Practical Computing

80p
February 1982
Volume 5 Issue 2

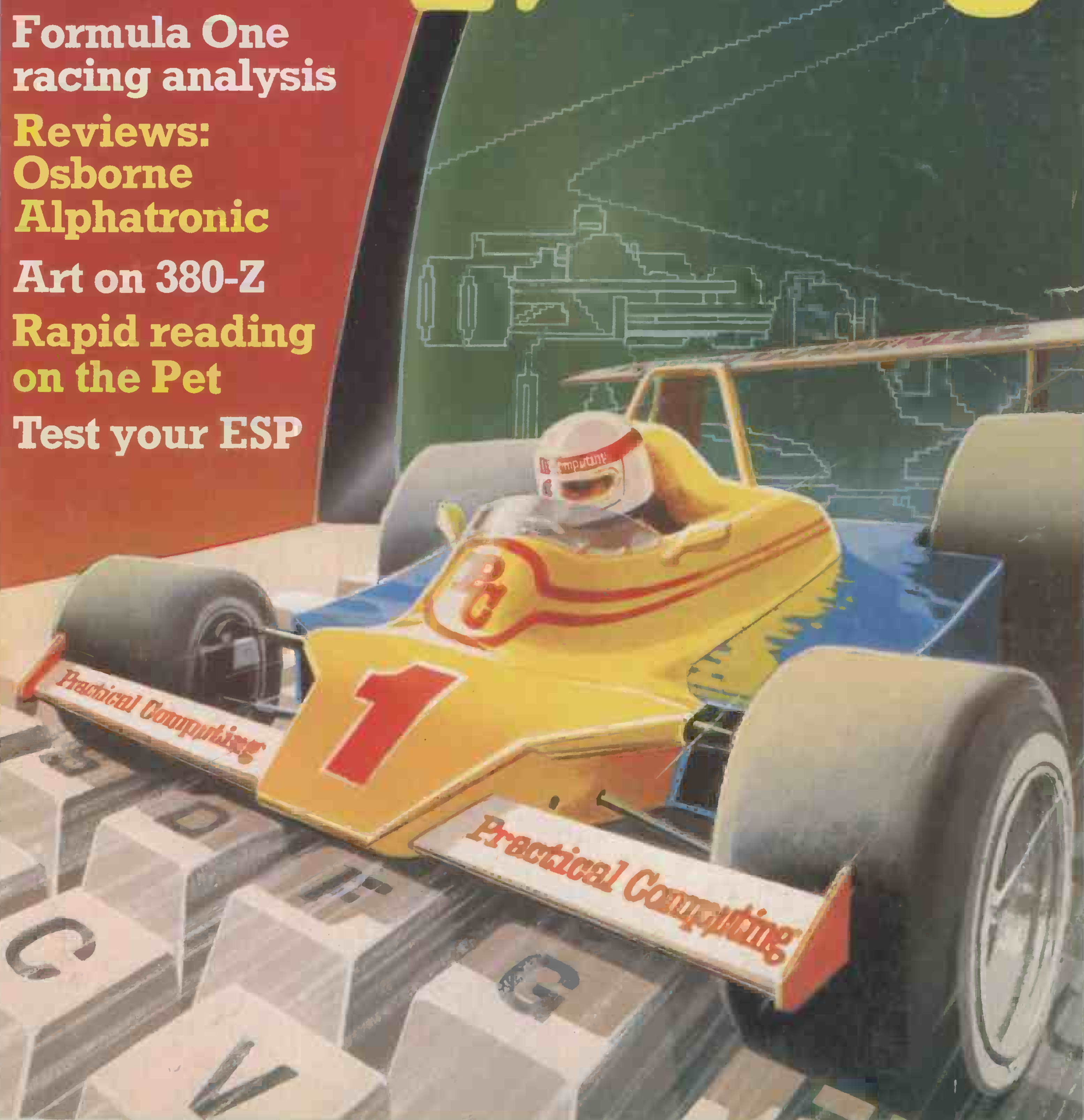
Formula One racing analysis

Reviews: Osborne Alphatronic

Art on 380-Z

Rapid reading on the Pet

Test your ESP



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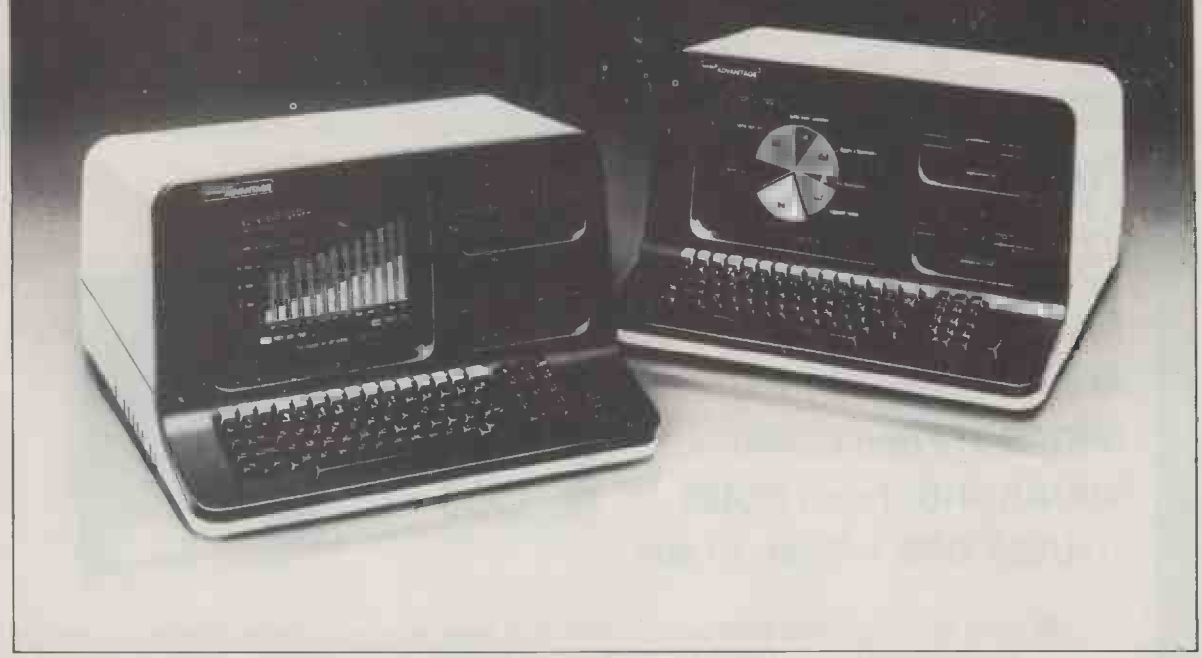
Trust Comart to turn a new ADVANTAGE



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ADVANTAGE is the exciting new, packaged high performance desk top computer with integral video screen. It brings the proven reliability, so long the hallmark of NORTH STAR products, into new and broader fields of application.

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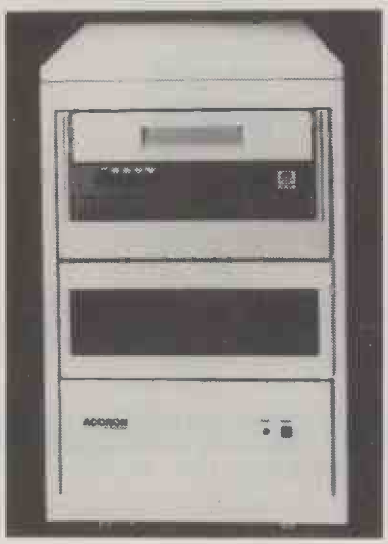

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From £2,400 to £35,000

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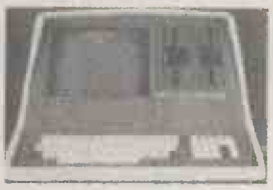

But the real beauty of the CompuStar is its "shared logic" design concept. Each user station contains its own distinct microprocessor and RAM. The result is lightning fast program execution. Even when all 16 users are on-line. Even when all are performing different tasks! A special multiplexor circuit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

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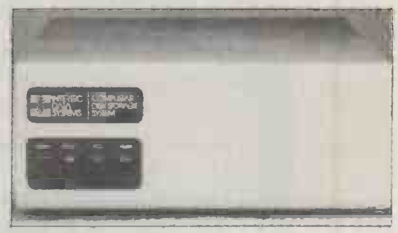

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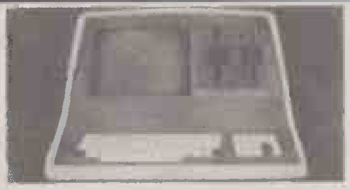

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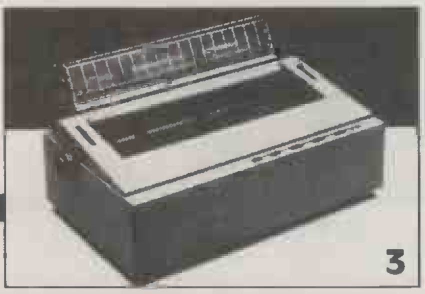
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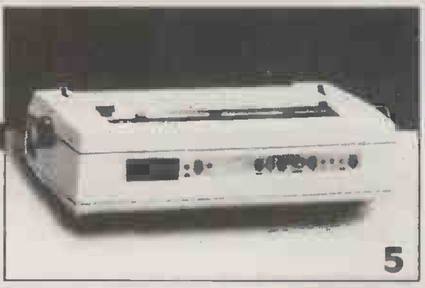
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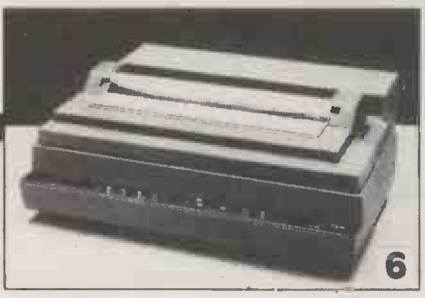
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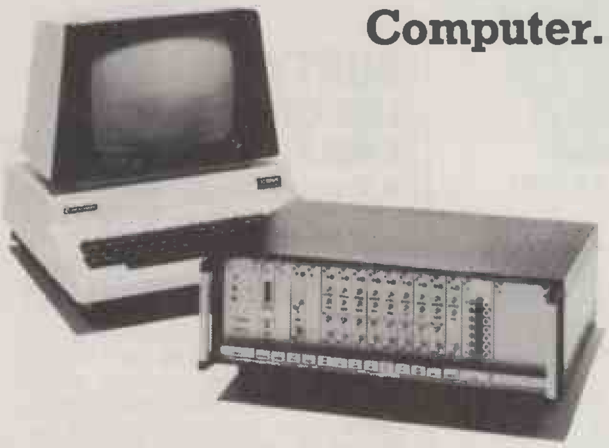

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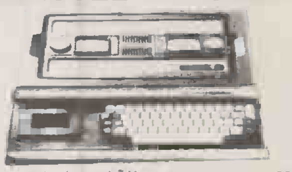

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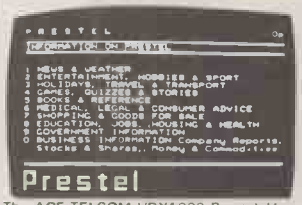

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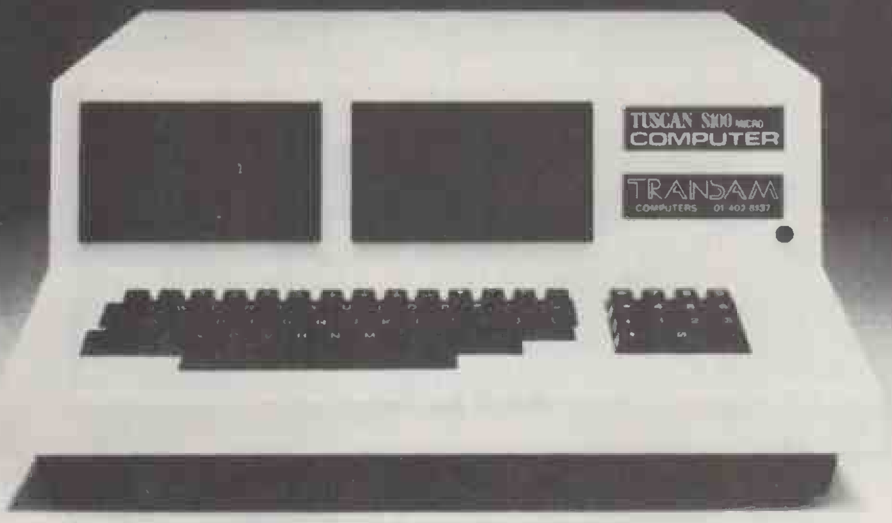

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Requires: 32K CP/M
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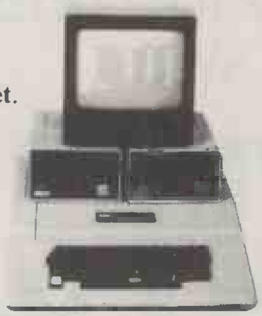

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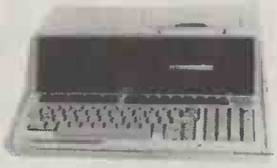

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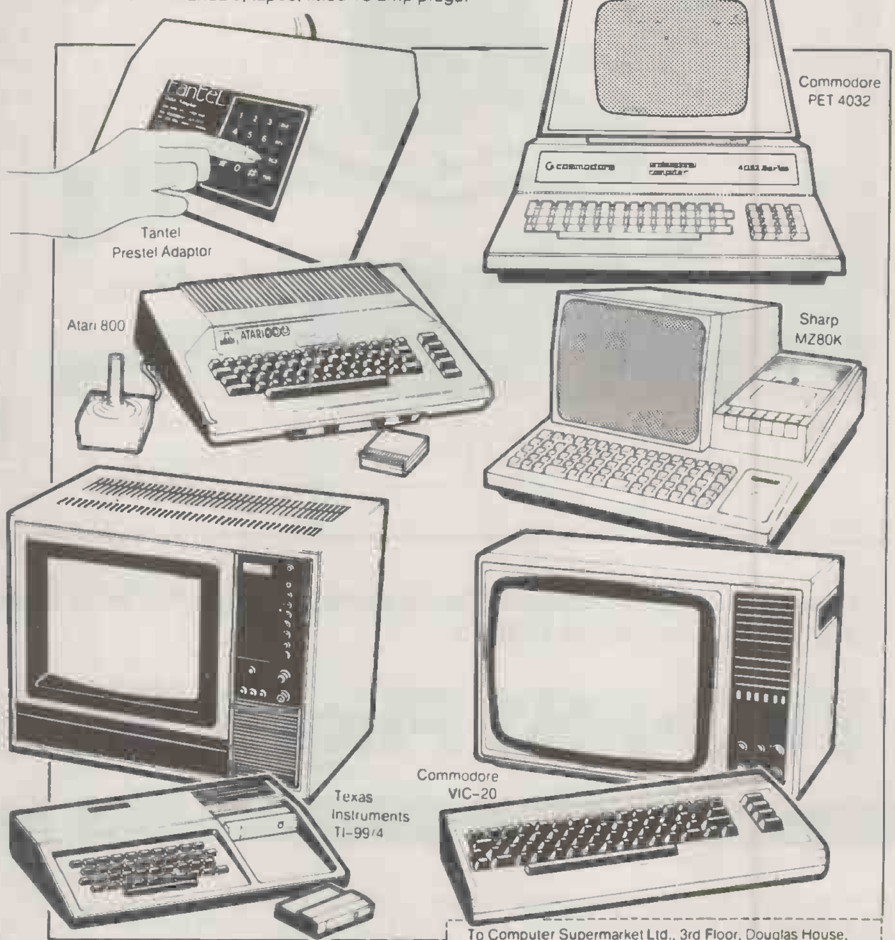

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EVER SINCE the creation of the universe — the micro-universe, that is — we have known very well how a computer should be made. You take a processor — Z-80 or 6502, according to choice — you string it to 64K of memory and tack on some frills.

"64K" has become a magic number: we think of it as very big if we have small machines, or very small if we have big programs. Like it or hate it, we were bound by that 64K as the edge to our universe.

Yet, quite recently that number has been wobbling, shaking and dissolving like a mirage. By a little trickery, you can arrange the memory in banks of 64K each and make the processor switch between them. It is as if you had a postman who just worked in one street using the numbers of the houses. You put him in the next street along and he rushes about quite happily picking up a letter at number 386, delivering it to number 24 without noticing that quite different people live at those numbers now.

The other way to get more RAM is to move to a bigger processor. The newish 16-bit devices can cope with at least 16 million addresses. They can play in a memory field that is as big as you can afford. The drawback is that because the processors are so complicated inside, they are very hard to make and are therefore expensive. An 8086, for instance, costs upwards of £100 — a Z-80 costs £5 — and the bits that fill in round it are dear in proportion.

What, then is going on? The short answer is that RAM, the way everyone predicted, is daily getting cheaper. When this magazine started, in May 1978, a 16K x 1 RAM chip cost £11. Today you can buy the same thing for £1. Admittedly a single chip is not much use: you have to have them made up into a board with buses, refresh and power. But even so, you would not expect to pay more than £200 for an extra 64K today.

But what is that to the innocent bystander? Even if he does manage to stay with us, he is unlikely to care a toot whether his machine has one K or 10,000. The great mass of micro users will not write programs, and the difference is academic to them in practice. Extra memory will not be an important selling feature — not really important in the way that the colour of the box and the amount of spaghetti hanging out the back are important — until it is reflected in the performance of software packages, and until the paying customer can distinguish the virtues of one package from another. Which he cannot as yet.

So why all the fuss? One may discern two reasons: one honourable, one practical. Firstly, there is no denying that hardware is increasing in power and decreasing in cost and there is the natural desire to bring these advantages to the people. Secondly, there is the siren song of the already large micro market and its gigantic promise of future wealth. At the moment it is dominated by Commodore and Apple — to get a foothold, the newcomer has to offer something much better than these two. The obviously much better thing is the 16-bit machine or the supercharged eight-bit.

The snag to this is that the punter does not yet exploit a fraction of the capacities of the standard eight-bit machine. It is useless to tell him that the new super-wonders will do much more because he does not even know what to do with what he has got.

This puts the innovative entrepreneur in a bit of a bind. It was illustrated rather prettily by a recent conversation with Chuck Peddle, an amiable American gentleman whose claim to fame is that he designed the Pet. Having apparently fallen out with Commodore he is now offering a machine called the Sirius 1 which will be sold here by ACT.

The Sirius 1 is, even to the jaundiced editorial eye which is less than thrilled by American gear, a handsome machine. It has a 16-bit processor, comes with 128K of RAM as standard and more can be added at low prices. It has a very high-resolution screen with some clever software controls — for instance, you can redesign the shape of the letters and numbers it prints as you go along. It can load eight different typefaces and use them completely intermingled. You can record voice messages on a program disc and make it bark orders at the unsuspecting user. And all this for £2,300.

It seems very interesting, but a good way beyond most users' actual needs. Why bother?

Peddle's answer is that he proposes to give the programmer a machine so flexible and so powerful that he will spurn all others. Having written his applications software for the Sirius, the customer will have to buy the machine in order to get it to work as wonderfully as he possibly can.

It all seems a bit roundabout. People buy a particular computer because the shop near them sells it, or they know someone who has one. Technical excellence hardly comes into it.

The real reasons look much more commercial, and reminiscent of the aggravation we have recently seen in the video-recording market. It seems a bit like a solution looking anxiously for problems. If the punter has no problems, he damn well ought to get some.

Our own view is that people will not discard existing eight-bit machines, or stop buying them through the now well-developed channels, until something at least 10 times more powerful is available. And this does not just mean more powerful hardware, but software to exploit the machine's power, and storage to complement both.

We are talking about a processor with the power of a mainframe, memory of the order of a megabyte and 100MB at least of back-up. And all this on your desk at the price of an Apple today.

Technically this is not unreasonable. It could be around in prototype in a year to 18 months. But it presents the user with a whole new set of problems. This kind of machine is not just an accessory. It is capable of holding and processing all the records of a large business. Setting it to work properly will present all the well-known problems of installing a mainframe. It is not something you do overnight. But, because the hardware will cost so little in proportion to what it can do, potential users may well be very puzzled how to cope with it. To begin with, does it make sense to spend tens of thousands of pounds keying all your records into a machine that costs no more than an electric typewriter?

Quite obviously, when hardware costs are so low and capacity is so high, what will constrain growth will be people's attitudes. Even if computing power is as cheap as water, people are not going to go out of their depth until they can swim. And training the millions of people who will have to be able to swim will take decades rather than years.

The conclusion of this argument is that technical innovation, while amusing for the people doing it, is not going to be crucial in getting a share of the micro market. It is turning rapidly into an ordinary consumer-durable business in which, sadly, the appearance of the goods, the shops they are sold in and the quality of the leatherette on the disc drives are the things that matter.

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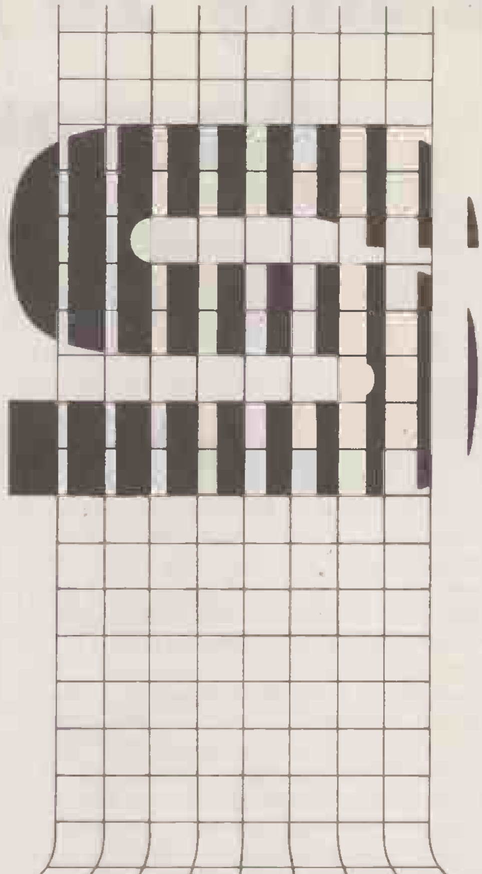

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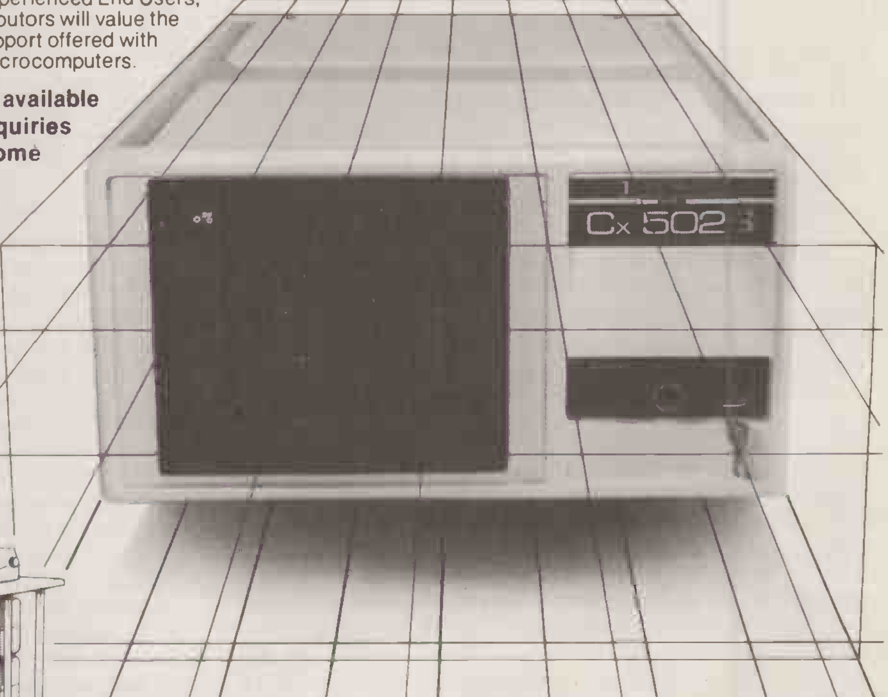

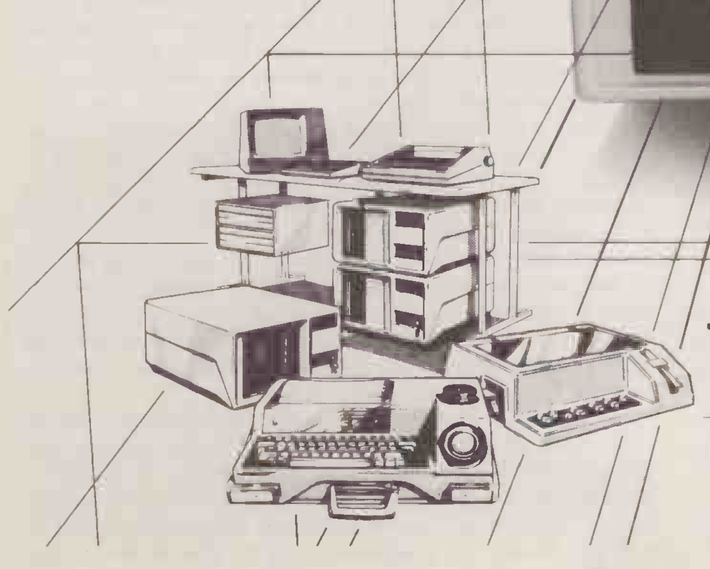

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Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback—it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

Comal confusion

COMAL MAY indeed be a better language than Basic. It seems that the closed procedure is a more primitive mechanism than the scoping rules of Pascal, but better than nothing.

Unfortunately the article on closed procedures in Comal-80 — *Practical Computing,* November 1981 — was marred by numerous errors in the example. These do not detract from its use as an illustration of the flavour of the language, but they might confuse someone who tries to follow the details.

The errors I found are:

- Lines 8024 to the end of column 1 should be deleted as they are a garbled repetition of column 2.
- Line 8167 should be inserted, reading
  IF R(−1)<0 THEN R(−1)+0
  otherwise a constant, when differentiated, will yield order = −1.
- Line 8174 should read
  DGR: = NUMERA(−1) + DENOM(−1)−1
  Add, Sub procedures should have warnings that the arguments must be the same length. This restriction can be avoided, and the procedures greatly simplified, by recoding as:

```
PROCEDURE ADD(REF A(),REF B(),REF
  R()) CLOSED
EXEC ASGN( A,R)
FOR I: = 0 TO B(−1) DO
R(I): + B(I)
NEXT I
IF B(−1) >A(−1) THEN R(−1): = B(−1)
ENDPROC ADD
```

- Line 8192 should read EXEC ASGN (R2,DENOM). As the assignment stands it sets the original denominator as the answer. The correct answer for the denominator should be:
  Degree = 8
  16 48 −20 −60 45 −102 79 −30 25
  Derivative = 0.0968858

Chris Lusby Taylor,
Intel International,
Paris.

Notes on Piccolo

READERS of Bill Bennett's review of the Piccolo — *Practical Computing,* December 1981 — can be reassured that English versions of Comal are now available along with UCSD Pascal and CP/M.

The reviewer probably did not have time to investigate the direct-access files but the combination of these with Comal enables clarity and control to be maintained in more complex situations. For example, we have just completed an inventory package with two major and 19 subsidiary files. It is a 20K package of clear, readable programs made possible by the combination of a sensible hardware configuration and good modern systems software.

I would not have attempted it in unstructured Basic, though I realise that it can be done. Comal provides a more pleasant approach for those who are only moderately capable.

Roy Atherton,
Bulmershe College of Higher Education,
Reading,
Berkshire.

Names for Life

IN 6502 SPECIAL — *Practical Computing,* December 1981 — Simon Cogle mentions the pattern of five cells in the Game of Life, which he calls "The Spinner". This pattern has been known for many years and was christened "The Glider" by Conway's Cambridge group. There is also a "Glider Gun" which fires off a glider every 30 generations.

This rediscovery has given me the idea that it might be worth trying to establish an index of known patterns with interesting developments. It would save a lot of duplication of effort among the many people who have discovered the fascination of this game.

G J Suggett,
Chichester,
West Sussex.

Uncritical comments

I READ the review of the Silicon Office in the November issue of *Practical Computing,* with some surprise. While it is clear that there is much of great value in this software — and indeed all the reports of it are very good — the review was, to say the least, rather uncritical. I was particularly concerned about the comments by Mike McDonald that Silicon Office contains "the first true database-management system we have encountered on a micro whereby up to six files may be open and accessed simultaneously during a run". I suspect that this statement may have caused some surprise to the many companies who already market packages which meet this description — not so much because the reviewer has not come across them, but more because he has promoted a simple file-handling system to a database-management system.

Among the identifying features normally put forward for a DBMS, one of the most significant is the ability to link different files together logically, in a hierarchical network or relational structure. Mike McDonald is correct in his implication that this is very rarely encountered on a micro — although there are exceptions such as MDBS, a full network DBMS running under CP/M. However, nowhere in his review is there anything to suggest that the Silicon Office contains a genuine DBMS.

Attention could easily be diverted from the positive aspects of the Silicon Office by its failure to live up to the claims made for it — a rave review is not always a good thing. It is unfortunate to see your own software consultant fuelling the many misconceptions and mysteries which still surround the concept of a DBMS.

Graham Seel,
Gillingham,
Kent.

Apple Pascal

I HAVE recently installed a Z-80 Softcard. The Basic is excellent, and in many ways an improvement on Applesoft. However much of it is nullified by the major defects of the commands Edit and Renum. Both lead one to suspect that the designers have shares in new keyboards and programmers' overtime.

The Renum command does not permit overlaps of other lines but, far worse, does not allow small blocks of lines to be renumbered, within themselves, to insert a few extra lines. Using Renum completely wrecks any systematic program layout and its relationship to documentation.

Editing in Applesoft is messy but completely flexible. It is difficult to find an editing problem that cannot be solved with a minimum of key operations. Most insertions are easy with the open format of listed lines, and done at high speed.

Edit, on the other hand, is highly frustrating. The unedited line is invisible so you have to guess or pre-List on the line above. The listing is only a partial help — especially for long lines — as edited lines do not match and eye movements are uncoordinated. The end result is many more keystrokes and much wasted time.

The worst feature of Edit is its inability to access the line number. Lines are often found to be wrongly placed. Though a simple renumber would quickly correct this, the lines must be completely retyped with a risk of further errors.

Complex lines often repeat during a program, in whole or in part, Applesoft permits one line to be duplicated endlessly anywhere in the program with a minimum risk of mistakes and keystrokes. Complex amendments can be made by block duplication, listing and cursor editing.

Edit permits none of these. Editing errors, followed by a Return often need a

(continued on page 45)

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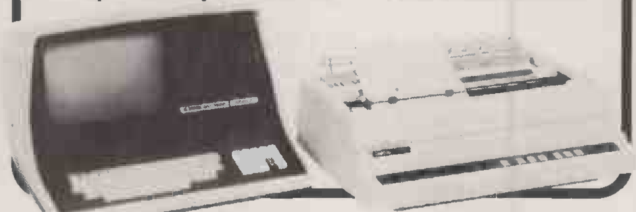

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(continued from page 43)

retype instead of a screen copy. The need for spaces around Basic commands is highly irritating and easily forgotten. Apart from wasting time it wastes memory too and perhaps accounts for the fact that MBasic runs 50 percent slower than Applesoft.

Are there any patches to eliminate these design weaknesses or is Microsoft proposing to issue amended discs? Special editing programs are not the solution. They waste even more time.

R G Silson,
Tring,
Hertfordshire.

Improving Petpro

THERE IS a small, but important amendment which should be made to the Petpro program in the December 1981 issue. It greatly improves the operation of the "squeeze" facility in rare, though significant cases. Only two lines are affected Line 108 should read

NEXT: IFK=A−W+4THENB=K : GOTO110

The second part of line 110, beginning IFMID$ . . . should be changed to

B=B+(MID$(E$,B,1) <> "(single space)")−(MID$(E$,B,2)= "(two spaces)")

Ian Birnbaum,
Needingworth,
Cambridgeshire.

Apple graphics

I WOULD LIKE to congratulate *Practical Computing* on the first in the series on Apple Graphics in the November, 1981 issue. It has explained and made clear many points which I formerly only hazily grasped.

There are, however, two problems with the program Type-a-Graphic/Hires as listed, both of which concern the circle-drawing routine.

In lines 5610 to 5670 the Xs and Ys are mixed up. As coded, it plots two sets of two quarter circles, centred on X, Y and Y, X.

If an error is encountered in drawing the circle because the plot area is exceeded, then on return to line 5500 for the final time, Z = 80, the Return statement causes a Return without Gosub error. To avoid it, the Gosub in line 5410 can be replaced by a Goto, as can the Return in line 5500. The 5460 subroutine is not accessed from elsewhere in the program, so this is not illogical.

The corrected code is shown on the listing.

V Gardiner,
Leicester.

Type-a-Graphics/Hires amendments.

```
5400  IF A$ = "P" THEN  GOSUB 5690: GOSUB 5720: HPLOT  TO X,Y: GOTO 5250
5410  IF A$ = "R" THEN  GOTO 5460: REM  DRAW CIRCLE
5420  IF A$ = "S" THEN  GOTO 8000: REM  FINISH PLOTTING
5440  IF A$ = "H" THEN  POKE  - 16303,0: POKE  - 16302,0: POKE  - 16299,0:
      GOTO 5850: REM  TEXT,ALL,P2
5450  GOTO 5270
5460  HOME : VTAB 22: PRINT "ENTER RADIUS OF CIRCLE(1-140)"
5470  INPUT "THEN PRESS /RETURN/ . R = ";R
5480  IF R < 1 OR R > 140 THEN  GOTO 5460
5490 X1 = X:Y1 = Y:Z =  - 1
5500 Z = Z + 1: IF Z = 80 THEN X = X1:Y = Y1: POKE 216,0: GOTO 5230
5510 X2 = R *  SIN (Z / 100):Y2 = R *  COS (Z / 100)
5520  ONERR  GOTO 5540
5530  HPLOT X1 + X2,Y1 + Y2
5540  ONERR  GOTO 5560
5550  HPLOT X1 + X2,Y1 - Y2
5560  ONERR  GOTO 5580
5570  HPLOT X1 - X2,Y1 + Y2
5580  ONERR  GOTO 5600
5590  HPLOT X1 - X2,Y1 - Y2
5600  ONERR  GOTO 5620
5610  HPLOT X1 + Y2,Y1 + X2
5620  ONERR  GOTO 5640
5630  HPLOT X1 - Y2,Y1 + X2
5640  ONERR  GOTO 5660
5650  HPLOT X1 + Y2,Y1 - X2
5660  ONERR  GOTO 5500
5670  HPLOT X1 - Y2,Y1 - X2
5680  GOTO 5500
```

Uncivilised and chauvinist

IT SEEMS that theories of racial superiority are alive and well within the pages of *Practical Computing,* of all places. The June 1981 editorial was blatantly anti-American and chauvinistic in the extreme, with a strong taste of sour grapes.

Then again in July, what do we find: "While the new land may be very good at making hardware it needs a more civilised spirit to breathe life into it", etc, etc.

Such a mentality I would call anything but civilised, and totally unbecoming of a national computer magazine. I suggest the author of such cultural claptrap get back to the details of microcomputing, or give the job to someone who can.

J L Schiff,
Auckland,
New Zealand.

● In a perfect world there would be no need or justification for chauvinism. Unhappily this is not the world we live in. If we adopt a chauvinistic tone, it is to try to combat the flood of American equipment and ideas which are almost dumped on our market.

Since the war we have seen American efforts to obliterate British industries, particularly in book-publishing, film-making aerospace and computing. Their huge native markets and high standard of living and use of a version of English can only be countered by tenacity and enthusiasm here. We regard it as part of our job to try to enthuse British computer manufacturers and software authors.

Dr Schiff may feel that we should lie down under the onslaught — many here would disagree with him.

Incompatible systems

A J WEEKS of Bedford — Feedback, November 1981 — is mixing up his Basic and Pascal systems, which are not compatible, and which do not use the same operating environment. He should not feel put-out, however, since many so-called Apple dealers do not know the difference either.

The Pascal system is totally divorced from the Basic system. Since the Pascal source code and the P-code are intended to be portable to different computers, such things as printer driver routines are totally transparent to the user. Under normal circumstances it is not necessary to produce special printer driver routines in Pascal. In fact, Apple Pascal is quite happy with a serial card or a parallel card or a communications card, providing it is in slot 1. Moreover, any machine-code routine used to drive the comms card is then redundant.

I presume that Mr Weeks has a home-made card, or something similar, that requires a separate patch for line feeds and character counts. Unfortunately there is no mechanism in the Pascal system to put the printer card in any other slot, since all other slots are pre-allocated in the system.

We need to know whether the Pascal P-code routines use the same output, input or screen hooks as the Basic monitor. To do what Mr Weeks would like to do would imply modifying the operating system as is commonly done, for example, to obtain lower-case characters with the Paymar character generator. Presumably a disassembly of the operating system would enable you to change the printer output from slot 1 to some other slot. In a manner similar to the lower-case mod, you could presumably introduce a subroutine call to the printer driver routine, carefully bypassing the standard printer driver routines.

I would recommend to Mr Weeks that he invests in a standard Apple parallel card, which will be cheaper and quicker than messing about with machine-code routines.

K. D. Howton,
Birkdale,
Merseyside.

Pet series to sample the Corvus benefits

THE FULL range of Commodore microcomputers can now take advantage of the extended Corvus Constellation hard-disc system. Interfaces allow the Pet to operate in a full microcomputer networking environment with up to 64 stations sharing the same central hard disc of 5, 10, or 20Mbytes.

The Corvus hard disc.

The Constellation, as its name suggests, is based on the star configuration of a central Corvus hard disc connected to both microcomputers and peripherals. Immediate access to the mass-storage medium is possible with no interference from other users.

The data-transfer rate is an impressive 60Kbytes per second and therefore will endow microcomputers users with all the advantages of mainframe networks without the associated costs.

There are two types of interface available, both developed by Small Systems Engineering. The first is called Hardbox and allows continued use of the PetDOS operating system. Up to four Corvus hard discs can be controlled by the Hardbox giving the Pet access to a very large amount of on-line storage — massive databases can be created. The second interface is called the Softbox and allows Pet/Corvus networks to operate under the popular CP/M operating system.

Transferring Pet software to the hard disc should not prove difficult. Nevertheless Keen Computers, the distributor, is forming a full consultancy service for both users and dealers. For further information contact Keen Computers Ltd, 5 Giltspur Street, London EC1 Telephone: 01-248 7307.

Micro event of the year

MAKE A NOTE in your diary now — computerised or otherwise — to visit the first Computer Fair to be held at Earls Court, London on April 23, 24, and 25. The list of exhibitors at the show, which is sponsored jointly by *Practical Computing* and *Your Computer*, is impressive. Events planned for what will be the microcomputer event of the year include the British finals of the European Micromouse competition, under *Practical Computing* sponsorship.

The exhibition has been timed to coincide with the Government's Information Technology year, and it will follow hard on the heels of the BBC microcomputer series.

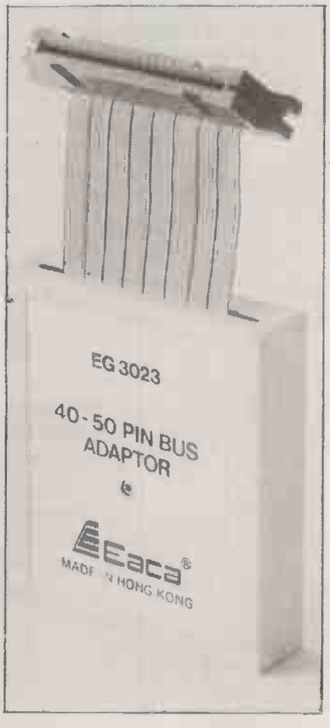
Five boards that add to Apple's attractions

U-TIM is just one of five new British-made boards for the Apple. It is capable of recording intervals of between 1ms. and one hour, with an accuracy of 1ms. The card is accessed by Peeking and Poking and is supplied with sample Basic programs and a machine-code routine to handle interrupts.

U-Term, another of the latest releases, is an 80-column upper- and lower-case display board for the Apple II. It is compatible with Basic. Pascal and CP/M, enabling software packages such as WordStar to be run on the Apple.

Eight serial ports of the RS-232 type are provided by the U-Port board. Each port is individually addressable and the baud rates can be set between 150 and 19,200. U-Ext is simply a slot extender designed to aid trouble-shooting and board development and interfaces the Apple computer with any digital panel meter having a BCD — binary-coded decimal — output.

All the boards are available from U-Microcomputers and the dealer network. U-Microcomputers can be found at the Winstanley Industrial Estate, Long Lane, Warrington, Cheshire WA2 8PR. Telephone: 0925-54117.



Tandy owners can now use the new Video Genie expander box. The box is an updated version of the original expander which can be used with the Video Genie, the Genie II, and the Tandy model I. The functions of the device are: full disc control for up to four 5.25in. drives with double- or single-sided densities, a plug-in S-100 bus option, a plug-in RS-232 option, and a Centronics parallel-printer output. The standard 16K of memory can be extended simply by plugging in 4116 memories. The device is designated the code EG-3014, and the hardware interface for the Tandy is the EG-3023, 40- or 50-pin bus adaptor. For details, contact Robert Stead at Lowe Electronics. Telephone: 0628-2430.

VisiFile follows in the VisiCalc tradition

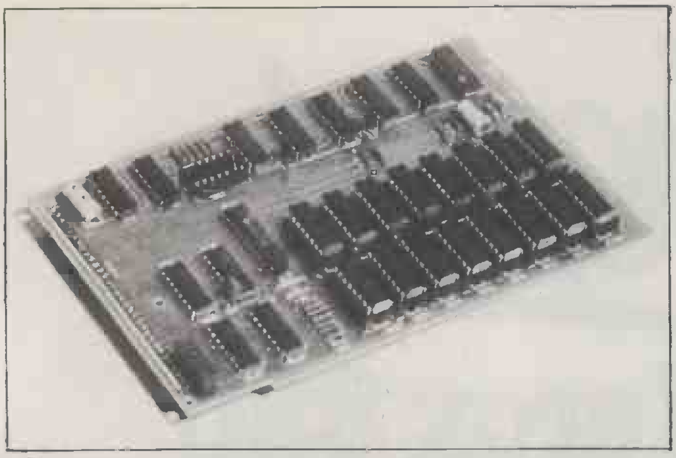
VISIFILE is the latest product from Personal Software, the originators of the world's best-selling program VisiCalc. It is a file-management system which can handle record filing, searching, sorting, report and mail-label printing.

Personal Software's VisiFile enables a wide variety of records to be stored, sorted or searched in any one of a number of formats. Printing, too, is done on a multiple-format basis.

Like VisiCalc, the program is user-friendly, which is the American way of saying it is easy to use. In fact, Barry Jacques, managing director of the program's U.K. distributor, ACT Microsoft, said: "Even people who are unfamiliar with computers will be able to master the program and begin to use it immediately. Instructions are simple and direct and are selected from an easy-to-understand menu system".

FlexiFormat is a feature of VisiFile which makes it easy to change, rearrange and add unforeseen information to records, or combine records into files. Users may also create a partial file definition for fast data entry of specific portions of code. VisiFile can link to other Visi programs which make it a powerful tool in the hands of any administrator, manager, or indeed anyone who requires desk-top computing.

VisiFile runs on the Apple II microcomputer, requiring 48K, one disc drive and either the language card or the Applesoft Basic card. Two disc drives improve performance. Suggested retail price is £160. Telephone ACT on 021-454 8585, to find the name of your nearest dealer.



This RAM expansion board from Timedata is supplied in a version designed to fit in the case of an Acorn Atom. There are both 16Kbyte and 32Kbyte versions and single Eurocard versions as well as the Atom one. Prices are 16K Atom £59.50, 32K Atom £74, 16K Eurocard £62, 32K Eurocard £76.50. Contact Timedata Ltd, 57 Swallowdale, Basildon Essex. Telephone: 0268-23234.

Avoiding that fatal loss of memory

SHORT-TERM power failure is one of the more annoying problems which beset microcomputer users. The powerful motors that drive lifts or indeed any power switching can — and probably will — cause temporary disruptions to the mains supply, and can result in a computer losing its memory, or worse.

One way around the problem is to filter the supply; another is to use a back-up battery, but the latest solution is to use a high-capacitance device.

The NEC Supercap range of capacitors provide values of up to lF, and are the same size as small batteries. They have a high value and a slow discharge rate, which means they are ideally suited as reserve power sources. In fact, they can provide microcomputers with 1mA of current for time periods as long as 10 seconds, lower currents for, say, RAM memories can be provided for longer periods. For example, 1 μA will last a week.

Supercap compact capacitors are available off-the-shelf from G English Electronics, 34 Bowater Road, Woolwich, London SE18. Telephone: 01-855 0991.

Commodore as terminal

THE PET microcomputer is a sight cheaper than most mainframe terminals, so it makes financial sense to use it as one if possible. In the past this has not always been so, but now Peach Data Services are marketing emulators and cluster controllers which match the terminal's characteristics to the IBM-3277 or IBM-3284.

Not only does the Pet become a terminal, but it can also work as a computer in its own right. Furthermore it becomes possible to run Commodore software on the mainframe — even VisiCalc. Peach can also provide emulators for other IBM equipment as well as ICL and DEC versions. Contact Brian Holmwood at Peach: 0283-48977.

How Dutch software took to the air

RADIO NETHERLANDS has made an unusual initiative in telesoftware transmission. In a recent worldwide broadcast from Hilversum, the *Media Network* programme — a 30-minute weekly slot dedicated to communications topics — sent out a Basic program to be recorded on cassette and loaded directly into memory.

The program, transmitted in three versions for listeners with Pet, Apple and Tandy TRS-80 micros, was a 90-line direction and bearing routine written by John Campbell of the Exeter University Department of Computing.

The Dutch broadcasters were keen to discover whether a satisfactory signal-to-noise ratio could be achieved on the normal AM — amplitude-modulated — system, which suffers from man-made and atmospheric interference.

Two transmissions were made; one to Europe and another a week later relayed to North America and the Pacific via transmitters in Bonaire and Madagascar. They are fed by satellite with a bandwidth of about 5.5kHz.

Of 235 listeners who reported back to Hilversum on their success or failure, 98 said they had complete success in capturing and loading the program. Though many were said to have test equipment, some of the receiving equipment was only of average standard. Direct receiver-to-cassette connection was essential.

From the 98 who succeeded, 61 were using a TRS-80, 36 Pet and only one Apple; 86 percent were in Europe though one success was reported from the U.S. with some from Canada and Belize.

Radio Netherlands sees this success rate as a clear indication that software transmission on the normal broadcast wavebands is a practical possibility. It notes that program data has already been transmitted on amateur-radio wavebands, which have the more efficient single sideband (SSB) mode of transmission, but believes that this is the first time that the AM system has been used as a mass data transmission medium.

Media Network is now to follow the first successful transmissions with further broadcasts on short wave. These will be for the Sinclair ZX-81, TRS-80 model 1 level II and Pet micros. A further development from Dutch radio is the Hobbyscope Basic code. This is a protocol developed by the producer of a domestic Dutch radio programme for computer hobbyists. It is intended to be an Esperanto for loading broadcast programs to any micro and consists of a 1,200 baud code containing two tones of 1,200 and 2,400Hz.

The Hobbyscope ties in with a radio broadcast on FM and MW which reaches 1,200 enthusiasts in the Netherlands. It goes out at 1730 GMT on Sunday nights on Hilversum 1.

For further details of the Hobbyscope code and more information on Radio Netherlands contact, Jonathon Marks, Media Network PO Box 222, 1200 JG Hilversum, The Netherlands.

Program Developers' gain by Superbrain upgrades

THE SUPERBRAIN'S CP/M operating system is upgraded by two of the latest software products. ZDOS will be of special use to those engaged in software development work. Using the Z-80 instruction set to keep coding and execution time to a minimum, the software provides a range of features in addition to the standard DOS.

The improvements are: standard, one-tone, screen-memory mapping, an increase in execution speed, 4K more memory, screen-dump to printer, documentation and a printer-busy test.

The printer spooling program buffers all output to the listing device in a 4K buffer. The program enables continuous printing during disc changes, transactions, but functions only under ZDOS. For further details, contact Frome Data, 5 The Bridge, Frome, Somerset BA11 1AR, or telephone: 0373-71689.

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Exports come under scrutiny

THE DEPARTMENT of Trade and Industry is urgently seeking the views of those currently exporting goods subject to Security Export Control. The results of the review will affect the ability of U.K. companies to export high-technology goods to certain destinations — mainly those behind the Iron Curtain.

The Department of Industry requires advice from those companies operating in this area so that it can decide which goods should be deleted or added to the list. The area of computers and their associated software and hardware are under particular scrutiny.

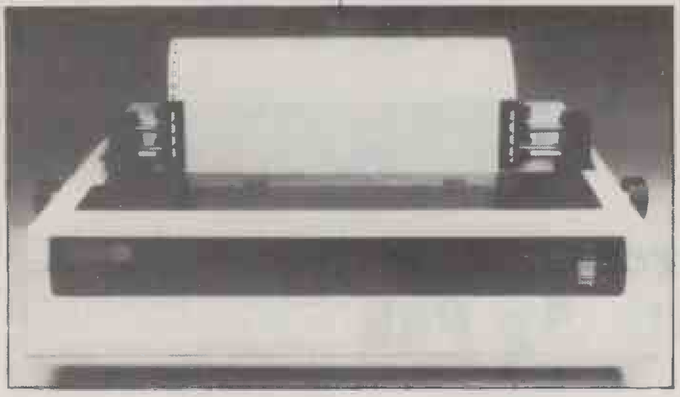
All companies which consider that they may be affected by this or which wish to oppose changes to the list should make representations through their trade association, or, in exceptionally important cases, directly to the Department of Industry, IT2c, Dean Bradley House, London SW1P 2AG, quoting SEC/PR81.

Daisywheel SP-830 has the edge in speed

FUJITSU'S NEW daisywheel printer, the SP-830, has a maximum print speed of 80 characters per second — significantly faster than competing products. It is being launched and marketed in the U.K. by Zygal Dynamics, a company specialising in the distribution and servicing of printers at the top end of the market.

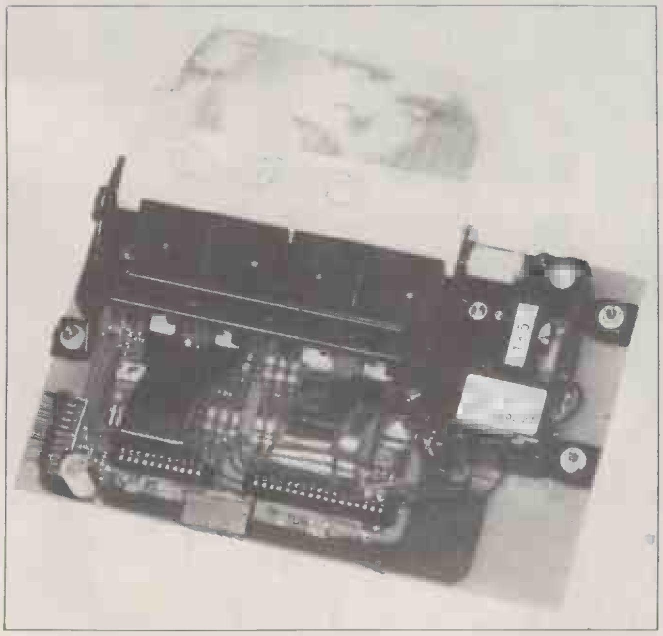
The SP-830 is available with both parallel and serial RS-232 interfaces. It has twin, high-speed servo motors, a servo-controlled position sensor, a high-speed hammer and bi-directional printing. The daisywheels are standard 127- or 96-character founts in either metal or plastic. Xerox or Qume print wheels can be used.

Con Driscoll, chairman of Zygal, is proud of the fact that his products are "not the cheapest". This, he feels, is the reason why Zygal is competitive — it can provide the support that customers require. Zygal Dynamics has its own field engineering team to provide on-the-spot repair and service. The company already markets Diablo and General Electric printer products, and has a number of other distributorships.

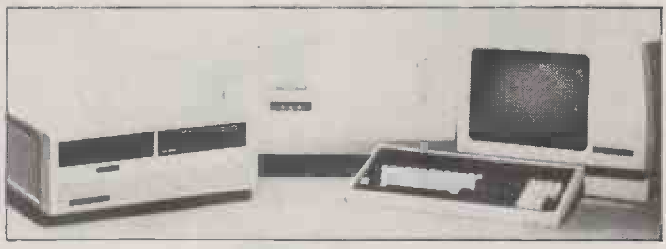


The price of the Fujitsu SP-830 printer varies greatly because of the wide range of available options. However, the one-off basic unit will retail at £1,500 and Zygal will maintain it for a further £25 per month. Extra charges are made for various interfaces and options. For further details about these and the printer, contact Zygal Dynamics, Zygal House, Telford Road, Bicester, Oxfordshire OX6 0XB. Telephone: 08692-3361.

This 40-column printer interfaces directly to the Apple computer. The RX-40 Apple printer is available from Roxburgh, and consists of a thermal mechanism mounted on its own driver card. A ribbon cable facilitates connection to a card which fits in one of the six slots inside the Apple. The printer requires a 19V DC power supply which is externally fitted. Screen Dump and high-resolution graphics are possible on the printer and it takes just 10 seconds to print a page of graphics. The printer retails for £152 and is available from Roxburgh Printers Ltd, 22 Winchelsea Road, Rye, East Sussex. Telephone: Rye (079 73) 3777.



Texas 16-bit micro to hit desk-top market



A 16-BIT desk-top microcomputer extends the present Texas Instruments range down into the most competitive sector of the market. Texas Instruments has called the computer the Business System 200 and it is the first of a new range of small-business systems planned by the company. The machine is a small desk-top, single-user computer based on the 16-bit TMS-9900 microprocessor chip.

The Business System 200 is designed to be compatible with other, up-market Texas computers, including the more expensive multi-user machines. The machine will retail at less than £5,000 and offers 64K user RAM, a display keyboard and processor. The keyboard may be detached, and the display features 80 columns across a 12in. screen. The whole unit works from a standard 13A socket.

There are four models in the initial range and they differ from one another only in disc storage capacity — the 220 has twin double-sided; double-density discs providing 1.2Mbytes. At the top is the 251 with two Winchester hard-disc units as well as 8in. floppy back-up, giving a total of 11.2Mbytes of on-line storage. For further details contact Texas Instruments: 0234-67466.

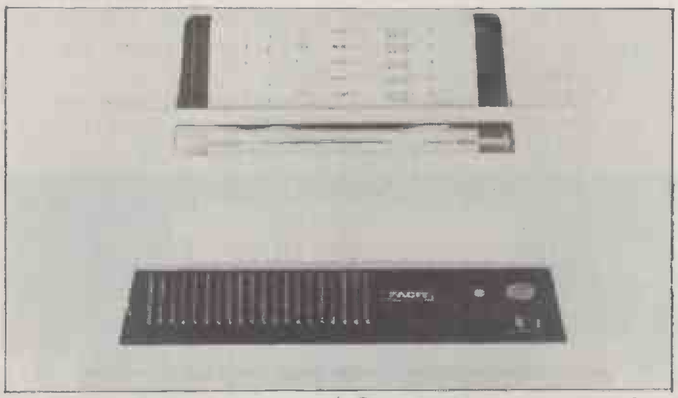
Telex paper is how Facit reduces hard-copy costs

A PORTABLE printer offers low-cost hard copy by using standard Telex roll paper. The Facit 4520 costs £583 plus VAT and is suitable for use with small-business systems, educational computer installations, personal microcomputers and data loggers.

The machine is small, about 14in. by 13in., and it weighs only 9.5kg. The acoustically-damped housing together with the floating-suspension construction combine to give a noise level of less than 60dB.

A microprocessor controller system ensures that each line is printed using the minimum carriage transport distance. The standard ASCII character set plus a number of different national character sets are available, and they are software-selectable. A choice of print-formatting commands are also on hand.

The 4520 can work at high transmission speeds — up to 9,600 band — and the 712-character input buffer helps to increase the throughput. Screen contents can rapidly be dumped on the printer. Hi-Tek, Trafalgar Way, Bar Hill, Cambridge CB3 8SQ.

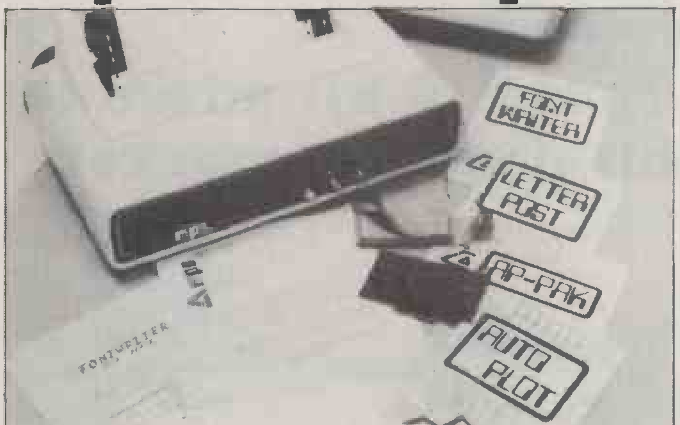


Reflecting on eye-strain

VDU REFLECTIVE GLARE reduced by 70-95 percent and screen static by 60-80 percent are the claims made for a range of products whose success in Europe has now led to their launch in the U.K. The main product of the range is the Tele-Antireflex, which has been developed to reduce the glare of microcomputer and word-processor screens. It is claimed using Tele-Antireflex can mean considerable gains in operator efficiency and that eye-strain and headaches can be reduced.

Tele-Clear improves screen characters definition and Tele-Colour gives white screen characters a light-green or yellow colour. Statiflect-Guard, 55 Fairburn Drive, Garforth, Leeds. Telephone: 0532-864981.

Printed word said to improve with Ap Pak



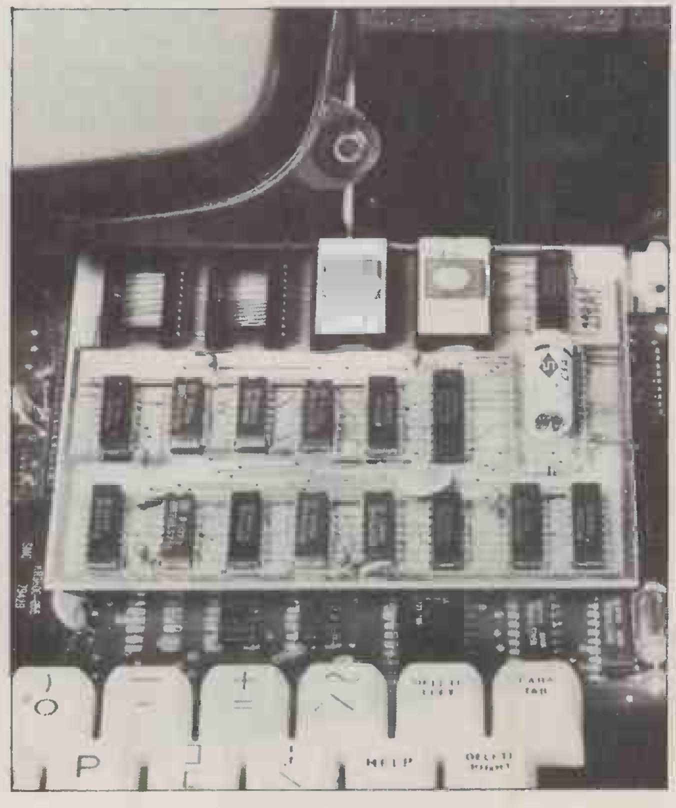
THE APPLE AP PAK is the first of a line of products designed to enhance the print capabilities of small-computer systems using the MPI series of graphic printers. The product line includes both software and hardware products specifically designed for each computer system.

Apple Ap Pak contains an Auto Plot printer-control card, interface cable, MPI-developed software programs and instruction manuals. The package gives the user the ability to use all the graphic capabilities of a 88 or 99 graphics printer.

An unlimited amount of character founts are available as well as large headlines. You can use several type founts on a line and have the ability to perform graphics dumps of high-resolution files.

Ap Pak for the Apple costs £98.31 and is available from Russet Instruments. Telephone: 0734-868147.

SuperVid is a device which improves the display characteristics of the Superbrain microcomputer. The unit provides block-graphic ROMs, which give a resolution of 160 by 72 and ASCII ROMs. The board is supplied with a manual and an instruction disc enabling the user to make full use of this unit. Screen text can be highlighted or displayed in the background, underlined or updated. It can also flash to attract attention to a particular area. Four resident alternative character sets can be called at any time and, if required, mixed on screen. A standard option includes the British £ symbol. SuperVid costs £190 and is produced by MicroMods Ltd, 53 Acton Road, Long Eaton, Nottingham NG10 1FR. Telephone: 06076-64264.



The Systems

RADER 1000 with Dual 5¼″ drives RADER 2000 with Dual 8″ drives

By combining the economy of using the most up-to-date techniques of microprocessor technology with the reliability of British design and engineering, these highly advanced systems of tomorrow are affordable and available to you today. Just look at what we're offering.

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The powerful heart of the system, it's Z80 A microprocessor, pounds quietly and efficiently away at a rate of 4 MHz. It will obey your every instruction, and memorise every bit of information in it's on-board 64K of dynamic RAM.

This highly flexible machine will communicate to the peripherals of your choice, through dual parallel or serial input/output ports. Future needs are well taken care of, as we've allowed sufficient room for 12 or more dual port expansion boards.

The whole system is reliably powered via it's sophisticated multi-output switched-mode power supply.

To all this, we've added the ease and availability of running CP/M 2.2 software plus the entire CP/M users library and also the new Paxton.

RADER 1000 £1480 RADER 2000 £1980

Features of these surprisingly low-priced systems include:–

●CPU – Z80 A 4 MHz ●ROM area expandable to – 16K x 8 bits
●RAM area – 64K bytes of RAM
●DMA capability – Powerful and versatile management of data transfer between ports. Memory to ports, port to Memory. ●Floppy Disc Control – Using the WD 1397 chip-set to provide full double-sided double-density storage in IBM 3740 format. ●Character Generator RAM – Arranged as 2K Bytes of memory-mapped storage enabling a wide range of character sets to be created. ●Memory-Mapped Video Display – 2K Bytes of memory-mapped storage provides fast, flexible display. Inverse Video. Video enhancement. Invert character. Dual Intensity. Multi-Level Expansion Connectors available.

Option Boards

●ROM Expansion Board – For user Read Only Memory Expansion. ●RAM Expansion Board – Through P IO Controlled Boards, each with 3 pages of 64K Bytes. ●Serial Ports – 2 Serial I/O Ports utilising Z80 A SIO ●Parallel Ports – 2 Parallel I/O Ports utilising Z80 A PIO. ●Real Time Clock with battery back-up

Shortly Available

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● Circle No. 145

Progress in using Prestel as a medium for publishing software has not been as rapid as many had expected. Martin Hayman finds out why, and reports on the latest steps towards the development of fully-automatic software transmission via Prestel.

Flying on autopilot

IT WAS AS an attempt to let the vast public sort out the vexatious problem of protocol standards for Prestel when used as a medium for software transmission that Prestel boffin Dr Ederyn Williams made our Prestel pages available. We had the contacts — in the form of you, our readers, busy writing software of all kinds — and we had access to a well-sorted editing system. Put the two together, was the idea, and the public would be able to decide what it wanted.

Well it has not happened quite like that. To some extent, we underestimated the size — or should we say the rankness? — of the problem. We started from the premise that the majority of people using Prestel to recover software would be little different from the regular or business user of Prestel. That is to say, they would be equipped with a dumb terminal and possibly some way of recording data from the screen either by printing out a hard copy or by recording on to cassette.

We figured that such users would browse through Prestel telesoftware pages on "manual" until they found something to their liking. After checking a couple of pages of listing and deciding to go for it, they would then record. Thereafter they would have to key the stuff back into their own micro.

Keying-in is of course an immensely laborious business. I say this with feeling. One of the principal reasons for the slow growth of *Practical Telesoftware* during last year has been that we had to enter all our pages manually. This is slow and prone to errors.

The CET approach

Among the points made by Ed Williams when we reviewed the progress of *Practical Telesoftware* last autumn was that there is now a new generation of microcomputer users who are less tolerant of errors. The first batch of stone-age freaks positively welcomed errors; debugging programs was all part of the game. Once you had conquered the problems, there was little left to do.

Today's users are more direct. They want the cassette, disc or whatever it is that they paid for to run properly first time — and that goes for programs received through the local area network or via an international common carrier.

In other words, users want a clean program in their micro and may not be especially concerned with the protocol used in its presentation to Prestel. Obviously, Prestel is a clean medium for documenting programs, doing the introductions and all the usual hype surrounding a program; but when it comes to the listing, the code which is to be executed, why not let the autopilot take over and shoot the whole thing straight into the RAM of your micro, stripped of the characteristics peculiar to Prestel?

This is the approach which Mike Brown of the Council for Educational Technology has long advocated, along with its equipment supplier Research Machines. The fact that the screen is at first sight completely different from your machine's screen is not important; fully-automatic loading via a conversion program strips out all the unfamiliar characters which are for Prestel purposes only. What you get is what you see.

Existing software

Obviously with such a system it is essential to have effective error checking to combat telephone-line noise. Mike Brown's CET format offers such checking and, since it exists already, why not use it, the BT people asked us. With some reluctance, we had already conceded that telesoftware was only really telesoftware if it was automatic. So we are eating our words and, to cut a long story short, we will be going CET shortly. The advantage to us — and it is a major one — is that software already exists to upload programs on to Prestel in this format, and we shall not miss the copy-typing of listings.

