make a complete change in my career, which had previously been social work and social research larded with a little teaching. I had been finding that the poetry of numbers, and more particularly of programs and systems called to me more powerfully than the compromises and uncertain premises of social studies.

It probably seems odd that anyone who has enjoyed, as I certainly did, an occupation as fulfilling in personal terms as social work should turn to computing. I was beginning to sense the kind of dissatisfaction you might feel in trying to play tennis with a soft boiled egg, and, to pursue the sporting analogy, felt some of the thrill of mastering an obstinate horse in coming to terms with a computer.

by Rose Deakin

The parallels are close; first, the sense of hopeless inadequacy and frustration when faced with an unco-operative beast and the lack of skills to dominate it. Then slowly feeling it beginning to respond; some success now in minor things and communication is beginning to be established, and gradually the heady sense of all that power at your command — a mighty beast working for you. It is no wonder that people have anthropomorphic feelings about computers.

The change was not quite as sudden and unheralded as I have implied, although the decision was a surprise even to me. Preparation had been gradual, over a period of years. After an entirely arts-based education and a degree in history I turned in 1971 to the Open University and did a degree in maths and statistics.

For the past two years I had been going as a user to the University of London Computer Centre, ULCC, and using the statistical package for the social services for analysis of social survey data. I had discovered there the essential role of the advisory office, and also the need for rudimentary programming skills and a language to write routines.

I took a course in programming in Fortran at Imperial College, London and had attended follow-up lectures.

That, and a row at work, inspired the decision. Next followed the search for

(continued on next page)

Rose Deakin in a happier moment.

(continued from previous page)
advice. It was all very well as a decision, but how does a female over 40 break into a highly-technical, young man's world?

I cannot say that the answer was courage, as I did not feel very brave. Perhaps it was luck of a particular kind — meeting unbelievably kind and helpful people right from the start, and having moral and financial support from my family.

I talked to some people at ULCC first, and they were encouraging. They did not see why I should not try, and thought that the main requirement was a good logical mind. A major difficulty was that I wanted a part-time job, and so I was not an attractive training prospect. I next went to see Dan Oestreicher, a computer consultant and friend of the family.

He said much the same, but added, at the end of our meeting, the suggestion that I might think about microcomputers. He pointed out that the advantage of these was that, being new, the lack of 20 years' experience could not be held against me. Also, if I bought one and worked at home, the part-time problem would be solved.

Stroke of luck

I decided to do that, on the follow-your-nose principle. Although it seemed mad, it made me feel cheerful to think about it, and nothing else did. Then came my next stroke of luck. A few months earlier when trying to find a MK-14 for my 14-year-old son, I had ended up at Transam — the only people we could find who stocked them.

They had been friendly and helpful, and so I went to see them again, and returned with a Triton. My son was worried about my obvious gullibility. My answer was that if you went on studying all the magazines or thought about it too much, you could never decide that one machine was better than another and you would end up buying nothing — naturally, I do not agree with this now.

Certainly, my biggest stroke of luck was to go to Transam, as without its staff's help and support, I would have been a piece of litter on the verge of the great microcomputer highway.

Consumer backlash

Perhaps being a woman helped, as I think that if they had not got a certain amount of entertainment from the very unlikeliness of my struggles, they might have been less kind and more irritated.

My very bewilderment may also have helped in a curious way, as I was loudly insistent about the dangers of a consumer backlash, if the kind of people to whom microcomputers would soon be sold were not given more help in the initial stages. I saw the help as better documentation and a reduction in the complexity of what users had to do.

Transam quickly recognised an opportunity to see just what a novice to the field finds hard to understand and master. I noticed that many of my ideas were soon incorporated into its philosophy.

There followed six months desperate struggle to develop some more programming skills while learning Pascal, and mastering the system. I had soon decided to buy a single 8in. disc drive to add to my Triton and to run CP/M. My tangle with CP/M proved quite my worst experience in years.

Document criticisms

I had started being very critical of the Triton documentation, but although I stick by my criticisms, it was clarity itself compared to the CP/M manuals. I have since realised that the CP/M manuals do in most cases include a correct description of the procedures and commands, but that they are comprehensible only to someone who knows already how to do it — a useful reminder but a useless introduction.

The addition of a disc operating system added horribly to my problem, and since there was no help to be got from the manuals, even at fifth or sixth perusal, I had to turn to the telephone, or personal visits to Transam — very embarrassing, but there did not seem to be anyone else to ask.

I forced myself. I had a mental picture of everyone sighing and muttering: "Oh lord, here is that woman again with more stupid questions". Yet the alternative would have been a pile of expensive, rotting equipment looking reproachfully at me each day: so I went back and asked.

Diary entries

Some entries in my diary may given an impression of the agonies endured;

May 6: Got copy of master disc made by Brendan, but system not added because different size. He told me what to do and I spent the rest of the day, 11am-9pm, trying and failing.

May 7: In despair and humiliation, returned with all discs. B not there so Paul tried for ages to do it and could not. Is it something I have done? Went home and tried again. No joy. Rang and got B who had meanwhile decided what to do. He worked out a special routine for me and this was OK.

May 19: Desperate work on E's project. Nightmare. Can so nearly do it, but it won't function. Stuck on parameters again. I think it's types.

May 23: Cannot get the answer. Wrote in despair to Dan for help.

June 3: Worries: How will I be ready in time? What should I concentrate on? Will I have anything to offer? Shouldn't I also learn Basic?

June 11: N.b. Must find a better input routine to save all these tedious corrections.

July 16: Went to see Graham about back-up for the hospital project. He was really helpful and enthusiastic.

Sept 2-11: Worked really well, and everything went like a dream. Developed several new programs for graphing etc. Now I begin to feel more confident.

I had decided that the only way to learn was to do, and that the only way to do was for real, not a theoretical exercise. On the other hand, being clearly incompetent, I could not take on ordinary jobs, so I went round bullying friends who had businesses or work susceptible to computer aid.

One friend gave me some social survey analysis to do for my first project, and another put me in touch with a hospital department with student nurse timetabling problems. In return for access to the hospital work and records, I devised and demonstrated a system of data files, information recall and update programs which they found useful as an introduction to the inevitable task of thinking out their own use of computers in the near future.

Under pressure

I had committed myself to producing results and so was under pressure to learn and to deliver the goods without the feeling of having taken any money for services I was not sure I could render. Now I feel I could render them.

The question today is: what happens next? I would like to write a fools' guide to the subject to help people like me, or even people who, though not so foolhardy, are interested in the subject. I want to develop teaching material and self-instruction guides. I want to improve my own skills almost indefinitely, and I want to set up some kind of advisory business.

The plan will be to help the people who, will find themselves in a mess trying to be their own systems analyst, programmer, operator and user all in one. I am afraid that this is what will happen with microcomputers, as they are so small and cheap that each one does not have a giant organisation to support it.

Advisory business

If I set-up an advisory business, my first piece of advice will always be: Find a reliable manufacturer or supplier but above all one that you can rely on for help and support. A friend once asked admiringly how on earth I had managed to learn it all, and laughed when I replied: "I read all the books and if I didn't understand them, I just kept on telephoning the shop".

The point is that you do have to have someone. There are few moments so bleak as being alone in a room with a computer which just says: "What"? Although machines can be enormously satisfying, and the use of them can be creative and poetic, they do not explain things to you; you cannot plead with them; they do not melt under the warmth of your smile; you cannot wheel and deal with them, nor can you bribe them or buy them off.

That all adds up to the fact that the people in your microcomputer life will be as important as the machine, despite the fact that a good machine is an essential part of the equation.

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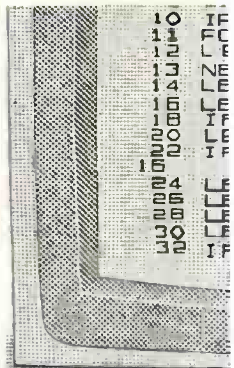
New! Sinclair ZX81 Personal Computer.

Kit: £49.95 complete



Reach advanced computer comprehension in a few absorbing hours

Built: £69.95 complete

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. At £99.95, the ZX80 offered a specification unchallenged at the price.

Over 50,000 were sold, and the ZX80 won virtually universal praise from computer professionals.

Now the Sinclair lead is increased: for just £69.95, the new Sinclair ZX81 offers even more advanced computer facilities at an even lower price. And the ZX81 kit means an even bigger saving. At £49.95 it costs almost 40% less than the ZX80 kit!

Lower price: higher capability
With the ZX81, it's just as simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

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

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, or to select a program off a cassette through the keyboard.

Higher specification, lower price – how's it done?
Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

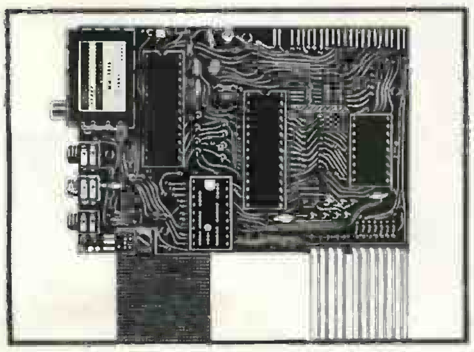
The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

Proven micro-processor, new 8K BASIC ROM, RAM – and unique new master chip.

Kit or built – it's up to you!

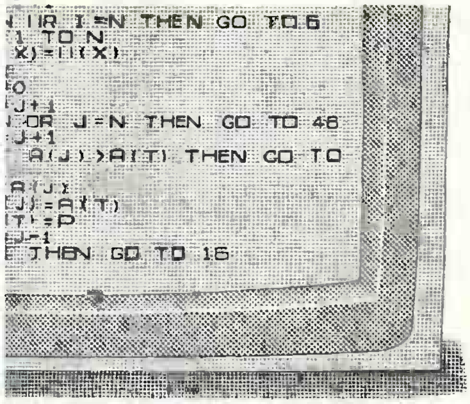
The picture shows dramatically how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9 V DC nominal unregulated (supplied with built version).

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



New Sinclair teach-yourself BASIC manual

Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs. You need no prior knowledge – children from 12 upwards soon become familiar with computer operation.



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Z80A micro-processor – new faster ersion of the famous Z80 chip, widely recognised as the best ever made.

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- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
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- Multi-dimensional string and ımerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function – useful for games s well as serious applications.
- Cassette LOAD and SAVE with amed programs.
- 1K-byte RAM expandable to 16K ytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer not available yet – but coming soon!)
- Advanced 4-chip design: micro-ocessor, ROM, RAM, plus master chip unique, custom-built chip replacing ZX80 chips.

sinclair ZX81

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Kings Parade, Cambridge, Cambs.,
82 1SN. Tel: 0276 66104.
eg. no: 214 4630 00

If you own a Sinclair ZX80

The new 8K BASIC ROM used in the Sinclair ZX81 is available to ZX80 owners as a drop-in replacement chip. (Complete with new keyboard template and operating manual.)

With the exception of animated graphics, all the advanced features of the ZX81 are now available on your ZX80 – including the ability to drive the Sinclair ZX Printer.

Coming soon – the ZX Printer

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alphanumerics across 32 columns, *and* highly sophisticated graphics. Special features include COPY, which prints out exactly what is on the whole TV screen without the need for further instructions. The ZX Printer will be available in Summer 1981, at around £50 – watch this space!

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

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

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

How to order your ZX81

BY PHONE – Access or Barclaycard holders can call 01-200 0200 for personal attention 24 hours a day, every day.
BY FREEPOST – use the no-stamp-needed coupon below. You can pay by cheque, postal order, Access or Barclaycard.
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 Ltd, FREEPOST 7, Cambridge, CB2 1YY.
Remember all prices shown include VAT, postage and packing. No hidden extras. Please send me:

Qty	Item	Code	Item price £	Total £
	Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (600 mA at 9 V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack(s).	18	49.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
			TOTAL: £	

Please tick if you require a VAT receipt ☐
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Nestar local network gives micros large-computer benefits

IN THE mid-1970s, two exciting avenues of development opened in the computer world. The first was the emergence of networks of large computers. At that time, I was teaching at a major university which participated in the pioneering ARPA computer network. Therefore, I had the opportunity to learn at an early stage what fun it could be to send and receive computer "mail" from colleagues on the network, to browse through the Associated Press releases stored in a remote file, to participate in a nationwide teleconference, or to play spacewar games with distant opponents.

Second development

The second exciting development around that time was the beginning of affordable personal computing. It was not long after obtaining an account on the ARPA network, that I bought an Altair computer.

Today, about five years later, it seems that networking and personal computing are beginning to move together. I know of 10 companies which have announced plans to market local networks of personal computers in the last six months.

They are not like the ARPA network, in which the computers are relatively-large machines spread throughout the States and Europe. They are networks of small computers, located, typically, within 100s of meters of each other. About half of the entrants in this new local-network market are large companies with backgrounds in semi-conductors and minicomputers and others are from the personal computer industry.

As far as I know, the first company to announce a product mixing network and personal computer technology was Nestar Systems of Palo Alto, California. Three years ago, Nestar developed a package which allowed several Pet or TRS-80 computers to be linked to share a common disc. That system was designed primarily with the schools market in mind.

Last year, Nestar announced a second-generation local network which ties together Apple computers and is aimed at providing the kinds of functions found on large computer networks. The new system, the Cluster/One Model A, is being developed with an eye to the office environment.

by Larry Press

A recent consulting job provided me with the excuse I needed to visit Nestar and spend a few days using its system and talking with its staff.

The Model A enables one to network up to 65 Apple II computers. At the centre of the network is a master Apple which controls a Nestar 8in. floppy disc subsystem and an optional hard disc. The hard disc may be either 16.5 or 33Mbytes, though larger discs are planned for the future. The system is connected via a 16-wire flat cable to up to 64 Apples. Each Apple must have a network interface card which plugs into any unused peripheral slot.

Any of the user systems can access the master disc as if it were a local Apple drive. It may be used to store commonly-used programs and, of course, shared databases. In addition to the use of the master system and its disc, the network members are able to communicate directly with each other since each has a local address set by switches on the interface card. That enables any user to control a resource which might be shared by others on the network. For example, one might control one or more printers which could be used by anyone on the network.

Figure 1 shows a typical configuration which could be installed in an office. The master system has a 16.5Mbyte hard disc in addition to the floppy-disc subsystem. There is one user system which is dedicated to controlling a relatively high-speed printer and 10 other user systems which are located on various people's desks in the office.

Shared resources

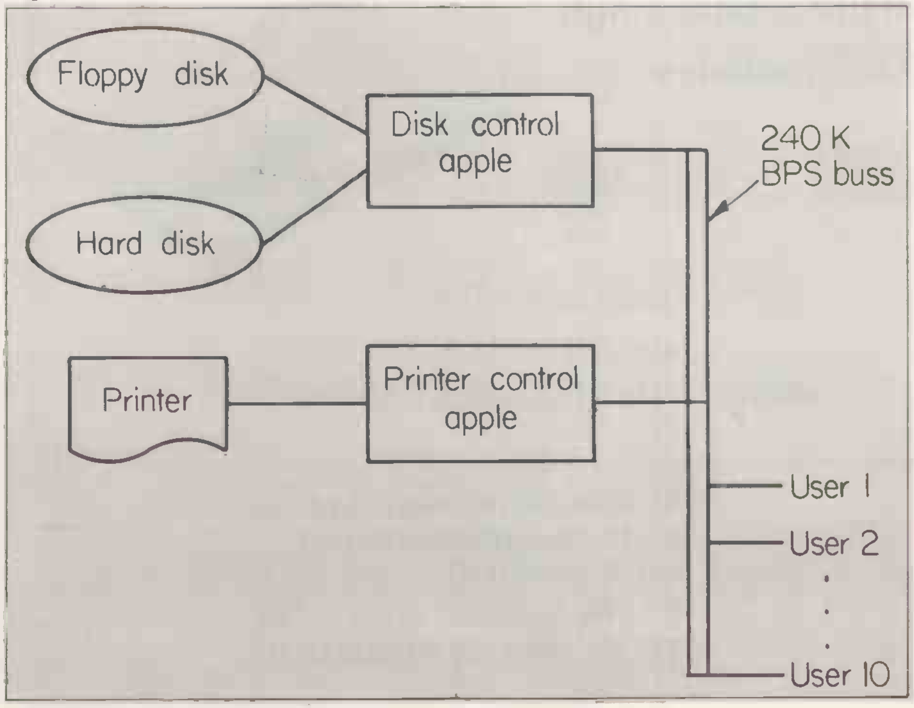
For the purpose of the example, let us assume that disc storage and printing are handled entirely by the shared resources, so that none of the users requires a floppy disc or printer. Each will, however, require a network interface card, memory, and probably an Apple Pascal card.

Table 1 shows the cost of such a system and table 2 the cost of 10 stand-alone Apples, each with two 143K floppy discs and an 80 character per second printer. As the tables show, the cost of the network system is roughly the same as 10 stand-alone machines. With more user stations, the network would begin to enjoy a cost advantage and with less, the stand-alone systems would be cheaper on a per-user basis. In fact, using those figures, the break-even point is reached at about 12 users.

As the example indicates, cost savings are not a significant factor in tempting one to install a 10-user network in an office environment, but there may be other reasons. I mentioned various functions such as electronic mail, teleconferencing and access to common data which contribute to the value of the ARPA network. It is clear that some software support is necessary if such facilities are to be provided.

We might distinguish among four general classes of software in the network environment. The first is associated with basic data transfer between the elements of the system. That software is responsible for the reading and writing of data,

Figure 1.



routeing it to appropriate units, error detecting, etc.

Operating system software is the second level which must be provided. That is the software which manages disc files and other resources. It maintains directories of files, associates logical files with devices, handles security and billing, interfaces with the system operator if there is one, etc. Next is generic applications software — applications such as electronic mail or teleconferencing.

Those are useful in many kinds of organisation, as opposed to the fourth category, specific applications software. That software is designed for a specific industry, but is written for the network environment in which a common database is maintained and common resources such as printers are shared.

Nestar, of course, provides the basic data communications software with the system. Each of the interface cards has 1K RAM for data buffering and a 2Kbyte program in ROM for controlling communications.

	List price	30 percent Discount
Shared facilities		
Floppy-disc subsystem	6,000	6,000
16.5 Mbyte hard disc	8,000	8,000
Disc control Apple	2,200	1,540
Printer	4,000	4,000
Printer control Apple	2,400	1,680
Cables and installation	500	500
User Apples		
10 at 2,400	24,000	16,800
Total	47,100	38,520

Table 1. Costs in U.S. dollars of a 10-user network assuming that a Teletype Model 40 printer and a floppy disc and a 16.5Mbyte hard disc are shared resources. The first column assumes list price for the Apples and the second assumes a 30 percent discount on the Apple components.

User station

The operating systems software is partially that of Nestar and partially that of Apple. The user station is an Apple running either Apple DOS or Pascal. The fact that a file might be physically located on a shared hard disc is transparent to the local Apple operating system. However, a number of additional facilities are provided by Nestar.

The operating system functions, which are necessary since the network is a multi-user environment, are supplied by Nestar. When a user logs-on, the system verifies his identity and password. A user-supplied command file may also be executed automatically when he logs-on, for example, to display the titles of any messages which have arrived in his mail file since he last used the system.

The Nestar operating system software also manages the shared disc. It maintains a Unix-like directory and allocates space. The user has the ability to create many virtual diskettes on the shared disc. He may then mount them — like inserting them in an imaginary disc drive on his Apple. From that point, the Apple operating system and programs running under it read and write from this virtual diskette as if it were a real diskette inserted in a real floppy disc drive.

The Nestar operating system also handles file protection, so that only authorised users can read or write specified files. Temporary locks are also provided so that one user does not inadvertently use a record while it is being processed by another. Finally, Nestar provides utilities for formatting and testing diskettes and backing up the hard disc on 8in., double-sided, single-density floppies.

The operating system facilities are all available for delivery today. A print-spooling utility package is also under development at Nestar. It is running now in a single-printer configuration, but is being extended to allow configurations in which several, heterogeneous printers are controlled by a single Apple.

Electronic mail

So much for operating systems and utility software. Nestar is also developing some generic applications software. I was able to use a preliminary version of its electronic mail package. An electronic mail system is a complex piece of software. The user creates and modifies messages he wishes to send to others. Once a message is composed, it must be sent; so, the system must maintain directories of user attributes and locations and it must be capable of routeing and broadcasting mail to them. When mail is received, it is stored in the recipient's in-file and he is informed that he has new mail.

The person receiving the mail will want to read through it and perhaps file it, erase it, forward it to someone else, make marginal notes on it, etc. Note that both the senders and recipients of mail need to edit documents and file them away in a meaningful manner for subsequent retrieval.

File-card handler

The software for that kind of editing, filing and retrieval is complex and its design is central to the utility of a network system. No-one who has used a screen-orientated word processor to edit documents will be satisfied with the clumsy line editors found in the electronic mail systems on most networks.

Nestar is also working on a file-card handler, which enables the user to create and manipulate lists of various kinds. Each file card in a list contains relevant information as well as tags for sorting and retrieval. Nestar will also provide a simple teleconferencing system in which several users may be on-line at the same time and exchange messages which may also be stored for further use. I saw only a brief demonstration of the package, but it is also planned for release this year.

The versions of those systems which I was able to use were preliminary and it would be possible to criticise them. For example, there was no screen-orientated editor for composing and modifying text. However, Nestar seems to be committed to continuing to refine those programs and to develop others. Its policy is to provide that kind of generic applications software with its systems.

The final type of software is specific applications packages. Nestar feels that these packages must be developed by people who are familiar with the specific application area so it is leaving this to end-users and OEMs. Several OEMs are writing applications packages and while Nestar will assist them technically, it has no plans for in-house products of this nature.

Anyone thinking of installing a network

(continued on next page)

Table 2. The price in U.S. dollars of 10 stand-alone Apples, each equipped with an 80 character per second printer and two 143K floppy discs.

	List price	30 percent Discount
48K Apple	1,400	980
Monitor	200	140
Pascal card	400	280
Dual discs	1,100	770
Printer and interface	1,200	840
Total per system	4,300	3,010
Total for 10 systems	43,000	30,100

(continued from previous page)

system must address the question of performance. Unfortunately, predicting how well a local network will perform in use is a difficult and yet unsolved problem. The problem is difficult because there are so many variables in each installation. How many users will usually use the system at once? What is the maximum number who will ever use it? Will the kinds of tasks they perform require frequent disc access? Will they produce a good deal of printed output? Will they have floppy discs or printers at their user stations? What are the seek and latency times for the disc used? What is the data rate on the buss? What is the algorithm for buss multiplexing? These factors will dramatically affect system performance.

As examples, let us consider several possible application environments. At Nestar, programmers use the in-house network for applications development and documentation. They do a great deal of program and text editing, compilation and debugging. This work uses the shared disc and printer rather heavily and they feel that six to eight users in this environment is about as many as the system can accommodate. At that load level, the response time becomes slow. Their guess is that the average time to run a job is about the same as on a stand-alone Apple, but that the standard deviation is high.

Amusement park

Another installation is at the Sesame Place Amusement Park. In that environment, users load programs from the disc, but then execute them locally. There is not much disc activity once a user has signed-on and loaded a program, so a single network can support more users. At Sesame Place, there are between 20 and 25 users on-line at a time.

There is a Nestar system installed at a bank in San Francisco which is being used for data entry. While there is a good deal of disc access in this case, the system accommodates 20 users satisfactorily.

To put the performance question in some perspective, I ran a few benchmark experiments comparing a stand-alone Apple with a floppy disc to the same Apple using a hard disc over the network. Table 3 shows the results I obtained when trying sequential disc I/O. I wrote a Basic program which wrote the numbers 1-1,000 in a disc file and another which read sequentially through the file created by the first program. As the table shows, the stand-alone and network system were about equal in speed.

At the time I ran the experiment, there were four other users on the network — one was on the print spooling system. However, they were essentially inactive. I was using Apple Basic rather than Pascal and had an empty diskette on the stand-alone Apple, which presumably reduced seek times.

	Stand-alone	Network
Read 1,000 numbers	22	21
Write 1,000 numbers	24	25

Table 4. Random disc I/O. This table shows the time in seconds to read and write — read time/write time — random files. In each case, the entire file was created — written — and read back sequentially.

The Apple II.

The second group of benchmarks are summarised in table 4. I wrote random files of fixed length records and subsequently read them back. In that case, I varied both the file size and the record size. As in the sequential case, write times are consistently longer than read times because data is checked after it is written. Those limited data also seem to indicate that the stand-alone system enjoys a comparative advantage in cases where record sizes are high. I suspect that reflects a feature of the I/O buffering system and it might be possible to tune the system to account for typical record and file sizes. I did not ask whether the user is able to tune the system in the field to perform well using his hardware, but this kind of thing should be possible.

Those tests are limited, but they do give a rough feel as to the speed of an Apple in this environment. I asked the people at Nestar if they had worked on either mathematical or simulation models of the system and was told that they had not had the time but that it would make a great masters thesis. I wholeheartedly agree. At the moment, it is difficult to configure intelligently a network system for a new application let alone compare two competing systems. With time, we will have to develop both far more "seat of the pants" experience and analytical models of the systems in the marketplace.

Table 3. Sequential disc I/O. This table shows the time in seconds to read or write the numbers 1 through 1,000 on a sequential file using a stand-alone Apple computer with a floppy disc and a networked Apple using a hard disc. There were four users on the network at the time the test was run, but they were inactive. The figures are averages for several runs and there was virtually no variance due to changing system loads.

File size	Record size	Stand-alone	Network
100	10	8/13	7/11
100	100	12/22	11/17
100	200	14/24	15/25
100	1,000	17/27	19/32
200	200	28/44	30/47
300	100	38/50	32/45

Enormous interest

Local networks are a enormous interest. Nestar has been a pioneer in the field, but it now has a much actual and announced competition. As we have seen, the cost of a local network will often be as great or greater than the equivalent number of stand-alone machines. Justification must derive from the value of sharing common data, and to do so, a heavy investment in software will have to be made. Middle managers are not going to be willing to have to learn an operating system which imposes a confusing view of the secondary store on them. Neither will they be willing to write electronic memos if they have to do it using editors which were designed for programmers sitting in front of Teletype machines operating at 10 characters per second over a phone line.

Nestar is off to an early start in that its second-generation system is in the field, while many other companies are just starting their advertising campaigns. However, it is my guess that software design will be the key to continued success in this area.

References

1. ARPA stands for the Advanced Research Projects Agency of the Department of Defence. ARPA has been instrumental in funding a good deal of development work in computing, including the earliest major time-sharing systems.

2. The same types of software must, of course, be provided in the stand-alone personal computing environment — device drivers, operating systems, and applications packages. While stand-alone applications packages will operate on a networked system, they must at least be modified if they are to take advantage of the capability for sharing data and other resources.

Financial modelling made easy

IF MICROMODELLER were a wine you might be forgiven for describing it as presumptuous and definitely non-vintage. As it is a software package, these may be seen as positive advantages.

Micromodeller comes to the market with the claim that it is the software program that will enable non-computer trained managers to do sophisticated financial modelling on a mere Apple microcomputer. It will cost a fraction of using an expensive program on a minicomputer let alone time sharing on a mainframe.

The Micromodeller software program costs just £425. A complete Apple II computer system, complete with video display, floppy disc drives for memory and a printer costs £4,000. By comparison the program for a mini-computer which rivals Micromodeller would cost around £10,000 according to Applied Computer Techniques the publicly quoted company, which is marketing the new program.

ACT believes that Micromodeller will rival Visicalc, the highly successful American software program which can be used on most micro-computers. Visicalc, which enables microcomputers to be used as sophisticated calculators, has itself been a significant driving force behind the success of minicomputers.

Micromodeller, which is considerably more sophisticated, is expected to encourage sales of micro-computers among business users. In the first 12 months, and it was only launched last week, ACT anticipates sales of over 2,500 programs. Many large companies with high financial modelling costs are expected to adopt Micromodeller on Apple computers.

Intelligence (UK) Limited, which wrote Micromodeller, says it has 95 per cent of the facilities offered by other financial modelling packages—including those costing around £10,000. It says the few features it does not offer are those like declining balance depreciation under French law, and third order polynomial regressions which are very seldom used.

The program has colour graphics and it can present information as line graphs, bar charts or pie charts. Instructions are given in English—the program is designed to be used by businessmen rather than by computer programmers.

ACT is claiming that it only takes a couple of hours to learn how to use—with the help of a tutorial guide. At its launch even some of the most jaundiced observers of the computer industry were making some highly favourable predictions for Micromodeller's future.

JASON CRISP

Planned obsolescence

The last journey. An historical one, too, for soon the job of anti-societal-material disposal engineers would cease. Progress was at last overcoming the final bastion of human toil. All other forms of necessary manual work had long since given way to the advances of automation and now this much-treasured, much-coveted vocation was finally succumbing. Refuse collectors, that is — dustmen.

Henry stared in disbelief at the computed value that had just flashed on to the screen in front of him. It was a hobby of his to study population trends and the algorithm which had just been executed had been designed to forecast the number of inhabitants of Las Vegas in the year 2200.

He felt, with some justification, that the answer should not have been —2.07. Momentarily he wondered what —2.07 people looked like. With a quickly typed-in command he recalled the input, displaying it on the VDU.

There he saw the glaringly obvious causes of the erroneous output — a misplaced decimal point here, an extra minus sign there; and a mispunched character "W" instead of the digit "2" in one of the numbers.

"What a heap of garbage", he rebuked himself.

He was about to correct things when the screen, which had been full of figures, suddenly blinked and Henry found himself looking at a live picture.

"We've picked up that piece of Saturn five, good buddy", a voice said over his intercom, "and you've a green light for Box2. So let's roll it. 10-four".

Henry was a little bored with Commander Daly's periodic fads. Space affects people in strange ways, but Daly was one of the extreme eccentrics. At present he was into 20th-century truck-drivers and CB radio — or at least his version of that jargon.

Henry was bored with many things and it was showing in his psychological read-out. He had a hard life and was long overdue for termination.

Henry reached to his side and punched a sequence of buttons on the navigation console. The view on the screen slowly changed as the Pandora, the vessel in which he was travelling, veered towards Box2 which was on a heliocentric orbit. They would rendezvous with it almost midway between Earth and the Sun and there they would deposit this, the latest and last, collection.

Of course, manual garbage disposal on the mother planet — and indeed on the five lunar bases — had been superseded by automated methods decades ago, but for some reason, possibly the sheer immensity of the task, space-sweeping had proved difficult to convert.

"Crew's quarters to bridge. Mike here, Henry", someone interrupted over the intercom. Several minutes had elapsed since the change of course.

"Go ahead, Mike", Henry acknowledged.

"We're going to get some shut-eye until we rendezvous. Look after things. Out".

Of the five crew, only Henry never slept. Somehow the two concepts of robots and fatigue had never been combined and the artificial slave had always been a 24-hour-a-day worker. Of late, Henry had started to envy his colleagues for their ability to switch-off from the everyday problems which they encountered and regenerate their tired bodies and minds.

At first, in his early years, he had been unable to comprehend the human need for dormancy, but as years had passed, he

by Andrew Walker

had begun to have a real yen for that precious state. Perhaps it was the weight of responsibility or the worries of the world he heaped on his own shoulders which seemed to drain his energy.

Perhaps it was simply age and the wearing out, the fading, of his circuits. He should have gone for termination on the last call at Earth, but some bureaucratic blunder had forced him to make one more trip.

His type had long since become obsolete, succeeded by the newer, faster, more intelligent, more human-looking robots which now proliferated around Earth and its colonies. The present chubby chassis on which his arms and head — the real Henry — were mounted had been designed for "optimal volume compactness" and not for his own comfort.

By his own analysis, his metal state was close to break-down. Whatever the situation, he knew that it no longer mattered, for within days he would be terminated. At that he felt some relief.

He held no grudge against the human race, even though many had befriended him yet were still apathetic about his impending destruction. That, in his experience, was the way they seemed to treat everyone and everything. He felt a little jealous perhaps — he would have liked to have retired as they did when no longer useful and finish his life in a casual manner. But they had created him and — possibly — they had the right to destroy him. A flash on the screen above his head interrupted his reverie. He operated one of the remote cameras and focused on the object which had, for a few moments, turned one of its silvery faces, catching the sunlight as it sailed through his field of vision.

Henry considered giving chase, but that would mean plotting a course, waking the crew and so on and he quickly decided to let it go. As a precautionary measure, he flicked a switch on the operational console. That caused an auxiliary micro to analyse the piece and its trajectory and relay the information back to one of Henry's VDUs. There was no problem this time — it was a light mass and well away from normal shipping routes.

"Give the new collectors something to do", he said aloud to himself.

He watched it pass for a while, wondering as ever why man had become such a litter-bug. His home planet had been close to self-destruction and was only now beginning to recuperate. Henry could still see the shores of the oceans, rotting fish scattered in their billions, suffocating, poisoned; birds crawling along the land, their feathers tarred and burned by the man-made pollutants; black city skies belched out by industrial gargantuans.

Even here, in the wide-open expanse of the solar system, whither man had been pushed by overcrowding, the debris of his conquest of space had become an eyesore and a danger.

A sudden thought crossed Henry's mind — a silly thought really. What would it be like — he lay back in the seat attempting to be as relaxed as he could. He exhaled slowly, he didn't know why, and closed his eyes.

His eyes blinked open and he looked at the screen in front of him. On it he could see Box2 away in the distance, but so soon? He wondered — had he really slept? What time was it? What time was it when he had closed his eyes? He could not remember. True, he felt a little less tired. Perhaps he had slept after all. Just a little. He nodded his head in hopeful confirmation. Well it would be a psychological fillip anyhow.

He pressed a button on the command console. The alarm in the crew's quarters would be sounding, telling them of their imminent arrival.

Box2. Its predecessor, Box1 — naming things had never been its designer's forte — had once been nicknamed the great scrapyard in the sky, but three more identical ones had been added, making the name obsolete.

All had started as floating computers with one or two extra, peculiar peripherals. Their function was to catch any nearby debris and also to rendezvous now and again with ships like the Pandora and relieve them of their loads.

Gradually, they had grown to immense proportions — artificial asteroids with microcomputer cores. They were to all intents and purposes spherical, kept that way by the computer which could orientate the speroid so as to distribute incoming garbage in the best manner.

Captured junk would be computer-analysed and appropriate agents sent to handle it. That could be cutting, bending, melting or even disintegration by bacteriological methods which had been developed during the Iranian Holy War of 2032-39.

"Welcome to Box2. Please go through correct identification and docking procedure. Thank you".

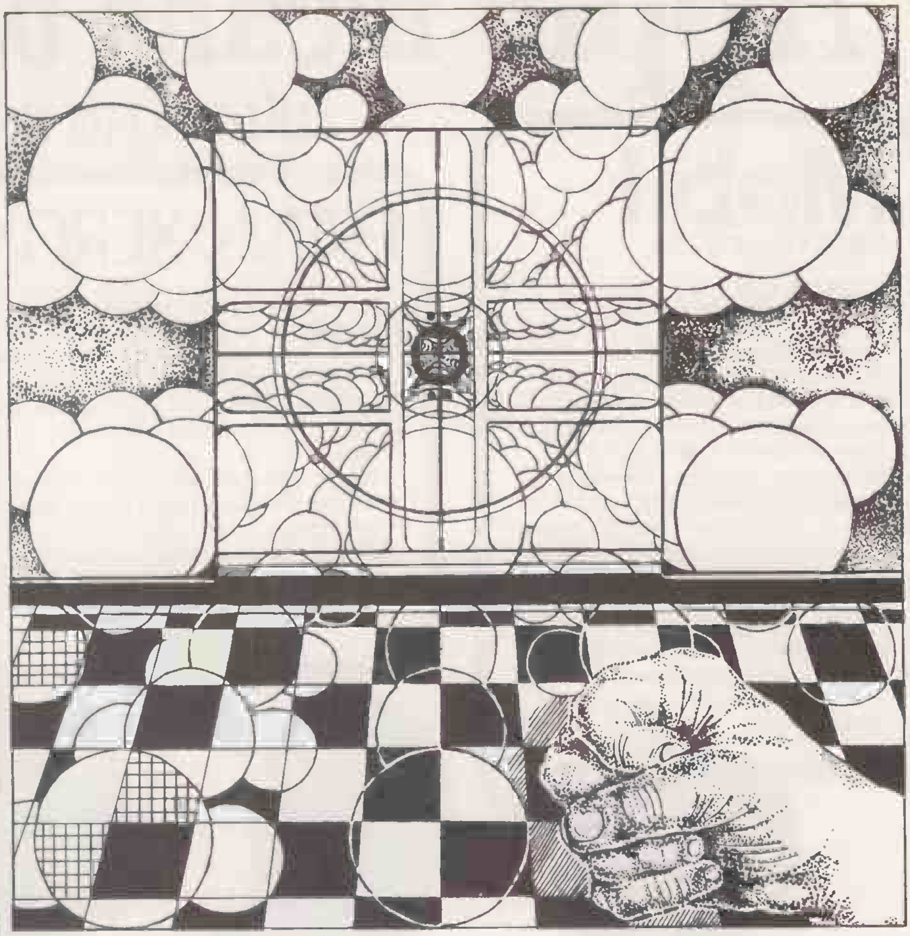
Henry read the incoming message from the Box2 computer by looking over the shoulder of Commander Daly who had taken Henry's seat at the controls. The cabin was full, each member of the crew not wishing to waste this last opportunity of seeing Box2 even though it was, after all, only a rubbish dump. Yet even Henry found himself savouring every moment — perhaps he did still have some emotive circuits left.

Yet this next part was pure routine and Henry knew every syllable of the exchange and he began to study his shipboard companions. Mike, whom he had known as a child, and Steve Duke were quite alike — blond curly hair, blue eyes; Steve was slightly taller and more solidly built; Mike was slim. Daly, the eldest, was stout, bald and a jolly character; his brown eyes always had a lively sparkle.

The fourth member and the youngest of the crew, who went by the assumed name of Ndabiningi Nkomo, was a six-foot-tall negro hailing from Hull in Canada. He was the rebel who hated convention — at the moment he was hovering above Henry in zero-G. After so many years in space, everyone had come to grips with the problems and advantages of free-fall, but only Nkomo refused to adopt the particular orientation chosen by the others.

There was one difference, Henry believed, between what he saw now and the images he had received when first meeting each of them. Wrinkles. The scars from an incessant war with time that all of them fought. All except Henry. The handsome features of his face were unchanged from those of decades ago. This, he knew, was a reason that robots had never quite been accepted into society.

On the outside, Henry stayed as young as every, while his colleagues began to exhibit the human weaknesses of age. On



the inside, however, it was the opposite — the youthful dreams, lively minds of the crew were in sharp contrast to Henry's perpetually depressed and unhappy state.

Box2 and the Pandora had closed to within a few miles, and the asteroid of junk occupied the larger part of several screens around the cabin. They were now stationary relative to each other, but Box2 had just begun to rotate. After a few moments an irregular, concave facet showed itself and Box2 made a sudden halt. Characters appeared on the communications VDU:

Orientation complete
RELEASE CARGO — 23.74609 mph
suggested optimum

Commander Daly deftly punched in a command.

"Bloody computer telling me what to do", he said. So he punched in 23.75 mph.

Nothing seemed to happen at first — Henry thought he could see Box2 shifting slightly but otherwise there was no change on the screens. Then, when a few minutes had passed, an object, large and irregular in shape, began to appear at the bottom of them and to progress towards its target.

Gracefully the two junk-mobiles moved closer, one simply floating inanimately in one direction, the other intelligently analysing, predicting and manoeuvring so as to provide the best conjunction, until at last they collided and Box2 held on to its prey. Now like Siamese twins they were joined permanently together.

For some reason everyone had been holding their breath as the tension rose and now that it was all over, there was a huge, accumulated sigh. Nkomo did a somersault before leaving and Daly stood up to allow Henry to take over.

"Well", the commander said glumly, "it's all over. Everything".

There was a general nodding of heads in agreement. Henry sat in the seat just vacated by Daly. The others were about to leave when a face flashed onto the communications screen and a voice was heard.

"Pandora, this is Earthcomm. Just a little news-flash for you guys to hear. The EEC space agency today launched its first fully-automated Solar-system material collection ship. That makes that old heap of yours, the Pandora, obsolete".

The face on the VDU spoke all of this with a smile, a joking pleasant smile. Then the man added:

"Say, I guess now that everything is automated, that makes humans obsolete, too. Never mind fellers — I'll buy you all a good drink when you arrive back. Signing off".

In silence, the human crew-members of the Pandora left the cabin. They could not share the speaker's joviality, for to them the Pandora was more than simply a ship.

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'Apple means business'

– who says so?

Mobil Oil Company Ltd. says so . . .

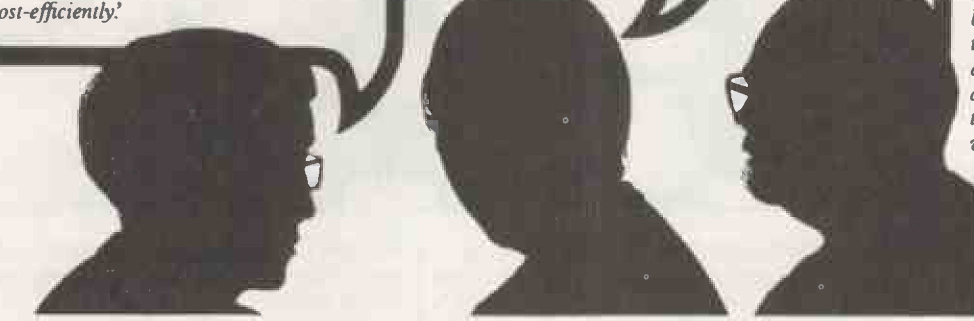
'Just one 48K Apple, VisiCalc, disc-drive and printer enabled us to save over £13,000 p.a. in outside computer bureau costs' states Mobil's Manager, Financial Analysis, Mr E.A.F. Peach. *'With this sort of saving it is hardly surprising that our use of Apples has grown from one Apple to five in under six months. Our trolley-mounted Apples bring the analytical powers of VisiCalc direct to the user's desk; and the simplicity and robustness of the system make it as easy to use as a desk calculator. Apples are now producing virtually all our analytical work, profit plans, forecasts etc., promptly and cost-efficiently.'*

RANK XEROX *says so . . .*

'If small businesses are to continue trading successfully during the next 10 years they cannot afford to let the business equipment revolution pass them by' observed Mr B.H. Nicholson, International Director of Rank Xerox Ltd., at the recent opening of the Xerox Store, Piccadilly, London. *'This store carries almost everything the small business needs, and that has to include Apple microcomputers, and the software programs that go with them. Our research has identified 500,000 small businesses in the UK: Apple will feature strongly in our service to this mass market.'*

CROWN JOINERY and LAMINATING *says so . . .*

'Faced with a 100% increase in turnover in our factories in Chesham and Aylesbury, we recently installed an Apple microcomputer in our Accounts Department' comments Mr R.F. Alderton, Partner of the Company. *'The results have been a revelation to us. Apple gives us prompt management information on sales and bought ledgers, our cash flow situation is much improved because of our debt analysis control, and my P.A. accountant has really enjoyed the transition to computerised accounting with Apple.'*



If you direct, manage or control a company or department then the Apple Computer can help you.

