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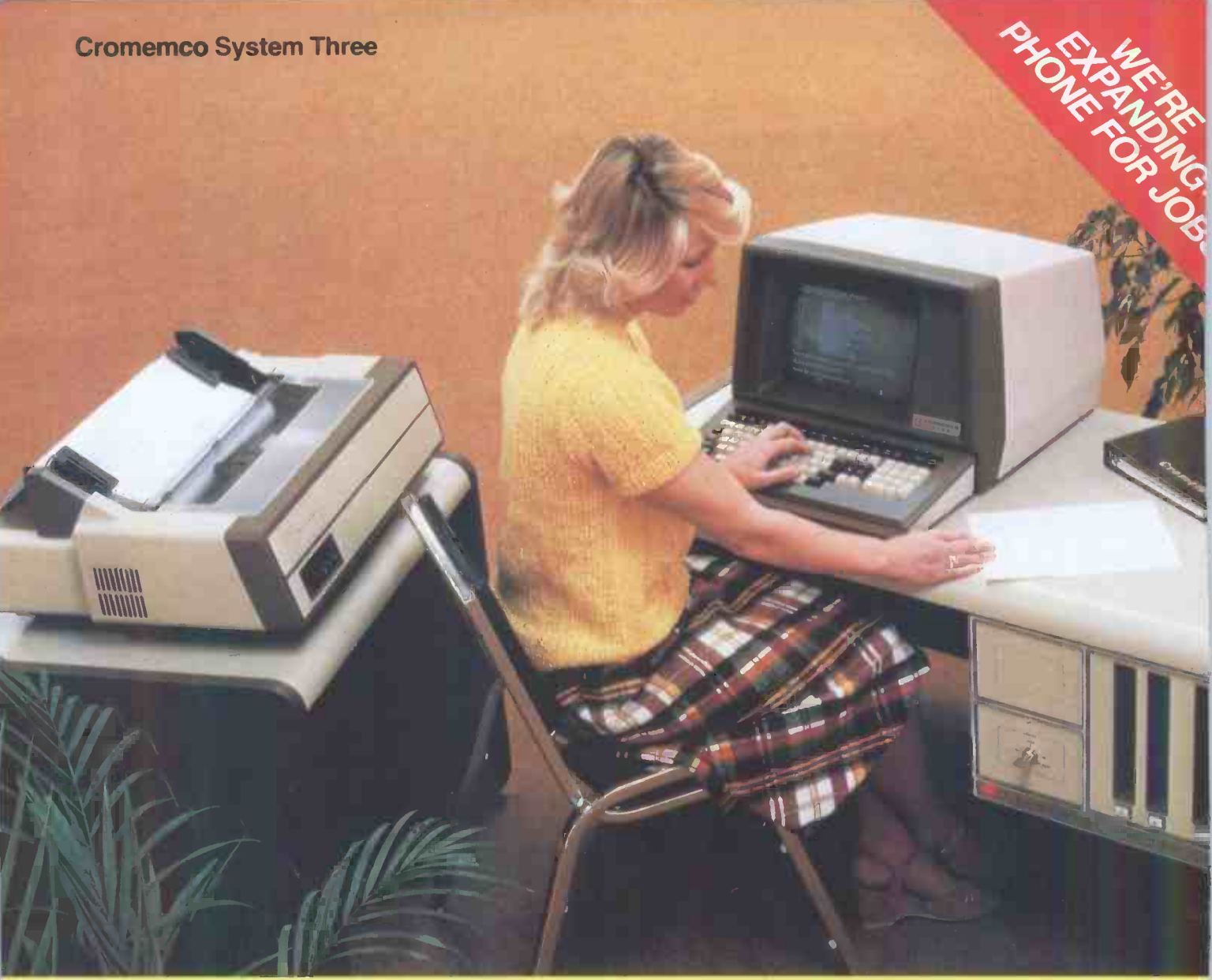

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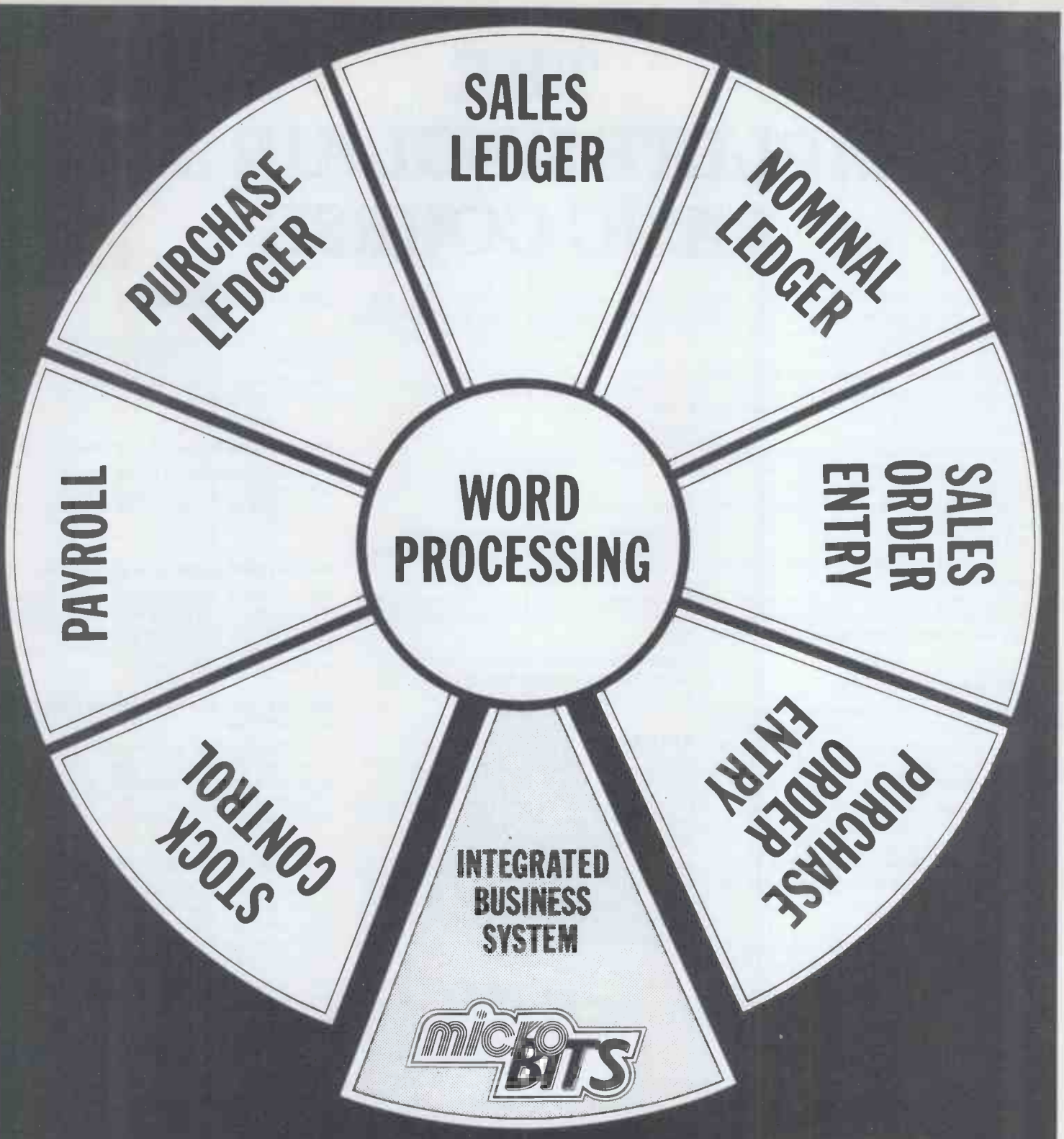

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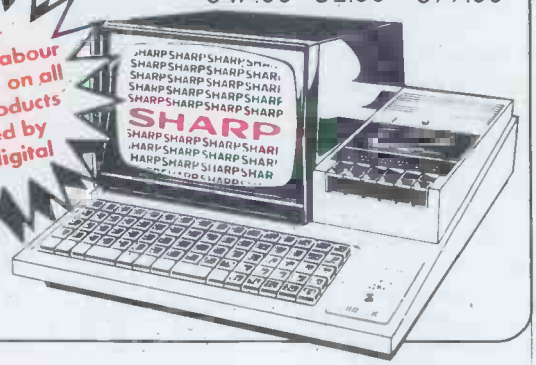

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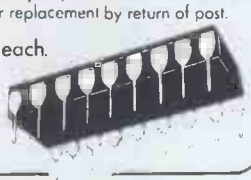

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***** Introducing the new Bus10.00/Dbms2 *****

If you are interested enough to study this section of our new manual, then you ave probably in need of a program embodying such features. If you understand the text, that is, if at least its meaning is a touchstone that fires your imagination towards grasping it with the mind then you and it are converging.

*** MULTIPLE FIELD SEARCHES ***
dbms2 and bus10.00

The following trajectory of a file interrogation may be set up and found to be both complex and of considerable power.
Try a Sequential search that is Slow and on Multiple fields within a range say of record '1 to 30'.
Notice that the cursor prompter will move to the first field in the record form. You will be able to ask any of the following types of questions on each field. When you set the question against that field; if the carriage return is not enabled by the fact that you hit the right-hand-field-bracket, then hit (cr).

There are five types of questions you may ask against a permutation of up to twenty fields. (Think about them.)

1=straight text identity (P=P) which is to say that you can enter TONY in a name search where the record may look like TONY WINTER or WINTER TONY. the 'TONY' text is sought for in any part of the field.

2=Greater than identity (P>Q) which is to say that you may first enter the symbol > followed by a numeric value (say 100) where the records may possess different ranges of numbers in that field, and you only want 100 upwards.

3=Smaller than identity (P<Q) as '2=' above in reverse using <.

4=Not identical (P<>Q) which is to say that all records found on other criteria must not possess the stated attribute. (ie: all records with TONY but not in W.C.1.). You must first enter the symbol ~ followed by the criteria that is to be excluded from the comparison.

5=Either or identity (P∧Q) which is to say that you may search for either TONY or someone in W.C.1. or telephones with a 01 in their number. Note: that only one match of those disjunctive premisses is sufficient to provide the truth condition establishing a match. That is to say you may find records of TONY in Birmingham and FRED in W.C.1. You must first enter the symbol ∧ followed by the text. A multiple example is shown below.

Field 01=number	( )	) The question is: ?
Field 02=name	(TONY	) straight text (cr)
Field 03=postcode	(∧ W.C.1.	) one or
Field 04=town	(∧ London	) other
Field 05=income	(>5000)	greater 5000
Field 06=age	(<40)	younger than 40
Field 07=sex	(~female)	not female

02–025

*** MULTIPLE FIELD ATTRIBUTES ***
dbms2 and bus10.00

The following is a list of the field attribute arithmetic functions that may be set up against up to 20 fields per record and found to be both complex and of considerable power.

fn1=Multiply one field against another and total per record/file. fn3=Divide one field from another and total per record/file.
fn2=Add one field against another and total per record/file. fn4=Subtract one field by another and total per record/file.
fn5=Total vertical columns within a file of records. Store. The result per record and per file.
fn6=Calculate a percentage of the value of one field and if the toggle is set to 1 then add that result to the field; whereas if the toggle is set to –1 then simply store the result.

Example:

		record.5 . . . . . computed values . . . . . record . . . . . file	
		Column A:	**Column B:**
Field 01=number	(5)		
Field 02=number	(MICRO)		
Field 03=quantity	(50)	[50,000.00]	[70,000.00]
Field 04=s.price	(1000.00)	[150.00]	[170.00]
Field 05=profit	(250.00)	[.25]	[.27]
Field 06=cost	(800.00)	[1,000.00]	[1,145.00]
Field 07=allocated	(20)	[30.00]	[450.00]

The two results to the right of the record show the use of several of the functions listed above.
Field 03 function 1 (03 * 04) has a value of 50,000.00 pounds worth of 'MICROS' for the number '5' and 70,000.00 pounds worth of for all such records so far scanned.
Field 04 functions 6 'toggle –1' (04 * .15) has the increase that is required to raise the price of record '5' by 15%, and so on averaging for all such records.
Field 05 function 3 (05 / 04) has the value of itself divided by the value found in field 04, for the record and all such records scanned. (profit margin ?).
Field 06 function 6 'toggle 1' (06 * 1.25) has the value of record '5' as if it were subject to an increase of 25%, and all such records scanned.
Field 07 functions 4 (03 – 07) has the quantity remaining in stock after allocations are subtracted.

You have a combination of multiple field searches of 5 TYPES and multiple compute functions of 10 TYPES against up to **20 fields**, using words you choose and printing only those columns in the order you desire in one SINGLE CORE PROGRAM.

02–026

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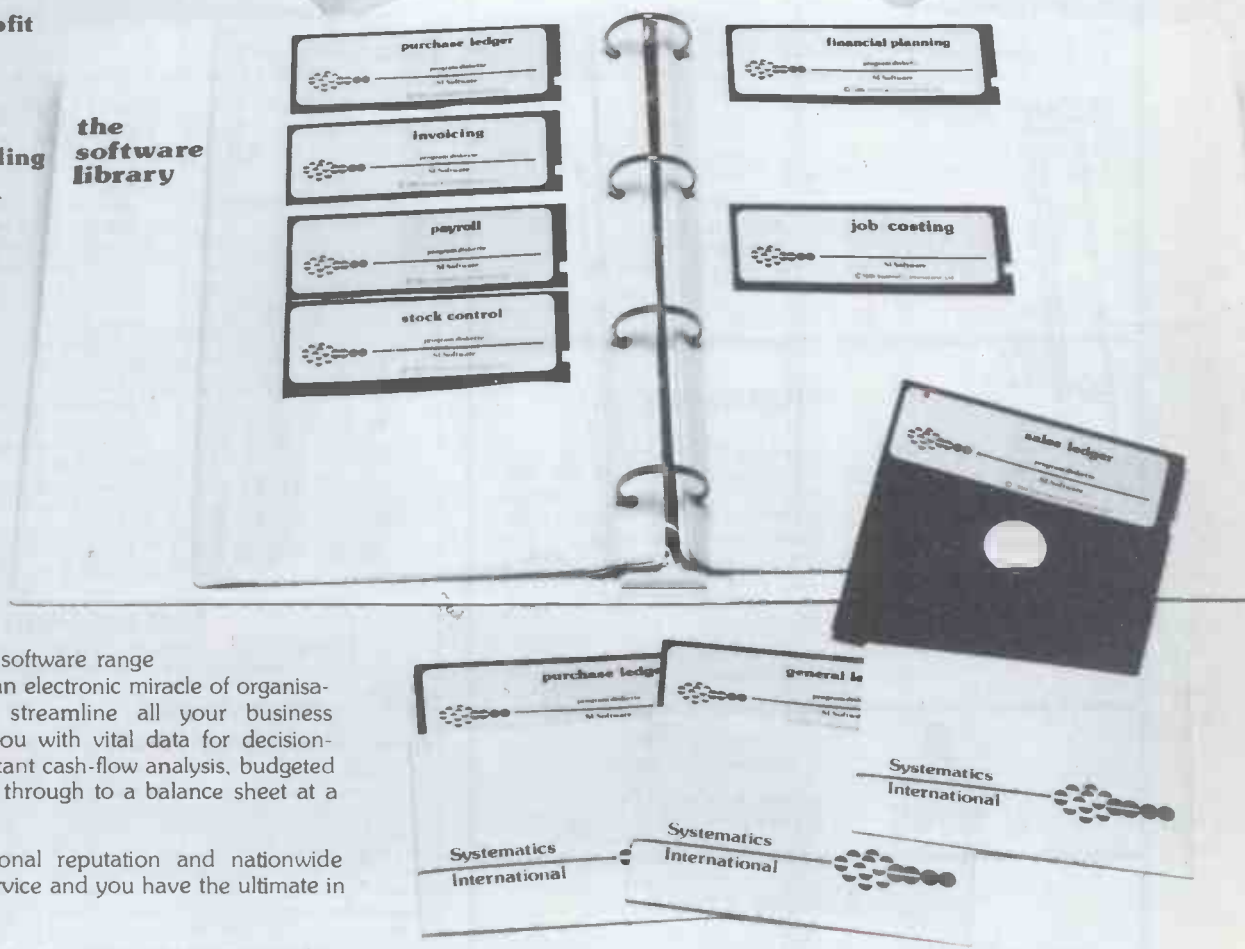

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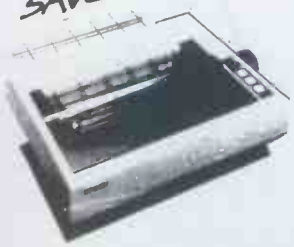

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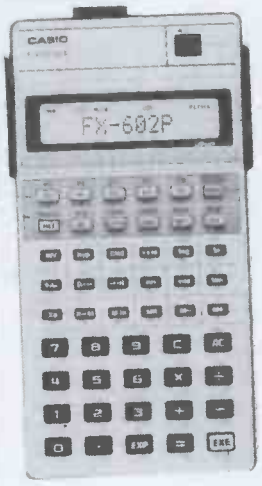

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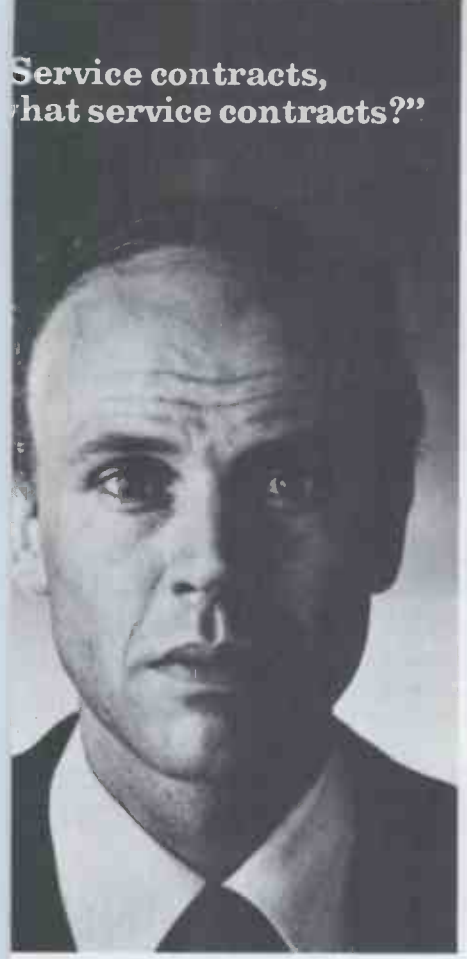

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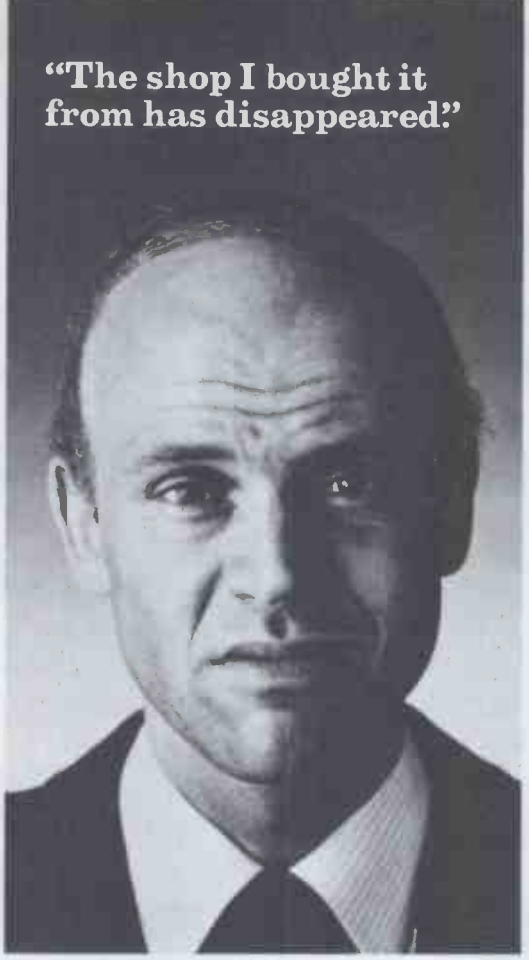

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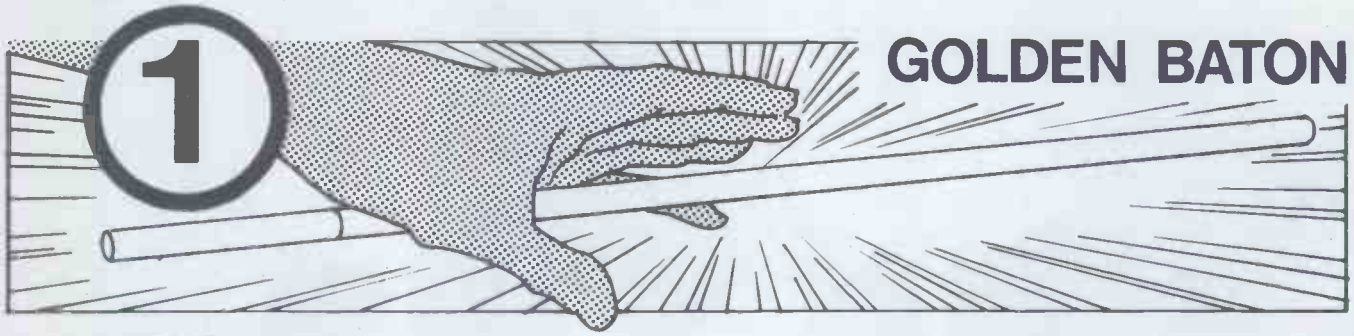
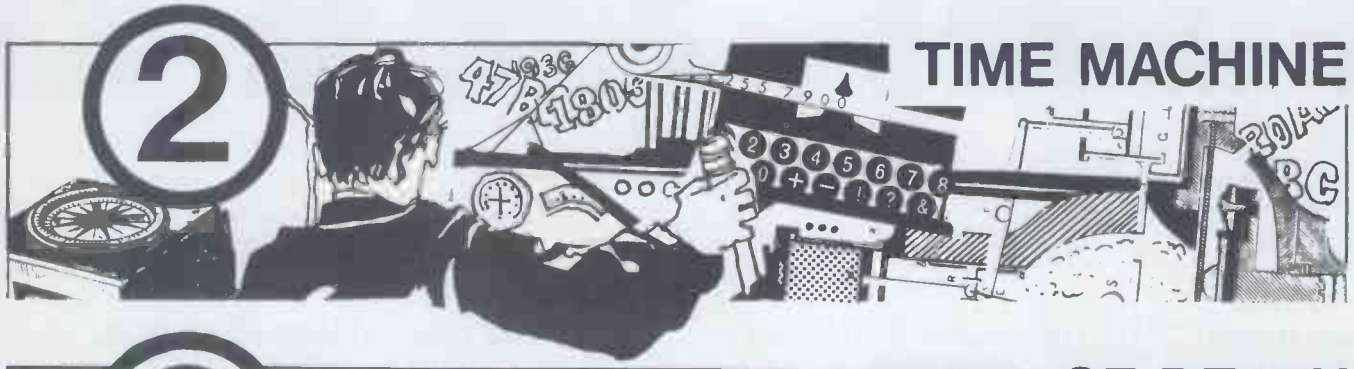
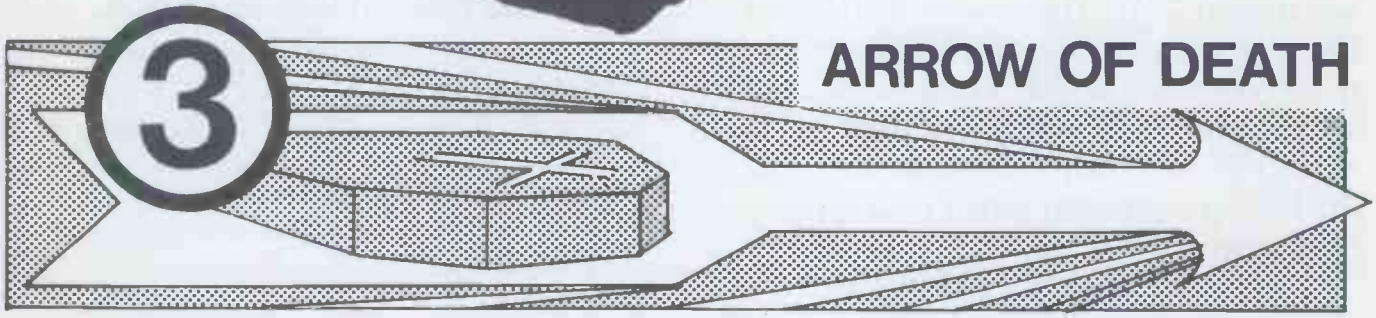
TRS 80-GENIE SOFTWARE

from the professionals

Mysterious Adventure







Three months ago we introduced the Mysterious Adventure series, a brand new series of machine language Adventures written by Brian Howarth. The first one, The Golden Baton, was greeted with enthusiasm by experienced and beginner Adventurers alike. Now the second and third in the series, The Time Machine and Arrow of Death, are available. The Arrow of Death, although entirely self-contained, is the first of a two part Adventure. The second part will be available early in the new year.

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LDOS

First there were the TRSDOS's, 2.0, 2.1, 2.2 and 2.3. Then came Newdos +, essentially a patched version of the TRSDOS's but with a number of very useful commands and utilities added. Then VTOS 3.0 and VTOS 4.0. These constituted a departure from the earlier DOS's and featured Device Independence so that devices such as the keyboard, printer, VDU and disk drives could interact directly together. Then came Newdos80 which is a rewrite of Newdos +, adding new utilities and new Basic commands, its main features being the ability to mix different capacity drives on the same cable and the ability to use variable length records. Now from LOBO International comes LDOS, the fifth generation disk operating system for the TRS-80 microcomputer. It combines most of the advantages of the preceding disk operating systems and unlike some of them, is accompanied by a complete and readable set of documentation, which includes a Technical Section containing relevant addresses.

It is impossible to describe all of the features of LDOS in an advertisement. For instance it includes no less than 35 library commands as follows:—

APPEND	COPY	DEVICE	DIR	DO	FILTER	KILL
LIB	LINK	LIST	LOAD	MEMORY	RENAME	RESET
ROUTE	RUN	SET	SPOOL	ATRIB	AUTO	BOOT
BUILD	CLOCK	CREATE	DATE	DEBUG	DUMP	FREE
PROT	PURGE	SYSTEM	TIME	TRACE	VERIFY	XFER

All of the useful abbreviations in Newdos are included and the System Commands in Basic (CMD) now number eleven. A program called LBASIC/FIX is included, with which the normal TRSDOS Disk Basic may be patched to include a number of new commands and features. A Job Control Language is included and in fact is one of the most powerful features of LDOS. It allows the user to compile a sequence of commands or key strokes for later execution as a chain, with or without user intervention. There are too many new features to list them herein, but examples are: The ability to provide an audible signal, output through the cassette port. To flash or blink a one line message on the video display. A WAIT feature is included so that the machine can be put into a "sleep" state until such time as the system clock matches the time specified. And so on!

Hard disks in addition to single/double density, single/double sided, 8" and 5¼" floppies are supported although they may, of course, require hardware modifications. Utilities included in the package are:

BACKUP	COMMAND FILE	FORMAT	LCOMM
PATCH	RS232	KEY STROKE/MULTIPLIER	PRINTER FILTER

A Basic Renumber facility is included, as is a Basic Cross Reference function. Both are similar to the ones in Newdos + and Newdos80. Most of the utilities are library commands which were existent in the previous DOS's, have been improved with the addition of new functions or facilities.

The prime development team of LDOS consisted of no less than 8 first rank programmers and they had the support and advice of six other well known programmers. They have done an excellent job to bring to the user what must be the best disk operating system so far produced for a microcomputer, which is destined to become the Standard DOS.

LDOS is totally upward compatible with TRSDOS, that is to say LDOS will be able to copy files and programs from TRSDOS disks onto LDOS formatted disks. As they are competitive disk operating systems, it is not suprising that the manual states that disks created under Newdos are not guaranteed to be compatible with LDOS, but we have not experienced any difficulty. We have done some work on investigating the compatibility of LDOS and the Video Genie and at the time of going to press we have found no incompatibilities. LDOS appears to run on the Video Genie without any problems at all. LDOS is compatible with either the Tandy or Electric Pencil lowercase modifications and Scripsit. LDOS is available for the Model I and Model III. A Model II version will be available shortly.

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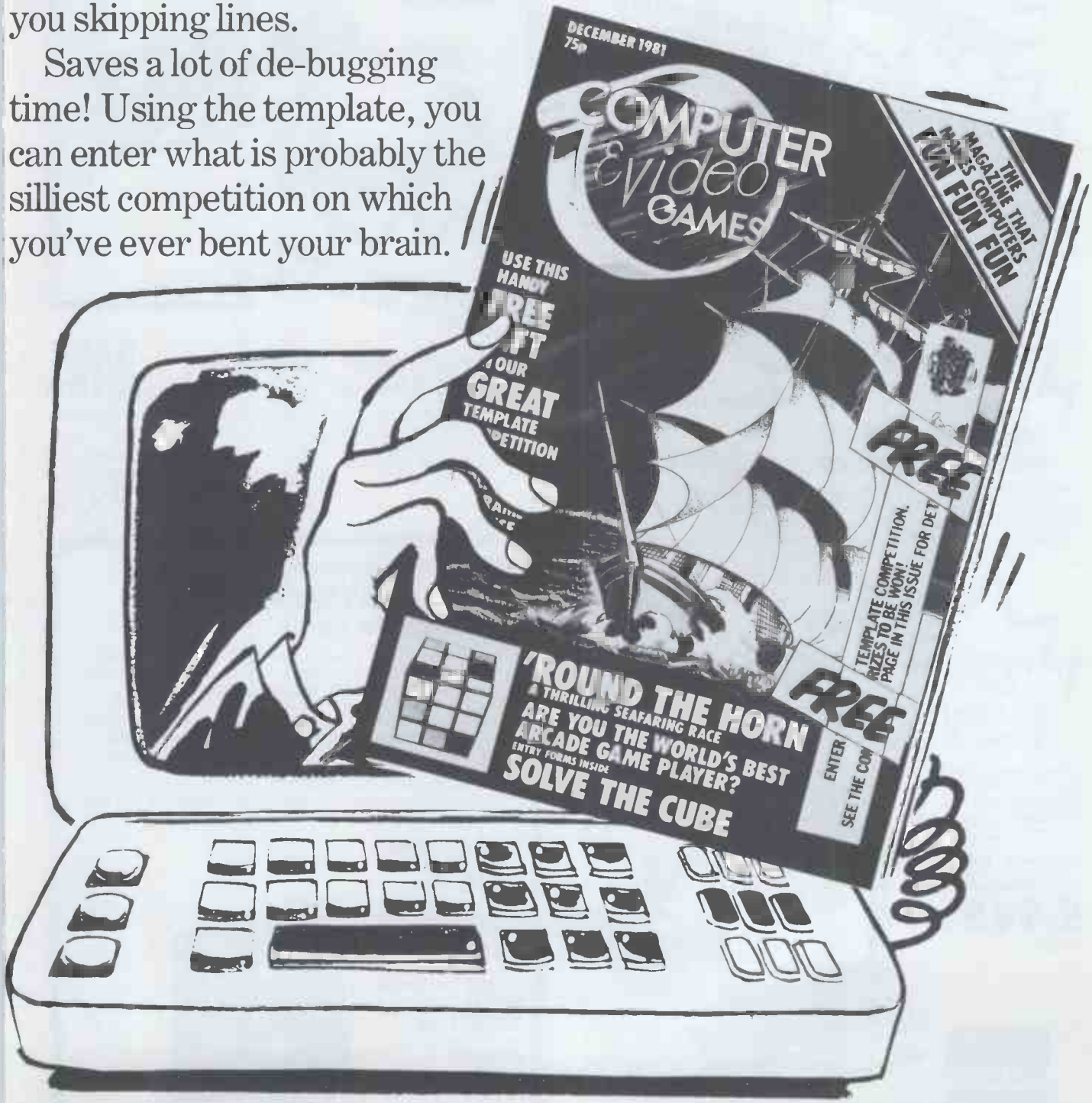

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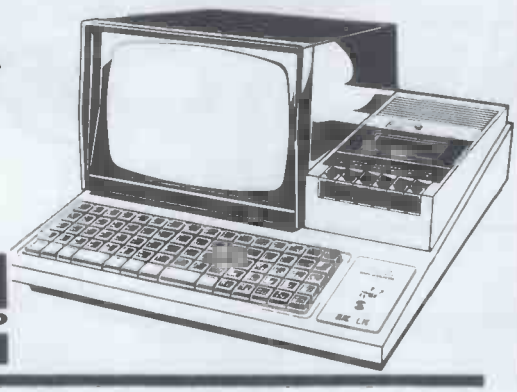

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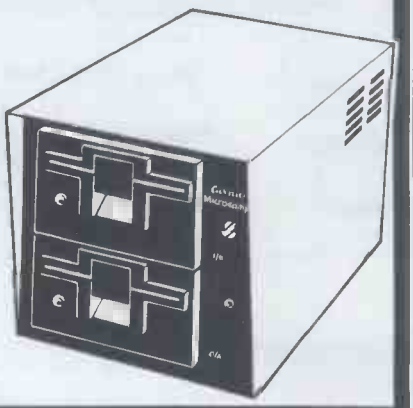

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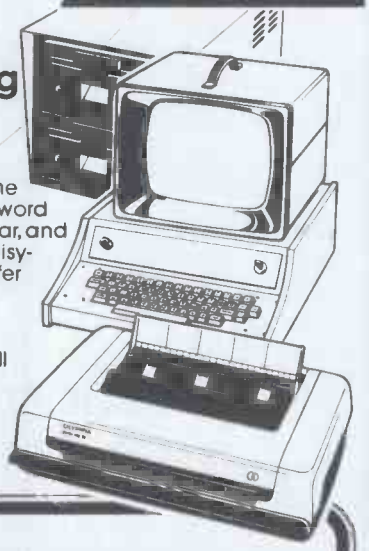

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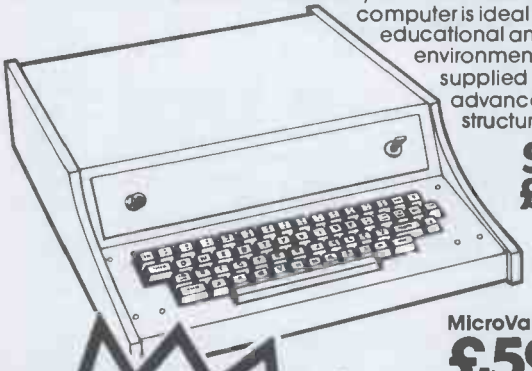

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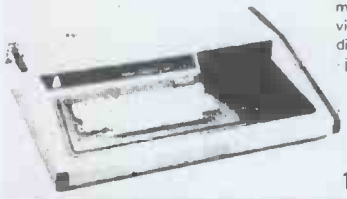

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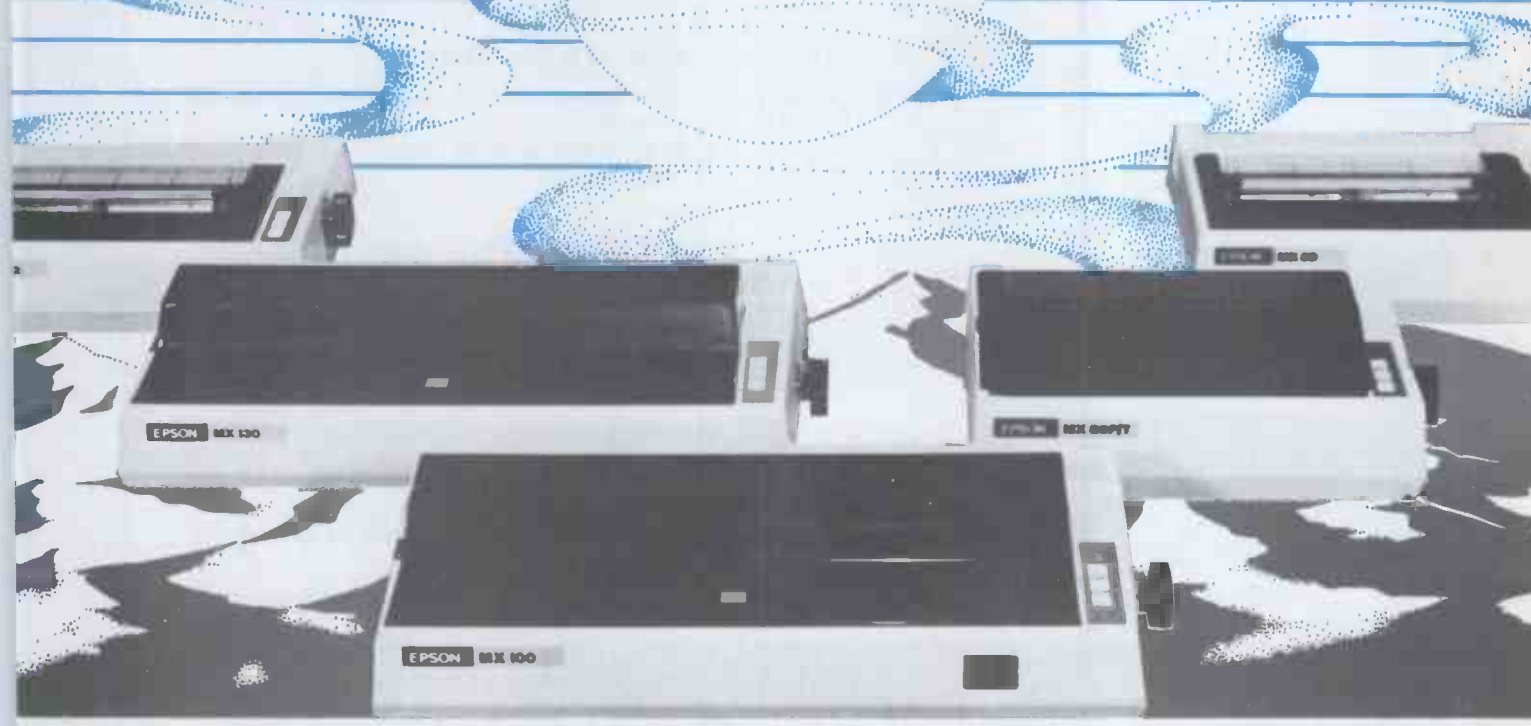

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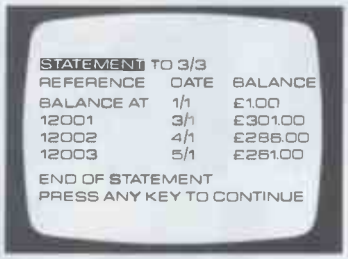

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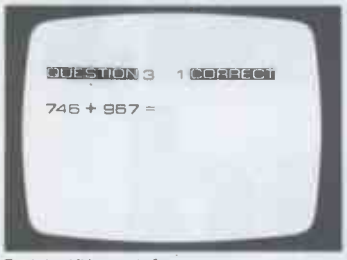

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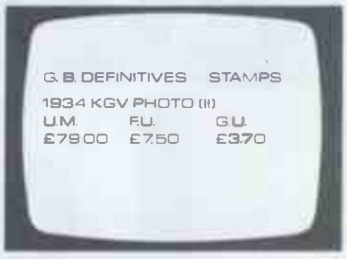

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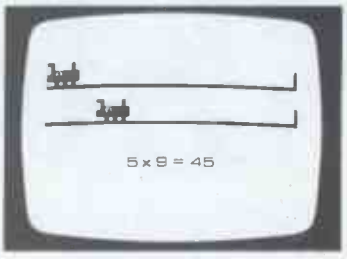

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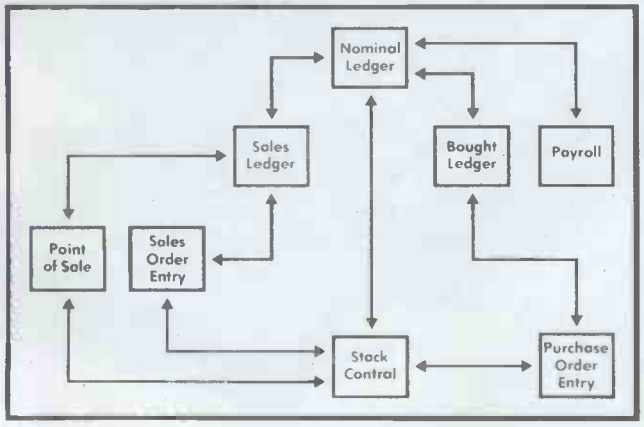

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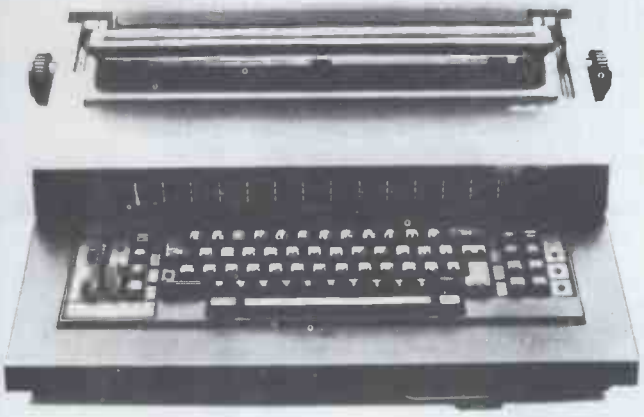

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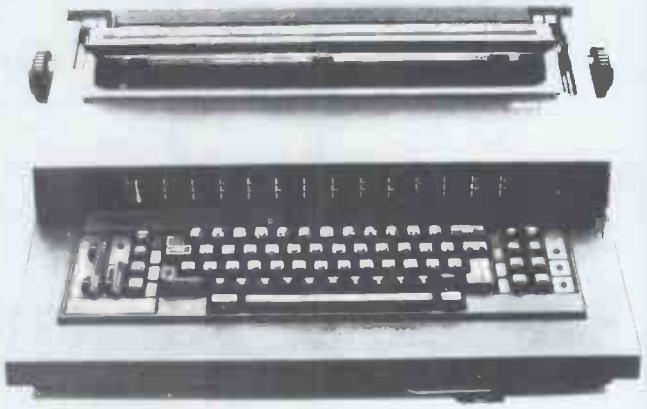

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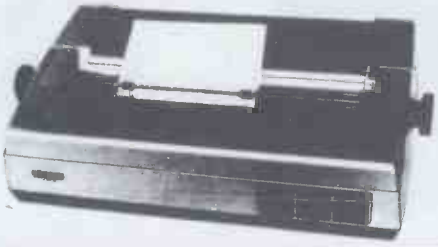

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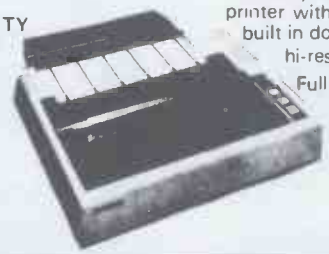

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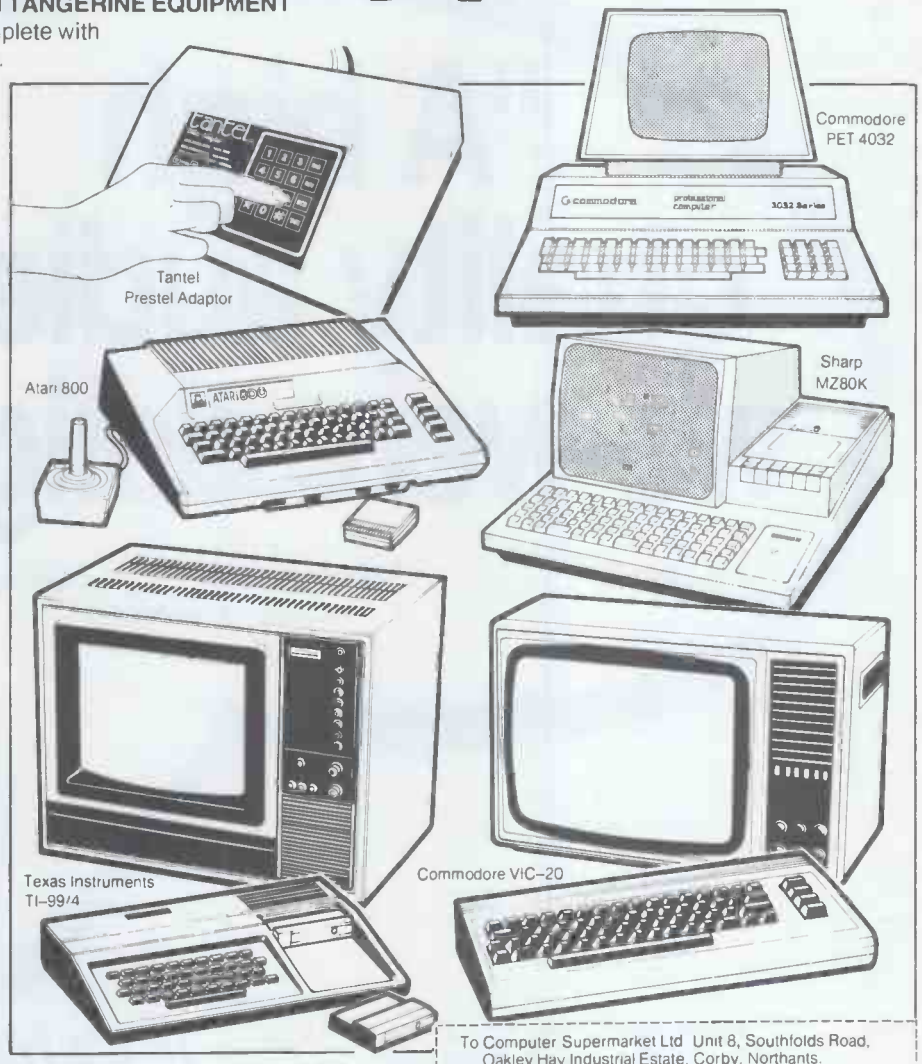

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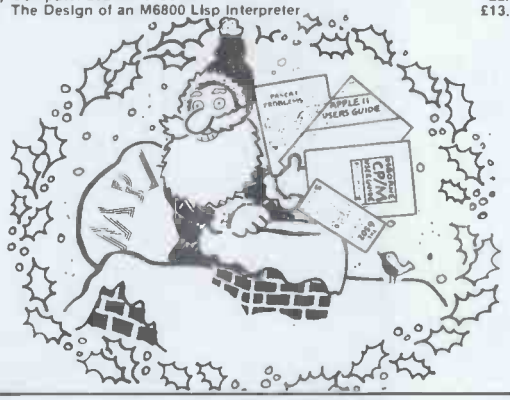

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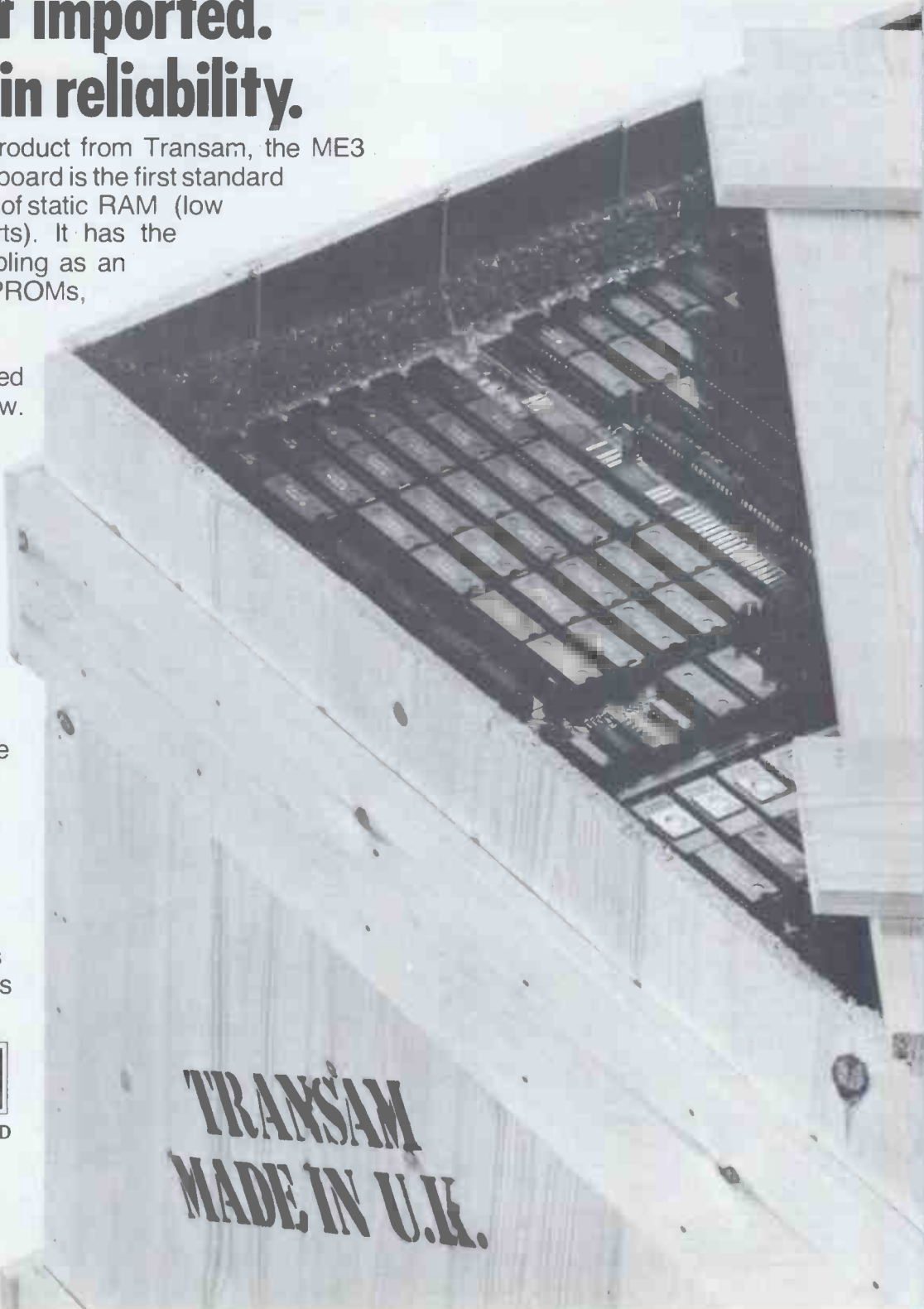

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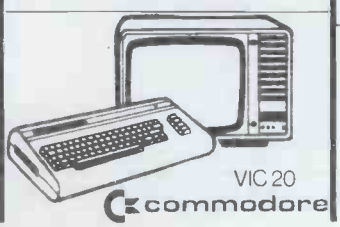

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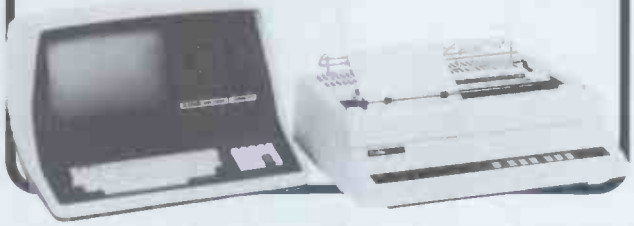

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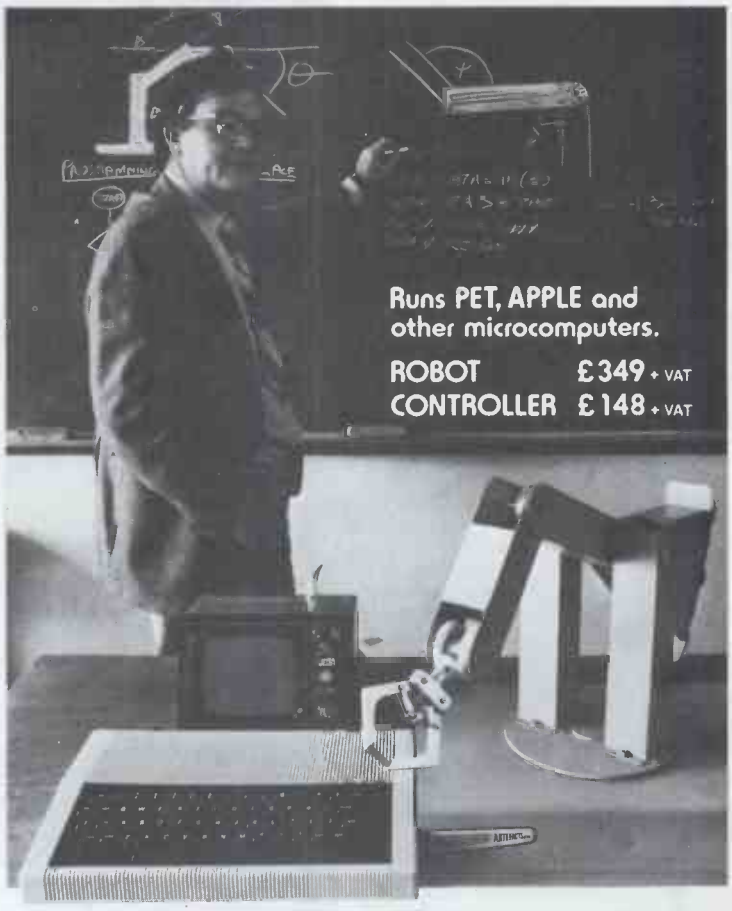

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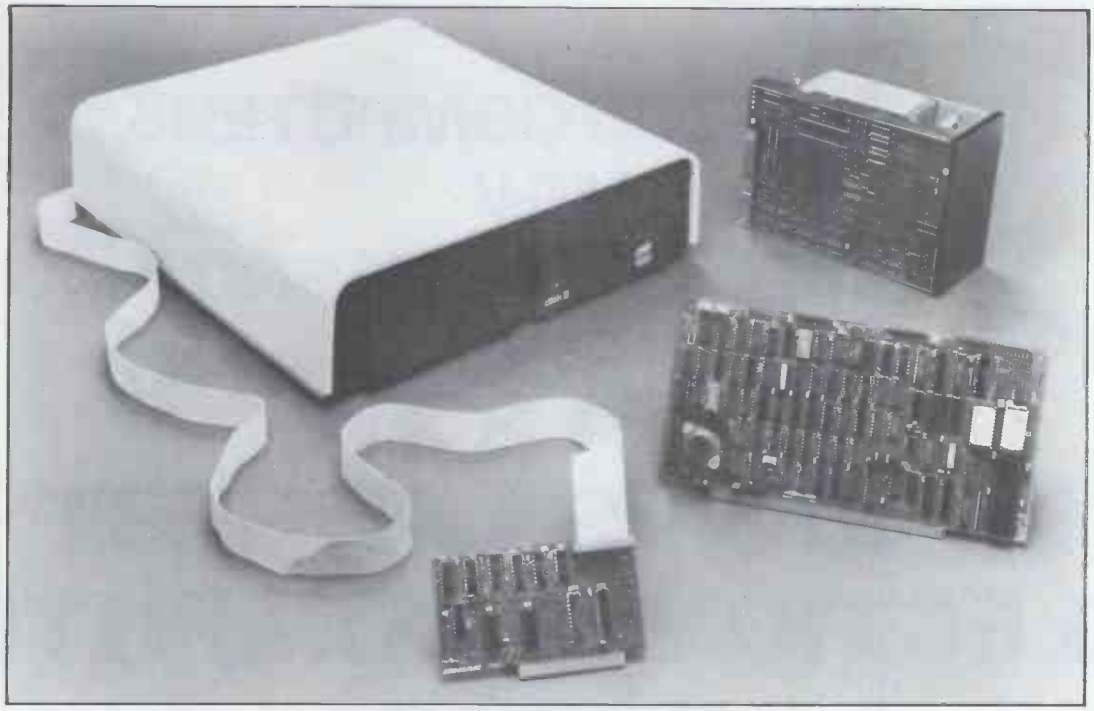

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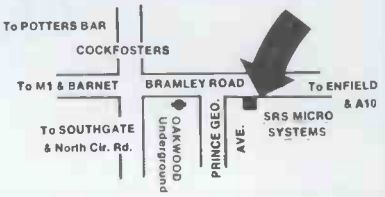

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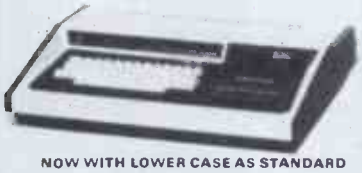

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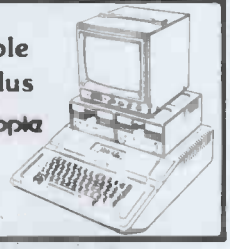

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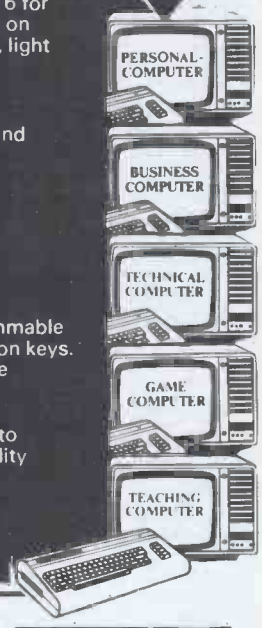

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NEWSPRINT

Compiled by Guy Kewney, editor of Datalink.

Not the ICL micro

Better late than never, they say. ICL has just decided that its original decision never to produce a micro wasn't as good as its latest idea — to announce one next year.

Don't believe any announcements you may have seen which suggest that it has already announced one. Our biggest computer company is getting ready to release a rather nice micro, but the DRS-20 range is not it yet. Neither, for that matter, is the extremely expensive Three Rivers machine (called the Perq). Having said what ICL is not making, it remains worth commenting enthusiastically on what it is producing.

The DRS-20 is a 'Distributed Resource System' which means a set of processor boxes, each with an Intel 8085 inside it to run your programs, and all connected to each other by a second board which runs the network. This second board is a good idea in one sense. It means that you can buy one big DRS machine — the Model 40 with big disks, or the Model 50 with even bigger hard disks — and connect a half-dozen or so users on the cheaper Model 10, so that they all share the big one's disks.

It's not such a brilliant idea, though, in terms of its price — nearly £1000 of the Model 10's price is made up of this network driver. However, ICL is first and foremost a maker of medium-scale 'mainframes' big computers which are sold to big organisations, and used by a team of programmers, operators, and other professional data processing staff. Anything it does in micros has to feed its mainframe business, if possible, as well as merely generating money. And the DRS-20 system will do that because it is designed to function as though it were one of ICL's old faithful 1500 terminals and connect the user to one of its old faithful mainframes.

ICL has the real option still up its sleeve, however. All it has to do is to take that network board out and put a disk controller in instead; plug that into a nice dual disk drive and there you have a better-than-average, sub-£2000 personal micro all ready for CP/M and with a network ready for when you can afford it.

The network looks like a local area network — something like the Econet in the Acorn, or the Nestar system from Zynar for Apple, or the Z-Net from Zilog (there is a very long list indeed). In fact, this one is rather different. Instead of having a wire down which everybody sends messages when the wire isn't busy, this system has a central switchboard which rings everybody up in turn to see if they have information to send. This is known as 'polling' and isn't the way most local area nets operate. It is, however, the way most host computers control intelligent terminals, so it is a bit hard to grasp why this non-revolutionary add-on should cost nearly £1000 extra. On the BBC Micro, for instance, the local net costs £47 extra on each machine.

There is some argument about the speed at which a local net has to run. For most of us, the speed of the Econet is more than enough; for people who want to do what they call 'transaction processing' a very much greater speed is needed to cope with the large amounts of data that have to be handed back and forward. We will see what ICL's 'net' can do.

In the meantime, however, ICL stands unique in having produced a system costing £2250, without even having CP/M, and which has no way of loading software. The Model 10 by itself (if ICL would sell one by itself) has no disks, no tape interface, no modem interface — just a network connection. By itself, if you want to run a Micro Focus CIS Cobol program, you have to type it in (having first paid the extra £600-odd) and then compile it. The same applies to that Microsoft Basic program. Details on 01-788 7272.

Thanks for the memory

There are an awful lot of bog-standard CP/M systems for around £3000; rather fewer for around £2000, and most of those don't include a pretty nice printer worth £400 in the price, the way the new Memory Computers machine does. It's called the Memory 2000 and is described by the north London company as a 'little sister' for the Memory 7000.

It actually looks like a nice machine on paper: not quite as cheap as the competition — UK-built systems like the Shelton Signet, or the Gemini, or even the new Nascom if prices stabilise — but not much more costly and a great deal nicer to look at. The two disks provide 400 kbytes, the screen has 24 lines of 80 characters (or 40 characters for those with tired eyes) and the recommended printer is the Centronics 737, normally at £400.

Details and local dealers from Graham Barrett, at Britannia House, 960 High Road, London N12 9RY.

Software already available (but not free with it) includes Wordstar, plus 'low-cost packages for all the basic business routines,' according to Memory Computers. That means payroll, invoicing, stock control, job costing, sales, purchase and nominal ledgers — plus specific business functions 'currently including solicitors' time costing and accounting, hotel reservations and billing, estate agency/property enquiry matching and construction industry contract costing.'

Learn with Clive

Not everybody likes Uncle Clive's beautiful manual which comes with the ZX81. As an alternative, Sinclair has produced a package of programs and booklets to teach you the things that the manual lists — an active, rather than passive, learning method.

The ZX Learning Lab costs £19.95. It includes six cassettes of software and two spare cassettes 'for practice' and a 160-page manual. In all, there are 20 programs to study, each demonstrating a particular aspect of writing code for the machine. Details from Sinclair at 6 Kings Parade, Cambridge.

In the air

Sending software over the airwaves seems to be the latest craze. As part of its forthcoming computer literacy series, the BBC hopes to send programs for the BBC Micro over Ceefax and in California, West Coast Faire organiser Jim Warren is hoping to set up a computer-readable broadcasting service called Datacast.

But in the meantime you can take part in an intersting experiment which will form part of the 3 December broadcast of 'Tomorrow's

World'. The TW team is going to broadcast two short programs, probably for the Apple and PET, during the program, which you can record on a cassette and — at least in theory — load into your machine. Initial experiments, using an old TV set and cassette recorder, proved that the idea does work and the BBC is interested in hearing from anyone who successfully loads the programs.

Just what those will be hadn't been decided when we went to press, some six weeks before the experiment and, indeed, the choice of machine hadn't been finalised, either — there was some talk of the ZX81 being included. For further details, keep an eye on *Radio Times*.

Meanwhile, Radio Nederland reports encouraging results from its experimental machine-readable broadcasts in September, using the service's short wave English language transmissions to various parts of the globe. A simple direction and bearing program in Basic, devised by Prof John Campbell of Exeter University, was transmitted in three versions, for the Apple , PET and TRS-80, with a reported 42 percent success rate for the 235 listeners who provided feedback.

The programs were transmitted on short wave from three transmitters, in Holland, Madagascar and the Antilles, to cover Europe, North America, Asia, Africa, Africa and the Pacific. Most of the successful receptions took place in Europe, but success reports also came from Canada, USA and even Belize.

Now Radio Nederland is to repeat the experiment on 28 January with programs for the ZX81, PET and TRS-80 Model I level 2 and — possibly — the Atari as well. The broadcasts will be at the following times (in GMT) and frequencies: Europe — 0950 hrs on 15560 kHz, 11930 kHz, 9895 kHz, 6045 kHz, 5955 kHz and at 1350 hrs on 17605 kHz, 11930 kHz, 9895 kHz, 6045 kHz and 5955 kHz; Pacific — at 0750 hrs on 9715 kHz, 9770 kHz and at 0850 hrs on 9715 kHz; Africa — at 1815 hrs on 15220 kHz, 6020 kHz; and Africa and Europe — at 2050 hrs on 21686 kHz, 17695 kHz, 17605 kHz, 15220 kHz and 9715 kHz.

Peter Rodwell

Speech lab

Heuristics Speechlab products listen to human speech and produce computer control commands based on them. Most of the time, they correctly pick up any one of 128 'words' and act as expected. Sometimes, they hear something else. Either way, US-built Heuristic products starting at £3000 are now available from 'sole distributor' Data Dynamics Services in the UK. Details on 01-848 9781.

All-in-one from Zilog

Fancy rivalling Sinclair's four-chip computer, the ZX81? Well, two of the chips he uses contain the processor and the Basic in Rom.

Zilog, however, has released a chip with both processor and Basic on it.

Unfortunately, the Basic that Zilog has put out is not Sinclair Basic, which is a shame, really. Sinclair Basic is quite friendly; more to the point, it also controls the video signals that drive an ordinary television, to provide such a cheap display. Nonetheless, it goes to show what can be done.

The chip is the Z8671, which is one of the single-chip system family called Z8. It has only 128 bytes of memory on it, enough for a simple FOR. . .NEXT loop, perhaps, with a few USR machine code routines. Details on Maidenhead (0628) 36131.

Taped training

It was described as 'a little bit unique' at its launch — the first computer designed to operate a videotape player. Sony launched it and called it the Video Responder, and very nice it was too.

It's supposed to be used for training. The film is operated entirely by the Responder, so all the student has to do is put the video cassette in the machine and start it up. The Responder even tells the student to do this. The tape loads a program (computer, not training) into the processor. This tells it to stop at various marks on the tape and which marks to move to from there.

For example, it starts off by playing a section of video showing how to boil an egg. It (the film) then asks the student a question, such as, 'Do you need to boil the water before putting the egg in, or do you put the egg in before boiling the water?' The student is told to press button 1 for yes, button 2 for no, and button 3 if he doesn't understand.

Then, if the machine has been properly set up, it will rewind to play the piece of tape which dealt with how the water was boiled, if the student got it wrong. Or it will repeat the whole first section if the student didn't understand. Or it will move onto the next section, if the student got it right. Or perhaps it will do something else — for example, it can see how long it takes the student to answer and it can play a different section, if the tutor thought that slow answers required different teaching. This is known as 'interactive video' in the new trade of interactive video.

Up till now, it has been the preserve of people like Mike Sterland who have connected up a disk video player and controlled it with an Apple. The Video Responder is a lot cheaper, but the Apple scores over it in the way it can display messages on the video along with the picture, and in the fact that the messages are a lot more under control of the producer.

Lifeboat waves wand

The best-known software for processing text on a CP/M system is Wordstar: compared with Wordstar, the Magic Wand program from Lifeboat is 'far better and has the best manual around.'

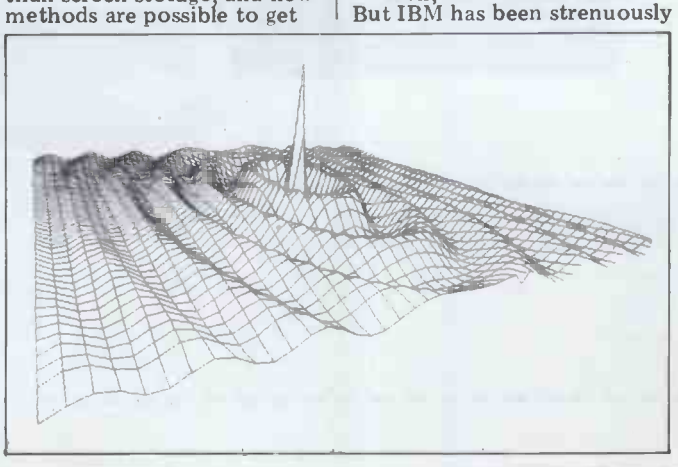
This is, not surprisingly, the opinion of Lifeboat — it's also the opinion of the editor of *PCW*. So I don't think I need say any more than that Magic Wand is available for a price of £185, complete with the fantastic manual, from Lifeboat on 01-836 9028 — ask for Helen Smith.

Great graphics

Time was when drawing pictures on a computer screen needed a special type of screen — and an expensive one at that — which actually remembered what was drawn on it. Getting the pictures off that 'storage tube' and onto paper took complicated electronics, built into most storage tubes as an even more expensive option and working almost exactly like a Xerox copier.

These days, because memory costs less than £1 for a simple 16-kbit chip, it is easier to store the diagrams in ordinary storage, rather than screen storage, and new methods are possible to get the picture onto paper. On normal microcomputers, several different printers are available, complete with software that prints a single dot on the paper wherever there was a dot on the screen. Now, it is available on ultra-lovely minicomputer screens, like Digital Equipment's VT100 terminal.

For a mere £800 to £2000 (depending on which printer you use) Riva Terminals supplies a micro in a box to take the VT1000 graphics, and print them out. A sample, below, shows the sort of detail possible on a fairly standard matrix printer. Details on Winkfield Row (03447) 5193.



Not-so-jolly giant

Any activity 'which competes with IBM or assists a competitor' creates a 'conflict of interest' in the mind of anybody who does it, even in their spare time, while working for IBM. This is official doctrine, officially handed out by IBM's legal department to staff who tried to sell programs to fellow PET or Apple users. IBM holds the copyright, it says, on all software it produces.

Quite how you decide whether what you are doing (if you work for IBM) competes with IBM isn't clear. If what you are doing is writing a program for a PET or an Apple or something like that, then just writing the program is not illegal. But selling it is. And, according to Mother IBM, 'programming computers for profit would compete. . . *even though a particular commercial activity might not be directly competitive with anything IBM is doing today.*'

Think about that. It means that any aspect of programming computers is something that IBM regards as an area where it is competing. Even if it doesn't have a product today, it intends to have one, in every area of computers, one day.

Well, we all knew that! But IBM has been strenuously

IF ANY OF THE FOLLOWING WORDS GIVE YOU A BUZZ . . . ANALYSIS STATISTICS DE SIGN PLOTTING GRAPHICS REPORT WRIT ING SPECIFICATIONS SCHEDULES COSTING PLANT MAINTENANCE PRODUCTION CON TROL SIMULATIONS IEEE INTERFACING IN STRUMENT CONTROL MONITORING TERM INAL COMMUNICATIONS PAPERTAPE READ ING PUNCHING & EDITING SELF PROGRAM MING BASIC ASSEMBLER LANGUAGE MA CHINECODE . . . GIVE US A BUZZ (OR SEND BACK THE COUPON)

The micro comes of age. The PET has come a long way since micros were regarded as toys. It's designed and built for demanding work and this shows in the 32K memory and 80 column screen as well as in its impressive disk capacity. When it comes to languages, you'll find the PET fluent in BASIC, PASCAL, FORTH, COMAL, LISP, PILOT and ASSEMBLER.

It can be used as a complete system in itself, or can be linked to other PETs or a mainframe.

Who needs PET? And why? The list above speaks for itself, but that's only part of the story as the PET now has over 600 applications. It's good news for any engineer who's tried to get even a modest budget approved – the PET is very acceptable to the most sceptical of money people.

It's an attractive proposition, too, to DP professionals who need their fingers on the pulse and are fed up with waiting for their turn on the company computer.

In fact, it's the nearest thing to the all-purpose computer for everyone. An extravagent claim? A demonstration can prove it to be true.

The PET has track record. We've been involved with electronics for over 20 years and there are now over 40,000 PET installations in the UK. We manufacture our own microchip which is happily accepted and used by makers of other well-known microcomputers.

You get nationwide dealer back-up with Commodore. What's more, many of our dealers have specific expertise – which means they can advise on anything from business systems to specialist technical applications. So, if your particular problem is of a highly specialised nature, it may be best to contact our Information Department direct. They will then recommend the dealers who understand – and who speak your kind of language.

What does all this cost? Not a lot. In fact, our computers start at £200 and go through to £3,000 – and that will buy you a complete system. Which is just one more reason why any professional worth his salt would be interested in a microcomputer that's made its name in the business world . . . but is far more than just an efficient business brain.

Send to: Commodore Information Services, P.O. Box 109, Baker Street, High Wycombe.
Tel: Slough 79292.
I'd like to know how a Commodore PET could give me a buzz.

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Over 40,000 working hard for Britain

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maintaining that it doesn't dominate the computer industry. It maintains that it doesn't want to dominate the industry. And it maintains that it doesn't involve itself in 'predatory' business practices — which means doing things that aren't designed to help it, but to hinder the competition.

I know what a 'conflict of interest' is. It's something that makes a person likely to act against his own best interests because he has other interests. If you have a PET and you work for IBM, it is obviously in your interest not to write programs. You might be tempted to give them away, and break your conditions of employment.

Oh, yes; didn't I say? You aren't even allowed to give them away. All that rubbish about 'profit-making activities' is just a smoke screen. 'Giving software away still represents a conflict of interest,' says IBM.

Going cheap

It's Christmas sale time! All stocks must go, don't miss this bargain offer, can't be repeated. . . and so on.

All of which we've got used to in the clothing industry over the years, and have learned the language. Let us not forget the translation now that old computer stocks are coming up on special offer. Two machines are available at suddenly improved terms: the Silver Apple or ITT 2020, and the Sharp MZ-80K.

In the case of the Silver Apple, the deal is simple enough: ITT used to assemble the Apple in Europe, but is preparing to launch the 3030. So it has emptied out its warehouses and Lion House picked up just about the last 250 systems. To make them go, they are being sold at £700 each, including a disk and Apple-writer word processing software, making the system a pretty nice word processor at the price, once you buy a suitable printer to go with it. In the case of the MZ-80K, the deal is not so clearly a question of replacing a dead design, but the fact is that the MZ-80K has now been superseded by the MZ-80B which has a much better keyboard.

It is now available through Microdigital with 48k bytes, at £400 including VAT, which is a good price for the machine. And I have no reason to suppose that Sharp is going to stop making the machine as long as it is attractive to users. Nor do I suppose that the price is more than a good deal done by Bruce Everiss with Sharp. But I do think that this is the sort of deal that people do towards the end of a product's life and I also think that the MZ-80K is getting near that point. Or, at least, it would be without a deal like this.

Taking change into account

It takes a certain stupidity to launch an American general accounting program onto UK computers — and MicroPro (the company which gave us Wordstar) isn't normally stupid. But MicroPro boss Seymour Rubinstein is launching an American accounting package.

'It will have no programs in it at all,' he said happily. 'It will be eminently customisable and dealers will use it to produce customised accounting systems.' It will, apparently, be the ideal thing for producing accounting programs, rather than a set of programs themselves.

'There are two problems in data processing,' Rubinstein mused: 'first, speed; second, changes. Frequently whatever is implemented in any system is only an approximation of what the user wants and it has to be changed, altered and revised — normally over several months. The programmer loses interest after the first change.'

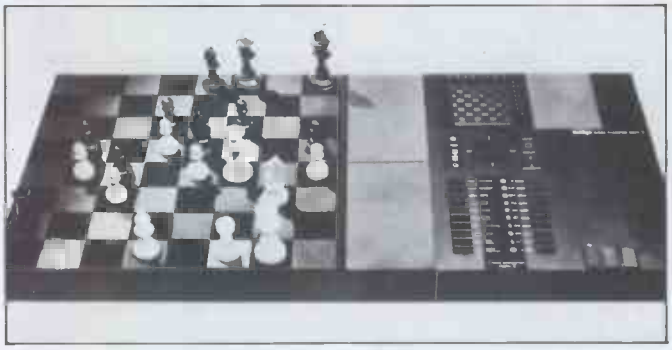
The result is that cost accounting systems never do what they were originally meant for — which is why we can't get paid at the end of the month. Programming twits just couldn't grasp how to pay half the staff weekly and the rest monthly, so they paid the rest every four weeks.

Things like this, Rubinstein promises, will be easy under his accounting program producer. And it will easily accept changes. 'Things always change — for example, time was when shops advertised free delivery in the States, and the cost of fuel was so low that nobody bothered to keep track of how far they went on each order. Then fuel costs went way up and they suddenly wanted an extra item on the form — which meant an extra field in the Cobol file. Have you ever tried adding a field in a Cobol program?' For that matter, as a dealer, have you ever tried amending a package which a customer bought, to add a field?

I'm impressed, if it works. I must be — do you realise that this is the first accounting system I've mentioned in this column?

World winner

The reason I like the idea of the Vulcan Chess Champion and would spend £279 (if I had it) has nothing to do with the fact that it won the World Microcomputer Chess



Championship in Hamburg recently.

No, it was a little scene at the *PCW* Show's chess championship that did the trick: one competitor, trying to untangle his power cable from another wire, solved the problem by unplugging both machines — his own and the one it was tangled with. This obliged his opponent to reload the whole system from scratch, because the machine entirely forgot its position and the position in the game. And even if the game hadn't started, the thought of preventing people, dogs and other natural disasters from tripping over a cable throughout a computer game has haunted me ever since.

And, yes — the Vulcan remembers the position in a game, up to a year after the power has been turned off. It also has an optional (extra £155) board which knows which piece is where on the board, if you don't like its little LCD board display.

Bigger Apple core

For those who regard the double-capacity memory of the Apple III as a move in the right direction but not quite enough, Merton Electronics has a way of plugging in 256k bytes into the old Apple II, which is cheaper.

To use it, you have to be able to write enough machine code to switch memory banks. Each memory bank holds 16k and there are four banks on each Merton card, making the capacity 64k bytes. The Apple can power up three of these cards, plus an add-on 16k byte card.