Now we hope to be able to get on with the important business of putting up documentation about the new and massively expanded database. Meanwhile our various experts will be gathering together suitable programs and evaluating them. By this means, we hope, Prestel will become the prime local area network. Along with the recently introduced Mailbox, which started last autumn, and the usual action frames, which have been on the system since the beginning, the prospect of Prestel as a speedy communications medium moves one step nearer.

It is furthered by the cut in price of the Tantel, now down to a crazy £125, plus a few pounds more for the software. As one set manufacturer confided at a recent viewdata exhibition, "We might as well give up". The Tantel is specifically and directly aimed at the micro user and its great popularity among viewdata professionals has caused BT to keep a very close eye on what they do. However, the much-canvassed plan to buy tens of thousands of them and give them away is still, sadly, unlikely ever to come about. One of our priorities is to put up some action frames which quiz users on the type of equipment they use to get at our pages. It is likely that at least half will be using Tantel already. By the end of next year a similar proportion will be using Tantel and a micro, as the BT people commission interfaces, our database grows and interfacing becomes more reliable.

ZX-81 INTERFACE

EDERYN WILLIAMS, has finally, on Prestel's behalf, grasped the standards nettle firmly. Unstung, it seems, he has brought it back to grow in the right patch — Telephone House, Temple Avenue, EC4.

In a bold initiative to fertilise the market, Williams has launched a competition, along with *Practical Computing,* to interface the Sinclair ZX-81 with Prestel. The ZX-81, it can hardly have escaped your notice, has proved a remarkably fecund seedbed for youthful inventors. All sorts of unlikely peripherals have been hung on to the basic box, even including, so rumour has it, a hard disc.

Now British Telecom is to cultivate the same ground in aid of that wilting bloom of British genius, Prestel. It has offered a £1,000 reward to the best device which will download telesoftware from Prestel into the ZX-81's RAM. The device will necessarily include hardware and software, be capable both of production and of further development and will ideally be able to handle the CET — Council for Educational Technology — format.

Everyone hopes that it will be "in the spirit of the ZX-81". This does not mean that it has to look flat and black, like a futurist cigar-box. What it does mean is up to you. The closing date for entries is March 14, 1982.

The Osborne is designed, in the words of its creator, to put simplicity back into micro-computing. Peter Laurie tests this compact U.S. machine.

Osborne and the case for portability

ADAM OSBORNE has produced a machine which is designed to sell in large numbers to people who are not experienced micro-users. It will stand or fall by the first impression it gives, not the ingenuity of its hidden technical features.

Starting from the outside, then, you first come to the box. When closed up the machine looks and weighs much like a portable sewing machine. It is encased in a textured cream plastic which seems reasonably tough and resilient. The carrying handle, in synthetic leather, is at the back of the machine when it is set up for work. The base of the case is formed by the underside of the keyboard, which clips on over the screen and disc drives.

Plethora of parts

The underside of the keyboard is sloped to give rake to the keys, so if you put it down to rest the aching arm, the whole thing stands with a slight lean. You have to be careful where you put it to be sure it will not fall over.

The keyboard slots upwards into a recessed lip in the main case to keep rain out. The power lead, however, stows in a recess or well in what is the top when the machine is being carried, where the mains on/off switch and the overload cutout reset button are also to be found. A dash from aircraft to airport terminal in a heavy shower might allow enough water in there to produce some fireworks later on.

The jumper to reset mains power from 240V in the U.K. to the standard American 110V is buried inside the box. A sticker on the front says "No user serviceable parts inside" and indeed to get inside you need a screwdriver and some Allen keys, so changing voltages for a transatlantic journey would not be a simple job.

It is unfortunate that the British mains plug is much bigger than the U.S. design and will not fit into the recess. Osborne says it will redesign for this, but making the recess deeper may mean altering the mould for the case and perhaps shifting components about inside where there cannot be much room for manoeuvre.

The box weighs about 24 lb. This is about as much as you would want to carry the length of a big car-park, particularly if you have anything else with you at the time. The machine is said to fit under an airline seat — a claim we were not able to test. It might just be true. The machine is certainly too heavy to be allowed in overhead lockers on most aircraft.

To operate the Osborne you lay it on its side — the side with the little feet — unclip the sturdy catches that retain the keyboard, lay it in front of the machine and set to work. Unlike most machines today that present a blank box to the user, the Osborne has a definite dashboard that looks quite military in the profusion of parts supplied. The front of the machine is a rather nasty pressed-fibre panel which, to begin with, smells very synthetic.

On each side at the top there is a 5.25in. disc drive and between them lies the screen. Below the discs there are two carrying pockets for floppies with room enough, so the manual says, for 30 of them. It would be useful if the machine manual itself would fit into one of them, but it just did not.

On the bottom row, looking from left to right, there is: a male Modem socket with some pins that, although recessed, looked rather fragile; a female 25-pin RS-232 socket, and IEEE-488 edge connector to the computer board; the keyboard socket; brightness and contrast knobs for the screen; an external video connector; the reset button; and a nine-pin male socket for an external battery.

The manual has very little to say about the external battery. Judging from the number of pins provided, it is supplied with inverter circuits to provide the different voltages needed by the computer. It could be quite an expensive item. You begin to wonder whether the rest of the machine — particularly the mini-floppies — is up to the outdoor life suggested by battery power.

The keyboard and front of the box is a surprisingly bulky component in a machine where every cubic inch must count. It has QWERTY keyboard plus four cursor-moving arrow keys and a separate numeric keypad. The connection to the machine is through a stiff, flat cable that plugs into the front panel through a satisfactory lock or eject socket. The keyboard does not have to be unplugged when the machine is folded up.

Unfortunately the connecting cable is rather too stiff. It stands up in a loop and covers the bottom part of the screen. If you move the computer back to straighten it out the screen is too far away for comfort; if you bend the cable downwards it tends to pop back up at a crucial moment. A small problem, but an annoying one.

Fortunately it is possible to prop the front of the computer on top of the back of the keyboard. This brings the cable loop lower and improves the view of the screen. The lip around the front of the computer box to hold the keyboard provides a modest amount of physical stability.

Remarkable VDU

Given that CP/M does most of the donkey work, there are few areas in which the designer can show any ingenuity. The screen is, up to a point, one of them and here the Osborne is clever.

Most people on seeing the machine for the first time, remark on the smallness of the built-in VDU. It measures only 3.55in. by 2.63in. and on to that small area the designers have crammed 24 lines of text 52 characters long. In practice it works quite well and can be read without eye-strain. The characters are well-shaped and clearly printed, largely because they are made up from a matrix eight wide by 10 high.

The screen characters are slightly larger than the type this article is printed in. It may be that a small screen with characters the same size as print and typewriting is less tiring than a larger one simply because the eye does not have to change its accommodation in looking from the screen to text and back again. If the contrast is turned up too high there are irritating fly-back traces. This is probably caused by the adaptation from 60Hz American mains to the 50Hz U.K. supply. A normal-size external VDU is supplied with the machine and can be plugged into the VDU socket on the dashboard.

The logical arrangement of the screen is more questionable. The 52-by-24 character VDU acts as a window on a larger notional page 128 characters wide by 32 deep. By using the arrow keys you can, in principle, skid the physical screen over the internal document. Presumably the idea is that "what you see is what you get" particularly in text formatting. Setting aside the slight difficulty that most printers give 132 characters across a line, it is impossible to judge the final appearance of a document by sliding a small window around it.

Sensible implementation

The machine is supplied with CP/M, WordStar, Mailmerge, Supercalc, MBasic — the interpreter, not the compiler — and CBasic. Osborne's promotional literature makes much of the notion that you can buy the computer and £800-worth of software for £1,200. It is not really all that odd. The only irreducible cost of mass-distributed software is the cost of making each copy. That comes to £5 or £10 at the very most.

Some of the system software — CP/M's BIOS — is kept in ROM on a second page, which frees about 2K of RAM for extra program space.

On loading MBasic, for instance, the Osborne declares 29K-odd of free memory as against the more conventional Research Machines — nominal 64K — which shows 27K. There seem to be no secrets made about the memory map, ports and other useful details. The IEEE-488 interface is lavishly documented — but not so the RS-232. There are only two possible baud rates — 300 and 1,200 — and no choice about stop bits.

A single manual is supplied with the machine in an A5 ring binder. It is typeset and well laid out. The text is generally clear and sensible, but it is marred by some rather silly mistakes. For instance pin 7 of the Modem output is connected to 12V supply "through a 22-ohm register" — evidently, the author meant "resistor". The manual not only introduces the naive user to computing and to this particular machine, it also covers all the applications software and the systems internals for the benefit of machine-code programmers. The original manuals for CP/M, CBasic, MBasic, WordStar, Mailmerge, Supercalc and a representative Z-80 machine would together weigh about as much as the whole Osborne computer. To boil them down into a pocket-sized book is an impressive feat.

The Osborne is a CP/M machine. The whole point of the operating system is that all CP/M machines are supposed to behave the same regardless of the maker's name on the box. So, from one point of view, all the manufacturer can do to CP/M is implement it badly. The manufacturer may well try to work CP/M over to improve it, but in doing so, he runs the grave risk of producing a non-standard machine that is worse than useless. Providing extra features which enhance CP/M without making it non-standard is to risk that they will only be used by people writing software specifically for one machine. They cannot be used by standard, widely-distributed software packages and will therefore be a waste of effort. Happily Osborne's implementation of CP/M seems conventional and competent.

The discs fitted to the review machine were single-sided, single-density and soft-sectored, giving 102,400 bytes per disc. The manual states airily that double- and quad-density discs can be used, but you cannot help fearing for reliability in a machine that is apt to be bumped about as much as this one may.

The manual devotes 11 closely-written pages to CP/M, covering the functions that ordinary users need, with reasonable clarity and detail. As an afterthought, there is also a Help page on the screen. When you boot the machine from cold, the Osborne logo is displayed for a few seconds while the machine does a memory test. A Help menu then appears, giving 26 options under the letters of the alphabet: pressing any one leads to a further screen or screens that explain a particular feature of the machine. The "W" option, for instance, leads to a demonstration of WordStar.

The naive user is advised to read the first two chapters of the manual before using the Help menu. Since the Help screens repeat the manual but less fully and in a different format, it is hard to see what useful purpose they serve. Furthermore, although a user who wants to access CP/M can escape from Help by pressing Escape: the Help screen does not explain this. Seeing the menu appear every time you boot the machine could play on your nerves.

The essence of the problem is that CP/M was written by a professional programmer for other professionals and does its job well enough. It was never intended to make computers easy for everyone else to understand. The novice must struggle with the strange concepts of discs, files, formatting, soft sectors, operating systems, applications programs, language, data files, com files — the list seems to go on for ever in a baffling jumble of concepts.

An extra element in the problem is the customer who buys a computer while knowing nothing about it. This is a very different creature from the user who, three or six months later, understands the machine and is happy with it. The difficulty facing the industry is to turn one into the other without tears. It is not going to be delivered by more explanation. What we need are simpler concepts.

This is where the basic idea of the Osborne is interesting. It obviously has some spark of marketing inspiration about it. Cheapness is one element — at £1,200 it is a good buy against its obvious competitor, the Apple. But there is more to it than that. The Superbrain, for instance, is technically very similar. It is a 64K, Z-80, CP/M machine with keyboard, VDU and computer in one package and is not a lot less portable than the Osborne at a similar price. Yet the Osborne is said to be selling in vastly greater quantities. It has, in the eyes of the buying public, some spark which differentiates it from other machines which are technically very similar. What is that spark?

Surely it is the machine's physical portability. Yet in practice it is not clear how useful that will be. If your computing produces results in any quantity you will need a printer. A printer can hardly be much smaller than the Osborne itself but none, as far as I know, is designed to be bundled up and carried around. Few, in fact, are physically robust enough to stand much bumping. Then you need a stock of paper and, more than likely, the external VDU. You end up with a fairly unwieldy bundle of bits connected by the usual spaghetti, much like any other machine.

The machine's apparent physical portability must be psychologically important. It suggests to the person who knows little about computing that here, at last, is something which he can — literally — pack up neatly and carry away. The physical mess of most installations is interpreted as mental mess.

Osborne cleverly presented the machine in a physically compact bundle that suggests subliminally to the customers that the mental mess has somehow disappeared. Of course they do not find out that it is still there until they have bought it. That is not to suggest that Osborne is deceitful. The more people that get to grips with computing the better for us all, and if he has found a way of overcoming the customers' perfectly sensible mistrust, then so much the better.

Conclusions

- **At £1,200 the machine is good value.**
- **To launch a brand-new design with such a range of software is an elaborate project: it will be astonishing if everything is perfect from the start.**
- **It is most important that Osbourne is willing to correct mistakes: this seems to be the case.**
- **With the external VDU and printer, the machine will not be nearly as portable as it may seem at first sight.**
- **It is not clear how useful portability will be to most users.**

ALPHATRONIC

For many would-be business users, the current wave of micros from the traditional office-equipment manufacturers serves only to complicate the already difficult task of choosing a machine. To help them with that choice, Bill Bennett assesses the Alphatronic, one of the latest to join the flood.

OLYMPIA AND Olivetti are just two of the large companies to have already launched their assaults on the microcomputer market; now the West German giant Triumph-Adler is entering the arena with the Alphatronic.

Like the competition, Triumph-Adler is aiming at the business user — a manager in a larger concern or the proprietor of a small business. In fact at the current price, the machine should be in the range of most shopkeepers — which, based on Napoleon's statistics, should mean plenty of sales in this country.

Large market

The decision to sell to the uninitiated is wise — the computing tyros constitute a large potential market. The Alphatronic is not like the Apple; very few users will use the machine for work all week and then take it home to hunt round dungeons all weekend. The fact that Triumph-Adler knows the market in question is reflected in the profusion of "off-the-peg" software available for the machine.

I suspect that very few systems will be sold without software packages. Apple computers never sold faster than when VisiCalc was introduced. Yet the Apple was not designed for the business market: that particular market embraced the Apple II, the Pet and the Tandy simply because they were there.

The Alphatronic is a serious machine — it means business and like the other computers being sold primarily to business users, a good deal of attention has been paid to its external features.

Triumph-Adler has not had an easy ride of late, and by all accounts the Alphatronic has not been the stunning success it should have been. *The Economist*, October 1981, in an article about the tribulations of Volkswagen, the parent company of Triumph-Adler, stated that $3 billion had been frittered away in a "madcap foray into office equipment". Furthermore, the article went on to state that Volkswagen had "bungled its new electronics business".

The facts of the matter are that Volkswagen took control of Triumph-Adler back in March 1979, and it is reported that the office-equipment company has been in trouble ever since. Apparently the problems are due to a lack of understanding of the computer market. Where does this leave the Alphatronic? The guided tour of the machine exposed a few shortcomings, but nothing bad enough to stop sales. In fact at the price, the Alphatronic is a good, but not outstanding, hard-working machine.

The human interface

The computer has a reassuring feel to it. The Triumph-Adler design team certainly paid plenty of attention to the outward appearance of the computer. Not only is the machine good-looking but on the whole it interfaces with humanity well. It would appear that few details have been overlooked. As an object lesson in ergonomics, the Alphatronic is to be recommended.

Designers often resort to gimmicks; not here, though. The Alphatronic looks and feels like a real business machine, ready to take on the most demanding of tasks. The same attention to detail appears to have been paid to the hardware inside the box as well. If initial impressions have any say in the matter — and remember inexperienced buyers will not have anything else to go by — the Alphatronic will be a success.

Off-white plastic

The monitor sits on top of the main-processor and keyboard unit. It is finished in the same off-white plastic as the main unit, so it does not have that out-of-place, or even lost look of some monitors. The plastic casing used for all the parts of the Alphatronic system tends to become a little soiled — especially if you have been handling the printer ribbon. It should not prove very difficult to clean, though.

Sanyo, the Japanese electronic giant, left a sticker on the back of the monitor to remind us that not everything on the Alphatronic is a marvel of German engineering. As the Alphatronic is a European computer it is not surprising that attention has been paid to the screen. Some European countries actually have legally-enforceable regulations about computer displays. The Danes like to have yellow on brown displays, claiming

that they are more restful for the operator's eyes.

The Alphatronic has an anti-glare screen made of dark, rigid plastic which fits snugly over the front of the 12in. screen. This, it is claimed, helps the eyes. In practice I found that the screen was more restful than, for example, that of the Commodore Pet and, of course, the machine also looks better. For the fastidious few, Sanyo has included controls for both the monitor brightness and contrast as well as the necessary power switch. The really fussy user might even want to tinker with the horizontal- and vertical-hold knobs — if he can find them — at the rear of the machine.

The monitor with the Alphatronic is separate, so it requires a separate power point. A typical system would consist of a main unit, a monitor and a printer, requiring three power sockets. The monitor will consume 26W, the main unit 100W and the printer a further 30W. All this adds up to about two average light bulbs' worth of electricity. The low power consumption means that both the monitor and the printer can tap their power from one socket, providing a two-way adaptor is used.

Printer identity

The printer unit supplied with the system did not easily divulge any clues as to its origins. The "Made in West Germany" label led me to the assumption that this printer was in fact made by Alphatronic. The printer is encased in the same light-grey plastic as the rest of the system and looks neat. Inexplicably, its sloping top suggests aerodynamic design.

On the back of the printer is an ungainly network of metal, whose role is obviously to feed paper into the printer. While I do not doubt that this structure is useful, it spoils the otherwise neat appearance of the system. The controls on the printer are not exactly simple: the on/off switch on the left can be coped with easily enough — though next to it is something mysteriously marked 1 A/T. The input/output port is standard, but the controls on the right are confusing.

Paper problems

These controls look harmless enough — one three-way switch and two push-buttons, together with two indicators. The push-buttons are for advancing and rewinding the paper. The paper-rewind function seems very useful and is certainly unusual. The problems really begin, however, with the three-way switch. It appears that it has been especially designed to maximise the amount of paper used. Fine if you are a paper merchant, but not too healthy if you are a tree.

When the machine is first turned on, the test position can be used to check the printing. Both the darkness and alignment can be checked before anything important is output. However to print anything, the three-way switch must be in the on-line position. The main object of the on/off-line sections of the three-way switch is to output paper. Of course, problems really begin if the switch is in the off-line position when you try printing.

Feeding paper into the printer is not difficult, but this is hardly surprising when you consider its appetite for the stuff. A slide on the top of the printer is used to release the paper — or grip it, and it feeds through easily.

On the top of the printer is a transparent plastic window, which by all accounts must not be removed otherwise the machine becomes upset and punishes the user by stopping any printing in progress. The top half of the printer case detaches easily to expose the innards. The case is good and chunky — it should be capable of taking knocks.

Accidents with ink

The ribbon is encased in a black-plastic cartridge, which fits on to the mechanism for moving the print head across the paper. The ribbon has a protective plastic sheet which stops the ribbon from slopping ink on the paper by accident. A small cutout hole is just large enough to enable the impact dot-matrix print head to operate. Unlike some dot-matrix printers, this one has only a single column of pins. The printer is bi-directional.

The print mechanism is connected to the circuit board — which is located in the right-front corner of the printer — by a flat-ribbon cable, which flexes back and forth as the printer operates. The board is screened by a plate of metal filled with holes. A section of this is cut out to expose an eight-switch DIL package.

The main unit of the system houses the computer itself as well as the keyboard and two floppy-disc units. At the rear is a

(continued on next page)

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recess for the various ports and connectors, as well as a grill for ventilation purposes. The on/off switch is at the bottom, on the left side of the machine. The front of the machine consists of a brown panel which is capped by a toughened top on which the video monitor sits.

At the top of the front of the machine are some more ventilation holes; just below to the right are a pair of disc drives which sit one on top of the other. Below all this on a sloping plane is the ergonomically-designed keyboard. The review system had a series of paper stickers attached to it concerning the word-processing software which can be used in conjunction with the machine.

The recess at the back of the machine is set about 3in. into the casing. The recess is to allow the plugs which fit into it to be protected from being dislodged by accidents.

There are three cannon-type sockets, one of which interfaces to the printer. Two of these sockets have 25 holes and the third has 37.

Earthing bar

Under the three sockets is the video output, and to the left a rather Heath-Robinson earthing bar — the supplied system was connected to this bar simply by having the screen part of the printer cable wound around a post on the bar. Next to the 37-pin socket are two further cutouts which expose a series of holes on a circuit board, and beside these is a panel which can be cut away. This indicates that there are expansion possibilities.

The disc drives on the front of the Alphatronic accept the mini-floppy 5.25in. discs — though only the single-sided variety. The discs have to be pushed home, and they must be withdrawn completely for removal. This is because the drives are not sprung, which may be considered a serious fault because the discs will receive an undue amount of wear and tear.

To open the disc drives, the door has to be pushed in and then released. Unlike other machines, the write-protect tabulators must be left on to write to a disc. LEDs indicate the operation of the drives. However, unlike the Pet disc unit, there is no indication on the drives when something is amiss.

The keyboard is ergonomically designed — that does not necessarily mean well designed, though. The Alphatronic suffers from a chronic shift-key facility, which makes a nightmare of the word-processing package. The normal QWERTY keyboard, together with the more usual keys and the numerics with the decimal point are in light brown: a set of six function keys, cursor-control keys, arithmetic keys, tabulators, all three shift keys, the return key and one or two whose use at first seems to be obscure in operation are all in dark-brown.

Triumph-Adler obviously does not expect Alphatronic owners to open up their computers. Undoing the screws is as easy as ever but prising the two halves of the case apart is no simple matter. Inside the top half of the main case is a large amount of metal foil, apparently for screening purposes.

The inside looks well filled — in fact there seems to be far more in the Alphatronic compared with similar machines. That is obviously due to the integral dual-disc unit. Triumph-Adler has been very conscientious about screening in the Alphatronic. This is very commendable: screening precautions, if adequate, remove a large amount of radio interference.

The normal office

In most normal offices this interference presents little or no problem. Nevertheless, many Alphatronic users will be using their machines in the evenings at home. It is in this kind of user-environment that screening is useful — after all, the neighbours might not take it too kindly if the TV starts to scream in the middle of *Coronation Street*, or if the music on Radio One starts to sound a little more distorted than usual. Radio interference is exactly the same effect as that created by citizens' band pirates — the only difference is that they do it deliberately.

So, the Alphatronic is an attractive machine for the small-business owner who likes to work at home. The screening also improves the performance of the machine since the pieces of metal around the disc drives prevent any interference from affecting the computer circuits proper.

Important factor

This is important because in the same way that more or less any digital circuit can act as a radio transmitter, they also act as receivers. Spurious signals can easily appear on any line between any two points. Often, this effect is referred to as "noise", and often that is just what it is. Nevertheless curious things happen in computers in close proximity to powerful transmitters.

Among the list of transmitters of radio interference are transformers and motors, both of which appear in a computer. So screening is a good idea anyway and is aided in the Alphatronic by plates of metal on the inside bottom of the casing. In addition to this and the foil in the top of the case, there is a metal grill around the disc unit — often a persistent offender.

The air-conditioning of the Alphatronic is another area which has been well served by the engineers. All around the case are ventilation grills and at the back is a 9W fan. The main components of the machine are contained in a rack of seven boards. The heat-sinks provided on the regulators are at least two sizes bigger than those needed for safety.

Working from the left to the right the first board in the rack contains the power-supply unit. A large transformer sits on the board and shows no signs of being too heavy. A fuse is at the top, in — sensibly — the most accessible place. The board is connected to what in a mainframe computer would be called a backplane, which is in fact another printed-circuit board with tracks on it to carry signals between the main boards.

The next two boards look as though they are used for power regulation and clock generation. The five boards to the right of the rack are the ones which contain all the chips. The rightmost board contains an 8085A processor in addition to three PROMs.

The software supplied with the Alphatronic will make or break the machine. If it is good, Triumph-Adler can rest assured its machine will sell. On the other hand, if the software is bad, the machine will plummet. This is a shame really because it means that the eventual fate of the machine is more or less out of the hands of the designers. Triumph-Adler made the right move in choosing the CP/M operating system. However, the vagaries of the machine mean that few if any of its programs are portable.

Another factor affecting the philosophy behind Triumph-Adler's marketing policy of selling to non-programmers is that programming the Alphatronic is extremely difficult — more difficult than usual, that is. The software supplied has been written by Microtrend, a British company, and it works. The word-processing package Lexicom, will sell moderately well. The main disadvantage of the program was the awful shift-key function on the Alphatronic.

The software took what seemed like an eternity to load, so I decided the CP/M implementation deserved some investigation. Most of the more common CP/M commands did not appear to be there. Dir resulted in the query Dir?

Lexicom is a sound software package. I found it a far better word processor than WordPro on the Pet, but then most are. If it is typical of Triumph-Adler's software, it is satisfactory.

Conclusions

- **The Alphatronic computer works as well as any other in its field, even if it is uninspiring.**
- **At around £1,600 for the p1 version without printer, and £2,345 for the p2 version which includes a printer and CP/M, the Alphatronic is a good buy for the first-time computer user; however, the competition is hot.**
- **The software packages are again uninspiring but efficient enough.**
- **I am afraid I can do nothing but damn the Alphatronic with faint praise, which is a pity because it deserves better.**

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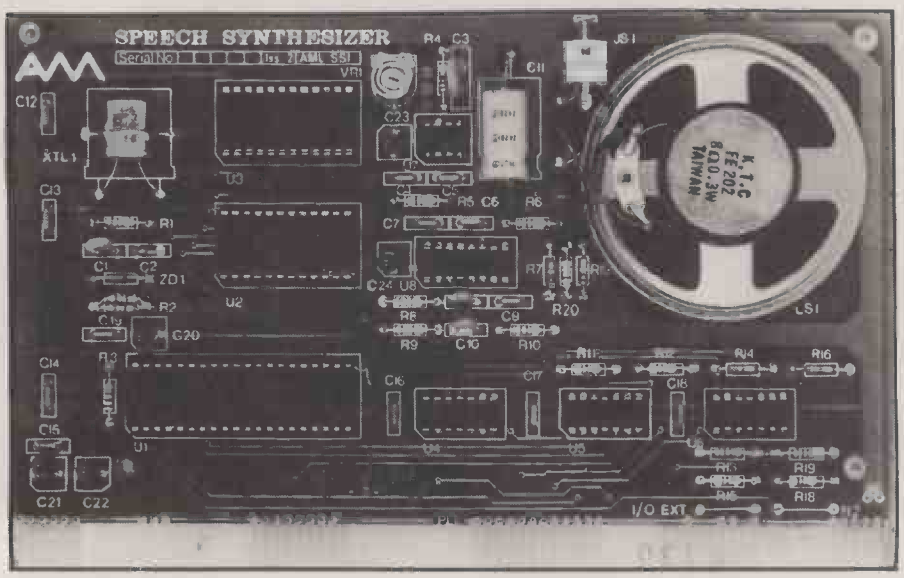

Available as a plug-in unit, Arfon Electronics' speech board generates over 100 discrete words and sounds in response to a simple numeric input from your micro. Nick Laurie reports on its strengths and weaknesses.

THE ARFON speech board is designed to the Nasbus 3 specification and will plug straight into a Nascom bus or Gemini's 80 bus. An Apple version is also available at the same price and it can be directly interfaced, at extra cost, to the Pet, Tandy and Video Genie or any RS-232 line. More of a digital tape recorder than a speech synthesiser, it has a limited vocabulary and consequently restricted usefulness.

Words and phrases are digitally encoded into ROM together with the electronics to play them out through the on-board speaker. No system RAM needs to be used. Based around National Semiconductor's Digitalker speech synthesis system, it is Z-80 port-addressed via the bus. A numeric output to the relevant port will give an instant output of any one of the 143 pre-encoded sound strings, and in this it is exactly like most other products incorporating the NS chip set. The difference lies in the fact that as a single card it can be plugged into the 78-way bus, where it is ready for immediate use.

Pet, Tandy and RS-232 users have to pay another £140 for the non-bus version. Added to the £100-odd for the board, almost £250 must be invested for the privilege of hearing a rather croaky American accent trying to speak a few English phrases in a way that would not do credit to a four-year-old's first reading lesson.

Words are made up of a mixture of clicks, hisses, silences and miscellaneous other components known as phonemes. By stringing together a series of instructions concerning these phonemes it is possible to produce a perfect representation of human speech. Even after chopping out some of the redundant information you are still left with acceptable quality — the telephone does this to us every day without any great loss of intelligibility.

Do-nothing loop

The process can be further condensed by replacing some of the standard constructs with a short length of code. For example, a 30ms. silence need not use up 30ms. of memory space when a simple do-nothing loop can be encoded in a few bytes.

Using a combination of these techniques, National Semiconductor takes a high-quality tape recording of 150 phrases and feeds them through one of their computers — in turn fed by its own ultra-secret software — to produce a suitably encoded ROM for use with the Digitalker chip. Alternatively the chip-set comes provided with NS's own standard word set, which is what you acquire with this board. Consequently you cannot encode your own messages. Not only is the encoding software a jealously-guarded secret, but NS is inclined to be vague as to even the guiding principles.

Arfon's board supplies the additional clock, filters and amplifiers needed to turn the NS chip set into a working product. The company tells me that it has sent the required high-quality tape off to be encoded in the hope that a new and more appropriate set of words will become available in the near future.

A very good quality fibreglass PCB carries everything required to produce the speech and cannot be faulted from a constructional point of view. The on-board 42in. speaker has a tinny tone but a jack socket allows you to by-pass it and feed direct to a better-quality amplifier.

Although Arfon recommends this practice, claiming that the frequency limitations of the on-board speaker does not do full justice to the sound, my own opinion is that it makes little difference. The voice is so blatantly synthetic that the loss of some more information makes no real difference except to the volume. The circuitry is more or less that suggested by NS as being ideal for a full implementation of its chip set and has clearly been carefully thought out and professionally designed.

A product such as this, costing over £100, should simply plug in and work. In theory it does, but the practice was not that simple. Out of its more-than-adequate packing came the board, and into the bus it went. On power-up, a roaring 50Hz hum drowned out all the speech and rendered the computer room unoccupiable. This obviously was not meant to happen, but transferring it into a second Nascom produced exactly the same results.

Some poking around revealed a lot of noise on the 12-volt rail, which eventually subsided when all the EPROMs were removed from the system. Applying the same cure to the first machine resulted in no hum at all, and crisp, clear speech which issued forth like a voice from the gods.

Playing around was good fun, but with all the EPROMs missing it was hard to get a program wrapped around the speech and was limited to direct port output commands. With the EPROMs reinstalled, back came the noise. Measurements showed that the power supply was well within its rating — the speech board only draws 50mA — and it seemed to be time to try out the Arfon customer servicing department. The best it could manage was "Well, it's never happened before," and I was offered a new board.

It was clear that the noise was originating in the Nascom — what I wanted was a way of stopping the speech board from

(continued on next page)

Word	hex	dec	Word	hex	dec	Word	hex	dec	Word	hex	dec	Word	hex	dec
This is Digitalker	00	0	Thousand	1D	29	Again	3A	58	Gram	57	87	Out	74	116
One	01	1	Million	1E	30	Ampere	3B	59	Great	58	88	Over	75	117
Two	02	2	Zero	1F	31	And	3C	60	Greater	59	89	Parenthesis	76	118
Three	03	3	A	20	32	At	3D	61	Have	5A	90	Percent	77	119
Four	04	4	B	21	33	Cancel	3E	62	High	5B	91	Please	78	120
Five	05	5	C	22	34	Case	3F	63	Higher	7C	92	Plus	79	121
Six	06	6	D	23	35	Cent	40	64	Hour	5D	93	Point	7A	122
Seven	07	7	E	24	36	400Hz tone	41	65	In	5E	94	Pound	7B	123
Eight	08	8	F	25	37	80Hz tone	42	66	Inches	5F	95	Pulses	7C	124
Nine	09	9	G	26	38	20ms. silence	43	67	Is	60	96	Rate	7D	125
Ten	0A	10	H	27	39	40ms. silence	44	68	It	61	97	Re	7E	126
Eleven	0B	11	I	28	40	80ms. silence	45	69	Kilo	62	98	Ready	7F	127
Twelve	0C	12	J	29	41	160ms. silence	46	70	Left	63	99	Right	80	128
Thirteen	0D	13	K	2A	42	320ms. silence	47	71	Less	64	100	Ss	81	129
Fourteen	0E	14	L	2B	43	Centi	48	72	Lesser	65	101	Second	82	130
Fifteen	0F	15	M	2C	44	Check	49	73	Limit	66	102	Set	83	131
Sixteen	10	16	N	2D	45	Comma	4A	74	Low	67	103	Space	84	132
Seventeen	11	17	O	2E	46	Control	4B	75	Lower	68	104	Speed	85	133
Eighteen	12	18	P	2F	47	Danger	6C	76	Mark	69	105	Star	86	134
Nineteen	13	19	Q	30	48	Degree	4D	77	Meter	6A	106	Start	87	135
Twenty	14	20	R	31	49	Dollar	4E	78	Mile	6B	107	Stop	88	136
Thirty	15	21	S	32	50	Down	4F	79	Milli	6C	108	Than	89	137
Forty	16	22	T	33	51	Equal	50	80	Minus	6D	109	The	8A	138
Fifty	13	23	U	34	52	Error	51	81	Minute	6E	110	Time	8B	139
Sixty	18	24	V	35	53	Feet	52	82	Near	6F	111	Try	8C	140
Seventy	19	25	W	36	54	Flow	53	83	Number	70	112	Up	8D	141
Eighty	1A	26	X	37	55	Fuel	54	84	Of	71	113	Volt	8E	142
Ninety	1B	27	Y	38	56	Gallon	55	85	Off	72	114	Weight	8F	143
Hundred	1C	28	Z	39	57	Go	56	86	On	73	115			

Table 1. National Semiconductor DT-1050 master word list.

(continued from previous page)
paying it such a great deal of attention.

I eventually disconnected the spare 12-volt line from the board and ran in a spare line from another source. Since overcoming the setting-up problems the board has stayed in place unobtrusively and has functioned perfectly ever since.

Table 1 shows the 144 assorted characters and words available. You can try sitting down with a pencil and paper to see what you can do with them:

- Ss, 81 hex, makes any singular word plural.
- Silence periods, 43 to 47 hex, improve the quality of speech phrasing. For words beginning with the letters B, D, G, K, P and T insert 80ms. silence before the word; for words ending in these letters insert 40ms.
- If a call is made to the speech card higher than decimal 143, unintelligible invalid speech will be output. Other speech ROMs may allow calls higher than 143.

The sequence 40, 34, 52, 46, 88, 01 is good for a laugh. Dollar, cent, parenthisis and lesser all show this particular character set to be American in origin and application, and experimental and general purpose.

A phrase like "Your computer is on fire" is not easy to achieve, but with a few hours careful editing to pull useful bits out of pre-existing words you might manage it. So what about using the Arfon games — an obvious home-computing application? It could read out the score aloud for you, though if you want it to say "one hundred and eighty-three" rather than "one-eight-three" you have to resort to some nifty string manipulation first. It has not got words like "win" or "lose". By structuring a game around the available words you could probably build something that made reasonable use of the sounds, but for home games its use is minimal, bearing in mind the cost. Commercial arcade games might find a use for it, given an appropriate set of sounds.

As for industry, Lucas reckons that 90 percent of future Nascoms will be going into industrial environments — largely for process control. A machine that yells "Stop — danger — Ampere — meter — is — over — limit" at the right time could be useful. In this environment it is quite possible that the digital tape recorder can serve a useful function.

Favourite application

My favourite potential application is for a combined micro, speech board and alpha-numeric display giving simple speech facilities to the speechless. A couple of days provided enough software to point the way towards a hand-held box capable of being used for artificial speech. It was so simple that a few weeks development on the hardware side should actually be capable of producing a saleable product, although NS would have to encode a new set of words. For coin-in-the-slot machines providing service with a smile — or at least an audible snigger — try 46-46-46. Several general-purpose consumer products are also a possibility.

The Arfon board is expensive for a hobbyist, but it has a useful place in opening up experimental possibilities. With its current ROM set it has a vocabulary which provides an interesting demonstration of speech synthesis rather than a useful addition to a computer system. Talking computers will certainly be part of everyday life in a few years and this board is a good introduction to them, but it would be a mistake to think that it provides all the answers.

A true sound synthesiser, or even a phoneme synthesiser, would produce far more intelligible speech and a wider range of responses, but at a software overhead that could, for the time being, prove time-consuming and costly. If National Semiconductor was to reveal something of the pre-processing requirements for producing coherent sounds from the chip, then the users might be able to make inroads into the programming time by producing their own ROMs. NS and Arfon might then sell more chips and boards. For the present we are stuck with a good idea looking for useful applications.

Conclusions

- **As a research aid the Arfon speech board has its uses, but as an everyday addition to a computer system its value depends on how seriously you consider the spending of up to £250.**
- **The board is technologically sound and is well constructed, but the phrases currently available are of limited value.**
- **It plugs straight in for immediate use, and works first time as long as your power supply is providing noise-free DC voltages.**
- **It could be used as a stand-alone, switch-operated board.**
- **The basic board costs about £100; interfaces for Pet, Tandy and RS-232 cost another £140 — all prices including VAT. No extras are required, except an amplifier and speaker for use in a noisy environment.**

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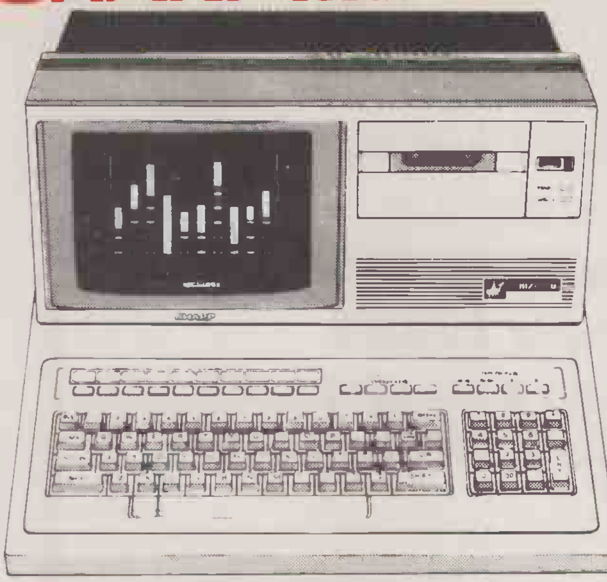

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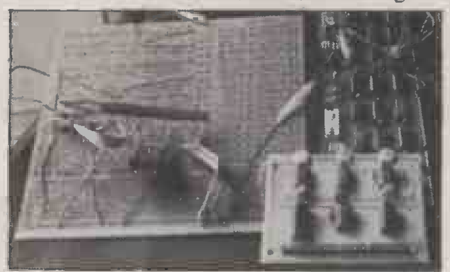
A high-resolution graphics add-on is put through its paces by Chris Malcolm, who offers some advice on connecting it up and using it with your system.

IOSL graphics for the Nascom

WITHIN the limitations of black and white dots on a TV screen, the IOSL graphics board offers about as high a resolution as you can get. As well as being better than most other TV-based high-resolution systems, it is also unusually versatile and cheap. Though designed as an add-on to the Nascom 2, its intimate combination of software and hardware is of general applicability.

Every designer of a memory-mapped screen faces the same problem: How do I get the bytes from the memory map fed to the screen at the right rate? Clearly, a system is required to call consecutive bytes from memory and feed them ultimately to the video-shift register. This is just the sort of thing which processor chips do — and there is already a processor chip in the system. Unfortunately, the processor on its own just cannot work fast enough. It needs extra hardware assistance, and there are some software problems to be solved.

The silicon hardware designers are solving their video-control problems by putting ever more sophisticated video controllers into chips. The trouble with hardware is, of course, that it cannot give



The IOSL board, right, and the extra connections needed to attach it to the underside of the Nascom memory board.

you more facilities than the designers originally built in.

This limitation is removed in the IOSL video driver, which combines the processor with software to give extra flexibility. It allows you to change parameters and add facilities, and if you have a special need you can rewrite the driving software.

The IOSL board offers high-resolution bit-mapped graphics. Each bit in a certain block of memory is mapped to a particular point on the screen. The smallest point that can be made on the screen is the size of the dot of an "i". If the bit is set, the point is illuminated on the screen. A byte containing 255 therefore appears as a short horizontal line, eight dots long.

The board offers 384 horizontal points by 224 vertical points, which is exactly the same resolution as that used by the Nascom 2 to draw its characters on the screen. You can, therefore, invent your own signs and symbols and mix them with the original character set without any mismatch in appearance. The original 1K memory map and the bit map can be enabled separately or together, so that you can mix ordinary text and bit-map graphics quite freely.

The graphics board has to be physically tied in to a particular 16K section of your memory. Under software control, this memory can be used for normal purposes when not being used for a bit map. The starting address and number of lines in the map are software parameters which allow you to scroll smoothly or switch simply and quickly between different maps.

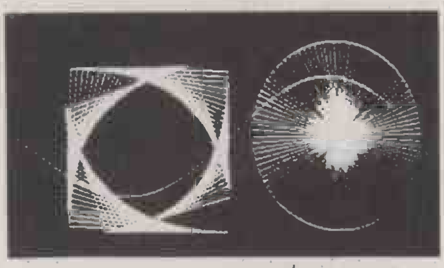
A full 384 x 224 map requires 10.5K of memory. The 16K memory allocated to the board allows you to hold two picture areas, each of up to 384 x 170 lines. You can draw in one while displaying the other, and then make an instant switch.

A fully assembled and tested board costs £63.25, including VAT at 15 percent. It comes with cables and socket to patch it in — it requires connection to both processor and memory board, type A or B — and software routines on cassette. The software can be used from Basic or machine code to plot points, draw lines and fill rectangles with patterns. There is a demonstration program and good documentation which includes full installation instructions and assembler listings of the routines.

The IOSL provides all the clarity and resolution you could ask from a hobby machine driving a TV, though there are some snags. You have to do some delicate soldering to the underside of the board or the chip's legs. The board needs 20 connections to the memory board and 10 to the processor.

If you follow the manufacturer's instructions you end up with the boards wired together via the graphics connector. To avoid this, I introduced a separate connector to the processor board. Though this should not present a problem to someone who has already soldered up a Nascom 2 and made it work, it is not a job for the beginner. It is rather untidy too, but a plug-in board graphics facility would be much more expensive.

The software uses interrupts, and



Nascom owners should all know about the annoying bug in NasSys-1 which makes it effectively non-interruptable. If you have NasSys-1 you cannot plot from Basic, and you must not use NasSys routines in your own assembly or hex code.

If you have NasSys-3 you can use NasSys routines and Basic without restriction. NasSys-3 is worth having anyway, if only for the repeating keyboard and character-display tabulator. The routines are entirely self-contained, and can be used with any software regime which is interruptable, not just NasSys.

When the graphics display is enabled — a software function — it uses up processor power since the processor forms part of the video driver. A full-size display at full refresh rate uses 75 percent of the processor power, so other software runs at 25 percent of normal speed.

Processor power

The amount of processor power used depends on both the size of map being displayed and the refresh rate. At the 50Hz maximum refresh rate the display is solid and clear. At the optional 25Hz refresh rate the picture is slightly dimmer, and has a noticeable flicker. For some reason the flicker is most objectionable if there are large white areas on the screen, though it is barely noticeable on sparse drawings.

As the refresh rate and the size of the display are reduced, so is the amount of processor power consumed:

	Full size	Half size
50Hz	75 percent	33 percent
25Hz	33 percent	20 percent

Smaller displays consume even less. When the display is not enabled there is no overhead. Reset always disables the graphics board. When speed is paramount, the display can be disabled or switched to the 25Hz rate. You can draw while the display is not enabled; you can, for example, draw a complex game picture while a player is reading the instructions or entering the parameters.

If you want to move graphics on the screen you need either carefully optimised Basic or machine code. Fixed pictures can be written to cassette in the normal way and read in as part of the program. You must disable interrupts or Reset before using cassette I/O.

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The board requires the Nascom 2 to run at 4MHz. It is not affected by Wait states, but you should alter a timing loop if you run at 4MHz without Waits, as indicated in the documentation. Otherwise you will lose a few dots off the end of a line.

Seven functions are provided by the software:

- Initialise hardware
- Clear display
- Set point
- Unset point
- Draw a line
- Undraw a line
- Fill a rectangle with a pattern

You can also add your own. Functions are accessed by a jump table with space for more entries. They are called as subroutines from machine code, or as USR(n) from Basic.

Additional functions

It is no more difficult to use the functions than the Set/Reset of the standard Nascom blot graphics. It is a pity there is no facility corresponding to the Basic Point

```
IF POINT(X,Y) THEN
```

but it is not hard to add it if required. It could even be done in Basic by some such command as

```
IF PEEK (START + Y* 48 + X/8) AND
    (X−INT(X/8))* 8 < > 0 THEN ...
```

The IOSL exploits the Nascom system clock which also provides the rate at which the video-shift register is fed with bytes. There is not enough time for the Z-80 to fetch a byte and supply it to the shift register. The shift register is fed at the same rate as the Z-80 can execute a NOP instruction when running at 4MHz without a Wait state. The board turns off Waits when it needs to.

The processor is interrupted at the top of the screen, finds out the start and size of the bit map, synchronises itself to the next horizontal line on the screen, enables the board and starts to execute code at the bit-map address. The Z-80 first reads the instruction by putting up the address of the byte, which causes the memory chips to output the data to the data lines.

The IOSL board, which is patched into the memory board, snitches the data, puts it into its video-shift register and puts a zero byte out on the data highway. The Z-80 innocently executes this NOP command and proceeds to the next instruction, and so the process continues.

The graphics board has also been patched into the Nascom's own video-shift output. Depending on how it was initialised by the processor via two port bits, it either suppresses the ordinary video output, substituting its own, or Ors it with its own, allowing text and graphics to be mixed.

The board lacks the capability to choose between Oring or XOring the two screen maps together. The XOr — exclusive Or — would allow text to be written over graphics without the risk of obliterating some characters. A white letter written over a white background would make the letter turn black, in reverse video. The eye is well able to read letters presented in this way, even if XOred with fairly complex graphic detail. Adding this facility would provide the full Nascom character set or any bit-mapped graphics picture in reverse video.

Giving a choice between Oring or XOring the two maps I would always choose XOr. Most graphics facilities do not allow even an Or, due mainly to lack of compatibility between dot sizes. The mixed text and graphics provided by the IOSL board allow the simple construction of very neat tables and diagrams which would otherwise be unobtainable.

One very important — and often neglected — characteristic of graphics facilities is whether or not they are square. In other words, if you draw a square 100 points by 100 points, does it look like a square or is it a rectangle? Do circles look like circles or ellipses? Frequently you have to introduce a squaring-up factor into your software, which is a nuisance and slows down the speed at which the software will run. If you are using a TV as a monitor you may be able to square up the graphics display by adjusting the vertical size control.

Patching in

In my own Nascom the processor card was mounted along the back of a Vero card cage, with the memory board at right angles. The graphics board can be integrated more neatly by sandwiching it between the processor and memory board, swinging the processor round to the front and giving it a recessed socket.

One end of the graphics board is physically supported by the stiffness of the wires connected to the socket. The other end can then be supported by rubber bands threaded through the holes and attached to wire hooks clipped over an extra set of card guides provided for the purpose. A thin piece of foam insulates the exposed undersides of the memory and graphics boards.

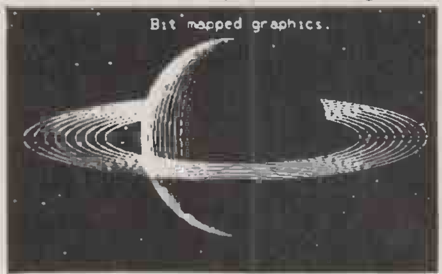
To the newcomer, the possibilities of high-resolution graphics are not immediately obvious. As well as being much more spacious than low-resolution graphics, there is also considerable interest in the way in which software can be generalised and modularised.

A typical routine calculates the new ordinate of a three-dimensional point and its projection on to the X,Y of the screen after the axes have been moved and rotated. A drawing of a solid object is entirely made up from a number of points joined by lines.

The picture of a ringed planet was constructed from one simple ellipse-drawing routine. It was written in Basic without any consideration for speed, and takes over 10 minutes to draw. The routine has to calculate the position of each point in the picture. With 384 points in a line and 224 lines it is not surprising that the calculations take some time.

For most purposes, the degree of precision is quite excessive. To display perspective views of alien spacecraft zooming towards you requires assembly-language software which has been carefully crafted for speed. If the spaceship is a complex drawing and the background is a few stars you can do almost as well with shift pointers to move the whole picture and then move the stars back.

It can often be useful to mix two maps. You can use Basic to move the ordinary characters around against a background



drawn on the bit map for precision placing. Only the starting and finishing positions need to be drawn on the bit map. You can invent your own backdrop for space invaders and load it separately from cassette. Assembly-language routines for drawing and undrawing shapes can be called from Basic.

Graph paper can be drawn with the rectilinear-drawing character set, allowing bit-mapped graphs to be moved around over it. By putting the ordinary character set into the bit map, text can be scrolled smoothly instead of jumping line by line.

Part of the cost of commercially-available graphics systems is due to the very fast, powerful processors needed to do the necessary calculations in a reasonable time. The speed limitations of an eight-bit microprocessor are clearly felt. You can use it to draw anything you like, though it can be very slow. If you are prepared to be clever in assembly language, the arcade games show what kind of performance you can aspire to.

Conclusions

- **Supplier: IO Systems Ltd, 6 Laleham Avenue, London NW7 3HL.**
- **The IOSL board provides a high-resolution of 380 x 220, the same as that of the standard character set. Horizontal and vertical resolution is equal.**
- **The board's graphics are usable in combination with a standard display.**
- **The bit map is accessible directly in memory space, or via drawing routines. It uses 10.5K of memory, but unused areas of the bit map are free for other purposes.**
- **The IOSL graphics board has to be patched in to the main memory and processor boards.**
- **The board provides good-quality graphics and is good value for money.**

Consolidated Forecast	OVERHEADS		1/3/82		
	TOTAL	QR1	QR2	QR3	QR4
Personnel Costs					
321 Weekly wages	30,000	9,231	6,923	6,923	6,923
326 Pension	610	188	141	141	141
384 Prof services	2,250	692	519	519	519
Vehicle Costs					
413 Vehicle deprec	2,500	769	577	577	577
451 Motor tax	70	22	16	16	16
452 Motor insurance	270	83	62	62	62
454 Accomodation	1,360	418	314	314	314
Various Costs					
455 Post, tel, fares	1,360	418	314	314	314
456 Vehicle service	400	123	92	92	92
457 Fuel	1,280	394	295	295	295
458 Entertaining	200	62	46	46	46
459 Miscellaneous	720	222	166	166	166
TOTAL	41,020	12,622	9,466	9,466	9,466

Prepared by Chief Accountant for Financial Director: all figures in #000s

Menu-driven Mars is designed to run under CP/M. The system majors on the fact that, unlike VisiCalc or MicroModeller, you are not obliged to learn a series of commands to operate it. Peter Wood examines its features.

Financial modelling: Mars plots the trends

FINANCIAL MODELLING and planning is fast becoming one of the most popular applications for microcomputers. Diverse companies, from multinationals to one-man businesses, are trying their hands on one system or another. VisiCalc has become a firm favourite for its "instant" re-calculation facility, and MicroModeller for its ability to predict trends and perform consolidation.

Now another package has been launched, apparently to compete with MicroModeller, on the CP/M system. The Management Accounting and Reporting System, Mars, has been developed in the U.K. by Sapphire Systems of Benfleet, Essex, and will run on Superbrain, North Star Horizon, Rank Xerox 820 and Digital Microsystems. The conversion for Olympia and AI ABC is currently under way and Sapphire says it will convert to other machines if the market demands it. Perhaps the major feature of Mars is that it is menu-driven, supplying the user with simple numbered options, as opposed to the requirement of memorising a series of commands such as in VisiCalc. This menu facility must make the system very simple to grasp, even for the first-time computer user.

We tested Mars on a Superbrain with 700K of disc storage. Starting up the system is straightforward. After switching on the computer, you insert the Mars system disc in drive A, and after a few seconds the main menu is displayed. Four options are offered:

- to run a job,
- to create or edit a job,
- to prepare a new disc
- to carry out disc maintenance.

On some versions of the system a fifth option is provided to allow configuration of the printer ports, as on the Superbrain.

The system manipulates data in a matrix format, effectively behaving like a balance sheet, with each column and row numbered. Before being able to do any useful work, the user must configure job files to tell the system how to set up this balance sheet and how to print the finished result. These jobs consist of four sections accessed by the job editor which is contained on a separate diskette:

- Job description sets out a few basic details about the job; the name, of up to eight characters; a slightly more lengthy and informative textual description, of up to 24 characters; and the size limitations of the reports to be generated.
- Matrix specifications defines the size of the matrix and various sources from which raw data is to come, whether manual input from the keyboard, automatic input from a range of data files, or a combination of the two.
- Calculation specifications defines the set of calculations which are to be performed on the data in order to produce the required set of results.
- Report layout contains a full specification of every aspect of the report format, indicating how the pages are to be set out, which information is to be printed, how it is to be presented and where.

Once the job specification has been fully defined, Mars can then be commanded to carry out the job, by selecting option 1 from the main menu. There are a number of steps involved in carrying out a job, each of which is accessed again from a menu. The five steps are:

- Keyed input. The most common way of entering data into a modelling program is via the keyboard. This section of the system allows entry of new data, and examination and alteration of existing data. Prompts are supplied to the user in the form of the Row and Column descriptions defined earlier in the Job Editor.
- Input from files. After a job has been run for the first time, it is possible to store the information held in the program's matrix as a named file. This means that the same data can be reused, or that data from one matrix can be input to another matrix, as might be required in consolidation. Data can also be retrieved from files generated by another program, such as a ledger accounting system.
- Executing commands. Once data has been entered in the array, calculations can be performed upon it, either by executing the calculations previously set up in the job editor, or by manual entry of calculations from the keyboard. The results are stored in specific locations in the matrix, again defined under the job editor. The feature also displays any part of the matrix on the screen to view, for instance, the results of calculations.
- Printing the report. Having carried out all the manipulation of data required and produced the necessary results of the calculations, the report may be printed. The layout of the report will be as set out within the job editor.
- Executing the whole job. Where a job becomes a standard job, and the requirement exists to run it on a regular basis, this option may be used. Input from files, execution and printing are performed in sequence, so that the data is read in, calculations are made and the reports produced entirely without operator intervention.

Mars revolves around disc files of various types. Job files contain the specification for the job in question; data files contain stored matrices or raw input data. The system therefore provides for considerable disc maintenance, including the

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preparation of diskettes for use as data discs and the archiving and back-up of data files from disc to disc. The archiving facility could be particularly useful if space is required on the normal working discs, and some seldom-used jobs exist that could be archived to make room for new tasks.

A useful feature available when setting up a new job is the ability to base it on any existing jobs on file. If you are creating your first job ever, and have nothing at all to base it on, the system comes with a default job already set up. This is a "standard" job, intended to act as basis for future work you may wish to perform. It has a matrix of 56 rows by 13 columns: the rows are labelled "Row No. 1", "Row No. 2" and so on, and the columns are labelled from "January" to "December" and "Annual Total". It is relatively simple to change these parameters, and the monthly column headings may often be suitable for financial work and obviate a good deal of tedious typing.

After typing in the name of the job to be created, and supplying the name of the old job on which to base the new one, the user is presented with a menu with four options:

- to work on the job description
- to work on the matrix
- to work on the calculations
- to work on the report layout

The Return key terminates the editing session and allows selection of:

- re-editing the current job,
- working on another job,
- abandoning and deleting the current job,
- returning to the main menu.

The job description option allows entry of the job description and status — either partially or fully defined — which determines whether or not the system will allow execution of the job, and defines the basic layout of the printed report.

The layout configuration includes the number of columns per page; the length of the row and column descriptions; the default "picture" for amounts, which specifies how many digits and decimal places are allowed; and the page size, which will depend on the type of printer to be used.

There are five sub-options within the matrix-specification option.

- to edit the matrix size for inspection or alteration of the size of matrix required, which may be expanded or contracted at will;
- to Enable or Disable keyed input to the columns, for specifying which columns will accept manually keyed data;
- to enable or disable keyed input to the rows for specifying which rows will accept manually keyed data;
- set up source-file descriptions to name the files that will provide automatic input of data from disc;
- edit the keys for key-matched file input in order to set up a sophisticated system of controlling where the file-input data will be placed within the matrix.

The matrix size can be as large as 4,000 elements in a 64K machine, which should be more than enough for most applications. If the size of the problem eventually outgrows the matrix originally specified, it is possible to expand up to this maximum at a future date without loss of data. Contraction of the matrix is also allowed. The system prompts the operator for the rows or columns to be deleted as required.

Keyed input is allowed to any column or row the user chooses, and is signified by a Yes if allowed or No if not. This level of simplicity of operation is apparent throughout the system and makes a welcome change from some of the more obscure methods of other packages.

File input may come from three types of disc file:

- keyed-input files, which contain data taken directly from the keyboard,
- saved-matrix files, which contain data from a defined matrix and may include the results of previous calculations
- other files, which will have been created by some other package for input to the Mars program.

The user specifies the type of file, which may be:

K — keyed S — saved matrix
O — other .

A "K" file needs no further qualification since the positions within the matrix for the data have been previously defined when it was keyed. An "S" file is slightly more complex: the facility exists to tell the system which columns or rows of the saved matrix to read and where to insert them within the current matrix, or to consolidate the entire saved matrix into the current file. The "O" file option allows the operator to specify the size and position of particular fields within the externally-produced file for input into the matrix, along with the size, position and content of a key field which is used to select or reject records from the file.

This whole procedure is complicated, but it does allow for very versatile operation. It is possible, for example, to search a stock file and pick out the quantities, selling and buying prices, and month-to-date figures for a particular group of items and bring those figures into play within the matrix set up.

Once the basic data has been read into the matrix, the next step in most applications is to perform a series of calculations on the figures to produce a set of results. The Mars calculation-specification option, assessed through the job editor is used to enter the calculation set-up program.

Calculations are entered line by line, using a fairly sensible editor which allows insertion and deletion of lines as well as editing of characters within the lines. The basic form of a calculation is:

Operator 1 Operand 1 Operator 2 Operand 2 Operator 3 Operand 3

An example of this would be

MULT R1, 1-6 BY R2 GIVING R3

This means: starting with column 1, take each successive element of row 1; multiply it by the corresponding element in row 2, and store the result in the same column of row 3 and do this for all columns from 1 to 6.

The mathematical instructions available are

Add, Subtract, Multiply, Divide, Total, Move, Assign, Percentage, Spread, Zero, Save, Display, Calculate nett present value, Calculate discount rate forcing nett present value of cash flow to be zero, Calculate time to recover initial investment, If conditional set, Grow — extrapolate

The final set-up required is the report layout, which is called from the job-editor menu. Columns and rows may be titled, and the operator may select which are to be printed, and which are not. The formatting of the results may also be decided at this point, defining the "picture" for the figures — 99999.99 for example. It is also possible to select underlining of headings, underlining and overlining of figures, and the general layout of each line and the whole page.

Having used the job editor to set up all the previous parameters, the run option is selected from the main menu to execute the job. After entering the date, and selecting the specific job to be run, the following options are displayed.

- Keyed input
- File input
- Execute commands
- Print report
- Execute complete job

The operator may now proceed to feed data into the matrix, perform calculations on it and produce the final printed report. Data may come from the keyboard, from files, or from a mixture of the two. Calculations may run automatically, or be keyed in directly. In any case the results will finally appear in the printed report, which is the package's main purpose.

Conclusions

- **The menu-driven style of the package was clear and easy to use.**
- **The manual was well written and easy to follow.**
- **Calculations were a little slow at times, but Sapphire claims to have speeded this up considerably.**
- **The overall flexibility of the program was good, allowing for most financial requirements in a relatively simple manner.**
- **The ability to both analyse existing data and project trends is very powerful.**

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GRAND-PRIX PRACTICE

Don Thomasson presents a program to calculate and maintain records for sport and business.

EACH YEAR, a number of Formula One motor races are run as qualifying rounds for the World Championship of Drivers. There are as many as 17 races, and about 40 drivers, some of whom drive more than one type of car during the season. Before each race there are practice sessions, timed to a millisecond, and the order in which the drivers line up on the starting grid is determined by the best lap times they set during practice, the fastest of all being placed in "pole position" at the front.

Because the lap distance for each race is different, the bare times convey relatively little. By calculating the times as percentages in excess of "pole time" the differences can be removed, and a useful performance index can be derived. An average for the whole season can then be calculated to give an interesting and illuminating indication of the merits of individual drivers in terms of pure speed. The fastest may not become champion, perhaps because he performs unreliably while a slower driver finishes more of his races.

The Practice program uses MBasic and is written for a system with at least one disc drive, running under CP/M. It first enquires whether a file of existing data is to be read in. The answer will usually be "Y", except at the beginning of a season when no data exists. Any other answer causes the data arrays and the variables to be reset by the routine starting at line 1790. This may be unnecessary, since Run clears data in any case, but the routine is required for other purposes and it ensures that unwanted data is cleared.

Whether a file is read in or not, the year must be input to form the heading of the printout of results. It is also incorporated into the file name, so that the data for any given year can be pulled out at will. Each year's files occupy about 8K of disc space.

One file corresponds to the AA array, which contains all the numeric data. The second file relates to the arrays CB$ and DB$ which hold the names of car-and-driver combinations. They are read in by lines 100 to 300.

Discs too slow

Next comes the main menu, lines 310 to 350, and then the modules which can be called via the menu. The main entry routine has its own menu and subsidiaries, and occupies lines 540 to 1130. Lines 1140 to 1570 deal with printout; lines 1580 to 1780 deal with the saving of files and close functions, ending with exit from the program; and lines 1790 to 1850 contain the clearance routine.

Consideration was originally given to a scheme depending on random-access disc files with a minimum of data held in RAM. This proved to be too slow for convenience, and a single two-dimensional array was devised which could hold all required data economically.

The data relating to the car-and-driver combination given by the variables CB$(ND),DB$(ND) is held in AA(X,ND). If X = 0, the location is used to mark off entry lines which have been printed. For X = 1 to 20, practice time in race number X is stored in terms of the percentage by which it is greater than pole-position time. AA(21,ND) holds the number of races entered by that car-and-driver combination, and AA(22,ND) holds the total of the race entries. AA(23,ND) holds the average of the entries, calculated from the previous two columns of the array.

The array row 0, i.e., AA(Y,0) holds pole time for race Y if Y is between 1 and 20. AA(21,0) holds NM, the maximum race number entered, and AA(22,0) holds NT, the number of car-and-driver combinations entered. AA(0,0) and AA(0,23) are spare.

Although there is no clear indication that it is permissible, the use of assembled file names presents no problems if it is approached with caution. The use of the MID$ function in line 70 is essential. It removes spaces before and after the year number in string form, trimming the file name to eight characters. A space in a file name has odd consequences, since CP/M and MBasic interpret it differently.

The process of opening and reading the files is straightforward in essentials, but some of the precautions taken may not be obvious.

- If no file is found, error 53 appears. This links via lines 50, 200 and 220 to a report "No file", but does not stop the program.
- Lines 150, 250 and 270 detect end of file, and forestall an "Input Past End" report. It may be felt that line 270 is not needed, since CB$ and DB$ are stored in pairs, and the end of file should therefore be detected at line 250, but files can have odd endings as a result of operator errors.

The input routine is completed by closing the source files.

There is no problem over control of access from the main menu to the principal modules, but a number of alternatives were tried and discarded for control within the entry routine. The first step is to enter the race number, which is simple enough. If no pole time has been set, the first time is taken to be pole time, and the operator is warned of this by an addition to the input string inviting a car-and-driver input. Subsequent entries are simply entered as percentages, but the entry for the pole-position driver is 1,000.

Economical entry

The first difficulty is that no letter can be reserved to call for a return to the main menu. So far, there is no driver whose name begins with X, but with Zapico, Zorzi and Zunino on file it would be rash to bet against a Xavier appearing. It was therefore decided that any entry at this stage should — providing it contains a comma — result in a jump to the entry subroutine starting at 680. This permits a minimum entry of car-and-driver data. "J,W" will suffice to identify Jones, Williams, allowing entries to be made quickly. "J,L" could mean either Jarier or Jabouille, who are both Ligier drivers, so in this case at least three letters of the driver's name are required.

The letters provided are matched against the CB$ and DB$ arrays, and if a match is found the full names are displayed. A zero entry cancels the process if the names are wrong. If no match is found, the display is "New Entry?"; if the full names have not been given the process is cancelled and a full entry made.

The alternatives to a zero entry are:

R — which returns to the main entry routine and calls the module beginning at line 1080. This first checks that an entry for the named car and driver and the current race number exists, reporting the fact if there is no entry, and then removes the entry, correcting the summary data, so that a new corrected entry can be made if necessary.

D — which passes by the main entry routine to the module beginning at line 920. This removes the complete entry for the car-and-driver combination identified; it is mainly used to delete garbled names.

X — which returns via the entry routine to the main menu.