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- **Apple Desk Top/Plan**
- **Apple Plot**
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- **Job Costing System**
- **Stock Control**
- **Time and Cost Recording**

Accounting Programs for Apple Users:

- **Apple Business Controller**
- **Fixed Asset and Plant Package**
- **Incomplete Records**
- **Invoicing System**
- **Sales Accounting and Invoicing System**
- **Sales and Purchase Ledgers**

Specific professions can benefit too:

- **Agriculture and Business Group Package**
- **Architecture**
- **Contract Costing**
- **Estate Agents**
- **Matching Vehicle Service Records**
- **Personnel Matching**

AND IN ADDITION—most companies can use:

- **Payroll and Salaries**
- **Apple Writer (Word Processing)**

*This is just a small selection of the hundreds of programs available for the Apple business user.

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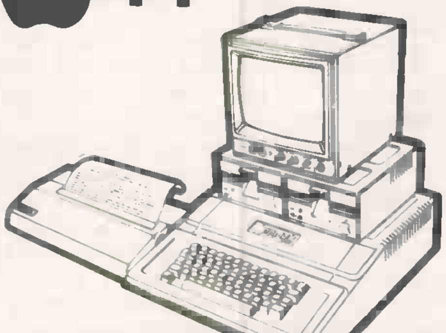

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• **Circle No. 163**

(continued from page 81)

It was home and freedom. Now that their job was over, they would have to return to the claustrophobic Earth from the infinite emptiness of the Universe.

Henry felt little — he was technically obsolete anyway and would be terminated, so for him there would be no painful reunion with the mother planet; no mind-numbing unemployment.

"Hey", Mike interjected. All eyes fell on him. His own were focused on the navigation console VDU. "Has anyone increased magnification on Box2"?

Everyone shook their heads and on looking at the screen saw what had made him ask the question — Box2 appeared bigger, now covering the whole view.

"It's moving towards us", exclaimed Steve Duke in a voice of disbelief.

Suddenly, there was no doubt in anyone's mind.

".. makes .... the Pandora .. obsolete ..."

The words of the Earthcomm man echoed in the minds of the men in the cabin. If the Box2 micro had monitored that transmission — Henry, eyes glued to the vision of approaching doom, was the first to react.

"Suits", he shouted.

The others were snapped out of the hypnotic trance of their own individual Armageddon. Momentarily, they hesitated, their befuddled brains unable to grasp the meaning of Henry's call. Then, in unison, they rushed out, their movements hampered by zero-G and the flailing bodies of their companions. Suddenly, it was every man for himself.

Only Henry had no need of a space-suit — he could survive, had been built to survive, in most environments. He watched unemotionally as Box2 closed in. There was nothing to be done. Even if there were time to steer the Pandora clear of the onrushing asteroid, Box2 would follow them and eventually catch up. Its job, Henry knew, was to gather up any floating garbage in its vicinity. Priorities would be assigned to pieces of debris by the computer and chase given accordingly.

".. makes .... the Pandora .. obsolete ..."

Those words, spoken only minutes ago, returned to Henry in all their chilling significance. The micro at the core of Box2 would have suddenly realised that a chunk of junk almost one-tenth its own size was sailing along only a few miles away.

It did not know that the junk had a name, Pandora, nor understand that human life existed within it; and it did not care. The Pandora would be the largest item Box2 had ever selected and it would hunt it down with all the zeal and ruthlessness of a jackal.

Earthcomm. If he could reach them, they might be able to do something, but then, with all the subtlety and timing of some cheap television adventure, the intercom began to fizzle and crackle and the scene on all VDUs turned to a heavy snowstorm. Finally everything went dead.

Henry settled back in the chair, staring at the blank screens. There was nothing to be done. Out there, somewhere, closing in rapidly on the blinded Pandora, was death itself in the shape of Box2. He wondered whether the crew would have time to don their suits.

He did not wonder long. For suddenly there was a huge jolt and everything not firmly fixed down flew about the cabin in a tumultuous display of free-fall chaos. Box2 had made its rendezvous with them. Henry found himself thrown to the back of the cabin, constantly being hit by the flying objects.

OXYGEN SENSORY INTERRUPT. AIR LOSS DANGEROUS TO HUMAN LIFE.

Henry's inhalation sensory system chips suddenly interrupted all his prior thoughts — oxygen was leaking from the ship at an alarming rate — he realised that they must have been holed. If the crew had not reached their suits in time, they would be dead, the breath sucked mercilessly from their lungs.

As if an answer to his morbid thoughts, a voice came over his internal personal communicator.

"Henry". The speaker sounded distraught, breathing quickly and heavily. "For God's sake Henry, are you there"?

Henry sent an affirmative response which seemed to ease the distress of the other slightly.

"This is Mike", the voice continued. "The others — they, they're all dead. We were all racing for our suits", he hesitated and Henry sensed that he was trying to fight back the tears — "I arrived first. Then all hell broke loose".

By now, Henry had stopped listening to the sobbing, rambling voice. What now, he wondered. What would Box2 do? What did it do with all junk? Analysis first, he remembered. Then the agents would be — but his thoughts were stopped by a peculiar sensation he felt, of vibrations in the ship. Of course — for a structure the size of Pandora, the Box2 micro had only one option — the crudest method, cutting it down to manageable pieces. He must tell Mike, he decided.

"Mike —",

"I know", Mike interrupted, "I see them. They're cutting the Pandora up. We can't stay, Henry, I'm leaving. Maybe if we can get to the core of Box2, we can do something".

"Such as"?

"Stop the computer, perhaps", Mike proposed hopefully. "Or send an SOS. We must try something. hell, I'm going — I just hope one of those damn cutters doesn't go for me".

Henry said nothing, but listened to his colleague's breathing quicken as he exerted himself. Not for the first time, Henry cursed the loose-tongued Earthcomm speaker who had initiated this predicament. He cursed also the creators of Box2, the first programmers who had created this inflexible gargantuan which had acted so decisively on an insignificant comment passed by an insignificant man. Then he swore at Earthcomm again.

He retrieved the words of doom from his Spram, the Semi-Permanent Random Access Memory, which made up 80 percent of his memory, where he stored all recent experiences.

".. makes .... the Pandora .. obsolete ..."

Damn stupid thing to say, Henry mused. But in the block of data he recalled from Spram lay other words which suddenly flashed into his registers.

".. everything is automated .. makes humans obsolete .."

A look of horified realisation appeard on his face. He was about to warn Mike when a loud shout came over the communicator.

"Help. I can't move — something's holding my feet. What the hell's going on"?

Gazing at a sharp pointed object which had been thrust through a wall of the cabin as Mike spoke, Henry realised it must be a cutter. Then like a knife cutting through butter, the instrument began to move along the wall.

"What the hell is that coming toward me"? Henry heard Mike say.

Henry disconnected the receiver — he knew what it would be and had no desire to listen to the dying yells of his friend. For several minutes he simply stood, patiently where he was, watching the point of the cutter slice swiftly along the cabin's bulk-head. It was joined after a while by two more.

During those few minutes he pondered his own fate. Eventually the computer controlling Box2's actions would discover him, analyse him as a defunct cybernetic machine and finally destroy him. He resigned himself to that fact and perhaps felt a little relief that at last his troubled life would come to an end.

He was abruptly plunged into darkness as the power system of the Pandora failed but even in the darkness his powerful visual system was able to pick out the blade which was cutting through the floor towards him.

He wondered momentarily if it was destined for him and he launched himself upwards and across the cabin to float on to a narrow console top from where he watched the razor's edge glide blindly by.

(continued on next page)

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He decided that Box2 would not yet have detected him — the cutters themselves had little in the way of sensory instrumentation and he had not perceived the presence of any other hardware at any time.

Then, suddenly, before he could comprehend the events that took place, he found himself out in the open, the celestial sphere gazing down on him in its speckled, glittering glory. Disorientation overcome him initially, the walls of the cabin having disappeared apparently in the blink of an eye to be replaced by the limitless expanse of the universe. The temperature of his circuitry rose by almost a degree as they raced and worked more than ever before — his internal interrupt system boosted his metabolism like an electronic adrenalin.

Eventually he realised that the cutters had finished their work an instant before the walls had gone and that some giant mechanism must have ripped the superstructure away and out of sight behind the Box2 horizon.

Now he was out in the open — vulnerable. He looked round for the sign of approaching danger with mixed emotions — not all of his emotive circuits had gone, apparently, he reasoned. Then, aware of his own bizarre stance — feet apart, atop a console, staring out into space — he began to feel rather foolish, though he did not know why, as no-one would see him. But that embarrassing agitation was there and he elected to move elsewhere.

Box2 had other ideas. Whatever commands his CPU gave, his short legs refused to obey. They seemed to him to be rooted to the surface on which he was standing, paralysed almost by some unseen force and the words, the terrified voice of Mike, caught in a similar predicament at what felt an aeon ago, flooded back to him as if in a nightmare. He looked around nervously, waiting to catch sight of the thing that had invoked Mike's final cry of *"What the hell is that coming toward me"?*

Then for the first time he glimpsed a huddled figure 10 yards from the remains of the ship. It was still. It was dead. It was Mike. Henry could see little detail and preferred not to. He turned away.

"Damn Earthcomm. Damn Box2. Damn its negligent creators", he thought.

He wondered where his executioner was — and what it would be. How long had he been out in the open? Surely he had been analysed by now. He glanced at the chronograph built into his left wrist, but gawked instead at the arm which now ended halfway along the forearm. Somehow his hand and wrist had disappeared. He looked around in horror but there was no sign of the robotic member.

On closer inspection of the arm he discovered that it was smothered in a yellow substance which seemed to be in a constant flowing motion. So that was it. Of course, he should have realised — the micro would have devised a different method of elimination from Mike's to cope with Henry's different structure. Yet to be eaten alive by an unintelligent bacterium? Henry closed his eyes sadly and shook his head. In a way he was relieved that termination was imminent. But he would never have wished to go like this — with the thoughts and problems that had dragged him down to such a low mental state being allowed to prey on his mind in these last moments.

The degeneration process was painless, Henry found. In fact his arm was without feeling completely and the bacteria had by now eaten to just past the elbow. Looking to his right hand he saw that that too was being attacked; the finger-tips had disolved.

It would be quite a while, he reckoned, before any vital circuits went and he did not relish such a long drawn-out death — not that he had any option, of course, for suicide was precluded.

There was one thing he could do, at least, to relieve his mind of its burden. A microchip anaesthetic. With his perfect-recall memory, he could induce an almost realistic dream-state for himself to live in — for a few moments, at least. The method had long since been used on terminal human patients in hospitals and on suicide-freaks who proliferated during Henry's lifespan.

Suddenly Henry's body was bathed in heat from the dazzling Pacific sun set in a beautiful blue sky, which was flecked with a few wispy, snow-white clouds. There was a deafening roar in his audio-sensory system. He wobbled on an unsteady surface but skilfully retained his balance. A strong wind blew refreshingly on his skin. Carefully he glanced over his shoulder at the rushing, mountainous wall of ocean — the pipeline.

Ahead he could see the golden, shimmering, palmlined Hawaiian beaches. In his mind, the console top had become a slimline, waxed surfboard. A shadow fell across him and he found himself surfing along a darkened tunnel of water.

Only with a supreme effort did he manage to defy the power of the legendary pipeline.

What a thrill. The realism of this imaginary event which he had recalled from old video-documentaries was truly incredible. It was for him a dream come true.

He had always wanted to "hang 10" — surf with his toes dangling over the edge of his board, teetering on the edge of disaster. Would he be able to move his feet, secured as they were by the unseen energy of Box2? He looked down.

No, he could not "hang 10", and never would. For he no longer had any toes, his feet, or what remained of them, being covered in the yellow matter which was slowly dissolving him.

The splash of the ocean on his chest. He tried to concentrate on his Hawaiian paradise. The spray from the water seemed to be increasing, he thought. He peered at his torso. There was no water. The Pacific panacea faded and he found himself back in reality, standing on a console not a surfboard; body bathed not in sunlight but in a voracious bacterium; breast sprinkled in the same yellow microbe and not by the cool sea.

He knew now that time was short. His left arm had gone and his right was a mere stub; his feet were being gradually eaten away; holes began to appear in his chest where the lemon scum touched him. He surveyed, quickly, the surroundings — the residue of the Pandora which was still being disposed of according to Box2's desires — Box2 itself, the millions of tonnes of discarded human waste, moulded into shape by its micro-core computer and subservient agents.

Then he got a surprise. No, it was more of a jolting shock. He stared out across the universe or, at least, the minute part of it between himself and Earth and realised that the mother planet had grown in size until now he could see some detail — vague outline of Africa, spiralling clouds which apparently covered a whole hemisphere. Above the clouds, silhouetted against their whiteness, Henry recognised the huge complex of Earthcomm itself, orbitting slowly.

Damn Earthcomm.

They were nearer. The thought flashed through is registers. But why? Why would Box2 approach anywhere near Earthcomm?

".. everything is automated .. makes humans obsolete .."

Had he had the facilities, Henry would have smiled an ironic smile, but his facial muscles had been eaten away. Earthcomm would succumb to its own flippancy. Millions of tonnes of Box2. Earthcomm would be pulverised.

He was fading fast. He could feel the energy draining from him.

".. everything is automated .. makes humans obsolete .."

Jewel Earth set amid the dark void of the universe. Even now a pleasure to behold. Millions of tonnes of Box2. The thought that occurred to him then would have sent a shiver down his spine if he had been human.

".. everything is automated .. makes humans obsolete .."

Box2 closed in on the human-infested Earth. It would make one hell of a dent in it, was one of Henry's last faint thoughts.

".. everything is automated .. makes humans obsolete .."

As schools computing grows, the micro begins to forsake its familiar function in computer science for new, unexpected roles in other subjects. David Walton reports.

Computer-aided learning leads pupils into new experiments

FOUR YEARS ago, something like five percent of secondary schools had access to a computer. That access might have involved using a terminal connected to a central computer via a telephone line or, more likely, would be a postal service to the computer, with anything up to two weeks before work was returned to the pupils.

Now, however, something like 25 percent of secondary schools have their own microcomputer, and the number is growing rapidly, with some schools now buying their second or third. That explosion of computing power has been financed largely by parent teacher associations, partly because of educational spending cuts, and partly because local education authorities have not been able to react quickly enough to the demands for money in a previously unheard of area.

Difficult time

A school which buys a microcomputer tends to think of using it to support the teaching of computer science, and there has been a corresponding growth in the number of pupils taking CSEs, O levels and A levels in this subject.

Of course, the real growth in this new area has yet to filter through the system, since the time from course initiation to pupils sitting exams is at least two years.

That is a difficult time for schools to introduce new courses, since in some cases, they are being asked to cut existing ones. Also, there are very few teachers with training or experience in the use of computers and many LEAs have virtually abandoned in-service training of teachers on the kind of scale needed.

Economic survival

However, it seems clear that if the U.K. is to survive economically, we must embrace the new technology with all our traditional skills and ingenuity. In 10 years, no-one will want to buy a car which is not made fuel-efficient by an on-board microcomputer — and we will be in a sorry state if we cannot even administer our own taxation system without help from another country.

A much wider use of computers in education is now developing, namely, computer-aided learning, CAL. That umbrella term covers several ways of using the computer to help the teacher, and two examples will illustrate the variety. Both originate from the Hertfordshire Advisory Unit for Computer-Based Education, and are being used in schools in Hertfordshire and elsewhere.

Route is a computer program which encourages pupils to think about the environmental problems associated with building a motorway. It is based on a real situation — building the A1M link through Hatfield in Hertfordshire — although the principles apply to any such development. Pupils are expected to consider three types of road; tunnels, cuttings, surface roads, and the environmental cost of each of them, in terms of noise, pollution, land grab, safety, etc. They then plan a route through, or around, Hatfield, which minimises environmental cost within a reasonable financial outlay.

The program runs on a microcomputer in the classroom, and while one pupil types in the route, the whole class is able to watch the output on a TV screen. That focuses pupils on the particular situation, and encourages group discussion on a rather nebulous subject.

Obstacle removed

The computer performs reasonably complicated background calculations which would otherwise be an obstacle to the pupils' understanding of the environmental problem. The program is aimed at 14- and 15-year-olds, and is used as part of a coherent environmental studies course.

The Route program, and its associated teacher and pupil materials, is an example of a CAL package. Most subjects contain topics for which a CAL package would be an appropriate teaching aid, and CAL materials already exist in physics, chemistry, biology, geography, history, environmental studies, mathematics, domestic science and economics. However, the CAL packages which exist barely scratch the surface of the microcomputer's classroom potential.

Computer-managed learning sometimes falls under the computer-aided learning umbrella, and involves treating teachers as classroom managers and offers them support in that role. An example of it is the Hertfordshire computer-managed mathematics project, which was developed under the auspices of the national development programme for computer-aided learning.

It is a complete two-year mathematics course, aimed at 11- and 12-year-olds, which allows individualised learning in a mixed-ability class. It is worksheet-based, and although pupils in a class are all on the same topic, once the topic has begun, pupils can work at their own pace, and the more able are free to progress more deeply into that particular subject.

Management problem

That presents a management problem for the teacher as he or she needs to monitor the progress of each pupil to ensure that they are progressing as well as they can, and that they have not left the rails.

The solution to that used in the maths project is to have a microcomputer mark approximately half of each pupil's work, giving immediate feedback and diagnostics to the pupil, and a regular daily progress report to the teacher. The computer also becomes involved in scheduling pupils, so that pupils who have done badly can be directed to remedial work, whereas those who have done well can be directed to a more demanding worksheet.

Careful monitoring

That system allows the teacher to monitor each pupil more carefully than might otherwise be possible, and frees him or her to help individual pupils or small groups of pupils with whatever difficulties they have. The maths project is running in about 15 schools, mostly in Hertfordshire, although at the moment it is unable to develop further because of lack of finance.

It is worth stressing that neither computer-aided learning nor computer-managed learning are intended to replace the teacher. The computer in the classroom is simply a tool for the teacher and is a sophisticated alternative to the blackboard or the overhead projector.

It will be appropriate in only some

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teaching situations, and it must be the teacher's job to decide where and when. The case I am making here is for wider availability of the tool, and for a wider range of "attachments" for it, so that the classroom teacher has a real choice.

Sophisticated aid

There are several reasons for using computer-aided learning, not all of which apply to every package. The computer provides the teacher with a sophisticated teaching aid which he or she can use dynamically as appropriate to the particular classroom situation. It provides a focus for pupils, and can put them in the role of decision maker.

The computer can be used to do background calculations which might otherwise cloud the issue. The use of dynamic graphics, which is available on most microcomputers, can provide a visual approach which would otherwise not be available. The computer allows the simulation of science or social science experiments which could not normally be conducted because of problems of time, or danger, or cruelty, or expense.

The use of computer-aided learning also has several advantageous side effects to do with familiarisation of pupils with computers, so that as potential users, or even designers, they can appreciate the considerable variety of possible applications.

There are several problems facing teachers who wish to use computer-aided learning in their classrooms. It is not practicable for the average classroom teacher to produce his or her own CAL packages. A reasonable estimate suggests that a single CAL package, such as Route, takes 150 man-hours to produce, of which only 10 hours is spent producing the program. The rest is passed in defining the problem and the teaching strategy, producing pupil and teacher support materials, documenting the program, and evaluating it in the classroom.

Central agencies

So, it becomes appropriate for central agencies to produce CAL packages, and make them available to classroom teachers. That is starting to happen with the Schools Council, ILEA, Hertfordshire, Devon, Birmingham, Durham and other centres already producing CAL packages, both for local and national use.

Computer-aided learning materials require a reasonably sophisticated distribution service, since a package consists of printed materials, and programs in computer-readable form. At the moment, the computer-readable items tend to be sent on cassette or floppy disc, but as the number of packages, and the number of users increases, that method will become less and less practicable.

What will be needed is distribution by telephone, using Prestel or a similar system, so that users would have immediate access to a library of programs, and could transfer the version of the program which is suitable for their particular microcomputer.

Such a system needs to be developed nationally, and should include assessment of the package, perhaps along the lines of the Consumers' Association, since the classroom teacher does not have sufficient time to obtain a range of CAL packages and evaluate them.

Comprehensive catalogue

Instead, he or she needs a comprehensive, subject-based catalogue of CAL packages, which includes an independent assessment of the aspects of each package, and an easy system to find the software, and printed material. Already, a start has been made in that direction, with several LEAs using their central computer as a software distribution service, and the Council for Educational Technology is involved in setting-up a similar software-distribution service on Prestel.

However, these are still early days for computer-aided learning. To develop its full potential, we need to invest a considerable amount of manpower and that must be done by educationalists, rather than computer manufacturers. Let us hope that the Government microelectronics programme acts as a suitable pump primer for a national development in this direction.

Micros' flexibility offered best solution for PAYE system

The coveted contract for the supply of PAYE systems to the Inland Revenue was settled some months ago in favour of ICL. However this paper by John Butcher MP and Philip Virgo MP sheds some interesting light on the whole question of computing in government.

BEHIND THE fuss as to who should win what equipment orders is a growing feeling of unease in the computer industry that the stage is being set for another Swansea — the Vehicle Licensing Centre fiasco. Equipment and suppliers will eventually be blamed for the result of decisions taken by a naive and inexperienced user more interested in what is politic, in departmental terms, than in what is practicable.

The Inland Revenue officials involved appear to have been more concerned to seek an alibi against responsibility for failure than to consider what it is practicable to implement in a reasonable timescale with a limited number of low-grade computer staff. After sharp criticism from parts of the British software industry, they called in expensive U.S. consultants to back-up an unnecessarily complex and grandiose proposal.

Complex and risky

The consequence was a tender requirement written to dictate an unprecedentedly complex, risky and oversized on-line, networking, database system at considerably greater equipment cost, and many times more accommodation, communications and systems expense, than a basic, reliable mixed system using experience gained from British systems.

Despite the officials' eagerness to avoid a subsequent Public Accounts Committee enquiry by taking U.S. advice, they have ignored the lessons of the 175 reports to Congress by the Comptroller General of the United States, some of which detail wastage and incompetence on a scale which makes Swansea look cost-effective and efficient.

They have also ignored the lessons of the Italian attempt to computerise tax assessment, using U.S. equipment and expertise, which collapsed after four years and had to be rescued by an Italian software house using largely Japanese equipment.

- The high turnover of Civil Service systems staff under a career and salary structure which values technical or managerial competence below political sophistication.
- Political inconsistency of the type which halted PAYE computerisation in the mid-1970s because of the possible change to subsequently-dropped tax credits and which may cause major changes at short notice.
- The probable inability of the Property Services Agency to construct new accommodation, at short notice, even in the middle of a slump in the construction industry.
- The frequent inability of the Post Office, British Telecoms, to commission new communications links at reasonable notice, whether to new or existing buildings and the questionable reliability of many links they do commission.
- The British paranoia over their tax affairs which will require far higher standards of privacy for this system than, for instance, manually held medical records.
- Staff opposition to a system which will be perceived, probably wrongly, to threaten their livelihood.

There are many ways to tackle the underlying requirement ranging from a totally centralised system on a single site to a microcomputer on every desk. The five main solutions — given that a single site would be administratively unworkable and a machine on every desk is unnecessary — are:

- **One microcomputer per administrative unit:** Instead of having a bank of filing cards containing the details of about 2,000 taxpayers, each allocation officer and his assistants would have a microcomputer with screen, a two to five million character fixed disc holding the records, a printer and a floppy disc drive for reading or writing data discs for record transfer, archiving, etc.

The equipment, mounted on a small trolley for plugging into a wall socket adjacent to the desk of whoever is using it, would cost less than £5,000 in the volume required so that, adding the cost of a central index-computer, containing information as to which unit currently handles which tax payers, the national cost would be less than £60 million.

Except for the central index machine — probably a contents-addressable file store, CAFS, computer like that being tested by the Post Office for directory enquiries — the only accommodation cost would be to check the fuses and earthing of the electricity mains in each office lest any power surge burn out the equipment.

Data transfer, including copies to update the central index, would be handled by an overnight mail service for floppy discs, while inter-site enquiries would be handled by a call to the index centre, where the operator would use a screen to interrogate the file to identify where the record is held, followed by a call to the site holding the record.

Tax tables, code changes, programme changes, etc., would be distributed on floppy discs, produced centrally, as for commercial microcomputers or word processors.

Standardisation

While there would be cost and organisational advantages in having equipment standardisation, it is not essential. For example, Peterborough Data Processing, whose Unipay system is used to pay one in five of the working population of Britain, annually alters the systems run on 100s of their customers' ICL, IBM, Univac and Honeywell computers at only one to two months' notice when tax, national insurance or pension legislation changes with the budget.

That operation is much more complex than is likely for PAYE since, while the Unipay system is standard, any given manufacturer may have a variety of ranges and some manufacturers have a variety of operating systems on the same range, each of which can require variations on the Unipay programs.

Implementation could be very rapid, with no delays for constructions, communications line laying, exchange installation, complex network testing etc.

- **One computer per site:** There are 200 sites housing anything from a single tax district for a few 1,000 taxpayers to 30 or 40 for a million. A modern British-

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designed and built small business system, like the ICL ME29 Burroughs B90 or Redifon 8000, could support anything from six screens and 10 million characters of storage — for a small, isolated district — to 100 screens and a few 100 million characters of storage, for a medium-to-large site with 50,000 to 100,000 taxpayers. Only the handful of big centres, like Bootle or East Kilbride, would require larger computers with expensive purpose-built accommodation.

Equipment costs would range from less than £40,000 for the small office, up to £250,000 for the medium-to-large office, and, allowing for the big centres, one of which would also house the CAFS central index, the total cost would be a little less than £50 million.

The main accommodation cost would be wall-mounted dust extraction and air conditioning for sites using exchangeable disc drives — perhaps £10,000 per site — and wiring to connect screens and work stations to the computer room, which would normally be a conversion of a small office.

Rapid implementation

As with the micro solution, implementation could be rapid since only limited accommodation work would be necessary and the systems could be quite straightforward.

The advantages over the micro option are primarily in eliminating the need to pass data discs between adjacent districts in the same building or cluster of buildings. However, with the availability of inexpensive local networking facilities, these may soon lose significance.

- **One computer per group of sites:** Frequently, a number of small offices are clustered in the suburbs of a city with a large site handling a number of districts in the centre. Sometimes, the offices may be only a few 100yd. from each other. However, the communications facilities available from the Post Office, British Telecoms, vary widely from place to place.

In some cities, the network is reliable and efficient and high-capacity lines are available at short notice. In other cities, the exchanges are overloaded and traffic vibration has collapsed chambers and concertinaed cables so that it can take years to install a new line and weeks to access an existing line for repair.

Thus, while it may be theoretically cheaper and more efficient to group adjacent offices, such grouping should be dictated more by the services available in practice from British Telecoms rather than distance. Such grouping would save several million pounds over the previous option and would often remove the need to transfer data physically between offices serving neighbouring towns or suburbs.

Implementation would be delayed by as long a delay in line availability as is acceptable rather than have an additional computer. The additional accommodation work for communications equipment is, by comparison, negligible.

- **Regional centres:** Theoretically, the cheapest solution, at a cost of around £36million, is to provide 12 centres servicing one workstation per 2,000 tax records, sited in local tax offices for on-line entry and validation of data and enquiry purposes. However, at least as much expense again is likely to be required for the construction of purpose-built accommodation, since existing accommodation is only rarely likely to be adequate.

The delay while communications links are installed could be considerable in four of the cities being considered for such centres, while the subsequent vulnerability to disruption also needs consideration.

Moreover, some regions have little geographic cohesion and any attempt to centralise, for example, eastern counties on Peterborough, could prove as problematical as the attempt to centralise the computing of the Anglian Water Authority on Huntingdon.

- **A national network:** The salesman-favoured option with communications processors and many more workstations added to the regional centres of the last option. Its main advantage is the easy transfer of data anywhere in the country. Its disadvantages spring from its complexity and consequent vulnerability.

Exponential increase

Reliable implementation cannot be tested until the last site is commissioned since traffic on a decentralised network rises exponentially with the number of sites linked and a network adequate for 11 sites could be swamped by the 12th. Therefore, it is easily the longest to implement and the most vulnerable to construction or communications delay. A centrally-controlled network would be easier to implement but subsequently more vulnerable to disruption.

The vulnerability to illicit access will dictate rigorous security which will, in the nature of security systems, inhibit, delay and increase the cost of legitimate access.

It is also likely to be the most expensive since, in addition to the £30million for the centres and £30million for the network concentrators and workstations, the purpose-built accommodation and high capacity landlines must be added on a greater scale than for the stand-alone regional centres.

- **The recommended approach:** Given the prime objective of the successful implementation in a reasonable timescale, of a cost-effective system capable of subsequently facilitating radical changes to the tax system, the key to a practicable approach is flexibility.

The system must use existing staff, buildings and communications as much as possible while retaining the capability of subsequent growth into either a centralised or a decentralised network as changes in organisation, tax structure, communications facilities or technology make that economic and/or desirable.

Therefore, we recommend a solution based primarily on small business computers or possibly linked micros for each site using shared larger machines only where existing accommodation and reliable communications links make installation in a short time-scale relatively easy. That also reduces the vulnerability of the operation to disruption from whatever cause.

We also recommend that the initial system be straightforward and robust enough for currently-available computer staff to develop and implement nationally, and user staff to learn to operate, before the end of the Government's first term of office.

Key to success

The key to successful implementation and development is to get a simple mark 1 system working in two tax offices as soon as possible, remove the bugs and implement it throughout the country. Then, with the basic data on computer file, and the experience gained from using the system operationally, it will be possible to develop a more sophisticated mark 2 system to cater for whatever, hopefully more rational, personal tax system the Government chooses in its second term of office. The attempt to jump straight to a sophisticated system entails unacceptable risks, given the staff and experience available.

The system should be:

- Capable of being installed in existing buildings using existing communications facilities or those available at six months' notice from British Telecoms.
- Capable of being operated by existing staff with minimum change or re-training.
- At least as secure, rapid and reliable as existing manual systems.
- Capable of easy change at no more than three months' notice for rates and/or allowances or 18 months for a fundamental change, e.g., tax credits.
- Capable of subsequent evolution into either a decentralised or a centralised network if either proves cost-effective.

All existing staff should receive guarantees of no compulsory redundancy but establishment numbers should not be guaranteed. Any staff found surplus to requirements after implementation should be re-trained to enable them to move voluntarily to better jobs.

The scope for early staff reduction should not be exaggerated, since experience shows that the correction of the many long-standing errors and anomalies uncovered when a manual system is computerised can be extremely labour-intensive.

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Striking it rich with drawn matches

IN BUILDING a microprocessor betting system, there are two distinct stages. Firstly, one must analyse the strengths and weaknesses of the various bets available. Would one be better off betting on the races, the football pools, roulette or staying at home? Secondly, having decided on the most advantageous type of bet, you must determine which factors and in what combination will best predict the winning alternatives. I shall show you how to manage both stages and I provide a detailed analysis program for the football pools — a program which can be adapted easily for any other type of bet.

The essence of any bet is that all the punters place money on the various alternatives. When the gamble is over, the money will be redistributed to those punters who chose the correct alternatives minus a certain percentage which the administering organisation retains as profit.

A betting shop retains 10-15 percent, the football pools firms about 30 percent, whereas the house only retains 2.5 percent if you are playing roulette with only one

by Gavin Potter

zero. To win, you must be able to predict the correct alternatives more often than the rest of the punters. The better you are at that, the more you are likely to win.

What advantages does a micro-based system have? — its ability to handle large amounts of data. To capitalise on that strength, it is necessary to find a bet where there is a large amount of readily-available data which the average punter is not going to bother to analyse. Of the bets I investigated, the football pools stand out as the paradigm.

A quick survey of the literature on football soon reveals several possible factors which might help predict the results of a match: the home team's league points, the away team's league points, the number of draws either side had produced in the last few games, the number of draws that that particular clash had produced in the last five years, and several extraneous factors such as the buying and selling of players.

The problem was to decide which of factors were relevant and in what combination they should be linked. I devised the program to help me resolve those questions.

The end-product of any micro-based pools system is a list of matches with a value attached to each of them which one hopes in some way will predict the result. To take a very simple example: one might suppose that the difference between the two teams' league positions would provide some predictive value of the result.

If that were the only factor which need be taken into account, all those matches with a difference less that a certain value would be a draw and all those with a difference above a certain value would be non-draws.

The world being what it is, that, of course, does not happen quite as neatly as one might hope. Indeed, if it did, there would be little point in gambling at all because everyone would soon discover such a simple system.

What, in fact, happens is that there is considerable overlap, some matches with large differences between the two teams' league positions end in draws whereas others with very little difference end in wins for one or other side. The greater that overlap, the worse the predictive measure one is using is at predicting the possibility of a draw.

What the program does is to provide a measure of that overlap so that it is possible to compare directly the predictive value of various combinations of factors. That way, it is very easy to decide on the ideal combination of factors and to reject quickly any which fail to provide a predictive value. The only other method is to wait until the end of the season and see whether you are out of pocket or not.

The way the program calculates that is reasonably simple. There are two ways in which the overlap can increase or decrease. Firstly, the mean value of the draws can be closer or further from the non-draws — see figure 1. Secondly, the spread of values of the draws and non-draws can increase or decrease, see figure 2. The principle becomes much clearer once you look at the figures.

Statistical decision theory provides a method whereby those two effects are taken into account and a value of the overlap — usually called prime — is produced. The larger the overlap value, the greater the predictive value of that combination of factors. For the mathematically-minded, d prime can be expressed as

$$d' = \frac{\mu_D - \mu_{ND}}{\sqrt{\sigma^2_D + \sigma^2_{ND}}}$$

where μ_D = the mean value of the distribution of draws
μ_{ND} = the mean value of the distribution of non-draws
σ^2_D = the variance of the distribution of draws
σ^2_{ND} = the variance of the distribution of non-draws

For the non-mathematically-minded, what that means is that in terms of the spread of the results, the larger the difference between the average value of a drawn match and the average value of a non-drawn match the better. The smaller the overlap will be and so the greater the predictive value.

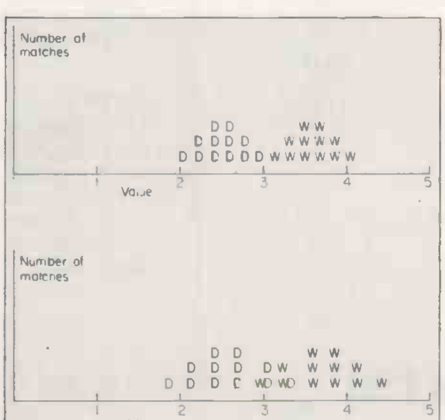
The first possibility I decided to investigate was the predictive value of the two teams' league positions. The first prompt the program gives you is for the number of factors you are going to investigate. In this case, the answer was of course two. The first factor being the home team's league position and the second the away team's league position.

You then have to input each of those factors for every match. It is much easier if you first write them on a sheet rather than attempt to read them straight from a newspaper. If you make a mistake entering them, you will be given a chance to correct it at the end. When you have finished typing any corrections, you must type —1.

The program then provides a menu of alternatives. As, in this case, we are trying to analyse the use of home and away league positions to predict draws, we must first input the numbers of those matches which were draws. If we were interested in home or away predictions, we would type those instead. Again, when you have finished, you should type —1. That will return you to the menu.

We are then ready to start the analysis proper. After entering the analysis section from the menu, the first thing the program will do is to ask you whether you are interested in the highest scores, the lowest scores or the absolute scores — the ones nearest to zero. If you are considering the predictive value of the home team's league position and the away

Figure 2. As the variability of the results grows larger, it again becomes more difficult to find a value above which all the matches will be non-draws and all those below it draws, even though the mean value of the draws and the mean value of the non-draws remains the same. This is the second way in which overlap can increase or decrease.



team's league position in predicting draws, it would be reasonable to be most interested in those scores which are nearest to zero.

If, however, you were considering the number of previous draws in the last five matches, you might expect those matches with the highest value to be most likely to be draws. In this case, you would, of course, choose the high-score option.

The program then asks for the weights you want to attach to the various factors. If you want to know the predictive value of the home team's league position and away team's league position, you would type 1 for factor 1 and —1 for factor 2. If you wanted to look at some other combination, i.e., just the predictive value of the away team's position, you can type some different weights — in our example, 0 followed by 1.

The program then analyses the data and prints out a value of d prime. As a rough guide, if your value of d prime is greater than 0.3 or less than —0.3, that combination of factors has a significant predictive value. If d prime is negative, you should choose those matches with the lowest score. If d prime is positive, you should choose those matches with the highest score.

You will then be returned to the menu. If you want to try different combinations of factors, all you have to do is to re-select the analysis option. There is no need to type those matches which were draws, as the program already has that data. The best way I have found to use the program is to type all the factors you wish to consider, and then try them in various combinations. If you do not want to consider a certain factor in that combination, you have only to type 0 in response to a request for its weight.

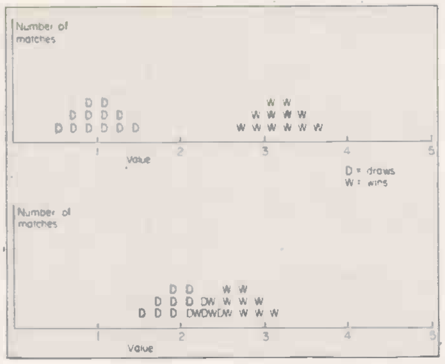


Figure 1. As the average difference between the matches which are draws and those that are not, grows smaller and smaller, it becomes progressively difficult to find a number above which all the matches will be non-draws and all below it, draws. That is one way in which the overlap can increase.

The only option not yet mentioned is the prediction option. You can use it to predict which matches will be draws as decided by your combination of factors. All you have to do is to enter next week's data, choose the prediction option and state the kind of score you are interested in — highest, lowest, etc — and the weights of the various factors. The program will then sort, by a bubble sort, the matches into order and output any number you require.

When you have finished, you can exit from the program by choosing the exit option. It is not complicated, as the program will prompt you at all the required places.

The program is written in modular form and so should be very easy to understand.

100-140	Sets-up program
200-330	Inputs data
400-490	Error trap for data
600-690	Menu
700-820	Inputs results of matches
900-1060	Requests weights and scores
1100-1250	Calculates values of matches
1300-1480	Calculates d prime
1500-1630	Prints out d prime
1700-1960	Bubble sort of matches and printout of those you require

The program was written in Microsoft Basic for the Ohio Superboard II and so should need minimal adaptation to run on other machines. The only things which must be watched are that "?" is used as an abbreviation for print and that ":" is used as a delimiter. The only other line which might need watching is line 5000. That is used to scroll the screen clear and so the value of the loop might need to be changed depending on the amount of lines your processor displays.

```
100 REM PREDICTION
101 REM VERSION 3.1
102 REM C GAVIN POTTER
110 DIM RE(55)
120 DIM SC(55)
130 DIM P(55)
140 DEF FNA(A)=INT(100*A)/A
200 REM DATA INPUT
210 GOSUB 5000
220 PRINT"DATA INPUT":PRINT:PRINT
230 PRINT"INPUT NUMBER OF FACTORS"
240 INPUT F
250 GOSUB 5000
260 DIM R(55,F):DIM W(F)
270 FOR I=1TO55
280 FOR J=1TOF
290 PRINT"MATCH";I;"/FACTOR";J
300 INPUT R(I,J)
310 PRINT
320 NEXT J
330 NEXT I
400 REM ERRORS
405 GOSUB 5000
410 PRINT"IF ANY WERE MISTAKES":PRINT
420 PRINT"TYPE IN THEIR NUMBERS":PRINT
430 PRINT"END CORRECTIONS BY":PRINT
435 PRINT"TYPING -1":PRINT
440 INPUT CH:PRINT
450 IF CH=-1THEN GOTO 600
460 FOR I=1TOF
470 PRINT"DATA":CH;"/FACTOR";I
480 INPUT R(CH,I)
490 PRINT:PRINT
500 NEXT I
510 PRINT"NEXT ONE":GOTO 440
600 REM MENU
610 GOSUB 5000
620 PRINT"  MENU"
630 PRINT:PRINT:PRINT
640 PRINT"(1) INPUT RESULTS":PRINT
650 PRINT"(2) PREDICTIONS":PRINT
660 PRINT"(3) ANALYSIS":PRINT
670 PRINT"(4) EXIT":PRINT
680 INPUT Q1
690 ON Q1 GOTO 700,800,900,6000
700 REM RESULTS
710 GOSUB 5000
720 FOR I=1TO55:RE(I)=0:NEXT I
725 PRINT"RESULTS INPUT":PRINT:PRINT:PRINT
730 PRINT"TYPE IN THE NUMBERS OF":PRINT
740 PRINT"THE RESULTS OF INTEREST":PRINT
750 PRINT" IE HOMES,AWAYS OR DRAWS":PRINT
760 PRINT"END BY TYPING -1":PRINT
770 INPUT S2
780 PRINT
790 IF S2=-1 THEN 600
800 IF S2>0ANDS2<56 THEN 810
805 PRINT"DO NOT UNDERSTAND":PRINT:GOTO 770
810 RE(S2)=1
820 GOTO 770
900 REM ABSOLUTE VALUES
905 GOSUB 5000
910 PRINT"SHOULD YOUR PREDICTIONS":PRINT
915 PRINT"BE.........":PRINT
920 PRINT"(1) THE HIGHEST SCORES":PRINT
930 PRINT"(2) THE LOWEST SCORES":PRINT
940 PRINT"(3) THE NEAREST TO ZERO":PRINT
950 PRINT"ENTER 1,2 OR 3":PRINT
960 INPUT Q2
1000 REM WEIGHTS
1010 GOSUB 5000
1020 PRINT"WEIGHTS":PRINT:PRINT
1025 FOR I=1TOF
1030 PRINT"FACTOR";I;"WEIGHT ?":PRINT
1040 INPUT W(I)
1050 PRINT
```

(continued on next page)

(continued from previous page)

```
1060 NEXT I
1100 REM CACULATES SCORES
1110 FOR I=1TO55:SC(I)=0:NEXTI
1120 FOR I=1TO55
1130 FOR J=1TOF
1140 S(I)=S(I)+W(J)*R(I,J)
1150 NEXT J
1160 NEXT I
1200 REM ABSOLUTE VALUES
1210 IF Q2<>3THEN 1250
1220 FOR I=1TO55
1230 S(I)=ABS(S(I))
1240 NEXT I
1250 ON Q1 GOTO1700,1300,6000
1300 REM ANALYSIS
1310 F1=0:F2=0:F3=0:F4=0:F5=0:F6=0
1320 FOR I=1TO55
1330 IF RE(I)=1THEN 1380
1340 F1=F1+1
1350 F2=F2+SC(I)
1360 F3=F3+SC(I)2
1370 GOTO 1410
1380 F4=F4+1
1390 F5=F5+SC(I)
1400 F6=F6+SC(I)2
1410 NEXT I
1415 U1=0:U2=0:U3=0:U4=0
1420 U1=F2/F1
1430 U2=F3-(F2^2)/F1
1440 U2=SQR(U2/(F1-1))
1450 U3=F5/F4
1460 U4=F6-(F5^2)/F1
1470 U4=SQR(U4/(F4-1))
1480 DP=(U3-U1)/SQR(U2^2+U4^2)
1500 REM PRINTOUT
1510 GOSUB 5000
1520 PRINT" ANALYSIS"
1530 PRINT:PRINT:PRINT:PRINT
1540 FOR I=1TOF
1550 PRINT"FACTOR";I;"WEIGHT";W(I)
1560 NEXT I
1565 PRINT:PRINT:PRINT:PRINT
1570 PRINT"****************":PRINT
1580 PRINT" D PRIME ="; DP :PRINT
1600 PRINT"****************":PRINT
1605 PRINT:PRINT:PRINT:PRINT
1610 PRINT"INPUT ANYTHING TO CONTINUE"
1620 INPUT A$
1630 GOTO 600
1700 REM PREDICTIONS
1710 FOR I=1TO55:P(I)=I:NEXTI
1720 FOR I=1TO55
1730 J=0
1740 FOR K=1TO54
1750 IF SC(K)<=SC(K+1)THEN1800
1760 Y=SC(K):Y1=P(K)
1770 SC(K)=SC(K+1):P(K)=P(K+1)
1780 SC(K+1)=Y:P(K+1)=Y1
1790 J=J+1
1800 NEXT K
1810 IF J=0 THEN 1830
1820 NEXTI
1830 REM PRINTOUT
1840 GOSUB5000
1850 PRINT"HOW MANY PREDICTIONS":PRINT
1855 PRINT"DO YOU REQUIRE ?":PRINT
1860 INPUT LI
1865 GOSUB 5000
1870 ONQ2 GOTO 1910,1880,1880
1880 FOR I=1TOLI
1890 PRINT"MATCH ";P(I);"SCORE";FNA(SC(I))
1895 PRINT
1900 NEXT I:GOTO1940
1910 FOR I=55TO(LI-1)STEP-1
1920 PRINT"MATCH";P(I);"SCORE";SC(I)
1930 PRINT:NEXT I
1940 PRINT:PRINT:PRINT
1950 PRINT"INPUT ANYTHING TO CONTINUE"
1960 INPUT A$:GOTO 600
5000 FOR I=1TO25:PRINT:NEXTI
5010 RETURN
6000 END
```

BLACK BOX

SOME MONTHS ago I bought a Pet. Fellow Petaholics may well decide to skip the next few paragraphs — the classic symptoms will be all too familiar. Having brought the beast home and installed it in place in the back lounge, I could begin to consider the question of its diet. Like all domestic animals, the Pet thrives on a varied menu of Pet food.