According to Merton, these cards can hold that much memory in the small area allowed for Apple cards because they use the very dense 64k bit chips. Each card costs £189 including VAT. Details on 01-543 3533.

Osborne delay

The arrival of the Osborne 1 has now been postponed by its new UK managing director Mike Healey on advice from Osborne, because, 'it will be better to start out with a lot of units available, then to kick off in dribbles.' The plan is to import 500 Osborne machines in January, by which time the useless modem plug on the front of the machine will suddenly become a functioning piece of hardware.

This is because the company has launched one of its first software products, a communications program called Micro-Link (shame he didn't have the sense to call it Data-Link). This will handle communications and will understand the special problems of the Osborne screen, which shows only 52 characters per line out of 120 actually held.

In anticipation of the software actually working, and of Osborne 1 owners buying it, The Source has opened up a 'mail box' in its big computer storage banks, which Osborne users can dial up and leave text in for other users to access. The machine has also acquired a big 'hard disk' storage capacity of five, ten, or 20 megabytes. This is provided by a Corvus drive.

ICL men go micro

It certainly is an ill wind that blows no good to anybody and the cold blasts that blew the board of our big computer company, ICL, to bits, may help a lot of engineers and it may help the micro market.

This thought is prompted by the appearance of a sound generator board by a company called Bulldog Video, staffed by ex-ICL engineers. It appears that several ICL people made redundant by the reorganisation are now setting up their own firms, and a lot of them are designing products for the micro market.

It may seem heartless, but the result should be very good for them. Their talents were undoubtedly wasted inside ICL, where good ideas were sat on for months and months before being dropped because they were out of date; and their talents are certainly going to be useful to us.

The sound generator board will appeal to Tangerine users, because it plugs into Tangerine computers. It has an on-board 2¼ in speaker and an audio amplifier, so sounds can be produced direct on the board. However, you can also hook it up to your hi-fi system.

This board costs £44.85 with a single sound generator chip for synthesising almost any sound. A second such chip can be fitted, and the board then costs £56.35.

By Christmas, promises Bulldog Video, there will be a high resolution colour graphics system for Tangerine users, costing £170 or so and providing 700 colours.

New Genie

There is a new machine in the Video Genie family. It costs £325 or so, and it is an improved version of the old Genie. The improvements include full upper and lower case display characters, with a flashing cursor; some dumb terminal routines and some networking abilities.

According to Lowe Electronics, the importer, a range of business software has been developed for this machine by Tridata in Birmingham. Details from Rob Stead on (0629) 4995.

Oracle GT

What word would you use for the experience of standing in front of a television for half a minute, waiting for a screen full of innocuous data, and of finding that it appeared after around 15 seconds instead (on average)?

Exciting, that's the word!

You doubt me? But I have it on the authority of ITV (he said indignantly): 'From the end of September, information on Oracle will be even more readily available to viewers, when the average 'access' time is effectively halved from 30 seconds to 15 seconds.

'This exciting development is made possible by the Home Office's finally confirmed decision to allow Oracle to extend from two to four line transmission — another milestone. . .' Oy, wake up! I'm quoting ITV! Exciting, isn't it?

Plug into Prestel

Two great rivals for the hearts, minds and pockets of the enthusiasts still exist — Tangerine and Acorn. Tangerine was first with a machine that turned a television into a Prestel receiver (which means it can plug into the phone system and get expensive information from the Telecom pages).

Acorn has now done it the other way: rather than turn a television into a Prestel set, on the way to being a computer, it has turned its computer into a Prestel set.

The system costs £120 plus the cost of a fully expanded Atom with 12k ROM and 12k user memory. That includes a £30 software package (the code is in ROM) called Atomtel, which handles automatic phone number dialling to Prestel and which turns the Prestel code into an Atom screen of displayed data. The rest of the cost comes from the equipment needed to connect the machine to the phone line — a modem, isolating unit, and power supply, plus odds and ends like cables and sockets. Details from Acorn on (0223) 311427.

Told you so

This is what I said a lot earlier this year (paraphrasing): 'Although the IBM Displaywriter is a word processor, it

The main reason this picture of a Commodore PET being used at the world waterski championships appears to show the imminent disaster of a competitor crashing into the computer room is simple: the picture has been clumsily faked by Commodore's publicity agency. Clever, that: I'd never have printed it otherwise.

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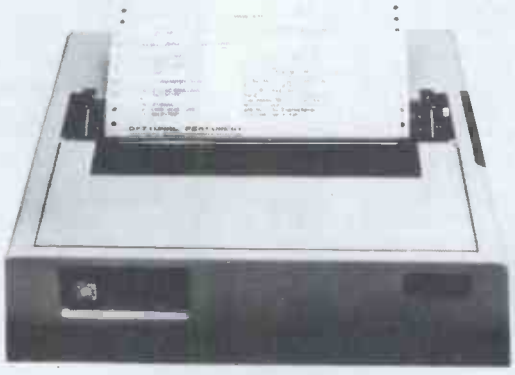


X-Data Limited, Marish Wharf, St Mary's Road, Langley, Slough, Berks SL4 1HE
Tel: Slough 49117. Telex: 847728.

X-DATA
Equipment Wholesalers

has all the features to be a general purpose microcomputer, except a general purpose operating system.'

Okay, I'm crowing; but at the time, IBM said I was nuts and it was just a word processor. Now it has just been said by Phillip Nelson of Digital Research, which has released a version of CPM86 to run on the Displaywriter.

The machine uses the Intel 8086 micro. IBM's official micro (the one its staff *are* allowed to write programs for) uses the 8-bit version of that chip, the Intel 8088. Digital Research has been working on CP/M-86 for both machines, in secret, for a few months.

Details from the European agents, Vector International of Research Park, B-3030 Leuven, Belgium; tel 32(016) 20 24 96.

Another Triton

Do not mistake the Triton for the Triton. Both are made in Britain and both can use the old Intel 8080 instruction set but that's the only resemblance. The Transam Triton you knew about as a cheap kit for enthusiasts. The Trivector Triton is one of the more elaborate attempts to imitate a minicomputer with a Z80 micro.

The idea of having a multi-user system is that 'the same unit can be used simultaneously for a variety of applications within a single business,' as Trivector puts it in its latest announcement. 'One user can be doing payroll calculations, one can be using it for inventory control and another can be running a word processor.'

The advantage is that you have a system costing £10,000 (plus about £1500 to £8000 worth of software) for two people, instead of two systems for about £1200 with some free software, which (if it is the Osborne) either person can take home for the evening.

You also have the advantage of the Business Operating System (BOS) which is no doubt as wonderful as CAP used to say it is and as wonderful as MPS (CAP's successor) now says it is in Version 5, and which still can't run CP/M even as a subtask. And that money isn't just thrown away: you also get a big hard-disk drive with 22 Mbytes of storage which you can dump to a tape from time to time (the tape holds 12 Mbytes for some odd reason). And you get a printer.

If you detect the edge of irony there, I should add, to be fair, that if you go to a conventional minicomputer maker for the same features, you will be charged comfortably twice as much, and certainly won't get a better engineered system. I recently had the rather sobering experience of watching Data General's idea of a microcomputer — keyboard, two minifloppies and a fair screen in a horrible shiny placky box — taking around a minute to abort and reload a simple and clumsy Space Invaders-type game.

If Trivector is competing with that, I suppose they're in business. Details (0767) 82222.

Speed up

For just under £30, a program which speeds up the average day's work on Basic programs by ten percent must be worth a try. It is called Compress and it assumes that you have Microsoft Basic code which is thoroughly tested and debugged. Then, according to Mike Lewis Consultants, you don't need good commenting, you don't need well-formatted lines of code, or even spaces between certain words, and these things all make a program bulkier and slower. Compress just takes all these debugging aids out, saving something like 30 percent in disk space and, though it has no effect on programs that do a lot of printing, it speeds calculation programs by about a quarter. Details on 01-794 3886.

Disk checker

Who knows what Mary Whitehouse would make of the announcement that the 'Digital Diagnostic Diskette is a fast and easy-to-use tool' used to analyse and adjust floppy disk drive alignment and performance characteristics? It only sounds complicated; in fact it's pretty simple: since floppy disks don't have grooves like long playing records do, the position of the head when recording or reading data is a critical matter, and if it is in the wrong position, software supplied by other people will not load and the data supplied by yourself will not be transferrable to other machines. This system shows what is wrong with (or right with) your disk drive. Mind you, fixing it is another story. Details from HAL Computers of Weybridge on (0932) 48346.

Apple crusher?

If it is true that Apple chief Steve Jobs once taunted a top executive of minicomputer giant Digital Equipment, by suggesting that Apple 'will bury you', then Digital's 'micro' would support the theory that it is out to kill Apple.

Jobs was recently in London, boasting of more than 300,000 Apple II users worldwide. And when Digital launched its kit of parts to turn its very successful VT100 terminal into a 'micro', it was at some pains to leak the information that there were 250,000 VT100 terminals in use worldwide.

Figures, however, lie. Those 300,000 Apples, although they seem to be rather similar, have a fair amount of trouble in running each other's software. Some 30,000 of them, indeed, are not even used for running Apple software most of the time but for running CP/M programs with the Microsoft Softcard. The others run programs with or without Applesoft, with different versions of the operating system — and with different versions of Basic, Pascal, and so on.

Digital Equipment Corporation (DEC to its friends) has decided to pick a standard which will attract the software development market: CP/M. It has gone straightaway for a large available market — that figure of 250,000 looks impressive. And its machine is one of the smartest CP/M items available. That said, it has all its work still to do.

First, those terminals aren't really potential CP/M computers. Not without a lot of heavy marketing effort, because most of them are firmly in the hands of programmers who are using them to run programs on their employers' DEC minis. And (with all respect to CP/M) nobody who has a DEC mini at his fingertips is going to want to start mucking around with CP/M. And they aren't going to give their nice terminals to the personnel assistant. Second, those VT100 terminals are very nice and very easy to use but they ain't cheap: £750 is the best 'street' price for them and, officially, they sell for around £1400. Plug in an extra kit (comprising a Z80, 64k of RAM and *one* 160k 5¼in disk drive) costing £1729 plus £166 for CP/M, and your machine has put itself in the middle band of the higher-priced rat-race, where there is no shortage of competition and everybody has some special feature or other.

For the rest of us, this machine will be as attractive as the next and the number sold will depend on the number we see in the computer shops. At the moment, the Apples are the ones we see in the shops, so I'll happily predict that the death of the Apple is still a long way off.

Sord back

The new Executive range of micros from Exleigh Business Machines is, in fact, the Japanese Sord range. The company has signed a contract to take an initial £1 million worth of hardware from Sord Computer Systems in Tokyo, and is looking for a dealer network. The deal follows a financial link with Dataplus of Cheltenham. Details on Penzance (0736) 66577.

Sharp data grabber

Sharp now sells three computers, the smoothest of the three being the PC-3201 and the cheapest being the MZ-80K. Hopefully, the new 'portable data capture' facility will start the smooth one selling faster than it has so far managed.

The idea, says Sharp, is to use the Mektronic interface to a device called the MSI77 portable terminal. This gets carried around the world, reading barcodes, or having its buttons pushed. When it is full of data, it plugs into the PC and pumps the data into it, like a bee collecting nectar and taking it home.

Nice, but on its own, it still isn't going to bring about a miracle, is it? Details through publicity agent Alan Fullelove on 061-228 0525.

Convert an atom

An indignant Chris Curry, head of Acorn, assures me that the rumour that he is producing a new control memory for the Atom, so that it looks as much as

'Or if you prefer something a little more modern'

possible like the BBC micro is true, but the reason I guessed — that this was in case the BBC machine wasn't ready in time — is wrong.

The memory will be available in the new year, and while it can't turn the Acorn into a full BBC machine, it will give it the same Basic, which is a lot nicer than the old Atom Basic. And it will give an operating system as close as the hardware allows — for instance, nothing will give the Atom the ten 'soft' function keys, nor a four-button cursor control system, nor can it have the ultra-high resolution graphics ability of the BBC micro.

Oh, the reason Curry is providing the Basic? He's making damn near 3000 Atoms a month and worries whether people will carry on buying them, even if they are cheaper than the BBC micro, unless they are very nearly as nice. Let's hope the idea works.

Network naughtiness

It's a little naughty of Zilog to claim that its network is safe because it is passive 'and failure of one or more nodes doesn't affect the remainder of the network'. It is known in the trade that networks with passive wires are prone to failure because of the probability of a node 'babbling'. And it is also known that the chances of a 'passive network' like Ethernet or Zilog's Z-Net falling prey to a babbling device are roughly the same as the chances of an 'active' network, like the Cambridge ring, failing because one of the active nodes is not transmitting data properly.

Babbling, by the way, means accidentally transmitting rubbish and killing the net. So I think I know what Zilog means when it advertises a 'free feasibility study' for companies with industrial or process control automations needs who think a network might help. I think it means that Zilog is trying to establish how feasible the system is — once it gets its enormous thick blue cables sorted out, that is.

Details on Maidenhead (0628) 36131.

Seeing speech

A deaf human can't learn to talk by hearing what his mouth is saying: with a computer, however, he can see a picture of the speech pattern. And, say researchers at the University of Kent at Canterbury, a system which doesn't even display the picture can still be programmed to detect similarity between the afflicted person's attempts, and the word he is trying to imitate. The Kent system shows a simple 'pass/fail' response but can be programmed to raise or lower its standards to accept a poor imitation from a beginner but to demand a better try from a student who has made some progress. Details of this project from Dr M C Fairhurst, Lecturer in Electronics on (0227) 6682, ext 389.

Japs buy Sinclair

Sinclair is the first British micro to be imported by the Japanese. It proves, at least, that he was right in saying he was a couple of years ahead of them. The deal has been struck with the giant Japanese trading group, Mitsui, and at first involves a simple purchase of 'several thousand' ZX81s by Mitsui, who will 'Japanesify' the manuals.

Eventually, Uncle Clive says, the deal will be expanded into setting up a joint company in which Sinclair will have a controlling interest, and which could be the start of something big. Apparently, Mitsui is looking for other British products to import, too. I dare say Uncle Clive mentioned he was working on a flat-screen picture tube. . .

Imsai exhumed

Back from beyond the grave comes the old Imsai computer, now renamed the Fulcrum and selling at a basic £810 including VAT for the nice blue box with an 8080 micro inside it and a power supply.

The Imsai was the first imitation of the original Altair, the first 'home computer'. And it was the fact that Imsai imitated the Altair that led to the Altair system of plugging in extra cards with 100 connection pins — the S100 bus — becoming a standard.

In its new form, the Imsai-turned-Fulcrum will obviously sell to people who have one Imsai and want another to match it. But even with a new processor card using the Zilog Z80, isn't it just a bit out of date?

Ask Malcolm D Cooze, managing director of the UK company, on 0621 828763.

About face

Not good news for fans of Zilog's big 16-bit processor, the Z8000 chip. After the rudest advertising campaign in years, in which AMD poured scorn on the rival Intel 8086 as not being anywhere near as good as the AM Z8000 (a copy of the Z8000), it has gone over to the enemy and has started making the Intel 8086.

The main attraction to the traitor was probably the simple fact that there is an 8-bit processor (the 8088) which is exactly software compatible with the 8086. And, of course, this 8-bit processor has just been picked by a little data processing company called International Business Machines, as the basis of its personal microcomputer.

Cooperative computing

For customers, members and staff of the Coop, a network of clubs is being set up around the country, so that these people can get involved in home computing.

The scheme was started off by the National Member Relations Officer, Frank Kent, who owns a Sinclair ZX81, and appreciates the need, he says, for computer owners to get together if they are to derive maximum benefit from their hobby. Presumably one major result will be to introduce Labour politics (at grass roots in the Coop movement) to real computers. The plan is to make home computing ('possibly the biggest growth leisure interest, that could rival photography') available

This Compadress address processing system is this month's entry in our sporadic 'Spot the Superbrain' competition. The system can produce addresses onto self-adhesive (yes, they are if you're not careful) labels, or onto continuous computer stationery, or directly onto envelopes. That's something which just couldn't be done a year ago. Details on Basingstoke (0256) 62444.

to those who need it.

The Society has already started one club in Barnsley, which has 25 members 'from all walks of life' and plans exist already for further groups in Brentwood, Birkenhead, Swansea, Hull, Bury St Edmunds, Exeter and St Blazey (where?) and Frank Dent reckons other areas could be considered if there is sufficient interest.

Details from Dent at CRS Ltd, 29 Dantzic Street, Manchester M4 4BA.

Looking for authors

Former *PCW* editor David Tebbutt is looking for software authors. Together with Digitus MD Alan Wood and former Data Logic director Bill Barrow, David has set up a software publishing company called Caxton, sited in trendy Covent Garden.

Caxton is looking for software authors with applications packages, initially for the Apple or for CP/M. The plan is to do to the software exactly what book publishers do to a writer's manuscript — polish it up, make sure it's robust and usable, package it with professionally prepared documentation and market it, both in this country and abroad. In return, the program's author will be paid a royalty, which will *increase* on a sliding scale as sales increase.

Initially the company plans to concentrate on business applications, although the possibility of games being marketed as well has not been ruled out. And the emphasis is very much on the international market — only packages which can be marketed internationally are of interest, which rules out things such as, for example, many accountancy packages.

To help would-be authors, the company is producing Author Guidelines, explaining how software can be developed to a marketable standard. Contact Caxton on 01-379 6502.

PR

I thought I'd print this picture of the Eagle, another two-disk CP/M system, even though Mediatech doesn't say how much it costs (normally a sure sign of an embarrassingly high price) because it looks nice. Quite a nice screen, I thought, and 800k bytes of disk space; hard disks are also available. If it costs less than £2000 (without the hard disk, of course), consider it. Details on 01-903 4372.

Speling check

A spelling checker has been introduced for the word processing package on the Exidy Sorceror. It holds 20,000 words, which can be added to, and costs £195 from Liveport Ltd on 0736 798 157.

Solid state images

Getting a video picture into a computer — for things like teaching a robot to 'see' objects — has recently been rather awkward. Now, cunning chips called charge-coupled devices are becoming available to make the job easier. Basically, they're multi-element light sensors which replace the large, expensive glass tube in a video camera with a small, expensive (at the moment, but not for much longer) chip which can be interfaced to a computer very easily.

Latest to get onto the market is the Fairchild CCD221, which gives a matrix of 488 horizontal by 380 vertical elements. Incorporated into a camera, this enables you to read the light levels of 185,440 individual elements, which is very handy for image-processing applications. More details from Celdis, the vendors, on (734) 586191.

Tangerine mag

Tangerine has dropped its discount scheme to members of the Tangerine Users' Group in favour of its own scheme, which centres round a new magazine, *The Tansoft Gazette*. Published bi-monthly, it costs £15 a year and will contain discount vouchers, product news, programs and a technical enquiry service. Editor is Paul Kaufman who runs the customer support department. Coming soon from Tangerine: a Forth compiler and a disk system.

Thin drives

Having trouble squeezing 8in drives into your system's cabinet? Hal Computers may have the answer in the form of a new thin Tandon disk-drive called, imaginatively, Thinline. The drive is half as thick as a conventional unit but, of course, takes standard 8in disks. Two versions are available, single- and double-sided. More on Weybridge 48346.

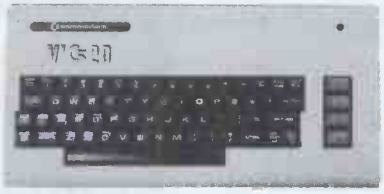
Sony discretely launched its 3¼in microfloppy disk and disk drive in the UK during October's International Business Show in Birmingham. Despite its remarkably small size (the drive measures 4in wide, 2in high and 5.1in deep) it has an incredible storage capacity — the tiny disk in its protective plastic case holds 437.5 kbytes unformatted in its single-sided, double-density format. The disk rotates at 600rpm and transfers data at an impressive 500 kbits per second and the drive has an industry-standard interface. Prices and availability haven't yet been announced but Sony is hoping that other manufactureres will adopt the format. More from Sony on (09327) 81211.

PR

the vic centre

Adda Computers Ltd., a major supplier of computer systems to industry and business, have opened the Vic Centre in West London. Here you can see, discuss and buy everything to do with the new VIC 20 personal computer—in person or by mail. Hardware, software, technical advice and information is available from an experienced staff of experts. Even if you already own a VIC 20, get on our mailing list to know about new developments. Remember—everything has the backing of Adda's reputation, and there's a full 12-month warranty on all hardware. The Vic Centre is easy to reach—Just off the A40, close to North Acton tube station.

Not just a computer but a whole expandable system



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The VIC 20 is a fully-fledged, easy-to-use computer. It's the core of a great expandable system, with full-size keyboard operation. First-time users can work it immediately with plug-in program cartridges, using your own colour TV to get up to 24 colours on screen, and three different sound tones. Or write your own programs in BASIC. The VIC 20 lets you build a system as needs and budget dictate. You can expand its memory to 32k Byte with Plug-in modules, and transfer data to external storage units. So the VIC 20 is more than just a personal computer—and its system will expand to put it even further ahead.

VIC 20 Dot Matrix Printer
Tractor-feed, 80 character-per-line, 30 characters-per-second printer.
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VIC-RS232 INTERFACE
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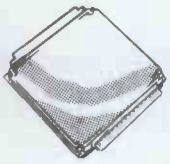
Small size—low cost memory expansion. Plugs into Vic and reproduces memory-port. Can be used with other expansions gives a total of 6k user static ramon Vic.
FEATURE This board allows Vic to move Basic to begin at 1024 ($0400) as in Pet, and enables the use of HIGH RESOLUTION COLOUR GRAPHICS **£40.25** incl VAT.



VIC-TOOL KIT **£28.75** incl VAT.
For those who know tool kit on Pet we now have same facilities for Vic.
Renumber, Auto, Append etc.
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adda

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more than 1,000 completely non-technical users in the UK alone used one British program to keep student records, personnel files, mailing lists, sales records, parrot breeding records, man hole cover records, electoral roll records, blood donor records, pharmacy records, patient records, stock records, library lists, dating agency files, parts files, exchange rate files, employment files, accountant and solicitors records, farm records, garage records etc, etc.

How could YOU use Compsoft's DMS* (Data Management System) this year?

*Available on CP/M with link to Wordstar or Commodore machines linking to Wordcraft, Wordpro, and Visicalc.

Designed with the non-computer expert in mind, DMS users, ranging from those in the smallest to those in the largest multi-national companies, have followed the simple screen instructions to create their own file, store, amend, sort and search for information.

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DMS can store up to 1,000 characters per record, and is backed up by its own British authors from Compsoft's base in Guildford, Surrey. We are always happy to discuss your applications or arrange demonstrations with your area dealers.

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NEWS

David Tebbutt brings you the latest update.

A BUMPER CROP

I'm pleased to report that ComputerTown Thanet is now up and running under the watchful eyes of Jon Finegold and Peter Kiff. The first session was held in the main foyer of Broadstairs library with just three machines, and with visitors peaking at around the 30 mark the evening was a great success. I understand that Southern Television was so tickled by the idea that it has invited the organisers along to its studios next Thursday. Next month I'll tell you what happened.

If you live in the Harrow area, you'll be pleased to hear that Susan Kelly of the Civic Centre Reference Library has got a ComputerTown running there and I'm sure she'd love to hear from people willing to bring along their machines from time to time.

Alan Waring writes from ComputerTown Enfield to say that, as a result of public demand, it is extending its activities to Palmers Green Library as well. I suggest that you check with Alan or the library for further details.

We seem to have received a bumper crop of letters this month, many of them asking for details of their local ComputerTowns. It serves me right for listing the 'Towns in October without addresses or phone numbers. Well, to save me work and to save you buying stamps and envelopes, I've persuaded the Editor to give a full listing of ComputerTowns every month in the 'Direct Access' section of the magazine. Thanks, Editor.

Mike Baker wrote from ComputerTown Ealing (which used to be held in Acton and is now run in Southall) to suggest regular get-togethers for the London ComputerTown organisers so that they can swap ideas and learn from each other's experiences. This idea was provoked by discussions Mike had with other organisers at the *PCW* show. He went on to suggest that the country should be divided into regions, with each region having an organiser/co-ordinator who could arrange regional meetings. This, he feels, is better than trying to have ComputerTowns all over the country trying to get together. I must say, I'm inclined to agree with him. What do you think? It's probably best if you send your ideas to me so I can disseminate them through this column. For the moment, Mike is acting as London coordinator and by the time you read this we will have had our first meeting. I'll let you know how it goes.

The latest news bulletin from ComputerTown, USA! devotes its cover to CTUK!. I noticed a couple of changes which sadden me a little. One is that Pat Cleland, coordinator of the CTUSA! project, is leaving and the second is that the bulletin is soon to be incorporated into *Recreational Computing*. People used to receiving updates on CTUSA! activities will now have to become subscribers to that journal.

Now let's look at the 'serious' letters. By this I mean those from people who look as if they might get a 'Town going themselves. The easiest thing to do is to list the names and addresses of those writing so that you may contact them if you're interested in helping out. If you write, I think you should enclose an SAE for the reply. Here's the list:

Nottingham Micro-Computer Club, c/o Geoffrey Jago, 1 Lucknow Avenue, Mapperley Park, Nottingham NG3 5AZ; Roger Clark, 6 Hawthorn Road, Ripley, Surrey GU23 6LH; R G Long, City of Leeds YMCA, 35 Albion Place, Leeds LS1 6JJ; P Aldridge, 20 Nita Court, 152 Burnt Ash Hill, Lee, London SE12 0LT; R J Shears, Southampton Computer Club, 181 Woodmill Lane, Bitterne Park, Southampton S02 4PY; Dick West, 21 Carmunock Road, Busby, Clarkston, Glasgow; P Masters — like a fool, I didn't note his address. Please contact me, Mr Masters; Malcolm Whapshott, 208 The Chantrys, Farnham, Surrey: Malcolm plans to have a 'Town running by the time you read this.

We have also had a letter from the National Centre for Alternative Technology, who would be pleased to help in any way possible with the setting up of a 'Town. Richard St George, who wrote, tells me that his workload is such that he couldn't take on the task of actually setting up the centre. The address to write to is Llwyngwern Quarry, Machynlleth, Powys, Wales. If you're into alternative technology — bio gas production, wind power, electric trucks and the like — you'd probably find Richard's centre worth a visit.

Other enquiries this month have come from London E17, NW1, E4, SW12 and SE20, New Addington, Northwood, East Horsley, Fleet, Gidea Park, Leeds (2), Reading, Rinteln — BFPO 29, Lyneham, Throckley — Newcastle-upon-Tyne, Lindley — Huddersfield, Hull, Southampton and Whitburn — Tyne and Wear.

The BBC sent out a letter written by me, typed by them and with my signature forged rather badly. The content was exactly as the original which, broadly speaking, asked for the names of 'Towns who wouldn't mind having viewers referred to them. The idea is to tie in with the forthcoming series. For those of you who may have started your 'Towns since the letter went out, I suggest you write to David Highton, Broadcasting Support Services, 252 Western Avenue, London W3 6XJ. There's no obligation to help with this: the decision is entirely yours.

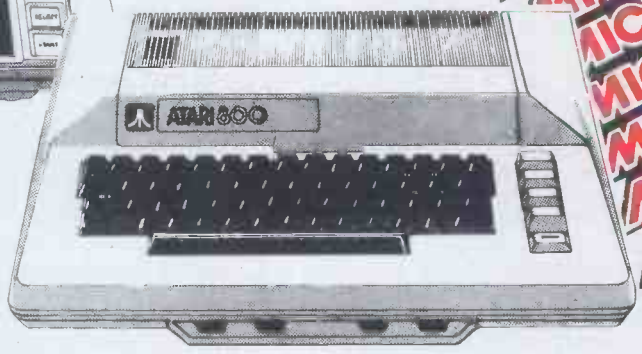
Finally, it has been suggested that we cobble together an internal newsletter for distribution within the ComputerTown network. This could contain the news, views, tips and hints which can't be handled in this single page in *PCW*. You might like to think about the idea of sending your local information to a central point and for the resulting newsletter being sent to anyone who pays, say, £1 with permission for them to reproduce it as they wish. This means that each 'Town need only pay £1, then it can reproduce it for its own members at a lower cost. I'm suggesting this approach to spread the cost and the effort around as much as possible. An alternative would be to obtain paid advertising, which does change the rules of the game a little. Please write and let me know what you think. Peter Rodwell (*PCW*'s new editor) has offered to take on the job of editing this newsletter.

Once again, I would like to thank all of you for your help and support for ComputerTown. Keep up the good work, and keep that news rolling in.

ComputerTown UK! is an ever-growing network of computer literacy centres, where members of the public are given free access to microcomputers, courtesy of those willing to volunteer their time and equipment. ComputerTowns might be found anywhere: in a church hall, a library or maybe in a school after hours. The emphasis is on making computing enjoyable and non-threatening and, because Computer Town is entirely non-commercial, overt axe-grinding of any sort is banned. Guidelines are available for those interested in setting up their own 'Towns: Write to CTUK!, 7 Collins Drive, Eastcote, Middlesex HA4 9EL and remember to enclose a large SAE (A4 would be fine) for your reply. Please don't try to telephone *PCW* for information because this project is entirely a spare-time activity.

ATARI

Find out why the Atari is the best home computer at your nearest Microcomputers at Laskys or write to Microdigital Freepost Liverpool L2 2AB



and ask for a free Atari brochure. We have large stocks of all Atari microcomputer products in all our shops.

LASKYS is the largest specialist Hi-Fi chain in Europe, in July 1980 they acquired Microdigital – an independent, specialist microcomputer store based in Liverpool. Since then specialist microcomputer departments have been set up within selected Laskys stores under the Microdigital name, these have now been renamed Microcomputers at LASKYS.

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Manager: Colin Draper. East end of Princes Street, St. James Centre.

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Manager: Alister Hawkes.
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Manager: Justin Rowles. Top of the Moor, opposite Town Hall.

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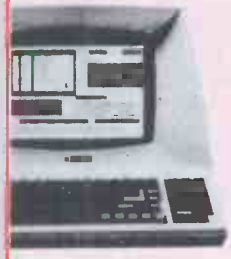
TVI

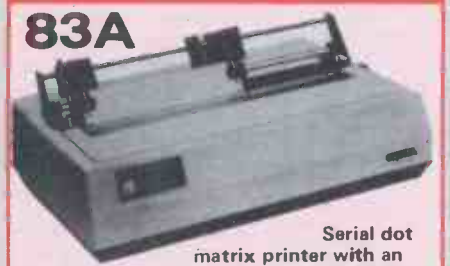
912/910/950



Fully intelligent terminals with 24x80 display & dual intensity, blinking, reversed, underlining and protect fields, 96 ASCII chrs etc.

OKI

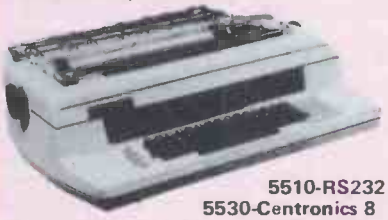
83A



Serial dot matrix printer with an impressive list of features including: 136 cols, 120 cps bidirectional, short line seeking, graphics, dual interfaces, 96ASCII

NEC

5510/5530



5510-RS232
5530-Centronics 8 bit parallel printers with the unique print thimble, produces up to 5 copies, with friction or tractor feed at 55 chrs.per sec.

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TEC

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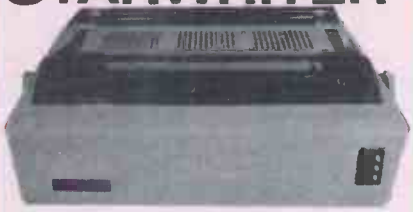

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Banks Statement

HERE'S TO DUMB USERS EVERYWHERE

Martin Banks tries to get to grips with a micro ... and fails.

This month's missive is being prepared for your delectation on boring old technology. It is being prepared in this manner for one simple reason — it actually works and has few quirks and eccentricities that I fail to understand. The technology being employed? Ah yes; it is a small, battered but excruciatingly reliable portable typewriter of the manually driven variety.

Now, I can hear a million voices being raised with the cry, 'so what?'. Never having been one to keep my opinions to myself, I will tell you. The following saga is true, for it happened to me. It is heavily biased because at the time of writing I have just about filled up my quota of dis for my gruntle, but despite that it's worth recounting for it is an object lesson in how the industry shouldn't (but does seem to) deal with the user. It is also an object lesson for that large army of potential users who are still to join the microcomputing fraternity and who perhaps wonder whether they should actually take the plunge.

This then is the story. The name of the specific manufacturer has, after some reflection, been expurgated. This is not from any sense of doubt over naming it; it is rather that I feel sure the following events are somewhat less than rare for all manufacturers and distributors and that naming just one is unfair relative to what is probably a general level of competence within the industry.

Right, here we go. I was asked by this esteemed magazine to try my hand at Benchtesting a microcomputer-based word processor. At first I was reluctant for, to be honest, I never have been (and probably never will be) either a technologist or a programmer. How, I wondered, could I do a thorough evaluation of a system when my professional duties have involved delving into the industry, its machinations and markets and never the nitty-gritty detail of PEEKing, POKing and GOing SUB.

After consultation with Editor Rodwell, however, it was decided that this was probably a positive advantage, for I would be able to approach the Benchtest in the same way the vast majority of genuine first-time users actually start with their new systems — *totally dumb*.

In fact, I started at a disadvantage over most first-time users. The system, precisely because it was for a Benchtest, was not of my own choosing. It arrived by taxi and without any prior demonstration of even its most simple requirements, capabilities or operations, so there had to be heavy dependence on the manuals to find out what the hell to do. In practice, of course, it wasn't too difficult to work out which cable plugged in where to get the processor connected to the video monitor, and the whole lot connected to the mains. It was interesting to note, however, that the hardware manual paid little attention to the requirements of a dumb klutz — full circuit diagrams and detailed explanations of the functions of all the devices were there, but I wasn't about to set to with a soldering iron. I was more interested in ensuring that 'el stupido' had stuck the right plug in the right socket.

Interestingly, the hardware in question had recently been enhanced by the addition of a 5.25in winchester drive — but no word of this appeared in the manuals.

At this point I must admit to the considerable possibility that I am being grossly unfair, precisely because the system was so new. The opportunity of a 'road-test' in *PCW*, even under the guise of a word processor Benchtest, is a chance most manufacturers and distributors jump at. It is, however, possible to surmise that some companies might well be tempted to grasp that opportunity for their latest system before it has been fully deduced whether all the machinery is in full working trim.

This certainly seemed to be the case with the system I had. The 'road-test' I had been commissioned to perform was on an 'old and established' word processing package (certainly in microcomputer terms). It has been around for some time, and many CP/M-based computers have an implementation of it available. In the case of the system I had, the implementation seemed to leave a little to be desired, particularly by a dumb klutz.

The manual for the WP software was quite sound, except for one failing — that it showed that it had been written *by* someone who understood the software very well, rather than *for* someone who didn't. A noticeably high degree of reader knowledge was implied, and it had the standard I'll-show-you-how-clever-I-am-at-writing-long-words type of introduction. I found myself starting in the middle of the manual and working outwards to find the bits that I needed.

Having at last established the order in which I should set about things, I set about them. The system happily booted itself into existence and told me to load a disk into drive A and key 5 or 8. Like a mug I keyed 8 and got a bootstrap error (8 for 8inch drives, 5 for 5.25s — clever that). On keying 5 we were away, and CP/M was automatically loaded. Goodie-good so far, thought I. Next, call up the WP package, a simple task to perform and, sure enough, up it came. So now I was away, or at least I thought so. Start the procedure to create a new file, name the file, watch the system sort itself out and get ready for the work to come and away we go.

Oh no, we didn't, did we? I started tickling the ivories with the opening sentence of some stunning prose, looked up at the screen and saw. . . garbage. Without wishing to duck any attacks about the words I normally write, and admitting that I am not the best typist in the world, even I would find it difficult to make 'This is the opening sentence of some words to test this package' come out on the screen as 'Tss h ongseef oe rsc. . . ' etc. On observation, I found that each time a

CHRIS PRIESTLEY

key was pressed the cursor would rocket up the screen from its position on the line. Then it would shoot across the top of the screen, updating page number, line number and column number on the way, then drop back down to the line and back across the screen to the location of the next character. In all, this circuit took about half a second and any key strokes made while it was on its travels were simply ignored.

The answer was, as such, simple. The version of CP/M delivered with the machine was wrong, requiring a replacement disk, and two ROMs had to be changed to give the system the necessary keyboard look-ahead capability. This a man from the supplier kindly did for me that evening (he lives locally).

All this time I had noticed that the winchester drive was conspicuous by its inactivity. It took a friend to notice that the instructions for booting it up were written on the label of the CP/M floppy. It was writ large for all to see; it just wasn't where I had expected to see it. Oddly, I thought it would be in a manual somewhere.

Anyway, it was now down to work with the start of the Benchtest, a central part of which is keying in a standard 3000-word article. This I did in two chunks and all seemed well, so it was save the file, switch off the system and off down the pub for the evening. Next day would be for editing the screed.

The day arrived, and off I went editing. Power up the system, boot all necessary bits, into the WP software, find the file and with great dexterity start to edit. But no, but no. Press CTRL and the relevant key to scroll the page and the letter appears on the screen at the start of file data. Oops, thought I, finger not on CTRL properly. I repeated the exercise and got the same result. Some quirk of the implementation (I assume) meant that I had to type an average of eight characters before the edit control keys would operate. When they would, I had to then go back and delete the 'addition'.

The next quirk to show up was that it (either and/or the software or hardware) had duplicated some paragraphs. Now I accept that this might have been some fault of mine in incorrectly saving the file, for I broke off a couple of times when entering the 3000 words but, as far as I was concerned, I had followed the manual's instructions. What I am not sure about accepting is that this would cause the system to duplicate paragraphs up to six times.

The next event was that the system had to go back to the supplier during the middle of my tenure as it was needed elsewhere. I decided to make a copy of the test file, only to find the system continually threw up BDOS errors and declined the request. The answer to this, I discovered, was an incorrectly formatted CP/M disk (the new one). Ho hum.

Eventually the machine came back from its travels with, I was informed, all relevant software, etc, etc. Nope: the WP software wasn't there (ie, the floppy) and without it I couldn't get onto the hard disk, where there was a copy. Further enquiries showed that a disk would be available the next day at the supplier's offices, plus two ROMs that were needed to go with it. Just for luck, there were some instructions on where the ROMs should go on the board.

As I've already said, I have never been one for soldering away the dark hours, so I approached this task with some trepidation. The great-CPU-in-the-Sky was on my side, however, and I won (at least, I think I did). Once again the system and I were up and away. Into edit mode we went, found the file (still there on the hard disk, fortunately) and found the same '8-character-addition' problem. By now I was well used to that and it was overcome with no difficulty. A-scrolling we both went until. . . oh, well, duplicated paragraphs are no problem, just delete the buggers.

Flashing fingers hit the keys to delete the first line and I waited for it to disappear from the screen. Did it? Did it be damned. The screen started scrolling at a million miles an hour with the same paragraph.

This was the time for decisive action — in the event, something not unakin to panic. I may have been wrong, but I pressed Escape. Nothing happened, so I pressed Return. Suddenly on the screen appeared the instruction 'Press Escape', so I did and the system returned to sanity. I scrolled back to the paragraph before the repeated one (not very far) and then scrolled forward to see the damage. . . and I scrolled forward and I scrolled forward. There were hundreds of them, the same paragraph, going over the hills and far away.

At this point, my gruntle was begin-

GOTO page 191

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COMMUNICATIONS

PCW welcomes corespondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add 'not for publication' if your letter is to be kept private. Please note that we are unable to give advice about the purchase of computers or other hardware/software these questions must be addressed to Sheridan Williams (see 'Computer Answers' page). Address letters to: 'Communications', *Personal Computer World*, 14 Rathbone Place, London W1P 1DE.

Auntie defended

There were some rather cool references to the forthcoming BBC microcomputer in Guy Kewney's 'Newsprint' column in your August issue: both Mr Kewney's own doubts about Acorn's ability to produce enough of the machines by January 1982, and also the Amateur Computer Club's objection to the machine's use of the 6502 mpu.

There was further critical comment from Derrick Daines in 'Young Computer World', complaining of the BBC losing its moral authority in promoting a de facto standard Basic, by choosing a particular manufacturer, Acorn Computers, to produce its microcomputer.

I admit that there was a certain redressing of the balance in Adrian Stokes' enthusiasm for the 'tele-software' add-on which will provide the BBC machine with the ability to down-load software directly from the air. However, the general critical tone of the August issue has prompted me to write to you.

I have no connection with Acorn at all save, I must admit, being the owner of an Atom with which I am well pleased. I am, though, responsible for coordinating microcomputer development in the Management Services Division of a major public authority in the West Midlands. We have a great deal of experience of both the hardware and software aspects of microcomputers, and it is our view that the whole BBC Computer Literacy Project, including the BBC microcomputer and the BBC Basic are, by far, the most significant and exciting developments on the UK microcomputer scene to date.

Just consider what the Computer Literacy Project involves besides the computer itself: there will be a series of ten TV programmes, large amounts of ready-written educational and consumer-type software; books; a '30-hour Basic' course available in the form of private study, correspondence course, or via so-called 'flexistudy' at local colleges of further education.

What of the hardware itself? For £335, you will get a 6502 running at 2MHz, accessing 32k of dynamic RAM and 32k of ROM, with options to extend the ROM further to include, for example, Pascal. There are eight graphics modes, including a 160 x 256 pixel mode with 16 colours and 20 x 32 text, and a 640 x 256 pixel mode with two colours and 80 x 32 text. There are RGB and UHF colour outputs, a two speed cassette interface, RS232 output with nine selectable baud rates, four channel 12 bit analogue to digital converter, sound generator, light pen input, parallel printer output and so on.

The Amateur Computer Club's unhappiness with the 6502 is irrelevant when you see that a second microprocessor can be added, leaving the original 6502 to handle just the I/O. This second processor can be a second 6502 running at 3MHz, a Z80A (opening up the world of CP/M), or a 16 bit micro — it seems likely to be the Motorola 68000. The BBC Basic will be very close to Microsoft, but with very worthwhile additions, such as multi-line procedures and functions, REPEAT.. UNTIL loops and very versatile graphics commands. It will also have an interactive assembler.

I could go on, but the letter's probably too long already, my point is that you ought to be supporting the BBC initiative as hard as you can, because of the tremendous impetus it will give to widening the understanding of, and interest in, microcomputing in the general public. The BBC machine has a very good specification, is competitively priced and, according to the trade press, will be made by CIL. Come on, *PCW* let's hear it for the BBC!

I G Nicholls, Kidderminster

Okay, you've won us over Mr Nicholls — see the feature on page 99 — Ed.

That ZX81 bug...

I was amused by your section on '81 bug-sorting' in the October issue. I had in fact traced this bug to what I thought was a simple programming error at bytes 5939-5941 (hex 1733-1735). The solution seemed to be to delete these three bytes. I had not got round to testing this solution, but it may not now be necessary. At the recent ZX Microfair I found that the interim 'hardware' solution to the problem by Sinclair did, in fact, simply nullify these three bytes by changing the third one. I also understand that the ROM has been rewritten and that it may be possible to obtain a corrected one without sending one's machine away. That remains to be seen. Incidentally, it is not SQR (1/2) that goes wrong. A simple test is PRINT SQR 25. It was also amusing that the programmes got their Chebyshev polynomials right but apparently made a simple mistake in addition (which affects the log which affects the square root, etc).

Frank O'Hara, Surbiton

Stand it on a book

Having experienced the frustration of losing many screens full of data, my enquiries to Sinclair resulted in the 'clean the contact,' etc, stock reply. This I did with no noticeable improvement.

I did notice, however, that with the 16k RAM attacked, only the front pads of the ZX81 and the back edge of the RAM pack touch the table top. This bridge flexes beautifully when inputting data. I now stand the ZX81 on a book with the RAM pack hanging over the back and in the last three weeks have had no problems at all.

Could this be the answer?

R D Lancaster, Perivale

....or tie it to a board

Regarding the problem of the the 16k RAM unit disconnecting and losing the program when it is lifted off a flat surface, the solution is to mount the ZX81 and 16k RAM on a board (4 or 6mm ply with do nicely) and hold the ZX81 to the board with two stout rubber bands.

Now that the ZX81 is developing into a mini-system, portability requires a mount which can take the computer, RAM, printer and have some space for a notepad and possibly for the smaller type of tape recorder. The system could then be used from an armchair near the television or even in bed.

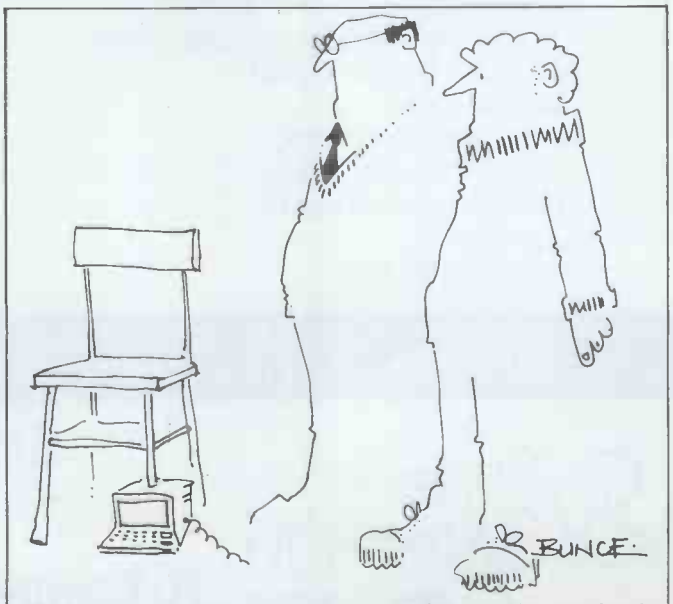
I have a small woodworking company so it is easy for me to make such a mount. If you found from your letters from readers that there is a demand for a mounting board we would consider designing and making them.

A R Hudson, Isle of Wight

Disgusted of Kent

Why is it that, after waiting seven weeks for Tim Hartnell's ZX81 book, *Getting Acquainted With Your ZX81* and paying £4 for it, I am confronted with page after page of programs that don't work? I've spent hours typing (if you can call a ZX keyboard 'typing') in a program (and I've got the highly unacclaimed RAM pack so they're extra long programs) only to get some silly report and an error. Then you spend the next half hour checking every semicolon, etc, but it's never in the way I type it in. The errors are all from the book and there can't be a better way to put people off computing than if they can't trust their books.

This book is awful . . . the programs that do work are so



'There you are Dad. I said they'd replace books one day.'

thin it's not true. I don't suppose you people try any of the programs before writing things like 'this is undoubtedly the book to read' — it may make good reading but, practically, it's totally hopeless.

I spent £50 on *the* RAM pack: and what do you think has been happening? My mile long programs that I've spent hours writing go . . . *zoom!* just like that and I'm left with a fuzzy screen. Why is it that when we have such great machines in the world, we can't get a decent book or hardware expansions?

I think I'm going to go mad pretty soon.

My ZX81 only loads when it's cool, which is bad — okay, it's small and cheap — but when it won't save those treasured programs that you've gone and put your heart into . . I wonder what the printer's like?
Brett McBain, Kent

Calm down Brett, you've still got the square roots to come . . . . Ed

Video interference

I note from 'Newsprint' (*PCW*, October) that you make references to the BBC Ceefax transmissions and interference between your video cassette recorder and Acorn Atom and Sinclair computers.

We, too, had problems when we tried connecting our Sinclair ZX81 to a video machine. In fact, precisely the same problems as we encountered when attempting to copy from one machine to another. Some years ago we linked two Philips VCRs to copy and found that the two machines interfered with each other and caused a tremendous degredation in quality. The reason was that both machines were operating on the same RF channel and consequently the modulated output of one machine was interfering with the input of the other.

A similar effect occurred when I connected the ZX81 to the video: the picture rolled quite considerably! A slight adjustment to tune the video away from the computer cured the problem. I think that I am right in saying that all UHG modulators for equipment such as home computers and video recorders are factory pre-tuned to UHF channel 36. Therefore both the ZX81 and the video were pushing out a RF signal on the same frequency — and presumably it was this that caused the interference.

A small screw adjustment is available on most modulators to permit a slight adjustment of the channel in either direction. On our video this was available on the rear panel so we made a small adjustment and then retuned the TV with the aid of the built in test signal. Channel 12 of the video was then carefully tuned to the output of the ZX81 — the result a perfect display of the computer output which could easily be recorded onto video tape.

Incidentally, the purpose of our experiments was to use the ZX81 to record an index onto the first two minutes of each video cassette. A short programme displays programme information and start numbers for the tape counter; this is then recorded and may be accessed by any teacher using the tape in a lesson as the complete index is displayed on the normal TV screen before the programmes begin.

As to the other point, regarding the Ceefax transmissions, I think that you are going to be disappointed. Although the Ceefax (and Oracle) information is transmitted as part of the 625-line picture it cannot be recorded. The only way that you might do it would be to use a separate Ceefax processor and take the output (either video or RF) to a video recorder to store the picture. This would, however, have the disadvantage that the picture would not be saved while the Ceefax would.

When I can lay my hands on a Ceefax equipped TV I will do some experiments — but I think that they will not be successful. However that remains to be seen.
Peter J Milford, Bognor Regis School.

Gomoku

B E Newsam ('Communications', *PCW*, October is to be congratulated. I thought that *PCW*'s statement that my Gomoku program was 'reputedly unbeatable' (a claim I didn't make for it) would result in someone quickly finding a way to defeat it.

The list of moves given by Mr Newsam certainly does produce a defeat for the program, though if you change W(3) on line 18 of the program to equal 35 instead of 30, it doesn't fall into that trap — I am not competent to judge whether or not it plays a better game as a result of such a change.

Perhaps readers would care to experiment with the weightings assigned to the W and K arrays (white and black

stones respectively) to see how much it affects the program's standard of play.
Bob Chappell, Norfolk

RTTY

I have just read a letter from G Caselton published in your November issue, concerning his intended purchase of a small computer to encode and decode amateur RTTY. In addition to the information given in your correspondent's response, I would suggest that Mr Caselton and others in a similar position would find it useful to become members of the British Amateur Radio Teleprinter Group.

The Group was formed in the late 50's to bring together those radio amateurs and listeners interested in transmitting and receiving RTTY. It has subsequently developed to include about 1000 members and embraces many enthusiasts using microprocessors for both RTTY and general radio work. Many of our members are happy to give assistance to newcomers in respect of interfaces with specific computers and we publish a quarterly journal which includes relevant articles.

Membership details can be obtained from Mrs Irene Double, 89 Linden Gardens, Enfield, Middx EN1 4DX.
Trevor Campbell Davis, Chairman, BARTG, North Acton

Sharp reproach

While we found your review of the Sharp IQ-3100 Microtranslator to be most interesting, we would like to correct the information concerning sole supply of this product through PHS of Burnley.

The IQ-3100 is available from any Sharp-authorised dealer throught the UK and anyone who has difficulty in finding the product locally should contact the Calculator Division of Sharp Electronics (UK) Ltd at Manchester for details of the nearest stockist.
R Travis, National Sales Manager — Calculators, Sharp (UK), Manchester.

Poly show

After queueing outside the Westminster Central Hall to get into the previous Sinclair Show in September and having to leave without seeing anything, I have decided to stage another show. It will take place at the Polytechnic of the South Bank on 28 November which is a Saturday. The Poly will be open from 10am to 6pm.

Sinclair will be there demonstrating and selling its equipment and so will the user group, along with suppliers of software and hardware for the ZX80 and ZX81 machines. We will also be telling people about the other micro-oriented activities at the Poly.

We will be charging £1 on the door, or 50p to school children. If any school parties want to come we will be happy to arrange group discounts, if they write to us in advance.

The Poly is also interested in setting up a computer interest group specifically for the disabled. We have electrical and mechanical engineering students eager to try out their skills making any special aids that would be required, and computing students who could give lessons in programming.

As none of us has actually been involved in this sort of project before, we would welcome any advice from any of your readers as to potential pitfalls, or areas likely to be particularly rewarding.
Lyn Antil, Polytechnic of the South Bank, London

Personal please

Thank you for your review of Memorite III for the Vector Graphics 3005. At a cost of over three times my total annual income, this is just the sort of thing I don't need.

Come on, you guys, it says *Personal* Computer World on the cover.
Ron Yorston, Reading

We use the phrase 'personal computer' to describe any microcomputer, whether it's for the home or for business use. Additionally, while half our readers fall into the home/hobbyist category, the other half are interested in more 'serious' machines and applications and we have to reflect this balance in the magazine. Ed.

Fibonacci fix

('YCW', October 1981) asks for a single-function Fibonacci-number generator better than his and a similar function for factorials. Both have been available for some time.

The standard nonrecursive (ie you don't have to add them all up) generator of the Fibonacci numbers F_N is

$$F_N = \frac{\left(\frac{1+A}{2}\right)^N - \left(\frac{1-A}{2}\right)^N}{A}$$

where $A = \sqrt{5}$. It is called the 'Binet form' (Jacques-Philippe-Marie Binet, 1786-1856); a good modern derivation is given by VE Hoggatt, *Fibonacci and Lucas Numbers*, Houghton Miflin, Boston, 1969.

This expression is exact; it produces the Fibonacci integers to within the accuracy of the computer. Programmed on the CBM 3032, taking closest integers to counter noise in the eighth or ninth significant figures, it succeeds through F_{36}, the smallest Fibonacci number having 8 figures (14930352). As long as one is taking closest integers, however, he/she may as well note that the absolute value of the second term never exceeds 0.3 and becomes negligible (to eight-figure accuracy) for N>20 or so. Hence an equally good generator of the Fibonacci sequence is simply the closest integer to the first term, $((1+\sqrt{5})/2)\uparrow N/\sqrt{5}$. This form (curious because $(1+\sqrt{5})/2$ is the 'Golden Ratio') has been called the simplest nonrecursive generator of the Fibonacci numbers (the most recent reference I recall is in one of Martin Gardner's *Scientific American* articles ten years or so ago).

We are now in a position to see why Daines's formula makes sense, and also why it fails (at N=28, as he says) at lower N than does the Benet form. Presumably Daines found that F_{N+1}/F_N approaches (as N becomes large) a constant (golden) ratio, and that a suitable coefficient then scales the values to the Fibonacci numbers. His base (1.618036) is very close to the Golden Ratio (1.618034 or so) and his (denominator) coefficient 2.23616 is close to $\sqrt{5}$. (2.236068 or so). Replacing his constants with the above more precise ones (and noting (i) that his 'X+1', in the usual convention of the literature ($F_1=1, F_2=1, F_3=2, \ldots$), is 'X' and (ii) that the 0.5 for closest integer is ordinarily added to the result rather than to the numerator alone) causes his equation to behave (on the PET) exactly as the Benet form, persevering through F_{36}.

To generate factorials via one statement function, try

```
DEF FNF(N)=INT((N/E)↑*
N(SQR(2*π*N)*EXP
(1/12/N))
```

where E is the Napierian base (EXP (1)).

The above factorial function which is based on Stirling's Formula, is simply an answer to Daines's question as posed. For speed, because only 33 values are involved due to overflow limitations, I think I would generate and use a look-up table in the vector NF (N).
John Thorson, Combe, Oxford.

Zaks wrong

Zak's view on page 63 of the November issue stated that the current series of 8-bit micros could not run a modern operating system like Unix.

This is not the case. For the past 18 months, SWTP has been marketing the TSC UniFLEX operating system on its M6809-based systems with over 700 installed sites to date.

With reference to the comment that 'today's 8-bit micros are just too slow to run Unix. Recent Benchmarks indicate that the SWTPc machine compares very favourably with machines costing up to five times as much.

UniFLEX has been examined by the European Unix Users' Group (EUUG) and fulfils the group's requirements for a Unix 'lookalike'.

It would be refreshing if the microcomputer population were presented with accurate information on the 8-bit processors and not subject to a continual worship of the Zilog Z80 and its companions.
Russell Brown, Software Manager, Southwest Technical Products

'The high-resolution graphics are really good, Brother Godfrey...'

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A SINGULAR PROBLEM

Jeff Taylor concludes his tour of US computer literacy projects with a visit to CTUSA!

Before leaving England, I envisioned my journey through the West as a meandering from ComputerTown to ComputerTown to ComputerTown, from Gallup, NM to Winslow, Ariz, to Needles, CA, observing and comparing their various methods in order to inform CTUK!. CTUSA! has had, after all, one and a half years' head-start on CTUK! and now, with its $250,000 NSF grant, surely it must have gone forth and multiplied across the West, just as CTUK! has quickly grown into a nationwide network.

Such is not the case.

CTUSA! is based in, and limited to, Menlo Park, CA, an affluent Shangri-La of 27,000 souls set on the peninsula between the coastal mountains and the San Francisco Bay in that heartland of microtechnology known to the world as Silicon Valley.

For reasons still unclear to me after several weeks' stay in Menlo Park and discussion with CTUSA! personnel, the decision had been taken or the policy evolved, that publicity of the project would be carefully controlled, the result being that no attempts have been made to replicate the project, to proliferate ComputerTowns. The reasons given for this suppression by Project Director Ramon Zamora (he claims to be holding at bay *Readers Digest*, which is eager to feature an article on CTUSA!) are that the project is not yet equipped to deal with all the mail it would receive as a result. Yet, the project was bending over backwards, from my observation, to re-stage 'drop-in' events that had recently proved successful, during which personnel transport computers to various sites, eg, storefronts, a senior citizens' centre, a boys' club, in order to accommodate filming for a series that is set to appear on nationwide television.

Instead of encouraging other initiatives as well, CTUSA! has decided to isolate its activities within the Valley, 'Bringing Computer Literacy to the Entire Community', as the CTUSA! motto states. Founder, project advisor, and brains behind CTUSA! Bob Albrecht predicted with characteristic foresight last year that, by July 1981, CTUSA! would have achieved its goal of making computer-literate 'the Entire Community'. At last count, CTUSA! had 'given more than 1000 persons, kids and adults, the opportunity to use a microcomputer,' according to the *CTUSA! News Bulletin*. At the present rate and discounting demographic changes, seer Albrecht's dream should come true, albeit belatedly, in 2007, just 26 short years away! It would be an interesting project for CTUSA! to assign devotees the task of computing by what millenial year would the entire USA become ComputerTown!

The early radical idealism of the People's Computer Company, recently disowned parent of CTUSA!, is best captured on the cover of newsletter Vol 1, No 1, Oct 1972:

'Computers are mostly
used against people instead of for
people, used to control people
instead of to *free* them
time to change all that ——
we need a. . .
PEOPLE'S COMPUTER COMPANY'

Now that computers are, for some, easily affordable pets to be played with rather than techno-monsters to be controlled by informed citizens, CTUSA! has arisen, 'Bringing Computer Literacy to the Entire Community'.

Too many bites at the Apple?

The fall from innocence has taken its toll among many of the 'sixties people', and the lineage of CTUSA! echoes this transition from apostle to devil's advocate. Suspicions cannot be suppressed when the goals of CTUSA!, both stated and implicit, are so cosily harmonious with those of computer manufacturers. CTUSA!'s 'educational' tactics and content point to the most utilitarian definition of Computer Literacy conceivable: the state of owning a computer. In CTUSA! staff meetings which I was invited to, success of project events was gauged by Zamora in terms of how many computers were sold. A functional description of the essence of CTUSA! activities, then, translates 'Bringing Computer Literacy to the Entire Community' into 'Selling People Computers'. Indeed, the latest inspiration of founder Albrecht, who gadflies from Idea to Idea leaving in his trail a host of opportunists to somehow make them pay off, is ComputerKid USA!, wherein computers are seeded throughout 'the Entire Community', to be supplied by a grateful manufacturer. As Albrecht explained to me over lunch, one computer (and games software?) would be 'loaned' to a group of four youngsters to share between them, each having it for a week at a time. The rationale is that, after experiencing the frustration of withdrawal that soon fills the children who have had the computer and then must do without for three weeks, they will soon pester their parents into buying them their own.

It is perhaps mere coincidence and, anyway, none of my damned business, that CTUSA! leaders' fingers are all in pies whose future depends upon an exploding home computer market, be they submerged in developing software, in writing technical manuals for manufacturers of computers, or in direct stock investments in computer companies.

I haven't the space — mental or physical — to relate here the genealogy of CTUSA! in detail, a confusion of what begat what; if it were a program listing, it would appear as a programmer's nightmare of incestuous GOTO loops. Nor can I articulate the many questions concerning conflicts of interest that have reared their ugly heads as a result. In many ways, I have been so close to the project for so long that further time is needed for objective unravelling and analysis.

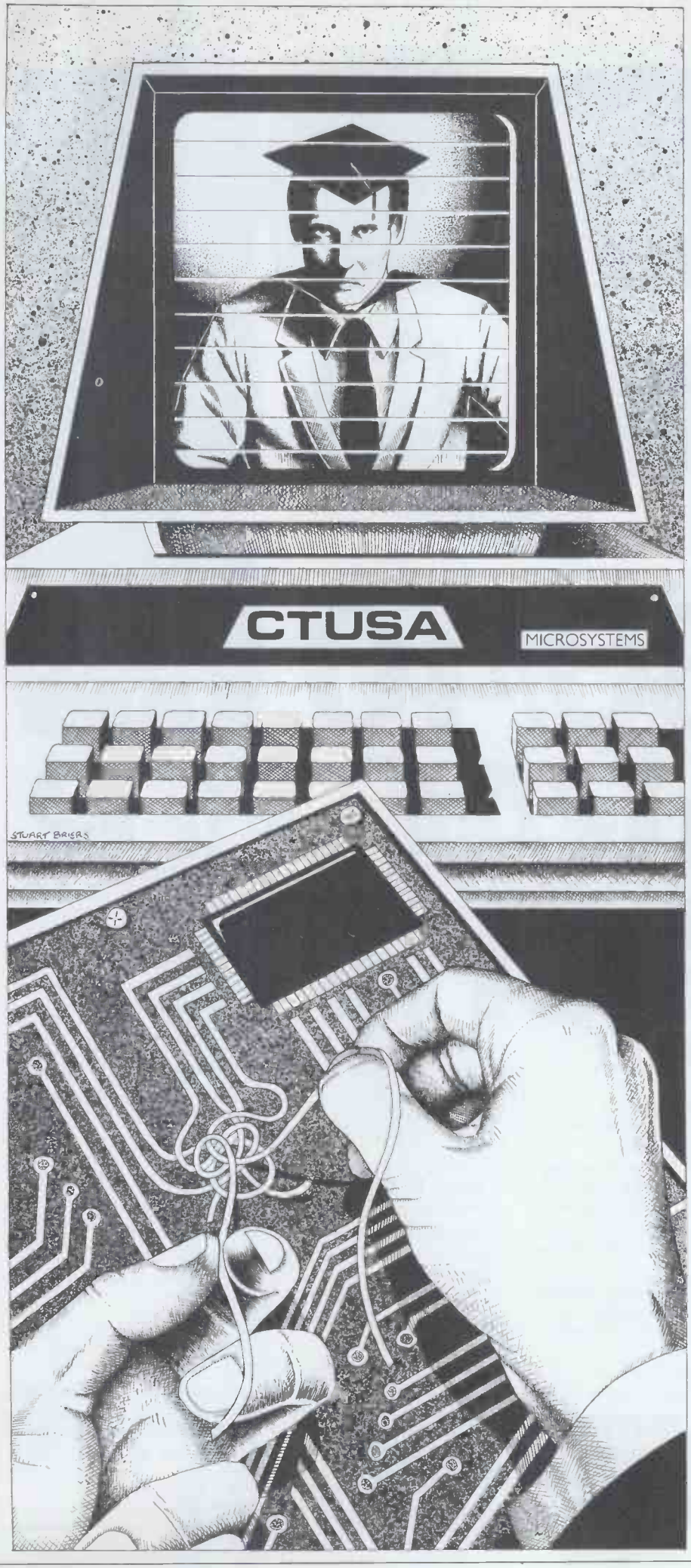
It would be remiss, though, to not pay at least passing homage to one Albrechtian Idea which was the prime mover and begat All, including the People's Computer Company and the *Whole Earth Catalog*, and which itself still soldiers on. I am referring to the authoring service that Albrecht so wisely founded as a kind of go-between for putting unknown writers into print through major publishers, and named after a term coined by Buckminster Fuller that was fashionable during its birth in the late sixties. As commendable as its early motives might have been, a description of its present function is best conveyed through the following: Q: How many Californians does it take to author a Dymaxion book?; A: Six. One poor sucker to actually write it, the rest to share the royalties.

Suffice it to say that if nearly as much energy and NSF funds had been directed into the grassroots work of making CTUSA! Menlo Park successful and in orchestrating the growth of a CTNETwork the likes of CTUK!, as has been cleverly channelled into manufacturing, advertising and trademarking the marketable image 'CTUSA!', a name which will soon have generated enough media publicity to sell *any* computing product, whether software, periodicals, books — even computers — then perhaps CTUSA! would not have recently lost the committed, enthusiastic and hierarchically powerless half of its staff, Editor and Community Coordinator Pat Cleland, and Technical Coordinator Cheryl Rhodes, without whose heartfelt support CTUSA! becomes indeed a drifting shell, an aimless advertising float.

The early demise of CTUSA! was predicted for me both by Art Melmund of the National Institute of Education in Washington DC at the start of this tour, and by Jim Warren, entrepreneur, publisher and instigator/perpetuator of the West Coast Computer Faires, who personally witnessed conflicts of interest rapidly erode and cause the collapse of the Free University in Berkeley over a decade ago.

Ten commandments

So, is this the obituary of CTUSA!, of CTUK!, and of all other such initiatives?



STUART BRIERS

Is it time to lay horizontal their exclamation points and leave permanently at half-mast the flag of volunteer grassroots initiatives, and to once and for all pledge our reluctant alliegance to the inviolability of free market forces?

Or are there lessons to be learned from CTUSA! that will increase others' chances of survival?

If so, *Lesson 1* certainly must be to give proper credit and recognition in print to the efforts of volunteers, the backbone of any grassroots initiative, instead of giving repeated press exposure to staff, as CTUSA! has done. It was irate volunteers who pointed out to me much of what is contained in these lessons that follow.

Lesson 2: Do you part in creating, maintaining and increasing the network of interactions with other Computer-Towns. As important as the nodes are to a network is the interaction between them. CTUSA!'s efforts toward engineering the creation of other initiatives have been confined to the terms of their NSF grant, to produce an implementation package that will facilitate replication in other libraries. CTUSA! has long had access to the People's Computer Company's latest periodical incarnation, *Recreational Computing*, yet has chosen not to publish its *CTUSA! News Bulletin* in that national media publication, choosing instead to limit circulation to libraries, complying with the minimum NSF grant terms. CTUSA! could easily have had free *Recreational Computing* space to act as a noticeboard, just as *PCW* has done for CTUK!, and instigated a nationwide network that could share ideas and experiences to guide the mutual development of all. Indeed, People's Computer Company, in hopes of retaining its non-profit tax-exempt low-postage status as an educational organisation, has tried to incorporate CTUSA! legally under its umbrella, a move which Albrecht and Zamora (who are on the board of directors of PCC) quickly thwarted. Instead, it was decided to carefully guard and quickly trademark the name 'CTUSA!' using *Recreational Computing* only for free self-congratulatory advertising hype. One could see a distinct advantage in keeping the name 'CTUSA!' quite distinct from *Recreational Computing*, especially if one foresaw the potential future success of a magazine called *CTUSA!*, a name that has already gained international repute through media publicity and NSF funding.

If this is the name of your game, so that self-interest is blocking you from doing anything useful in a community sense, then better to clear out.

Lesson 3: Be sensitive to the equity issue. CTUSA! has established base in the Menlo Park Library, located in a white affluent neighbourhood. Over the tracks, or rather freeway, is East Menlo Park, known by its predominantly black inhabitants as 'The Ghetto' People from East Menlo Park don't use the Menlo Park Library as a rule, but rather go to the East Palo Alto Library, which they describe as being 'friendlier'. Libraries, especially those in white neighbourhoods, are alien turf to many black kids. Besides, black parents are afraid to let their kids stray too far from

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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.

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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:

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- ☐ ***an additional set of 128 user-definable characters;***
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- ☐ ***user defined windowing (and independent scrolling) of screen areas;***
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home, especially into white neighbourhoods, since the Atlanta killings.

Yet CTUSA! wonders why it is not attracting new people to the library. CTUSA! has staged two 'drop-ins' in E Menlo, and one repeat for the purposes of film publicity. Policy now is to curtail drop-ins, since their purpose is to attract people back to the library, which they are failing to do. Instead, CTUSA! should be increasing drop-ins in E Menlo to give more equal access. To show that CTUSA! isn't entirely insensitive to this point, good dragon Albrecht donated to the Hoover Boys' Club in E Menlo his old PET computer for them to be getting on with.

So, set up the main access base in neutral turf, if possible. If not, set up on disadvantaged turf, involving locals as volunteers. If neither of these is possible, make frequent 'drop-ins' to poor areas and provide regular free transport back to base. It may in the end be unwise to use a library as base, since this may automatically serve to exclude the disadvantaged.

Lesson 4: If your base is a library, be certain to involve library staff as much as possible and integrate with library programs. Publicise other library events as well as your own. CTUSA! has attracted resentment from Menlo Park Library staff for using its media access and other publicity mechanisms to advertise its own library events, such as its struggling adult literacy program.

Lesson 5: Try as much as possible to motivate and direct computer users outward in the library to make use of other library facilities. Give exposure and easy access to books and magazines that are obviously relevant to computer users, yet are relevant to other areas of study as well, so that when waiting for machines to be free, users can be drawn into reading. Display a bibliography of other books that they might be motivated to pursue, such as *The Mighty Micro*, which might attract users to other library areas.

Lesson 6: Make availability of good quality software a priority. CTUSA! uses NSF funding to pay an outside evaluator (who co-authors with Zamora) to travel 500 miles from San Diego to have dinner with the Director and Advisor. If it invested as much to update the library software, perhaps there would be less computer vandalism and 'fistfights' that now plague CTUSA! and no need for the 'bouncer', as one library staff calls the new person that is being hired with NSF funds.

Make certain you know what values and behaviours are being reinforced. For kids, why make available shoot-out and stock market games that reinforce aggression and greed, and thereby do your part in assuring the continued dominance of these software and values?

Lesson 7: Try to give emphasis to the social implications of the technology. Do this by assembling literature, displaying books, articles and news items prominently and attractively; show videos like 'Now the Chips are Down' to coincide with discussion groups; advertise upcoming television or radio broadcasts dealing with wider issues; arrange visits to museums or workplaces where applications are evident, from which further social implications can be drawn, such as automated factories or offices; build up a library of tapes of relevant television programs and have a video and television with headphones available for private or small group viewing.

The difficulties of facilitating this kind of study in even a compulsory educational context, much less an informal volunteer one, are not to be underestimated. Many teachers I have spoken with who are involved with computer literacy would like to expose students to wider social issues, but are stymied by the problem of creating interest in these issues. An average class of seventh graders will busily beaver away at Basic or simulations and games, but just try lecturing or encouraging discussion in today's schools. There is a clear need for software to address this problem, something on machines that rivals adventure gaming, yet helps discovery of the social implications of new technology. I would be pleased to hear from anyone with ideas for this software, a problem for which I am actively seeking solution.

One reason CTUSA! has not concerned itself with increasing awareness of the social implications of microtechnology is, apart from lack of expertise in that area of knowledge, a feeling of inhibition and reluctance to displease the NSF by using its grant to educate about what it might consider to be politically contentious implications, according to Zamora. In the UK, where the amateur science tradition thrives, it is traditional policy of amateur clubs and societies not to accept government sponsorship, which might lead to government channelling control of their activities. Herein is *Lesson 8:* Beware foundations bearing grants. If an offer is made you can't refuse, as was the case with CTUSA! who were first approached by the NSF, then the sponsor's interest in you won't be shaken by your insistence on certain terms. Don't be afraid to scrupulously examine the mouths of gift horses. By far the best path in the long run is one that leads to self-sufficiency and the mutual support of initiatives.

Lesson 9: Avoid conflicts of interest. If your own interests are obstructing the optimal running of your local ComputerTown, then you should resign. The Director of CTUSA! nearly reached this wise decision during my visit to Menlo Park, but unfortunately decided to stay on. Had he gone, Pat Cleland, Editor and Community Coordinator, would no doubt have gained the post and thereby given CTUSA! much-needed direction. It is sad that Pat decided to leave instead.

These conflicts of interest which have become such a sub-theme of my study, arise when personal gain, whether for the individual or from media sponsor, becomes the dominating goal, eclipsing community needs and implications. This is, of course, natural and unavoidable in a selfish and competitive world governed by sociological immaturity and new-found faith in solipsism.

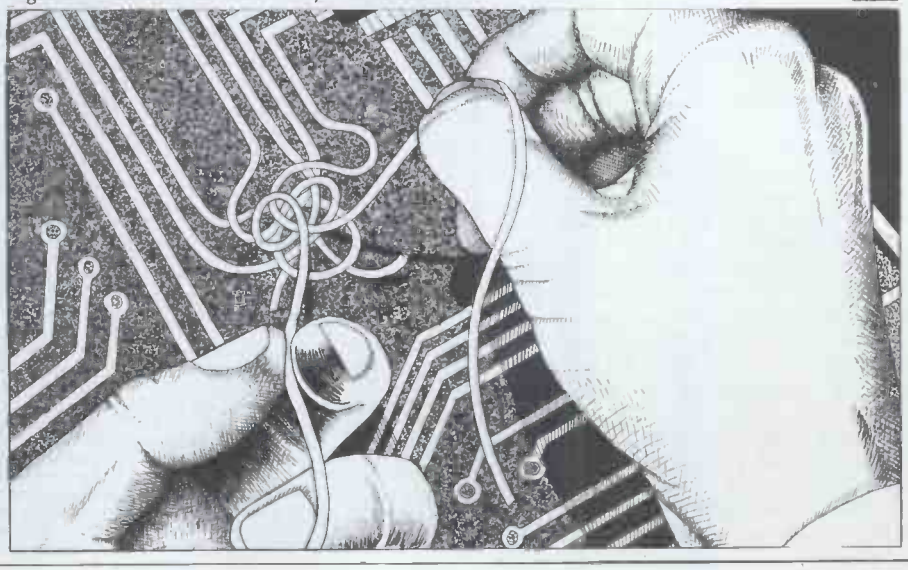
Just as in the Menlo Park Library, the social implications of telematics could provide the key motivation to draw computer users into other areas of the library of knowledge, into social concerns to which they would not otherwise be exposed, so then on a larger scale could these far more important concerns come to overshadow self-interest as a citizenry becomes collectively more demanding of access to information and techniques that can involve them more directly, more democratically, in social decision making.

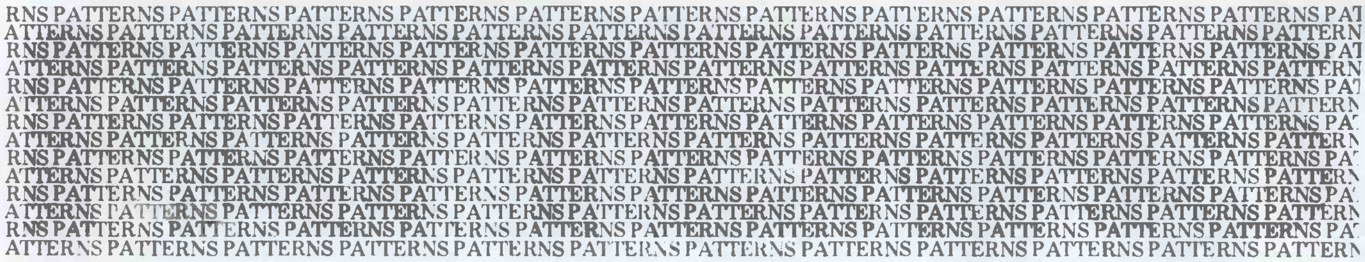
Do we have the technology?

Or does the technology have us?

Lesson 10: The onus is on *us*, not them.

END





Alan Sutcliffe examines an area where art and computing meet.

Ken Knowlton has an exceptional combination of talents in computer science and graphic arts. By his own admission, he tends more to the science than to the art end of the spectrum. In a paper 'Collaboration with Artists — a Programmer's Reflections' he argues the need for a new breed of artist-programmer:

'. . . . A rather unlikely, or at least a rare phenomenon. I say this because, in my experience, artists and programmers are rather different groups. Both groups are creative, imaginative, intelligent, energetic, industrious, competitive and driven. But programmers, in my experience, tend to be painstaking, logical, inhibited, cautious, restrained, defensive, methodical and ritualistic. Their exterior actions are separated from their emotions by enough layers of logical defenses that they can always say "why" they did something. Artists, on the other hand, seem to me to be freer, alogical, intuitive, impulsive, implicit, perceptive, sensitive and vulnerable. They often do things without being able to say why they do them and one is usually polite enough not to ask.'