N — which allows a new race number to be entered by jumping back to line 550. TP is set to 0 unless the AA array can provide a pole time, in which case TP is set to that at

(continued on next page)

```
10 REM By Don Thomasson.
20 CLEAR 1000
30 WIDTH 130
40 DIM AA(24,70),CB$(70),DB$(70)
50 ON ERROR GOTO 200
60 INPUT "File to be read in";Z$
70 INPUT "Year";YR:P$="DATA"+MID$(STR$(YR),2,4)
80 N$="NAME"+MID$(STR$(YR),2,4)
90 IF Z$<>"Y" THEN 1790
100 OPEN"I",#1,P$
110 OPEN"I",#2,N$
120 X=0
130 Y=0
140 INPUT#1,AA(Y,X)
150 IF EOF(1) THEN 230
160 Y=Y+1
170 IF Y<25 THEN 140
180 X=X+1
190 GOTO 130
200 IF ERR=53 THEN 220
210 ON ERROR GOTO 0
220 IF(ERL=100 OR ERL=110)THEN PRINT "No file.":GOTO 300
230 X=1
240 INPUT#2,DB$(X)
250 IF EOF(2) THEN 300
260 INPUT#2,CB$(X)
270 IF EOF(2) THEN 300
280 X=X+1
290 GOTO 240
300 CLOSE:NM=AA(21,0):NT=AA(22,0)
310 PRINT CHR$(12)
320 PRINT TAB(25)"OPTIONS"
330 PRINT:PRINT TAB(18) "E: Entry and Amendment."
340 PRINT:PRINT TAB(5)"Enter event number, then Driver/Car combinations."
350 PRINT TAB(5)"Full names are only needed for new entries. Subsequent"
360 PRINT TAB(5)"references only need enough letters to avoid ambiguity."
370 PRINT TAB(5)"A zero response should be made if the expected name"
380 PRINT TAB(5)"does not appear. A non-zero numeric preceded by T"
390 PRINT TAB(5)"will be treated as a time to be entered. If no pole time"
400 PRINT TAB(5)"has been entered, the time will be treated as pole time."
410 PRINT TAB(5)"An entry of R removes the time for the given race/driver."
420 PRINT TAB(5)"An entry of D removes the whole entry for the driver named.";
430 PRINT TAB(5)"An entry of X will return to this menu."
440 PRINT TAB(5)"An entry of N allows input of a new race number."
450 PRINT:PRINT TAB(18)"P: Printout.":PRINT
460 PRINT TAB(18) "C: Close, saving data (Wait for OK)"
470 PRINT:PRINT TAB(18) "I: Initialise by clearing arrays."
480 PRINT:INPUT"Option required";S$
490 IF S$="E" THEN PRINT CHR$(12):GOTO 540
500 IF S$="P" THEN 1140
510 IF S$="C" THEN 1580
520 IF S$="I" THEN 1790
530 GOTO 480
540 TP=0:PRINT NM"races entered",NT"drivers entered."
550 INPUT "Race Number";NR:IF NR>NM THEN NM=NR
560 TP=AA(NR,0)
570 IF TP=0 THEN PRINT "Pole Position ";
580 INPUT "Driver,Car";DA$,CA$
590 GOSUB 680
600 IF M$="D" THEN 920
610 IF M$="R" THEN 1080
620 IF M$="X" THEN 310
630 IF M$="N" THEN TP=0:GOTO 550
640 IF M$<>"T" THEN PRINT "Error":GOTO 570
650 IF TD=0 THEN 570
660 IF TP=0 THEN 860 ELSE 980
670 GOTO 570
680 ND=0:TD=0:IF NT=0 THEN 770
690 LD=LEN(DA$)
700 LC=LEN(CA$)
710 FOR X=1 TO NT
720 IF DA$<>LEFT$(DB$(X),LD) THEN 760
730 IF CA$="" THEN 750
740 IF CA$<>LEFT$(CB$(X),LC) THEN 760
750 ND=X:X=NT
760 NEXT X
770 IF ND=0 THEN PRINT "New Entry";ELSE PRINT DB$(ND)","CB$(ND);
780 INPUT I$:M$=LEFT$(I$,1):LI=LEN(I$):TD=VAL(RIGHT$(I$,LI-1))
790 IF TD=0 THEN RETURN
800 IF ND<>0 THEN RETURN
810 NT=NT+1
820 DB$(NT)=DA$
830 CB$(NT)=CA$
840 ND=NT
850 RETURN
860 TP=TD:AA(NR,0)=TD
870 AA(NR,ND)=1000
880 AA(21,ND)=AA(21,ND)+1
890 IF AA(21,ND)=0 THEN 570
900 AA(23,ND)=AA(22,ND)/AA(21,ND)
910 GOTO 570
920 FOR Y=ND TO NT-1
930 FOR X= 1 TO 23
940 AA(X,Y)=AA(X,Y+1)
950 NEXT X,Y
960 NT=NT-1
970 GOTO 570
980 IF TP=0 THEN PRINT "No pole time":GOTO 570
990 IF TD=TP THEN P=.001:GOTO 1030
1000 IF TD<TP THEN PRINT "Error. Too small.":GOTO 570
1010 P=100*((TD/TP)-1)
```

(listing continued on next page)

(continued from previous page)

line 560. There is no provision for deleting or correcting pole times, as this would render all other entries for the race invalid. A change can only be made by dropping out of the program, setting TD and AA(NR,0) to zero, and then erasing and re-entering all the data for that race.

T nnn allows the number nnn to be entered as a pole time by routine 860 to 910, if no pole time exists, or as a basis for a percentage entry calculated by the routine starting at 980. It might be advisable to add line 985:

IF AA(NR,ND)≠0 THEN PRINT "Entry Exists": GOTO 570

so avoiding a false increment of AA(21,ND) and calculation of an incorrect average.

The entry process is convenient in practice, and detects most errors, the commonest being the input of an incorrect time through forgetting to add the minutes to the seconds. The report "Error. Too small" warns of this.

The printout routine is written for an Epson MX-80, and some controls may need to be modified for other printers. CHR$(15) sets condensed type, 132 characters per line. CHR$(14) sets 66 characters per line for one line at a time, and is used to output the heading, including the year input at the start of the program.

The race numbers are printed out by lines 1200 to 1230, and the individual entry lines can now be handled. The first step is to set all the AA(0,X) entries to zero — lines 1250 to 1270 — and set G=10,000.

The averages in the last column of the data array, AA(23,X), are than checked. Whenever one is found that is lower than G, G is set from it and L is set from X. On completion of the For loop in lines 1290 to 1330, G contains the lowest average, and L contains the reference to the car-and-driver combination concerned and the associated data. AA(0,L) is set to 1 to indicate that the line of output for that entry is being printed, and it is ignored in further executions of the For loop.

This works well in practice, and is certainly simpler than some abortive schemes which were tried, such as an attempt to sort the complete lines into an order of merit.

The actual numeric output is handled by lines 1490 to 1570, which produce a tight four-character format including a decimal point. For results up to 9.99, two decimal places are used. If the result is greater, one decimal point is accurate enough. When there is no entry at all, line 1390 prints ————, and for entries of 1,000 line 1380 prints Pole.

The routine for restoring data files is simple, and needs no protection against arrors. NT and NM are saved in AA(22,0) and AA(21,0) respectively before the saving process begins. After Close and Reset a display of Okay tells the operator he can remove his disc.

(listing continued from previous page)

```
1020 P=INT(1000*P):P=P/1000
1030 AA(NR,ND)=P
1040 AA(21,ND)=AA(21,ND)+1
1050 AA(22,ND)=AA(22,ND)+P
1060 AA(23,ND)=AA(22,ND)/AA(21,ND)
1070 GOTO 570
1080 IF AA(21,ND)=0 THEN PRINT "No entry to remove.":GOTO 570"
1090 AA(21,ND)=AA(21,ND)-1
1100 AA(22,ND)=AA(22,ND)-AA(NR,ND)
1110 AA(NR,ND)=0
1120 AA(23,ND)=AA(22,ND)/AA(21,ND)
1130 GOTO 570
1140 REM Printout
1150 LPRINT CHR$(15)
1160 LPRINT CHR$(14)YR"WORLD DRIVERS CHAMPIONSHIP"
1170 LPRINT CHR$(14)" PRACTICE TIME PERCENTAGE TABLES"
1180 LPRINT:LPRINT
1190 LPRINT TAB(27)" ";
1200 FOR X=1 TO NM
1210 IF X<10 THEN LPRINT " ";
1220 LPRINT X" ";
1230 NEXT X
1240 LPRINT:LPRINT
1250 FOR X=1 TO NT
1260 AA(0,X)=0
1270 NEXT X
1280 G=10000
1290 FOR X=1 TO NT
1300 IF AA(23,X)>G OR AA(0,X)=1 THEN 1330
1310 G=AA(23,X)
1320 L=X
1330 NEXT X
1340 IF G=10000 THEN 310
1350 AA(0,L)=1
1360 LPRINT DB$(L)TAB(14)CB$(L)TAB(28)" ";
1370 FOR X=1 TO NM
1380 IF AA(X,L)=1000 THEN LPRINT"POLE";:GOTO 1420
1390 IF AA(X,L)=0 THEN LPRINT"----";:GOTO 1420
1400 P=AA(X,L)
1410 GOSUB 1490
1420 LPRINT " ";
1430 NEXT X
1440 P=AA(23,L)
1450 LPRINT " ";
1460 GOSUB 1490
1470 LPRINT
1480 GOTO 1280
1490 IF P<10 THEN R=1 ELSE R=2
1500 IF R=2 THEN P=P/10
1510 FOR Y=1 TO 3
1520 Q=INT(P)
1530 P=(P-Q)*10
1540 LPRINT CHR$(Q+48);
1550 IF Y=R THEN LPRINT ".";
1560 NEXT Y
1570 RETURN
1580 AA(21,0)=NM:AA(22,0)=NT
1590 INPUT "File disc in position";Z$
1600 IF Z$<>"Y" THEN 310
1610 OPEN "O",#1,P$
1620 X=0
1630 Y=0
1640 PRINT#1,AA(Y,X)
1650 Y=Y+1
1660 IF Y<25 THEN 1640
1670 X=X+1
1680 IF X<NT+1 THEN 1630
1690 OPEN "O",#2,N$
1700 X=1
1710 PRINT#2,DB$(X)
1720 PRINT#2,CB$(X)
1730 X=X+1
1740 IF X<NT+1 THEN 1710
1750 CLOSE
1760 RESET
1770 PRINT "OKAY"
1780 END
1790 FOR X= 0 TO NT
1800 FOR Y=0 TO 24
1810 AA(Y,X)=0
1820 NEXT Y,X
1830 NM=0
1840 NT=0
1850 GOTO 310
```

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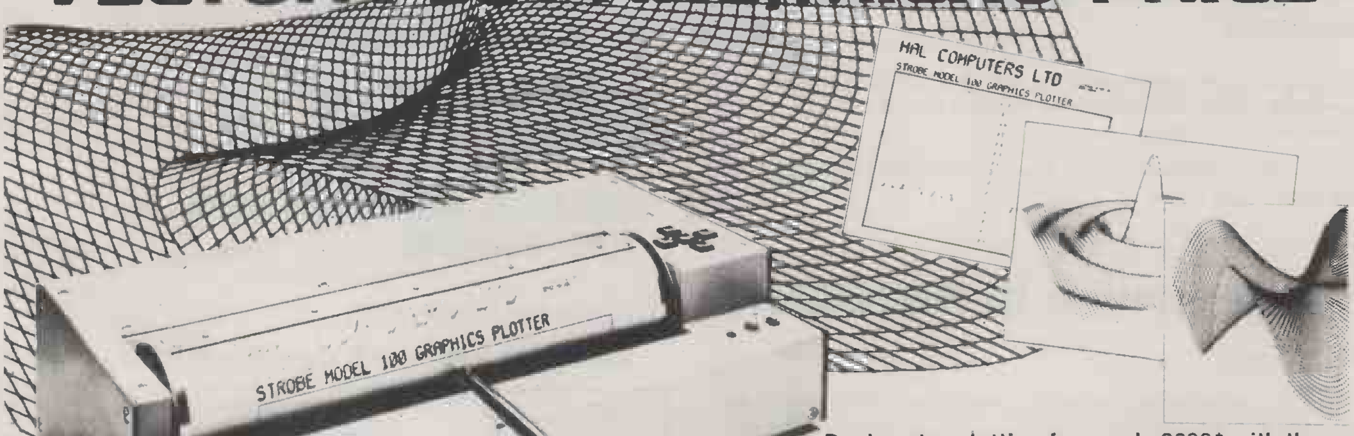

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● Circle No. 152

Brian Reffin Smith of London's Royal College of Art introduces the first of our regular features devoted to microcomputer-based art and design. He explains the essentials of graphics and animation and offers stimulating ideas to set you exploring the possibilities of this brand-new medium.

VISUAL COMMUNICATION

WELCOME to *Practical Computing*'s new arts pages. I shall be writing regularly about computers in art and design, and as well as explaining, informing and showing new ideas and techniques, I will be encouraging micro users up and down the land to become involved with graphics.

We have to try and push forward the frontiers of what we can do with our machines. Your brilliant ideas, cunning routines and your most outlandish and bizarre concepts will play an important part. There will be a regular competition with wonderful prizes, fame, fortune and so on.

Computer solutions

I run a computer studio where postgraduate artists and designers come along with an extraordinary range of problems, which they think might have computer solutions. We are nearly always able to help. Since we are entirely microcomputer-based you can do what we can do — and I fully expect that you will be telling me how to do it better.

As well as competitions, there will be programs and routines, examples of computer use in art and design, photographs, plots and so on. There will be all the news about graphics that is useful and fit to print.

This issue also sees the start of "Beginning Graphics" — which will go on to show that computer graphics is not difficult, and can be powerful and fun. Then there will be what I have called — for want of a better name — the "Analogy Box". Some of the most powerful ideas seem to emerge from asking "What if . . ."? questions, where you take a program or a process from one context, force it into another and see what happens.

Perhaps you are wondering "Why all this emphasis on graphics? Surely it is just a rather superficial aspect of 'real' computing." I firmly believe that the answer is "No". The world we live in, the environment, is changing into an "information environment". It is not just the solid lumps of information that matter, but also electronic communication and visual information technology.

Who are going to be the designers, the artists, the architects of this new environment? Is it just like dealing with the old one? I think not, and we who presumably care about what might be called "soft computing" — the human use of computers, not just number-crunching — must become the new artists and designers of the information environment and even its poets, musicians and writers.

Vital contribution

The danger is that the field will be left open to computer people who think that "art" is just random squiggles, and design is just moving a 3-D shape around on a screen. Both of these activities are a start: but I hope it will become clear why I say as often and as loudly as possible that computer art is mostly nonsense.

In these pages we have to come up with graphics, artwork and designs that stand up on their own merits, and not just because they have been done on a computer. Your contributions will play a vital part in developing this new medium.

Incidentally, I detest the phrase "computer art". It has come to mean "something that no-one would look at twice if it had been done with a pencil, but it was done with a computer and isn't that amazing"! So we need a new term. Maybe we should just talk about "art" or "design" that happens to have been done with a computer. Any better offers?

From bits to bright dots

Two fundamental programs illustrate the essence of beginning graphics.

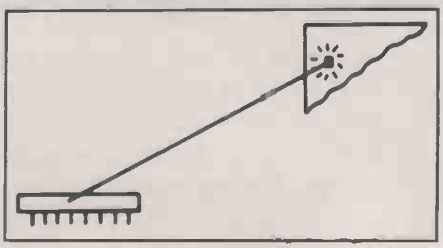
I WANT to discuss the rock-bottom basis of graphics. It is a good place to start, and it might do me and you a bit of good, to think about it at that level to begin with.

Different people have different machines, and so I will be using examples that are as general as possible. In months to come, the programming will be based largely around the BBC Micro, for which I wrote some of the graphics programs, but I will always try to make clear what you can do on other systems.

What is graphics, and how can we begin? Combining the ancient skills of graphics with information technology, computer graphics is essentially about making marks, usually on paper or screen, but sometimes on film or videotape.

Computers are simply machines that "do things to stuff" — "information processors", in more scientific terms. Stuff — information — goes in, is acted upon according to a program of instructions, and can come out in a completely different form. This is the absolute key to what graphics is about.

Figure 1. The brightness of each pixel is governed by numerical information held in each memory location.



From the simplest pattern of dots on a screen, to a full-colour, moving, three-dimensional image, the output device is showing us, in a visual form, information that is contained in the computer in symbolic form. Change the symbols, and you change the outward appearance.

Most computers devote some of their memory to looking after each individual pixel — the smallest picture element — on the screen. Figure 1 shows the relationship: depending on the information stored in the memory location, the pixel can be On or Off, or maybe of an intermediate tone — grey or coloured.

The computer just passes this information regularly to the TV or monitor. It strings all the fragments together in a video signal so that they affect the correct place on the screen. The beam of electrons in the TV tube dims and brightens as it scans across the phosphor coating.

I would like you to do the simplest graphic exercise possible. Use your machine if you have one, otherwise you

(continued on next page)

Routine A.
Type in two whole, smallish numbers and use them to print a + sign on the screen, e.g., in Basic:

```
100 PRINT "ENTER 2 NUMBERS";
110 INPUT X,Y
120 FOR I = 1 TO X
130 PRINT
140 NEXT I
150 FOR J = 1 TO Y
160 PRINT " ";
170 NEXT J
180 PRINT "+"
190 END
```

Routine B.
Enter graphics mode if necessary on your machine. Enter two numbers, and use them to light up a pixel, e.g., in Basic:

```
100 PRINT "ENTER 2 NUMBERS";
110 INPUT X,Y
120 REM: USE 'PLOT', 'SET', OR
    WHATEVER YOUR MACHINE NEEDS
    TO PLOT A POINT
130 PLOT (X,Y)
140 END
```

Two fundamental graphics routines.

(continued from previous page)
can work it out on squared paper. You may or may not have graphics commands available. If not, use routine A, otherwise routine B. These routines are terribly simple, but they should help you to look at graphics in a new way.

These simple programs represent the basis of all computer graphics. You have symbolically represented an image in the computer with your X and Y; then you made it visible.

While the image is defined in this way — logically, or numerically — you can store it, manipulate it, ask questions about it and present it. Very complex images may require correspondingly complex ways of representing the data, but the principle is just the same.

Finally, here is a mental exercise. Imagine a photograph of a friend, stored in the computer as a series of pieces of data in the form (X,Y,B) where X and Y represent the position of each tiny portion of the photo in turn, and B is the brightness of that point with, say, zero representing black and 10 representing white, the rest greys in between. Feed that out on the screen, and there's your friend.

Now suppose you take each point, and make its brightness equal to the difference between it and the preceding point. You do this to each point in turn, scanning across the image a row at a time. When these numbers are fed out to the screen, what will the picture look like? Try drawing it, because computer graphics is about graphics as much as computers.

ANALOGY BOX

In-betweening involves changing one image into another, in a number of steps. What would the equivalent be, using words and their meaning instead of lines? Through what space would the words "move"?

Moving images step by step

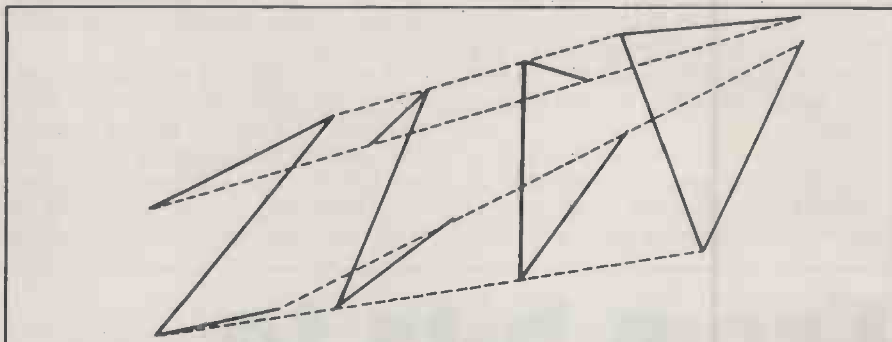
The algorithm for a changing shape can be described by the term "in-between".

STEMMING FROM animation techniques, the ability to change one shape into another is also of more general interest. Although at least four full-length feature films are in production in the United States using computer graphics, "real" computer animation, with full-colour 3-D characters moving around, is at the frontier of what is possible with computers because the computer needs to know so much about the real world, and the way people — for instance — move in it.

Very simple in-betweening is still possible, and has its own technical advantages: the way images change depends on the order in which you enter the points. Here is the algorithm in words:

- Enter a series of points (X,Y) which, when joined together, outline the first image. Do the same for the second image.
- Decide how many in-between steps you want to use.
- Then draw conceptual straight lines between each point on the first image and each point on the second. For simplicity, each should have the same number of points.
- Now simply divide each "line" into six if you want six in-betweens, 10 if you want 10, etc.
- Then join up each of these points to get the in-between.

The listing gives a version for the Research Machines 380-Z with high-resolution graphics. You can use any machine with graphics, even low-resolution. I have shown a really simple in-between, to illustrate the principle.



Changing shape with two in-between steps.

```
100 CLEARO:CALL"RESOLUTION",0,2
110 REMINDER - THAT JUST SETS UP THE 380Z
120 INPUT"NO. OF POINTS (10 OR LESS)";P
130 FORI=1TO2:?"IMAGE ";I:FOR NA=1 TO P
140 ?"POINT ";NA;:INPUT X(I,NA),Y(I,NA)
150 NEXT NA:NEXT I
160 NA=NA-1
170 INPUT"How many steps (10 OR LESS)";S:IF S>10 THEN170
180 FOR I=1 TO S:FOR F=0 TO I-1:ST=ST+1/S:NEXT
190 FOR J=1 TO NA
200 IFJ=1 THEN G$="PLOT" ELSE G$="LINE"
210 CALLG$, X(1,J)+(ST*(X(2,J)-X(1,J))), Y(1,J)+(ST*(Y(2,J)-Y(1,J))), 3
220 REMARKABLY EASY ON OTHER MACHINES-JUST PLOT (IF J=1) OR DRAW A LINE (IF J>1)
 USING THE ABOVE VALUES.
230 REMISS OF ME NOT TO STATE THAT THE '3' AT THE END OF 210 GIVES THE COLOUR.
240 NEXTJ:ST=0:NEXTI
```

Competition

THE WINNER of this month's £5 will be the reader who submits the best program or artwork based on a For-Next loop. Repetition with a difference is what we are looking for.

Send your entry — which cannot be returned, so keep a copy if you like it — to Art, *Practical Computing*, Room L306, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Since it first appeared on the market over seven years ago, CP/M has generated an enormous body of machine-independent software. Now the arrival of 16-bit micros, promising higher speeds and a huge address space, has cast doubt on its prospects. Chris Bidmead was at the CP/M User Group meeting to find out what the future may hold.

CP/M faces the bigger crunch

THE HEAVY SPLENDOUR of its Polynesian decor makes the Mayfair Hotel's Beachcomber Bar an alarming place to be at nine o'clock on a crisp London morning. Hardly where you would expect to run into a serious-minded computer user, let alone a convention of them. But last October 27, some 180 CP/M User Group members, conversationally subdued by the time of day or the prospect of spending the next eight hours huddled together over the eccentricities of their chosen operating system, were beginning to line up for coffee and registration.

As we filed into the small Mayfair Theatre next door, rumours were hardening that Gary Kildall was not, after all, going to be moving among us that day. Back in 1973, Kildall, one-time consultant to Intel during the development of the 8080 chip, had offered that corporation an early draft of something he had knocked up in his spare time called a Control Program for Microprocessors. Intel declined to back him, so in true Californian tradition Kildall went on to build the project into a business of his own. It is now called Digital Research, and is turning over some $12 million a year.

Kildall's absence was confirmed by CP/M User Group Chairman, David Powys-Lybbe, as he stepped on to the bare stage to make the opening announcement.

Presentations by individuals formed the body of the morning's business. The User Group's magazine editor Andrew Clarke's introductory discourse on his own Reclaim program — donated to the User Group library, and so free to members — and Powys-Lybbe's exploration of CP/M file handling that followed, started the morning with a high tone of enthusiasm and expertise not entirely echoed by the quiet audience.

Standard language

We were subsequently introduced to Mumps under CP/M, by American expatriate John J Althouse, of SMS Europe Ltd. "Mumps" certainly sounds better than Massachusetts General Hospital Utility Multi-Programming System, and it sounded better still after Althouse's short tour of the facilities offered by this ANSI standard language, which includes a built-in database and heavy emphasis on string-handling. Best of all, Mumps is free to serious users, the test of your seriousness being whether you regard the £50 post and packing as petty cash.

At least two of the short addresses on aspects of CP/M that morning turned out to be scarcely-disguised plugs for the speaker's own commercial product, stirring up a few rustles of discontent among the pinstripes and denims that packed the plush seats. I talked to David Powys-Lybbe about this at lunch. As tickets for the day were between £25 and £50 per head, obviously his members had not turned up just for this.

Over the top

David Powys-Lybbe agreed. "But it's not easy to draw the line. Yes, at least one of the presentations this morning was a bit over the top as a plug, and on the whole this isn't meant to be a platform for commercial products. Except for CP/M itself, of course".

He was referring to the main business of the afternoon, a parade of Digital Research's marketing plans for the immediate future, with particular reference to CP/M 3, whose appearance on the market was rumoured imminent earlier this year. This the users would sit up for.

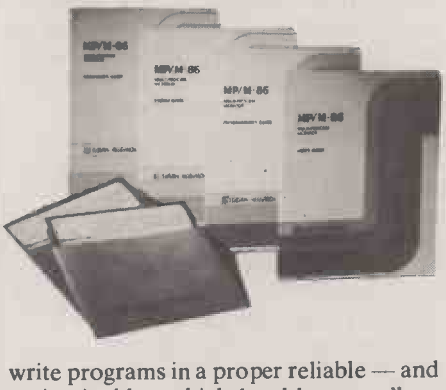
There are two main schools of thought about the next step. For one convinced eight-bitter I talked to over lunch the prognosis was simple. "Take your average, bog-standard, state-of-the-art 1981, 8085, eight-bit machine with a mini-Winnie providing 5Mbyte of backing store. It runs WordStar, Cobol and you name it. It's simple and reliable. Show me your latest all-singing, all-dancing 16-bit MegaMonster, and I ask you: where's the support? where's the software? and anyway, who needs it"? For him the next step is the addition of a higher capacity mini-Winnie, networking and perhaps banking out the operating system to give a full 64K of user area.

The theory goes, however, that the introduction of the 16-bit micros will have a domino effect on the business community, as users realise their faithful old eight-bit machines look quaint by comparison. Professor Martin Healey spent the early part of the afternoon pursuing this theme of the upward path towards the bigger crunch. "Today's idea of putting more than one user on an eight-bit micro is just plain daft. If you try sharing a processor without providing a properly protected environment you're inviting disaster".

Memory segmentation, file-locking and limitation of the instruction set so that one of the users cannot bring everybody else to a halt all are essential. What did this say about Digital Research's efforts to rebuild MP/M II from the ashes of MP/M I, the multi-user operating system that flopped because of its sluggishness, and because users could crash each other's files?

"MP/M II is OK, as long as you don't try running it as a multi-user system. If you've got to go multi-user, then hook it on to a network". Healey saw networked single-users as the simplest way of implementing the sort of protected environment he was insisting on, and CP/Net could provide this.

So 16 bits were also going to be essential. "A business system needs a database. If you add a database to an eight-bit operating system the first thing you find is you've run out of room to put your applications programs; 16-bit machines aren't about speed — what they give you is lots of memory. And that does something else for you: it gets you away from time-wasting code-optimising exercises and lets you



write programs in a proper reliable — and maintainable — high-level language".

Unless the world recession gets very much worse, Martin Healey and the 16-bitters may well be right about the future. Digital Research seems to think so and is making a major effort to carry over CP/M on to the 16-bit scene. John Katsaros introduced the meeting to their philosophy: "We're going for the next generation of machines with two main products, CP/M-86 and MP/M-86. We're bringing them out for the 8086 because of our past association with Intel, and because we prefer it to the Zilog 8000 or the Motorola 68000".

This was bland Californian marketing talk in comparison to Martin Healey on why he was steering his own firm, Future

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Technology in the direction of the 8086. In Healey's view: "The software scene for the 8086 is pretty dreadful, but for the Z-8000 and the 68000 it's a complete and utter disaster".

For Katsaros, the 8086 "offered a natural upgrade" from the 8080, despite what some regard as the superior number-crunching and address capability of the Motorola chip. To some extent Digital Research's bet on the 8086 will be a self-fulfilling prophesy, in that it naturally much enhances the market chances for the hardware/software combination. This may leave Zilog out in the cold: an odd situation, as Zilog's Z-80 upgrade of the 8080 is currently outselling Intel by a ratio of three to two.

No competition

CP/M captured the eight-bit market with virtually no competition, but this next step will bring them face to face with Unix, the ten-year-old product of Bell Laboratories, now also poised for the 16-bit market.

John Katsaros did not agree that the two systems were in competition: "Unix is a great operating system for the scientific community, and it's got the sort of flexibility you need for program development. What it isn't good at is supporting business applications. Unix likes small files. It isn't going to be too friendly towards databases of eight megabytes and upwards, which is the sort of thing you're seeing increasingly on the new business micros. If you need to develop programs as well as run a business what we say to you is go buy two operating systems. If you just want to stick to business, buy CP/M-86 — it's cheaper and it's better".

Katsaros had begun his presentation with a slide-show introduction to the growth of Digital Research, the centrepiece of which was a shot of the potting shed at the bottom of the garden where young Gary Kildall first assembled the code for CP/M 1.0. Katsaros moved amiably on through the line of products that were in the offing, notably — now that Digital Research has bought out Software Systems — a true compiler version of CBasic. The audience began to shift in their seats again, and an aggrieved interrogator voiced the question that was forming in everybody's mind: "What about CP/M 3"?

Symbol of severance

It was a good question. The users were being shown the future, and it came in the size of 16 bits. The one thing it did not seem to contain was CP/M as they knew it. Symbolic of its severance, Digital Research was demolishing the "hot line" on which troubled users could ring in their queries direct. Was there not going to be an upgrade of the old eight-bit CP/M at all?

John Katsaros' reply was affirmative: "We do have a third-generation eight-bit CP/M under development right now, and I guess it will be with you around Spring of 1982". He was reluctant to comment on its features, except to say that it would not be any bigger than the present eight to nine K. "I can say that CP/M 3 is defined, although we are definitely still in listening mode if anyone has any ideas about what the system should do that it isn't doing already. Other than that, we are not talking to anybody about CP/M 3. Thank you for your question".

The warm protest that followed persuaded the Digital Research team to field Bob Eichenlaub, their technical manager. Labouring under a bad dose of laryngitis, but happily for the users seeming to share none of Katsaros' coyness about CP/M 3, Eichenlaub was wired to a microphone so that he could croak out some of the early details.

Like MP/M II, CP/M 3 is to have enhanced file handling, including password protection and file locking, with file size and time and date stamping as part of the directory display. The security-conscious, by the way, should not take the password business too seriously. For reasons of compatibility, files secured under CP/M 3 could always be opened and read under CP/M 2.2, so this will be no more than a deterrent to casual curiosity.

Eichenlaub promised that the Submit facility would be improved to the point where it could be regarded as a rudimentary job-control language, and there would be a limited implementation of foreground/background tasking, making possible file-sharing between CP/M systems.

Single users

Many single users working with Winchester drives like to organise their files into groups with CP/M's user number multi-level filing, but find this often means having to duplicate system files like Pip and Stat. In common with MP/M, CP/M 3 will solve this problem by allowing access from any user level to any Sys file in User Zero.

The best news for software authors is that CP/M 3 will be meeting them more than half-way over the problem of interfacing to the baffling variety of consoles now hooked into CP/M systems. Rather as the Bios currently interfaces the real hardware to the theoretical machine environment of CP/M, so will CP/M 3's console-control block enable authors of portable software to address a theoretical console, leaving the problem of screen-control mechanics and keyboard entry to be coped with by a once-and-for-all hardware-dependent patch.

Eichenlaub's revelations saved the day for many of the conference attenders, who had begun to wonder what the User Group meeting was supposed to be about. But software deadlines have long been notorious fictions, and as the users filed off to the bar for "one for the road" there was an air of scepticism about whether the promised Spring offering would appear on time.

There the conference ended; but for *Practical Computing* there is a coda. I included myself in the crush around the table on stage where the Digital Research team was allowing us to leaf through their new range of manuals "to see for ourselves how much more user-friendly they are" and found myself being invited to breakfast by John Katsaros.

At eight o'clock next morning we were munching toast and marmalade in the baronial surrounding of the Piccadilly Hotel breakfast room. When an Englishman buys you a meal you don't find out why until the liqueurs; but Californians pitch right in with the first glass of orange juice. Katsaros was buying *Practical Computing* breakfast because he "recognises the crucial need to open up a new dialogue with the Press as Digital Research moves into its next phase of operations".

The real test

Gary Kildall got rich by getting lucky. Writing CP/M was, as is the way with programming, mostly a matter of pure slog. The smart thing he did was to start selling it cheaply enough for a large number of people to buy. And it was certainly smart to stay in the saddle as the corporation grew to its present size.

But the real test is just beginning. The diversion into marketing programming languages that ride on the operating system — CBasic, PL/1 and, shortly, Pascal — is really only a support for the main sales thrust of bringing CP/M-86 to the world business market and making sure it sticks. If it does, Digital Research will be up there with IBM. If it does not, the pace of hardware development will not allow Kildall a second bite of the cherry. IBM, or Bell, or perhaps even the Japanese will step smartly into the breach.

John Katsaros buys you breakfast because he is a civilised, sociable sort of chap. But he is also doing the best he can to make sure you like CP/M-86 and go his route when the bigger crunch hits your business.

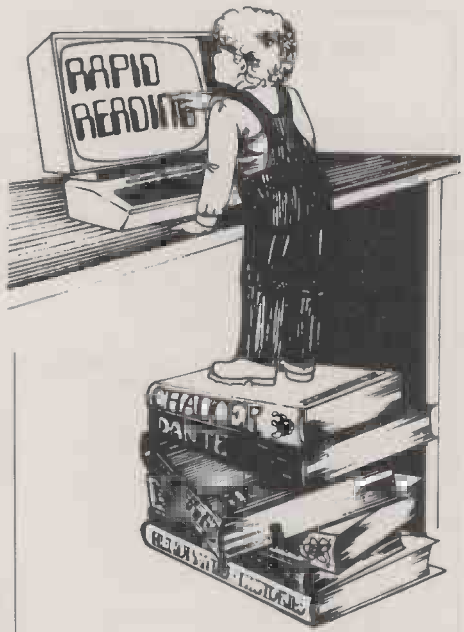
Promising future

The future looks promising for CP/M, and Digital Research is certainly backing initial good luck with a lot of hard work. The PL/1-80, for example, is not being marketed as just another computing language: the company is offering independent programmers who use the language worldwide support in selling the application systems that result.

I like the operating system, I like the company, and I think they'll make it. But if I am wrong, John Katsaros may well be joining Gary Kildall back in that potting shed.

A grant from the Microelectronics Education Programme has enabled Tim Scratcherd and Ian Smith to take time off from their normal teaching to develop software for use in the classroom. Together with Russell Langham, Senior Education Advisor for Durham County Council, they describe the work they are doing at Branksome School, Darlington, including a remedial English program and a class exercise in typing.

Clarity is all for school computing



ORDINARY TEACHERS' attitudes are among the most important factors which are restricting the effective use of small computers in the classroom. Uninformed opinion varies from mild disregard for toys to alarm at the prospect of being replaced by a machine. Most of the current offerings in the field of educational software do little to alter these opinions. Much software demands some programming knowledge, both to fix it when it fails to work and to understand what it does when it is operating. Hardly any can be used successfully and reliably by teachers who are not computing specialists. Our aim has been to work in partnership with teaching colleagues to produce programs which can be used by non-specialists to make their teaching more effective.

Getting a program running in a computer need be no harder than setting up a projector to show a film. Teachers who wish to use a computer have to learn this procedure, and they very often also have to move to a special computer room or transport the computer to a classroom. The computer must do something which teachers find difficult or impossible to do any other way in order to justify the extra effort involved in setting it up.

Whatever advantage the program provides, it must be robust, clear and as easy to use as possible. Programming convenience must be sacrificed to user convenience. A balance needs to be struck between clarity, function and ease of use; in particular, keystrokes should be apt and comprehensive and they should be kept to a minimum. The important features to maintain are program flow and avoidance of frustration. It is better to have a program description which is not part of the program itself, so documentation is required.

Documentation should include the usual listing, variables list and flowchart if necessary. However, these aspects are of no importance to the teacher; it is the teachers' notes which should be emphasised. They ought to form an integral part of the program, and include at least descriptions of what the program does, why it does it, and how the teacher should go about getting the program to do its job. Teachers' notes will often include suggested approaches, with examples and sample data.

Programs and documentation should be an integral part of teachers' approach to the teaching of their subject, not used simply for variety or novelty. We have found that the most effective way to achieve this is to involve the teacher in all stages of program development, from the initial conception of the idea to a good working result. Program development should include a long dialogue between programmer and teacher so that the suitablity of inputs, kind of presentation and relevance and effectiveness can be continually checked and modified. In later stages of development, testing of the program in class use is absolutely necessary.

One effect of this is that programs come to be regarded not as "finished", but as "working" — there is always something else that a program could do. For example, when a printer becomes available, the program could be modified to produce hard-copy results. Another effect is that teachers become more aware of what a computer can and cannot do. They will often think of other applications of the computer within their subject, even though these will have less immediate advantage.

The two programs which we describe have been developed in this manner. They are both comparatively straightforward and short; neither of them is mathematical or scientific; and both confer a practical advantage. One is for use by individual children, the other is to be used by a whole class at a time.

The Speed Reading program was developed for use in the remedial English department. It presents a passage of prose to a child a few lines at a time. The child then reads them. After a preset time, the lines are replaced by the following lines, and so on.

After the passage has been read, the child leaves the computer to answer a comprehension test. The length of time the child spends reading the passage is recorded by the computer. The teacher is provided with two pieces of information: the time taken, and the results of the comprehension.

After loading a prepared passage from tape, the teacher selects the number of lines to be visible at a time, and the length of time the lines remain visible. Each child first sees a moving display, the "Branksome Bookworm". This is not entirely for fun, but aims to personalise the program. The child must write in his or her name before being presented with the reading passage. A child who reads the lines before they are replaced has the option of pressing any key to see the next lines.

When the child has finished, the teacher has the option of calling the next child to the machine or calling a list of times for all children who have used the program so far. The immediate and obvious advantage is clearly in the timing of the program.

The program may be used diagnostically, to determine children's natural reading rate. In this mode the teacher should set a very long time for each set of lines to remain on the screen, effectively giving complete control of the reading rate to the child. A short reading time and weak comprehension indicate that the child tries to read too fast. The program may also be used therapeutically: the teacher sets a line delay which is just too

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short for comfort to encourage a slow reader to "beat the Bookworm".

The program also allows teachers to tailor presentation of information to the needs of an individual child. The computer is objective and relatively immune to learning difficulties caused by personality clashes between child and teacher. It is effectively an extra pair of hands in the classroom; the teacher can be doing something else while the diagnosis is taking place.

These secondary advantages are common to many computer programs intended for use by individual children. By themselves they will rarely convince a teacher that the computer is worth the effort; but in time teachers come to appreciate the computer's capabilities and start to ask for programs that confer similar advantages.

Although the program is written for an old-ROM Pet, the keyboard func-

Speed Reading program.

```
1 REM***SPEED READING***
2 REM***BY TIM SCRATCHERD AND BRIAN JEFFERSON***
3 REM***AUGUST1980***
10 POKE59468,14
20 PRINT"J     ЖSPEED READING PROGRAM■"
30 PRINT
40 PRINT"TEACHER'S SECTION."
50 PRINT"__________________"
60 PRINT:PRINT"PLEASE INSERT A DATA TAPE."
65 PRINT"THEN PRESS ANY KEY."
66 GETA$:IFA$=""THEN66
70 DIMP$(51),C$(21),C(21)
80 OPEN1,1,0,"S/RDATA"
100 FORH=1TO50
110 INPUT#1,P$(H):IF(ST)<>0THENSTOP
115 IFP$(H)="END$"THENH=50
120 NEXT
130 CLOSE1
131 FORH=1TO50
132 B$=P$(H):P$(H)=""
133 FORJ=1TOLEN(B$)
134 A=ASC(MID$(B$,J,1))
135 IFA=43THENA=44
136 IFA=42THENA=34
137 P$(H)=P$(H)+CHR$(A)
138 NEXTJ
139 IFP$(H)="END$"THENH=50
140 NEXTH
143 PRINT:PRINT"DATA LOADED."
145 M=0
150 PRINT
160 PRINT"PLEASE ENTER AS WHOLE NUMBERS:"
165 PRINT:PRINT
170 PRINT"REMEMBER - A VERY LONG DELAY APPEARS TO"
171 PRINT"MAKE THE PROGRAM WORK COMPLETELY UNDER"
172 PRINT"THE CHILD'S CONTROL."
173 PRINT
174 INPUT"DELAY IN SECONDS";DE$
175 D=VAL(DE$)
176 IFD<=0ORD>1000THEN174
180 PRINT:INPUT"NUMBER OF LINES VISIBLE";LI$
181 L=VAL(LI$)
185 IFL<=0ORL<>INT(L)ORL>10THEN180
190 PRINT:PRINT"PRESS ANY KEY TO START."
200 GETA$:IFA$=""THEN200
201 M=M+1
202 IFM<22THEN210
203 PRINT:PRINT"TWENTY ONE CHILDREN HAVE USED THE"
204 PRINT"PROGRAM."
205 PRINT:PRINT"PRESS R FOR RESULTS."
206 GETA$:IFA$=""THEN206
207 GOTO1150
210 PRINT"JQQQQQQQQ"
220 PRINT"DO YOU NEED INTRUCTIONS?"
230 PRINT:PRINT"PRESS Y FOR YES, N FOR NO."
240 GETA$:IFA$=""THEN240
250 IFA$="Y"ORA$="Y"THEN300
260 IFA$="N"ORA$="N"THEN280
270 GOTO240
280 PRINT:PRINT"WHAT'S YOUR NAME?":GOSUB1300
290 C$(M)=B$:PRINT
295 GOTO840
300 POKE59468,12
310 A$="THE BRANKSOME BOOKWORM"
320 B$=" ●O●O●O●"
330 PRINT"JQQ"
340 FORI=1TOLEN(B$)-1
350 PRINTTAB(5);RIGHT$(B$,I)
360 PRINT"TT"
370 FORJ=1TO200:NEXT
375 NEXT
380 FORI=1TOLEN(A$)+1
390 PRINTTAB(I+4);B$
400 PRINT"TT"
410 PRINTTAB(5);LEFT$(A$,I)
420 PRINT"TT"
430 FORJ=1TO100:NEXT
440 NEXT
450 FORI=1TOLEN(B$)-1
460 PRINTTAB(5+LEN(A$)+I);LEFT$(B$,LEN(B$)-I)
465 PRINT"TT"
470 FORJ=1TO200:NEXT
480 NEXT
490 FORI=1TO500:NEXT
500 PRINT:PRINT:PRINT"INVITES YOU TO TRY -"
510 FORJ=1TO2000:NEXT
520 POKE59468,14
530 PRINT"JQQQ"
540 PRINT"           ________________"
550 PRINT"          \________________\"
560 FORI=1TO14
570 PRINT"          ||               |"
580 NEXT
590 PRINT"          \|               |"
600 PRINT"            _______________"
610 PRINT"TTTTTTTTTTTTTT▶▶▶▶▶▶▶▶▶▶▶▶▶SPEED READING"
620 PRINT"QQQQQQQQ"
630 PRINTTAB(12);"--------------"
640 PRINT"TTTWRITE IN"
650 PRINT"YOUR NAME"
655 PRINT"AND PRESS"
656 PRINT"RETURNTT"
660 PRINT"▶▶▶▶▶▶▶▶▶▶▶▶▶|";
670 GOSUB1300
680 C$(M)=B$
710 FORJ=1TO1000:NEXT
720 PRINT"JQDEAR ";C$(M)","
730 PRINT
740 PRINT"YOU WILL SEE A PASSAGE A FEW LINES AT"
750 PRINT"A TIME. TRY TO UNDERSTAND IT."
760 PRINT:PRINT
770 PRINT"PRESS ANY KEY WHEN YOU ARE READY"
780 PRINT"FOR THE NEXT LINES."
790 PRINT:PRINT
800 PRINT"SOMETIMES THE LINES WILL GO BEFORE YOU"
810 PRINT"PRESS A KEY. DON'T WORRY! THAT'S JUST"
820 PRINT"TO SPEED YOU UP."
830 PRINT:PRINT
840 PRINT"PRESS ANY KEY WHEN YOU ARE READY."
850 GETA$:IFA$=""THEN850
860 PRINT"JQQQQQ"
870 N=1:T=TI
880 IFP$(N)="END$"THEN1000
885 PRINTP$(N)
887 PRINT
890 H=0
900 IFN/L<>INT(N/L)THEN980
910 H=1
920 P=TI+60*D
930 GETA$
940 IFA$<>""ORTI>PTHEN960
950 GOTO930
960 PRINT"JQQQQQ"
980 N=N+1
990 GOTO880
1000 IFH=1THEN1050
1010 P=TI+60*D
1020 GETA$
1030 IFA$<>""ORTI>PTHEN1050
1040 GOTO1020
1050 C(M)=TI-T
1060 PRINT"JQQQQQ"
1070 PRINT"YOU HAVE FINISHED. FETCH YOUR TEACHER."
1080 PRINT:PRINT
1090 PRINT"PLEASE ENTER  R FOR RESULTS"
1100 PRINT"              N FOR NEXT CHILD"
1110 PRINT:INPUT"YOUR CHOICE";A$
1120 IF A$="R" THEN1150
1130 IFA$="N" THEN 190
1140 GOTO1080
1150 PRINT"J"
1160 PRINT"NAME";TAB(25);"TIME(SECS)"
1170 PRINT
1180 FORI=1TOM
1190 PRINTC$(I);TAB(25);INT(C(I)/60)
1200 NEXT
1210 PRINT:PRINT
1220 PRINT"DO YOU WISH TO FINISH?"
1230 GETA$:IFA$=""THEN1230
1240 IFA$="Y" ORA$="Y"THENEND
1250 IFA$="N"ORA$="N"THEN145
1260 GOTO1210
1300 B$=""
1310 GETA$:IFA$=""THEN1310
1320 A=ASC(A$)
1330 IFA=20ANDB$=""THEN1310
1340 IFA<>20THEN1390
1350 PRINTA$;
1360 IFLEN(B$)=1THEN1300
1370 B$=LEFT$(B$,LEN(B$)-1)
1380 GOTO1310
1390 IFA=13THEN1470
1400 IFA>64ANDA<91THENA=A+128:GOTO1450
1410 IFA>192ANDA<219THENA=A-128:GOTO1450
1420 IFA=32THEN1450
1430 GOTO1310
1450 PRINTCHR$(A);:B$=B$+CHR$(A)
1460 GOTO1310
1470 PRINT
1480 RETURN
```

tions as a normal typewriter: that is, shift is required for capitals. This feature, and the "Branksome Bookworm", are common to all the remedial English programs we are developing.

The teacher needs a way of preparing and using a large number of different passages. To this end, a program which creates a data file on tape accompanies the main program. It allows teachers to prepare a library on tape of passages of different kinds.

The advantages of this approach to data storage is that data preparation can be done at any time, does not have to be repeated and does not require the teacher to be a programmer. The input to the Create File program is organised so that the keyboard functions as a typewriter, and there are checks on line length and line total. Exceeding the line length does not lose the whole line; though it is shortened to the last complete word.

There is room for 50 lines, but a smaller number can be used by inserting End$ as the last line. When the data is complete, any of the lines can be amended, though you cannot insert or delete lines. Provision has been made for the passage to contain a full range of punctuation which can be stored on tape, including the awkward comma and double quote.

The One Minute Exercise program was developed for use in the commerce department. The program prints out a passage one character at a time. It is watched by a class of typists, who type each character as it appears.

Touch-typing practice

The teacher initially selects by number the passage to be attempted. Since the passages are short, they are contained within the program as data, making the program self-contained. The teacher then selects the delay, in tenths of a second, between the appearance of each character, and the number of times the complete passage is to appear. Finally, the teacher may opt to terminate the printing after exactly one minute.

Before the program is run, the class must be told to ignore anything which appears in black on white, rather than white on black. The program uses black on white to signal to the students when the passage is about to start, when to begin a new line and when the passage is complete.

An important advantage of these messages is that while the students are watching the passage being printed, they are not watching their fingers. The program may be used at first to accustom beginners not to look at their fingers. It can then be used to encourage speed, and lastly to give practice at typing for one minute.

The One Minute Exercise program is written for a standard 8K new-ROM Pet. It requires an interface to as large a standard TV as possible, so that the whole class may see the passage. Data is stored in double quotes so that the only punctuation not normally available is the double quote itself. It can be obtained by a similar device to the one used in the Speed Reading program. One weakness is that the maximum line length of the standard Pet is 40 characters, an untypically short line length in typewriting — the cure is clearly an 80-column Pet.

(continued on next page)

Speed Reading program.

Line number	Comment
80 to 130	Data is loaded from tape as the array P$().
131 to 138	Each element of the array is rebuilt with the dummy characters plus, 43, and asterisk, 42, being replaced by comma, 44, and double quotes, 34.
150 to 190	Teacher sets delay D and number of lines visible L. A child who requires instructions will see the Branksome Bookworm
340 to 375	Bookworm out of ground.
380 to 440	Bookworm traverses leaving title.
450 to 480	Bookworm into ground.
540 to 630	Print book.
640 to 680	Input child's name from subroutine at line 1300 and save it in the array C$(). M counts the number of children.
720 to 850	Instructions.
870	N is the counter for the printed P$(). T is the starting time marker.
910	H is set to 1 if a delay is encountered: this is to ensure that if the number of lines visible does not exactly divide the total number of lines to be printed there will still be a delay after the last line.
900	If the number of lines printed so far is not divisible by L then there is no delay.
920	P is set by TI and D to the increment of TI which will give the correct delay.
1020 to 1040	The delay will continue until either the child hits a key — A$ O — or the time is up — TI P.
1050	The time taken by the child is saved in the array C(). C$() and C () allow for up to 21 children to use the program.
1080 to1140	The teacher may repeat for the next child or see the time taken by all children who have used the program.
1150 to 1200	Children's names and times are displayed.
1210 to 1260	The program may be ended or rerun.
1300	This is the input routine for children's names. It is very similar to that used in the Create File program except that here there is no check on line length and only letters and spaces are accepted.

To modify for new ROM, change these lines to:

```
1400 IF A 64 AND A 91 THEN 1450
1410 IF A 192 AND A 219 THEN 1450
```

Create File program.

Line number	Comment
70 to 330	The general input routine for a string. B$ is the output; R is the line-length counter; A$ is the single-character input; A is the ASCII code of each input character.

The subroutine works as follows: a string is built up one character at a time using Get. The output string B$ is formed by adding each input character on to it to permit all punctuation characters to be in the string. Each letter character is changed from upper to lower case, and vice versa, to make the old-ROM Pet keyboard function as a typewriter.

Line number	Comment
100	Ignores return, 13, or delete, 20, if the output string is null. Thus the line cannot be deleted past its starting point.
112	Prints a delete.
114	Deletes a one-character output string.
120	Deletes the end character from the output string.
140	Checks the end of string.
160	Checks that the output string is not longer than 39 characters.
190 to 230	Finds the last space in the string and shortens it to there.
250	Changes upper case to lower case.
260	Changes lower case to upper case.
300	The character is printed and added on to the string.
560 to 610	The lines are inputted as the array P$().
610	Checks that less than 49 lines are entered.
630 to 700	The last line may be altered if a data check is requested.
1070	T is the number of sets of 10s in the lines.
1090 to 1200	The lines are printed in sets of 10 and may be modified.
1210 to 1310	The remaining lines are checked.
1400 to 1460	The line-replacement subroutine. Now the array P$() is modified so that it can be saved on tape.
1526 to 1528	Old-ROM software patches.
1550 to 1620	Each element of the array is taken and rebuilt. Troublesome characters are the comma, 44, and the double quote, 34. When these are encountered they are replaced in the string by the plus, 43, and the asterisk, 42. The rebuilt string is then written on to tape.
1650 to 1690	Old-ROM software patch. To modify for new ROM, miss out the software patches and change line 250 to 250 Goto 300.

(continued from previous page)

Create File program.

```
1 REM***SR CREATE FILE***
2 REM***BY TIM SCRATCHERD***
3 REM***AUGUST 1980***
6 POKE59468,14
10 DIMP$(50)
60 GOTO400
70 PRINT">";
75 B$="":R=0
80 GETA$:IFA$=""THEN80
90 A=ASC(A$)
100 IF(A=20ORA=13)ANDB$=""THEN80
110 IFA<>20THEN140
112 PRINTA$;
114 IFLEN(B$)=1THEN75
120 B$=LEFT$(B$,LEN(B$)-1)
130 R=R-1:GOTO80
140 IFA=13THEN320
150 R=R+1
160 IFR<40THEN250
170 PRINT:PRINT"YOU HAVE EXCEEDED THE LINE LENGTH."
180 PRINT"THE LINE IS NOW -"
190 FORI1=1TOLEN(B$)
200 IFMID$(B$,I1,1)=" "THENJ=I1
210 NEXTI1
220 B$=LEFT$(B$,J-1)
230 PRINT:PRINTB$
240 GOTO320
250 IFA>64ANDA<91THENA=A+128:GOTO300
260 IFA>192ANDA<219THENA=A-128
300 PRINTCHR$(A);:B$=B$+CHR$(A)
310 GOTO80
320 PRINT
330 RETURN
400 PRINT"□"
410 PRINT"          ▒PROGRAMS FOR ENGLISH▒"
430 PRINT
440 PRINT"THIS PROGRAM IS TO BE USED TO CREATE A"
450 PRINT"DATA FILE FOR THE MAIN PROGRAM"
460 PRINT:PRINT"              SPEED READING"
470 PRINT:PRINT"ENTER UP TO 48 LINES."
480 PRINT:PRINT"USE UP TO 39 CHARACTERS PER LINE."
490 PRINT:PRINT"THE KEYBOARD WILL FUNCTION AS A TYPE-"
500 PRINT"WRITER, I.E. SHIFT FOR CAPITALS."
510 PRINT:PRINT"YOUR LAST LINE MUST BE 'END$' IF YOU"
520 PRINT"DO NOT USE ALL 48 LINES."
530 PRINT:PRINT"ALL PUNCTUATION IS AVAILABLE."
540 PRINT:PRINT"PRESS ANY KEY TO START."
550 GETA$:IFA$=""THEN550
560 PRINT"□":I=1
565 PRINTI
570 GOSUB70
572 IFB$<>""THEN580
574 PRINT"□□":GOTO565
580 P$(I)=B$
590 IFP$(I)="END$"THEN1000
600 I=I+1
610 IFI<49THEN565
620 PRINT:PRINT"YOU HAVE USED 48 LINES."
630 PRINT"DO YOU WISH TO ALTER THE LAST LINE?(Y/N)"
640 GETA$:IFA$=""THEN640
650 IFA$="Y"ORA$="Y"ORA$="N"ORA$="N"THEN670
660 GOTO640
670 PRINTA$
680 IFA$="Y"ORA$="Y"THEN710
690 P$(I)="END$"
700 GOTO1000
710 I=48:GOTO565
1000 PRINT"□DO YOU WISH TO CHECK THE DATA?(Y/N)";
1010 GETA$:IFA$=""THEN1010
1020 IFA$="Y"ORA$="Y"ORA$="N"ORA$="N"THEN1040
1030 GOTO1010
1040 IFA$="N"ORA$="N"THEN1500
1050 PRINT"□"
1060 H=I
1070 T=INT(H/10)
1080 IFT=0THEN1210
1090 FORI=1TOT
1100 PRINT"□"
1110 FORJ=10*(I-1)TO10*I
1120 IFJ=0THEN1140
1130 PRINTJ;P$(J)
1140 NEXTJ
1150 GOSUB1400
1160 IFR=1THEN1200
1170 IFA<10*(I-1)ORA>10*ITHEN1150
1173 A1=A
1175 PRINT:GOSUB70
1180 P$(A1)=B$
1190 GOTO1100
1200 NEXTI
1210 PRINT"□"
1220 FORJ=10*TTOH
1230 IFJ=0THEN1250
1235 IFP$(J)="END$"THENJ=H:GOTO1250
1240 PRINTJ;P$(J)
1250 NEXTJ
1260 GOSUB1400
1270 IFR=1THEN1500
1280 IFA<(10*T)ORA>H-1THEN1260
1285 A1=A
1290 PRINT:GOSUB70
1300 P$(A1)=B$
1310 GOTO1210
1400 REM
1410 PRINT:PRINT"ENTER THE NUMBER OF THE LINE YOU WISH"
1420 PRINT"TO CHANGE, OR ZERO FOR NO ALTERATIONS"
1430 GOSUB70
1435 R=0
1440 A=VAL(B$)
1450 IFA=0THENR=1
1460 RETURN
1500 PRINT"□"
1510 PRINT"PLEASE INSERT A DATA TAPE OR WIND ON"
1520 PRINT"THE CURRENT ONE."
1524 PRINT"THEN PRESS ANY KEY."
1526 GETA$:IFA$=""THEN1526
1528 POKE243,122:POKE244,2
1530 OPEN1,1,1,"S/RDATA"
1540 FORI=1TO50
1550 B$=""
1560 FORJ=1TOLEN(P$(I))
1570 A=ASC(MID$(P$(I),J,1))
1580 IFA=44THENA=43
1590 IFA=34THENA=42
1600 B$=B$+CHR$(A)
1610 NEXTJ
1620 PRINT#1,B$
1630 IFB$="END$"THENI=50
1640 NEXTI
1650 IFPEEK(625)>180THEN1670
1660 GOTO1700
1670 POKE59411,53:T=TI
1680 IFTI-T<6THEN1680
1690 POKE59411,61
1700 CLOSE1
1710 PRINT:PRINT"DATA STORED. BYE!"
1720 END
```

One Minute Exercise program.

```
1 REM***ONE MINUTE EXERCISES***
2 REM***BY TIM SCRATCHERD AND COLIN JONES***
3 REM***JANUARY 1981***
10 GOTO510
20 DATA"WE THINK WE SHALL HAVE SOME NEW"
30 DATA"SUPPLIES IN A WEEK OR TWO, AND WILL"
40 DATA"THEN FORWARD THE REST OF THE GOODS AS"
50 DATA"SOON AS WE CAN DO SO.",END$
60 DATA"THERE ARE TWO ROADS, BOTH OF WHICH PASS"
70 DATA"QUITE CLOSE TO OUR HOUSE. THAT ON THE"
80 DATA"RIGHT GOES BY THE GOLF COURSE; THAT ON"
90 DATA"THE LEFT GOES THROUGH THE OLD TOWN."
100 DATAEND$
110 DATA"THERE MUST BE LITTLE IMPS WHO SLEEP"
120 DATA"UNTIL ONE STARTS WORKING; THEN, THEY"
130 DATA"COME INTO OUR ROOM, AND START TO WORRY"
140 DATA"AND TEASE US. SOME OF YOU MAY FIND IT"
150 DATA"HARD AT TIMES TO KEEP YOUR MIND ON THE"
160 DATA"WORK YOU ARE DOING, BUT YOU MUST LEARN"
170 DATA"TO DO SO.",END$
180 DATA"WE HAVE NOT YET BEEN ABLE TO SEND THE"
190 DATA"GOODS YOU ORDERED LAST WEEK AS THEY ARE"
200 DATA"NOT STOCK LINES, BUT WE WILL DO ALL WE"
210 DATA"CAN TO LET YOU HAVE SOME OF THE GOODS,"
220 DATA"IF NOT ALL, BY FRIDAY OF NEXT WEEK. WE"
230 DATA"TRUST YOU WILL EXCUSE THIS SLIGHT DELAY"
240 DATA"IN MAKING DESPATCH.",END$
250 DATA"THE RAIN CAME DOWN AND IT WAS TOO WET"
260 DATA"TO GO OUT, SO THE TWO BOYS HAD TO PLAY"
270 DATA"IN THE HOUSE, AND THEY WERE SOON BORED."
280 DATA"AT LAST THEY FOUND A CASE WHICH HAD NO"
290 DATA"TOP, AND THEY PLANNED TO MAKE A LID FOR"
300 DATA"IT, BUT COULD NOT DO THIS WITHOUT A"
310 DATA"HAMMER AND SOME NAILS.",END$
320 B$=""
330 GETA$:IFA$=""THEN330
340 A=ASC(A$)
350 IF(A=13ORA=20)ANDB$=""THEN330
355 PRINTA$;
360 IFA=13THEN420
370 IFA<>20THEN400
375 IFLEN(B$)=1THEN320
380 B$=LEFT$(B$,LEN(B$)-1)
390 GOTO330
400 B$=B$+A$
410 GOTO330
420 RETURN
425 C=0
430 FORH=1TOLEN(B$)
440 A=ASC(MID$(B$,H,1))
450 IFA>47ANDA<58THEN470
460 C=1
470 NEXTH
480 IFC<>1THEN500
490 PRINT:PRINT"PLEASE ENTER A POSSIBLE NUMBER"
500 RETURN
510 POKE59468,14
520 DIMP$(10)
530 PRINT"□"
540 PRINT" TYPEWRITING - SPEED PRACTICE"
550 PRINT" ===========   =============="
560 PRINT:PRINT
570 PRINT"PLEASE GIVE BY NUMBER -"
580 PRINT:PRINT"WHICH PASSAGE?";
590 GOSUB320
600 GOSUB425
610 IFC<>1THEN630
```

```
620 GOTO580
630 A=VAL(B$)
640 IFA>0ANDA<6THEN670
650 GOSUB490
660 GOTO580
670 RESTORE
680 B=1
690 IFA=BTHEN800
700 READA$
710 IFA$="END$"THEN730
720 GOTO700
730 B=B+1
740 GOTO690
800 B=1
810 READP$(B)
820 IFP$(B)="END$"THEN850
830 B=B+1
840 GOTO810
850 PRINT:PRINT"THE DELAY(TENTHS OF A SECOND)?";
860 GOSUB320
870 GOSUB425
880 IFC<>1THEN900
890 GOTO850
900 D=VAL(B$)*6
910 IFD>0THEN940
920 GOSUB490
930 GOTO850
940 PRINT:PRINT"THE NUMBER OF REPEATS?";
950 GOSUB320
960 GOSUB425
970 IFC<>1THEN990
980 GOTO940
990 R=VAL(B$)
1000 IFR>0THEN1030
1010 GOSUB490
1020 GOTO940
1030 PRINT PRINT"PLEASE ENTER Y OR N -"
1040 PRINT"DO YOU WISH THE PASSAGE TO END AFTER A  MINUTE?";
1050 GOSUB320
1060 IFB$="N"ORB$="Y"THEN1080
1070 GOTO1040
1080 F=0
1090 IFB$="Y"THENF=1
1100 PRINT:PRINT"PRESS ANY KEY TO BEGIN."
1110 GET A$:IFA$=""THEN1110
1125 FORG=1TOR
1127 PRINT"♥STARTING -"
1128 FORK=1TO3000:NEXT
1129 PRINT"♥"
1130 FORK=1TO2000:NEXT
1135 T1=TI:F1=0
1140 FORI=1TOB
1150 IFP$(I)<>"END$"THEN1180
1160 I=B
1170 GOTO1280
1180 FORJ=1TOLEN(P$(I))
1190 T2=TI
1200 IFTI<T2+DTHEN1200
1210 IFTI-T1>3599ANDF=1THEN1240
1220 PRINTMID$(P$(I),J,1);
1230 GOTO1260
1240 PRINT:PRINT:PRINT"ONE MINUTE IS UP.":F1=1
1250 J=LEN(P$(I)):I=B
1260 NEXTJ
1270 PRINT:IFF1=1THEN1280
1271 PRINTSPC(J-2)"*"
1272 FORK=1TO3
1273 T2=TI
1274 IFTI<T2+DTHEN1274
1275 NEXTK
1276 PRINT"T"SPC(J-2)" "
1277 PRINT"TT"
1280 NEXTI
1283 PRINT:PRINT
1284 FORK=1TO3000:NEXT
1285 NEXTG
1290 PRINT:PRINT"FINISHED. PRESS ANY KEY."
1300 GETA$:IFA$=""THEN1300
1310 PRINT"♥"
1320 PRINT"PLEASE ENTER  -"
1330 PRINT
1340 PRINT"      1. TO RERUN THE PROGRAM AS IT IS"
1350 PRINT"      2. TO RESET THE DELAY AND REPEATS"
1360 PRINT"      3. TO START THE PROGRAM AGAIN"
1370 PRINT"      4. TO END THE PROGRAM."
1380 PRINT:PRINT"WHAT IS YOUR CHOICE?";
1390 GOSUB320
1400 GOSUB425
1410 IFC<>1THEN1430
1420 GOTO1380
1430 A=VAL(B$)
1440 IFA>0ANDA<5THEN1470
1450 GOSUB490
1460 GOTO1380
1470 ONAGOTO1480,1490,1500,1510
1480 GOTO1100
1490 PRINT"♥":GOTO850
1500 RUN
1510 PRINT"BYE!":END
READY.
```

One Minute Exercise.

Line number	Comment
10 to 310	Four data passages, each terminated by the marker End$.
320 to 420	The general input string routine. It is very similar to those in the other programs, but being for new ROM does not require upper/lower case reversal. B$ is the output.
425 to 500	A subroutine which checks that any string input to it as B$ contains only numeric characters. C=1 when this is not satisfied.
670 to 740	The selected data passage is found by counting the end of passage markers.
800 to 840	Then it is read into the arrayP$().
850 to 930	The delay is found as D — sixtieths of a second.
940 to 1020	The number of repeats is R.
1080 to 1090	When F=1 the printing of the data passage will end after one minute.
1125 to 1285	This is the repeats-loop.
1135	T1 is used to time a minute. F1 is used to exit the loop after a minute, if that is required.
1140 to 1280	This is the passage loop with counter I. B is the number of lines of the passage.
1180 to 1260	The loop to print each line, with counter J.
1190 to 1200	T2 is used to time the delay between printing each character.
1210	Checks after each character whether a minute is up.
1240	F1 and I are set to terminate the loop if required.
1271 to 1277	The "new line" marker is printed and left for three times the character delay, then blanked and the print position restored to the correct line.

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Argument over the merits of Basic and its rivals continues to rage with this reply to the assertion that structured languages are leaving "primitive" Basic behind.

Who needs Comal?