My early efforts at programming included the various ideas I had held for some time — a calendar, fortune telling, etc., but none of them was really what I was looking for. I needed inspiration — perhaps a holiday would help to clear the mind.

So, in mid-August, our family bid a temporary farewell to the Pet and headed for a cottage in the depths of rural France. There we could look forward to lazing on sandy beaches and so I armed myself with

by Bob Merry

a pile of science fiction novels and also a game I had bought recently — the mini version of Waddingtons Black Box.

Like many other games of deduction, Black Box is most fun for the person seeking the answer and one has to rely on the patience of one's opponent as you try to discover the logic behind the various replies. How much better it would be, I mused as I spent my turn as setter, if the patterns could be generated randomly and the answers supplied automatically. At last — a project worthy of the Pet.

The object of Black Box is to deduce the position of a number of atoms placed on an eight-by-eight grid. Normally, there are four or five atoms in the molecule. You find the atoms by shooting rays into the box. Three things can happen to a ray — figure 1.

A ray which goes directly into an atom is absorbed, as has happened to the rays starting from points 12 and 19. A ray is deflected at right angles by an atom in the next row to its path. The ray from point five is deflected three times before emerging from 26.

A ray can also be reflected back on itself and that can happen in one of two ways; a reflection can happen as the result of two simultaneous deflections, as happens to the ray from point seven. Alternatively, a ray will be reflected if there is an atom on the edge of the grid, next to the point of entry. That happens to the ray entering at point 22 in the diagram.

The score against you depends on the result of each ray: deflections count two points, reflections and absorptions one point each. In addition, there is a five-point penalty for each atom you have guessed wrongly when the final molecule is revealed.

The average score for a four-atom game is 13 points. Occasionally, one atom may be hidden by the others and its position may be ambiguous. In those cases, the technique is to know when it is better to accept a five-point penalty for an incorrect guess.

My usual method of programming is to divide the problem into several short routines. They are then entered in what I consider a logical order and the various patches in the form of IF THEN and GOTOs are added.

Most of the routines are first sketched in the form of rough notes and then the program is formed on the screen. Wherever possible, I run short sections to test their action. Gradually, the program is developed into one which works.

At that stage, I will see how it can be improved and whether, in fact, the routines are foolproof. Usually, there are a few special cases which are not accounted for and the program has to be edited.

The Black Box program was no exception to the rule and I started by deciding on the various building blocks I would need. The first element was the mode in which I would store the game. The game board, figure 1, is an eight-by-eight grid, surrounded by the numbers 1-32, which are used to identify the rays.

The obvious way to represent that in the computer was to use an array, P(X, Y), where X and Y lie from 0 to 9 inclusive. The elements P(0, n), P(9, n), P(n, 0) and P(n, 9), where n = 1 to 8, will be used to store the ray numbers and the remainder of the ray will be set to zero. The program asks the player to select a number of atoms, Z, which are placed randomly in the array, using 99 to represent an atom.

Having decided how to represent the game for the computer, I now turned to how I would display it to the player. I decided I would keep the board on the screen all the time, making modifications as the game progressed.

There would be space under the board for inputs to be called and error messages to be added, while I could use the area to the right of the board for a score read-out. The modifications to the display could be placed into the appropriate area of screen by using Poke commands, but I have a bias against that because of the burst of snow which accompanies them on most Pets.

Instead, I decided to use two strings, A$ and D$, which contain, respectively, 39 cursor-right and 24 cursor-down commands. Now, using LEFT$ (A$, x) and LEFT$ (D$, y), I could move the cursor to any point x, y on the screen. The only special case to be taken into account is when either x or y = 0, since LEFT$ (A$, 0) is not acceptable to the Pet.

The skeleton of the Black Box board is reasonably straight-forward and a little study shows that some elements are repeated several times. I therefore defined two graphics strings, L$ and M$, to cover those repeated elements. L$ is two spaces followed by a vertical line, centrally placed — the shifted right-hand square bracket key. M$ is two horizontal lines, centrally placed — shifted @ — followed by a cross — shifted left-hand square bracket.

When rays emerge from the board we need to label both ends of the ray in a way which distinguishes it from other emergent rays. Since the ray entry points are already marked by numbers, I have used letters for emergent ray labels and they are contained in the string, B$.

The pointer used to select the labels in turn is the variable, B, and we will select our label with the command MID$ (B$, B, 1).

Lines 170-220 initialise the program, and as well as those variables, we also have RT for the running total for all the games played, GT for the number of games played and S for the score in the current game.

Array elements

Lines 230-260 set all elements of the array to zero, 240, and then put the ray entry points into the appropriate elements, 250. During the instruction sequence, 90-160, the player entered the number of atoms he wanted, Z. The sequence 270-310 generates random co-ordinates, RX(I) and RY(I), for I = 1 to Z. Line 300 checks to see if the selected element is clear and if it is, the element is loaded with 99.

Now we are ready for the display to be printed. I decided it would look better if the whole board appeared on the screen in its completed state, so I used POKE 59409,52 to blank the display until it was finished. The board consists of 19 lines of print. The first 18 alternate between a line of vertical bars and a line of horizontal bars and cross-points. The 19th line is another row of vertical bars.

Each row of vertical bars consists of nine repetitions of L$, followed by a carriage return, while each horizontal row consists of nine repetitions of M$, followed by two horizontal lines, centrally placed. Lines 360 and 370 print the first 18 lines, with I as the counter for the pairs of lines and J counting the repetitions of the graphic strings. Line 380 prints the final line of vertical bars. The next three lines enter the ray entry numbers.

In line 390, we start by moving the cursor 'HOME', then one space to the right — since the first set of numbers are single-digit numbers — two spaces down to reach the position for ray 1, and there we print 1. The cursor is then moved one space left and two down to print 2, and so on until we have printed 1-8.

After 8, we move two down and two right and print 9; the numbers 10 to 16 are all preceded by a single cursor right. That has now printed the numbers 1 to 8 down the left-hand edge of the board, and 9 to 16 along the bottom of the board.

Line 400 prints 32 down to 25 along the top edge of the board. After HOME, are three cursor-rights followed by 32; the remaining numbers in the row have a single cursor right in front of them. The numbers to the right of the board are printed by 410. That uses A$ to position the cursor to the 28th column. Then we go down two and print the first number; each number is then preceded by two cursor downs and two cursor lefts.

Hidden atoms

The final two cursor downs move the cursor clear of the board before any carriage return. Now the board is ready, the atoms are hidden in the array, so we can reveal all with POKE 59409,60, and we are ready to start the game.

While it would be possible to include a routine to enter guesses and have the computer check them — there is about 2K of memory left on an 8K Pet — I decided to leave the checking of the final answer to the player.

That brings the options for the player down to two; input a ray, or look at the answer. Lines 430-490 offer this option, check to see that the player has answered correctly and then branches to the appropriate part of the program. At that stage, we will assume a ray is to be entered and so the program goes on to the section covered by lines 500-540.

Line 510 calls for the entry of ray number G which is first checked to see that it is in the range 1-32. Then we need to decide on which side of the board the input point is located, since it will determine the initial direction of the ray. That is provided by N which returns a number from 1 to 4, and the program can now be directed to the proper area.

The four routines for tracing the ray's movement are essentially the same, so we will assume that G is in the range 1-8, N = 1 and the program branches to 560. That is the left-hand side of the board and the ray will move from left to right. The initial values of X and Y are 0 and G, respectively.

The routine operates on a search-ahead basis, since it is atoms in the row ahead of the ray which affect its path. The first check is to look straight ahead (X + 1), since an atom there will always absorb the ray, irrespective of other atoms.

If an atom is encountered there, the program is sent immediately to the absorbed ray routine at 960. Next we check for reflection; there are two possibilities for that — one in the middle of the board and one in an edge position. Lines 580-600 check all the possibilities for reflection, and divert the program to the routine at 1050 if required.

We can check for deflection; if there is an atom ahead of and above the ray, the ray will be deflected downwards, while an atom ahead of and below the ray will deflect it upwards. The GOTOs in lines 610-620 divert the program to the appropriate points in the other routines.

If the look-ahead has failed to reveal any atoms, the ray is advanced one space and checked to see if it has reached the right-hand edge. If it has not, we return to 570 and start another step forward. When we reach an edge, the ray has emerged and we can go on to mark the two ends of the ray in 1120-1240.

Each of the four routines in 550-640, 650-740, 750-840 and 850-940 are similarly structured, differing in the way that the ray input, G, is converted to the form P(X, Y) at the start of each routine and in the direction of look-ahead and movement.

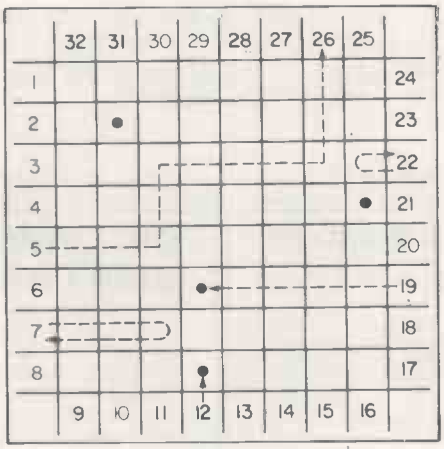


Figure 1. The game board.

Once the ray has exited the board, the result can be marked on the display. The first alternative is absorption covered by 950-1030. The score, S, is increased by one and is printed on the screen to the right of the board using the subroutine at 1380.

The cursor is moved down the screen and the message "Ray was absorbed" printed. Since the only point to be marked is the entry point, we can use the values of N and G to determine the place to print a marker.

N tells us to which side of the board to go, and G can form the basis of the length of A$ or D$ to use to reach the proper point on the screen. We shall replace the ray number with a reversed diamond symbol, but because most of the rays are two-digit numbers, we also include a space in the printout.

Lines 980-1010 deal with the four sides, as addressed by N. Line 1020 gives you time to read the result before the subroutine at 1350 clears fives lines at the bottom of the screen and the program returns for another choice of input.

The routine to mark a reflection is virtually the same as that for absorption, apart from the symbol used — a reversed star. Lines 1120-1240 are the routine for an emergent ray. We need to mark both ends of the ray, so, although we can mark its start in a similar way to that used before, we use a slightly different technique for the end of the ray.

The end of the ray is, of course, given by the value of X and Y, since P(X, Y) is the output point. We can use the values of X and Y in A$ and D$, unless X or Y is zero, which occurs when a ray emerges at the top or on the left. In those cases, only the non-zero value is used. Line 1160 covers the right-hand and bottom edges; 1170 the left-hand edge and 1180 the top. Lines 1190-1230 use the same technique for the beginning of the ray as was used for reflection and absorption. 1240 gives you time to read the result before returning for another input.

Confession of errors

Eventually, you will be ready to guess the answer and the choice in lines 430-490 will lead the program to the routine starting at 1250. The positions of the Z atoms are still stored in RX(I) and RY(I), for I = 1 to Z, and they are now printed on to the board.

You are asked to confess your errors and the penalty of five points per atom is added to your score. RT and GT are also updated before you are given the chance to play again, with a new value of Z if required.

Lines 1340-1380 contain the two subroutines we have used. The first moves the cursor to the 20th line on the screen and then blanks five lines by printing 200 spaces. The second prints the score at a position to the right of the board.

If the player has decided to end play, lines 1390-1490 calculate his average score for the number of games played and gives its own assessment of the standard of play.

Those assessments are purely arbitrary and for example, take no account of the number of atoms. However, 13 is a normal score for four atoms — do not forget that anyone could score 20 by four wrong guesses earning five-point penalties. A consistent score of less than 10 would verge on extra sensory perception.

Most of the routines should be easy to adapt for other systems which very few virtually changes, although the graphics of the display may require more thought. One can achieve a good deal of satisfaction by indulging in a little home cooking. There is no need to confine your Pet's diet to prepacked offerings.

Black Box was invented by Dr Eric Solomon and is marketed by Waddingtons House of Games in two versions; the standard version and a mini pocket version. The author is grateful for Waddingtons' permission to use its game for the program.

(continued on page 97)

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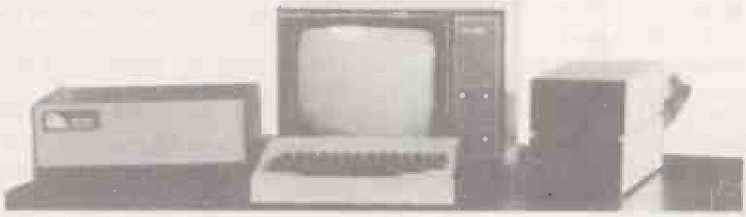

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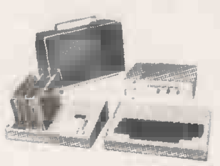

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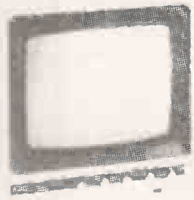

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(continued from page 95)

```
READY.
 10 REM*****BLACK BOX*****
 20 REM**              **
 30 REM***PROGRAMMED BY***
 40 REM**              **
 50 REM*****R.C.MERRY*****
 60 REM**              **
 70 REM*****SEPT 1979*****
 80 REM*******************
 90 REM***INSTRUCTIONS***
 100 PRINT"■           ■BLACK■ ■BOX■"
 110 PRINT"■■■■THIS IS THE GAME OF BLACK BOX, THE GAME"
 120 PRINT"■OF DEDUCTION BY WADDINGTONS. YOU WILL"
 130 PRINT"■NEED THE STANDARD RULES OF BLACK BOX"
 140 PRINT"■TO PLAY. THE COMPUTER GENERATES RANDOM"
 150 PRINT"■PATTERNS OF ATOMS. HOW MANY ATOMS"
 160 INPUT"■WOULD YOU LIKE IN THE FIRST GAME";Z
 170 REM***INITIALIZE***
 180 A$="■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■"
 190 D$="■■■■■■■■■■■■■■■■■■■■■■■■■■■■"
 200 L$="   |":M$="——+":RT=0:GT=0
 210 B$="ABCDEFGHIJKLMNOP":DIMP(9,9)
 220 S=0:B=0
 230 REM**CLEAR ARRAY,LOAD RAY NUMBERS**
 240 FORX=0TO9:FORY=0TO9:P(X,Y)=0:NEXTY,X
 250 FORY=1TO8:P(0,Y)=Y:P(9,Y)=25-Y:NEXT
 260 FORX=1TO8:P(X,0)=33-X:P(X,9)=X+8:NEXT
 270 REM***PLACE RANDOM ATOMS***
 280 FORI=1TOZ
 290 RX(I)=INT(8*RND(1)+1):RY(I)=INT(8*RND(1)+1)
 300 IFP(RX(I),RY(I))<>0THEN290
 310 P(RX(I),RY(I))=99:NEXT
 320 REM*PRINT DISPLAY DURING BLANKING*
 330 POKE59409,52
 340 PRINT"■";
 350 FORI=1TO9
 360 FORJ=1TO9:PRINTL$;:NEXT:PRINT
 370 FORJ=1TO9:PRINTM$;:NEXT:PRINT"——":NEXT
 380 FORJ=1TO9:PRINTL$;:NEXT
 390 PRINT"■■■■1■■■2■■■3■■■4■■■5■■■6■■■7■■■8■■■■9■10■11■12■13■14■15■16"
 400 PRINT"■■■■32■31■30■29■28■27■26■25"
 410 PRINT"■";LEFT$(A$,27);"■■24■■■■23■■■■22■■■■21■■■■20■■■■19■■■■1
     8■■■■17■■"
 420 POKE59409,60
 430 REM***INPUT OPTION***
 440 PRINT"■";LEFT$(D$,20);"DO YOU WANT TO 1)INPUT A RAY"
 450 INPUT"                      2)SEE THE ANSWER";R
 460 IFR=1ORR=2THEN480
 470 PRINT"PLEASE ENTER 1 OR 2";:GOTO440
 480 GOSUB1350
 490 ONRGOTO500,1250
 500 REM***INPUT RAY NUMBER***
 510 PRINT"■";LEFT$(D$,20);:INPUT"RAY NUMBER";G
 520 IFG<1ORG>32THENPRINT"NOT A VALID RAY":GOSUB1350:GOTO510
 530 N=INT((G-1)/8)+1
 540 ONNGOTO560,660,760 ,860
 550 REM***LEFT TO RIGHT***
 560 X=0:Y=G
 570 IFP(X+1,Y)=99THEN960
 580 IFP(X+1,Y-1)=99ANDP(X+1,Y+1)=99THEN1050
 590 IFP(X+1,Y-1)=99ANDX=0THEN1050
 600 IFP(X+1,Y+1)=99ANDX=0THEN1050
```

(continued on page 99)

(continued from page 97)

```
610 IFP(X+1,Y-1)=99THEN870
620 IFP(X+1,Y+1)=99THEN670
630 X=X+1:IFX<>9THEN570
640 GOTO1120
650 REM***BOTTOM TO TOP***
660 X=G-8:Y=9
670 IFP(X,Y-1)=99THEN960
680 IFP(X-1,Y-1)=99ANDP(X+1,Y-1)=99THEN1050
690 IFP(X-1,Y-1)=99ANDY=9THEN1050
700 IFP(X+1,Y-1)=99ANDY=9THEN1050
710 IFP(X-1,Y-1)=99THEN570
720 IFP(X+1,Y-1)=99THEN770
730 Y=Y-1:IFY<>0THEN670
740 GOTO1120
750 REM***RIGHT TO LEFT***
760 X=9:Y=25-G
770 IFP(X-1,Y)=99THEN960
780 IFP(X-1,Y-1)=99ANDP(X-1,Y+1)=99THEN1050
790 IFP(X-1,Y-1)=99ANDX=9THEN1050
800 IFP(X-1,Y+1)=99ANDX=9THEN1050
810 IFP(X-1,Y-1)=99THEN870
820 IFP(X-1,Y+1)=99THEN670
830 X=X-1:IFX<>0THEN770
840 GOTO1120
850 REM***TOP TO BOTTOM***
860 X=33-G:Y=0
870 IFP(X,Y+1)=99THEN960
880 IFP(X-1,Y+1)=99ANDP(X+1,Y+1)=99THEN1050
890 IFP(X-1,Y+1)=99ANDY=0THEN1050
900 IFP(X+1,Y+1)=99ANDY=0THEN1050
910 IFP(X-1,Y+1)=99THEN570
920 IFP(X+1,Y+1)=99THEN770
930 Y=Y+1:IFY<>9THEN870
940 GOTO1120
950 REM***ABSORBED RAY***
960 S=S+1:GOSUB1380:PRINT"■";LEFT$(D$,20);"RAY WAS ABSORBED"
970 ONNGOTO980 ,990 ,1000,1010
980 PRINT"■";LEFT$(D$,2*G);" ■■":GOTO1020
990 PRINT"■";LEFT$(D$,18);LEFT$(A$,3*(G-8));" ■■":GOTO1020
1000 PRINT"■";LEFT$(D$,2*(25-G));LEFT$(A$,27);" ■■":GOTO1020
1010 PRINT"■";LEFT$(A$,3*(33-G));" ■■"
1020 FORI=1TO3000:NEXT
1030 GOSUB1350:GOTO430
1040 REM***REFLECTED RAY***
1050 S=S+1:GOSUB1380:PRINT"■";LEFT$(D$,20);"RAY WAS REFLECTED"
1060 ONNGOTO1070,1080,1090,1100
1070 PRINT"■";LEFT$(D$,2*G);" ■■":GOTO1110
1080 PRINT"■";LEFT$(D$,18);LEFT$(A$,3*(G-8));" ■■":GOTO1110
1090 PRINT"■";LEFT$(D$,2*(25-G));LEFT$(A$,27);" ■■":GOTO1110
1100 PRINT"■";LEFT$(A$,3*(33-G));" ■■"
1110 FORI=1TO3000:NEXT:GOSUB1350:GOTO430
1120 REM***RAY EMERGES***
1130 S=S+2:B=B+1:GOSUB1380:PRINT"■";LEFT$(D$,20);"RAY EMERGED
     AT ";P(X,Y)
1140 IFX=0THEN1170
1150 IFY=0THEN1180
1160 PRINT"■";LEFT$(A$,3*X);LEFT$(D$,2*Y);" ";MID$(B$,B,1):GOTO1190
1170 PRINT"■";LEFT$(D$,2*Y);" ";MID$(B$,B,1):GOTO1190
1180 PRINT"■";LEFT$(A$,3*X);" ";MID$(B$,B,1)
1190 ONNGOTO1200,1210,1220,1230
1200 PRINT"■";LEFT$(D$,2*G);" ";MID$(B$,B,1):GOTO1240
1210 PRINT"■";LEFT$(D$,18);LEFT$(A$,3*(G-8));" ";MID$(B$,B,1):GOTO1240
1220 PRINT"■";LEFT$(D$,2*(25-G));LEFT$(A$,27);" ";MID$(B$,B,1):GOTO1240
1230 PRINT"■";LEFT$(A$,3*(33-G));" ";MID$(B$,B,1)
1240 FORI=1TO3000:NEXT:GOSUB1350:GOTO430
1250 REM***PRINT ANSWAR,FINAL SCORE***
1260 FORI=1TOZ:PRINT"■";LEFT$(A$,RX(I)*3);LEFT$(D$,RY(I)*2);"●":NEXT
1270 PRINT"■";LEFT$(D$,20);"HOW MANY DID YOU GET WRONG";
1280 INPUTW
1290 S=S+5*W:GOSUB1350
1300 PRINT"■";LEFT$(D$,20);"YOUR FINAL SCORE WAS ";S:RT=RT+S:GT=GT+1
1310 INPUT"■■ANOTHER GAME (Y/N)";R$
1320 IFLEFT$(R$,1)="N"THEN1390
1330 INPUT"■HOW MANY ATOMS";Z:GOTO220
1340 REM***CLEAR BOTTOM OF SCREEN***
1350 PRINT"■";LEFT$(D$,19);
1360 FORI=1TO200:PRINT" ";:NEXT:RETURN
1370 REM***PRINT SCORE***
1380 PRINT"■";LEFT$(A$,30);LEFT$(D$,5);"■SCORE■:";S:RETURN
1390 REM***WORK OUT FINAL AVERAGE***
1400 AV=RT/GT
1410 PRINT"■YOUR MEAN SCORE WAS:";AV
1420 PRINT"■YOU PLAYED:";GT;"GAMES"
1430 IFAV>20THENG$="POOR!!"
1440 IFAV<=20THENG$="FAIR"
1450 IFAV<15THENG$="ABOUT AVERAGE"
1460 IFAV<13THENG$="GOOD"
1470 IFAV<10THENG$="EXCELLENT!!"
1480 PRINT"■YOUR PERFORMANCE WAS ";G$
1490 END
READY.
```

Even friends of the famous have to pay VAT

FEW COMPUTER owners can boast that their keyboards have recently felt the touch of the impressive and highly-paid hand of superstar Kate Bush. Yet the computer at London Features International, LFI, were it to have any feelings at all, would probably be extremely blasé about the procession of famous rock stars who have admired their reflections in its screen.

LFI is a photographic agency which specialises in providing action, studio and glamour shots of musicians to record companies, magazines and newspapers worldwide. Its computer is an all-British starlet in its own right, the Transam Tuscan, and all its software — including ledgers and a rental management system for its photographs — is being written by a self-taught programmer, Adrian Boot, who happens to be one of the LFI agency photographers.

Boot had had little experience of computing when he bought his 4K Triton board from Transam. True, about 10 years ago he had done a degree in physical chemistry at London University: "I did a one-year option in computing there, but it was all mainframes in those days".

He used the computer to help him in his final thesis, an opus with the snappy title, The Disassociation of Constants of Picric Acid: "but I did very little of the programming myself".

New world

After university, Boot went a long way from London, to Jamaica, and left the world of picric acid and computers well behind him: "I went to Jamaica to teach, but at college, my photography had always been of a semi-professional standard, and it didn't really take me long to establish myself as a photo-journalist in the Caribbean".

That must have been more fun than teaching, and as it happened Adrian Boot and his camera were in the right place at the right time: "Reggae was becoming more popular and I sold quite a few pictures of reggae musicians to European magazines". He also took some photographs for the Rolling Stones who recorded the *Goat's Head Soup* album in Jamaica.

On his return to England eight years ago, he became a full-time freelance photographer with a speciality in rock music and a *Melody Maker* contract. He also set up his own photographic library and his work started to be syndicated across the world.

Now he is very near the top of his profession, but despite the fact that in the few weeks before we visited him, he had photographed a spectrum of rock musicians from Gary Numan and the Professionals to Kate Bush and Status Quo, he is emphatic that his life is not entirely composed of glamour.

"A good 30 percent of my time at home is spent on administration. My wife and I are often forced to spend cosy evenings battling with the VAT return, and believe me, doing administration goes against the very nature of what makes a good photographer".

His administrative work is split between the basic business accountancy — his business is turning over about £15,000 a year at the moment — and running his

by Cathy Lane

library of several 1,000 transparencies. "Coping with all that is hell. LFI and I find that only about 60 percent of the pictures we loan are returned".

Thanks to his academic background, Boot has become an avid reader of scientific magazines like *Scientific American* and *New Scientist*, so he was not unaware of the micro boom: "Something like four years ago, I began to think that this might be the answer to my VAT problems" — a farsighted conclusion at a time when few commercial applications were being put on to the new microcomputers.

He went to some personal computer exhibitions in the States and encountered a micro in a recording studio over there: "As well as the business functions, they were trying to link it to their studio console — I was intrigued".

Boot looked round and decided that there was no way that he was going to be able to buy software which could run his business. It was early days for the small business system, and the standard, and availability, of low-cost cassette programs was, frankly, poor.

His conclusion was that he would have to program any machine himself and decided that the best way to learn how a computer works was to build one himself from a kit.

So he bought the Triton board from Transam. Why Transam? "I liked their attitude", he says. "There's a kind of snobbishness about microcomputers; if you're in the know, everything is fine and you're a member of the club. If you aren't, it's really difficult to learn anything. That turned out to be a real contrast to the States — everyone there was enthusiastic about micros and helpful to novices like me".

After receiving short shrift from a computer shop that had no patience for his beginner's questions, he tried Transam and: "They answered even my most stupid questions patiently and very helpfully".

Boot initially bought a 4K Triton board to plug into his own television set. It took him three days of solid effort to build the computer — albeit with plenty of help from Transam. The hiccups were split evenly between his own soldering errors and faulty parts. He takes a phlegmatic attitude to that somewhat staccato progress: "I don't think anyone can really expect to plug in and go with one of those things, not unless you happen to earn a living as an electrical engineer, but it wasn't really too difficult for me".

The first program that Adrian wrote was a routine for solving his VAT problems. They can be complicated because of the vast number of small transactions involved. At first his system did not have a printer, so the computer was acting just as a sophisticated calculator and everything which appeared on the screen was copied by hand into a ledger.

Boot is constantly re-writing that program as he upgrades his system and as Transam releases bigger and better versions of the Basic programming language. He started with the compact, economical and generally neat Tiny Basic implementation — ideal for a small beginner's system and as an introduction to the programming language, but nobody's idea of the kind of function-filled language required for business uses.

Upgraded Basic

The upgraded Basic he uses now is running on a system that has grown into 32K of memory, a single 8in. floppy disc drive, keyboard and screen, and a Teletype as its printer. All this is worth around £1,000; his original outlay was nearer £200.

Doing the VAT used to take two people five brain-numbing hours one evening each month. With the latest version of the VAT program on the computer, it takes just 20 minutes.

Having solved the immediate problems, Adrian slowed down: "We had the computer in the corner of the sitting room, which made a marvellous conversation piece — it was used a good deal for games, but computer games can become boring. Either they are too simple, or the computer wins all the time. It even cheats sometimes, and it's certainly not a good drinking partner".

However, more computing activity was around the corner. About this time, Boot had started to talk to LFI about its acquiring a computer. "We had, in fact, been thinking for some time of computerising the photo library", says John

London Features International photographer Adrian Boot's self-portrait.

Halsall, one of the two company directors of LFI. "Three years ago we had spoken to IBM. It was all much too expensive, though. They were quoting about £15,000 for the hardware, and I realised even then that prices were going to fall".

As a result of Adrian Boot's good experiences with Transam, LFI bought a Tuscan from the company. This Z-80-based microcomputer was then a new product, but it represented a hardware upgrade from the Triton and used the same software. The LFI configuration had double-density disc drives, a fast — 120 cps — matrix printer, 48K memory, and a price tag around the £4,000 mark.

First objective

The first objective for the Tuscan was to computerise the LFI address book. That would then form the basis of the customer file for the photographic library and would provide a mailing list divided into about 50 category codes. Adrian Boot had already started to develop a mailing-list program on his Triton, and the software on Transam computers is helpfully interchangeable.

It took Boot two months to have the mailing list up and running, and he also produced a program which runs the photographic library — it is similar to the standard mailing list, except that everything is categorised as a subject record.

Under each subject record, there are details about the number of different photographic sessions available, the number of transparencies from each session, the code for the photographer who took them and an indication of exactly which transparencies have been taken out and the customer number of the recipient — which refers back to the customer number of the mailing list.

Adrian Boot is working on programs to handle LFI's invoicing and which will also produce statements and a sales ledger.

The long-term plan is to market the programs when they are all completed. "I've deliberately written them all in little modules", says Boot, "but they all interface to each other so that the invoicing file can access the mailing list and so on".

There is also scope for further sophistication: "At the moment when John wants to check on where a particular photograph is, he has to look through the customer ledger, page by page. Or he could blanket-Telex everyone, which is expensive. We might well be missing many sales of rights because of this".

Boot reckons he would not have been able to write such clever programs were it not for the fact that he had built a computer himself: "Building your own certainly isn't the quickest way of doing it. It probably isn't the cheapest either, but it certainly helps you understand how the thing works".

Future expansion

John Halsall is a little more sceptical about computing, but when all systems are go he intends to capitalise on it — maintaining larger files and handling more pictures. "We want to expand our subject matter — I'm not sure into what areas, but you can sell photographs of anything. Like there's a man who spends all his time at Heathrow just photographing aeroplanes. He doesn't sell that many — but believe me, every time there's a plane crash and the papers want a shot of the exact model, he makes a bomb".

Clear data coding unlocks door to information analysis

ONE ASPECT of statistics is to analyse data to try to determine if it is in agreement with some given hypothesis, and to try to determine the probability that any apparent agreement is real. Such analyses can be conducted with only a limited amount of data available, though the reliability of the analysis increases with the amount of data used, up to a certain point.

The other aspect of statistics is the collection, tabulation and summarising of large quantities of data. Information

by Owen Bishop

collected during censuses, market research, or from, say, the customer records of a large insurance company, may be used to provide summary information on which future action will be based.

Microprocessors are ideal for processing that kind of data in very large quantities. A small system may have some limitation because of its restricted memory space, but with a suitable method of recording the data on tape or disc, that disadvantage can be overcome.

As an example of how a small microcomputer can be used for data-handling we will follow the analysis of the readership survey, Tell us about you, which was published in the August 1979 issue of *Practical Computing*. The principles involved can, however, be applied equally well to most other kinds of data, such as customer files, library catalogues, and information gathered in surveys.

All information is codable, but it is worthwhile when collecting information to do so in a way that lends itself to subsequent coding. In our survey, the division of readers into four age-groups was ideal, for the four groups can readily be coded as a two-digit binary number. The division of system-cost and future-system-purchase-costs into nine bands each was not ideal, for that took four-digits in coding, whereas, with an eight-band division, almost as much information could have been contained in a three-digit code.

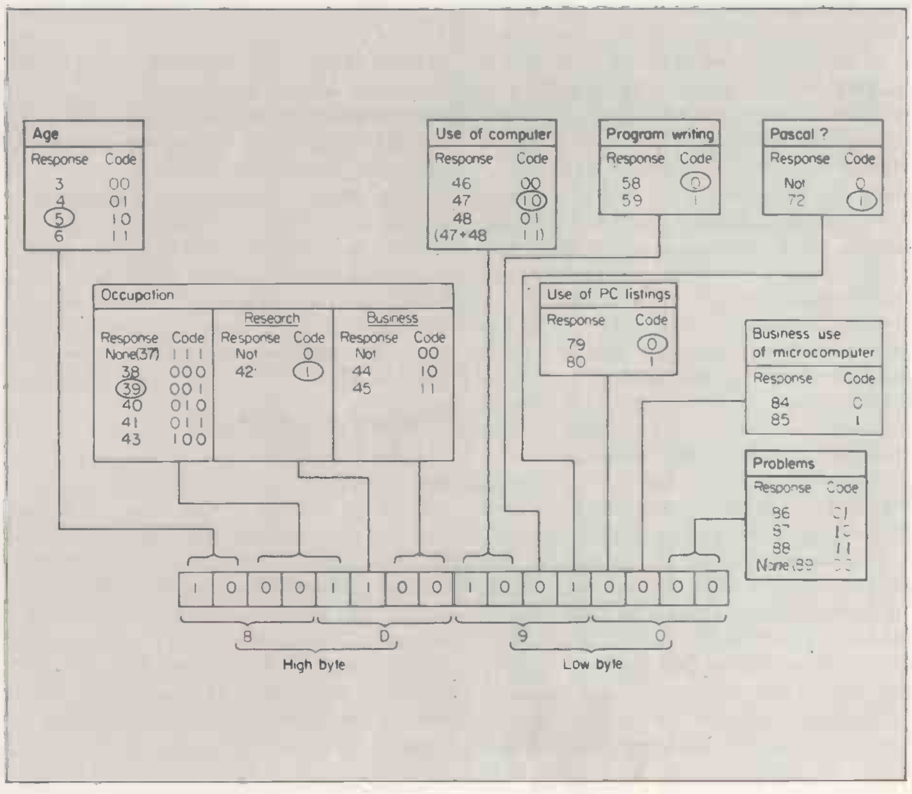
Users of large systems may be prodigal with memory space but, for the user of the small system, the motto is: Take care of the bits, and the bytes will take care of themselves. It may be possible to record additional information without requiring additional bits, and that should be considered during the planning stage. For example, the coding of occupations required six bits, and it would have been possible to code for three additional occupations and a third category of business within a six-bit code.

It is easy to find fault with the planning after the information has been gathered, for it is notoriously difficult to prepare a perfectly satisfactory questionnaire. If a good deal of time and effort are to be spent on a survey, it is advisable to run a pilot survey first to discover just where the pitfalls lie.

If we want to correlate certain items of information, those items must be coded as a unit for each individual. For example, if we wish to know how many school teachers read *Practical Computing*, run through the questionnaires and count how many people circled 38.

Similarly, we can run through again and discover how many circled 72, to indicate they want a Pascal course. Yet if we want to know how many school teachers want a Pascal course, we must include both items of information in one unit of code. Figure 1 shows several items of information, all contained within a double-byte code group.

Figure 1. Data coding.



Mutually exclusive

The example shows a reader aged 21-40, teaching and researching in a college or university, who uses a computer for amusement only, writes programs, wants a Pascal course, and uses the *Practical Computing* program listings. Note that the coding must take into account whether, in certain groups, the responses are mutually exclusive — age, program writing, Pascal, business use — or whether it may be legitimate for two or more responses within the same group to be circled.

In occupations, a person may be a teacher and in research, or be a computer professional and in a big business. Similarly, problems in operating computers may be due to hardware, software, or both; and there must also be a code for neither.

The example covers most of the essential facts about a reader and enables us to discover how many of our readers are school teachers less than 16 years old — code 00XX — and how many computer professionals above the age of 40 use computers for amusement only and do not write programs — code EOAX. Such code groups did not appear in our survey.

Even without further analysis, the conversion of information into compact code form allows the data to be inspected by eye and broad features can be picked out easily. For example, the group AOXX appears often in the listing indicating that a significant proportion of readers are

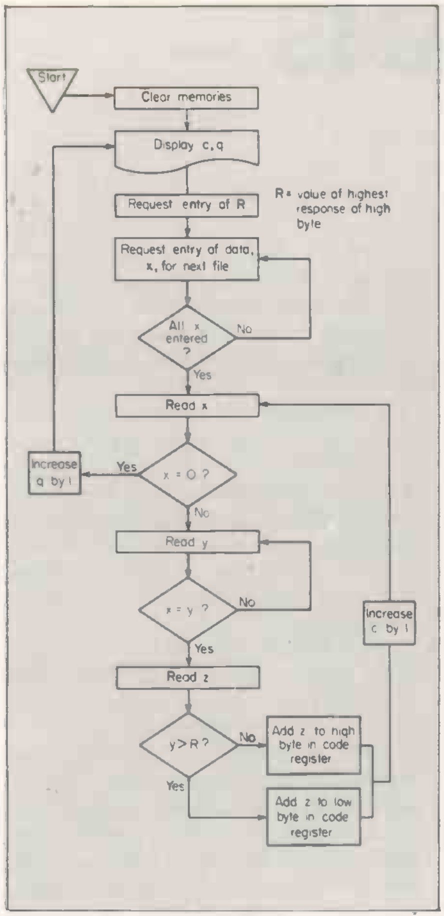


Figure 2. Program flowchart.

computer professionals in the 21-40 age group. Another common group is 82XX — businesses with fewer than 50 employees, aged 21-40 — while the group 10XX — school student, less than 16 — is distinctive but rare.

However, it is extremely rare to find two double-byte groups which are identical, indicating the wide variety found among our readers. To extract the detailed information, the code groups must be analysed systematically.

A program for producing the kind of code shown in figure 1 is described by the flowcharts of figures 2 and 3. The reader is left to write a listing for his own system. The system need not be a large one, for

OFB2	03	04	05	06	37	38	39	40
OFBA	41	42	43	44	45	46	47	48
OFC2	58	59	72	79	80	84	85	86
OFCA	87	88	89					

Figure 4. Response table for data coding program, for items shown in figure 1.

the program was run in machine code on an MK-14, leaving enough memory to hold 100 double-bytes of coded data. Data is entered by typing in the ringed numbers from a questionnaire or file.

For the coding of information shown in figure 1, the number 37 was entered if no occupation number had been circled, and 89 to indicate no problems. That made it possible to distinguish later between a genuine no ring response and an omission on the part of the operator to enter a response which had, in fact, been ringed.

All possible responses are listed in a response table in the program — figure 4. When data has all been entered, the program reads each item, x, in turn and runs through the response table, y, until it finds a match. It then finds the corresponding code from the code table, also in the program — figure 5 — and arithmetically adds it to the appropriate register in the code register table.

When coding is complete, the program displays the number of items entered, c, as a check that none has been accidentally omitted.

It also displays q, the number of files or questionnaires coded, as a check against such errors as turning over two sheets together or entering the same set of data twice. It also indicates when memory is full.

Correlation

If we wish to correlate more information, we need more bytes in the code group. For certain types of information, the number of bits required is relatively large. There were 16 newspapers listed in the questionnaire and since an individual can ring any number and combination of newspapers, we need 16 bits to cover all possibilities. So the addition of newspaper information means that we need a quadruple-byte code.

It is easy to modify the program to deal with quadruple-bytes, but if memory space is limited, the number of questionnaires processed in one run is now halved. To cover all the information on the questionnaire sheet requires 12 bytes in each unit. If it is necessary to be able to correlate any item of information with any other item, the complete questionnaire must be encoded in 12 bytes.

For a small system, this makes the program so long that memory space to store the results is very limited — especially since it requires 12 bytes to store the code of each questionnaire.

Manual process

In the good old days, when analyses were done by hand on paper with perhaps the help of a mechanical calculating machine, a statistical analysis could take several hours. Nowadays, it can be done in microseconds, yet is that speed entirely beneficial? Although calculating results by hand was certainly exacting and often tedious, the analyst had the feeling of really being in contact with the analysis.

As the results gradually grew on the page, he could see how things were developing, to ponder and to anticipate, to think what it all meant in terms of real events.

That opportunity to work with the computation is lost when everything is done in a flash. A computer has no feel for an analysis and it is doubtful if it could be programmed to behave as if it had one. It cannot see how the results are emerging and develop a hunch as to what type of analysis to try next — or perhaps decide that the whole thing is a waste of time.

Certainly if there is a mass of data which need processing according to some well-tried routine, a large computer has all the advantages of speed and freedom from error. Yet in many applications, where the analysis itself is of an exploratory nature, much can be lost if the analyst loses contact with the analysis. That is where a small system is best.

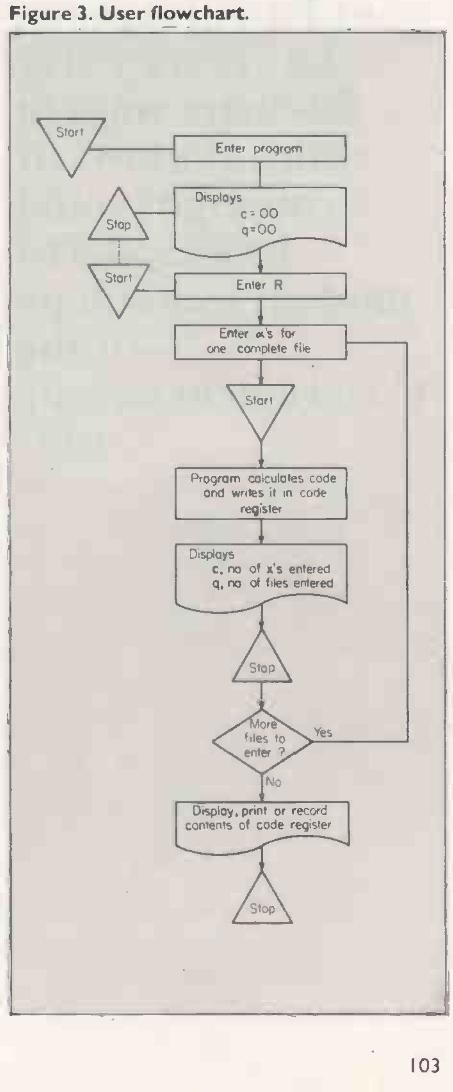
OFD4	00	40	80	C0	38	00	08	10
OFDC	18	04	20	02	03	00	80	40
OFE4	00	20	10	00	08	00	04	01
OFEC	02	03	00					

Figure 5. Code table from data coding program, for codings shown in figure 1.