Now I do not altogether like these categories, though I have never read a better description of myself. Ken himself does not fit into either category now, even if he did when the article was written in 1972. He is one of the new breed of artist-programmer. This article is largely about Ken and particularly some of his latest work. At the end I give the result of the competition that I set in the August issue of *PCW*.

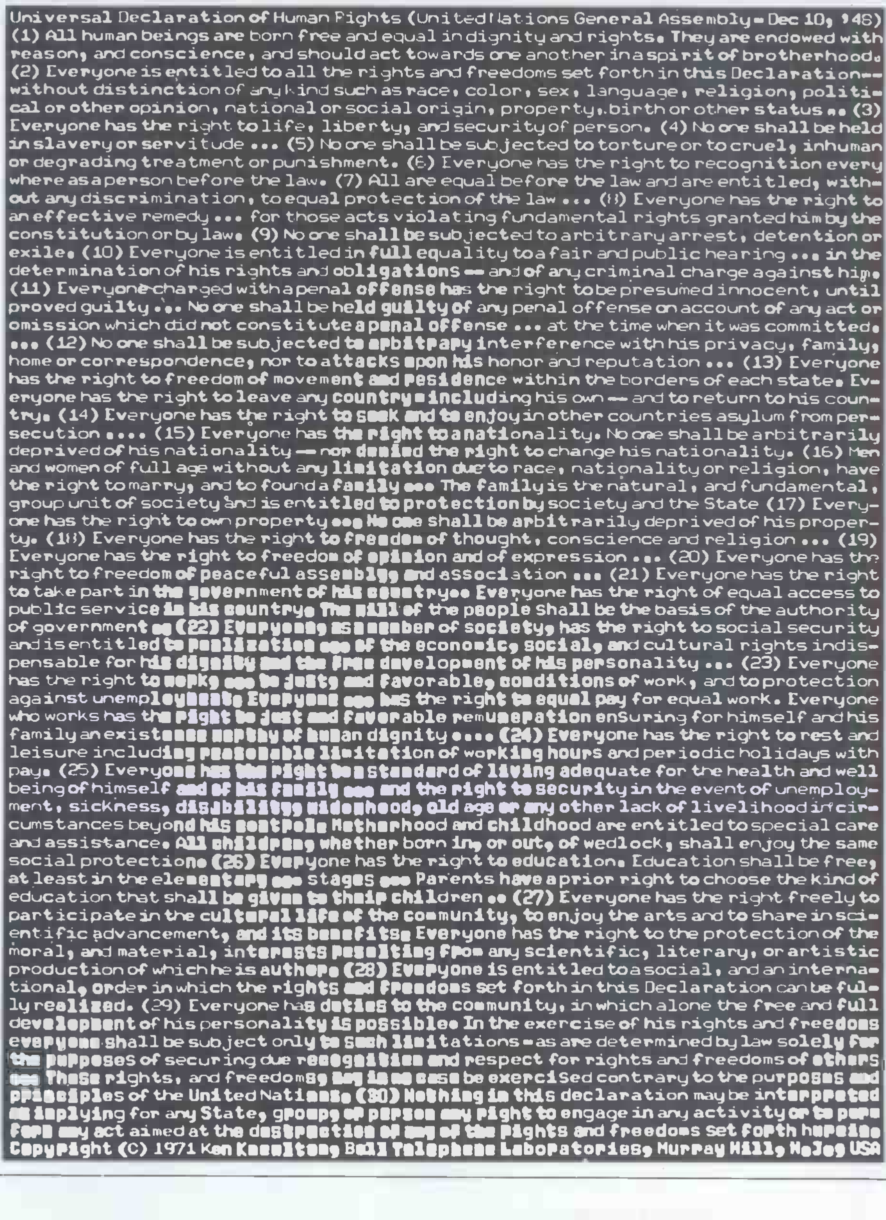
Kenneth C Knowlton has been for many years a scientist at Bell Telephone Laboratories at Murray Hill in New Jersey. His work is concerned with computing and particularly the man-machine interface: developing ways of inputting information that suits human skills, outputs that match human perception, rather than being simply what is convenient for the hardware or systems program. One very attractive device he developed is a keyboard on which the functions of the keys are redefined by software, depending what functions are allowable at a particular stage in the sequence of an operation. One implementation is for a telephone operator: the functions that can be used when a call is being set up are quite different from those when the charge is being sent to the subscriber's account at the end of a call. Appropriate symbols on the keys covered by the fingers are still visible. This system gives all the flexibility of a menu-driven sequence of operations, but directly on the keyboard, not displayed on a separate screen.

In the late 60s Ken worked with film-maker Stan Vanderbeek, who certainly had many of the attributes of an artist listed above, and what I would call a truly Californian openness about what art is and how it might be made. The idea of using a computer in art was then quite novel and scorned by many.

There were two main outcomes from this collaboration. On one side the language Tarps, which might stand for Two-dimensional Alphanumeric Raster Picture System, itself written using Ken's earlier language Beflix. This is used to describe operations on a 92 x 126 array of characters. Individual cells and whole areas can be set to given values, and various kinds of transformation carried out on them, to produce forms and textures. By performing functions on a sequence of frames, motion for an animated film is produced. At Bell Labs there was sophisticated hardware for plotting directly onto film, but the same system could be used for printer output which could then be filmed.

On the other side, this collaboration produced the series of Poemfield films of concrete poetry and abstract designs. It is interesting for those who have seen the films to speculate how much of their quality comes from Vanderbeek's creative ability and how much their characteristic appearance owes to the language.

Ken has worked with many artists and the attribution 'X and Ken Knowlton' must appear for more values of



X than almost any name in the history of creation. I think there are three main reason for this: the systems were attractive to use, the environment at Bell Labs enabled artists to visit, and Ken himself is good to work with. But his most productive collaboration was with Lillian Schwartz, beginning around 1970. Again the outcome was a language and a series of films. Lillian and the films deserve an article to themselves. She has just completed two years work on a film of the archeological excavations at Carthage, which includes computer-processing of some images. This may be shown by the BBC in 1982. She is currently in China filming the recently found and amazing tombs of the Han dynasty.

Explor

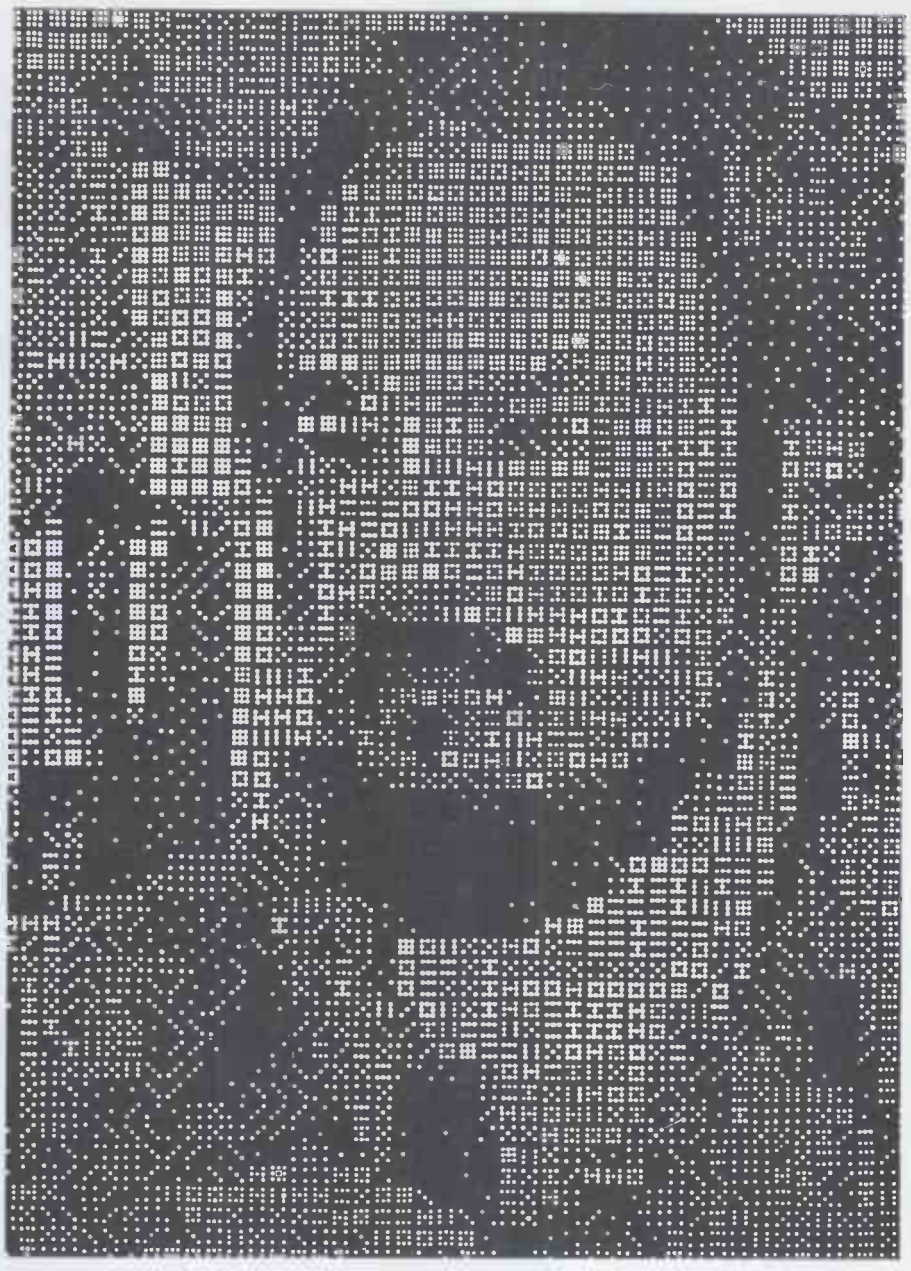
The language that Ken developed in 1970 was Explor, which stands for the basic ingredients of the pictures it produces: Explicit Patterns, Local Operations, and Randomness. It is a set of CALLs to Fortran subroutines. In it Ken corrected what he thought were some of the shortcomings of his earlier languages. I will just mention one important new feature: the local operations. As before, Explor acts on an array of cells, each one of which has a value. How this value is interpreted depends on the output medium, but usually it will represent grey levels, perhaps realised by using characters of different densities. But they could also be used to represent different colours.

In this context, the value of a cell can be affected by the values of its eight immediate neighbours, using the local operations. Each neighbour can vote for a change to the cell being processed and the votes can be weighted by numbers given in the program. This is like a powerful generalisation of Conway's famous game of Life. An enormously rich variety of effects can be obtained with these processes. A portrait, for example, which has been digitised and input can be blurred out of focus, have its contrast enhanced, or be transformed into an abstract pattern such as stripes or a checker-board.

In 1975 Ken produced Mini-Explor to run on the small machines of those days. I would like to see a version for today's micros.

Stills cannot do justice to these animation effects. Beflix can also be used for single graphics, and Figure 1 is one of the most striking of these. The text is abridged from the UN Declaration of Human Rights, and the original photograph is by Richard Swanson. From a distance it is clearly a portrait and equally clearly it is text when viewed closely. In between, our perception is torn between the two interpretations. As well as being very clever, I am sure that it is an important work of art, stemming from Ken's deeply held convictions. He was one of those Americans strong enough to stand out against military service in Vietnam, a fact which is still affecting his life and career.

Now for Ken's most recent work: Figure 2 is an example. Unlike all his earlier work that I have seen, it is not computer output, although it was designed with the aid of a computer. It is very heavy, as I found when I visited Ken recently and helped to move it into place for display. Some people



see right away what it is, but even confronted with the original, others take some time to realise that it is constructed with dominoes. This array of 44x60 cells is made up from 24 complete sets of dominoes from double-0 to double-9 — 55 dominoes in a set.

Think for a few minutes how you would go about arranging one or more sets of dominoes to form a predetermined picture. Were the elements single cells, like the faces of dice, the problem would not be so horrendous. But they are linked together in pairs and there is a fixed quantity of each kind, depending on how many sets are used. If there are large blank areas in the picture, you may simply not have enough doubles to fill them. Equally, you may have far too many high-contrast tiles, such as 0-9, for the sudden changes of contrast in the picture. But this coupling of tiles must be taken into account from the beginning — it is no use assigning single half-dominoes to cells and hoping for the best. It is also vital to take into account the possible ways there are of arranging these two-cell tiles in an area. There is no point in almost filling a corner, say, and then finding that there is a single isolated cell into which a domino will not fit.

I have not fully understood Ken's method, but in part it goes like this: first choose your picture, one with about the right mixture of high, medium and low contrasts. Start the process of filling with the extreme valued dominoes: a complete set can be arranged in order in the form of a right angled triangle with 0-0 in the lower left, 9-9 in the upper right, and 0-9 at the right angle in the lower right. Start trying to assign the tiles from the corners of this triangle. The reason for this appears to be that these are the most characteristic parts of the picture, of highest and lowest contrast, and there is more error to the eye in substituting, say, 8-9 for 9-9 than there is replacing 4-5 for 5-5. Also, the extreme values have fewer alternative values nearby.

As the picture builds up, the critical part of the process comes: getting the best near-solution when an exact fit is no longer possible. First rearranging the existing dominoes can be tried to free one that is needed. If this does not work, then nearly the right domino must be used. Problem: when the picture is almost complete, how far back do you go taking it apart to get a possible small improvement?

Well, Ken has a program that does it and the proof is here for all to see.

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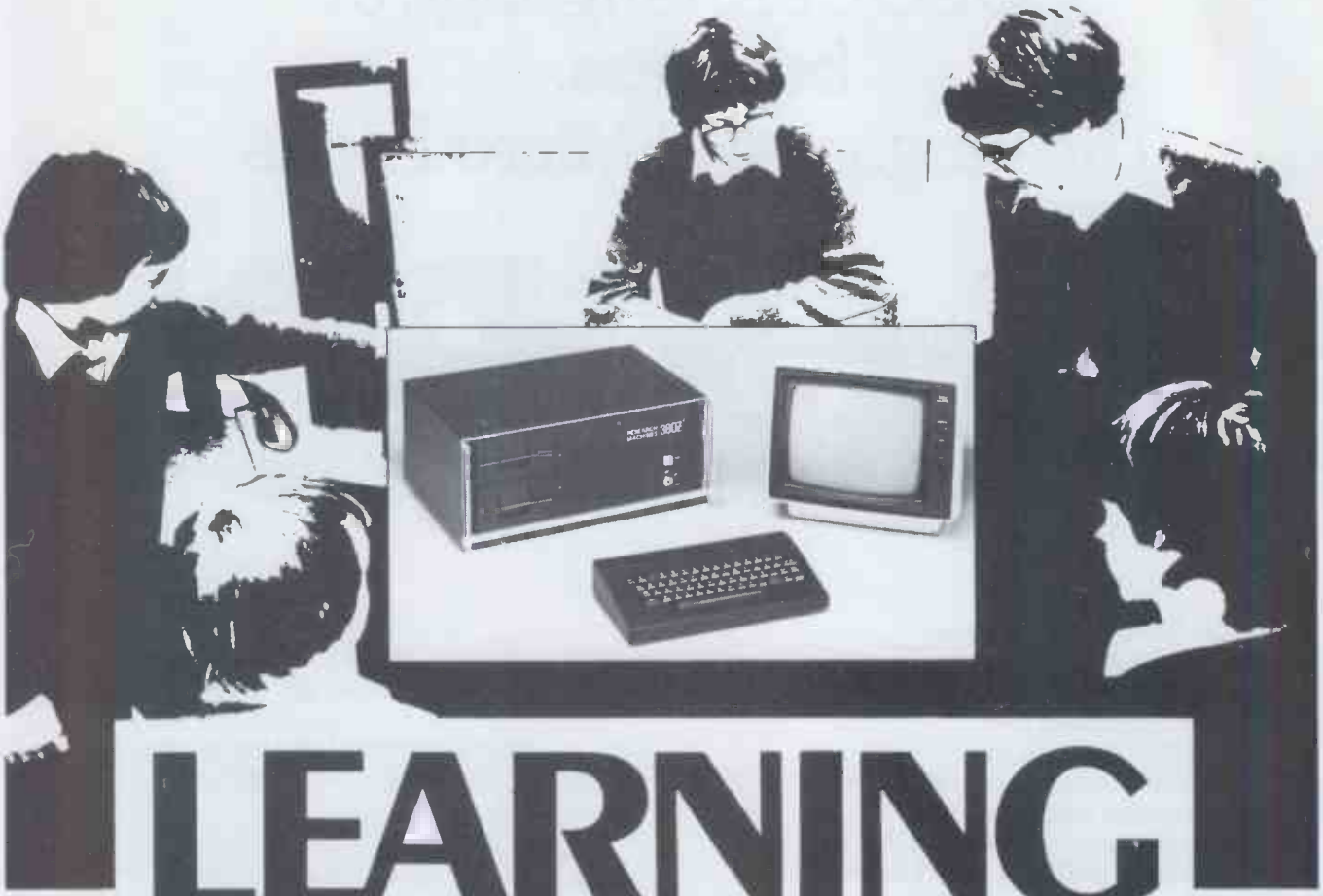

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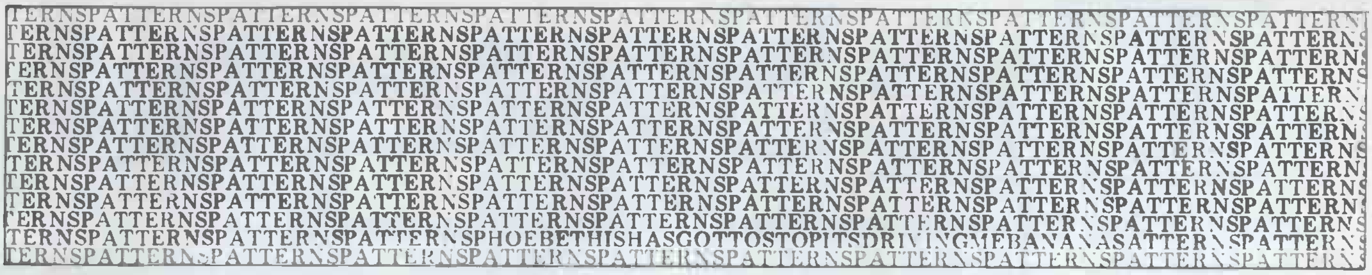


Now he is busy composing other pictures with it and an exhibition is planned in New York sometime in 1982. He did a 'sketch' for the big portrait here using just two sets of dominoes. As the long winter evenings are upon us, why not give yourself a box or two of dominoes for Christmas and see what you can do by hand?

I am afraid that it has not been possible to do justice to the rich variety of Ken's work in this short article. No-one has done more for and with computers in the arts; no-one better deserves the title, Master of Patterns.

Next month, I will deal with a problem about dominoes that arose from talking to Ken. How many ways are there of filling a given rectangle with dominoes — face down — so that all the tiles are equivalent? I have got some answers to this. The next problem is: how many ways are there with the dominoes face up, so that they are all distinct? A report next month — in the meantime, you may like to work on it yourself.

Competition

In the August issue of *PCW* I set a competition for most interesting output from a program of fewer than ten lines. I am awarding the prize of a year's subscription to *PCW* to Billy Burey of Tooting, London, for his program to animate a sine wave. It is simple and effective, and the only entry to attempt animation. It is also in more-or-less standard Basic and should run on almost any machine. The effect does depend on the speed of the processor, and it works well on my DAI. It could be speeded up by computing one cycle of the sine function and storing it in an array before the animation loop. This could still be got into nine statements, by omitting the heading and delay in lines 3 to 5.

The effect of the animation can be seen in two quite different ways: as a sine wave moving up the screen, or as one oscillating back and forth across the screen. The eye/brain can flip from one to the other as in an optical illusion. Every program can be improved, of course, and one useful change is to make the wave oscillate with increasing amplitude. This can be done by changing the expression in line 60 to: INT (25+S*SIN(S)/5). The constants in this may need to be adjusted depending on the number of characters allowed per line on the screen: decrease the 25 and increase the 5 if the display goes off the screen.

An attractive variety of programs were submitted and I have enjoyed running all of them. Several entries used POKE and other machine dependent features. This did not disqualify them, or anything like it, but where the other factors appeared to be in balance, this counted as a small minus. My only disappointment was that all the entries produced graphics: no-one attempted poetry or text of any kind.

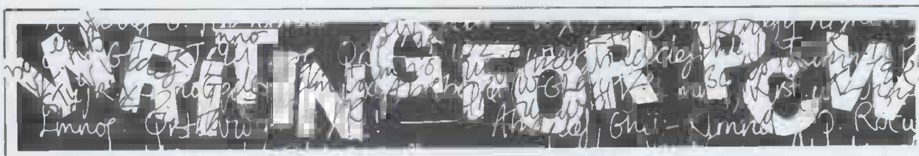
There were two programs to plot Lissajous' figures, 'the locus of two simple harmonic motions acting at right angles to one another'. It is well worth reproducing the slightly more flexible of these, by David Harrison, of Bury, Lancashire. David got more computing into his 9 than anyone else. His own commentary on the program is as follows.

This program draws Lissajous' figures on a high resolution screen. As my Superboard's graphics board is home-made, I have replaced the rather weird plotting instructions with 'PLOT (X,Y)'. Replace this with the appropriate instruction for your own machine. The four items of data are, in order:
(1) The horizontal resolution;
(2) The vertical resolution;
(3) The plotting density variable. The smaller this is, the more dots are plotted. I found that 0.02 gives a reasonable density with acceptable speed;
(4) The factor determining the shape of the figure. Some other values to try are 1.1, 1.3, 2 and 4 (pi is good, too, and DI can be altered in line 3, for variety.

The program works by drawing the figure until the origin has been plotted three times — firstly, straight off, secondly, after half the figure has been drawn and, finally, after the whole figure has been plotted once. Line 4 checks to see if the point being plotted is, or very nearly is, the origin. If you use a higher plotting density than 0.02 or significantly lower resolution graphics, then you will have to alter the '2.5' in line 4 to a lower figure, so that the program does not think the origin is being plotted when it is not.

```
Animated Sine by Billy Burey:
1 PRINT "[CLEAR SCREEN]"
2 A$=".—+**+—:."
3 PRINT " SINE WAVE"
4 FOR R=1 TO 500
5 NEXT R
6 FOR S=1 TO 100 STEP 0.25
7 A=INT(13+10*SIN(S))
8 PRINT TAB (A);A$
9 NEXT S
```

```
Lissajous' Figures by David Harrison:
1 READ H,V, ST, DI
2 X=SIN(T)*H/2+H/2
3 Y=SIN(T*DI)*V/2+V/2
4 IF ABS(X-H/2)+ABS(Y-V/2) < 2.5 THEN CY=CY+1
5 IF CY=3 THEN END
6 PLOT(X,Y)
7 T=T+ST
8 GOTO 2
9 DATA 255, 191, 0.02, 1.2
```



PCW welcomes approaches from would-be writers, even those who may never have appeared in print before. In this game it is often those with practical experience who have important things to say so we don't mind too much if their prose is less than perfect. Providing that submissions have a sensible structure and follow a logical sequence, we can take care of the polishing. Here are some tips:

If the article is already written, simply send it in, making sure that your name, address and 'phone number appear on both the article and the covering letter. If you have submitted the same work to other magazines you should tell us — it would be embarrassing (to say the least) if the same article appeared in more than one.

If you have an idea for an article or a series, write us a letter outlining your ideas. A one or two page synopsis giving the proposed structure, sequence and content will give us a sound basis for discussion. Please give us a daytime 'phone number if possible.

If you have nothing specific in mind but feel qualified to conduct case studies, Benchtests or whatever then drop us a line saying what you'd like to do and why you think you're qualified to do it. We're not particularly looking for strings of academic qualifications — experience carries just as much weight.

Dick Pountain is always on the look-out for interesting calculator features and we wouldn't mind seeing one or two readers getting on their soapboxes but remember: even articles such as this need a structure.

Reading *PCW* will give you a good idea of the style we prefer. You may notice that we try to avoid pomposity at one extreme and flippancy at the other (except in 'Chip Chat', that is).

Finally, have a look through back issue indexes and try not to re-invent any wheels. Oh, we almost forgot — *PCW* does pay for all published work.

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BOOKFARE

Malcolm Peltu looks at the latest micro literature

Pure Pascal, earthy Basic

Two contrasting books provide this month's dialectic signposts to some traditional computing debates. In the academic, pro-Pascal, pro-programming purity, British corner is *Principles of Programming Languages* by R D Tennent. On the other side is the bouncingly pragmatic, brutishly Basic, get-your-hands-dirtily commercial, infuriatingly appealing American contender, *Executive Computing — How To Get It Done On Your Own* by John M Nevison.

Of course, these books are not directly comparable as they are aimed at very different markets. Tennent says his book is a 'systematic exposition of the fundamental concepts and general principles underlying programming languages in current use. It may be used as a text for courses in computing science and software engineering programs, and as a reference by advanced programmers, programming theorists, and programming language implementers, describers and designers.' Nevison says his *Executive Computing* is 'for the business person who wants to get work done with the help of a computer — from the busy executive who owns a microcomputer to the business student who needs a practical way to apply quantitative methods.' Nevison uses nothing but Basic; Tennent does not mention Basic, but concentrates mainly on Pascal, with liberal sprinklings of Algol, Lisp and Snobol.

I have linked the books together, however, because they are good examples of some arguments I have covered in previous 'Bookfares'. Tennent shows why programming purists prefer Pascal and Nevison illustrates why Basic is so beloved of pragmatic programmers. There is also the common thread of what makes a well-designed, well-written program. Tennent provides a surprisingly lucid and readable book, given the complexities of his subject and his avowed intention of aiming at an academic rather than a populist readership. He has identified all the main aspects of programming languages where there are common underlying principles between most languages, even when there are surface differences.

These include language syntax, data structures, storage assignment, control methods, parameter and subroutine handling and program structure. He discusses each aspect in general using Pascal for examples, then frequently provides examples in other languages to extend and illustrate the principles involved.

From a practical point of view it has two major failures. Firstly, it does not even refer to Basic. The book would appeal to a larger audience if it at least said which principles Basic followed or where it went wrong. Basic is such a popular language, even among Tennent's target audience, that missing it out makes the book seem too abstracted from the real world. The other, related fault is that it does not attempt to evaluate how the principles could be applied in trying to evaluate different languages.

The arguments that rumble on about Basic v Cobol v Pascal, etc, are often conducted from the prejudiced viewpoint of the participants' personal experiences. Most programmers tend to favour the languages they first learnt. Tennent's book illustrates, however, that there is a strong and objective body of work into programming principles which are tools to help resolve the arguments. Tennent offers a superb description of programming principles but does not show the practical significance of the different ways language designers have interpreted these concepts.

Incidentally, on the vexed question of the use of GOTOs, which some advocates of structured programming would like to ban, Tennent is a Wet. He says that GOTOs are not intrinsically harmful. What is more important, he says, is the ways the GOTO label is handled. If the label is unambiguous and its destination does not move too far out of the immediate vicinity of the code, then, he says, GOTOs could be allowable. Of course, one of the criticisms of Basic has been that it does not promote good structured programming and allows GOTOs to run out of control.

Although Nevison's book is generally heavily biased towards practice rather than theory, he provides some basic rules of thumb on good style and structure in Basic: always point IF . . THEN . . ELSE statements down the page; use a FOR-NEXT pair wherever possible; use GOTO only in IF. . THEN . . ELSE structures; no piece of finished code should exceed one page in length; and indent consistently. These principles in a nutshell are typical of the American approach to computing (and to life in general). Wrap everything up in glossy capsules. Assume nobody has a concentration time longer than the gap between commercials on US TV. Do everything with pzazz, zest, zing and zealousness for getting on with it. Wang, Bang, yer coding's done M'am!

Of course, it is this approach which gave explosive birth to the whole personal computing scene and many other American inventions. It is an approach which, to jaded European eyes, seems refreshingly knock-out at first sight but which increasingly irritates because it becomes a monotonous high-speed hype which tends to commercialise, trivialise and Americanise many important subjects. Nevison's book has the best and worst of this approach. It starts out seeming to be extremely readable, although he encompasses a wide range of complex topics, such as linear programming, decision analysis and project management, as well as bread and butter business computing tasks.

It is written in the form (almost) of a novel. The action takes place in a company with various division called Bear, Worlf, etc, and with executives who keep coming into the scene. The programming examples are intermixed with dialogues between the executives who are faced with a problem, chat it over, then write a program.

Besides expecting a degree of computer literacy among managers that is unrealistic in Britain, this technique quickly palls. When he comes to explaining some of the more technical methods, like linear programming, Nevison is forced into the conversational mode by sending executives on a training course and the description is then put in the words of the instructor.

Nevison is also four-square in the American tradition of teaching through doing. He jumps feet-first into coding and then explains the principles involved. Of course, this is the main advantage/disadvantage of Basic. It provides a simple way of writing programs without much thought or previous training. The hope is then that people can develop a theoretical understanding out of their practical achievement. This can be an effective approach in many circumstances but, once again, I find it irritating and ultimately superficial when ladled out in an unrelenting torrent.

Having let off that bit of anti-American steam, would I recommend the book to anyone? Yes. Despite its title, I would not generally recommend it to managers because it expects a higher level of programming expertise than most business managers might have. It also assumed that managers have probably been on some form of business management course which, again, I think is more applicable in America than this side of the Atlantic. But I do think it is a very useful book for programmers (amateur or professional) who want to learn how to code up business techniques.

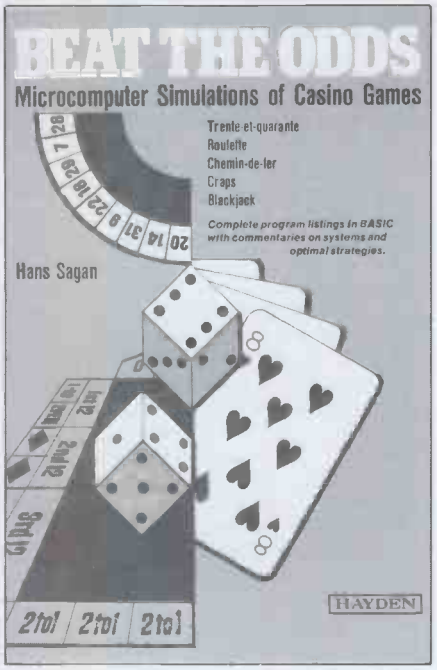
If it were not for the sylistic straightjacket of putting the text in dialogue form, I would unreservedly recommend, particularly, the sections on linear programming, decision making and project management (PERT) which explain pragmatically the underlying principles as well as giving coding examples. (All code is in Tandy Level II Basic.)

Between Tennent's academic purity and Nevison's pragmatic hype, a middle road does exist. A synthesis of serious theoretical study and concern, combined with a realistic, well-packaged application to practical problems. That, after all, is one of the objectives of Pascal, which is why it is a language that appeals both to theorists and practical programmers.

I hope that more books will be published, though, which try to bridge the gap, between the approaches typified by Tennent and Nevison.

Micro casino

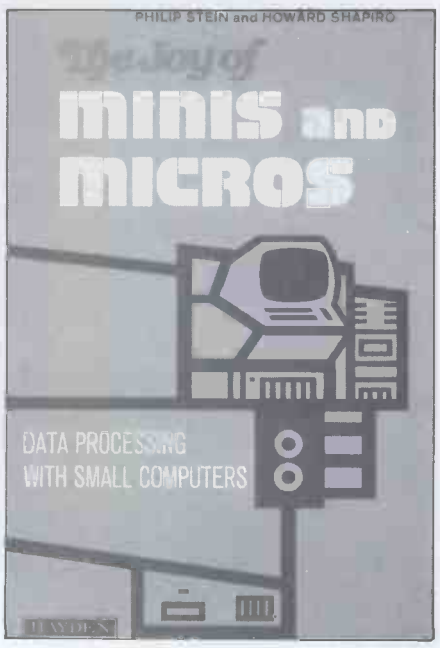
Like a government health warning on cigarettes, *Beat The Odds* by Hans Sagan states: 'It is not the purpose of this volume to promote gambling or to entice anybody who has not succumbed already. To be sure, gambling is



immoral . . . and you can't win in the long run anyway.'

Despite being immoral and a long-term waste of money, Sagan feels that gambling is interesting enough to provide a fix for addicts of gambling and computing. The book focuses on five casino games: trente-et-quarante, roulette, chemin-de-fer, craps and black-jack. For each game he explains the general rules and shows how to write a Basic program to simulate it (written in HP 2000 Basic). In the course of this he describes some 'utility routines' that could be used in other games, like how to 'shuffle a pack' of computer-ised cards.

An interesting, well-written book, if you have succumbed to gambling immorality.



Micro joys

The Joy of Sex is an erotic best seller. Here now is *The Joy of Minis and Micros* by Phil Stein and Howard Shapiro. It may not be erotic but it is a lively, practical guide for newcomers to computing. Its most remarkable quality is that it is based on articles in the American magazine *Computer Decisions* which were first written in 1973 yet are still relevant today.

In the forward, Hesh Wiener, one of America's leading computer journalists and former editor of *Computer Decisions*, provides an apt description of the book. He writes: 'This book is written with clarity and wit. The authors take computers too seriously to take them seriously all the time. You will find the clever phrase or unexpected pun serves you well, helping you to understand and retain the fundamental principles of acquiring and using small computers.'

The book consists of over 50 brief 'articles' combined into eight chapters. Topics covered include: So You Need a Mini — or Do You?; What are minis and micros?; How to pick the right computer; The great Basic-Pascal debate; The Forth dimension; The horrors of the RS232 interface; Writing and good computer games; Computers in medicine; Word processing; . . . . and a varied and satisfying brew.

This is one of the best practical introduction to small computers. It will make the first-time user agree with Wiener that buying a computer 'really is nothing to worry about if you apply your common sense and somebody else's experience to problems that are solved by people just like you thousands of times a year.'

A life of leisure?

Britain's major political parties are failing to face the facts of unemployment. Left and right still talk about plans to move once again towards full employment. Yet many objective analyses have shown, including the book *The Collapse of Work* by Clive Jenkins and Barrie Sherman, that the impact of microelectronics is likely to be that growth in the future may happen without a significant increase in the number of jobs available. 'Improvement in productivity' can be another way of saying producing more goods with the same or fewer people.

Despite Jenkins's charismatic reputation and powerful position as General Secretary of white collar union ASTMS, the Jenkins/Sherman thesis has received little public support within the TUC or Labour Party. In fact, they have been criticised by many trade unionists as being too soft in talking about the Leisure Society.

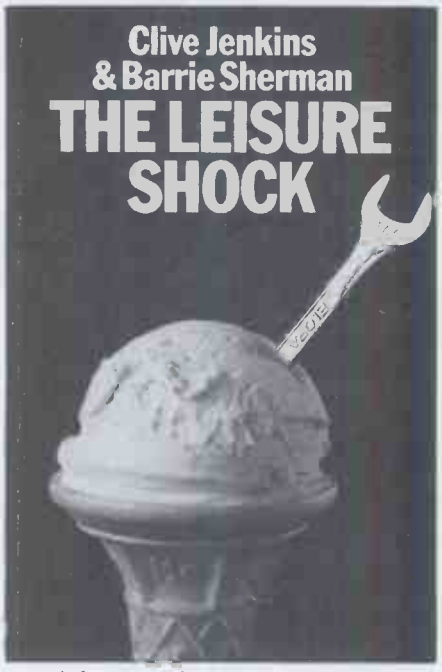
Jenkins and Sherman have returned to the attack with a new book, *The Leisure Shock*. It provides a clearly thought-out and clearly expressed blue-print for a way in which policies could be established which will take account of the likelihood that 'work', as it is currently conceived, will be permanently reduced.

For anyone who has followed the arguments about the likely impact of information technology on employment (I have frequently reviewed books on this subject), Sherman and Jenkins do not have a lot new to say in terms of analysis. It's the prescriptions for the future that are most interesting.

Of course, any forecasts about the future must be regarded with scepticism. It is true, however, that those who argued a few years ago that unemployment was likely to reach three million and more have been proved right. There are also demographic factors (the current 'bulge' of school leavers, for example) which indicate that more jobs have to be created to keep unemployment steady because the size of the workforce is expanding.

It is also clear that many firms are implementing new technology to cut back on staff and that the new technology will allow more goods to be produced and more services to be provided using fewer staff than before. At the same time, economic growth is stagnant around the world and falling in Britain.

In these circumstances, Sherman and Jenkins argue that the trade unions should take a lead in campaigning for measures that would ensure the 'leisure shock' is a 'managed shock'. These measures include: use wealth from pension funds, insurance companies, building societies, etc, to set up a Public Investment Bank to stimulate investment in high technology industries to ensure Britain gets a share of what-



ever jobs are going; use computer-assisted learning, the Open University and other techniques to extend education into a flexible life-time opportunity; improve the 'caring' services to the old, sick, disabled, young, etc; stimulate more local craft-based and cooperative companies; invest in sports, recreational and arts resources to encourage involvement from the whole community; use video, cable TV and other techniques to have greater local participation in the media; and create a new government department (or co-ordinating unit) to manage the provision of leisure facilities.

The aim, say Sherman and Jenkins, is to 'grasp the *opportunity* of less work to have a more rewarding and enjoyable life'. Their plan, however, is based on what they recognise is an optimistic assumption that economic growth will

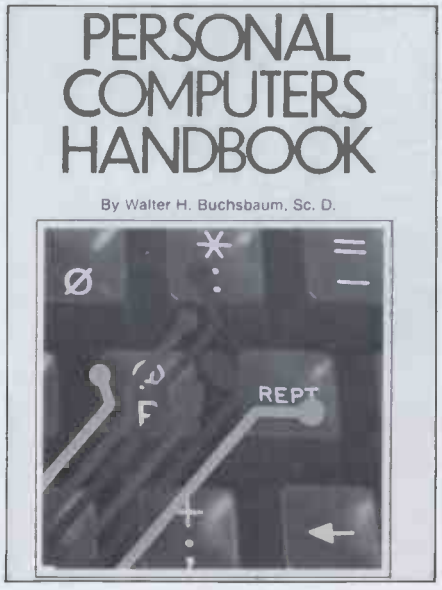
BOOKFARE

resume and that Britain's adoption of new technology will help to gain a chunk of that growth, which would help to pay for these plans.

I hope the book gets as wide a readership as possible. Whatever one's view of the validity of their case, it is a subject too important to be excluded from public debate. Even if their analysis and recipe is only partially correct, most current political argument and policy making is based on the false premise that full employment (or near-full employment) is possible.

The book also rectifies the mistaken and prejudiced image often created that trade unionists are all unthinking, die-hard state-addicts.

Sherman and Jenkins write intelligently and argue their case with clarity and passion. They also stress their desire to avoid setting up a corporate state mechanism which tries to control the whole country through a central plan. Sherman and Jenkins want a great deal of local control over local policies; a pluralistic society with a desire to experiment and take risks in an environment that is based on community care and individual pride. They do not want people to be thrown into despair because they are unemployed in a society where work may be scarce but the opportunities for individual and community enrichment are abundant.



A hard intro

'This book deals with all the practical aspects of personal computers,' says the puff for *Personal Computers Handbook* by Walter H Buchsbaum. But although it does touch on the topics you would expect, there is such a heavy bias towards hardware and electronics aspects that it cannot be regarded as a balanced introduction to the subject.

Like other American books of this ilk, it also has the major fault of giving only US examples of personal computers (and out-of-date ones at that.) No Sinclair, Atom, Research Machines, etc.

If you want to learn about the logic gate innards of memory, I/O, peripherals, etc, the descriptions are straightforward, detailed and reasonably clear. Chapter headings include: How a computer computes; Microprocessors; How information can be stored; Memory for your computer; I/O functions; Peripherals — the outside world, Principles of Programming (mainly Basic); Troubleshooting hardware and software.

This week's Bookfare included:
Principles of Programming Languages by R D Tennent (Prentice-Hall International, £12.95)
Executive Computing — How to get it done on your own by John M Nevison (Addison-Wesley, £3.95)
The Leisure Shock by Clive Jenkins and Barrie Sherman, (Eyre Methuen, £4.50 paperback, £8.95 hardback)
The Joy of Minis and Micros by Philip Stein and Howard Shapiro (Hayden £8.55).
Beat the Odds — Microcomputer Simulations of Casino games by Hans Sagan (Hayden, £6.80).
Personal Computer Handbook by Walter H Buchsbaum (Howard W Sams, £8.35).

COMMONS REPORT

Ian Lloyd MP brings the latest of his occasional reports from Westminster.

Electronic democracy

The Parliamentary year, which formally began on 4 November, overlaps 1982, now designated as 'information Technology Year. The Government has given both its blessing and fairly considerable resources to this programme and I would be surprised if the whole enterprise didn't enjoy virtually unanimous support on all sides of the House. In the space of about two years, at most, information technology has moved on to a high level of prominence at Westminster and is probably in that innocent phase before its importance, sadly if inevitably, creates the usual spectrum of political judgement, allegiance and controversy.

Our own Information Technology Committee, an all-party organisation now know as PITCOM, will make its contribution by organising a series of meetings, visits, seminars and exhibitions. At the first, on 16 November, there is to be a live demonstration of the use of microcomputers in education, a subject of general interest to most Members because of their growing awareness of the current importance of computer literacy in schools. PITCOM will also be making a presentation to the House's official Computer Sub-Committee (a sub-committee of the Services Committee) on the impact of information technology on the Legislature. Westminster has made limited progress in this field and the purpose of this presentation is to suggest new horizons and a new pace. I have argued elsewhere that if the House wishes to exhort the country to move with the times it must embrace relevant information technology with somewhat more enthusiasm and imagination than it has demonstrated so far.

It is in this context that I have chosen the title of this article. I came across the phrase in a set of brochures which have just reached me on the impact of a cable television device known as QUBE, which has been attached to a significant sample (8000) of domestic television sets in Columbus, Ohio, with fairly dramatic results. It has been said that it: '. . .will revolutionise the relationship between Americans and the electronic tube. . .'; '. . . is the nation's first two-way television system . . .'; '. . . is going to put Harris and Gallup in the 19th Century. . .'; '. . . is our (an editor's) nomination for the decade's most significant event. . .'; '. . .Is. . . an instant, electronic, show of hands.' The last comment may explain why the company which has developed QUBE, Warner Amex, is considered to have stolen the show at a technology fair organised by the House Telecommunication Sub-Committee in the Rayburn Building in Washington in March. This was designed to 'expose members of Congress to the remarkable advances in the communication industries' and prompted the sub-committee's Chairman, Congressman Wirth, to say that his committee's main task was to examine and eliminate the three barriers to telecommunications technology — legislative, regulatory and marketplace concentration. If PITCOM can perform the same function at Westminster (and persuade our MEPs to do likewise in Brussels) we shall have performed a useful role.

But why is QUBE at the centre of this political excitement? The answer, I think, derives from the simple awe-inspiring fact that it is a device which gives its possessor the ability to answer back at television. It is the first practical alternative to throwing a teapot at the screen when whoever happens to be the political *bete-noire* of the day occupies it to mouth the platitudes of the day. It is, of course, an adjunct of cable television and it is the cable, coupled presumably with Prestel-type technology, which enables the viewer to express his approval or disapproval, without employing a telephone line for the purpose.

QUBE has already been used in Columbus, Ohio to invite the audience to suggest, while the game is live, what tactics the full-back should employ. The community's judgement was flashed on the screen within seconds. It has been used to obtain an immediate reaction to speeches by the

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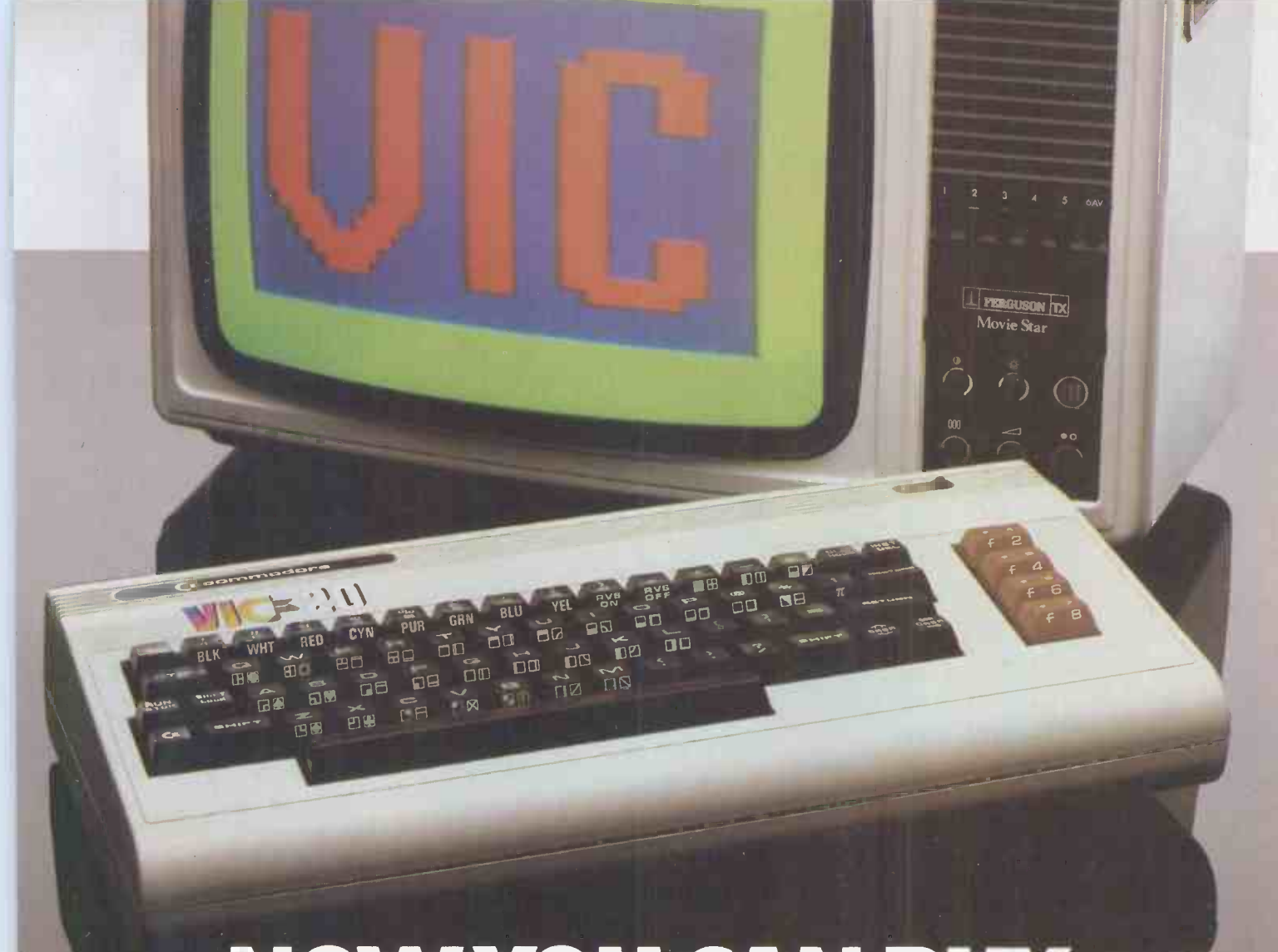

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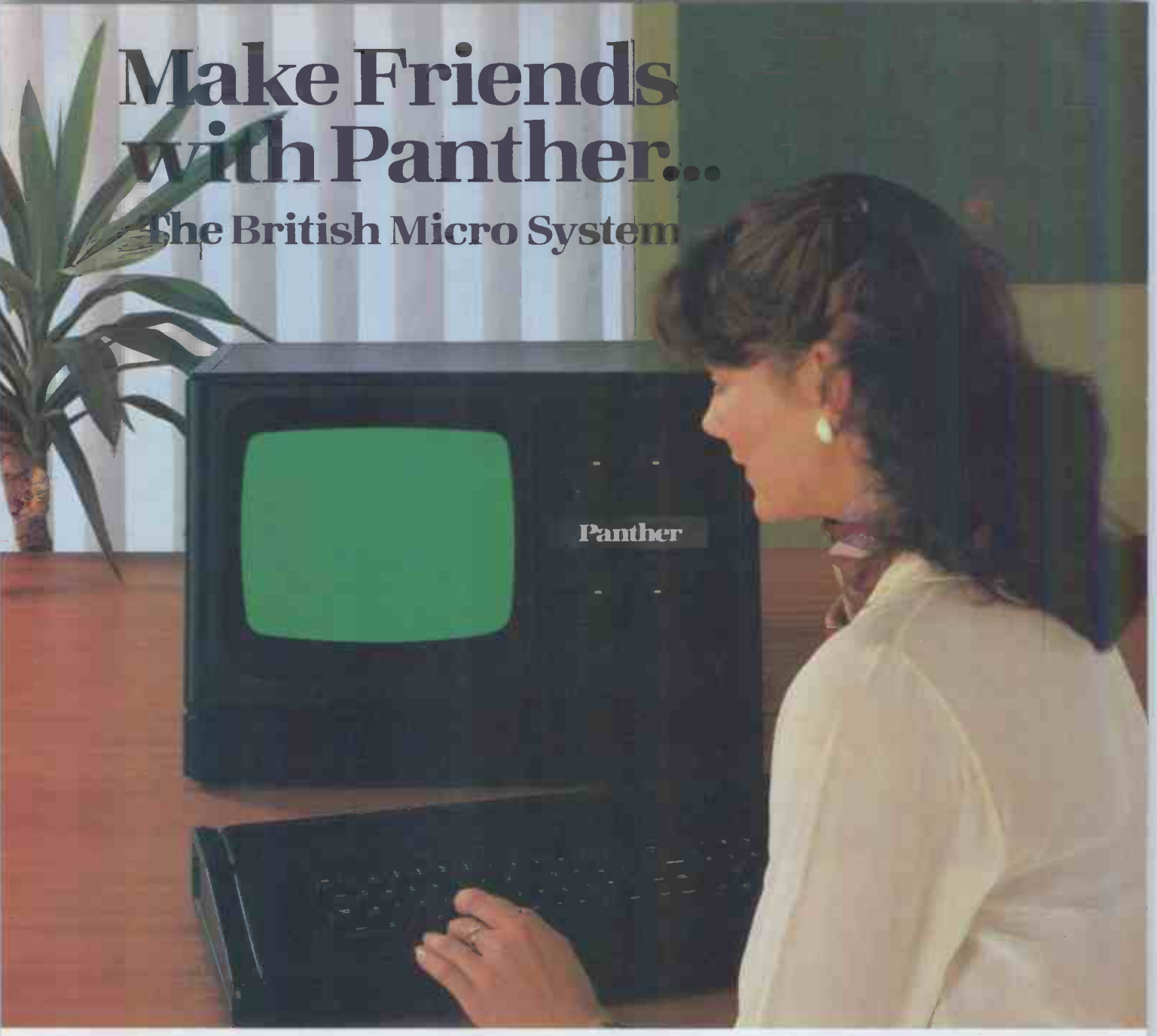

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AUNTIE'S MICRO

In a couple of months' time, the BBC will transmit a series of TV programmes aimed at increasing the public's awareness of computers. To accompany this major computer literacy push, the BBC commissioned a microcomputer and promptly found itself deep in controversy. In this special feature, we look at the back ground to the whole BBC project, examine the machine itself and describe the main language which will be available on it: BBC Basic.

In some ways it's a miracle that the BBC Microcomputer Project has got as far as it has. The following insight, although written from the periphery of the whole thing, will explain why.

Sometime in early 1980, a group of production people at BBC-TV Further Education in Ealing Broadway conceived the idea of a series of programmes to follow up the 'Silicon Factor' series which was just about to be broadcast. Two people seemed instrumental in this — John Radcliffe, Executive Producer and David Allen, Producer. The idea was toted around various BBC and government departments and various educational groups, like the National Extension College. Support for the idea was forthcoming from most areas. In some ways this was unfortunate, as the inevitable inter-departmental wrangling began to take place. BBC Engineering was given the task of seeing whether an objective specification for a microcomputer could be drawn up, so that any programmes would be applicable to most users.

BBC Publications decided to get a book written and BBC Education in Leeds, dealing with schools and colleges liaison, was asked to see how its expertise could be used to get some form of 'referral' service going.

Various other groups now got in on the act, from MUSE — a group of computer-using educators — to the Department of Industry. And so did BBC Enterprises which saw the opportunity to make some money by selling a machine to go with the series. In some ways this latter decision has caused more problems than anything else — it has certainly distracted public attention away from the programme makers to the system marketing — and surely the programmes are the most important aspect? Once the decision to sell a system had been taken, it began to dominate the whole scene. What language to use — Basic, Comal, Pascal; what processor should it be based upon — Z80, 6502, even a 16-bit; what amount of support is necessary — none at all, or a dealer network; what do we do about Prestel, Ceefax, Telesoftware? These questions seemed to take up most of the time, leaving the programme makers at a loose end until the decision had been made.

Eventually, under some pressure from the DoI to choose a British system, the powers-that-be settled on the Newbrain, at that time under seemingly endless development by Newbury Laboratories, a subsidiary of the now-defunct NEB. However, it soon became clear that, although this system fitted the so-called objective specification perfectly — some say the machine came first, the spec second! — Newbury was incapable of making it. The programmes, initially scheduled for broadcast in Autumn 1981, were moved back to Spring 1982.

This was good news for those of us working on the book, as the inevitable problems associated with a three-author publication began to raise their ugly head; we each have distinct styles of writing and the book needed some reworking to get it into shape. After the draft had been read and re-read by numerous people, it was essentially rewritten and this time, if it is possible for me to be objective, the result was one of the best introductory books on the market.

By the spring of 1981, the programme makers had come up with a pilot programme that was shown around the country to literally thousands of people. A market research project also showed that just under 20 percent of those who would consider watching the programme would also consider buying a microcomputer if it was about £200. And here was the rub; with Newbury incapable of producing a pre-production prototype, let alone thousands a month, what was going to happen? Well, a pragmatic decision was made: the original specification, calling for a Z80, CP/M-based system, was quietly shelved, and a 6502-based system closely modelled on the successful Acorn Atom was adopted.

There was much press comment about Clive Sinclair's involvement at this time. A ZX81 derivative would indeed have fitted the original specification and Clive had shown that he could produce machines in the quantity needed. Unfortunately, a mixture of misunderstanding, personality conflicts — and even anti-Sinclair feeling at the DoI — meant that this obvious approach was not followed up.

However, Chris Curry and Herman Hauser at Acorn had a development of the Atom, called the Proton, on the stocks and this needed little modification to meet the new specification. The argument then centred around the language to be used. For some reason, which in retrospect looks a bit like good old British muddle-through, an extended Basic very similar to Microsoft 5 (although we mustn't really say that) was chosen and a race was on to produce the interpreter coding, as well as a target of 250 programs, for the launch in November 1981.

At the same time as the Beeb had made its decision on the Proton, the DoI, thinking it would help the situation, decided to make the Proton-based system available to schools at half price — as well as using it for prizes in one of its competitions. This meant that Acorn was now working towards two deadlines imposed by two masters — not a very nice position to be in. The DoI initiative probably delayed the launch by a few months, although it did generate a lot of interest.

All the while the programme makers were reforming their ideas, and a link with the National Extension College (NEC) to provide a home-based 'Teach Yourself BBC Basic' course meant that most of the programming or language development aspects could be kept out of TV programmes. Consequently, the latest outline for the programmes emphasises 'awareness' of a computer's capabilities, more than an attempt to teach programming per se. Any allusion to Basic in the programmes is for illustration more than anything else.

As things will be hotting up by the time this issue hits the streets, what future developments are likely to occur? Another two, or three, series could follow in the next couple of years, looking at particular aspects of computer application. Another development could be the appearance of ROM-sets, or interpreters on disk or tape, that would allow PETs, Apples, etc, to run BBC Basic. However, the most important area could be the development of the referral centres mentioned earlier.

Broadcasting Support Services has many years' experience in working with this type of referral service, having cut its teeth with the very successful Adult Literacy and Numeracy programmes. It has contacted hundreds of computer clubs, colleges and ComputerTowns throughout the country, and is hoping to coordinate local centres spread around the country. These may range from centres having a five-evening walk-in service to those offering once-a-fortnight gatherings. The database built up in this exercise will be invaluable for all sorts of follow-up work, as well as for giving individual viewers a chance to get together with those interested novices like themselves. Some of the centres contacted will also be putting on the NEC training course to coincide with the TV programmes. In some ways this informal network of interested amateurs could do more for computer literacy in the UK than any number of TV programmes, books or mass-produced systems.

In conclusion, we can see that the whole project 'grew like Topsy' and seemed at one stage to begin to devour the original idea. It now seems to be under control and promises to be one of the major influences on computer awareness ever conceived.

Robin Bradbeer

nascom

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It isn't often a journalist can sit down to write about a computer with the certain knowledge that he has never seen a nicer machine. But apart from the fact that you can't buy software in the shops to run on it, you can't get a nicer micro than the BBC Micro. There, I've said it.

When pre-written programs are available for it, it will be able to play games that will be faster, prettier, and more fun than the new Commodore VIC, and it will be able to run serious business software as well. As a programmable machine, it will be by far the easiest thing to write useful code on.

As an enthusiast's machine, it allows the attachment of add-on bits and pieces. . . no, that's not true, it positively *insists* that you add on bits and pieces. Things like stepper motor controllers, sensor inputs, and all the other aspects of wiring a computer into an office or a house.

As a small system, it can be expanded to a big and powerful one, and as a single system, it can be tied into a network where lots of single ones all talk to each other and share disks and printers.

Enough fanfare; what's inside it?

Inside the BBC Micro is (for £235) 16 kbytes of user memory, 32 kbytes of permanent software, one of the most powerful graphics systems around on a special chip, and something called the Tube, which allows it to 'drive' a second computer. And there is a standard 6502 micro to handle the Basic and operating system.

For an extra £100, you get some analogue inputs, four of them, so that you can plug in four games paddles. And they will be a lot more accurate than any other games paddles, because this machine reads them to 12 binary places, rather than eight — 16 times more precise, in fact. That compares with only one paddle on the Commodore VIC, by the way, or with eight on the Atari 400. For the extra money, you also get another 16 kbytes of memory.

For around another £100, you can buy a little box which picks up the BBC's Ceefax text broadcasts (and, presumably, ITV's Oracle) and which can load software if the BBC puts software on some of its Ceefax pages. Within six months, you will be able to buy a dual disk unit for well under £500, including interface and operating system, a network connection for £47 and an add-on Z80-based processor, probably for under £300 — but that's a guess.

The bog standard BBC Micro will display its data, like the VIC and Atari and several other machines, on a standard British colour television. It will store its data on an ordinary audio cassette.

It can talk to other BBC Micros down its audio cassette interface and, with a little work, it will be able to load programs and data produced by other machines such as the Tandy. In many cases, it will run them, too.

The heart of the machine is that 32k bytes of ROM, with Basic and other routines in it, including a powerful machine-code assembler. The Basic will accept most programs written for popular micros that use Microsoft Basic but it has few of the limitations of normal 8k Microsoft Basic and it allows some features of what professional programmers call structured programming.

For instance, there are procedures which can be performed, there is a REPEAT . . . . UNTIL instruction, and several others which make a program easier to understand when you're trying to fix it. And the variables can be any number of characters long, not just two. Other new features, which aren't available on other Basics, include the fascinating ability to EVALuate an input string — as in INPUT A$; EVAL A$ — and A$ can be a user input formula such as Y=X^2—3X+6.

Running somebody else's Basic, however, involves more than obeying the same commands. There is also the question of how many characters there are on the screen; on the BBC machine the answer is, take your pick.

The BBC machine has *eight* graphics modes. Mode 0 gives 32 lines of 80 characters text or 840x256 resolution graphics in two colours. Mode 1 gives 40x32 text or 320x256 graphics in four colours and Mode 2 gives 20x32 text with 160x256 graphics in 16 colours. The snag with these three modes is that they each take up 20k of RAM, leaving just 12k for your program on a fully-expanded system. The other modes, with their memory requirements, are: Mode 3: 80x25 text in two colours (16k); Mode 4: 40x32 text, 320x256 graphics, two colours (10k); Mode 5: 20x32 text, 160x256 graphics, four colours (10k); Mode 6: 40x25 text, two colours (8k); and Mode 7: 40x25 teletext compatible (1k). At power-on, the machine is automatically in Mode 7.

The screen can look like just about any other well-known micro on the market. It can have (in Mode 4, for instance) most of the characteristics of the Apple II. Or it can have something incredibly like the VIC, in mode 5, even to the full fat characters, and only 20 across the screen, too. Or it can display characters exactly like those used on Prestel or Ceefax sets. You pick the mode you want out of eight options, and you use the PRINT instructions from the software you want, and it should make the screen look right — as long as you go to the bother of programming the right graphics characters.

Programming special characters (except in Prestel mode) is another option. This means that not only can the PET graphics characters be reproduced, but also special characters of your own. Two or more of these special characters can be joined together, next to or on top of each other, to make a new, larger character — and this can be moved around the screen as a unit.

Particularly fascinating is the ability to move one of these special characters — one looking like a cowboy, for instance — along the screen, automatically watching it go behind things in the foreground, and in front of things on the background.

All these clever colour graphics are handled by a special chip, built for Acorn by Ferranti. It is the same type of uncommitted logic array (ULA) chip used in Sinclair's ZX81, to replace a dozen or so logic chips. Here it performs totally different functions because it is committed in a different way. And there is another ULA on the board, to perform the function of serial communications — normally, driving the tape cassette interface, but also providing the standard computer input and output plug known as RS232. In fact, this one is RS423, which is better; it will drive a wire 4000ft long rather than only 50 feet and it is cleverer at changing the transmission speeds. But it will pretend to be an ordinary RS232 if you like.

The graphics are truly incredible. The full resolution of which the BBC machine is capable won't show on an ordinary television set — the lines are too fine for the TV tuner to pick up; you would need a special colour monitor, which Acorn hopes to sell at £150. Even at the lower levels of detail, the plotting and drawing options are incredible — there are 90-odd such options — allowing you to draw lines, circles, and other shapes.

To illustrate just one, there is the 'fill' option which draws blocks of colour. After the programmer has specified two points on the graphics screen, PLOT 85 (the 85th option) and two more co-ordinates, x and y, will cause the machine to draw a triangle from the first two as the base line, to the third. Specify another co-ordinate, and a second triangle, using the side of the first as base, turns your triangle into a quadrilateral, or folds back on

The BBC computer neé Proton

itself. And this plot can be in any colour. It can also be a colour 'logically' combined with the background over which the triangle is drawn — OR, exclusive "OR" or "AND" with the background colour code.

It isn't necessary to use the screen for text only, or for pictures only. It's possible to set apart any bit of the screen as a 'window' where either will appear and this allows, for instance, the well-known Apple trick of having several lines of text at the bottom of the screen and a picture above, with the text scrolling only in those lines. The difference is, of course, that the BBC Micro can have five lines. Or it can have the whole left side of the screen, or a bit at the top and a bit at the bottom, or anywhere. Full word-wrap scrolling is handled inside each text window. And one can label diagrams with text, too.

Most of these features are fully detailed in the BBC's leaflet on the system and so this is a selection of things that appeal. But possibly the most important thing about the system is its strong encouragement to the owner to write machine code programs. Machine code is difficult, usually, mainly because there are so few really friendly software tools for producing it. On the BBC Micro, the tools are more friendly than most Basic software tools.

For example, the system has that very nice Acorn Atom feature of allowing you to write in assembler mnemonics behind square brackets, and of editing them in exactly the same way you edit Basic. That is, if you leave out a line between lines 50 and 60, you just type in line 55, and the missing instruction is automatically inserted between them.

If you need some arithmetic done, you can load the accumulator with the result of a calculation done with Basic — that is, LDA # 10* SIN RAD 45 will load the accumulator with the value. No more tedious attempts to write machine code mathematics routines!

There are lots of other things to drool over and in the space available, they will just have to be left out of this list. One which I must find space for, however, is the Tube.

The BBC Micro should never go out of date the way other 6502-based micros will because of its ability to perform as a keyboard unit controlling another computer. By May, Acorn promises, there will be the add-on Z80-based board, as well as an ultra-fast 6502 board with 60k bytes of user RAM. And the Z80 board will run CP/M programs, with the 6502 front bit handling the CP/M operations.

This will be done by trapping all CP/M system calls in the Tube, which watches the CP/M memory location. Whenever it is required to display some text on the screen, or to read or write disk data, or to input something from the keyboard, the Z80 will fill a 32 character buffer with the required information, as fast as it can and the 6502 will read it out from the other box and act on it. When the Z80 starts processing its application again, it will be quite happy that it handled the CP/M system command itself. But it will have been much faster than real CP/M, which is not efficiently coded and which has one or two bugs in it.

It's hard to see anybody being disappointed with this system.

Guy Kewney

Meanwhile, what's Sinclair up to?

The announcement that the BBC had opted for a development of Acorn's Proton (the machine intended to follow on where the Atom left off) caused quite a stir in the micro industry.

Although, as you can see from the main feature, the BBC Micro boasts some very sophisticated and powerful features, many questioned the wisdom of choosing a machine which was not only still in prototype stage but which, some felt, was too complex for beginners. Among the most vociferous of the BBC's critics was, not unnaturally, Clive Sinclair. He pointed out that his ZX81 was not only simple and easy to use but was already available and cost only £70, a third of the then-quoted price for the BBC Micro. And if the original ZX81 wasn't quite what the Beeb wanted, a derivative, priced similarly to the '81 and churned out in the mass quantities required to keep the price down, would have been feasible, he claimed.

Sinclair — cold-shouldered by Beeb.

Quite why Sinclair, with a proven track record of mass producing cheap computers didn't get the contract while Acorn, with the Atom not long launched and only just gearing up into full production did, will probably never be known. The most probable reason is that the BBC wanted a more sophisticated machine and Acorn was working on a design which would fit the requirements without too much modification.

What is more interesting is what Sinclair is up to now. Rumours abound that Clive is working on a new machine which will be at least software-compatible with most of the BBC Micro's facilities. It's possible that a new ROM chip and a keyboard overlay could turn the ZX81 into a machine capable of running a subset of BBC Basic. But this would be a very limited machine compared to the BBC Micro — there's no way, for instance, that the sound and complex video functions could be emulated on the basic ZX81 and the ability to incorporate assembler mnemonics into a Basic program would have to go, as the ZX81 uses a Z80 processor while the BBC Micro uses a 6502.

Producing a machine which is totally hardware- and software-compatible would be expensive and time consuming. Some of the 'official' machine's features stem from a custom-designed chip which Sinclair would have to emulate — not an easy task. The same would apply to the BBC machine's very sophisticated operating system; producing a look-alike would cost money.

Could Sinclair produce a BBC-compatible machine which would undersell the 'official' micro? Yes, he has the *nous*, the resources and the access to the necessary production capacity, together with an already-established mail order marketing setup.

Will he do it? Naturally, he won't say what he has in the pipeline next. Rumour has it that he's rather lost interest in computers and is concentrating on his flat-screen TVs and his electric car project.

Certainly, the temptation to put a BBC-compatible machine on the market must be very strong (for others as well as for Sinclair), not only to make a lot of money but to hit back at the Establishment which seems to have an inexplicable but marked anti-Sinclair feeling (witness the omission of the ZX81 from the micros-for-schools program).

The likelyest scenario is that *if* Sinclair has a new micro in the pipeline, and if the project isn't too far advanced, he'll think very hard about making it as BBC-compatible as possible. But whether he'll do it or not, he's not saying right now.

BBC Basic

While a fairly public controversy raged around the BBC's choice of Acorn as the manufacturer of its microcomputer, a quieter stir was caused by the decision to make Basic the machine's 'natural' language. For entirely inexplicable reasons, programming languages arouse strong emotions in their devotees' hearts. Each language attracts its band of followers and it sometimes seems that the more obscure or difficult or awkwardly-syntaxed the language, the more fanatical its proponents.

Basic in particular seems to anger more people than just about any other aspect of microcomputing, yet it has helped thousands of newcomers to get to grips with their machines, which would certainly not be the case were Pascal, say or APL the most commonly-implemented languages on micros.

It seems that before the decision on Basic was finalised, some lively debates took place as to the 'best' language to use on the BBC machine, with Pascal and Comal devotees being notably anxious to push their languages on the theory that if the public was to be taught programming, it should be taught tidy, academically-satisfying structured programming from the start. Although other languages are planned for the BBC Micro, it was Basic which won in the end, probably because it is so easy to learn, although the fact that a Basic was under development for the Proton before it became the BBC Micro must

GOTO page 188

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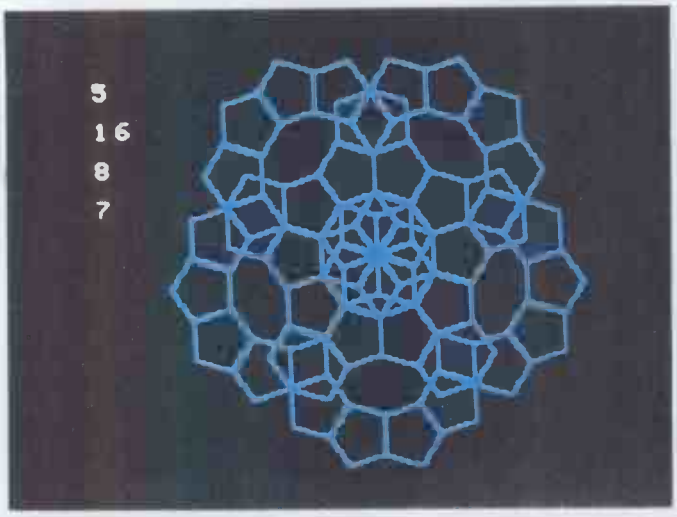

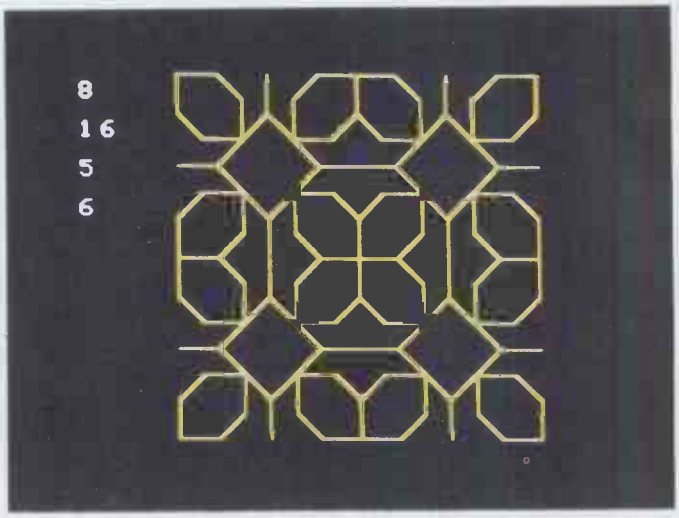

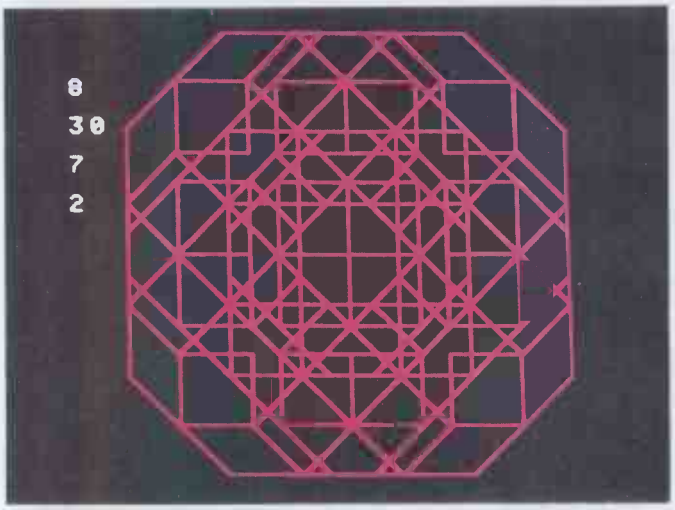

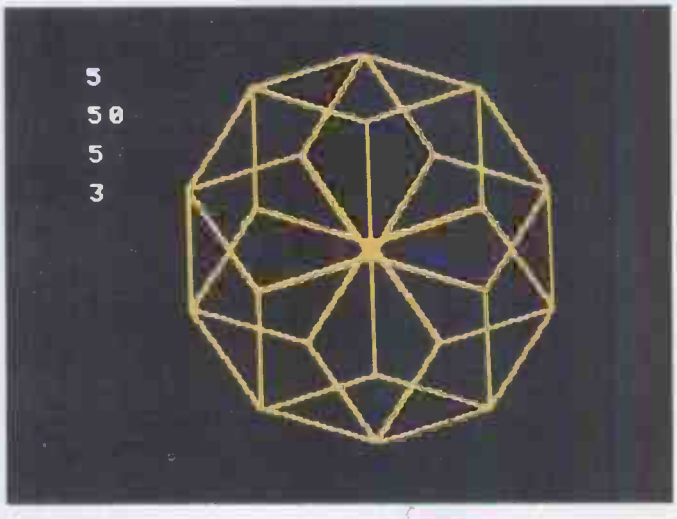

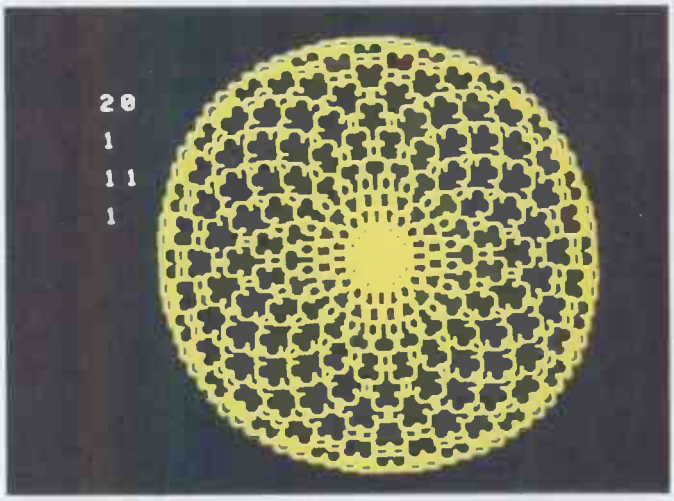

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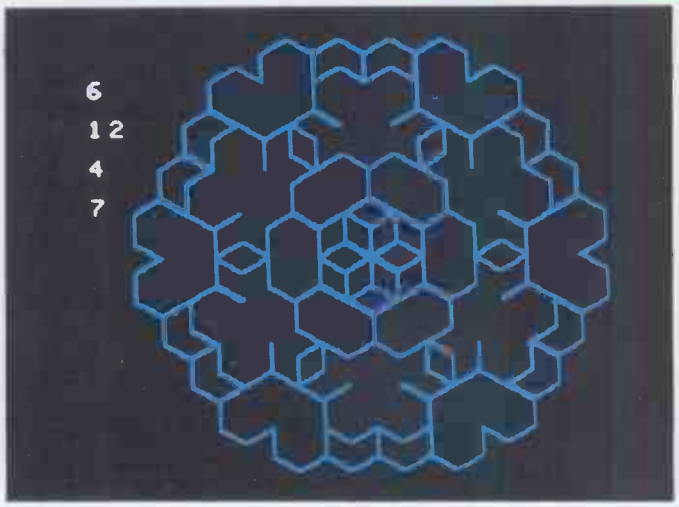

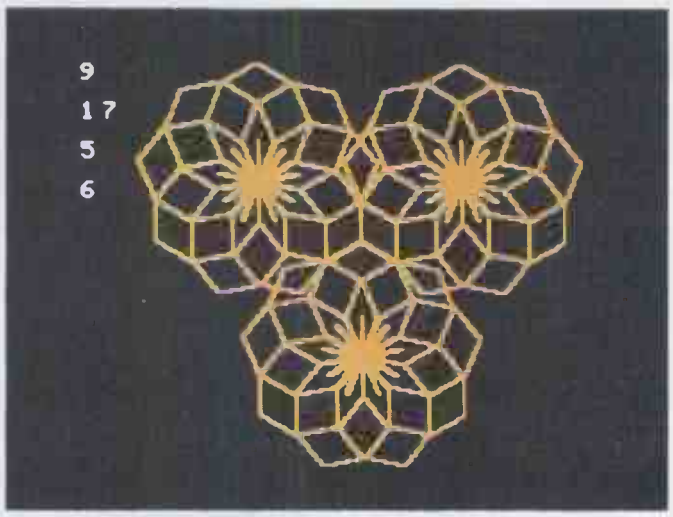

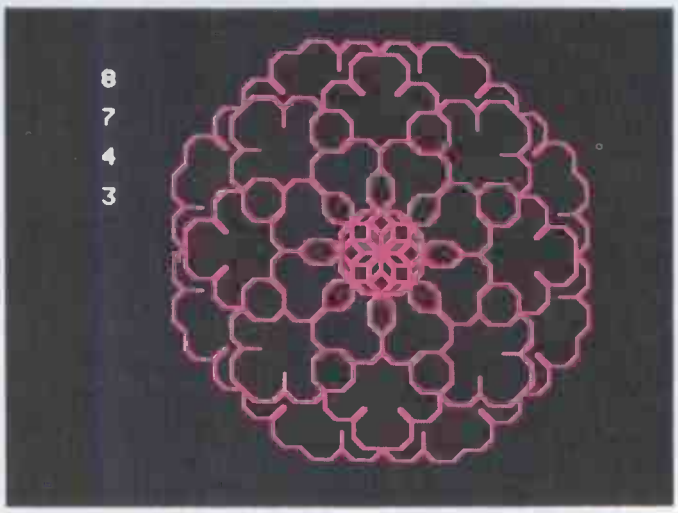

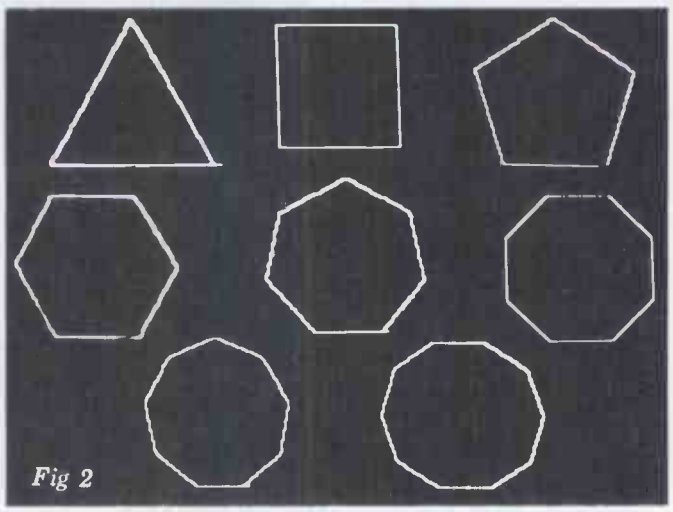

Fig 2

YGONS

Malcolm Banthorpe shows how to implement 'Turtle' graphics on the Apple II.