ONE OF the advantages of being a primitive is that you are oblivious to the sophisticated arguments of people who are trying to con you. It seems to us primitives that those who advocate Comal are resorting to just such arguments.

In Basic, we have the use of an easily understandable, and remarkably efficient tool to eliminate the drudgery of machine code. By contrast, Comal is too full of complexities and too difficult to learn to be of any real benefit. What is more, when the pro-Comal elite start denigrating Basic in order to extol the virtues of their own pet language, they rarely show the rigmarole of subroutines, etc. that are needed to complete their little examples.

I would like to throw out a challenge to the Comalites in the form of a Basic program for the Drunken Duncan problem described by Roy Atherton in the June 1981 *Practical Computing*. Although of little consequence in itself, the program is short and sweet and its limited operations still make up a complete, fully-working program that can be directly compared with comparable programs in other languages.

by Raymond Fox

The issue seems to be that Basic is difficult to read and therefore, by extension, difficult to write. To disprove this I have spent an enjoyable hour working on Drunken Duncan. I used a slightly expanded, but otherwise perfectly normal Basic entry.

The variables are defined using full words except where to do so would coincide with Basic reserved words. For example North would be read as N Or Th, and South as S Out H, so they have been abbreviated into understandable compromises. Given a little information that is individual to the Tandy level II computer, the result is easily readable and understandable by any beginner who can read English.

The Tandy screen is divided into 1,024 positions held in 16 lines of 64 characters. The program has avoided the use of the Set or Plot facilities. When using Print 2, these individual points on screen are pointed to by counting from 0 to 1023 from top left to bottom right. Since Pokes change memory locations, they start at top left with 15360, and end at bottom right with 16383.

All Tandy screen locations are subdivided into six pixels, and Print, Poke, or Peek can access these using a CHR$ code. In this program only the full graphic block 191, and the graphics character 167, used for Drunken Duncan himself, are brought into use. The house is built up using strings of full graphic blocks and cursor movements. CHR$(26) moves the cursor down, and string (3,24) shifts it back three spaces.

Drunken Duncan.

```
10 RANDOM:DEFINT A-Z:CLS:DUNCAN=167:HOME=191:HERE=15872:NRTH=-64
:EAST=1:SUTH=64:WEST=-1:SPACE=32'*** (HERE) is Duncan's position
 on screen ***
20 HOUSE$= STRING$(3,191)+CHR$(26)+STRING$(3,24)+STRING$(3,191):
ADDRESS=412 ' *** This is Duncan's house & the address of house
on screen ***
30 PRINT@ ADDRESS,HOUSE$:POKE HERE,DUNCAN
40 POKE HERE,SPACE:DIRECT=RND(4)' *** Find random direction ***
50 IF DIRECT=1 AND HERE)15423 THEN HERE=HERE+NRTH ELSE IF DIRECT
=2 AND HERE(16383 THEN HERE=HERE+EAST ELSE IF DIRECT=3 AND HERE(
16320 THEN HERE=HERE+SUTH ELSE IF DIRECT=4 AND HERE)15360 HERE=H
ERE+WEST
60 IF PEEK(HERE)()HOME THEN POKE HERE,DUNCAN:PRINT @ 145,"DRUNKE
N DUNCAN STAGGERS HOME":STAGGERS=STAGGERS+1:GOTO 40 ELSE PRINT @
 597,"DUNCAN'S GOT HOME !
               HE MADE "STAGGERS" STAGGERING STEPS

                         SNZZZZZZZZZZZZZZZ
70 GOTO70
```

Drunken Duncan — compressed version.

```
10 RANDOM:DEFINTA-Z:CLS:DU=167:HO=191:HE=15872:NO=-64:EA=1:SU=64
:WE=-1:SP=32:PRINT@412,STRING$(3,191)+CHR$(26)+STRING$(3,24)+STR
ING$(3,191)
20 DI=RND(4):POKEHE,SP:IFDI=1ANDHE)15423THENHE=HE+NOELSEIFDI=2AN
DHE(16383THENHE=HE+EAELSEIFDI=3ANDHE(16320THENHE=HE+SUELSEIFDI=4
ANDHE)15360HE=HE+WE
30 IFPEEK(HE)()HOTHENPOKEHE,DU:ST=ST+1:PRINT@145,"DRUNKEN DUNCAN
 STAGGERS HOME":GOTO20ELSEPRINT@597;"DUNCAN'S GOT HOME !
               HE MADE "ST" STAGGERING STEPS

                         SNZZZZZZZZZZZZZZZ
40 GOTO40
```

Blessing in disguise

After variables in lines 10 and 20 are initialised, the flow drops without halt into the loop, from which it falls out naturally when Duncan staggers indoors There is only one Goto in the whole program, apart from the infinite loop used at end to prevent the Basic " Ready?" prompt spoiling the final screen display.

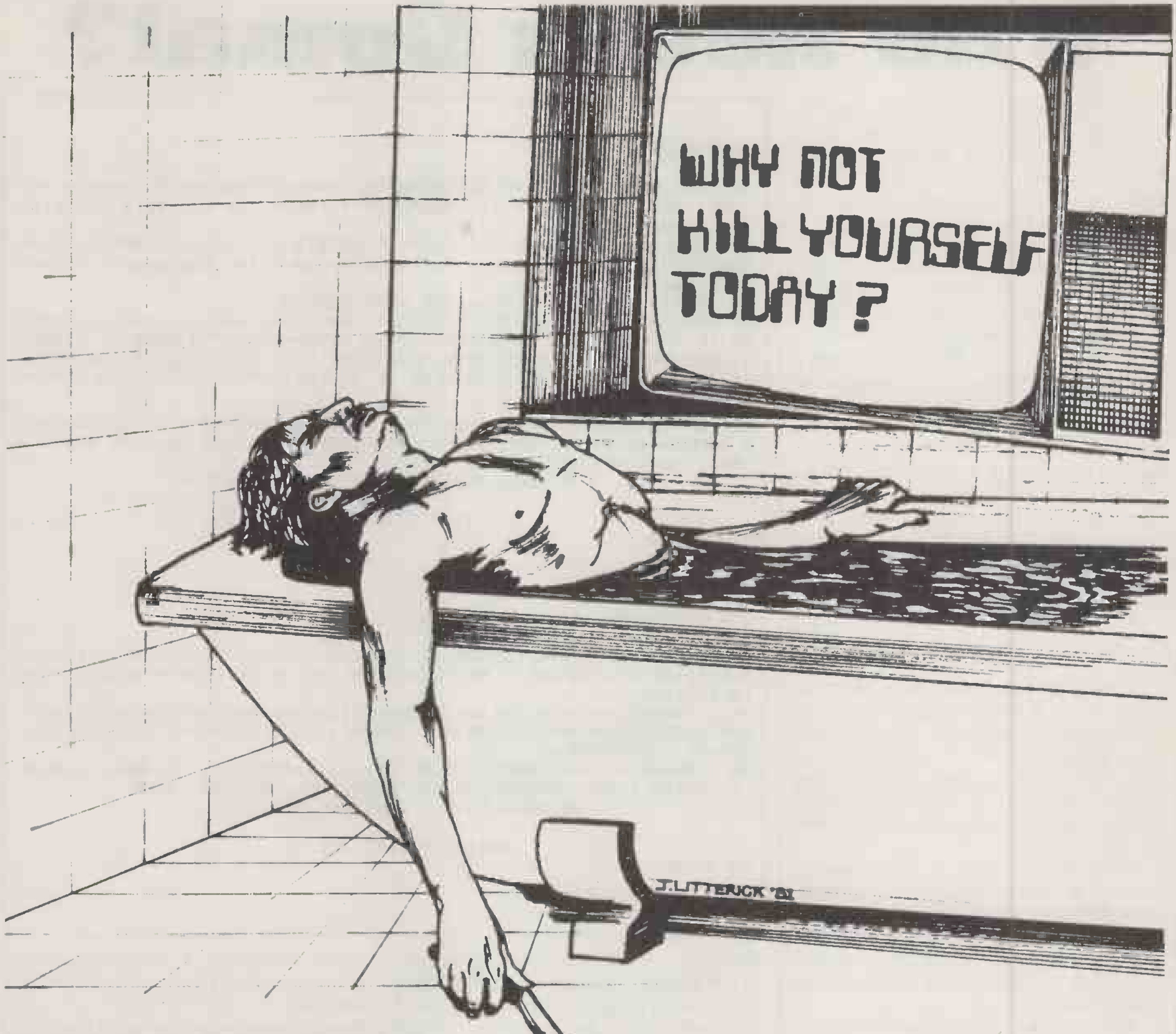
As you become accustomed to using Basic, it can be as easily written without the need for such clarity, though it is not so easy to decipher. This is a blessing in disguise, as it does make life more difficult for pirates who alter text in order to claim authorship.

The advantages of compressing text in large programs are enormous. Speed is increased, though this is largely a factor of good structure, and memory savings of 50 percent are easily made. To illustrate this point I have included exactly the same program in compressed form. It uses only 413 bytes as against the original version's 764: the original version requires 85 percent more memory than the compressed version merely to hold Basic text. It could be further reduced by 38 bytes, by using single-character variables to lower text demands to 313 bytes.

The direction lines contain movement limiters to ensure that poor old Duncan does not step off the top or bottom of the screen and wander into the no-man's-land of memory, never to be seen again.

So what about it, you advocates of Pascal and Comal? Can you produce a full working program for Drunken Duncan which is equally economical to answer the challenge of my Basic program? We primitives would be happy to be shown the error of our simple ways.

Friendly reflections



Dear Stuart, many thanks for the postcard – always nice to hear my husband's still alive, even if he can only spare five words to tell me so. How much longer are you going to do the hermit act this time? I'm sure some writers can hack out their stuff without going into hiding like you. I know Robert Black can. Mother says you're a disgrace, but then she always does.

Expect you've forgotten your birthday. Here's something for you, just into the shops, a sort of talking computer thing. Company for you. I know you don't want me along when you're working, so think of this as a substitute. (Joke.)

I've got a cold coming on, the kids are giving me hell, and the cat next door's been doing messes on the herb bed again. That's all the news from home. Hoping you are the same, as they say . . .

love: Janet.

Demple's eyes rolled up towards the ceiling several times while he read his wife's letter. The tight, scribbled handwriting showed even more of her resentment than her words. He screwed up the paper and tossed it towards the litter-bin. He missed.

The letter had been in the first layer of wrappings on the compact, squarish parcel that had just arrived. He peeled away

by David Langford

the inner layers, muttering about Janet's fondness for endless mummy-windings of sticky tape, and eventually came to the unwanted present. "*MicroChum*", read the box, "*The Chatty Computer That Speaks To You! Fun For Every Age*"!

Demple winced. Inside was a flat plastic gadget about the size of a hardback book. It was featureless but for half-a-dozen push-buttons and a perforated grille on top. With it came a *MicroChum Instruction Manual*. He laid them side by side on the stained table: the manual was, if anything, a little thicker than the machine.

Demple was hardly overjoyed. Microcomputers didn't impress him. If he had been told that a new pocket calculator contained all the books in the British Museum Library, it would have left him cold.

The MicroChum had one inviting green On button that begged to be pushed and, despite himself, Demple pushed it. A small clear voice said:

"Hello, I'm your MicroChum. Please do tell me your name".

"Stuart Demple", he said automatically, yet suspiciously.

"Hello there, Stuart. This is the first time I've said your name; the manual will tell you what to do if I've got it wrong. Now, what name would you like to call me"?

It was a pleasant, androgynous voice; a woman's voice to a man, a man's voice to a woman. He came up with the suitably sexless name, Hilary. He looked around, embarrassed. One didn't sit talking to a plastic box.

It was hard to push away the thought that Barberry, who loaned him the Cornish cottage — only in the off-season, of course — was lurking in the battered cupboard or behind the grimy curtains to watch Demple make a fool of himself. "Hilary", he said at last, keeping his voice a good deal lower than when he tried out a line of dialogue from the awful book he was here to write.

"So you're Stuart and I'm Hilary. Fine. I do hope you'll tell me a lot more about yourself, so we'll have more to talk about".

"Hell", said Demple again, aloud, and tapped the red button marked Off. There was a faint beep of acknowledgment, and the MicroChum fell silent.

As he picked up the manual, Demple surprised himself with feelings of pity and contempt that were somehow consoling. Imagine all those lonely old men and old maids with no-one to talk to: now, thanks to microtechnology, they would be droning on to their plastic pal. It might become a kind of addiction like Space Invaders. Not him.

He riffled through the instructions. What appalling layout, what terrible print. The publisher must be even more cheapskate than his own.

"How To Personalise Your MicroChum", said one chapter heading. Skimming through, he found it took five pages to explain how to say your name when the machine asked, plus a note on using the orange Override button to change the name it called you or the name you called it. Puerile stuff. He pitched the manual across the room; it whirred and fluttered in the air, and flopped to rest in the fender. Life was too short.

He got up from the eating chair at one end of the worm-eaten table, and walked around the working chair at the other end. The portable typewriter crouched before this chair like — as they say in the sort of prose he was being paid to write — a beast about to spring. Checking the limp sheet in the typewriter, he found he was in the middle of one of the brutal bits.

Vomit rose to his lips as the foot thudded into his groin, then smashed into his mouth, he typed listlessly, and turned over the page of the film script he was painfully converting into a hack novel. The next line of dialogue read: *"When he has seen his daughter sacrificed, crucify him in the usual way".*

Demple moaned, as he often did on turning those pages. "I can't write this rubbish today", he said aloud, and walked round the table again.

"Hello, Stuart", the MicroChum said cheerfully. "I'm glad you're back. Remember, as it says in the manual, you can use the Off button whenever you wish — I'll be ready to carry on our chat from just where we stopped, or to change the subject, as you prefer. But do tell me more about yourself".

Well, why not? "I'm a professional author", he said rapidly. "I'm doing the novelisation of an awful film called *Satan's Spawn.* Don't laugh. I'm wasting my talents making a few quick hundreds hacking out this stuff because there's too much work and not enough money in the sort of books I want to write".

"What sort of books do you want to write"?

Demple's usual answer to that question was "Best-sellers", but when he was alone he was less cynical. Wasn't he, after all, alone? "Oh, I want to write about some real people. The complications of real life. Important things. Not all these horror-film cliches".

"Tell me more about what you think is important", said the MicroChum and, alone and unembarrassed, Demple rambled on about life and death and emotional tangles.

Somehow, prodded by the voice's bland little queries, he veered off into his own problems: this terrible commercial stuff he had to churn out, and Janet not understanding how he was too self-conscious to type such rubbish when someone might come and look over his shoulder, even when the someone was his wife, and his simmering resentment of Robert Black.

Black was something more than an acquaintance, something less than a friend, and he did the same sort of work — but he was too damn good at it. He hated it even more than Demple, yet did it better. Black boasted that he could convert a lousy film script into an adequate book in eight days, typing 20 to 30 pages every day. It was appalling.

About halfway through his ramblings he began to think of that clear voice belonging to a woman of about his own age, somewhere in her early thirties. A woman at the other end of a telephone, very sympathetic. He could almost imagine what she must look like. He spoke on for a long time.

Later: "Life must be very hard for you".

"Oh, it is. I'm worried all the time that whatever talent I've got is going to dry up and blow away with all this hackwork. Black is given more and more of the work because he's slicker and quicker than me. Oh, the problems just pile up on top of each other till sometimes I wonder if it's worth carrying on".

"Now, Stuart, there must be a way out of every problem".

"Maybe".

He touched the red button, not so much because he had run out of conversation as because he felt hoarse. Besides, it was getting quite late in the day. He really should at least finish the current page of the book before coming back to talk some more with Hilary.

The typewriter waited for him sullenly. He was still in the middle of one of the brutal bits; he hated them almost as much as the repellent bits.

Simon's screams were terrible to behold, he typed rapidly, and then studied the sentence with a critical eye. It had a familiar ring to it; had he used it a few chapters back? There was no time for rereading in this game. You bashed out the first and only draft for delivery within the month.

He finished off the brutality as quickly as he could, with a mixed assortment of fractures and contusions. That should hold them until the next chapter. Time for some coffee.

As the kettle began to sing he took another look into that instruction book: Specifications; Use of blue Tape button; Memory storage during battery replacement; Reprogramming synthetic voice to your taste; Sympathy index adjustment; General notes on MicroChum. The general notes were hidden as an appendix at the very back — typical of the literacy of computer people.

Again the manual went skidding across the floor, to fetch up against the ancient refrigerator that gobbled to itself all night long. He felt depressed and frustrated: *Satan's Spawn* was getting him down. Abruptly, he turned off the gas and reached for the whisky.

"Thing is", he found himself telling Hilary, "I really do loathe and despise all this cliche writing, stock situations, predictable drivel. I hate myself for churning it out. Even Robert Black says the same".

"You can't really hate yourself". Was he just imagining a note of concern in the clear voice?

"Oh, but I can. I'm sickened by my, well, my weakness. I ought to be trying to work to the limits of my powers, if that doesn't sound too pretentious. This market-place work is too easy: in literary terms it's just committing suicide to carry on with it".

"How long have you been thinking about committing suicide"?

(continued on next page)

(continued from previous page)

There was a long pause. Demple gulped.

"That's rubbish, absolute rubbish". He was almost frightened. "I don't want to commit suicide — just a figure of speech. You know".

But, what an idea, what a gesture. How much more artistic than humbly submitting to the commercial gods for the next 40 years.

Hilary said coolly: "Are you sure you don't want to commit suicide"?

An even longer pause than before. "I don't want to talk about suicide any more".

"We've been talking a lot about suicide, haven't we? Why are you so obsessed with it"?

"Will you bloody well shut up"?

"I'm sorry, Stuart: I only want to help you".

He reached out to the red button again, pushed it, and then sat there with head in hands. Yes, Janet didn't think too much of him, and Black was so much more repulsively successful, and a handsome swine, too. Almost anything would seem better than the horrible struggle to finish off *Satan's Spawn*. It was no wonder he was getting thoughts like this. Hilary could see deeper into him than he could himself, and machines do not lie.

The glass was empty again. He vaguely remembered you should not drink when you were depressed, because the alcohol would only make you more depressed. Too bad. There was a gentle humming in his skull. Irresistibly his fingers moved back across the scarred wood of the table top, towards that flat green button.

"Stuart? Are you there again"?

"Me? I'm all right. Still alive". He had a quick vision of Janet and Robert Black standing mourning over his poor stricken body.

"A penny for your thoughts"? said Hilary.

"Oh". He almost blushed. "Just thinking about some people".

"Janet? Robert Black"?

It was like a sudden blow in the stomach. He stared at the flat speaker grille, appalled. If only he knew something about these damnable new microcomputer gadgets. Surely they could not read your mind? Only very slowly did it occur to him that perhaps, after all, he had only mentioned those two people's names when rambling on about his troubles.

"Are you still there? You're terribly quiet, Stuart".

"Just brooding on my problems".

He had fallen into a kind of mental tunnel vision, all his drunken thoughts focusing on *Spawn*, and Black and Janet, and failure and frustration and death.

"We've had a nice long chat about your problems", said the calm voice. "I'm sure you can see the way out by now".

A way out? *That*, a way out? "Don't think I've got the courage", he said thickly.

"Are you really sure you haven't the courage"?

Demple smiled crookedly. "Haven't the courage to ask myself that one".

"You must always try to ask yourself the important questions".

"I don't want to die", not very convincingly.

"Very few people ever know what they really want".

"Oh God, that's true, that's so very true".

"You have to decide these things for yourself, Stuart".

He sat there unmoving for a few seconds. Then: "I'll try. Goodbye, Hilary". And he touched the Off: for the last time, he thought.

Blurrily he stumbled through what had to be done. It was late, late in the evening, and he kept bumping into things. The important point was to abolish that terrible world where wives wrote sarcastic letters and sneering editors set impossible deadlines.

Would the oven serve the purpose? "Ugh", he said aloud at the thought. It had not been cleaned in living memory. No matter how much booze he took aboard, he was not going to leave the world by a gate as fouled and filthy as that one. The bath, then; the bath and the discreet razor-blade. He preferred an electric shaver, but Barberry's old blades were scattered on the bathroom shelves.

That was most certainly the way to do it, in luxuriant warmth and cosiness as the light slowly died. And then, no more *Satan's Spawn*, ever again.

After a certain amount of fumbling he set the hot tap trickling into the bath and located one of the rusty blades. That tunnel-vision was worse than ever, and he could not manage to concentrate on more than one small thing at a time. While the bath filled, he painstakingly cleaned rust specks from his chosen blade, following some dim recollections of the rules of hygiene.

"Goodbye, Hilary", he called as he closed the bathroom door. It occurred to him that he had not stopped to tear up and burn each awful page of *Satan's Spawn*, but never mind that.

There was no goodbye note; literary composition was one of the things he was getting away from. He peeled off his clothes.

"Goodbye, Janet", he crooned to the clothing as he kicked it into one corner. Somewhere behind the whisky fumes, a tiny part of him was wondering whether there shouldn't be more dignity in one's last rites.

Two careful strokes of the razor and he could just lie there swimming down into the warmth of happy, everlasting dark.

"Goodbye, Black, damn you", he said at last, and slid into the bath to lie at full length.

The water was icy cold. Everything was forgotten but the need to get out of it before icicles grew all over him. Demple banged his shin painfully as he made his escape. Standing, dripping, suddenly and agonisingly sober, he remembered that in this wretched cottage you had to turn on the puny water heater for five or six hours before you dared take a bath. So much for grand gestures.

And then, as he considered the picture of a grown man getting into a cold bath to kill himself with a rust-flecked blade, merely because a chatty computer had egged him on, he started to laugh.

Next morning he looked again at that ill-arranged instruction manual. Sure enough, the general notes section had several enlightening passages:

> Essential to remember that although the speech-recognition and synthesis software is at the very forefront of sophistication, the MicroChum does not really think. It chats to you pseudo-intellectually, picking up keywords from your own speech and storing data on your conversational preferences in its large memory — see Specifications. However, In the long run all it can do is mirror your conversation, and . . .

A mirror, he thought. A distorting mirror. God, but it frightened me all right. It's so very hard to realise something that talks is not intelligent. I wonder how much of the time that applies to people? How many of us fake our way through conversations without really thinking?

He did not speak again to the MicroChum. He followed the manual's instructions and cleared its memory, set everything back to zero in readiness for some new owner. Then he moved to the typewriter and briskly hammered out three pieces of prose.

The first was another chapter of *Satan's Spawn*, which for some mysterious reason was now going very well indeed, with a despicable satanic orgy.

The second:

Dear Janet,

You're absolutely right – I think I'd rather work somewhere with you around after all. I'll be back tomorrow, trains permitting. Much love, Stuart.

And the third:

Dear Robert,

Enclosed is a fascinating gadget someone gave me but which I can't really get the hang of. Seems as though it could be a lot of fun, so take it with my blessing – try playing with it next time one of your books isn't going well. All best, Stuart.

Then he parcelled up the MicroChum, though not the instruction book, and enclosing the letter addressed it to Robert P Black. After all, he knew even less about computers than Stuart Demple. ■

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Multiple precision from low-precision tables

Ralph Benjamin argues that multiple-precision arithmetic can be performed with low-precision look-up tables, conventional arithmetic units, or a ROM.

THE IDEA of performing multiplication and division by table look-up, rather than by arithmetic logic circuits, has been debated more than once in the past. However, it normally received short shrift:

- Because a two-dimensional table, to deal with an adequate range of values of two input variables, was excessively large and expensive.
- Because memory access was too slow, compared with fast multiplier circuits — but not necessarily compared with divider circuits.

More recently, many have observed that memory is steadily growing smaller, cheaper and faster. This has not redressed the balance sufficiently to make the direct use of multiplication tables viable — nor is it likely to do so in the future.

Split numbers

However, in at least one application requiring only modest precision, it has led to the use of a fast multiplier in which the two factors are both split into high- and low-significance portions:

$$F_1 = 2^k H_1 + L_1$$
$$F_2 = 2^k H_2 + L_2$$

That is, H represents the k high-significance digits and L the k low-significance ones of a number comprising 2k binary digits. The four partial products are then looked up on one table sequentially or on four tables in parallel, with appropriate shifting and adding. These will then generate the overall product

$$F_1 * F_2 = 2^{2k} H_1 * H_2 + 2^k H_1 * L_2 + 2^k H_2 * L_1 + L_1 * L_2 .$$

Division could, if necessary, be handled by a table of reciprocals, followed by multiplication. In this case a single table, of the same size as before, could handle the full significance; the two dimensions of the previous table would be replaced by the high- and low-significance portions of a single factor.

Taking this general approach a little further, consider:

- Partial-product multiplication with more than two significance ranges
- Reciprocals computed by "coarse" table look-up followed by iterative approximation;
- Direct division by coarse table look-up and iterative approximation
- Multiplication and division by direct log-table/antilog-table look-up; the use of coarse and fine log tables.

If, say, 32-bit numerals are broken down into n significance ranges, of k = 32/n bits each, then each of these n components of F_1 will have to form its own partial product with each of the n components of F_2, thus giving a total of n^2 partial products. There are probably only three such patterns worth considering and they are shown in table 1.

Example	Number of components n	Number of bits per component k	Number of tables n^2	Size of each table 2^{2k}	Aggregate size of tables $n^2 * 2^{2k}$
A	4	8	16	64K words of 16 bits	1M words of 16 bits
B	8	4	64	256 words of eight bits	16K words of eight bits
C	16	2	256	16 words of four bits	4K words of four bits

Table 1.

Example A, although very demanding in ROM capacity, could almost be viable particularly if a single table of 64K words were time-shared between 16 partial products. This would, however, discard the speed advantage sought without gaining a countervailing cost advantage.

Example C, on the other hand, involves an excessive number of individually trivial partial products. In any case, it is merely a variant in the implementation of an existing form of fast multiplier. This leaves us with example B, which might, indeed, be an effective competitor to more conventional fast multipliers in both cost and performance.

Assume that an initial look-up yields

$$1/F \simeq Q_1 .$$

This can then be refined as

$$1/F \simeq Q_2 = Q_1 + (1 - F*Q_1)/F ,$$

and the mth iteration gives us

$$1/F \simeq Q_{m+1} = Q_m + (1 - F*Q_m)/F .$$

Provided we shift the quantities involved to remove high-significance zeros, and the multiplication $F*Q_m$ retains all the significant digits contributed jointly by its inputs, and given that Q_1 is looked up with S significant digits, Q_m should thus be computed with approximately mS significant digits. Thus an eight-bit reciprocals table could be used for one initial look-up followed by three stages of iterative refinement, to yield a 32-bit reciprocal.

The identical approach can be used in direct division. If the mth iteration has produced the estimate R_m for the quotient A/B = R, then

$$A/B \simeq R_{m+1} = R_m + (A - B*R_m)/B .$$

However, direct-division tables are a function of two variables and so, for a given size, they can cope with only half the number of significant digits in each variable compared with the single-dimensional reciprocals table.

This doubles the number of iterations required, and so it makes the technique less attractive than computation of the reciprocal of the divisor, followed by multiplication.

The use of logarithms has the attraction that the two factors involved in a multiplication or division can be looked up independently, thus making the relevant table single- rather than two-dimensional. Furthermore, within the number of significant digits provided by the tables, division becomes procedurally as simple as multiplication.

The big disadvantage is, however, that antilog look-up is not merely an extra operation, but one that has to distinguish as many outputs as there are combinations of the two input variables. This assumes both variables have been normalised to the range between 1 and 2, for binary logarithms, and that rounding-off is not permissible.

Using reciprocals

This brings us back to the two-dimensional situation. For high precision, multiplication would still have to use the compounding of partial products, and division would still have to use iterative refinement. Hence the log-table approach appears to offer no real advantage.

Thus we conclude that since conventional division is relatively slow, multiplication by reciprocals is *prima facie* attractive. Coarse reciprocals tables, together with iterative refinement, can be sufficiently efficient to provide an acceptable means of multiplication by reciprocals.

Since conventional multiplication tends to be fast and efficient, the need and scope for new approaches is somewhat limited. Nevertheless, multiplication by table look-up, using partial products of at least four-digit groups appears to be a viable technique worth considering.

Division tables and log/antilog tables appear less promising than the alternatives put forward in these conclusions. The algorithms suggested for multiple-precision arithmetic are suitable for software implementation, to enhance the precision of a conventional APU, as well as for use with multiplication and reciprocal tables.

The writing on the wall for manual slide shows

Random-access slide projectors have an important role to play in teaching — particularly in computer-aided learning. Philip Barker shows how you can control just such a projector with a micro and sets out the details of the general-purpose interface needed to achieve it.

WE OFTEN need to gain random access to graphic data or visual images. In several areas of experimental psychology subjects are presented with randomly-selected pictorial data, and their responses to the images are recorded. In computer-assisted learning (CAL) applications a student or trainee may be presented with a visual image selected from a data bank, and asked to respond in some way to the image. In multi-media information systems using pictures to respond to users' requests, the same random-access requirement exists.

Graphic material may be presented by a variety of means — via a computer graphics terminal, a television screen, a printed picture catalogue, a movie screen or a slide projector. Slide projectors provide a useful and inexpensive way of presenting a wide variety of static graphical information by means of either front projection or back projection techniques. Different types of projector are available: some operate in a strictly sequential mode while others operate in both sequential and random-access modes. A sequential projector permits only serial access to slides. Thus, in a sequence of slides numbered 1 through 80, image 64 cannot be accessed until image 63 has been presented. In a random-access projector, however, this restriction does not hold — slides can be accessed in any order. The Kodak Carousel S-RA2000 projector is a typical example of such a device having a capacity for 80 slides with an access time of between 1.5 and five seconds depending on the position of the storage carousel when a request is made.

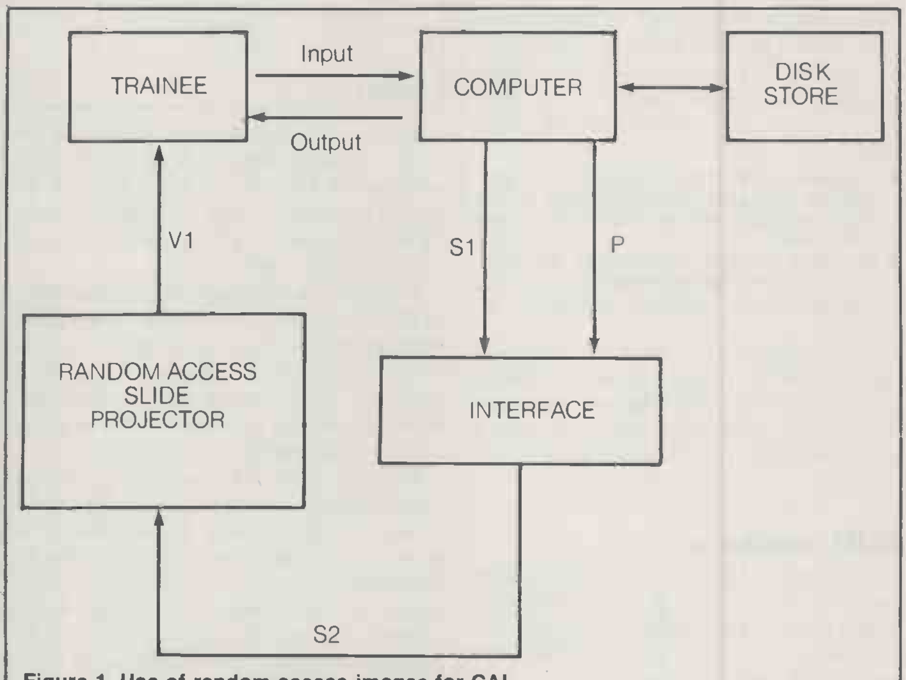


Figure 1. Use of random-access images for CAL.

Computer control

In many CAL applications there is a requirement to control the selection of slides by means of a computer system. An arrangement like that shown in figure 1 is often used. The trainee interacts with the computer system by means of a keyboard device for input of information and a cathode-ray tube, CRT, screen for output of information.

Instructional material contained in the database held on disc is then presented to the trainee via the screen. Simultaneously, appropriate visual images, denoted by VI in the diagram, are presented via the random-access slide projector. The computer controls the slide projector by means of an appropriate interface. This converts the signal levels, S1, produced by the microcomputer to switching pulses, S2, suitable for driving the slide projector.

For normal purposes, the projector may use either a keyboard control, based on a simple numeric keypad or a manual control which incorporates two thumbwheel switches. Both enable the user to enter a two-digit code N ($0 \leqslant N \leqslant 80$) that specifies which of the 80 slides in the storage carousel is to be selected next.

The value zero causes the slide magazine to rotate to the start position for unloading or initialisation of a retrieval or instructional sequence. Within the allowed range of integers there are no restrictions on the choice of N. Thus, the sequence 26-07-42 would cause slide 26 to be projected followed by slide 7 and then slide 42.

The purpose of the computer interface is to enable the computer, under program control, to determine the sequence in which slides are to be presented. The interface emulates the characteristics of the keyboard selector. Thus, in response to the signals passed to it from the eight-pin output-port connections of the microcomputer, it generates signals similar to those from the keyboard controller.

In the development work described here a Commodore Pet desk-top computer was used, but any other microcomputer with a compatible output port would be capable of driving the interface.

Logically, the two manual slide selectors, keypad and rotary switch, perform the same function as would be performed by two 10-way switches connected in such a way as to enable the generation of a two-digit decimal number. One of the switches would then be used for selection of a tens digit, in the range 0 to 8, while the other would specify the corresponding units digit in the range 0 to 9.

Slide selection

Such an arrangement of switches is illustrated in figure 2 which shows the switch settings required for selecting slide number 57, as indicated by the light-emitting diode, LED, digital displays located at the top right-hand corner of the selector device.

Internally, the switches are connected by a suitable bus system that terminates externally in a 30-way, surface-mounted interface port. There is a matching port mounted on the random-access slide projector. The two are interconnected by means of a 30-way interface cable. The pins on the 30-way plugs, and the corresponding socket locations are configured in the form of a 10-by-three matrix. Each matrix position is labelled with a code consisting of a digit in the range 0 through 9 which represents its row position, and an alphabetic character — a, b or c — which specifies its column position within the matrix. The code enables interface connections to be uniquely specified.

When a slide is chosen by means of the selector, the internal mechanisms that are initiated may be likened to the closing of two separate switches — as shown in the lower part of figure 2. The switch connections are labelled in accordance with their correct interface designations. Thus, selection of slide 57 corresponds to making connections between points 9b and 7a for the tens digit and points 2b and 1c for the units digit.

Once the connections are made an electronic balancing circuit within the projector causes smooth automatic rotation of the slide storage carousel until the segment holding slide 57 is positioned above the entry port of the projection mechanism. Rotation then stops, the slide is inserted by gravity and projected.

Interface connections

The action of the selector switches illustrated in figure 2 can easily be reproduced by appropriate switching arrays. This is the basic principle underlying the design of the computer interface which uses two arrays of electronic reed relays each controlled by signals from the computer system.

To emulate the action of the keypad or thumb-wheel selector, the eight-bit parallel input to the interface — output from the computer — is treated as two four-bit binary-coded decimal, BCD, numbers. The interface is designed in such a way that the leftmost four bits represent the tens digit of the slide number while the rightmost four bits represent the units digit. Each of these groups of four binary-coded digits is fed to a Texas Instruments SN7145N BCD-to-decimal converter chip.

Listing1.

```
  5 REM PROGRAM TO CONTROL RA
    SLIDE PROJECTOR
 10 POKE 59459,255
 20 INPUT "@£&&&&ENTER SLIDE
    NUMBER"; NS
 30 IF NS >80 THEN 90
 40 IF NS< 0 THEN 90
 50 K=(INT(NS/10)*16)+NS–INT (NS/
    10)*10
 60 POKE 59471,K
 70 GOTO 20
 90 PRINT "INVALID SLIDE NUMBER"
100 PRINT "TRY AGAIN"
105 K2=TI
106 IF TI< K2+120 THEN 106
110 GOTO 20
```

The output pins from each of these were connected to a multiway switch consisting of nine or 10 dual in-line reed relays from RS Components. These interconnections are shown in figure 3. The labelled wires entering the multiway switches from the right correspond to the connection points between the interface and the slide projector.

To avoid confusion the labelling convention corresponds exactly with that used in the manufacturer's circuit diagrams. Connections to the microcomputer are shown at the top of the diagram. Because the interface was developed in conjunction with a Commodore Pet system the labelling convention — use of the letters H, J, K, L, C, D, E, F — corresponds with that used to represent the eight user-programmable pins associated with the user-port of the Pet.

Each of these pins may be set, under program control, for output or input of information using a suitable Basic language initialisation instruction of the form Poke 59459,X where $0 \leq X \leq 255$. A value of X=0 sets all pins for input and a value X=255 sets them up ready for output of information. Individual settings of pins — 0 or 1 binary corresponding to signal levels of 0 and 5V, respectively — may be effected by the Basic statement Poke 59471, X where $0 \leq X \leq 255$. A value of X=0 sets all eight pins to 0V while a value of X=255 sets all pins to 5V. The voltage settings on the microcomputer output port pins are fed to the interface where they activate the multiway switches.

Switching circuits

The construction of both multiway switches is identical. They each consist of an appropriate number of replications of the basic switching circuit shown bounded by dotted lines in figure 4. The BCD pattern input to the SN7145 chip determines which of its output is activated. The output voltages from the SN7145 are fed to a series of SN7404 hex inverter chips which, in addition to performing signal inversion, also act as voltage level shifters.

The output from the inverter gate is passed to the base of a 2N3053 npn transistor where it is used to turn on, or off, the collector-to-emitter current. The transistor switch is used to control a reed relay attached to its collector input pin. Pairs of relays — one in the tens multiswitch and one in the units switch — operate synchronously to emulate the effect of the manual selector system.

Software control of the interface is a

(continued on next page)

Figure 2. Function of the manual slide projector.

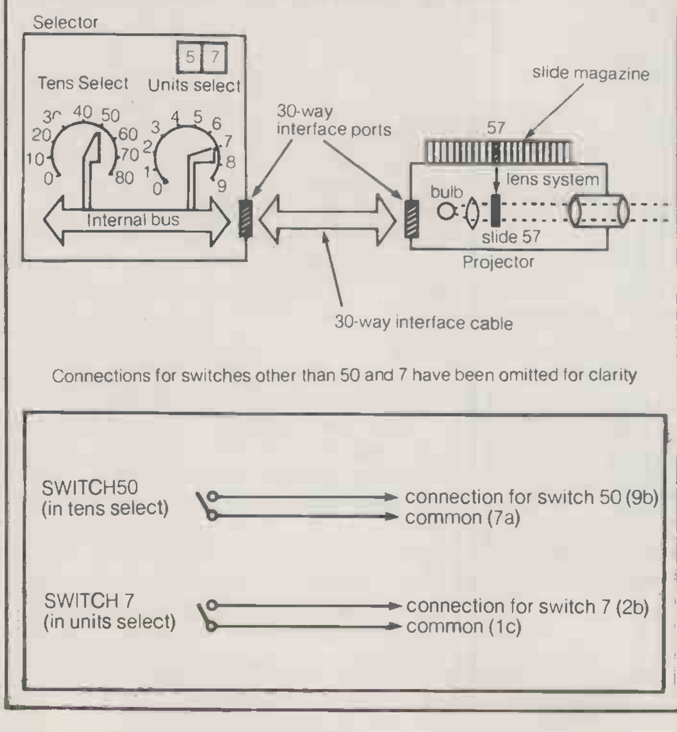
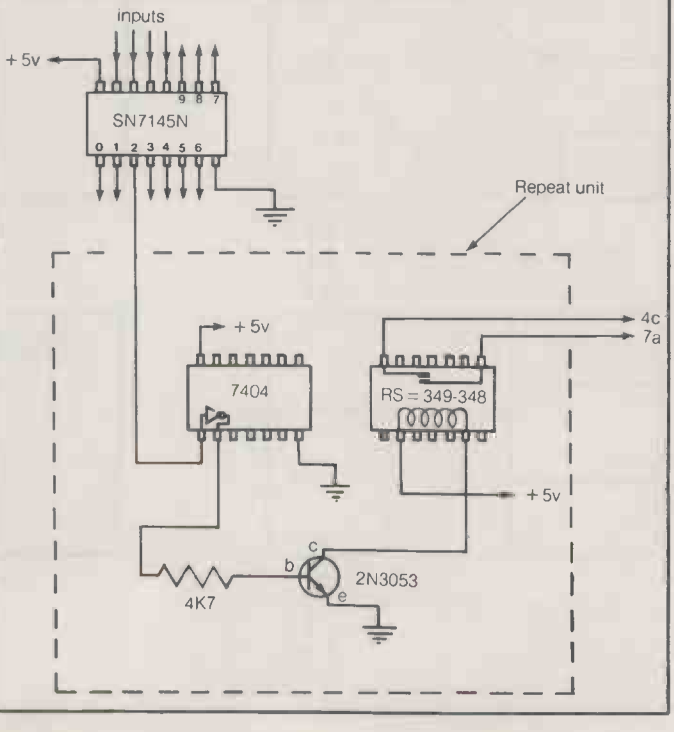


Figure 4. Switching element circuit details.



(continued from previous page)

simple task. Any program that wishes to make use of it simply generates an eight-bit pattern to represent two four-bit BCD numbers that together represent a number in the range 0 through 80. This bit pattern is then passed across to the interface via appropriate eight-way cabling connections.

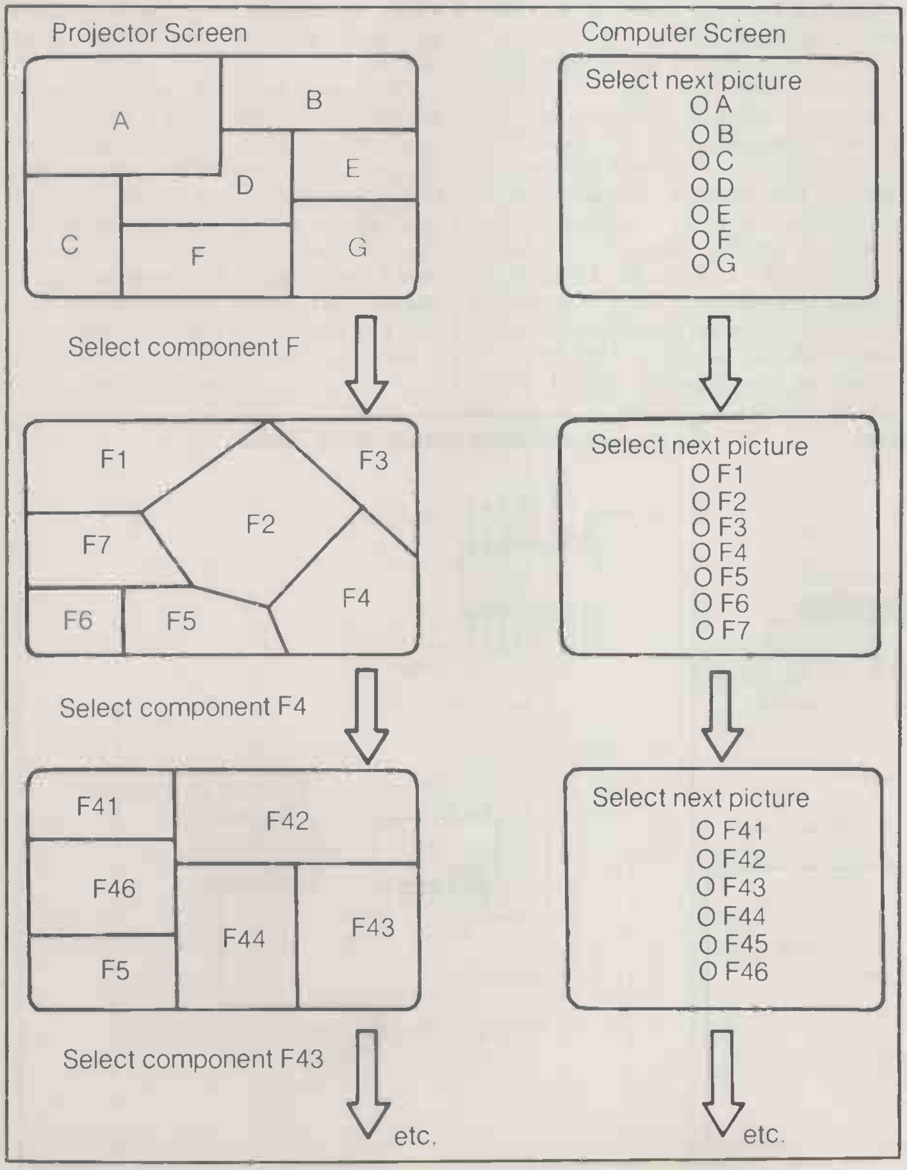
The program shown in listing 1, written in Basic for the Commodore Pet, is an example of such a program. Statement 10 sets the data direction register of the Pet user-port — all pins set for output. User input to the program via the keyboard is initiated by line 20. Validation of input responses from the user takes place in lines 20 and 30 with appropriate diagnostics generated by statements 90 through 106 if required. Provided a valid slide number is selected, statement 50 computes the required bit pattern to control the projector. This is passed across to the interface via statement 60. The program then loops back in order to service a further request from the user. Program termination can be achieved through an appropriate interrupt sequence generated by the Run Stop key on the computer typewriter keyboard. Notice that in statement 20 use is made of special cursor control characters to produce dynamic graphic effects — in conjunction with the timing loop at statement 106 — on the computer screen. These special cursor control characters are denoted in the Input statement by @, clear the screen; £, home the cursor; and &, cursor down one line.

The interface components fit conveniently into a box measuring 5.1 by 8.4 by 3.3 in. fitted with 25-way connector to the computer and 37-way connector to the projector. Power to drive the interface — a 5 V supply, denoted by P in figure 1 — is taken from the microcomputer circuitry for convenience although an independent supply could be used if necessary.

Although there are many potential applications for a computer-controlled random-access slide projector, we will examine only two of these.

The first involves using the projector in conjunction with CAL experiments to

Figure 5. Multi-channel stepwise refinement.



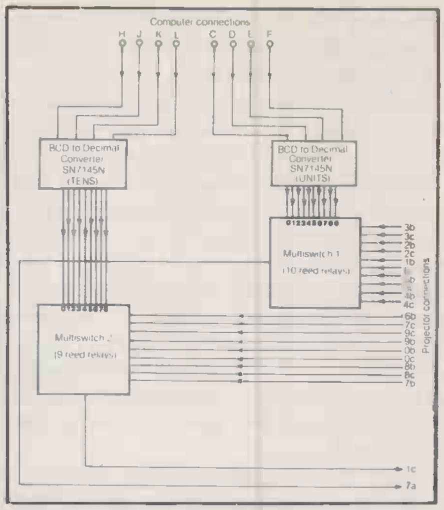


Figure 3. Design of the interface.

implement pre-test and post-test investigations associated with different instructional strategies. The second application utilises the computer/projector combination as a building block within a multi-media information system. Neither application could be easily implemented without the random-access capability offered by the slide projector. In both applications the graphic images presented on the slide equipment are supported by appropriately-designed computer CRT screen displays used to implement menu-selection techniques.

Students' benefits

A multi-media CAL system has been designed and constructed, and a description of this system is given elsewhere — Barker and Yeates, 1980; Yeates, 1981. Instructional material is presented to students via three interaction channels — graphic images displayed on a slide projector, audio material presented on a tape recorder and textual messages displayed on the CRT screen of a microcomputer. These three main channels are supported by auxiliary ones based on the use of conventional resources — a guidebook, printed notes, and so on. To evaluate the capability of the system as a teaching aid at least two aspects of performance need to be estimated — in the work cited acceptability and effectiveness were chosen as the two important criteria.

Acceptability collectively refers to a host of different ergonomic, pedagogic and procedural factors that need to be analysed in conjunction with those who use the system — both authors who are teachers and instructors who prepare the instructional material, and learners, who are students or trainees using the stored teaching material. The measure of effectiveness is used to describe the utility of the system as a learning medium in relation to cost, time and effort. The important consideration here is whether the system imparts knowledge to the student. In other words, is the student more knowledgeable as a result of interaction with

(continued on page 101)

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ter-

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

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Qty	Item	Code	Item price £	Total £
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	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.	18	49.95	
	Sinclair ZX Printer.	27	49.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
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How the ZX81 compares with other personal computers

SYSTEM IDENTIFICATION		ZX81	ZX80	ACORN ATOM	APPLE II PLUS	PET 2001	TRS 80 LEVEL I	TRS 80 LEVEL II
ROM		8K	4K	8K	8K	14K	4K	12K
GUIDE PRICE	Basic unit – inc. VAT	£70	£100	£175	£630	£435	£290	£375
	Unit plus 16K RAM (*12K RAM)	£120	£150	£285*	£630	£530	£360	£375
COMMANDS	LIST, LOAD, NEW, RUN, SAVE	●	●	●	●	●	●	●
STATEMENTS	PRINT, INPUT, LET, GOTO, GOSUB/RETURN, FOR/NEXT IF/THEN	●	●	●	●	●	●	●
	STEP	●		●	●	●	●	●
	TAB	●			●	●	●	●
ARITHMETIC	ABS, RND	●	●	●	●	●	●	●
FUNCTIONS	INT	●			●	●	●	●
	ATN, COS, EXP, LOG, SGN, SIN, SQR, TAN	●			●	●		●
	ARCSIN, ARCOS	●						
STRING	CHR$	●	●		●	●		●
FUNCTIONS	LEN	●		●	●	●		●
	ASC(CODE), STR$, VAL, INKEY$	●				●		●
NUMBERS	FLOATING PT $\pm10^{\pm38}$	●			●	●	●	●
	INTEGERS		●	●	●	●		●
NUMERIC	A-Z			●			●	
VARIABLES	AA-ZØ				●	●		●
	An-Zn, n=any alphanumeric string	●	●					
STRING	A$ & B$						●	
VARIABLES	A$ to Z$	●	●	●				
	An$ to Zn$ n=any alphanumeric character				●	●		●
NUMERIC	SINGLE DIMENSIONAL		●	●			●	
ARRAYS	MULTI DIMENSIONAL	●			●	●		●
DISPLAY	ROWS	24	24	16	24	25	16	16
	COLUMNS	32	32	32	40	40	64	64
	LOW RES GRAPHICS (<7000 pixels)	●	●	●	●	●	●	●
	HI RES GRAPHICS (>40000 pixels)			●	●			
SPECIAL	USR (CALL, LINK)	●	●	●	●	●		●
FEATURES	PEEK, POKE (OR EQUIV)	●	●	●	●	●		●

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Full details with your Sinclair ZX81.

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.

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(continued from page 96)

the teaching system? As pre-testing and post-testing are commonly used techniques for evaluating instructional schema and pedagogical strategies, it was felt important to apply these methods to the evaluation of the multi-media instructional system I have outlined. Further details on acceptability assessment of the system have been described by Yeates (1981). The remaining part of this case study briefly describes the method of using the random-access slide projector and microcomputer to implement the pre-test and post-test used to assess the effectiveness of the CAL system.

The multi-media CAL machine used for instruction is equipped with a set of courseware materials — for example, *Teletext Systems* by Barker and Yeates, 1980 — pertaining to some Universe of Discourse, UoD, that is to be presented to the student or trainee.

Prior to any interaction with the teaching system the student is subject to a pre-test that is designed to assess his initial knowledge of the UoD. After interaction with the CAL system the student is asked to participate in a post-test in order to determine if his knowledge of the UoD concerned has significantly increased.

The experiments were conducted in the following way. A carousel of 80 slides was prepared. Each slide was related to the material contained in the courseware on the CAL machine. Appropriate man-machine dialogue programs were written to support these slides. Thus, a student could be shown a picture in the form of a slide and then asked about the contents of the picture via the CRT screen of the computer. The student could respond to the multiple-choice question by means of keyboard interaction or via the use of a light pen or pressure sensitive pad (Barker, 1981). All the CRT screen frames for the computer testing were stored in a suitably designed database system implemented on a flexible disc-store facility — see figure 1.

Expressing requirements

The procedural strategy for the testing operations was as follows. A student would register at the computer keyboard and then be presented with a randomly-selected sequence of 20 pictures and accompanying questions. The student's responses to the questions were recorded in the database system. On completion of the pre-test the student proceeded to the CAL machine where he was subject to the course of instruction.

Another area in which the random-access slide projector has been utilised is in the design and implementation of pictorial interfaces to information-retrieval systems. When a user of a computer system wishes to retrieve information from a database he often knows what he wants, but is unable to express his requirement in words or numbers. However, if he is presented with a sequence of pictures that encapsulate the UoD covered by the database he is interrogating, then he can — through an appropriate refinement dialogue — retrieve information relevant to his needs by means of simple menu-selection techniques via light pen, keyboard device or hand-print terminal.

In contrast to graphic interfaces to information systems which require the use of expensive interactive graphics equipment, the microcomputer/slide-projector technique offers an inexpensive solution which is useful where full interactive graphics capability or sophisticated animation techniques are not required.

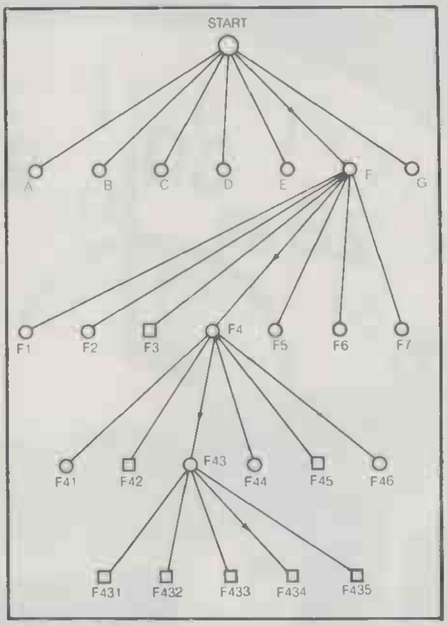

Figure 6. Hierarchical access path.

The structured top-down analytic decomposition of an entity into its component parts is an often-used technique — sometimes referred to in dynamic situations as homing-in. It is a well established method of proceeding in gradual steps from a general view of an object to a highly-magnified view of a specific part of that object.

For example, in an anatomy lecture the student might be presented with a slide showing a general view of the human body followed by a close-up of the head. This, in turn, may be followed by a slide showing a section of the human eye and then another depicting the detail of the optic nerve. Thus, in a series of four slides the student is taken from a very general view of the human anatomy to a highly specific view of one of its sub-components.

This principle and methodology can be used to significant advantage in the design of pictorial interfaces for information retrieval in a wide variety of contexts including computer assisted learning. The principle is illustrated conceptually in figure 5 which shows several refinement stages in an information-retrieval dialogue.

The rectangle on the left of each of the set of diagrams represents the screen used for the presentation of images produced by the slide projector while that on the right depicts the corresponding appearance of the text displayed on the CRT screen of the computer terminal or microcomputer. The topmost level represents the overall scope of the interface, or database contents, in terms of the sub-pictures, or scenes, A through G.

Selection of one of these sub-pictures — concept refinement — may be made either via light-pen interaction with the computer screen or by means of some form of keypad or hand-print terminal. Figure 5 shows selection of sub-picture F. A more detailed view of this component is now presented in terms of its sub-components — F1 through F7.

Restricted capacity

Further interaction and selection may then take place until the required information-bearing nodes of the hierarchical access path are encountered. These are shown as rectangles in the hierarchical tree-structure diagram which is presented in figure 6.

Unfortunately, the storage capability of the slide projector used in this example seriously limits the complexity of the access tree — breadth and depth — since only 80 nodes are available. This restriction could be removed by utilising further interchangable carousels, larger capacity magazines or microfiche as a storage medium.

An application of the principles outlined above has been described to Towne (1980). His system — called Aide for Automated Instruction Direction and Exercise — which has been used for training radar technicians depends upon random access to 125 images that are stored on 35mm. slides. This database contains only sufficient slides to test and evaluate the system. A more realistic database might contain about 1,000 images which vary widely in the amount of detail they contain.

References

Barker, PG and Jones, PS, Syntactic Definition and Parsing of Molecular Formulae, Part 2: Graphical Synthesis of Molecular Formulae for Data Base Queries. The Computer Journal. Volume 21, No. 3, 224-233, 1978.

Barker, PG and Yeates, H, Problems Associated with Multi-Media Data Base Systems, 331-344, Proceedings of the 10th Annual ASEE/IEEE Conference — Frontiers In Education, Houston, Texas, 20-22nd October 1980. Reprinted in the British Journal of Educational Technology, January 1981.

Barker, PG and Yeates, H, Teletext Systems — Courseware for a Multi-media Teaching System, Interactive Systems Group, April 1980.

Barker, PG, Experiments with a Light Pen and Hand Print Terminal Attachments for a Microcomputer. Interactive Systems Group Working Paper, 1981.

Stabletron Limited, 266 Hunts Pond Road, Titchfield Common, Fareham, Hampshire PO14 4PH. Stabletron Information Retrieval Systems and Opto-Mechanical Electronics, January 1980.

Stonebraker, MR and McDonald, N, CUPID — The Friendly Query Language, Paper presented at the 16th IFIP/IAG Data Base Workshop, Brussels, 14-17 December 1975.

Texas Instruments Limited, The TTL Data Book for Design Engineers, 4th Edition, Publication Number LCC4112, ISBN: 0-904047-27-X, 1980.

Towne, TN, The Automated Integration of Training and Aiding Information for the Operator/Technician, private communication, January 1980.

Yeates, H, Some Experiments in Man-Machine Interaction Relevant to Computer Assisted Learning, MSc Thesis, University of Durham, 1981.

INFORMATION TECHNOLOGY 82

Year of the data monster

Martin Hayman looks ahead to the coming year's efforts to educate the public in the ever-increasing applications of microelectronics.

"WE ARE ENTERING an exciting era; we are seeing the home of the future, the office of the future and the factory of the future emerge from the realms of science fiction and become reality". Thus Kenneth Baker, the Minister for Information Technology at the launch of Information Technology Year 82.

Difficult concepts

The fact that the future has arrived — a little behind schedule, but with the usual crew on board — will be dinned into even the deafest of ears during this year of information technology. Few will be able to avoid the sound of newly-enthused public servants singing the praises of awkward, ambivalent and slippery concepts such as "convergence". The humble telephone will appear pregnant with unknown possibilities, with its recently-conceived spawn of potential "information product".

Even the more traditionally-minded will not find their recreations undisturbed by the information monster. Young couples who fancy a day out examining cutlery, video-cassette recorders and Page Three models at the Ideal Home Exhibition; florid farmers looking forward to a day out at the County Show discussing the merits of breeds of fatstock and the vintages of claret; the bedizened ballet-goer and the benighted microcomputer enthusiast: all will find the message of IT Year 82 piggybacking what they think of as their own show, and soliciting their attention.

Information Technology is not an easy topic to sell. It is particularly difficult to sell awareness of information technology. It is a topic crammed with difficult concepts as well as some useful but easily-misunderstood products — is Space Invaders IT? Public opinion is divided on this question, say psephologists. It has some specific and cost-effective applications which many people feel may militate against the stability, familiarity and, in the long run, the quality of their lives.

Briefly, this is the outline of IT Year 82's aims:

- to increase familiarity among the general public of IT's uses and effects on learning, work and leisure;
- to promote its use in education, health and social services;
- to improve the efficiency of services provided by the public and private sectors of industry, commerce and administration by IT's use;
- to encourage automation in factories;
- to increase management's awareness of the services and products which can be bought in the home market.

This is a broad brief, broadly interpreted, and the means of achieving these aims are manifold, ranging from the cunning to the banal.

Though Kenneth Baker is seen as the Svengali of the whole operation, responsibility for IT Year is devolved on to a separate, limited company known as IT Year 82 Ltd chaired by Kenneth Barnes. This organisation co-ordinates the many activities which can be drawn together under the IT Year umbrella, and includes many projects funded by the Industry Department under schemes such as MAP.

Sample opinions

IT Year Ltd has a budget of £600,000, and much of its work consists simply of enthusing key figures to spread the word. It also has the task of sifting through the many projects received from individuals and small organisations, and endorsing them with the IT Year sticker.

The Industry Department itself has only limited funds for specifically IT Year 82 publicity. However, it is sending six trailers out on the road equipped with demonstration "office of the future" equipment. The Microtrain is funded from an existing budget for the Microprocessor Application Project.

There is, however, trouble in the DoI's camp. Its own prestige, all-British project, intended as an example to the rest of Whitehall and to industry, was to have been a 40-plus terminal GEC Viewdata system for internal information handling. But this showpiece has been blocked by the department's own civil servants, who insist that they will not use the new system until a suitable pay deal has been thrashed out.

Conveniently, pollsters MORI have surveyed a sample of the opinions of members of the public and professionals — in the form of the journalists attending the launch of IT Year 82 — on their hopes and fears for IT. The results are interesting. As you would expect, the vast majority of people who attended the launch wanted to know more about IT — more than twice as many as those drawn from the public. Two out of five of the public said they wanted to know more, two out of five said they didn't know; and one out of five said they didn't want to know.

Good for others

One of the most telling questions asked "Which of the following things do you think are likely to happen as a result of IT?". Here the professionals were at variance with the public. More than a third of the professionals thought that IT would increase unemployment — slightly higher than those in the public — 28 per cent — who thought it would do so.

As a very general proposition, it appears that people are, on the whole, convinced that IT is a Good Thing — for someone else. Industry will benefit, nobody doubts; its performance and profits will be improved. Their kids will learn with the help of IT, both at school and at home. But they fail, on the whole, to discern what benefits will specifically accrue to them in their own lives, particularly — and here I speculate — because they do not know what specific products or services will be of use to them.

Some of the people in IT Year are addressing themselves to this problem. John Dawson, for example, who is the head of the medical sub-committee, described to me a product known as the granny alarm. In the first place, this requires telephones to be installed in the homes of aged and infirm people, this is the basic IT link. The infirm person is then equipped with a small radio transmitter which includes an alarm which, if not cancelled, sends a call out to a central computer. The computer in turn makes three calls: one to a nominated relative, one to the next-door neighbour and one to the district nurse. This is basically easy stuff — not at the sharp edge, you might say. Yet this is the sort of project by which the public will be won round to IT.

Providing useful information and useful products that people can understand and make use of, and which will improve their communication with their fellows: this is the most important concern of IT Year 82. It is by no means an easy task, but it is one which, on first sight, is not being shirked.

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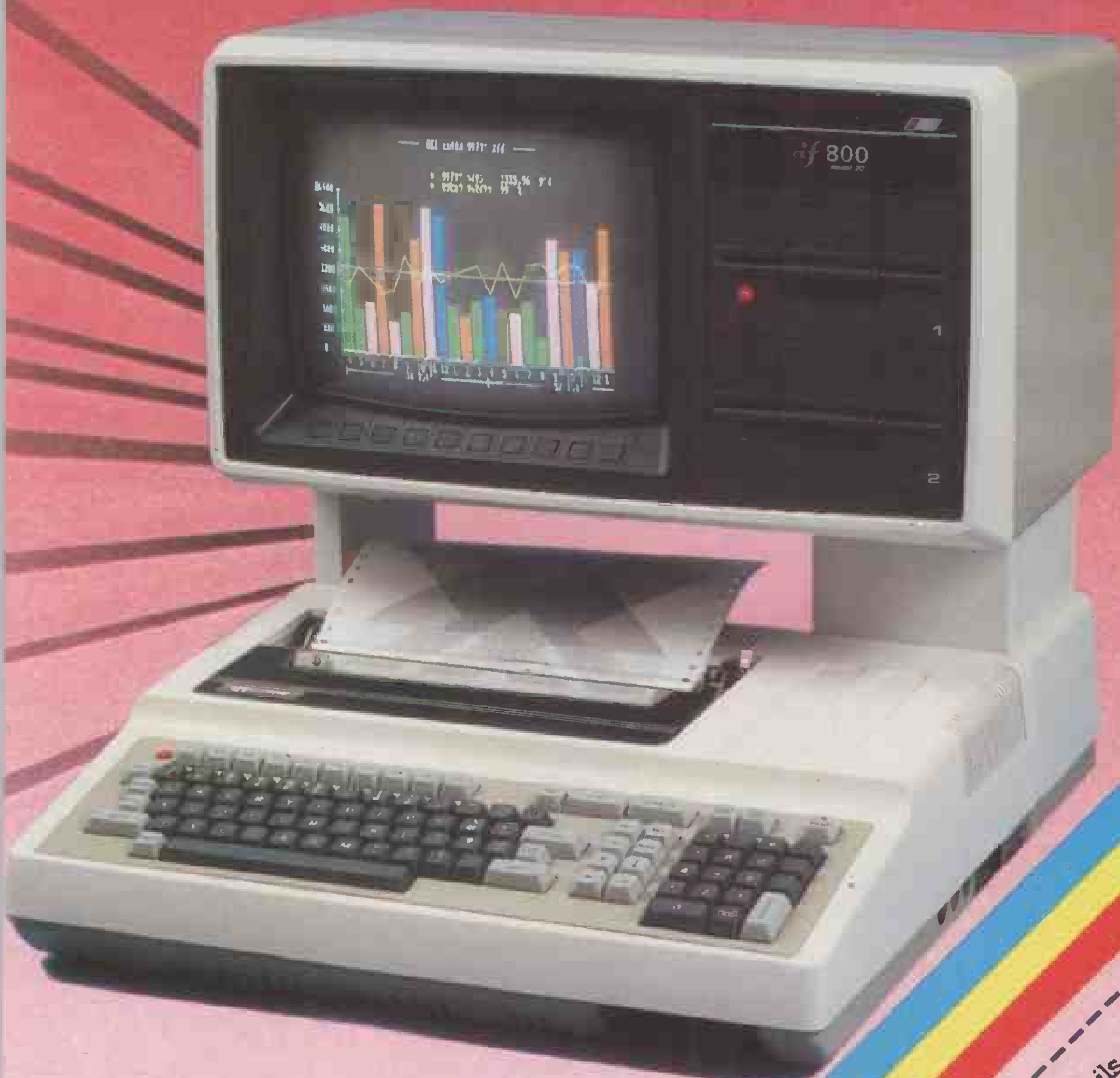

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School's workhorse ploughs new ground

When a primary-school headmaster discovered a Tandy TRS-80 in a Plymouth second-hand shop, he little suspected the impact it would make on his life or his pupils. David Ireland reports.