If cannot do everything for itself, so it needs to be used intelligently, and needs programming specially for the work in hand. The programming should preferably be done by the analyst, who will know exactly what the machine is doing on his behalf.

The program should allow scope for examining the computations at several stages along the line — for example, it is useful for the analyst to be able to look through the code groups before they are processed further. So, use a system slightly smaller than you think you need and keep in contact with the data.

Figure 3. User flowchart.



COMPUTER PROGRAMS — ART OR SCIENCE?

There has yet to be a definitive ruling in the courts to decide if computer programs can be copyrighted or patented or whether there is some other legal way to prevent the pirating of original software. In this paper, which was presented to the Chartered Institute of Patent Agents, Lawrence Perry discusses ways in which the laws of copyright could be adapted to modern technology — if the Government has the will.

by Lawrence Perry

SECTION 1, sub-section (2) (c) of the Patents Act 1977 declares that, for the purposes of the Act, a program for a computer is not an invention. An identical clause is found at Article 52 (2) (c) of the European Patent Convention. The inclusion of a similar clause in the 1949 Act was not given a moment's thought.

By 1949, hardly more than two or three computers had been built and were operating successfully. The Automatic Sequence Controlled Calculator was completed in 1944. It was a machine constructed of electric relays and controlled by punched paper-tape. The first electronic computer, the ENIAC, was completed in 1946 and was controlled by plugboards so that changing from one computation to another was an arduous task.

It was only in 1945 that von Neumann and his group at the Moore School of Electrical Engineering in Philadelphia, first articulated the idea of the stored-program digital computer. Essentially, it was proposed that the controlling information — the instructions to the machine — should be coded and stored in the machine together with the data on which the machine was to operate.

Yet even in 1945, at the end of a decade in which the electronics industry had made great progress, the von Neumann proposals were ahead of their time. What was lacking was a suitable storage device. The development of the modern computer depended on the discovery of the magnetic core, the transistor, and especially, integrated circuitry.

First success

The first British computer to operate successfully did so at Manchester in June 1948. At Cambridge University, Dr M V Wilkes' EDSAC, Electronic Delay Storage Automatic Calculator, performed its first fully-automatic calculation in May 1949.

So, it is not surprising that the drafters of the 1949 Act, if they had heard at all about computers, saw no reason to make mention of them — still less were they aware of computer programs.

It is difficult to identify any single reason for treating computer programs as non-inventions, although, insofar as the U.K. is concerned, the governing motive was the desire to unify European Patent Law.

Since the European Convention had excluded computer programs, the British were obliged to follow suit in their domestic law. Yet why exclude computer programs anyway? Although one can never know for certain what advice was sought and tendered, perhaps the following considerations were taken into account.

- The computer was viewed, rather simplistically, as a calculating machine, and the computer program as a mere expression of calculations. Just as a method of solving an equation was not patentable, so, it was argued, should the mere expression of such a method as a set of instructions be excluded from patentability.
- It was thought that an activity associated rather with the study than with the laboratory was not appropriate to patents, which were, traditionally, granted for technological rather than merely intellectual achievement. Writing a program is like playing chess. If the thought processes are accurate, the game will not be lost and the program will not fail. In the laboratory, the technologist is seeking to master the physical world and may fail for reasons beyond his control.
- In the late 1950s, early 1960s, when the problem was under close discussion, the Patent Offices of the world were under extreme pressure. They took a significant proportion of the technologically-qualified personnel of a country and were demanding more as the arrears of unexamined applications mounted to beyond acceptable levels. The introduction of a new class of patentable material — computer programs — would only increase the pressure. Further, the difficulty of establishing the novelty of a computer program would lead to the grant of invalid patents, leading the patent system into yet more disrepute.
- In 1966, in the U.S. the President's Commission recommended that computer programs be excluded from patentability. At least one European country, France, was extremely unwilling to grant U.S. applicants what foreign applicants, it seemed, would not be granted in the States — namely, patents for computer programs. France was, in 1968, the first country to legislate the exclusion of computer programs, and rather jumped the gun, because, even in 1980, the question is not decided in the States.

The third and fourth of these reasons are questions of high politics and I do not propose to touch further on them. It is sufficient to remark that high politics is subject to the whims of fashion rather more than low technology and that, in the future, it is conceivable that the Patent Office may be used to mop up a large pool of unemployed graduates.

The second reason represents nothing more than the prejudice that patents should only be granted to those with oil in their fingernails. It is the first reason, that the computer program is the expression of a calculation, which has had the most widespread influence and needs the most careful examination.

Cyclical operation

A typical stored program computer is a machine which is designed to operate cyclically as follows:

1 Get the next instruction;
2 Get the data specified by the instruction;
3 Perform the operation specified by the instruction;
4 Store the result of the operation;
5 Indicate which is the next instruction;
6 Repeat steps 1 to 6.

An instruction, therefore, selects the operation to be performed on specified data. A computer program is a set of instructions designed to cause the computer to execute some task. In other words a computer program is the means whereby a computer is caused to perform some function.

Yet the same function could be implemented equally well in electronic circuitry. The design of a computer involves the decision as to how many of the computer functions will be implemented as programs rather than as electronic circuitry. The IBM System/360 announced in 1964 is an interesting example of that.

Although all machines in the range were designed to have the same instruction sets, i.e., the same repertoire of instructions, the manner in which the instructions were implemented differed in different machines of the range. At the low end and middle of the range, the computers were provided with read-only storage containing microprograms. They are computer programs which perform the operations defined by the same instruction set and were effected directly by electronic circuitry. In general, appropriately-designed electronic circuitry will effect a given operation more quickly, at rather higher capital cost, than a computer program driving simpler circuitry of more general application.

Intellectual property

To demonstrate the equivalence of computer programs and electronic circuitry is not to establish that they are identical, and it does not necessarily follow that they should be deserving of the same protection, viewed as intellectual property. However, if the universality of computer programs is considered, serious questions arise as to the wisdom of declaring that a computer program is not an invention.

In the early days of computers, the universality of the machine referred to its capability of solving any problem which could be presented as a finite series of steps. In the practical world of applied science, that means the computer can solve virtually any problem, can perform any regulatory function. To that universality of application, modern technology has added an extra dimension of patentability. A computer of equivalent power to that which once filled a room can be held in the palm of the hand.

While in the past, the computer has always been capable of calculating appropriate fuel/air mixtures, it is now possible to install the machine beneath the bonnet of a car where it can form part of the engine-control system.

A glance through the pages of the patent abridgement volumes will show that the programmed computer is being used in almost every conceivable application. The programmed computer can be an element in an inventive combination.

Judicial recognition

Perhaps the clearest judicial recognition of the modern facts of life was given by the United States Court of Customs and Patent Appeals in allowing Johnson's application for a patent, reported at 200 USPQ on page 210:

> "Very simply our decision today recognises that modern technology has fostered a class of inventions which are most accurately described as computer-implemented processes. Such processes are encompassed within 35 USC 101 under the same principles as other machine-implemented processes, subject to judicially-determined exceptions, *inter alia,* mathematical formulae, methods of calculation, and mere ideas. The overbroad analysis of the PTO, Patent and Trade Mark Office, errs in failing to differentiate between a computer program, i.e., sets of instructions within a computer and computer-implemented processes whereby a computer or other automated machine performs one or more of the recited process steps. This distinction must not be overlooked because there is no reason for treating a computer differently from any other apparatus employed to perform a recited process step".

Perhaps by the time those words are delivered, the CCPA will have been firmly stamped on by the United States Supreme Court, for the Patent and Trade Mark Office has appealed most aggressively against several CCPA decisions which have interpreted Supreme Court utterances narrowly. That will not detract from the obvious good sense of the quotation, but U.S. law and practice do not help us in Europe, faced with Article 52 (2) (c) of the Convention. There is, of course, the mysterious Article 52 (3):

> "The provisions of paragraph 2 shall exclude patentability of the subject matter ... referred to in that provision ... only to the extent to which (an application or patent) relates to such subject matter as such".

The guidelines firmly avoid discussion of this Article and my expository task would be easier if the wording mentioned claims or scope of protection. It is true that the German verb, *sich beziehen,* besides meaning to relate to also means to cover, but it also means to cloud over and, regretfully, the life-line offered by this reading must be rejected.

What is a computer program "as such"? It is the program *per se,* the list of coded instructions set apart from any technical context. Patentability of such a list is excluded by Article 52 (3). Consider again Article 52 (2) (c).

Apparatus or system

It states that schemes, rules and methods of playing games are not inventions. That does not mean that a new and inventive game cannot be patented. Provision is made in the international classification A63F for board-games such as chess or geographical games. What is protected is the scheme, rule and method as implemented in the board and playing pieces.

Applying this to computer programs, it could be argued that, as long as the program of itself is not claimed, a patent can be obtained to an apparatus or system which implements the scheme underlying the program. There must be some validity in the argument for the computer program exclusion was, in the drafting of the Convention, deliberately placed in the "schemes and plans" section of Article 52 — but this argument alone will not do.

A new board-game necessarily involves new apparatus. A new program can be implemented on old apparatus. I have little sympathy with those who claim that, during its execution, a new program changes the old computer into a new machine. A typewriter tapping out a new poem does not change its intended function. The same keys are used sequentially as would be used in copying Tennyson.

Accurate analogy

The analogy between the typewriter keys and the instruction set of a computer is quite accurate. To claim a computer program as apparatus, in the form required by Rule 29, implies that the claim would have a characterising portion something like, "characterised by a machine-readable medium bearing control data such that the computer is caused to perform the following operations". Such claim would be refused under Article 52. Is that the limit of the scope of Article 52?

There are two computers A and B, of which B is subservient to A. The invention is that, at fixed intervals, A checks whether B wants to transmit or receive information to or from A. The invention could be implemented in electronic circuitry or in a computer program, or rather two programs, one in each machine.

A deliberate infringer is likely to choose the program alternative as that is the quickest and cheapest to implement. Assume that two computers connected together are known. The invention does not reside in the program as such and it is unnecessary to refer to the program in the claims.

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In theory, the claims could be based on a description including only a single embodiment — program or circuitry — but that would be a risky practice and both embodiments should be mentioned, or at least a general statement about the equivalence of programs and electronic circuitry should be included. All this looks rather like subterfuge but is merely compliance with the implications of Article 52.

The patentee is rather more interested in the question of whether a computer program implementation infringes the claims to the invention. The infringer's defence is, of course, that a patent claim cannot cover what is unpatentable. However, this argument depends on splitting the claim into notional implementations and excluding some while including others. This is impermissible.

Business scheme

The patent is granted to an invention, Article 52 (1). The question is, has the infringer taken the invention? The program implementation is not the attempted patenting of a program as such, but a means of achieving the invention, which does not lie in the program. This approach does not permit the covert protection of what would otherwise be unpatentable.

If the invention is a business scheme or a mathematical method, it will be apparent from the specification and will not be hidden in a cloud of words, such as a computer programmed to perform a given function, or other evasions practised under the British 1949 Act.

If we turn to another class of invention, characterised by the use of microprocessors in technological applications, the problem is simpler. The microprocessor is integrated so intimately in its technological environment that inventions usually involve a change in the environment and the characterising clause will include that change.

Easy conversion

If, for example, an improvement is made to a microprocessor-controlled system by increasing the number of parameters to which the system responds, the characterising clause will include means for sensing the extra parameters and the invention cannot be said to be a computer program as such. If the improvement resides merely in an improved program, it is probably best to avoid protection by means of patents and to rely on secrecy and copyright.

It is to copyright that I now turn. In the case of most programs now on the market, the owner does not mind if a competitor invests time and money in developing a similar program independently. His investment is protected by the necessity, as in a poker game, for a competitor to equal it to stay in the game.

What is strongly contested is the unauthorised use of his program to develop a competitive program. That is why a copyright-like type of protection is favoured so strongly and why the possible gaps in such protection are subject to increasingly-critical examination.

Briefly, to summarise the relevant provisions of the 1956 Copyright Act, copyright resides in original literary, dramatic, or musical or artistic works. Original means simply originating with an author and having required sufficient skill and labour.

It can be taken that any computer program worth protecting possesses originality. A computer program is not a dramatic work, nor is it a musical or artistic work. The program may generate such works but does not itself fall in any of these classifications.

By elimination, it is a literary work, which according to Section 48 (1) includes any written table or compilation. In relation to a work having copyright, there are certain acts which require authorisation of the copyright owner before they may be performed. The acts in respect of literary works requiring authorisation include:

- Reproducing the work in any material form;
- Publishing the work:
- Making any adaptation of the work; and,
- Doing, in relation to an adaptation of the work, any of the acts requiring authorisation. Adaptation means, *inter alia*, a translation of the work.

On the precedents, as I understand the authorities, there is nothing in the technological nature of the computer program to deny it copyright. The qualification "literary" has been understood as going to the form and not the content of the work.

Characterising clause

It follows that copyright subsists in a printed or written program. The nature of programs is such that the same program can be expressed in many different program languages and codes with relatively little investment required to convert from one language or code to the other. Different codes are required for different machine designs. The format of instruction word will, in general, differ with different machine manufacturers.

Different languages arise because the spread of computers has depended on making them easy to program, not in the sense of making programming easy, but in allowing the scientist, the mathematician and the businessman to concentrate on the problem he is solving without worrying too much about the complex machine he is using. Languages have been developed, such as Cobol, Basic, PL/1 and Algol, which enable the task to be performed by the computer to be expressed relatively simply.

In the view of the Whitford Committee, the wording of the 1956 Copyright Act is adequate to cover using a program to develop essentially the same program in a different language or code, and such an act requires authorisation as a translation of the literary work.

That view is not accepted universally and Alistair Kelman, a barrister, has felt the need to propose amendments to the Copyright Act to cover the situation. His proposal is to use the word transmutation to mean changes in the form or expression of a computer program. In particular, he proposes the term "cross-transmutation" to mean a change of code or language. I have two objections to the proposal.

Established precedents

I take it as axiomatic, that, wherever possible, computer programs should be fitted into the Copyright Act without modifying the language of the Act — then advantage can be taken of the established precedents. I see no objection to the use of the term "translation" to mean changing a program from one code or language to another. A translator converts a text from a form in which it is expressed according to one set of rules of grammar and syntax to a form in which it is expressed according to a different set of such rules. The last sentence defines precisely what is done in changing programs.

My second objection is to the use of the word "transmutation", which implies a change in the nature of a substance. Uranium is transmuted atomically into lead. The two substances are essentially different. The changed program should be essentially the same as the original.

Machine-readable

Next must be considered whether copyright subsists in computer programs expressed in machine-readable form. E P Skone-James in the 11th edition of Copinger and Skone-James on Copyright argues as follows:

Writing is defined by the Copyright Act as including any form of notation, whether by hand, printing, typewriting or any similar process. A literary work is defined as including any written table or compilation. From this and the precedents, he deduces that some form of notation is essential but that any form of notation is sufficient. Turning to the Shorter Oxford English Dictionary, he finds "notation" defined as "the process or method of representing numbers, quantities, etc., by a system of signs, and concludes "there seems no reason why ... punched cards, punched tapes, magnetic tapes and even magnetic cores should not be protectable as literary works".

The only weakness in the chain of reasoning is in the last link which relies on calling a magnetic disturbance of a magnetic medium, or a microscopically small connection in a read-only store — a sign. I have no doubt that a defendant faced with this argument will produce the submission that a sign should be sensible to a human observer. Copyright subsists in Braille documents, which are essentially sensible by touch. It was this kind of difficulty that caused Kelman to initiate public discussion of the problem of computer programs and copyright, for which he is to be applauded.

If copyright does not subsist in computer programs expressed in insensible signs, there is an odd asymmetry in the Act. For it is undoubtedly true that reproducing a printed program on a magnetic medium is reproduction in a material form and requires authorisation. However, reproducing a program recorded on one magnetic disc on another disc does not require authorisation.

Printed copy

In practice, the problem is avoided by retaining a printed copy of the program. Disc-to-disc reproduction is as much a reproduction of the printed original as a direct copy would be.

The problems which arise in determining the ownership of copyright in the output of computer programs are interesting logical exercises. They do not, however, present any essential difficulties and can be solved using the principles as precedents established by the Copyright Act.

Is the protection afforded by the Copyright Act sufficient? The essential purpose of a computer program is not to provide a work of study or reference as would a book or compilation. It is to control the operation of a computer. The Act does not envisage a literary work as a tool.

Authorisation

A person may obtain a machine-readable copy of a program and use it, thus depriving the copyright owner of a return on his labour for that use. During execution of the program, each instruction is copied into computer storage. It can be argued that use necessarily involves reproduction in a material form and thus requires authorisation. Yet the reproduction is of so transient a nature that a court might feel it does not qualify as a reproduction at all.

This difficulty was recognised by the Whitford Committee, Stationery Office, 1977, Command 6732, which recommended that, for the avoidance of doubt, the storage of computer programs, or of any other copyright material, in a computer store should be a restricted act, i.e., an act requiring authorisation.

Restricted act

The Committee went on to consider whether use of a computer program should be a restricted act. A minority of the Committee did not support the recommendation that this should be so.

There are two possible reasons for dissent with the recommendation. First, that it is unnecessary. Usage necessarily involves some kind of storage and thus involves a restricted act.

Second, that the concept of use of a literary work so modifies the philosophy of copyright as to change its nature. One has sympathy with these views while feeling that copyright has proved adaptable to modern technology in such fields as sound recordings and cinematograph films without losing sight of its essential character.

Postscript

Lawrence Perry died in August, 1980. It would have been uncharacteristic of him to reach this stage of an argument without having his conclusion clearly in mind. In essence, the question is whether this last extension of the restricted acts would stretch the links between Copyright Law and its philosophical foundations beyond breaking point, and perhaps unnecessarily.

After all, the author of a cookery book cannot reasonably expect a royalty each time a recipe is used. On the other hand, it does not seem unreasonable for the owner of a program to look to copyright to help obtain a fair return on its use.

Although I suspect I know the direction in which Lawrence Perry was moving, I shall not seek to articulate his conclusion for him. Rather, I shall enjoy, as I am sure he would have enjoyed, the discussion provoked by this and the other issues he addressed. Neil Killgren

Step-by-step approach to programming fundamentals

THIS IS not yet another of those endless series of articles which promise to explain everything — next month. I believe there are many new and not-so-new micro owners who have been left behind. There are a mass of articles levelled at the middling-to-confident programmer. I don't criticise that, but they have left the breeding ground and are off over the hill. For the inexperienced, it is a confusing jungle and they are left in the dark — and are likely to stay there.

From now on, I will assume very little about you, except that you have the use of one of the many microprocessors running Microsoft or a similar Basic. As a word of encouragement, the only really bug-free program I have ever seen is:

10 NEW

That causes few problems and runs on just about all machines. Variables used are zero and you are always returned to the command (READY) mode when the run is complete. However, it brings me to a point on program differences between machines. My micro is a TRS-80 but I have the use of a Pet 2001 and an Ohio, and even on that small selection, there are a surprising number of differences, particularly with the graphics handling. So we will keep our Basic general and if I have to resort to a specialised type of command, I will provide the decode for other machines.

Correct alignment

This month's problem is: using only the following commands, Print/For-Next/If-Then/CLS (Cursor Home), print the numbers 1 to 100 in lines of 10 with all the 10s and units correctly aligned.

I have seen, quite literally, a 100 different ways of achieving that. Some are better than others — but they all work — and, to begin with, that is the most important thing. You probably do not know how to start. Well, let's go through it byte by byte. If I said to you — print the numbers 1 to 100 on the screen — there would be smoke drifting from the keyboard, as you typed:

10 CLS: 'The :' is to indicate a REM(ARK) and is not run by the computer.
20 FOR X = 1 to 100 :' poor old X, always busy in a loop.
30 PRINT X :' The X is not in quotes so the value will be printed.
40 NEXT X :' It is not vital to add the loop variable to the 'NEXT' statement, but it can help.

Try adding either a comma or semicolon to the end of the print statement in line 30. You will find that if there is no print limiter, the numbers will all be printed down the left-hand side of the screen. The reason for this apparently perverse piece of behaviour is that in the absence of any command to do otherwise, the cursor will always return to the beginning of the next line.

The simple, but much misused, semicolon and comma are known as print limiters, because they limit the movement of the print cursor. The semicolon holds it at the next available print position and the comma usually allows the cursor to advance to the next screen tabulator — just like a typewriter's tabulator function — except the computer screen tabulators are pre-set.

So you have now managed to arrange the numbers 1 to 100 in two shabby-looking lines across the screen. We now

by Ken Smith

need to arrange them into lines of 10. If they were, what would the numbers on the right-hand side of the screen be?

If you didn't say — 10/20/30/40/50/60/70/80/90/100, you should re-learn your 10 times table. So what is special about those numbers? They are all multiples of 10. Put another way — when you divide them by 10 you always obtain an integer result — integers are whole numbers. 1 is an integer but 1.5 and 3.764 are not.

Well, perhaps we can exploit that fact to help use with our problem. Micros, unless you specify otherwise, will usually perform what is known as single-precision arithmetic. That is, they will always work to around seven digits of accuracy. Thus, if you ask the machine for the answer to 23/10 you will always obtain the answer 2.3 — trailing zeros are not displayed. Now ask for the integer answer to that sum. Type:

PRINT INT(23/10)

You should now have the answer 2.

So, when will the machine generate identical answers to the problems X/10 and INT(X/10) ? Only when X is an exact multiple of 10. Now, we are making progress. We have found a method of making the computer recognise when X is the correct value to start another line. How do we start another line? It couldn't be simpler — just tell it to print and leave out the print limiter. So we can add another line to our program.

35 IF X/10 = INT(X/10) THEN PRINT

Now run that. Isn't programming easy? Just look at those numbers lining up in lines of 10 — if yours didn't, you have forgotten the semicolon on the end of the print statement on line 30.

My screen display still looks rather tatty. None of the 10s and units lines up, and the lines are of unequal length. What can be done? Once again, let us resort to English.

It is perhaps a good time to introduce Ken's rules. They are a selection of sayings/proverbs/nonsenses, etc. which have been stolen/invented/dreamed and which I have plastered all over the wall above my VDU. They are a source of great inspiration and provide something to read when I am completely stuck.

KROT # 1 = if it will not code in Basic — try English.

Minor detour

After that little excursion from the main event, your brains should have had time to unwind. The problem is that the top line contains too few digits. We need to insert either a leading space or 0 when there is only one digit to print. So in English, if there is only a single digit, insert a leading blank. Now expressed that way the required basic code is easy:

25 IF X<10 THEN PRINT" ";

Note that we need this line to operate before the main print sequence, otherwise the leading blanks would end up as trailing. I hope that an explanation of the semicolon is not required by now. Now the 100 is sticking out a little — a small amount of tidying is needed. I will let you work out that one for yourselves.

For something to while away the long nights, try the same problem with the numbers 1 to 64 in lines of eight and use leading zeros to format the screen neatly. TRS-80 owners may like to key the following. Other micro owners will need a little thought before they attempt it.

Here is the listing for mousetrap — my compliments to a Leeds school and an unnamed pupil.

```
10 CLS:PRINT@10,CHR$(23);"***** MOUSETRAP *****"
15 FORI=1 TO 1000:NEXTI
16 PRINT@896,"DO YOU WANT INSTRUCTIONS?"
20 M$=INKEY$:IF M$=""THEN20
30 IF M$="Y" GOSUB 370 ELSE IF M$<>"N" THEN 16
40 DEFINT A-Z:W=9999
```

```
 50 R=0:CLS:V=0: FOR X=0 TO 127:SET(X,0):SET(X,47):NEXT X
 60 FOR Y=0 TO 47:SET(0,Y):SET(127,Y):NEXT Y
 70 FOR X=0 TO 8:SET(X,5):NEXT X
 80 X=RND(126):Y=RND(46):A=1:B=1:M=RND(126):N=RND(46)
    :SET(M,N):Z=126:D=46
 90 P=X:Q=Y
100 IF X>9 OR Y>5 THEN J=0 ELSE J=J+1:IF J=25 THEN 280
110 G=PEEK(14400):IF G AND 121 THEN220
120 V=V+1:PRINT@120,V;:SET(X,Y):IF POINT(X+A,Y+B)THEN 130 ELSE
    X=X+A:Y=Y+B:RESET(P,Q):SET(X,Y):GOTO090
130 A1=A:A2=B:RESET(X,Y):IF POINT(X,Y+B)THENB=-B
140 IF POINT(X+A,Y)THEN A=-A
150 IF NOT POINT(X+A,Y+B) THEN100
160 A=-A1:B=-A2:IF NOT POINT(X+A,Y+B) THEN100
170 A=A1:B=A2: IFNOT POINT(X+A,Y)THENX=X+A:GOTO100
180 IF NOT POINT(X,Y+B) THEN Y=Y+B:GOTO100
190 IF NOT POINT(X-A,Y)THENX=X-A:GOTO100
200 IF NOT POINT(X,Y-B)THENY=Y-B:GOTO100
210 R=1:GOTO280
220 IF G AND 64 THEN IF M<Z THENM=M+1:SET(M,N):GOTO260
230 IF G AND 16 THEN IF N<D THENN=N+1:SET(M,N):GOTO260
240 IF G AND 8 THEN IF N>1 THEN N=N-1:SET(M,N):GOTO260
250 IF G AND 32 THEN IF M>1 THEN M=M-1:SET(M,N)
260 IF G AND 128 THEN RESET(M,N)
270 GOTO120
280 FOR B=1 TO 8
290 PRINT@800,"--GAME OVER--";:FOR X=1 TO200:NEXTX
300 PRINT@801,"                 ";:FOR X=1 TO 200:NEXTX:NEXT B
310 CLS:PRINT@10,CHR$(23);"***** MOUSE TRAP *****";
320 IF R=1 THENPRINT@132,"BOUNCING DOT COULD NOT MOVE!  -2000
    PTS PENALTY";V=V+2000
330 PRINT@458,"YOUR SCORE";V;:PRINT@522,"BEST SCORE";
340 IF V<W PRINT" YOURS";:W=V ELSE PRINTW;
350 PRINT@900,"PRESS ENTER TO CONTINUE"
360 IF PEEK(14400) AND 1 THEN 50 ELSE 360
370 CLS:PRINT@21,"***** MOUSE TRAP *****":PRINT
380 PRINT"THE OBJECT OF THE GAME IS TO TRAP THE BOUNCING DOT
    IN THE   TOP LEFT HAND CORNER OF THE SCREEN"
390 PRINT"IF THE DOT HITS A WHITE LINE IT WILL BOUNCE
    OFF IT. TO DRAW THE   LINES USE THE FOUR KEYS MARKE
    D [ ";CHR$(92);CHR$(93);CHR$(94);
400 PRINT"THESE KEYS WILL DRAW A LINE IN THE DIRECTION
     INDICATED ON THE KEYTOPS"
410 PRINT"IF THE DOT CANNOT MOVE THE GAME WILL END AND YOU
    WILL RECEIVE A PENALTY OF 2000 POINTS."
420 PRINT"TO ERASE A LINE OR MOVE WITHOUT DRAWING A LINE HOLD
    DOWN THE    SPACE BAR & AT THE SAME TIME PRESS THE
     APPROPRIATE ARROW KEY."
430 PRINT"THE STATIONARY DOT WHICH APPEARS IN A RANDOM PLACE
    ON THE SCREEN AT THE START OF PLAY INDICATES THE STARTING
    POSITION OF YOUR   LINE."
440 PRINT@980,"PRESS ENTER TO PLAY";
450 IF PEEK(14400)AND 1 THEN RETURN ELSE450
```

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Labour-saving solution

JERRY HUDSON'S piece — January 1981 — giving a machine-language method of defining inverse-field characters for the Sorcerer, states that this facility "can be achieved ... by laboriously defining each user-defined key with its inverse field counterpart". I suggest that the following Basic solution is far from laborious, and is more easily integrated into a Basic program writes Tom Baldwin of Le Chesnay, France.

To invert the standard graphics on the user-defined graphics keys:

```
10 FOR I = —1024 TO —513:POKE I + 512,
255—PEEK(I) : NEXT
```

To invert the upper-case alphabet on the user-defined graphics keys:

```
10 A$ = "A*B*C*D*E*F*G*H*I*J*K*L*M*
   N*O*P*Q*R*S*T*U*V*W*X*Y*Z*"
20 FOR I = 1 TO LEN(A$) —1 STEP 2
30 A = ASC(MID$(A$, I + 1))*8—2048 :
   B = ASC(MID$(A$,I))*8—2048
40 FOR J = 0 TO 7 : POKE A + J,255—PEEK
   (B + J) : NEXT : NEXT
```

A word of explanation: the string A$ consists of pairs of characters. The first of each pair is the character to be inverted, the second to each pair — * in the example — is the graphic character which will display the inverted character. This method is very flexible. A$ can be filled with any combination of characters to give any inverted character on any key.

A further example — to invert the digits 0 to 9:

```
10 A$ = "0*1*2*3*4*5*6*7*8*9*"
```

Shorter converter

I WAS reading the January 1981 issue of *Practical Computing* when I discovered the Decimal to Hex converter on page 114, writes Roger Moffatt of Belfast.

I would like to submit this much shorter version which was written for a RML 380-Z, and should run on any machine with good string handling.

```
 999 REM***DECIMAL TO HEX SUB-
     ROUTINE BY R.MOFFATT
1000 FOR N = 1 TO 4
1010 H = D — 16 * INT( D/16 )
1020 D = INT( D/16 )
1030 HEX$ = MID$ (" 0123456789ABCDEF
     ", H + 1 , 1 )
1040 TOTAL$ = HEX$ + TOTAL$
1050 NEXT N
1060 RETURN
```

In the subroutine the decimal number to be converted is put into D before the routine is called; the result is outputted in TOTAL$, e.g.,

```
10 INPUT " DECIMAL NUMBER TO BE
   CONVERTED (0-65535)";D
20 GOSUB 1000
30 PRINT " HEX EQUIVALENT IS....";
   TOTAL$
40 END
```

For all users of systems based on the Z-80 chip, Z-80 Zodiac offers an opportunity to have programs and ideas published. We pay at least £5 for each contribution used.

Multiplication routine

FOLLOWING the note from Dominic Dunlop, January 1981, I developed this multiplication routine, writes G A Wooster of Cambridge. It takes an unsigned 16-bit number in the BC register-pair and multiplies it by an eight-bit unsigned number in the A register. The 24-bit product is left in H,L&D; the carry problem is avoided. The listing is at the foot of this page.

Using ZEAP 1.1 on my Nascom 2, I cannot assemble listings containing relative jumps to a named routine as shown in Dunlop's program. Am I doing something wrongly or is the ZEAP incomplete? For example, if in line 90 of my program, JR NC SHIFT is written, it gives "Error 23" "Truncation Error" or assembly.

Automatic pilot

IF YOU have ever wanted to switch-on your computer, press the cassette-play button and let the machine continue by itself, assuming you do not have a disc drive, then this is the program for you writes L D Howe of Bristol.

More realistically, it allows any beginner to operate the computer, for instance, to run a games or teaching program, unsupervised and without first learning the commands and other details necessary to have the program up and running from switch-on.

It can be incorporated within any other program by starting the main program at line 1000. The whole program is then saved by typing 'RUN', starting the cassette recorder, in record mode, and then hitting return.

On completion, the VDU announces, "Break in 240", the recording is then stopped. The program records on to the tape, not only the file itself, but also the commands necessary to initialise the computer, load the file and run the program, starting at line 1000. The only instructions that have to be given to a complete beginner are to switch-on and press the cassette play button.

The program can then give any other instructions necessary as and when they are required. Of course, the computer must be able to accept a tape input on switch-on for the program to work.

The program is written in Nascom ROM Basic, version 4.7, a dialect of Microsoft, and runs on a Nascom 2, using the Nas-Sys 1 monitor. As written, it occupies less than 800 bytes. Table 1 lists the variables used and table 2 the routine/subroutine index of first lines.

PR$ is included to ensure that each command starts a new line, allowing sufficient time for a return to be executed and any error messages etc. The following notes on the listing will be helpful, particularly to those with other types of machine.

10 — string space of 100 characters is sufficient.

20 — allows variables to be dimensioned, unnecessary here, but good practice after CLEAR.

110 — 'J' is the Nas-Sys command for a Basic cold-start. If your machine cold-starts in Basic on switch-on, then lines 110-120 may be omitted.

140 — extra delay to allow the machine to reach Basic command level.

170 — the file identity, "A", may be changed or omitted, but if included, it must match line 190.

600 — sends the decimal number 13, ASCII code for RETURN, to port 1. Different machines use differing instructions for this operation.

610 — delay suitable for 1,200 baud operation with a 4MHz clock. Adjust to suit your system, e.g., — 300 baud/2MHz — FOR I = 0 TO 800.

830 — see 600, but substitute X for 13.

840 — see 610.

1000 — this sets the print-head to column 20, line 7. Other machines use different commands for this.

1040 — clears screen. PRINT CHR$(12) works here on most machines.

1050 — in a real program, this would be the start.

(continued on next page)

Multiplication routine

```
IC0B 3E64     0010          LD    A 100     ; MULTIPLIER
IC0D 011027   0020          LD    BC 10000  ;  MULTIPLI-
                                               CAND
IC10 CD141C   0030          CALL  DBMULT    ; DOUBLE
  BYTE MULTIPLY
IC13 E7       0040          RST   #20       ; TO DISPLAY
  RESULT (ON NASCOM)
IC14 210000   0050 DBMULT   LD    HL 0      ; ZERO
  REGISTERS (WITH NASSYS)
IC17 54       0060          LD    D H       ;
IC18 1E08     0070          LD    E 8       ; SET NUMBER
                                              OF LOOPS
IC1A CB3F     0080 LOOP2    SRL   A         ;
IC1C D2201C   0090          JP    NC SHIFT  ; TEST LSB
  OF MULTIPLIER
IC1F 09       0100          ADD   HL BC     ; AND IF
  ZERO, SKIP ADD
IC20 CB1C     0110 SHIFT    RR    H         ; MOVE
  PRODUCT ONE PLACE TO
IC22 CB1D     0120          RR    L         ; RIGHT IN
  READINESS FOR
IC24 CB1A     0130          RR    D         ; NEXT LOOP
IC26 1D       0140          DEC   E
IC27 C21A1C   0150          JP    NZ LOOP2  ; LAST TIME?
IC2A C9       0160          RET
```

(continued from previous page)

Lines 1000 — 1040 are just one simple method of instruction the operator.

Table 1 — variables used.

OP$ — output string for writing to tape.
PR$ — pre-string header.
PP$ — clear screen string.
X — numerical value of current character being written.
I,J — loop counters.

Table 2. Routines/subroutines.

10 — initialisation.
100 — dump; saves the file and commands.
400 — set variables.
600 — return and delay:prints 'RETURN' and allows time to process this.
700 — output string and clear screen.
800 — output string: writes command to tape.

```
   9 REM *** program name ***
  10 CLEAR 100
  20 RUN 100
  99 REM *** dump ***
 100 GOSUB 400
 110 OP$ = "J"
 120 GOSUB 800
 130 GOSUB 600
 140 GOSUB 600
 150 OP$ = CHR$(0)
 160 GOSUB 700
 170 OP$ = "CLOAD" + CHR$(34) +
     "A" + CHR$(34)
 180 GOSUB 700
 190 CSAVE"A"
 200 OP$ = PP$
 210 GOSUB 700
 220 OP$ = "RUN 1000"
 230 GOSUB 700
 240 STOP
 399 REM *** set variables ***
 400 PR$ = CHR$(13)
 410 FOR I = 1 TO 8
 420 PR$ = PR$ + CHR$(0)
 430 NEXT
 440 PP$ = CHR$(12)
 450 RETURN
 599 REM *** return & delay ***
 600 OUT 1,13
 610 FOR I = 0 TO 400
 620 NEXT
 630 RETURN
 699 REM *** O/P & CLS ***
 700 GOSUB 800
 710 OP$ = PP$
 720 GOSUB 800
 730 RETURN
 799 REM *** output string ***
 800 OP$ = PR$ + OP$
 810 FOR I = 1 TO LEN(OP$)
 820 X = ASC(MID$(OP$,I))
 830 OUT I,X
 840 FOR J = 0 TO 10
 850 NEXT
 860 NEXT
 870 GOSUB 600
 880 RETURN
 999 REM *** main program ***
1000 SCREEN 20,7
1010 PRINT "Stop tape."
1020 FOR I = 0 TO 5000
1030 NEXT
1040 CLS
1050 END
```

Ticker tape

I HAVE been working on a control and display problem, writes Jeff Tock of Bishop Auckland, County Durham. In the course of that work, I wrote a little program to display some information ticker-tape style, i.e., with the string of characters apparently moving on a closed, endless track.

The program is for a Nascom 2 and the program will obviously translate easily to other equipment with memory-mapped displays. To save memory space in working programs, I do not document subroutines, relying on the filed sample routine being available.

Here is also a dump of the machine-code routine which was generated by the Poke and Doke instructions.

```
20 REM        'TICKER TAPE'
30 REM   routine for T.V. display
40 REM          NASCOM 2
60 REM   J.TOCK     29/12/80
110 REM      demonstration program
120 REM using ticker tape routine
140 PRINT CHR$(12):REM   clear screen
141 C=17:REM             set column
142 R=4:REM              set row
150 PRINT "Input a string of characters"
160 INPUT"of your choice";N$
170 SCREEN C,R
171 PRINT N$
172 GOSUB 200
173 GOSUB 500
180 Z=USR(0)
190 GOTO 180:REM        infinite loop
200 L=1993+C+(64*):REM  calc.memory location
210 R=L+LEN(N$):REM  take length into account
220 S=200:REM        controls speed
230 RETURN
510 REM       USRLOC       address
530 DOKE 4100,3200
910 REM       USR          routine
1000 POKE 3200,33
1010 DOKE 3201,L
1020 DOKE 3203,12926
1030 DOKE 3205,3237
1040 POKE 3207,14
1050 POKE 3208,(R-L)
1060 DOKE 3209,32291
1070 DOKE 3211,30507
1080 DOKE 3213,8995
1090 DOKE 3215,-15859
1100 DOKE 3217,3210
1110 DOKE 3219,-23238
1120 DOKE 3221,11020
1130 POKE 3223,119
1140 POKE 3224,6
1150 POKE 3225,S
1160 POKE 3226,14
1170 POKE 3227,S
1180 DOKE 3228,-15859
1190 DOKE 3230,3228
1200 DOKE 3232,-15867
1210 DOKE 3234,3226
1220 POKE 3236,201
1230 RETURN
1300 REM T 0C80 0CA5
1310 REM   0C80 21 DA 08 7E 32 A5 0C 0E
1311 REM   0C88 06 23 7E 2B 77 23 23 0D
1312 REM   0C90 C2 8A 0C 3A A5 0C 2B 77
1313 REM   0C98 06 C8 0E C8 0D C2 9C 0C
1314 REM   0CA0 05 C2 9A 0C C9 20 00 00
```

Making music

THIS PROGRAM allows the user to produce music using the ZX-80, writes David Harris of Pinner, Middlesex. There is no need for any extra hardware as the sound can be amplified by plugging a cassette recorder or amplifier into the SAVE socket. Users will be familiar with the supercharged bumble-bee sound programs make. That can be organised by a machine-code routine to produce a steady note.

The subroutine listed must be GOSUBed at the very first line of your program. Any time after that, two pieces of information need to be provided before the machine code which has been set-up can be used. The first is the number of cycles the note lasts. The bigger the number, the longer the note lasts.

The second is a delay between each peak of the wave. The bigger that is, the longer the wave length, the longer the time between peaks and the lower the pitch of the note. The program is capable of playing a limitless number of notes one after another. It is possible to make it play one note, return to Basic, set-up another note and return to the machine-code routine. However, the long time taken by Basic produces a click and sounds terrible. Therefore, many notes can be placed one after the other in the array B as follows.

```
B(0)   Length of first note
B(1)   Frequency of first note
B(2)   Length of second note
B(3)   Frequency of second note
. . .   .   .   .   .
. . .
B(n)   Dummy length of 0 to terminate routine
```

B should be DIMensioned at line 1010 to accept the maximum number of notes you will put in it. Remember the dummy last note when you do it.

As a rough guide, frequency of 255 gives a real frequency of 500Hertz. Be careful not to make the length 0 or very high as you will have to wait a long time — the routine cannot be stopped by BREAK.

I have found that if the television is plugged-in, there is a loud humming on top of the music. If you have that problem, it can be cured by half pulling-out the connection at the back of the computer, so that the signal line is connected but the screening is not.

The Basic routine at 1000 returns the address to use in the USR command in P. Therefore, to produce a note, use the command USR(P) as shown. Here is the routine to include in your program and call on the first line:

```
1000 DIM A(23)
1010 DIM B(However much you need)
1020 LET P = 2 + PEEK(16392) + PEEK
     (16393)*256
1030 LET A(0) = 2090
1040 LET A(1) = 4416
1050 LET A(2) = 26
1060 LET A(3) = 6425
1070 LET A(4) = 6891
1080 LET A(5) = 4975
1090 LET A(6) = 26394
1100 LET A(7) = —14155
1110 LET A(8) = 6675
1120 LET A(9) = 7730
1130 LET A(10) = 4928
1140 LET A(11) = 12826
1150 LET A(12) = 16415
1160 LET A(13) = —194
1170 LET A(14) = —45
1180 LET A(15) = 19437
1190 LET A(16) = 16414
1200 LET A(17) = 30731
1210 LET A(18) = 8369
1220 LET A(19) = 11259
1230 LET A(20) = —19076
1240 LET A(21) = —4064
1250 LET A(22) = 6163
1260 LET A(23) = 218
1270 RETURN
```

Here is an example to produce two different notes:

```
10 GOSUB 1000
20 LETB(0) = 255    ; Length first note
30 LET B(1) = 100   ; Frequency, reasonably
                      high
40 LET B(2) = 1000  ; Length of second note
50 LET B(3) = 200   ; Frequency of second
                      note — lower than first
60 LET B(4) = 0     ; Dummy to return to
                      Basic
70 LET Z = USR(P);  Call routine — Z is not
                      used but makes the
                      syntax correct
80 GO TO 70         ; Repeat
```

Simpler inverse graphics

AN EASY method for obtaining inverse graphics or text in print statements has been written by David Bailey of Leeds, West Yorkshire. It is quite simple, he writes, and slightly less tedious to enter than the method given in February 1981 by Richard Wildash.

```
  10 PRINT "ANY TEXT GRAPHICS OR
     SPACES" rest of program
 999 STOP
1000 FOR A = 16428 TO 16454
1010 POKE A,PEEK(A) + 128
1020 NEXT A
```

Run the program by RUN 1000. That should result in a blank screen with 0/1020. If the listing is returned to the screen the text in line 10 will be in inverse characters.

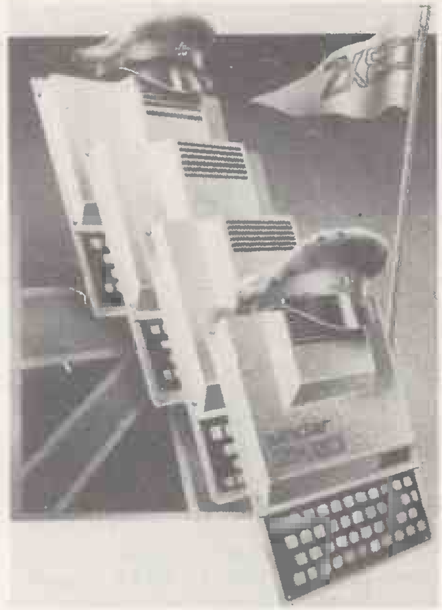
The routine can be easily modified to cope with longer print statements by counting the number of characters and spaces between the quotes in the print statement and extending the FOR — NEXT loop to suit. Remember that 16428 is the location in RAM of the first character after the quote in the print statement.