This article describes a simple method of drawing any equal-sided polygon in high resolution graphics and leads to a versatile pattern generating program with scope for further development. The programs are designed for use on either Apple or ITT 2020 computers, but details for adaptation to other computers with suitable graphics resolution are also given.

The most common way of using high resolution graphics to draw a line on a VDU is to specify the co-ordinates of its endpoints. For example, in Palsoft/Applesoft Basic you could type in, say, HPLOT 10, 10 TO 200, 150 and the interpreter would do the rest, joining the points 10,10 and 200,150. You could then go on to type HPLOT TO 60,100 and the interpreter would draw a line from the most recently plotted point (ie, 200, 150) to 60,100.

Commands similar to HPLOT are used in many other computers with high resolution graphics as a means of drawing lines. There is, however, another way of specifying to a computer the line that you wish to be drawn, which can be advantageous in some circumstances. I'm referring to so-called 'turtle' graphics in which an imaginary turtle moves around the screen leaving a trail of activated pixels in its wake. It can obey two sorts of instructions: either how far to move forward or what angle it should turn through. Although Palsoft/Applesoft has no turtle commands as such, the same effect can quite easily be achieved, with the result that some graphics programs can be simplified and made to execute more quickly.

The technique involves the use of a shape table to define the simplest plottable shape, ie, a single vector of unit length. It is then possible by using a SCALE= command to make the line any length, to a maximum of 255. Using ROT=, the line can be turned through any angle up to 360 degrees.

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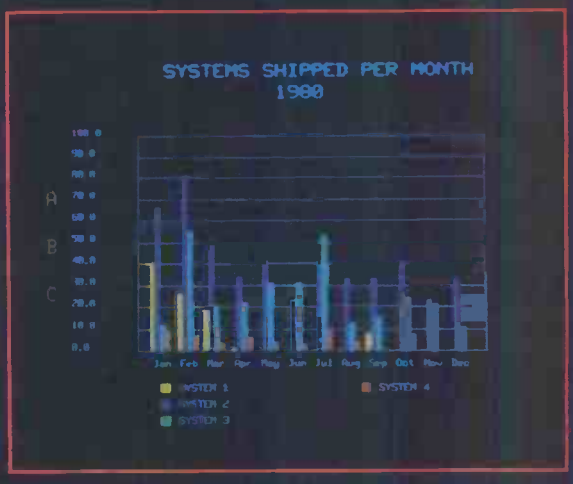

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POLYGONS

Actually, it's not quite true that it can be turned through *any* angle, as ROTation can only be defined as an integer in the range 1 to 64 (ie, 64 = 360 degrees, 32 = 180 degrees, 8 = 45 degrees and so on) and consequently some angles, such as 30 degrees, cannot be defined precisely because this would require a ROTation of 5.333. The command DRAW is then used to put the line on the screen.

For example, DRAW 1 AT 100,50 will draw SHAPE 1 at coordinates 100,30. DRAW 1 (omitting the co-ordinates) will draw SHAPE 1, starting from the last plotted point. In this way, where the shape is a line as described above, one line may be joined to another ad infinitum with length and rotation varied, but with the only coordinates required being those of the starting point.

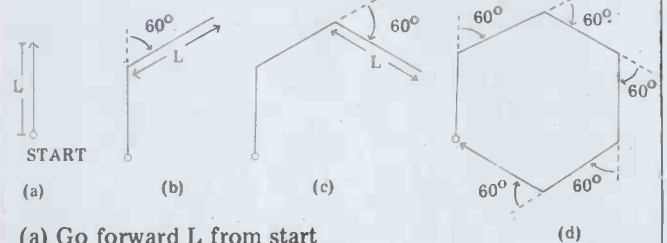
Now for a simple application of the system. To draw an equal-sided polygon with N sides of length L, we could, in general terms, proceed as follows:

1) Define the starting point.
2) Go forward a distance L.
3) Turn 360/N degrees.
4) Repeat from 2) until N lines have been drawn (see Figure 1 for a practical example).

This can be translated into a simple Basic program to draw any equal-sided polygon, as shown in Listing 1.

The limitation imposed by the fact that there are only 64 possible degrees of rotation means that some of the polygons are not absolutely accurate but, as can be seen from Figure 2, they are not too bad, taking into account the resolution of the graphics. As the number of sides is increased, the polygon approaches a circle and this program can be quite useful as a fast method of drawing circles without the need for the computation of any sines or cosines, which generally make for slow execution times. Beware of using a scale of less than 4 for drawing circles as this will fail to produce a smooth curve.

My interest in computer art led me to experiment with the possibility of using polygons to generate patterns. One idea was to use just parts of polygons (eg, just the first four sides of a pentagon) and to repeat these shapes, starting each successive part-polygon where the previous one ended. The initial results proved to be fairly uninteresting, showing little variety. I then tried submitting the turtle to a 180-degree shift every so often so that the line would turn back upon itself. This proved to give more interesting patterns and led to the program shown in Listing 2. Some of the results are



(a) Go forward L from start.
(b) Turn 360/6 degrees and go forward L.
(c) Repeat (b)
(d) Repeat (b) until six sides have been drawn

Fig 1. The construction of a hexagon, using turtle commands

```
5  REM  POLYGON GENERATOR 1
6  REM
10  TEXT : HOME
17  REM
18  REM  SET UP SHAPE TABLE
19  REM
20  FOR I = 800 TO 805
30  READ C
40  POKE I,C
50  NEXT I
60  POKE 232,32: POKE 233,3
70  INPUT "HOW MANY SIDES ?";N
75  INPUT "SIDE LENGTH ?";L
80 K = 64 / N:R = 0: SCALE= L
90  HGR : HCOLOR= 3
97  REM
98  REM  PLOT STARTING POINT
99  REM
100  HPLOT 180,80
107  REM
108  REM  DRAW POLYGON
109  REM
110  FOR I = 1 TO N
120  ROT=  INT (R + 0.5)
130  DRAW 1
140 R = R + K
150  NEXT I
160  END
167  REM
168  REM  SHAPE TABLE DATA
169  REM
170  DATA 1,0,4,0,4,0
```

Listing 1

```
 95  REM POLY-PATTERN GENERATOR
 96  REM
 97  REM BY MALCOLM BANTHORPE
 98  REM
 99  REM
100  TEXT: HOME
110  INPUT "SYMMETRY ?"; S
120  A = 64/S
140  INPUT "SCALE ?"; L
160  INPUT "M ?";M
170  INPUT "F ?"; F
180  FOR I = 800 TO 805: READ C: POKE I,C: NEXT I
190  POKE 232,32: POKE 233,3
200  HGR2: HCOLOR = 3: SCALE = L
210  HPLOT 180,96
220  FOR H = 1 TO S
230  FOR I = 1 TO S
240  FOR J = 1 TO 2
250  FOR K = 1 TO M
260  ROT = INT (R + 0.5)
270  DRAW 1
280  R = R + A
290  IF R > 64 THEN R = R - 64
300  NEXT K
310  R = R + 32 - A
320  IF R > 64 THEN R = R - 64
330  NEXT J
340  R = R + F * A
350  IF R > 64 THEN R = R - 64
360  NEXT I
370  R = R + F * A
380  IF R > 64 THEN R = R - 64
390  NEXT H
400  END
410  DATA 1,0,4,0,4,0
```

Listing 2

POLYGONS

shown in the accompanying photographs, which also show the input parameters used.

The program first asks for four parameters to be inputted. These are Symmetry (how many sides would a complete polygon have?), Scale (length of side) and two other factors M and F which will determine the actual form of the pattern. As the examples show, an enormous range of variations is possible and it is almost impossible to predict what type of pattern will be produced from a given set of parameters. Incidentally, although six-fold symmetry occurs widely in nature in such diverse systems as snowflakes and honeycombs, this particular program does not seem to do very well with that particular number: five, seven and eight all provide a better selection of designs. It is possible that, with some modification to the program, this deficiency could be overcome. The scale is alone among the four parameters in that it does not affect the form of the pattern, merely its size, but if set too high the design will exceed the screen dimensions and will 'wrap round' to produce some further possible variation.

This program is by no means *the* definitive program for producing this type of pattern, and there is considerable room for further variation. Here are some possible changes that you may like to try:

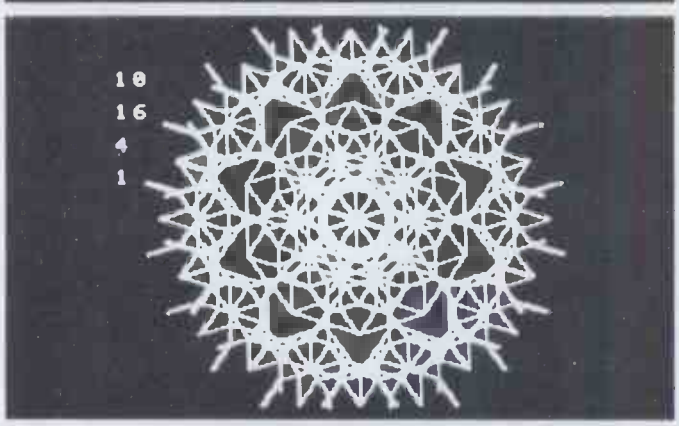
1) My program uses four loops, but there is no reason why further loops should not be introduced together with more user-defined parameters;
2) Use XDRAW 1 instead of DRAW 1. This will have the effect of erasing any line or part line which is subsequently overdrawn. Even values of F produce patterns which eventually tend to erase themselves completely;
3) The scale could be varied during the program (eg, doubled or halved) to give some variation of line length;
4) Similarly, the variable A (the turning angle) could be varied within the program;
5) If you have colour available, this could be put to good use.

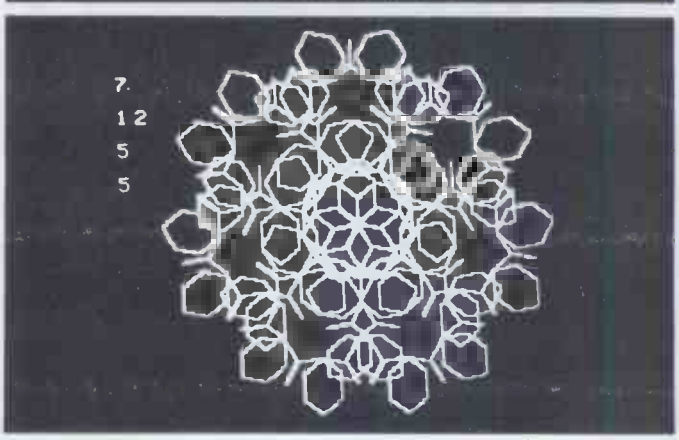
The use of colour is particularly effective in displaying composite patterns of differing scales, M and F, but with the same or related symmetry, eg, 16 and 8, or 10 and 5. With the use of a different plotting colour for each set of parameters, complex designs can be created.

Adaptation to other computers is not difficult, but as most of them do not have the shape table facility, this must be circumvented by using more conventional line drawing techniques. As an example of what is required, a version of the original polygon generator program in Palsoft/Applesoft, which does not use a shape table, is shown in Listing 3. While this version of the program is slower, it is more accurate than the previous one, as it is not limited to 64 degrees of rotation and there should be little problem in adapting it to other Basics. Similarly, this technique may be applied to the main pattern-generating program. More care must be taken to limit the scale so that the size of the pattern does not exceed the screen, since wrap-round will not occur and the program will crash with an 'illegal quantity error'. END

```
3  REM  POLYGON GENERATOR 2
4  REM
5 PI = 3.141592654
10  TEXT : HOME
70  INPUT "HOW MANY SIDES ?";N
75  INPUT "SIDE LENGTH ?";L
80 K = 2 * PI / N:R = 0
90  HGR : HCOLOR= 3
97  REM
98  REM   PLOT STARTING POINT
99  REM
100 X = 180:Y = 80: HPLOT X,Y
107  REM
108  REM  DRAW POLYGON
109  REM
110  FOR I = 1 TO N
120 X = X + L *  SIN (R)
125 Y = Y + L *  COS (R)
130  HPLOT  TO X,Y
140 R = R + K
150  NEXT I
160  END
```

Listing 3





SCHOOL SUPERBOARD SOLUTION

Teacher Maurice Whelan describes the low-cost network implemented at De La Salle school, Liverpool

Our interest in the use of computers at De La Salle sprang from the need to provide relevant and interesting courses for the sixth form General Studies course. Our initial 'opinion poll' showed that more than 50 or more lads out of 90 were interested and the proportion has increased over the three years we have offered the course. After a first year using coding forms which were typed and run by the local Poly (don't!) we decided to invest what we could in some hardware of our own. The requirements that governed our choice were: one or two machines would be useless among 50 or 60 pupils and 'hands on' experience was seen as a most important requirement; we neither wished, nor were qualified, to teach to A level; and examination boards require hard copy of programs and runs.

Following from these requirements, we decided to buy a printer and an initial three Ohio Superboards. The intention was to buy further Superboards as money became available and to build up a computer lab over a number of years. However, two problems became apparent in the first year of their use: 30 bd cassette storage, although reliable, was too slow, even for O level use and having to physically change the connection to the printer was time-consuming and invited accidents, as the plug is an RS232 25-pin.

Also, following a visit to King Edward VI School, Five Ways, in Birmingham, several members of staff were converted to CAL and were busy spreading the good news and spending a lot of time loading and saving 6k programs at 30 bd!

The system

Our solution was to buy, with the generous help of our Williams & Glyn's Bank, our PTA and our enlightened LEA, an extra seven Superboards and an Ohio CII with a distributor board attached. The distributor board allows up to 16 Superboards to be connected to the CII and have access, via the CII, to the printer and to dual 8in floppy disks. The CII acts as a signal box in a railway marshalling yard, channelling the information flow but doing very little processing itself.

The distributor board works in a similar way to a polled keyboard: the CII examines each port cyclically until a port receives a signal saying the Superboard wishes to communicate with the CII. All further communication is only with this port until the software decides that the message(s) have finished and polling can recommence. The system is very robust: no machine can interrupt another and even a crash on the CII would affect at most one Superboard, which can be reset quite easily.

The communications between computers are in ASCII strings and the strings are passed into the respective input buffers to be processed by the monitor or Basic. This is obviously not as fast as other network-type systems, but it is as fast as we need and the flexibility allowed by being able to rewrite the operating system is very useful. An example of the speed of transfer is that it takes 20 seconds to load from disk a program filling 3100 bytes in the Superboard's memory.

The program supplied with the system to use the distributor board is very skimpy, but it is fairly easy to rewrite once you have mastered the oddities of the system (both documented and undocumented!). Our system forces every user to use a password and allows several short programs to be stored in one file instead of the one program per file system used by the operating system. This is possible because of the INDEX function which allows a file to be handled in the same way that the monitor reads individual memory locations in RAM. Packing programs is also necessary because, with around 100 regular users, disk space very soon gets eaten up.

System uses

Computer Studies O level will remain the largest single user, although use of the system out of lesson time will no longer be necessary and will not be allowed. The large number of small computers is proving quite satisfactory: in our view, teaching programming with only one computer, no matter how powerful, is like teaching English Literature with only one copy of the *Complete Works of Shakespeare*.

Two 'whizz-kids' were allowed to do the A level course, both as a stimulus for some of the staff to go deeper into the subject ourselves, and as a source of information for the staff! It is impossible for 'teacher' to know all the answers in such a fast-moving subject and pupils often have more time to keep up with the latest developments, etc.

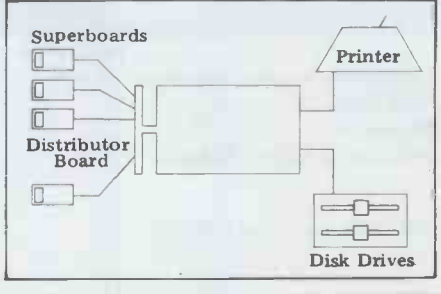
To make any serious use of computers, the admin staff would need more time than is free even at present, so when they ask, we tell them they really need a machine or two of their own! Surely it is only a matter of time before the larger secondary schools have computers (with word processor-quality printers) to aid the administration staff.

It is now a viable proposition to load the same program into ten Superboards at the beginning of a lesson and so use a program with a class. This loading takes five to ten minutes and is the first stage at which we find the transfer time being too slow. However, it is still comparable with setting up a practical lesson and vastly better than using tapes.

Our biggest problem is that we only have a room big enough for 15 pupils and so cannot accommodate a class of 30. This means that the class must be split or the computer used out of lesson time. This will not be too much of a problem initially, but it could cause problems as the rest of the staff learn the value of the system.

Another problem we have is that of getting suitable software. It is in this field that we have needs not encountered with the O level course: 8k RAM is not enough, especially for software from sources outside the school; the Basic/Monitor are not ideal for teaching use: cursor control is limited, there are no medium or high resolution graphics possible, and the Basic is limited; and no cassettes for other makes of computer can be read by the Ohio, so a lot of typing in is necessary.

The first problem would be solved by Ohio, or someone else, producing a cheap 8k expansion board. However, the problem is not as bad as it seems: during the inevitable typing-in process, programs have to be edited so that the output is suitable for the screen available and this allows time for shortening tricks. Another point is that we have found that pupils cannot absorb even moderate amounts of information presented on the screen and so instructions, questions, etc, are presented on printed sheets as far as possible. This not only saves RAM space, but it is quicker to produce a sheet of, say, questions than it is to type them in and do the necessary editing. For example, we have a program that holds the



SCHOOL SUPERBOARD SOLUTION

answers to five years of Physics A level multiple choice questions. The pupil answers the questions from the original paper and his progress is monitored (and stored on disk) by the program.

Custom ROMs?

The second problem probably needs personalised ROMs to provide the monitor, graphics set and Basic required by the user. The new Intemon monitor is a step in the right direction (and a vast improvement!) but why not take the process further and be able to have a choice of graphics sets and Basics, not only as replacements, but available at the time of buying the machine?

My own option would be to remove SIN, COS, TAN, LOG, etc, functions from Basic (there are adequate polynomial approximations if you really want them — see *PCW*, July 1981, page 97). This would allow space for IF. . . THEN. . . ELSE. . . ENDIF and maybe labels to identify GOTOs instead of line numbers. This would give me much greater flexibility in writing programs and allow them to have a much greater degree of structure. Comal and Pascal are better structured languages, but their compiler/interpreters are not going to fit into the 8-12k ROM that the education market can afford to buy in bulk. We may be able to afford one such machine for the A level students, but if there is to be a general increase in computer literacy it must come through small, cheap units. Also, computers are *not* glorified pocket calculators so why is it necessary for them to mimic calculators when the ROM space can be used for things computers are so much better at?

Software

One problem with this idea is that it would only further compound the problem of incompatibility of different machines. Efforts are being made to overcome this problem by MUSE and other bodies: hopefully a chunk of the government's £9m will be dedicated to helping to solve this problem. Getting different machines to 'talk' to each other is the first (easy) half of the problem: the harder part is for a system of automatic translation from one dialect of Basic to another. Software standards help the problem, but the special features will continue to be used by programmers as they save much effort and time.

What software we have is either written ourselves or bought from the School's Council. The process of typing it in has started in a rather piecemeal fashion, but this year we hope to get a group of more successful programmers from last year to work on the programs and then move on to writing programs suggested by members of staff. This way they will not only learn about programming but also the social skills needed when having a 'boss' who doesn't have their technical skills.

Looking to the future, we are starting a computer club for the fourth year: we need confident programmers and they enjoy using the machines. Space Invaders isn't banned: they must write their own! Some members of staff feel that preparing CAL material is a sufficiently broad field of study as to be an alternative to the O level syllabus: by the time the pupil has understood the material from the teacher's point of view, discussed the possibilities with the teacher (who needs know nothing about programming), written and tested the program and prepared the supplementary material and documentation, he has covered far more than is contained in an O level course work program.

In conclusion, the system is robust, secure and easy to use and develop. It is a little slow for some of the more adventurous uses, but it fits our requirements and was available a year ago. (The whizz-kids are looking at the speed problem. . .) If there is to be a general increase in computer awareness in the school population as a whole, then large numbers of unsophisticated machines sharing disks and printer is going to be the only way that we can afford to provide the necessary practical experience (would *you* teach typing with only a handful of typewriters?). Now that PET and Tandy have moved into the same market as the Superboard (hopefully having learnt from the Superboard's mistakes), the need for suitable network or distributor systems to make this type of machine useful in schools is paramount. Computers have an important role as a general teaching aid and not merely as a topic of study.

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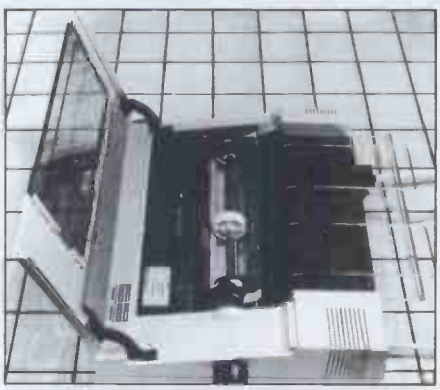
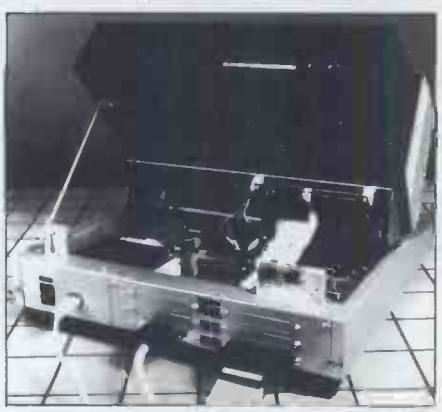
JACK OF ALL TRADES, MASTER OF MOST...

Dick Pountain finds the Sharp MZ80B lives up to its 'general purpose' tag





Above from the top: Complete system, printer internals, I/O expansion unit and connectors, MZ-80B open for inspection, keyboard layout.

My deepest impression after a few hours with the MZ-80B is that this is probably the machine that Sharp's design team wanted to make when they worked on the 80K. All the compromises inherent in that design, presumably to bring it in at a price acceptable to the PET buyer, have been abandoned and the result is an integrated system, rather than a computer plus afterthought peripherals. In external appearance, the 80B shows evidence of Sharp's hi-fi connections along with a distinctly Italianate line far removed from the rounded Star Wars look which is the current Japanese vogue. This long low look is assisted by the 9in rather than 12in CRT and the absence of on-board disk drives.

The base/keyboard unit is of pressed steel (to help shield RF emissions?) with a hi-fi style shot-blasted finish, while the pedestal containing the VDU and cassette-drive is in ABS plastic cunningly metallised to an identical finish. This pedestal swings up and forward on removing two screws to yield access to the internals and has a car-bonnet-like support to keep it open. A peek inside reveals a neatly packed array of nicely finished boards with much use made of nylon clip fasteners and ribbon cable connectors. The CPU (a Z80A running at 4MHz), PIO and various support chips are socketed, but the 32k of dynamic RAMs (4116s) on the CPU board are soldered. The expansion RAM is all socketed. At the rear right of the case is a six-slot bus expansion cage with six corresponding ports for I/O connector sockets. Two of these were occupied on the test machine by the interface cards and sockets for the disk drive and printer (which uses Sharp's own 8-bit parallel interface); RS232 and Centronics will be available in due course, but at present the '80B only accepts Sharp's own MZ-80P5 printer. A third slot is taken up by the optional second graphic memory card.

The full-size typewriter keyboard has a standard layout with extra control keys, a separate numeric pad and good pitch and feel. In addition to a proper space bar, a small TAB key is provided alongside for fast table entry. Break, Insert/Delete and Clr/Home are on the main keyboard with three levels of shift; Shift gives lower case, Grph gives 30 graphic symbols and Rev gives reverse field characters (but not for the graphics). The two latter keys and Shift lock have built-in red LEDs to warn that they are engaged. For touch typing, the Shift can be altered by the Basic command CHANGE to give upper case. Above the main keyboard are ten user-definable keys, four cursor control keys and four cassette control keys. On booting up Sharp Disk Basic, the user-defined keys default to ten Basic commands whose repertoire can be inspected by KLIST. In fact most of the keyboard is software-defined; in Sharp Basic there is no repeat on any keys except the cursor controls, but under CP/M all keys repeat, while in Wordstar the user and numeric pad are assigned to control characters as well.

The 9in green screen display is software-switchable between 40 and 80 characters per line by 25 lines; the characters are 8x9 and have true descenders. At 80 per line, text is quite legible but marginally harder on the eye than 40. The screen is memory-mapped three times over; a 2k video RAM provides for the display of the ASCII characters echoed from the keyboard in normal fashion. In addition, there are two 8k graphics RAMs (the second is optional) which independently map the screen as a 320x200 high resolution dot-addressable display; all three of these video stores reside outside the 64k of user RAM and are switched in and out of the memory map by a Z80A PIO (parallel I/O controller) device. The 'character RAM' is always enabled but either or both of the graphics RAMs may be written to — or displayed under — program control. The screen can be thought of as having a foreground of characters and pixel graphics and two separate 'backdrops' of hi-res graphics, the combination of which allows some very fancy displays.

As you might expect, this facility complicates the memory management of the '80B more than somewhat, but the resulting juggling of page addresses is handled in a user-transparent fashion by the PIO and a PPI (programmable peripheral interface) device so that you always see 64k of contiguous RAM starting at 0000H. Switching between character RAM and graphics RAM 1 is performed by the PIO and between graphics 1 and 2 by OUT port F4H. Should a program access graphics RAM while lying in that part of RAM (above D000H) which would normally be disabled by the PIO, there's no problem; the graphics RAM addresses are changed to begin at 5000H. A similar conjuring trick is performed by the Initial Program Loader on boot-up to allow the boot ROM into the memory map. The result is an unprecedentedly 'clean' machine with all 64k available to the user. The graphics are not particularly fast, which is hardly surprising considering the amount of interrupting that must be going on. It takes six seconds to SET 1000 points.

There is no resident software other than a 2k bootstrap loader in ROM. If a system disk or cassette is present then booting follows automatically on power-on or by pressing the 'IPL' button on the back of the case. Next to this is a separate RESET button which puts you into the monitor without clearing the Basic text area; very handy for recovering from a crash. Booting Disk Basic or CP/M is satisfactorily quick at four seconds and tape Basic is quicker than one expects (105sec) since the cassette drive transfers at a fast 1800 bits/sec. All the tape functions, including FFwd, Rewind and Eject, can be under program control and searching is performed at FFwd speed. Folk of nervous disposition may suffer a nasty turn, however, when the cassette hatch pops open of its own volition in the middle of a program!

Aural stimulation is catered for by an audio amplifier and loudspeaker set in the facia below the cassette hatch. The volume is controllable by a knob at the rear and goes up to well past annoyance level. A music 'language' is incorporated in the Basic which allows programming of pitch and duration but not of volume or envelope.

The dual double-sided disk drive is the same hardware introduced for the MZ-80K but, thanks to a new controller card on board the 80B, it no longer requires an interface box and provides twice the capacity (280k per drive under Basic, 340k under CP/M) through double density. It worked without a hiccup during the test even when fed supposedly single-sided disks.

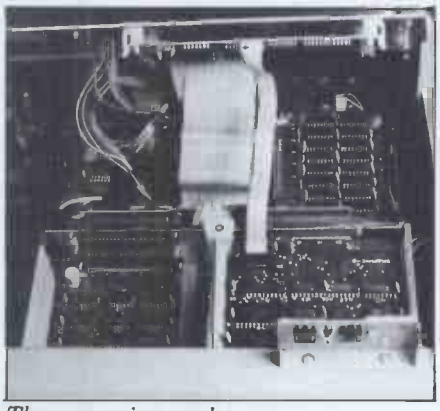
The printer supplied was the new MZ-80P5 which looks and acts remarkably like an Epson MX-80 in Sharp's own case, which is sharply (sic) styled to match the computer. Attached through a 24-pin connector cable, it can print all the graphics including user-defined symbols as well as half- and double-width text. It uses fan fold paper from 4 to 10in and ribbon cassettes.

All the necessary connectors are supplied, including braided earthing wires between units. Each unit requires its own mains lead which is a nuisance; a firm that also makes racked hi-fi ought to have found a neater solution.

Software

The 80B was supplied with two Basic interpreters (single and double precision) on disk and one on cassette, Pascal on cassette and Sharp's FDOS operating system together with demonstration programs including stock control, word processing and various fancy graphics demos. In addition to this rather overwhelming plethora of Sharp's own software, Microtechnology Ltd supplied a sample of its implementation of CP/M 2.2 for the machine, along with Wordstar and Datastar.

The single precision disk Basic, SB-6510, is not compatible with versions for the MZ-80K, though a converter program is available so you can run '80K software. It takes up 21k and is booted up automatically along with the 4.5k monitor by the IPL system, in about four seconds. It consists of a 'kernel' of commands which are a fairly standard, though by no means luxurious, implementation of the language together with extensions which



The expansion cards

Fig 1

control the special hardware features, such as the hi-res graphics, the music, the cassette drive and the 'soft' keys. No 'structured' extensions, such as ELSE or DO. . .WHILE, are supported. Full screen editing is provided and AUTO line numbering but not RENUMber or DELETE (the latter facility mysteriously enough is included in the Double Precision version). Syntax checking is only performed after RUN and the error messages, although copious (there are 44 of them) are annoyingly of the form 'Error 53 in line 40' which necessitates keeping the look-up chart at your elbow. To be fair though, the descriptions on the chart are usefully detailed. No HELP is given by cursor position during debugging but the cursor controls will go into quickstep when depressed after SHIFT, which speeds editing considerably.

Variable names may be any length, although only the first two characters are significant; surprisingly, integer variables are not supported.

String variables are 255 chars maximum and in addition to the usual string functions there are CHARACTER $ (x,y) which returns a character from that screen position, STRING $(x$,n) which gives n repetitions of the first character of x$, and SPACE $x, which gives a string of x spaces. Arrays of one or two dimensions only are permitted and scientific users will, alas, find no matrix-handling functions.

The precision of the arithmetic is 8-digit over the range 10E-19 to 10E19 with error trapping of overflow and underflow.

Both sequential and random access files are supported by the WOPEN and XOPEN statements; sequential files must not exceed 64k and the maximum number of files on a disk is 64, up to ten of which may be simultaneously open. The other file control statements include LOCK, UNLOCK, RENAME, IF EOF THEN, KILL, CHAIN and SWAP; the latter is a handy way of calling in a Basic program file from disk as a subroutine to a running program in memory, which is saved while the SWAPped routine is running and then resumed. All variables are passed unharmed to and from the SWAP routine. Random access files have a fixed record length of 32 bytes, which made it impossible to run the *PCW* disk Benchmarks in a meaningful way. Reading from and writing to files is a straightforward process using. INPUT# or PRINT# and a string or numeric variable; a buffer number follows the '#', defining which open file is referred to. Machine language files may be saved on disk through Basic only by first saving to tape and then invoking a machine code utility called CMT on the master disk, which transfers from tape to disk. Another such utility formats disks, taking one minute to do so. All in all, file handling is simple and effective, if not hypersophisticated.

The picture becomes a bit more exciting when we come to the special graphics control statements. Screen control in the character mode is achieved through CONSOLE statements which can reverse the whole screen, define a scrolling window and set the display to 80 or 40 columns. CURSORxy puts the cursor at any desired position on the screen and saves its coordinates in two system variables, CRSH and CRSV. Control of the hi-res graphics is at three levels, the lowest of which is addressing of a single dot on the 320 x 200 grid by SETx,y and RESETx,y which blacks the dot out again. The page of video RAM in which this occurs is chosen by the GRAPH statement which selects page 1 or 2 and sets it in input or output mode or clears it, eg, GRAPH 012 sets both areas in output mode.

The next level is that of vector graphics, using LINEx1, y1, x2, y2, x3, y3, . . .which connects the pairs of points specified in its parameters by lines; a whole polygon can be drawn with a single LINE statement. BLINE draws a black line, ie, it resets a line in the same fashion. The third level is that of user-defined pixels through PATTERN n,X$, which defines an 8 by n dot pattern. Each line of eight dots in the pattern is set to match the eight bits of the binary ASCII code for the corresponding character in string X$. This pattern can be displayed at any screen location by specifying POSITION x,y. Each graphics area has its own position pointer whose current coordinates are found in system variables POSH and POSV.POINT (x,y) is a function which flags whether or not x,y is set in either or both areas.

In combination, these various facilities amount to a very powerful and economical graphics package though you will probably find PATTERN rather mindbending to use at first. It seems a bit churlish in the circumstances to say that I would have liked shape table graphics as well; certainly these graphics will satisfy most scientific and technical users as well as providing neat screen formatting for business programs.

Printer control is acheived through PRINT/P,LIST/P and DIR/P, in addition to which COPY/P dumps the screen contents to the printer (see Figure 1) and IMAGE/P defines a shape in the same way as PATTERN, but horizontally and on the printer.

The remaining special statements include FAST and REW for the cassette drive, DEF KEY to program a user key and KLIST which lists the key assignments. Multiple statements can be put on one key and may be defined to execute immediately or merely be displayed.

The music feature is controlled by MUSIC, followed by string data, and although the square-wave tones produced are hardly suitable for serious computer music, I found the feature useful for writing little recognisable sequences as audible error messages; these tunes can be accessed by ON ERROR GOTO branches and allow you to relax with a drink while some lengthy procedure is being performed. When a bad sector crashes your program, a little snatch from Siegfried's 'Funeral Music' will summon your attention or the 'Eroica' announce successful completion.

The Monitor is entered by the MON command or by RESET. It provides the minimal facilities for listing blocks of hex, changing the contents of a location and jumping to a specified address as well as saving, verifying and loading hex files on tape. It has its own manual which includes a complete assembler source listings and Z80 mnemonics.

I've dwelt at length on Disk Basic 6510 because the cassette Basic, which comes free with the machine, is merely a subset of it, minus the file handling, and the Double Precision Basic is Disk Basic with 16-digit accuracy (10E-+76) minus the trig log and exponential operators and with DELETE and PRINT USING added. All three Basics are compatible where they overlap. The set of compromises adopted is rather curious since scientific users will require the maths functions and are thus condemned to single precision; business users will certainly need the double precision if they wish to count the pennies as well as the pounds. All three Basics are fast (see Benchmarks), the single precision being as fast as any we've tested.

CP/M

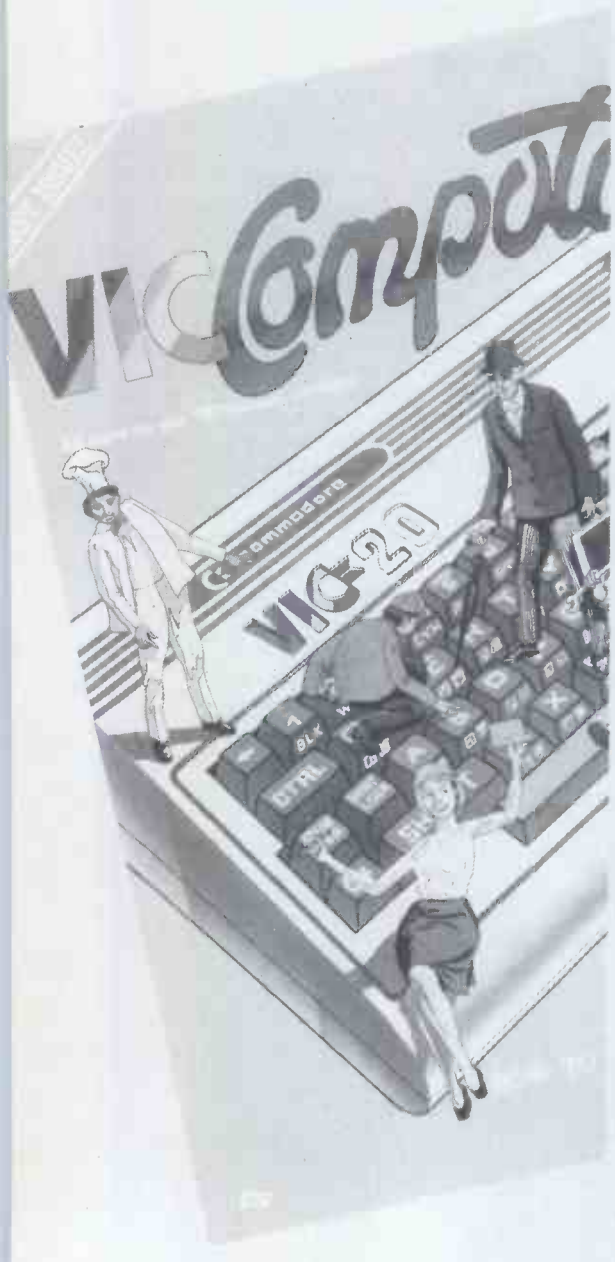
An attraction of this machine for business and sci/tech users must be its ability to run the CP/M operating system. The version adopted is CP/M 2.2 with a BIOS written for the machine by Microtechnology Ltd of Tunbridge Wells. It's a full and well-conceived implementation with various tweaks to make use of the special hardware features of the '80B. Some of these are extra transient commands including BACKUP, a fast copy utility for files and system tracks, CMT which copies between disk and tape allowing all 80B file types and full recorder control, CONSOLE which imports these commands (see above) into CP/M, and COPY which dumps screen contents to

ABS	IMAGE/P	REM
ASC	INP	RENAME
ATN	INPUT	RESET
AUTO	INPUT#	RESTORE
BLINE	INPUT/T	RESUME
BOOT	INT	RETURN
CHAIN	KILL	REW
CHANGE	KLIST	RIGHT$
CHARACTER$	LEFT$	RND
CHR$	LEN	ROPEN#
CLOSE	LET	ROPEN/T
CLOSE#	LIMIT	RUN
CLOSE/T	LINE	SAVE
CLR	LIST	SAVE/T
CONSOLE	LIST/P	SET
CONT	LN	SGN
COPY/P	LOAD	SIN
COS	LOAD/T	SIZE
CSRH	LOCK	SPACE$
CSRV	LOG	SQR
CURSOR	MID$	STEP
DATA	MON	STOP
DEF FN	MUSIC	STR$
DEF KEY	NEW	STRING$
DELETE	NEXT	SWAP
DIM	ON	TAB
DIR	OUT	TAN
DIR/P	PAGE/P	TEMPO
END	PATTERN	THEN
ERL	PEEK	TI$
ERN	POINT	TO
ERROR	POKE	UNLOCK
EXP	POSH	USR
FAST	POSITION	VAL
FOR	POSV	VERIFY
GET	PRINT	WOPEN#
GOSUB	PRINT#	WOPEN/T
GOTO	PRINT/P	XOPEN#
GRAPH	PRINT/T	
IF	READ	

Table 1 reserved words of Disk Basic SB-6510

VIC Computing

The 'how-to' magazine all about Commodore's VIC computer



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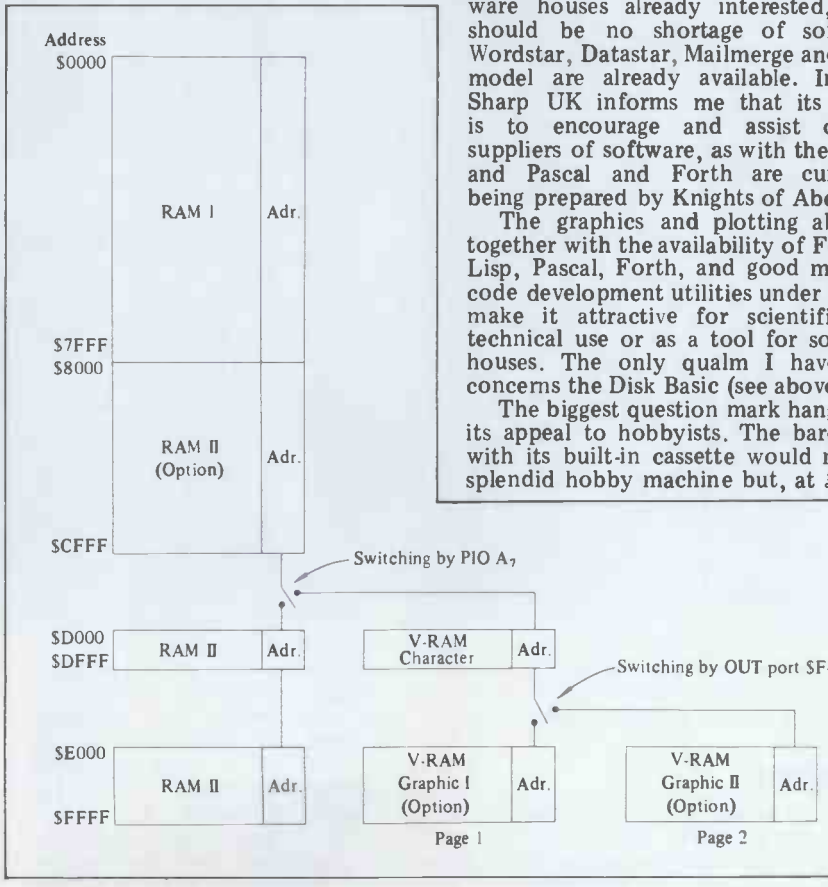
VIC Computing

the printer. The keyboard is configured with n-key rollover, auto repeat, SHIFT for caps and 60 user-defined keys (all the soft, cursor, tape and numeric pad keys, plus their shifts). On boot-up, these default to CP/M commands plus emulation of a Lear-Siegler ADM3A terminal; reprogramming is possible to emulate the control codes of Super-Brain, the MZ-80B itself and other terminals to facilitate software transfer. I was supplied with Wordstar, ready-installed by Microtechnology, which made full use of these keys and on which this review was written. The hi-res graphics and music (except for BELL) are not directly available under CP/M but Microtechnology has a suite of sub-routines called EXPAND which allow access to both, and the cassette recorder through Microsoft Basic or any other language under CP/M which uses the Microsoft Calling sequence.

FDOS and Pascal

I didn't get very far into Sharp's own FDOS operating system, having been supplied with nothing to run under it (it has only just arrived in the UK). It includes a Z80 assembler, linker, editor, symbolic debugger and PROM formatter and is quite 'CP/M-like' in its command structure. A Basic compiler will be available for it by the time you read this review.

Sharp Pascal has the almost unique distinction of being interpreted rather than compiled and comes on tape together with its own monitor. Not being a qualified Pascal nut, I merely entered a couple of programs from *'Pascal Programs for Scientists and Engineers'* and perused the manual. It is a fully interactive interpreter with screen-oriented editing, as in Basic, combined with line editing to insert and delete since line numbers are provided automatically and consecutively. The interpreter performs a certain amount of formatting, such as converting reserved words to lower-case and adding '.0' to integer reals, then syntax-checking is performed on entering G FOR GO. The reward, for a novice such as myself, is usually a rich crop of syntax errors. The main limitations of this Pascal seem to be that it can only handle tape, not disk files, that procedure declarations may not be nested, parameters are passed only by value, and no data structures more complex than an array are allowed. On the plus side, it includes all the graphic and music control statements from Sharp Basic as well as colour control statements for a future colour enhancement, which the Basic doesn't have. The user keys come up with Pascal reserved words which goes some way toward mitigating the verbosity of the language. It would seem to be handy for learning Pascal if not for serious applications; hopefully, a Disk Pascal will emerge in due course.



Potential

Sharp's claim that the MZ-80B is a 'general purpose personal computer' is not without justification. Running CP/M, the full system compares favourably with currently popular small business systems in its price range (around £2500, VAT included), especially if it gets discounted. The screen size is not a problem; it can display 80 chars/line of legible text and is quite acceptable for word processing. To judge by the number of the UK software houses already interested, there should be no shortage of software; Wordstar, Datastar, Mailmerge and Minimodel are already available. In fact, Sharp UK informs me that its policy is to encourage and assist outside suppliers of software, as with the CP/M, and Pascal and Forth are currently being prepared by Knights of Aberdeen.

The graphics and plotting abilities, together with the availability of Fortran, Lisp, Pascal, Forth, and good machine code development utilities under FDOS, make it attractive for scientific and technical use or as a tool for software houses. The only qualm I have here concerns the Disk Basic (see above).

The biggest question mark hangs over its appeal to hobbyists. The bare '80B with its built-in cassette would make a splendid hobby machine but, at £1095, one strictly for the wealthy or the dedicated.

Docmentation

The MZ-80B came with a whole bookshelf full of manuals, a user and a service manual for each hardware item and one for each language. Sharp ran into some flak for the 'kiddies guide to computing' approach taken in the MZ-80K manual and has veered to the other extreme for the '80B Owner's Manual. After 20 pages of basic introduction to the keyboard and operations, it launches into 100-plus pages of detailed hardware discussions including the memory management, PIO control codes and processor architecture, all of which will delight the experienced and terrify the first-time user. The various Basic language manuals consist of very full definitions of the reserved words (with examples) and little more; they inevitably overlap considerably. An experienced Basic user will find them quite adequate for reference. The Pascal manual is rather more ambitious and includes a readable and well-structured beginner's course in Pascal, while the FDOS manual is a massive loose-leaf binder containing an excellent and detailed account of all the facilities plus a detailed description of assembler programming with all relevant listings. All the manuals are well produced on good paper though the standard of translation varies from manual to manual and occasionally sinks to the obscure. The upshot is that none of the manuals save the Pascal will be of much use to the total novice, but they contain all the information that an experienced user will need to exploit the system.

The CP/M was supplied with only a sheaf of notes on the new transient commands and the BIOS but Microtechnology assures me that it will be sold with the standard Digital Research manual plus these notes.

Expandability

The standard spec for the '80B in the UK comes with 64k RAM, one of the graphics RAMs and tape Basic. The review system was just about fully expanded in terms of what is available now. Another double disk drive could have been daisy-chained and that's it. In early 1982 a 'universal I/O' card is promised, an 8-bit programmable parallel interface accessible by Sharp Basic through INP and OUT. RS232, Centronics and IEEE will follow so that daisywheel printers, plotters and other instruments can be hooked up. Sharp itself will soon have the friction/tractor version of the tested printer, designated P6. Also planned is a hard disk controller and a colour card for use with a separate monitor.

Conclusions

There is nothing in the spec of the MZ-80B which breaks new ground as we enter the era of the 16-bit processor; rather, it's a refined example of well-established concepts, a Volvo among micros. It's a versatile and likeable machine which shows evidence of much thought in its design, particularly in the area of user conveniences. It could be equally happy as a high class home

GOTO page 190

The first we heard of the Philips P2000 was in a letter sent in August to the 'Pascal Readers Write' column, containing some figures for the Pascal Benchmarks. Then it turned up at the September USUS (UK) conference with a number of firsts to its credit — the first commercial UCSD version IV p-system; the first European manufacturer to select UCSD; the first 'volume sales' Z80 system to offer UCSD as its primary operating system (together with the proprietary PDOS) rather than CP/M. This month we've managed to get our hands on a P2000 for review.

Hardware

The P2000 comes in two silver-and-black moulded plastic cabinets (*a la* Tandy) although the styling is quite distinctive. The first box contains the keyboard, a power supply, a pair of ROM-pack slots, a miniature cassette-drive (Philips dictaphone special) and the basic electronics. The processor with the first 16k of RAM is on the bottom board of a stack of three boards ingeniously fixed within the cabinet and connected by ribbon cable. This board was remarkably sparsely populated on the review machine — presumably the TV set dis-

BENCHTEST
BUSINESS SYSTEM

PHILIPS P2000

Chris Sadler and Sue Eisenbach test the latest desk top micro from a major office equipment manufacturer.

PHOTOGRAPHY BY IAN DOBBIE

play version requires this space for some of the logic which, on our (monitor) version, was placed in the other cabinet. Alternatively, perhaps Philips is planning some (as yet unannounced) enhancements or extra facilities. The next board up contains mostly memory chips (32k worth) and the top board houses the disk controller.

The system comes in several configurations, mostly related to how many of these PC boards are in place — ie, 16k or 48k; disks or no disks; monitor or TV set display. The second cabinet of the review system contained a 12in monitor and a pair of vertically mounted mini-floppy drives. Also supplied is a black metal framework on which the monitor cabinet can be mounted. This raises it about six inches above the table-top, leaving space for the keyboard cabinet to slide in beneath the monitor. The whole system therefore can be set up in the shape of a large terminal (Super-Brain-style) although the individual units are more manoeuvrable in relation to one another and, in addition, there is a mechanism for altering the tilt of the monitor screen.

Each cabinet requires its own power cable and there are two connections between the cabinets — a shielded

ribbon cable for the disk-drives and a simple DIN-plug terminated cable for the video. The review machine was accompanied by a matrix printer (actually an OEM Epson MX80) in matching silver-and-black casing — for which there is a serial 25-way D-plug connector at the back of the keyboard cabinet. Both cabinets feature on/off switches, visible and accessible from the operating position. There are no fans in either cabinet, so operation is relatively quiet.

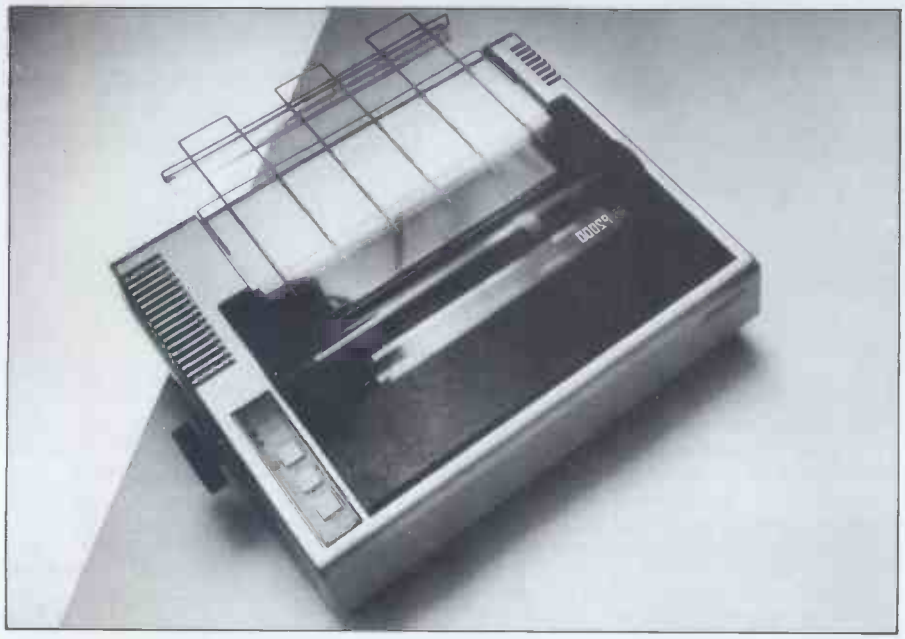
The system attempts to boot when the keyboard cabinet is switched on. Boot-up involves reference to a ROM-pack (16k), which must have been previously installed, together with access to a disk inserted in the first (left-most) drive. This procedure is required for both the UCSD p-system and the Microsoft Basic system. Although we did not have a version to review, presumably the turnkey word processing system doesn't require this since it can be used without disk drives. Failure to follow the described procedure can result in a variety of outcomes including error messages (such as 'load error') or a screenful of garbage. There is a re-boot button for when thi happens, recessed into a slot near the cassette drive and not accidentally hittable from the keyboard.

The keyboard features rather soapy-feeling 'calculator' keys which are not de-bounced and, although there is a nice big RETURN key, some of the keys (notably # — essential for UCSD) are badly placed, while others (notably the comma) are confusingly inscribed. Incidentally, there are also German, French and Swedish keyboards, about which we are not qualified to comment. Good points include auto-repeat on all keys and the facility to slow execution by holding down the SHIFT key. This is a clever choice since you can get screen output at a readable pace and, using SHIFT-LOCK, there is no need to keep your finger on the button — as with the PET and other systems with this feature. The screen character set is extremely good, being derived from a 6x10 matrix (this gives real true descenders) in 'eye-friendly green' (extract from Philips brochure). The floppies are single-sided, soft-sectored 5¼in, rated at 218 Kbytes unformatted — which works out to 272 512-byte UCSD blocks, exactly the same as the Apple.

Software

The review system came with ROM-packs, disks and full documentation for both the UCSD version IV p-system and the Microsoft Basic system. In addition, there were disks and documentation for Stock Control and Sales Ledger packages, both running under the Basic system. Apparently there is a word-processor package in ROM and a few more commercial packages are available, also running under the Basic system. On the face of it, therefore, the Basic operating system is the obvious initial choice for the commercial end-user, but it is equally obvious, both from the quantity and the style of the p-system documentation, that Philips intended to use UCSD to attract small software houses onto the P2000, thereby solving the software famine experienced by any non-CP/M latecomer to the small business market.

'P-system' stands for 'pseudo-system', which is an ingenious device for ensuring portability of software between substantially different machines. The UCSD p-system refers to an operating system together with utilities for file and disk handling; translators for Pascal, Fortran 77 and Basic; and some advanced program development features, largely written in Pascal at the University of California, San Diego and compiled into a theoretical machine-code called pseudo-code. Any given microcomputer system can run this software provided a program is written to translate the pseudo-code (p-code) into the machine's own 'native' code. Such a program (called a 'p-code interpreter') resides in the P2000 ROM-pack which must be installed before booting up. From the point of view of the software, a P2000 running under UCSD doesn't look like a Z80 system at all, but a p-system indistinguishable (apart from peripheral details like the disk capacity) from those found on Apples, LSI-11s and even IBM's new personal computer. For anyone who doesn't want their software limited to a single processor, it is not necessary to spell out the benefits of this scheme, and there are an estimated 75,000 p-systems installed worldwide (versus 300,000 CP/M installations).

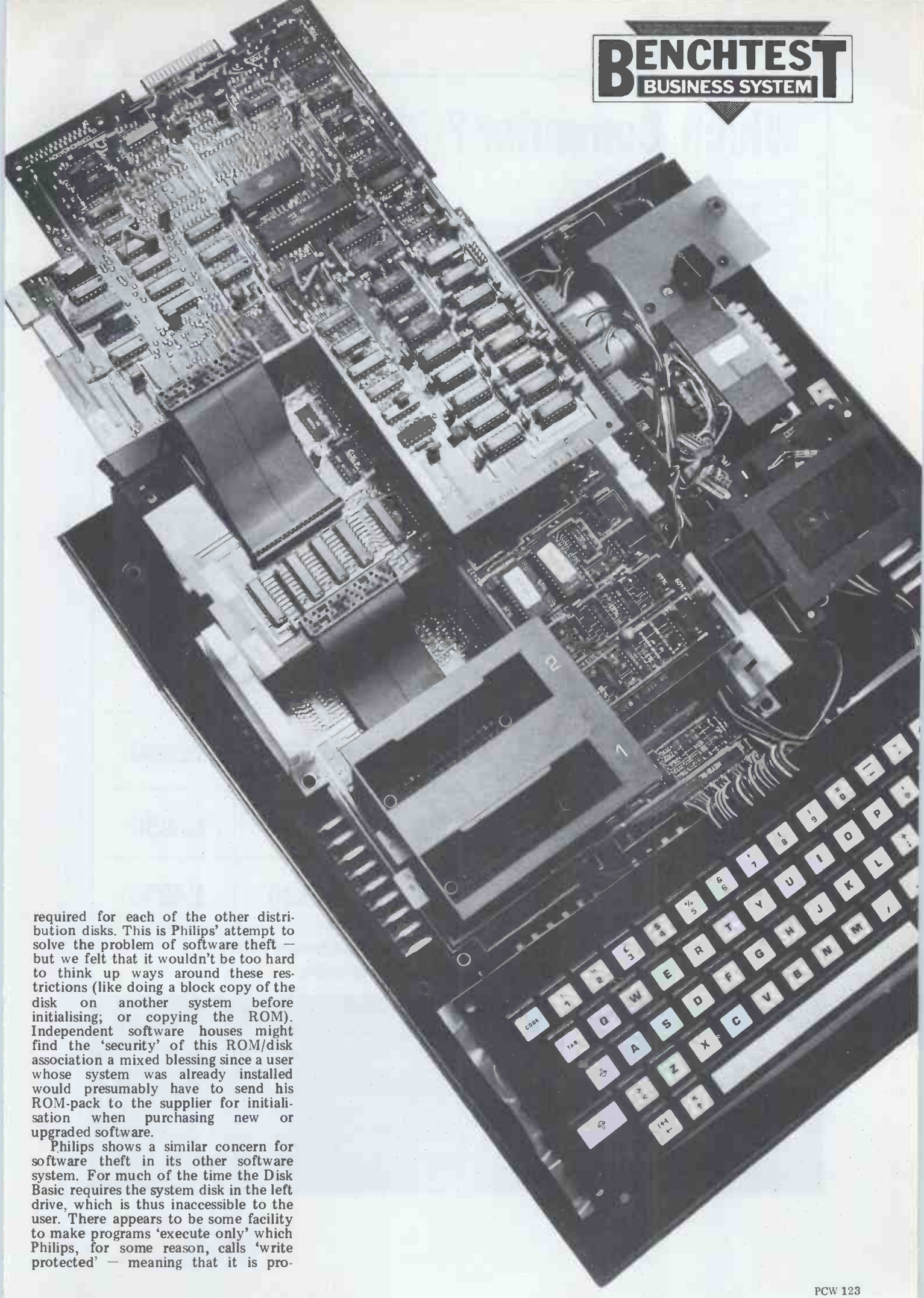


The UCSD operating system (or, more properly, 'program development environment') features a two-level command structure. The top level gives access to language translators (normally Pascal and the appropriate assembler, optionally Basic or Fortran 77), matching library and run-time systems, a screen editor, a peripheral utilities package, and a set of fairly sophisticated program development aids. The second level gives control options within these utilities. Initiation is by single-key entries (ie, you type 'C' for the compiler, etc) and there is a type-ahead buffer, so that it is fast and easy for the expert user. On the other hand, prompting is exhaustive — each facility asks lots of questions to check what you are doing — so that it is easy for beginners to use. Finally, the Edit-Compile-Run cycle incorporates a default workfile to help bridge mode-boundaries; this means that you can move from the editor to the compiler and back without constantly naming disk files.

The UCSD p-system had a lot of the rough edges knocked off after it left university and started work in the 'real' world and the new, improved version IV was announced by Softech Microsystems earlier this year. This warrants a full-length article in its own right and, in fact, such a project is currently in the pipeline. In any case, it is proper for us to declare an interest here since we are both members of the UCSD p-System Users' Society (USUS[UK]).

Philips' approach to the p-system has been very much oriented towards the independent software developer. The documentation explicitly distinguishes between the 'programmer' who requires language translators, librarians and so on, and the 'user' who wants to run an application without the intrusion of system problems. To this end the p-code interpreter, the run-time system and the basics of the operating system are lumped together in a Turnkey Subsystem (TKS) while all the other facilities are provided in the Total System Set (TSS). The p-system incorporates a range of facilities and utilities to enable a programmer to set up a turnkey system. These include the capabilities of booting directly into the application program; accepting all input from a file, rather than a keyboard; the chaining of programs; full error trapping and utilities for creating menus and exploiting the screen. To this Philips has added a utility called Backup which contains a subset of the housekeeping routines sufficient for a turnkey user. Thus an applications programmer can set up a complete turnkey system without ever using assembler or patching machine-code.

Compared to other p-systems we have used, our impressions were that the disk capacity was a bit small for comfortable development work and that the type-ahead buffer was needlessly small (? four characters). In addition, on first booting up the UCSD system disk, it was necessary to 'initialise' the disk before it could actually be used. This involved running a program (resident on the disk) which copied the serial number of the ROM-pack interpreter onto the disk. The same procedure was



required for each of the other distribution disks. This is Philips' attempt to solve the problem of software theft — but we felt that it wouldn't be too hard to think up ways around these restrictions (like doing a block copy of the disk on another system before initialising; or copying the ROM). Independent software houses might find the 'security' of this ROM/disk association a mixed blessing since a user whose system was already installed would presumably have to send his ROM-pack to the supplier for initialisation when purchasing new or upgraded software.

Philips shows a similar concern for software theft in its other software system. For much of the time the Disk Basic requires the system disk in the left drive, which is thus inaccessible to the user. There appears to be some facility to make programs 'execute only' which Philips, for some reason, calls 'write protected' — meaning that it is pro-

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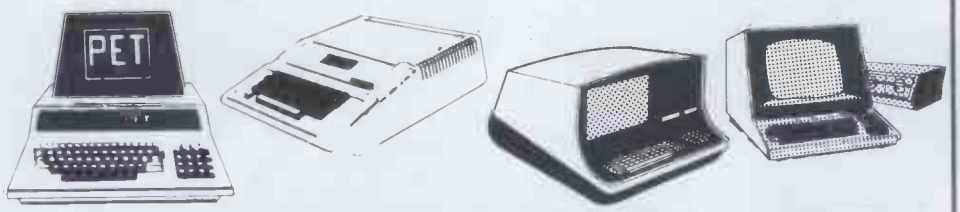

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SYSTEM A Basic computer including screen & keyboard	£399	£755	–	–
SYSTEM B As 'A', plus floppy disk drive(s) and matrix printer for small business user.	£1700	£1579	£2380	£2400
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tected against having another copy of it written. For a medium as unreliable as floppies, this can present severe problems.

The Disk Basic is a 24k OEM Microsoft Basic which runs stand alone. On boot-up, the system interrogates for the number of file buffers (0-15, default is 3) and whether run-time support is required, in the usual OEM Microsoft fashion. Depending on the answers, the user space can end up anywhere between 12k and 29k. There is an additional utility called 'Volorg' which is similar to Backup provided on the p-system. Volorg enables users to backup files and disks and to set parameters (although there appears to be no facility of unwrite protecting a program).

The two applications packages provided (Stock Control and Sales Ledger/Invoice) were both written in Basic. They appeared to be quite robust, had a consistent and uniform style, and used the screen imaginatively. Setting up the data files was a lengthy process, surprising because of the relatively small capacity of the disks. Files could not cross disks so that when a disk gets full (400 stock items, 250 sales customers) the user has to divide his records and run separate systems.

Potential

The glossy for the P2000 calls it 'a general-purpose information handler for any work situation', but we suspect that it must be fairly choosy in its definition of 'work'. Judging by the repertoire of applications packages, it is aimed at the business user and (since we could find no reference to a planned increase in disk density or upgrade to a hard disk) with data files limited to (say) 250 customers per disk, they mean the small business work situation. However, Philips does market a turnkey word processor, the P5000, to which the P2000 can act as an extension provided the typists can accept the rather down-market keyboard. The other end users suggested by the brochure include the home user (but it's probably too pricey); the scientific user (expansion/interfacing capabilities are limited); the education user (not robust enough and no graphics) but this is open to some scepticism.

On the other hand, Philips seems also to have aimed the system at the software developer (both in Basic and Pascal), with development aids for the creation of turnkey systems, excellent documentation and some means of providing software protection (of sorts). It is amazing what some really creative software development can do to sell a system — consider how many Apples were sold just to run Visicalc — so the P2000 may yet become a better buy than we've made out here.

Documentation

Philips' documentation comes in bold orange ring-back binders. The UCSD manuals from Softech are very good to start with and Philips has taken the 'Internal Architecture' and the 'Reference Manual' and added page headings so that information can be found very easily. There is also the 'Total System Set Programmers Guide' in which Philips describes its own enhancements together with some of the information distilled from the Softech Installation Guide. It all seems well put together, informative and quite chatty at times.

The Basic system manual 'Disk Basic' follows the same pattern, being the Microsoft Basic manual with a few appendices devoted to the Philips implementation, in particular the Volorg utility. The documentation for the applications packages is of the same high standard, although pitched at a totally different level of user. It is difficult to find fault with the documentation except that we were not supplied with a Technical/Hardware manual — although we were assured that it does exist.

Prices

The Philips price list was posted to us after we'd had the system for about a week, by which time we'd built up our own pricing picture which put the system hardware with some basic software (eg, Basic or Pascal, no applications) at around the £2000 mark, in direct competition with Tandys, Apples and SuperBrains. This estimate was based on the observation that, apart from the lavish documentation, there is an element of corner-cutting in the Tandy-style casings, the calculator-style keys, the low capacity drives, the absence of a back-plane, fans, etc. Finally, the standard matrix printer is a plain Epson MX80 rather than the MX80 FT (quieter, more versatile, more expensive) and the keyboard cabinet (Z80, 48k RAM, ROM-pack) is reminiscent of an Exidy Sorcerer (£500-£800 price bracket).

On receiving the price-list, however, we realised that Philips is not planning to compete in the micro market. Perhaps being a multinational it has sales contracts in the business world which provide an adequate market so it can afford to ignore the punters. All products are unbundled and are priced as follows:

Review System:

P2033 (Keyboard cabinet as described with 48k RAM)	£1325
P2103 (Monitor cabinet with pair of mini-floppy drives)	£1345
P2123 (OEM Epson MX80 printer with serial interface)	£820
Sales ledger and invoicing	£350
Stock control	£300
Microsoft Basic interpreter	£210
UCSD Pascal Version IV	£420
Total (excluding VAT)	£4770

This could constitute a fairly ordinary small business configuration (apart, possibly, from the program development software). For anyone still interested, other configurations could include:

P2121 Daisywheel printer (OEM TEC)	£1730
P2031 Minimal keyboard cabinet with 16k RAM	£895
P2032 Keyboard cabinet with 16k RAM and disk controller	£1099
P2101 Monitor cabinet with no drives	£470
Purchase ledger	£350
Nominal ledger	£300
Payroll	£150
Word processing package	£230

Conclusions

The hardware people at Philips Data Systems seem to have designed a practical, inexpensive to mass-produce, limited capability machine; the software people gave it the potential to compete with its well-established rivals — providing not only a range of business packages but a program development environment for independent software houses, supported by superior documentation. However, the marketing people seem to have slotted it into too high a price bracket, where it will be outclassed both in quality and capacity. END

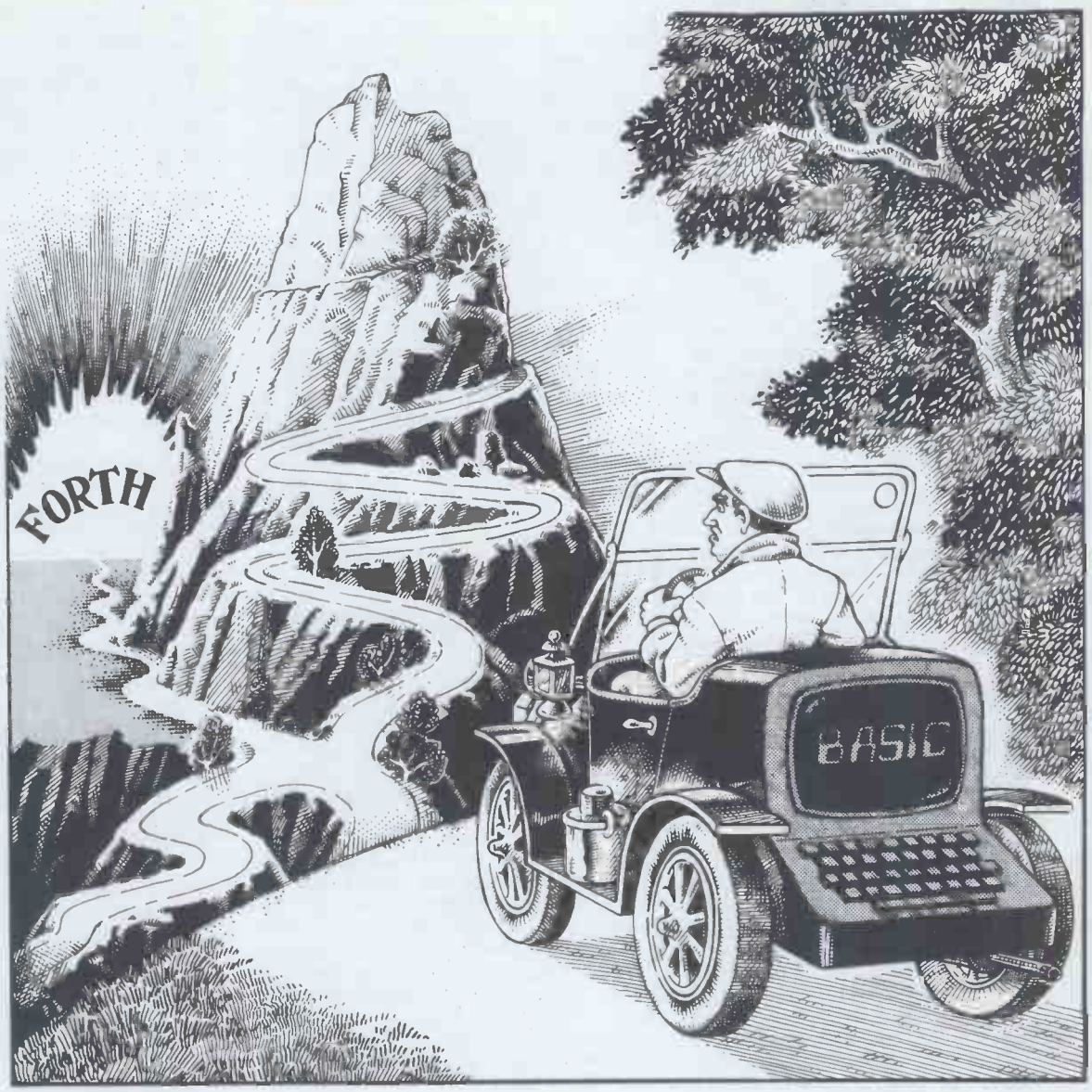
Benchmarks
All timings in seconds.

Basic:	BM1	1.9
	BM2	5.9
	BM3	15.8
	BM4	15.7
	BM5	16.7
	BM6	29.8
	BM7	47.2
	BM8	8.5
Pascal:	magnifier	4.7
	forloop	56.3
	whileloop	52.6
	repeatloop	46.9
	literalassign	68.1
	memoryaccess	70.5
	realarithmetic	71.4
	realalgebra	67.0
	vector	148.2
	equalif	92.6
	unequalif	90.7
	noparameters	38.6
	value	41.4
	reference	41.4
	maths	39.1

Technical specifications

CPU	: Z80
Memory	: 48k RAM: 8 or 16k ROM-pack
Keyboard	: 74 keys, qwerty + numeric pad; (four 'nationalities')
Monitor	: 12in, 80 char x 24 lines, green, 6x10 matrix
Printer	: Epson MX80 (or TEC daisywheel — both OEM versions)
Cassette	: 120 kbyte mini-cassette
Disk Drives	: 2 x 5.25, single-sided, 140 kbytes
Ports	: RS232, 1200 baud (optional UHF video)
System software	: UCSD p-system; PDOS
Languages	: UCSD — Pascal, Basic, Fortran 77, assembler PDOS — Microsoft Basic

GO FORTH AND MULTIPLY



JOHN STOREY

Mike Curtis explains the features of Forth which make it an ideal language for small systems.

Basic has done for microcomputing what Henry Ford did for the motorcar; that is, made it easily and cheaply available to a large number of people. There comes a point in the education of many microusers, however, where an urge is felt to branch out into other languages; this step gets more feasible by the month as compilers and interpreters become available for languages hitherto unavailable on micros. Pascal, Lisp, C, PL/I, APL, Forth, Cobol, the list goes on.

Some users will opt for a language with more sophisticated control structures and more readable code, such as Pascal or Comal, others for the speed and economy of Assembler. Standing at this fork in the road between higher and lower level languages, many people have overlooked a less distinct third path, the language Forth.

Developed in the middle 1960s for instrument control applications, it was initially only available on mainframe and minicomputers from Forth Inc, a company set up by its inventor Charles H Moore and his early collaborators. The name came from Fourth generation computer language; unfortunately the Third generation IBM 1130 on which it was developed only allowed Five character identifiers. The news spread and it developed a devoted 'underground' following among groups who have propagated the language by writing and distributing Forth systems for micros among themselves. Now Forth is beginning to appear 'off the shelf' for many machines and seems destined to join the shortlist of popular microlanguages.

The attraction of Forth's 'middle road' for micro applications is that it combines a speed and memory economy comparable to Assembler with a novel modular program structure which, once mastered, allows much more rapid program development than many high level languages, let alone machine code. The price paid is that the source code is not as readable as Pascal or even Basic, and that many facilities taken for granted such as strings, arrays and floating point arithmetic are not initially provided (though they can

be added at will once you become fluent). How this happens will only become clear after a little discussion of Forth's unique structure, which is so different from sequentially executed languages like Basic and Pascal that it will provoke quite a major mental reshuffle. In particular you will have to abandon any concept of what constitutes a 'program' derived from Basic. At the heart of Forth is a 'dictionary' of around 100 'words' held in memory while the system is active. Fifty or so of these words define machine code routines which are linked and executed when the word is invoked; the remainder are defined in terms of these words. Words have names, like ALLOT, ECHO or +. This concept of defining words using previous definitions is crucial to the operation of Forth and is (this is a crude simile) similar to writing a Pascal program as a cascade of nested procedures. The activity of the programmer in a Forth system consists of defining new words which perform functions required in his final application. Once defined these new words are compiled into the dictionary and become just as much a part of Forth as the 'core' words. They can be tested immediately in direct mode, at the keyboard. The programmer then defines 'higher level' words in terms of these words and so forth (ouch!) until his final 'program' typically consists of a single word. When this word is executed, one of Forth's interpreters looks at its dictionary entry which contains pointers to the words by which it was defined. These in turn contain pointers to the words by which they are defined and so on down to the level of the machine code 'core' words. Each word is 'executed' as it is found so that Forth is neither interpreted nor compiled in the traditional sense, it is both. Thus, Forth enforces the 'top-down' development of programs beloved of structured programming proponents. The source listing of a Forth program consists of a series of definitions of new words (all of which are independently executable) leading up to the final application. These blocks of code could be loaded from disk or tape during development together with the Forth 'core', but for crucially memory conserving applications, such as industrial control, anything not needed on the run (which includes the compiler and unused dictionary entries) may be stripped away leaving a minimal necessary system for the job; this may be burned into ROM and can typically occupy as little as 800 bytes.

A great beauty of Forth is then its extendability or contractability. The user extends the language himself in the directions which he requires, or pares the system down to target on a specific application. Having written a Forth program, it is likely that many words created will go on to be used in future programs.

Forth is more than just another programming language, it can be an operating system, incorporating its own compiler, interpreter, assembler, text editor and a rudimentary file management system; in short it provides a complete environment for the writing, testing and using of programs. Basic, of course, also provides such an environment, though not so comprehensive, but Forth has a number of distinct advantages over Basic.

The speed of execution of a Forth program is very much greater than an equivalent Basic program, of the order of ten times as fast. A 16-bit machine should execute a Forth program at virtually the same speed as ordinary machine code, and an 8-bit machine should only be slightly slower. A good compiled Basic may be as quick in some applications but it is always possible to use the assembler option and write Forth definitions directly in machine code where speed is really important.

The amount of memory required by a Forth application is also usually much less than with other systems; as with Basic the entire Forth system is resident in memory the whole time; on most systems, however, this only requires 6-8k, and that includes the space for the compiled programs. A little more space is required for disc I/O buffers, or pseudo-disk in a cassette-based system, but this means that a really good Forth system can be fitted into 16k!. Compare this with the 48k at least for a decent Pascal system.