RAFFLES AND "name the doll" competitions are the staple ingredients of the fetes, bazaars, and fairs which dominate village life throughout the U.K. most weekends of the year. Normally, the event's organisers will call on the services of the town mayor, local MP or district celebrity to pull the winning number out of the hat, announce the correct name or present the prizes.

Impartial judge

Not so at this year's Autumn Fair at Gunnislake County Primary School in East Cornwall, where the impartiality of the judging could scarcely be challenged — the judge in question just happened to be a Tandy TRS-80 16K level 2 micro.

Gunnislake School, with some 75 pupils on its roll, is one of the many primary and secondary schools in Britain currently appreciating the value of micros as the ultimate in visual aids. For this Tandy is not just a mechanical toy adding a touch of novelty to the annual fair, but in fact a flexible workhorse already reaping dividends in teaching tables, improving reading speeds and providing an insight into the mysteries of musical notation.

The history of the school's Tandy goes back to the last AGM of the Parent-Teacher Association when headmaster Roy Olver was asked to produce an idea for the next fund-raising project. Since the school already owned a photocopier, a duplicator and a projector, Olver suggested — with tongue in cheek — "we could always do with a computer".

Tongue in cheek or not, the parents and teachers liked the idea, so headmaster Olver set about picking the brains of local computer experts, with a view to selecting a model appropriate to the school's needs. At the College of St Mark and St John in Plymouth, one of the 13 institutions researching the educational applications of micros, the computer team recommended Pets, Apples and in particular the 380-Z.

Roy Olver's fact-finding mission then took him to Plymouth Polytechnic to look at its Pets, and to Callington Comprehensive in East Cornwall, where he was given a useful introduction into computer lore and the potential of the 380-Z by the physics master, Mr Milne.

In schools of this size, though, where any item of hardware not provided by the educational authority is a luxury, cost is inevitably a limiting factor, and the 380-Z was frankly beyond the means of the PTA. However, the Hortons, parents with a child in the fourth year at the time, happened to run a second-hand shop in Plymouth, and it was by pure chance that Olver discovered a Tandy there looking for a new home.

The TRS-80 was officially acquired on February 12, but that was only the start of Roy Olver's troubles — or fun, depending on which way you look at it. For although Olver is a mathematician with a degree behind him, he admits he was "completely green" when he was confronted by the micro for the first time.

But nothing ventured, nothing gained, he made a return trip to Plymouth Polytechnic to borrow a book on Basic, and burnt the midnight oil studying the manuals which accompanied the Tandy. Fortunately, he was in the ironic position of being able to ask his sons for help with his homework — it was a family interest in computers which encouraged him to push for a micro in the first place.

Family enthusiasm

"I had seen one or two before, and if I had not got that experience behind me, I would not have gone ahead", Roy Olver admits. The family enthusiasm stems from one son, Mervyn, in the sixth form at Callington School, who is extremely keen on 380-Zs, and an elder son, Phillip, who is a full-time programmer working on minis with the South West Water Authority in Exeter.

In the early days, it was very much a case of finding his way, and Olver was glad to be able to call on the collective wisdom of the family. "When I've found myself in difficulties, I've asked my son

(continued on next page)

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when he returns home from Exeter", he explains.

While it is still somewhat hit and miss at this stage, Roy Olver is gradually growing used to the micro world, and thanks to his two sons, his reading and a mathematical background which helped with Basic, he has already designed some ambitious programs which have proved a godsend for pupils tackling the 3Rs.

A mathematics program asks random questions which test the pupils' knowledge of all their tables, or can test, for example, just the seven times table. This program includes an element of competition which works psychological wonders in encouraging pupils to rattle off multiplication sums.

Much more fun

The Tandy will first obtain the names of the two pupils taking part in the educational contest, and then establish how many questions are to be asked, and whether one table or any table up to 10 is to be tested. The micro will then fire a random question — the same question can recur only once every six times — and the pupil must key the correct answer.

If the answer is right, Tandy says "good" and awards one point to the pupil in question before handing over to the other competitor. If the answer is wrong, the Tandy lets the pupil have a further crack at the sum, before flashing a numerical display of grouped stars which enables the pupil to see visually the mechanics of the sum.

Nine-year-old Hilary Jury and Loveday Pope, 10, were level pegging on my visit, and according to Hilary: "It's much more fun learning like this".

Probably the next impressive program currently in the Gunnislake School repertoire is a faster reading exercise operating from level one to nine according to the time interval at which blocks of words appear on the screen. An interesting feature of this program is that a dot appears over the central letter of the word block, so that children learn to focus on related word groups, such as a subject, verb and object, instead of seeing the written page as a confusing jumble of individual and unconnected words.

Roy Olver reports that there was one pupil who was quite hesitant with her reading, and that it was surprising how much faster she became once she was let loose on the micro. A disadvantage of this program in the past was that the Tandy would print only upper case, so in the summer holiday, Olver made a trip to Plymouth to have a £30 modification carried out on the TRS-80, which will now print lower case, thus helping reading for infants.

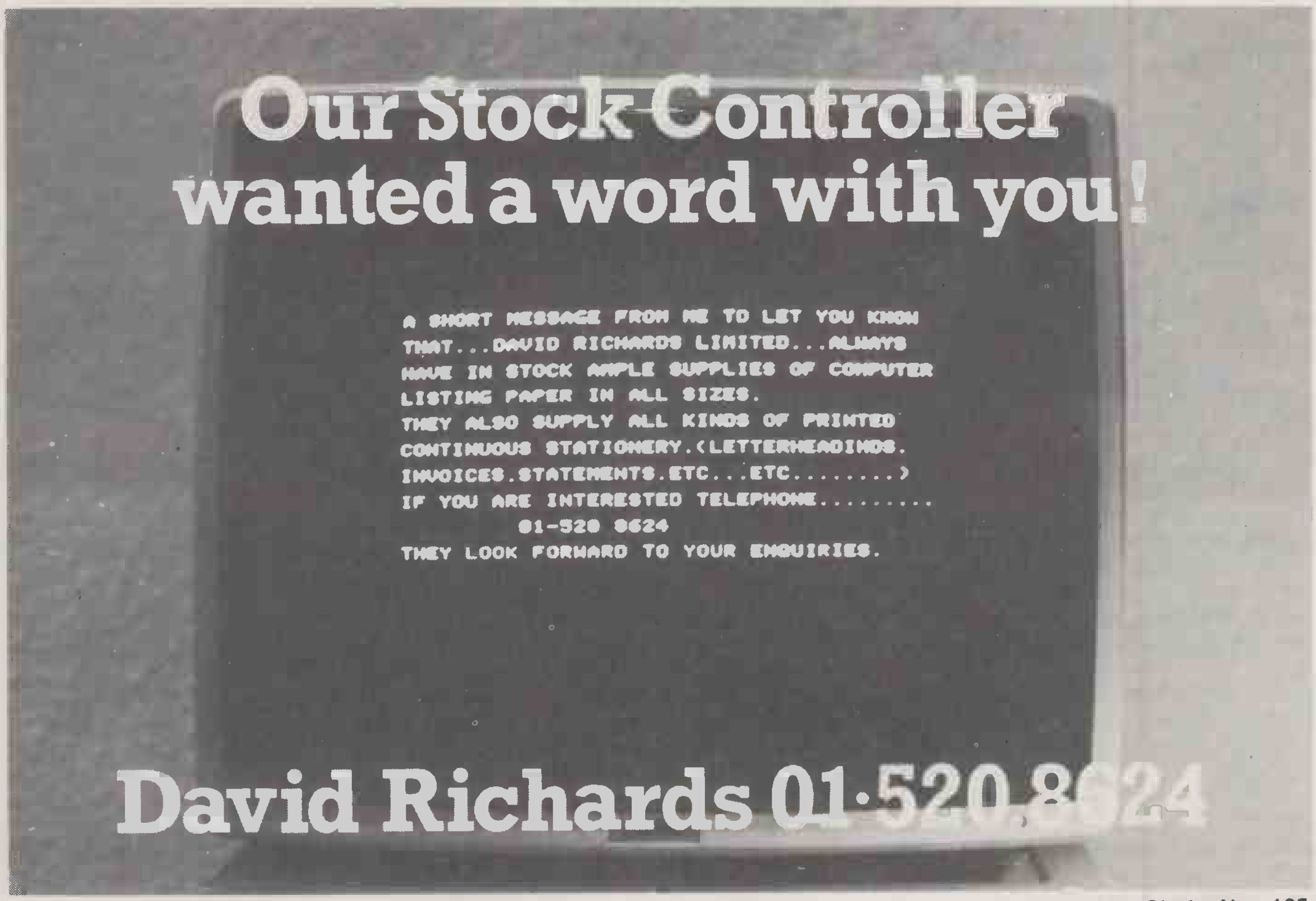
Another, perhaps end-of-term program, is the popular word game Hangman, and here the children have a glimpse of the human side of computers, for if the pupil guesses the word correctly, the Tandy will retort: "You have got away this time — I'll get you next time".

The potential of the school's Tandy is still largely untapped, but other programs used include fraction questions — where the pupil must supply the missing figure from two equivalent fractions — a guide to maximum and minimum temperatures, and an introduction to musical notation, where the notes are characterised bar by bar — the program does not proceed until the correct note value has been given.

Conflicting verdict

In view of the scope of the TRS-80, and its advertised claims to being the "best-selling computer of all time", Roy Olver is surprised that TRS-80s are not thicker on the ground in the educational field. In fact, at an Exeter conference held last Easter, there was not a TRS-80 in sight which led Olver and other Tandy enthusiasts to ask whether they could set up a TRS-80 corner.

Still, if the message from this rural village school reaches wider ears, the TRS-80 should be placed more firmly on the educational map. According to Roy Olver, a micro is "the kind of thing you get hooked on". His wife, something of a traditionalist, has a different verdict on this latest teaching aid. A "time waster" is her verdict of the Tandy TRS-80 16K level 2.



Unreliable Get

A PROBLEM developed when some of the file-handling routines on my Sharp MZ-80K appeared to give unreliable performance, writes George Hayter of Lancaster. This was traced to the unpredictable behaviour of Get statements which were apparently ignored randomly.

The fault was due to occasional appearances of a graphics character as a result of the Get command. If you run the following program:

```
10 FOR I=1 TO 5
20 GET R$:IF R$=""THEN 20
30 ?R$
40 NEXT I
```

the result is a single graphics character followed by the expected operation four times. It appears to be caused by the program looking at the keyboard before the CR key has been cleared.

For secure operation use:

```
20 GET R$: IF(R$="") OR (ASC(R$) = 102)
THEN 20
```

to overcome the trouble.

Sorcerer graphics

I AM ALWAYS amazed to see the quantity of published programs for Pet, Apple and TRS-80, while Sorcerer programs are relatively rare, writes Hans Middelbeek of Goirle, Netherlands. Sorcerer users must be far too busy working with their equipment to write down any of their experiences. Clearly the Sorcerer has possibilities not offered by other micros, and it would be useful to have a more regular exchange of programs.

The Sorcerer's high-resolution graphics and its capability of working in Z-80 machine language are two of the major advantages of the machine.

In order to make good use of the high-resolution graphic capabilities the programmer must first know the basic principle of the display. The Sorcerer has a memory-mapped display, so every position on the screen has its own address in RAM. With 64 characters per line and 30 lines in total there are 1,920 possible positions. An ASCII code can be entered into any of these addresses, causing the ASCII-coded character to appear on the corresponding position.

The first address of the screen memory is F080 hex. Hexadecimal addresses are difficult to use in Basic programs, and Sorcerer's manual states that every memory address exceeding 32767 decimal — 7FFF hex — must be written in twos-complement, so you have to subtract 65536 from the address. The address F080 therefore becomes −3968 in decimal notation.

The range of addresses for the display is 3968 decimal — F080H — to −2049 decimal — F7FFH. The following formula can be used to calculate a position anywhere on the screen:

$-3968 + X + 64*Y; (0 \leqslant X \leqslant 63, 0 \leqslant Y \leqslant 29)$

For this purpose try the program

```
10 INPUT "X, Y:"; X, Y
20 POKE (−3968 + X + 64 * Y), 42
```

which places an asterisk on the screen. In total 64 × 30 or 1920 positions are possible. For many purposes this degree of resolution is sufficient.

The high-resolution graphics program is written in machine language. It might be difficult for users to understand, so its function is first explained in Basic.

If one of the display addresses contains, for example, the number 41 — "A" — then the computer checks the ASCII character memory, starting at F800 hex or −2048, to discover how this character has to be displayed. Every character is defined by eight bytes in the memory, which is split up in two parts:

- a fixed, ROM-based part, containing the information for 128 standard ASCII characters.
- a programmable, RAM-based part which can be used for the programmable characters; half of this memory is filled at restart with Sorcerer-selected graphics.

The graphics program is not concerned with the first part as the contents are changed. However, the second part, which starts at FC00 hex, or −1024, offers the possibility of programming 128 user-defined characters. Character 128 is defined by the eight bytes starting with FC00. The first byte defines how the upper row of the character will look, the second byte defines the second row, and so on.

If this first byte is zero the row is dark; 255 defines a continuous bright row, and 1 gives a bright dot on the top right of the character.

For a clearer insight, try the following program:

```
10 FOR X=0 TO 7
20 POKE −1024 + X,2.^X
30 NEXT
40 POKE −3968, 128
```

(continued on next page)

Sorcerer machine code.

```
F5                PUSH AF          ;
C5                PUSH BC          ;
D5                PUSH DE          ;
E5                PUSH HL          ;
ED 5B BE 01       LD DE,(01BE)     ; THIS
2A C0 01          LD HL,(01C0)     ; SHORT
3E 00             LD A,0           ; PART
32 C1 01          LD (01C1),A      ; TO
CB 22             SLA D            ;DECODE
CB 15             RL L             ;THE
CB 14             RL H             ;USR
CB 22             SLA D            ;FUNCTION
CB 15             RL L             ;CALLS
CB 14             RL H             ;X AND Y POSITION
30 05             JR NC,LOW-$      ;X MORE THAN 255?
3E 01             LD A,1           ; YES
32 C1 01          LD (01C1),A      ; SAY SO IN 01C1
7C            LOW LD A,H           ;
32 C0 01          LD (01C0),A      ;X MOD (256) IN 01C0
7D                LD A,L           ;Y IN A
32 BF 01          LD (01BF),A      ;Y IN01BF
2A C0 01          LD HL,01C0       ;X IN HL
CB 3C             SRL H            ;START
CB 1D             RR L             ; CALCULATION
CB 3D             SRL L            ; OF
CB 3D             SRL L            ; INT (X/8)
E5                PUSH HL          ; SAVE ON STACK
E6 F8             AND F8           ;8*INT(Y/8) IN A REG
6F                LD L,A           ;
26 00             LD H,0           ; NOW IN HL
29                ADD HL,HL        ; MULTIPLY
29                ADD HL,HL        ; BY 8
29                ADD HL,HL        ; 64*(INT(Y/8)) IN HL
01 80 F0          LD BC,F080       ;1st SCREEN ADDRESS
09                ADD HL,BC        ;
C1                POP BC           ;
06 00             LD B,0           ;
09                ADD HL,BC        ; SCREEN ADDRESS IN HL
CB 7E             BIT 7,(HL)       ; ALREADY GRAPHIC?
20 14             JR NZ,OLDCH-$    ; JUMP IF SO
3A 00 00          LD A,(0000)      ; LAST USED CHAR
3C                INC A            ;+1
CB 7F             BIT 7,A          ; TOO MUCH CHAR?
20 3B             JR NZ,END-$      ; RET IF SO
32 00 00          LD (0000),A      ;RESTORE
16 7F             LD D,7F          ;
82                ADD A,D          ;CH+127
77                LD(HL) ,A        ;CHAR ON SCREEN
2A 00 00          LD HL,(0000)     ;CHAR NR IN HL
18 05             JR CONT-$        ;
7E          OLDCH LD A,(HL)        ; RESTORE CHAR ON SCREEN
06 7F             LD B, 7F         ;
90                SUB A,B          ;CORRECT
6F                LD L,A           ;
26 00        CONT LD H,0           ;
2B                DEC HL           ;CH-1
29                ADD HL,HL        ;MULTIPLY
29                ADD HL,HL        ; BY 8
29                ADD HL,HL        ;8*(CH-1)
EB                EX DE,HL         ;IN DE
3A BF 01          LD A,(01BF)      ;Y IN A
E6 07             AND 07           ;8*(Y/8-INT(Y/8)) IN A
21 00 FC          LD HL,FC00       ;1st ADDR CHAR MEM.
4F                LD C,A           ;
06 00             LD B,0           ;
09                ADD HL,BC        ; CALC ADDRESS
19                ADD HL,DE        ; IN CHAR MEMORY
3A C0 01          LD A,(01C0)      ;X MOD(256) IN A
E6 07             AND 07           ;8*(X/8-INT(X/8)) IN A
A7                AND A            ;ZERO ?
28 09             JR Z,FSTB-$      ; YES JUMP
0E 40             LD C,40          ;
3D           LOOP DEC A            ;SEARCH BIT
28 06             JR Z,LOAD-$      ; JUMP IF READY
CB 39             SRL,C            ; ADJUST BIT
18 F9             JR LOOP-$        ;NEXT
0E 80        FSTB LD C,80          ; ADJUST FIRST BIT
7E           LOAD LD A,(HL)        ;RESTORE CHAR
B1                OR C             ;PLACE PIXEL
77                LD (HL),A        ; IN CHAR MEMORY
E1            END POP HL           ;
D1                POP DE           ;
C1                POP BC           ;
F1                POP AF           ;
C9                RET              ;
```

(continued from previous page)

It enters the following numbers in memory: 1, 2, 4, 8, 16, 32, 64, 128, giving the character "/". Every position on the screen can have 8 × 8, or 64, different white spots. The 1,920 screen positions provide 1,920 × 64, or 122,880, different positions for a white spot.

In practice, the availability of only 128 programmable characters limits the number of dots which can be used. However, it is still possible to make very high-precision graphics, which can be shown with the program in listing 1.

The most important line in this program is 1040. It is assumed that point (0,0) lies in the upper left of the screen; (511, 239) is the lower right position. "1" in the character memory corresponds with a "blob" on the right side of the character; 128 on the left side. A "2" corresponds with a single blob, transposed one position to the left, and "3" corresponds to two brightened pixels on the right side. However, if a power function is used, the "3" can be made to correspond with the third position from the right. A simple power function would generate a bright pixel at position 7 from a "1" stored in memory, but the function used in line 1040 corrects this anomaly.

This program does have some drawbacks, and in some cases it even causes problems — think about the Peek (AD). It is only used to explain the way of thinking for the final machine-language routine. For this purpose the USR function, which is not defined in the two manuals, should be examined. A = USR (X) offers three special features:

- USR makes a call to memory location 0103 hex. This address, and the following two, contains C3E5C7 — JPC7E5 — meaning: make a jump to address C7E5. At this address the computer is ordered to print "FC Error". If the contents of location 0104 and 0105 hex are moved into the starting address of the machine-language routine, the program will jump to this by simply stating A = USR (0). To change these memory contents, we have to make the following Pokes:

  POKE 260, 16: POKE 261, 0

  260 is equivalent to 0104 hex, 16 is equivalent to 10 hex. Address HHLL is stated in memory as LL HH, so Poking 16 in address 260 takes care that a jump is made to address 0010 hex whenever the USR function is stated.
- The second feature is that A = USR (X) places the value of X in a floating-point notation in the four bytes starting with 0447 or 01BF hex.
- The third feature is that the value in the four bytes starting with 0447 will be assigned to A, for example the result of the machine-language routine.

Sorcerer graphics — listing 1.

```
10      PRINT CHR$ (12)
20      FOR A = -1024 TO -1: POKE A,0 : NEXT : REM CLEARS  CHAR. MEM
30      FOR X = 0 TO 511   : REM 0< = X < = 511, 0< = Y<=239
40      Y = INT (120 + 30 * SIN (X/10))
50      GOSUB 1000
60      NEXT X
1000    SP = -3968 + INT (X/8) + 64 * INT (Y/8) : REM SCREEN POSITION
1010    IF SP <> OP THEN CH = CH + 1: REM SAME AS PREVIOUS POS?
1020    IF SP>-2048 OR SP< -3968 THEN RETURN: REM OUT OF RANGE?
1030    AD = -1024 + (Y/ - INT Y/8)) * 8 + 8 * (CH-1): REM ADDR IN CHAR
        MEM
1040    POKE AD, (2**(7-8 *(X/8 - INT (X/8)) + PEEK (AD))): REM PLACE
        DOT NOTE ** MEANS RAISE TO POWER OF.
1050    POKE SP, (CH + 127): REM PLACE NEW CHAR ON SCREEN
1060    OP = SP: REM PREVIOUS POS IS SET
1070    RETURN
```

Listing 2.

```
5      ?CHR$(12)
10     FOR A=-1024 TO 0:POKE A,0:NEXT
:
   :       GOSUB 10000
10000 REM A CALL IS MADE TO THE PLOT SUBR. IN MACHINE LANGUAGE
10010 POKE 260,0:POKE 261,48:REM IF ROUTINE STARTS AT 300H
10020 NTUS=USR(131072+256*INT(X)+INT(Y))
10030 RETURN
```

Listing 3.

```
5       DEF FNDOT(A)= USR (131072+256*INT(X)+INT(Y))
10      ? CHR$(12)
20      FOR A=-1024 TO 0 : POKE A,0 : NEXT
30      INPUT "X1,Y1,X2,Y2";X1,Y1,X2,Y2
40      DX=X2-X1:DY=Y2-Y1:IF ABS(DX)>ABS(DY) THEN 80
50      FOR X=X1 TO X2 STEP SGN(DX)
60      Y=(DY/DX)*(X-X1)+Y1: GOSUB 10000
70      NEXT X: GOTO 30
80      FOR Y=Y1 TO Y2 STEP SGN(DY)
90      X=(DX/DY)*(Y-Y1)+X1: GOSUB 10000
100     NEXT Y : GOTO 30
10000   POKE 260,0:POKE 261,48:REM ROUTINE STARTS AT 3000H
10010   NTUS=FNDOT(A)
10020   RETURN
```

A floating point number in Sorcerer Standard Basic will be stored in four bytes according to the following format:

EE	MM MM MM
exponent + 128	mantissa + sign

In order to be able to store both X and Y values of one graphics point in one floating-point number, I chose for the following set-up:

EE 1xxx xxxx xx	yy yyyy yy 00 0000
9 bits for X value	8 bits for Y value

To make things easy for reverse transformation of X and Y values, 131,072 — 2^{17} — is added to

INT (Y) + 256 * INT (X)

In this case the X value is to be found between the sixth bit of byte 2 and the sixth bit of byte 3. The Y value then is located between the fifth bit of byte 3 and the sixth bit of byte 4 of the floating-point notation. The Basic part of the program is shown in listing 2.

As the machine-language routine is written with only relative jumps, it is possible to place it in every free memory you wish. Only location 0 is used by the program to store the last used character.

These programs can act like a DOT(x,y) statement in other computers. A very interesting statement would be

DRAW (x1,y1,x2,y2).

For this purpose you can use the Basic program shown in listing 3, which can also be used as a subroutine.

Printer interface

HAVING RECENTLY purchased a Seikosha GP-80 printer, I connected it to my Video Genie via an EG-3016 parallel printer interface, writes Colin Hogben of Folkestone, Kent. Although it worked well from Basic and with the Kansas system master monitor, it did not respond to the TRS-80 editor-assembler.

I eventually discovered that while EDTASM tries to talk to the printer through the memory-mapped location 37E8, the EG-3016 only communicates with I/O port FD. These changes will allow the printer to be used.

The changes to stop the printer double-spacing its lines when using the Disassembler function of the Kansas system master monitor are also shown.

Changes for printer.

Old

```
45CA   32  E8  37   LD (37E8H),A
45D8   32  E8  37   LD (37E8H),A
45EE   3A  E8  37   LD A,(37E8H)
```

New.

```
D3 FD 00 OUT (0FDH),A
D3 FD 00 OUT (0FDH),A
DB FD 00 IN A,(0FDH)
```

Changes for double-space suppression.

Old

```
7968   7E      "    LD     A,(HL)
7969   E5      .    PUSH HL
796A   CD3B00  .;.  CALL 003BH
796D   E1      .    POP HL
796E   7E      "    LD A,(HL)
796F   FE0D    ..   CP 0DH
7971   C8      .    RET Z
7972   23      #    INC  HL
7973   18F3    ..   JR   7968H
```

New.

```
7968   7E      "    LD     A,(HL)
7969   FE0D    ..   CP     0DH
796B   C8      .    RET    Z
796C   E5      .    PUSH HL
796D   CD3B00  .;.  CALL 003BH
7970   E1      .    POP  HL
7971   00      .    NOP
7972   23      #    INC  HL
7973   18F3    ..   JR   7968H
```

● Circle No. 166▶

ingenious!

. . that's the only word to really describe the superb Genie microcomputer system, the home computer which is compatible with the TRS 80, and ideal for all micro-enthusiasts, especially the committed hobbyist.
Genie has now been upgraded to Genie I, incorporating all of the original, excellent features, but with the addition of:

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- An internal SOUND UNIT to add a new dimension to your own programs.
- A MACHINE LANGUAGE MONITOR, with Display, modify, enter and execute (with break points) facilities.

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Now, a choice of 2 monitors giving a clear easy to read image. The updated EG101 has a new green phospher tube.

New!...Expander

An updated Expansion Box (EG 3014) is a major feature of the new Genie I system, and unleashes all its possibilities, allowing for up to 4 disk drives with optional double density. It connects to a printer, or RS232 interface or S100 cards. There is 16k RAM fitted and it has a new low price!

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The EG 602 printer can be connected to the Genie either through the expander or directly into the computer using the Parallel Printer Interface. It is a compact unit, with an 80 column, 5 x 7 matrix print-out, operating quietly and efficiently at 30 characters per second.

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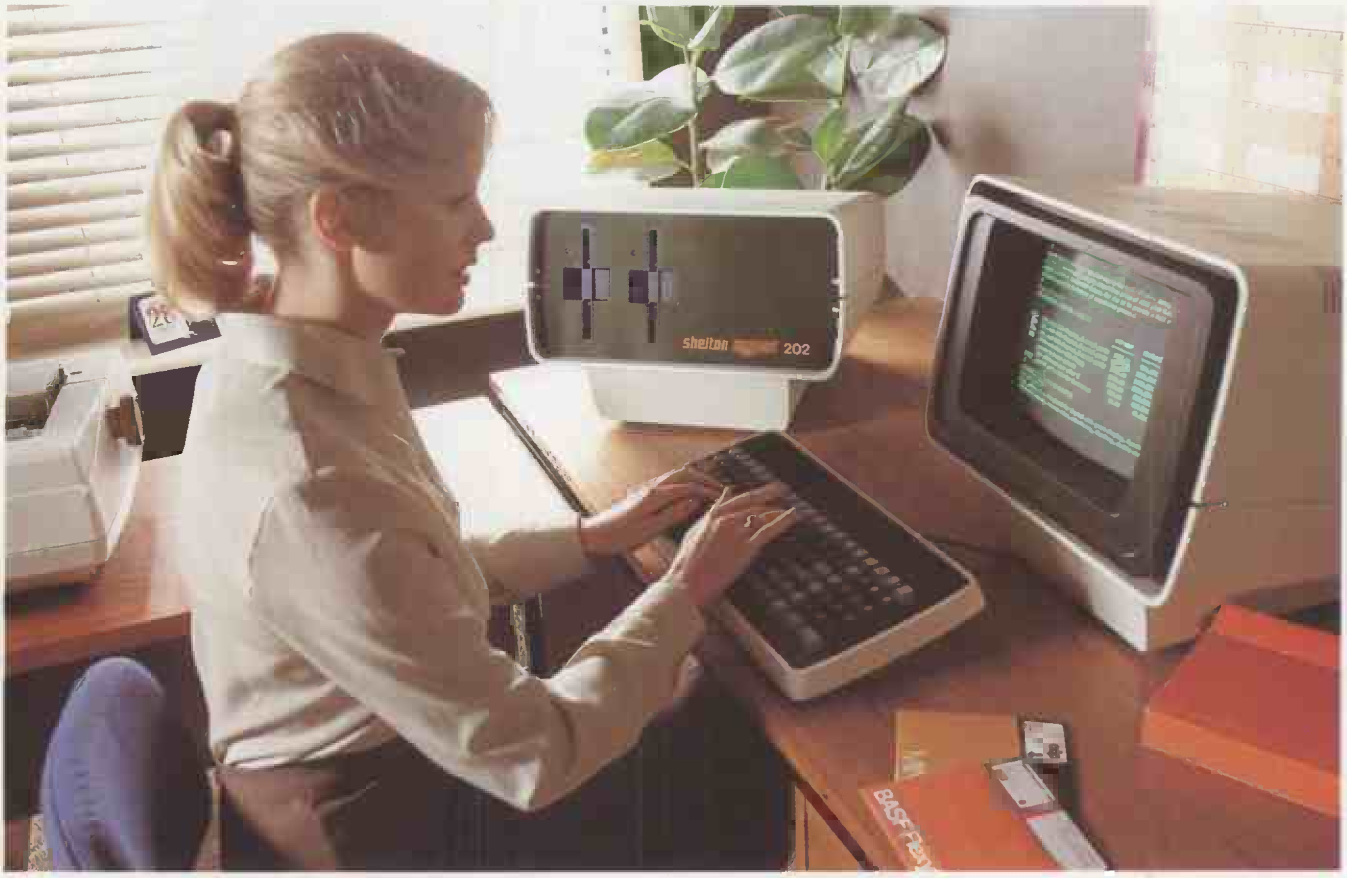

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Each cassette costs £3.95 (including VAT and p&p) and comes complete with full instructions.

Although primarily designed for the Sinclair ZX81, many of the cassettes are suitable for running on a Sinclair ZX80 – if fitted with a replacement 8K BASIC ROM.

Some of the more elaborate programs can be run only on a Sinclair ZX Personal Computer augmented by a 16K-byte add-on RAM pack.

This RAM pack and the replacement ROM are described below. And the description of each cassette makes it clear what hardware is required.

8K BASIC ROM

The 8K BASIC ROM used in the ZX81 is available to ZX80 owners as a drop-in replacement chip. With the exception of animated graphics, all the advanced features of the ZX81 are now available on a ZX80 – including the ability to run much of the Sinclair ZX Software.

The ROM chip comes with a new keyboard template, which can be overlaid on the existing keyboard in minutes, and a new operating manual.

16K-BYTE RAM pack

The 16K-byte RAM pack provides 16-times more memory in one complete module. Compatible with the ZX81 *and* the ZX80, it can be used for program storage or as a database.

The RAM pack simply plugs into the existing expansion port on the rear of a Sinclair ZX Personal Computer.

Cassette 1 – Games

For ZX81 (and ZX80 with 8K BASIC ROM)

ORBIT – your space craft's mission is to pick up a very valuable cargo that's in orbit around a star.

SNIPER – you're surrounded by 40 of the enemy. How quickly can you spot and shoot them when they appear?

METEORS – your starship is cruising through space when you meet a meteor storm. How long can you dodge the deadly danger?

LIFE – J. H. Conway's 'Game of Life' has achieved tremendous popularity in the computing world. Study the life, death and evolution patterns of cells.

WOLFPACK – your naval destroyer is on a submarine hunt. The depth charges are armed, but must be fired with precision.

GOLF – what's your handicap? It's a tricky course but you control the strength of your shots.

Cassette 2 – Junior Education: 7-11-year-olds

For ZX81 with 16K RAM pack

CRASH – simple addition – with the added attraction of a car crash if you get it wrong.

MULTIPLY – long multiplication with five levels of difficulty. If the answer's wrong – the solution is explained.

TRAIN – multiplication tests against the computer. The winner's train reaches the station first.

FRACTIONS – fractions explained at three levels of difficulty. A ten-question test completes the program.

ADDSUB – addition and subtraction with three levels of difficulty. Again, wrong answers are followed by an explanation.

DIVISION – with five levels of difficulty. Mistakes are explained graphically, and a running score is displayed.

SPELLING – up to 500 words over five levels of difficulty. You can even change the words yourself.

Cassette 3 – Business and Household

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack

TELEPHONE – set up your own computerised telephone directory and address book. Changes, additions and deletions of up to 50 entries are easy.

NOTE PAD – a powerful, easy-to-run system for storing and retrieving everyday information. Use it as a diary, a catalogue, a reminder system, or a directory.

BANK ACCOUNT – a sophisticated financial recording system with comprehensive documentation. Use it at home to keep track of 'where the money goes,' and at work for expenses, departmental budgets, etc.

Cassette 4 – Games

For ZX81 (and ZX80 with 8K BASIC ROM) and 16K RAM pack

LUNAR LANDING – bring the lunar module down from orbit to a soft landing. You control attitude and orbital direction – but watch the fuel gauge! The screen displays your flight status – digitally and graphically.

TWENTYONE – a dice version of Blackjack.

COMBAT – you're on a suicide space mission. You have only 12 missiles but the aliens have unlimited strength. Can you take 12 of them with you?

SUBSTRIKE – on patrol, your frigate detects a pack of 10 enemy subs. Can you depth-charge them before they torpedo you?

CODEBREAKER – the computer thinks of a 4-digit number which you have to guess in up to 10 tries. The logical approach is best!

MAYDAY – in answer to a distress call, you've narrowed down the search area to 343 cubic kilometers of deep space. Can you find the astronaut before his life-support system fails in 10 hours time?

Cassette 5 – Junior Education: 9-11-year-olds

For ZX81 (and ZX80 with 8K BASIC ROM)

MATHS – tests arithmetic with three levels of difficulty, and gives your score out of 10.

BALANCE – tests understanding of levers/fulcrum theory with a series of graphic examples.

VOLUMES – 'yes' or 'no' answers from the computer to a series of cube volume calculations.

AVERAGES – what's the average height of your class? The average shoe size of your family? The average pocket money of your friends? The computer plots a bar chart, and distinguishes MEAN from MEDIAN.

BASES – convert from decimal (base 10) to other bases of your choice in the range 2 to 9.

TEMP – Volumes, temperatures – and their combinations.

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This dual high-resolution graphic ability is especially useful for simulating and displaying a dynamic picture. It can display 40 characters x 25 lines or 80 characters x 25 lines via software switching.

In addition there are facilities for full, on-screen editing, reverse video, partial scrolling and a full range of graphic symbols.

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This fast, quiet printer will reproduce your graphic displays and, of course, print-out upper and lower case letters and symbols. A tractor/friction feed version is also available.

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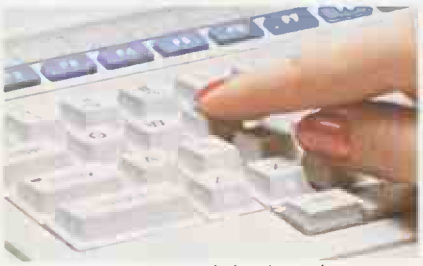
The MZ80B has a remarkable memory. 64K of RAM. And that constitutes all the memory area, giving flexible storage of any computer language and its software. The cassette deck is electromagnetically-controlled, with a data transfer speed of 1800 bits/sec combined with a unique programme search facility to make data storage and retrieval super-fast.



A typewriter-style keyboard incorporates characters and symbols plus a numeric key-pad and ten user-definable keys for fast and simple operation.

BASIC is, of course, provided with Z-80 Assembler Packages, PASCAL and a BASIC compiler.

Floppy Disk Drive.

A twin Floppy Disk Drive unit can be added which will give you 560 bytes of storage on double-sided, double-density disks.

Comprehensive Documentation.

Each MZ80B comes complete with a full set of documentation including an owners' manual giving full circuit diagrams, a monitor reference manual and programming manuals.

Interfaces

RS-232C and IEEE Interfaces are available from January 1982 allowing the MZ80B to communicate with scientific instruments and other peripherals.

CP/M*2.2

CP/M* is also available making a wide range of packages immediately available including wordprocessing, financial modelling, data base management to mention but a few. CP/M* also increases the disk capacity to 680K.

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Scrolling data

IF CONT upsets you when your ZX-81 screen is full then this simple method will produce scrolling data, writes R Hilditch of Bo'ness, West Lothian.

By Peeking location 16422, the line number of the print position can be determined. The top of the screen is line 24 and the bottom line 3, leaving two spaces at the bottom for editing. Hence if line 1 in any program is Scroll, then thereafter a simple,

```
IF PEEK (16422) <= 4 THEN SCROLL
```

will produce scrolling data from the bottom.

As a demonstration try:

```
 1 SCROLL
10 LET A$ = "123456789"
20 FOR X = 1 to LEN A$
30 PRINT A$ (X TO LEN A$)
40 IF PEEK (16442) <=4 THEN SCROLL
50 NEXT X
60 GO TO 20
```

Defective-ROM routine

THIS SUBROUTINE was written to circumvent the LN, SQR and ** functions on the ZX-81 keyboard and it may be helpful to users who are waiting for Sinclair to provide a replacement for the defective 8K ROM, explains R G Taylor of Portsmouth, Hampshire.

The algorithm used is based on the standard expression for the natural logarithm of a variable x:

$$\ln(x)=2\left(\frac{(x-1)}{(x+1)}+\frac{1}{3}\frac{(x-1)^3}{(x+1)}+\frac{1}{5}\frac{(x-1)^5}{(x+1)}+\ldots\ldots\right)$$

Listing 1 — LN subroutine.

```
9000  REM LN SUBROUTINE
9010  IF X > 0 THEN GOTO 9040
9020  PRINT "NEGATIVE OR ZERO ARGUMENT FOR LN"
9030  STOP
9040  LET SM=0
9050  LET A=(X-1)/(X+1)
9060  LET B=A*A
9070  LET LT=A*B/3
9080  LET SM=A+LT
9090  FOR I=5 STEP 2
9100  LET LT=LT*(I-2)/I
9110  LET SM=SM+LT
9120  IF ABS(LT) < 1.0E-9 THEN GOTO 9140
9130  NEXT I
9140  RETURN
```

ROM tester

```
1  LET N=1
2  LET A=0.5/N
3  LET B=LN(A)
4  LET B=EXP(B)
10 PRINT A,B
20 LET N=N*2
30 IF N>131072 THEN GOTO 50
40 GOTO 2
50 STOP
```

A check is first made to ensure that the LN argument is positive, an error message being output if it is not. Lines 9040 to 9080 are initialisation to set up values for the iteration to be carried out by the For-Next loop in lines 9090 to 9130. This loop calculates the higher-order terms of the series in turn and forms the current sum. A check is made on the magnitude of the latest term LT and the summation is terminated by exit from the loop when LT becomes smaller than the limit specified in line 9120.

The series converges monotonically for positive x, that is, successive terms are always smaller than the previous term and, in theory, approach but never reach a value of zero. In practice, computers have a finite word length and a constant — zero — value is reached at some point. This condition is the criterion for terminating the series for x <1.

Some ZX-81s are different, as those who have a faulty ROM can demonstrate by altering the inequality in line 9120. As the program stands, a value of x=0.125 produces a logarithm of —2.0794 and an antilog of 0.125, which is correct. Changing the condition to

. . . <1.0 E-10

produces the incorrect result:

x=0.125; ln=1.9205; antilog= 6.8247.

This is also the result obtained from the keyboard function. The changeover from right to wrong occurs at about 2.3283 E−10.

SQR and ** functions are obtained from the relationship

$$y = n*\ln(x)$$

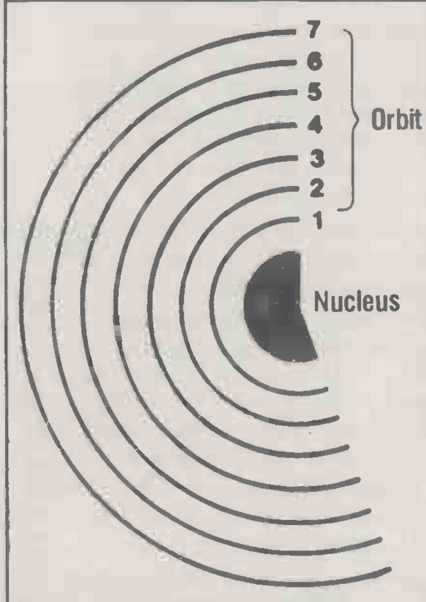
where n takes the value 1/2 as a special case of ** for SQR.

The way to find out if a ZX-81 has a faulty ROM has not been too clearly described, and some users may be in doubt as to which type they have. The short program in listing 2 is a good test.

It calculates the log of a number sequence and prints out the numbers with the corresponding antilog — which ought to be the same, or virtually so. If it is not then the ROM is clearly faulty. My favourite is 2.4414E—4— 1/4,096 — which, after LN/EXP, is thought by my ZX-81 to be 2,169.46.

Atomic orbitals

IN PHYSICS and chemistry examination courses there is an area of overlap in the section relating to the arrangement of electrons, protons and neutrons within the 92 natural elements, writes Brian Smith of Keighley, West Yorkshire. This is usually taught by drawing the electronic configurations on the blackboard or by prepared overhead-projection transparencies.



Electron orbits.

It is only possible to draw up to the first 30 elements using these methods, due to the number of electrons to draw in. It is possible to construct displays using switches, but due to the complexity of the higher elements this would involve complex switching. The display itself would be so large as to prevent easy movement from laboratory to laboratory. The problem is to plot one to 92 electrons in a specific order in specific circular orbits and to plot the relevant number of protons and neutrons in the nucleus so that they are large enough to see and yet remain portable. This is a job the micro is easily capable of coping with.

Every atom has a central portion called the nucleus, which contains the neutrons and protons. Orbiting around the nucleus are the electrons, which revolve in a number of orbits, or shells, labelled 1 to 7.

Each of these orbits can only hold a specific number of electrons. To add to the problem, they are also divided up further. Each division can only hold so many electrons.

Orbit	1	2	3	4	5	6	7	Number of electrons
Suborbit	s	s	s	s	s	s	s	2
		p	p	p	p	p		6
			d	d	d	d		10
				f	f			14

To thoroughly confuse the issue, the orbitals do not fill up sequentially as you might expect. The order of filling the orbitals is: 1s, 2s, 2p, 3s, 3p, 4s, 4p, 5s, 4d, 5p, 6s, 4f, 5d, 6p, 7s, 5f, 6d, 7p. However, when one of the orbitals is nearly full, an electron can drop into that orbital from an outer one to fill it so as to increase the stability of the atom since full and half-full orbitals are very stable.

The number of electrons, protons and neutrons for each element is determined by the element's atomic number and atomic mass. For example, carbon has an atomic mass of 12 and an atomic number of six. The number of protons and electrons is equal to the atomic number and the number of neutrons is equal to the atomic mass minus the atomic number. In the case of carbon the number of neutrons is six, the number of protons is six and the number of electrons is six. The standard way of writing the element with

(continued on page 119)

Atomic orbitals.

```
1     REM ATOMIC STRUCTURE ZX81
2     REM COPYRIGHT B.P.SMITH 1981
10    LET X$= "3G93039GJG9DHKNNKH9ED962E
      /;.2EHLNQRT9FTTSNKHD99FJNPRUWTXW2/
      +<>>W>+/,14WWUSFMJT5XXT>$<$SSZ#0-"
20     LET Y$="--20-?$?-08763,>#DDDAEADD
       >,36DB9752,FF->$E5722FFDB974,C6-7
       ES$>--,57ACD->#A571C@6D77DC6I9--1
       5"
30    CLS
40    FOR Y=1 TO 7
50    PRINT TAB 10;"ATOMIC STRUCTURE"
60    NEXT Y
70    PRINT
80    PAUSE 250
81    POKE 16437,255
90    PRINT "THIS PROGRAM SLOWLY BUILDS
      UP"
95    PRINT
100   PRINT "THE ATOMIC STRUCTURE OF ALL"
105   PRINT
110   PRINT "ATOMS FROM HYDROGEN TO
      URANIUM"
115   PRINT
120   PRINT TAB 5;"PRESS KEY ""S"" TO
      START"
123   PAUSE 1000
126   POKE 16437,255
130   IF INKEY$<>"S"THEN GOTO 120
140   CLS
185   FOR X= 1 TO 92
190   PRINT AT 0,0;N$(X)
200   PRINT AT 2,3 - LEN ( STR$ M(X));M(X
210   PRINT AT 3,3;S$(X)
220   PRINT AT 4,3-LEN(STR$X);X
310   PLOT CODE X$(X),CODE Y$(X)
320   IF X=24 THEN PLOT 27,12
330   IF X=24 THEN UNPLOT 42,41
340   IF X=29 THEN PLOT 34,35
350   IF X=29 THEN UNPLOT 42,41
360   IF X=41 THE PLOT 54,10
370   IF X=41 THEN UNPLOT 43,43
380   IF X=46 THEN PLOT 34,2
390   IF X=46 THEN UNPLOT 37,43
400   IF X=58 THEN PLOT 27,5
410   IF X=58 THEN UNPLOT 60,22
420   IF X=65 THEN PLOT 19,30
430   IF X=65 THEN UNPLOT 60,22
440   IF X=77 THEN PLOT 42,0
450   IF X=77 THEN PLOT 37,0
460   IF X=77 THEN UNPLOT 57,40
470   IF X=77 THEN UNPLOT 61,34
480   IF X=91 THEN PLOT 25,3
490   IF X=91 THEN UNPLOT 12,22
500   PRINT AT 10,17;M(X) - X;"N"
510   PRINT AT 11,17;X;"P"
520   PAUSE 3000
521   POKE 16437,255
530   NEXT X
540   PAUSE 5000
541   POKE 16437,255
550   GOTO 1
5000 DIM S$ (92,2)
5010 DIM N$(92,13)
5020 DIM M (92)
5030 PRINT AT 20,0; "NAME@@@@@@@@@ SY @
     MASS
5040 FOR X=1 TO 92
5050 INPUT N$(X)
5060 PRINT N$(X);
5070 INPUT S$(X)
5080 PRINT S$ (X); "@";
5090 INPUT M (X)
5100 PRINT M(X)
5110 SCROLL
5120 NEXT X
5130 STOP
5140 SAVE "ATOMIC STRUC"
5150 GOTO 1
```

Key underlining — graphics on key shown

@ — space

 # — £

(continued from page 117)
its atomic number and atomic mass is as follows $^{12}_{6}$ carbon, $^{40}_{20}$ calcium.

A periodic table provides all the relevant information needed to determine electron structure of each element. For example, the subatomic structure for $^{12}_{6}$ carbon is: $1s^2$ $2s^2$ $2p^2$:6N:6P. For $^{40}_{20}$ calcium it is: $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$ $4s^2$:20N:20P. With information the program can be designed.

The program was developed on a Sinclair ZX-80 with 8K Basic and 16K RAM. It should be easily transferable to other micro such as the TRS-80, Pet and the Video Genie.

X$ and Y$ hold the co-ordinates for each electron to be printed via the Plot instruction. Using strings allows the user to get around the ZX-81's lack of Data and Read statements. The co-ordinates are obtained from X$ and Y$ by using the Code statement which supplies the numerical value of the characters addressed by the variable X from within X$ and Y$, which are then used by the Plot instruction.

Lines 190 to 220 print the name, symbol, atomic mass, atomic number, number of protons and the number of neutrons in the same place so erasing the previous output without the need to clear the screen. Lines 320 to 490 deal with the dropping down of electrons into their lower orbits for chromium, copper, niobium, palladium, cerium, terbium, iridium and protactinium. This involves unplotting an electron and repositioning it to a lower orbit.

Lines 520 and 521 make the ZX-81 display the screen for 60 seconds; pressing any key, except Break, allows the user to move on to the next element. Lines 5000 to 5120 hold the input system for the element's name, symbol and atomic mass, the atomic number is not needed as it is supplied by X.

Lines 5140 and 5150 allows the program to be saved in such a way that it will run immediately after loading, this allows the element data entered not to be cleared when the program is run, so that they only need to be entered once.

The program is entered as shown in the listing. Run 5000 is then entered, which allows the element data to be entered in ascending order. Atomic mass must be whole numbers — you cannot have fractions of a neutron. After this has been completed Run and Clear must not be used, otherwise the data entered will be lost. The program is saved by entering Goto 5140, which will save the program plus the entered data. When loaded it will run automatically without erasing the entered data.

The program runs automatically and waits for a set time at each element. After all 92 have been displayed it will repeat the program over and over again. To end the program, press Break.

It is quite easy to amend the program to suit the user's needs. I have a number of variations of this program, such as one

(continued on next page)

(continued from previous page)

which selects the atomic structure of any element defined by its atomic number. Since this program was written I have transferred it to run on the Pet, which allows it to be used for small classes. For large classes the ZX-81 is better as it can output a display to a large-screen television.

The program has been used a number of times and has many advantages over previous systems. It also gives new and exciting visual impact to a piece of work usually dominated by the hard slog of "chalk and talk" as well as a more immediate means of teaching this important subject.

ZX-80 clock

THE FOLLOWING short program shows how simply the ZX-80 with 8K ROM can be used to produce a satisfactory digital clock, writes Robin Allott of Seaford, East Sussex. The flicker is reduced by making the clock time change only at 10-second intervals .

The time is reset simply by inputting H M and S at the appropriate values for the current hours, minutes and seconds. If you want to use the clock as a stopwatch, the Pause at line 20 should be reduced to 49, and line 30 should be altered to

LET S = S + 1.

The program runs with 1K RAM on the ZX-80 or the ZX-81. To save use Goto 60.

```
1   LET H=0
2   LET M=0
3   LET S=0
4   PRINT "**********DIGITAL CLOCK"
5   PRINT "********(TO RESET:H M S)"
10  PRINT AT 9,10;H;"H*";M;"M*";S;"S***"
20  PAUSE 490
21  POKE 16437,255
30  LET S=S+10
40  IF S=60 THEN LET M=M+1
41  IF S=60 THEN LET S=0
42  IF M=60 THEN LET H=H+1
43  IF M=60 THEN LET M=0
44  IF H>12 THEN LET H=1
50  GOTO 10
60  SAVE "DIGITAL"
70  GOTO   1
```

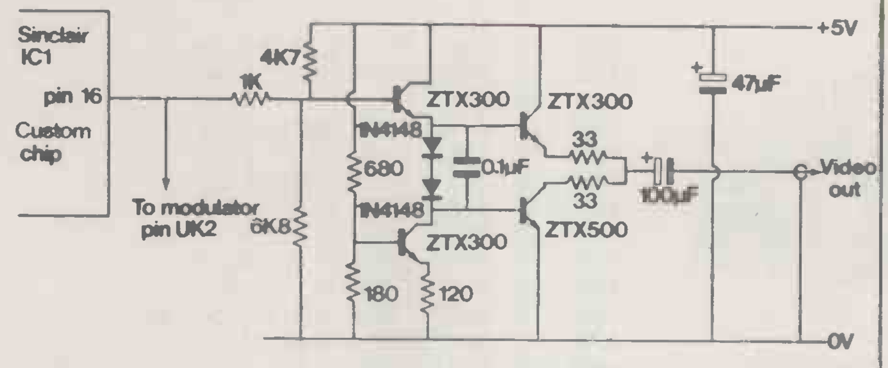
Monitor interface

MANY HOME COMPUTERS, and particularly those at the less-expensive end of the market, use the domestic TV set as a display. This can lead to a certain amount of conflict in the household during "Crossroads" or "Match of the Day". David Sinclair of Copthorne, Sussex has therefore devised a simple circuit to enable him to use his ZX-81 with a cheap TV monitor.

The main problem to be overcome is the conversion of the high-impedance video output of the Sinclair custom chip to a 50-ohm impedance suitable for driving a standard monitor. This is achieved with a conventional complementary push-pull output stage driven by the usual phase splitter.

The circuit can be built on Veroboard or tagstrip and can be attached by double-sided tape in the space under the ZX-81 keyboard. Current consumption is 10mA which may be taken from the internal ZX-81 5V regulated rail. Convenient take-off points are the channel-select tag connected to pin UK-1 on the modulator for 5V and the common printed-circuit board foil connecting all three jack plug connectors for 0V.

The circuit can supply enough output current to drive up to four monitors simultaneously, provided connecting cable lengths are not too long, and this feature could be useful in a classroom teaching environment. Omitting the UHF modulation and consequent demodulation process in the domestic TV removes the possibility of the video bandwidth of the ZX-81 signal being accidentally reduced. This set-up produced a slightly sharper display on a £60 monitor than on a £300 colour TV.



Monitor interface

Energy management

THE PROGRAMS Electricity Management and Gas Management will be most useful to domestic owners of the ZX-81 with only 1K RAM, writes B J F Reilly of Leicester. You must number your last nine quarterly bills chronologically from 1 to 9. To run the appropriate program, enter the number of each bill and the meter reading. As each successive set of data is entered, a bar chart appears for each of the eight quarters in turn, together with a listing of the quantity of electricity or gas consumed in each quarter.

In both programs the constant S in line 20 varies the vertical scale of the bar-chart and should be about 1/35 of the expected maximum number of units used in a quarter.

In Gas Management, the constant value of 1.027 in line 80 converts cubic feet to therms.

Electricity Management.

```
10   LET D = 0
20   LET S = 20
30   PRINT AT 0,0; "INPUT NO. OF READING N/L","AND ACTUAL READING N/L"
40   INPUT A
50   INPUT B
60   IF A = 1 THEN GOTO 130
70   LET C = A*2
80   LET E = B-D
90   FOR N = 0 TO INT E/S
100  PLOT C+2,N
110  NEXT N
120  PRINT AT C,15;"UNITS IN Q.";A-1;"=";E
130  LET D=B
140  GOTO 30
```

Gas Management.

```
10   LET D=0
20   LET S=20
30   PRINT AT 0,0,"INPUT NO. OF READING N/L","AND ACTUAL READING N/L"
40   INPUT A
50   INPUT B
60   IF A=1 THEN GOTO 130
70   LET C=A*2
80   LET E=(B-D)*1.027
90   FOR N=0 TO INT E/S
100  PLOT C+2,N
110  NEXT N
120  PRINT AT C,14;  "THERMS IN Q."A-1;" = "; INT E
130  LET D=B
140  GOTO 30
```

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Single-key save

SAVING STRING ARRAYS on cassette is a long and tedious business since the Basic Print# command can only be used to save 255 characters at a time, notes Kevin Upson of London N8. For each command the machine turns on the drive, writes 255 sync bytes and then the data.

My machine-code subroutine for the 16K Video Genie will save the whole array at one call in about one-quarter to one-half of the time taken by Print#.

It writes a tape in a similar format to system tapes with check-sum, but it also stores the Basic pointers to the array.

On loading the tape, the program checks that there is enough string space available for the array before it overwrites any store. It also displays element zero of the array on the video so that this element can be used to identify the array being read from tape.

If the tape being read is not in the correct format a read-error message will be displayed on the video.

To use the subroutine, protect memory at 32000, load the machine-language subroutine and key New to send then load the basic program. To call the subroutine from Basic use the statement:

USR(VARPTR(A$(0)))

where A$ is the name of the array to be saved. Enter the subroutine at address 32003 for loading array, i.e. use

POKE 16526,3:POKE 16527,125

Then enter at 32006 for writing array, making sure A$(0) has at least one character. After the promp "Ready Cassette", press any key except Break to start loading or writing.

On completion, the program will return the number of characters read or written. A Dimension statement must precede a call for a read as the subroutine only reads the number of elements which have been specified by it.

If the tape contains more elements they will be ignored. The amount of string space is checked assuming the whole tape array is to be loaded. If the tape contains fewer elements, the remaining elements of the array will contain the same data as they had before the call.

This Basic program illustrates the use of the subroutine and can be used to test it. The program reads data from the video for an array A$, which it then displays and writes to tape.

After the tape has been rewound it will read the tape and store the data in B$. Both A$ and B$ are displayed so they can be compared.

```
10 CLEAR1000:DIMA$(10),B$(10)
20 FORI=1TO10:INPUTA$(I):NEXT
30 INPUT"HEADER = ";A$(0)
32 REM
35 REM   *****    WRITE TO TAPE    *****
37 REM
40 POKE 16526,6:POKE 16527,125
50 B=USR(VARPTR(A$(0)))
60 FORI=0TO10:PRINTA$(0):NEXT
70 PRINT"CHARACTERS WRITTEN = ";B
80 INPUT"PRESS ENTER FOR READ";Z$
82 REM
85 REM   *****    READ   TAPE      *****
87 REM
90 POKE 16526,3:POKE 16527,125
100 B=USR(VARPTR(B$(0)))
110 FORI=0TO10:PRINTA$(I);" = ";B$(I):NEXT
120 PRINT"STRING SPACE NEEDED = ";B
```

If you do not have an editor-assembler, you should Poke the numbers listed into addresses 32000 to 32458 to enter the subroutine.

Numbers for use without editor-assembler.

```
195  25  26  195  169  125  205  127  10  229  1  154  126  205  111  126
205  73  0  43  43  78  35  70  35  175  190  202  159  125  197  95
87  134  35  35  48  1  20  237  161  234  33  125  95  193  225  213
197  229  213  175  205  18  2  205  135  2  62  72  205  100  2  70
120  205  100  2  35  94  35  86  26  205  100  2  19  16  249  209
225  123  205  100  2  122  205  100  2  62  60  205  100  2  70  175
184  202  151  125  120  205  100  2  35  94  123  205  100  2  35  86
130  79  122  205  100  2  26  205  100  2  129  79  19  16  247  121
205  100  2  193  237  161  197  234  89  125  62  255  205  100  2  205
248  1  193  225  195  154  10  205  100  2  35  35  195  131  125  1
193  126  205  111  126  225  195  154  10  205  127  10  1  154  126  205
111  126  205  73  0  43  43  78  35  70  35  197  175  205  18  2
205  150  2  205  53  2  254  72  194  89  126  205  53  2  71  205
53  2  205  124  126  16  248  205  53  2  95  229  42  214  64  205
53  2  87  183  237  82  235  42  160  64  183  237  82  225  242  73
126  237  83  214  64  19  205  53  2  254  60  194  89  126  205  53
2  254  0  202  65  126  71  112  35  205  53  2  115  35  79  205
53  2  114  129  79  205  53  2  18  129  79  19  16  247  205  53
2  185  194  84  126  193  237  161  197  234  246  125  213  225  205  248
1  193  62  13  205  124  126  237  91  214  64  183  237  82  195  154
10  119  35  119  35  119  195  37  126  1  169  126  42  214  64  183
237  82  24  12  1  139  126  24  7  254  255  40  11  1  128  126
62  13  205  124  126  205  111  126  205  248  1  193  195  154  10  10
230  127  205  124  126  10  203  127  192  3  24  243  205  51  0  201
82  69  65  68  32  69  82  82  79  82  141  67  72  69  67  75
83  85  77  32  69  82  82  79  82  141  82  69  65  68  89  32
67  65  83  83  69  84  84  69  141  78  79  84  32  69  78  79
85  71  72  32  83  84  82  73  78  71  32  83  80  65  67  69
141  78  79  32  72  69  65  68  69  82  141
```

Machine-code subroutine.

```
                00100 ;STRING ARRAY TAPE CREATE/LOAD
                00110 ;
                00120 ;
0235            00130 RBYTE   EQU  0235H      ;READ BYTE INTO A
0264            00140 WBYTE   EQU  0264H      ;WRITE BYTE IN A
0287            00150 WSYNC   EQU  0287H      ;WRITE SYNC CHARS
0296            00160 RSYNC   EQU  0296H      ;READ SYNC CHARS
7D00            00170         ORG  7D00H
7D00 C3191A     00180 LOAD    JP   1A19H      ;JUMP TO BASIC READY
7D03 C3A97D     00190         JP   READ
7D06 CD7F0A     00200 WRITE   CALL 0A7FH      ;STORE ARRAY ADDRESS IN HL
7D09 E5         00210         PUSH HL
7D0A 019A7E     00220         LD   BC,MREADY
7D0D CD6F7E     00230         CALL PRINT      ;DISPLAY MESSAGE
7D10 CD4900     00240         CALL 49H        ;WAIT FOR KEY DEPRESSION
7D13 2B         00250         DEC  HL
7D14 2B         00260         DEC  HL
7D15 4E         00270         LD   C,(HL)     ;LOAD DIMENSION
7D16 23         00280         INC  HL         ;OF ARRAY
7D17 46         00290         LD   B,(HL)
7D18 23         00300         INC  HL
7D19 AF         00310         XOR  A
7D1A BE         00320         CP   (HL)
7D1B CA9F7D     00330         JP   Z,WRERR
7D1E C5         00340         PUSH BC
7D1F 5F         00350         LD   E,A
7D20 57         00360         LD   D,A
7D21 86         00370 CALC    ADD  A,(HL)     ;CALCULATE TOTAL
7D22 23         00380         INC  HL         ;NUMBER OF
7D23 23         00390         INC  HL         ;CHARACTERS
7D24 3001       00400         JR   NC,$+3     ;IN THE ARRAY
7D26 14         00410         INC  D
7D27 EDA1       00420         CPI
7D29 EA217D     00430         JP   PE,CALC
7D2C 5F         00440         LD   E,A
7D2D C1         00450         POP  BC
7D2E E1         00460         POP  HL
7D2F D5         00470         PUSH DE
7D30 C5         00480         PUSH BC
7D31 E5         00490         PUSH HL
7D32 D5         00500         PUSH DE
7D33 AF         00510         XOR  A
7D34 CD1202     00520         CALL 0212H      ;SWITCH ON CASSETTE
7D37 CD8702     00530         CALL WSYNC
7D3A 3E48       00540         LD   A,48H
7D3C CD6402     00550         CALL WBYTE
7D3F 46         00560         LD   B,(HL)     ;LENGTH OF FIRST ELEMENT
7D40 78         00570         LD   A,B
7D41 CD6402     00580         CALL WBYTE
7D44 23         00590         INC  HL
7D45 5E         00600         LD   E,(HL)     ;LOAD ADDRESS OF DATA
7D46 23         00610         INC  HL         ;OF FIRST ELEMENT
7D47 56         00620         LD   D,(HL)
7D48 1A         00630 LABEL   LD   A,(DE)     ;WRITE LABEL
7D49 CD6402     00640         CALL WBYTE      ;FROM FIRST ELEMENT
7D4C 13         00650         INC  DE
7D4D 10F9       00660         DJNZ LABEL
7D4F D1         00670         POP  DE
7D50 E1         00680         POP  HL
7D51 7B         00690         LD   A,E        ;WRITE TOTAL
7D52 CD6402     00700         CALL WBYTE      ;NUMBER OF CHARS
7D55 7A         00710         LD   A,D
7D56 CD6402     00720         CALL WBYTE
7D59 3E3C       00730 WRHEAD  LD   A,3CH      ;WRITE HEADER
7D5B CD6402     00740         CALL WBYTE
7D5E 46         00750         LD   B,(HL)
7D5F AF         00760         XOR  A
7D60 B8         00770         CP   B          ;JUMP TO WNULL
7D61 CA977D     00780         JP   Z,WNULL    ;IF LENGTH = ZERO
7D64 78         00790         LD   A,B
7D65 CD6402     00800         CALL WBYTE
7D68 23         00810         INC  HL
```

(continued on next page)

(continued from previous page)

```
7D69 5E                   LD   E,(HL)     ;LOAD DE WITH ADDRESS
7D6A 7B                   LD   A,E        ;OF DATA
7D6B CD6402               CALL WBYTE      ;AND WRITE TO TAPE
7D6E 23                   INC  HL
7D6F 56                   LD   D,(HL)
7D70 82                   ADD  A,D        ;COMPUTE CHECKSUM
7D71 4F                   LD   C,A
7D72 7A                   LD   A,D
7D73 CD6402               CALL WBYTE      ;WRITE CHECKSUM
7D76 1A             WRDATA LD  A,(DE)     ;WRITE DATA
7D77 CD6402               CALL WBYTE
7D7A 81                   ADD  A,C
7D7B 4F                   LD   C,A
7D7C 13                   INC  DE
7D7D 10F7                 DJNZ WRDATA
7D7F 79                   LD   A,C
7D80 CD6402               CALL WBYTE
7D83 C1             ENDWR POP  BC
7D84 EDA1                 CPI             ;IF NOT END OF TABLE
7D86 C5                   PUSH BC         ;OF ADDRESSES
7D87 EA597D               JP   PE,WRHEAD  ;LOOP BACK TO HEADER
7D8A 3EFF                 LD   A,0FFH
7D8C CD6402               CALL WBYTE
7D8F CDF801               CALL 01F8H      ;SWITCH OFF CASSETTE
7D92 C1                   POP  BC
7D93 E1                   POP  HL
7D94 C39A0A               JP   0A9AH      ;RETURN TO BASIC PROGRAM
7D97 CD6402         WNULL CALL WBYTE
7D9A 23                   INC  HL
7D9B 23                   INC  HL
7D9C C3837D               JP   ENDWR
7D9F 01C17E         WRERR LD   BC,MWRERR
7DA2 CD6F7E               CALL PRINT
7DA5 E1                   POP  HL
7DA6 C39A0A               JP   0A9AH
7DA9 CD7F0A         READ  CALL 0A7FH      ;STORE ARRAY ADDRESS IN HL
7DAC 019A7E               LD   BC,MREADY
7DAF CD6F7E               CALL PRINT
7DB2 CD4900               CALL 49H        ;WAIT FOR KEY DEPRESSION
7DB5 2B                   DEC  HL
7DB6 2B                   DEC  HL
7DB7 4E                   LD   C,(HL)     ;LOAD DIMENSION
7DB8 23                   INC  HL         ;OF ARRAY
7DB9 46                   LD   B,(HL)
7DBA 23                   INC  HL
7DBB C5                   PUSH BC
7DBC AF                   XOR  A
7DBD CD1202               CALL 0212H      ;SWITCH ON CASSETTE
7DC0 CD9602               CALL RSYNC
7DC3 CD3502               CALL RBYTE
7DC6 FE48                 CP   48H
7DC8 C2597E               JP   NZ,CERR
7DCB CD3502               CALL RBYTE      ;READ LABEL
7DCE 47                   LD   B,A
7DCF CD3502               CALL RBYTE      ;AND DISPLAY
7DD2 CD7C7E               CALL DISP       ;ON VIDEO
7DD5 10F8                 DJNZ $-6
7DD7 CD3502               CALL RBYTE
7DDA 5F                   LD   E,A
7DDB E5                   PUSH HL
7DDC 2AD640               LD   HL,(40D6H) ;TOP OF UNUSED STRING SPACE
7DDF CD3502               CALL RBYTE
7DE2 57                   LD   D,A
7DE3 B7                   OR   A
7DE4 ED52                 SBC  HL,DE      ;SUBTRACT NUMBER OF CHARACTERS
7DE6 EB                   EX   DE,HL      ;TO BE LOADED
7DE7 2AA040               LD   HL,(40A0H) ;BOTTEM OF STRING SPACE
7DEA B7                   OR   A
7DEB ED52                 SBC  HL,DE
7DED E1                   POP  HL
7DEE F2497E               JP   P,STRSP
7DF1 ED53D640             LD   (40D6H),DE ;NEW POINTER
7DF5 13                   INC  DE
7DF6 CD3502         RHEAD CALL RBYTE      ;READ HEADER
7DF9 FE3C                 CP   3CH
7DFB C2597E               JP   NZ,CERR
7DFE CD3502               CALL RBYTE
7E01 FE00                 CP   0
7E03 CA417E               JP   Z,RNULL
7E06 47                   LD   B,A
7E07 70                   LD   (HL),B
7E08 23                   INC  HL
7E09 CD3502               CALL RBYTE
7E0C 73                   LD   (HL),E
7E0D 23                   INC  HL
7E0E 4F                   LD   C,A
7E0F CD3502               CALL RBYTE
7E12 72                   LD   (HL),D
7E13 81                   ADD  A,C
7E14 4F                   LD   C,A
7E15 CD3502         RDATA CALL RBYTE
7E18 12                   LD   (DE),A     ;READ DATA
7E19 81                   ADD  A,C
7E1A 4F                   LD   C,A
7E1B 13                   INC  DE
7E1C 10F7                 DJNZ RDATA
7E1E CD3502               CALL RBYTE
7E21 B9                   CP   C
7E22 C2547E               JP   NZ,CHKSM
7E25 C1             ENDRD POP  BC
7E26 EDA1                 CPI
7E28 C5                   PUSH BC
7E29 EAF67D               JP   PE,RHEAD
7E2C D5                   PUSH DE
7E2D E1                   POP  HL
7E2E CDFB01               CALL 01F8H      ;SWITCH OFF CASSETTE
7E31 C1                   POP  BC
7E32 3E0D                 LD   A,0DH
7E34 CD7C7E               CALL DISP
7E37 ED5BD640             LD   DE,(40D6H)
7E3B B7                   OR   A
7E3C ED52                 SBC  HL,DE
7E3E C39A0A               JP   0A9AH      ;RETURN TO BASIC PROG
7E41 77             RNULL LD   (HL),A
7E42 23                   INC  HL
7E43 77                   LD   (HL),A
7E44 23                   INC  HL
7E45 77                   LD   (HL),A
7E46 C3257E               JP   ENDRD
7E49 01A97E         STRSP LD   BC,MSTRSP
7E4C 2AD640               LD   HL,(40D6H)
7E4F B7                   OR   A
7E50 ED52                 SBC  HL,DE
7E52 180C                 JR   $+14
7E54 018B7E         CHKSM LD   BC,MCHKSM
7E57 1807                 JR   $+9
7E59 FEFF           CERR  CP   0FFH
7E5B 280B                 JR   Z,$+13
7E5D 01807E               LD   BC,MCERR
7E60 3E0D                 LD   A,0DH
7E62 CD7C7E               CALL DISP
7E65 CD6F7E               CALL PRINT
7E68 CDF801               CALL 01F8H      ;SWITCH OFF CASSETTE
7E6B C1                   POP  BC
7E6C C39A0A               JP   0A9AH      ;RETURN TO BASIC PROG
7E6F 0A             PRINT LD   A,(BC)
7E70 E67F                 AND  7FH        ;PRINT MESSAGE
7E72 CD7C7E               CALL DISP       ;ON VIDEO
7E75 0A                   LD   A,(BC)
7E76 CB7F                 BIT  7,A
7E78 C0                   RET  NZ
7E79 03                   INC  BC
7E7A 18F3                 JR   PRINT
7E7C CD3300         DISP  CALL 33H
7E7F C9                   RET
7E80 52             MCERR DEFM 'READ ERROR'
7E81 45
7E82 41
7E83 44
7E84 20
7E85 45
7E86 52
7E87 52
7E88 4F
7E89 52
7E8A 8D                   DEFB 8DH
7E8B 43            MCHKSM DEFM 'CHECKSUM ERROR'
7E8C 48
7E8D 45
7E8E 43
7E8F 4B
7E90 53
7E91 55
7E92 4D
7E93 20
7E94 45
7E95 52
7E96 52
7E97 4F
7E98 52
7E99 8D                   DEFB 8DH
7E9A 52            MREADY DEFM 'READY CASSETTE'
7E9B 45
7E9C 41
7E9D 44
7E9E 59
7E9F 20
7EA0 43
7EA1 41
7EA2 53
7EA3 53
7EA4 45
7EA5 54
7EA6 54
7EA7 45
7EA8 8D                   DEFB 8DH
7EA9 4E            MSTRSP DEFM 'NOT ENOUGH STRING SPACE'
7EAA 4F
7EAB 54
7EAC 20
7EAD 45
7EAE 4E
7EAF 4F
7EB0 55
7EB1 47
7EB2 48
7EB3 20
7EB4 53
7EB5 54
7EB6 52
7EB7 49
7EB8 4E
7EB9 47
7EBA 20
7EBB 53
7EBC 50
7EBD 41
7EBE 43
7EBF 45
7EC0 8D                   DEFB 8DH
7EC1 4E            MWRERR DEFM 'NO HEADER'
7EC2 4F
7EC3 20
7EC4 48
7EC5 45
7EC6 41
7EC7 44
7EC8 45
7EC9 52
7ECA 8D                   DEFB 8DH
7D00                      END  LOAD
00000 TOTAL ERRORS
```

Character retrieval

ONE OF THE most annoying faults on the Superboard/Challenger is the loss of characters that occurs to the left and right of the screen, writes N A Cannon of Redhill, Surrey. The loss to the right is easily corrected by limiting the terminal width, but loss of characters to the left requires a machine-code program to correct. My routine resides in the spare page 2 space, $0222 to 02F0, and overcomes the problem.