The print statement to be modified must always be the first line in the program but, of course, by editing, the whole line can be re-numbered and the whole line or parts of it can be used elsewhere in the program. After use, lines 1000 to 1020 should be deleted.

Cricket computer

WHEN YOU run this cricket program, the computer tells you the name of the game and who is battling, writes Sean Clark of Wormshill, Kent. You tell it to bowl by pressing New line. By this time, the computer has prepared your score and decided how many runs you are going to have this bowl. It is now waiting for an input (A$).

When you press New-line, the screen



will go blank for a certain length of time — while the computer goes through loop D. When the screen goes back on, nothing will appear to have changed but you are being timed.

You must wait about one second before pressing New-line. If you wait more than 1.3 seconds, you will automatically be out. If you take between 0.9 and 0.8, you will win two runs, if you take between 0.8 and 0.7, you will hit 1 run and if you take less than 0.7, you will win no runs.

If you have been caught or stumped, you will obviously be out. The computer will tell you how many runs you have unless you were out — in which case it will have told you — and your score. Again it is waiting for an input (A$).

If you are still in, it will return to the beginning. On that input, you may also retire by pressing S and New-line. If you are out, the computer will tell you that it is batting, and ask you to bowl. When you press New-line the computer goes through loop F, and tells you the result of the game.

```
5 REM CRICKET
10 PRINT "THIS IS CRICKET."
20 PRINT
30 PRINT
40 LET Y=0
50 LET I$="FOR ME"
60 LET H$="YOU ARE"
70 LET Z=-1
80 LET X=RND(8)
90 PRINT H$;"IN BAT"
100 PRINT "PRESS NL.";I$;"TO BOWL"
110 INPUT A$
120 IF Z>-1 THEN GOTO 600
130 FOR D=1 TO RND(2000)
140 NEXT D
150 POKE 16414,0
160 POKE 16415,0
170 INPUT A$
180 CLS
190 LET A=PEEK(16414)
200 LET B=PEEK(16415)
210 LET C=(B*256+A-4)*20
220 IF C>1300 THEN GOTO 500
230 IF X>6 THEN GOTO 500
240 IF C<900 THEN LET X=2
250 IF C<800 THEN LET X=1
260 IF C<700 THEN LET X=0
270 PRINT X;"RUNS"
```

(continued on next page)

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```
280 LET Y=Y+X
300 GOTO 550
500 PRINT"YOU'RE OUT."
510 LET H$="I AM"
520 LET I$=""
530 LET Z=Z+1
550 PRINT"SCORE:";Y
560 INPUT A$
570 IF A$="S" THEN GOTO 510
580 IF H$="I AM" THEN GOTO 90
590 GOTO 80
600 FOR F=1TO100
610 LET G=RND(7)
620 IF G=7 THEN GOTO 645
630 LET Z=Z+G
640 NEXT F
645 CLS
646 IF Z>Y THEN LET J$="I WIN"
647 IF Z=Y THEN LET J$="A DRAW"
650 IF Z<Y THEN LET J$="YOU WIN"
660 PRINT "I HAVE";Z;"RUNS"
670 PRINT "YOU HAVE";Y;"RUNS"
680 PRINT J$
```

Task master

THIS program gives a test on any information, such as French verbs, vocabulary, historical dates, multiplication tables, etc., which can be set out in two parallel columns, writes D M Bennion of Wolseley Bridge near Stafford.

It achieves considerable economy by using dummy string variables, which are POKEd to their correct values. Taking as an example the French prepositions *de*, of, *par*, by, *sous*, under, *sur*, on, *avant*, before, the program works like this:

On being RUN, it asks first for the number of entries, in this case 10. The words are then typed in the order shown. The screen then displays the words in two columns. Type a number, and the computer gives a test, choosing words from the first column at random — but choosing each only once.

A correct answer gives the response right, a wrong one, try again. If a second wrong answer is given, the correct answer is displayed. At the end, a score is given. The test can be saved on tape, and started again by GOTO 20.

Even in 1K of RAM, a reasonable amount of space is available for data. About 185 characters can be typed in 12 entries, decreasing by about six per two extra entries, to about 150 in 24 entries.

If the shorter version of lines 45 to 64 is used, those figures are increased by about 25. Should the screen not show all the data, space may be made for about 50 more letters in the following way. Delete lines 1 to 14, correct line 22 to 'PRINT A$;' and subtract 104 from each of the addresses in lines 24, 25, 28, 45, 46 and 47.

The resulting program can be saved in the normal way, but must always be started by GO TO 20, never RUN. The program must be entered exactly as listed.

```
1 PRINT "NO OF ENTRIES"
2 INPUT E
3 IF E >24 THEN GO TO 2
4 DIM U(E/2)
5 CLS
10 FOR J = 1 TO E
11 INPUT A$
12 POKE 16485, PEEK(16485) + 1
13 NEXT J
14 POKE 16485, 38
20 FOR J = 1 TO E/2
21 LET U(J) = 1
22 PRINT A$;
23 LET P = PEEK (16552)
24 POKE 16552, P + 2
25 POKE 16606, P + 1
26 PRINT "=";A$
27 NEXT J
28 POKE 16552, 38
30 INPUT Z
31 LET N = 0
32 LET R = 0
40 CLS
41 LET Q = RND(E/2)*2—1
42 IF U(Q/2 + 1) ≠ 0 THEN GO TO 41
43 LET U(Q/2 + 1) = 0
44 LET N = N + 1
45 POKE 16766, Q + 37
46 POKE 16787, Q + 38
47 POKE 16821, Q + 38
48 LET T = 0
49 PRINT N;".";A$
50 INPUT Y$
51 PRINT Y$
52 IF Y$ = A$ THEN GO TO 59
53 IF T = 0 THEN GO TO 56
54 PRINT "NO,IT    WAS    ";A$
55 GO TO 61
56 PRINT "TRY    AGAIN"
57 LET T = 1
58 GO TO 50
59 PRINT "RIGHT"
60 LET R = R + 1
61 INPUT Z$
62 IF N = E/2 THEN GO TO 64
63 GO TO 40
64 PRINT R;"   OUT   OF   ";N
```

Here is an alternative version of lines 45 to 64, allowing no second attempt at a wrong answer.

```
45 POKE 16759, Q + 37
46 POKE 16780, Q + 38
47 POKE 16803, Q + 38
```

Omit lines 48, 53, 56, 57, and 58 from the program.

If space for data is not at a premium, some lines might be added to give an opinion of the score, such as:

```
65 IF R = N THEN PRINT "EXCELLENT"
66 IF R < N AND R > N—3 THEN PRINT
   "VERY GOOD"
67 IF R < N—2 AND R > N/2 THEN PRINT
   "NOT BAD"
```

I have not included them, because individual opinions of what is good, bad, or indifferent will vary. Their inclusion does not affect any of the addresses PEEKed or POKEd in the main program.

Free movement

AS ON the ZX-80 you cannot move anything, this program enables you to move in any direction and print anything you wish, writes M Dhanda of Slough, Berkshire. First, type-in the direction. They are marked over 5,6,7 and 8.

You do not have to shift and then press those letters — just type 5 for left, 6 for down, 7 for up and 8 for right. Then you type in the code number. This could be any code number which is for graphics.

```
10 LET A=8
20 LET B=1
30 LET W=0
40 LET M=0
50 LET P=0
60 FOR N=1TO512
70 PRINT CHR$(128);
80 NEXT N
90 GOSUB 280
100 POKE W+232,20
110 INPUT C
120 IF C=-1 THEN GOTO 320
130 INPUT D
140 GOSUB 280
150 LET M=W+(A-1)*33+B
160 POKE M,D
170 IF C=6 AND A<11 OR C=7 AND A>1 THEN LET A=A-2*C+13
180 IF C=8 THEN LET B=B+1
190 IF C=5 THEN LET B=B-1
200 LET M=W+(A-1)*33+B
210 POKE M,20
220 IF B=32 THEN GOTO 240
230 GOTO 110
240 PRINT "DO YOU WANT ANOTHER GO?"
250 INPUT A$
260 IF A$="YES" THEN GOTO 10
270 STOP
280 LET P=PEEK(16397)
290 IF P>127 THEN LET P=P-256
300 LET W=PEEK(16396)+P*256
310 RETURN
320 CLEAR
330 LIST
340 STOP
```

Useful oddity

I FEEL that the following oddity might be of some interest to ZX-80 users, writes S McCallum of Watford, Hertfordshire. I discovered that the statement:

LET X = Y = Z

was accepted, as long as Y and Z — which can be expressions, too — had been previously defined. The interesting feature is that the value assigned to X by the expression is:

—1 if Y = Z
and
0 if Y ≠ Z

i.e., X could then be used in a Boolean-type expression, e.g., if X then goto 1000. Taking the case one step further, I discovered that the statement

LET X = Y = Z = A

was also accepted as a valid statement as long as Y, Z and A were defined previously. However, this time, the values assigned to X are:

—1 if Y = Z AND A = —1
or if Y ≠ Z and A = 0
and 0 if Y = Z AND A ≠ —1
or if Y ≠ Z AND A ≠ 0

i.e., A could be a control switch. Again, expressions can be substituted for Y and Z — and A.

Running percentage

ANDREW JONES of Loughborough, Leicestershire has sent us some additions to the program, ZX-80 as a mathematician contributed by Dave Sampson, December 1980. It allows a running percentage to be kept as the program proceeds and allows for an adjustment of difficulty for all ages, he writes.

```
92 PRINT "HARDNESS 1 TO 10"
94 INPUT E
96 CLS
100 LET R = RND(40*E) — (30*(10*E))
290 PRINT "SCORE = ";(W*100)/X;
    "PERCENT"
310 DELETE
```

I would like to submit a pattern-generation program similar to that seen in the ZX-80 brochure. It will fit easily on to the 1K model:

```
10 PRINT "PATTERN GENERATION BY
   ANDREW JONES 10/12/80 "
20 LET Z = RND (5)
30 IF Z = 1 THEN PRINT "THIRTY TWO
   DIFFERENT GRAPHIC SYMBOLS"
40 IF Z = 2 THEN PRINT "ANOTHER
   THIRTY TWO DIFFERENT SYMBOLS"
50 IF Z = 3 THEN PRINT "ANOTHER
   THIRTY TWO DIFFERENT SYMBOLS"
60 IF Z = 4 THEN PRINT "ANOTHER
   THIRTY TWO DIFFERENT SYMBOLS"
70 IF Z = 5 THEN PRINT "ANOTHER
   THIRTY TWO DIFFERENT SYMBOLS"
80 GO TO 20
90 STOP
```

It is also possible to use numbers and letters instead of graphic symbols. If letters are used, it is possible to produce hidden words which must be found, and similarly with numbers.

TANDY FORUM is devoted to the Tandy TRS-80. Sometimes we will use it to pass on news about the TRS-80 but, above all, it is for users, and would-be users, of the well-established model I and now the new model II. With your tips, queries, moans and comments, this page can become a market-place for TRS-80 information.

New-found characters

THOSE WHO have had the lower-case modification installed by Tandy may be interested by the following, writes James Bamber of Doncaster, South Yorkshire. First type in the following program, which runs with or without the upper- lower-case driver program loaded.

```
10 CLS
20 DATA 96, 123, 124, 125, 126, 127
30 A = 15371
40 FOR B = 1 TO 6
50 READ C
60 PRINT "CODE"; C;" = ": POKE A,C
70 A = A + 64
80 NEXT
```

You should see on the VDU screen six characters which are not on the keyboard — the most useful is the £. Not only are they not available via the keyboard but they cannot be accessed by using CHR$ — try it.

To make use of our new-found characters we first have to find the video memory address of the cursor. That is stored in bytes 16416, least significant byte, and 16417, most significant byte.

By converting these bytes from Hex to a single decimal number, we arrive at the address of the cursor. The rest is easy; move the cursor forward a space out of the way, and then poke the code number of the character required into the address we have found.

This subroutine should do the trick.

```
1000 END
1010 REM * SPECIAL CHARACTER POKE
     SUBROUTINE
1020 REM * USES Q1 INTERNALLY —
     INPUT Q
1030 Q1 = PEEK(16417) * 256 + PEEK
     (16416)
1040 PRINT "1 space";
1050 POKE Q1, Q
1060 RETURN

1030 'FINDS CURSOR AND CONVERTS
     TO DECIMAL
1040 'MOVES CURSOR ONE SPACE
1050 'PRINTS CHARACTER
```

To use, initialise variable Q with the code number of the character required. Early in the program, if only one character such as £ is to be used, at the point of use, several characters will be called. Then GOSUB when required, e.g.,

```
10 PRINT "This year's profits are ";: Q = 96
   : GOSUB 1030 : PRINT "100,000. But
   are expected to fall next year by about "
   ;: GOSUB 1030 : PRINT " 10,000, owing
   to the recession."
```

Trial and error

AS A NEW user of the Aculab floppy tape unit, I found I could not use the Tandy re-number program for programs loaded from the unit writes P Errington of Cardiff. Having little knowledge of systems tapes and much less about the machine language involved, it took me some time to think through the problem.

Eventually, after reading the Aculab manual again, I realised that the start address for programs would be altered as the Aculab occupies some of the TRS-80 memory. The manual showed that the new start number was decimal 18437 or 4801H compared to the normal start number of decimal 17129 or 42E9H.

I then devised a short program to Peek the contents of locations 31820 to 32766, which is where the re-number routine is stored, to find those locations which contained the elements of the old start address — the equivalent decimal numbers of 42E9 are 66 and 233.

The short program prints-out those locations where those two numbers are in adjacent locations and also showed me which of the two elements was contained in the lower location number.

```
10 FOR X = 31820 TO 32766
20 IF PEEK (X) = 66 THEN PRINT X,
   PEEK (X), PEEK (X + 1), PEEK (X — 1)
30 NEXT
```

The program showed that the two bytes of the start address are stored at location numbers 31909, 31910, 31999, 32000, 32427 and 32428, and so now all that was necessary was to Poke the new start address numbers which I calculated as 1 and 72 into these locations, as follows:

```
POKE 31909,1
POKE 31910,72
POKE 31999,1
POKE 32000,72
POKE 32427,1
POKE 32428,72
```

With those Pokes complete, I found that the re-number routine, as amended, would deal with programs loaded from the Aculab. Much of this may seem obvious to more experienced programers, particularly those with a knowledge of machine language, but in my case, it was very definitely a case of trial and error.

Efficient conversion

YOU MAY find the following a little more efficient for conversion of decimal to hexadecimal, writes Nigel Dibben of Poynton, Cheshire, than the routine given in the January 1981 issue:

```
10 INPUT "ENTER POSITIVE DECIMAL
   NUMBER";A
20 A$ = ""
30 B = INT (A/16) : C = A—16*B
40 IF C > 9 THEN C = C + 7
50 A$ = CHR$ (C + 48) + A$
60 IF B > 0 THEN A = B: GOTO 30
70 END
```

It is similar to the usual machine-code technique and it is rather more compact than some of the other versions that I have seen.

It is good to see someone publicising the method of using an integer array to store machine code for use in a Basic program, instead of the often-seen technique of pushing the data into a string — a method which is so confusing. Programs containing such strings are not only difficult to understand but can be easily damaged by editing. In addition, the technique is no bar to copying programs.

Talking of copying programs, there seems to be a misapprehension about the meaning of the term back-up. In my opinion, the buyer of software should be able to make as many back-ups of his purchase as he needs — after all, if the original is only able to spawn one copy of itself, it ceases to be an original thereafter. I always keep three copies of regularly-used software:

- Master — the original which is never modified or changed in any way.
- Back-up — a copy of the current version in case that is damaged.
- Current — the day-to-day version.

In one or two cases, I have grouped original versions on a protected master disc to release a spare disc, but only when I know I have back-up copies to hand.

To change the subject, anyone having overheating problems with a TRS-80 could take a hint from the users' group and run their computer and expansion interface on a reduced voltage. Mine now runs at a low temperature on about 160 V AC — two-thirds of the rated supply — from a scrap radio transformer. It is important, by the way, not to reduce the voltage to the video display.

There is a dormant function in TRS-80 DOS Basic which is available in Model 2 and MBasic as INPUT$ (n,f) — INPUT-dollar. That inputs a string of n characters from file f — or keyboard if f is unspecified, there is no echo to the video in that case — into a string variable, e.g.,

```
A$ = INPUT$ (20, # 1)          # is optional
```

That cannot be implemented in Model I with INPUT but can be by using INSTR instead. The following changes need to be made to the NewDOS version of Basic/CMD with a program such as Prozap or Superzap:

Relative file sector 00H, from byte 58H onwards, address 4DFCH. to: 8B 5D.
Relative file sector 0CH, from byte B0H onwards, address 5D8BH, to:
D7 FE 24 C2 30 58 C3 97 61.

Do not make these changes unless you have a spare copy of Basic/CMD available. You may then type a Basic statement such as PA$ = INSTR$(6) to input a six-character password from the keyboard.

Finally, using apostrophes in TRS-80 Basic is not shorthand. Each apostrophe generates three bytes, wherever it is used: 3AH 93H FBH — 93H is the REM token, 3AH is a colon. Each REM uses one byte at the start of a line or two if following a colon at the end of the line.

Random numbers

MANY applications of a computer require it to respond in an unpredictable manner, writes Christopher Willmot of Durham. Often games require an element of surprise or chance, and more serious use in simulations or teaching programs can be enhanced greatly by an element of randomness.

By their nature, random numbers have no pattern. If two random numbers are added together, the result must also be a random number. This algorithm will generate either decimal or Hex numbers depending on whether the decimal flag is set when the subroutine is called. Single characters are maintained by masking the result of the addition with 0F, but random numbers up to 99 or FF can be generated by calling the subroutine twice, shifting one result and combining both using ORA.

The program should be completely portable between 6502 machines and can be located anywhere in memory by modifying the addresses of the random number store, RNDSTO, and the start of the generation table, RNDTAB.

Saving and restoring the registers is included in the subroutine which means that the subroutine can be called at any convenient point in the main program prior to loading RNDSTO into accumulator, X or Y registers.

```
100     48              PHA
101     8A              TXA
102     48              PHA
103     AE 1D 01        LDX RNDSTO,X
106     D0 03           BNE PASS
108     EE 1D 01        INC RNDSTO
10B     BD 1E 01 (PASS) LDA RNDTAB,X
10E     6D 1D 01        ADC RNDSTO
111     29 0F           AND #0F
113     8D 1D 01        STA RNDSTO
116     9D 1E 01        STA RNDTAB,X
119     68              PLA
11A     AA              TAX
11B     68              PLA
11C     60              RTS
11D             RNDSTO
11E-12D         RNDTAB
```

On calling the subroutine, the registers are saved on the stack. The result of the previous run is then loaded into the X register and used to index the loading of another number from the table — line 10B. Both numbers are then added and masked so that selection is limited within the table.

The new result is stored in RNDSTO for later access, and in the used position within the table, thus constantly renewing it. No numbers need be loaded into the store or table initially as a brief run will liberally sprinkle appropriate values in a random fashion.

Observant readers may be tempted to eliminate lines 106 and 108. The precaution was introduced to avoid the possibility of becoming stuck, as would happen otherwise if two 0s were selected consecutively. After many hours of test running, I feel happy to guarantee the effectiveness of this trusty subroutine.

THE 6502 SPECIAL is dedicated exclusively to the exchange of information between 6502 users. It is up to you, the reader, to help establish this page with your ideas, problems and guidance for other 6502 users. Please mark your letters 6502 Special. We pay £5 for each contribution published.

Space savings

IN MOST home micros, memory is limited, writes A H Whitfield of Maidenhead, Berkshire. Here are two ways of saving space in the UK 101 and AIM 65 when PRINTing. It probably applies to most 6502 Microsoft Basics. Quotation marks are unnecessary when followed by RETURN.

A semicolon is necessary only: if the cursor is not to move at the end of a PRINT statement; if two variable labels need separating for identification. So RUNning the following prints two identical lines:

```
10 A=1: B=2: C$="X"
20 PRINT "This is a test";CHR$(A);A;B;
   C$;A;"OK?"
30 PRINT "This is a test"CHR$(A)A;B;
   C$A"OK?
```

Superboard ideas

AT THE END of each line on the screen of the Superboard II, characters are lost, writes Phil Ogden of Halifax, West Yorkshire. The PRINT routine takes care of that automatically, but with POKE, the problem can become more acute — the most common manifestation being the invaders hiding in the undisplayed memory. I suggest two methods to detect that.

DEF FNA(X) = SGN((X — 37 — 32 * INT ((X — 37)/32) + 8) AND 32)

defines a function FNA(X) where X is either a constant or a variable to be tested and is the memory address of the character in question in decimal. If FNA(X) = 0, the character can be seen on the screen. If, however, FNA(X) = 1, the character is not visible, and appropriate action can be taken to bring the character back into sight.

A similar technique is to add guard bands of an invisible character; on the Superboard II, the space code is 32 but the machine also supports another space character with code 96. While both look identical to the observer, the machine knows differently. So, if the routine:

FOR I = 53252 TO 54244 STEP 32 : POKE I, 96 : POKE I + 25,96 : NEXT

is executed. Providing there are no further screen scrolls, by testing the intended position before moving the character by Peeking the intended location for 96, the visibility of the character can easily be determined. That method also has the advantage that a similar test could be made for detecting the top and bottom of the screen.

It is useful to be able to convert the address of a character to the X and Y coordinates from the cursor HOME position (54117) and vice versa. These routines do that.

DEF FNX(X) = X — 37 — 32 * INT((X — 37)/32)

FNX(X) returns the X co-ordinate of the location given as the argument of the function.

DEF FNY(Y) = INT((54114 — Y)/32) + 1

FNY(Y) returns the Y co-ordinate of the location given as the argument of the function.

DEF FNP(P) = 54117 + X — (32 * Y)

FNP(P) returns the location of the character, having stored co-ordinates in variables X and Y. Those variables should not otherwise be used by the program, and the argument P is a dummy argument — not used by the function, FNP(Ø) would work.

Sometimes it would be useful to turn off the display while drawing a picture or a gaming board, and flash the completed board when ready. This machine-code routine will copy a picture drawn in the last 1K of RAM in an 8K system — it will modify easily for other systems — to the screen in an instant. The last 1K must be protected by answering the D/C/W/M ? prompt with 7168.

If, in program development, you use a reference for all pokes to screen, i.e., POKE REF + 287,240, all that needs to be done to draw the picture in the last 1K rather than in the video RAM is to redefine the reference as the original reference minus 46080 and use this routine:

```
0276 A2 00       LDX £00
0278 8D 00 1C    LDA 1C00,X
027B 9D 00 D0    STA D000,X
027E BD 00 1D    LDA 1D00,X
0281 9D 00 D1    STA D100,X
0284 BD 00 1E    LDA 1E00,X
0287 9D 00 D2    STA D200,X
028A BD 00 1F    LDA 1F00,X
028D 9D 00 D3    STA D300,X
0290 CA          DEX
0291 D0 E5       BNE 0278
0293 60          RTS
```

To use, make sure that the last 1K contains space characters — a FOR/NEXT loop should ensure that, draw the required display in the memory. To copy the display to the screen use:

POKE11,118:POKE12,2:X = USR(X)

the machine code is stored in the spare memory locations before the start of the Basic program and is not affected by reset.

Using a similar routine, it is possible to exchange the screen and the bottom 1K —

that gives instant screen change, and is useful for creating explosions by filling one screenful of the standard display, and the other of just white blocks, 161. By exchanging rapidly between the two at the critical moment, a good explosion effect can be achieved with only a minimal amount of machine-code programming.

Again the last 1K of memory must be protected by replying 7168 to the D/C/W/M ? prompt, and the code is stored in the spare memory. The routine is accessed by using:

POKE11,149:POKE12,2:X = USR(X)

Here is the program:

```
0294
0295 A2 00       LDX £00
0297 BD 00  1C   LDA  1C00,X
029A 8D 94  02   STA  0294
029D BD 00  D0   LDA  D000,X
02A0 9D 00  1C   STA  1C00,X
02A3 AD 94  02   LDA  0294
02A6 9D 00  D0   STA  D000,X
02A9 BD 00  1D   LDA  1D00,X
02AC 8D 94  02   STA  0294
02AF BD 00  D1   LDA  D100,X
02B2 9D 00  1D   STA  1D00,X
02B5 AD 94  02   LDA  0294
02B8 9D 00  D1   STA  D100,X
02BB BD 00  1E   LDA  1E00,X
02BE 8D 94  02   STA  0294
02C1 BD 00  D2   LDA  D200,X
02C4 9D 00  1E   STA  1E00,X
02C7 AD 94  02   LDA  0294
02CA 9D 00  D2   STA  D200,X
02CD BD 00  1F   LDA  1F00,X
02D0 8D 94  02   STA  0294
02D3 BD 00  D3   LDA  D300,X
02D6 9D 00  1F   STA  1F00,X
02D9 AD 94  02   LDA  0294
02DC 9D 00  D3   STA  D300,X
02DF CA          DEX
02E0 D0 B5       BNE  0297
02E2 60          RTS
```

Missing points

A FEW points to help Superboard users which Ohio neglected to mention in its manuals, writes C Boyle of Bradford, West Yorkshire.

If the machines crashes, i.e., no response to Break W, try Break M G. If that fails, try BREAK M.A274G.

The key sequence BREAK C A gives you the Basic author's name. A one-line special program — it only fits if PRINT is entered as?

```
10 FOR 2 = 1TO7:FORX = 1TO2:PRINT:
   PRINTTAB(20—X):FORY = 1TO2*X:
   PRINT CHR$(42);:NEXTY,X,Z
```

That will obviously work on almost any machine, CHR$(42) produces a star.

Memory test

THIS program is used to check that the memory on an Acorn system one is working correctly, writes Tony Edgecombe of Abingdon, Oxfordshire. The program checks every bit of each location to make sure that it is not permanently one or nought.

The program is executed from 0040H. It will request the first address of the ram to be tested. That should be entered and terminated with any command key. The end address should then be entered and again terminated with a command key.

If there is a fault in the RAM, the computer will display the message fail otherwise it will display the message pass.

```
0030 00 00 73 77 6D 6D 00 00 'PASS'
0038 00 00 71 77 06 38 00 00 'FAIL'
0040 A2 20          LDX $20
0042 20 88 FE       JSR QDATFET
0045 A2 22          LDX $22
0047 20 88 FE       JSR QDATFET
004A A0 00          LDY $00
004C A9 FF          LDA $FF
004E 91 20          STA (20) . Y
0050 B1 20          LDA (20) . Y
0052 C9 FF          CMP $FF
0054 F0 03          BEQ 03
0056 4C 7A 00       JMP $007A
0059 A9 00          LDA $00
005B 91 20          STA (20) . Y
005D B1 20          LDA (20) . Y
005F F0 03          BEQ 03
0061 4C 7A 00       JMP $007A
0064 A2 1A          LDX $1A
0066 20 A0 FE       JSR COM16
0069 F0 03          BEQ 03
006B 4C 4A 00       JMP $004A
006E A2 07          LDX $07
0070 B5 30          LDA Z X.30
0072 95 10          STA Z X.10
0074 CA             DEX
0075 10 F9          BPL F9
0077 4C 04 FF       JMP RESTART
007A A2 07          LDX $07
007C B5 38          LDA Z X.38
007E 95 10          STA Z X.10
0080 CA             DEX
0081 10 F9          BPL F9
0083 4C 04 FF       JMP RESTART
```

Load routine

THE FOLLOWING routine occupies an essentially free and protected area of RAM from 0235 — 02CD, writes A J Jameson of Muir of Ord, Ross-Shire, and provides the facilities of:

- Preview of tape contents.
- Loading from tape to memory.
- Auto LIST, RUN or STOP at the end of a listing.
- No character masking, therefore, the total range of characters may be loaded — with the exception of the control characters CR/LF.

The program is entered by POKE536,53: POKE537,2. The contents of a cassette may now be previewed. The preview mode is indicated by the presence of a white block in the top right-hand corner of the screen.

If Key 'L' is now pressed, the program will be loaded; Key '0' will exit the routine at any time. Prior to operating the given POKEs, the following instruction must be entered:

1) POKE717,0 Auto RUN
2) POKE717,64 Auto LIST
3) POKE717,26 Auto STOP

The automatic Run, List or Stop at the end of a program Load is dependent on the presence of the OK provided by the UK101 after a SAVE operation, which normally results in the irritating syntax error message. Alternatively, the routine searches for Run which may be produced by an additional software 'patch' when SAVEing programs.

```
0235 JSR  20 B802           Set up key-
                            board address
0238 LDA  AD 00DF           Keyboard port
023B CMP  C9 BF
023D BEQ  F0 16     (0255)  'L' key, load ?
023F CMP  C9 DF
0241 BEQ  F0 62     (02A5)  '0' key, out ?
0243 JSR  20 BE02           Test cassette
                            port
0246 BCC  90 F0     (0238)  Data ready ?
0248 LDA  AD 01F0           Get data
024B JSR  20 2DBF           Display data
024E LDA  A9 A1
0250 STA  8D 36D0           Display block
  indicates preview
0253 BNE  D0 E0     (0235)  Branch always
0255 LDA  A9 5F
0257 STA  8D 1802           Set input vector
                            for load mode
025A JMP  4C 74A2           Basic warm-
                            start
025D LDY  A0 01             Set OK/Run
                            flag
025F JSR  20 B802           Set-up key-
                            board address
0262 LDA  AD 00DF           Keyboard port
0265 CMP  C9 DF
0267 BEQ  F0 3C     (02A5)  '0' key, out ?
0269 JSR  20 BE02           Test cassette
                            port
026C BCC  90 F4     (0262)  Data ready ?
026E LDA  AD 01F0           Get data
0271 CMP  C9 0A
0273 BEQ  F0 E8     (025D)  LF ?
0275 CMP  C9 00
0277 BEQ  F0 E9     (0262)  NULL ?
0279 CMP  C9 0D
027B BEQ  F0 0C     (0289)  CR ?
027D DEY  88
027E BEQ  F0 0A     (028A)  'OK/Run' Flag
                            set ?
0280 JSR  20 C302           Display and
                            store data
0283 CPX  E0 47
0285 BNE  D0 DB     (0262)  Maximum line
                            length ?
0287 LDA  A9 0D             CR
0289 RTS  60
028A CMP  C9 4F
028C BEQ  F0 04     (0292)  '0' ?K
028E CMP  C9 52
0290 BNE  D0 EE     (0280)  'R' ?UN
0292 LDY  AC CD02           Load message
                            pointer
0295 LDA  B9 A5A0           Get character
0298 BMI  30 06     (02A0)  MSB set ?
029A JSR  20 C302           Display and
                            store character
029D INY  C8
029E BNE  D0 F5     (0295)  Get next
                            character
02A0 AND  29 7F             Clear MSB
02A2 JSR  20 C302           Display and
                            store character
02A5 LDA  AD 00DF           Keyboard port
02A8 CMP  C9 DF
02AA BEQ  F0 F9     (02A5)  '0' key still
                            closed ?
02AC LDA  A9 BA
02AE STA  8D 1802           Re-set input
                            vector
02B1 LDA  A9 FF
02B3 STA  8D 1902           Re-set input
                            vector
02B6 BNE  D0 CF     (0287)  Branch always
02B8 LDA  A9 DF             Set keyboard
                            row address
02BA STA  8D 00DF           Keyboard port
02BD RTS  60
02BE LDA  AD 00F0           Test cassette
                            port
02C1 ROR  6A
02C2 RTS  60
02C3 STA  9D CDD3           Display data
02C6 STA  95 13             Store data in
                            input buffer
02C8 INC  EE 0002           Cursor position
02CB INX  E8                Cursor pointer
02CC RTS  60
02CD REM
Message pointer $00 = RUN   — POKE717,0
                $40 = LIST  — POKE717,64
                $1A = STOP— POKE 717,26
```

Character input

THE PROGRAM by Jeremy McGhee to input a single line of text from the keyboard contains a clever idea to do something useful, *Practical Computing* February 1981, but is unnecessary, writes Tim Scratcherd of Darlington.

I resort to machine code/Basic hybrids only when I require to do something which is either too slow or impossible in Basic, and there is a way of inputting any characters into a string using GET$. In its simplest version, the subroutine is:

```
 10 PRINT " ";
 20 B$ = ""
 30 GET A$:IF A$ = "" THEN 30
 40 A = ASC (A$)
 50 IF (A = 13 OR A = 20) AND B$ = ""
    THEN 30
 60 IF A = 13 THEN 130
 70 PRINT A$;
 80 IF A < > 20 THEN 110
 90 B$ = LEFT$ (B$,LEN (B$)—1)
100 GOTO 30
110 B$ = B$ + A$
120 GOTO 30
130 PRINT
```

Text is returned in B$ and the subroutine uses A$ and A as local variables which could be used elsewhere as much.

Line 10 contains an empty string which could be replaced by any kind of query or request for information, with or without a question mark. The character delete works in the usual way, but any other character — text, graphics or control — will be included in the string.

Line 50 disallows a null string or an attempt to delete from a null string. Lines 80-90, having detected a character delete, reduce the string by that character and obtain the next character.

The subroutine has many advantages over input and other uses. Because the cursor control characters can be incorporated into B$, you can draw a little picture on the screen and reproduce it any time very simply by printing B$. Superimposition of a set of subscripted B$ will then give simple animation.

Any characters can be excluded from the string by inserting a line or lines between lines 50 and 60 of the kind:

55 IF A = OR A = ... THEN30

Those of us with old ROMs can use a routine like this to make the keyboard function in the correct typewriter manner, that is, with capitals appearing when the shift key is depressed, and with the string remaining correct. That is done by adding 64 to A to change upper-case to lower, and subtracting 64 from A to change lower-case to upper, and adding those values to B$. Remove line 70 and put it at 85:

85 PRINT A$;

Remove line 110 and substitute:

```
110 IF A > 64 AND A < 91 THEN A =
    A + 64
112 IF A > 128 AND A < 155 THEN A
    = A —64
114 PRINT CHR$ (A);
116 B$ = B$ + CHR$ (A)
```

Even when you have put the awkward characters into B$, there are still problems saving the string in a data file on cassette. If B$ contains a comma or quotation marks, when printing to a file, B$ will be saved up to the comma, and then you will have an extra ignored error.

The solution is to substitute into the string some other arbitrary character whenever awkward punctuation is encountered. That is done in a similar manner to changing upper- and lower-case. Remove line 70 and put it at 85 as shown, then remove line 110 and substitute:

```
110 PRINT A$;
112 IF A = 34 THEN A = 42
114 IF A = 44 THEN A = 43
116 B$ = B$ + CHR$ (A)
```

That will appear on the screen as usual, but B$ will contain an asterisk in place of quotes and a plus in place of a comma. B$ can then be saved on a data file in the usual way. Of course, when the data file is read, they will have to be changed back to their correct characters, as for example:

```
 5 A$ = ""
10 FOR I = 1 TO LEN (B$)
20 A = ASC (MID$ (B$,I,1))
30 IF A = 43 THEN A = 44
40 IF A = 42 THEN A = 34
50 A$ = A$ + CHR$ (A)
60 NEXT I
70 B$ = A$
```

When using a set of subscripted B$, that may take some time, but I find that a small price to pay for a simple, trouble-free method. In use 1, you are of course limited to 255 characters to a string.

I see only one disadvantage with this method of inputting and that is that you lose the cursor. I suppose you could get it back with:

```
30 GET (A$)
32 PRINT CHR$ (160) cursor left CHR$
   (32) cursor left;
34 IF A$ = "" THEN 30
```

but that is bound to play havoc with the length of B$, and there must be a better way.

Word of warning

JONATHAN Dick's routine for dumping the contents of the Pet screen on to the 3022 printer *Practical Computing* October 1980, calls, I feel, for the following warning to be made, writes JM Round of London.

Page 34 of the 3022 manual warns clearly that not more than five lines should be printed in reverse field without the print-head having time to cool. This routine does not take into account the number of reverse-field characters counted in any one line. The user, therefore, should take great care in using it as a burnt-out print-head could easily be the result should a large proportion of the screen happen to be in reverse field.

Graphplot for equations

ONE OF my most-used programs for the Pet is called Graphplot and enables you to plot a graph of any equation you can express in Basic writes Ian Mercer of Loughborough, Leicestershire.

It uses the maximum available resolution — 80 by 50. The program is in two sections. The first inputs the function, checks it for errors then enters it into the program as line 100. The second section from line 100 onwards plots the function over any desired range scaling it automatically to fit on the screen.

The user can then have axes if desired or change the range or start again with a new function. The conversion for old-ROM Pets is included as a REM statement at line 71 to use it convert line 70 to read POKE 525,2:POKE 527,13: POKE 528,13.

```
8 PRINT"                  GRAPH PLOT"
9 PRINT"                  ___________"
10 PRINT"                 BY I.MERCER"
12 PRINT"TYPE IN THE EQUATION"
13 OPEN1,0:PRINT"Y = ";:INPUT#1,A$:CLOSE1:PRINT
22 CC$="↑()+-*/.ABCEGILNOPQRSTX0123456789"
23 Q=0:FORH=1TOLEN(A$):H$=MID$(A$,H,1):I$=MID$(A$,H,3)
24 FORL=1TO33:IFH$=MID$(CC$,L,1)THEN26
25 NEXT:GOTO34
26 IFH$="("THENQ=Q+1
27 IFH$=")"THENQ=Q-1:IFQ<0THEN32
28 IF(I$="SIN"ORI$="COS"ORI$="TAN"ORI$="LOG")ANDMID$(A$,H+3,1)<>"("THEN33
29 IF(I$="EXP"ORI$="ABS"ORI$="ATN"ORI$="SQR")ANDMID$(A$,H+3,1)<>"("THEN33
30 NEXTH
31 IFQ=0THEN40
32 PRINT"BRACKETS MISMATCH PLEASE RETYPE EQUATION":GOTO12
33 PRINT""I$" MUST HAVE ITS ARGUMENT IN BRACKETS":GOTO12
34 PRINT"ILLEGAL CHARACTER :- ";H$;"  PLEASE RETYPE":GOTO12
40 PRINT"WHEN THE GRAPH HAS BEEN DRAWN , PRESS :"
41 PRINT"C TO CHANGE THE EQUATION."
42 PRINT"R TO CHANGE THE RANGE."
43 PRINT"S TO END."
44 PRINT"A FOR AXES."
45 PRINT"PRESS ANY KEY WHEN YOU ARE READY"
46 GETR$:IFR$=""THEN46
47 POKE59409,52
50 PRINT"100 DEFFNA(X)="A$
60 PRINT"RUN100";
70 POKE158,2:POKE623,13:POKE624,13
71 REM FOR OLD PETS USE 525,527,528
80 END
100 DEFFNA(X)=SIN(X)
101 POKE59409,60
105 DIMQ(80)
110 DIMZZ%(15):FORG=0TO15:READZZ%(G):NEXT
120 DATA 32,123,108,98,126,97,127,252,124,255,225,254,226,236,251,160
130 INPUT"STARTING VALUE FOR X";SX
140 INPUT"FINISHING VALUE FOR X";EX
150 XX=ABS(EX-SX)/79
160 SF=79/ABS(EX-SX)
165 PRINT"PLEASE WAIT A MINUTE"
170 M=0:B=0:FORX=SXTOEXSTEPXX:Z=FNA(X):Q(B)=Z:B=B+1
171 IFN>ZTHENN=Z
172 IFM<ZTHENM=Z
173 NEXT:SY=47/(M-N)
180 YF=ABS(INT(SY*N))
190 PRINT""
200 FORA=0TO79
210 Y=Q(A)*SY+YF:X=A:GOSUB10000
220 NEXT
230 GETR$:IFR$=""THEN230
240 IFR$="R"THENRUN100
250 IFR$="S"THENPRINT"":END
260 IFR$="C"THENRUN
270 IFR$="A"THEN500
280 PRINT"PRESS R TO ALTER RANGE, S TO END, C TO CHANGE THE EQUATION, A FOR A
XES"
290 GOTO230
500 IFSX>0OREX<0THEN600
510 X=-SX*SF:FORY=0TO49:GOSUB10000:NEXT
600 IFN>0ORM<0THEN700
610 Y=YF:FORX=0TO79:GOSUB10000:NEXT
700 GOTO230
10000 X%=X:Y%=Y
10005 SC=32768+X%/2+INT(24-Y%/2)*40
10010 DD%=((X%AND1)+1)*((1-(Y%AND1))*3+1)
10020 QQ%=PEEK(SC)
10030 FORJJ=0TO15:IFQQ%=ZZ%(JJ)THEN10050
10040 NEXT:JJ=0
10050 POKESC,ZZ%(JJORDD%)
10060 RETURN
READY.
```

This section is open to the Apple user. In every issue we hope to print ideas, hints and comments about the Apple and its suppliers. They must come from you, so write and tell us what you know.

Determinant evaluation

I AM an electrical engineer and an Apple user writes John Suzin of Paddington, London. Although you have published many useful programs and various tips, the lack of practical mathematical programs has prompted me to submit this short, but nonetheless, fundamental mathematical program for evaluating the numerical value of a determinant.

As that is related closely to a more complex matrix algebra applied to digital computation, it is the matrix algebra which is the basis of numerical solutions of algebraic and differential equations, solutions of networks and so on, and because of shortcomings of micro Basic, the knowledge of the technique of matrix manipulation is indispensable.

The program occupies 4.5Kbyte of memory; line 90 reserves computer memory for a 15 by 15 determinant; lines 160 to 390 will require inputting the order of determinant and its elements and will print the determinant (A,J) in matrix form. For ease of entry and to avoid any mistakes, the rows and columns are indicated in the program.

The evaluation, based on the old, established method of Chio, begins in line 410 which sets in the indices. Since the method begins by division by the element A(1,1), lines 420 to 510 ensure that the element A(1,1) is not 0 even if it is.

If A(1,1) > 0, the program proceeds normally to line 530. If the element A(1,1) = 0, the program branches to line 450 where the second row is subtracted from the first. It depends on the positions of the zeros. There is almost no end to the various precautions one might take to prevent division by zero errors, but they would involve a very much longer program.

Having taken some of the precautions, the loop in line 560 to line 610 will multiply the first row by the first element of the second row and subtract the resultant first row from the second row and repeat it with the second row up to the Nth row of the determinant.

It must be remembered that each operation takes place in a loop and, therefore, the number of successive multiplications and subtraction will be determined by the order of the determinant.

Statements in lines 620 to 640 increase the indices and after repeating the whole process of reduction, the determinant is reduced to a lower order. In line 640, if the last operated element is not the last row element, the whole process is repeated again until L = R, in which case the value of the determinant is given in line 660.