Forth is by its very nature modular, interactive and structured; there is no equivalent to a GOTO statement and it is almost impossible to think of an occasion where one could be used. The modular and interactive nature of Forth is particularly useful and important as it means that a program can be developed in small sections which can be seperately compiled and tested before using them in larger modules. In practice this leads to a much quicker program development time and fewer bugs. Experience has shown that one should be able to at least halve this time compared to Basic.

The final advantage of Forth, and the one that many feel is the most important, is that the Forth system itself is written in Forth. There are usually only a few bytes that are outside the dictionary, so that the programs that you write, or the words that you define are treated in exactly the same way as the words that are already there. When Forth is searching for a word in the dictionary it starts with the most recent definitions, which gives you the option of redefining any of the system words, or defining your own control structures. A Forth program is, in effect, better thought of as an extension of the system to provide commands and facilities suitable to your application.

This does lead us to one of the disadvantages of Forth: it can be very easy to crash and this is one of the penalties of having the system so open to the user. Some of the more sophisticated systems do have some protection built in, and it is always possible to add your own, but a certain amount of fragility is a natural consequence of the nature of Forth. It is usually easy enough to recover from such a crash without too much damage being done, but if it is bad enough to need a complete reload and you are using 300 baud cassettes. . .!

The other main disadvantage of Forth, at least as far as beginners are concerned, is its extensive use of stacks and postfix (reverse polish) notation. The difficulty that many people have with this is usually more imagined than real; though there is no doubt that a language like Basic is easier to learn initially, anyone who understands the basic principles of programming should be able to master Forth without much difficulty.

Stacks

A stack is best thought of as a pile of objects, a common analogy being that of a pile of plates or trays in a canteen. Objects can only be added to the top of the stack, and the only object that can (safely) be removed is the top one. The objects on the Forth stack are 16-bit numbers and the stack provides a convenient place for temporary storage, since the user doesn't have to concern himself with where the numbers are stored, only with the order in which they are stored. Placing a number on the stack is known as PUSHING and removing it is known as PULLING — see Figure 1 for an example.

Part of the documentation for a Forth word should be its effect on the stack, eg, + (n1 n2. . . . . .sum) indicating that the Forth word '+' expects to find two numbers n1 and n2 on the stack. n2 is on top and the effect of that word is to pull the two numbers from the stack and to push their sum back on.

Postfix notation fits in very naturally with stacks: it involves writing an operator after its operands, so we write 2 3 + instead of 2+3 in ordinary infix notation, or B C + A * instead of A*(B+C). Each operand is pushed onto the stack as it comes, each operator pulls its operands from the stack and pushes its result back on.

It is now possible to have a look at some Forth; if the following sequence is entered at the keyboard:
4 5 + (return) OK (OK is the Forth response, output on the same line before the carriage return is echoed) will result in the two numbers 4 and 5 being pushed on the stack, then the + pulls them off, adds them and pushes the sum back on. To see what is on the stack we use the Forth word '.' which prints the top number so:
. (return) 9 OK .
Try this
HEX F 2 *. (return) 1E OK
(Warning: everything will be done in HEX from now on until you enter DECIMAL)

Some Forth words do nothing but manipulate items on the stack, eg:

DUP	(n1 . . . . .n1 n1) duplicates the top item on the stack;
SWAP	(n1 n2. . . . .n2 n1) swaps the top two items around;
OVER	(n1 n2. . . . .n1 n2 n1) copies the second item onto the top;
ROT	(n1 n2 n3. . . . .n2 n3 n1) rotates the third item onto the top;
DROP	(n1. . . . .) drops the top item.

Dictionary

The major difference between Forth and languages like Basic lies in its use of a dictionary and Indirect Threaded Code (ITC). Direct Threaded Code (DTC) means that a program consists of a list of addresses of pre-written routines; in ITC a program consists of a list of addresses of addresses of routines. Provided that the pre-written routines are sensibly chosen so that every programming need can be met by some combination of them, then both methods produce particu-

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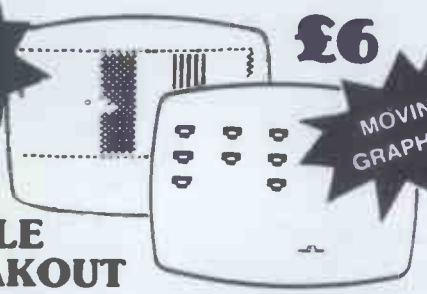

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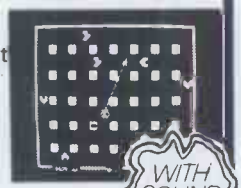

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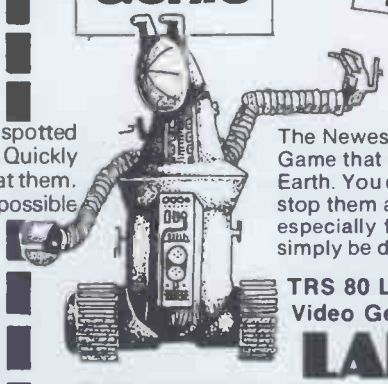

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larly efficient programs because the routines act like a high-level instruction set for the processor, and are themselves usually written in machine code. You thus get a combination of high-level programs running at very nearly the speed of machine code, with the advantage over normal compiled languages that each routine, no matter how complicated, reduces to a two byte address, so the programs do not use up much memory. The advantages of ITC over DTC are not so clear, and beyond the scope of this article, but it makes it easier to treat the programs as routines that can be included in other programs. Forth has, in fact, been implemented in DTC, but the use of ITC is now almost universal.

A Forth dictionary entry contains the following information:

— A name field, which contains the name of the routine (there is very little restriction on the choice of name) and a few other details, such as the length of the name.
— A link field which contains a two-byte pointer to the preceding entry, used when the dictionary is being searched.
— A code field which contains a two-byte pointer to actual machine code which could be the next part of the entry (a code definition), or to a routine that interprets the rest of the entry.
— A parameter field which may contain machine code, addresses of other dictionary entries, variable values, or other information depending on the type of entry.

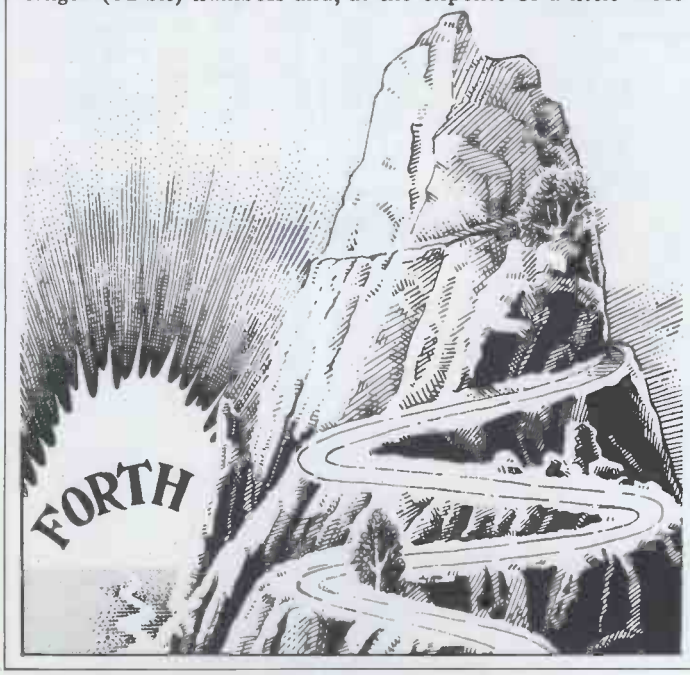
Writing a Forth program involves the creation of a new dictionary entry, whose parameters are the addresses of the other words that go to make up the new word. There are a number of different ways of doing this, the most common being the COLON definition; the Forth word ':' having been defined to create a new dictionary entry. The word ';' is used to terminate a definition, eg, to convert a temperature in Centigrade to Fahrenheit we must multiply by 9, divide by 5 and add 32. We can define a word 'DEGC=' thus:

```
: DEGC= 9 * 5 / 32 + ." DEGF" ;
```

Note the use of spaces; Forth uses spaces as a delimiter so there must be at least one space between every word. The word '." ' prints the character string following up to the next ". Note also that there must be a number on the stack before this word is executed since the '*' requires two numbers to be on the stack. The word 'DEGC=' has now been added to the dictionary and may be used in just the same way as any other word; either in subsequent definitions or directly interpreted from the terminal thus:

```
10 DEGC= (return) 50 DEGF OK
```
or
```
12 DEGC= (return) 53 DEGF OK
```

from which you may gather that Forth uses integer (fixed point) arithmetic. There is no standard method of dealing with floating point numbers in Forth, though a number of routines have been published. Many people think that this is another disadvantage of Forth, but in practice most Forth programmers don't find it much of a restriction; there are a number of useful words available for integer arithmetic, an example being /MOD (n1 n2. . . . .rem quot) which leaves on the stack both the remainder and quotient after a division. Forth also has words for dealing with double length (32-bit) numbers and, at the expense of a little more thought, these give faster, more accurate results than floating point arithmetic.



Variables are not so widely used in Forth programs, since the stack is used for temporary storage; any that are needed must first be defined as dictionary entries, thus:

```
0 VARIABLE X (return) OK
```

which defines a word X as a variable whose parameter field is two bytes long and may be used to store any 16-bit value. When the word 'X' is executed its effect is to leave the address of this parameter field on the stack; values may be stored and retrieved using the words '!' (pronounced store) and '@' (pronounced fetch). X @ will place the value stored in X onto the stack. While X ! will place the current top of the stack into X.

Other types of variable are possible, but it is up to the programmer to allot enough space in the dictionary (using the word ALLOT) and to write the words necessary to access their values. For example a simple one-dimensional array of ten 16-bit numbers could be defined by:

0 VARIABLE ARRAY 18 ALLOT (18 bytes + 2 bytes assigned by VARIABLE). Execution of the word 'ARRAY' will also place the address of the parameter field (the first element of the array) on the stack, but the word 'ARRAY' could be redefined to access all the elements thus:

```
: ARRAY 1 — 2 * (to work out the byte offset)
    ARRAY (uses the previous definition to get the address)
    + ;
```

Now, for example, 3 ARRAY will put the address of the third element on the stack. There are other ways of doing this with only one definition, using one of the other methods of creating a dictionary entry, but this is perhaps the easiest to understand.

The usual control structures are available, with the exception of a CASE construction, though there are a number of published versions of this. The major ones are:

IF (true clause) ELSE (false clause) ENDIF

where the ELSE and the false clause may be omitted;

DO (routine to be repeated) LOOP

which is the equivalent of a FOR. . .NEXT loop in BASIC, with a variation using +LOOP for an increment which is not 1;

BEGIN (condition) WHILE (routine) AGAIN
BEGIN (routine) (condition) UNTIL

which should be self-explanatory.

Here is an example which illustrates the IF and DO. .LOOP constructions, and also shows the way in which a program may be built up in modules. Suppose our ARRAY contains ten marks in an exam, and results must be printed out as PASS (45 per cent or over) or FAIL. First we define a word 'GRADE' which will test the number on top of the stack and print the appropriate message.

```
: GRADE 45 < (pulls the top two numbers and pushes a 1
                if the second is less than the top, 0 otherwise )
    IF ." FAIL"
    ELSE ." PASS"
    ENDIF ;
```

This can now be tested by, for example:

```
62 GRADE (return) PASS OK
```

and it can be then incorporated in:

```
: GRADES 11 1 (the DO LOOP index, performed ten times, 11
                is the value at which it will exit)
    DO
      I ARRAY @ (I pushes the index onto the stack)
      DUP . (to print the mark) 5 SPACES
      GRADE CR (to do a carriage return)
    LOOP ;
```

To sum up, Forth is not a language for absolute beginners, but it has so many advantages over Basic and similar languages that it should be seriously considered by anyone else. There are now versions of Forth available for most popular micros and a thriving user group, the Forth Interest Group (FIG), publishes a newsletter in the UK. For more information write to: The Hon Sec, Forth Interest Group UK, c/o 38 Worsley Road, Frimley, Camberley, Surrey, GU16 5AU.

A very good introductory book, which not only tells you all you need to know about Forth, but also gives an insight into the workings of computers is *Starting Forth* by Leo Brodie, available for £11.95 from Computer Solutions. Treway House, Hanworth Lane, Chertsey, Surrey, which also supplies a lot of the more sophisticated (and expensive) Forth material.

FIG in the States publishes a magazine *Forth Dimension* and distributes a lot of material, including Assembler listings for all major microprocessors. Its address is: Forth Interest Group, PO Box 1105, San Carlos, CA 94070, USA.

CUBIC SPLINE CURVE FITTING

MJ Parrot explains a technique for fitting a smooth curve to complex dataplots

Before your eyelids begin to droop uncontrollably, I must hasten to explain that Cubic Spline Fitting has nothing whatsoever to do with Mr Rubik, less still with the reassembling of his cubes. Cubic spline interpolation is a mathematical technique which does for a curved line what linear regression does for a straight line graph. Even if you are not a mathematician, ponder a while on whether or not you have ever wanted your program to display results as a graph; not a messy scatter of points but a line or smooth curve, which enables you to predict values other than those plotted. These may be sales figures or sightings of the Great Crested Grebe by month, laptimes of a racing bike by percentage of a fuel additive, soccer scores by phase of the moon — there are many areas outside of pure mathematics and statistics where the correlation between two related phenomena can best be understood by graphical display.

Anyone who has been involved in a discipline where experimental or sample data have to be presented in graphical form will probably be familiar with linear regression (LR) analysis. The data points are plotted on graph paper; they appear to show a trend, but they by no means fall into a neat straight line. In fact, a multitude of straight lines could be drawn which pass close to most of the points. LR analysis finds the single straight line which is optimally close to the most points; in other words, the line which best represents the trend of the data.

The actual method used is based on minimising the difference between the sum of squares or products of data coordinates and the squares or product of their means; it yields as well as the equation of the best fit line, a coefficient of correlation and variance (a measure of the goodness of fit). The method can be found in any statistics textbook and programs are widely available for scientific calculators as well as for micros. The 'least squares' method can be extended to fit some simple curves to data, namely exponential, logarithmic and power regression. But, by and large, these only work well for a continuously increasing or decreasing function. If the best graph for your data has several turning points, then the far less widely known technique of cubic spline interpolation can fit a series of cubic curves to the points. The following program is for Apple II, and the relevant portions could easily be lifted out for inclusion as a subroutine in a larger program or suite of programs, in order to present results as a smoothly curved graph.

The program allows the plotting of up to 50 points on Apple's high resolution screen and allows the user to remove one or more points. This is useful if one point is so far off the curve as to be suspect.

Essentially a cubic spline consists of cubic equations knotted together at the datum points. These equations are mutually dependent in that on either side of each datum point they have the same x & y values (naturally), the same slope, and the same curvature. (For more detailed information on cubic splines try reading J H Ahlberg, E N Nilson & J L Walsh, *The Theory of Splines and Their Applications*, Academic Press, London, 1967.) Briefly, for each cubic equation, interpolated between points with x-values x_i and x_{i+1} the equation has the form:

$$y = a_i + b_i(x-x_i) + c_i(x-x_i)^2 + d_i(x-x_i)3$$

The program is written as a collection of subroutines which may easily be added to or changed. (It is worth noting that several of the routines could be used as elements in a linear regression program.) The sort routine (line 190) is a fast sorting routine for the number of points likely to be involved and is really only used to find the minimum (left in A(0)) and maximum (left in A(N−1)) values of the points 0 to (N−1).

In the program the linear parameters a_i, b_i, c_i, d_i have been calculated and stored in the arrays A1(I), B(I), C(I), D(I). Note that early on in the calculations the arrays B, C, D are used for other parameters which become redundant. Having calculated the spline parameters the program draws the curve. In both programs the axes are arbitrarily drawn, although it is quite easy to scale them and also to label them using a shape table of characters.

With the cubic spline technique, the order of data input is obviously important as pairs of data are used to calculate the parameters, therefore some care is needed in entering the data. Also, to facilitate curve drawing and to lessen memory overheads, some assumptions have been made. These are that the x-values increase from one point to the next and that the curve generated is not going to go wildly off the screen. If these points are not adhered to, the program will not crash but will draw some 'odd' shapes. Thus the program will not draw a spiral through points which lie on a spiral although the parameters have been correctly calculated. A more wide-ranging plotting technique could easily be implemented if the user desires.

The cubic equations generated may be used to 'read' a value from the graph or may be used to draw the first derivative of the curve since parameter B is the value of the slope at each point and this can be plotted and a second cubic spline can be interpolated.

The output formatter of the program merely aligns output within a field and can easily be dispensed with. If anyone wants to use it in other programs, note that the subroutine requires F(1), the number to be output; F(2), the number of decimal places to be printed; F(3), the size of the field in which to print and an array F$(35).

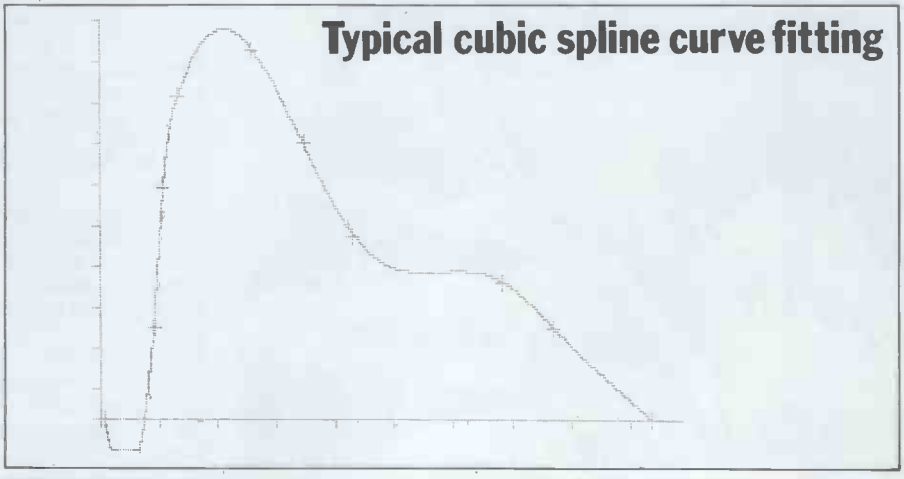
Conversion to other Basics

The major difficulty in converting this program to run on other micros will centre around their plotting capabilities, but I don't see why it should not be possible. Points to note are:

1. HOME. . . clears the screen & returns the cursor to top left-hand corner;
2. CALL-868. . . clears from cursor to end of the line;
3. POKE 32,4. . . moves the left-hand side of the text window to column 5. This is used to indent a table. POKE 32,0 restores the full text window;
4. LOMEM: 16384. . . used to set the start of variable space in order to protect the high resolution page;
5. VTAB & HTAB. . . are respectively vertical & horizontal tabbing commands used outside of print statements;
6. HPLOT x,y. . . plots a point at the coordinates x,y on a grid where x runs from left to right with values 0 to 280 and y runs from top to bottom with values 0 to 160 (on the part of the screen seen in the program);
7. HPLOT TO x',y'. . . plots a straight line from the last point plotted to the point x',y'.

END

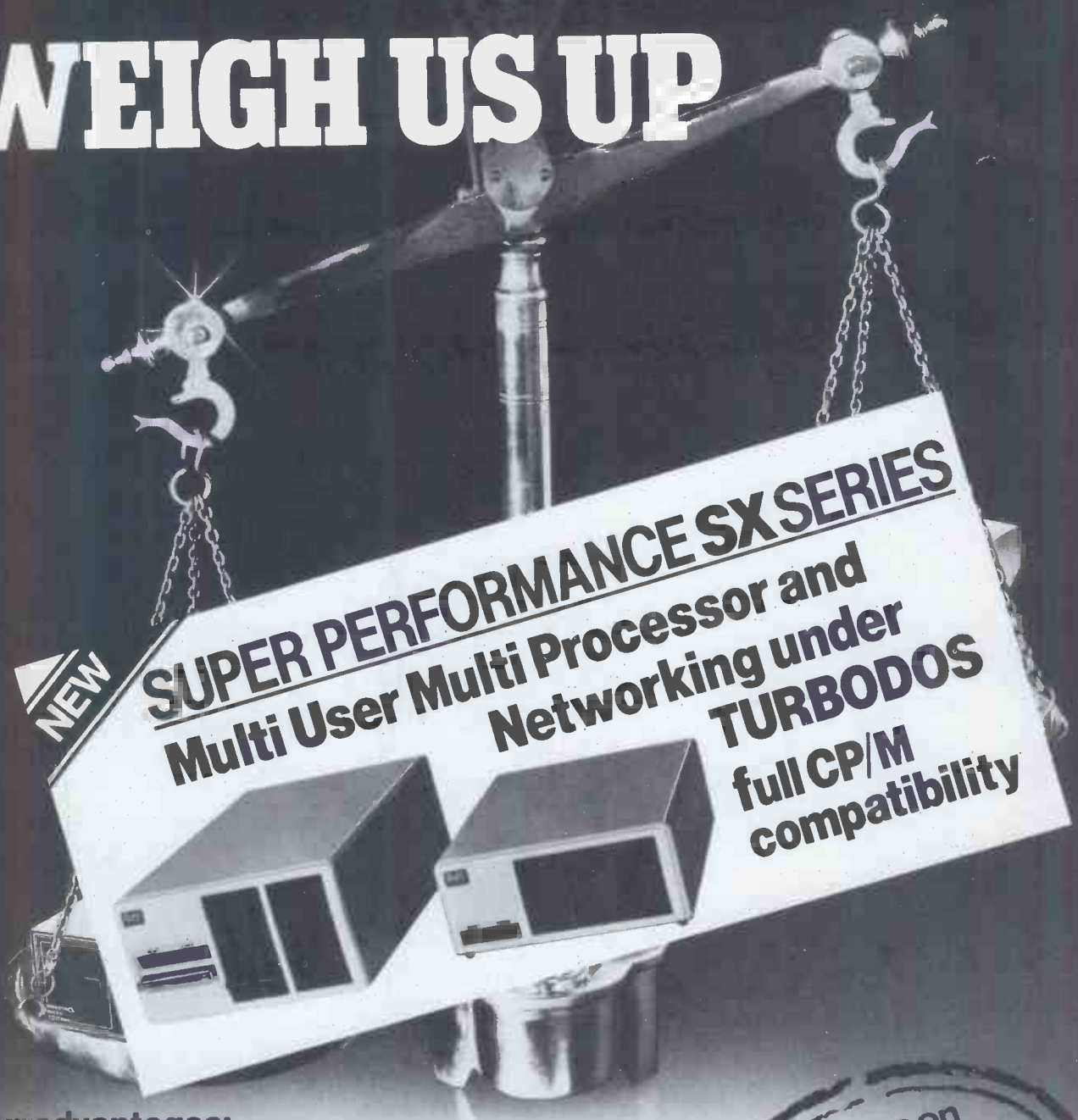
Typical cubic spline curve fitting



```
1  LOMEM: 16384: POKE 232,009: POKE 233,66
5  DATA   "1","2","3","4","5","6","7","8","9","0"
10  DIM P(1,30),F$(35),F(10),A(30),X(32),Y(32),A1(30),B(30),C(30),D(31),V(30),W(30)
20  GOTO 10000
24  REM


SPACE BAR


25  VTAB 24: HTAB 7: FLASH : PRINT "PRESS SPACE BAR WHEN READY"; : NORMAL : GET T$: RETURN
39  REM


OUTPUT FORMATTER


40  FOR J9 = 1 TO F(3):F$(J9) = " "; NEXT J9: IF F(2) > F(3) - 2 THEN  GOTO 120
45 F(2) =  ABS ( INT (F(2) + .5)):F(4) = F(3) - F(2):F(5) =  ABS (F(1)) + .5 * 10 ↑ ( - F(2)):F(6) =
 0:F(8) = 0: IF  INT (F(5)) = 0 THEN  GOTO 85
50  IF F(6) > 0 THEN F(5) = F(5) / 10
55 F(6) = F(6) + 1: IF F(6) > F(3) - F(2) - 2 THEN  GOTO 120
60  IF  INT (F(5)) > 9 THEN  GOTO 50
65  FOR J9 = F(6) TO 1 STEP  - 1: IF  INT (F(5)) = 0 THEN F(5) = F(5) + 10
70 F(8) = F(8) + 1:F$(F(4) - J9) = F$( INT (F(5)) + 25): IF F(8) > 6 THEN F(5) = 0
75 F(5) = 10 * (F(5) -  INT (F(5))): NEXT J9: IF F(8) > 6 THEN  GOTO 105
80 F(5) =  ABS (F(1)) + .5 * 10 ↑ ( - F(2))
85  FOR J9 = 1 TO F(2):F(7) = F(4) + J9:F(5) = 10 * (F(5) -  INT (F(5))): IF  INT (F(5)) = 0 THEN F(
5) = F(5) + 10
90 F(8) = F(8) + 1:F$(F(7)) = F$( INT (F(5)) + 25): IF F(8) > 6 THEN  GOTO 100
95  NEXT J9
100  IF F(2) > 0 THEN F$(F(4)) = "."
105  IF F(1) < 0 THEN F$(F(4) - F(6) - 1) = "-"
110 F$(F(3) + 1) = "":F$ = "": FOR J9 = 1 TO F(3):F$ = F$ + F$(J9): NEXT : IF  ABS ( VAL (F$)) >  =
1 THEN F$ = " " + F$: RETURN
115  T$ =  LEFT$ (F$,F(4) - 1):Z$ =  RIGHT$ (F$, LEN (F$) - F(4) + 1):F$ = T$ + "0" + Z$: RETURN
120 F$ = "": FOR J9 = 1 TO F(3):F$ = F$ + "*": NEXT : RETURN
130  REM


SORTING


190  FOR J = 1 TO N
200 I = J - 1
210 A = A(J)
220  IF A >  = A(I) THEN 260
230 A(I + 1) = A(I)
240 I = I - 1
250  IF I >  = 0 THEN 220
260 A(I + 1) = A
270  NEXT J
280  RETURN
350  REM


AXIS PLOTTING


340  HPLOT 3,0 TO 3,159: HPLOT 0,156 TO 279,156
370  FOR I = 0 TO 159 STEP 16
380  HPLOT 0,I TO 3,I
390  NEXT
400  FOR I = 3 TO 279 STEP 28
410  HPLOT I,156 TO I,159
420  NEXT
430  RETURN
630  REM


POINT REMOVAL


640  VTAB 23: PRINT "DO YOU WANT TO REMOVE A POINT? Y OR N?"
650  GET T$: IF T$ = "N" THEN  RETURN
660  HOME : VTAB 21: PRINT "THE BOX WILL MOVE TO EACH POINT IN TURN"
670  PRINT "IF REMOVAL WANTED TYPE R, ELSE K"
690  FOR I = 0 TO N: GOSUB 870
720  GET T$: IF T$ = "R" THEN  GOSUB 780
730  IF T$ = "K" THEN  HCOLOR= 0: GOSUB 870
740  HCOLOR= 3
750  NEXT
760  RETURN
770  REM


ARRAY SHUFFLE AFTER POINT REMOVAL


780  FOR K = I + 1 TO N
790 X(K - 1) = X(K):P(0,K - 1) = P(0,K):Y(K - 1) = Y(K):P(1,K - 1) = P(1,K): NEXT : FOR K = N TO N +
 1:X(K) = X(K + 1):Y(K) = Y(K + 1): NEXT :N = N - 1: POP : POP : GOTO 10010
840  REM


BOX PLOTTING


870  HPLOT X(I) - 5,Y(I) - 3 TO X(I) + 1,Y(I) - 3 TO X(I) + 1,Y(I) + 3 TO X(I) - 5,Y(I) + 3 TO X(I)
 - 5,Y(I) - 3: RETURN
5005  REM


PLOT POINTS


5010  FOR I = 0 TO N:X(I) =  INT (5.5 + SX * (P(0,I) - XO)): NEXT
5020  FOR I = 0 TO N:Y(I) =  INT (156.5 - SY * (P(1,I) - YO)): NEXT
5030  FOR I = 0 TO N: HPLOT X(I) - 3,Y(I) TO X(I) + 3,Y(I): HPLOT X(I),Y(I) - 3 TO X(I),Y(I) + 3: NE
XT : RETURN
5040  HOME : VTAB 22: HTAB 9: PRINT "THESE ARE YOUR POINTS": GOSUB 640: RETURN
5059  REM


CALCULATE SPLINE PARAMETERS


5060  HOME : VTAB 22: HTAB 10: PRINT "SPLINE BEING FITTED": VTAB 1
5069  REM


PARAMETER A1


5070  FOR I = 0 TO N:A1(I) = P(1,I): NEXT
5079  REM


PARAMETER H


5080  FOR I = 0 TO N - 1:D(I) = P(0,I + 1) - P(0,I): NEXT
5085 D(N) = D(N - 1):D(N + 1) = D(0)
5089  REM


PARAMETER V


5090 B(0) = 2 * D(0): FOR I = 1 TO N - 1:B(I) = 2 * (D(I) + D(I - 1)): NEXT :B(N) = 2 * D(N - 1)
5099  REM


PARAMETER W


6000 C(0) = 3 * (A1(1) - A1(0)): FOR I = 1 TO N - 1:C(I) = (D(I - 1) * (A1(I + 1) - A1(I))) / D(I)
6010 C(I) = C(I) + ((D(I) / D(I - 1)) * (A1(I) - A1(I - 1)))
6020 C(I) = 3 * C(I): NEXT :C(N) = 3 * (A1(N) - A1(N - 1))
6029  REM


PARAMETER V'


6030 W(0) = B(0):W(1) = B(1) - (D(1) * D(N + 1) / W(0))
6040  FOR I = 2 TO N:W(I) = B(I) - ((D(I) * D(I - 2)) / W(I - 1)): NEXT
6049  REM


PARAMETER W'


6050 W(0) = C(0): FOR I = 1 TO N:W(I) = C(I) - (D(I) * W(I - 1) / W(I - 1)): NEXT
6059  REM


PARAMETER B


6060 B(N) = W(N) / V(N): FOR I = (N - 1) TO 1 STEP  - 1:B(I) = (W(I) - (D(I - 1) * B(I + 1))) / V(I)
: NEXT
6070 B(0) = (W(0) - (D(N + 1) * B(1))) / V(0)
6079  REM


PARAMETER C


6080 C(0) = 0:C(N) = 0: FOR I = 1 TO N - 1:C(I) = (A1(I + 1) - A1(I)) / (D(I) ↑ 2):C(I) = 3 * C(I):C
(I) = C(I) - (((2 * B(I)) + B(I + 1)) / D(I)): NEXT
6089  REM


PARAMETER D


6090  FOR I = 0 TO N - 1:D(I) = (C(I + 1) - C(I)) / (3 * D(I)): NEXT : RETURN
6130  REM


PLOT THE CURVE


6140  HPLOT X(0),Y(0): FOR I = 0 TO N - 1: FOR J = X(I) TO X(I + 1):TEMP = XO + (J - 5) / SX
6150 TEMP = TEMP - P(0,I)
6160 TEMP = A1(I) + B(I) * TEMP + C(I) * TEMP ↑ 2 + D(I) * TEMP ↑ 3
6170 TEMP = 156 - SY * (TEMP - YO) + .5: IF TEMP > 170 OR TEMP < 1 THEN  GOTO 6190
6180  HPLOT  TO J,TEMP
6190  NEXT : NEXT : RETURN
9999  REM


MAIN PROGRAM


10000  HGR : GOSUB 50000: TEXT : GOSUB 25: GOSUB 45000:SIY = 145: GOSUB 40000: POKE  - 16304,0: HCOL
OR= 3
10010  GOSUB 5010: GOSUB 360: GOSUB 5040:
10020  GOSUB 5060: GOSUB 6140: GOSUB 25: GOSUB 50000: TEXT : END
39999  REM


SCALING FOR DRAWING


40000  FOR I = 0 TO N:A(I) = P(0,I): NEXT : GOSUB 190:SX = 260 /  ABS (A(N) - A(0)):XO = A(0)
40010  FOR I = 0 TO N:A(I) = P(1,I): NEXT : GOSUB 190:SY = SIY /  ABS (A(N) - A(0)):YO = A(0): RETUR
N
49999 REM


 DATA  INPUT


45000  HOME : VTAB 5: HTAB 4: PRINT "YOU NOW HAVE TO ENTER YOUR DATA": PRINT : HTAB 5: PRINT "YOU FI
RST ENTER THE X-VALUES"
45010  HTAB 9: PRINT "AND THEN THE Y-VALUES ": PRINT : PRINT : PRINT : HTAB 11: PRINT "TO FINISH TYP
E '/'": GOSUB 25:N = 0
45020  HOME : VTAB 5: PRINT "WHAT IS X-VALUE OF POINT "N + 1: PRINT "PRESS <RETURN> AFTER TYPING YO
UR NUMBERS": INPUT N$: IF  ASC (N$) = 47 THEN  GOTO 45070
45030  IF  ASC (N$) < 48 OR  ASC (N$) > 57 THEN  GOTO 45020
45040 P(0,N) =  VAL (N$)
45050  PRINT : PRINT "WHAT IS Y-VALUE ": INPUT N$: IF  ASC (N$) < 44 OR  ASC (N$) > 57 OR  ASC (N$)
 = 46 OR  ASC (N$) = 47 THEN  GOTO 45050
45060 P(1,N) =  VAL (N$):N = N + 1: GOTO 45020
45070 N = N - 1:F(3) = 7:F(2) = 2: FOR J = 0 TO (1 + .4343 *  LOG (N))
45080  HOME : PRINT "READING  X-VALUE  Y-VALUE": PRINT : PRINT : PRINT : FOR I = 0 TO 9: IF I + 10 *
 J > N THEN  GOTO 45100
45090  PRINT 1 + I + 10 * J;:F(1) = P(0,I + 10 * J): GOSUB 40: PRINT  SPC( 6 -  LEN ( STR$ (1 + I +
 10 * J)));F$:F(1) = P(1,I + 10 * J): GOSUB 40: PRINT  SPC( 2);F$: NEXT
45100  PRINT : PRINT "IS DATA OKAY?  Y OR N?": GET T$: IF  ASC (T$) <  > 89 AND  ASC (T$) <  > 78 TH
EN 45100
45104  IF  ASC (T$) = 89 AND I + 10 * J > N THEN  GOTO 45125
45105  IF  ASC (T$) = 78 THEN  GOTO 45110
45110  PRINT "ENTER NUMBER OF WRONG SET ": INPUT X: HOME : PRINT "NOW ENTER X-VALUE FOR POINT "X: I
NPUT P(0,X - 1)
45120  PRINT "& NOW THE Y-VALUE ": INPUT P(1,X - 1): GOTO 45080
45123  NEXT J
45125  HOME
45130  HOME : VTAB 5: HTAB 8: PRINT "CALCULATIONS BEING MADE": RETURN
49999  REM


INTRODUCTION


50000  HOME : VTAB 7: POKE 32,7: PRINT :A$ = "=========================": INVERSE : PRINT A$:A1$ = "=
=": PRINT A1$;X =  VAL (A$)
50010  PRINT A1$: PRINT A1$; PRINT "= CUBIC SPLINE FITTING =": PRINT A1$
50020  PRINT A1$: PRINT A1$: PRINT A$: NORMAL : POKE 32,0
50025  FOR I = 26 TO 35: READ F$(I): NEXT I: RESTORE : RETURN
```

'I've heard that the Space Invaders here are really good.'

WEIGH US UP



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Yesss COMPUTER WORLD

Compiled by Derrick Daines

Statistics

Wow! That was the show, that was — two floors of the Cunard Hotel packed solid with visitors for three whole days! According to He-Who-Shall-Be-Obeyed (the Editor), attendances were 2.6 times as great as last year, a statistic that had me reaching for my calculator. A few minutes later I had reached the conclusion that if this phenomenal rate of growth were to continue, in 1988 the entire population of the British Isles would be clamouring to get in! I wonder where they'll hold it — Windsor Great Park? No, that's far too small: they'd have to take a short-term lease on the county of Yorkshire. (The police advise visitors that those wishing to shoot Derrick Daines must join the queue at Hull. Coffee and sandwiches are available at Beverley and York.)

Talking of daft statistics reminds me of the remark of the man who heard that 25 percent of all traffic accidents were caused by drunken drivers. 'We've got to do something about these non-drinking drivers,' he muttered darkly. 'They're causing three times as many accidents as the rest of us put together!'

The point at issue is how long one may expect the popular interest in computing to continue to grow at 260 percent per annum, a question that is causing enormous numbers of heads to be scratched and considerable discussion all over the place. My own guess, for what it is worth, is that 'popular' or 'games' computing will grow a lot more yet, but not nearly so much as more serious applications. For my money, the great growth area of the coming decade will be educational computing and I am supported in this belief by the great number of women — mothers and/or teachers — who wanted to talk to me about the use of computers specifically for education on the home and/or classroom. Nor were these women easily put off, but they examined every statement critically — even suspiciously. It seems to me that men and boys very often take up computing out of an enthusiasm for the technology itself, but that women as a rule tend to question more what it will do for the quality of life. Both attitudes are, of course, valid and useful, but it implies that if manufacturers and suppliers are to cash in fully, they would be well advised to heed the tastes and needs of potential women customers. Among other things, this means paying more than lip service to the educational advantages of computers. It means compact computers free of spaghetti-like trailing wires and it means a loading system that will load programs easily and faultlessly time after time — and if that means getting rid of cassette systems, then I, for one, will cheer.

Security

I was happy to meet a young reader at the show who hailed from Norwich. Regular readers will remember that some time ago they suffered a rip-off there when a dishonest youth copied another student's programs. My visitor reported that Norwich Tech was hard at work trying to improve the security of disk files.

He didn't report what disk-operating system they were running under, but if they are running Flex 1.0 or Flex 2.0, I can make it easy for them. A long time ago I altered TSC (or SWTP) Basic so that it refused to LIST, SAVE, APPEND, TSAVE or CATalogue any file with a .PRO extension. (By refusing to CAT, I mean that a program with a .PRO extension did not appear in the catalogue — it was invisible.) I also altered FLEX 1.0 commands so that they, too, refused to do these things.

When Flex 2.0 came out, they included the invisibility bit as a protection command and it was easy for me to include all of my previous alterations. I also taught my students to include a run-time protection:

```
10 INPUT 'WHAT IS THE CODE WORD',D$
20 IF D$< > 'ANY STRING' THEN NEW.
```

In combination, these measures provide an enormous amount of software protection – certainly adequate for a college. The would-be thief has no inkling of the program and even if he has, he doesn't know its name, so cannot call it. And given that he knows the above, he cannot know the code-word necessary to run the program. He cannot list it, either in Flex or Basic and he cannot APPEND it to another file of his own. Also, he cannot SAVE it under another name and extension. That, I think, takes care of him! (There *are* ways around it, but I am certainly not going to broadcast them here.)

I have prepared a leaflet giving details of how this protection can be acquired in about half an hour and with no hardware involved. Although written specifically for Flex 1.0, Flex 2.0 and TSC Basic, it is quite likely that the principles may be adapted to other disk systems. If any school or college would like a copy of this leaflet, send me £1 (c/o *PCW*) to help defray expenses and I will be happy to oblige.

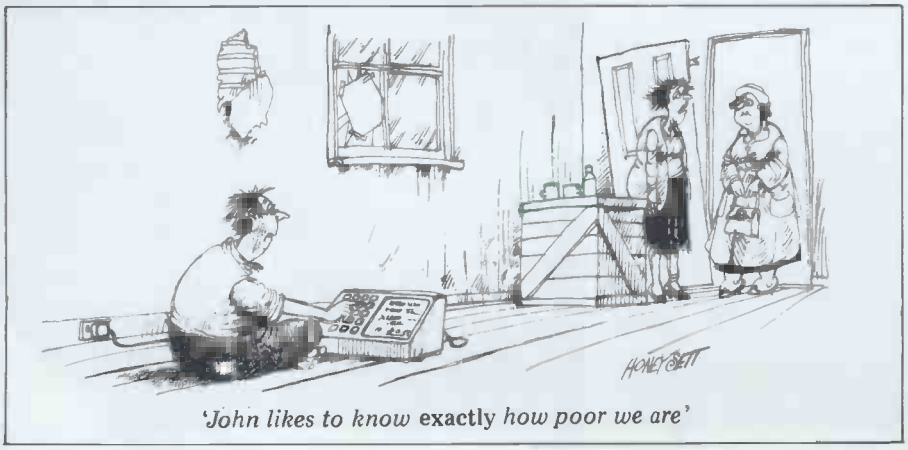
Programs received

Space Rescue & Cosmic Wars (UK101) by Chris Thompson (16) of Orpington, Kent. Shootout (ZX81) by Patrick Addison of Crowthorne, Berks. Outlaw (ZX81) by Jonathan Hale (15) of Leeds. Astro-Stop (PET) by W Purefoy of Horsham. Snakewinder, Space Shoot, Zap! & Sketchpad (ZX81) by Daniel Haywood of Ormskirk. Asteroid Run (Atom) by Christopher Witton of Holland-on-Sea, Essex. Sharpshooter (Apple II) by Adam Broun of Bicester. Clock & Timer (Atom) by Declan Moriarty of Kingston-on-Thames. Island, Heli-Lander, Space-Docker and Horses (ZX81) by Timothy Reeves of South Benfleet, Essex. High-Res Doughnuts (380Z) by Neil Hutton of Didcot. Base Converter by Adam Bockland of Sevenoaks and, finally, no less than seven programs for the ZX81 from Aled Morris (15) of Bangor — Fruit Machine, Base Converter, AA Gun, Drawing Board, Parachutists, Defender and Drawing 2. Wow!

My thanks also go to Billy Burgar of Hemel Hempstead, Ian Shenker of Edgware and Michael Roberts of Colchester, who have sent me some more mugtraps. I think we've mined that seam pretty thoroughly by now, so reluctantly I draw the mugtrap correspondence to a close.

Adam Broun also asked me to say that he would like to get in touch with any Apple II users. Write to him at Half-Mile House, Little Chesterton, Bicester, Oxon.

While I'm on that subject, my friend Dave Futcher of Beaconsfield First and Middle School, Beaconsfield Rd, Southall, Middlesex, asked me some time ago to announce that he has formed a TRS-80 and Video Genie User's Group. He is particular interested in educational uses, but I imagine that he'll be pleased to hear from anyone with those machines.



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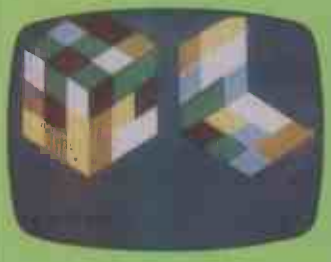

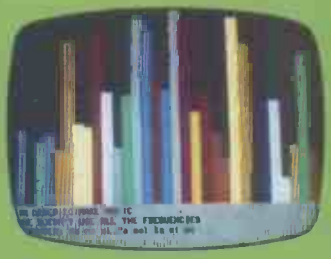

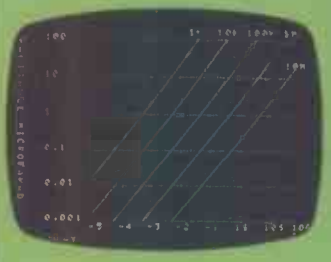

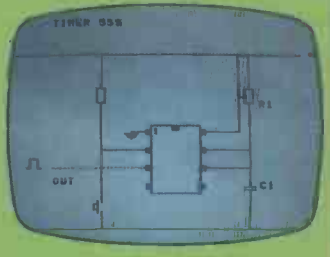

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PASCAL BE
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Compiled by Chris Sadler

In March of this year we published our first reader feedback on the proposed PCW Pascal Benchmarks. The flow continues unabated and we present here the latest timings and suggestions for improvements, together with a Pascal book review. If you have a contribution for Pascal Benchmarks, send it to Chris Sadler, c/o PCW, 14 Rathbone Place, London W1P 1DE.

I tested your Pascal Benchmarks on my Pegasus II from National Multiplex Corporation in the USA. It is based on a Z80A/S100 running at 4 MHz, with 65k RAM, 8in double-sided, double-density floppy disks. As the timings show, I have not yet installed a number-cruncher. The software is MT/+ release 5.2 from MT MicroSystems. The compiler translates directly to 8080/Z80 code. Apart from the calculations it seems pretty fast. The Pascal MT/+ package includes the software for handling the AMD9511 and I guess the company hasn't bothered too much about optimising subroutines for handling of reals in the Z80.
Hans Erik Busk, Denmark

I suspect you may be right in your speculations regarding optimisation and the AMD9511. I would like to see any timings with the floating-point chip installed.

I have been running the Benchmark programs on a Mycro-3 microcomputer with Pascal/MT+ version 5.1. This computer has a Z80 CPU with a 4 MHz clock but one wait cycle makes it appear as a 3 MHz clock. Mycro-3 is manufactured by the Norwegian microcomputer company A/S Mycron and is a relatively high-priced unit.

Remarks on the Benchmarks:

1. The result of the maths (494 seconds) is due to the unrealistic argument of the 'sin' function. If the inner body of the program is expanded with the following code, and z is initialised to 0,

```
z := z + 0.001 ;
x := sin(z) ;
y := exp(x) ;
```

the Benchmark results in 1000 iterations will be 50 seconds. The large argument in the 'sin' function is not realistic and should be avoided in a Benchmark program.

2. CASE OF should be included in the Benchmarks. This is a very much-used construction in data communication programming and could be implemented in different manners in different compilers.

3. 8080 code is generated by the compiler.
Dag Paus, Norway.

I thought everybody with a Mycro was running Smalltalk. None of the Benchmarks are intended to be realistic — instead, they are supposed (artificially) to isolate single features of the implementation. In the case of maths, it is a fairly casual look at the transcendental functions that is being attempted. My guess is that the argument normalisation routine in your implementation depends on successive subtraction rather than some form of modulo arithmetic, and that explains the comparatively long times. Incidentally, look at the timings associated with Mr Busk's letter above (MT/+ version 5.2) to see how your figures have been improved upon. We thought about the CASE statement quite a bit before rejecting it as a candidate for Benchmarking. Different implementations tend to differ markedly in terms of the space allocated to the stack-frame during compilation and there seems to be no sensible way of offsetting the arguable improvements in execution time against this rather swamping effect.

As I have stated before, there are several important features which are completely ignored by the Benchmarks. These include compile-time speed; both compile-time and run-time space utilisation; and a more complete investigation of the floating-point facilities. (In addition, readers have mentioned that character-handling is not tested for.) A moment's thought should persuade anyone that designing Benchmarks that fairly take into account all of these things, and at the same time are simple enough to be typed in and run in (say) an afternoon's work, is a daunting task which Sue Eisenbach and I decided not to attempt when we designed the original tests.

I feel that one area of compiler design is not tested in your Pascal Benchmarks; this is run-time checking. Because Pascal is such a well thought-out language, run-time checks are normally only needed in one instance: when functions or procedures are passed as arguments to routines. Consider the statement:

```
procedure proc (function fun:real) ;
```

At compile-time, all the compiler 'knows' about function 'fun' is that it returns a real result; it knows nothing about the type of parameters it requires, nor their passing mechanism (by value or reference). Hence the compiler must insert code to check these at run-time.

Slow, inefficient run-time checks indicate a poor compiler; I think it would be worthwhile to write a Benchmark to test this. May I suggest the following program?

```
program passprocedure; var i,j : integer;
procedure proc1 (n: integer);
var temp : integer;
begin
   temp := n
end;

procedure proc 2 (procedure proc ; n:
   integer);
begin
   proc (n)
end;

begin (* main *)
   i := 0 ;
   writeln ('s') ;
   for j := 1 to 10000 do
      proc2 (proc1, i) ;
   writeln ('e')
end.
```

I haven't checked the program — I don't have access to a Pascal compiler or interpreter.
D J Danziger, Manchester.

This is a lovely idea and you have presented an extremely well-argued justification for its inclusion as a Benchmark.

Unfortunately, I have not been able to test the program myself since my compiler (UCSD Version 4) doesn't implement this feature and my researches have revealed that of the several micro compilers whose documentation I have, about half (UCSD — all versions, Pascal M, NASPAS, Pascal Z) do not implement this while the other half (TCL, OMSI, Microsoft) split between implementing the ISO standard and the Jensen and Wirth standard. In ISO Pascal, your procedure heading would be:

```
procedure proc2 (procedure proc(n:
integer) )
```

which neatly avoids the necessity for run-time checks as imposed by the Jensen and Wirth syntax. According to

NCHMARKS

UNDUP ROUNDUP ROUN

Dr Addyman, the chairman of the BSI committee whose work eventually became the ISO standard, it was Wirth himself who requested the alteration.

We are proud to submit PCW *Benchmark timings for our 12k Pascal compiler, Naspas 3. The compiler has been written in Z80 assembler language and produces Z80 object code directly, ie, not via p-codes. This produces both fast compile time (typically 250 lines in five seconds) and very fast execution of the compiled object code (see enclosed Benchmarks).*

Naspas 3 is currently available for Nascom 1 and Nascom 2 systems but we shall shortly be releasing the compiler for other Z80 systems.

The timings given were measured on a Nascom 2 running at 4 MHz with wait states off. We shall supply a time for the Maths Benchmark in due course, ie, when the relevant run-time routines have been finalised.

From inspection of the timings you will see that Naspas 3 produces object code that runs faster than any other code produced by a Pascal compiler for an 8-bit machine and, in all cases other than the floating point tests, faster than the Pascal Microengine!

David Link and David Nutkins, Hisoft, Swindon.

I have written to these gentlemen requesting a copy of their compiler — and have received a cassette for the Nascom 2. This is currently undergoing evaluation but will not unfortunately be written up in time for this issue. Meanwhile...

I have recently finished running your Pascal Benchmarks on the Naspas Package for the Nascom, which you mention in the July issue. The package is, in fact, advertised in PCW *(at the back) and this is where I saw it.*

The package can run under Nas-sys and seems to provide most standard features up to and including Real Arithmetic, plus Recursive procedures with Value/Variable parameters. In addition, it provides some non-standard features such as PEEK/POKE and INCH (or is this standard?).

The Benchmarks were run with the Z80 at 4 MHz with wait states, with all the default compiler options on. It seems to run fairly fast, maybe because it generates machine code directly, and I think it's good value at £35.

I M Cullen, Suffolk

Thanks for your independent figures. It's interesting to note the effects of the wait states.

Finally, I thought Apple owners might be interested in *Pascal Programming for the Apple* by T G Lewis (231 pages, Reward Books, (Prentice Hall), £6.95 paperback, £9.70 cloth) which was sent to me for review.

Mr Lewis, who bubbles with enthusiasm throughout the book, has had some good ideas, both in his approach to the subject and in respect of some of the sample programs he lists. Although I do have some reservations, for the most part I think he succeeds in offering a stimulating introduction to the UCSD program development environment (as implemented on the Apple) and, to a lesser extent, to the Pascal language. At the same time, in the application programs, he discussed a useful range of 'professional' techniques which are of general interest to the serious computer hobbyist.

The first clever idea Mr Lewis had was to present the UCSD environment 'top down' — starting with the outer list of options (E(dit ,R*un ,F(ile . . . etc) ; going on to describe the Filer and the Editor; introducting the concept of the workfile and concluding with a description of the commands which access the Compiler and Linker and the options associated therewith. All this is good UCSD stuff and this is an excellent way of going about introducing it, but here Mr Lewis reveals the first indication of a flaw which pervades certain sections of the book. While he has some good ideas, he is not very skilful at developing them or at describing them particularly satisfactorily. In this instance, the deficiency manifests itself in the form of a silly 'character' called

		Magnifier	Forloop	Whileloop	Repeatloop	Literalassign	Memoryaccess	Realarithmetic	Realalgebra	Vector	Equalif	Unequalif	Noparameters	Value	Reference	Maths
16-bit																
Heath HIA	(UCSD)	3.9	42.8	40.1	35.0	49.9	52.0	61.7	40.6	102.9	66.8	65.8	26.4	29.3	29.7	25.3
Microengine	(UCSD)	0.8	9.5	9.3	9.1	11.0	11.4	8.7	6.8	26.4	16.0	15.8	4.5	5.0	5.0	7.0
ONYX	(UCSD)	0.5	6.1	5.9	5.4	6.7	6.9	—	—	23.7	9.9	9.9	7.4	8.0	7.9	—
PDPII/04	(OMSI)	0.3	3.3	2.5	2.2	3.9	4.3	58.0	53.3	9.4	5.3	5.2	3.0	3.9	3.9	21.6
Z80																
Pegasus	(MT+V5.2)	0.2	4.7	7.8	6.9	5.5	5.7	59	45	10.8	11.2	11.4	0.9	3.4	3.4	304
Mycro	(MT+V5.1)*	0.5	8.5	12.5	11.0	3.0	9.0	78	60	14.5	16.5	16.5	1.5	5.5	5.5	494
Nascom 2	(NASPAS)	0.2	3.1	5.4	4.7	3.7	3.9	28	27	9.3	6.0	6.0	4.0	4.6	4.6	—
	(NASPAS)*	0.9	6.5	10.4	9.1	7.2	7.5	34.3	34.0	20.5	10.6	10.4	5.5	6.2	6.3	15.0
TRS80	(Bourne)	2.2	26.6	28.6	26.4	29.5	31.2	—	—	72.2	46.1	45.9	21.4	21.7	—	—
Midas																
Horizon	(Pascal Z)	2.4	29.3	29.9	29.3	30.3	31.4	192.9	127.9	51.6	33.9	33.4	13.7	14.2	15.0	314.2
Horizon	(UCSD)	3.5	38.5	35.0	31.2	44.8	45.0	47.2	44.7	96.4	58.8	58.4	20.7	23.9	24.2	23.6
Tuscan	(TCL)	4.5	56.2	66.5	62.1	67.6	70.1	69.4	51.7	154.1	104.1	101.1	29.3	31.7	32.4	—
Ithaca	(TCL comp.)	5.0	62.6	74.4	69.1	75.3	77.7	80.0	59.4	172.5	115.7	112.5	31.3	35.1	36.1	206.9
	(TCL res.)	5.8	69.7	99.0	107.7	83.8	86.8	83.1	62.3	201.2	159.1	140.5	48.2	52.4	53.3	219.7
6502																
Apple	(UCSD)	6.4	74.3	70.0	63.3	88.5	91.0	93.0	83.4	203.3	116.7	115.3	50.2	54.4	55.3	66.0
PET	(TCL)	9.5	119	158	168	149	155	164	156	332	240	231	66	75	77	—
Others																
Cyber	174	0.05	0.64	0.68	0.75	0.8	0.87	0.3	0.26	1.22	1.55	1.35	1.86	2.01	1.92	0.16

* = with wait states

PASCAL BENCHMARKS

ROUNDUP ROUNDUP ROUNDUP ROUNDUP ROUN

Fingers who has a 'dialogue' with the UCSD operating system. In addition, every chapter concludes with a 20-question quiz, some of these questions inevitably being jokey.

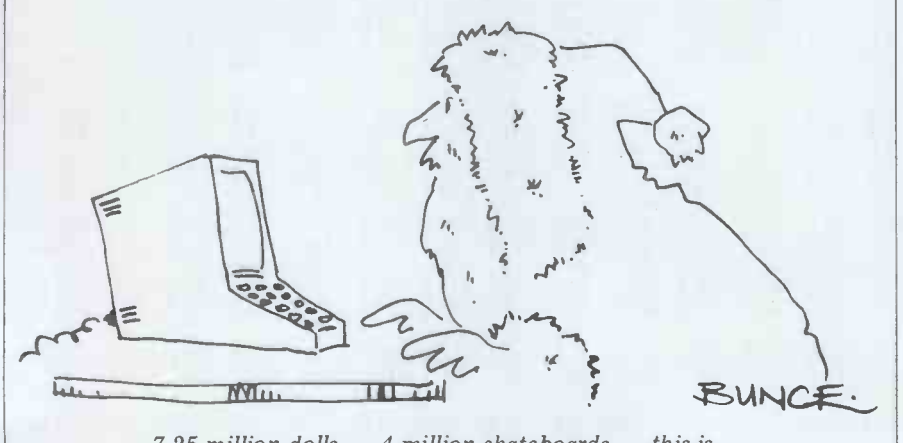
This is all a bit embarrasing, unnecessary and inconsistent since, in other segments of the text, Mr Lewis appears to assume a high degree of sophistication in his readers. For instance, who would regard 'base types are called scalars because they require no structuring of their values' as a sensible introductory definition? The other assumption Mr Lewis makes is that the reader will have an Apple (with all UCSD add-ons) and will type-in and run most of the programs he lists. In view of the somewhat inferior quality of his descriptive powers, this probably provides a valuable additional aid to understanding and the reader will, I suppose, have been forewarned by the title of the book.

The next chapters begin to explore the syntax of the Pascal language, again using the top-down approach and again displaying a few carelessly or inadequately developed passages which tend to spoil the effect a bit. The section on data type is, I think, too rushed — most hobbyists who have taught themselves to program need a bit more propaganda to get them to think of data as a part of a program's design. Likewise, the section on modules seems very abrupt and somewhat confusing. I must take issue with two points of detail: Mr Lewis describes (and uses) the ';' as a terminator rather than a separator; and the values returned when a call-by-reference (VAR parameters) procedure completes, he names as a 'side-effect'. I believe these usages to be out of line with the majority of Pascal texts — and hence misleading. Another confusion arises occasionally out of clumsy proof-reading, as with the program listings in Chapter 5, none of which match their titles.

However, the sections on the syntax of the Pascal control structures are quite well done and reasonably entertaining, and this completes the first third of the book. From here on the exposition centres around a series of application programs, and the various topics concerning both the UCSD development environment (eg, segmentation, graphics) and on the more sophisticated Pascal features (file handling) arise coincidentally rather than as explicit subjects for instruction. Thus, a series of financial programs (starring Fred instead of Fingers) is used to introduce the special UCSD file intrinsics (like CLOSE). In addition, the UCSD segmentation scheme is described in conjunction with some hare-brained property speculation program which left me floundering (although the segmentation material is reasonably clear). The programs are well presented with reserved words in lower case, identifiers in upper case and a consistent formatting style to emphasise the structure.

Next, character handling and screen formatting is dealt with in a chapter on word processing (he calls it 'drow' processing!). The introduction to UCSD string functions is very confusing, but I liked the screen-formatting program since it is useful in itself and also gives a good illustration of the production of a general purpose utility which can feature in the design of almost any interactive program. The chapter concludes with a section on natural language programming which introduces random access files and hash coding — but this turned out to have been accomplished a bit clumsily. Succeeding chapters deal with large-scale program development (use of $INCLUDE, UNITS and EXTERNAL in UCSD), TURTLEGRAPHICS, the Apple sound generator and ISAM. This is implemented the hard way, with integers, rather than pointers to the heap, (which is unfortunately not mentioned at all), leaving the reader with the impression that Pascal doesn't have dynamic data allocation. Once again, some of the programs are useful and interesting, some of the descriptions are clumsy and abrupt.

For Apple owners I would recommend the book, particularly those who want a cheap preview before embarking on the purchase of their UCSD Pascal enhancements. I rate it good on the UCSD program development environment and fair on its treatment of the Pascal language.



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BETTER GRAPHICS

Until quite recently, the Atom was at the top of its class — the VIC 20 being its only serious competition. This domination was not least due to its graphics facilities which, given enough memory, are comparable with an Apple's or ITT's. The Atom's secret lies in the amazingly versatile 6847 VDG — as used in the TRS-80 Color computer — which offers a total of nine different graphics modes.

Of course, high resolution graphics have their disadvantages, the most serious of which is their consumption of memory — in the Atom more than half the user memory is tied up by the highest graphics mode (CLEAR 4). However the next mode down offers a similar resolution but only uses half of the graphics memory, leaving a total of 8k free. Another, and some might say, more serious disadvantage is the Atom's inability to display text in any modes other than the lowest resolution (CLEAR 0); however, as I shall describe later, this is relatively easy to implement, especially in the higher modes.

Black and white graphics. The manual gives a number of hints as to the workings of the black and white modes, mostly dealing with mode 0, which it explains in detail. Inspection of the point-plotting subroutine on page 88 actually yields all the information necessary. Nevertheless, Table 1 shows clearly the arrangement of the different memory maps on the screen and how the picture elements (pixels) are arranged within the memory locations.

The easiest way to understand how points are displayed on the screen is to think of the screen as being divided up into 1000 (above mode 0) or more rectangular windows, all of which are eight pixels long and one high (see table). Each of these windows displays the eight bits of the memory location it represents as a line of eight pixels. When a bit is set (1) its corresponding pixel is displayed in white. When a bit is clear (0) its pixel is black.

Thus, when in CLEAR 1 or above, POKEing B5H (181 decimal) into a screen location would result in the (much enlarged) display shown in Figure 1.

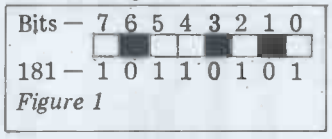


Figure 1

Colour modes. I realise that the majority of Atom owners don't actually own a computer with the PAL colour board, either because they do not own a colour television or because they would rather reserve the living-room set for its original purpose. However, the colour modes are still available to those of us without the colour board and the addition of a shade of grey to the plain old black and white of the normal graphics can be very useful.

The Atom manual gives as good as no information about the workings of the colour modes but, as luck would have it, their operation is very similar to that of the normal modes. Again, the screen is divided up into 1000 or more rectangular windows, each representing a memory location. However, this time each window is only four pixels long and one high. This means that each pixel represents two bits of a memory location and, as any mathematician will tell you, there are four ways of arranging a pair of binary digits — 00, 01, 10, 11. Each one of these pairs is made to represent a different colour on the screen and the result is four-colour graphics. When both the bits of a pair are clear, the corresponding pixel is green (grey for those of you without colour). When the lower bit is set, the pixel is yellow (white). It is blue when the upper bit is set and red (both blue and red appear black on non-colour Atoms) when both bits are set.

This is summed up diagrammatically in Figure 2.

And Table 2 gives details of all the colour modes.

Character designing. The Atom has three statements used for plotting on the screen. MOVE X,Y allows positioning of an imaginary cursor anywhere on the graphics screen and DRAW X,Y moves this cursor while drawing a line behind it. The PLOT P,X,Y statement has an extra parameter which defines whether to plot a single point, DRAW, MOVE, plot in white or in black and whether to take the co-ordinates as relative or absolute (0,0 in the bottom left corner of the screen).

In games, it is frequently necessary to draw a character and have it move about the screen or alternatively it may be necessary to label a high resolution graph. In both cases the plotting statements could be used for the drawing of the characters; however, this technique does have one or two disadvantages:

1. The DRAW statement, although at first sight appearing to be very fast, is in fact rather slow and, as a result, restricts any real-time movement of a character plotted with it.
2. Plotting individual points with PLOT doesn't suffer from being slow, but requires that every point in the character is defined by a pair of coordinates. Thus the character uses a disproportionately large amount of memory in its storage off-screen.

An easy way of getting around both of these problems is to design the character as a group of memory locations, using the information given in previous sections. For example, take the idea of labelling a graph in mode 4. The characters required would be standard ASCII along with some non-standard mathematical symbols, all of which could be designed on a 5x7 dot matrix. As I have already said, each memory location on the screen appears as a row of eight pixels. Eight memory locations in a column, one above the other, would provide an 8x8 dot

Mode	Resolution	Structure of locations	Memory used
1a	64x64	16x64 locations — ▭▭▭▭▭▭▭▭	1k
2a	128x64	32x64 locations — as above	2k
3a	128x96	32x96 locations — as above	3k
4a	128x192	32x192 locations — as above	6k

Table 2

Mode	Resolution	Structure of locations	Memory used
0	64x48	32x16 locations — ▦	0.5k
1	128x64	16x64 locations — ▭▭▭▭▭▭▭▭	1k
2	128x96	16x96 locations — as above	1.5k
3	128x192	16x192 locations — as above	3k
4	256x192	32x192 locations — as above	6k

Table 1

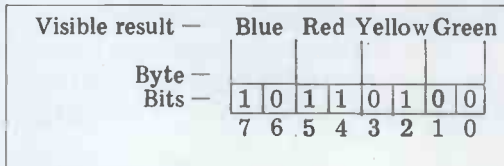


Figure 2

matrix, allowing plenty of room for the characters.

The easiest way to design the characters is to use graph paper sectioned off in millimetres (these approximate to the size of mode 4 pixels on most TVs) and mark out the outline of an 8x9mm matrix for each character. The character can then be drawn by shading in the squares to be white when it is plotted on the screen. It is then a simple matter of converting the binary represented by each row of dots into hex (see page 112 of the manual) and storing the hex in eight consecutive bytes in the text space. This can then be repeated for all the characters, placing them into memory directly after one another. A Basic or assembler subroutine can then be written to transfer the characters from the text space to the screen memory (not forgetting that on the screen, each byte needs to be 32 bytes after its predecessor in order to be directly below it).

Figure 3 explains this more clearly.

Other uses. Things, of course, don't stop at letters and numbers. Space Invader characters, etc, lend themselves extremely well to this treatment, although characters are really limited to a 24x24 dot matrix (3x24 locations) to be practical. For this reason, large characters are best drawn in lower modes.

When a character needs to have fast, real-time movement it is advisable to use a simple machine-code program to transfer the bytes from the text space to the screen memory. The assembler program at the end of this article provides just such a program. As it is, it plots characters on a 16x16 matrix (two 16-byte columns) in mode 4, but it can quite easily be altered for other modes and character sizes. For example, to convert it for the plotting of an 8x8 character, you remove the line:

CPY @10; BEG LL3

and change the line below it to

:LL2 CPY @8; BNE LL1

The routine requires that the bytes are stored in memory by working down each column of the character from the top (see text-space locations of the example character 'A'). It also requires two inputs:
81H(hi) and 80H(lo) should contain the 2-byte address of where the first byte of the character is to be stored on the screen.
83H(hi) and 82H(lo) should contain the 2-byte address of the first byte of the character in the text space.

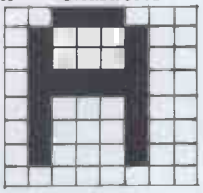
For example, to print the character 'A' given earlier when it is stored in the text space from 2800H to 2807H and you wish it to go on the screen from 8000H downwards, the sequence of commands would be as follows: (all addresses in hex)

```
?80=0; ?81=80 (hex)
?82=0; ?83=28 ( " )
CLEAR 4
LINK LL0
```

One disadvantage of this technique is that there are only 32 or 16 (depending on the mode) positions across the screen for the character to be plotted in. This can be overcome using the ROR instruction in an assembler program. This program would be quite complex, though, and it would probably be better (or at least simpler) to plot the character point-by-point using an assembler program or using PLOT in Basic.

I realise that I have barely scratched the surface of the possibilities here and obviously a lot more can be discovered by simple experimentation. This article isn't intended as a comprehensive manual of all the techniques possible, it simply provides the necessary basis for ideas of your own and hopefully has proved useful to a few newcomers to the Atom.

Jonathan Millar

Text space location	Screen location	Character	Memory contents
2800	8000		38
2801	8020		44
2802	8040		44
2803	8060		7C
2804	8080		44
2805	80A0		44
2806	80C0		44
2807	80E0		00

(All numbers are in hexadecimal)

Fig 3

```
: LL0  LDX  @0;    LDY @0
: LL1  LDA  (82),Y;      STA (80,X)    transfer byte from text space to screen
       INY                            next byte
       LDA  80;    CLC ; ADC @20: STA 80
       LDA  81;    ADC @0; STA 81     next screen address (+20)
       CPY  @10; BEQ LL3              finished first column ?
: LL2  CPY  @20: BNE LL1              finished character?
       RTS
:LL3   LDA  80; SEC; SBC @FF; STA 80
       LDA  81; SBC @1; STA 81        next column (—1FF)
       JMP  LL2
```

NB All numbers and addresses are in hexadecimal

Listing 1 Assembler routine to put characters to screen.

ZX80 TO ZX81 CONVERSION

Owners of the new ZX81 currently find themselves very short of software. Magazines still concentrate on the ZX80 and, so far, advertisements cater only for the ZX80. Some new owners, however, may have graduated from the ZX80 and may have some software they would like to run on their new machine.

In general, ZX80 programs will not run on the ZX81. The tape save and load facility on the ZX81 doesn't accept tapes recorded for the ZX80 and keyboard — entered programs will rarely work without some modification. As I have owned a ZX80 and currently have a ZX81, I am in a good position to detail some of the changes needed to run ZX80 programs on the new computer.

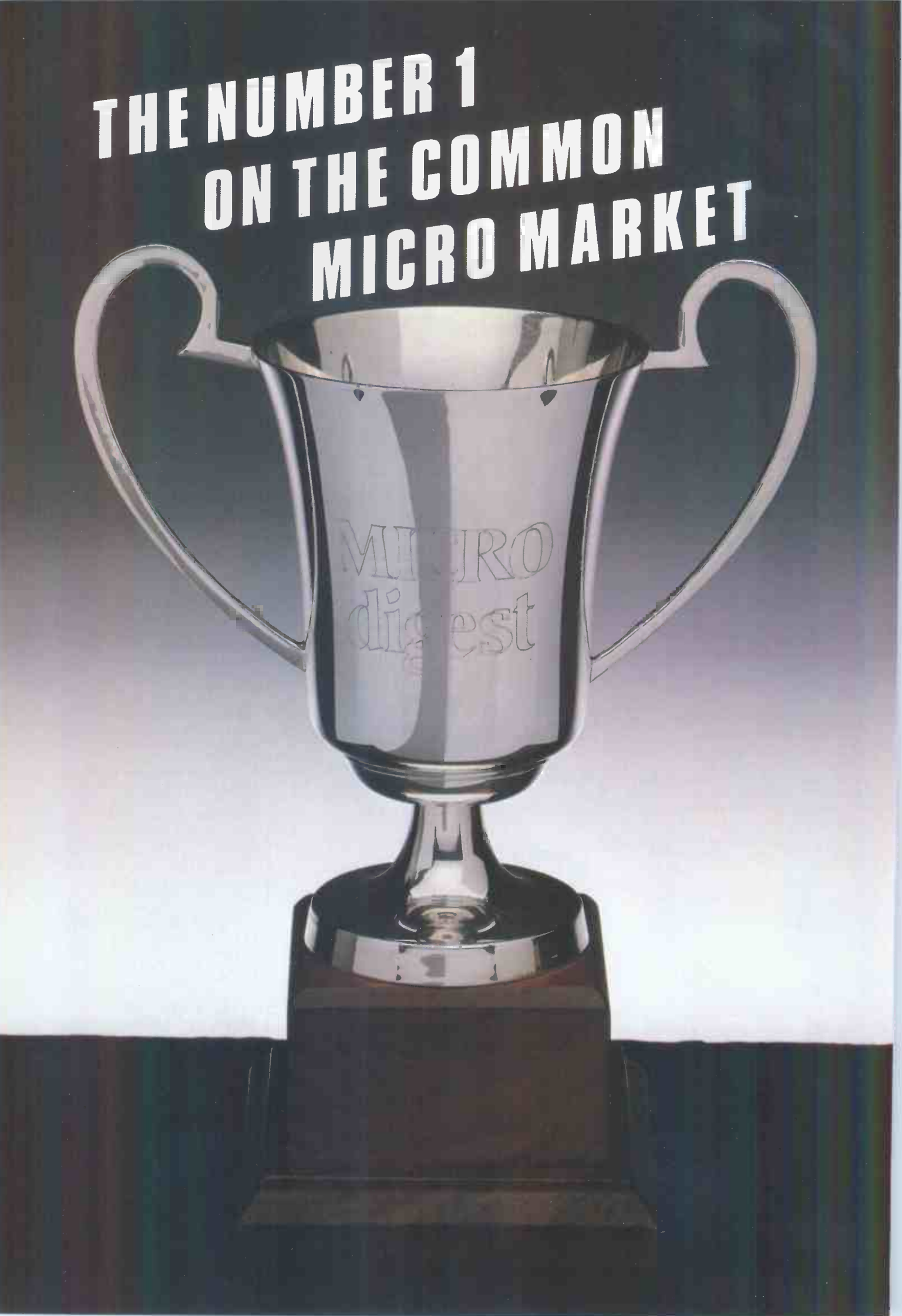
On the face of it, there is only one function, TL$, on the ZX80 which is not available on the ZX81. This can be replaced exactly. A ZX80 program line which includes A$ TL$ can be changed to A$(2 TO LEN A$) on the ZX81. This may not be the best answer, however. One big problem in converting programs is that the 1k ZX81 is very much more restricted in effective memory capacity than the 1k ZX80. This will be covered in more detail later. To save memory, it may be desirable where TL$ appears to rewrite the ZX80 program using the much better string handling facilities on the ZX81. For example, a typical use of TL$ in a ZX80 program could be to pick up the codes of an eight-letter string A$. A program to do this could be:

```
10 DIM A(8)
20 FOR N=1 TO 8
30 LET A(N)=CODE A$
40 LET A$=TL$ A$
50 NEXT N
```

On the ZX81, this program would be virtually unnecessary because the code of any letter in the string can be pulled out as required by CODE A$(N).

While the ZX80 and the ZX81 both have a RND function, they work in rather different ways. Often in a ZX80 program you will find RND(6) which gives a random number from 1 to 6.

GOTO page 147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The ZX81 will reject RND(6) as a syntax error. RND in the ZX81 gives an eight digit number from 0 to .99999999. To match RND(6) we will need INT(RND*6)+1 on the ZX81.

Another difference arises from the integer arithmetic on the ZX80. Division can create some unusual situations. For example, 4/3 is 1 to the ZX80, but would be 1.333333333 to the 81. To get the same result on division on the ZX81 we need to change A/B to INT A/B.

Having converted a ZX80 program to ZX81 basic it will often still fail to run, stopping with a 4/ report code. In fact, the 1k ZX80 can remember a longer program than the ZX81. The main reason for the difference is that the ZX80 handles only integers requiring two bytes per number. The ZX81 holds numbers in floating point format taking up five bytes of memory. As a result, any constants in the program take up more bytes of memory in the ZX81. Variables also take up more memory space. Some of the extra functions also increase the memory requirement in the ZX81. For example, the STEP function in a FOR... NEXT loop requires that the loop control constant holds a series of numbers; start, stop and step, each taking five bytes of memory.

What can you do if a ZX80 program busts the bank? You can first try the obvious:

1. Delete all REM statements;
2. Reduce all print statements to a bare minimum;
3. Delete check routines unless an essential part of the program;
4. Ensure that any constants in the program are in the simplest form. For example, INT(54/23) will take up less memory bytes if put in as 2.

Even with all your best efforts many programs will be impossible to run because of this memory limitation. The only real solution is then in the hardware; you need to extend the memory.

The 16k extended memory is really needed for any long programs, but at £50 this may be too expensive for some of us. According to the kit schematic drawing, a 2k RAM can be fitted on the board. If you have a ZX81 with a 4118 1kx8 RAM then the schematic shows that this IC can be changed in its socket for a 2kx8 4816. The wire link L1 must be changed to position L2. This only applies to the ZX81 with a single 1kx8 RAM. Some ZX81s use two smaller IC's (1kx4). These can be recognised by the number 2114 and by the fact that there are two smaller 18 pin ICs on the bottom left-hand side of the board. In this case, the left-hand socket must be changed to accept a 4816 2kx8 IC. The 2x2114 version has no links, so a link must be fitted in position L2.

It may be that the coding arrangements will not allow the 4816 to be used with the 16k extension or the printer.

Alan Fowke

UK101 IMPROVED DISPLAY

One minor fault with the UK101 when compared with more expensive computers is the interference produced on the TV screen whenever anything is printed or POKEd into the display RAM.

In the UK101, a monostable switches off the video signal during VDU access to prevent spurious noise and so small parts of the signal don't reach the screen.

In white parts of the display, these appear as dark lines and interference is especially bad during animated games or listings.

This simple modification which doesn't require any extra IC s allows the VDU RAM to be accessed at full speed without any noise at all on the TV screen.

The modification is as follows:

Remove the ICs numbered below, bend out the pins indicated and re-insert them.

IC no 28 bend out pin 9
IC no 42 bend out pin 2
IC no 55 bend out pin 11
IC no 56 bend out pin 6
IC no 69 bend out pin 1

Now make the following connections on the front of the board with insulated wire

Pin 1 of IC 55 to pin 3 of IC 8 (the CPU)
Pin 9 of IC 28 to pin 3 of IC 8
Pin 6 of IC 56 to pin 11 of IC 55
Pin 1 of IC 58 to pin 2 of IC 42
Pin 1 of IC 69 to +5 volts

The hardware adjustments made above are:

1. The address/control selectors, ICs 53,54,55 are switched by 01.
2. The monostable (IC28) producing the load signal for the shift register is triggered by 01.
3. The shift register receives its clock signal from the non-inverted 8 MHz signal.
4. The VDU RAM is selected by IC 56.
5. The blanking monostable is disabled.

When these alterations are made, the VDU circuitry is synchronised with the 01 signal from the CPU so that the display RAM is accessed by the VDU during one phase of 01 and the CPU accesses it during the other.

This modification has worked well on my UK101 and below is a small program, which, if run before and after the alteration, shows its effectiveness.