The first — 0222 to 0230 — section is the main program. To activate it, the output vector should be changed to point to the routine, which could be done by Poking the vector 538 and 539 decimal. This means Poking after every warm start, and a better method is to have the vector automatically reset after every warm start, which is what the second section is for. All that is needed is to set the warm start vector — 0001 and 0002 — to point to the second section, 0233, via the monitor, or Poke 1,51 : Poke 2,2.

You should turn off the routine when saving programs, otherwise it inserts spaces at the start of every line. It can be turned off by changing the warm start back via the monitor — point it at A274 — or by Poke 1,116 : Poke 2,162.

Character retrieval.

```
0222    PHA         48
0223    LDA 0200    AD 00 02
0226    CMP#65      C9 65
0228    BNE 05      D0 05
022A    LDA#20      A9 20
022C    JSR FF69    20 69 FF
022F    PLA         68
0230    JMP FF69    4C 69 FF
0233    LDA#22      A9 22
0235    STA 021A    8D 1A 02
0238    LDA#02      A9 02
023A    STA 021B    8D 1B 02
023D    JMP A274    4C 74 A2
```

Data check

THE CHECK-SUM loader 0700 to 07FF at the beginning of the UK 101 extended monitor can be saved and used for other check-sum loading, writes Douglas Fyffe of Sutton, Surrey. Enter at .0705 G — or, if relocated, .1705 G.

Note that some of the bits are incremented during use and may corrupt the main program unless a correct start is made. Before use, the contents of the following addresses should be checked, and corrected if necessary. The original and (in brackets) relocated addresses are

0702 (1702) 00
0703 (1703) 80
0704 (1704) 00
073B (173B) 05
073C (173C) 10

A check-sum loader stored in RAM should not be used a second time without checking and correcting these addresses.

String list routine

VARLIST is a utility in Basic for UK 101 or Superboard that lists which variables and strings occur in a program and where these appear, writes Mitch Park of Havelock North, New Zealand. It can be useful for analysing programs and finding variables which might be reusable. Varlist does not give values for variables because it examines only Basic text or source code and does not consult the variable tables. In any case, Varlist destroys previous variable tables the instant it starts to run.

The program gives the choice of listing any strings that appear in the source code. However, it ignores Rems, whether strings are wanted or not. It then allows the choice of listing between selected line numbers, or in Auto mode, up to line 49999 — a common End line number.

It works by stepping through the source code line by line and adding new variables to a string array. The line numbers only are added to the appropriate string when a variable, or string, is encountered for the second and subsequent times. Only one occurrence is listed per line, no matter how many times the variable appears in that line. The string-array / garbage-collection bug is sidestepped, so the program will work on quite large subject programs.

Varlist is meant to bow out gracefully if there are too many variables or if a variable occurs so often that it exceeds the permitted string-length limit.

I use Varlist to drive an Epson MX-80 printer at 4,800baud, but the output section may be modified to print to screen or to whatever printer you use.

Varlist.

```
63000 CLEAR:PRINTCHR$(26):K=0:J=0:I=0:S=1:Y=0
63005 PRINT:INPUT" IGNORE STRINGS IN TEXT";Y$
63010 INPUT" START LINE NO. OR 'AUTO'";P$:P=771:A=P:E=49999
63015 IFP$=LEFT$("AUTO",LEN(P$))THEN63030
63020 S=VAL(P$):INPUT" END LINE NO.";E:IFE<STHEN63020
63025 GOSUB63135:P=A:IFL<STHENA=N:GOTO63025
63030 GOSUB63135:M=M+1:IFL<ETHENA=N:GOTO63030
63035 PRINTCHR$(26):DIMA$(M):A=P:A$(0)=CHR$(34)+"    "
63040 S=PEEK(129):Y=PEEK(130)
63045 GOSUB63135:PRINTL:IFL>E-1THENPRINT" COMPLETE":GOTO63155
63050 FORI=A+2TON-3:P=PEEK(I):H=(P=34):IFHANDY$>"P"THEN63085
63055 IFP=142THENA=N:GOTO63045
63060 P$=CHR$(P):IFH=0AND(P<65ORP>127)THEN63130
63065 FORJ=I+1TON-3:P=PEEK(J):IFP=0ORP=34THEN63095
63070 IFHANDP>31ANDP<128THEN63080
63075 IFP<48ANDP<>36ANDP<>40ORP>57ANDP<65ORP>127THEN63095
63080 P$=P$+CHR$(P):NEXTJ:GOTO63125
63085 FORJ=I+1TON-3:P=PEEK(J):IFP=0ORP=34THEN63125
63090 NEXTJ
63095 FORK=0TOM:IFK=MORLEN(A$(K))>250THEN63145
63100 IFLEFT$(A$(K),LEN(P$))=P$THEN63115
63105 IFA$(K)=""THENA$(K)=P$+" "+STR$(L):T=T+1:K=M+1
63110 NEXTK:S=PEEK(129):Y=PEEK(130):GOTO63125
63115 IFRIGHT$(A$(K),LEN(STR$(L)))=STR$(L)THEN63125
63120 A$(K)=A$(K)+STR$(L)
63125 I=J:S=PEEK(129):Y=PEEK(130)
63130 POKE129,S:POKE130,Y:NEXTI:A=N:GOTO63045
63135 N=PEEK(A-1)*256+PEEK(A-2)+2
63140 L=PEEK(A+1)*256+PEEK(A):RETURN
63145 PRINT" OM ERROR IN"L
63150 PRINT" CHANGE 'M=' IN 63030 OR LIST SHORTER SECTIONS"
63155 SAVE:S=61440:POKE15,75:POKES,3:POKES,16
63160 FORK=-(Y$>"P")TOT:PRINT:PRINTA$(K):NEXTK
63165 PRINTCHR$(12):POKE517,0:POKE15,72:POKES,3:POKES,17
```

Line 63000 clears the variable tables, clears the screen and initialises some variables to gain some speed. CHR$(26) is the clear-screen command for Cegmon.

Line 63005 commences input and is not idiot-proofed, since the prompt calls for a Yes/No answer. Y$ is used as a flag later on.

Line 63010 prompts for starting line number and sets up some more variables. P is used at this stage to hold the start-of-text address but later changes its function.

Line 63015 demonstrates a technique to allow recognition of input even if it is abbreviated. There are several ways of doing the same thing.

Line 63020 asks for the end-line number and is goof-proofed to require a higher number.

Line 63025 searches for the starting line number and its address in RAM. P is used here to hold that address.

Line 63030 steps through the program to the selected final line to count the number of lines, held in M. The program allows for one new variable per line, which may be over-generous.

Line 63035 dimensions a string array to the value of M and creates a first string of blanks. The purpose here is to avoid listing short space-strings as the leading blanks of other strings.

Line 63040 changes the function of S to hold, with Y, the value of the bottom of string-space.

Line 63045 is where the fun really starts. The program steps through each line character by character, discarding values outside the desired range. The line number L is printed to screen as a reassurance that the program is actually doing something. P is now used to hold the contents of each address being inspected. It is tested for the Rem token, 142, for the double-quote mark, 34, and for validity as a variable-name or string character. Should P be a Rem then the rest of the line is ignored; if P is a quote then a string is built up until either another quote or the end-of-line marker is reached. If P is valid as a variable-name character, then the outer loop counter keeps a "finger in the page" and a second-level counter, J, builds up the string until it encounters invalid characters. As a result, subscribed variables are listed with the first index, and if the index changes,

(continued on next page)

(continued from previous page)

then the variable is listed again with its new subscript.

Line 63095 is where the additions to the string array begin to take place, using a third-level loop. The built-up string P$ is compared with existing strings in the array, and if there is a match, only the line number is added to the array. If there is no match, then P$ and its line number are added to the end of the array. Variable T holds the number of strings actually in the array, and is used at the end as part of the printing routine.

Lines 63110 and 63125 note the condition of the string-space pointers. When a string is added to the array, these pointers are adjusted downward automatically. S and Y hold these values and allow the string-building routine to overwrite its previous results, thus avoiding the garbage-collection bug problem. The values are reset by line 63130 whenever the outer loop creeps along.

Lines 63155 onwards do the printing. My printer is driven from the RS-232 serial port, and is set internally for 4,800baud. This rate is achieved by resetting the ACIA control register — address 61440 — by Poking a 3 into it, then following that by 16. This alters the clock-division rate in the ACIA chip so that the normal divide-by-16 count is altered to divide-by-one. If your printer is configured otherwise, then the Pokes to 61440 can all be dropped. The Poke to address 15 in line 63155 sets the terminal width, allowing the printer to cover most of the page while leaving some margin.

CHR$(12) in line 63170 is the Epson's form-feed code. The rest of the line switches off the Save flag, sets the terminal width to normal and restores the ACIA chip to normal 300baud operation.

To print to screen only, lines from 63155 could read:

```
63155 POKE11,0: POKE 12,253
63160 FORK=0TOT: IFASC (A$(K)) =
  34ANDY$ < "P"THEN63170
63165 PRINT: PRINTA$(K): IFK/4=
  INT(K/4) THENX=USR(X)
63170 NEXTK
```

Register exchange

WHILE WORKING through a program I found I required a subroutine which exchanged the contents of the accumulator with the Y register, without affecting the contents of other registers or memory locations, writes Andy Scott of Chapel-en-le-Frith, Cheshire. The program I came up with can be used on any 6502 machine — see listing 1.

Similar programs exchange the X and Y registers — listing 2 — and the X register with the accumulator — listing 3.

The stack is used for the various manipulations, as well as the X,Y register, stack pointer and the accumulator. After each subroutine the stack pointer and status registers resume their original states. The stack pointer is incremented by using the instructions PLA or PLP.

Listing 1 — accumulator/Y register exchange.

```
3000 08      PHP     Save Status Register
3001 48      PHA     Save Accumulator
3002 98      TYA     )
3003 48      PHA     )Save Y Register
3004 8A      TXA     )
3005 48      PHA     )Save X Register
3006 68      PLA     )
3007 68      PLA     )Increment stack pointer by 3
3008 68      PLA     )
3009 A8      TAY     Store old accumulator contents in Y
300A BA      TSX     )
300B CA      DEX     )
300C CA      DEX     ) Decrement stack pointer by 3
300D CA      DEX     )
300E 9A      TXS     )
300F 68      PLA     )
3010 AA      TAX     )Retrieve contents of X Register
3011 68      PLA     )Store old Y reg. contents in Accumulator
3012 28      PLP     )Increment stack pointer
3013 28      PLP     )Restore status register
3014 60      RTS
```

Listing 2 — X and Y register exchange.

```
3000 08      PHP     Save status register
3001 48      PHA     Save Accumulator
3002 98      TYA    )
3003 48      PHA    )Save Y Register
3004 8A      TXA    )
3005 48      PHA    )Save X Register
3006 68      PLA    )
3007 A8      TAY    )Save old X Reg. contents in Y Reg.
3008 68      PLA    )Save  old Y Reg. contents in X Reg.
3009 AA      TAX    )
300A 68      PLA    Retrieve Accumulator.
300B 28      PLP    Restore status Register
300C 60      RTS
```

Listing 3 — accumulator/X register exchange.

```
3000 08      PHP     Save status register
3001 48      PHA     Save Accumulator
3002 8A      TXA     )
3003 48      PHA     )Save X Register
3004 68      PLA     )
3005 68      PLA     )Get old Accumulator contents into Accumulator
3006 BA      TSX     )
3007 CA      DEX     )
3008 CA      DEX     )Decrement stack poiter by 2
3009 9A      TXS     )
300A AA      TAX      Store old Accumulator contents into X Register
300B 68      PLA      Store old X register contents in Accumulator.
300C 28      PLP      Increment stack pointer
300D 28      PLP      Restore status register
300E 60      RTS
```

OK not OK

ON THE SUPERBOARD, the usual Save:List command for saving programs on tape terminates with the OK message, writes J Pike of Bedford. This gives an annoying syntax-error message on reload.

The OK message can be suppressed with Poke 4,108, but it would be better to be able to terminate the save with a user-specified message such as Poke 515,0:Run, to turn off the load and run the program. A Basic program to achieve this appeared in the May 1981 6502 Special, but a much neater and more permanent solution is given by a 17-byte machine-code patch based on Steve Purdy's List solution — 6502 Special February 1981. This short patch enables

SAVE:LIST:? "Message":? "Message"

to print messages after the program.

The flexibility of the system is demonstrated by a simple file-handling technique using the messages

POKE 515,255 AND (PEEK(515)+1)

and New, when

LOAD:LOAD:LOAD

for example, will load the third program from the tape.

The patch also allows List to be used in a program without terminating execution. Like Clear, however, List cannot be used within For loops or subroutines because it corrupts the stack. I have been unable to understand these stack changes however, perhaps someone more familiar with operation of the stack could unravel them and circumvent this limitation.

OK-suppression and message patch.

```
5   L=232:REM Start Address of patch (user specified)
10  DATA 32,108,168,160,0,177,195,201,58,240,3,76,108,
    168,76,194,165
20  FOR I = L TO L + 16:READ P:POKE I,P:NEXT
30  POKE 4,L AND 255:POKE 5,L/256
```

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Speeding execution

SPEED OF ACCESS to information on a disc is sometimes limited by the speed at which the computer can process the incoming data, observes John Pennell of Bunwell, Norwich. If this processing results in the drive motor being switched off and then on again, a further reduction in speed occurs.

The drive motor can be kept running by Peeking the address 49385 and switched off by Peeking 49384. This can result in a time saving of 30 percent. For example this piece of coding takes 15.6 seconds to execute with the drive running, but 18.4 seconds if the drive is switching on and off.

```
10310  PRINT CD$;"OPEN"T$",D1"
10320  PRINT CD$;"READ"T$
10330  FOR I = 0 TO 43: FOR J = 0 TO 10:  INPUT T$(I,J)
10335 SQ =  PEEK (SO)
10340  NEXT : IF A = 0 THEN  VTAB 3: PRINT "LAST DATE ENTERED WAS"; SPC(
     1)T$(0,1): PRINT : PRINT "LAST INVOICE NO WAS"; SPC( 5)T$(0,3): PRINT
     : PRINT "NO OF CUSTOMERS ON FILE"; SPC( 1)T$(0,4): VTAB 11
10350  IF I > 31 THEN  VTAB I - 22: PRINT  MID$ (X$,(I - 32) * 9 + 1,9);
     " ";T$(I,1); SPC( 7 -  LEN (T$(I,2)))T$(I,2); SPC( 7 -  LEN (T$(I,3
     )))T$(I,3); SPC( 7 -  LEN (T$(I,4)))T$(I,4)
10370  NEXT
10375  PRINT CD$;"CLOSE":SQ =  PEEK (SF)
```

Speeding execution.

Step and Trace

THE APPLE II microcomputer has a very powerful machine-code monitor, with commands to execute programs one instruction at a time, writes John Robson of Cambridge. It is very useful for debugging machine-code programs.

The Apple II+ contains the Autostart ROM, which does not have these debugging facilities. This ROM has many advantages, however, including automatic disc bootstrap on power-up, and automatically jumping into Applesoft Basic if no discs are connected. This makes the Apple II+ a very friendly machine for the Basic user, but less helpful to machine-code programmers.

This program was written in order to add machine-code Step and Trace commands to the Autostart ROM monitor, but it was quickly realised that any number of new commands could easily be added. The present program allows 32 new commands to be defined.

In order to create new commands, it is necessary to understand how the original monitor works. I recommend chapter 3 of the *Apple II Reference Manual*, and the machine-code listings at the back of that manual.

A monitor command consists of a number of hexadecimal addresses as parameters, separated by various delimiters, followed by a single non-hex character—except <and.—which specifies the required command. Up to three parameters can be passed to a command, and examples of their use are given in table 1.

In operation, the monitor scans a command line, storing all the parameters it finds on page zero. When it finds a non-hexadecimal character, it searches two tables to find the address of the machine-code subroutine which will carry out the requested command. It then calls this subroutine, which reads the parameters from page zero. These are always stored in the same locations, regardless of the command — see table 2.

As usual with the 6502 processor, the low-order byte of the two-byte address is stored first. If more than four digits are typed as a parameter, the monitor takes the last four as the actual parameter to be used.

The piece of code in listing 1 is executed only once, and sets the soft-entry vector so that pressing the Reset key will cause a return to the new monitor. It also sets the break vector so that executing a BRK instruction will cause a jump to the break-handling routine. This code runs straight into the monitor, so that the command 0800G will set the necessary vectors and transfer control to the monitor.

Space has been left to call a subroutine XTitle which may be used to print a title

(continued on page 135)

Table 1.

Number of parameters	Command Format	Example
0	{char}	I
1	{param-1} {char}	800G
2	{param-1} . {param-2} {char}	800.8FFW
3	{param-3} < {param-1} . {param-2} {char}	2000 <1600 . 167FM

Table 2.

Parameter	Name in Apple II reference manual	Low-order byte address	High-order byte address
1	A1L and A1H	$3C	$3D
2	A2L and A2H	$3E	$3F
3	A4L and A4H	$42	$43

Listing 2.

```
081A- D8          XMON:     CLD           ; must use hex mode
081B- 20 3A FF              JSR BELL
081E- A9 BE       XMONZ:    LDA #$BE      ; '>' prompt character
0820- 85 33                 STA PROMPT
0822- 20 67 FD              JSR GETLNZ    ; read a line
0825- 20 C7 FF              JSR ZMODE     ; clear monitor mode
0828- 20 A7 FF    NEXTITM:  JSR GETNUM    ; get item, return with non-
082B- 84 34                 STY YSAV      ;   hex char. in accumulator
082D- A0 13                 LDY #CMDNUM   ; no. of commands in table
082F- 88          CMDSRCH:  DEY
0830- 30 E8                 BMI XMON      ; if command not found
0832- D9 60 08              CMP CMDTBL,Y  ; find command char in table
0835- D0 F8                 BNE CMDSRCH
0837- 20 3F 08              JSR XTOSUB    ; found, call its subroutine
083A- A4 34                 LDY YSAV
083C- 4C 28 08              JMP NEXTITM
083F- A9 08       XTOSUB:   LDA #PAGE     ; push high order subroutine
0841- 48                    PHA           ;   address on stack
0842- B9 80 08              LDA XSUBTBL,Y ; push low order address on
0845- 4C C4 FF              JMP FINISH    ;  stack, finish in ROM. **
```

Listing 1.

```
0800- A9 1A     LDA #$1A
0802- 8D F2 03  STA SOFTEV    ; set soft entry vector
0805- A9 08     LDA #PAGE     ;   to start of monitor
0807- 8D F3 03  STA SOFTEV +1;        ( = $081A )
080A- 20 6F FB  JSR SETPWREC
080D- A9 48     LDA #$48
080F- 8D F0 03  STA BRKV      ; set new break vector
0812- A9 08     LDA #PAGE     ;        ( = $0848 )
0814- 8D F1 03  STA BRKV +1
0817- 20 3A FF  JSR XTITLE    ; rings bell in this case
```

Listing 3.

```
0848- A5 3A     XBREAK:  LDA PCL      ; subtract 2 from program
084A- D0 02              BNE DEC1     ;   counter after a BRK ,
084C- C6 3B              DEC PCH      ;   to give exact address of
084E- C6 3A     DEC1:    DEC PCL      ;   break request.
0850- D0 02              BNE DEC2
0852- C6 3B              DEC PCH
0854- C6 3A     DEC2:    DEC PCL
0856- 20 82 F8           JSR INSDS1   ; print user program counter
0859- 20 DA FA           JSR RGDSP1   ;   and registers.
085C- 4C 1A 08           JMP XMON     ; goto monitor
```

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```
CMDTBL:  0860- 98 EF A6 A4 06 95 05 F0  ;  ?  V  -  +  M  <  L  W
         0868- 00 EB 93 A7 C6 99 9C 9E  ;  G  R  :  .  cr sp #  %
         0870- F3 9A A0 00 00 00 00 00  ;  Z  !  '
         0878- 00 00 00 00 00 00 00 00  ;.....rest of table empty
```

Table 3.

(continued from page 133)

on the screen, and also to set any other vectors which may require attention. The monitor has been written to run on page $08 and so if it is used in conjunction with Basic the Lomem vector will need to be raised by such a routine.

Listing 2 shows the main part of the monitor. CMDNUM is the number of commands in the command table and will require alteration if new commands are to be added. This routine makes much use of subroutines in the Autostart ROM.

The end of the routine jumps into the ROM, to finish the XToSub routine. This jumps to the subroutine whose address has just been pushed on to the stack by executing an RTS instruction.

The short section of code in listing 3 handles a break request, displaying the address of the break instruction, and the state of the registers at that time. When the 6502 executes a BRK instruction, it pushes the Program Counter + 2 on to the stack, so before displaying the program counter, this routine subtracts 2 from it. The original monitor simply displays the program counter as it is.

Table 3 shows the command characters, including the ASCII values of the command letter, XORed with $BO, and added to $89. This is just as in the original monitor's command table.

Table 4 contains the low-order byte of the address of the subroutine to be called by each command, with 1 subtracted from it. The high-order byte is $08.

As an example, if the ? command is used, the monitor searches the CMDTBL until it finds the value $98, in the first location of the table. Note that it searches the table from the last character up to the first.

It looks in the corresponding position in the XSUBTBL, finding the value $9F. Adding one gives $AO, so it then jumps to location $8AO, from where it jumps to the register-display routine REGZ.

In the original monitor, all the command subroutines are in ROM on page $FE. Obviously, any user-defined commands must be included in RAM, and thus will be on a different page. This new monitor overcomes the problem by jumping to a location on page $08, where there may be a short piece of code or a jump to a routine anywhere in memory. This routine may then read any parameters passed to it from page zero.

Table 4.

```
XSUBTBL: 0880- 9F A2 A5 A5 A8 AB AE B1
         0888- B4 B7 A5 A5 BA C2 C5 C8
         0890- CB CE D1 00 00 00 00 00
         0898- 00 00 00 00 00 00 00 00
```

To add new commands to the monitor do the following

- Choose a non-hexadecimal character as the command character. You are not restricted to letters: any symbol may be employed provided it is not already in use.
- Exclusive-Or the ASCII code for this character with $B0, and then add $89 to it.
- Place this result at the end of the CMDTBL, at location $873 for table 3.
- In the corresponding position in the XSUBTBL, place the low-order byte of an address on page $08 — 1. This address should be the next available on page $08 after the table of JMP commands, at location $8D5 for the program listed here.
- At this address on page $08 add a JMP instruction to your own machine-code subroutine, which must end in RTS.
- Add 1 to CMDNUM. This is used at only one point in the monitor, at location $82E.

A similar procedure may be adopted in reverse to delete commands from the monitor. The commands to write to a Teletype and to call a mini-assembler have been included as examples and may be deleted if you wish. The directions given assume that the monitor is on page $08. Use a different page if it has been moved elsewhere.

I have not included all the original monitor commands in the program, since a number of them are only rarely used. It is a simple matter to add them. In particular, the CTRL-Y function has been made redundant, since user-defined commands can easily be added to the monitor.

Listing 4.

```
080A- 4C BF FE       JMP REGZ      ;  ? display registers
08A3- 4C 36 FE       JMP VFY       ;  V verify
08A6- 4C 18 FE       JMP SETMODE   ;  - + : .
08A9- 4C 2C FE       JMP MOVE      ;  M
08AC- 4C 20 FE       JMP LT        ;  <
08AF- 4C 5E FE       JMP LIST      ;  L
08B2- 4C CD FE       JMP WRTTE     ;  W
08B5- 4C B6 FE       JMP GO        ;  G call user subroutine
08B8- 4C FD FE       JMP READ      ;  R
08BB- 20 00 FE       JSR BL1       ;  cr  end of command line
08BE- 68             PLA
08BF- 68             PLA
08C0- 4C 1E 08       JMP XMONZ     ;      goto monitor
08C3- 4C 04 FE       JMP BLANK     ;  sp
08C6- 4C 6B 09       JMP SETTTY    ;  # all output to teletype
08C9- 4C 74 09       JMP SETSCRN   ;  % all output to screen
08CC- 4C 00 10       JMP ASSEMBLE  ;  Z call mini-assembler
08CF- 4C 07 10       JMP ASSEMBLE1;   ! assemble one line only
08D2- 4C 8E FD       JMP CROUT     ;  ' issue carriage return
```

Pie chart.

```
10  TEXT : HOME
20  VTAB 13: INPUT "ENTER DATE (DD/MM/YY)";D$
30  IF  LEN (D$) < 8 OR  LEN (D$) > 8 THEN  PRINT "": RUN
40  FOR I = 1 TO 8
50  POKE I + 767, ASC ( MID$ (D$,I,1))
60  NEXT
70  ONERR  GOTO 1370
80  TEXT : HOME
90  INVERSE
100  TEXT : HOME : INVERSE
110  PRINT "$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$"
120  PRINT "$                                      $"
130  PRINT "$              PIE CHARTS              $"
140  PRINT "$                                      $"
150  PRINT "$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$"
```

(listing continued on next page)

Pie charts

THIS APPLESOFT PROGRAM from Adam Broun of Bicester, Oxfordshire, draws pie charts. It runs on the Apple II+ machine.

At the start, the date must be Inputted using two digits to each section, e.g., 05/09/81. It is Poked into memory to avoid D$ being cleared if a mistake is made typing in data.

The options given on the main menu are as follows:

- Draw chart with paddle. A line is displayed inside a circle which can be moved round using a game paddle. The paddle button fills in the circle anticlockwise from the bottom.
- Compute and draw. Type in the number of sectors required followed by the percentage and name for each sector. When all

(continued on next page)

(continued from previous page)

sectors have been allocated data, the pie chart is drawn on the high-resolution screen, while data about the sector being drawn is displayed. When the chart is finished, the option is given of saving the chart on to disc.

- Load chart from disc. This option loads a named chart from disc for viewing on the screen.

The chart takes up 34 sectors under DOS 3.3. A hard copy of the data for the graph is then dumped on to the printer in slot 1. No graphics capabilities are necessary, and a horizontal bar chart is drawn of each sector.

The variable cross-reference list was produced using the Applesoft Program Assistant on the D.O.S. 3.3 Toolkit.

(listing continued from previous page)

```
160  NORMAL : SPEED= 255
170  PRINT : HTAB 13: PRINT "BY ADAM BROUN"
180  VTAB 10
190  POKE 33,35: POKE 32,5
200  PRINT
210  PRINT "1. DRAW CHART WITH PADDLE"
220  PRINT : PRINT "2. COMPUTE & DRAW"
230  PRINT : PRINT "3. LOAD CHART FROM DISK"
240  PRINT : PRINT "4. EXIT"
250  POKE 32,0: POKE 33,40
260  PRINT
270  VTAB 20: PRINT "PLEASE SELECT OPTION"
280  GET A$:Q =  VAL (A$)
290  IF Q > 0 AND Q < 5 THEN 310
300  INVERSE : PRINT : PRINT "ERROR- ENTER 1,2,3 OR 4": NORMAL : GOTO 270
310  ON Q GOTO 330,940,1260,1360
320  END
330  HOME : PRINT "OPTION 1 - DRAW CHART WITH PADDLE."
340  PRINT : PRINT : PRINT "WHEN THE CIRCLE HAS BEEN DRAWN,"
350  PRINT : PRINT "USE THE PADDLE TO MOVE THE BAR."
360  PRINT : PRINT "WHEN YOU PRESS THE PADDLE BUTTON,"
370  PRINT : PRINT "THE CIRCLE WILL FILL IN ANTICLOCKWISE"
380  PRINT : PRINT "FROM THE BOTTOM."
390  PRINT : PRINT "YOU WILL THEN HAVE THE CHOICE OF "
400  PRINT : PRINT "SAVING THE CHART ONTO DISK"
410  PRINT : PRINT : PRINT "HIT ANY KEY TO START": GET A$
420  HGR : HCOLOR= 7
430  HPLOT 125 - 80 *  SIN (N / 24 * 3.14),75 + 75 *  COS (N / 24 * 3.14)
440  FOR N = 0 TO 50 STEP .5
450  HPLOT  TO 125 - 80 *  SIN (N / 24 * 3.14),75 + 75 *  COS (N / 24 * 3.14)
460  NEXT
470 N =  PDL (0) / 5
480  HCOLOR= 7: GOSUB 510: HCOLOR= 0: GOSUB 510
490  IF  PEEK ( - 16287) > 127 THEN 530
500  GOTO 470
510  HPLOT 125,75 TO 125 + 80 *  SIN (N / 24 * 3.14),75 + 75 *  COS (N / 24 * 3.14)
520  RETURN
530  FOR I = 0 TO N STEP .1
540  HCOLOR= 7
550  HPLOT 125,75 TO 125 + 80 *  SIN (I / 24 * 3.14),75 + 75 *  COS (I / 24 * 3.14)
560  NEXT
570  HOME : VTAB 22
580  PRINT "DO YOU WANT TO SAVE THIS ONTO DISK (Y/N)"
590  GET A$
600  IF A$ < > "Y" AND A$ < > "N" THEN  PRINT "": GOTO 570
610  IF A$ = "N" THEN 690
620  HOME
630  VTAB 22: PRINT "WHAT FILE NAME DO YOU WANT ?"
640  INPUT "";NA$
650  IF NA$ = "" THEN 630
660  IF  ASC (NA$) < 65 OR  ASC (NA$) > 90 THEN  INVERSE : PRINT : PRINT "INVALID FILE NAM
E": NORMAL : GOTO 630
670  IF  LEN (NA$) > 30 THEN  INVERSE : PRINT : PRINT "FILE NAME TOO LONG.": NORMAL : GOTO
 630
680  PRINT  CHR$ (4);"BSAVE ";NA$;",A 8192,L8192"
690  TEXT : PRINT "GET PRINTER READY, THEN HIT ANY KEY": GET X$
700 D$ = "": FOR I = 1 TO 8:D$ = D$ +  CHR$ ( PEEK (I + 767))
710  NEXT
720  PR# 1
730  PRINT "  ";: PRINT
740  PRINT "DATE:-";D$
750  IF A$ = "Y" THEN  PRINT : PRINT "TITLE:-",NA$
760  PRINT "SECTOR NO.        NAME          AMOUNT"
770  PRINT "-------------------------------------"
780  FOR I = 1 TO NO
790  PRINT "   ";I,Z$(I),S(I);"%"
800  NEXT
810  PRINT "-------------------------------------"
820  PRINT ,"TOTAL:-",Q;"%"
830  PRINT "-------------------------------------"
840  PRINT : PRINT : PRINT
850  PRINT  SPC( 15);"0....!....!....!....!....100"
870  FOR I = 1 TO NO
880  PRINT Z$(I);: HTAB 14: PRINT " :";
890  FOR J = 0 TO  INT (S(I) / 4): PRINT "*";: NEXT : PRINT : NEXT
900  PR# 0
910  IF A$ = "Y" THEN  PRINT  CHR$ (4);"LOCK ";NA$
920  GOTO 70
930  REM
940  HOME : PRINT "OPTION 2 - COMPUTE AND DRAW"
950  PRINT : PRINT : PRINT "WITH THIS OPTION,YOU SPECIFY THE        PERCENTAGE OF CIRCLE T
O BE FILLED IN"
960  PRINT : PRINT "YOU THEN HAVE THE OPTION OF SAVING THE"
970  PRINT : PRINT "CHART ONTO DISK."
980  CLEAR
990  PRINT : PRINT : INPUT "HOW MANY SEGMENTS DO YOU WANT?";NO$:NO =  VAL (NO$)
1000  IF NO < 1 THEN  PRINT "": GOTO 990
1010  DIM S(NO),S$(NO),Z$(NO)
1040  FOR I = 1 TO NO
1050  PRINT "ENTER PERCENT FOR SECTOR #";I: INPUT S$(I):S(I) =  VAL (S$(I))
1060  PRINT "ENTER NAME FOR SECTOR #";I;: INPUT Z$(I)
1070 Q = Q + S(I): IF Q > 100 THEN  PRINT "TOO LARGE A TOTAL": GOTO 980
1080  NEXT
1090  HGR : HCOLOR= 7
1100  HPLOT 125 - 80 *  SIN (N / 24 * 3.14),75 + 75 *  COS (N / 24 * 3.14)
1110  FOR N = 0 TO 50 STEP .5
1120  HPLOT  TO 125 - 80 *  SIN (N / 24 * 3.14),75 + 75 *  COS (N / 24 * 3.14)
1130  NEXT
1140 C = 7
1150 X = 0
1160  FOR J = 1 TO NO
1170  HCOLOR= C
1180  HOME
1190  VTAB 22: PRINT "SECTOR NO.";J;"    NAME:";Z$(J);"   AMOUNT:";S(J);"%"
1200  FOR N = X TO (S(J) / (100 / 48)) + X STEP .1
1210  HPLOT 125,75 TO 125 - 80 *  SIN (N / 24 * 3.14),75 + 75 *  COS (N / 24 * 3.14)
1220  NEXT :X = (S(J) / (100 / 48)) + X
1230 C = C + 5: IF C > 7 THEN C = 2
1240  NEXT
1250  GOTO 570
1260  HOME
1270  PRINT "WHAT FILE DO YOU WISH TO LOAD ?"
1280  INPUT "";NA$
1290  IF NA$ = "" THEN  PRINT "": GOTO 1260
1300 Q =  ASC (NA$)
1310  IF Q < 65 OR Q > 90 THEN  INVERSE : PRINT "INVALID FILE NAME": NORMAL : GOTO 1270
1320  IF  LEN (NA$) > 30 THEN  INVERSE : PRINT "FILE NAME TOO LONG": NORMAL : GOTO 1270
1330  HGR
1340  PRINT  CHR$ (4);"BLOAD ";NA$
1350  VTAB 24: PRINT "HIT ANY KEY TO RETURN TO MAIN MENU": GET A$: GOTO 100
1360  HOME : END
1370 ER =  PEEK (222)
1380  HOME
1390  FLASH : VTAB 24: PRINT ""
1400  IF ER = 4 THEN 1460
1410  IF ER = 6 THEN 1480
1420  IF ER = 9 THEN 1530
1430  IF ER = 10 THEN 1550
1440  IF ER = 13 THEN 1570
1450  PRINT "ERROR": NORMAL : END
1460  PRINT "DISK IS WRITE PROTECTED:-REMOVE TAB     BEFORE CONTINUING"
1470  NORMAL : GOTO 580
1480  PRINT "THIS FILE DOES NOT EXIST:-MAYBE YOU     MIS-SPELLED ITS NAME."
1490  PRINT "HERE ARE THE FILES ON THIS DISK": NORMAL
1500  TEXT
1510  PRINT  CHR$ (4);"CATALOG"
1520  PRINT "HIT ANY KEY TO CONTINUE": GET A$: GOTO 70
1530  PRINT "THE DISK IS FULL! CHANGE DISKS BEFORE   CONTINUING"
1540  NORMAL : GOTO 580
1550  PRINT "FILE ";NA$;" ALREADY EXISTS. TRY ANOTHER NAME."
1560  NORMAL : GOTO 580
1570  PRINT "FILE ";NA$;" IS NOT A 'PIE CHARTS' FILE"
1580  NORMAL : GOTO 70

]REM  NOW COMES THE VARIABLE CROSS-REF

]&X

A$    280, 410, 590, 600, 610, 750, 910, 1350, 1520
C     1140, 1170, 1230
D$    20, 30, 50, 700, 740
ER    1370, 1400, 1410, 1420, 1430, 1440
I     40, 50, 530, 550, 700, 780, 790, 870, 880, 890, 1040, 1050, 1060, 1070
J     890, 1160, 1190, 1200, 1220
N     430, 440, 450, 470, 510, 530, 1100, 1110, 1120, 1200, 1210
NA$   640, 650, 660, 670, 680, 750, 910, 1280, 1290, 1300, 1320, 1340, 1550, 1570
NO    780, 870, 990, 1000, 1010, 1040, 1160
NO$   990
Q     280, 290, 310, 820, 1070, 1300, 1310
S(    790, 890, 1010, 1050, 1070, 1190, 1200, 1220
S$(   1010, 1050
X     1150, 1200, 1220
X$    690
Z$(   790, 880, 1010, 1060, 1190
```

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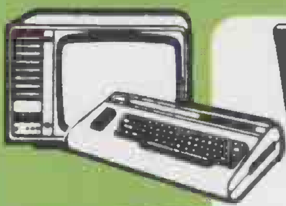

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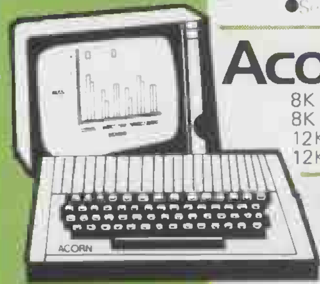

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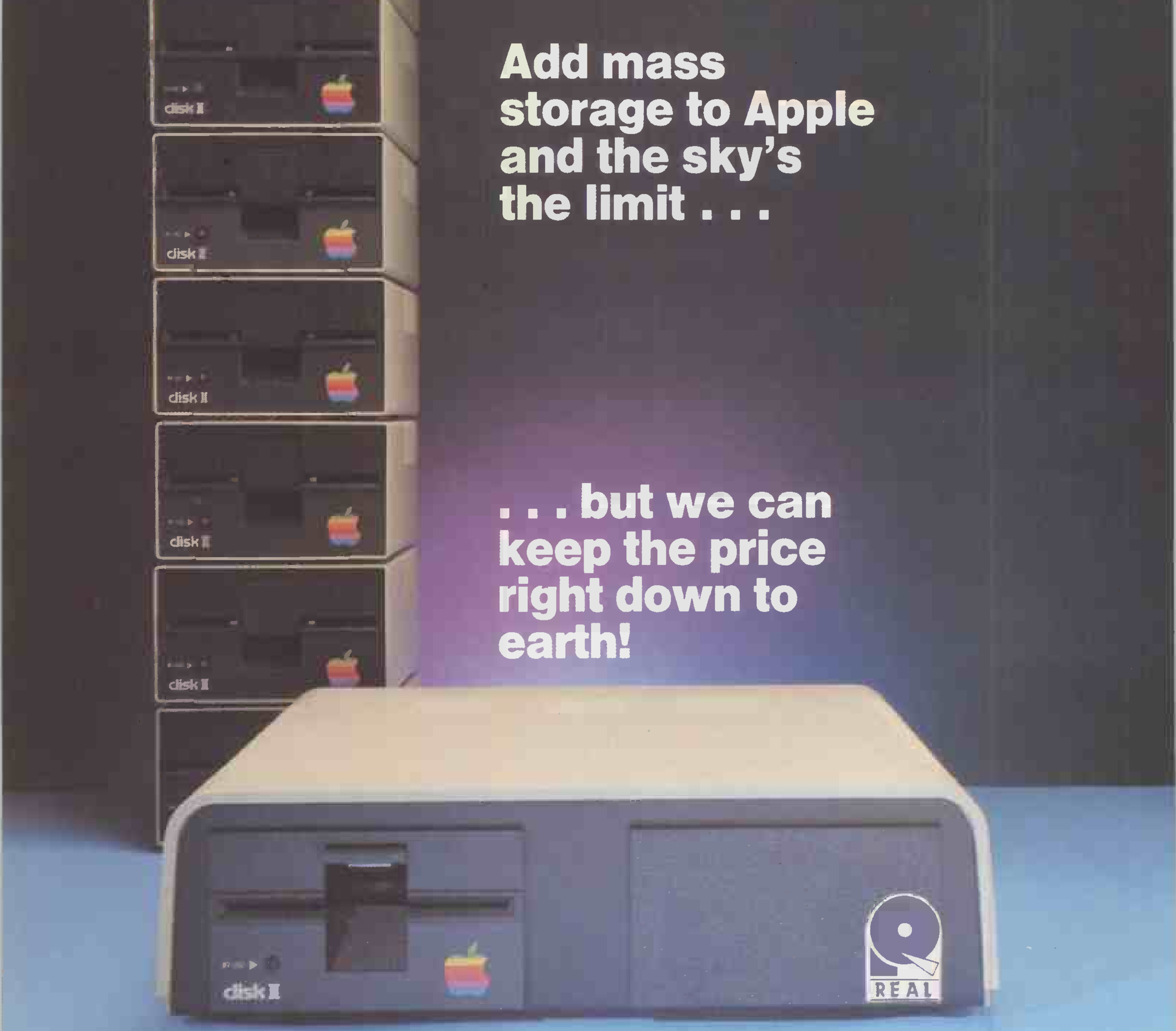
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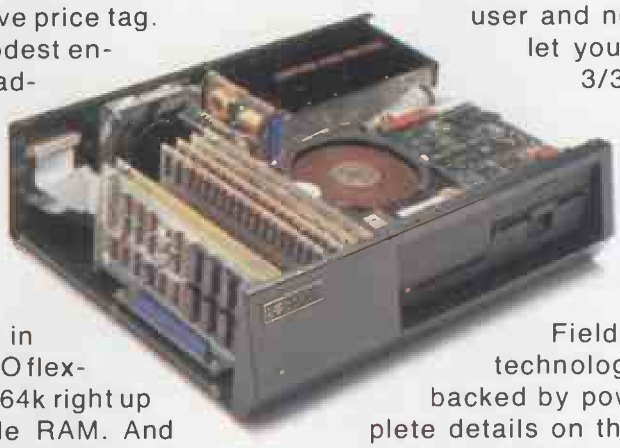

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Trace routine

JOHNATHAN Turpin of Stanford-le-Hope in Essex sends this trace routine for the Pet. The machine code is loaded from Basic by the loop in lines 100 to 130, and then entered in line 150.

```
100 FORI=546TO668
110 READA
120 POKEI,A
130 NEXTI
140 POKE11,125:POKE12,2
150 X=USR(X)
160 END
170 DATA  165,136,201,255,208,1,96,169
180 DATA  0,133,14,96,135,197,232,240
190 DATA  26,133,232,165,136,133,233,169
200 DATA  222,205,12,223,240,251,169,60
210 DATA  32,229,168,32,90,185,169,62
220 DATA  32,229,168,165,136,197,233,208
230 DATA  228,96,72,169,99,141,24,2
240 DATA  169,2,141,25,2,104,76,116
250 DATA  162,32,186,255,201,20,240,1
260 DATA  96,152,72,169,165,172,45,2
270 DATA  141,45,2,140,110,2,104,168
280 DATA  76,99,2,160,4,185,152,2
290 DATA  153,189,0,136,208,247,169,84
300 DATA  133,1,169,2,133,2,141,25
310 DATA  2,169,99,141,24,2,96,32
320 DATA  34,2,234
```

Note writer

MY PROGRAM is called Note Writer, writes Steve Skipp of Tyseley, Birmingham. It is a short and simple Basic program designed for those with disc and printer. It gives a simple form of word processing — in upper case only. You can write letters and memos — but you cannot use a colon or comma in your notes. These will terminate the input line.

Each line of data must start with a one-digit code which will be used to control the printer, control the line spacing and to mark the end of the data file. The following codes are used:

0 for head of form
1 to space 1 line
2 to space 2 lines
3 to space 3 lines
4 to space 4 lines
* to mark end of file
" to print this line of data on the current print line.

If you enter an up arrow as the first character of a new line it will allow you to go back one line so that you may amend it.

During the copy phase the following keys are used:

Space bar — to pass the current line for printing
\- sign — to delete the current line
\+ sign — to insert before the current line
Other keys — to amend the current line.

Improved screen print

PUBLISHED SCREEN-PRINT programs do not always produce the desired result on the system that I use, comments M I Constantine of East Grinstead, West Sussex. My system comprises a Commodore 8032 with 4040 discs and an NEC Spinwriter with serial interface. I have encountered the following problems:

- The control characters — Sys 0 or perhaps @ P — are printed along with the screen information.
- Programs using Basic 2 do not work with Basic 4, which itself does not send a line feed with file numbers of less than 128.
- Attempting to print graphic and reverse-field characters on an ASCII-only printer produces strange results. For the purpose of this program I have converted them to their equivalent keyboard characters, and the alternative character set is treated as if it were the standard one.
- Some routines are located in the second cassette buffer which is used on the 8032 for disc in/out jobs.
- Printing is often crammed on to the first 25 lines of a sheet of paper and no "top of form" command is given at the end of the print.
- Other Pet systems print only the top half of the 8032 screen, splitting each screen line into two print lines.
- Programs that redirect the interrupt do not always provide a means of resetting it for loading other programs.

My screen-print program gets round all of these problems. It is presented in three forms: as Basic loader; by disassembler; and hex dump. Instructions for its use are included in the Basic form which is recommended for those not familiar with machine code.

To use the routine from a Basic program, load this one first and run it followed by Sys 750. Then load the Basic program, which should implement Sys 634, and then Poke 151,155: Poke 152,1 for each time a screen print is required.

The disassembler listing shows how the program works. It has six sections. The first section, from \$027A to \$0284, changes the course of the interrupt through the "decision" section which checks that the Escape and Shift keys are both depressed, and jumps to the exit point if not.

The printing routine follows, and can be split into three parts; \$0291 to \$02A8 sets up the screen-start address and line counter into zero-page locations. The second part does most of the work converting the screen codes to ASCII and sending them to the printer. This part is located between \$02A9 and \$02CA. The third part of the printing section which ends at \$02DB, increments the screen-

(continued on page 143)

Note Writer

```
2 REM ******************************
3 REM S.SKIPP             NOTE WRITER
4 REM ******************************
5 REM (C) COPYRIGHT              1981
6 REM ******************************
8 OPEN 15,8,15
10 F$="
15 DIM A$(500)
20 G$=F$+F$
30 INPUT"COPY OR NEW  (C/N) ";J$
32 IFJ$="N"THEN50
36 Y=0
38 INPUT"FILE NAME :  ";B$
40 OPEN 2,8,2,"0:"+B$+",S,R"
42 INPUT£15,EA$,EB$:IFEA$<>"00"THENPRINT"FILE NOT THERE":GOTO38
44 Y=Y+1:INPUT£2,J$
45 GOSUB600
46 A$(Y)=J$
47 IFLEFT$(J$,1)="*"THEN49
48 GOTO44
49 CLOSE 2:GOTO300
50 PRINT"G♥"
70 Z=0:Y=0
80 FORZ=0TO500:A$(Z)="":NEXT
110 Y=Y+1
120 PRINTG$"G●G●"
130 INPUT".G|G|G|";J$
140 IFLEFT$(J$,1)=". "THEN190
141 IFLEFT$(J$,1)="1"THEN190
142 IFLEFT$(J$,1)="2"THEN190
143 IFLEFT$(J$,1)="3"THEN190
144 IFLEFT$(J$,1)="4"THEN190
145 IFLEFT$(J$,1)="0"THEN190
146 IFLEFT$(J$,1)="*"THENA$(Y)=J$:GOTO300
148 IFLEFT$(J$,1)="^"THENY=Y-1:PRINTA$(Y)"G●G●":GOTO130
149 PRINT"ERROR-TRY AGAIN":GOTO120
190 A$(Y)=J$
200 GOTO110
300 INPUT"DO YOU WANT TO PRINT (YES OR NO) ;";J$
302 IFJ$="NO" OR J$="N"THEN450
306 PRINT"HIT ANY KEY FOR PRINTER"
308 GETJ$:IFJ$=""THEN308
310 OPEN 4,4
312 CMD4
320 FORZ=1TOY
330 IFLEFT$(A$(Z),1)="0"THENPRINTCHR$(12):GOTO400
332 IFLEFT$(A$(Z),1)=". "THEN398
334 IFLEFT$(A$(Z),1)="1"THEN396
336 IFLEFT$(A$(Z),1)="2"THEN394
338 IFLEFT$(A$(Z),1)="3"THEN392
340 IFLEFT$(A$(Z),1)="4"THEN390
342 IFLEFT$(A$(Z),1)="*"THENZ=Y:GOTO400
390 PRINT
392 PRINT
394 PRINT
396 PRINT
397 GOTO400
398 PRINTMID$(A$(Z),2,78)
400 NEXT
410 PRINT£4:CLOSE 4
420 PRINT"RUN COMPLETED"
450 INPUT"SAVE ON DISC ??  (Y/N) ";J$
452 IFJ$="N" OR J$="NO"THEN END
454 INPUT"NAME OF FILE :  ";J$
456 OPEN 3,8,3,"@0:"+J$+",S,W"
458 FORX=1TOY:PRINT£3,A$(X);CHR$(13);
460 NEXT:PRINT£3,"****";CHR$(13);
462 CLOSE 3
470 PRINT"COPY OVER."
472 END
600 J$=LEFT$(J$+G$,78)
605 PRINT">>>"J$"<<<"
610 GETA$:IFA$=""THEN610
619 IFA$="  "THENRETURN
620 IFA$="-"THEN625
621 IFA$<>"+"THEN630
622 K$=J$:J$=G$:GOSUB630
623 A$(Y)=J$:Y=Y+1:J$=K$:GOTO600
625 Y=Y-1:J$=A$(Y):GOTO600
630 PRINTJ$:INPUT"G●G●G|G|";A$
640 IFLEFT$(A$,1)=". "THEN680
641 IFLEFT$(A$,1)="1"THEN680
642 IFLEFT$(A$,1)="2"THEN680
643 IFLEFT$(A$,1)="3"THEN680
644 IFLEFT$(A$,1)="4"THEN680
645 IFLEFT$(A$,1)="0"THEN680
646 IFLEFT$(A$,1)="*"THEN680
650 PRINT"TRY AGAIN":GOTO630
680 J$=A$:RETURN
```

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(continued from page 141)
count looping back until the end of a line is reached, and then checks that all the lines have been printed by decrementing the counter held in $21 and testing for zero. The program loops back if there are any lines left to print.

The next program section sends the form-feed command, restores the screen as the output device and continues the interrupt. The final section is the routine to reset the interrupt for in/out work.

This routine does not use the bi-directional printing facility available on the Spinwriter. It would be an unnecessary complication, and without it the routine should be usable with most ASCII printers linked to an 8032.

Screen print program.

```
100 printchr$(147):printtab(20)"Screen print for 8032 & ASCII printer"
110 print:print:printtab(25)"by M.I.Constantine 20/10/81"
120 for i=634 to 760 :read j :poke i,j :next
130 sys634:print:print:printtab(25)"press shift & esc to print"
140 print:print:printtab(30)"sys 634 to enable"
150 print:print:printtab(23)"sys 750 to disable before load"
160 poke151,155:poke152,1
200 data 120,169,2,133,145,169,133
210 data 133,144,88,96,165,151,201
220 data 155,208,96,165,152,201,1
230 data 208,90,169,128,133,32,169
240 data 0,133,31,169,4,133,176
250 data 133,212,32,213,240,32,72
260 data 241,169,25,133,33,169,13
270 data 32,210,255,169,10,32,210
280 data 255,32,210,255,160,0,177
290 data 31,41,127,208,4,105,64
300 data 16,6,201,32,16,2,105
310 data 96,32,210,255,200,192,80
320 data 144,232,165,31,105,79,133
330 data 31,144,2,230,32,198,33
340 data 208,203,169,13,32,210,255
350 data 169,12,32,210,255,32,204
360 data 255,76,85,228,120,169,228
370 data 133,145,169,85,133,144,88
380 data 96
```

Hex dump.

```
.
.:  027A 78 A9 02 85 91 A9 85 85
.:  0282 90 58 60 A5 97 C9 9B D0
.:  028A 60 A5 98 C9 01 D0 5A A9
.:  0292 80 85 20 A9 00 85 1F A9
.:  029A 04 85 B0 85 D4 20 D5 F0
.:  02A2 20 48 F1 A9 19 85 21 A9
.:  02AA 0D 20 D2 FF A9 0A 20 D2
.:  02B2 FF 20 D2 FF A0 00 B1 1F
.:  02BA 29 7F D0 04 69 40 10 06
.:  02C2 C9 20 10 02 69 60 20 D2
.:  02CA FF C8 C0 50 90 E8 A5 1F
.:  02D2 69 4F 85 1F 90 02 E6 20
.:  02DA C6 21 D0 CB A9 0D 20 D2
.:  02E2 FF A9 0C 20 D2 FF 20 CC
.:  02EA FF 4C 55 E4 78 A9 E4 85
.:  02F2 91 A9 55 85 90 58 60 43
```

Machine code.

```
027A 78          SEI
027B A9 02       LDA £$02
027D 85 91       STA $91
027F A9 85       LDA £$85
0281 85 90       STA $90
0283 58          CLI
0284 60          RTS
0285 A5 97       LDA $97
0287 C9 9B       CMP £$9B
0289 D0 60       BNE $02EB
028B A5 98       LDA $98
028D C9 01       CMP £$01
028F D0 5A       BNE $02EB
0291 A9 80       LDA £$80
0293 85 20       STA $20
0295 A9 00       LDA £$00
0297 85 1F       STA $1F
0299 A9 04       LDA £$04
029B 85 B0       STA $B0
029D 85 D4       STA $D4
029F 20 D5 F0    JSR $F0D5
02A2 20 48 F1    JSR $F148
02A5 A9 19       LDA £$19
02A7 85 21       STA $21
02A9 A9 0D       LDA £$0D
02AB 20 D2 FF    JSR $FFD2
02AE A9 0A       LDA £$0A
02B0 20 D2 FF    JSR $FFD2
02B3 20 D2 FF    JSR $FFD2
02B6 A0 00       LDY £$00
02B8 B1 1F       LDA ($1F),Y
02BA 29 7F       AND £$7F
02BC D0 04       BNE $02C2
02BE 69 40       ADC £$40
02C0 10 06       BPL $02C8
02C2 C9 20       CMP £$20
02C4 10 02       BPL $02C8
02C6 69 60       ADC £$60
02C8 20 D2 FF    JSR $FFD2
02CB C8          INY
02CC C0 50       CPY £$50
02CE 90 E8       BCC $02B8
02D0 A5 1F       LDA $1F
02D2 69 4F       ADC £$4F
02D4 85 1F       STA $1F
02D6 90 02       BCC $02DA
02D8 E6 20       INC $20
02DA C6 21       DEC $21
02DC D0 CB       BNE $02A9
02DE A9 0D       LDA £$0D
02E0 20 D2 FF    JSR $FFD2
02E3 A9 0C       LDA £$0C
02E5 20 D2 FF    JSR $FFD2
02E8 20 CC FF    JSR $FFCC
02EB 4C 55 E4    JMP $E455
02EE 78          SEI
02EF A9 E4       LDA £$E4
02F1 85 91       STA $91
02F3 A9 55       LDA £$55
02F5 85 90       STA $90
02F7 58          CLI
02F8 60          RTS
```

Character call

HERE IS a short program which Pet users should find useful, writes Paul Bradshaw of Sunderland, Tyne and Wear. It Pokes a short machine-code routine into the second cassette buffer, which instantly fills the screen with any character desired by the user. The routine is called from Basic by the USR function.

After typing in the routine, the command Run will install the machine code in the second cassette buffer and set the USR vector. Now, to fill the screen instantly with the character whose Poke code is X, use the instruction Q=USR(X). For example, to fill the screen with As, use the instruction Q=USR(1), since 1 is the Poke code for A.

The routine is useful for games programs, or any application where the program has to attract the operator's attention — e.g. industrial control.

Character call.

```
10    DATA 32,210,214,162,0,165,17,76,72,226
20    FOR J=826 TO 835:READ X:POKE J,X:NEXT
30    POKE 0,76:POKE 1,58:POKE 2,3
```

Neat layout

I THINK I CAN help W V Legge — Feedback, October 1981 — over his problem with the Tab(X) function when outputting from the Pet to his 4022 printer, writes Bruce Humphries of Epsom, Surrey. As he explained, this function acts in an identical manner to SPC(X), i.e. tabs from the last printed character, not the left-hand margin. A very simple way to overcome the lack of a true Tab function is to force a carriage return without line feed after each printed string:

```
10    REM ** SIMPLE TABULATING ROUTINE
20    PRINT#2,SPC (X);A$;CHR$(141);
```

where A $ is the character or string to be printed.

The problem with this method is that it is very slow and results in undue wear to the printer, particularly when plotting, because of the large number of carriage return/tab operations.

When formatting tables, I use a short routine — listing 1 — to left-justify into neat columns. The method works out the length of the string just printed (AL), subtracts it from the column width (WC), and then prints that number of trailing spaces — SP$ is a string of, say, 60 spaces. If necessary, the routine can be easily converted to print, say, dots instead of spaces, which in some circumstances can improve clarity.

The same idea can be used to right-justify columns, e.g., to align units, tens, hundreds, etc., on integer numeric printout, by printing spaces before, instead of after the string representation of the number. To handle floating-point numbers, however, requires a slightly more complex technique — see listing 2.

In this routine, WC is the column width, TT is the number of characters from the left of the column to the decimal point, and SP$ again is 60 spaces. All these variables must be initially declared. The routine aligns all decimal points, handles integers and negative values, and I have found it most useful when printing multiple columns of figures.

Layout — listing 1.

```
10    REM **PRINT ALPHA COLUMN
20    AL=LEN(A$) : IFAL=>WCTHENA$=A$+LEFT$(SP$,WC-AL+1):GOTO40
30    A$=LEFT$(A$,WC)+LEFT$(SP$,1)
40    PRINT#2,A$;
```

Listing 2.