```
30 ? "DETERMINANT EVALUATION"
40 ?
50 ? "COPYRIGHT 1978"
60 ? "BY J.B.SUZIN"
90 DIM A(15,15)
100 ?
160 ?"ENTER ORDER OF
    DETERMINANT";
170 INPUT R
180 IF R=0 THEN END
190 ?
200 ? "ENTER THE ELEMENTS"
210 ?
220 FOR I=1 TO R
230 ? "ROW";I
240 FOR J=1 TO R
250 ?"COLUMN ";J;
260 INPUT A(I,J)
270 NEXT J
280 NEXT I
290 ?
300 HOME:VTAB 5
310 ?"DETERMINANT A(";R;",";R;")"
320 ?
330 FOR I=1 TO R
340 ?
350 FOR J=1 TO R
360 ? TAB(5);A(I,J);" ";
370 NEXT J
380 ?
390 NEXT I
400 ?
410 L=1:K=2:D=1
420 D1=A(L,L) :D2=A (K,L)
430 IF D1 < > 0 then 530
440 IF D1=0 AND D2=0 THEN 490
450 FOR J=1 TO R
460 A(L,J)=A(L,J)—A(K,J)
470 NEXT J
480 GOTO 520
490 FOR I=1 TO R
500 A(I,L)=A(I,L)+A(I,K)
510  NEXT I
520 D1=A(L,L)
530 FOR J=L TO R
540 A(L,J)=A(L,J)/D1
550 NEXT J
560 FOR I=K TO R
570 X=A(I,L)
580 FOR J=L TO R
590 A(I,J)=A(I,J)—A(L,J)*X
600 NEXT J
610 NEXT I
620 L=L+1:K=K+1
630 D=D*D1
640 IF L< R THEN 440
650 D=D * A (R,R)
660 ?"DETERMINANT VALUE= ";INT
    (D * IE3 + .5)/1E3
```

Calendar routine

THIS CALENDAR routine for Apple I and ITT 2020 has been sent to us by Gavin Haines of Hastings, East Sussex. As he points out in the program, if you use it with one of your own routines, be careful to initialise data printers. If your program has READ statements, it could read the wrong data.

```
100  REM
        INITIALIZE
110  SPEED= 255: TEXT : HOME : NORMAL
120  REM

        DIMENSION ARRAYS
130  DIM M$(12),M%(12),J(12),Y%(12),Y1%(12),Y
2%(12),Y3%(12),S%(12)
140  REM M$=MONTHS M%=MONTH CODE J=NO.OF DAYS
 Y%=TOTALS   S%=HTAB VARIABLE
150  REM

        MODULO
160  DEF  FN A(A) =  INT ((A / B -  INT (A /
B)) * B + .05) *  SGN (A / B)
170  REM
        READ IN STRINGS
180 W$ = "SUN MON TUE WED THU FRI SAT"
190 C$ = "  CALENDAR FOR THE YEAR "
200  FOR I = 1 TO 12: READ M$(I),M%(I),J(I):
NEXT
210  DATA   JANUARY,0,31,FEBRUARY,3,28,MARCH,
3,31,APRIL,6,30,MAY,1,31,JUNE,4,30,JULY,6,31,
AUGUST,2,31,SEPTEMBER,5,30,OCTOBER,0,31,NOVEM
B(R,3,30,DECEMBER,5,31
220  REM
        SET UP FIELDS
230  FOR I = 0 TO 6: READ T(I): NEXT
240  DATA  32,8,12,16,20,24,28
250  REM
        MENU
260  HOME
270  PRINT ,"CALENDAR ][" 
280  VTAB 4: PRINT "WOULD YOU LIKE TO:-"
290  PRINT : PRINT
300  PRINT  TAB( 8)"1. LOOK AT A CALENDAR"
310  PRINT : PRINT  TAB( 8)"2. YOUR OWN SUBRO
U]INE"
320  PRINT : PRINT  TAB( 8)"3. END PROGRAM"
330  VTAB 23: HTAB 30: PRINT "WHICH?";: GET A
$
340  IF  VAL (A$) > 3 OR  NOT  VAL (A$) THEN
330
350  IF A$ = "2" THEN S1 = 1
360  IF A$ = "3" THEN  HOME : PRINT "BYE!": G
OTO 1000
370  REM
        START
380  HOME : PRINT "        ";C$;
390  INPUT Y$
400  IF  NOT  VAL (Y$) THEN 380
410 Y =  VAL (Y$)
420  IF Y < 1582 OR Y > 9999 THEN 380
430  HOME : PRINT "        ";C$;Y$
440  REM
        CENTURY AND DECADE
450 C% =  VAL ( LEFT$ (Y$,2))
460 D% =  VAL ( RIGHT$ (Y$,2))
470  IF Z THEN 520: REM  LAST YEAR
480 I = 0
490 I = I + 1
500  REM
        LEAP YEAR?
510  IF Y / 400 <  >  INT (Y / 400) THEN 530
520  IF Y / 4 =  INT (Y / 4) THEN M%(1) = 6:M
%(2) = 2:J(2) = 29
530  REM
        1ST DAY OF THE MONTH
540 Y%(I) = Y + (Y / 4)
550 Y%(I) = Y%(I) + (C% * 6)
560 Y%(I) = Y%(I) + (C% / 4)
570 Y%(I) = Y%(I) + M%(I) + 1
580 Y2%(I) = Y%(I) / 7
590 Y3%(I) = Y2%(I) * 7
600 S%(I) = Y%(I) - Y3%(I)
610  REM
        PRINT HEADINGS
620  VTAB 4: HTAB 20: CALL  - 958: INVERSE :
PRINT M$(I): NORMAL
630  PRINT : PRINT : PRINT  TAB( 10)W$: PRINT

640  HTAB T(S%(I))
650  REM
        PRINT CALENDAR
660  FOR L = 1 TO J(I)
670  IF  POS (0) >  = 33 THEN  PRINT : PRINT
: HTAB 8
680  IF L = 1 THEN  VTAB 9
690  IF L < 9 THEN S$ = "   "
700  IF L > 9 THEN S$ = "  "
710  PRINT S$;L;: NEXT L
720  REM
        GO ON A MONTH
730  PRINT : PRINT
740  VTAB 23: HTAB 10: IF I = 1 THEN  INVERSE
 : PRINT "PRESS ANY KEY FOR NEXT MONTH"
750  IF I = 2 THEN  INVERSE : PRINT "PRESS 'R
ETURN' FOR LAST MONTH"
760  IF I = 3 THEN  INVERSE : PRINT "PRESS 'E
SC' KEY TO END"
770  NORMAL
780  GET A$
790  IF  ASC (A$) = 27 THEN 250
800  REM
        GO BACK A MONTH
810 Z = 0:X =  FRE (0)
820  IF  ASC (A$) = 13 THEN I = I - 2:M%(1) =
 0:M%(2) = 3:J(2) = 28: IF I < 0 THEN I = 12:
Y$ =  STR$ (Y - 1):Z = 1: GOTO 410
830  REM
        END OF YEAR?
840  IF I < 12 THEN 490
850  REM
        GO ON A YEAR
860 Y$ =  STR$ (Y + 1):M%(1) = 0:M%(2) = 3:J(
2) = 28
870  GOTO 410
880  REM

1000 D$ =  CHR$ (4): PRINT : PRINT D$"RUN MEN
U"
2000  REM

2010  REM    IF YOU USE THIS CALENDAR ROUTINE
 WITH ONE OF YOUR OWN PROGRAMS, BE CAREFUL TO
 INITIALIZE DATA POINTERS.

2020  REM   IF YOUR PROGRAM ALSO HAS READ STA
TEMENTS, IT COULD READ THE WRONG DATA.
2030  REM
```

What makes Brainy Bricks run?

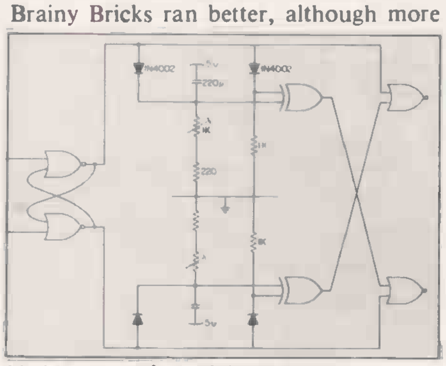
by Nick Smith

THE FASTEST and most impressive mouse at last year's finals was undoubtedly Brainy Bricks. Pete Gissing designed the circuit shown in figure 1 to interface each of a pair of Lego motors and battery boxes to a Kim single-board computer mounted on top.

The circuit has three special features: firstly, it checks the data from the output port to stop the motor from trying to go forwards and backwards simultaneously — that tends to explode transistors. Secondly, it reverses the power supply automatically to the motors for a short time when a drive signal is removed — the 1K pre-sets should be adjusted until the motors stop dead but do not reverse.

Thirdly, the opto-isolator separates the computer power supply completely from the motor supply. That is good design practice as it eliminates a major cause of computer problems. Unfortunately, it also means the circuit will not work using CMOS chips unless a transistor buffer is used on the input to the opto-isolator, as CMOS chips will not sink enough current.

I am told the circuit can handle enough current to drive a small bus — two to three amps — and is, therefore, ideal for small robots of all kinds. The auto-stop facility has, however, some disadvantages. The motors always go at full speed or are stopped. That means that there is little or no possibility of speed control. Brainy Bricks ran better, although more



My interpretations of the control bit.

slowly, with used batteries because there was a tendency for wheel spin with new batteries. No speed control also means that steering is more difficult.

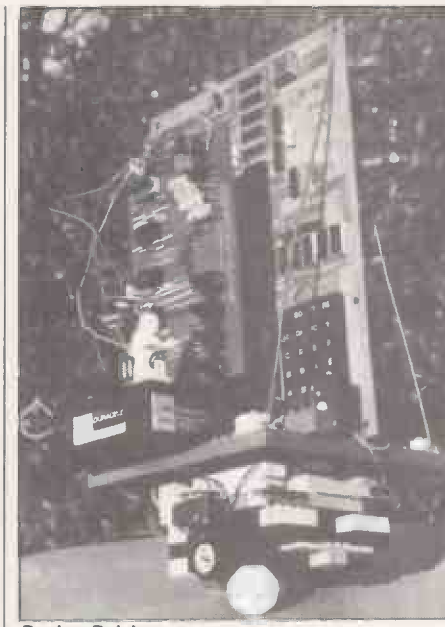
Phil Yeardley — who wrote the Brainy Bricks software — overcame the problem with what he called a nudge routine. Broadly, the idea is full speed ahead on both motors until the sensors indicate impending doom then the nudge routine takes over, stopping the motors and then jiggling the wheels until the sensors indicate it is safe to continue.

For example, in the competition, Brainy Bricks tended to veer to the left. When it hit the left-hand wall, it then stopped. The nudge routine then reversed the right wheel until it was safe to continue, then off it went again. Apparently, there are seven different types of nudge guaranteed to help a mouse out of all kinds of trouble. The danger of a nudge routine is that your mouse might move from one square to another, or turn through 90 degrees, without the main control program noticing.

The only other problem with normal electric motors is that if you switch them on and then off, you do not know how far they have moved — even if they stop instantly. To solve that problem, you need to count wheel revolutions, or parts of revolutions by some other method.

The normal solution is a slotted or banded disc, together with optical sensors. The control program then counts pulses of light or changes from light to dark bands, but beware — the control program must check the sensor more often than it can change, or changes, and therefore distance, will be lost. If the distance sensor is connected to an undriven wheel, most skidding problems will be eliminated.

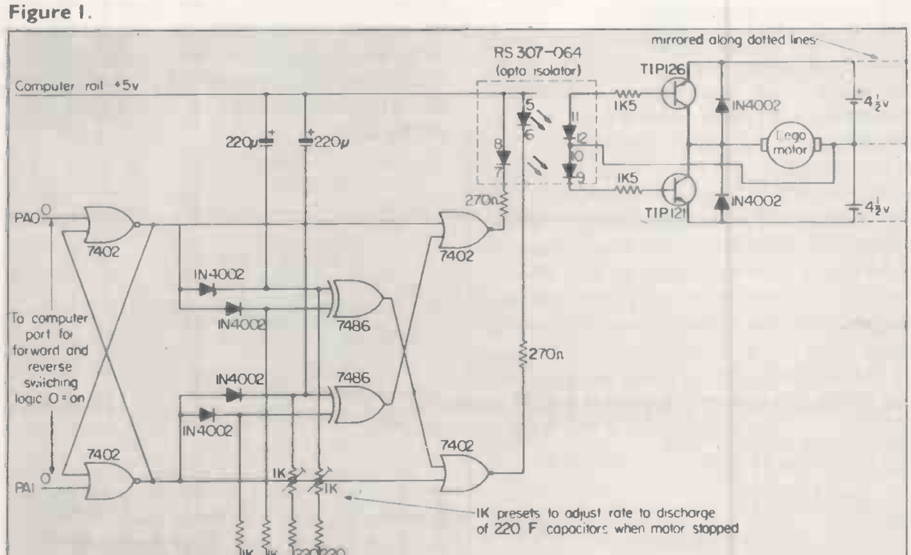
If you do not like that approach, you could use two of my circuits — see *Practical Computing,* Micromouse March 1981 — to control each motor. Motor speed can then be controlled by switching the power supply to the motors on and off. The greater the percentage of time power is supplied, the faster the motors go. Stopping is another problem, of course. If your mouse does not stop quickly enough, you could program your micro to reverse the current to the motors like Brainy Bricks. Do not forget, though, it is easier to adjust a variable resistor than it is to re-program an EPROM. You will of course, still, need a distance sensor and so you could monitor that to discover when you have stopped.


Brainy Bricks

To summarise the major differences: ordinary motors are faster than steppers and/or use much less current. Stepper motors travel in known, fixed increments of distance — if your mouse has not crashed — and do not, therefore, require extra circuitry to calculate distance. Stepper motors need more software to move at all — ordinary motors do not need any — but stepper motors then need less software for steering.

If you have a different approach to motor control, send it to the Micromouse page. It is fascinating to see how different people approach the problem of trading off electronic complexity with software sophistication.

Figure 1.



30 programs for the Sinclair ZX-80-1K

111 pages paperback, spiral bound. Price £6.95 plus postage and packing 50p. Available from Melbourne House Publishers, 131 Trafalgar Road, Greenwich SE10, ISBN 0 86161 100 4.

THE 30 programs are a mixture of 15 games, five programming subroutines, three demonstration programs, three mathematics programs and four teaching programs.

It is difficult to establish at what readership this collection is aimed. The documentation of even the simpler programs is insufficient to enable a complete beginner to enter the program and run it without difficulty.

For example, entering data into an array is simple when you know how, but faced, as in Lunar Lander, with the command: "Enter following values", with no other instructions, results in a string of error messages until the correct procedure is found. The use of I as a variable also is a potential source of confusion — with 1.

Whatever the intended readership, one thing above all is essential in a book of programs and that is accuracy. Of 10 of the shorter programs tested, five either resulted in error codes or produced an erroneous result. For example, in Noughts and Crosses, lines 230-250 produce a subscript outside the range of line 100, and line 130 produces values outside the required range of 29-37.

That subscript failure also occurs in other programs such as Nim. The Chinese Remainder algorithm produces erroneous results for inputs of 315 and 316, which are within the stated limits of the program. Prime Numbers outputs numbers which are not prime — the test on line 150 is the wrong way round. Results like these deterred us from testing the longer programs.

Having pointed-out the pitfalls, it must be said that this book is still a valuable item in the library of ZX-80 users, as it leads to a greater appreciation of the potential programming capabilities of its 1K Basic. The programs included illustrate space compression, the use of Peeks and Pokes, and the use of the USR function to determine how much memory is still available.

It is to be hoped that further volumes of ZX-80 programs will be published, and it would be very interesting, in view of the relatively low cost of additional memory units, to see the volumes extended to cover 2K and upwards applications. It is to be hoped that, in future volumes, care will be taken to check the accuracy of the published program listings.

Conclusions

- **A source book of programming ideas for those users of the ZX-80 who already have a good working knowledge of Basic.**
- **Not recommended for beginners who are unwilling, or unable, to debug the programs.**

L C Thomas

Computer graphics: Infotech state of the art report.

Series 8 number 5, 1980, Charles White, editor, two volumes — invited papers and analysis — 548 pages hardback. £120. Available from Infotech, Nicholson House, Maidenhead, Berkshire. ISBN 8553 9660 1 both volumes.

INFOTECH state of the art reports are too expensive to be bought for most private bookshelves, but they can be found in public libraries and are within the budget of most companies, so it is worth knowing the kind of information they contain.

State of the art reports are always in two volumes. The invited papers are papers given at a recent state of the art conference — since attendance at these conferences costs more than £100 a day, the reports begin to seem good value.

The conference papers are usually supplemented by a number of specially-commissioned papers from authorities on particular topics which, for one reason or another, were not covered adequately at the conference.

Since Infotech has smaller publishing delays than many of the specialised technical journals where these papers might otherwise appear, the invited papers can represent as up-to-date a picture of current work in a particular field as you can obtain anywhere. On the debit side, the papers are still, typically, 12 months old and they will not have been refereed as critically as papers in technical journals, so they may be lower in quality.

The second volume, analysis, is the work of the report editor. It is an introduction to the subject area, and a review and analysis of current experience, problems and solutions. Analysis is constructed by the editor as a discussion between various authors, by extracting relevant paragraphs from the papers in the other volume, supplemented by other material referenced in the bibliography. The editor writes text which links the extracts into a comprehensive whole.

The result, if the editor knows the subject and has the necessary writing skills, is a readable and informative volume arranged so that all the relevant information on each topic can be extracted with minimum effort by the reader. The volume is completed by an annotated bibliography, i.e., references and associated abstracts, and an index.

In general, then, Infotech state of the art reports are a valuable source of information about specialised topics, providing a convenient way of finding your bearings in the subject and extensive papers and references to follow up.

What of this specific report, computer graphics? It is a typical example of the series, competently commissioned and edited. The invited papers cover data management, image processing, standardisation, computer animation, trends, cost-effectiveness, hardware, communications and management. They include the users' views as well as the designers'.

The analysis contains an introduction to the whole subject, and chapters on man/machine interfaces, hardware, software, and applications. There is the usual, excellent bibliography.

Inevitably, the report is a snapshot, a collection of papers reflecting the views, interests, and current activities of 24 individuals early in 1980. Nevertheless, it is a good introduction to computer graphics and although far too expensive for most individuals, it is readily available — free — through your local library.

Conclusions

- **The Infotech state of the art reports are worth investigating if you have an interest in one of their special subject areas — the 1980 series included data communications, microelectronics, office automation, data design, computer graphics, factory automation, life-cycle managemnet, and computer audit and control.**
- **This particular report is up to standard, and is recommended to anyone seeking a picture of current thinking and activity in the field of computer graphics worldwide.**

Martyn Thomas

Infotech state of the art report, Microcomputer Software

Volume 1: analysis and bibliography and Volume 2: invited papers.

TAKEN together, the two volumes comprise approximately 500 pages of text. The first volume, which is slightly shorter than the second, is an edited discussion among microcomputer software experts annotated by the editor, R Dowsing who is a senior lecturer in computing studies at the University of East Anglia.

The discussion is topical and ranges from a review of the current state of microprocessor software to a detailed discussion of microcomputer software development to a look at future trends. The bibliography consists of 20 pages of useful references with short abstracts included for over half of the items listed.

The second volume contains 15 invited papers. Material used in the discussion volume has sometimes been extracted directly from the invited papers. While that makes for some replication of material, it also enables the reader to gain a fuller appreciation of the context in which the original point was made.

Most of the papers are short — only two are more than 20 pages. While brevity alone does not command a paper, it means that people with little time for reading through the volume can easily assess its

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usefulness. Most of the papers are either survey papers or papers of a tutorial nature; and most authors have included references although the quality of these is sometimes uneven.

To give prospective readers a flavour of the second volumes, the topics covered may be summarised as follows:

Surveys of: techniques for software validation, microcomputer database systems, microprogram assemblers for bit-slice processors, microcomputer architectures related to software.

Tutorials on: Structuring Basic software for commercial applications, A simple microprocessor task monitor, Communicating sequential processes, Forth, BCPL, Measures of programmer productivity.

Assessments of: Portability achieved with MicroCobol, Automatic assembler generation, Software used in two Post Office Microprocessor applications, Present micro software and future trends.

Conclusions

- **For those with some knowledge of the field, the first volume represents a useful distillation of microprocessor software folklore and experience.**
- **For such people, the surveys and tutorials of the second volume may be of less relevance.**
- **For the novice prepared to work and follow up the many references, both volumes should be good source books even though some of the material is already becoming dated.**
- **Infotech reports are notoriously expensive; while anyone seriously interested in the development of microcomputer software may wish to consult these volumes for reference, their uneven quality makes the case for individual rather than institutional purchase dubious.**

Cornelia Boldyreff

Computer consciousness: surviving the automated 80s

By H D Covvey and N H McAlister. Published by Addison-Wesley. 212 pages paperback. Price £3.85. Available from any bookseller. ISBN 0 201 01939 6.

THIS BOOK is intended for intelligent readers, possibly professionals in medicine, law or business, who want to learn about computers and automation but who have no desire to enter the computer industry or to learn how to program.

As computer systems become increasingly widely used, an increasing number of people need to understand what the new technology is about — this book should help them.

Without that understanding, people risk being overtaken by more enlightened competitors; they may be exploited by unscrupulous salesmen or ruined by incompetent consultants; they may feel threatened and not know how to fight back.

Knowledge is power, whether you are struggling to retain your company's share in a diminishing market or arguing with the accounts department of a local bureaucracy.

Computer consciousness is an attempt to explain what computers are, how they work and what they can do, in simple terms. The authors are researchers in medical computing, working at the University of Toronto, Canada, and Toronto General Hospital.

This book is not another set of predictions of the likely impact of microprocessors on society — it is more useful than that. It is a genuine overview of computers, computer systems, software and communications for the interested and intelligent outsider.

Reading the book will not make anyone a computing expert, but it will certainly help the layman to understand the potential of computer systems and their limitations, the possible benefits and the likely costs.

Also, and importantly, the reader will learn about the jargon which can be so intimidating until you realise how trivial and ill-formed most of it is.

Much of the ground covered by the book is included in computer awareness courses in enlightened secondary schools. Nevertheless many teachers, faced with the imminent arrival of a microcomputer, will find a valuable and inexpensive introduction to what may be an unknown subject.

The business user too, will find the book a useful alternative to the wide range of material published. There are omissions, inevitably, and the emphasis is almost wholly on computers as free-standing systems rather than as embedded components providing flexible control elements in automatic machines and instruments.

Even so, *Computer consciousness* provides a useful, readable and inexpensive overview, just as the authors intended. Readers looking for a more radical and polemical introduction to the subject, are strongly recommended Theodor Nelson's book *Computer lib*, ISBM 0 89347 002 3.

Conclusions

- **Recommended to complete newcomers to computing who want an overview of computer systems, hardware and software, communications, applications, risks and benefits.**

Martyn Thomas

Pascal programming structures: an introduction to systematic programming.

By George W Cherry. Published by Reston Publishing Company, Inc, a Prentice-Hall Company, at $8.40 paperback, $11 cloth, 1980.

IT IS an excellent introductory textbook on Pascal programming written by psychologist and computer scientist, George W Cherry. The constructs of the Pascal language are nicely developed by Cherry as a vehicle for his introduction to systematic programming.

The text which is devoted to presenting the language is very clearly written and Cherry takes great pains to equip the reader with a carefully-developed model of how the language is compiled and programs are executed.

His explication of Pascal syntax is particularly thorough. Cherry points out in his preface:

> It is gratuitous frustration for a student to wrestle with a malfunctioning program because his textbook failed to elucidate some syntactical banana peel it's easy to slip on.

The author appeals to both the proposed British Standards Institution/International Standards Organisation draft standard and the *de facto* standard of Jensen and Wirth. In asides, he interjects comparisons with the U.S. Department of Defence-sponsored language, Ada.

In the programming sections, Cherry warns against the dangers of "side-effects", advocates "information hiding" and shows how to control "power of access". The programming examples derive from problems in fields as diverse as chemistry, psychiatry, information theory and typesetting. In fact, the author prepared the book himself on his personal microcomputer.

Occasionally, the author's style jars; for example, consider:

> Before we describe these new facilities, let's motivate their introduction.

My only major criticism of the book is that in some of the example programs, the rigour advocated in the text is not apparent. For example, Cherry's use of subrange data types does not always reflect characteristics of the data.

Cherry is better at describing the syntax of Pascal with the aid of Extended Backus Naur Form than the semantics. He confuses pragmatic issues with semantic ones. Lay-out of programs may make the semantics clearer but it is certainly not a semantic issue. Perhaps it is because we are still lacking in a popular, widely-known and conveniently-used notation for describing semantics that the book fails in this area.

Those are small points and in no way would I wish to deter readers from what is one of the most accessible books on Pascal.

Conclusions

- **An excellent text on Pascal programming which gives readers a firm grounding in principles.**
- **The book is an ideal introduction to the more advanced textbooks written on programming by Wirth, the inventor of Pascal.**
- **Highly recommended for self-study by the hobbyist who wishes to learn Pascal for "cultural reasons" and who should find its informal style a welcome relief from the more academically-orientated textbooks.** *Cornelia Boldyreff*

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Solutions which reveal elegant face of recursion

NO DOUBT the title of Boris Allan's article about recursion, *Recursion is highly wasteful and seldom truly needed*, in the December 1980 issue was intended to be inflamatory, and I certainly found it so as an admirer of recursive algorithms.

I thought, however, that I would have to concede that recursion is wasteful in some cases if a large stack is generated, but his most ingenious algorithm for the Towers of Hanoi problem made me think and do some tests which showed this not to be the case in realistic situations. I now stand an even firmer advocate of recursion.

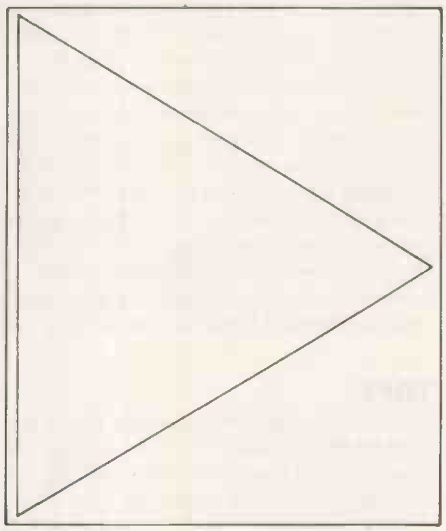


Figure 2.

Recursion is implemented by pushing return address and local variables on to a stack, so it can always be implemented in Basic using an array and some statement such as GOTO N where N is a variable or ON I GOTO for the return. I take it that Allan classes this kind of solution as recursive and thinks that it is seldom needed.

I intend to show that this example program belongs to a special class or recursive routines which is in no way general. Consider procedures with the general form:

by Ian Glendinning

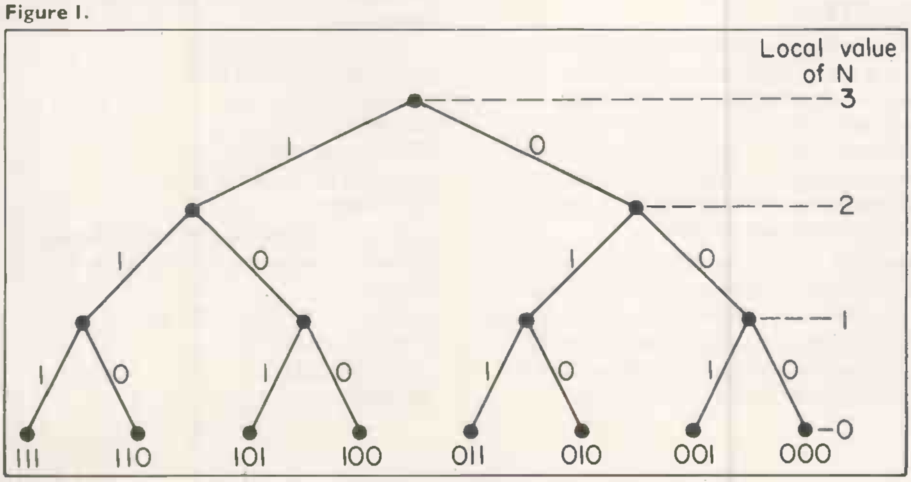
```
PROCEDURE A(N: INTEGER; . . . .);
  BEGIN
  IF N=0 THEN
    . . . . .
  ELSE
    BEGIN
      A(N—1, . . . .);
      A(N—1, . . . .);
      .
      .
      (* R RECURSIVE CALLS *)
      END
  END;
```

Consulting the recursive solution of the Towers of Hanoi that I provide, you can see that it falls into this class and contains two recursive calls. The structure of the calls on execution can be represented on a tree diagram as shown in figure 1 for N = 3.

This is a binary tree because R = 2 for the Hanoi problem, and if each left and right branch is labelled 1 and 0 respectively, each terminal node at the bottom is identified by a three-digit binary number which consists of the digits passed on traversing the tree to arrive there. Notice that the binary numbers at the terminal nodes increase by one from right to left — in the order of execution of the calls. Each level of the tree represents another recursive call and, taking the left or right branch, indicates which of the two calls in the procedure is then taken.

Hence, what has happened is that in this special case, the stack of return

Figure 1.



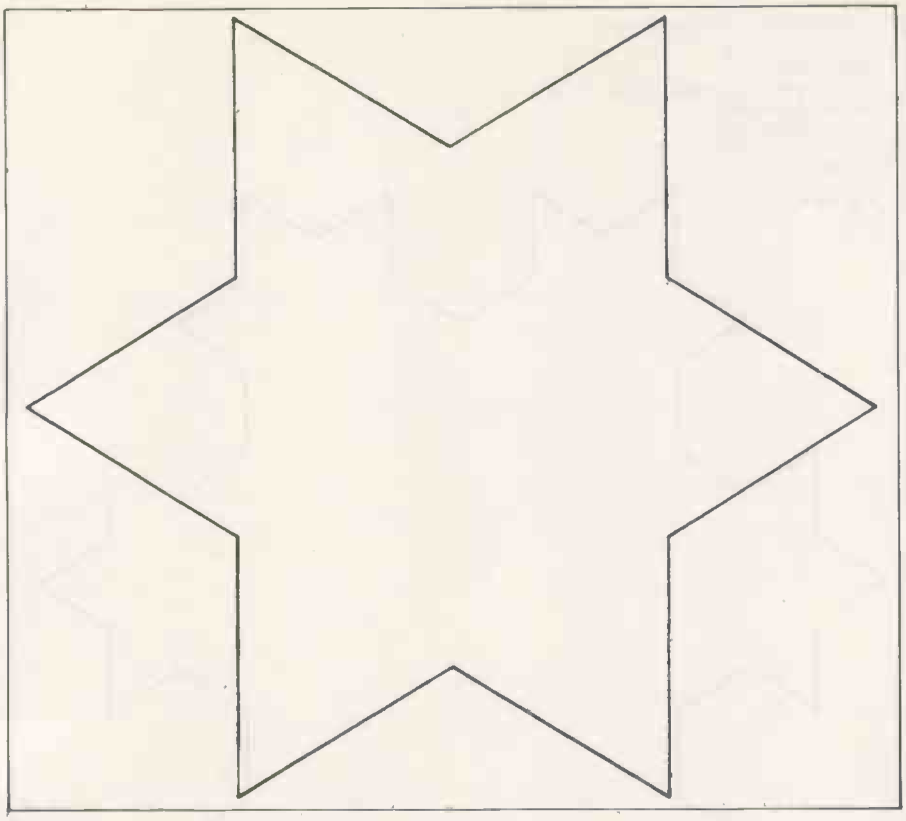


Figure 3.

addresses may be represented by a binary number. If a procedure has R recursive calls, its tree will have R branches at each node, so its stack can be represented by a number to base R. Each digit position refers to the depth of call and the digit at that position refers to the call active at that level. Notice that the depth of recursion, i.e., the number of levels of the tree or the number of digits in the base R number, cannot exceed the value of N in the initial call. So, if N is small, a large stack will not be generated. This is usually the case.

Iterative method

Using these ideas, it is possible to re-write simple recursive programs iteratively. The listing is a recursive Snowflake-drawing program together with example plots, figures 2 to 7, and there are two slightly different iterative solutions — one a little less efficient than the other.

I have run the programs on the University of Manchester Regional Computing Centre UMRCC, CDC Cyber 170/720 and obtained the following results for fifth-order curves.

	Compile time/s	Run time/s	Core used/Octal words
Flake 1	0.755	3.083	13772
Flake 2	0.982	3.353	14124
Flake 3	0.988	5.146	14130

Flake 3 is programmed less efficiently, but comparing 1 and 2, we see that the recursive version, 1, is faster in execution. Compile time and core comparisons are slightly unfair because an extra routine to perform 4**N was included in Flake 2 due to the lack of exponentiation in standard Pascal, but this certainly shows the insignificant size of the stack in Flake 1.

I think I have shown that recursion is not highly wasteful and that, unless Allan can produce some more general iterative solutions, recursion is not seldom needed. I would certainly be interested to see him write an iterative treatment of a program to deal with data that is itself recursively defined, a parser, syntax analyser, for the language Pascal for instance.

Such matters aside, I still think recursion is highly elegant and much more comprehensible and transparent once one is familiar with it. Writing programs this way is not only satisfying to one's self, but to those others who have to understand them.

```
PROGRAM HANOI(INPUT/,OUTPUT+);
TYPE PEG=0..2;
VAR N : INTEGER;
PROCEDURE MOVEDISCS(N: INTEGER; FROM,ONTO: PEG);
   BEGIN
   IF N=1 THEN
      WRITELN('MOVE TOP DISC FROM PEG ',FROM:1,' ONTO PEG ',ONTO:1)
   ELSE
      BEGIN
      MOVEDISCS(N-1,FROM,3-ONTO-FROM (*OTHER PEG*));
      WRITELN('MOVE TOP DISC FROM PEG ',FROM:1,' ONTO PEG ',ONTO:1);
      MOVEDISCS(N-1,3-ONTO-FROM,ONTO)
      END
```

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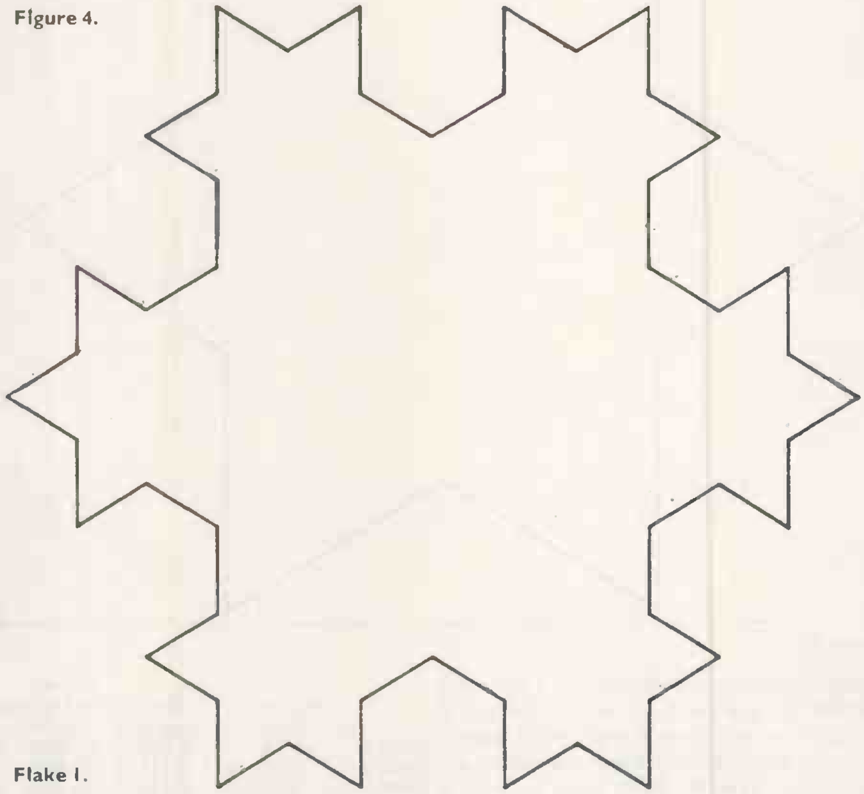
```
    END;
BEGIN
WRITELN('HOW MANY DISCS');
READLN;
READ(N);
MOVE(N,0,1)
END.
```

Figure 4.

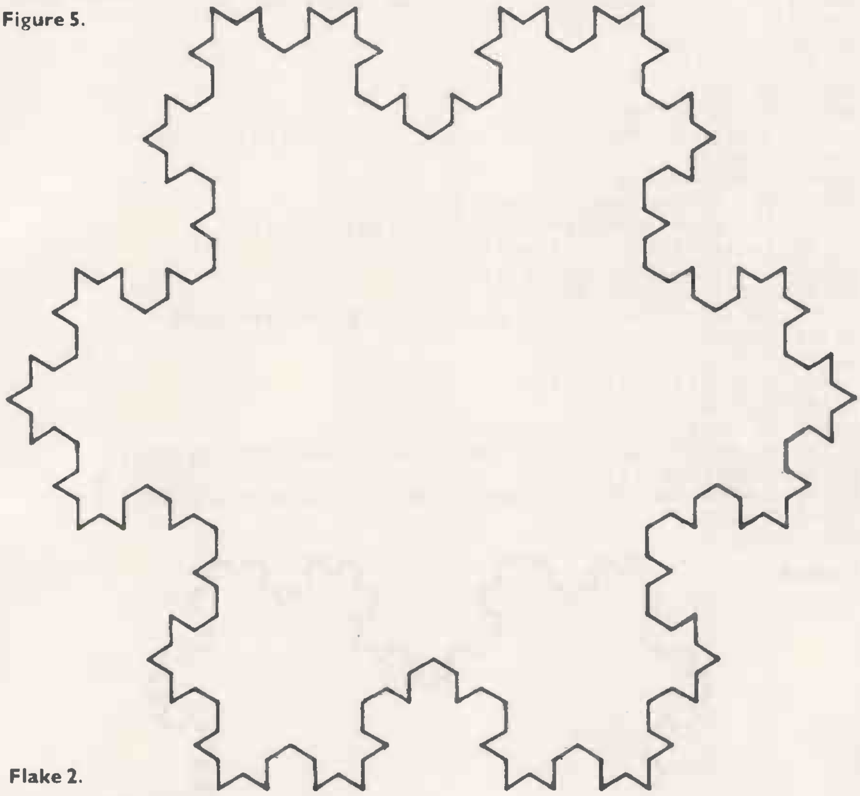


Flake I.

```
(*$W10000*)
PROGRAM FLAKE(INPUT/,OUTPUT+);
CONST PICWID=184;     (* SCREEN WIDTH *)
      PICHIG=140;     (* SCREEN HEIGHT *)
      MAXORDER=5;     (* MAXIMUM CURVE ORDER *)
VAR ORDER : INTEGER;
    INC,X,Y,INITX,INITY,PI : REAL;
(* GINO GRAPHICS DECLARATIONS *)
PROCEDURE T4010; FORTRAN;     (* DEVICE IS TEKTRONIX 4010 *)
PROCEDURE PICCLE; FORTRAN;    (* CLEARS SCREEN *)
PROCEDURE MOVTO2(X,Y: REAL); FORTRAN; (* ABSOLUTE MOVE *)
PROCEDURE LINTO2(X,Y: REAL); FORTRAN; (* ABSOLUTE DRAW *)
PROCEDURE CURDEF(CH: CHAR); FORTRAN;
PROCEDURE CURSOR(I: INTEGER); FORTRAN;
PROCEDURE DEVEND; FORTRAN;    (* END DRAWING *)
(* PROCEDURE TO DRAW A KOCH CURVE OF GIVEN ORDER
   AT A GIVEN ANGLE TO THE HORIZONTAL *)
PROCEDURE KOCH(ORDER: INTEGER; ANGLE: REAL);
   BEGIN
   IF ORDER>0 THEN
      BEGIN
      KOCH(ORDER-1,ANGLE);
      KOCH(ORDER-1,ANGLE+60);
      KOCH(ORDER-1,ANGLE-60);
      KOCH(ORDER-1,ANGLE)
      END
   ELSE
      BEGIN
      X:=X+INC*COS(ANGLE*PI/180);
      Y:=Y+INC*SIN(ANGLE*PI/180);
      LINTO2(X,Y)
      END
   END;
BEGIN
PI:=4*ARCTAN(1);
WRITELN('ORDER OF CURVE [0..',MAXORDER:1,']');
READLN;
READ(ORDER);
IF ORDER<0 THEN ORDER:=0;
IF ORDER>MAXORDER THEN ORDER:=MAXORDER;
INC:=3*PICHIG/(2*SQRT(3));
INITX:=(PICWID-INC)/2;
INITY:=PICHIG/4;
INC:=INC/EXP(ORDER*LN(3)); (* IE INC/3**ORDER *)
```

```
T4010;
PICCLE;
X:=INITX; Y:=INITY;
MOVTO2(X,Y);
(* DRAW TRIADIC KOCH ISLAND *)
KOCH(ORDER,60); KOCH(ORDER,-60); KOCH(ORDER,180);
CURDEF('A');
CURSOR(ORDER);  (* DUMMY CALL TO PAUSE FOR HARD COPY *)
DEVEND
END.
```

Figure 5.



Flake 2.