Note CHR$(161) is a white block.

```
10 FORI=1TO47:A$=A$+
   CHR$(161):NEXT
20 PRINT A$:GOTO 20
```

Ian Bradbury

ATOM GETKEY

If you own an Acorn Atom you may have found that the only keys not available for use in programs are the arrowed cursor control keys. These keys can be useful when writting games, cursor select menus, etc. In order to use these keys, an assembly code routine has to be written to scan the keyboard and convert the keys to their ASCII equivalents.

The following routine makes use of some subroutines in the ROM, so as to save memory space. The routine can be called from Basic by LINK NN6 or from an assembly code program by JSR NN0. The arrowed keys are given their ASCII equivalents, ie:

Left arrow — $08
Right arrow — $09
Down arrow — $0A (10)
Up arrow — $0B (11)

Note that after a LINK NN6, the ASCII code is in variable 'K'.

Nigel Capper

```
10 REM GETKEY ROUTINE BY N.P. CAPPER.
20 REM USES NN AND P
30 REM CALL BY LINK NN6
40 DIM NN(6),P(-1)
50[
60:NN0 PHP          SAVE PROCESSOR REG.
70     STX #E4      SAVE X
80     STY #E5      SAVE Y
90     CLD          BINARY MODE
100:NN1 BIT #B002   TEST REPT KEY
110    BVC NN2
120    JSR #FE71    SCAN KEYBOARD
130    BCC NN1      WAIT UNTIL KEY RELEASED
140:NN2 JSR #FB8A   WAIT 1/10 SECOND
150:NN3 JSR #FE71   SCAN KEYBOARD
160    BCS NN3      WAIT UNTIL KEY PRESSED
170    JSR #FE71    SCAN KEYBOARD
180    BCS NN3      DEBOUNCE
190    CPY @6       LEFT/RIGHT ARROWS
200    BEQ NN5
210    CPY @7       UP/DOWN ARROWS
220    BEQ NN4
230    JMP #FEB1    GET ASCII CODE
240:NN4 INY
250:NN5 ASL #B001   SHIFT INTO CARRY
260    ADC @2       CONVERT TO ASCII CODE
270    JMP #FE60    RESTORE REGISTERS
280\
290:NN6 JSR NN0     GET ASCII CODE
300    STA #032C    STORE IN LOW-BYTE OF K
310    RTS          RETURN
320]
330 END
```

TJ's WORKSHOP

NASCOM 2 BASICS

With the 11th hour rescue of Nascom by Lucas Logic there will hopefully be many owners of Nascom 2s who would find this article useful. The first half is devoted to the keyboard and the second half to Basic reserved words and single key Basic word entry. Finally, there is a small hardware addition which the author considers almost essential.

1. The Keyboard Map. The so-called keyboard map consists of eight bytes of workspace between 0C01H and 0C08H, the most significant bit being unused and permanently low. Each of the remaining 56 bits are assigned to one key as shown in Table 1. A subroutine in NAS-SYS called 'IN' (DF 62) updates the keyboard map whenever it is called. Each key that was pressed has its bit set and the rest are cleared. This enables user programs to add auto repeat by calling this subroutine regularly, clearing all bits of the map after each call has been acted upon. User programs can also assign combinations of keys being pressed to special uses.

Note that there are actually 57 keys on the keyboard, the two shift keys sharing one bit in the keyboard map.

2. Typing graphics using the keyboard. Although Nascom says that all 256 possible characters can be entered using the keyboard, it doesn't say how. The author therefore spent an evening working this out. To save the reader this trouble a list is given in Table 2.

Characters C0H-FFH are the pixel characters and would normally be accessed from a program rather than the keyboard. The pixels displayed within a pixel character are determined as follows:

A	D
B	E
C	F

The character.

1	1	F	E	D	C	B	A

Each pixel is white if its corresponding bit is high.

3. Basic reserved words and single key entry. User Basic programs are stored in RAM and cassette in a compressed format in order to save memory. Each of the Basic words (PRINT, GOSUB, NEXT, etc) are stored as single byte 'reserved words' These lie in the range 80H-CFH and the complete list is given in Table 3. The 8k Microsoft Basic supplied with the Nascom 2 will accept these reserved words in place of the whole Basic word, enabling the user to type in his/her programs more quickly. By looking at Tables 2 and 3 the keys to be pressed for each Basic word can be determined. For example, instead of typing the five letters G-O-S-U-B, one can type in 8CH which is Graph, CTRL,L and although it is slow at first, one soon gets used to it.

Although the program being typed in will look odd (consisting of graphics characters in place of Basic words) it will look correct when listed again.

4. The NASIO control signal. Unlike, say, the 6800 series, the Z80 has separate memory and I/O spaces. The two are very similar, IORQ being used in place of MREQ and only A0-A7 being used. Thus, there are 256 I/O 'ports', which the Nascom 2 unfortunately does not decode properly. The Nascom 2 uses ports 00H to 07H for its own I/O, but does not decode A3-A7. Instead, it allows external decoding by providing an input on the NASBUS called NASIO and a DIL switch called LSW2/8. With this

0C01H:		LF CH	@	SHIFT	CTRL	= _	ESC ENTER	CS BACK
0C02H:		↑	T	X	F	5	B	H
0C03H:		←	Y	Z	D	6	N	J
0C04H:		↓	U	S	E	7	M	K
0C05H:		→	I	A	W	8	< ,	L
0C06H:		GRAPH	O	Q	3	9	> .	+ ;
0C07H:		[\	P	1	2	0	? /	* :
0C08H:		] ¯	R	SPACE-BAR	C	4	V	G

Table 1 The keyboard map

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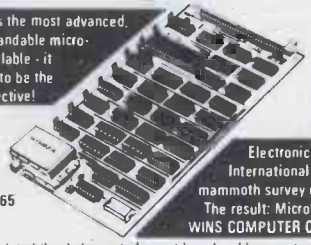

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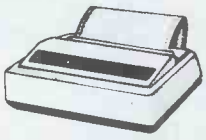

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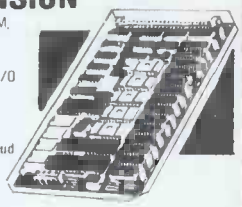
TANEX EXPANSION



Expanded, TANEX offers 7K RAM, locations for 4K EPROM (2716), locations for 10K extended MICROSOFT BASIC, 32 parallel I/O lines, two TTL serial I/O ports, a third serial I/O port with RS232/20mA loop, full modem control and 16 programmable baud rates, four 16 bit counter timers, cassette interface, data bus buffering, and memory mapping

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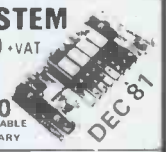

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- Complete with DATA

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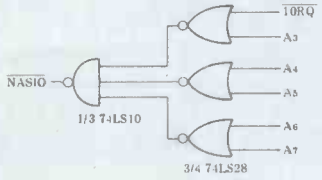
switch set to 'INT' (down), ports 00H-07H will repeat themselves 32 times as A3-A7 are not decoded. With it set to 'EXT' (up), ports 00H-07H cannot be accessed, unless NASIO is pulled low when these ports are needed.

Thus, to complete the I/O decoding and get rid of the NASIO line, all that need be done is to set LSW2/8 to 'EXT' and add the following gates:



NASIO is now pulled low when a port used by the Nascom 2 is selected, as desired. NASIO can then be safely ignored on all expansion boards and ALL 256 ports can be uniquely addressed (unlike the partial decoding done on, say, the Gemini EPROM board and others).

TJ's WORKSHOP

5. Conclusion. Ideally, all this information would have been in the Nascom 2 manual and I hope the reader will find all the 'donkey work' I have done useful.

M V Hartz

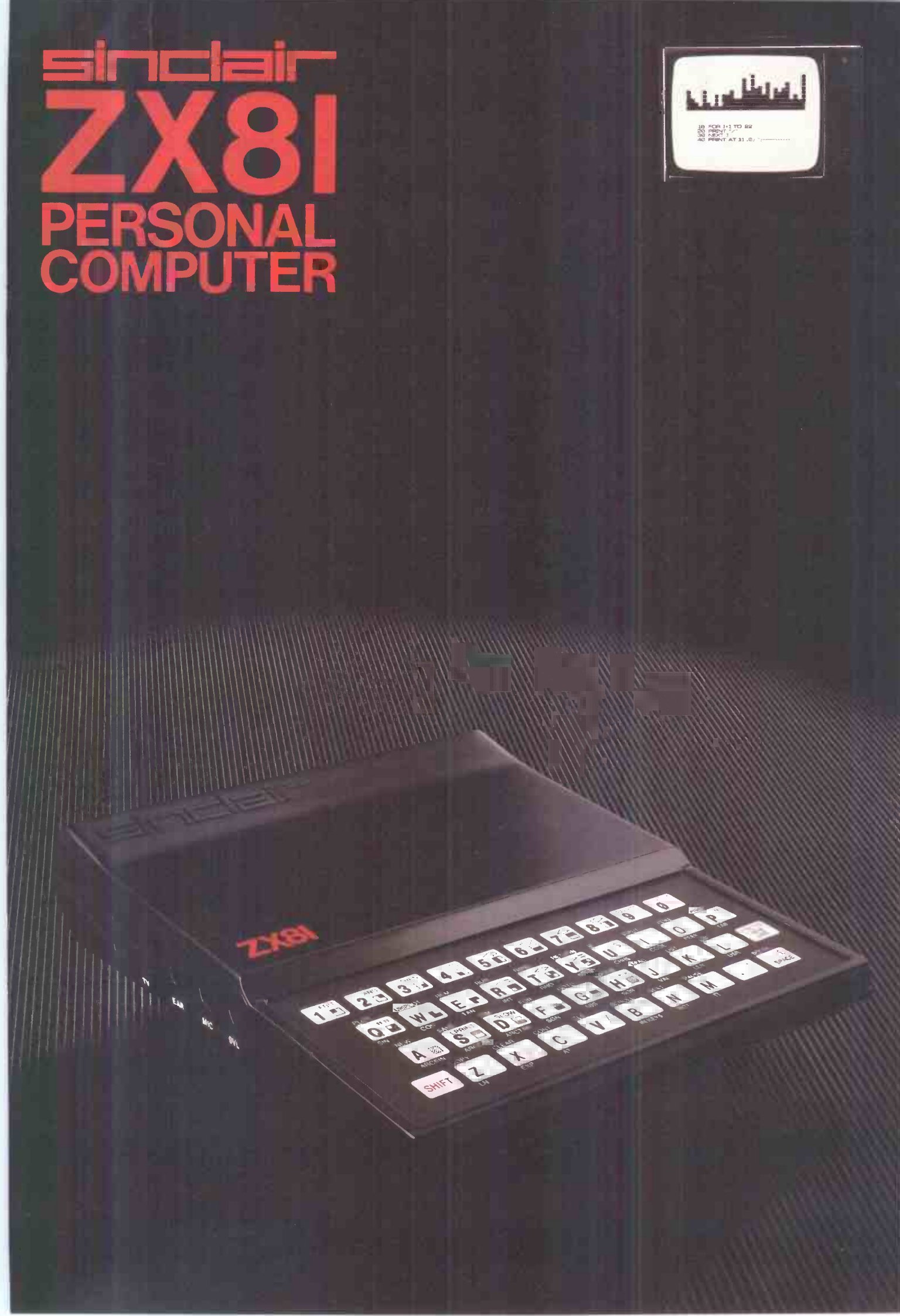
Hex character code	how typed
00	CTRL,SHIFT,@
01	CTRL,A
02	CTRL,B
03	CTRL,C
04	CTRL,D
05	CTRL,E
06	CTRL,F
07	CTRL,G
08	BACK
09	CTRL,I
0A	SHIFT,LF
0B	CTRL,K
0C	SHIFT,CS
0D	ENTER
0E	CTRL,N
0F	CTRL,O
10	CTRL,P
11	←
12	→
13	↑
14	↓
15	SHIFT,←
16	SHIFT,→
17	CH
18	CTRL,X
19	CTRL,Y
1A	CTRL,Z
1B	SHIFT,ESC
1C	CTRL,SHIFT,\
1D	CTRL,]
1E	CTRL,SHIFT,0
1F	CTRL,SHIFT,]
20-7F	Standard printable ASCII character set.
80	CTRL,SHIFT,GRAPH,@
81	CTRL,GRAPH,A
82	CTRL,GRAPH,B
83	CTRL,GRAPH,C
84	CTRL,GRAPH,D
85	CTRL,GRAPH,E
86	CTRL,GRAPH,F
87	CTRL,GRAPH,G
88	GRAPH,BACK
89	CTRL,GRAPH,I
8A	CTRL,GRAPH,J
8B	CTRL,GRAPH,K
8C	CTRL,GRAPH,L
8D	GRAPH,ENTER
8E	CTRL,GRAPH,N
8F	CTRL,GRAPH, O
90	CTRL,GRAPH,P
91	GRAPH,←
92	GRAPH,→
93	GRAPH,↑
94	GRAPH,↓
95	CTRL,GRAPH,U
96	CTRL,GRAPH,V
97	GRAPH,CH
98	CTRL,GRAPH,X
99	CTRL,GRAPH,Y
9A	CTRL,GRAPH,Z
9B	CTRL,GRAPH,[
9C	CTRL,SHIFT,GRAPH,[
9D	CTRL,GRAPH,]
9E	CTRL,SHIFT,GRAPH,0
9F	CTRL,SHIFT,GRAPH,]
A0	GRAPH,SPACEBAR
A1	SHIFT,GRAPH,1
A2	SHIFT,GRAPH,2
A3	SHIFT,GRAPH,3
A4	SHIFT,GRAPH,4
A5	SHIFT,GRAPH,5
A6	SHIFT,GRAPH,6
A7	SHIFT,GRAPH,7
A8	SHIFT,GRAPH,8
A9	SHIFT,GRAPH,9
AA	SHIFT,GRAPH,:
AB	SHIFT,GRAPH,;
AC	GRAPH,“,”
AD	GRAPH,=
AE	GRAPH,.
AF	GRAPH,/
B0	GRAPH,0
B1	GRAPH,1
B2	GRAPH,2
B3	GRAPH,3
B4	GRAPH,4
B5	GRAPH,5
B6	GRAPH,6
B7	GRAPH,7
B8	GRAPH,8
B9	GRAPH,9
BA	GRAPH,:
BB	GRAPH,;
BC	SHIFT,GRAPH,“,”
BD	SHIFT,GRAPH,=
BE	SHIFT,GRAPH,.
BF	SHIFT,GRAPH,/
C0	SHIFT,GRAPH,@
C1	GRAPH,A
C2	GRAPH,B
C3	GRAPH,C
C4	GRAPH,D
C5	GRAPH,E
C6	GRAPH,F
C7	GRAPH,G
C8	GRAPH,H
C9	GRAPH,I
CA	GRAPH,J
CB	GRAPH,K
CCQ	GRAPH,L
CD	GRAPH,M
CE	GRAPH,N
CF	GRAPH,O
D0	GRAPH,P
D1	GRAPH,Q
D2	GRAPH,R
D3	GRAPH,S
D4	GRAPH,T
D5	GRAPH,U
D6	GRAPH,V
D7	GRAPH,W
D8	GRAPH,X
D9	GRAPH,Y
DA	GRAPH,Z
DB	GRAPH,[
DC	SHIFT,GRAPH,[
DD	GRAPH,]
DE	SHIFT,GRAPH,0
DF	SHIFT,GRAPH,]
E0	CTRL,SHIFT,GRAPH,SPACEBAR
E1	SHIFT,GRAPH,A
E2	SHIFT,GRAPH,B
E3	SHIFT,GRAPH,C
E4	SHIFT,GRAPH,D
E5	SHIFT,GRAPH,E
E6	SHIFT,GRAPH,F
E7	SHIFT,GRAPH,G
E8	SHIFT,GRAPH,H
E9	SHIFT,GRAPH,I
EA	SHIFT,GRAPH,J
EB	SHIFT,GRAPH,K
EC	SHIFT,GRAPH,L
ED	SHIFT,GRAPH,M
EE	SHIFT,GRAPH,N
EF	SHIFT,GRAPH,O
F0	SHIFT,GRAPH,P
F1	SHIFT,GRAPH,Q
F2	SHIFT,GRAPH,R
F3	SHIFT,GRAPH,S
F4	SHIFT,GRAPH,T
F5	SHIFT,GRAPH,U
F6	SHIFT,GRAPH,V
F7	SHIFT,GRAPH,W
F8	SHIFT,GRAPH,X
F9	SHIFT,GRAPH,Y
FA	SHIFT,GRAPH,Z
FB	CTRL,GRAPH,;
FC	CTRL,SHIFT,GRAPH,“,”
FD	CTRL,SHIFT,GRAPH,=
FE	CTRL,SHIFT,GRAPH,.
FF	CTRL,SHIFT,GRAPH,/

Table 2 Typing characters on the keyboard

Hex code	Basic word
80	END
81	FOR
82	NEXT
83	DATA
84	INPUT
85	DIM
86	READ
87	LET
88	GOTO
89	RUN
8A	IF
8B	RESTORE
8C	GOSUB
8D	RETURN
8E	REM
8F	STOP
90	OUT
91	ON
92	NULL
93	WAIT
94	DEF
95	POKE
96	DOKE
97	SCREEN
98	LINES
99	CLS
9A	WIDTH
9B	MONITOR
9C	SET
9D	RESET
9E	PRINT
9F	CONT
A0	LIST
A1	CLEAR
A2	CLOAD
A3	CSAVE
A4	NEW
A5	TAB(
A6	TO
A7	FN
A8	SPC(
A9	THEN
AA	NOT
AB	STEP
AC	+
AD	—
AE	*
AF	/
B0	↑ (to the power of)
B1	AND
B2	OR
B3	>
B4	=
B5	<
B6	SGN
B7	INT
B8	ABS
B9	USR
BA	FRE
BB	INP
BC	POS
BD	SQR
BE	RND
BF	LOG
C0	EXP
C1	COS
C2	SIN
C3	TAN
C4	ATN
C5	PEEK
C6	DEEK
C7	POINT
C8	LEN
C9	STR$
CA	VAL
CB	ASC
CC	CHR$
CD	LEFT$
CE	RIGHT$
CF	MID$

Table 3 Basic reserved words

sinclair ZX81 PERSONAL COMPUTER



Sinclair ZX81 Personal Comp

the heart of a system that grows with you.

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

In March 1981, the Sinclair lead increased dramatically. For just £69.95 the Sinclair ZX81 offers even more advanced facilities at an even lower price. Initially, even we were surprised by the demand – over 50,000 in the first 3 months!

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

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

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, *and* to drive the new ZX Printer.

New BASIC manual

Every ZX81 comes with a comprehensive, specially- written manual – a complete course in BASIC programming, from first principles to complex programs.

Kit: £49.95

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

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

New, improved specification

- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function – useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
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- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

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

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

ter-

Available now- the ZX Printer for only £49.95

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alpha-numerics *and* highly sophisticated graphics.

A special feature is COPY, which prints out exactly what is on the whole TV screen without the need for further intructions.

At last you can have a hard copy of your program listings – particularly useful when writing or editing programs.

And of course you can print out your results for permanent records or sending to a friend.

Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

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

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

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

With the RAM pack, you can also run some of the more sophisticated ZX Software – the Business & Household management systems for example.

How to order your ZX81

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day.

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Qty	Item	Code	Item price £	Total £
	Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (600 mA at 9 V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack.	18	49.95	
	Sinclair ZX Printer.	27	49.95	
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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 $\pm 10^{\pm 38}$	●			●	●	●	●
	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)	●	●	●	●	●		●

Sinclair software on cassette.

The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with others to form single-subject cassettes.

Software currently available includes games, junior education, and business/household management systems. You'll receive a Sinclair ZX Software catalogue with your ZX81 – or see our separate advertisement in this magazine.

The ultimate course in ZX81 BASIC programming.

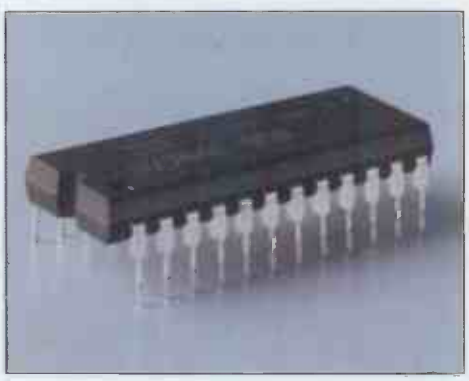
Some people prefer to learn their programming from books. For them, the ZX81 BASIC manual is ideal.

But many have expressed a preference to learn *on* the machine, *through* the machine. Hence the new cassette-based ZX81 Learning Lab.

The package comprises a 160-page manual and 8 cassettes. 20 programs, each demonstrating a particular aspect of ZX81 programming, are spread over 6 of the cassettes. The other two are blank practice cassettes.

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.

sinclair
ZX81

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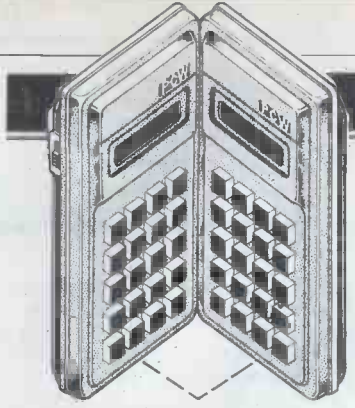


CALCULATOR CORNER

Compiled by Dick Pountain

A NEW LOOK FOR HEWLETT-PACKARD

Hewlett-Packard have launched two new programmable calculators, the HP-11C Scientific and 12C Financial. Since the two machines differ only in the special functions built into some of the keys I have only reviewed the 11C here with appropriate comments at the points of difference.

Hardware

The most obviously new feature of the HP-11C is its appearance which has taken on, dare I say it, a slightly Oriental look. That is to say HP have adopted the 'sideways' format first introduced by Sharp which allows a longer than normal display to be used; this is combined with the first use I've seen by HP of a brushed alloy facia. The actual case is the expected rugged ABS moulding with a matt finish and rubber non-slip feet, and has the nice touch of a rear alloy panel with printed on instructions for hard to remember operations such as P-R conversion, Stats and the Error messages. Despite its solid construction the 11C is quite dainty at 128x80x15mm and when slipped into its soft leatherette pouch is easily held in a shirt-pocket.

There is nothing at all Oriental about the keyboard which is pure Hewlett-Packard. No-one else has yet come closer to the ideal calculator keyboard than this; solid, boldly printed, bevelled keys with a slight but satisfying positive click. To accommodate the horizontal format the 39 keys are arranged with a numeric pad to the right, functions to the left and the enter key set vertically to separate them. Two colour coded shift keys f and g provide for a total of 108 functions.

Power is provided by three alkaline or silver oxide cells, the latter giving at least 180 hours continuous running or two years memory protection (yes it has got non-volatile memory).

The display is of the now compulsory grey LCD variety and shows 10 digits plus annunciators for PRGM and USER modes plus angular mode and shift. The characters are 7 segment numeric only and no separate area is provided for exponents which come out of the 10 digits. Alpha Error messages and a 'running' prompt are provided by cunning fiddling of the display segments.

A self-test routine is built in which operates by holding down x during power-on and returns — 8,8,8,8,8,8,8,8,8,8 if all is well.

Memory

The 11C is fitted out with 203 bytes of non-volatile CMOS memory which on power up is configured as 20 data registers and 63 program steps (all key sequences are fully merged). Memory management is an automatic system as used on the 41C ie, when more than 63 steps of program are entered data registers are converted one at a time to provide seven more steps of program space apiece. In the limit of a full 203 step program being entered no data registers remain save for the Index register I which is separate from program/data memory and of course the automatic stack and 'last X' registers. The memory allocation at any time is inspected by a MEM command which displays steps remaining and the next register to be converted. Single digit addresses are used for the memory registers with a '.' prefix beyond 9.

Functions

As befits a serious scientific calculator the 11C has a full set of trig. (including hyperbolics), log, exponential, root power and reciprocal functions plus conversion. In addition factorial, permutation and combination and statistics including linear regression are provided. The random number generator requires the storing of a seed by the user and promises a distribution which passes Knuth's spectral test. Incidentally the 12C differs by substituting compound and simple interest, amortisation, net present value, internal rate of return bonds and annuities, depreciation and discounted cash flow for the trig and conversion routines, and in lacking some of the more sophisticated loop control functions.

Arithmetic is of course Reverse Polish (innovation is a fine thing but it must stop short of heresy). Regular readers will know that I refuse to be partisan on the issue of Algebraic v RPN, but I will say that having recently developed an interest in Forth, I have HP to thank for my lack of terror on this score. The customary automatic four register stack x,y,z,t takes care of all the work done by parentheses on an algebraic calculator.

All arithmetic works to 10 digit internal precision and the allowed display formats are FIX,SCI and ENG. In the latter two only seven digits can be displayed because of the exponent but the whole mantissa can be inspected by pressing f PREFIX. Rounding is also possible by means of RND n.

Programming

The programming language of the 11C is pretty much the same as for previous HP models. Three digit line numbers are automatically supplied during program entry and the numeric keycodes must be interpreted by their row and column number on the keyboard. A three keystroke instruction appears on a single line. Editing is rendered efficient by automatic insertion and manual deletion, with scrolling on SST and BST though the latter is still irritatingly a shifted function. There is no block delete.

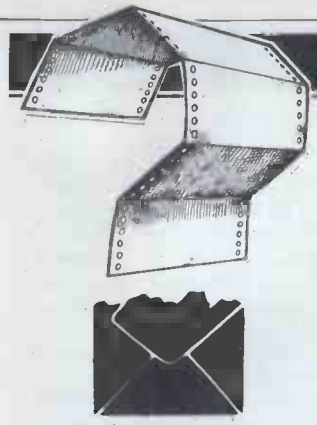
Full register arithmetic (STO+,=,x and :) is permitted along with indirect addressing via the contents of the I register. This register also holds the counter for the loop control instructions DSE and ISG and the addresses for indirect jumps and subroutine calls. All jumps are to labels not absolute addresses, permitted labels being the numbers 0 to 9 and the User keys A to E. These latter are used as beginning markers to execute programs from the keyboard, a process which is facilitated by the User Mode in which these keys become un-shifted functions to allow single key operation. Two user flags and eight conditionals are provided; subroutines may be nested four deep and are called only by label. All the special functions are usable in programs.

It goes almost without saying that the manual is excellent, an example to all manufacturers of how it should be done (though I fancied there were a few more typographical errors than usual).

Conclusions

The HP-11C seems to be aimed at the middle of the scientific programmable

GOTO page 189



COMPUTER ANSWERS

Send your queries to: Sheridan Williams, 35 St Julian's Road, St Albans, Herts. Please note that Sheridan can no longer answer questions on an individual basis, so please don't send an SAE with your query.

Easy routine

Is there any easy way to get machine code routines into my Exidy Sorcerer
(Name and address supplied)

The following routine allows machine code routines to be easily written into a Basic program as DATA. Although designed for use on the Exidy Sorcerer, it should work on most machines with a line editor.

The program displays the data in the normal Basic format which can then be entered into the program text with the line editor. The data can be POKEd back into memory from the data statement.

```
9000 A=4096 :REM FIRST
    ADDRESS
9010 E=4196 :REM LAST
    ADDRESS
9020 L=1000 :REM FIRST LINE
    NO
9030 PRINT TAB(61);
9040 IF A>E THEN
    PRINT:STOP
9050 L$=STR$(L)
9060 L$=RIGHT$(L$,LEN(L$)-1)
9070 A$=STR$(PEEK(A))
9080 A$=RIGHT$(A$,LEN
    (A$)-1)
9090 IF POS(I)>60 THEN 9120
9100 PRINT ",";
9110 GOTO 9150
9120 PRINT
9130 PRINT L$; " DATA ";
9140 L=L+10
9150 PRINT A$;
9160 A=A+1
9170 GOTO 9040
READY
```

Steve Cousins, Springfield Computer Club

Freelance hopes

I am thinking of buying a micro because I've been assured by various salesmen that there is a lot of freelance work available for Basic programmers with their own micro. Before committing myself, how can I check the state of the market?
G M Davis, Stanmore, Middx

I have known several people who have set up on their own and yet have found no work in over a year. The main problem is that no-one knows that you exist unless you are well-known or you advertise. The next problem is that if you eventually attract some custom, they will almost certainly insist on seeing some of your previous software. If you have never done any professional work before then you have none to show.

There are only a couple of escape routes from this vicious circle: share a programming contract with someone who already has the experience or join an established agency who can back up your work. Neither of these is easy.

Your letter doesn't say how much experience you have, but if you have less than three years' dedicated programming and systems analysis experience; you may not be competent as a professional. Can you, for instance, conduct the systems design and specifications necessary if the person requiring the program has no such capability? Do you know how to write out the necessary contract between you and the company? What software maintenance can you offer? I hope you have read 'The Secrets of Systems Analysis' serialised in *PCW* (now available in one volume as *Desk Top Computing*). However, I do wish you luck; let me know if you succeed.
SW

Floppy tape for PET?

Can you please tell me who makes floppy tape drives for the PET? Can you also tell me of a program which will enable me to: input information in a file by direct typing, not using DATA statements; read the information from a file and display it; and add to and edit the information (by 'information', I mean sentences as in reports)?
Mohab Mufti, London NW8

There are two main magnetic recording systems used for personal computers: cassette recorders and floppy disks.

Cassettes are cheap and very slow; disks are one or two orders of magnitude faster and offer much wider possibilities than simply program storage and retrieval, but are expensive. There is also a miniature tape cassette system known as 'Stringy Floppy', to convey the idea that despite being a tape system it has some of the speed advantage of a floppy disk. The price is intermediate between the two. The system uses extremely tiny, continuous loop cassettes, available in various lengths, according to your needs. If you need to store large programs or a lot of data, you need a longer cassette, but this will take correspondingly longer to search through. I can only imagine that the first part of your question refers to this unit, as I know of nothing else with a similar name.

These units were made originally by the Exatron Corporation of America, and details may be found in American magazines. They used to be imported into Britain, but I am informed that this is no longer done, so you would have to import the item yourself. There is also a British device of similar type sold by Aculab, of 24 Heath Rd, Leighton Buzzard.

In the second part of your question, you seem to be talking about a word processor. Now this is an application where speed of data access and ability to store very large amounts of data are important, and consequently most word processors are written for disk systems. They also tend to be written in machine code, which makes them difficult to customise. There is a word processor called Papermate, and also some early Commodore ones, written in Basic, which you might be able to modify for the stringy floppy. It is also possible that the Exatron users' group could recommend something.

This illustrates a problem with an unusual device like the stringy floppy: is anyone writing useful software for it? If not, and if you depend upon software written by other people, you would be better advised to go for a disk system.
B J Biddles

A 'stringy floppy' based on the Philips mini-digital cassette recorder, called the Currah 220M, holds 64k per cassette side with full motor control and 6000 bits/s is available for less than £200 from Sumlock Bondain Ltd, 263-269 City Road, London EC1 (01-250 0505)
SW

NS mail

We have a North Star Horizon on which we run CP/M software and have received an enquiry about 'electronic mail' and the possibility of communication between different microcomputers.

We have been advised that this is possible using a new CP/M facility called 'pip-out' for receipt by a machine running a similar program called 'pip-in' at the receiving end. Does the widespread availability of machines supporting CP/M make such an arrangement a likely basis for standardisation?
N Shindler, London EC1

It must be appreciated that the reply to this question can only be an opinion. CP/M has become very popular as an operating system for microcomputers and is available on a large number of machines, including some with a 6502 processor. In view of this international acceptance, I would say definitely that CP/M does form a likely basis for standardisation.

However, notwithstanding the above remarks, I would like to point out that British Telecom is currently engaged in finding a suitable standard for electronic mail and that the first service to operate should start in April 1982, called TELETEX.
Ian Pardington

Homework

At work I have access to a Systime 6700 minicomputer operating under RSTS/E with 1.25 Mbyte of memory and with disk and mag tape facilities. However, my Basic+ programming ability is still rather limited and there isn't the time to get much hands-on experience. I would be interested in buying some kit for use at home, from which programs could be input on the office machine.

I would also want my home equipment to handle financial problems such as investment portfolios, home accounts, banking, name and address files, etc. Games-playing would be of minor importance.

Could you explain the approach to adopt and any books or publications I could read to get a better understanding of the problems involved?
J V Cope, Beckenham

Your first objective should be to find a type of home equipment which can generate program coding in a version of Basic as close as possible to the Basic+ used by your office machine. Secondly, you will want to make sure that the programs are stored in a format compatible with the Systime 6700. For example, if your home machine stored Basic key-words as tokens (one or two character codes), while the bigger machine stored all program text as full ASCII strings, you would have considerable problems in transferring.

The third major point is compatibility of storage media. If your home kit saves on cassette tape, is there any way to read this into the Systime, and if so will the format be the same? The most likely type of mutually compatible media are likely to be 8in single density, single sided floppy disks, recorded in standard IBM format.

However, an 8in

floppy drive and controller will make your home system rather expensive.

Another approach, if your home equipment is relatively light and portable, would be to fit it with an RS232 interface, and plug this directly into an RS232 port on the Systime, thus transferring your programs direct from memory to the bigger machine. You could even consider getting an acoustic coupler and sending your programs to the office machine down the phone!

Yet another approach, if your machine didn't store its Basic programs as ASCII strings, might be to write them using a word-processing package running on your kit, and using ASCII for its text storage.

I hope these thoughts have given you some idea of the type of approach needed. As regards books on the subject you may well get some good ideas from the manuals for the Systime. As both RSTS and Basic+ are DEC products, Digital Equipment Corporation publications will also be worth consulting. A good treatment of Basic+ is given in *Instant Basic* by Jerald R Brown (Dilithium Press). You may well find this worthwhile, even without having your own machine, to help improve your programing skills in Basic+.

You might be interested to know that Tandy level II Basic bears some quite strong resemblances to Basic+. Even in Tandy Disk Basic the approach to file handling is not that different from the DEC approach.

P L McIlmoyle

ZX81 queries

I am halfway through my Computer Studies O-level course, and am considering buying a Sinclair ZX81. Would the ZX81 be suitable for me?

I am also interested in machine code. Is this explained in detail in any book? Does it use standard Z80 code?

Can the screen be turned on and off, and be POKEd with ASCII codes?

Can the ROM be used to experiment with machine code and be able to reload Basic if anything drastic occurs?

Can statements be strung together on the same line?

Does one *have* to use LET? Can ? be used instead of PRINT?

Neale Gray, Witney

The ZX81 is an ideal first computer and is an excellent tool to develop your programming skills. You will probably grow out of it in due course, as it has a limited display and lacks a proper keyboard.

There are two books I know of on machine code on the ZX81 — *Mastering Machine Code on Your ZX81 or ZX80* by Tony Baker (£5.95 from the users' club) and *Machine Language Made Simple for Your ZX81* (£9.45 from Melbourne House). Standard Z80 codes apply.

The screen can be turned on and off, but only with a machine code routine you would write. There is no provision in the monitor for such a facility. The ZX81 doesn't use ASCII codes, but this isn't a problem when you get used to the codes used.

The Basic stays in the ROM. It doesn't have to be booted up. No matter what you do, you cannot corrupt the ROM by PEEKing or POKEing it. At worst, you need to turn it off for a few seconds to reset.

Multi-statement lines are not possible on the ZX81, although you can emulate multi-statement lines by making use of the logic. For example, GOTO 20*(X=9) + 30*(X=20) will act as GOTO 20 if X equals 9 and as GOTO 30 if X equals 20.

Yes, one has to use LET and THEN is also compulsory. No, ? cannot be used instead of PRINT but PRINT is entered by just touching one key. This single key stroke entry system covers nearly every command and function you need, from SAVE to RUN to INKEY$ to RND.

Tim Hartnell, National ZX80 and ZX81 Users' Club.

Colour wanted

Where can I get an RGB video monitor for colour graphics?

M J Walshe, London SE9, Dr L C Payne, St Albans

As you are probably aware, there are three colours that make a television picture — red, green and blue — hence RGB. The computer system must be capable of giving these three signals. If the computer only has a UHF colour output then you will have to use a colour TV. You must check what is required before purchasing. Gadney Electronics, 179 Torridon Road, London SE6 (01-697 0079) markets the Salora range of colour monitors, and a 22in set costs £370 plus VAT. I have such a set, which can be used in either the PAL or RGB mode on a Research Machines 380Z system and I'm very pleased with it.

SW

Portrait poser

I am trying to find information on a computer system which produces a computer portrait. This is a system involving a closed circuit TV linked to a computer and a printer.

The image of the subject is captured with a TV camera and stored in the computer's memory. The computer then processes this data and transfers it to a printer on which the final portrait is printed.

Do you have any information on such a system or know of any manufacturers of such a system?

N Brimage, Merseyside

The American magazine *Robotics Age* regularly carries advertisements for such systems but these tend to be very expensive. The March/April issue contains an article which describes how using readily available parts, the amateur can construct a circuit which will input a video signal via a DMA interface.

Robotics Age is bimonthly, subscription is $19 a year and is obtainable from: *Robotics Age*, PO Box 725, La Canada, Calif.91011.

D Stocqueler

Moving games

Is it possible to get continuous motion games for an Exidy Sorcerer? If so, how do I do it, or where can I get hold of a contender?

Julian Rose, Horsham

Yes, you can play 'arcade games' on the Exidy Sorcerer. There are some very good games available. See the European Sorcerer Club (ESC) newsletters for details. The Sorcerer has a memory-mapped screen and therefore movement on the screen may be obtained using POKE. Validity of moves, etc. can be checked with PEEK.

Many games (eg, Space Invaders) require one key to be held down to move, while another is examined as a fire button. The program below achieves this by use of a machine code routine to test a specified key.

Experiment will show the POKEs required for any particular key to be tested. (POKE 68 with 0 to 15 and POKE 75 with 1,2,4,8 or 16.)

Steve Cousins, Springfield Computer Club.

```
10 REM * INITIALISE *
20 FOR Z=64 TO 77:READ D:POKE Z,D:NEXT Z
30 PRINT CHR$(12);:A=-2982
40 POKE 318,195:POKE 320,0
50 DATA 253,126,69,246,0,211,254,219,254,47,230,0,183,201
100 REM * TEST KEYS *
110 AN=0:CH=42
120 POKE 68,2:POKE 75,4:IF INP(64) THEN AN=-1:REM   'A'?
130 POKE 68,3:POKE 75,2:IF INP(64) THEN AN=AN+1:REM 'D'?
140 POKE 68,7:POKE 75,1:IF INP(64) THEN CH=45:REM   'K'?
150 IF AN<>0 THEN POKE A,32
160 A=A+AN:POKE A,CH
170 GOTO 100
```

RML secrecy

I have access to a Research Machines 380Z which is always used by other people. I need to keep my records confidential. Is it possible to prevent an unauthorised user from accessing the file directory on my disk via the CP/M command DIR until a code number has been entered?

Name and address supplied

There is no method of preventing any unauthorised user from accessing the directory on a disk without rewriting the disk operating system. An obvious method is to keep your disk under lock and key!!.

Presumably, you have thought of this method and from some reason have decided that a special piece of software would be suitable. It is possible to alter the disk organisation so that on warm start, the system switches to a program on disk. The operation of this program would then ask for a keyword, on receipt of which, the system would switch to the normal CP/M start. Such a program is outlined in the 380Z User Group magazine *Read using [RMLus]* issue 1, a copy of which may be obtained from the Secretary, RML National User Group, c/o Research Machines Ltd, PO Box 75, Oxford.

Ian Pardington

Micro insurance

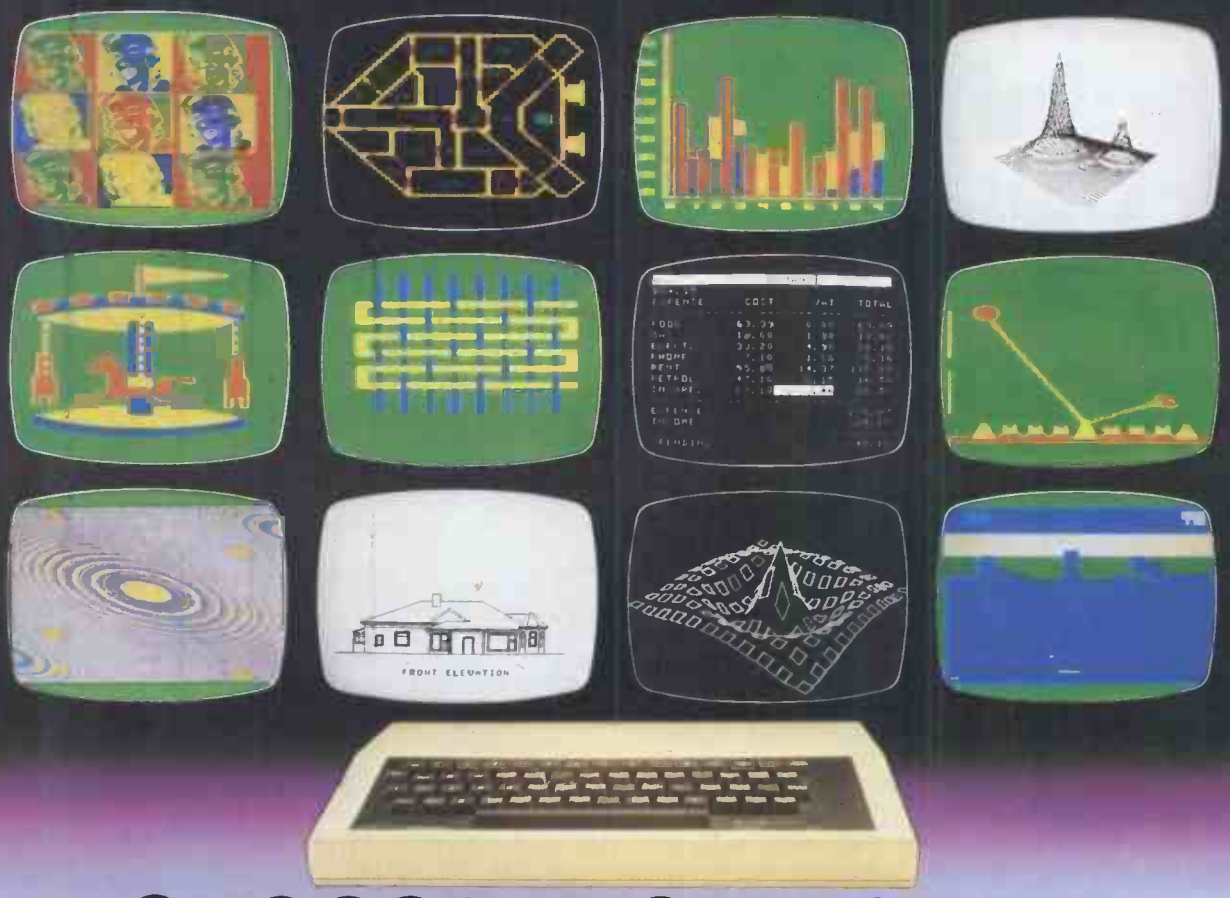
I am having difficult in insuring my computer equipment. Please would you tell me any companies that offer this type of insurance at reasonable rates.

Name and address withheld

I agree that it is difficult to find reasonable rates. When I tried to find similar insurance in 1977, all I got back from companies was requests for details of the fire protection conditions and air conditioning in the computer room. Nowadays, with computers becoming as common as hi-fi systems and often selling at similar prices, it would seem sensible for insurance rates to be comparable, too.

Although there are many ways to arrange cover, the simplest is to contact R J Dee Insurance Services, 14 York Place, Clifton, Bristol BS8 1AH (0272 738117). You should also be able to include it on your household policy provided you write and give them all the details. Stress that it is a *micro* computer as you will be surprised how behind the times some insurance brokers are.

SW



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* Expanded version only

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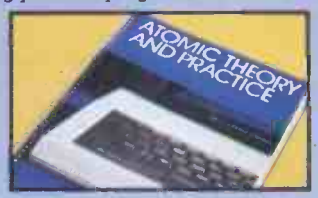

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PCW12/81

ATOM SOFTWARE is designed and produced by Acornsoft, a division of Acorn Computers, Trust the manufacturer to get the very best from its own product. Current software includes word processing, maths packs over 30 games, database, Forth and business packages.

Write to Acornsoft, 4a Market Hill, Cambridge for full details and prices.

SEE OUR DEALER LIST ON PAGE 219

Make the most of your Sinclair ZX Computer...

Sinclair ZX software on cassette.

£3.95 per cassette.

The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with other programs to form a single-subject cassette.

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.

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312pp., 124 illustrations £12.10 A comprehensive introduction to assembly level programming in the language of the Z8000. The detailed description of the Z8000 architecture and its family of support chips is indispensible for engineers, students and PDP-11 users.

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440pp., 130 illustrations £11.50 This highly recommended book is a logical progression and graduated exercise – designed to provide practice as well as test skill and comprehension. This invaluable book enables the reader to write simple programs almost immediately.

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Microprocessor Interfacing Techniques *by Rodnay Zacs and Austin Lesea*
464pp., 400 illustrations £12.10 This valuable book clearly and systematically presents the techniques and components required to put together a complete system interfacing the central processor to a variety of peripherals ranging from keyboard to CRT or floppy disk.

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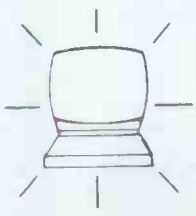

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NEWCOMERS START HERE

This is our unique quick-reference guide, reprinted every month to help our readers pick their way through the most important pieces of (necessary) jargon found in* PCW. *While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!

Welcome to the confusing world of the microcomputer. First of all, don't be fooled; there's nothing complicated about this business, it's just that we're surrounded by an immense amount of necessary jargon. Imagine if we had to continually say 'numbering system with a radix of 16 in which the letters A to F represent the values ten to 15' when instead we can simply say 'hex'. No doubt soon many of the words and phrases we are about to explain will eventually fall into common English usage. Until that time, **PCW** will be publishing this guide — every month.

We'll start by considering a microcomputer's functions and then examine the physical components necessary to implement these functions.

The microcomputer is capable of receiving information, **processing** it, storing the results or sending them somewhere else. All this information is called **data** and it comprises numbers, letters and special symbols which can be read by humans. Although the data is accepted and output by the computer in 'human' form, inside it's a different story — it must be held in the form of an electronic code. This code is called **binary** — a system of numbering which uses only 0s and 1s. Thus in most micros each character, number or symbol is represented by eight binary digits or **bits** as they are called, ranging from 00000000 to 11111111.

To simplify communication between computers, several standard coding systems exist, the most common being **ASCII** (American Standard Code for Information Interchange). As an example of this standard, the number five is represented as 00110101 — complicated for humans, but easy for the computer! This collection of eight bits is called a **byte** and computer freaks who spend a lot of time messing around with bits and bytes use a half-way human representation called **hex**. The hex equivalent of a byte is obtained by giving each half a single character code (0—9, A—F): 0=0000, 1=0001, 2=0010, 3=0011, 4=0100, 5=0101 .... E=1110 and F=1111. Our example of 5 is therefore 35 in hex. This makes it easier for humans to handle complicated collections of 0s and 1s. The machine detects these 0s and 1s by recognising different voltage levels.

The computer processes data by reshuffling, performing arithmetic on, or by comparing it with other data. It's the latter function that gives a computer its apparent 'intelligence' — the ability to make decisions and to act upon them. It has to be given a set of rules in order to do this and, once again, these rules are stored in **memory** as bytes. The rules are called **programs** and while they can be input in binary or hex (**machine code** programming), the usual method is to have a special program which translates English or near-English into machine code. This speeds programming considerably; the nearer the **programming languge** is to English, the faster the programming time. On the other hand, program execution speed tends to be slower.

The most common microcomputer language is **Basic**. Program instructions are typed in at the keyboard, to be coded and stored in the computer's memory. To run such a program the computer uses an **interpreter** which picks up each English-type **instruction**, translates it into machine code and then feeds it into the **processor** for execution. It has to do this each time the same instruction has to be executed.

Two strange words you will hear in connection with Basic are **PEEK** and **POKE**. They give the programmer access to the memory of the machine. It's possible to read (PEEK) the contents of a byte in the computer and to modify a byte (POKE).

Moving on to **hardware**, this means the physical components of a computer system as opposed to **software** — the programs needed to make the system work.

At the heart of a microcomputer system is the central processing unit **(CPU)**, a single microprocessor chip with supporting devices such as **buffers**, which 'amplify' the CPU's signals for use by other components in the system. The packaged chips are either soldered directly to a printed circuit board **(PCB)** or are mounted in sockets.

In some microcomputers, the entire system is mounted on a single, large, PCB; in others a **bus system** is used, comprising a long PCB holding a number of interconnected sockets. Plugged into these are several smaller PCBs, each with a specific function — for instance, one card would hold the CPU and its support chips. The most widely-used bus system is called the **S100**.

The CPU needs memory in which to keep programs and data. Microcomputers generally have two types of memory, **RAM** (Random Access Memory) and **ROM** (Read Only Memory). The CPU can read information stored in RAM — and also put information into RAM. Two types of RAM exist — **static** and **dynamic**; all you really need know is that dynamic RAM uses less power and is less expensive than static, but it requires additional, complex, circuitry to make it work. Both types of RAM lose their contents when power is switched off, whereas ROM retains its contents permanently. Not surprisingly, manufacturers often store interpreters and the like in ROM. The CPU can only read the ROM's contents and cannot alter them in any way. You can buy special ROMs called **PROMs** (Programmable ROMs) and **EPROMs** (Eraseable PROMs) which can be programmed using a special device; EPROMs can be erased using ultra-violet light.

Because RAM loses its contents when power is switched off, **cassettes** and **floppy disks** are used to save programs and data for later use. Audio-type tape recorders are often used by converting data to a series of audio tones and recording them; later the computer can listen to these same tones and re-convert them into data. Various methods are used for this, so a cassette recorded by one make of computer won't necessarily work on another make. It takes a long time to record and play back information and it's difficult to locate one specific item among a whole mass of information on a cassette; therefore, to overcome these problems, **floppy disks** are used on more sophisticated systems.

A floppy disk is made of thin plastic, coated with a magnetic recording surface rather like that used on tape. The disk, in its protective envelope, is placed in a disk drive which rotates it and moves a **read/write head** across the disk's surface. The disk is divided into concentric rings called **tracks**, each of which is in turn subdivided into **sectors**. Using a program called a **disk operating system**, the computer keeps track of exactly where information is on the disk and it can get to any item of data by moving the head to the appropriate track and then waiting for the right sector to come round. Two methods are used to tell the computer where on a track each sector starts: **soft sectoring** where special signals are recorded on the surface and **hard sectoring** where holes are punched through the disk around the central hole, one per sector.

Half-way between cassettes and disks is the **stringy floppy** — a miniature continuous loop tape cartridge, faster than a cassette but cheaper than a disk system. **Hard disk** systems are also available for micro-computers; they store more information than floppy disks, are more reliable and information can be transferred to and from them much more quickly.

You, the user, must be able to communicate with the computer and the generally accepted minimum for this is the visual display unit **(VDU)**, which looks like a TV screen with a typewriter-style **keyboard**; sometimes these are built into the system, sometimes they're separate. If you want a written record **(hard copy)** of the computer's output, you'll need a **printer**.

The computer can send out and receive information in two forms — **parallel** and **serial**. Parallel input/output **(I/O)** requires a series of wires to connect the computer to another device, such as a printer, and it sends out data a byte at a time, with a separate wire carrying each bit. Serial I/O involves sending data one bit at a time along a single piece of wire, with extra bits added to tell the receiving device when a byte is about to start and when it has finished. The speed that data is transmitted is referred to as the **baud rate** and, very roughly, the baud rate divided by ten equals the number of bytes being sent per second.

To ensure that both receiver and transmitter link up without any electrical horrors, standards exist for serial interfaces; the most common is **RS232** (or **V24**) while, for parallel interfaces to printers, the **Centronics** standard is popular.

Finally, a **modem** connects a computer, via a serial interface, to the telephone sytem allowing two computers with modems to exchange information. A modem must be wired into the telephone system and you need British Telecom's permission; instead you could use an **acoustic coupler**, which has two obscene-looking rubber cups into which the handset fits, and which has no electrical connection with the phone system — British Telecom isn't so uppity about the use of these.

IN STORE

DIRECT ACCESS

'In Store' this month includes details of the Canon CX-1, a powerful business machine for which Canon offers full professional support. Two other notable entries are the OKI if800 and the TRS-80 Color Computer, both recently Benchtested in PCW. *Please send any updates or additions to* Dick Olney, 'In Store', *PCW*, 14 Rathbone Place, London W1P 1DE.

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
ABC 80 (£738)	Datormark Ltd: 97 44896	16-40k RAM; Z80A; C; 12", 16 x 40 b&w VDU; 4680 bus; IEEE 488; RS232 port.	DOS; Basic (16k ROM;*Fortran; Pascal; A; Multi user Basic.*	Colour video graphics with UHF output. Viewdata compatible. Loudspeaker. Numeric keypad. Options: dual 5¼" F/D (320k) £895; dual 8" F/D (2 Mb). BT 1/80. (I)
ACT Series 800 (£3495)	ACT: 021-501 2284 (50)	48k RAM: 6502; dual 5¼" F/D (800k); 12", 30 x 64 VDU; 1 S/P; 1 P/P; Multi-screen int. Option: 10-20 Mb H/D	MDOS; Basic; A; *CBasic;* PL/M; *Forth; Fifth; Cesil; Pilot; Fortran.*	IBM compatible K/B. High resolution graphics. Available with dual 8" F/D (2.4 Mb) £4950 — 4.8 Mb maximum. BT 2/80 (E).
Adler Alphatronic (£1600)	Adler 01-250 1717	48k RAM: 8085Asingle 5¼" F/D (160k): 12", 24 x 80 VDU: S/P: P/P	*CP/M: Basic: CBasic: Fortran: Cobol*	With 80 cps printer and dual F/D £2345 (inc CP/M). (S)
Alpha Micro (£5650)	Alpha Micro (UK) Ltd: 01-250 1616 (TBA)	64k — 1 Mb RAM; 16 bit; dual 8" F/D (2.4 Mb); 6 S/P.	Multi-user OS; Basic; M/A; Pascal; U. *Fortran: Cobol*	Modular. Expands to 1200 Mb, 24 terminals or multiprocessor system. (E)
Altos ACS 8000-2 (£2995)	Logitek: 02572 66803 (33)	64k RAM; Z80A; dual 8" F/D (1 Mb); 2 x RS232 ports; 2 P/P.	CP/M; *Basic; CBasic; Cobol.*	Single user. Options: DMA. Floating point processor. Prototyping board.
Altos ACS 8000-10 (£6675)	As above.	208k RAM; Z80A; single 8" F/D (500k); 10 Mb H/D; 6 x RS232 ports; P/P; network RS422 port; DMA	CP/M; *MP/M; Basic; Cobal: Forbran: APL: Pascal.*	Multi-user/multi tasking. Up to 4 users. Options: 10 Mb; mag *tape backup (S + H).*
APL Signet (£1750 or £130pm)	Micro APL: 01-834 2687	64k RAM: Z80A: dual 5¼" F/D (380k): 2 x RS232 ports.	CP/M: APL: *Basic: U: Fortran: Cobol: Algol: Forth*	Desktop APL computer with self teaching course. (S)
Apple II (£695)	Microsense: 0442 41191 (190)	16-48k RAM; 6502; 8 I/O slots.	OS; Basic; *Pascal; Fortran: Cobol: Pilot*	280 x 192 high resolution graphics; Integer Basic in 6k ROM; Option: single 5¼" F/D (116k) £349.
Atari 400 (£345-16k)	Ingersoll: 01-226 1200 (40)	16k RAM; 6502; C int; cartridge slot; 12 x 20 TV int; RS232C port; touchpad k/b; Opt: C £40.	OS (10k ROM); Basic (8k ROM). *Pilot: Forth.*	High resolution colour graphics. 4-channel sound. Four games controller/light pen sockets.. BT 10/80. (I/B).
Atari 800 (£645-16k)	As above.	16-48k RAM; 6502; C int; 4 x cartridge slots; 12 x 20 TV int; RS232C port. Opt: single 5¼" F/D (90k) £345; 16k RAM £65.	As above.	As above. Software & RAM on cartridge modules. Up to 4 disk drives. BT 10/80. (I/B).
Athena 8285 (£5694)	Butel-Comco Ltd: 0703 39890 or 01-202 0262 (TBA)	64k RAM; 8085A; dual 5¼" F/D (644k); 12" 25 x 80 VDU; 150 cps printer; RS232 port.	AMOS; T/E; Basic; *Cobol; Fortran; Pascal; APL; M/A.*	Extended ASCII K/B with numeric pad; graphics. Options: dual 8" F/D (2 Mb); up to 1200 Mb H/D.
Atom (£120)	Acorn: 0223 312772 (35)	2-12k RAM; 8-16k ROM 6502; Full K/B: C int; TV int; 20 I/O lines; 1 P/P.	Basic in 8k ROM; A Cass O/S.	High resolution graphics on bigger model; colour monitor O/P. Loudspeaker. Note also, systems based on Acorn SBC. BT 7/80 (B).
Attache 201 (£8000)	COLT 01-572 3784 (10)	64k RAM; Z80; dual 8" F/D (2.4 Mb); 12" 24 x 80 VDU; 180 cps printer.	Basic; *Fortran; Cobol.*	Upgradable to multiuser system with 18 Mb H/D. Full range of business packages included software dealers TBA. (S)
BASF 7120 (£3600)	BASF: 01-388 4200 (12)	64k RAM; Z80A; 3 x 5¼" F/D (480k); 12", 24 x 80 VDU; RS232 port; P/P.	DOS;(OASIS) *Ex Basic; Cobol U. A: CP/M*	H/D available soon. Also 7125 with 930K F/D £4280 and 7130 with single F/D (430k) & 5Mb H/D £4950. Disk controller has own Z80A. BT 9/80
Billings BC-12 FD: (£3995)	Mitech: 04862 23131 (TBA)	64k RAM; Z80A; dual 5¼" F/D (640k); 12", 24 x 80 b&w (or b&g) VDU.	DOS; Basic; *Fortran; Cobol; A.*	With dual 8" F/D (2 Mb) £5995. Additional dual 8" F/D £3000 option: 50MB H/D. (S).
C/09 (£3500)	SWTP Ltd: 01-491 7507 7507 (16)	64k RAM; 6809; dual 5¼" F/D (700k); 9", 24 x 80 VDU; 2 S/P; 1 P/P.	TSC FLEX; *Basic; Fortran; Pascal; A; Dis A; T/E; U.*	Expandable to S/09 UniFLEX 32 user system. (H).
Canon BX-3 (£4250)	Canon 01-680-7700.	32k RAM; 6809; dual 5¼" F/D (640k); 28 char display; 80 cps printer; 3 x RS232 port; P/P.	OS; Basic; A. *Cobol; Pascal*	Fully integral unit. Extensive applications support offered on all Canon Machines. Options: dual dual 5¼" F/D (640k) £1500
Canon CX-1 (£6000)	As above.	128k RAM; 6809; dual 5¼" F/D (640k); 12", 24 x 80 VDU; 180 cps printer; 3 x V24 ports; P/P; light pen.	OS; Basic; A; *Cobol; Pascal.*	Price includes installation & training. Extensive application support offered. Options: dual 5¼" F/D (640k) £1500; dual 8" F/D (1Mb) £3300. (S)
Canon TX-25 (£1600)	As above.	16-32k RAM; 6809; C; 20 char display; 26 col, 2.4 lps printer. Option: 2 x RS232 port.	Basic; A.	Fully integral unit. Cassette is Canon's own design (8k). Can be used with communications. (S)

List of Abbreviations

A	Assembler	G/C	Graphics card	M/A	Macro assembler	S	Software
BT	Bench Tested	H	Hardware	N/A	Not available	S/P	Serial port
C	Cassette	H/D	Hard disk	N/P	Numeric pad	T/E	Text editor
E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

DIRECT ACCESS

IN STORE

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Challenger 1P & C4P (£220 & £395)	CTS: 0706 79332. Millbank Computing: 01-549 7262. Mutek: 0225 743289. U-Microcomputers: 0925 54117 (18)	4-32k RAM; 6502; C int; RS232 port. Options: dual 5¼" F/D (160k) £550; for C4P dual 8" F/D (1.15 Mb) and 20MB H/D	O/S; Basic (8k ROM) *Ex Basic;* A.	D/A conv; colour capability. Runs OSI business software on 8" F/D Plato educational software avail. soon. BT 4/80. (S).
Challenger 2 (£1500)	As above	48k RAM; 6502; dual 8" F/D (0.5 Mb); RS232 port.	OS65U; Ex Basic; A.	Designed as low cost business system (S).
Challenger C3 (£2334)	As above	32-56k RAM; 6502; 6800; Z80; dual 8" F/D (1.15 Mb); 2-16 S/P.	OS65U; Basic; *CP/M; Fortran; Cobol.*	Expandable to multi-user (8) system. Options: C3B & C3C H/D units. 74 Mb for about £8500. (S&H).
Clenlo Conqueror (£2475)	Clenlo Computing Systems Ltd: 01-670 4202 (TBA)	64k RAM; Z80; dual 8" F/D (1 Mb); 3 S/P; 2 P/P.	CP/M; CBasic-2; Pearl 1; *U. Fortran: Cobol: Pascal*	With 2.4Mb F/D £2950. Also H/D systems with 10 Mb H/D & tape drive £5430.
Comart Communicator (£1995)	Comart 0480 215005 (25)	64k RAM: Z80A: daul 5¼" F/D (780k): 2 S/P: P/P.	CP/M: *Basic: Cobol: Fortran: Pascal*	With 1.5 Mb F/D £2295. With 4.8 Mb H/D & 790k F/D £3795. Option: 18 Mb H/D. £3395 (S)
Compucolor II (£1175)	Dyad Developments: 08446 729 (TBA)	16-32k RAM; 8080; 13" 32 x 64 8-colour VDU; single 5¼" F/D (51k); RS232 port.	DOS (ROM); Ex-Basic (ROM); A. *M/A: T/E: Fortran: U*	32k version £1295. High resolution graphics. 6-month subscription to user magazine inclusive BT 9/79. (S)
Compucorp 625 (£6000)	Compucorp: 01-952 7860 7860 (17)	48-60k RAM; Z80; dual 5¼" F/D (630k); 9". 16 x 80 VDU; 40 col printer; RS232 port, P/P.	Basic: A; *Fortran; Pascal;* U.	IEEE-488 Controller and SJ00 int. Many applications packages avail. (E)
Compucorp 655/ 665/675/685 (from £5050)	As above	60k RAM; Z80; Up to 4 x 5¼" F/D (160k-2.4 Mb); 9", 20 x 80 or 12" 20 x 80 or 20" 60 x 80 VDU; 40-col printer; RS232 port.	As above	Prices incl installation and training. Opt: 10-20 Mb H/D
Computermart 2000 DS (£1500)	Computermart: 0603 615089	32-256k RAM. 8085; dual 8" F/D (1-2 Mb); S/P; P/P.	CP/M; *Cis Cobol; Basic; Fortran*	Expandable to multi-user, multi-tasking, multi-processor 96 Mb H/D system (around £15000).
Cromemco System Zero/DDF, System 2, System 3, System Z2H. (£2627/£2873/ £4893/£6118).	Datron: 0742 585490. Comart: 0480 215005. MicroCentre: 031-556 7354 (18)	64k RAM; Z80; dual 5¼" F/D (346k) on System Zero, System 2 & Z2H; dual 8" F/D (1.2 Mb) on Sys 3; 10 Mb H/D on Z2H; S/P; P/P.	CDOS; *Basic; Cobol; Fortran; RPG II; Lisp; A; W/P; Multi-user Basic. Cromix.*	System 2 & 3 expandable to Multi-user (max 7) £8373 System 2; £10252 System 3. Options: dual 8" F/D (996k); 11.2Mb H/D. BT 10/79 (E).
DAI (£998-48k)	Data Applications (UK): 0285 2588 (7)	48k RAM; 8080; C int; 24 x 60 VDU int; RS232 port; over 20 industrial ints.	Basic (ROM); U.	Colour graphics up to 255 x 335; 3 notes & noise generator; PAL O/P to TV; Paddle int; H maths option. (I). BT 10/80
Diablo 3000 (£6950) (TBA)	Business Computers Ltd: 01-207 3344	32k RAM; 8085; dual 8" F/D (1.3 Mb); 12", 24 x 80 b&w VDU; 45 cps printer.	DOS; Basic; DACL; A; U.	Selection of business packages included (S).
Digital Micro-systems DSC-3 (£3530)	Modata: 0892 41555 (14)	64k RAM; Z80A; dual 8" F/D (1.14 Mb); 4 x RS232 ports; EIA port.	CP/M; CBasic: *Cobol; Fortran: Pascal: PL/I*	Expandable to multiuser system with 10-28 Mb H/D. Extensive software avail. (S)
Digital Micro-systems DSC-4 (£4395)	As above	128k RAM; Z80A; single 8" F/D (500k); 11 Mb H/D; 4 x RS232 ports; 2 P/P.	CP/M; Basic-E; CBasic; *Cobol; Fortran; Pascal.*	Also DSC-3 with 64k RAM. Options; 128k RAM £1295; up to 4 Mb F/D and 20 Mb. H/D. (H).
Durango F-85 (£4995)	Comp Ancillaries: 0784 36455 (12)	64k RAM; 8085; dual 5¼" F/D (1 Mb); 9", 16 x 64 green VDU; 132 col 165 cps printer; N/P.	O/S; DBasic; *CP/M; CBasic; Micro Cobol.*	Up to 5 work stations; fully integrated system. Options: additional dual 5¼" F/D (1 Mb); 12-24 Mb H/D. (S).
Dynabyte 5200 5900 (£2600)	Metrotech 0895-57780 (15)	64k RAM; Z80; S100 bus; 2 ser ports; 1 par port; any com of 5¼" F/D (630k), dual 8" F/D (1Mb), 9/27/45 Mb H/D, 32/64/96 Mb Cart Module Disk.	CP/M; MP/M; CP/Net, CBasic, MBasic Cobol, Fortran, Pascal, PL/1-80	All systems expandable to multi-user and net working; CP/M inc in base price for F/D systems, MP/M for H/D systems.
Equinox 200 (£7500)	Equinox: 01-739 2387 (N/A)	64-512k RAM; Z80; 10 Mb-1200 Mb H/D; 6 x S/P; 1 P/P.	CP/M; CBasic; *Cobol; Fortran.*	Multi-user MVT/FAMOS available in place of CP/M. 16-bit version (Equinox 300) £10,000. (S&H).
Exidy Sorcerer (£695)	Liveport Data Products: 0736 798157 (27)	48k RAM; Z80; RS232 port; 1 P/P; S100 connector; 30 x 64 VDU int. - N/P	O/S; Basic (ROM); *T/E; A; CP/M; Algol; Fortran; Basic; 80. Pascal: W/P*	High-resolution graphics capability; user programmable character set. Option: single 5¼" F/D (316k) £600
Gemini 801 (£1075)	*Gemini: 02403* 22307 (7).	*64k RAM; Z80A; Single 5¼" F/D* (315k); 25 x 80 VDU int; RS232 port. P/P.	*CP/M Basic; Cobol; Fortran; Pascal; A; T/E.*	Up to two integral & two external F/D. Graphics. With no F/D and C int. £750. (S)
Gimix System 68 (£2000)	SEED: 05433 78151: Windrush 0692 405189	16-64k RAM: 6800/6809: dual 5¼" F/D (500k): 2 x RS232 ports.	OS-9: Flex *Basic: Pascal: A: Dis A: T/E: U*	With dual 8" F/D (2 Mb) £2900. Designed as development system for industrial control. (H).
Haywood 3000 (£1925)	Haywood: 01-428 0111. (TBA)	32-64k RAM; Z80A; dual 5¼" F/D (800k); RS232 port; P/P. Opt: 15" 28 x 80 VDU £799.	CP/M; *Basic; Cobol; Fortran; Pascal; W/P.*	Also system 7000 with 48-65k RAM and 8" F/D /2.5 Mb) £2999. (S)
HP 85 (£1830)	Hewlett Packard Ltd: 0734 784774 (16)	16-32k RAM; C.P.U.; 5", 16 x 32 VDU; C (200k): 64 cps printer; 4 P/P. Options: dual 5¼" F/D (540k) £1408; dual 8" F/D (2.4 Mb) £3744.	Basic (ROM)	Full dot matrix graphics. Complete range of interfaces, peripherals and application packages avail. 16k RAM £222. (S).

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E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

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IN STORE

DIRECT ACCESS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
IMS 5000 (£1500)	Equinox: 01-739 2387 (20)	16-56k RAM; Z80; dual 5¼" F/D (320k); 2x S/P; 1 P/P;	CP/M; C/Basic; *Cobol, Fortran.*	3 drives option: (S&H).
IMS 8000 (£2500)	As above	64-256k RAM; Z80; dual 8" F/D (1 Mb); 2 x S/P; 1 P/P	CP/M; CBasic; *Cobol; Fortran; MicroCobol.*	Multi-user MVT/FAMOS available in place of CP/M. (S&H).
Intecolor 8000 (£2999)	Dyad Developments: 08446 729(TBA)	8-32k RAM: 8080: 19", 80 x 48 colour VDU: single 5¼" F/D (90k): Option: up to 26 Mb H/D.	DOS(ROM): Ex-Basic: *A: M/A: T/E: Fortran: U*	High res graphis avail: Many options including size of F/D and VDU. (S).
ITT 2020 (£867)	ITT: 0268 3040 (15)	16-48k RAM; 6502	Monitor; A; ExBasic; Dis A.	360 x 192 high res graphics. Ex-Basic in 6k ROM; Options: single 5¼" F/D (116k), £425; 16k RAM, £110; RS232 port, £96; 32k system, £931: 48k system. £995. (B).
Ithaca DPS1 (£3995)	Ithaca: 01-341 2447 (10).	64k RAM; Z80; dual 8" F/D 1 Mb); 2 x RS232 ports; 4 x P/P. Opt: H/D.	CP/M; *Basic; Cobol; Fortran; Pascal; A; U.*	Z8000 16-bit processor board avail. IEEE/S100 (8 or 16 bit) compatible. (E).
LX-500 (£3500)	Logabax Ltd: 01-965 0061 (13)	32k RAM; Z80; dual 5¼" F/D (180k); 12" 25 x 80 b&w VDU; 100 cps printer.	DOS; Basic; A.	Other printers available. (S).
LSI M-One (£4200)	LSI Computers: 04862 23411 (20)	8-16k RAM; 8080; dual 8" F/D (1.2 Mb); 12", 24 x 80 b&w VDU	FMOS; A	Choice of standard business packages included in price. (S).
LSI M-Two (£7900)	As above	64-128k RAM; 8085A; dual 8" F/D (1.2 Mb); 12", 24 x 80 VDU; 60 cps printer	Elsie; *CP/M; Basic; Cobol Fortran; Pascal; A; U*	Max 8 VDUs and 4 printers. Many applications packages available. Option: 10 Mb H/D £2600. (S)
Macro 1 (£3950 or £294 pm).	Micro APL Ltd. 01-834 2687 (TBA)	64k RAM; Z80A; dual 8" F/D (1 Mb); 4 x RS232 ports.	CP/M; APL; U; *Basic; Fortain; Cobol; Word-*2star Algo; Pascal; Forth.	Designed as timesharing replacement. Macro 2 with 2 Mb F/D £4750 or £334 pm..
Megamicro (£6080)	Bytronix: 0252 726814(5)	56k RAM; Z80; dual 8" F/D (500k); 12", 20 x 80 green VDU; 180 cps printer; 2 S/P; 2 P/P.	CP/M; U; *Basic; A; M/A.*	Range of bus. packages now avail. from Ludhouse of Streatham. (H&B).
Micro Trainer 1 (£650)	Hewart; 0625 22030 (N/A)	16-32k RAM; 6800/6809; 10" 16 x 24 VDU; 2 x C int; Opt: dual 5¼" F/D (160k) £595; 8k RAM £17.	Basic; A; *Pascal; PL/M; W/P*	SS50-based system. Graphics avail. Int card with real time clock £17. (I)
Microstar 45 Plus (£4800)	Data Efficiency Ltd: 0442 63561 (30)	64k RAM; 8085; dual 8" F/D (1.2 Mb); 3 S/P; RS232 port	Stardos; CP/M; Basic; *Cobol; Fortran*	(E)
Microtan 65 (£69)	Tangerine: 0353 3633 (6)	2k RAM; 6502; T Mint; Exp up to 277k RAM.	2k TANBUG monitor; 2k A, disassembler, cassette firm ware; *10k Microsoft Ex-Basic.*	Options: bulk I/O modules, hi-def graphics, CP/M, system racking, ASCII keyboard. Prestel adaptor (S&H)
Millbank Sys 10 (£2995)	Millbank: 01-788 1083 (6).	65k RAM; Z80; dual 5¼" F/D (700k; 12", 24 x 80 VDU; 2 x RS232 ports; RS4449 port; P/P.	CP/M; *Basic; Cobol; Fortran; Pascal; PL1; W/P*	One high level lang. included. 12-month warranty. Main-frame comm. package. H/D avail. soon. (S&H)
MS5001 (£7450)	BMG Ltd: 0793 37813 (N/A)	64k RAM; 8085; dual 8" F/D (1 Mb); 12", 80 x 24 VDU; 80 cps printer; RS232.	CP/M; *Basic; Cobol; Fortran; MP/M.*	Price includes desk mounting and one computer. Hardware & software support. Leasing arrangements available. (E)
MSI 6816 (£1200)	Strumech: 05433 4321 (5)	16-56k RAM; 6800; dual 9" 16 x 64 b&w VDU; C int; 1 S/P; 1 P/P.	Basic; A.	Graphics & PROM programmer available (S&H)
MSI System 12 (£8000)	As above	56-184k RAM; 6800; 10 Mb H/D; single 8" F/D (500k) 24 x 80 VDU; 1 S/P; 1 P/P.	SDOS; Basic; CBasic; U.	As above. Business packages avail. Up to four terminals (H & S).
NEC PC 8001 (£450)	NEC(UK)	32k RAM; Z80A: RS232 port: P/P Option: dual 5¼" F/D (574k) £675	*CP/M: Basic N: Fortran Cobol: Pascal*	Colour monitor £250 (low res) or £480 (high res) both 12", 25 x 80(E) BT 6/81
Newbrain MB £219	Newbury Labs: 021-707 7170. Newbear: 0635 30505 (N/A)	2-4k RAM; Z80A; Nat 420; 14x 16 VDU; 2 x C int; TV int; V24 port. Option: C (50k) £60.	C Basic (16k ROM)	Graphics. Battery or mains. Mains only with 16k RAM £269. (low power battery version £299). (I).
North Star Horizon (£2230)	Comart: (7) 0480 215005. Comma: 0277 811131. Equinox : 01-739 2387 (20)	48-56k RAM; Z80A; dual 5¼" F/D (360k); 15", 24 x 80 VDU; 150 cps printer; 2 S/P; 1 P/P.	DOS; Basic; CP/M; *Cobol; Fortran; Pascal.*	Options: 18 Mb H/D.
Oki if 800 (£4000)	Encotel.	64k RAM; Z80A; 2k ROM; dual 5¼" F/D (560k); 12", 24 x 80 VDU; 80 col printer; loudspeaker; RS232 port; 20k ROM cartridge.	Basic: A: *CP/M Cobol: Fortran:*	Fully integral unit. Graphics. Options: dual 5¼" F/D (560k): RS232 port: PP. (I). BT 10/81
Onyx C8000 (£6875)	Onyx Dist Ltd: 0734 664343 Colt 01-577 2150. (TBA)	64k RAM; Z80; 12 Mb Cartridge; 10 Mb H/D; 4 S/P; P/P	CP/M; *MP/M Oasis: Unix; Fortran; Pascal; W/P*	C8001 with 128k RAM £8220. Multi-user version avail. using Oasis. (E) BT 3/81
Oscar (£2560)	IDS Ltd: 0908 313997 (30)	64k RAM; Z80; dual 5 ÷ F/D (800k); 12", 25 x 80 VDU; RS232 port; 1 P/P	CP/M: *Basic; Pascal Fortran; Cobol; W/P; A*	Also avail. with daul 5¼" F/D (1.6 Mb) £2905 and dual 8" F/D (2 Mb) £3380. Advanced video board. (S + H).
Panasonic JD 800U, JD840U (£4275, £4950)	Panasonic Business Equipment: 0753 75841 (10 regional dist)	56k RAM; 8085A; 2-4k PROM; dual 8" F/D JD800 U (500k), JD840U (2 Mb); 12", 24 x 80 green VDU; 3 x RS232 ports.	CP/M; Basic; *Micro-Cobol.*	Also available with 5¼" F/D; JD740U (570k) £4095. H/D avail soon. BT 3/80 (S).
Pascal Microengine (£2295)	Pronto Electronic Systems Ltd: 01-554 6222	64k RAM; MCP 1600; 2 x RS232 ports: 2 P/P.	Pascal.	CPU instruction set is P-code; no interpreter needed. Available with dual 8" F/D (2 Mb) £3900.