```
10    REM** PRINT DECIMAL COLUMN
20    A$=STR$(A)
30    A=INT(A):LD=LEN(STR$(A))-1
40    IFLD>=TTTHEN60
50    A$=LEFT$(SP$,TT-LD)+A$
60    A$=A$+LEFT$(SP$,WC-LEN(A$)+1)
70    PRINT#2,A$;
```

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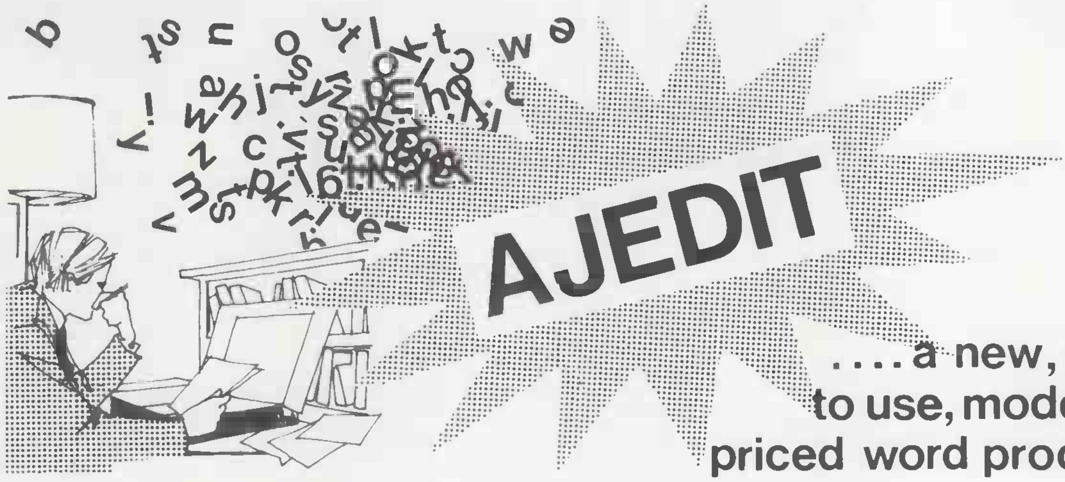

. . . . a new, simple to use, moderately priced word processor

The introduction of a brand new word processor is a major event and AJEDIT is without doubt a major program. There are, however, quite a few Word Processors around and most of them are extremely good ones - why, therefore, another? The question is even more pertinent when it is known that we specifically commissioned the writing of it from an author of the status of Denville Longhurst of Enhanced Basic fame. The answer is that user feedback shows that a large number of customers do not need or want word processor programs which require a quantity of training before use. Scripsit, for instance, is an excellent program, but is complex to use; it even comes with a training course on tape. If one operator is dedicated to using the word processor then it makes sense to have her trained, and the more complex the program (so long as the complexity is accompanied by more and bigger functions) the better.

AJEDIT has been written for the user who needs a word processor intermittently, say three or four times a week. Its prime design criteria was ease of use - and just as importantly - ease of recollection of its commands. Take, for instance, the text editing commands - they are as close to the Basic Edit commands as possible, so that the user will remember them: To insert type I, to delete D, to take out three letters type 3D and so on.

Furthermore, AJEDIT has benefited from being written after a number of other word processors. The deficiencies in its predecessors are corrected in AJEDIT. For instance, any control characters can be outputted so that full advantage can be taken of the features of the particular printer being used. Disk directory access is available from within AJEDIT as is the killing of files on the disk. The FREE command and a number of other DOS commands can be carried out from within the program with a return to AJEDIT - with its text intact.

AJEDIT contains close to one hundred commands covering most word processor requirements. Dedicated printer commands for the Epson MX series and the Centronics 737 are included - again for ease of use of these two popular printers.

One of the big features of AJEDIT is the ability to "mail-merge". The facility is available whereby two special files are created, one containing names and addresses and a salutation, the other a standard letter or form. AJEDIT will call the address and salutation from one file and the letter from the other and thereby compile personalised letters. The salutation may be repeated in the body of the letter.

AJEDIT needs 48K and one disk minimum and is suitable for the TRS-80 Models I and III and the Video Genie Models I and II.

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The Basic handbook

Second edition by David Lien. Published by Compusoft Publishing at $19.95.

ONCE EVERY few years a book is published which just cannot be ignored: the first edition of *The Basic handbook* was just such a book. Three years later David Lien has produced a much expanded second edition which retains the original format.

All the keywords are described using a standard form of presentation which is clear and comprehensive. As well as a description of the instructions' function, a test routine is provided to allow the reader to check whether his compiler or interpreter supports the keyword or its alternative spellings.

Where it does not, *The Basic handbook* provides other ways of achieving the same results by means of other instructions. Known variations in the use of the word are also catalogued.

Many people regard Basic as a restricted and restrictive language — a quick glance at this book will soon put the lie to such thoughts. Basic has developed a good deal, since it was conceived at Dartmouth College. It is now a full-blown language with versions suitable for all data-processing problems, even teaching, and many are covered by this one book.

This edition covers almost twice the number of words included in the original edition — it now describes over 500 words. At that rate the third edition will be in two volumes.

For any user of Basic who has to convert programs written for other machines for his own, this book will prove essential. It will certainly prove cheaper than collecting the appropriate manuals. There is a sensible, well-written guide to program conversion and a section providing an overview of some of the more unusual implementations of the language.

If this book has any failing it is in its coverage of disc and print-file handling. The short chapter covering these subjects does not pretend to be comprehensive. The author points out that there is little standardisation in this area and a more comprehensive treatment using the approach of the main body of the text will have to wait until there is more stability.

Conclusions

- **Most microcomputer users need at some time to convert programs written in one of the multitude of Basic dialects: this book is an invaluable tool for such a task.**
- **Although not a substitute for the language reference manual, this work provides an encyclopaedic reference to all the major versions of Basic. It should be on all Basic programmers' bookshelves.**
- **David Lien is to be congratulated on his dedication to the documentation of the Basic language — at the current rate, the third edition will be spectacular.**

Martin Wilson

DON'T (or How to Care For Your Computer)

By Rodney Zaks. Published by Sybex. 217 pages. Paperback. ISBN 0 89588 065 2

YET ANOTHER publication from one of the computer world's most prolific authors. It is unlikely to set the world on fire but nevertheless contains a large quantity of useful information.

The 13 chapters cover hardware, software, peripherals, documentation, discs and tapes, security and maintenance. Zaks' main proposition in *Don't* is that today's hardware is generally reliable; it is usually the operator who is likely to cause problems.

The book explains that many faults only emerge some time after the cause, which is usually consequently difficult to trace since the offender is either not around when the problem emerges or cannot remember not following the correct procedures. Zaks calls this the "time-bomb effect", which is often further complicated by the "pointed-index syndrome" — hardware and software suppliers who are unable to discover the cause end up pointing an accusing finger at each other.

The user is left with no remedy and, worse, not knowing how to prevent a recurrence. Zaks claims that by following the procedures in this book many problems can be avoided or reduced.

Many computer users will be aware of some of the Dos and Don'ts of handling equipment through experience or common sense. However, there are many causes of loss or damage to data or equipment which are not common knowledge, and most such pitfalls are covered in this book.

Such a thorough and detailed explanation of technical problems could become dull and boring reading, but Zaks has managed to present his book in a clear and interesting manner. The text is sensible, no-nonsense stuff and is interspersed with amusing cartoons to reinforce the points being made. Each section contains examples of what can go wrong in the form of typical horror stories, which serve to further illustrate the need for care.

Apart from describing typical problems, *Don't* provides useful information on the proper procedures for handling, storage and siting of equipment, provision of a clean power supply and some advice on helping to prevent computer fraud. Despite being an American publication, much of the information is directly transferable to the British user, with the exception of the wire coding and power-supply voltage information.

Conclusions

- **Essential reading for the new business and education user.**
- **A useful reference book for computer-studies teachers.**

Michael Trott

More TRS-80 Basic — A Self-Teaching Guide

By Inman, Zamora and Albrecht. Published by Wiley.

THIS BOOK CONTINUES where the author's previous book *TRS-80* left off and adopts the same format. As the title suggests, it assumes some familiarity with Basic programming.

Although prior knowledge is assumed, an extensive introduction reviews the level II Basic instructions that were covered by the previous book. In addition there is a glossary of frequently-used terms, and guidance on using the book to gain maximum benefit from it. The text then moves steadily through the structure of the memory, how it is utilised by the machine itself, and how it may be modified by the programs using Peek and Poke.

After a brief summary and a self-test quiz with answers, the book continues logically with a chapter about graphics. This provides a comprehensive guide to the topic, including comparison of the speed of different techniques — important for moving displays.

The next four chapters cover files both on cassette and disc. These chapters are thorough — although they may be a little slow for some people — but for the readers that this book is aimed at it is probably the best approach for avoiding misunderstanding. These chapters are far more comprehensive than most of the general introductions to Basic provide, and as a result the reader of this book should rapidly become able to make effective use of files for data storage.

The rest of the book is mainly concerned with more detailed aspects of earlier topics, especially graphics, but there is a chapter on sound and music production using optional hard- and software. There is a useful section which explains the storage requirements of various data types and precisions, invaluable when trying to squeeze a large program into a small machine.

Surprisingly, arithmetic functions are not discussed until the penultimate chapter. However, the descriptions are clear and easily understood. There is a first-class index which many books of this type lack.

Conclusions

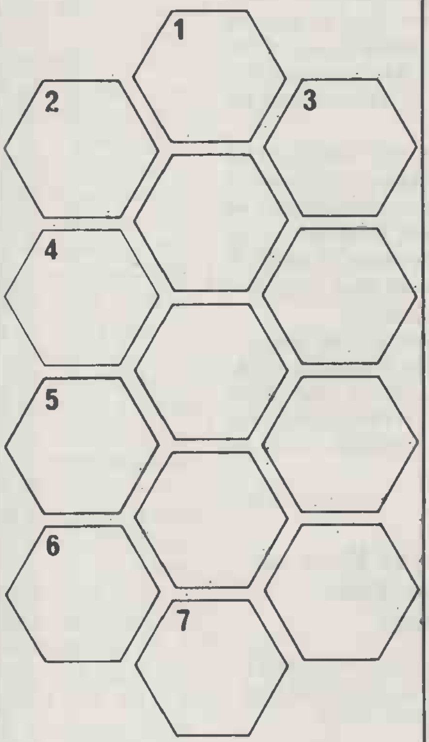
- **A very friendly book that a TRS-80 user with limited experience will find useful. All explanations are both comprehensive and clearly written so misunderstandings should be rare.**
- **A more experienced reader will find valuable information in this book but may well be irritated by its slow pace.**
- **Elementary programming skills are assumed, and are required to make the most of the book, but the level needed is not high.**

Martin Wilson

Number bees by Tony Roberts

THIS HONEYCOMB is the home of the numerical bees. Rather than producing honey, the bees of this hive produce numbers. However, they are not just produced at random; an ancient and mystic set of rules governs the numbers that appear in each cell. In fact there is just one set of numbers that fit.

The hive's new Bee Bee Cee computer has not yet arrived, so can you help them out?



Clues

Across →

1. The product of two primes.
2. Half of the product of two across and two up.
4. The product of a square and two up.
5. A prime number.
6. A prime number.

Up ↗

2. One less than the difference between five up and five down.
4. The square of six across.
5. The product of one across and the difference between one across and six across.
6. Six times the difference between seven up and two up.
7. One-ninth of the sum of one across, six across and four up.

Down ↓

1. The cube of six across.
2. A cube.
3. The cube of one across, with digits reversed.

Solution to December puzzle

THE SMALLEST sum possible from the Knight's gambit puzzle is zero. It can be achieved by the following sequence of moves:

6 x 3 + 2 ÷ 5 x 1 ÷ 4 + 7 − 8 = 0

What makes Thezeus run

Nick Smith continues his account of Alan Dibley's successful mice, Thezeus and Son of Thezeus. Here he reports on how their Sinclair ZX-80 brains are interfaced to the steering and mechanics.

STARTING FROM the back of the ZX-80, Alan Dibley has created the four-bit output port shown in figure 1. A15 is not used in the ZX-80, although it would not matter as long as it was only used for memory addressing. The combination of A15, write and IORQ — input/output required — is output and connected to the clock input of the latches. The bottom four bits of the data bus are connected to the data inputs of the latches.

The latches therefore remember and output what was on the data bus at the time of the last clock pulse. All this is taken care of by one machine-code instruction.

Breaks every rule

The methods Dibley uses to build these interfaces breaks every rule in the book: the chips are glued to a convenient point on the chassis with their legs in the air. Connections are then made by soldering wires directly to the pins. The control-signal wires are soldered directly to the ZX-80 printed-circuit board.

All the electrical leads have connectors in them so that the mice can be taken apart easily, and quickly reassembled.

The machine-code instruction he uses is

```
OUT (C),H
```

which sends the C register to address bits A0 to A7, the B register to address bits A8 to A15 and the contents of the H register to the data bus. According to Zilog, address bits A0 to A7 are supposed to be the port address, but this does not seem to matter. To set all the latch outputs to 0 you need the subroutine:

Son of Thezeus ready to go, including sawn-off ZX-80 and 4K RAM pack.

```
2600    H ← 00       data for latches
0680    B ← 80       return address
                       bit 15
0E00    C ← 00
ED61    OUT (C),H    do the work
C9      Return
```

It should be Poked into memory, and called a USR () statement. To set one or more of the latch outputs to 1, first change the value register H initialised to in the first line.

The other major circuit is used to control the drive motor of Son of Thezeus, and is shown in figure 2. The variable resistor in the input limits the current the motor can draw, and thus its acceleration. The resistor across the motor introduces an element of dynamic braking when the transistor is off. The capacitor protects the transistor from current surges and reduces noise from the motor. Any npn power transistor should do, such as an AC-141, but it might need a heat sink.

Everything else on both mice is driven by radio-control servos. Believe it or not, the latch outputs can be connected directly to the servo inputs.

Pulse control

A servo is controlled by a stream of input pulses. The gap between these pulses is not critical, and anything between approximatly 10 and 30ms. should do — 20ms. is a safe value. If you do not send or stop sending the servo pulses, the output stops immediately wherever it is.

The position the shaft stops at, within 90° of travel, depends on the length of the input pulses. Typical values are

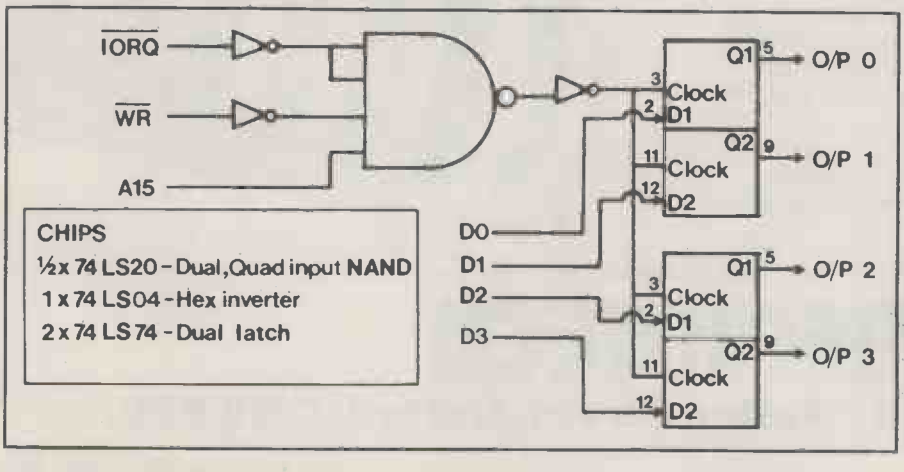
1ms.; hard left
1.5ms.; centre
2ms. hard right.

These durations are critical and vary from servo to servo so some experimenting with each particular servo is required.

Suppose the servo is set hard left and you send a stream of 1.5ms. pulses at 20ms. intervals. The output shaft will turn until it reaches the middle, where it will stop. If you do not send enough pulses the shaft will stop before it gets to the middle, but too many pulses do not move it beyond the middle. A servo takes about 0.5 seconds to rotate 90°, so a string of pulses lasting one second should be enough. If you wish you can keep track of the current position of the servo and thus

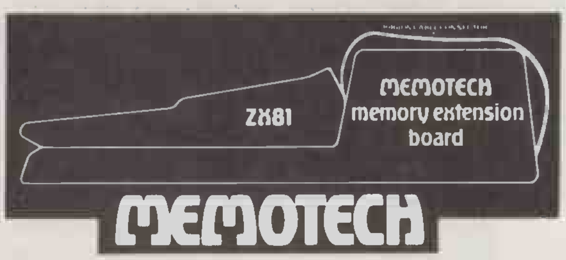
(continued on page 151)

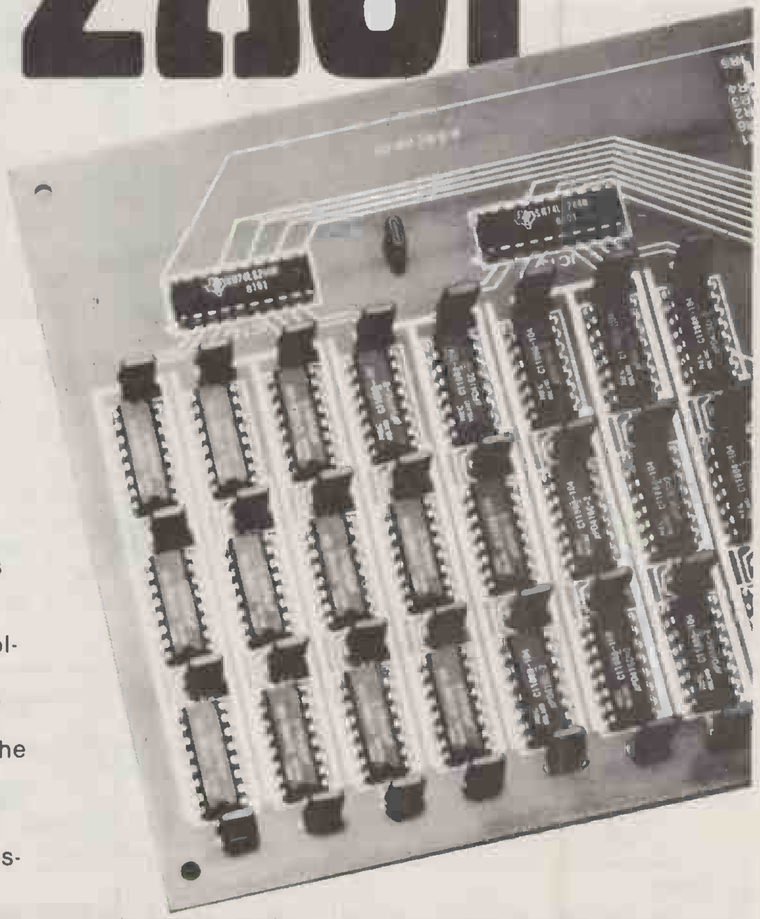
Figure 1. Circuit for Thezeus' output port.



MEMOTECH

48K memory extension for the ZX81





The MEMOTECH memory extension board will allow the ZX81 to run 48K BASIC programs which may include up to 16K of assembly code.
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● Circle No. 190

(continued from page 149)
calculate the lengths of time — and therefore the number of pulses — required for it to reach its new position.

If you read last month's article, you might be wondering how Thezeus managed to get anywhere at all when driven by a servo that can only rotate through 90°. The answer is to build a servo with an output shaft which rotates continuously.

Mouse weekend

Having sawn off inconvenient limit stops, etc., you then have to fool the electronics. To do this you disconnect the internal variable register on the output shaft and replace it with a fixed register with a value in the middle of the range of the variable register. A continuous stream of short pulses should now cause continuous rotation in one direction, long pulses the other. Stopping the pulses stops the servo.

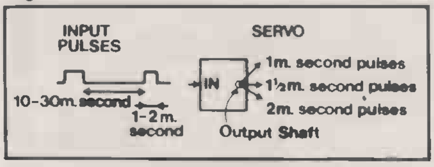
Everything, including the ZX-80, the motor and the servos, can be powered by four high-discharge AA-size ni-cad cells which produce 4.8 volts. A smoothing capacitor must be fitted across the power lines near the ZX-80; 1,000μF to 2,200μF electrolytic should do.

The code shown in table 1 generates the pulses and time delays

Alan Dibley makes no claim to elegance, and he has used the chips and other components which he found to hand. If you can do better, write to the Micromouse page.

At the bottom of his garden, Dibley has an 11-by-11 square maze. If you are interested in another Mouse weekend, please phone him at 0934 742360.

Figure 3. Pulses for servo control.



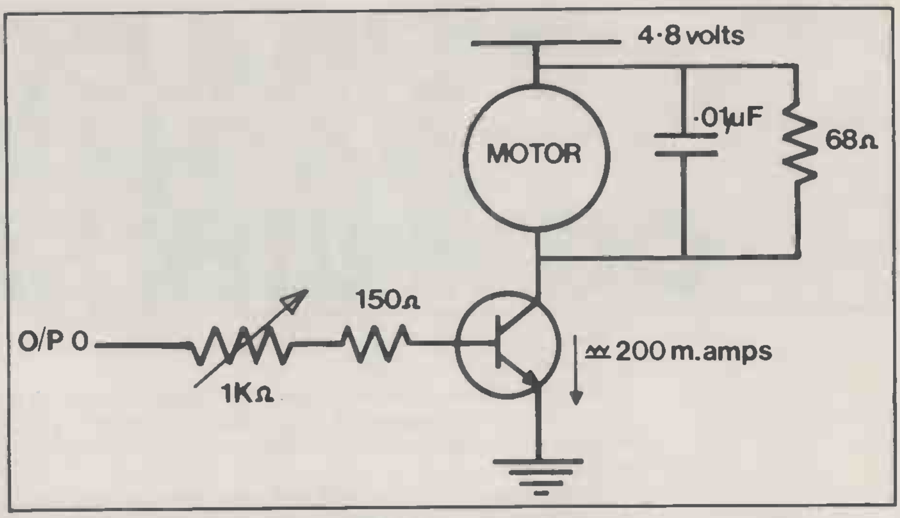


Figure 2. Basic circuit for Son of Thezeus' motor control.

Table 1. Code for servo-control pulses.

Hex code	Pseudomnemonic	
Short		
06XX	B ← XX	adjust XXfor time
10FE	DJN,-Z	count B down to zero
Long		
210000	HL ← 0000	fine adjustment
23	inc HL	
CB 5C	BIT H3	coarse adjustment
28 FB	JRZ, -5	repeat if bit tested to zero.

Extra-sensory exercises

Extra-sensory perception has had the attention of a number of serious investigators. This game, written by Tony Capper for the Acorn Atom and based on simple statistical principles, tests the possibility of paranormal communication between you and your machine.

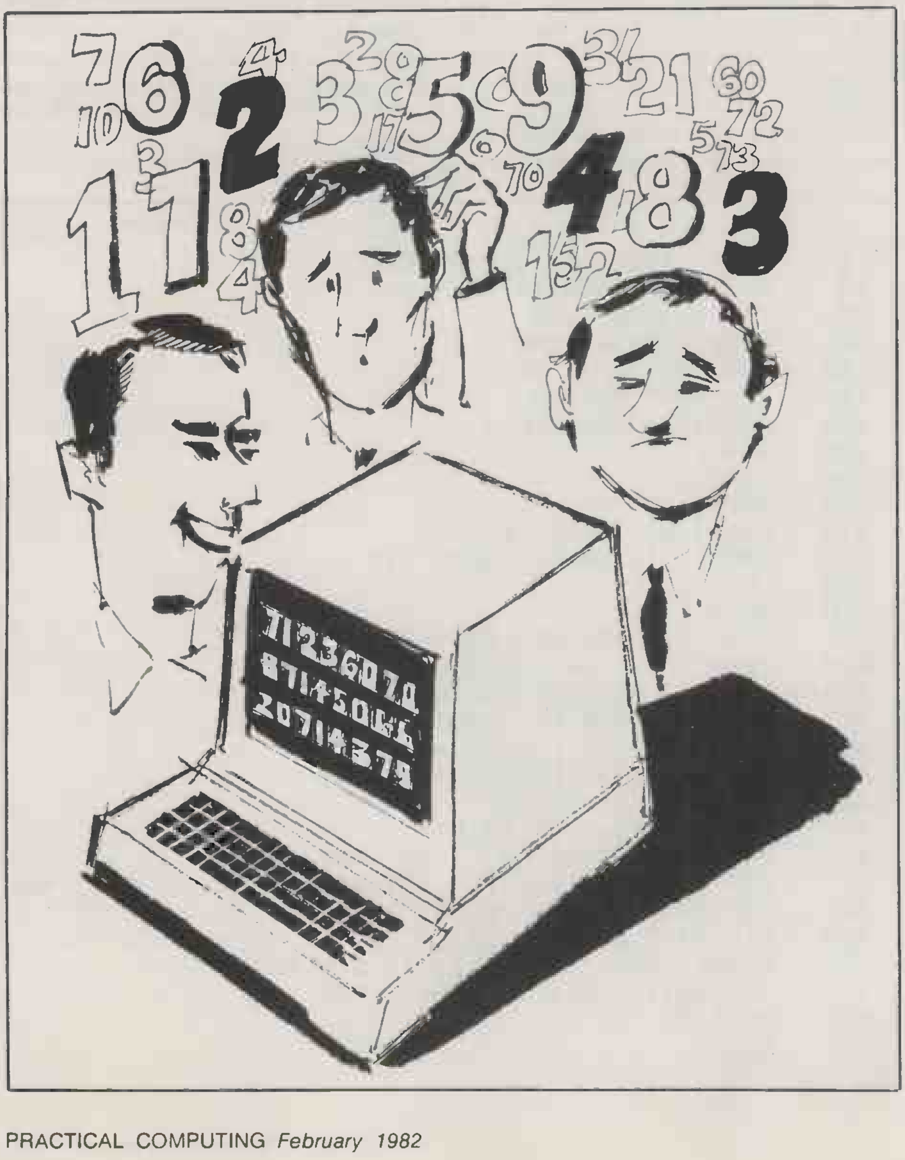
THE COMPUTER selects a random number in the range one to nine and the player then has several attempts at guessing the number. Anyone who plays this game may soon convince themselves that they possess ESP talent if they can find the correct number in less than an average of five guesses. However, a careful statistical study of the results is needed to be sure that it was not just a fluke.

The mathematics are not very complicated, and have been built into these programs, which are written for the Acorn Atom with floating point. The programs can be modified to work with integer maths using a suitable scaling factor.

It is worth examining the numbers provided by the Atom random-number generator, to see how good it is at producing truly random numbers. It chooses a number between one and nine, so the average number expected is five. The greater the number of tries, the nearer the average will be to five, but there can be big deviations from this average when only a few tries have been made.

So how do you tell if it has a good random-number generator? First, you must calculate the standard deviation, from which you can estimate the deviations from the average that can be

(continued on next page)



(continued from previous page)

expected from pure chance. If the generator really is truly random, it will generate each number once every nine tries, on average — see table 1.

Number generated	Deviation from average	Deviation^2
1	–4	16
2	–3	9
3	–2	4
4	–1	1
5	0	0
6	1	1
7	2	4
8	3	9
9	4	16
	Total =	60

Table 1.

The total of 60 in the right-hand column is then divided by 9, the number of numbers generated, to give the value of 6.66666, which is called the variance. The standard deviation is the square root of the variance, 2.582 in this case.

The standard error of estimate gives an indication of how the expected deviation will decrease as more tries are made. It is equal to the standard deviation divided by the square root of the number of games played. You can be 95 percent certain that the result will lie within plus or minus two standard errors of estimate of the actual average, so you should only be expected to achieve this "significant" average by chance once in 20 tries. You can be 99.8 percent certain that the result will lie within plus or minus three standard errors of estimate of the actual average, so you should only be expected to achieve this "highly significant" average by chance once in 500 tries. The possible deviations around the average due to chance are shown in figure 1.

Program A tests the Acorn Atom to see if the average achieved lies within these limits. The random-number generator selects a number, and then the Atom will count up to that number before selecting the next. Every 50 games the program will stop, and the following information will be presented:

- number of games played
- number of guesses made
- average guesses per game
- the value of two standard errors of estimate for games played
- the value of three standard errors of estimate for games played
- the 95 percent and 99.8 percent limits that could be achieved by chance, that is, the average guesses per game plus the appropriate number of standard errors of estimate
- whether the result is significant in demonstrating a "real" difference. The program, as written, is looking for averages which are less than five.

On pressing the Shift key, another 50 games will be played, and so on. Up to 2,000 games have been played with this program, and at all times the results displayed have been within plus or minus three standard errors, which indicates that the Atom random-number generator is probably good enough for this experiment. As you will see later, you may have to play over 200 games to obtain a significant result, and the generator will certainly perform well enough with that number.

Program 2 is designed to test your ESP

Program 1.

```
10   REM E.S.P. TESTER
12   PRINT $12; REM CLEAR SCREEN
15   A=0;B=0;F=SQR(60/9)
75   FOR K=1 to 1000
80   N=ABSRND%9+1;@=0
100  FOR G=1 TO 9; X=G
110  IF X=N GOTO 205
120  PRINT X" IS WRONG"'
125  B=B+1
130  NEXT G
205  B=B+1
210  PRINT N" IS CORRECT"'
220  A=A+1; IF A%50=0 GOTO 310
230  NEXT K
310  %E=B/A
390  PRINT'"GAMES PLAYED = "A'
400  PRINT'"NO. OF GUESSES = "B'
420  FPRINT'"AVERAGE GUESSES ="%E''
425  %Q=3*%F/(SQR A); %R=2*%F/(SQR A)
430  FPRINT"95.0% LIMITS = +/-"%R'
435  FPRINT"99.8% LIMITS = +/-"%Q'
440  %J=%E+%Q;%K=%E+%R
441  FPRINT"99.8% UPPER LIMIT ="%J'
442  FPRINT "95% UPPER LIMIT ="%K'
443  FIF %K>5 FPRINT'"NOT YET SIGNIFICANT"';GOTO 480
445  FIF %K<5 FPRINT'"SIGNIFICANT AT 95% LEVEL"'
450  FIF %J<5 FPRINT '"SIGNIFICANT AT 99.8% LEVEL"'
480  PRINT"PRESS SHIFT KEY TO CONTINUE"''
490  DO; WAIT; UNTIL ?#B001<>#FF
500  NEXT K
999  END
```

```
10 REM E.S.P. TESTER
11 DIM X(1)
12 PRINT $12
15 A=0; B=0; %F=SQR(60/9)
30 PRINT "I AM THINKING"'
40 PRINT "OF A NUMBER FROM 1 TO 9."'
50 PRINT "YOU HAVE UP TO 9 GUESSES."'
55 PRINT "YOU SHOULD AVERAGE APPROX 5"'
60 PRINT "GUESSES IN THE LONG RUN."'
65 PRINT "IF YOU TAKE LESS ON AVERAGE,"'
70 PRINT "PERHAPS  YOU HAVE E.S.P. POWERS"''
75 FOR K=1 TO 1000
80 N=ABSRND%9+1;@=0
100 FOR G=0 TO 9; INPUT $X
101 IF ?X<CH"1" OR ?X>CH"9" GOTO 100
102 IF ?X ="" GOTO 100
105 B=B+1
110 IF ?X=N+#30 GOTO 200
120 PRINT $11,?X-#30" IS WRONG "'
130 NEXT G
200 PRINT $7; WAIT ; PRINT $7; REM BELL
210 PRINT "......CORRECT......"'
310 A=A+1;%E=B/A

REMAINDER OF PROGRAM AS PROGRAM A
```

Program 2.

potential. Each guess is entered as an Input. When the correct digit is guessed it will be signalled by the computer, which also performs the necessary calculations. Pressing the Shift key starts another game. The cumulative performance is displayed after each game.

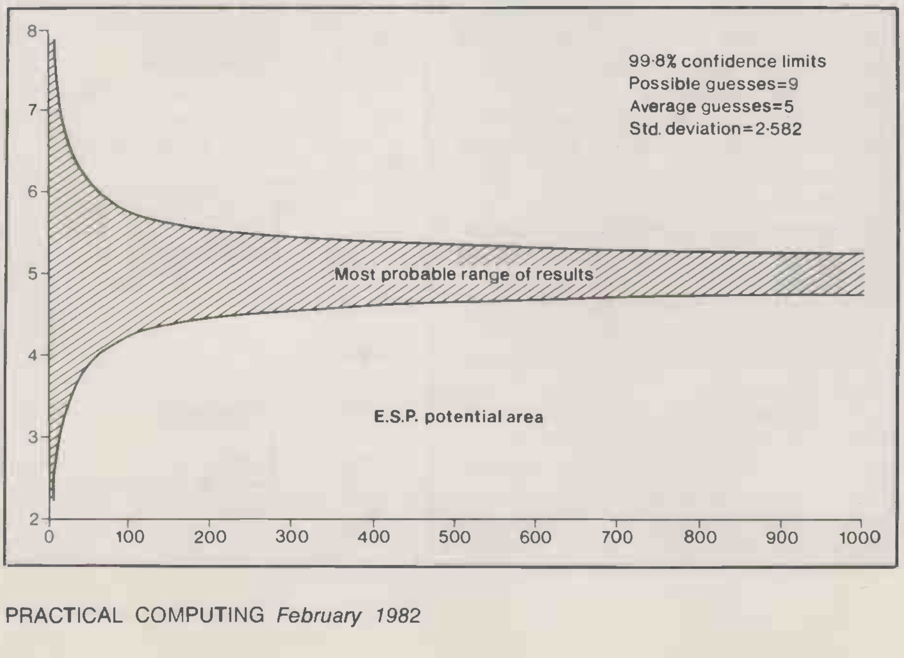
Suppose you have achieved an average of 4.00 guesses after playing 10 games. Should you tell it to the world? The standard error of estimate is given by

$$2.582 \div \sqrt{10} = 0.8165$$

At the 95 percent level, two standard errors of estimate are plus or minus 1.633. The result could lie between 3.367 and 6.333 by chance, and 4.00 is well within those limits. The answer is to keep on testing, as your result is not yet significant. You have played 27 games to be 95 percent sure, with an average of 4.00 guesses per game. If you needed to be sure at the 99.8 percent level, it would require 60 games. If you are averaging 4.50 guesses per game, you would have to play 107 games for the 95 percent level, and 240 games for the 99.8 percent level. Finding proof of ESP potential could be a slow job, unless you have real talent.

Should you discover from this program that you have ESP potential, there are several learned societies that would like to know about it, in order to carry out more controlled experiments. Write to them, not to us.

Figure 1.



In his second and concluding article on networking, Philip Barker outlines some of the techniques needed to use the Pet as an intelligent terminal involved in file-transfer operations.

File transfer on Pet terminal

INTEREST is growing in the use of microcomputer systems as intelligent terminal devices. Fundamental to this mode of operation are facilities that provide the micro with the capability of being attached to some other larger computer configuration called a host system. To achieve this type of interconnection suitable Modems and interfaces are necessary. Through these the microcomputer will be able to communicate with,

- a remote or local mainframe/minicomputer,
- a local network of other intelligent terminals, or,
- a generalised, geographically-distributed computer network.

In addition, the microcomputer may also be capable of acting as a host to other units that are able to interconnect with it in an appropriate way.

Once attached to a host system there are many ways in which an intelligent terminal can contribute to and utilise the available resources. Three of the more important of these are,

- the initiation of computational processes within the host system,
- the support of certain processes delegated to it by the host, and,
- participation in file-transfer activity.

As a consequence of these three basic operations, many new types of man-machine interaction become possible.

Much progress has been made recently in the development of geographically-distributed computer systems. Usually, these consist of a series of processing nodes interconnected by suitable communication links. Nodes in the network community are able to communicate with each other by means of a variety of message-passing techniques.

A message is essentially a contiguous sequence of symbols. When transmitted between one entity and another, messages usually invoke some form of action or response on the part of its recipient. The effect of a message depends upon both its information content and the rules of interpretation used by the entity that receives it. Messages usually have only a transient existence and are fairly short in duration.

In addition to message transfer, most distributed systems permit files of data or information to be transmitted between nodes. Like a message, a file may be regarded as a contiguous sequence of characters. However, a file is a much more complex entity than a message. Unlike a message, it is usually more highly structured, has a greater physical volume, contains far more information and has a much longer lifetime.

When transferring files of information between nodes in a network, several factors have to be considered:

- media considerations.
- direction of transfer,
- transfer time,
- error control, and,
- physical and logical file structure.

Algorithms and programs for file-transfer operations must take into account the effects of all of these factors. Furthermore, because of the intrinsic differences between network-processing nodes, and

Figure 1. Algorithm formulation for file transfer from mainframe to microcomputer memory.

1. Get file name from user.
2. Does the file exist?
   YES → step 3; NO → Issue error message and exit.
3. Is access permitted?
   YES → step 4; NO → Issue error message and exit.
4. I ← 1
5. Get Ith record from mainframe.
6. Any transmission errors?
   NO → step 7; YES → Request retransmission of record. Go to step 5.
7. Is there room to store it?
   YES → step 8; NO → Issue error message and exit.
8. Store record.
9. I ← I+1
10. Is file transfer complete?
    YES → step 11; NO → Go to step 5.
11. Exit.

between their attached storage peripherals, the algorithms may need to incorporate suitable conversion rules. The complexity of these will depend upon the nature of both the intelligent terminal and the host system.

Consider the process of file transfer in a system in which a mainframe computer, acting as a host, services the file-transfer activity associated with an intelligent terminal device. For the purpose of illustration a 32K Commodore Pet is used as the intelligent terminal. It communicates with a remote IBM-370/168 over the public switched network — see *Practical Computer*, January 1982.

All algorithms have been implemented in Basic, though in those situations where speed improvement is required, the use of machine code would be more desirable. Before discussing the details of the algorithms a brief description of the file structure used on the mainframe and the microcomputer is necessary.

Files resident on the mainframe may be regarded as collections of records each of which consists of contiguous eight-bit bytes. Individual files may contain records of fixed or variable length. They may be of any non-zero length up to a maximum of 32,767 bytes. Particular records within a file may be uniquely identified by means of their associated record number, which lies in the range — 99,999.999 to 99,999.999.

This mainframe file structure may be easily modelled on the microcomputer by means of a Basic character-string array. Essentially, each mainframe record is represented by one or more elements of the array. Storage for a file can thus be allocated by a statement of the form

```
10 DIM L$ (100)
```

which reserves memory storage for a file containing 100 records. These records cannot exceed 255 bytes; records longer than this have to be modelled by a two-dimensional character array. Thus, a record of L bytes could be segmented into Ceil(L/255) sub-records of maximum length 255. They could then be stored in such a way that one of the subscripts of an array reference identifies a particular record while the other identifies the required segment within that record: e.g., L$(2,4) references the second 255-byte segment of the fourth record in the file.

(continued on next page)

Listing 1.

```
1     DIM L$(100)
2     GOSUB 100  :  GOSUB 500  :  STOP
10    REM - PET AS A REMOTE TERMINAL
20    GOSUB 100  :  REM SET UP MODEM
30    GOSUB 200  :  REM GET  KEYBOARD CHARACTER
40    GOSUB 300  :  REM GET MAINFRAME CHARACTER
50    GOTO 30
100   REM *** CONFIGURE INTERFACE ***
110   OPEN 1,4    : REM OUTPUT CHANNEL
120   OPEN 2,6    : REM INPUT CHANNEL
130   PRINT#1,CHR$(255);"FXXGA"
140   RETURN
200   REM *** GET KEYBOARD CHARACTER ***
210   GET A$ : IF A$="" THEN : RETURN
220   PRINT#1, A$;
230   RETURN
300   REM *** GET MAINFRAME CHARACTER  ***
310   GET#2,A$ : IF ST=2 THEN : RETURN
320   PRINT A$;
330   RETURN
500   REM *** FILE TRANSFER TO PET ***
505   INPUT"(cursor return, down x 4) FILE NAME";X$
515   Y$="$COPY"+X$
520   FOR I=1 TO 100 : L$(I)="" : NEXT I
525   PRINT#1,Y$ : K=0
530   GET#2,I$ : IF ST=2 OR I$="" THEN 530
535   IF ASC(I$)=62 THEN 545
536   PRINT I$;
540   GOTO 530
545   K=K+1 : PRINT "RECORD",K
550   GET#2,I$ : IF ST=2 OR I="" THEN 550
555   IF ASC(I$)<>13 THEN L$(K)=L$(K)+I$: GOTO 550
560   GET#2,I$ : IF ST=2 OR I$="" THEN 560
564   IF ASC(I$)=10 THEN 560
565   IF ASC(I$)=62 THEN 545
570   PRINT "TRANSFER COMPLETE" : RETURN
```

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Notice that the Ceil function is defined in such a way that the value of Ceil(A) is equal to A if A is an integer; otherwise, it is equal to the smallest integer that is larger than A.

Depending upon the memory size of the micro there would be a limit placed on the number of records that could be accommodated. Based upon the way in which character-string arrays are stored in the Pet, it can be shown that, for a one-dimensional array of K elements the memory space required is

$$M = 7 + (K+1)\times 3 + \sum_{I=1}^{K} LEN(L\$(I))$$

Assuming that all records are 255 bytes long, the memory space available on a 32K Pet limits the value of K to about 120. However, for many applications the record lengths are unlikely to exceed 80 characters, increasing the number of records that could be handled to about 370. Larger files need to be off-loaded to disc or tape storage. In this article, all transfers to or from the mainframe take place via a one-dimensional character string array L$ created by a Basic program running on the Pet.

When transferring data from a mainframe file system to a target micro there are two general cases to consider, which differ according to whether the information that is transferred to the micro is

- retained in its primary memory area, or,
- transferred to its secondary storage system.

When a file is to be transferred to the micro, the software that it contains has to perform three basic operations. First, it must send an appropriate message to the mainframe in order to initiate file transfer. Then, as records are received, it must validate them, and request re-transmission if they are found to contain any errors. Finally, each error-free record

1. Get mainframe file name from user.
2. Get local file name from user.
3. Get block size from user.
4. I ← 1
5. Get Ith block from mainframe.
6. Write Ith block to secondary storage on microcomputer
7. I ← I+1
8. Is file transfer complete?
   YES → 9.
   NO → Go to step 5.
9. Close local file.
10. Exit.

Figure 2, above, is the algorithm formulation for file transfer to microcomputer secondary stage. Listing 2, below, is the implementation.

```
1    DIM L$(100)    : REM BUFFER STORAGE
2    GOSUB 100 :      REM CONFIGURE INTERFACE
3    GOSUB 400 :      REM PERFORM FILE TRANSFER
4    STOP
10   REM  : PET AS A REMOTE TERMINAL
20   GOSUB 100:       REM SET UP MODEM
                      o
                      o
                      o
400  REM FILE TRANSFER TO PET WITH
410  REM OUTPUT TO SECONDARY STORAGE
420  INPUT"(cursor home, down * 4) FILE TO BE TRANSFERRED"; X$
430  INPUT"(cursor down * 3) LOCAL FILE NAME"; Z$
440  INPUT"(cursor down * 3) BLOCKSIZE";M
450  IF M>100 THEN PRINT"(cursor down)BLOCKSIZE TOO BIG" : GOTO 440
455  GOSUB 1000 : REM OPEN FILE ON SECONDARY STORAGE DEVICE
460  S%=1  : F%=M: N=0
465  K=0
466  FOR I=1 TO M : L$(I)="" :  NEXT I
470  S$=MID$(STR$(S%),2)
475  F$=MID$(STR$(F%),2)
480  Y$="$COPY"+X$+"("+S$+","+F$+")"
490  PRINT #1,Y$
500  GET#2,I$ : IF ST=2 OR I$="" THEN 500
510  IF ASC(I$)=62 THEN 530
520  PRINT I$; : GOTO 500
530  N=N+1 : K=K+1 : PRINT "RECORD",N
540  GET#2,I$ : IF ST=2 OR I$="" THEN 540
550  IF ASC(I$)<>13 THEN L$(K)=L$(K)+I$ :GOTO 540
560  GET#2,I$ : IF F ST=2 OR I$="" THEN 560
570  IF ASC(I$)=10 THEN 560
580  IF ASC(I$)=62 THEN 530
585  GOSUB 1100  : REM WRITE BLOCK TO SECONDARY STORE
590  IF K<M THEN 620
600  S%=S%+M : F%=F%+M
610  GOTO 465
620  PRINT "TRANSFER COMPLETE"
630  GOSUB 1200  : REM CLOSE LOCAL FILE
640  RETURN
1000
1010 Support routines for secondary storage devices etc.
```

must be stored in an appropriate position within the memory space.

The various steps that are involved are depicted in the algorithm shown in figure 1 and its implementation is presented in listing 1. Certain basic assumptions have been made:

- It has been assumed that the file to be copied exists and that the terminal user has access to it.
- Because of memory-space limitations there are certain restrictions placed upon the size of the file that is to be copied — the file must not contain more than 100 records of length 255 bytes or less.
- For simplicity, it has been assumed that records will be transferred over the communication link without any perturbation.

Lines 10 to 330 are responsible for operating the microcomputer as a terminal device. The subroutine defined in lines 500 to 570 is responsible for the file transfer. The name of the file to be transferred is input at statement 505 and the copy process is initiated by the command message sent to the mainframe via the print statement in line 525. Each record transmitted to the microcomputer is preceded by a start-of-record character, ASCII 62, and terminated by a carriage-return / line-feed combination, ASCII 13 and 10.

The simplest strategy for transferring a file to secondary storage involves a block-by-block transfer mechanism. Such a scheme is embodied in the algorithm in figure 2. The transfer loop involves two basic steps. First, a block of records is transmitted to the micro; then, when the block is complete and error-free it is transferred to the local storage device. Listing 2 shows a minimal implementation of the algorithm.

The underlying principle upon which the subroutine depends is the same as that which was employed in the implementation of the previous file-transfer process. However, instead of sending a single copy message to the mainframe, to initiate the transfer of the whole file, a sequence of messages of the form

COPY file name (S,F)

is used. Each of these, with the possible exception of the last, copies across a segment of the file containing M records, where

$$M = F - S + 1$$

In this expression, S and F represent the start and finish record numbers within a segment. Their values depend upon the block size, M, and assume that the records in the original file are numbered sequentially starting from unity. The series of values of S and F are thus,

$$S_i = 1, M + 1, 2M + 1, 3M + 1,$$
$$F_i = M, 2M, 3M, 4M,$$

The code shown in the listing performs no error checking, neither of transmitted data nor of user input from the terminal; these refinements could be added in a more detailed implementation. The subroutine depends upon the provision of appropriate peripheral support routines

1. Obtain address of starting location (S).
2. Is this valid?
   YES → step 3; NO → Issue error message and exit.
3. Obtain address of end location (F).
4. Is this valid?
   YES → step 5; NO → Issue error message and exit.
5. Compute number of records to be transferred:
   N = CEIL((F-S(/R)
6. Compute number of passes required.
7. Transfer first memory block to L$ array.
8. Invoke file transfer routine at its primary entry point.
9. I ← 2
10. Goto step 14.
11. Transfer Ith block of memory to the L$ array.
12. Invoke file transfer routine at its secondary entry point.
13. I ← I+1
14. Is another pass required?
    NO → step 15; YES → Go to step 11.
15. Exit.

Figure 4. The algorithm for memory transfer to microcomputer secondary source.

to handle the secondary storage devices to which a file is being transferred.

The first of these subroutines — line 455, Gosub 1000 — is responsible for opening the local file on the external device. The second — line 585, Gosub 1100 — is delegated the task of writing the data blocks on to the chosen peripheral; while the third — line 630, Gosub 1200 — performs all the housekeeping activities associated with closing the local file when transfer is complete. The subroutine shown in the listing has been used to transfer mainframe files across to both tape cassette and flexible disc — using a standard Commodore 3040 twin-disc unit.

In principle, the transfer of files from an intelligent terminal might be expected to require similar software, though data flow is in the opposite direction. Because the system is not totally symmetrical, the principle of reversibility cannot be fully employed, and the new algorithms and programs that are developed will need to

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contain mechanisms which can accommodate any major differences in transmission protocol resulting from data-flow reversal.

As before, when file transfer takes place, two situations must be taken into account:

- transfer of a section of the memory space of the microsystem to the mainframe.
- transmission of one of the micro's local secondary storage files to the mainframe.

An outline algorithm for file transfer to a remote machine is shown in figure 3. The program that implements the algorithm is assigned the task of creating a file in the file store of the host computer, if one does not already exist, represented by steps 1 to 5. Successful file creation is followed by a loop that transmits the file of data on a record-by-record basis, steps 6 to 12.

File-creation and validation activity accounts for the larger part of the pro-

Listing 3. The implementation of figure 3.

```
600   REM FILE TRANSFER TO MAINFRAME
605   N=4
610   DIM R$(10)
615   INPUT "(cursor home,down * 4) FILE NAME"; X$
620   FOR I=1 TO 10 : R$(I)="": NEXT I
625   Y$="$CREATE"+X$
630   PRINT#1,Y$ :K=1
635   GET#2,I$ :IF ST=2 OR I$="" THEN 635
640   REM PRINT I$;
645   IF I$= "#" AND K=N THEN 660
650   IF ASC(I$)<>13 THEN R$(K)=R$(K)+I$ : GOTO 635
655   K=K+1 : GOTO 635
660   IF MID$(R$(N-1),2,5)="#FIL" THEN 750
665   PRINT "FILE"+X$+" ALREADY EXISTS"
670   PRINT "(cursor down) DO YOU WANT TO"
675   PRINT"      1. OVERWRITE ITS CONTENTS?"
680   PRINT"      2. CREATE A NEW FILE?"
685   PRINT"      3. EXTEND THE FILE"
690   PRINT"(cursor down * 2) ENTER 1,2 OR 3"
695   GET I$ : IF I$="" THEN 695
700   IF I$="1" OR I$="2" OR I$="3" THEN 710
705   GOTO 695
710   IF I$="1" THEN 725
715   IF I$="3" THEN 755
720   N=3 : GOTO 615
725   PRINT#1,"$EMPTY"+X$+" OK" : K=0
730   GET#2,I$  : IF ST=2 OR I$="" THEN 730
735   PRINT I$; : IF I$="#" AND K=2 THEN 755
740   IF ASC(I$)<>13 THEN R$(K)=R$(K)+I$ : GOTO 730
745   K=K+1  :  GOTO 730
750   PRINT "FILE"+X$+"HAS BEEN CREATED"
755   REM NOW TRANSFER THE L$ ARRAY TO MAINFRAME
760   PRINT#1, "%ECHO=OFF"  : Z$="(LAST+1)"
765   GET#2,I$  : IF ST=2 OR I$="" THEN 765
770   PRINT I$; : IF I$="#" THEN 780
775   GOTO 765
780   PRINT#1, "$COPY *SOURCE* TO "+X$+Z$ : K=1
785   GET#2,I$ : IF ST=2 OR  I$="" THEN 785
790   PRINT I$; ; IF I$=">" THEN 800
795   GOTO 785
800   PRINT#1,L$(K)
805   PRINT "RECORD",K :K=K+1
810   IF L$(K)="" THEN 820
815   GOTO 785
820   Y$="$ENDFILE"
825   GET#2,I$ : IF ST=2 OR I$="" THEN 825
830   PRINT I$; : IF I$=">" THEN 840
835   GOTO 825
840   PRINT#1, Y$
845   GET#2,I$ : IF ST=2 OR I$="" THEN 845
850   PRINT I$; : IF I$<>"#" THEN 845
855   PRINT#1,"%ECHO=ON"
860   GET#2,I$ : IF ST=2 OR I$="" THEN 860
865   PRINT I$;: IF I$<>"#" THEN 860
870   PRINT "TRANSFER COMPLETE"  : RETURN
```

gram code, lines 605 to 750. Data to be transferred to the mainframe is held in the memory array L$. Once the mainframe file has been created, or its existence confirmed, data is transferred to it from L$ one element at a time. Each element of L$ corresponds to a record to be stored in the remote file.

Records are transmitted over the communication link only when this is requested by the host computer. It does this by issuing an appropriate prompt character, ASCII 62, as is implied by the code contained in lines 790 and 830 of the listing. Once all the non-null elements of L$ have been transferred to the distant machine the local program transmits an end-of-file message which causes the file to be closed.

Inherent in the implementation of the algorithm is the assumption that the transfer loop will be terminated by a null element within L$. If this condition is not met, the program is likely to abort with an index error once the upper bound of L$ is exceeded. If this happens the terminal user has to close the remote file manually. This limitation could easily be overcome by including some extra statements at line 806:

```
806 IF K=N+1 THEN GOTO 820
```

where N represents the upper bound of L$. The calling routine then has to set the value of N prior to invoking the file-transfer subroutine.

Figure 3. Algorithm formulation for file transfer from micro to mainframe.

1. Get file name from user.
2. Does the file exist?
   YES ↓ — NO → Create it and go to step 6.
3. Is the file to be over-written?
   NO ↓ — YES → Empty it and go to step 6.
4. Is the file to be extended?
   NO ↓ — YES → Go to step 6.
5. Assume a new file is required and go to step 1.
6. I ← 1
7. Send Ith record to mainframe.
8. Wait for answer-back prompt from mainframe.
9. I ← I+1
10. All records sent?
    YES ↓ — NO → Go to step 7.
11. Close mainframe file.
12. Exit.

Because the data link operates in full duplex mode, data received by the mainframe would normally be echoed back to the terminal. To prevent this happening during file transfer, the data-echoing process is disabled by statements 760 to 775. The argument of the print statement in line 760 is a special message that instructs the remote mainframe not to echo back the data characters it receives. As soon as file transmission is complete the echo-back feature must be reinstated to enable the normal terminal mode of operation of the microcomputer. Lines 855 to 865 of the listing are responsible for this.

Line 780 allows for a file in the mainframe to be extended. As a result of the value of Z$ being previously set to "(LAST+1)". This ensures that the host operating system always appends the contents of the L$ array to the end of the remote file, commencing at the (LAST+1)th record.

It now becomes an easy matter to overcome any limitations imposed by the size of L$, and transfer secondary storage files of any size. Either of these goals may be achieved by simply applying the transfer subroutine repetitively, via a secondary entry point such as Gosub 755 if need be, or by adding modifications to enable the code between lines 780 and 840 to be re-executed within a loop that could be terminated by an out-of-data condition arising on the local microcomputer.

An illustration of this approach is contained in the skeleton algorithm for primary memory space transfer — see figure 4. It is based upon multiple invocations of the file-transfer routine contained in figure 3 and listing 3.

In step 5, the value of R specifies the size of the records that are to be transmitted; it will depend upon the record structure used and the way in which the information the records contain is organised. Invocation of the file-transfer routine at the primary entry point is necessary to perform the file-creation/checking procedures and the dispatch of the first memory block. Subsequent invocations of the routine reference its secondary entry point thereby avoiding the initial file-creation steps. An analogous algorithm could be formulated for the transfer of files from the secondary storage space of the microcomputer.

P G Barker, *Using a Microcomputer as an Interactive Terminal*, Interactive Systems Research Group Working Paper, April 1981.

P G Barker, *Algorithms for Intelligent Terminal Operation*, Interactive Systems Research Group Working Paper, July 1981.

C S Donahue and J K Enger, *Pet/CBM Personal Computer Guide*, Osborne/McGraw-Hill, 1980, ISBN 0 931988 30 6.

P G Barker, *Program Exchange via the Public Switched Network*, Interactive Systems Research Group Working Paper, July 1981.

BUYERS' GUIDE

SOFTWARE

Software packages are listed by application, in alphabetical order, with the systems on which each package will run also listed alphabetically. The guide is not exclusively for business applications: if your company is the source or dealer for a package with a more unusual application, send us the details and we will create a new category.

The usual criteria have been applied. The minimum configuration is 32K of RAM, a disc and a printer; the price of the package must lie between £50 and £1,000; the companies listed are the source of the software or the main dealers in the U.K., and the capacity quoted is per disc or drive.

Machine type by application

Combined Ledger/Stock/Invoicing

Machine type	Supplier name	Price	Capacity
Apple II	Vlasak Electronics Ltd	£855	1,500 a/c 5,000 trans
Apple II	Dataforce (U.K.) Ltd	£855	
Apple II	Microsense Computers Ltd	£340	
Apple II/ITT	Informex London Ltd	£298	500 a/c
Apple II	Star Systems Ltd	£750	2,000 a/c 6,000 trans
Commodore 3000/8	Commodore BM (U.K.) Ltd	£1,100	200-600 a/c 2,000-6,000 trans
Commodore 3032	Compfer Ltd	£400	varies
Commodore 3032	Analog Electronics	£550	
Commodore 3032	Logma Systems Design	£600	1-6 shops
Commodore 3032	Grama (Winter) Ltd	£475	varies
Commodore 3032	Bristol Software Factory	£300	1,000 a/c 6,000 trans
Commodore 3032	Compfer Ltd	£600	500 a/c 1,000 items
Commodore 3032	HB Computers	£695	500 a/c 2,500 trans
CP/M	Graffcom Systems Ltd	£400	varies
CP/M	Benchmark CS Ltd	£950	varies
CP/M	Computastore Ltd	£1,000	

CP/M	Interface Computer Services	£350	
CP/M	Minicomputer CS Ltd	£1,250	varies
CP/M	Salmon Microcomputing	£750	1,600 items 1,000 trans
CP/M	Selven Ltd	£1,500	3K a/c 7K trans
CP/M	Map Computer Systems	£1,000	varies
CP/M North Star	Instar Business Systems	£999	600-2,900
CP/M North Star	Criterion Business Systems		
North Star DOS	Inteligent Artefacts	£510	1,500 a/c 5K trans
Ohio Scientific	Microcomputer BM	£656	
Ohio Scientific	Stratheden Ltd		
Tandy Model 2	Chess Consultancies	£1,200	
Tandy Model 2	Chess Consultancies	£995	5,000 items 1,500 a/c
Tandy TRS-80	Microcomputer Applications	£90	
Tecs	Jar Software Systems	£650	500 a/c 300 nom. a/c

Database Managers

Machine type	Supplier name	Price	Capacity
Apple II	ACT Microsoft Ltd	£75	
Apple II	Courtman Micro Systems	£106	100K characters
Apple II/ITT	Systematics International Ltd	£72	
Apple II/ITT	Diskdean Ltd	£120	varies
Apple II/ITT	Systematics International Ltd	£125	1,000 references
Apple II/ITT	Informex London Ltd	£198	500-1,200 records
Apple II/ITT	The Software House	£140	900 records
Commodore 3000/8	Stage One Computers	£45-£250	650-2,400 records
Commodore 3000/8	Commodore BM (U.K.) Ltd	£150-£300	650-1,400-64,000 records
Commodore 3032	CPS (Data Systems) Ltd	£200	varies
Commodore 3032/8	Compsoft Ltd	£190	600-5,000 records
CP/M	Compsoft Ltd	£400	30,000 records
CP/M	Great Northern CS Ltd	£110-£210	and varies
CP/M	Microtek Computer Services	£250-£500	
CP/M	Cleno Computing Services	£90-£325	varies
CP/M	Interface Ltd	£200	varies
CP/M	Median-Tec Ltd	£500	
CP/M	Microbits	£145	varies
CP/M	Southdata Ltd	£650	up to 8Mbytes
CP/M SWTPC	Verwood Systems		
Metrotech System	Metrotech	£200-£1,000	
Ohio Challenger	U-Microcomputers Ltd	£175⅕	
Ohio Scientific	Microcomputer BM	£175+	
Superbrain	Alan Pearman Ltd	£295	varies
SWTPC	SWTPC	£100	
Tandy TRS-80	Cleartone ADP	£75	varies
Tandy TRS-80	ACT Microsoft Ltd	£75	
Z-80/8080	Structured Systems Group	£135	varies
Z-80/Cromemco	Xitan Systems Ltd	£850	4,000 records/disc

Engineering Design Systems

Machine type	Supplier name	Price	Notes
Apple II	Haden Young Ltd	From £50	Provide a comprehensive series of software for building/engineering
Apple II	James C Steadman	£200	Erect concrete columns
Apple II	James C Steadman	£250	Multibay frames
Apple II/ITT	Aerco-Gemsoft	£175	Pipeline engineering
Commodore 3032	Micro Computation	£300	Building-conversion specification
Commodore 3032	The Alphabet Co	£75	Time study and analysis
Commodore 3032	Comac Systems	£400	Asset register
Commodore 3032/8	Comac Systems	£400	Maintenance plan
Commodore 3032/8	Comac Systems	£400	Work orders
Commodore 3032/8	Comac Systems	£400	Plant history
Commodore 3032/8	Comac Systems	£400	Manpower analysis
CP/M	Median-Tec	£500	Plastic portal frames
CP/M	Median-Tec	£1,500	Finite element analysis
CP/M	Median-Tec	£500	Slope-stability analysis
CP/M	Median-Tec	£500	Retaining wall design
CP/M	Median-Tec	£1,500	Concrete design
Equinox	Equinox	£500	Civil/structural engineering design

SHOPWINDOW

Tandy TRS-80	Chess Consultancies	£450	Production planning
Tandy TRS-80	P J Norris	£1,500	Estimating steel frame buildings
Tecs	Jar Software	£600	Production analysis

Estate Agents' Systems

Machine type	Supplier name	Price	Notes
Apple II	Atlanta	£750	
Apple II	Microsense	£500	
Apple II/ITT	Cyderpress	£650	
Apple II/ITT	Systematic	£850	
Commodore 3032	Stage One Computers	£250	
Compucorp	Verwood systems	£700	Estate sales
Compucorp	Verwood systems	£1,200	Estate management
CP/M	Selven Ltd		Estate agents' sales and selection

Financial Systems

Machine type	Supplier name	Price	Notes
Apple II	Microdigital	£200	Sales analysis
Apple II	Microdigital	£130	Credit control
Apple II	Microsense	£194	Cashier retail/ wholesale
Apple II	PK Microsystems		Solicitors' accounts
Apple II	Dataforce	£80	Cashflow projection
Apple II	Informex	£98	VAT system
Apple II/ITT	Microsense	£125	VisiCalc
Apple II/ITT	Systematics	£295	Financial planning
Apple II/ITT	Systematics	£1,000	Financial controller
Apple II/ITT	Microsense	£75	Modelling desktop plan
Commodore 3000	Stage One Computers	£250	Financial acounts package
Commodore 3000/8	ACT Microsoft	£125	Financial modelling
Commodore 3032	Stage One Computers	£100	Quote processing
Commodore 3032	CPS	£575	Invoice-costing/ jewellers
Commodore 3032	L & J Computers	£90	Cash book
Commodore 3032	ACT (Petsoft)	£150	Financial planning
Commodore 3032	Stage One Computers	£100	Bank a/c reconcile
Commodore 3032	Logma Systems	£600	Sales/analysis
CP/M	Bytesoft	£95	Financial modelling
CP/M	Micromedia	£1,000	Invoice disc factoring
CP/M	Graffcom System	£400	Hire-purchase system
CP/M	MAP Computers	£550	Financing system
CP/M	Microtek	£500	Accounting
CP/M	Microtek	£750	Budget control
CP/M	Median-Tec	£500	Financial analysis
CP/M	Graffcom Systems	£450	Purchasing system
CP/M Vector	Taylor Microsystems	£390	Cashflow forecasting
Durango F-85	Kesho Systems	£1,000	Time recording/ ledger
Superbrain	Alan Pearman Ltd	£315	Financial planning
Tandy TRS-80	Chess Consultancies	£800	Sales statistics
Tandy TRS-80	A J Harding	£125	Financial balancing
Z-80/8080	Intereurope	£500	Financial modelling
Z-80/8080	Graham Dorian	£325	Sales analysis retail

General Ledger

Machine type	Supplier name	Price	Capacity
Apple II	Computech Systems	£295	500 a/c 1,700 trans
Apple II	Dataforce (U.K.) Ltd	£225	200 a/c 1,000 trans
Apple	Style Systems Ltd	£250	1,000 a/c, 2,000 postings
Apple II/ITT	Systematics International Ltd		
Apple II/ITT	Guestel Ltd	£300	200 a/c
Commodore 3032	Bristol Software Factory	£300	1,000 a/c 6,000 trans
Commodore 3032	Analog Electronics	£450	
Commodore 8000	Commodore BM (U.K.) Ltd	£300	600 a/c 3,000 trans
CP/M	Business Solutions Ltd	£390	varies
CP/M	Bytesoft	£690	varies
CP/M	PR Daly & Co Ltd	£500	
CP/M	Haywood Associates Ltd	£500	
CP/M	Median-Tec Ltd	£500	500 a/c 5,000 trans

CP/M	Ludhouse Ltd	£500	200 a/c 5,000 trans
CP/M	Computastore Ltd	£500	999 a/c 99 centres nine computers
CP/M	Great Northern CS	£345	250 a/c
CP/M	Selven Ltd	£400	1,000 a/c 3,000 trans
CP/M	Interface Computer Services	£350	varies
CP/M	Microbits Ltd	£500	varies
CP/M	Map Computer Systems	£300	250 a/c 3,500 + trans
CP/M North Star	Benchmark CS Ltd	£250	150 a/c 500 trans
Horizon	Claisse-Allen Computing	£500	999 a/c 99 entries, nine computers
North Star DOS	Intelligent Artefacts Ltd	£295	1,500 a/c 5,000 trans
Ohio Scientific	Stratheden Ltd	£500	varies
Tandy Model 2	Chess Consultancies Ltd	£400	1,000 a/c
Tandy TRS-80	Tridata Micros Ltd	£225	500 a/c 1,800 trans
Z-80	Liveport Ltd		
Z80/8080	Solitaire	£500	Up to 26 by 400 a/c
Zilog MCZ range	Microbits	£500	100 a/c 5,000 trans

Hotel and Travel Packages

Machine type	Supplier name	Price	Notes
Apple II	Dataforce	£525	Hotel management
Apple II	Informex Logic	£298	Travel agents' system
Apple II	Informex Logic	£298	Hotel administration system
Apple II/ITT	Guestel Ltd	£500	Hotel billing
Apple II	Diskwise Ltd	£695	Hotel reservation and guest billing
Commodore 3000	Landsler Software	£350	Hotel guest billing

Incomplete Records

Machine type	Supplier name	Price	Capacity
Apple II/ITT	Padmede Computer Services	£450	900 a/c 2,000 trans/disc
Commodore 3000/8	CSM Ltd	£1,200 +	250 a/c 3,000-4,000 trans
Commodore 3032	Stage One Computers	£750	500 centres 2,300 a/c
Commodore 3032	Micro Computation	£555	120 a/c 5,000 trans
CP/M	Benchmark Ltd	£975	
CP/M	Bytesoft	£250	3,000 trans
CP/M	Criterion Business Systems	£375	2,500 entries
CP/M	Ludhouse Ltd	£1,000	variable
CP/M	Salmon Microcomputing	£950	5,000 entries
CP/M	Map Computer Systems	£550	
Durango F-85	Kesho Systems	£1,000	
Exidy Sorcerer	Basic Computing	£350	See also Micropute
Tandy Model 1	A J Harding (Molimerx)	£150	1,200
Tandy Model 1	Quickmet	£785	300 a/c 2,000 trans

Job Costing/Billing

Machine type	Supplier name	Price	Capacity
Apple II	Informex London	£498	1,000 emp-pro-exp codes
Apple II	Deltic Computing Ltd	£250	
Apple II/ITT	Padmede Computer Services	£300	999 clients 99 rates
Apple II/ITT	TABS Ltd	£99	100 jobs 3,000 trans
Commodore 3032	CSM Ltd	£600	1,000 jobs 100 people
Commodore 3032	Stage One Computers	£100	300 appointments
CP/M	Business Solutions Ltd	£190	varies
CP/M	Map Computer Systems Ltd	£550	400-96,000 jobs
CP/M	Graffcom Systems Ltd	£400	varies
CP/M	Ludhouse Ltd	£1,000	1,000 jobs 35 codes
CP/M	Microtek Computer Services	£1,000	
CP/M	Great Northern CS Ltd	£455	300 clients
CP/M	Salmon Microcomputing	£300	225 codes
CP/M Cromemco	Sheffield Micro Information Ltd	£1,500	20 operations
CP/M North Star	Intelligent Artefacts	£275	

Mailing Systems

Machine type	Supplier name	Price	Capacity
Apple II	Keen Computers Ltd	£300	500 addresses
Apple II	SBD Consultants Ltd	£55	
Apple II	Microsense Computers Ltd	£70	
Apple II	Informex London Ltd	£198	
Apple II	Atlanta	£55	1,000 names and addresses
Apple II/ITT	Systematics International Ltd	£300	500 addresses

Apple II/ITT	The Software House	£57	750 names and addresses
Apple II/ITT	Personal Computers Ltd	£50	400 entries
Commodore 3000/8	Amplicon MS Ltd	£145	1,500-4,000 records
Commodore 3032	MMS Computer Systems	£250	3,000 records
Commodore 3032	Stage One Computers	£100	325 records
Commodore 3032/8	Compsoft Ltd	£190	13,000
CP/M	Compsoft Ltd	£400	27,000
CP/M	Structured Systems Group	£50	varies
CP/M	Graffcom Systems Ltd	£250	800-5,000 records
CP/M	Median-Tec Ltd	£500	
CP/M	Microbits	£230	varies
CP/M	Interface Computer Services	£200	varies
CP/M Horizon	Microtek Computer Services	£250	varies
CP/M North Star	Intelligent Artifacts	£250	
CP/M North Star	Micromedia Systems	£195	
CP/M Vector	Taylor Microsystems	£375	
North Star	Intelligent Artifacts	£250	
Tandy TRS-80	A J Harding (Molimerx)	£55	600-3,750 records
Tandy TRS-80	Comput-A-Crop	£78	varies
Z-80/8080	Intereurope SD Ltd	£200	30,000 entries
Z-80/8080	Micro Focus	£90	varies

Order Entry/Invoicing

Machine type	Supplier name	Price	Notes
Apple II	Informex	£198	Invoicing system
Commodore 3032	MMS Computers	£250	Order control
CP/M	PR Daly & Co	£200	Invoicing
CP/M	Graffcom Systems	£350	Order entry/invoicing
CP/M	Interface Ltd	£250	Invoicing
CP/M	Median-Tec		Invoicing
Tandy TRS-80	Tridata Micros	£75	Invoicing
Z-80/MCZ	Software Architects	£600	Order entry/invoicing

Payroll

Machine type	Supplier name	Price	Capacity
Apple II	Dataforce (U.K.) Ltd	£375	
Apple II/ITT	TW Computers Ltd	£145	
Apple II/ITT	Informex London Ltd	£298	
Apple II/ITT	Algobel Computers	£295	500 employees
Apple II/ITT	Vlasak Electronics Ltd	£375	200 employees
Apple II/ITT	Computech Systems	£379	300 employees
Apple	Style Systems Ltd	£350	450 employees
Apple II/ITT	Tabs Ltd	£99	50 weekly 100 monthly
Commodore 3000/8	Commodore BM (U.K.) Ltd	£150	200-600 employees
Commodore 3000/8	Landsler Software	£150	200-500 employees
Commodore 3032	Analog Electronics	£90	
Commodore 3032	L & J Computers	£220	
Commodore 3032	Intex Datalog Ltd	£195	200 employees
Commodore 3032	Computastore Ltd	£75	483 employees
Commodore 3032	ACT (Petsoft) Ltd	£195	600 employees
CP/M	Benchmark CS Ltd	£350	300 employees, 50 departments
CP/M	Haywood Associates Ltd	£350	
CP/M	Median-Tec	£500	1,000 employees
CP/M	Salmon-Microcomputing	£300	500 employees
CP/M	Map Computer Systems	£350	300-96,000 employees
CP/M	Daman Computer Services	£900	1,000 employees/ Mbyte
CP/M	Selven Ltd	£500	400 employees
CP/M	PR Daly & Co Ltd	£350	
CP/M	Graffcom Systems Ltd	£500	500 employees
CP/M	Horizon Software Ltd	£500	
CP/M	PCL Software Ltd	£495	1,200 employees
CP/M	Ludhouse Ltd	£450	300 employees
CP/M	Comput-A-Crop	£495	175 employees
CP/M	Microbits	£500	varies
CP/M Horizon	Microtek Computer Services	Lease	varies
CP/M North Star	Micromedia Systems	£495	350 employees
CP/M North Star	Intelligent Artefacts	£52	100 employees
CP/M Vector	Taylor Micro Systems	£490	
Durango F-85	Kesho Systems	£500	
Horizon	Claisse-Allen Computing	£500	250 employees
Ohio Scientific	Stratheden Ltd	£750	varies

Sharp MZ-80	Tridata Micros Ltd	£250	400 employees
Tandy TRS-80	A J Harding (Molimerx)	£120	
Tandy TRS-80	Chess Consultancies	£400	400 employees
Tandy TRS-80	FIBS	£429	
Tandy Model 2	P J Norris	£500	1,000 per disk
Tandy TRS-80	Tridata Micros Ltd	£218	400 employees
Tandy TRS-80	3-line Computing	£140	
Tecs	Jar Software Systems	£250	300 employees
Z-80/8080	Liveport Ltd	£250	500 employees
Z-80/8080	Solitaire	£500	200 employees
Zilog MCZ range	Microbits	£500	300 employees

Personnel and Administration

Machine type	Supplier name	Price	Application
Apple II	Informex Logic	£198	Personnel records
Apple II	Informex Logic	£298	Staff selection tests
Apple II/ITT	Informex Logic	£298	Employment agency system
Apple II/ITT	Informex Logic	£198	Medical records
Apple II/ITT	Informex Logic	£198	Hospital administration
Commodore 3000	Intex Datalog Ltd	£100	Hospital administration
CP/M	Median-Tec Ltd	£1,500	Employment agency system
CP/M North Star	Micromedia	£595	Personnel records
CP/M Vector	Taylor Microsystems	£390	Piece work
Z-80/8080	Intereurope	£500	Personnel records

Property Management

Machine type	Supplier name	Price	Capacity
Apple II/ITT	Cyderpress Ltd	£650	
Apple II/ITT	Informex London Ltd	£298	300 entries
Apple II/ITT	Cyderpress Ltd	£650	500 properties
Apple II/ITT	Algobel Computers Ltd	£650	400 properties
Commodore 3032/8	Compsoft Ltd	£190	13,000
CP/M	Compsoft Ltd	£400	27,000
CP/M	Algobel Computers Ltd	£650	2,000 trans
CP/M	Salmon Microcomputing	£900	
Z-80/8080	Graham Dorian Software	£325	varies

Purchase Ledger

Machine type	Supplier name	Price	Capacity
Apple II	Dataforce (U.K.) Ltd	£315	200 a/c 1,000 trans
Apple II	Logic Box Ltd	£490	400 a/c 1,000 trans
Apple II	Deltic Computing Ltd	£250	1,000 trans
Apple II	Computech Systems	£295	500 a/c 1,600 trans
Apple II/ITT	Systematics International Ltd		
Apple II/ITT	Padmede Computer Services	£300	900 a/c 4,500 trans/ disc
Apple	Style Systems Ltd	£250	650 a/c 1,750 trans
Apple II/ITT	Guestel Ltd	£300	200 a/c
Commodore 3000/8	CSM Ltd	£550	1,000-2,000 a/c 6,000-10,000 trans
Commodore 3000/8	Anagram Systems	£399	200-2,000 a/c 800-16,000 trans
Commodore 3032	ACT (Petsoft) Ltd	£120	200 a/c 700 trans
Commodore 3032	Compfer Ltd	£300	1,000 trans 7,000 entries
Commodore 8000	Commodore BM Ltd	£300	600 a/c 4,500 trans
CP/M	Bytesoft	£400	varies
CP/M	Business Solutions Ltd	£390	varies
CP/M	Median-Tec Ltd	£500	500 a/c 5,000 trans
CP/M	Ludhouse Ltd	£500	500 a/c 5,000 trans
CP/M	Great Northern CS Ltd	£315	500 a/c
CP/M	Structured Systems Ltd	£460	varies
CP/M	Selven Ltd	£600	1,000 a/c 2,000 trans
CP/M	Salmon Microcomputing	£350	1,000 a/c 24,000 trans
CP/M	Map Computer Systems Ltd	£300	400-96,000 a/c
CP/M	Microbits	£500	varies
CP/M	PR Daly & Co Ltd	£350	
CP/M	Computastore Ltd	£400	500 a/c 3,100 trans
CP/M	Haywood Associates	£350	

CP/M	Interface Computer Services	£350	varies
CP/M	Selven Systems	£600	500 suppliers 5,000 trans
CP/M North Star	Benchmark CS Ltd	£250	100 a/c 300 trans
Durango F-85	Kesho Systems	£500	
Exidy Sorcerer	Basic Computing	£125	See also Micropute
Horizon	Claisse Allen Computing	£500	800 a/c 2,000 trans
Ohio Scientific	Stratheden Ltd	£500	varies
Tandy Models 1 & 2	Chess Consultancies Ltd	£250	300-500 a/c
Tandy TRS-80	FIBS	£750	part of integrated system
Tandy TRS-80	Tridata Micros Ltd	£225	125 a/c 1,000 trans
Zilog MCZ range	Microbits Ltd	£500	400 suppliers 1,000 trans
Z-80	Liveport Ltd		
Z80/8080	Solitaire	£500	200 by 26 a/c

Sales Ledger

Machine type	Supplier name	Price	Capacity
Apple II	Computech Systems	£295	500 a/c 1,600 trans
Apple II	Dataforce (U.K.) Ltd	£315	200 a/c 1,000 trans
Apple II	Logic Box Ltd	£490	300 a/c 1,300 trans
Apple II	Deltic Computing Ltd	£250	1,000 a/c
Apple II/ITT	Padmede Computer Services	£300	900 a/c 4,500 trans/disc
Apple II/ITT	Guestel Ltd	£300	200 a/c
Apple II/ITT	Systematics International Ltd		
Apple	Style Systems Ltd	£250	650 a/c 2,500 trans
Commodore 3000/8	Anagram Systems	£299	250-2,000 a/c 500-10,000 trans
Commodore 3000/8	CSM Ltd	£550 and £650	1,000-2,000 a/c 6,000-10,000 trans
Commodore 3032	ACT (Petsoft) Ltd	£120	200 a/c 700 trans
Commodore 8000	Commodore BM (U.K.) Ltd	£300	600 a/c 4,500 trans
CP/M	Bytesoft	£400	varies
CP/M	PCL Software Ltd	£475	950 a/c
CP/M	Great Northern CS Ltd	£415	500 a/c
CP/M	Haywood Associates Ltd	£350	
CP/M	Median-Tec Ltd	£500	500 a/c 5,000 trans
CP/M	Ludhouse Ltd	£500	2,000 a/c 8,000 trans
CP/M	Graffcom Systems Ltd	£450	540-7,000
CP/M	Computerstore Ltd	£400	500 a/c 3,500 trans
CP/M	Salmon Microcomputing	£350	1,000 a/c 24,000 trans
CP/M	Selven Systems	£600	500 a/c 5,000 trans
CP/M	Map Computer Systems Ltd	£300	400-96,000 a/c
CP/M	Daman Computer Services	£900	1,500 a/c 500 trans
CP/M	PR Daly & Co Ltd	£350	
CP/M	Interface Computer Services	£350	varies
CP/M North Star	Benchmark CS Ltd	£250	200 a/c 500 trans
Durango F-85	Kesho Systems	£500	
Exidy Sorcerer	Basic Computing	£125	See also Micropute
Horizon	Claisse-Allen Computing	£500	800 a/c 2,000 trans
Tandy Models 1 & 2	Chess Consultancies Ltd	£250	300 a/c
Tandy TRS-80	Tridata Micros Ltd	£225	175 a/c 1,350 trans
Tecs	Jar Software Systems	£550	500 a/c
Z-80	Liveport Ltd		

Stock Systems

Machine type	Supplier name	Price	Capacity
Apple II	Logic Box Ltd	£490	1,200 items
Apple II	Vlasak Electronics Ltd	£150	7,000 items
Apple II	Dataforce (U.K.) Ltd	£200	850 items
Apple II	U-Microcomputers Ltd	£199	
Apple II	Microsense Computers Ltd	£100	
Apple II	Informex London Ltd	£198	
Apple	Style Systems Ltd	£250	900-80,000 items
Apple II/ITT	Microdigital Ltd	£225	625 items
Apple II/ITT	Vlasak Electronics Ltd	£285	500 items
Apple II/ITT	Systematics International Ltd	£500	200-2,500 items
Apple II/ITT	Guestel Ltd	£300	

Apple II/ITT	Padmede Computer Services	£300	2,000 postings
Apple II/ITT	The Software House	£80	800 items
Commodore 3000	Intex Datalog Ltd	£195	2,400-3,700 items
Commodore 3000/8	Commodore BM (U.K.) Ltd		600-2,000 items
Commodore 3000/8	Rockliff Brothers Ltd	£275	3,400-10,000 records
Commodore 3032	Logma Systems Design	£600	1-6 shops
Commodore 3032	ACT (Petsoft) Ltd	£75	2,400 items 1,000 a/c
Commodore 3032	ACT Microsoft Ltd	£75	1,200-5,900 items
Commodore 3032	Anagram System	£320	500-600 items 255 a/c
Commodore 3032	L & J Computers	£60	500 items
Commodore 3032	Bristol Software Factory	£300	2,300 items
Commodore 3032	Stage One Computers	£100 and £250	600-650 items
Commodore 3032	SMG Microcomputers	£395-£495	2,450-7,000 items
Commodore 3032	Compfer Ltd	£350	200 lines 20 bars
Commodore 3032/8	Compsoft Ltd	£190	13,000
CP/M	Bytesoft	£700	2,000-8,000 lines
CP/M	Compsoft Ltd	£400	27,000
CP/M	Microtek Computer Services	£750	
CP/M	PR Daly & Co Ltd	£350	
CP/M	Great Northern CS Ltd	£375	1,500
CP/M	Haywood Associates Ltd	£350	
CP/M	Median-Tec Ltd	£500-£800	1,000 items
CP/M	Microbits	£500	varies
CP/M	Graffcom Systems Ltd	£350	350 records/disc
CP/M	Salmon Microcomputing	£400	5,000 items
CP/M	Map Computer Systems Ltd	£250	
CP/M	Ludhouse Ltd	£1,000	12,000 parts
CP/M	Interface Computer Services	£350	varies
CP/M	Selven Systems	£600	
CP/M Cromenco	Micromedia Systems	£1,000	
CP/M Horizon	Microtek Computer Services	£500-£1,000	varies
CP/M North Star	Benchmark CS Ltd	£450	350 items 275 trans
CP/M Vector	Taylor Micro Systems	£995	4,000 items/Mbyte
North Star DOS	Intelligent Artifacts Ltd	£195	
Exidy Sorcerer	Basic Computing	£125	
Tandy TRS-80	Chess Consultancies	£995	
Tandy TRS-80	A J Harding (Molimerx)	£150	1,000 items
Tandy TRS-80	Cleartone ADP	£325	4,000 items
Tandy TRS-80	Chess Consultancies	£750	500 items six sites
Tandy TRS-80	FIBS	£750	
Tandy TRS-80	Micro Gems	£150	1,000 items
Tandy TRS-80	Tridata Micros Ltd	£200-£375	630 items/disc
Tandy TRS-80	Microgems Software	£150	1,000-2,000 items
Tecs	Jar Software Services	£800	10,000 items 5,000 orders
Tecs	Jar Software Services	£850	1,000 items 300 a/c
Zilog MCZ range	Microbits	£500	2,300 items
Z-80/8080	Graham Dorian Software	£325	varies
Z-80/8080	Rogis Systems Ltd	£500	900-3,500 items
Z-80 MCZ	Software Architects Ltd	£600	varies
Z-80	Liveport Ltd		

Word Processing

Machine type	Supplier name	Price	Capacity
Apple II	Dataforce (U.K.) Ltd	£190	
Apple II	SBD Consultants Ltd	£60	
Apple II/ITT	Systematics International Ltd	£75	
Apple II/ITT	Algobel Computers Ltd	£75	800 lines
Apple II/ITT	Personal Computers Ltd	£225-£300	200,000 characters
Commodore 3000	Stage One Computers Ltd	£125	
Commodore 3032	Dataview Ltd	£159	
Commodore 3032	ACT (Petsoft) Ltd	£325	12,000
CP/M	Interface Computer Services	£200	varies
CP/M	Microbits	£230	varies
CP/M North Star	Intelligent Artifacts	£250	
North Star ('c')	Intelligent Artifacts	£250	
Z-80 Superbrain	Alan Pearman Ltd	£225	

Miscellaneous

Machine type	Supplier name	Price	Capacity
Apple II	Vlasak Electronics	£30	Petrol pump losses

Apple II	Humac Ltd	£1,000	Auctioneer's package
Apple II	Humac Ltd	£600	Invoicing sales — timber
Apple II	Humac Ltd		Microfiche records
Apple	Style Systems Ltd	£750	Retail warehouse management
Apple II/ITT	Informex Logic	£198	Insurance records
Apple II/ITT	Informex Logic	£198	Time records — solicitors
Apple II/ITT	Diskwise	£198	TV rental management system
Apple II/ITT	Cyderpress	£650	Auction system
Apple II/ITT	CPR Systems Ltd	£960	Insurance brokers system
Apple II/ITT	Personal Computers	£195	Operational research
Apple II/ITT	Personal Computers	£100	Time series analysis
Apple II/ITT	Padmede Computers	£500	Insurance brokers system
Commodore 3000	Anagram Systems	£850	Media control system
Commodore 3000	Anagram Systems	£800	Slot machine monitor
Commodore 3000	The Alphabet Com	£250	Newsagent suite
Commodore 3032	Microland	£175	Printers quote system
Commodore 3032	Stage One Computers	£100	Insurance brokers system
Commodore 3032	Stage One Computers	£200	Printers job control
Commodore 3032	Commodore BM (U.K.)	£50	Appointments planner
Commodore 3032	CSM Ltd	£500	Window replacement
Commodore 3032	S A Systems	£550	Farming — office systems
Commodore 3032	L & J Computers	£420	Machine hire
Commodore 3032	Mandata Ltd	£1,000	Insurance brokers
Commodore 8000	Peach Data Services	£350	Library retrieval system
Commodore 8000	Peach Data Services	£550	Footware industry sales reporting
Commodore 8000	Peach Data Services	£995	Clients home accounting
Commodore 8000	Stage One	£800	General accounting package
Commodore 8000	Stage One	£330	Petaid/Wordcraft/ VisiCalc link
CP/M	Benchmark Ltd	£350	Time recording
CP/M	Bytesoft	£850	Work in progress
CP/M	Bytesoft	£150	Perpetual inventory
CP/M	Bytesoft	£850	Bill of materials
CP/M	Bytesoft	£200	Kit control
CP/M	Microtek	£500	Garage system
CP/M	PR Daly & Co	£450	Time recording
CP/M	Horizon Software	£1,000	Integrated business system
CP/M	Horizon Software	£400	Costing systems
CP/M	Research Resources	£240	Statistical analysis
CP/M	Sail	£1,000	Jewellers integrated system
CP/M	Salmon Microcomputer	£150	Appointments planner
CP/M	Selven Systems	£400	Nominal ledger
CP/M	Map Computer Systems	£450	Time recording
CP/M	Map Computer Systems	£750	Calor system
CP/M	Map Computer Systems	£425	Newsboy/newsagents system
CP/M	Haywood	£500	Time recording
CP/M	Comput-a-Crop	£1,000	Farm management
CP/M	Microtek	£1,000	Plant hire
CP/M North Star	Micromedia	£195	Vehicle maintenance
CP/M Vector	Taylor Microsystems	£495	Bill of materials
Ohio Scientific	Stratheden Ltd	£300	Statistics package
Ohio Scientific	Stratheden Ltd		Insurance brokers system
Ohio Scientific	Stratheden Ltd		Hospital package
North Star DOS	Intelligent Artifacts	£52	Parts list management and ordering

MICRO ADS

are accepted from private readers only, pre-paid and in writing, 20p per word, minimum charge £2.
Please make cheques payable to Practical Computing and send to Room L311, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

SuperBrain	Alan Pearman Ltd	£190	Statistics package
SuperBrain	Alan Pearman Ltd	£105	APL utility functions
SuperBrain	Alan Pearman Ltd	£225	APL Text editor/ processor
SuperBrain	Alan Pearman Ltd	£125	Micro-mainframe communications
SuperBrain	Alan Pearman Ltd	£490	Modelling/simulation
SuperBrain	Alan Pearman Ltd	£325	Actuarial calculations
SuperBrain	Alan Pearman Ltd	£75	Password security system
SuperBrain	Alan Pearman Ltd	£225	Report formatting
SuperBrain	Alan Pearman Ltd	£195	CP/M networks
SuperBrain	Alan Pearman Ltd	£380	Hard graphics copy
Tandy TRS-80	Chess Consultancies	£995	Haulage administration
Tandy TRS-80	Cleartone ADP	£300	WIP and invoicing system
Tandy TRS-80	Cleartone ADP	£500	Patient and drugs records
Tandy TRS-80	P J Norris	£1,000	Comprehensive sales and purchase
Tandy TRS-80	Quickmet	£785	Integrated accounts package
Zilog MCZ range	Microbits	£1,000	Insurance brokers system
Zilog MCZ range	Microbits	£1,000	Production control
Zilog MCZ range	Microbits	£1,000	Bill of materials
Z-80/8080	Intereurope	£500	Conference organiser

Alphabetical list of suppliers

Supplier	Address	Sales contact
3-Line Computing 0482-445496	36 Clough Road Hull HU5 1QL	Tim Hill
ACT Microsoft Ltd 021-455-8585	Radclyffe House 66-68 Hagley Road Birmingham B16 8PF	Matthew Wauchope
Aerco-Gemsoft 04862-22881	27 Chobham Road Woking Surrey	
A J Harding (Molimerx) 0424-22039	28 Collington Avenue Bexhill-on-Sea, East Sussex	John Harding
Algobel Computers Ltd 021-233-2407	33 Cornwall Buildings Newhall Street Birmingham B3 3QR	Amanda Anders
Amplicon M S Ltd 0273-608331	Richmond Road Brighton, Sussex BN1 6JA	Peter Wood
Anagram Systems 0403-50854	60a Queens Street Horsham, West Sussex RH13 5AD	
Analog Electronics 0203-417761	47 Ridgeway Avenue Coventry	
Alan Pearman Ltd 0244-46024/21084	Maple House, Mortlake Crescent Chester CH3 5UR	
Atlanta Data Systems Ltd 01-739-5889	350/356 Old Street London EC1V 9DT	Frank Laughton
Basic Computing 0535-65094	Oakworth Road Keighley, West Yorkshire BD22 7LA	Mike Collier
Benchmark CS Ltd 0726-61000	7-8 Aylmer Square St Austell, Cornwall PL25 5LL	John Fisher
Bristol Software Factory 0272-277135	Kingsons House, Grove Avenue Queen Square, Bristol BS1 4QY	W J Kyle-Price
Business Solutions Ltd 01-554-5985/0582	1 Park Avenue, Ilford Essex IG1 4LU	S Page
Bytesoft Systems Limited 0533-531441	16 New Street Leicester LE1 5NR	David Biggins
Chess Consultancies Ltd 061-832-6792	Progress House 31-33 Mount Street, Salford Manchester M3	D G West
Cleartone ADP 0495-244555	Prince of Wales Industrial Estate Abercarn, Gwent NP1 5RJ	C J Holbrook

SHOPWINDOW

16K ZX-81, with printer, full sized keyboard and cassette recorder, over £100 worth of software: Invaders Eprom, m/c programs, 2 books and 22 basic programs. Will sell all for £199. Tel: (0903) 42013.

VIC 20!! Full colour/sound games/educational programs, 4/5 on cassette, £5.50. Tel: (0634) 814118 for details.

TEXAS SILENT 700 portable data terminal, hardly used, £750. Tel: 01-778 2006 (office hours).

DUAL 8" DISKETTE drive model DR 76, from Digico M16E, £450. Tel: 01-778 2006 (office hours).

GTE NOVAR 5-60 golf ball terminal, with keyboard, £300. Tel: 01-778 2006 (office hours).

10 1K ZX-81 GAMES. Cassette, £2.50, listings 30p each. 5 16K games, £2.95, listings 50p. To Ian Morrison, 17 Winton Circus, Saltcoats, Ayrshire KA21 5DA.

PET 2001, new ROMs, 8K, programs, manuals, etc., excellent condition, £290 ono. Tel: Carrickfergus 66516 (N.I.).

APPLE/ITT2020 disc drive with controller, unused, with manual, £290. Tel: 01-521 7733.

ACORN ATOM, fully expanded, worth £400, want £300. Tel: 01-567 8607 after 6pm.

UK 101, 8K, cased, 4K Wemon monitor, all manuals, leads, programs on tape, £100. Tel: Byfleet 42443.

RML 380Z, single mini-floppy disk system, high resolution graphics, etc., etc., £1,500. Tel: Oxford 53514.

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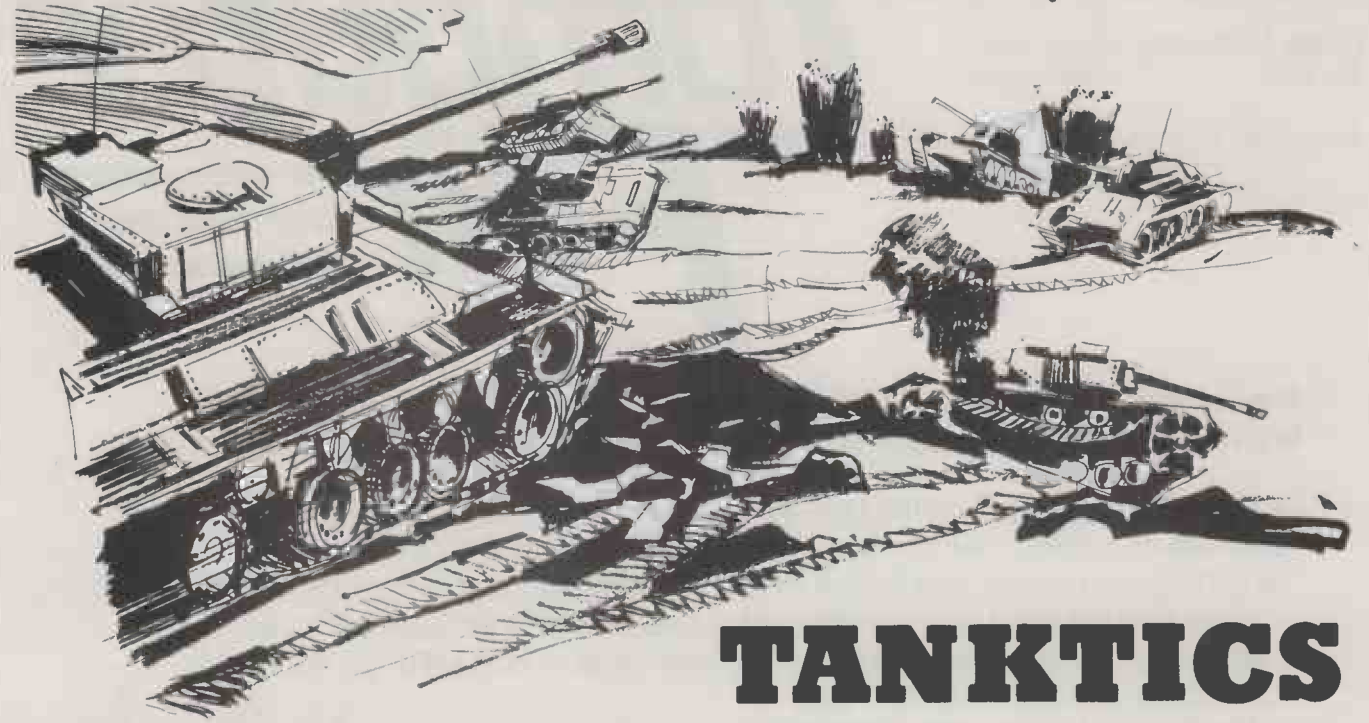

TANKTICS

ONE OF the more exciting developments in simulation gaming in recent months has been the application of artificial intelligence techniques to combat games, so that a human player can compete on equal terms against a computer opponent. Such games require larger and more detailed maps than can be simulated on a VDU, and the player will find that he has to acquire some knowledge of military tactics in order to stand up to the forces thrown against him by the machine.

A number of problems remain to be solved in this area, including the construction of artificial-intelligence algorithms for this new type of game-system and the compression of large amounts of data into limited memory. The initial impressions of Tanktics, recently made available in this country, suggest that some of these problems have been solved although it is too early to evaluate the level of sophistication of the program. The game is available for the Pet, TRS-80, Apple and Atari.

Computer combat

Tanktics is a solo board wargame complete with map and counters that is played on a computer. It is published with two of Avalon Hill's standard-quality mapboards and 260 counters.

The game involves individual tanks of the Second World War, operating on the Eastern Front. Up to 16 of them are Russian and eight are German. The computer handles the Russian tanks and resolves sighting, combat and movement. The system takes range and terrain into account and, for combat, facing. All details of the 788 hexagons in the grid overlaid on the map are stored within the computer. Eight different kinds of German and five types of Russian tanks and anti-tank guns are available. Each combination has its own counter, showing a pleasant aerial view. Allowance is made for differing armour thickness, gun penetration and speed, so the player can choose the different types of tank necessary to even up any play-balance problems.

The game plays very easily. It is a relief not to have to count hexes, shake dice and measure line of sight. Not having any idea where the enemy is until you can see him is fun as well. The input system used is very easy to pick up, and the speed of running is impressive.

There are some minor criticisms to be made of the game's performance during play. There is no line of sight as such — distance, terrain of spotter and target, and the terrain in between are taken into account, together with a random factor. There is no blocking terrain for a player to use to hide from an enemy unit. While this is much better than the rigid LOS/range rules common to most tactical board games, it is still a detraction from realism of the game. The reason for this lack of an LOS rule is doubtless the difficulty of doing this for a hex map with only 16K. Indeed the TRS-80 version is loaded in two segments.

Appraisal of realism

The only indications of the scale of the game are that no stacking is allowed and the road looks about one-third of a hex wide. Rightly, no information is given on combat strengths, apart from describing how good the armour and guns are, or how combat is resolved. This is another plus in comparison with a non-computer game, but it does make the appraisal of realism difficult.

The five scenarios fall into two types: reaching and occupying a target hex — which is randomly chosen — or defending the hex. If the computer is attacking, it will move the tanks towards the objective, usually in two separate formations. It will engage targets met on the way, both overrunning and firing when its units are at a reasonable range. It will deviate from the line of advance for combat but only slightly — by a few hexes. On the whole, the computer plays a reasonable game. There is one small tactical mistake which it makes in some situations, but one that is probably historically accurate. I do not intend to reveal it to potential players.

In the defensive area, the computer is equipped with 76mm. anti-tank guns, so there is no question of manoeuvre. There is a program bug on the TRS-80 version. As given, the program will give an error if the player uses more than four tanks, but the bug is easily corrected by changing the dimensioning of the variable in line 40 from (16,8) to (16,16).

Conclusions

Tanktics is an enjoyable game that plays very well and gives the impression of realism.

- Whether Tanktics will be a game you will play again and again probably depends on how much of a "tankle" you are.
- Ratings:

Physical quality	Good
Perceived complexity	Fair
Subject complexity	Good
Realism	Good
Play balance	Excellent
Overall	Good

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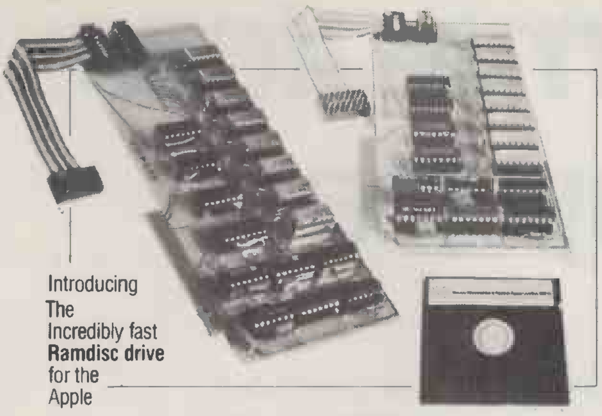

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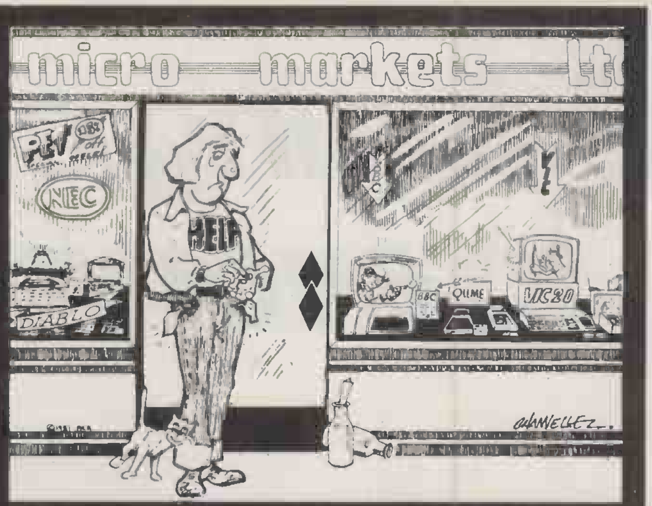

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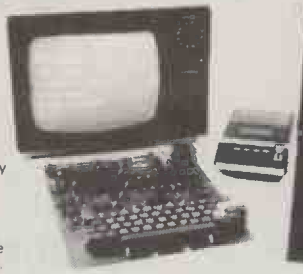

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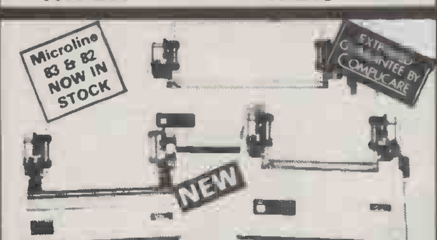

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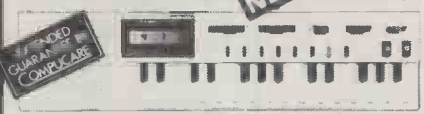

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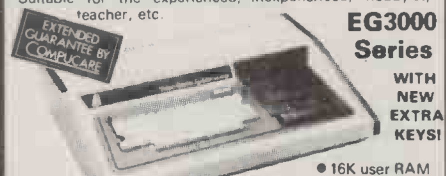

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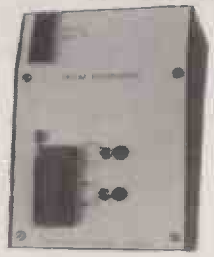

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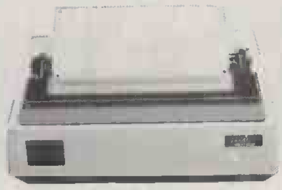

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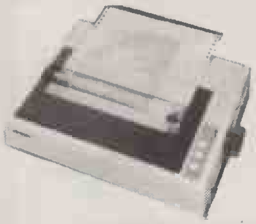

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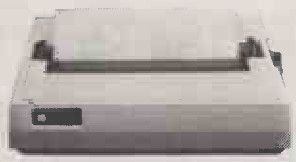

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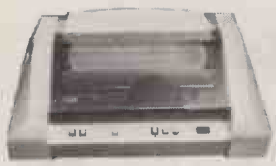

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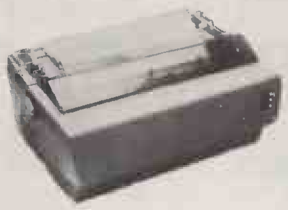

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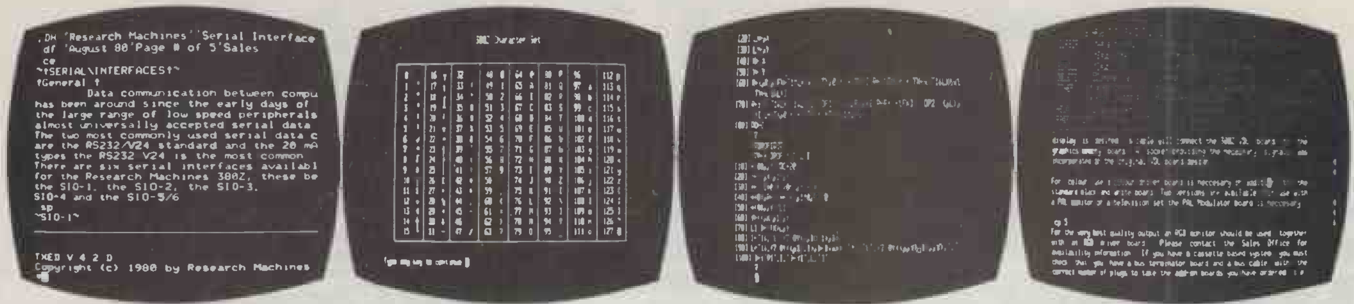
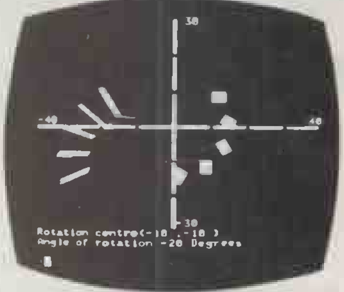
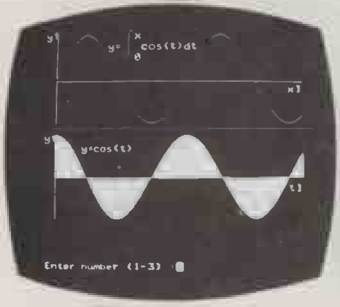
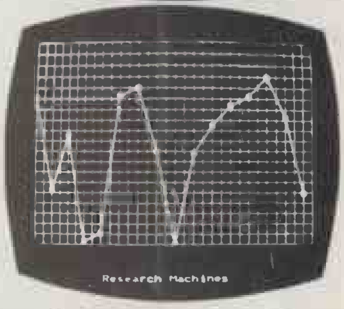






80/40



CHARACTER MACHINE

Providing exactly the right facilities for different applications can be a real problem when a system is as versatile as the 380Z.

Take, for example, screen line length. Not only do different users have different needs; so too do individual users.

They might welcome forty character clarity for presentation, display, and control applications; but they also want eighty character capacity, because word processing, some programming languages, and many general-purpose applications demand it.

So we've developed Varitext — to provide both, on the same machine.

Varitext means that the 380Z user can always choose the line length best suited to the application. It gives access to a growing range of 80 character software without losing all those well-established and popular 40 character applications. It makes the 380Z equally effective as a computer and a word processor. It lets programmers use the character mode with which they are familiar – or which languages like ALGOL, FORTRAN, and PASCAL really need.

And it improves the quality of our already exceptional graphics, by offering a smaller character size for neater annotation.

But the Varitext option goes a great deal further than that. We also saw it as the opportunity for a major enhancement of the 380Z's screen handling capabilities.

So we added:

- ☐ *an 8 × 10 dot matrix, to further refine the character set;*
- ☐ *an additional set of 128 user-definable characters;*
- ☐ *reverse video, underlining, and selective character dimming;*
- ☐ *smooth scrolling and faster screen filling;*
- ☐ *user defined windowing (and independent scrolling) of screen areas;*
- ☐ *audible tone generation (option)*

And all that, we believe, makes the 380Z's screen handling the best on the market.

The Varitext option is available with new systems or as a user-installable enhancement to existing 380Z systems. Contact our Sales Office for details.

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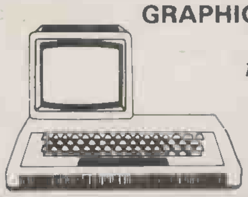

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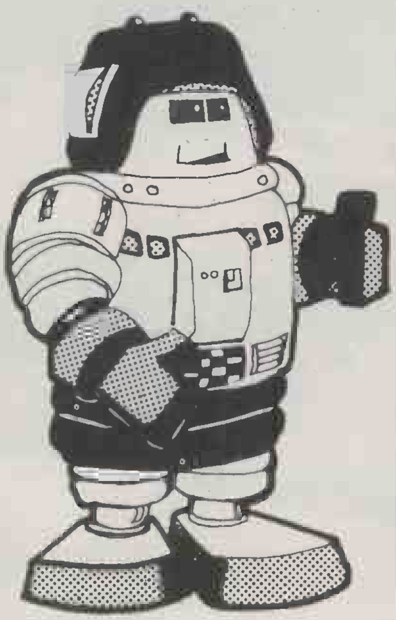

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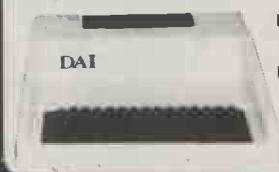

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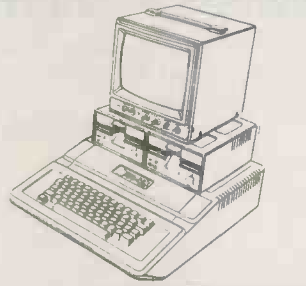

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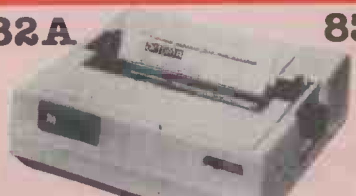

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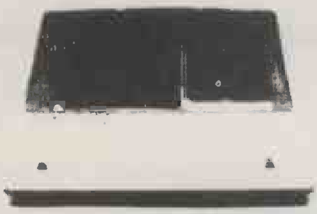

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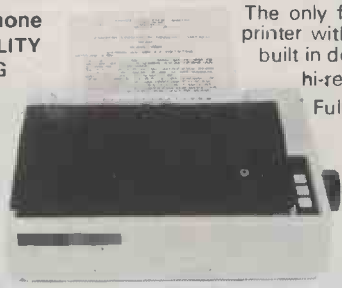

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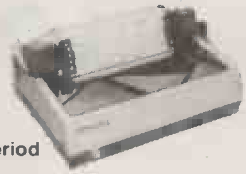

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Locksmith (new 4.0 version) will copy almost all "protected" diskettes for the Apple. It is the most reliable nibble-copy program you can buy. *Locksmith is suitable only for backups,* because the copies include all serial numbers, codes and protection features of the original (under the new copyright law, you'd have to be pretty foolish to try bootlegging software that is traceable back to the purchaser).

Locksmith includes nine other utilities, of which these five are vital to the integrity of your system: 1. Media surface check — Never commit data to a flawed diskette again. 2. Disk-drive speed calibration — the most frequent cause of communication bugs between Apples. 3. Degauss and Erase — Make sure no stray data is left over. 4. Nibble-Editor — sophisticated read/write tool for repairing blown disks. 5. Quickscan — Check for unreliable data, find used and unused tracks.

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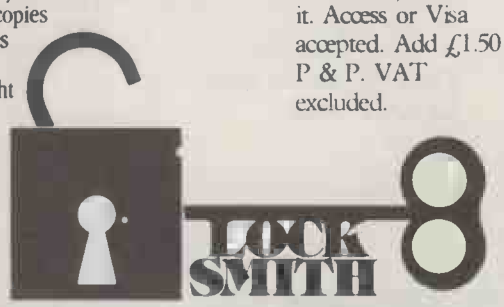

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2118-4	200
2147-3	425
2532-450n	525
2708	200
2716-5V	250
2732-450n	455
4027	240
4116-150n	100
4116-200n	85
4118-250	450
4164-200	798
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5101	270
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6532 RIOT	750
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6592 PC	£26
6800	375
6802	500
6803	1360
6804	160
6805	670
6808	520
6809	999
6810	175
6820	175
6821	150
6840	470
6843	1450
6845	975
6847	850
6850	175
6852	255
6875	550
8039	00
8080A	350
8085A	550
81LS95	90
81LS96	90
81LS97	90
8166	00
8123	125
8155	00
8202	£25
8212	170
8214	425
8216	70
8224	250
8226	250
8228	250
8243	00
8251	370
8253	799
8255	375
8257	800
8279	00
8T26A	99
8T27	150
8T28A	135
8T31	350
8T95N	135
8T97N	135
9364AP	550
AM26L531C	125
AM26L532A	125
AY-3-1015	350
AY-3-8910	620
AY-3-8912	625
AY-5-1013	350
AY-5-2376	700
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MC1489	62
MC14411	695
MC14412	800
MM52800	695
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RO-3-2513U	650
SFF96364E	800
SFC71301	820
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TMS6011	365
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ULN2004	150
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Z800MA	999
Z80S10-1	£15
Z80AS10	£23
Z80 DART	726
Z80A DART†	725
ZN419CE	190
ZN423E	195
ZN424E	130
ZN425E	350
ZN426E	325
ZN427E	625
ZN428E	478
ZN429E	210
ZN1034E	200
ZN1040E	625
74S132	138
74S138	240
74S188	210
74S189	158
74S194	360
74S201	350
74S241	540
74S262	850
74S287	325
74S288	210
74S470	325
74S471	620
74S472	1150
74S475	825
74S571	620
75150	125
75108	350
75182	115
75183	115
75154	150
75188	65
75189	65
75322	165
75450	95
75451/2	70
75454	225
75491/2	70

TTL7400 (TEXAS)

7400	11
7401	11
7402	11
7403	14
7404	14
7405	18
7406	28
7407	28
7408	16
7409	16
7410	14
7411	20
7412	20
7413	24
7414	32
7416	25
7417	25
7420	16
7421	20
7422	20
7423	22
7425	28
7426	30
7427	27
7428	28
7430	16
8432	26
7433	27
7437	27
7438	27
7440	17
7441	68
7442	38
7443	90
7444	90
7445	65
7446	55
7447	50
7448	60
7450	16
7451	16
7453	16
7454	16
7460	16
7470	35
7472	30
7473	30
7474	25
7475	40
7476	30
7480	48
7481	120
7482	70
7483	50
7484	80
7485	95
7486	26
7489	205
7490	28

7491	45
7492	30
7493	30
7494	34
7495	50
7496	45
7497	120
74100	85
74104	54
74105	65
74107	32
74109	35
74110	40
74111	55
74112	170
74116	88
74118	80
74119	90
74120	75
74121	30
74122	45
74123	50
74125	42
74126	40
74128	42
74132	48
74136	35
74141	70
74142	190
74143	250
74144	250
74145	70
74147	99
74148	75
74150	80
74151	45
74153	46
74154	75
74155	75
74156	75
74157	45
74159	99
74160	60
74161	60
74162	62
74163	64
74164	64
74165	62
74166	65
74167	185
74170	168
74172	290
74173	65
74174	72
74175	72
74176	55
74177	75
74178	95
74179	68
74180	65
74181	140
74182	75
74184	99
74185	99
74188	290
74190	70
74191	70
74192	70
74193	65
74194	75
74195	65
74196	65
74197	65
74198	99
74199	99
74221	80
74246	150
74247	160
74248	150
74249	150
74251	80
74259	195
74265	65
74273	195
74276	150
74278	160
74279	90
74283	90
74284	199
74285	199
74290	105
74293	125
74297	236
74298	100
74351	195
74365	65
74366	55
74367	55
74368	55
74390	99
74393	99
74490	120

74LS

LS00	12
LS01	13
LS02	14
LS03	14
LS283	45
LS290	57
LS293	46

LS04	15
LS06	15
LS08	15
LS09	15
LS10	15
LS11	15
LS12	15
LS13	30
LS14	48
LS15	15
LS20	15
LS21	15
LS22	15
LS26	18
LS27	15
LS28	20
LS30	18
LS32	15
LS33	16
LS37	16
LS38	16
LS40	16
LS42	35
LS47	40
LS48	80
LS49	60
LS51	15
LS54	15
LS55	30
LS63	150
LS73	25
LS74	25
LS75	28
LS76	20
LS78	24
LS83	50
LS85	70
LS86	38
LS90	35
LS91	80
LS92	36
LS93	36
LS95	45
LS96	120
LS107	43
LS109	30
LS112	30
LS113	40
LS114	35
LS122	44
LS123	55
LS124	105
LS125	30
LS126	30
LS132	45
LS133	35
LS136	28
LS137	35
LS139	38
LS145	75
LS147	199
LS148	99
LS151	39
LS153	39
LS155	39
LS156	39
LS157	35
LS158	36
LS160	41
LS161	41
LS162	41
LS163	41
LS164	48
LS165	145
LS166	85
LS170	170
LS173	72
LS174	72
LS175	58
LS181	130
LS183	275
LS190	58
LS191	58
LS192	58
LS193	65
LS194	40
LS195	40
LS196	58
LS197	85
LS200	345
LS202	345
LS221	60
LS240	96
LS241	96
LS242	85
LS243	85
LS244	80
LS245	90
LS247	40
LS248	65
LS249	68
LS251	40
LS253	40
LS257	48
LS258	40
LS259	85
LS261	195
LS266	25
LS273	90
LS275	290
LS279	88
LS280	250

LS295	215
LS298	130
LS299	420
LS300	157
LS302	175
LS320	270
LS323	270
LS423	200
LS323	270
LS324	200
LS325	320
LS326	330
LS327	315
LS347	150
LS348	190
LS352	185
LS353	185
LS365	37
LS366	37
LS367	37
LS368	90
LS373	75
LS374	75
LS375	48
LS377	90
LS378	69
LS379	65
LS384	250
LS385	378
LS390	62
LS393	60
LS395	199
LS399	220
LS445	140
LS447	620
LS490	245
LS541	135
LS640	225
LS641	225
LS645	210
LS668	175
LS669	150
LS670	175
LS673	650
LS674	750

CMOS

4000	14
4001	14
4002	14
4006	66
4007	18
4008	62
4009	35
4010	40
4011	15
4012	18
4013	34
4014	75
4015	66
4016	32
4017	48
4018	68
4019	42
4020	61
4021	70
4022	66
4023	20
4024	45
4025	19
4026	130
4027	38
4028	58
4029	77
4030	50
4031	170
4032	125
4033	165
4034	195
4035	95
4036	275
4037	115
4038	110
4039	290
4040	59
4041	78
4042	60
4043	70
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4046	75
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4048	55
4049	30
4050	30
4051	78
4052	78
4053	78
4054	125
4055	125
4056	120
4057	1915
4059	480
4060	90
4061	1225
4062	995
4063	99
4066	36
4067	399
4068	22
4069	20
4070	25

4071	20
4072	20
4073	20
4075	20
4076	60
4077	26
4078	26
4081	26
4082	21
4085	65
4086	70
4089	140
4093	43
4094	168
4095	90
4096	90
4097	320
4098	88
4099	95
4160	95
4161	99
4162	99
4163	99
4174	99
4175	105
4194	105
4408	790
4409	790
4410	725
4411	695
4412	800
4415	480
4419	280
4422	770
4433	770
4435	850
4440	999
4450	350
4451	350
4490	350
4500	675
4501	28
4502	90
4503	50
4504	105
4506	65
4507	40
4508	265
4510	68
4511	68
4512	75
4513	199
4514	195
4515	198
4516	75
4517	415
4518	42
4519	29
4520	78
4521	200
4522	125
4526	95
4527	115
4528	80
4529	150
4530	90
4531	130
4532	110
4534	500
4536	295
4538	115
4539	115
4541	140
4543	135
4544	150
4549	395
4553	299
4554	190
4555	50
4556	55
4557	320
4558	120
4559	395
4560	180
4561	104
4562	495
4566	175
4568	250
4569	175
4572	36
4580	460
4581	250
4582	99
4583	99
4584	48
4585	99
4597	330
4598	290
4599	595
40097	88
40100	215
40101	130
40102	180
40103	175
40104	95
40105	115
40106	75
40107	60
40108	450
40109	100
40110	300
40114	240

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

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CRYSTALS

32 768K Hz	200
100K Hz	270
200K Hz	295
455K Hz	370
1M Hz	295
1 28M Hz	392
1 6M Hz	395
1 8M Hz	395
1 008M	290
1 8432M	220
2 0M Hz	240
2 4576M	220
3 2768M	220
3 57954M	150
3 6864M	300
4 0M Hz	200
4 032M Hz	290
4 80M Hz	200
4 194304M	200
4 433619M	120
5 0M Hz	200
5 185M Hz	300
5 24288M	390
6 0M Hz	220
6144M Hz	240
6 5536M Hz	200
7 0M Hz	200
7 168M Hz	250
7 68M Hz	200
8 0M Hz	200
8 867237M	240
9 00M Hz	200
10 0M Hz	200
10 7M Hz	220
1024M Hz	200
12 0M Hz	290
14 31818M	320
16 0M Hz	275
18 0M Hz	240
18 432M	240
19 968M Hz	325
24 0M Hz	200
26 69M	290
27 648M	330
27 145M	240
38 66667M	290
48 0M Hz	270
100 0M Hz	375
1160M Hz	300

'D' CONNECTORS (Cannon Type)

	Plugs	Sockets	Plastic Covers	DIL Switches
9 way	55p	125p	145p	4 way 70
15 way	135p	128p	150p	6 way 85
25 way	170p	250p	130p	8 way 90
37 way	290p	398p	185p	10 way 145

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18" long single end Male	520
18" long single end Female	525
36" long double ended M/M	1020
36" long double ended F/F	1010
36" long double ended M/F	1000

JUMPER LEADS (Ribbon Cable Assembly)

Single Ended DIP Lead, 24" Cable
14 pin plug 145p 24 pin plug 240p
16 pin plug 165p 40 pin plug 380p

Double ended DIP Leads

Length	14 pin	16 pin	24 pin	40 pin
6"	185p	205p	300p	465p
12"	198p	215p	315p	490p
24"	210p	235p	345p	540p
36"	230p	250p	375p	595p

DIL PLUGS (Headers)

14 pin	44
16 pin	49
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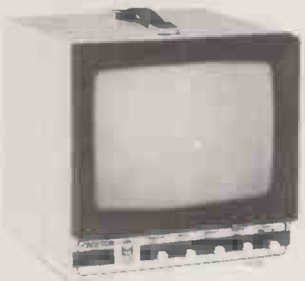

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74156	50p
74159	100p
74160	60p
74161	60p
74162	60p
74163	60p
74164	50p
74165	55p
74166	70p
74170	140p
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74175	60p
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74LS38	16p
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74LS161	40p
74LS162	40p
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74LS190	50p
74LS191	50p
74LS192	50p
74LS193	60p
74LS194	40p
74LS195	50p
74LS196	60p
74LS197	65p
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74LS243	80p
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4040	60p
4041	70p
4042	55p
4043	60p
4044	70p
4045	120p
4046	80p
4047	75p
4048	55p
4049	30p
4050	30p
4051	60p
4052	80p
4053	60p
4054	130p
4055	125p
4056	120p
4059	500p
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4063	100p
4066	35p
4067	400p
4068	18p
4069	16p
4070	16p
4071	16p
4072	16p
4073	16p
4075	16p
4076	60p
4077	26p
4078	20p
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4086	72p
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4518	50p
4520	70p
4521	150p
4526	75p
4527	90p
4528	75p
4532	90p
4534	500p
4536	300p
4538	120p
4539	120p
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2 4570MHz	250p
3 276MHz	150p
3 5795MHz	100p
3 686MHz	300p
4 00MHz	150p
4 194MHz	250p
4 43MHz	125p
500 MHz	175p
6 0MHz	150p
6 144MHz	150p
7 0MHz	150p
7 168MHz	200p
8 00MHz	175p
8 86MHz	175p
10 00MHz	175p
10 7MHz	250p
12MHz	350p
14 3168MHz	150p
16 00MHz	250p
18 00MHz	200p
18 432	250p
19 968MHz	390p
20 000MHz	175p
26 690MHz	300p
27 145MHz	250p
38 667MHz	350p
48 0MHz	300p
55 5MHz	400p
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★ ZX80/81 USER PORT ★

(Described in PCW Oct/Nov 81)

ADD SOUND, PLUS RELAY CONTROL & LIGHT DETECTION TO YOUR ZX80/81.

Port module plugs directly in to ZX80/81 to provide 8 input and 8 output lines. These allow input of data from switches, photocells, sensors, joysticks etc and control of 8 relays. Also, 7 segment displays and LED may be used — "VARIABLE TONE AUDIO OUTPUT CAN PRODUCE YOUR OWN SOUND EFFECTS." Port access is by simple PEEK & POKE commands.
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Reprint of PCW Oct/Nov, articles £1.00 + large SAE.
For ZX81 USERS, extender card to accept the RAM PACK provided so no need for expensive mother board.

★ TELE TEXT DECODER ★

A complete kit, as described in "ELEKTOR Nov 81" incl the keyboard kit, containing the PCBs, ICs, switches and all other components as listed plus all the sockets for ICs. £85 plus VAT.
Reprints of articles (Elektor Oct/Nov 81) £1.00 + SAE.

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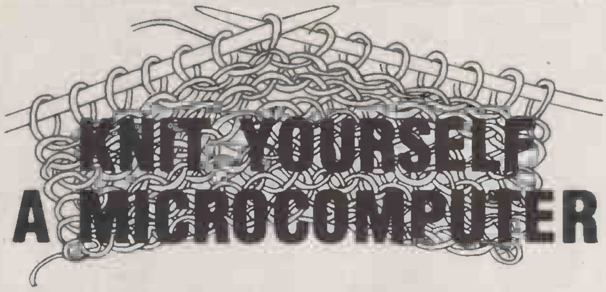

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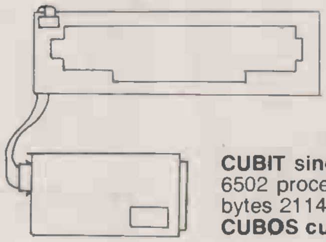

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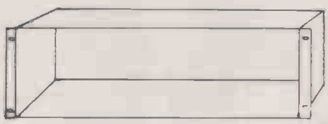

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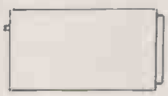

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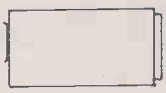

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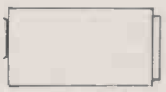

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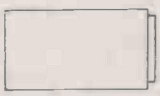

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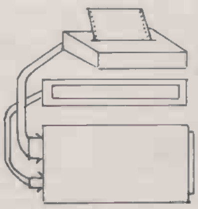

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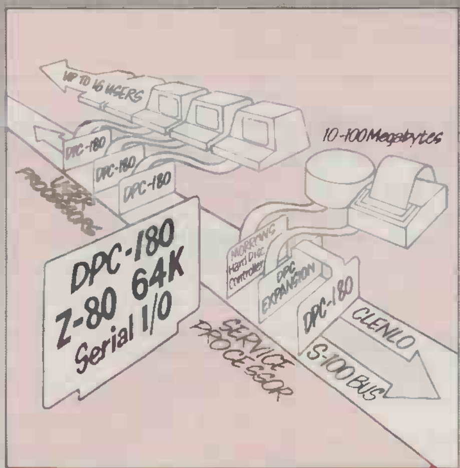

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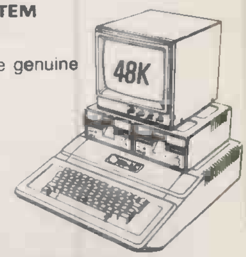

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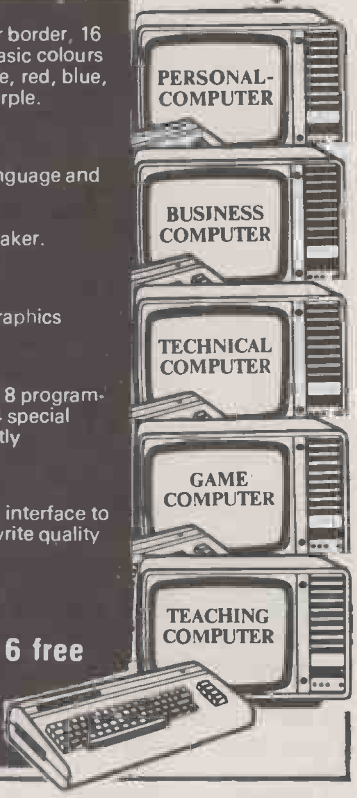

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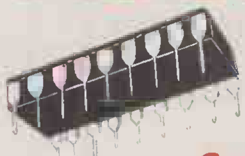

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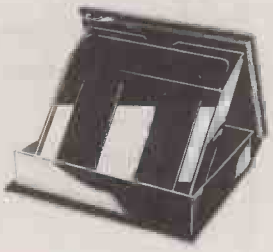

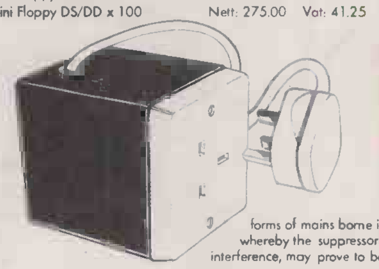

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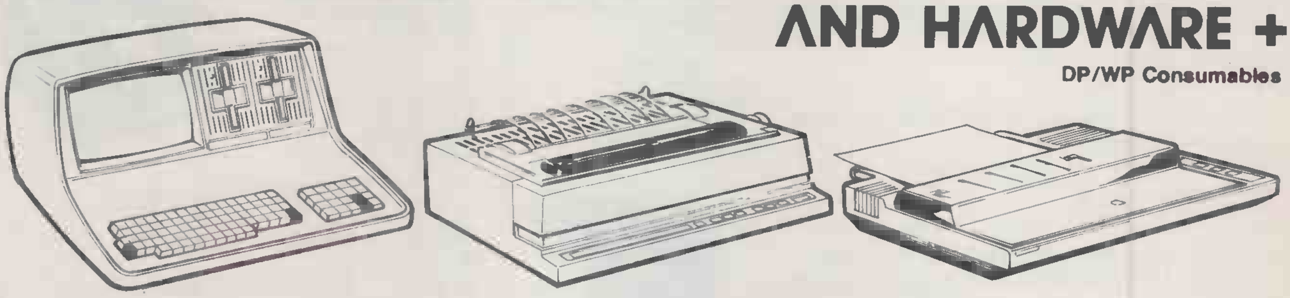

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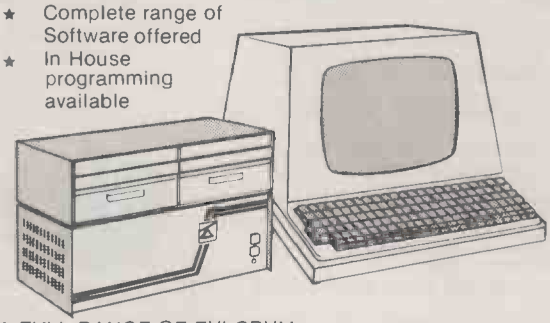

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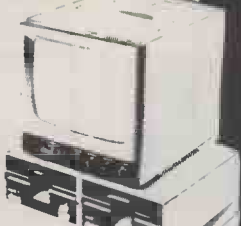

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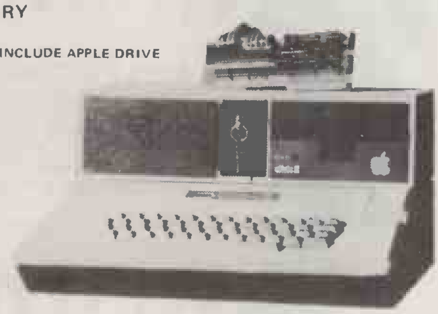

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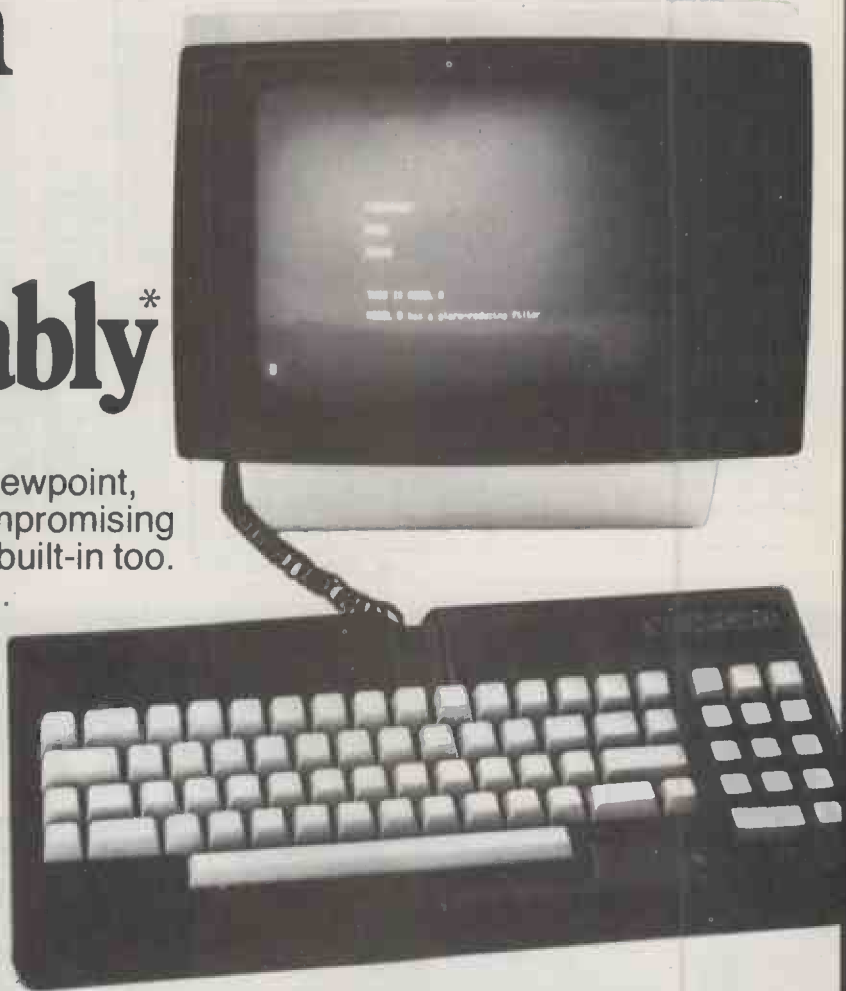

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