```
(*$W10000*)
PROGRAM FLAKE(INPUT/,OUTPUT*);
CONST PICWID=184;     (* SCREEN WIDTH *)
      PICHIG=140;     (* SCREEN HEIGHT *)
      MAXORDER=5;     (* MAXIMUM CURVE ORDER *)
VAR ORDER : INTEGER;
    INC,X,Y,INITX,INITY,PI : REAL;
(* GINO GRAPHICS DECLARATIONS *)
PROCEDURE T4010; FORTRAN;    (* DEVICE IS TEKTRONIX 4010 *)
PROCEDURE PICCLE; FORTRAN;   (* CLEARS SCREEN *)
PROCEDURE MOVTO2(X,Y: REAL); FORTRAN; (* ABSOLUTE MOVE *)
PROCEDURE LINTO2(X,Y: REAL); FORTRAN; (* ABSOLUTE DRAW *)
PROCEDURE CURDEF(CH: CHAR); FORTRAN;
PROCEDURE CURSOR(I: INTEGER); FORTRAN;
PROCEDURE DEVEND; FORTRAN;   (* END DRAWING *)
(* PROCEDURE TO DRAW A KOCH CURVE OF GIVEN ORDER
   AT A GIVEN ANGLE TO THE HORIZONTAL *)
PROCEDURE KOCH(ORDER: INTEGER; ANGLE: REAL);
   VAR MOVE,DIGIT : INTEGER;
       THETA : REAL;
   FUNCTION FOUR(I : INTEGER): INTEGER; (* EXPONENTIATION
   NOT ALLOWED IN PASCAL *)
      VAR F : INTEGER;
      BEGIN
      F:=1;
      WHILE I>0 DO
         BEGIN
         F:=F*4;
         I:=I-1
         END;
      FOUR:=F
      END;
   BEGIN
   X:=X+INC*COS(ANGLE*PI/180);
   Y:=Y+INC*SIN(ANGLE*PI/180);
   LINTO2(X,Y);
   FOR MOVE:=1 TO FOUR(ORDER)-1 DO
      BEGIN
      THETA:=0;
```

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SHOPWINDOW

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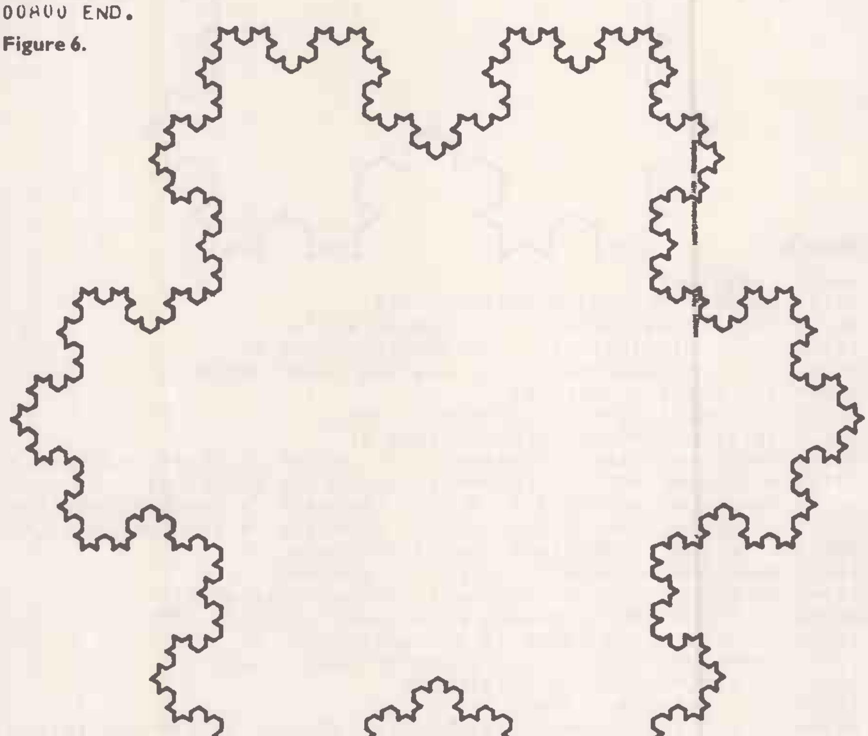
```
        FOR DIGIT:=0 TO ORDER-1 DO
           CASE (MOVE DIV FOUR(DIGIT))MOD 4 OF
              0: ;
              1: THETA:=THETA+60;
              2: THETA:=THETA-60;
              3:
              END;
        X:=X+INC*COS((ANGLE+THETA)*PI/180);
        Y:=Y+INC*SIN((ANGLE+THETA)*PI/180);
        LINTO2(X,Y)
        END
    END;
BEGIN
PI:=4*ARCTAN(1);
WRITELN('ORDER OF CURVE [0..',MAXORDER:1,']');
READLN;
READ(ORDER);
IF ORDER<0 THEN ORDER:=0;
IF ORDER>MAXORDER THEN ORDER:=MAXORDER;
INC:=3*PICHIG/(2*SQRT(3));
INITX:=(PICWID-INC)/2;
INITY:=PICHIG/4;
INC:=INC/EXP(ORDER*LN(3)); (* IE INC/3**ORDER *)
T4010;
PICCLE;
X:=INITX; Y:=INITY;
MOVTO2(X,Y);
(* DRAW TRIADIC KOCH ISLAND *)
KOCH(ORDER,60); KOCH(ORDER,-60); KOCH(ORDER,180);
CURDEF('A');
CURSOR(ORDER);   (* DUMMY CALL TO PAUSE FOR HARD COPY *)
DEVEND
END.
```

Figure 6.

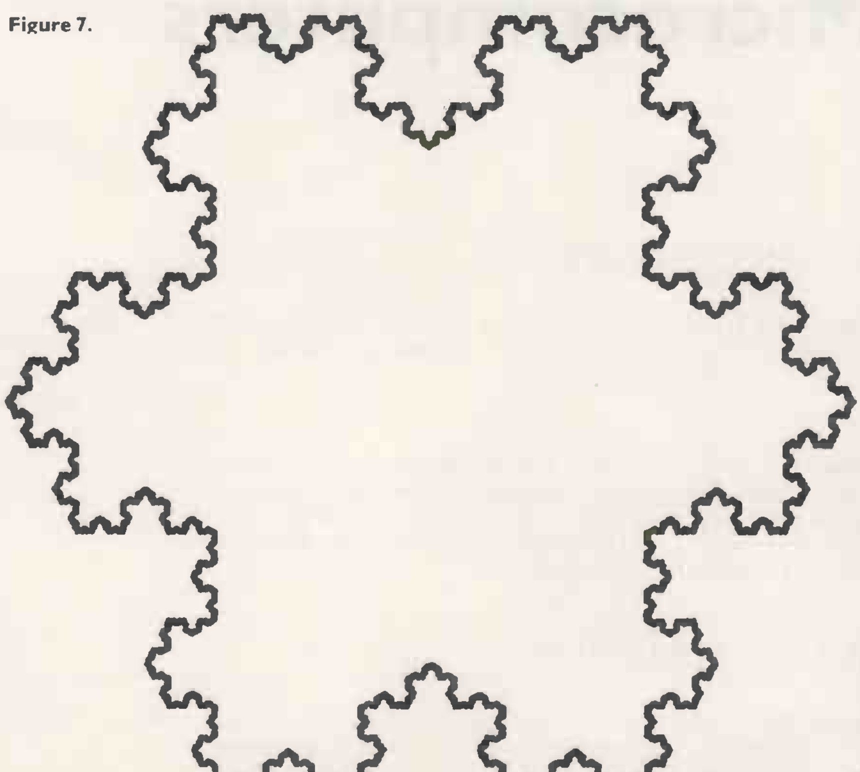


Flake 3.

```
(*$W10000*)
PROGRAM FLAKE(INPUT/,OUTPUT+);
CONST PICWID=184;     (* SCREEN WIDTH *)
      PICHIG=140;     (* SCREEN HEIGHT *)
      MAXORDER=5;     (* MAXIMUM CURVE ORDER *)
VAR ORDER : INTEGER;
    INC,X,Y,INITX,INITY,PI : REAL;
(* GINO GRAPHICS DECLARATIONS *)
PROCEDURE T4010; FORTRAN;   (* DEVICE IS TEKTRONIX 4010 *)
PROCEDURE PICCLE; FORTRAN;  (* CLEARS SCREEN *)
PROCEDURE MOVTO2(X,Y: REAL); FORTRAN; (* ABSOLUTE MOVE *)
PROCEDURE LINTO2(X,Y: REAL); FORTRAN; (* ABSOLUTE DRAW *)
PROCEDURE CURDEF(CH: CHAR); FORTRAN;
PROCEDURE CURSOR(I: INTEGER); FORTRAN;
PROCEDURE DEVEND; FORTRAN;  (* END DRAWING *)
(* PROCEDURE TO DRAW A KOCH CURVE OF GIVEN ORDER
   AT A GIVEN ANGLE TO THE HORIZONTAL *)
```