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Pasca 640 (£3700)	Westrex Ltd: 01-578 0957 (TBA)	64k RAM; Z80A; dual 8" F/D (512k); 12", 24 x 80 VDU; RS232 port; P/P.	CP/M; *Basic; Cobol; Fortran; Pascal; A; W/P; U*	Maintenance contracts avail. 10 Mb H/D avail. soon. (S) BT 5/81
Periflex 630/64 (from £2250)	Sintrom: 0734 85464 (5)	64k RAM; Z80; dual 5¼" F/D (1.2Mb); 2 x RS232 ports; 1 P/P	CP/M; *Basic; Fortran; Cobol; A.*	One-day installation training on site included in price. Option; dual 5¼" F/D (630k) £464, dual 8¼" F/D (1 Mb) £1025. 35Mb H/D. BT 6/80 (S&H)
Periflex 1024/64 (from £2750)	As above	64k RAM; Z80; dual 8" F/D (1.2 Mb); 2 x RS232 ports; 1 P/P.	As above	As above.
PET 16k, & 32k (£550, £695)	Commodore: 0753 79292 (150)	16-32k RAM; 6502; C; 9" 25 x 40 VDU; IEEE-488 port; Options: dual 5¼" F/D (353k) £695; same but (950k) £895	O/S; Basic (in 8k ROM); *Forth; Pilot; Pascal; Comal; Lisp; A*	8032 with 80-col screen (32k) BT 12/80. £895 Field service avail. (I)
Powerhouse 2 (£1125)	Powerhouse Micros: 0422 48422 (TBA)	32-64k RAM; Z80A; 5" 29 x96 VDU; RS232 port; external bus.	4k Monitor; *FDOS; Basic; ExBasic (14k EPROM)*	VDU has flexible screen logic. Options; FDOS & Basic £210; graphics card £200. (H)
Powerhouse 3 (£2600)	As above	32-64k RAM; Z80A; dual 5¼" F/D (350k); 5", 29 x 96 VDU; RS232 port; external bus.	As above.	VDU as above. With 1.2 Mb F/D £3500. ExBasic & FDOS in 14k EPOMs £300. (H)
Prince (£3045)	Digico: 04626 78172 (TBA)	48-64k RAM: 2 x Z80: dual 5¼" F/D (800k): 2 x RS232 port: 12", 24 x 80 VDU	CP/M: *Basic: Pascal: Fortron: Cobol: W/P: A:* T/E: U	High res graphics. Options: single 5¼" F/D (400k) £600: dual 8" F/D (2 Mb) £2000. Rentals avail. (S).
Raannd SP1 (£4500).	Raannd: 0506 33372 (TBA)	64k RAM; MCP 1600; dual 8" F/D (2 Mb); 12", 24 x 80 VDU; RS232 port; P/P.	Pascal *ADA: Basic*	Based on Microengine (with integrated P-code). Up to 4 F/D drives. 64k RAM expansion avail. BT 12/80. (S)
Rair Black Box III (£2750)	Rair; 01-836 6921 (N/A)	64-512k RAM; 8085; dual 5¼" F/D (260k); 2 x RS232 ports.	CP/M; Basic; Cobol; Fortran; M/A	16k RAM expansion £500 10 Mb H/D £2500.
Research Machines 380Z (£895)	Research Machines: 0865 49791 (N/A)	16-56k RAM; Z80A; 2 x C; RS232 port. P/P	ExBasic; A; T/E; U; *CP/M; Fortran; Cobol; Algol; Cesil: Pascal.*	High res colour graphics. Many possible systems. With 48k RAM & dual 8" FD (1 Mb) £3394.
S/09 (£7000)	SWTP Ltd: 01-491 7507 (16)	128k RAM; 6809; dual 8" F/D (2 Mb); 12", 24 x 80 VDU; 2 x S/P; 1 P/P	UniFLEX; *Basic; Pascal; Fortran; A; Dis A; TIE; U.*	Expands to 32 users, 768k RAM, 90Mb H/D. UNIX 'look alike'. (S & H).
Saracen (£1925)	Bytronix 0252 726814 (TBA)	32-64k RAM; Z80; dual 5¼" F/D (800k); 2 x RS232 ports.	CP/M; *Basic; Cobol; Fortran; Pascal; A.*	Applications packages & maint. contracts avail. With dual 8" F/D (2 Mb) and 64k RAM, £2676. (E)
SBS 8000 (£1449)	Manhattan Skyline Ltd: 0801 3442; C Itoh 01-353 6090 (TBA)	64k RAM; Z80A; 12", 16 x 64 VDU; 1 P/P; RS232 port (extra £133).	ExBasic (24k ROM); *DOS*	Options: disk control card £237; dual 5¼" F/D (368k) £795; dual 8" F/D (2 Mb) £1400. BT 11/80. (S)
SEED System 1 (£2000)	Strumech: 05433 4321 (5)	32-56k RAM; 6800; various disk options: 12", 24 x 80 VDU: RS232 port: P/P	DOS; Basic U; *Fortran; A; Pilot; Strubal; T/E*	Graphics. PROM programmer Also system 19 multi-user (£3000). (E).
Sharp MZ-80K (£460-34k)	Sharp Electronics (UK) Ltd: 061-205 2333 (22)	6-34k RAM; Z80; C; 10" 24 x 40 VDU; Option: dual 5¼" F/D (289k) £695.	Basic (14k ROM); A. *CP/M: Pascal.*	Graphics; loudspeaker. BT 10/79 (B)
Sharp MZ-80B (£1095)	As above	64k RAM: Z80A: C: 9", 25 x 80 VDU: RS232 port: P/P.	Basic: *A: Pascal: FDOS*	High res graphics. Options: dual 5¼" F/D (560k) £800: 80 cps printer £415. (S)
Sharp PC3201 (£2995)	As above *CP/M: Cobol.*	64k RAM; Z80A; dual 5¼" F/D (500k); C int; 12", 25 x 80 VDU; *70 lpm printer.*	DOS; U; Basic. *CP/M: Cobol.*	Various expansion cards avail. *BT 7/81 (I&B)*
Sinclair ZX81 (£50-kit, £70-built - prices inc VAT).	Sinclair: 0276 66104	1-16k RAM: Z80A: C int: TV inb: full K/B: 44-pin expansion port.	Basic (8k ROM).	Advanced 4-chip design. Printer avail soon BT 6/81
Smoke Signal Chieftan (£1800)	Windrush 0692 405189: Seed 05433 78151 (TBA)	32-64k RAM; 6800/6809; dual 5¼" F/D (500k); 2 x RS232 port.	DOS; *68/FLEX; Basic; Fortran; Cobol; A: Dis A: Pascal: U.*	With dual 8" F/D (2 Mb) £2600. Designed as development system for industrial control. (H)
Solitaire WP & BS200 (£6750 & £8200)	Solitaire KPG: 01-995 3573 (TBA)	64k RAM; 8085; 14" VDU (with own CPU); 45 cps printer; CPU port; dual 5¼" F/D (700k) 8" F/D (1.02 Mb) with BS200.	DOS; Basic	All solitaire systems are compatible; and can be upgraded to multi-user H/D system. (S)
Sord M100 ACE (£2339)	Midas Computer Services Ltd: 0903 814523 Exleigh Bus. Mach. 0736-66577.(10)	48k RAM; Z80; 8k ROM dual 5¼" F/D (246k): 24 x 64 green VDU; RS232 port: N/P	O/S; Basic; *A; Fortran; Pascal.*	Up to 3 drives possible. Colour graphics avail. Option S100 bus. (I)
Sord M223 Mk II-VI (£4078)	As above	64k RAM; Z80; 8k ROM; dual 5" F/D (700k); 12", 24 x 80 green VDU; RS232 ports; S100 bus; N/P	*O/S;* Ex Basic; *CBasic; Multi-User Basic; Fortran; Cobol.*	Expandable to 4 Mb F/D. 32 Mb, H/D, 5 screens, 2 printers. M243 with 192k RAM & 1.4 Mb F/D £5087.
SPC/1 (£3770) (TBA)	Digital Data: 01-573 8854	64-1024k RAM; 8085A-2; dual 5¼" F/D (90k); 12", 24 x 80 VDU; 2 x RS232 ports; Option: single 8" F/D (1 Mb) £1090: 20 Mb H/D £7000.	Mikados, Comal; Pascal; A.	With 32k RAM and single F/D (Comal only) £1995. Expandable to multi-user system (8 users). BT 7/80 (S).
Superbrain (£1950)	Icarus: 01-485 5574 (45)	64k RAM; 2 x Z80; dual 5¼" F/D (320k); 12" 25 x 80 VDU; 2 x RS232 port.	CP/M; A; *Basic; Cobol; Fortran; APL; Pascal.*	Limited graphics, Mainframe int avail. Full range of application packages avail. Also avail with 700k & 1.5 Mb F/D. BT 8/80. (S&H).

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System 10 (£2995)	Millbank 01-788 1083 (TBA)	64k RAM; Z80; dual 5¼" F/D (700k); 12", 24 x 80 VDU; 2 x RS232 port; P/P	CP/M; *Basic; Fortran; Pascal; Cobol; PL/1; W/P.*	12 month warranty. Maint contracts. Applications packages avail. Choice of high level language in price. (E)
System 20 (£3500)	Extel: 01-739 2041 (TBA)	64-512k RAM; Z80A: dual 8" F/D (1 Mb); 12", 24 x 80 VDU; 3 x V2	CP/M:E Basic; *M Basic; Pascal; Cobol; Fortran*	Maintenance contracts avail (132 field service engineers). Expands to multi-user system. Options 13.7 Mb H/D £5799; 27.4 Mb H/D £6674.(S)
System 80 (£1355-48k)	Nascom: 02405 75155 (32)	16-48k RAM; Z80A; dual 5¼" F/D (560k); TV int; RS232 port.	CP/M; Basic (8k ROM)	EPROM firmware avail. Colour graphics card £165. Many configurations possible. (S&H).
Tandberg EC10 (£4000)	Tandberg: 0532 774844 (N/A)	64k RAM; 8080A; single 8" F/D (250k); 12", 25 x 80 VDU; 7 x RS232 ports; printer int.	CP/M; ExBasic (24k) *Multi-user Basic; Pascal; Cobol;* A; U;	Up to 7 terminals. Includes V28 comms port. (S & H).
Tandberg TG 8450 (£2200)	As above	64k RAM; 8085; single 5¼" F/D (77k); C int; 12", 24 x 80 VDU; RS232 port; P/P	TDOS; *Basic; Cobol; Fortran; Pascal.*	TDOS is CP/M compatible. Opt: single 5¼" F/D (77k) £250 (up to four); dual 8" F/D(2 Mb) £1800. (S&H)
Tandy TRS-80 Model I (£289)	Tandy: 0922 648181 (200)	4-48k RAM; Z80; C; 12", 16 x 64 VDU: RS232: P/P	Basic (4k ROM); A.	Fully expandable. Option: single 5¼" F/D (175k) £339 (up to 4). Many extras available. (I)
Tandy TRS-80 Model II (£2499)	As above	64k RAM; Z80; single 8" F/D (500k) 12" 24 x 80 VDU; 2 x RS232 port; P/P	Basic; *M/A Fortran; Cobol*	Option: single 8" F/D (500k) £899 (subsequent £450, up to 4). 32k RAM £344.
Tandy TRS 80 Model 3 (£500-£1700)	As above	See Model I Levels I and II		Fully intregral unit. Up to 2 integral and 2 external 5¼" F/D. BT 8/81
Tandy TRS-80 Colour (£349)	As above.	4-16k RAM; 6809; 8-16k ROM; C; 16 x 32 TV int; RS232 port.	Colour Basic.	With 16k RAM, 16k ROM & Extended Colour Basic £449 (I). BT 9/81.
TECS(£1200)	Technalogics Computing Ltd: 061-793 5293 B&B Computers Ltd: 0204 26644 (TBA)	4-56k RAM; 8k PROM; 6800/ 6809; 2xC; TV int; 2xRS232 ports; internal viewdata modem & printer port.	FLEX: Basic; *Pascal; TDOS; A; T/E; Pilot; Fortran; Cobol.*	Fully viewdata compatible. Options — dual 5¼" F/D (320k) £850; dual 8" F/D £120 £1200. (S&H).
Terodec CPC-100 0 (£4095)	Terodec: 0734 664343 (8)	80k RAM: Z80A: single 5¼" F/D (819k): 2 S/P: 3 P/P	CP/M: CBasic; *Fortran: Pascal: Cobol.*	System with Okidata 80 printer: TVI 910 VDU: W/P and various appliation packages £5995 (S + H).
Terodec DPS 64/2M (£3598)	As above	64k RAM: Z80A: dual 8" F/D (2 Mb): 2 S/P: 3 P/P. Options: 10 Mb H/D: Tape.	CP/M: *MP/M: CP/Net: CBasic: Fortran: Pascal: Cobol: Basic.*	2 user system with 10 Mb H/D £7400 4 user system with 34 Mb H/D & tape backup £11981. (S + H).
TI 99/4 (£299)	TI: 0234 67466 (TBA)	16k RAM; 26k ROM; 9900; 2 x C int; 24 x 32, 16 colour TV int; 3 tones & noise; P/P.	OS: Basic.	12 month guarantee. Options; 32k RAM; 2 x RS232; 3 x 5¼" F/D (92k each); Speech Synthesiser.
Tuscan CP/M Starter (£999)	Transam: 01-405 5240 (N/A)	24k RAM: Z80: single 5¼" F/D (190k): Cint: TV int: RS232 port: P/P: N/P.	CP/M: *Basic: Fortran: Pascal: Cobol:*	options: single 5¼" F/D (190k) £155: single 5¼" F/D (370k) £285: 8k RAM £50. (S + H)
UDS 3000 (£2300)	Kemitron: 0244 21817. (TBA)	64k RAM; Z80A; dual 8" F/D 2 Mb; 2 x RS232 ports. Option: 10 Mb H/D	CP/M; *Basic; Cobol; Fortran; Pascal.*	Full range of industrial support cards, and applications software. (E)
Vector MZ (£2650)	Almarc: 0602 52657 (3)	56k RAM; Z80A; dual 5¼" F/D (630k); 3 S/P; 2 P/P.	CP/M; Basic; *Algol; Cobol; Pascal; Fortran; Coral; CBasic; A.*	High resolution graphics. Also system B with video board & terminal £3450. (E).
Vector System 2800 (£4600)	As above	56k RAM; Z80A; dual 8" F/D (2.4 Mb); 3 S/P; 2 P/P.	As above	High-res graphics. Many Options. Fully expandable to 5005 multi user system (max 5) £5400.
Vic 20 (£200)	Commodore: 0753 70292 (150)	5-32k RAM: 6502: Cint: 22 x 23 TV int: S/P: P/P: Games int.	Basic	Graphics 3 tone sound generator. Will interface to PET. Option: single 5¼" F/D (170k). BT 9/81 (S).
VIP (£2650)	Almarc 0602 52657 (3)	64k RAM; 3k ROM; Z80A; single 5¼" F/D (315k); 12", 24 x 80 VDU; RS232 port; 3 x P/P	CP/M; *Basic; Fortran; Cobol; Pascal; A.*	Up to 3 additional F/D drives. Options: dual 8" F/D (2 Mb) £1063, 32 Mb H/D (TBA). (H&S). BT 2/81
Video Genie EG3003 (£300)	Lowe Electronics: 0629 4995 (N/A)	16k RAM; Z80; 500bps C; 16 x 64 TV int; extra C int; 1 P/P	Basic (12k ROM); *Pascal: A M/A; Fortran*	Graphics available with ex-Basic (13.5k) £350.
WH8 (£352)	Heath 0452 29451 (N/A).	16-64k RAM; 808A (or Z80); 4 S/P. Option: single 5¼" F/D (102k) £241.	OS; HDOS; CP/M; *Fortran; Pascal; Basic*	Kit. 3 drives max. Colour graphics avail. (S&H) BT 2/80.
Zentec (£4838)	Zygal Dynamics: 02405 75681 (TBA)	32-64k RAM; 2 x 8080; dual 5¼" F/D (256k); 15", 25 x 80 VDU; RS232 port.	O/S; A; U; *Basic;* Cis Cobol.	User programmable character set. Option: dual 8" F/D (1 Mb). (S).
Zenith WH-11A (£2673)	Heath Ltd: 0452 29451 & 01-636 7349 (N/A)	LSI 11; 16-32k RAM; 25 x 80 VDU; S/P; P/P.	*O/S; Basic; Fortran;* A: U.	PDP 11-compat. Option: 2 x 8" F/D (1 Mb). £1717 (S&H).
Zenith Z89 £1570-£1710	As above	16-48k RAM; Z80; single 5¼" F/D (102k); 12" 24 x 80 b&g vdu; RS232.	*Basic; A; HDOS;* CP/M; *MBasic; CBasic; Fortran.*	3 x 5¼" F/D possible. Options: dual 8" F/D (1 Mb) £1717, 20 Mb H/D.
Zilog MCZ 1/05 (portable): MCZ 1/20A (£3250)	Micropower: 0256 54121. Memec; 084421 5471 (N/A)	64k RAM; Z80; dual 8" F/D (600k); RS232 port; MCZ 1/20A only 1 P/P; Option: 10 Mb H/D £7100	RIO; O/S; *Cobol; Basic; Fortran; Pascal; M/A; U.*	Available desk top or rack mounted. Debug in 3k PROM. 1/20A runs multi-user Cobol, up to 5 terminals with 40 Mb H/D. (S&H).

List of Abbreviations

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E	Extensive	I	Introductory	O/S	Operating system	TBA	To be announced
F/D	Floppy disk	Int	Interface	P/P	Parallel port	U	Utility

Please note: Software items listed in *italic* are not included in the basic price of the equipment. All prices are *exclusive* of VAT.

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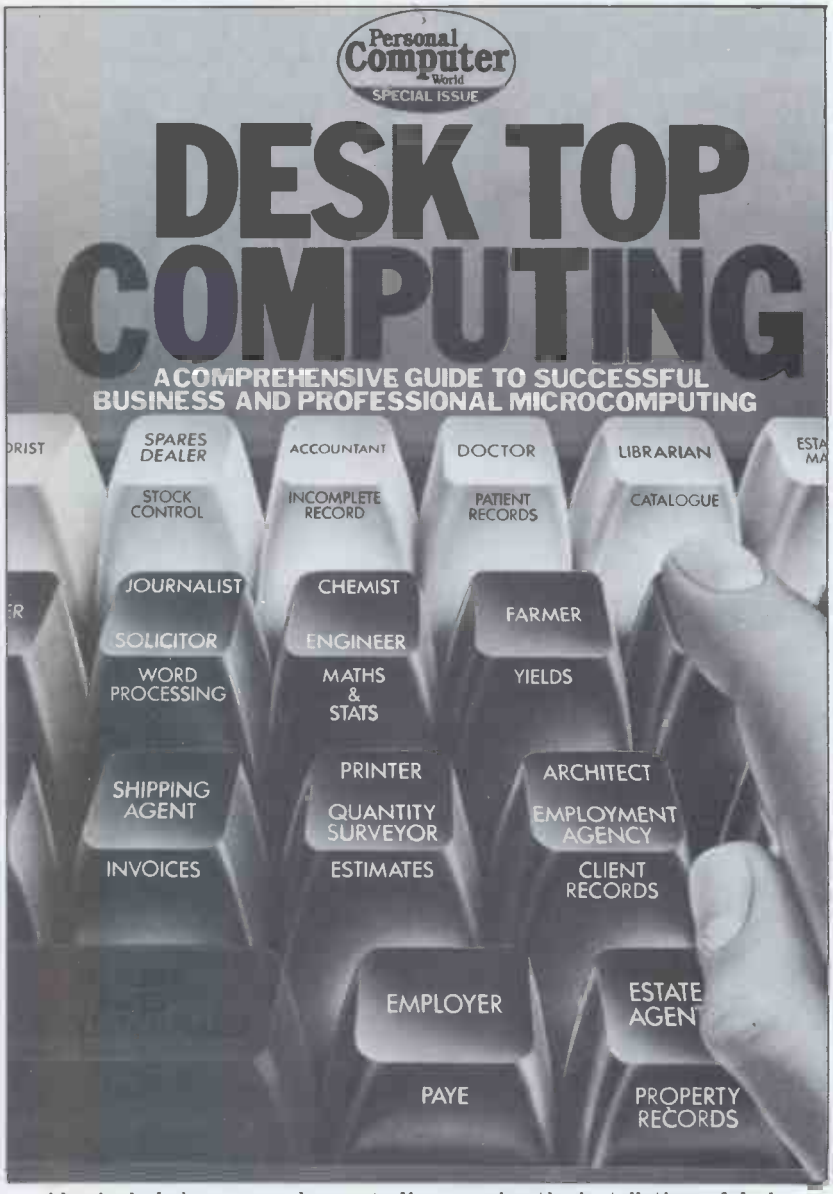

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Personal Computer World SPECIAL ISSUE

"WORDSTAR GOES APPLE!"

Q: What additional equipment do I need to run WordStar on my Apple computer?
A: WordStar 3.0 and later versions require a Microsoft SoftCard and a minimum of 48K RAM. Earlier releases of WordStar require both, plus an 80-column VIDEX Videoterm card.
Q: What about "shift-key" modifications to the 80-column video board? Do I need these to run Wordstar?
A: Not necessarily. All WordStar functions run without modification. Upper/lower case characters can be generated using the escape key.
Q: What Disk-Sector format do I need to run WordStar on the Apple computer?
A: WordStar is available on both 13-Sector and 16-Sector Apple formats — but please specify when ordering.
Q: Are there any differences between the Apple version and the standard CP/M version of WordStar?
A: No, there are no functional differences between the two versions. The Apple version supports all WordStar and MailMerge functions. The Apple version can be installed only on Apple computers.
Q: What printers are compatible with WordStar on the Apple?
A: WordStar supports letter-quality and teletype-like printers, including dot-matrix, line, and thermal devices. While WordStar provides full functions for quality daisy-wheel printers (e.g. NEC, Ricoh, TEC, Qume, and Diablo), it can also take advantage of many lower priced non-daisy-type printers.
Q: Why is WordStar considered the "ultimate" word processor?
A: Strength, versatility and many useful features position — WordStar as the leading word processing package. WordStar offers:
1. Screen orientated editing — when you add, delete, or manipulate text, all changes are displayed on the screen.
2. Install program — WordStar can be user installed for many configurations of VDU's, video boards, and printers.
3. Extensive menus — comprehensive prompting reduces the need to refer to the manual, and you can choose between one of four help levels.
4. Disk-biffered text entry — the size of your document is limited only by the storage capacity of your disk.
5. Incredible features — video editing, word-wrap, powerful editing commands, dynamic page-break display, print enhancements, decimal tabbing, paragraph indent, global search and replace, on-screen flexible page formatting, horizontal scrolling, block and column moves, and many more.

WordStar has been enhanced by other MicroPro products that work together to provide complete text and data-handling solutions for business:—

MailMerge: A powerful data and text merging tool that enables WordStar to produce personalised form letters.

CalcStar: NEW: — "Electronic Spread Sheet" and financial modelling program.

SpellStar: A one-step "proofreader" that exposes misspellings and typos. Provides a compressed 20,000 word dictionary, and allows user-created supplementary dictionaries.

DataStar: Fast, accurate data entry, retrieval and updating system.

SuperSort: Sophisticated data sorting, merging and selecting power for DataStar and other file structures.

WordMaster: Comprehensive text and data editor designed for programmers.

WordStar	£205.00	APPLE WordStar	£145.00
MailMerge	£ 60.00	APPLE MailMerge	£ 50.00
SpellStar	£110.00	APPLE SuperSortI	£ 85.00
DataStar	£160.00	APPLE SpellStar	£ 75.00
SuperSortI	£110.00	VIDEX Videoterm Card	£185.00
WordMaster	£ 60.00	MicroSoft SoftCard	£195.00
CalcStar	£125.00	APPLE CalcStar	£ 75.00

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DIRECT ACCESS

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Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Z-Plus (from £4000)	Rostronics Ltd: 01-870 4805(16).	64k RAM; Z80A; dual 8" F/D (0.5/1 Mb); 12", 24 x 80 VDU; 4 S/P; 1 P/P	CP/M: MP/M; A; U; *Basic; Cobol; Fortran; Pascal; APL; PL/1; Algol.*	Complete with furniture. Various business packages avail. Option; 20 Mb H/D £4000. BT 12/79 (S&H).

SINGLE BOARDS

Machine (Price from)	Main Distributor/s (No. of Dealers)	Hardware	Software	Miscellaneous (Documentation)
Acorn System 1-5 (£65-£1600)	Acorn: 0223 312772 (35)	1l/8k RAM; 6502; EPROM socket; Hex K/B; C int; 8-digit LED display; up to 16 ports. Options: Eurocard 64-way connector; VDU card; full K/B card.	½k monitor; *Basic. Pascal: Forth: DOS.*	Kit. Programmable address linking. On-board 5 V regulator. Available assembled £79. Cn be expanded to disk-based system. (S&H)
AEX-09 (£750)	Micro Design 0908 663655	8k RAM; 32k PROM; 6809; 16 I/O lines; RS232 port; RS422 port.	OS-9; *(Basic; Pascal; Fortran avail soon)*	Full A/D & D/A conversion facilities. 4 x 8 bit outputs. (H).
Aim 65C (£259)	Pelco: 0273 722155(7)	1-4k RAM: 6502; 4-20k; ROM; Full K/B 2 x C; 20 char LED; 20 char thermal printer; RS232 port.	A. Dis A; T/E; 8k monitor; *Basic (8k ROM); PL65. Forth*	Expandable using RM65 models to full disk systems (E).
Bigboard. (£450)	Maclin-Zand 01-837 1165 (N/A)	64k RAM; Z80; F/D controller; 24 x 80 VDU controller	2k monitor; *CP/M; Basic; Fortran; Cobol; Pasal; A.*	Many options. Will support up to four 8" F/D drives. BT 3/81. (E)
Biproc (£119)	B L Micros: 0494 443073. (TBA)	1k RAM; Z80; TV int; RS232 port. Opt: 4k RAM £8; K/B £30.	2k Monitor; A.	With 9980 instead of Z80 £155 as well as Z80 £180. Kit. (H)
Cromemco SC (£355)	Comart: 0480 215005 (25) Datron. 0742 585490.	1k RAM; Z80A; 8k EPROM sockets; RS232 port; 3 P/P. Option: S100 bus.	Monitor; *Basic.*	5 program interval timers. Can put own Basic program in EPROM. (E).
Elf II (£50)	Newtronics: 01-348 3325 (N/A)	¼-64k RAM; RCA 1802; Hex K/B; 2-digit LED; TV int; C int; RS232. Options: Full K/B; VDU card.	1k monitor; A; Dis A; T/E; Elf-bug; *Tiny Basic; Basic,*	TTY N-line decoders. Low re-solution graphics (high res avail). Kits or built. Full range of peripherals. (H).
Explorer (£82)	As above	4-64k RAM; 8085; Full K/B; RS232 port; 6 x S100 bus; C int; 1k video RAM.	2k monitor; *Basic (8k) CP/M: Basic Fortron: Cobol.*	Supplied in kit or built. Full range of peripherals including F/D. (H).
Hewart 6800S (£299)	Hewart: 0625 22030 (N/A)	16k RAM; 6800; full K/B VDU int; 2 x C int; 1 S/P; 2 P/P; Option: 16k RAM £90	1k monitor; A; T/E.	Can be upgraded with 6809. (H).
Hewart 6800 Mk III (£152)	As above	1k RAM; 6800; VDU board	1k monitor.	Options: single 5¼" F/D (75k) £350; PROM programmer £32. (H)
Microaxis 1 (£250)	Micro Design 0908 663655 (N/A)	1k RAM; 1-8k PROM; 6809; 8 channel A-D system; 12 optically isolated I/O lines.	1k monitor	Designed for industrial control. Can be expanded to F/D system. (H)
MPC 09 (£750)	As above	17k RAM; 48k PROM; 6089; RS232 port; 50 I/O lines; 4 timers; 1 W audio amplifier.	1k monitor; *Multi-tasking 0S.*	As above. New 64k version avail.
Microtan 65 (£69)	Tangerine: 0353 3633 (6)	2k RAM; 6502; 16 x 32 TV int; Options; 64 Pixel graphics £6.50;	2k monitor, *Basic*	TANEX expansion kit with 7k RAM; 4k EPROM sockets; 10k Basic; 4 S/P; 32 P/P £145. (E)
Nascom 1 (£125)	Nascom: 02405 75155 (20)	4k RAM; Z80; Full K/B; TV int; 2 P/P; 1 S/P. Options; 16k RAM £140; single 5¼" F/D (250k) £240 (4 disk controller £127).	2k monitor; *B Basic; Tiny Basic; A; T/E; U.*	Kit. Built version £140. Also Nascom 2 with 8k Microsoft Basic in ROM £225 (no RAM). (S&H)
77/68 (£90)	Newbear; 0635 30505 (N/A)	4k RAM; 6800; LED; C int; VDU int.	1k monitor; *Basic*	Expandable to 64k RAM with F/D. (B)
79/09 (£65)	As above	1k RAM: 6809; P/P; S/P	2k Monitor.	Designed to upgrade 77/68. (H).
SBC 100 (£135)	Airamco: 0294 57755 (TBA)	1k RAM; Z80; 8k ROM; S100; 1 S/P; 1 P/P.	*1k monitor; DOS in ROM.*	Kit. Available assembled £196. (E).
Superboard (£188)	(as Challenger)	4-8k RAM; 6502; 10k ROM; full K/B; VDU int; C int.	Basic (8k ROM)	Options; RS232 port; single 5¼" F/D (100k) £316; 8k RAM £188. (S&H).
Smoke Signal SCB 68 (£181)	Windrush 0692 405189 (TBA)	1k RAM; 6800/6809; 8k EPROM; 1 S/P.	2k monitor	Fully expandable to 64k RAM with F/D. (H)
SYM-1 (£160)	Newbear; 0635 30505 (N/A)	1-4k RAM; 6502; C int; VDU int; 2 x 6522 ports. Option: TV int.	4k monitor; *Basic A.*	Expandable to 64k RAM with F/D. (B).
Tuscan (£299)	Transam 01-405 5240 (N/A)	8k RAM; 8k ROM; Z80A; 5 x S100 slots; RS232 port; TV int; C int; 1 P/P.	*2k monitor; 8k Basic; CP/M; Pascal.*	High res graphics available. Can be expanded to F/D system. BT 1.81. (S&H)
UK101 (£149)	Comp Shop: 01-441 2922 (4)	4k RAM; 6502; full K/B; 16 x 48 VDU or TV int; C int: RS232 port, Options; 4k RAM £16.	2k monitor; 8k Basic; *Dis A; U.*	Graphics. Expansion & colour avail. Kit or fully assembled. (S&H).
Windrush 6801 (£175)	Windrush: 0692 405189	2k RAM: 6801/3/5: 12k EPROM: S/P: 3 P/P	2k Monitor	Designed for industrial control & dedicated small systems. (H)
ZCB (£260)	Almarc: 0602 625035 (3)	1k RAM; Z80A; 3 PROM sockets; RS232 port; 3 P/P	*Will take any 2708/ 16/32 software.*	S100 bus compatible. Expand-able to full system. (E).

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ACC NEWS

Rupert Steele of the Association of Computer Clubs surveys the club scene.

I write this fresh from the ACC's Annual General Meeting at which Peter Whittle was re-elected as Chairman and, what's more, they didn't throw me out. Robin Bradbeer was elected as a new Committee Member and Richard Larkin was co-opted as ACC Real Ale Rep. In his first report, Richard told us that the City of London Polytechnic was running a course on 'Computers and Microprocessors in the Brewing Industry'. Unfortunately, this article won't appear in time for this term's course, but ring the Poly on 01-283 1030 for details of the next one.

Over 200 local clubs and User Groups are now on the ACC Club Database. Is yours? Write to Derek Fordred, who edits *Accumulator* and maintains the database, and check your entry. His address is: 72 Mill Road, Hawley, Dartford, Kent. We are currently negotiating for some pages on Prestel so that we can put the database online and I'll let you know of any progress.

New clubs: by the time this appears, meetings will have been held in Brighton and Guildford to form now local clubs. Derek Fordred should have the details (assuming that they've sent them in).

The subject of Robotics is causing quite a lot of interest at the moment. In addition to Micro Mice, people are getting involved with more 'useful' robots, such as arms for the disabled. Developments in this field are very welcome, as the professionals tend to be more interested in automating assembly lines because that's where the money is. The North London Club has a robotics group which has built two micro mice, although only one was debugged by the time the competition came. They are also obtaining some robot arms for general experiments, although, at the time of writing, the project was held up by red tape.

While we're on robotics, Vernon Gifford threatened to set his ComputerTown mob on me if I didn't mention the ACC National Micromouse and Robotics Conference. It's at Imperial College on Saturday 28 November, and this should be out just in time for you to send your registration fee of £9.50 to Vernon at 111 Selhurst Road, London SE25 6LH (tel 01-653 3207). Vernon points out that many people are finding robotics an interesting introduction to practical hardware, and he hopes that the conference will form a bridge from micromouse to other forms of robot.

The North London Hobby Computer Club have written to tell me that their AGM is on Wednesday 25 November at the North London Poly. So go along and exercise your democratic rights (if you're a member, of course). Meanwhile, Richard Larkin tells me that the North London Club are doing all sorts of interesting software things. They have a Tiny-C interpreter up and running on several machines, and are now selling it at a bulk purchase rate to ALCC members; the next project will be a Tiny-C compiler. They also have Forth and are buying a Basic compiler for the PET. As regards Pascal-S, the story is not quite so successful as they still can't read Dr I Wilson's disk. It appears to be written in an 'unusual' disk format, but hope has not been abandoned yet.

Club news

If you have anything worth a mention in *PCW*, write to me (address at end of article) and tell me. Deadline is the 26th of each month or maybe the 27th, if it's a full moon. At this point, the style of ACC News changes, and it degenerates into me subjecting you to my so-called wisdom on some computing-related topic. So those of you who want to learn about computing, stop reading now. The rest of you can laugh at my mistakes.

Choosing your computer

At the *PCW* Show, many visitors came up to the ACC stand, where I was answering questions and running our database, and asked me for impartial advice about which systems to buy. Since there seemed to be so much confusion, I thought I would kick-off this series with some general advice about choosing computers. Of course, I'm as bigoted as the next man, so don't expect what I say to be impartial, but I hope that it will be useful.

The first decision that you must make when you are considering buying a computer is what function the machine is meant to perform. are you wanting a computer primarily to do a job, or are you mainly interested in learning about them? The computer that is meant to do a job has to be faster than doing it by hand, or at least easier, or else it is a waste of money. If it's for learning, the choice then reduces to which particular aspect of personal computing you are interested in, and how much money you want to spend.

The most important question to solve first is whether or not you actually need a personal computer to do the job. Would you be better off with a programmable calculator, or does your application really demand a minicomputer? Let us illustrate this point with two examples.

1. Job cost estimates: A businessman from the North was talking to some exhibitors at the *PCW* Show. He wanted to be able to calculate the cost of a job for producing estimates over the telephone as well as by post. His application essentially involved solving a complicated formula. My advice would be to buy a programmable calculator, such as a TI-59 or the appropriate Casio equivalent. His program could be stored on a magnetic card or in 'permanent' memory and be ready to use at a moment's notice. This man didn't need a 24-line display, or graphic symbols, and certainly no colour. He only required a number to say to the customer, and that the machine be simple and quick to use.

2. Stock control/accounts: Do not expect to process this sort of data efficiently (ie, saving rather than wasting time and effort) on any new machine costing less than £1200. Before you can seriously process data, you require four things: a disk of some kind, or preferably two; a hard copy device (ie, a printer) that can output lines at least 80 characters wide and, preferably, with lower case available; a video display with at least 40-character width, preferably 80; a decent operating system — CP/M is adequate but not perfect.

The reason why all this expense is necessary is that cassettes are not a sufficiently fast, convenient or safe medium in which to store important data. It can take several minutes of fiddling about to persuade a computer to read a cassette tape, an operation that a disk machine (even with 5in floppies) can do in a second. It is no good trying to use a computer stock control system that takes several minutes of fiddling with cassette tapes to do what you could do with a ballpoint pen and a stock book in the same time.

Once you have a disk and a printer, your computer can be quite a useful tool. Program writing is much faster if you can take a paper listing away from the screen, and a machine with a printer can produce records that can't be erased, not to mention invoices, letters (if you have a high enough quality printer), packing notes and whatever takes your fancy. Don't neglect considering a minicomputer; while they tend to cost £15,000 or so, they have capabilities that are quite beyond most micros. For example if you have a requirement to handle large amounts of data, you would need a hard disk (usually a winchester with a floppy for back-up) and a fast printer. This set-up might cost £5000 or more, and you might need two or three of them, with maybe complicated arrangements for the computers to talk to each other. A mini, which would have software to run multiple users, might be more convenient and no more expensive.

So there is my advice to somebody wanting a computer primarily to do a job. Think carefully about your requirements, and avoid cassette-based systems like the plague.

If you want a computer for learning and/or entertainment the dominant factor must really be how much you want to spend. Personal computers aimed at the hobbyist rather than the businessman come in a bewildering array of different forms, varying in price for £69 or so for a ZX81 to about £1500 for a machine with disks and printer. One thing that is worth deciding early on is whether you wish to place more emphasis on the recreational side of computing, or whether you are more interested in learning.

If your main interest is games, then it would be worthwhile to consider a machine like the Commodore VIC-20 which is clearly geared up for games, with pretty colours, sound and medium resolution graphics. Nevertheless, for teaching computing, the machine may be limited by its 22-character width screen display. If you don't want to commit too much money at the start, the best bet must surely be the Sinclair ZX81; yes, I know that it has many weak points, and that you'll get fed up with it in time, but it is astounding value for money. Don't worry about expandability, your ZX81 is an introduction to the world of computing at a low price; when you want to expand, I suggest that you sell it and buy and Acorn Atom or Compukit UK101 or, when available, the BBC computer. Each of these is a system in

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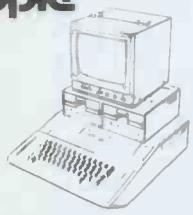

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ACC NEWS

the £200-£300 range, which will substantially outperform a ZX81 at a reasonable price. These are still cassette systems.

At this stage, you should be thinking about a printer. As I have already pointed out, one can write programs much more efficiently with a paper listing to look at; a printer is cheaper than a disk drive, and probably more useful in a 'learning' environment.

Ideally, you should aim for an impact (plain paper) printer. They are more expensive to buy, but less trouble in the end as you don't have to go trailing round for special papers. A popular printer is the Microline 80, which prints at a moderate rate with reasonable quality. Most medium-sized systems have a printer sold as an optional extra.

At the top of the expansion pyramid, we find disk units. Once you get a disk, you'll wonder how you ever got on without it, but they are expensive. At this stage, it is probably worth changing computers; the sort of machines to look for in the disk market include Commodore PET, Tandy TRS-80, Research Machines 380Z, and Apple.

So the message if you're buying a computer to learn with is to buy a system that fits your initial budget, and don't be afraid to trade it in for a new one rather than expand it beyond its limits. A ZX81 is very good value with a cassette, but it is not the device to use with a winchester disk, expansion interfaces notwithstanding!

Whatever your reasons for purchasing a computer, I strongly recommend that you first join a club and talk to the people there. They will tell you the good and bad points of their own machines, and you get a good opportunity to see a wide range of computers in operation so that you can decide which features you can live without.

Details of the ACC are available from: Rupert Steele, St John's College, Oxford OX1 3JP.

TRANSACTION FILE

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Texas SR 52. . . mag card. Programmable calculator + PC100A printer cradle, hardly used. Many progrs. manuals, spare cards, printer paper rolls. £175 the lot. Will split. Phone Guisborough 41259.

TRS-80. . . quick printer II, Serial, Parallel, Tandy interfaces, connects direct to TRS-80, cable included. Prints lower case without upgrade. Five rolls of paper. £95. Tel: Rainham (Essex) 23089 (eve).

TRS80. . . 16k L2. . . Brand new and unused, unwanted gift, with documentation, £385 ono. Tel: Crewe (0270) 665774.

PET 3032 32k. . . with twin disc drive 3032 and printer with all cables and cassette deck. Hardly used, best offers, tel: 01-254 7132 ext 23 (daytime).

ZX81. . . 16k, Sinc built, £30 s/ware, & cassette recorder, all under guarantee & boxed woth £180. Forced to sell at £130 Manchester 061-338 5242.

Tuscan S100. . . Full board 8k Basic, 2k monitor, 8k RAM on board, S100 RAM board) with 12k RAM, switching P/S. All manuals, £300 ono. Tel: 01-902 4738 or 01-450 2542.

Sorcerer 48k. . . 8k Basic ROM 4k monitor, as new, warranty, with original packing. Software worth £50 inc. games, utilities, manuals and tapes £500. Tel: Aldridge (0922) 53764 after 6.

ZX81. . . 2 months old, Sinc built, as new, in box, leads, Basic manual, mains adaptor, games tape, £65. A Malivoire, 2 Ruskin Lane, Hitchin, Herts.

ZX81. . . Sinc built, 1k RAM, all leads, manual, ready to run. £45 (inc post) David Lowe, 12 Renals Way, Calverton, Nottingham, NG14 6PH.

TRS-80 L1. . . 16k, lttle used, inc leads, power supply, modulator and manuals. Must sell £200 ono. Phone Chris on 730 4163 after 6.

Atom 12 + 12. . . Acorn built, exc cond, 5 months old, with PSU. £40 worth of software and all leads. Offers over £225 please. Phone Southport (0704) 42297 after 4.

ZX81. . . Immaculate cond. 1k, price inc Sinc Power supply, all leads, £15 of programs. Why join a long waiting list? Incredible value at £70. Southend 521627.

S100. . . 8k static RAM board (Ithaca). Addressable to any 4k boundry, with NI-CAD standby voltage option and up to 3 wait states. Only £70. Phone 03047 4550. Ask for Chris.

Sharp. . . EL-8020 LCD calculator with EA-20C AC adaptor — fully rechargeable £15. Prinztronic 12 place display desk calculator (large figures) £30. Sanyo LW/MW car radio £30. All perfect and ono. Tel 0626 85226 or write F R Farquhar, Glen Eyre Hall, Bassett, Southampton.

Paper Tiger. . . 440 printer 198 cps with serial lead — low mileage — can be seen London. £275. Steve Burgess Hill 42489.

PET 32k. . . Cassette, toolkit, Superchip, visible music monitor. Also light pen, reset key. Many programs including PETchess, draughts. Full manuals and Basic teaching program. Perfect cond £50. Tel 0403 731650.

Acorn Atom. . . 12k RAM & 12k ROM, 4 colour graphics. All original leads, manual and PSU with Acorn Atom Magic Book. Mint condition 3 month old, Acorn built. £250 asked for. Phone Nick 01-550 2669.

MEK6800D2, 6800 evaluation kit. . . For sale (£120) but would prefer to exchange for Z80 evaluation system, eg, Nanocomputer. Tel 028-488 453.

TRS-80 16k L2. . . Green VDU, cassette, programmable sound generator, covers, 50 programs, editor assembler, level 2 instruction course on tape, manuals, many books and level 3 & 4 Basic. £425 ono. 01-703 9265.

Microtan 65. . . plus Tanex, manuals, 7k RAM, x-bug, ASCII keyboard with numeric keypad. Utilities/games include invaders (sound effects unit included), asteroids and music program. £260 ono Wentworth 2688.

Superboard 2. . . 32x48 cased, 16k RAM Cegmon, toolkit & Basic 5 EPROMS, High speed cassette interface £60 of taped programs, 12in TV. All manuals. £370 ono. Rochdale 33576.

TRS80. . . 48k with expansion interface, new Tandy TEAC disk-drive, rock steady green screen monitor, cassette recorder. Keypad also. Manuals, magazines, books for learning Basic and machine code. Lots of tape and disk software. Worth over £1200 want £800. Buyer collects. Tel: South Shields 559251 after 5.

Apple II. . . Silentype 80 column graphics and text printer £250. Sup'r'terminal 80 column video card for Apple £150. 12in Hitachi monitor ideal for 80 col display £120. All work with Pascal and Basic. Tel: 01-444 4184 7-9pm.

HP41C card reader . . . unused complete with handbook, head cleaning card, 20 double sided blanks and card holder. Normally £145. Asking only £95. Phone 0703-554222.

ZX81. . . 16k RAM pack, Sinc built, nearly new, perfect working order, manual, leads, adaptor, software, cassette are all included. Only £100. Tel: Adam 727 3606 (5-9) and all day Saturday.

Microtan 65 (L/C). . . 3k Tanex, MSP1, mini motherboard + keypad £140 ono. Tel: (0942) 671963.

16k Superboard II. . . with 610 expansion board (up to 24k), numeric keypad, PSU, all cased, 48x32 display and Cegmon monitor. Manuals and software. £280 ono. Tel: Pontefract (0977) 704418 anytime.

Superboard II. . . 8k RAM, cased PSU, Cegmon monitor, mini EPROM board. Codekit mini assembler. manuals. £195 Great Missenden (02406) 2179.

Superboard Series II. . . cased, PSU, Wemon monitor, lots of software, 8k RAM, 19in b/w TV. £190. 01-950 6845 (Bushey Herts).

Acorn Atom . . . 8k ROM 2k RAM. Includes power supply and manuals + some progs. Acorn built. Only 6 months old. £150 ono Tel. Mark any time after 4. 051-638 8504.

Acorn Atom . . . Fully expanded. 12k RAM. Floating point. 8255 PIA 6522 UIA. 2 months old. £250 or best offer. Tel Cheltenham (0242) 30463.

ZX81+16k RAM pack. . . Sinc built. All leads, mains adaptor and manual. Still under guarantee. Two books, tapes, £120 ono. Tel: 01-864 2203.

TRS-80 4k Level 1. . . 1HC VDU CTR 80 cassette recorder, power supply, Basic instruction course tapes, game and plain tapes, manual £250 ono. Tel: 805 0885 (Enfield) after 6.

16k ZX81. . . Sinc built, PSU, manual, cassette recorder, all leads, plenty of software, exc. cond, only £120. Buyer collects demo if asked for. Wantage (023 57) 65122 after 4pm.

TRS-80. . . green screen monitor, will suit most micros. £70. Centronics P1 Microprinter, connector & one roll of paper £165. L Carasco, 43 Broadfield Close, London NW2.

Nascom 2. . . 32k RAM, 27 k ROM, 5 cards Kenilworth case, EPROM programmer, TV recorder, Naspen, Z2 Zeap 2, Nasdis, 3 monitors + tons of extra Nascom hardware, software & literature. £550. Tel: 01- 581 2451.

PET 8k. . . old ROM, small keyboard, microchess, starwars etc. Pet revealed £350. Tel: Warrington (0925) 72 2430 anytime.

ZX81. . . Sinc built, inc leads, manual, adaptor £16k RAM pack. Both in perfect working order £100. Tel; York 26390 after 5.

Microtan 65. . . Tanex, 10k, Basic, XBug, keypad, Apple ASCII keyboard, graphics, Invaders software, good working order, £200. Wrexham 265325.

TRS-80. . . 16k L2 VDU, cass, num pad, manuals, loads of s/ware eg ten adams adventures, star trek, temple apshai (40 in all) £450 Whiston, Liverpool 051- 430 0162.

Commodore CBM. . . 8k Level computer, Model 3008, 10 months old. In perfect cond. Complete with I/O unit and a selection of computer games. £400. Tel: Bradford 492480.

S100 System. . . runs CP/M, Z80A, ROM monitor, 64k RAM, twin 8" SD floppies, 10 slot integrand cabinet, Tarbell controller, S/P cassette I/O board, GR Keyboard, 4 page video board, £1500. 0276 61543 after 6.

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ZX80. . . Sinc built, boxed complete with PSU, leads, manual, Little used, £35. Paul 01-841 4268 (eve & w/ends).

Acorn Atom. . . 12k + 12k, floating point ROM, printer drive, assembler etc. Manual, PSU, leads, game cassettes, Acorn Atom Magic Book. Only 6 months old. £210 ono. Tel: Paul Wirdnam, daytime, Sheffield 71111 ext 346.

Acorn Atom. . . 12k ROM, 12k RAM, as new, Acorn built, with PSU, leads and manual, plus Magic Book. £225 the lot. Tel Hull (0482) 443178 eve.

Sharp MZ-80k. . . 48k RAM, brand new, with games progs, manual and cover. £520 ono. Phone Wendy Edwards, Merthyr Tydfil (0685) 73109 after 9.

Sharp MZ-80k. . . 48k RAM. Eight months old, very good cond. Over £100 of software inc. Visicalc, Zen assembler, Invaders, Breakout, Advanture, Headon, Life, Basic toolkit. £450. Tel: Maidenhead 39393.

Acorn Atom. . . 12k RAM. PSU floating point & printer ROMs. VAI games inc. invaders & Asteroids soft VDU. Disassembler. £200. Tel: 01-882 3422 eve.

APF colour computer. . . 12in monitor, 9k, built-in cassette, tutors, demonstration tapes, cartridges, space invaders etc, paddles, high resolution graphics music £490. Phone 0778 6228 (near Stamford).

Mountain Hardware Apple Clock. . . with extra Ni Cad battery (list price £200) £65. Symtek apple light pen (list £160) £60. Teletype RS232 with tape punch £75. Aylesbury 631200.

Casio fx8000 calculator. . . with stopwatch Cadd and lap. five alarms and 43 scientific functions. Good cond. manual unused. Boxed. Upgrading to T159 £20 ono. Phone Earlswood 2143 after 6.

Sharp PC1211. . . and cass int, manuals etc, good cond offers around £70 0no. Tel Kidderminster 67802, after 5pm.

Sorcerer 84k computer. . . good cond. 1 year old, with manuals & Basic ROM pack + games, 2 adventures, space invaders etc. £450 tel 858 8377.

Apple II Europlus 48k. . . with Eurocolour card & modulator, 4 months old, cond as new. £550 ono. Tel Selby (N Yorks) 703418.

CBM 3032 32k. . . 2040 disc, 3022 printer, cables, toolkit, dust covers, progs, etc, 1 yr old £1600 ono. Tel: Woking (048 62) 67839 after 6.

ZX81 and ZX80. . . with leads and power supplies. One 16k RAM, 50 rip roaring games + hints and tips books, 2 Sinc game cassettes, £130. Phone Chris 0723 75848.

PET old ROM. . . Computhink disks, 24k RAM, loads of software, sound box, manuals & disks, £850 ono. Tel: Cwmbran 71921.

TRS-80. . . 16k L2. . . monitor, cass. recorder, Level 1 and 2 manuals, hardly used, £350. Tel: Andy, Coventry (0203) 412297 after 6.

Nascom 1. . . Ideal for learning Z80 code. Full documentation as supplied, also tiny Basic on tape. £85. Also 10A multirail power supply in 19in Verorack with fan. £50. Tel 01-889 9897 eves.

TRS-80 L2 16k. . . Complete with numeric keypad, green monitor, c/recorder, manuals, books, dust covers. All hardly used & boxed. £420 ono. Tel Kang 01-703 4621 eves after 6 and w/ends.

Cased Microtan 65. . . with Tanex min config., 3k Tanbug, keypad, graphics, PSU + some software. Also sound board using AY-3-8910. Cost £240. accept £180 ono. Tel (eve) 0332 552648 ask for Nigel.

Science of Cambridge. . . cassette interface and memory expansion for MK 14, unused + book — A Guide to SC/MP programming, £10. Tel: Middlesbrough 314964.

ZX80. . . Sinc built, leads, psu, hardly used, ideal for beginner. £45 ono. Tel Chris 01-730 6279 after 6pm (near Victoria)

Acorn Atom. . . 12k RAM, 8k ROM 5 months old, rarely used. gc, lost interest in computing. PSU & Acorn games pack, manual £200 ono. Tel: Grimsby 825698.

ZX81. . . Sinc built, with adaptor, leads, manual. Virtually unused (dup gift). Available right now with no waiting for only £62. Call David 01-995 7663 after 6.

Microtan 65 Board. . . with full documentation manual, never used, still in factory pckging. This years bargain at £58. Call David 01-995 7663 after 6.

Acorn Atom. . . 12k+12k. . . 6522 VIA. cassette, video & power leads, manual, circuit diagram, software, games, disassembler etc, 3A power supply. Complete ready to run. £175 ono. Phone 041-632 3284.

PET 4032. . . new ROM, new keyboard, 3 months old, with tape recorder little used, £776 when purchased will now accept £600 ono. Tel: Bishops Cleeve 4960 Cheltenham, Glos.

TRS-80 . . . L2 16k, boxed, numpad, CTR80 cassette, TV modulator, leads, manuals, 7yold, books, software (blackjack, backgammon, mazechase, lunarland, tandy startrek, swords & sorcery) £385. 0634 721672 eve.

ITT 2020 48k. . . ex cond, paddles ,manuals, software, 3.2 disk controller card. £630 ono. £600 ono (exc disk controller). Demonstrations, enquiries — Graham Hesketh. Tel: Cumnor (08676) 3180 (Oxford)

ZX81. . . 16k RAM, sincl built, two Sinc cassettes, cassette recorder, all as new, £110. Also Modern 12in b/w TV £25. 0254 31573 (Accrington, Lancs).

Atari. . . games computer + 2 cartridges, combat and space invaders, 139 games. Still guaranteed, 7 months old, hardly used, exc cond. Value £190 accept £140. Tel: Hexham 604294 after 5.

TRS80. . . Level II 16k. . . complete with VDU cass rec, manuals, desk, various game tapes, carrying cases, books. £400. Contact Skegness (Lincs) 5976.

TRS80. . . 16k L2 complete system, green screen VDU, cassette recorder, numeric keypad, latest ROMs, manuals, Tandy editor/assembler, taped programs, £400, Tel: 021-308 3696 after 6 w/ends.

UK101. . . 8k, prof. built, metal case, new monitor, full documentation, 300/600 baud. Recently serviced software inc. real time startrek, poker, adventures. £200 ono. Tel: Goole (0405) 3238 after 6.

32K Commodore PET 3032 . . . Complete with cassette £375. Phone 0244 3629. Could possibly deliver.

Sinclair ZX80 . . . with 8k ROM, 16k RAM, leads, PSU, manuals, book and tape of programs. Sinc built. £110 ono Phone Dundee (0382) 76061

ZX80 . . . Full working order, + manual and leads. £40. Tel 01-730 9142 eves.

Acorn Atom . . . 12k RAM + 12k ROM (4k floating point) PSU, leads, manual. Acorn Built. Hardly used, £200. Tel. Biggin Hill 72093 eves.

ZX80 . . . 8k ROM, manual, PSU, leads plus program book and 3 flicker-free games, plus how to write them. £70 M Silver, 82 Ferndale, Waterlooville, Hants.

PET 32k . . . Cassette recorder, toolkit, dustcover, manuals, the Strathclyde Basic Course + cassettes. Only £600 ono Tel 01-889 6490.

Sorcerer MKII 32k . . . with manuals and user group magazines. Also software including powerful toolkit (indispensable), Sargon chess, disassembler and arcade type asteroids. UHF modulator. £450 ono tel Waltham Cross 28877.

TRS-80 16k L2 . . . Upgrade to disks forces sale of £600 of tape based software incl utilities, educational, and games. All at bargain prices. Tel 061-445 7191 after 6 for details.

ZX80 . . . New & old ROM, both manuals, all connecting leads, cassette deck, tape of 20 programs, exc condition, £80. Tel Egham 34643 after 5.

ITT 2020 . . . (Apple II+) 48k Palsoft Basic in ROM, UHF colour modulator, paddles, manuals, dust cover, wide range of software — perfect condition. £570 or offers. Tel 01-863 3287.

ZX80 . . . Sinc built & extra 3k RAM, leads, mains adaptor and manual — little used. £55 ono. Windsor 67264.

ZX81 . . . Sinc built with 16k RAM add on. Excellent cond. leads, guarantee, adaptor, manual, original box. First offer of £100 secures. Tel Manchester (061) 226 8430 eve.

PET 8k . . . 24k expansion. Small keyboard, green screen, new ROMs, sound box, toolkit, Superchkp, Arrow chip plus programs and books £350 ono 061 793 1059 after 6.

PET 2001 . . . 16k, new ROM, large keyboard, cassette, sound box, toolkit, microchess, invaders, acrobat & others, manuals. £500 ono Tel 0624 4804.

Tangerine 'Micron' . . . With latest ASCII keyboard £295 ono 0254 886371 (Lancs).

Casio fx502 . . . FA1 cassette interface, program library, all manuals. As new, original boxes. £100 Ring Norwich (0603) 22583 after 6.

PET 8k . . . Small keyboard, 2nd cassette deck. PET work books, also Sinc. built ZX80, mains adaptor. Lot for £300. Phone Medway 250375.

ZX81 . . . 16k Sinc built, all leads, PSU and manual. Games tapes and book. All exc condition £105 Tel Luton 37354.

PET 3016 . . . 16k new ROM, large keyboard with programs and games tape. Cass rec. Must sell — buying house. £600. Tel 01-300 6059.

Acorn system . . . 6502 CPU, cassette interface, VDU interface, colour encoder/mod., memory board, cased hex keypad and display, backplane with 'pull ups' and buffers, 5V/3A PSU, connectors, manuals & S/ware, £200 ono. Tel Robin, 051 4266997 eves.

Just for you . . . Vidio Genie 3003 as new with joysticks, sound, TSHORT, games on cassette, cover + manuals and books. Hardly used, £350 ono call 01-891 2473.

24k Expandamem board. . . Suit PET or KIM. Must sell £200 ono phone 061-654 8983.

Acorn Atom . . . fully expanded + software: soft VDU, asteroids, invaders, breakout, star trek and other. Worth £340.00, accept £230.00 Chris Bennett Birmingham 021-777 9915

Wemon . . . extended monitor with manual for UK101, £10. Tel 094 875 385 after 6.

Ohio C2-4P . . . 20k RAM. Cegmon-2mHz 3 board computer. Room for 32k total RAM on expansion board. Manuals etc, lots of tapes, chess etc. Excellent condition £325. Ring 070-682 6188 after 6.

Texas . . . TI59 programmable calculator, up to 960 prog steps, complete with master module, magnetic recording cards, 3 manuals, coding sheets, case, charger. Boxed, as new £80. Phone 0484-23127 eve/w/ends.

Acorn Atom . . . 12k ROM + 12k RAM including software — £210 ono Tel. Batley (0924) 440418 after 5.

Acorn Atom . . . 12k RAM + 12k ROM, 7 months old, inc 3 A PSU, leads + manuals. Acorn software on tape + books. £225. Tel (0531) 821634.

PET 32k . . . New ROMS, green screen, large keyboard, external cassette, toolkit, reset button, original manuals £600. CBM 2040 dual disk drive £600, with lots of games. Or £1100 together. Some business progs also available. Owner going 80. Chelmsford (0245) 352856.

Texas . . . TI58C programmable calculator. 60 constant memories. 480 program steps. Interchangeable software modules. As new (boxed) £45 01-337 3327.

ICL Termiprinter. . . Just paid £150 for it, can't get it to work. Purley Computer Systems (who sold it) willing to help buyer. Any offers? Hedingham (0787) 61004.

Fidelity . . . Voice Sensory Chess Challenger, value £259, accept £210 ono. Tel Cardiff 754795

48k Sorcerer . . . All manuals, two Hitachi cassette recorders with moto-control cables, one Hitachi 9" monitor complete with cables, various software £650 ono tel Cheltenham (0242) 37954.

Superbrain 64k Quad . . . Over £1,000 worth software. Diablo 1500 with stand and tractor feed (Needs attention). Private sale, no VAT, bargain at £1995. Phone 01-989 0430.

Expanded Microtan 65 . . . With Tanex and Tanram also Tbug V2. 3, Xbug, 10k Basic and 40k of RAM £450 ono. Tel St. Albans 60432 (eve) Uxbridge 51166 xt. 229 (days)

UK101 8k . . . PSU, new mon, sone programs, uncased, perfect condition £130. Tel Torquay 615332 J K Mumford.

PET 8k . . . Model 2001 and software, little used £310 Tel 01-464 7925 anytime. Can deliver London area.

Sharp MZ-80K . . . 24k. Only six months, as new. Complete with Basic manual/tape, demagnitizer and many games. £300. Emmigration forces sale. Tel; 0279 725333 After 8. (Stortford/Herts).

TRS-80 L2 16k . . . VDU, cassette, PSU quick printer, manuals (L1 and L2 + reference). L1, L2 (Pt 1 & 2) teaching tapes, Level III Basic and infinite Basic tapes. Desk. £500 ono. Tel Chestfield (022779) 2748 Kent.

ZX81 . . . Sinc built plus 16k RAM, PUS, All leads, manual and three cassettes (Games 1, Games 4 and Junior Ed 2). Brand new and fully working with guarantee. Unexpected bills force sale. £125 the lot. Tel Leatherhead 72697 after 7.30.

USER GROUPS INDEX

INTERNATIONAL

Central Program Exchange. Full membership (£25 Europe, £40 overseas) provides 30 free programs pa. Small user service (£10 Europe, £20 overseas) provides 10 free programs pa. Contact Mrs Judith Brown, The Polytechnic, Wulfruma St, Wolverhampton WV1 1LY.

Comp 80 User Group. Monthly newletter. Annual subscription £6.50 UK, £8.00 overseas. Contact Philip Probetts, 50 Cromwell Road, Wimbledon, London SW19 8LZ.

European Sorcerer Club. For sample newsletter contact Colin Morle at 32 Watchyard Lane, Formby, Nr Liverpool L37 3JU. Annual sub UK £5, Overseas £12.

International Sharp User Group. 1400 members in 31 countries £3 sub includes MZ-80K Space Invaders cassette and newsletters. Contact Graham Knight, 108 Rosemount Place, Aberdeen, tel: 0224 630526.

National Personal Computer Users Association. Cassette/SAEs supplied for continuous program exchange. ALL PERSONAL COMPUTERS. Subscriptions £12 (£15 overseas) with computer details to NPUCA, 11 Spratling Street, Manston, Ramsgate, Kent.

Powertran Users Club. Annual subscription £6.50 UK membership, £8.00 for members abroad, which includes a monthly newsletter. Contact Philip Probetts, 50 Cromwell Rd, Wimbledon, London SW19 8LZ tel:01-540 3713.

Tangerine Users Group (International), recently formed for users of the Microtan 65, the TUG will act as a central information clearing house, including exchange of programs, etc. Annual membership £5.00. Details from TUG at 16 Iddesleigh Rd, Charminster, Bournemouth, Dorset BH3 7JR.

USCD System User Society. Existing special interest groups include industrial application, word processing; real time, business applications and forward planning. UK contact: John Ash, Dicoll Data Systems Ltd, Bond Close, Kingsland Estate, Basingstoke, Hants RG24 0QB.

ZX80/81 Users Club. Low cost software. Technical support, newsletter. Subscription £6 UK, £10 overseas. Contact D Blagen, PO Box 159, Kingston Upon Thames, Surrey KT2 5UQ (sae for further information).

NATIONAL

USUS (UK) — British arm of the UCSD p-system Users Society. An international organisation created to promote the UCSD p-System (which includes Apple Pascal) and other machine independant software systems. Contact Malcolm Harper, PRG, 45 Banbury Road, Oxford OX2

Scottish TRS-80 Users' Group. Meetings on 2nd Thurs. Monthly at 7.30pm, normally in the Mansion House Hotel, West Milton Road. Software library and monthly newsletter. Contact Dick Mackie on 031-229 6032 or at 3 Warrender Park Crescent, Edinburgh EH9 1DX.

Atom User Group. Quarterly newsletter, software library, technical help when possible. Some local groups. Membership £4 pa inc. newsletter. Contact: Peter Frost, 18 Frankwell Drive, Potters Green, Coventry CV2 2FB

REGIONAL

Thames Valley Nascom User Group. Newsletter to be published for novice and expert alike. Regular meetings in Slough/Stalnes/Windsor planned and we need support! Interested? Contact Mike Rothery, 37 Eton Wick Road, Windsor, Berks, and enclose SAE. Tel: Windsor 56106.

West Sussex — Rustington, Littlehampton. Is anyone interested in starting a computer club in this area? Contact Chris Evans, Rustington 74998, 115 Worthing Rd, Rustington, W Sussex.

TOWNS

Aylesbury ZX Computer Club — Regular meetings at Aylesbury College 1st Tues monthly 7-30 — 9.30. Contact D P Nowotnik (secretary) Aylesbury 630867.

North Manchester — Anyone interested in a ZX81 Users Group? Contact: Jon Harvey, 93 Glebelands Road, Prestwich, Manchester M25 5WF.

Nottingham Microcomputer Club. Lectures arranged by visiting speakers. Meetings 1st Tues monthly at the Friends Meeting House, Clarendon St, Nottingham. Subs £5pa, reduced for students and OAPs. Non-members pay 50p entrance fee to meetings. Contact Geoffrey Jago, Nottingham (0602) 621453.

Exeter and District Amateur Computer Club. General meetings 2nd Tuesday monthly, specialist meetings 3rd or 4th Tuesday. £7.50 adults pa. Contact: Ian Hodgson, 21 Dean St, Exeter, EX2 4HH. Tel: Exeter 50812

NETWORK NEWS

Here is a list of all British (and one Dutch) personal computer networks. As more networks appear — and as more facilities are added to existing ones — we'll report them in this section, which appears monthly.

Forum-80 Hull. . . Operator: Frederick Brown, tel 0482 856169. Facilities: electronic mail, software up/down loading, Forum-80 Users' Group, PET users' section, shopping list. Hours: 7 days/week, midnight-0800, Tues & Thurs 1900-2200, Sat & Sun 1300-2200.

Forum-80 London. . Operator: Leon Jay, tel 01-286 6207. Facilities: electronic mail, program downloading. Hours: Tues, Fri, Sat & Sun 1900-2300.

80-NET . . . Operators: Leon Heller & Brian Pain, National TRS-80 Users' Group, tel 0908 566660. Facilities: electronic mail, software for downloading, newsletter, TRS-80 information. Hours: 7 days/week, 1900-2200.

CBBS London. . . Operator: Peter Goldman, tel 01-399 2136. Facilities: electronic mail, program downloading. Hours: Wed 0700-0930 & 1900-2200, Fri 1900-2200, Sun 1600-2200.

Forum-80 Holland. . . Operator: Nico Karssemeyer, tel 010 313 512 533. Facilities: electronic mail, program up/downloading, shopping list. Hours: Tues-Sat 1800-0700 nightly, continuous from 1800 Sat — 0700 Tues.

CTUK! CENTRES

Here's an updated list of people organising ComputerTowns. Don't forget to enclose an SAE if you write to your nearest 'Town for details.

Lyn Antill,
1 Defoe House,
Barbican,
London

Peter J Kiff,
52 Stone Road,
Broadstairs,
Kent CT10 1DZ

Patrick Colley,
52 Queensway,
Caversham Park Village,
Reading,
Berks RG4 0SJ

Pete Shaw,
15 St Vincent Road,
Clacton-on-Sea,
Essex C015 1NA

Steven Christian,
51 Burnstones,
West Denton,
Newcastle-on-Tyne NE5 2DF

David Tebbutt,
7 Collins Drive,
Eastcote,
Middx HA4 9EL

Vernon Gifford,
111 Selhurst Road,
Croydon,
London SE25 6LH

John Stephen Bone,
2 Claremont Place,
Gateshead,
Tyne & Wear NE8 1TL

Mike Baker,
5 Edinburgh Road,
Hanwell,
London W7 3JY

Vernon Quaintance,
50 Beatrice Avenue,
Norbury,
London SW16 4UN

Pete Rowan,
10 Lambton Road,
Jesmond,
Newcastle-on-Tyne NE2 4RX

Steve Haynes,
5 Guinea Street,
Kingsholm,
Gloucester GL1 3BL

Ted Broadhead,
27 Cardinal Road,
Leeds LS11 8EY

Andrew Holyer,
10 Masons Field,
Mannings Heath,
Horsham, Sussex RH13 6JP

Brigitte Gorton,
18 Purbright Crescent,
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PCW SUBSET

Alan Tootill presents more useful assembler-language subroutines.

As from this issue, Sub Set falls into line with practice elsewhere in the magazine and PCW will pay for those contributions that achieve Datasheet status. But don't let this put off the many of you who have been happy enough simply to share your efforts freely with others. If you'd like to contribute your routines (for any of the popular processors) send them to Sub Set, PCW, 14 Rathbone Place. London W1P 1DE.

Z80 binary display

When we had all those conversion routines at the start of this series, we never had one to convert a group of bits to ASCII ones and zeroes. Yet we are likely to need this conversion to display the state of ports on our screens or in showing the workings of binary arithmetic in learning systems. Luckily one such conversion which, from the state of the envelope it was delivered in, looks as if it has been kept buried at the bottom of a coal cellar, has now surfaced. It is from Ian Macro of London and is the subject of our first Datasheet, CVBA.

Ian also gives a routine for converting a field of 16 ASCII ones and zeroes back into a binary value in HL. I don't see enough general usefulness in this to hold a Datasheet on it but send in details if you have found differently.

Datasheet

```
;= CVBA — bit field to ASCII conversion.
;/ CLASS: 1
;/ TIME CRITICAL? No
;/ DESCRIPTION: Converts a 16-bit field to ASCII ones and zeroes
;/ ACTION:      B ← 16
;/              C ← ASCII zero (30H)
;/              Then repeat 16 times:
;/              A ← zero (00H)
                        HL
;/              Cy ← [15 — — 0] ← 0
;/              A ← C + Cy
;/              (DE) ← A
;/              DE ← DE + 1
;/ SUBr DEPENDENCE: None
;/ INTERFACES: None
;/ INPUT:    HL holds the bits to be converted
;/           DE holds the start address of the result
;/ OUTPUT:   HL = zero
;/           DE holds the end of conversion + 1 address
;/ REGs used: HL,DE
;/ STACK USE: 4
;/ LENGTH:   15
;/ T STATES: 781
;/ PROCESSOR: Z80
```

```
;
CVBA:   PUSH   AF        ; save                    F5
        PUSH   BC        ; registers.              C5
LD      LD     B,+16     ; set loop counter.       06  10
        LD     C,"0      ; set C to ASCII zero.    0E  30
CVB1:   XOR    A         ; zeroise A.              AF
        ADD    HL,HL     ; shift most sig bit to cy. 29
        ADC    A,C       ; add this to 30H in A.   89
        LD     (DE),A    ; store/display ASCII value. 12
        INC    DE        ; increment destination addr. 13
        DJNZ   CVB1      ; get next bit till all   10
        POP    BC        ; processed, restore      C1
        POP    AF        ; registers.              F1
        RET              ;                         C9
```

6502/Z80 comparison

In the October issue we printed Dave Barrow's two-language Datasheet, BGCB, to convert Gray Code to and from binary. Here is another two-language Datasheet of his, RANDI, to generate either a 32-bit binary or an 8-digit BCD pseudo random number. The two Datasheets illustrate quite well the strengths and weaknesses of the 6502 and Z80 instruction sets.

Datasheet

```
;= RANDI — Pseudo random integer generator
;/ CLASS: 1
;/ TIME CRITICAL?: No
;/ DESCRIPTION:  Generates an unsigned 32-bit binary or an
;/               8 digit BCD pseudo random number from the
;/               cyclic sequence R ← (R * a + 29) mod m
;/                  where:  R = random number
;/                          a = 257 for binary or 101 for BCD
;/                          m = 2**32 for binary or 10**8 for BCD
;/                          the constant 29 is read as a Hex no. (41 dec.)
;/                          for binary or as decimal for BCD.
;/ ACTION:           Hex/Dec digits h g f e d c b a
;/                  +Hex/Dec digits f e d c b a
;/                  +Hex/Dec constant.        2 9
;/                 Achieved Z80 by register rotation through temporary
;/                 storage in C.
;/                 Achieved 6502 by incrementing pointer to page
;/                 locations with temporary storage in Y.
;/ SUBr DEPENDENCE: None
;/ INTERFACES: None
;/ INPUT: Seed (or previous random number) in M3,2,1,0 (Z80: DEHL)
;/        Decimal Mode flag set accordingly (Z80: Cy set for BCD)
;/ OUTPUT: Seed replaced by new random number. Flags as input.
;/         X = 0, Y = previous value of M3.
;/ REGs Used: X, Y, M3,2,1,0, P (Z80: DEHL F)
;/ STACK USE: 2 (z80: 4)
;/ LENGTH: 20 (Z80: 27)
;/ TIME STATES: 101 ignoring page boundaries
;/              Z80: 457 binary, 481 BCD)
;/ PROCESSOR: 6502 (Z80)
;  6502 version
RANDIS: PHP              ;                         08
        PHA              ;                         48
        CLC              ; no carry into lowest byte. 18
        LDY   £$29       ; treated as 29 if D set. A0  29
        LDX   £$FC       ; index M0 to start.      A2  FC
LOOPS:  TYA              ; A ← Y (const. or pre. M(X)). 98
        LDY   M4,X       ; Y ← M(X).               B4  ZZ
        ADC   M4,X       ; M(X) ← M(X) + A.        75  ZZ
        STA   M4,X       ;                         95  ZZ
        INX              ;                         E8
```

```
                BNE     LOOPS   ; four times.           D0   F6
                PLA             ;                       68
                PLP             ;                       28
                RTS             ;                       60
; Z80 version
RANDIZ:         PUSH    BC      ;                       C5
                PUSH    AF      ;                       F5
                LD      BC,0429H ; loop count in B,const. in C. 01   29   04
                OR      A       ; no carry into lowest byte.  B7
LOOPZ:          LD      A,C     ; A ← C(const. or prev byte)  79
                LD      C,L     ; rotate right Seed through C. 4D
                LD      L,H     ;                       6C
                LD      H,E     ;                       63
                LD      E,D     ;                       5A
                EX      (SP),HL ; input flags into L.   E3
                BIT     O,L     ; test Cy on input      CB   45
                EX      (SP),HL ;                       E3
                JR      Z,BADD  ; do binary if Cy was reset.  28   03
                ADC     A,C     ; else decimal byte + prev  89
                DAA             ; byte (or const)+Cy followed  27
                DEFB    16H     ; by dummy LD D,89H= 16 89.  16
BADD:           ADC     A,C     ;                       89
                LD      D,A     ; new number shifted in at  57
                DJNZ    LOOPZ   ; left                  10   EE
                POP     AF      ;                       F1
                POP     BC      ;                       C1
                RET             ;                       C9
```

Note the byte-saving dodge in the Z80 RANDIZ. In order to skip the ADC A,C instruction (89H) at label BADD, the previous instruction is a dummy one byte to load 89H into D instead of a 2-byte JR +1 to skip the 89H.

Z80 memory compare

Dave Yeomans of Halifax sends a straightforward routine, CPARE, to compare two areas of memory, byte by byte and note any differences in another area of memory. Straightforward that is but for one tricky bit: the code from label GETDIF to the instruction JRNZ GETDIF is always executed twice; the first time to put the DE address and difference in memory and the second time to store the HL address and difference. This is achieved because the instruction CP (HL) at label GETDIF always clears the zero flag first time through (not zero) and sets it the second time.

Datasheet

```
;= CPARE — Compare memory
;/ CLASS: 1
;/ TIME CRITICAL?: No
;/ DESCRIPTION:  Compares one area of memory of specified length
;/               with another and notes any differences in a third
;/               area of memory.
;/ ACTION: Not given
;/ SUBr DEPENDENCE: None
;/ INTERFACES:   An area of RAM, pointed to by IY, is needed for
;/               noting differences. This must provide 6 bytes
;/               for every difference found in the two memory
;/               areas being compared.
;/ INPUT:        DE = start address of first area of memory
;/               HL = start address of second area of memory
;/               BC = number of bytes to be compared
;/               IY = start address of memory where differences noted
;/ OUTPUT:       A note of all differences is stored in the IY memory
;/               area in the format:-
;/                   D/E/(DE)/H/L/(HL)/D/E etc.
;/               BC = number of differences found
;/ REGs USED: BC DE HL IY
;/ STACK USE: 8
;/ LENGTH:    43
;/ PROCESSOR: Z80
CPARE:          PUSH    AF      ; save AF               F5
                PUSH    IY      ; difference area start addr.  FD   E5
```

```
            PUSH    BC          ; number of bytes to compare.   C5
            ID      BC,+0       ; zeroise no. of diffs. counter. 01 00 00
NXTBYT:     LD      A,(DE)      ; get next byte.                1A
            CP      (HL)        ; compare it.                   BE
            JR      Z,EQUAL     ; jump if same.                 28 12
            PUSH    IY          ; store diff area pointer.      FD E5
GETDIF:     CP      (HL)        ; adjust zero flag.             BE
            EX      (SP),HL     ; HL on stack, IY in HL.        E3
            LD      (HL),D      ; put DE                        72
            INC     HL          ; and (DE)                      23
            LD      (HL),E      ; into differences area         73
            INC     HL          ; first time round              23
            LD      A,(DE)      ; then                          1A
            LD      (HL),A      ; HL and                        77
            INC     HL          ; (HL)                          23
            EX      (SP),HL     ; get HL back.                  E3
            EX      DE,HL       ;                               EB
            JR      NZ,GETDIF   ; if HL not processed, do so    20 F3
            POP     IY          ; get IY off stack.             FD E1
            INC     BC          ; another difference to count.  03
EQUAL:      INC     HL          ; increment                     23
            INC     DE          ; pointers.                     13
            EX      (SP),HL     ; get no. of bytes to compare.  E3
            DEC     HL          ; adjust for one just processed. 2B
            LD      A,H         ; check                         7C
            OR      L           ; for last.                     B5
            EX      (SP),HL     ; stack no of bytes to compare. E3
            JR      NZ,NXTBYT   ; in not last, do next.         20 E1
            POP     AF          ; lose byte count.              F1
            POP     IY          ; restore diff. start address.  FD E1
            POP     AF          ; restore AF.                   F1
            RET                 ;                               C9
```

Sorting

Sorting is an interesting area of programming, though not so much practised in personal computing as in old batch processing commercial systems. It was because I needed a quick scan of the incidence of certain characters in a large area of RAM that I tried out the simple byte sort, INSORT, sent in by Paul Bloomfield of Blandford.