```
PROCEDURE KOCH(ORDER: INTEGER; ANGLE: REAL);
   VAR MOVE,DIGIT,VAL : INTEGER;
   FUNCTION FOUR(I : INTEGER): INTEGER; (* EXPONENTIATION
   NOT ALLOWED IN PASCAL *)
      VAR F : INTEGER;
      BEGIN
      F:=1;
      WHILE I>0 DO
         BEGIN
         F:=F*4;
         I:=I-1
         END;
      FOUR:=F
      END;
   BEGIN
   X:=X+INC*COS(ANGLE*PI/180);
   Y:=Y+INC*SIN(ANGLE*PI/180);
   LINTO2(X,Y);
   FOR MOVE:=1 TO FOUR(ORDER)-1 DO
      BEGIN
      DIGIT:=0;
      REPEAT
         VAL:=(MOVE DIV FOUR(DIGIT))MOD 4; (* SELECT BASE 4 DIGIT *)
         DIGIT:=DIGIT+1
      UNTIL VAL<>0;
      CASE VAL OF
      1: ANGLE:=ANGLE+60;
      2: ANGLE:=ANGLE-120;
      3: ANGLE:=ANGLE+60
      END;
      X:=X+INC*COS(ANGLE*PI/180);
      Y:=Y+INC*SIN(ANGLE*PI/180);
      LINTO2(X,Y)
      END
   END;
BEGIN
PI:=4*ARCTAN(1);
WRITELN('ORDER OF CURVE [0..',MAXORDER:1,']');
READLN;
READ(ORDER);
IF ORDER<0 THEN ORDER:=0;
IF ORDER>MAXORDER THEN ORDER:=MAXORDER;
INC:=3*PICHIG/(2*SQRT(3));
INITX:=(PICWID-INC)/2;
INITY:=PICHIG/4;
INC:=INC/EXP(ORDER*LN(3)); (* IE INC/3**ORDER *)
T4010;
PICCLE;
X:=INITX; Y:=INITY;
MOVTO2(X,Y);
(* DRAW TRIADIC KOCH ISLAND *)
KOCH(ORDER,60); KOCH(ORDER,-60); KOCH(ORDER,180);
CURDEF('A');
CURSOR(ORDER);  (* DUMMY CALL TO PAUSE FOR HARD COPY *)
DEVEND
END.
```

Figure 7.



BUYERS' GUIDE

The Buyers' Guide is a summary of low-cost computers available in the U.K. It appears every third month; we add new computers and amend existing information, as required, to keep it up-to-date. Systems are listed by manufacturer.

Microcomputers

ACORN COMPUTERS

Systems 1,2,3: 6502-based, 1-8K RAM, COS or DOS, Hex or full keyboard, TV interface, Acorn bus. Personal or scientific use. Reviewed September 1979. — *From £65 for System 1 kit; £285 for System 2 kit; £670 for System 3 kit*

Atom: 6502, 2-12K RAM, up to 40K external memory, full keyboard, Basic in ROM, high-resolution graphics, cassette and TV interface, parallel port, I/O lines. Should eventually be able to link into a ring. Acorn Computers Ltd, 4a Market Hill, Cambridge CB2 3NJ (0223) 312772. Reviewed November 1980. — *From £130*

ALAN PEARMAN LTD

Maple: Z-80A, 16-64K RAM, S-100 bus, CP/M, 8in. discs, RS232 serial and parallel. Sold mainly as Micro-APL system. Alan Pearman Ltd, Maple House, Mortlake Crescent, Chester CH3 5UR. (0244) 46024. — *From £1,510*

ALPHA MICRO

AM-1010, AM-1051: WD-16, 64K-16MB RAM, S-100, four 8in. up to 90MB hard discs, RS232 up to 20 ports. Alpha Micro, 13 Brunswick Place, London N1 6ED. (01) 250 1616. — *From £7,500*

APPLE COMPUTERS

Apple II Plus: 6502, 16-48K RAM, 8K ROM, colour graphics, 5¼in. discs, general use. Own bus. Reviewed October 1979. — *From £695*

Apple III: 6502A with supporting chips, giving it a superset of 6502 instruction set. 96-128K RAM, colour graphics, integral 5¼in., RS232, four 50-pin expansion slots. Microsense, Finway House, Hemel Hempstead, Hertfordshire HP2 7PS. (0442) 48151. — *P.O.A.*

ATTACHE

Attache: 8080, 64K RAM, S-100, parallel port, 8in. discs, business system. Friargrove Systems Ltd, 494 Great West Road, Hounslow, Middlesex (01) 572 3784. — *From £1,737 to £7,000*

BASF

System 7100: Z-80A, 64K RAM, RS232, 5¼in. discs, business systems. MPR, 293 Grays Inn Road, London WC2. (01) 837 6332. — *From £4,937*

BILLINGS

BMS: Z-80A, 64K RAM, 8in. 200MB hard discs, business system. Mitech Data Systems, 8 Guildford Road, Woking, Surrey. (04862) 23131. — *From £4,295*

B L MICROELECTRONICS

Biproc: Z-80 or TMS9980 kit, 1K RAM, 2K monitor, RS232, cassette, TV. BLM, 1 Willow Way, Loudwater, High Wycombe, Buckinghamshire HP11 1JR. (0494) 443073. — *From £150*

BLEASDALE COMPUTER SYSTEMS

UDS: 8080, Z-80, 6809, 32K-1MB, Multibus, CP/M, 5¼in., 8in., hard, RS232, four parallel ports, IEEE 488, development system. Bleasdale Computer Systems, Francis House, Francis Street, London SW1. (01) 828 6661. — *P.O.A.*

BRUTECH ELECTRONICS

BEM: Single-board processor with 6502 and no RAM. Data Precision Equipment, 81 Goldsworth Road, Woking, Surrey GU21 1LJ. (04862) 67420. — *From £133*

BYTRONIX MICROCOMPUTERS

Megamicro: 8080/Z-80, 64K RAM, 8in. discs, CP/M. Business and university use. Bytronix, 83 West Street, Farnham, Surrey GU9 7EN. (0252) 726814. — *From £6,080*

CANON BUSINESS MACHINES

Canon BX-1/BX-1d: 6800, 64K RAM, 5¼in. integral, RS232, V24 ports, business use. Canon Business Machines, Wadden House, Stafford Road, Croydon, Surrey. (01) 680 7700. *From £3,250*

COMMODORE BUSINESS MACHINES

Pet: 6502, 8-32K RAM, IEEE ports, integral 9in. screen, personal and general use. Reviewed August 1979. *From £460*

8000 Series — SuperPet: Upgrade of original Pet. 12in. screen, 5¼in. discs, business and general use. Reviewed October 1980. *From £895*

Kim-1: 6502, LED six-digit display, 1K RAM, cassette and Teletype interface, evaluation board for 6502 chip. Commodore Business Machines, 818 Leigh Road, Slough Industrial Estate, Slough, Berkshire. (75) 74111. Reviewed November 1978. *From £99.95*

COMPSHOP

UK101: 6502, 4-8K RAM, TV interface, RS232, full keyboard, single-board, personal use, similar to Ohio Superboard. Compshop, 14 Station Road, New Barnet, Hertfordshire EN5 1QW. (01) 441 2922. Reviewed May 1980. *From £199 for kit*

COMPUCOLOR

Compucolor II: Z-80, 8-32K RAM, 5¼in. integral discs, 13in. colour VDU, RS232. General use. Dyad Developments. The Priory, Great Milton, Oxfordshire OX9 7PB. (08446) 729. Reviewed June 1979. *From £998*

Copernicolor II: 8080A, 8-32K RAM, 5¼in., 8in. and Winchesters available, VDU, RS232 bus, standard ASCII keyboard with optional keyboards available, graphics 128 by 128, Basic, assembler, Fortran. Based on Compucolor II, wide range of software. General use. Copernicus Ltd, 7 Wey Hill, Haselmere, Surrey. (0428) 52888. *From £1,200*

COMPUCORP

655-675: Z-80, 60K RAM own OS but will run CP/M with modifications, RS232, IEEE and others optional. 1-4 5¼in. discs, 16by80 VDU. Business use. Barnet House, 120 High Street, Edgware, Middlesex. (01) 952 7860. *From £2,595 to £4,750*

COMPUTER CENTRE

Minikit: Z-80, 16K RAM, serial and parallel, 5¼in., CP/M, S-100. *From £800*

Maxikit: Z-80, 16K RAM, serial and parallel, 8in., CP/M S-100. Computer Centre, 9 De la Beche Street, Swansea SA1 3EX. *From £911*

COMPUTERMART LTD

Computermart 2000 range: Z-80A, single/multiple, 16-256K, CP/M, S-100 bus, graphics, 8in. single-density double-sided, 180MB hard disc, general/business use. Computermart, 60 St. Faiths Lane, Norwich, Norfolk. Norwich 615089. *From £6,000*

COMPUTHINK

Act System 800: 6502, 48K RAM, full keyboard, graphics, 5¼ or 8in. discs, 12in. VDU integral. Business system. Act, 66-68 Hagley Road, Edgbaston, Birmingham B16 8PF. (021) 455 8686. Reviewed February 1980.	*From £4,000*

CROMEMCO

Single Card Computer: Z-80, S-100, 1K RAM, 20mA/RS232. OEM and industrial use.	*From £273*
Z2: Z-80, 31A power supply, motherboard, 21 sockets, serious hobbyist and OEM use. Reviewed February 1979.	*From £573*
Z2-H: Z-80A, 64-512K RAM, S-100 bus, CDOS, 10MB formatted fixed disc, two 5¼in. discs, hard discs up to 70MB.	*From £5,373*
System 2: Z-80A, 64-512K RAM, S-100 21 slots, CP/M, VDU, two 5¼in. discs, hard discs up to 70MB. Multi-channel interface available. General/business use.	*From £2,095 to £6,408 for seven users*
System 3: Z-80A, 64-512K RAM, S-100, CP/M, two or four 8in. discs, hard discs up to 70MB, general/business use. Datron Microcentre, 2 Abbeydale Road, Sheffield S7 1FD. (0742) 585490. Microcentre, 30 Dundas Street, Edinburgh EH3 6JN (031) 556 7354. Comart, PO Box 2, St Neots, Huntingdon, Cambridgeshire PE19 4NY. (0480) 215005.	*From £3,568 to £8,304 for seven users*

DATA APPLICATIONS

DAI Personal Computer: 8080, 8-48K RAM, colour graphics, 20 Eurocard industrial interface modules, RS232, industrial use. Data Applications, 168 Dyer Street, Cirencester, Gloucestershire GL7 2PF. (0285) 2588. Reviewed February 1981.	*From £998*

DIGITAL DATA ELECTRONICS

SPC/1: 8085, 32-48K RAM, own OS, COMAL, Assembler and Pascal, graphics, up to three 5¼in. drives, up to four 8in. drives, 10MB Winchester, up to four 20MB cartridge, many ports. DDE, Clark House, Pump Lane, Hayes, Middlesex. 01-573 8991.	*From £1,995*

DIGITAL MICROSYSTEMS

DSC-3: Z-80, 64K RAM, CP/M, 8in. discs, hard discs up to 28MB, RS232/V24, business and general use.	*From £3,445*
DSC-4: Z-80, 128-512K RAM, CP/M, 8in. discs, hard discs up to 28MB, RS232, RS422, business and general use.	*From £3,995*
Hex-29: AMD 2900 16-bit, 64K-1,024K RAM, Hex bus, 8in. discs, hard discs up to 28MB. Eight to 32 ports, RS232. Modata, 30 St Johns Road, Tunbridge Wells, Kent TN4 9NT. (0892) 41555.	*From £6,445*

DURANGO

F85: 8085, 64K RAM, own bus and OS, graphics, four RS232 ports, integral 9in. VDU, 9 × 9 printer, keyboard and two 5¼in. disc drives. General use. Comp Ancillaries, 64 High Street, Egham, Surrey. (07843) 6455.	*From £7,500*

DYLE HOUSE

System 2000: Z-80, 64K RAM, dual 8in. discs, own OS, business use. Dyle House, 36 Abbot Way, Wellingborough, Northamptonshire. (0933) 79135.	*P.O.A.*

DYNABYTE

Dynabyte 5000: Z-80, 32-64K RAM, S-100, CP/M, MP/M, CP/Net, RS232, 5¼ or 8in. discs, hard discs up to 96MB, expands to multi-task/user system. Business use. Microtech Ltd, Waterloo Road, Uxbridge, Middlesex, UB8 2YW. (0895) 57780.
From £1,600 to £12,000

EACA

Video Genie EG3003: Z-80, 16-48K RAM, S-100, CP/M, 5¼in. discs, RS232, personal and general use. Lowe Electronics, Bentley Bridge, Chesterfield Road, Matlock, Derbyshire DE4 5LE. (0629) 2430. Reviewed February 1980.
From £369

ECS MICROSYSTEMS INC

Aristocrat: Z-80A, 32-180K RAM, 12K PROM, dual 5¼in. drives, 946K. Three RS232 and one parallel port, CP/M, wide range of protocols, business and general use. Telecomputing Systems Ltd., Seacourt Tower, Westway, Oxford. (0865) 723621.
From £3,950

EQUINOX

200: Z-80, 64-512 RAM, S-100 bus, CP/M, Omnix, MicroCobol, MVT FAMOS, cartridge disc, six serial and one parallel port, business use.
From £7,500

300: WD-16, 64-256K RAM, S-100 bus, CP/M, Omnix, MicroCobol, MVT FAMOS, cartridge disc drive, six serial ports, business use. Equinox, 16 Anning Street, New Inn Yard, London EC2A 3HB. (01) 729 4460/(01) 739 2387.
From £10,500

EUROCALC

Euroc: 8080, 64K RAM, 8in. discs, 15in. VDU, CP/M, business use. Eurocalc, 55/56 High Holborn, London WC1. (01) 405 3113.
From £8,000

EXIDY

Sorcerer: Z-80, 16-48K RAM, S-100, RS232, CP/M, 5¼in. discs. Plug-in ROM pack programs. Liveport, The Ivory Works, St Ives, Cornwall TR26 2HF. (0736) 798157. Reviewed May 1979.
From £749

GNAT

System 10: Z-80, 65K RAM, own bus, CP/M, graphics, 5¼in. discs, RS232, RS449, 12in. VDU, full keyboard, optional IEEE. Business use. Millbank Computers, 98 Lower Richmond Road, London SW16. (01) 788 1083. Reviewed December 1980.
From £2,995

HAYWOOD

Systems 1000-8000: Z-80, 32-65K RAM, 6000 is S-100, 3000 single-board, CP/M, graphics, 5¼in. discs, three serial and parallel ports. Business, scientific and general use. Haywood Electronics Assoc., 11 Station Approach, Northwood, Middlesex. (01) 428 9831.
From £2,359

HEATH/ZENITH

H8: Single-board WH8 assembled, 8080, 16K-65K RAM. Heathbus nine slots, cassette interface, nine-digit LED.	*From £321*
Z89: Z-80, 16-48K RAM, CP/M, integral 5¼ in. drive, optional dual external, two RS232, full keyboard, 12in. VDU.	*From £1,570*
WH-11A: LSI-II, 16-bit, 16-32K RAM, own bus and OS, optional dual 8in. drives, serial and parallel ports. Heath Ltd, 11b Bristol Road, Gloucester GL2 6EE. (0452) 29451. (01) 636 7349.	*From [illegible]250*

HEWART

6800Mk II: 6800 single-board, 1K monitor, 1K user RAM, 1K VDU RAM, 128byte scratchpad, education and home user. S-50 bus.	*From £155*
6800S: 6800, 16K monitor, 8K Basic in ROM, graphics, 5¼in. drive. Hewart, 95 Blakelow Road, Macclesfield, Cheshire. (0625) 22030.	*From £229*

HEWLETT-PACKARD

85A: 16-32K RAM, 32K ROM, IEEE 488, RS232, graphics, 5¼in. drives, integral 32 by 16 VDU, integral thermal printer, QWERTY and numeric keypad. Scientific use. Hewlett-Packard, King Street Lane, Winnersh, Workingham, Berkshire. (0734) 784774.	*From £1,830*

HYTEC MICROSYSTEMS

H-3000: Z-80A, 4MHz, 32-128K RAM, two minifloppy discs, standard I/O, two parallel, three serial ports, single board.	*From £2,381-£2,640*
H-4500: Z-80, 64-208K, two minifloppy discs, standard I/O, two parallel, three serial ports, 4MHz option.	*From £3,110*
H-7000: Z-80A, 4MHz, 32-128K, two 8in. floppy discs, standard I/O, two parallel, three serial ports.	*£3,350*

IMAGE DATA PRODUCTS LTD

Image Data Eight: 6802, 4-40K RAM, 43-way bus, own OS, Basic assembler and editor, viewdata-style graphics, up to four 5¼in. discs, up to 12 RS232 ports. Image Data Products, 1-4 Portland Square, Bristol, BS2 8RR (0272) 40248.	*£500-£4,000*

INDUSTRIAL MICROSYSTEMS

Series 5000: Z-80, 16-56K RAM, CP/M, S-100, two or three 5¼in. discs, two serial and one parallel port, desk unit, business and general use.	*From £1,500*
Series 8000: Z-80, 64-256K RAM, S-100, CP/M, MicroCobol, MVT FAMOS, Omnix, two, three or four 8in. disc drives, two serial and one parallel port, desk unit, business and general use. Equinox, 16 Anning Street, New Inn Yard, London EC2A 3HB. (01) 739 2387/(01) 729 4460.	*From £2,500*

INSTAR

Omega: 16-bit, 48-256K RAM, dual floppies, hard discs, up to 12 simultaneous users, business use.	*From £7,500*
Asatayd: Z-80, 16-56K RAM, dual floppies, CP/M, S-100 bus, business use, Instar, 61 High Street, Croydon, Surrey CR0 1QD. (01) 680 5330.	*From £4,950*

INTERTEC

Superbrain: Z-80, 64K RAM, 256 static RAM, dual Shugart, optional hard disc, CP/M, S-100 bus, business and general use. Encotel, Succombs Hill, Upper Warlingham, Surrey. (820) 5701. Sun,138 Chalmers Way, North Feltham Trading Estate, North Feltham, Middlesex. (01) 751 6695. KGB, 88 High Street, Slough, Berkshire. (75) 38581. Icarus Computer Systems Ltd, 27 Greenwood Place, London NW5 1NN. 01-485 5574. Reviewed April 1980. — *From £1,495*

ITHACA INTERSYSTEMS

Pascal Micro DPS1: Z-80, 64K-1MB RAM, full IEEE S-100 bus, CP/M version 2.2, graphics 8in. and hard discs, RS232, four parallel and two serial ports per S-100 board. Ithaca Intersystems, 58 Crouch Hall Road, London N8 8HG. (01) 341 2447. — *From £4,258*

ITT

2020: Built under licence from Apple. See entry under Apple II. ITT, Star House, Mutton Lane, Potters Bar. (77) 51177. — *From £827*

KEMITRON ELECTRONICS

UDS 3000: Z-80, 1-64K RAM, Kbus, own OS, CP/M, 8in. and hard discs, ports up to 256. Kemitron Electronics, (0244) 21817. — *From £640 to £4,000*

LOGABAX

LX-500: Z-80, 32K RAM, S-100, CP/M dual 5¼in. drives, business use. LogAbax Ltd., 1-7 Wesley Avenue, London NW10. (01) 965 0061. — *From £3,000*

LSI COMPUTERS

M-One: 8080, 8-16K RAM, own OS, dual Shugart 8in. drives, two serial and one parallel port, 12in. VDU and full keyboard. Business use. — *From £5,995 with software package*

M-Two: 8085, 64K RAM and 4K EPROM. Launched in December 1980. LSI Computers, Copse Road, St Johns, Woking, Surrey GU21 1SX. (04862) 23411. — *P.O.A.*

LUXOR

ABC 80: Z-80, 16-40K RAM, 12in. VDU, IEEE 488, RS232, 5¼in. drives, loudspeaker, personal and education use. CCS Microsales, 7 The Arcade, Letchworth, Hertfordshire ST6 3ET. (04626) 73301. — *From £795*

MICRO V

Microstar: 8085, 64K RAM, three RS232, serial inputs, StarDOS, twin 8in. drives, general use. Data Efficiency Ltd, Maxted Road, Maylands Avenue, Hemel Hempstead, Hertfordshire. (0442) 63561. — *From £4,950*

MICROMATION

Z-Plus: Z-80, 64K RAM, S-100 bus, CP/M (3), MP/M two serial and six parallel ports, business use. Rostronics, 115-117 Wandsworth High Street, London SW18 4HY. (01) 874 1171. Reviewed May 1980. — *From £3,950 to £8,550*

MICRONEX

MX-100: Z-80A, 64K RAM, S-100 bus, RS232, CP/M, Pixel graphics display system, twin 8in. drives. Micronex, Harford Square, Bristol BS18 8RA. (027) 589 3042. — *From £3,485*

MIDWEST SCIENTIFIC INSTRUMENTS

MSI 6800: 6800, 16K-56K RAM, 5¼ or 8in. or hard discs up to 10MB. Systems 1,2,7 and 10. System 7 runs Flex, MSI, DOS and SDOS, RS232. System 10 is System 7 with hard disc. Business use. Strumech (SEED), Portland House, Coppice Side, Brownhills, Walsall, West Midlands. (279) 4321. Reviewed March 1980. — *From £1,100 to £12,000*

MODULAR BUSINESS SYSTEMS

Tutor: 8085, 32-64K RAM, Intel Multibus, CP/M, optional graphics, twin 5¼in. drives or four 8in., two RS232 serial ports. — *From £2,500*

Elite: 8085, 32-256K RAM, Intel Multibus, CP/M, 5¼in. to 24MB hard discs, RS232, 24-bit TTL programmable port. Modular Business Systems, 21 Chappel Lane, Yeadon, Leeds LS19 7NX. — *From £5,400 to £25,000*

NASCOM

Nascom 1: Z-80, 2-64K RAM, serial and up to 16 parallel ports , 8K Microsoft Basic, 1K monitor in EPROM. Personal use. Reviewed January 1979. — *From £125*

Nascom 2: Z-80, 1K RAM expandable to 256 with Nascom System 80 case. Nasbus, 8K Basic, 2K monitor and 2K character generator, low/high-resolution graphics and colour. 5¼in. single or twin floppy discs, RS232, parallel port, Kansas City cassette port. Nascom Microcomputers, 92 Broad Street, Chesham, Buckinghamshire. (02405) 75151. Reviewed April 1980. — *From £295*

NATIONAL MULTIPLEX

Pegasus: Z-80, 48K RAM, S-100 bus, 5¼in., 8in. drives, CP/M, 12in. VDU, business use. London Computer Store, 43 Grafton Way, London W1. (01) 388 5721. — *From £2,700*

NEWBURY LABORATORIES

7768: CPU board, 4K RAM, cassette and VDU interface, up to 64K RAM, kit only. — *From £45*

NewBrain: Z-80A, 2K static RAM plus 4K static or 16K dynamic, RS232 ports, 16-character, LED display, hand-held. Newbury Laboratories, King Street, Odiham, Hampshire. (025) 671 2910. — *From £155 for model without LED*

NEWTRONICS

Elf II: Single-board on 1802, 256bytes to 64K RAM, Hex keypad, RS232 I/O and VDU interface, option keyboard, machine code or Tiny Basic, educational. — *From £39 for kit*

Explorer 85: 8085, 4-64K RAM, S-100 bus, RS232, VDU interface, 8080 and Z-80 software, hobbyists and OEM use. Newtronics, 255 Archway Road, London N6. (01) 348 3325. — *From £299*

NORTH STAR

Horizon: Z-80A, 16-56K RAM, 5¼in. twin drives, S-100 bus, own OS, business, educational or scientific use. Comart, PO Box 2, St Neots, Huntingdon, Cambridgeshire PE19 4NY. (0480) 215005. Equinox, Kleeman House 16 Anning Street, New Inn Yard, London EC2A 3HB. (01) 729 4460. Reviewed April 1979. — *From £995 to £2,500*

OHIO SCIENTIFIC

Ohio Superboard and Challenger I: 6502, 8K Basic in ROM, 2K monitor, 4K RAM, full keyboard and VDU interface. Hobbyist use. Reviewed June 1979. — *From £160*

Challenger 2: 6502, 48K RAM, dual 8in. drives, serial port, low-cost business use. — *From £1,500*

Challenger 3: 6502, Z-80 and 6800, 48-56K RAM, OSI 48-pin bus, serial port for VDU, CP/M, expands to eight users, 10, 20 and 75MB hard disc, business use. — *From £2,300*

Challenger 4: Similar to Challenger I but 64 by 32 display, colour and sound option. U-Microcomputers, Winstanley Industrial Estate, Long Lane, Warrington, Cheshire WA2 8PR (0925) 54117/8. CTS (0706) 79332. Millbank, 98 Lower Richmond Road, London SW16. (01) 788 1083. Reviewed September 1979. Mutek, Quarry Hill, Bath, Wiltshire. (0225) 743289. — *From £450*

PANASONIC

Panasonic: 8085, 56K RAM, full keyboard, integral 24 by 80 VDU, integral twin 5¼ or 8in. floppy drives. Three RS232, business use. Panasonic Business Systems, 9 Connaught Street, London W2. (01) 261 3121. Reviewed June 1979. — *From £4,150*

PROCESSOR TECHNOLOGY

Sol: 8080, 16K RAM, S-100 bus, 5¼in. drives, VDU integral, business system. Comart, PO Box 2, St Neots, Huntingdon, Cambrideshire PE19 4NY. (0480) 215005. Reviewed July 1979. — *From £1,750*

RAIR

Black Box: 8085, 32-256K RAM, dual mini-floppy discs, eight programmable serial ports, RS232, CP/M, hard discs to 10MB, general and business use. Rair, 30-32 Neal Street, London WC2H 9PS. (01) 836 4663. Reviewed November 1979 and August 1980. — *From £2,300*

RCA

Cosmac: 1802 micro with Hex pad and TV interface. Machine-code programming with Tiny Basic option. HL Audio, 255 Archway Road, London N6 5BS. (01) 348 3325. *From £79 for kit*

RESEARCH MACHINES

380-Z: Z-80, 4-56K RAM, RS232, CP/M, twin 5¼ or 8in. discs, high-resolution graphics. Sold principally to higher and secondary education. *From £830 to £3,500*

280-Z: Board version of 380-Z. Research Machines, PO Box 75, Mill Street, Oxford. (0865) 49791. *From £722 for 4K version*

ROCKWELL

Aim-65: 6502, 1-4K RAM, full keyboard, RS232, discs, hobby use, Portable Microsystems, Forby House, 18 Market Place, Brackley, Northamptonshire NN13 5SF. (0280) 702017. Reviewed July 1979. *From £250*

SATTCO AB

Databoard 4680: Z-80, 16-64K RAM, own bus, full-colour graphics, 5¼in., 8in. and hard discs up to 10MB, 64 interface units. General use. Microsystems Technology, PO Box 5, Knutsford, Cheshire, WA16 9DU. (0565) 52911. *P.O.A.*

SCIENCE OF CAMBRIDGE

MK-14: 8060, 256bytes user memory to which ¼K RAM can be added, Hex pad, cassette interface, seven-digit LED, single-board. Reviewed May 1979. *From £39*

ZX-80: Z-80A, 1-16K RAM, 4K Basic in ROM, cassette and TV interface, touch-sensitive keyboard, educational use. 22 graphics. Science of Cambridge, 6 Kings Parade, Cambridge CB2 1SN. (0223) 311488/312919. Reviewed July 1980. *From £79 for kit*

SD SYSTEMS INC

SBC-100: Z-80, 1-48K, S-100 bus, Basic in 8K ROM, four ROM sockets, optional 5¼in. drives, RS232 serial and parallel, single-board. Reviewed January 1981. *From £155*

SD-100/200: Z-80, 64-256K RAM, 8K PROM, S-100 bus, RS232, CP/M, 12in. VDU, twin 8in. drives, business, industrial and general use. Airamco, Unit A2, 9 Longford Avenue, Kilwinning Industrial Estate, Kilwinning, Ayrshire KA13 6EX. (0294) 65533. Barcellos, Kimberley House, Vaughan Way, Leicester. (0533) 26584. *From £3,750*

SEN ELECTRONICS

Organiser: Intel 8085, 64K RAM, multi-user Basic, 8in. drives or 20MB hard discs, three RS232, business use. SEN, 5 London Street, Chertsey, Surrey KT16 8AP. (09328) 66744. *From £7,500*

SGS-ATES

Nanocomputer: Z-80, 6-64K RAM, Gamma bus, 2K NC-2 monitor in ROM, Basic as option, RS232, cassette interface, Hex keypad. Midwich, Hewitt House, Northgate Street, Bury St Edmonds, Suffolk, IP33 1HQ. Reviewed October 1979. — *From £350*

SHARP ELECTRONICS

MZ-80K: Z-80, 16-48K RAM, 10in. integral VDU, integral cassette, loudspeaker, 5¼in. disc optional, general use. — *From £480*

PC-1211: Pocket computer. Programmable in Basic with cassette interface. Sharp Electronics, Sharp House, Thorp Road, Newton Heath, Manchester M10 9BE. (061) 205 2333. Reviewed July 1980. — *From £85*

SINTROM ELECTRONICS

Periflex 630/48: Z-80A, 32-48K RAM, S-100, CP/M, twin Micropolis 5¼in. discs, two serial and three parallel ports. — *From £1,995*

Periflex 1024/64: Z-80, 64K, S-100, CP/M, dual 8in. discs, two serial and three parallel. Sintrom Electronics, Arkwright Road, Reading, Berkshire RG2 0LS (0734) 85464. — *From £2,750*

SIRTON COMPUTERS

Midas Range: Z-80, from 8K RAM, S-100 or IEEE bus, CP/M, MP/M, graphics, up to four 5¼in. or 8in. drives, hard disc, RS232, 8-bit parallel, IEEE 488. Sirton Computers, 76 Godstone Road, Kenley, Surrey CR2 5AA. 01-668 0761. — *£785-£2,150*

SMOKE SIGNAL

Chieftain 511-821: 6800/6809, 32-64K RAM, S-50 bus, Flex DOS68/68d/69 dual 5¼in., 8in., dual RS232, video board, wide range of options, general use. Windrush Micro Designs, Gaymers Way, North Walsham, Norfolk. (069) 245189. — *From £1,807*

SOLID STATE TECHNOLOGY

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INSTANT SORT/SEARCH DATABASE

Everything in electronics takes a finite time, consequently nothing can be instantaneous. However a database that will search 500 records and sort the names into alphabetical order in 1½ seconds, that will go on to do the same thing with 1,000 names in only 2½ seconds, is fast. If you add that ability to search 500 or 1,000 records for a specific range of names or ages or sexes or whatever, in such a small amount of time that it is not worth timing it, then the program deserves to be described as instantaneous. Especially as these times are attained on a standard Level II TRS-80.

These results are achieved, obviously, by some very clever machine language coding. This however is not enough. After all GSF from Racet will sort 1,000 arrays in about 11 seconds and that is indeed a clever program. No, in order to achieve the results required from this program it is necessary to change one's entire overview of database.

There are many databases available for the TRS-80 now. All of them have been designed to store as much data as possible, as easily as possible. Not as an afterthought, but nor as a prime design requirement, they have also incorporated as fast a sort as was practicable. This program was designed from the outset to achieve unbelievably fast sort and search times. Indeed we do not recommend this database for application in which fast searching or sorting is not a prime requirement. And what are the applications? It's a hackneyed phrase to say that they are limited only by the user's imagination, but that's about it. Let's take an example. Suppose you are running a marriage or data bureau. An ordinary database will file all the names and addresses away together with the necessary information as to sex, age and so on and with some you would be able to sort the list, so that only people with similar characteristics were eventually obtained. With this database you could, for instance, file the name, sex, age, category of hobby, category of chief interest, vital statistics and other data so that at the touch of a button you could instantaneously display on the screen all women of a certain age with certain vital statistics, living in a certain area. You could also display men with similar (excluding the vital statistics!) data that fall into similar categories. And all of this almost instantaneously. Not everybody runs a marriage bureau, but other applications are not hard to think of. Estate agents can file details of property away so that they can instantaneously obtain data on houses in a certain area or of a certain size. Doctors can reach information as to patients with similar diseases, ages or whatever immediately. In the home, a record library can be stored and every record by a certain composer written in a certain year can be accessed without delay. The list of applications is endless. For any use where it is important to extract information within a certain range or it is important to sort information, this database will find a use.

The prime commands and features of this program are as follows:

Datafile creation

1. Create a file.
2. Add a record.
3. Delete a record.
4. Display a record.
5. Tape a file.
6. Amend a record.
7. Display the file data.
8. Load a tape.

Sort/Search

1. Sort up or down.
2. Page forward or backward.
3. Select a range for search.
4. Select or exclude a category.
5. Select or exclude on initial letter.
6. Resort records in a sort.
7. New sort all records.
8. Extended sort.
9. Arithmetic.
10. Display file data.
11. Load a tape.
12. Printout sorted data.

The data is displayed in columnar form and the data may be alphabetical, alphanumeric, integer or decimal. The number of columns is from 2 to 10 and the records may contain a maximum 44 - 60 characters depending upon the number of columns used. Columns may be of any width within the screen capacity but integer or decimal columns more than five and six characters wide respectively will not have the option of searching within a range.

The program consists of two parts. The first is used for entering the data and the second for the sort or search. The second part overlays the first when it is loaded so only 4K of memory is used by the entire program. The remainder of your memory space is available for data. The amount of data that can be contained will of course depend upon the amount of memory available, but as a rough guide a 16K user will be able to manipulate at one time 250 records of 39 characters each or 514 records of 17 characters each. As a further rough guide on sorting speed, the time to sort 1,000 records on fields of random strings of random length, or of random number between 1 and 99,999, averages under 2½ seconds.

Numeric columns either integer or decimal may be arithmetically manipulated almost instantaneously. A total may be cast or an average taken for any numeric column up to five digits. This is so fast that when adding 1,000 numbers totalling over 50 million, only a slight hesitation can be noticed before the total is given.

In summary therefore this program is ideal for any application concerning the manipulation of information whether it be business, personal or hobby which can be comfortably displayed as one record per line upon the screen and in respect of which it is required that super fast searches or sorts be carried out. The program is supplied on cassette. At this time it is not compatible with disk systems. A disk version is in the course of preparation. The cassette includes a set of data randomly generated which can be fed into part 2 of the program to demonstrate the fantastically fast sort and search features.

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Son of Hexadecimal Kid

Samson Synapse discovers the strange effects he can have on living things when some apple trees he planted bear floppy discs as fruit. He knows that in a world dominated by the fanatical Nullards, he dare not tell anybody about it but even so, little does he realise — in his first flush of enthusiasm for computers — just how dangerous his mysterious gift will prove.

Samson gave himself up to the subtle seductiveness of software completely. His secret night-time visits to the cedar wood where Bootstrap had hidden the moonshine micro became more frequent. Thanks to Bootstrap's acquisitiveness and his own green fingers, he possessed the finest micro laboratory in the world.

There he taught himself Basic and several assemblers, and there he spent many happy hours entranced by the musical whirr of discs in their drives or devouring back issues of the CP/M User Group Newsletter — otherwise known as the Gary Kildall Fan Club Magazine.

The brilliant flame of forbidden knowledge shone into the crevices of his mind like the glare from an atomic explosion. It took him over. Computing became the focal point of his life. Programming was his opium: if a day went by without a line of coding, his hands would tremble and his limbs begin to twitch. He even started constructing simple microcircuits from some plans Bootstrap had left behind, though he was hampered by a shortage of solder.

Meanwhile, his behaviour at home became increasingly eccentric. His mother was worried and Johnny McNull grew deeply suspicious. Samson's nocturnal outings took their toll — there were black bags under his eyes, and his conversation was absent-minded to the point of idiocy. Sometimes he dozed-off at the table in the middle of a meal from sheer tiredness.

Preoccupied with the mental dance of registers and stack-pointers, he became lazy in his work on the family plot, where before he had been an energetic and eager little boy. His relations with the rest of the household took a turn for the worse. McNull in particular was angered by the change that had come over him.

His home life would have been under strain anyway at that time, for his mother was pregnant once more. Her relationship with McNull, who now spent virtually all his time with them, had ripened over the years in an unspectacular fashion. Though nothing had ever been said, it was accepted that he was the man about the house and, in effect, Samson's stepfather.

The imminent arrival of a new baby, combined with his own erratic behaviour, distanced him from his mother; and his relationship with McNull deteriorated badly. He had never had much truck with Piltdown 2, so that left only Lambda to talk to.

"Aunt Lambda", he enquired one day, trying to sound off-hand, "you know when you have a PI/O attached to the interrupt line of a Z-80 processor"?

"Yes", she answered guardedly, giving him a quizzical look.

"Well, how do you make it hold the signal on the second channel if it's already busy with the first one"?

"Now why should you want to know a thing like that"? she replied with a wry smile, and the conversation was at an end.

During the period leading up to the birth, he kept up his experiments in vegetable cultivation on a small scale. He had his own little plantation at a discreet distance, well concealed from the house. He was not really worried that it would be discovered.

His main concern was that he would inadvertently affect some of his mother's vegetables and give the game away. That happened only once, when a row of runner beans started sprouting RS232 interfaces and he was forced to take the blame for the destruction of their entire bean crop.

In his own patch, there was nothing as dramatic as his first effort with the apple trees, though one myrtle bush surprised him by growing a plastic leaf with straight edges which was to prove useful later. On one side, it had the words, American Express, embossed in blue lettering with his own name underneath. On the reverse, it bore the legend, I promise to provide the bearer, on demand, anything he can credit.

Not knowing what to do with it, he popped it in his back pocket and kept it for luck. It had a reassuring feel to it, and when he brought it out and waved it about he felt oddly self-confident.

On one plant he lavished particular affection. It grew from a cutting he saved when he had to uproot his original apple orchard. He put it in a pot and kept it on the window ledge of his bedroom. Sometimes, he would sit gazing abstractedly at the delicate tracery of its branches spreading outwards and upwards from the smooth green surface of moss at its base. On one of these occasions McNull barged in.

"Wherefore doest thou waste time sitting up here"? he demanded. "If thou wouldst do something of value the potato beds need weeding".

"This is the Binary Tree of Knowledge", declared Samson, still half in his reverie.

"Talk not of such things", warned McNull, "for fear the Nullards hear of it; and if they take thee this time, I shall not try to save thee".

"You didn't save me last time".

"I said I shall not try", answered McNull. Then he turned and swept out of the room.

Samson waited until his footsteps faded, then rushed to his bed and lifted the mattress to reveal a few precious sheets of notepaper. Looking at the branching of his tree had suddenly given him an idea for a new sorting procedure.

So busy was he with his tree-sort routine that he did not notice the rumpus downstairs which started a few minutes later, nor the fact that McNull had returned.

McNull took one look at what he was doing and snatched the papers away.

"Hey", he expostulated. "I need those".

"Others have needs greater than thine", replied McNull. "Hasten to thy mother's side. Do as thine aunt commands, for the child is shortly to be born". Cleo's labour had begun.

"What about my subroutine"? Samson demanded.

McNull turned to face him and, very deliberately, tore it to shreds in front of his eyes. Something in Samson's head clicked at that moment. He looked up at his stepfather and saw an enemy. Grudgingly, Samson slouched downstairs.

Soon both he and McNull were scurrying about under Lambda's direction, fetching water, heating up pails, rushing about with clean linen and bumping into one another.

The baby was born late at night. It was a little girl. McNull held her up and made a long speech no one could understand while Lambda looked on beaming. Cleo sat propped up by pillows looking somewhat stupefied. Samson was left to do most of the clearing-up. There seemed to be an awful amount of blood. He did not like any of it — the blood, his mother's moans, McNull's speechifying.

Lambda swaddled the baby and put it in its cot. It slept at once and the whole household settled down to rest, but Samson could not sleep. A strange hunger gnawed at his entrails. After what seemed like hours of restless tossing and turning, he crept downstairs.

He peered at the little infant, sleeping so peacefully by candlelight. Only its head and one plump shoulder were showing from its wrappings. Samson licked his lips. He stared at one tiny blue vein in its neck, trembling like a butterfly's wing.

An animal compulsion took hold of him. He bared his teeth and bent down, his eyes feasting on the succulent newborn flesh. Has Dracula risen from the grave?

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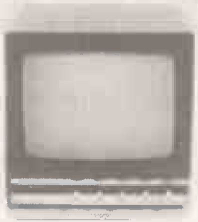

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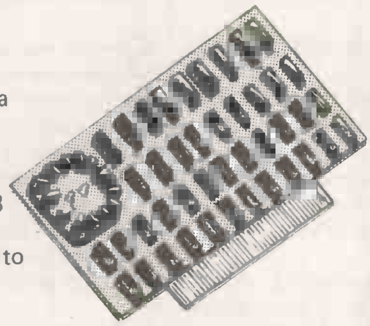

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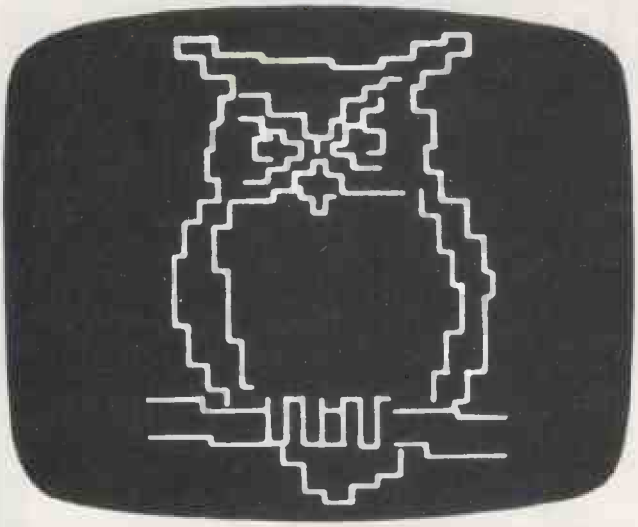

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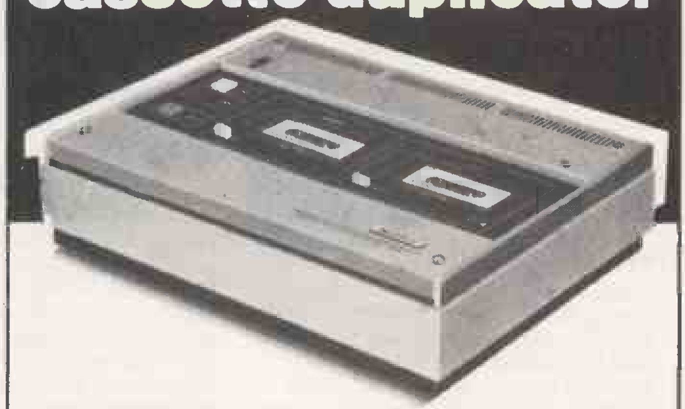

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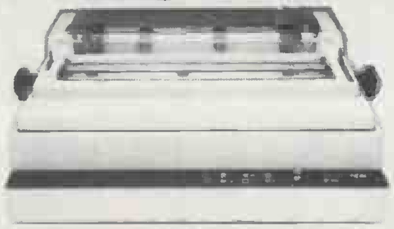

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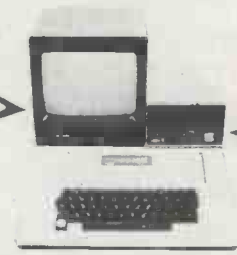

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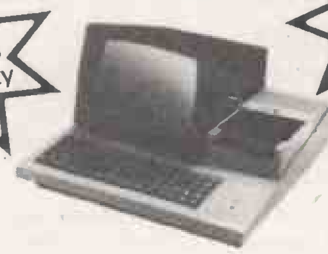

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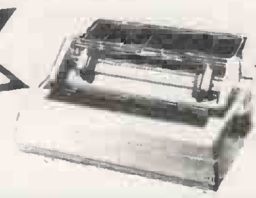

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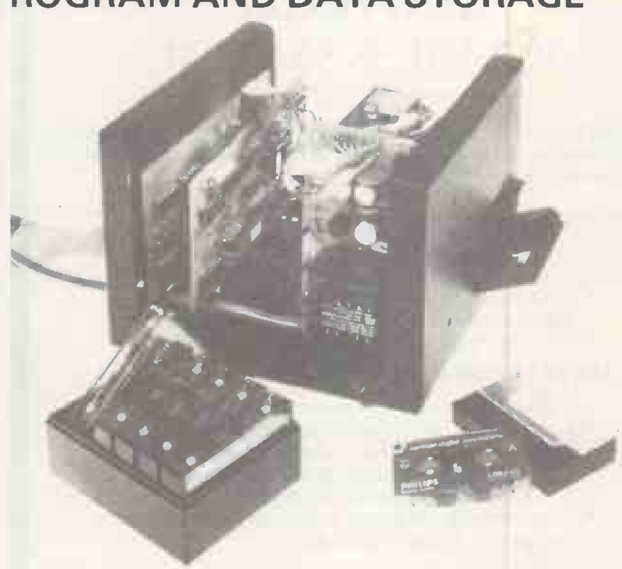

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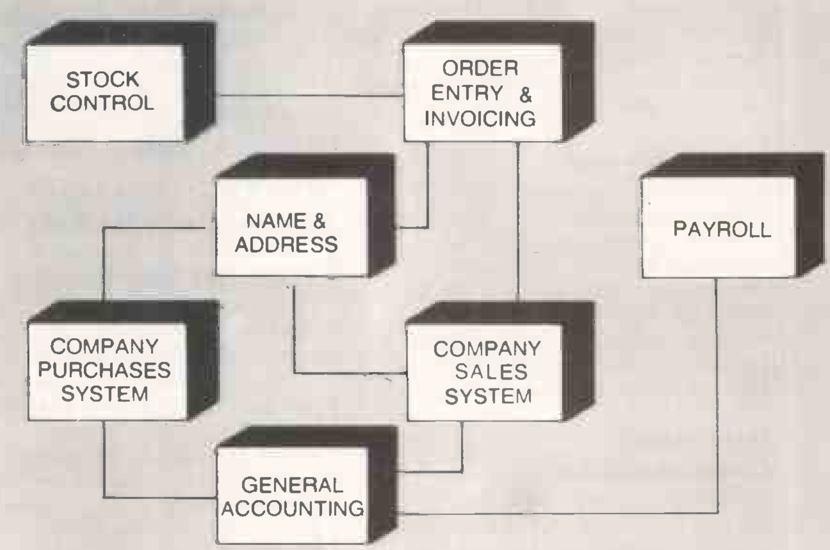
INTEGRATED SMALL BUSINESS SOFTWARE ISBS

ISBS - F



A totally Integrated Small Business System designed for single user floppy disk based systems. ISBS-F is already being used by many Businesses and Professions throughout the UK. Each package can be used as standalone or can be built into an integrated system depending on user requirements. All packages are fully supported and maintained, and are supplied with easy to follow Reference Manuals. ISBS-F is easy to install and ideal for the first time small Business user with no previous computer experience.

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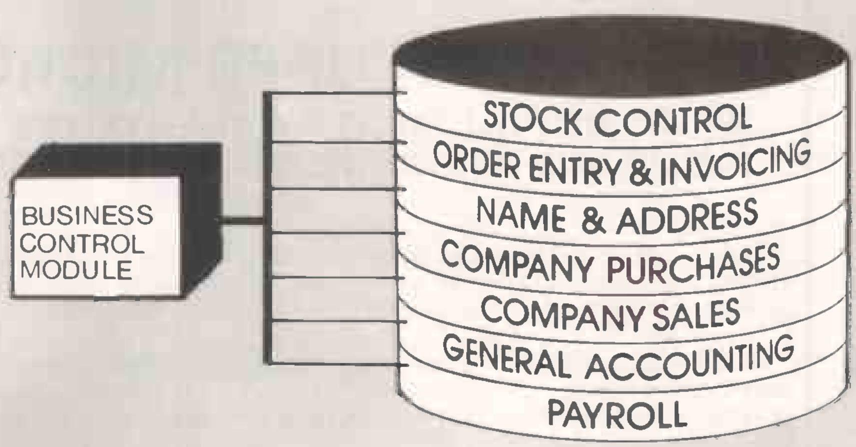
A Hard disk or Winchester disk based Integrated Business Software system which is upwards compatible with ISBS-F. This system is ideal for the small to medium size user where data storage and processing speed exceeds the capabilities of floppy disk based systems. Choose from any combination of modules and add others at a later stage if required. The system features many facilities found in minicomputer and mainframe business packages. All modules are fully supported and maintained and comprehensive documentation is supplied with each installation.



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ISBS has been designed for most popular 8080/Z80 Microcomputer disk systems running under CP/M*
ISBS-F: 48k & 2 floppy disk system, VDU, 132 col printer, CP/M* 1·4 or 2·x
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I.C.L. — BURROUGHS — DEC — I.B.M.

The 4500 talks to ICL, Burroughs, IBM, DEC, etc.

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Z80 processor/158 instructions 64K memory addressability plus 16K switch in blocks. Microbus for easy expansion — data, address, interrupt, control and timing.
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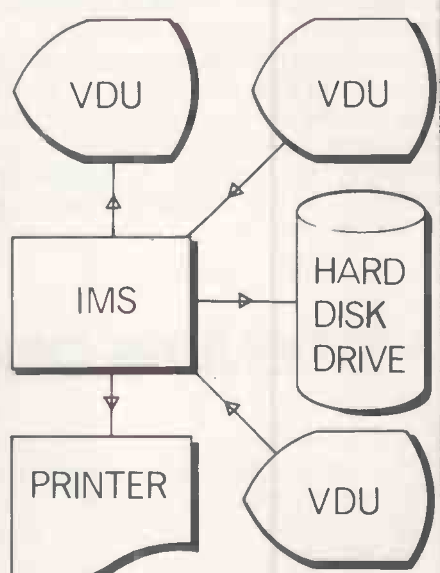

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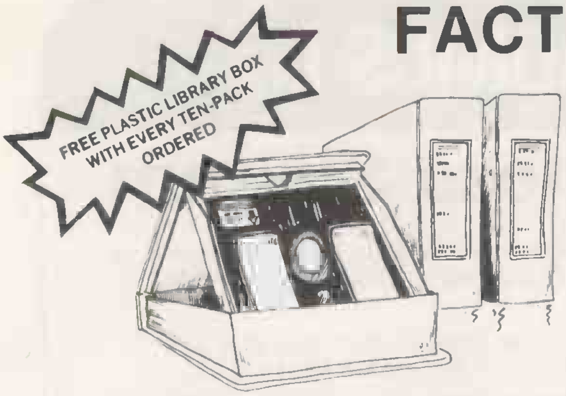

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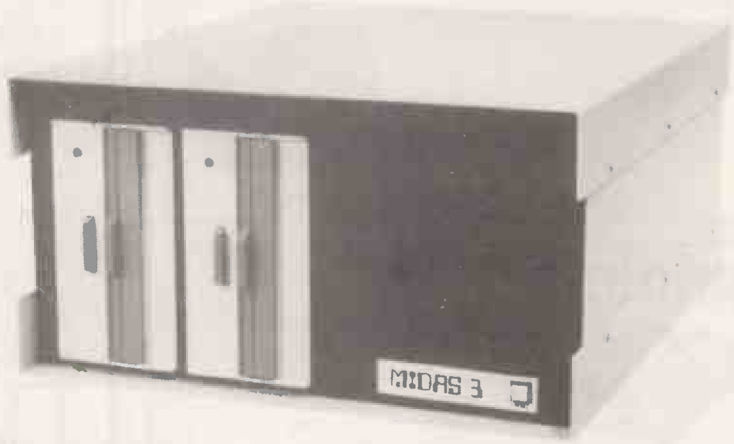

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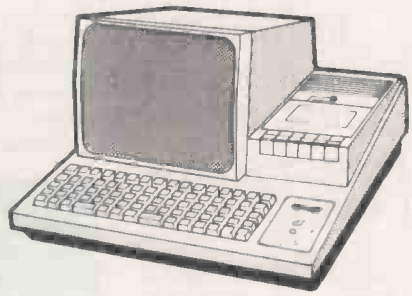

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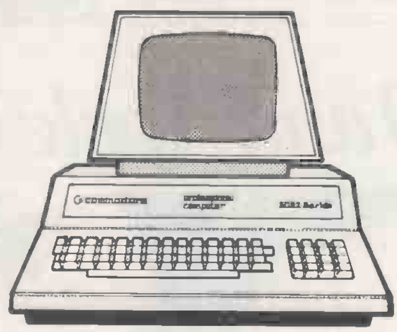

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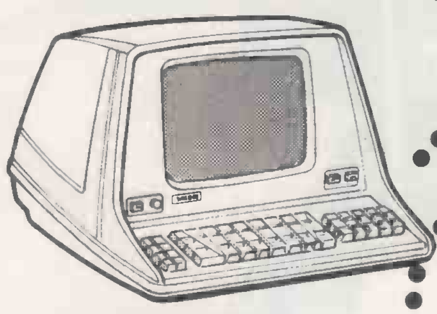

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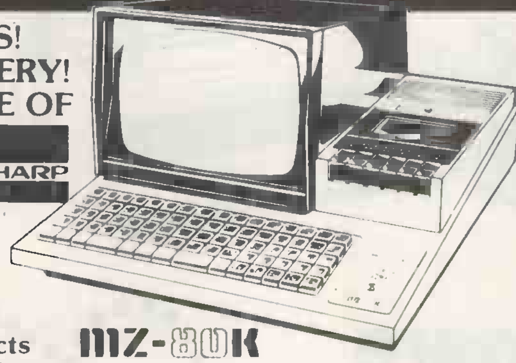

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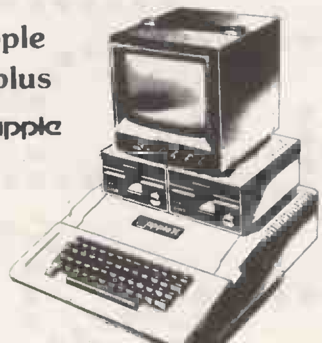

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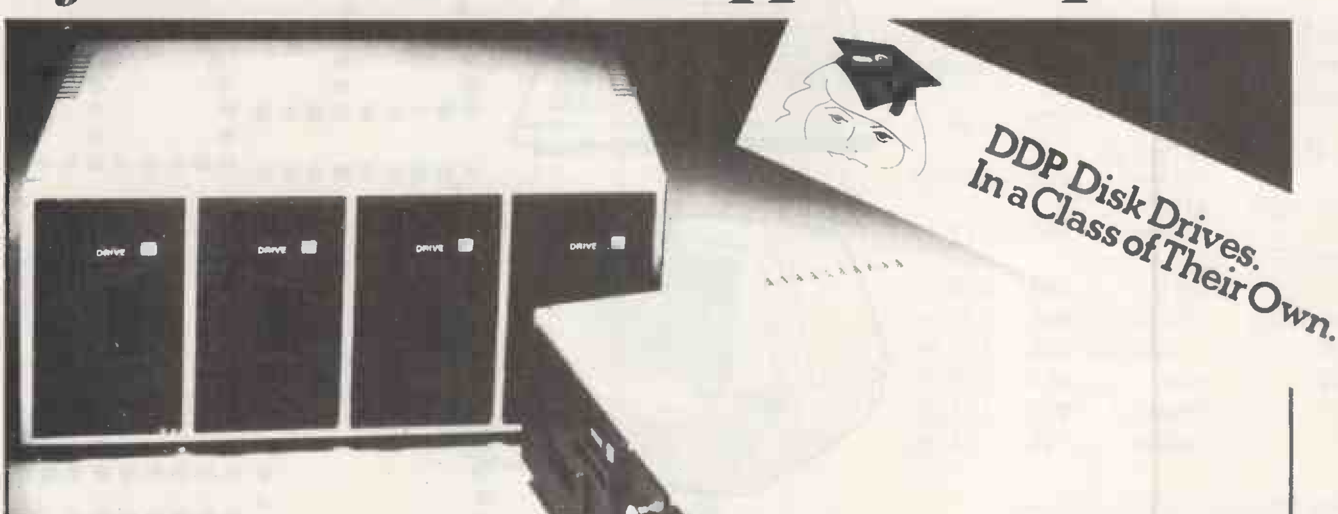

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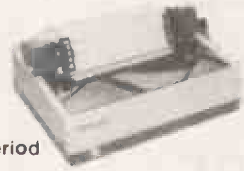

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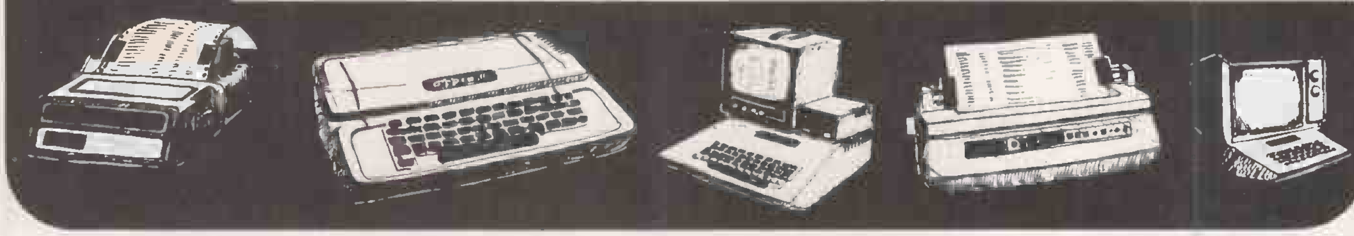

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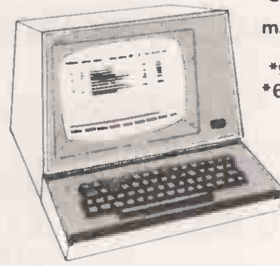

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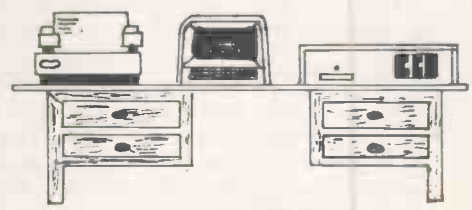

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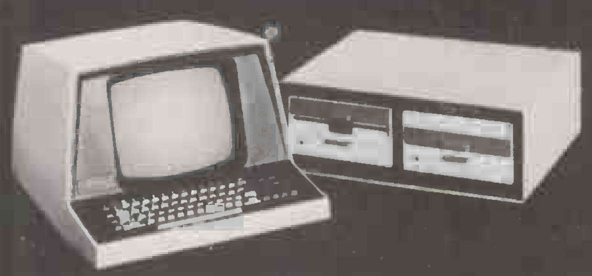

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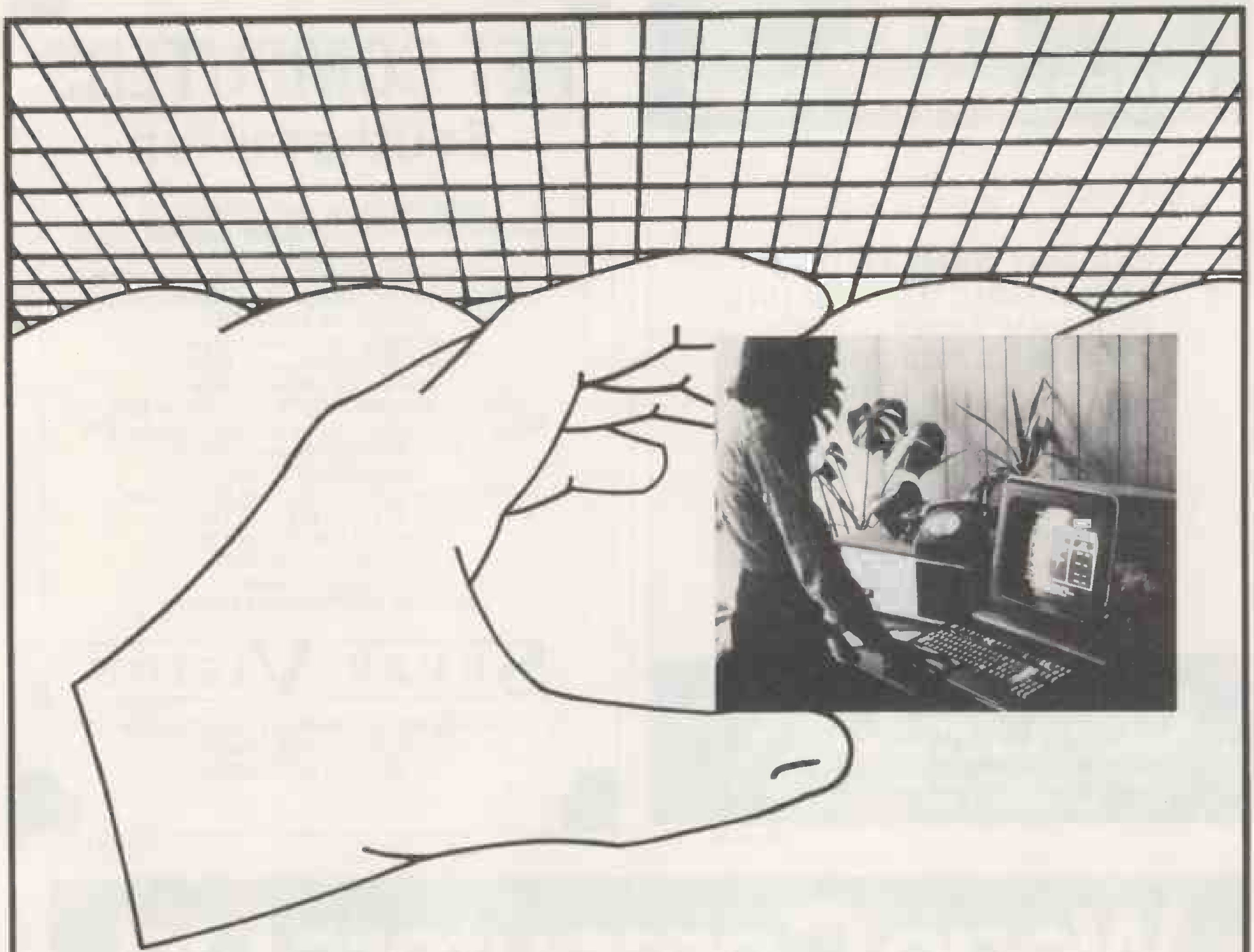

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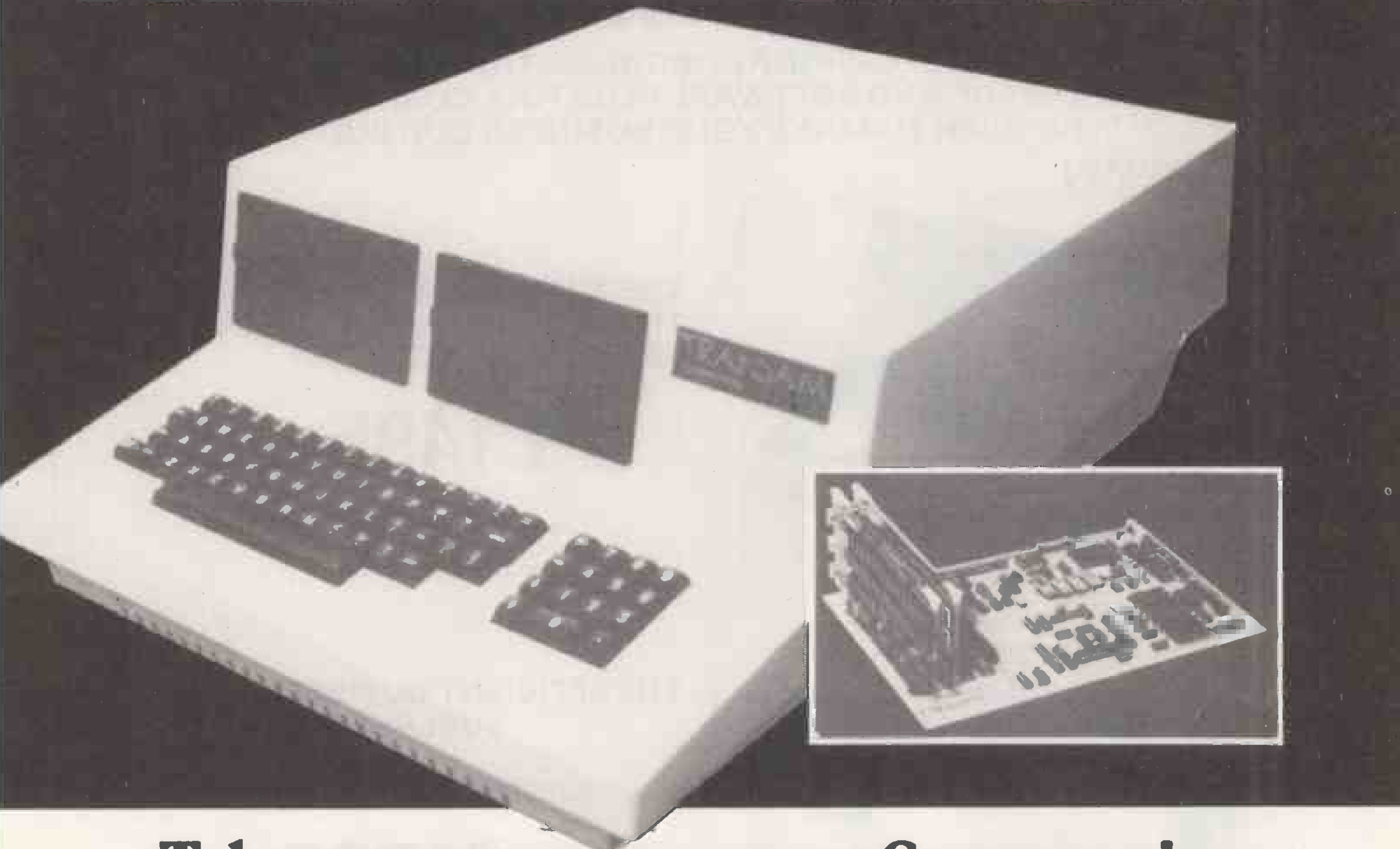

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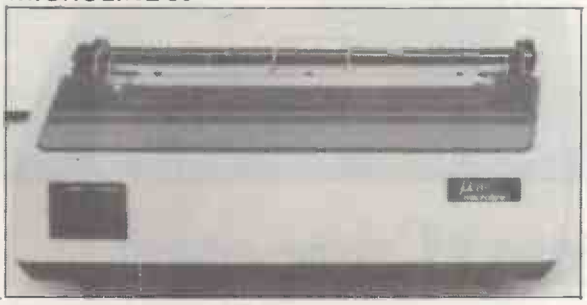

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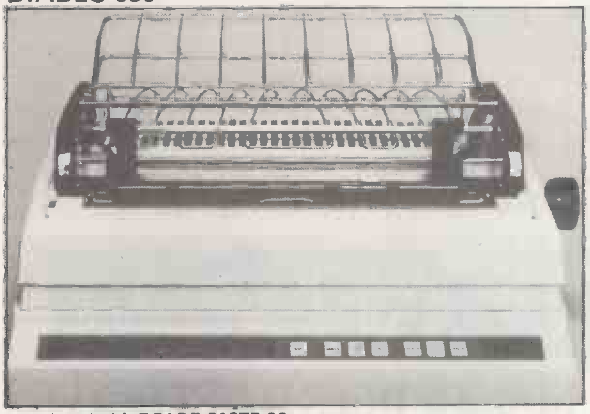

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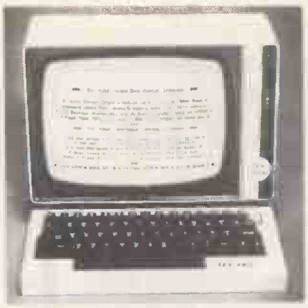

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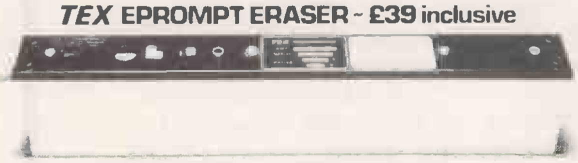

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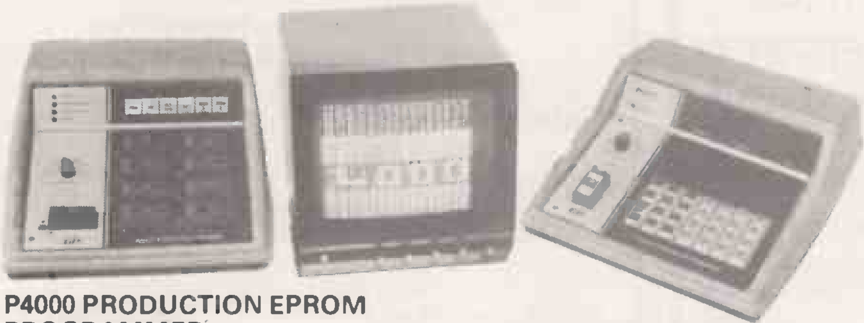

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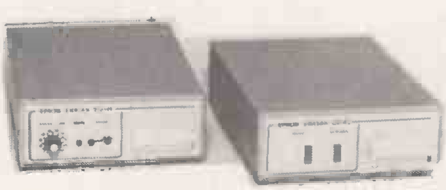

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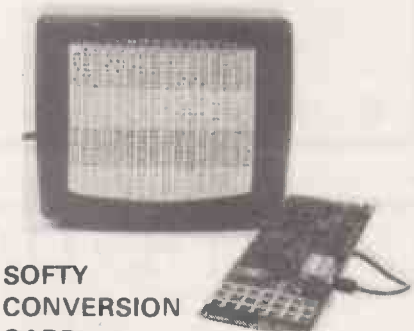

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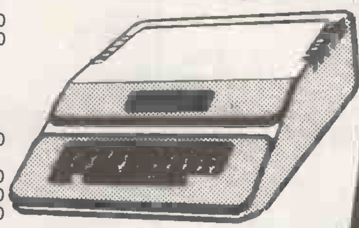

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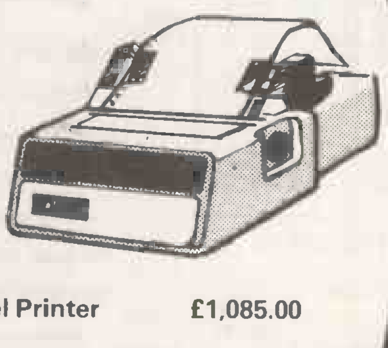

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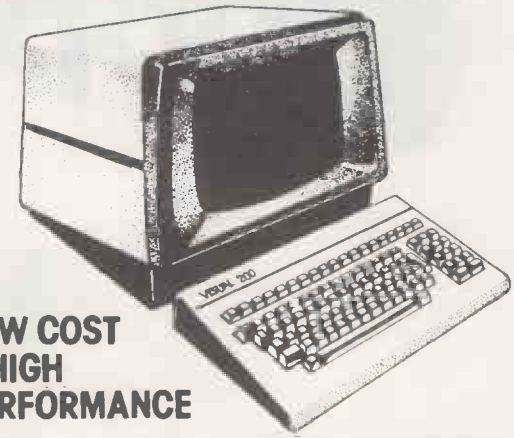

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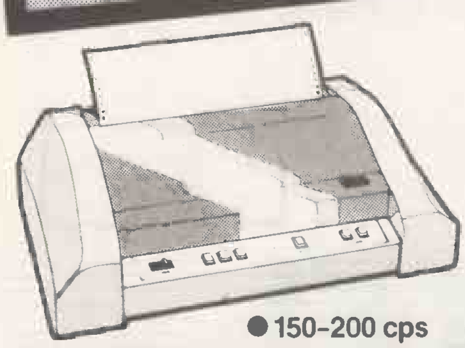

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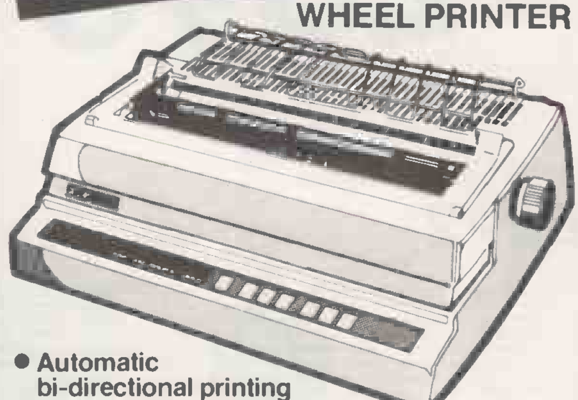

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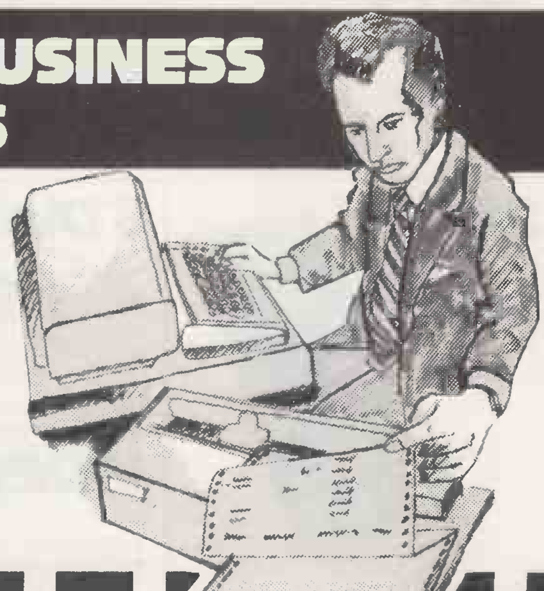

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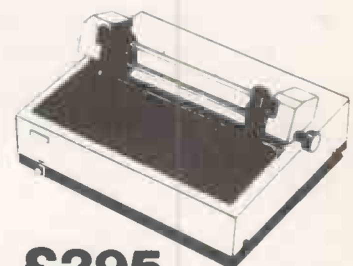

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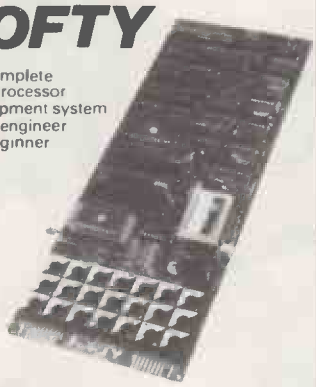

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For the software, all codes and features have been implemented in a manner identical to the VT100 assuring plug-to-plug compatibility.

The big difference between the VISUAL 100 and the DEC VT100 is that the VISUAL 100 offers features not available on the VT100, or available only as extra-cost options. These added features include:

- ETCHED NON-GLARE FACEPLATE
  Your operator will appreciate viewing characters through an etched non-glare faceplate. This feature assures crisp, sharp character resolution even in the brightest office environments. Further, the tilt screen feature allows an adjustable viewing angle, 10° to 15°, for optimal viewing comfort.
- ADVANCED VIDEO PACKAGE IS STANDARD
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VISUAL 200

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The VISUAL 200 is a new, low cost, microprocessor based video display terminal which truly stands above competitive teletype compatible terminals in its price range.

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- Detachable Keyboard
- Smooth Scroll
- Tilt Screen (10° to 15° viewing angle)
- Large 7 × 9 Dot Matrix Characters

Perhaps the most distinctive feature of the VISUAL 200 is the Switchable Emulation capability. A switch on the rear panel programs the terminal for code-for-code emulation of a Hazeltine 1500, ADDS 520, Lear Siegler ADM-3A or DEC VT-52. To an O.E.M. customer it means no change in software to displace the older, less powerful terminals in his product line with the new, reliable and low cost VISUAL 200. To a Distributor it means offering a single modern terminal which is compatible with all the software his customers have written for the older terminals. And you're not limited to merely emulating these older terminals; you can outperform them at the same time by taking advantage of the additional features of the VISUAL 200.

Reliability designed into the VISUAL 200 is evidenced by its solid state keyboard, single P.C. Board and self test diagnostics on power up.

Seeing is believing, so see for yourself. For a demonstration and a pleasant surprise on quantity pricing of the powerful, easy to use and reliable VISUAL 200, call or write us today.

Standard Features

- 24 × 80 Screen Format
- 7 × 9 Dot Matrix
- Upper/Lower Case
- Numeric Pad
- Background/Foreground
- Blink Line
- Insert/Delete Line & Character
- Columnar and Field Tab
- Set/Clear Tab
- Security Mode (non-display)
- Clear End Line, Field & Page
- Clear Line
- Clear Screen
- Line Drawing
- Current Loop or RS-232 Interface
- Secondary Channel
- Composite Video
- Serial Copy Port
- Hold Screen
- Baud Rates to 19,200
- Self Test
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- Cursor Control Keys
- Read Cursor Address
- Typamatic Keys
- Smooth Scroll
- Microprocessor
- Detachable Keyboard
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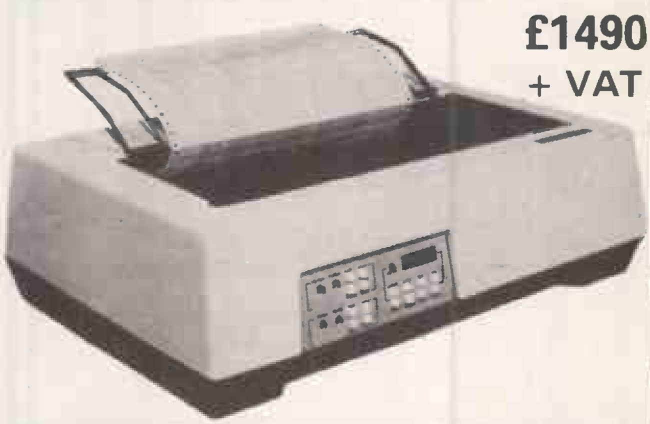
- Read Terminal Status
- Tilt Screen
- Switchable Emulations

DATASOUTH DS180

HIGH SPEED MATRIX PRINTER

£1490 + VAT



The Datasouth DS180 is a dot-matrix serial impact printer designed for high performance at an economical price. Application flexibility and a long list of standard features make the DS180 an ideal device for small business systems, distributed communications networks and intelligent terminals.

HIGH SPEED PRINTING

Utilizing 180 cps optimized bidirectional printing, the DS180 offers higher throughput than any printer in its class. Its 9-wire printhead produces highly legible 9x7 characters with decenders for lower case letters and true underlining. All 96 ASCII characters may be printed across a 132 column line at 10 characters per inch. Expanded characters (5 cpi) may be selected for highlighting portions of the text.

USER PROGRAMMABLE

The DS180 offers a large number of user programmable features, yet is easy to operate. A unique programming keypad with a non-volatile memory makes printer set-up quick and simple. Top of form, horizontal and vertical tabs, perforation skip-over and auto line feed are just a few of the features the user may select. Communications status may also be programmed and monitored using the indicator panel lights and LED display.

ATTRACTIVE DESIGN

Compact, desk-top packaging allows the DS180 to fit into almost any installation. Its noise dampening cover makes it suitable for use in a quiet office environment. The cartridge ribbon makes routine changes clean, fast and convenient.

MICROPROCESSOR ELECTRONICS

Through the use of state-of-the-art microprocessor electronics, reliability and maintainability have been greatly improved. The simple modular design of the DS180 provides easy access to all major components. A single printed circuit board contains both the power supply electronics and digital controller for the printer. A self-test feature and diagnostic display panel help the user verify proper operation of the unit and isolate problems should they occur.

COMMUNICATIONS

Interfaces on the DS180 include RS232 and 20mA current loop serial interfaces, and a Centronics compatible parallel interface. Baud rates from 110-9600 and parity selection may be keyed in by the user for his specific application.

FORMS HANDLING

Adjustable tractors accomodate forms from 3-15 inches wide. A head-to-platen gap adjustment ensures optimum print quality on up to 6-part forms. Fanfold paper may be fed from the front or bottom of the DS180. A paper out sensor may be programmed to send a stop transmission character and sound an audible alarm.

QUALITY MANUFACTURING

Reliable performance is ensured by a stringent quality control program. Datasouth uses pretested, high reliability parts from leading manufacturers. Multiple tests are performed on sub-assemblies during each stage of production, with each completed unit undergoing a final 24 hour print test and burn-in. The DS180 carries a 90 day warranty on materials and workmanship.

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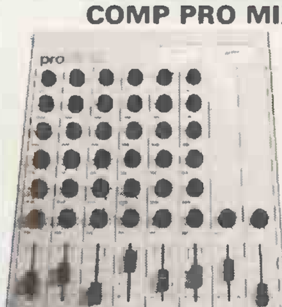

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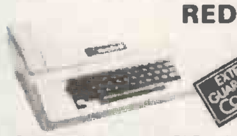

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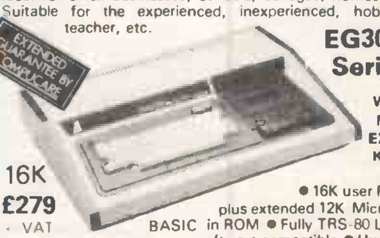

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WITH NEW EXTRA KEYS!

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- Fully TRS-80 Level II software compatible
- Huge range of software already available
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- Absolutely complete — just fit into mains plug.

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