Datasheet

```
;= INSORT — Insertion sort
;/ CLASS: 1
;/ TIME CRITICAL?: No
;/ DESCRIPTION: Sorts the bytes in an area of RAM into
;/              ascending order of their values 00H-FFH
;/ ACTION:   Set byte preceding RAM area to zero
;/           Then for each byte :-
;/           Get next byte to be inserted
;/           Find its position
;/           Make room for it
;/           Put it there
;/ SUBr DEPENDENCE: None
;/ INTERFACES: RAM area to be sorted — from DE to DE + HL
;/ INPUT:    DE = Address of byte preceding start of RAM area
;/           HL = Length of RAM area (last byte is at DE+HL)
;/ OUTPUT:   (DE) on entry + 0
;/           (DE+1) to (DE+HL) are in ascending order
;/           DE points to the last byte + 1 of the RAM area
;/           BC = HL = 0
;/           Flags — Z and N set, ot hers reset
;/ REGs USED: AF BC DE HL
;/ STACK USE: 4
;/ LENGTH: 36
;/ PROCESSOR: Z80
INSORT:     XOR     A           ; clear byte preceding RAM      AF
            LD      (DE),A      ; area to prevent               12
            INC     DE          ; overrunning.                  13
MAINLP:     PUSH    HL          ; save counter.                 E5
            INC     DE          ; increment counter pointing    13
            LD      H,D         ; to byte to be inserted. Make  62
            LD      L,E         ; this the point to search      6B
```

```
        LD      A,(DE)      ; back from. Get its value.     1A
SEARCH: DEC     HL          ; look at preceding byte        2B
        CP      (HL)        ; & if bigger than current      BE
        JR      C,SEARCH    ; byte, go back further.        38  FC
        PUSH    DE          ; otherwise save pointer.       D5
        EX      DE,HL       ; get difference between        EB
        DEC     HL          ; byte's current position &     2B
        SBC     HL,DE       ; desired position in HL.       ED  52
        JR      Z,NOMOVE    ; if diff. 0, don't move byte.  28  09
        LD      B,H         ; otherwise make difference     44
        LD      C,L         ; byte counter for LDDR.        4D
        ADD     HL,DE       ; recalculate current pos'n.    19
        LD      D,H         ; make it destination for       54
        LD      E,L         ; LDDR, leaving HL as source    5D
        INC     DE          ; one below it.                 13
        LDDR                ; shift a block up to make      ED  B8
        LD      (DE),A      ; room. Put current byte in new 12
NOMOVE: POP     DE          ; place. Get pointer position.  D1
        POP     HL          ; get back counter.             E1
        SCF                 ; decrement it,                 37
        SBC     HL,BC       ; setting flags (BC=0 after     ED  42
        JR      NZ,MAINLP   ; LDDR). If not end loop again. 20  E0
        RET                 ;                               C9
```

LEISURE LINES

by J J Clessa

Over 200 entries were received in response to our prize puzzle which asked you to tell us on what day all the pubs were open, and yet only a couple of months ago we were asking for long words from the Oxford Dictionary and we had about a dozen replies. It makes you wonder!

Anyway, it seems that many of you found two possible answers to the problem due to the ambiguity in the statement 'at least one pub is open on Mondays and Saturdays'. We allowed either solution.

The answer we wanted was 'Tuesday', and the winning entry picked at random was from Andy Scott of Chesham, Bucks. Well done, Andy. You'll get your prize very shortly.

Quickie

No answers, no prizes. A man is standing on a railway line and hears a train coming. He runs for safety as quickly as possible. However, he first runs 20 yards along the track towards the oncoming train. Why?

Prize puzzle

Two parts this month: a) find the smallest number that has exactly 104 factors, ie, 104 different numbers that it divides by — including itself but excluding unity. For example, the number 12 has five factors — 2, 3, 4, 6 and 12. b) find the smallest odd number that has exactly 104 factors.

Answers on postcards, please, to: December Prize Puzzle, Leisure Lines, *PCW*, 14 Rathbone Place, London W1P 1DE, to arrive no later than 31 December.

PROGRAMS

We welcome programs from readers for consideration for this section. But before you send in your masterpiece, please take note of the following.

We're looking for original, interesting and/or unusual programs for any of the popular personal computers; the more original your program, the more chance it has of being published. We're interested in more 'serious' programs as well as games but we can only accept programs in Basic or Pascal — assembler language programs take up too much space, although if you have an interesting assembler subroutine, send it to 'Sub Set' (see appropriate page for more details). We're *not* interested in more Space Invaders, Rubik Cube solutions, Duck Shoots, etc!

When you've written your program and *thoroughly* debugged it (get a

PROGRAMS

friend to try it out too!), put it on a cassette or disk and make certain it loads and runs correctly — we receive a lot which don't. We *must* have a printed-out listing, on plain, white paper done with fairly new ribbon to give a good, dark printout. If you haven't a printer, try your local computer club or even a dealer — let us know if anyone helped you to obtain a listing and we'll credit them in the magazine (eg, 'Listing courtesy of Bloggs Computers'). Enclose a *brief* note saying exactly which machine it's for and how much memory is required. If the program requires instructions, these should be included within the program if possible, otherwise they should be listed very briefly. Put your name and address on each piece of paper you send us and on each disk/cassette. Finally, if you want your program returned, should we decide not to use it, please enclose an SAE! Send your program to: PCW Programs, *PCW*, 14 Rathbone Place, London W1P 1DE.

We receive lots of programs and evaluation takes quite a while so please, don't ring to ask whether we've received it and whether we're going to use it — we'll be in touch with you in due course.

Finally, we pay very well for all programs which we publish and you'll receive details of this when your program is accepted.

PET Fantasy

by Jeff Aughton

This is an adventure game which runs in 8k on the PET. As it uses no graphics, it is fairly easily adaptable to run on other computers. The game consists of two programs written in Basic. Part 1 is used to set up the initial scenario which is different every time and must be typed in and run on its own before the second can be loaded. Part 2 is the playing section of the game itself.

Complicated instructions are needed to play the game, which are not included in the program in order to save memory. The idea is that you are trapped in a giant maze from which the only escape is a golden door. If you're going to escape, however, you must first have treasure to the value of 1000 gold pieces. If you can do this, you win the game, but no-one has yet achieved this. Treasure is to be found by searching the rooms that you visit in the maze or by attacking others in the maze and forcing them to drop what they have.

When you are attacked, your strength diminishes and can only be restored by the first aid room. Play is conducted by the computer asking you which action you want to take. You respond with a number corresponding to one of the commands used in the game. Any other response will give you a list of the options available to you.

In order to start the game again without reloading the initialisation program, type POKE 8071,255 (RETURN) which will resume the game as before and save you a lot of trouble.

Our thanks to Lion House of Tottenham Court Road for the loan of a CBM PET.

Part 1

```
READY.

 10 POKE52,134:POKE53,31
 20 DIMTX(30)
 30 DEFFNR(X)=INT(X*RND(1)+1)
 40 B1=826:B2=8070:B3=8130
 50 NI=28:NM=29:NR=26
 60 PRINT"□LOADING DATA"
 70 FORI=1TOVAL(RIGHT$(STR$(TI),3))
 80 X=RND(1):NEXT
100 REM DOORS
110 L=B1:FORI=1TONR:FORJ=1TO5
120 READX:L=L+1:POKEL,X
130 NEXTJ:L=L+1:NEXTI
140 L=B1:FORI=1TONR:FORJ=1TO5
150 L=L+1:X=PEEK(L)
160 IFX=00RX>NRTHEN220
170 Y=32*FNR(7):POKEL,X+Y
180 FORK=B1+6*X-5TOB1+6*X-1
190 IFPEEK(K)=1THENPOKEK,I+Y
200 NEXTK
220 NEXTJ:L=L+1:NEXTI
```

PROGRAMS

```
 230 P=16+FNR(10)
 240 POKEB1+6*P-5,PEEK(B1+6*P-5)AND31
 300 REM ROOM NAMES
 310 FORI=1TONR:TX(I)=I:NEXT
 320 FORI=NRTO2STEP-1
 330 X=FNR(I):K=TX(X):TX(X)=TX(I):TX(I)=K:NEXT
 340 FORI=1TONR
 350 POKEB1+6*I,TX(I):NEXT
 400 REM STRENGTHS
 410 POKEB2+1,255
 420 FORI=1TONM
 430 POKEB2+2*I+1,170+FNR(70):NEXT
 500 REM LOCATIONS
 510 FORI=0TONM
 520 POKEB2+2*I+2,FNR(NR):NEXT
 600 REM OWNERS
 610 FORI=1TONI
 620 X=64:IFFNR(9)>3THENX=64+FNR(NM)
 630 IFFNR(9)>3THENX=FNR(NR)
 640 POKEB3+2*I,X:NEXT
 700 REM VALUES
 710 FORI=1TONI
 720 READX:POKEB3+2*I-1,X:NEXT
 730 L=988
 800 READX:IFX<0THEN820
 810 POKEL,X:L=L+1:GOTO800
 820 PRINT"■■■NOW LOAD FANTASY 2":END
 900 DATA 2,8,22,0,0,1,3,0,0,0,2,11,20,24,0,5,12,18,22,0,4,10,22,0,0
 910 DATA 7,16,0,0,0,6,8,21,22,0,1,7,19,0,0,13,14,0,0,0,5,23,24,0,0
 920 DATA 3,12,18,21,26,4,11,0,0,0,9,14,16,0,0,9,13,15,0,0,14,19,24,25,0
 930 DATA 6,13,0,0,0,21,18,18,23,0,4,11,17,17,19,15,9,18,23,25,26,3,0,0,0
 940 DATA 7,11,17,0,0,4,1,5,7,26,17,10,19,0,0,10,3,15,25,25,15,19,24,24,0
 950 DATA 20,11,22,0,0
 970 DATA 250,220,180,160,100,50,120,2,90,40,0,160,10,4,0
 980 DATA 15,100,125,0,0,45,5,3,90,140,0,30,0
 990 DATA 169,32,162,240,157,119,128,157,103,129,202,208,247,96
 995 DATA 169,32,162,200,157,87,130,157,31,131,202,208,247,96,-1
READY.
```

Part 2

```
READY.

 0 REM FANTASY GAME-J.AUGHTON
 1 POKE52,134:POKE53,31:DIMTX(9)
 2 DEFFNR(X)=INT(X*RND(1)+1)
 3 L$="■                    ■"
 4 NM=29:NI=28:NR=26:PRINT"□"
 5 B1=826:B2=8070:B3=8130
 6 N=PEEK(B2+2):GOSUB740:GOSUB600
 7 PRINT"YOU ARE IN A ";Z$:GOSUB2140
 8 GOSUB400:GOSUB2700:GOTO1500
10 C$="SPRAINED AN ANKLE":RETURN
15 C$="TRIPPED OVER A BRICK":RETURN
20 C$="BEEN STUNG BY A BEE":RETURN
25 C$="BEEN ATTACKED BY VAMPIRE BATS":RETURN
30 C$="BEEN BITTEN BY A MAD DOG":RETURN
35 C$="BEEN PLAGUED BY KILLER MOTHS":RETURN
40 C$="STEPPED ON A RAKE":RETURN
45 C$="CONTRACTED A BAD COUGH":RETURN
50 C$="STUMBLED TO THE GROUND":RETURN
55 C$="HAD A BAD FALL":RETURN
60 C$="SLIPPED ON A BANANA SKIN":RETURN
65 C$="BUMPED INTO A WALL":RETURN
100 T=0:FORI=1TONM:Q=PEEK(B2+2*I+2)
110 IFQ=NTHENT=T+1:TX(T)=I:IFT=9THENI=NM
120 NEXT:V=TX(FNR(T)):RETURN
200 T=0:FORI=1TO5:Q=PEEK(B1+6*N-6+I)AND31
210 IFQTHENT=T+1:TX(T)=Q
220 NEXT:R=FNR(T):M=TX(R)
230 D=INT(PEEK(B1+6*N-6+R)/32)+8*((N+M)AND1):RETURN
300 T=0:FORI=1TONI:Q=PEEK(B3+2*I)
310 IFQ=NTHENT=T+1:TX(T)=I:IFT=9THENI=NI
320 NEXT:U=TX(FNR(T)):RETURN
400 PRINTL$;"PRESS SPACE TO CONTINUE"
410 GETA$:IFA$<>" "THEN410
420 RETURN
500 SYS988:PRINT"■■■":GOSUB950:RETURN
600 SYS1002:PRINT"■■■■■■■■■■■■■■■■":GOSUB950:RETURN
700 C=NM+E:GOTO800
720 C=V:GOTO800
740 C=16+NM+NI+N:GOTO800
760 C=1+NM+NI+D
```

MICROMART

PROGRAMS

```
800 RESTORE:FORI=0TOC:READZ$:NEXT:RETURN
900 INPUT"▮▮▮.▮▮▮▮";A$
910 Q=ASC(A$)-48:RETURN
950 FORI=1TO550:NEXT:RETURN
1500 ONFNR(5)GOSUB1700,4000,4000,4600,4700
1550 PRINTL$:GOSUB950:GOTO1500
1700 PRINTL$;"YOUR ACTION";:GOSUB900
1720 IFQ<1ORQ>9THEN1800
1730 ONQGOSUB2000,2300,2400,2500,2600,2700,2800,2900,2200
1750 RETURN
1800 GOSUB500:PRINT"N YOUR OPTIONS:N
1810 PRINT"1.MOVE
1820 PRINT"2.SEARCH ROOM
1830 PRINT"3.TAKE ITEM
1840 PRINT"4.DROP ITEM
1850 PRINT"5.CHECK EXITS
1860 PRINT"6.CHECK POSSESSIONS
1870 PRINT"7.EVALUATE ITEM
1880 PRINT"8.CHECK OCCUPANTS
1890 PRINT"9.ATTACK":GOTO1700
2000 P=N:N=64:GOSUB300:N=P:IFT>FNR(14)THENGOSUB4600
2010 GOSUB200:PRINTL$;"WHICH EXIT";
2020 GOSUB900:IFQ<1ORQ>TTHEN2010
2030 M=T%(Q):R=0:GOSUB230:IFD=0THEN6000
2040 GOSUB600:IFPEEK(B2+1)>FNR(55+5*D)THEN2060
2050 PRINT"YOU CAN'T":RETURN
2060 N=T%(R):POKEB2+2,N:G=0
2070 GOSUB740:A$=Z$:GOSUB760
2080 PRINT"YOU HAVE ENTERED A ";A$
2090 PRINT"VIA A ";Z$:IFN>1THEN2140
2110 PRINT"NYOU HAVE BEEN HEALED !!
2120 PRINT"NYOU ARE BACK TO FULL STRENGTH":POKEB2+1,255
2140 GOSUB2900:GOSUB400:GOSUB2600:RETURN
2200 GOSUB100:IFTTHEN2230
2220 GOSUB600:PRINT"THERE'S NOBODY THERE!!!":RETURN
2230 PRINTL$;"ATTACK WHO";:GOSUB900
2240 IFQ<1ORQ>TTHEN2230
2250 P=0:X=0:Y=T%(Q):GOTO4030
2300 G=1:GOSUB500:PRINT"N YOU FIND:N
2310 GOSUB300:IFT=0ORFNR(9)>7THEN2340
2320 FORJ=1TOT:E=T%(J):GOSUB700
2330 PRINTJ;"A ";Z$:NEXT:RETURN
2340 PRINT"NOTHING!!!":RETURN
2400 GOSUB300:IFT>0ANDFNR(5)<5*GTHEN2420
2410 GOSUB600:PRINT"NOTHING FOUND TO TAKE!":RETURN
2420 PRINTL$;"TAKE ITEM#";:GOSUB900
2425 IFQ<1ORQ>TTHEN2420
2430 E=T%(Q):POKEB3+2*E,64:GOSUB700
2440 GOSUB600:PRINT"YOU HAVE PICKED UP A ";Z$:RETURN
2500 P=N:N=64:GOSUB300:N=P:IFTTHEN2530
2520 GOSUB600:PRINT"YOU HAVE NOTHING !":RETURN
2530 PRINTL$;"DROP ITEM#";:GOSUB900
2535 IFQ<1ORQ>TTHEN2530
2540 E=T%(Q):POKEB3+2*E,N:GOSUB700
2550 GOSUB600:PRINT"A ";Z$:PRINT"HAS BEEN DROPPED":RETURN
2600 GOSUB500:PRINT"N THE EXITS ARE:N
2610 GOSUB200:FORR=1TOT:M=T%(R)
2620 GOSUB230:GOSUB760:PRINTR;"A ";Z$:NEXT:RETURN
2700 GOSUB500:PRINT"N YOU POSSESS:N
2710 P=N:N=64:GOSUB300:N=P:IFT=0THEN2340
2720 GOTO2320
2800 P=N:N=64:GOSUB300:N=P:IFT=0THEN2520
2810 PRINTL$;"EVALUATE ITEM#";:GOSUB900
2820 IFQ<1ORQ>TTHEN2810
2830 E=T%(Q):GOSUB700:GOSUB600
2840 PRINT"A ";Z$;" IS WORTH";PEEK(B3+2*E-1):PRINT"GOLD PIECES":RETURN
2900 GOSUB500:PRINT"N IN THE ROOM IS:N
2910 GOSUB100:N=N+99:FORI=1TONM
2920 IFPEEK(B2+2*I+2)=NTHENT=T+1:T%(T)=I+99:IFT=9THENI=NM
2930 NEXT:N=N-99:IFTTHEN2940
2935 PRINT"NO-ONE.YOU'RE QUITE ALONE":RETURN
2940 FORJ=1TOT:V=T%(J):IFV>99THENV=V-99
2950 GOSUB720:IFT%(J)>99THENZ$=Z$+" (DEAD)"
2960 PRINTJ;Z$:NEXT:RETURN
4000 GOSUB100:IFT=0THENRETURN
4010 ONFNR(5)GOTO4300,4400,4500
4020 X=V:P=0:GOSUB100:V=V
4030 GOSUB600:IFX=VTHENV=0:P=1
4040 V=X:GOSUB720:A$=Z$
4050 V=Y:GOSUB720:C$=Z$
4060 U=FNR((9+PEEK(B2+2*X+1)/9)*(1.6+(Y=0))-60*(RND(1)>.95))
4070 B$=" DEALT A MIGHTY"+CHR$(13)+"BLOW TO "
4080 IFU<50THENB$=" MADE A VICIOUS"+CHR$(13)+"ASSAULT ON "
4085 IFU<33THENB$=" INFLICTED A"+CHR$(13)+"LIGHT WOUND ON "
4090 IFU<9THENB$=" MISSED ":U=0:IFLEN(A$)+LEN(C$)>31THENRETURN
4100 PRINTA$;B$;C$
4105 C$="YOU ARE "
4110 IFV>0THENC$="HE IS "
```

PROGRAMS

```
4120 IFY>17THENC$="SHE IS "
4130 IFY>24THENC$="IT IS "
4140 K=PEEK(B2+2*V+1)-U:IFK<1THEN4230
4150 POKEB2+2*V+1,K:IFU=0ORFNR(9)>7THEN4210
4160 B$="NOT BADLY HURT":IFFNR(5)>3THENB$="STILL O.K."
4170 IFK<130THENB$="SLIGHTLY WOUNDED"
4180 IFK<75THENB$="SERIOUSLY INJURED"
4190 IFK<40THENB$="CRAWLING ON THE GROUND!!":P=1
4200 PRINTC$;B$
4210 PRINT:IF(FNR(9)<4)ORPTHENRETURN
4220 P=X:X=Y:Y=P:P=1:A$=LEFT$(C$,3):GOTO4050
4230 PRINTC$;"DEAD!!":IFY=0THEN5000
4240 POKEB2+2*V+1,0:POKEB2+2*V+2,N+99
4250 FORI=1TONI
4260 IFPEEK(B3+2*I)=V+64THENPOKEB3+2*I,N
4270 NEXT:RETURN
4300 GOSUB200:GOSUB720:A$=Z$:GOSUB760:GOSUB600
4310 IFPEEK(B2+2*V+1)>FNR(9*D+88)THEN4340
4320 PRINTA$;" TRIED UNSUCCESS-
4330 PRINT"FULLY TO LEAVE ":GOTO4350
4340 POKEB2+2*V+2,M:PRINTA$;" HAS LEFT"
4350 PRINT"BY A ";Z$:RETURN
4400 GOSUB300:IFT=0THENRETURN
4410 POKEB3+2*U,64+V:GOSUB720
4420 GOSUB600:PRINTZ$;" HAS PICKED":PRINT"UP SOMETHING":RETURN
4500 P=N:N=64+V:GOSUB300:N=P
4510 IFT=0ORPEEK(B2+2*V+1)>20*T+FNR(59)+5*U*(V=0)THENRETURN
4520 POKEB3+2*U,N:GOSUB720
4530 IFV=0THENZ$="YOU HAVE"
4540 GOSUB600:PRINTZ$;" DROPPED SOMETHING":RETURN
4600 V=0:GOTO4500
4700 GOSUB200:P=N:N=M
4710 GOSUB100:N=P:IFT=0THENRETURN
4715 IFFNR(9)>5THEN4800
4710 GOSUB100:N=P:IFT=0THENRETURN
4715 IFFNR(9)>5THEN4800
4730 GOSUB720:A$=Z$:GOSUB760
4740 GOSUB600:PRINTA$;" HAS ENTERED VIA
4750 PRINT"A ";Z$:POKEB2+2*V+2,N:RETURN
4800 IFFNR(9)>2THENRETURN
4810 ONFNR(12)GOSUB10,15,20,25,30,35,40,45,50,55,60,65
4820 GOSUB100:GOSUB720:IFT=0ORFNR(7)>5THENV=0
4830 IFV=0THENC$="YOU HAVE "+C$:GOTO4850
4840 C$=Z$+" HAS"+CHR$(13)+C$
4850 GOSUB600:PRINTC$:U=FNR(20)
4860 P=1:V=V:GOTO4105
5000 PRINT"▒YOU DIED OF YOUR WOUNDS-NEXT TIME LOOK
5010 PRINT"FOR FIRST AID OR KEEP OUT OF FIGHTS
5020 GOSUB500:PRINT"YOU DIED POSSESSING:▒":GOSUB27:0
5030 PRINT"▒LOAD FANTASY 1 FOR A NEW GAME▒":END
6000 T=0:FORI=1TONI:X=B3+2*I
6020 IFPEEK(X)=64THENT=T+PEEK(X-1)
6030 NEXT:GOSUB600:IFT<1000THEN6100
6040 PRINT"THE GOLDEN DOOR OPENS!!!▒▒
6050 PRINT"YOU HAVE TREASURE TO THE VALUE OF
6060 PRINTT;"GOLD PIECES-YOU ARE A HERO!!
6070 GOTO5030
6100 PRINT"YOU CAN'T-YOUR TREASURE IS
6110 PRINT"ONLY WORTH";T;"GOLD PIECES":RETURN
7000 DATAYOU,SARGON,ATTILA THE HUN,DARTH VADER,COLIN THE CAMEL,SUPERMAN,IGOR
7010 DATASTEVE ZODIAC,HISSING SID,BIGGLES,GOLIATH,KERMIT THE FROG,MR.WOO
7020 DATATHE LONE RANGER,RICHARD III,COUNT DRACULA,JOHN OF GAUNT
7030 DATASIR JASPER,THE WITCH OF AGNESI,JOAN OF ARC,THE MERRY WIDOW,SUE ELLEN
7040 DATAESKIMO NELL,JULIE ANDREWS,IOLANTHE,THE MAGIC CON,PILTDOWN MAN
7050 DATATHE THING FROM THE DEEP,THE INVISIBLE WOMBLE,IT CAME FROM SPACE
7100 DATAPLATINUM BAR,BOX OF GEMS,PICASSO PAINTING,MING VASE,SILVER SALVER
7110 DATALIFE OF SHAKESPEARE,GOLDEN HARE,MAP OF WIGAN,FUR COAT
7120 DATAMONA LISA(FORGERY),STUFFED WEASEL,SACK OF MONEY,CLARINET,RUSTY SABRE
7130 DATACAN OF COLA,FLOPPY DISC,PENNY BLACK,DIAMOND TIARA,LUMP OF CHEESE
7140 DATAUSED TEABAG,CUP FINAL TICKET,FLORAL TIE,SINCLAIR ZX81,GOLD WATCH
7150 DATAPEARL NECKLACE,DAILY MIRROR,PAIR OF EARRINGS,BOX OF PAPERCLIPS
7200 DATAGOLDEN DOOR,VELVET CURTAIN,TALL ARCHWAY,SMALL TIMBER DOOR,TRAPDOOR
7210 DATAWOODEN DOOR,LOOSE GRILLE,HOLE IN THE WALL,RED DOOR
7220 DATAPANELLED OAK DOOR,NARROW SHAFT,FLIGHT OF STEPS,RUSTED METAL DOOR
7230 DATASTEEL DOOR,HEAVY IRON GATE,SOLID STONE PORTAL
7300 DATAFIRST AID ROOM,LONG DARK TUNNEL,SECRET PASSAGE,LIBRARY,COLD PANTRY
7310 DATALARGE SQUARE ROOM,DRAUGHTY CORRIDOR,DIMLY LIT PASSAGE,DUSTY CHAPEL
7320 DATABIG BOXROOM,LONG GALLERY,HALLWAY,DINING ROOM,CONSERVATORY,CELLAR
7330 DATAROOM WITH GREEN WALLS,DIRTY KITCHEN,WINDOWLESS CELL,DISUSED ATTIC
7340 DATABANQUETING HALL,PANELLED STUDY,LOFTY TURRET,SUMPTUOUS BEDCHAMBER
7350 DATATILED BATHROOM,ROOM WITH NO CARPET,HUGE LOUNGE
READY.
```


MICROMART

PROGRAMS

PET Juggle

by Paul Bradshaw

This runs on an 8k new ROM PET and should also work with 4.0ROMs, although we haven't tested this.

```
100 REM ***  JUGGLE'-BY P.BRADSHAW***
110 DIMP(25),M(25)
120 DEFFNA(P)=3*P-1-4*INT(P/2)
130 NI=9:TH=32:RS=160:RH=224:S$=96:S3=63:T5=25:T4=254:T7=127:FV=5:ZE=0:SN=59464
140 A=RND(0):T(1)=39:T(2)=41:T(3)=-39:T(4)=-41:TB=33000:UN=1:E7=87
150 DATA110,130,98,110,130
160 FORJ=1TO5:READN(J):NEXT
170 DATA2,1,2,,5,2,5
180 FORJ=1TO5:READL(J):NEXT
190 PRINT"■"; PRINTTAB(17)"JUGGLE"
200 PRINTTAB(17)"──────"
210 PRINT"■■TRY TO KEEP THE BALLS IN THE AIR BY
220 PRINT"■REBOUNDING THEM WITH YOUR PADDLE.
230 PRINT"■YOU START WITH JUST ONE BALL, THOUGH
240 PRINT"■MORE WILL APPEAR AS THE GAME PROCEEDS.
250 PRINT"■THE GAME ENDS AS SOON AS A BALL PASSES
260 PRINT"■YOUR PADDLE. THE LONGER THE GAME LASTS,
270 PRINT"■THE HIGHER YOUR SCORE.
280 GOSUB680
290 PRINT"■■PRESS SPACE TO CONTINUE...
300 GETR$:IFR$<>" "THEN300
310 PRINT"■MOVE YOUR PADDLE AS FOLLOWS:-
320 PRINT"■PRESS 'LEFT SHIFT' TO MOVE IT LEFT.
330 PRINT"■PRESS 'RIGHT SHIFT' TO MOVE IT RIGHT.
340 PRINT"■PLUG IN A SOUND BOX IF YOU HAVE ONE!
350 PRINT"■■PRESS SPACE TO START THE GAME...
360 GETR$:IFR$<>" "THEN360
370 PRINT"■"
380 C=0
390 POKE15,210:POKE16,131
400 FORJ=33729TO33766:POKEJ,96:NEXT
410 FORJ=32768TO33728STEP40:POKEJ,224:POKEJ+39,224:NEXT
420 FORJ=32768TO32807:POKEJ,160:NEXT
430 REM ***PLOT PADDLE***
440 FORJ=33746TO33749:POKEJ,160:NEXT
450 SYS826
460 PRINT"■"
470 TI$="000000"
480 Q=200:A=0:GOSUB630:Q=400
490 T=TI
500 REM ***MOVE BALLS***
510 IFTI-T<NITHEN510
520 POKESN,ZE
530 T=TI:FORJ=UNTOA:X=P(J)+T(M(J)):IFPEEK(X)=THTHEN600
540 IFPEEK(X)=RSTHENPOKESN,T4+T7*(X>TB):M(J)=FV-M(J):C=C-UN*(X>TB):GOTO580
550 IFPEEK(X)=SSTHENPOKE16,192:POKE15,0:POKESN,ZE:POKEP(J),TH:POKEX,E7:GOTO940
560 POKESN,S3
570 M(J)=FNA(M(J)):GOTO610
580 IFC=FVTHENC=ZE:GOSUB630
590 GOTO610
600 POKEP(J),TH:P(J)=X:POKEX,E7
610 NEXT:GOTO510
620 REM ***NEW BALL***
630 A=A+1:REM ***INCREMENT BALL COUNT
640 P(A)=32768+INT(RND(1)*Q)
650 IFPEEK(P(A))<>32THEN640
660 M(A)=INT(RND(1)*2+1):RETURN
670 REM ***INSTALL M/C SUBROUTINE***
680 X=0
690 FORJ=826TO979:READA
700 X=X+A:POKEJ,A:NEXT
710 IFX<>19148THENPRINT"■ERROR IN DATA LINES 740-930":END
720 RETURN
730 REM ***MACHINE CODE***
740 DATA120,165,144,141,197,3,165,145
750 DATA141,198,3,169,93,133,144,169
760 DATA3,133,145,169,0,141,72,232
770 DATA169,16,141,75,232,169,15,141
780 DATA74,232,96,173,18,232,201,239
790 DATA208,15,169,0,141,75,232,173
800 DATA197,3,133,144,173,198,3,133
810 DATA145,169,8,141,16,232,173,18
820 DATA232,73,255,41,33,240,62,201
830 DATA1,208,27,198,15,165,15,201
840 DATA255,208,2,198,16,160,0,177
850 DATA15,201,96,208,23,169,96,160
860 DATA4,145,15,76,180,3,160,4
870 DATA177,15,201,96,208,23,160,0
880 DATA169,96,145,15,230,15,208,2
890 DATA230,16,169,160,160,3,145,15
900 DATA136,192,255,208,249,169,249,141
910 DATA16,232,76,46,230,120,173,197
920 DATA3,133,144,173,198,3,133,145
930 DATA88,96
940 REM ***END OF GAME***
950 FORD=1TO2500:NEXT
960 S=INT(TI/10)*10
970 IFS>HSTHENHS=S
980 PRINT"■"TAB(12)"YOUR SCORE:"S
990 PRINT"■"TAB(12)"HIGH SCORE:"HS
1000 FORJ=1TO5:POKE59464,N(J)
1010 FORG=1TO220*L(J):NEXT:NEXT
1020 POKE59467,0:SYS967
1030 PRINT"■■ANOTHER GAME? (Y/N)
1040 GETH$:IFH$=""THEN1040
1050 IFH$="Y"THEN350
1060 IFH$<>"N"THEN1040
```

PROGRAMS

ZX81 Battleships and Cruisers

by J Edgvane

This program needs 16k to run. It's based on the children's game but, of course, you play against the computer. At start-up, the computer takes about 15 seconds to 'position its fleet'. Note that '#' in the listing signifies a space, that in line 310 the letters and one space each side of them are in reverse video, and, in line 900, the '[]' between quotes is the graphic character on the 'A' key.

```
  5  SAVE "B,C,"
 10  REM****BATTLESHIPS AND****
 12  REM****CRUISERS BY****
 13  REM****J.C. EDYVANE****
 15  LET H=0
 20  LET I=0
 25  LET J=0
 30  DIM A(2,10,10)
 40  DIM N(2,6)
 50  DIM N$(6,11)
 60  RAND
 65  LET N$(1)="BATTLESHIP"
 66  LET N$(2)="CRUISER"
 67  LET N$(3)="DESTROYER 1"
 68  LET N$(4)="DESTROYER 2"
 69  LET N$(5)="SUBMARINE 1"
 70  LET N$(6)="SUBMARINE 2"
 71  FOR S=1 TO 2
 72  LET N(S,1)=5
 73  LET N(S,2)=4
 74  LET N(S,3)=3
 75  LET N(S,4)=3
 76  LET N(S,5)=2
 77  LET N(S,6)=2
 78  NEXT S
 80  GOTO 300
 90  LET I=Y
 95  IF K=1 THEN LET H=X
100  IF K=1 THEN LET J=1
105  RETURN
161  INPUT A$
165  IF A$="" THEN GOTO 161
170  LET X=(CODE A$(1))-37
175  IF X<1 OR X>10 THEN GOTO 161
180  LET A$=A$ (2 TO)
182  IF CODE A$<28 OR CODE A$>37 THEN GOTO 161
185  LET Y=(VAL A$)+1
187  IF A(2,X,Y) <0 THEN GOTO 161
190  RETURN
200  IF H<>0 AND J<>0 THEN GOTO 222
202  IF H<>0 THEN GOTO 230
205  LET X=INT (RND*10)+1
210  LET Y=INT (RND*10)+1
215  IF A(1,X,Y) <0 THEN GOTO 205
220  RETURN
222  LET P=H
225  LET Q=I
230  FOR D=-1 TO 1
231  FOR U=-1 TO 1
233  LET X=U+P
234  IF X<1 OR X>10 THEN GOTO 263
235  LET Y=D+Q
260  IF X<1 OR Y>10 THEN GOTO 265
261  IF A(1,X,Y)<0 THEN GOTO 263
262  RETURN
263  NEXT U
265  NEXT D
270  GOTO 205
300  PRINT "###YOUR FLEET#####ENEMY FLEET"
305  PRINT
310  LET B$="## ABCDEFGHIJ #### ABCDEFGHIJ "
315  PRINT B$
320  FOR S=3 TO 12
330  PRINT AT S,2; CHR$ (168-S)
340  PRINT AT S,13; CHR$ (168-S)
350  PRINT AT S,16; CHR$ (168-S)
360  PRINT AT S,29; CHR$ (168-S)
370  NEXT S
380  PRINT B$
385  PRINT AT 15,2;"I AM POSITIONING MY FLEET"
400  FOR S=1 TO 6
410  LET D=INT (RND*3)-1
420  LET U=INT (RND*3)-1
430  IF D=0 AND U=0 THEN GOTO 410
440  LET P=INT (RND*10)+1
450  LET Q=INT (RND*10)+1
460  FOR L=0 TO N(1,S)-1
480  IF P+D*L>10 OR P+D*L<1 THEN GOTO 410
490  IF Q+U*L>10 OR Q+U*L<1 THEN GOTO 410
495  IF A (2,P+D*L,Q+U*L)<>0 THEN GOTO 410
500  NEXT L
510  FOR L=0 TO N(1,S)-1
520  LET A(2,P+D*L,Q+U*L)=S
530  NEXT L
540  NEXT S
550  PRINT AT 15,2; "ENTER YOUR SHIPS NOW.####"
570  FOR S=1 TO 6
580  PRINT AT 17,2; N$(S)
590  FOR L=1 TO N(2,S)
600  PRINT AT 19,2;"SQUARE#";L
610  GOSUB 161
620  IF A (1,X,Y)<>0 THEN GOSUB 161
650  LET A(1,X,Y)=S
655  PRINT AT 13-Y,X*2; N$(S,1)
660  NEXT L
670  NEXT S
680  PRINT AT 15,2;"######################"
690  PRINT AT 17,2;"############"
693  PRINT AT 19,2;"###############"
695  LET K=2
702  IF K=1 THEN PRINT AT 15,2;"MY GO####"
703  IF K=2 THEN PRINT AT 15,2;"YOUR GO"
710  FOR G=1 TO 3
712  FOR S=1 TO 20
713  NEXT S
715  PRINT AT 17,2;"######################"
720  PRINT AT 16,2;"FIRE";G
730  IF K=1 THEN GOSUB 200
740  IF K=2 THEN GOSUB 161
755  LET Z=A(K,X,Y)
760  LET A(K,X,Y)=-1
770  IF Z=0 THEN GOTO 900
780  PRINT AT 13-Y,X;(K*16)-14;"*"
783  PRINT AT 17,2;"BANG#################"
784  IF K=1 THEN GOSUB 90
790  LET N(K,Z)=N(K,Z)-1
800  IF N(K,Z)=0 THEN GOTO 850
810  PRINT AT 17,2; N$(Z);"#SUNK"
815  IF K=1 THEN LET H=0
817  FOR S= 1 TO 15
181  NEXT S
820  FOR S= 1 TO 6
825  IF N(K,S)>0 THEN GOTO 850
830  NEXT S
835  IF K=2 THEN PRINT AT 19,2;"YOU";
836  IF K=1 THEN PRINT AT 19,2;"##I";
839  PRINT "WIN."
840  STOP
850  NEXT G
860  IF K=1 THEN GOTO 880
870  LET K=1
875  GOTO 700
880  LET K=2
890  GOTO 700
900  PRINT AT 13-Y, X+(K*16)-14;"[]"
910  PRINT AT 17,2;"SPLASH################"
915  IF K=1 THEN LET J=0
920  GOTO 850
```

'Waiter! I'd like the bill please and a thirteen-amp plug.'

continued from page 102.

BBC Basic reserved words

ABS	LOMEM
ACS	MID$
ADVAL	MOD
AND	MODE
ASC	MOVE
ASN	NEW
ATN	NEXT
AUTO	NOT
BGET	OLD
BPUT	ON
CALL	OPENIN
CHAIN	OPENOUT
CHR$	OPT
CLEAR	OR
CLOSE#	PAGE
CLG	PI
CLS	PLOT
COLOUR	POINT
COS	POS
COUNT	PRINT
DATA	PRINT$
DEG	PROC
DEF	PTR#
DELETE	RAD
DIM	READ
DIV	REM
DRAW	RENUMBER
ELSE	REPEAT
END	REPORT
ENDPROC	RESTORE
ENVELOPE	RETURN
EOF	RIGHT$
EOR	RND
ERR	RUN
EVAL	SAVE
EXP	SGN
EXT$	SIN
FALSE	SOUND
FN	SPC
FOR	SQR
GCOL	STEP
GET	STOP
GOTO	STR$
GOSUB	STRING$
HIMEM	TAB
IF	TAN
INKEY	THEN
INPUT	TIME
INPUT LINE	TOP
INPUT#	TO
INSTR	TRACE
INT	TRUE
LEFT$	UNTIL
LEN	USR
LET	VAL
LIST	VDU
LN	VPOS
LOAD	WIDTH
LOCAL	
LOG	

have been an important factor. Once the Acorn and Basic decisions had been made, a further *frisson* circulated when people remembered what the Basic was like on the Acorn Atom; would the BBC Micro have the same very non-standard Basic, people wondered?

For those of you unfamiliar with Atom Basic, it incorporates a number of very non-standard features. These pose absolutely no problem if you're learning Basic for the first time but can be most inconvenient if you're moving to the Atom from a machine with a more standard Basic, or if you want to move on from the Atom to another machine – in either case you have quite a bit of re-learning to do. On the plus side, though, Atom Basic has some very nice features indeed, such as allowing you incorporate assembler language mnemonics into a Basic program.

For the BBC machine, the same team which developed Atom Basic evolved a far more standard implementation of the language which makes the conversion to or from another machine (both of user and of programs) much easier, while retaining some of Atom Basic's more elegant features.

There is, of course, no such thing as a 'standard' Basic, as each implementation has a number of features designed to fit in with the particular machine's hardware facilities. In the case of BBC Basic, while a large proportion of its facilities are similar to Microsoft Basic (about the nearest thing to a standard Basic you can get), there are extra features to take advantage of the machine's sophisticated hardware, mostly in connection with the graphics and sound capabilities. A full list of the BBC Basic's features is printed below, so we'll just look at some of the more unusual/interesting facilities here.

Starting with the graphics, you can select any of the eight modes with the MODE statement, ie, MODE 3 or MODE A. CLG clears the current graphics area on the VDU; GCOL sets the fore and background graphics colours and COLOUR (good to see it in English!) allows you to play clever tricks, such as making an object move in front of the background but behind an object in the foreground. POINT returns the colour of a specified point on the screen. DRAW and PLOT appear to be very similar; they give very comprehensive control over graphics displays, including the drawing and infilling of triangles. There isn't space here to describe all of the very powerful graphics capabilities of the BBC Micro, but it's safe to say that the machine offers about the most sophisticated graphics available at the price.

Similarly, the sound generator is very powerful, having three channels for music and one for 'noise'. It's controlled by a couple of commands which are deceptively complex and will take some real getting to grips with before the machine's full sound potential can be exploited. First, the ENVELOPE statement, which is used to define the shapes of up to 16 envelopes and requires *14* parameters! These sounds are played using the SOUND statement, which defines the channel to be used, the envelope number and the note's fre-

quency and duration. Built in is the ability to 'stretch' all or even parts of each envelope, too!

At a less exotic level, BBC Basic has some other nice features. Yes, you can type in assembler mnemonics and, with many statements requiring parameters, etc, in brackets, the brackets can be omitted, ie, ADVALn (which returns the last known value of analogue-to-digital converter channel n) can be written as ADVAL(3) or ADVAL3 or ADVALN, etc. And in conditional statements, such as IF A=B THEN C=D, the THEN can be left out.

BBC Basic allows multi-line definitions of both functions and procedures. A very useful feature of procedures is that you can define local variables within them, which saves having to keep a careful track of variable names. And those variable names can, incidentally, be of any length with all characters significant; further, upper and lower case characters are recognised separately, so TOTAL is different to 'total'. You'd have to be careful about this, though, for it would eat up RAM space quite extravagantly. You can use reserved words as variables in lower case, so goto=3 would be legal but not GOTO=3.

There are other nice features, too, such as the ability to re-define the character set (although this needs some care as some of the non-printing ASCII characters are recognised as control codes). And it's possible to place text anywhere on the screen, not just in pre-defined lines, which would allow you to do fancy things like displaying superscripts and subscripts or proportionally-spaced text.

Peter Rodwell

CALCULATOR CORNER

Continued from page 155.

market, quite close to the earlier 34C model over which it has the advantage of an LCD display with consequent long battery life and more compact and attractive presentation. However its lack of printer, external storage and alphanumerics together with rather limited memory space makes it well short of 'state-of-the-art' in this market given its £91.42 price tag. It is also fairly slow in processing speed (see Benchmark table) due no doubt to the forward search method of label location which it uses. However Hewlett-Packard, like Rolls-Royce, have never worried over much about the competition's prices preferring instead to maintain a reputation for quality and a loyalty to their brand among scientists and engineers. The 11C certainly shows every evidence of being constructed to the usual high HP standard and may be purchased in confidence by those who are prepared to pay extra for a well tried product in a new slimline package.

BENCHMARKS

Machine	Timing	Memory used	% of total memory
Texas TI-59	43	59 steps	10.3
Hewlett-Packard HP-41C	37	41 bytes	15.6
Sharp PC-1211	52	81 steps	5.9
Casio fx-602p	20	21 steps	4.1
Casio fx-702p	20	77 steps	4.6
Hewlett-Packard HP-11C	75	30 steps	14.8

COMMONS REPORT

Continued from page 95.

President of the United States and the local Mayor, to test opinion on the relative merits on different types of food and drug labelling, to choose between a civic bandstand and a football field and to decide whether the citizens of Columbus, after a heavy snowfall, wished to pay an extra rate to expedite the removal of snow. The answer, incidentally, was 'no'. When former President Nixon's book appeared, QUBE subscribers had an opportunity to express their views on its veracity.

I believe this to be a technical development which has outstanding *political* significance. It has, in effect, re-created for democracy, the Agora of Athens, the market-place in which the Athenians assembled to hear, approve or disapprove the advice of

COMMONS REPORT

their leaders. The Agora has always been held up as the democratic ideal for which the ballot-box has become a cumbersome substitute, as distance and population made regular consultation impractical. The QUBE has changed this situation dramatically and it will not be long, in my judgement, before political leaders in the great democracies, at least, will be asked to add to the checks and balances already imposed in between elections by free speech, press and television, the more immediate and dramatic constraint of the television vote or electronic referendum. It will cost virtually nothing. It will provide an immediate response on any issue. It will present a quantum jump in the political process as challenging as any development which has occurred since Demosthenes addressed the Athenians. In my next article I hope to examine some of the questions which will have to be answered before we adopt the system, for I suspect that once it is available, the populist and the demagogue will immediately seek to command the immense power that this device will offer. The question we have to address is whether QUBE and parliamentary democracy can both survive.

SHARP MZ80B

Continued from page 119

computer, a useful small business system or a laboratory instrument. After-sales service should be above average, given that Sharp has a UK operation and an extensive dealer list. It is already supported by more software than most machines have on launch and more will follow from independent houses as well as the manufacturer. It remains to be seen how many high level languages will be available which can utilise its excellent graphics potential. Sharp has done most of it right with this product and I wish it well.

Prices

(Recommended, including VAT)

MZ-80B (inc tape Basic and manuals)	1259.00
Expansion port	57.50
Graphics RAM 2	138.00
Disk unit (inc controller card and ribbon cable) + FDOS	856.00
+ CP/M	897.00
Printer (inc interface card and cable)	477.50
Universal I/O card	51.75
Disk Basic (single precision)	35.65
(double precision)	46.00
Pascal interpreter	46.00
Basic compiler	34.50
Hardware system as tested	2735.95

Benchmarks:

(Timing in seconds)

	Single Precision Basic	Double Precision Basic
BM1	0.6	0.7
BM2	4.5	5.0
BM3	8.5	12.0
BM4	11.5	19.0
BM5	13.0	20.0
BM6	19.0	27.5
BM7	27.5	38.0
BM8	5.0	—

Technical specifications

CPU:	Sharp LH0080A (Z80A) 4 MHz.
Memory:	64k dynamic RAM, 10k Video RAM (expandable to 18k), IPL in 2k ROM, character generator in 2k ROM
Keyboard:	92 keys inc numeric, function, cursor and cassette controls, ASCII standard typewriter main keyboard.
VDU:	9in diagonal, green-on-black CRT, 25 lines x 40 or 80 chars, 320x200 dots in graphics mode.
Cassette:	Audio cassette tape, 1800 bits/sec, fast search facility, all functions programmable.
Disk drives:	Sharp MZ-80FD twin double density double-sided 5in 280k per drive, 560k per unit, up to 2 units (4 drives)
Printer:	Sharp MZ-80P5 9x8 dot matrix, 80cps. 40, 68, 80 or 136 chars/line.
Ports:	Optional RS232C, IEEE-488, Sharp Universal I/O
System software:	Optional CP/M, Sharp FDOS
Languages:	Basic, Basic Compiler, Pascal.

Banks Statement

Continued from page 75

ning to seriously waver, so I rang Editor Rodwell, while sequentially saving the file so that I could start again after seeking advice. Unfortunately, an overlay subroutine (that the manual said *must* be on the disk) could not be found by the system, so it refused to save anything at all.

After consultation with Editor Rodwell, it was felt that the only way out of this hole was to press Reset, which might lose some of the file (even all of it wouldn't have mattered as I had been provided with a copy by the supplier after it had reformatted the CP/M) but which shouldn't do much damage. After all, as we both comforted ourselves, modern systems have strong safeguards against inadvertent loss of data.

I pressed Reset.

Oh, how I wish I hadn't. When I had booted up again there was nothing on the hard disk. *Nothing at all.* Not only had my own file been dumped, the system had dumped the entire disk into wherever it is that dumped data goes.

'I think,' said Editor Rodwell, 'we will blow out this particular Benchtest.' Strangely enough, I concurred. I know when I'm beaten.

Epilogue

So why write out these trials and tribulations in such stunningly boring detail, I hear Agatha Spotiswood of Maida Vale ask in a loud voice? It's just another tale of woe from a dumbo.

And my answer? It is precisely because I *am* a dumbo in driving computers that I have written. I don't particularly want to be a smart-ass gizmo twiddler who can delve into the guts of CP/M and tweak it about; in the context of the *PCW* word processor Benchtest I am like the vast majority of potential users of microcomputers: I want a system that works.

I look at it from the small businessman's point of view, for this was no 'el cheapo' kit for funsters, this was a system with hard disk store that is intended for the small business market. Depending on the printer, the whole shemozzle would probably cost the best part of £4500 and for that money (a sizeable but potentially important investment for many small companies), the suppliers ought to ensure that it does work.

The microcomputer industry has yet to really tap the market for systems in small businesses. The people they currently sell to normally have some idea about computers. They normally buy from the industry, rather than being sold to by it. But there are still millions more customers out there (and I say millions with due malice of forethought) and they are dumbos. They know all there is to know about making wimwoms for church steeples — or whatever else it is they produce, do or service — but they haven't got a clue about computers.

All they want is a box that solves a problem and helps them do their thing. They give not a toss whether that box is powered by steam, elastic bands or the by-product of a million baked beans as long as it actually performs the specified task(s). It seems a stunningly simple prerequisite for the industry to realise that all it has to do is ensure that the boxes it sells actually work. Then maybe it (or some sectors of it) will stop trying to emulate Mr and Mrs Bates's young son.

There, the polemic is now concluded. The system in question now sulks in the corner of my living room while I glower at it occasionally. In the next few hours I should be back down from off the ceiling and return, next month, to sanity. END

BLUDNERS

A couple of sillies in 'TJ's Workshop' last month, in the article about interfacing the Seikosha printer to the Acorn Atom. The save command should have read:

*SAVE "HIRES" 2800 28B5 2800;

the two references to DATAB should have read DATA8; the address printed as #B8002 should be #B802; and the last sentence in paragraph three: '...printer on and off and also not to send the character.'

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Benchtest: Tandy TRS-80 Model II/Benchtest: Sintrom Periflex 630/48 / Staff case study/Checkout: Softy Intelligent EPROM Programmer/Checkout: Exatron Stringy Floppy/Practical examples of the IEEE-488 bus use/Programs: Naming Nascom files, 380Z Pictures, Fuel tank calculations — PET, PET large numeral generator, PET tank battle, Basic string handling routines/Pascal: Final instalment.

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3-D graphics/Benchtest: Atari 400 & 800/Benchtest: DAI/Robotics/Benchmarks/Programs: PET Racer, PET Fighter Pilot, UK101 Graphics, Apple Plotting, UK101 Gunfight, PET Algebraic evaluation, ZX80 Breakout

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Benchtest: Microwriter/Printerfacing: Series — Part 1/Sharp PC-1211 speed-up/Programs: TRS-80 Tarot, PET Cat & Mouse, PET Rebound, MZ-80K Alligator Swamp, PET Connect, UK101 Minefield, PET Simon

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Benchtest: Transam Tuscan/Real-time control using trains — part 1/Recover from a data tape disaster/PET Music/Multi-user systems — part 1/Programs: TRS80 Four in a row, TRS80 Target Practice, PET Convoy, PET Wire, PET Maze Chase, PET Android Attack, PET Anagram

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Benchtest: NEC PC-8001/Multi-user Benchtest: MP/M/Benchtest: Sinclair ZX81/West Coast Faire report/Radio Teletype/WP Benchtest: Wordpro 4 Plus/Budget tape interface/Further Casio quirks/Programs: UK101 Zor, PET Chords.

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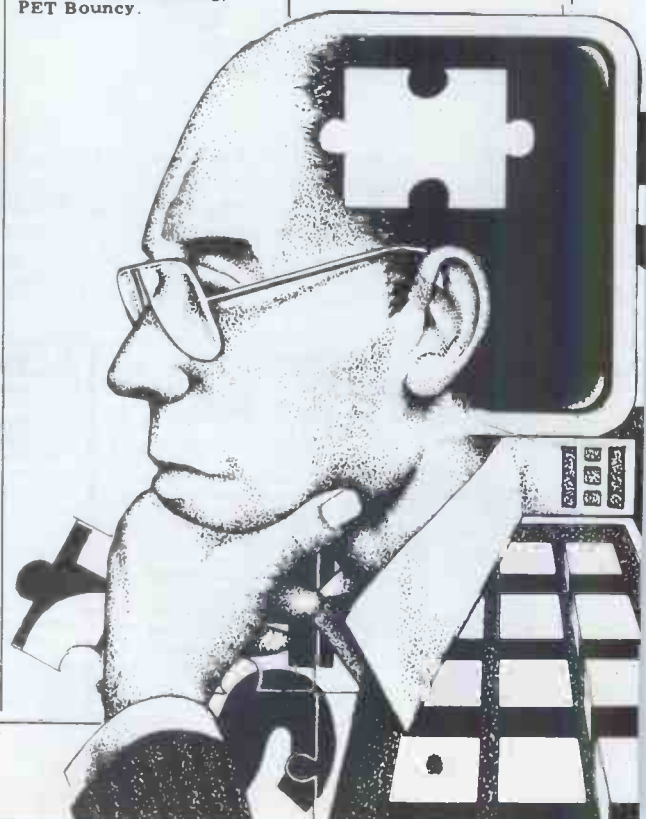

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Benchtest: Tandy Model III/Viewdata update/WP Benchtest: Spellbinder/ Printer survey/Microholism/Programs: ZX80 Othello; Easter Sunday; Apple Mondrian; MZ-80K Duck Shoot; PET Gomoku; MZ-80K Football.

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Benchtests: Tandy Color Computer, Commodore VIC/Checkouts: Hi Tech Speakeasy, Tantel/ Multi-user Benchtest: HMSOS/ WP Benchtest: Memorite III/Word proc program for PET/Apple dealership run by spastics/Printer-facing extra/Calc Corner: Casio fx602p review/ Programs: PET Arithmetic test, ZX80 Eldorado, 380Z Memory test.

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Benchtests: Osborne 01, IBM Personal Computer. Checkout: Sharp IQ3100 Microtranslator. Calc Corner: Casio fx702p. *PCW* Show report, Benchmark Summary, Euro Micro Chess Championship report. Programs: TRS-80 Sheepdog trial, ZX81 Sun and Planets.

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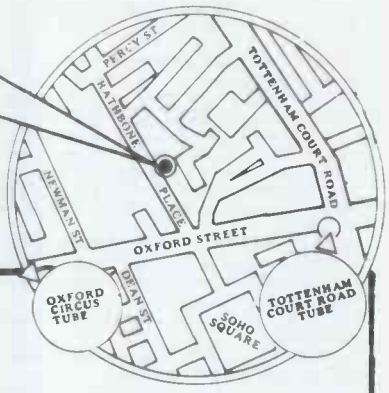

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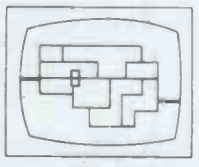

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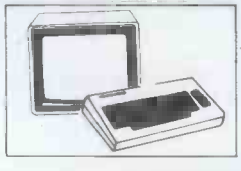

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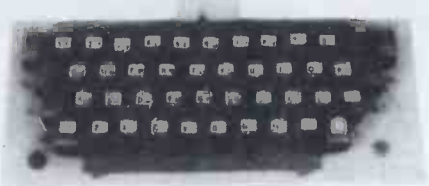

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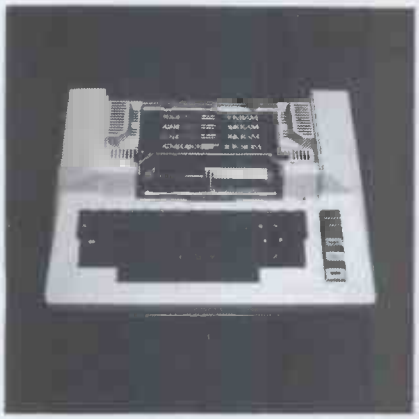

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LS645	210
LS668	175
LS669	150
LS670	175
LS673	550
LS674	750

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	58
4041	78
4042	60
4043	70
4044	65
4045	170
4046	75
4047	75
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	26

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

VIC 20 Microcomputer

At last it is here, the long awaited Commodore's VIC 20 Microcomputer. Connects directly to any colour TV set. Sound reproduced through TV Speaker (Music, Language & other Sound effects). Has PET type Graphics. Standard PET Basic. Full size Keyboard. 5K memory expandable to 32K. Attractively cased.

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Cassette Deck incl. Free
6 programme Cassette £34

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Send SAE for details.

SEIKOSHA GP80A

Unihammer Printer, gives normal and double width characters as well as dot resolution graphics 8" Tractor feed. Parallel Interface standard. £195

SOFTY·2

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The Currah Mini Digital Recorder is the fast and simple alternative to Disc £195

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	1+	50+
2114L-450n	90p	85p
2114L-300n	99p	85p
2114L-200n	130p	115p
2708	200p	185p
2532	525p	499p
2716	230p	199p
2732	455p	390p
4027	240p	215p
4116	85p	70p
4334-3	325p	290p
6116-3	855p	805p
8216	120p	80p

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Now available from stock at very competitive prices.

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- MX80FT2 Has high resolution Graphics option plus all the MX80FT's facilities. £435
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- Teleprinter Roll (no VAT) £3.50
- 15½" Fan fold paper
- UHF Modulator 6MH2 280p
- UHF Modulator 8MH2 450p

CRYSTALS

32 768K Hz	200
100K Hz	270
200K Hz	295
455K Hz	370
1M Hz	295
1 28M Hz	392
1 6M Hz	323
1 8M Hz	323
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 032MHz	290
4 80M Hz	200
4 194304M	200
4 433619M	120
5 0M Hz	200
5 185MHz	300
5 24288M	390
6 0M Hz	220

6 144M Hz	240
6 55536M Hz	200
7 0M Hz	200
7 168MHz	250
7 68M Hz	200
8 0M Hz	200
8 867237M	240
9 00M Hz	200
10 0M Hz	200
10 7M Hz	220
10 24M 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
116 0MHz	300

'D' CONNECTORS (Cannon type)

	Plugs	Sockets	Covers plastic
9 way	55p	125p	145p
15 way	135p	198p	150p
25 way	170p	250p	130p
37 way	290p	398p	185p

25 WAY 'D' CONNECTOR Jumper Lead Cable Assembly.

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 14 pin 145p 16 pin 165p; 24" length Cable 24 pin 240p 40 pin 380p.

Double ended DIP	14 pin	16 pin	24 pin	40 pin
6"	185p	205p	300p	465p
12"	198p	215p	315p	490p
24"	210p	235p	345p	540
36"	230p	250p	375p	595p

DIL PLUGS (Headers)

14 pin	44
16 pin	49
24 pin	88
40 pin	255

Ribbon Cable

ft.	
10 way	22p
20 way	40p

VOLTAGE REGULATORS
1A TO220 Plastic Case
-5V -12V -15V -18V 50p
1A 5V 12V, 15V, 18V 55p
78H05 5A/5V 550p 78HG 850p
78HG 650p, LM309K 135p

DIL SOCKETS (TEXAS)

	Low profile	Wire wrap
8 pin	8p	25p
14 pin	10p	35p
16 pin	10p	42p
18 pin	16p	52p
20 pin	22p	60p
22 pin	25p	70p
24 pin	25p	70p
28 pin	28p	80p
36 pin	–	105p
40 pin	30p	99p

EDGE CONNECTORS double type

	1	156
2 x 10 way	–	135p
2 x 15 way	–	140p
2 x 18 way	180p	145p
2 x 22 way	199p	200p
2 x 25 way	225p	220p
2 x 30 way	245p	–
2 x 36 way	295p	–
2 x 40 way	315p	–
2 x 43 way	395p	–

IC Test Clips DIL Gold plated contacts.

8 pin 600	22 pin 1037
14 pin 368	24 pin 1130
16 pin 389	28 pin 1245
18 pin 815	36 pin 1630
20 pin 945	40 pin 1700

ZERO Insertion Force DIL Sockets

24 way 600p
28 way 850p
40 way 975p

VERO WIRING PEN and Spool 310p

Spare Wire (Spool) 75p
Combs 6p ea

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MONDAY-SATURDAY
9.30-5.30

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RAM SCOOP
4116 200 NS 8 for £12.95
4164 200 NS £8.50 each
2102-650 NS 8 for £5.50
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25 WAY "D" CONNECTORS

		50+	100+
25p	1.70	1.10	0.95
25S	1.90	1.20	1.00

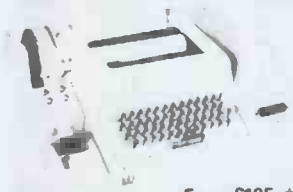
ALL + VAT

WIRE WRAP SKTS.
24 Pin Vero 28p
14 Pin Gold 22p
16 Pin Gold 24p
100 PCS Min Ord.

C10 DATA CASSETTES
10 for £5.75
Inc. VAT

RF CONNECTORS
50Ω BNC PLG 50p
75Ω BNC PLG 50p
PL259 PLG 40p
SO239 SKT 35p
100 PCS MIN ORD.

TELETYPE ASR33 I/O TERMINALS



From £195 + CAR + VAT

Fully fledged industry standard ASR33 data terminal. Many features including: ASCII keyboard and printer for data I/O, auto data detect circuitry, RS232 serial interface, 110 baud, 8 bit paper tape punch and reader for off line data preparation and ridiculously cheap and reliable data storage. Supplied in good condition and in working order.
Options: Floor stand £12.50 + VAT
Sound proof enclosure £25.00 + VAT

ICL TERMIPRINTER 300 BAUD TERMINALS

REDUCED TO CLEAR
NOW ONLY £80 +CAR +VAT

Made under licence from the world famous GE Co. The ICL Termiprinter is a small attractive unit with so many features it is impossible to list them in the space available! Brief spec. as follows; RS232 serial interface, switchable baud rates 110, 150, 300, (30 cps), upper and lower case correspondence type face, standard paper, almost silent running, form feed, electronic tab settings, suited for word processor applications plus many more features. **Supplied complete, in as seen condition, no guarantee.**

MPU EXPERIMENTORS +5v·12v·12v·24v POWER SUPPLY

Once again we are very pleased to offer this superb Power Supply Unit, and hope to satisfy most of our previous customers who were disappointed when we sold out due to demand last time they were advertised!!! These units may just have well been made for your lab., they consist of a semi-enclosed chassis measuring 160mm x 120mm x 350mm containing all silicon electronics to give the following fully regulated and short circuit proof outputs of:

+5v @ 2 amps DC + 12v @ 800 ma DC
-12v @ 800 ma DC + 24v @ 350 ma DC

and if that's not enough a fully floating 5v output @ 50 ma DC which may be sensed to give a host of other voltages. All outputs are brought out to the front panel via miniature jack sockets and are also duplicated at the rear on short flying leads. Units accept standard 240v mains input. They are ex GPO and may have minor scratches on the front panels, they are sold untested but in good internal condition. £16.50 each + £2.50 p+p complete with circuit and component list. Transformer guaranteed. HURRY WHILE STOCKS LAST!!

HIGH SPEED DATA MODEMS

A superb piece of engineering made by SE Labs Ltd. to a "no cost spared" spec for the GPO, the Modem 12 is a synchronous Modem for use on DATEL 2412 services, or other data links. Many features include switchable V26 modulation, 2400 baud full duplex 600/1200 standby, auto answer, 4 wire or 2 wire operation. Self test, LED status indication, CMOS technology, modular construction, original cost over £700 each. Believed brand new supplied complete with PSU etc.
£185.00 + £9.50 carriage + VAT.
*Permission may be required for connection to PO lines.

PERTEC

PERTEC TAPE DRIVES
7 track 6840 — 75-25 £175.00 + VAT
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Phone for more details

DIABLO S30 DISK DRIVES

Another shipment allows us to offer you even greater savings on this superb 2.5 MB (formatted) hard disk drive. Two types are available both fully refurbished and electronically identical, the only difference is the convenience of changing the disk packs.
S30 front loader, pack change via front door £550 + vat
S30 fixed, pack change via removal of top cover £295 + vat
+ & — 15v PSU for 2 drives £125 + vat
SPECIAL OFFER new, 12 sector packs £20 + vat carriage & insurance on drives £15.00 + vat fully DEC RK05, NOVA, TEXAS compatable further info on controllers etc on request.

NATIONAL MA1012 LED CLOCK MODULE

★ 12 HOUR
★ ALARM
★ 50/60 HZ

The same module as used in most ALARM/CLOCK radios today, the only difference is our price! All electronics are mounted on a PCB measuring only 3" × 1½" and by addition of a few switches and 5/16 volts AC you have a multi function alarm clock at a fraction of cost. Other features include snooze timer, am pm, alarm set, power fail indicator, flashing seconds cursor, modulated alarm output etc. Supplied brand new with full data only. Suitable transformer £1.75. **£5.25**

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Corcom Inc F1900 30 amp £13.95 + pp £1.00

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Keep your equipment Cool and Reliable with our tested ex-equipment "Muffin Fans" almost silent running and easily mounted. Available in two voltages. 110 V.A.C. £5.05 +pp 90p OR 240v A.C. £6.50+pp 90p. DIMENSIONS 4¾" x 4¾" x 1½"

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Due to our massive bulk purchasing programme which enables us to bring you the best possible bargains, we have thousands of I.C.'s, Transistors, Relays, Cap's., P.C.B.'s, Sub-assemblies, Switches, etc. etc. surplus to our requirements. Because we don't have sufficient stocks of any one item to include in our ads., we are packing all these items into the "BARGAIN PARCEL OF A LIFETIME" Thousands of components at giveaway prices! Guaranteed to be worth at least *3 times* what you pay plus we always include something from our ads. for unbeatable value!! Sold by weight

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10kls £11.75+pp £2.25 20kls £19.99+pp £4.75

SAVE OVER £1400

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THE LOGABAX Z80 MICROPROCESSOR CONTROLLED LX180L MATRIX PRINTER

A massive bulk purchase enables us to offer you this superb professional printer at a fraction of its recent cost of over £2000. Utilising the very latest in microprocessor technology, it features a host of facilities with all electronics on one plug in P.C.B. Just study the specification and you will instantly realise it meets all the requirements of the most exacting professional or hobbyist user.

STANDARD FUNCTIONS ★ Full ASCII character set ★ Standard ink ribbon ★ RS232/V24 serial interface — 7 xtal controlled baud rates up to 9600 ★ 194 characters per line ★ Parallel interface ★ Handshakes on serial and parallel ports ★ 4 Type fonts, italic script, double width, italic large, standard ★ Internal buffer ★ Internal self test ★ 170 CPS ★ Variable paper tractor up to 17.5" wide ★ Solid steel construction ★ All software in 2708 eproms easily reconfigured for custom fonts etc.

All this and more, not refurbished but BRAND NEW At Only **£525** +VAT
Also available identical to above LESS Electronics Card £250 + VAT
+ carriage and ins. £18.00 + VAT

OPTIONAL EXTRAS ★ Lower case £25.00 ★ 16K buffer £30.00 ★ Second tractor for simultaneous dual forms £85.00 ★ Logabax maintenance, P.O.A.

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EPROM BLOWER

Software development system invaluable tool for designers, hobbyists, etc. Enables open heart surgery on 2716, 2708 etc. Blows, copies, reads EPROMS or emulates EPROM/ROM/RAM in situ whilst displaying contents on domestic TV receiver. Many other features. £115 + carr. + VAT. Optional 2716, 2716 Function Card £40 + VAT. PSU £20 + £1.50 carr. + VAT.
Softy 2 for 2716/2732 £169+VAT
Write of phone for more details.

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Ex-equipment 9" Motorola Video Monitors 75Ω composite input, tested but unguaranteed. £39.99 +£7.50 carriage + VAT. Complete with circuit.

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Mixed Semis amazing value contents Include transistors, digital, linear, I.C.'s, triacs, diodes, bridge recs., etc, etc. All devices guaranteed brand new full spec with manufacturer's markings, fully guaranteed. 50+ bag £2.95 100+ bag £5.15

TTL 74 Series
A gigantic purchase of an "across the board" range of 74 TTL series I.C.'s enables us to offer 100+ mixed "mostly TTL" grab bags at a price which two or three chips in the bag would normally cost to buy.
Fully guaranteed at I.C.'s full spec. 100+ £6.90 200+ £12.30 300+ £19.50

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Yet again we've managed to secure a large shipment of tomorrows technology at prices as yet unheard of!! And as with most of our purchases can pass these savings direct to you!! The DR 7100 & 7200 8" floppy disk drives have many inbuilt features to provide literally any BUS configuration with full daisy chain via internal jumpers 77 tracks on the single sided 7100 give upto 0.8 MB of data and 154 tracks on the 7200 double sided drive give a massive 1.6 MB of data. Many other features such as soft or hard sectoring, IBM or ANSI standards, only 240v AC, +24 & +5 v dc power requirements, and our unbelievable prices make these drives a snip.
Supplied BRAND NEW and boxed complete with user manual;
7100 single sided £225.00 + 8.50 ins. & carr. + vat.
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Full technical manual available £7.50 write or phone for more details.

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LMC C5V
5V 10 AMP
PSU, 240V
NEW £45 + VAT
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OECTU60 TWIN CASSETTE DRIVE . . . £375+VAT
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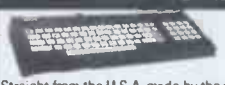
LSI1102 PROCESSOR CARD £275.00+ VAT
* * All types of DEC equipment purchased for cash * *

RCA FULLY CASED ASCII CODED KEYBOARDS



IDEAL — TANGERINE, OHIO ETC,

Straight from the U.S.A. made by the world famous R.C.A. Co., the VP600 Series of cased freestanding keyboards meet all requirements of the most exacting user, right down to the price! Utilising the latest in switch technology. Guaranteed in excess of 5 million operations. The keyboard has a host of other features including full ASCII 128 character set, user definable keys, upper/lower case, rollover protection, single 5V rail, keyboard impervious to liquids and dust, TTL or CMOS outputs, even an on-board tone generator for keypress feedback, and a 1 year full R.C.A. backed guarantee.

VP601 7 bit fully coded output with delayed strobe, etc.	£43.95
VP611 Same as VP601 with numeric pad.	£54.95
VP606 Serial, RS232, 20MA and TTL output, with 6 selectable Baud Rates.	£64.26
VP616 Same as VP606, with numeric pad, Plug and cable for VP601, VP611 £2.25	£84.34
Plug for VP606, VP616 £2.10	
Post, Packing and Insurance.	£1.95

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Following the recent "SELL OUT" demand for our 5v 3 amp P.S.U. we have managed to secure a large quantity of ex-computer systems P.S.U.'s with the following spec.; 240 or 110v A.C. input. Outputs of 5v @ 3-4 amps, 7.2v @ 3 amps and 6.5v @ 1 amp. The 5v and 7.2v outputs are fully regulated and adjustable with variable current limiting on the 5v supply. Unit is self contained on a P.C.B. measuring only 12" x 5" x 3". The 7.2v output is ideal for feeding "on board" regulators or a further 3 amp LM323K regulator to give an effective 5v @ 7 amp supply.
Supplied complete with circuit at only £10.95 + £1.75pp. Believed working but untested, unguaranteed.

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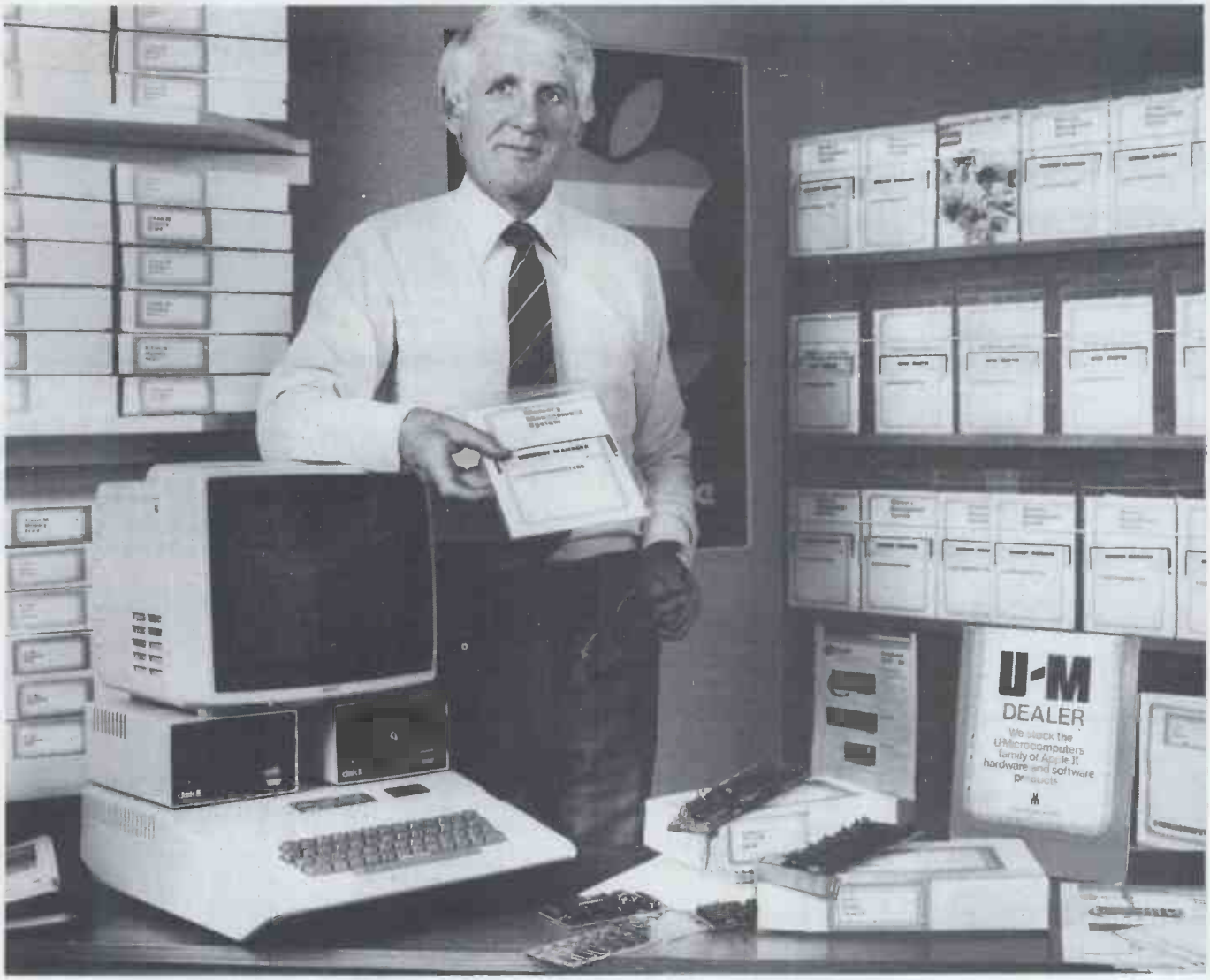
U-Microcomputers family of Apple II software and hardware products NOW off the shelf.



U-RAM 16 16K RAM card compatible with Language card £95.00.
Memory Management Software to put DOS onto U-RAM 16 and give more room for Applesoft programs £15.00.

U-Z80 Processor card £95.00. **CP/M** serialised diskette with introductory manual £30.00. Detailed **CP/M** manual £25.00

U-S232 Serial interface card with handshaking plus Pascal and CP/M compatible £95.00.

U-TERM 80 column display board. BASIC, Pascal and CP/M compatible. User definable character sets £175.00.

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And expect shortly:

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DEAL C	" " BASIC, PASCAL, FORTH, 10 programs, AND FORTRAN	£379
DEAL D	everything in DEAL C AND MACHINE COOE	£395
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6.	HYPNO, 3D MAZE, OTHELLO	£5
7.	TEACH MAJOR SCALES' ORGAN KEYS	£5
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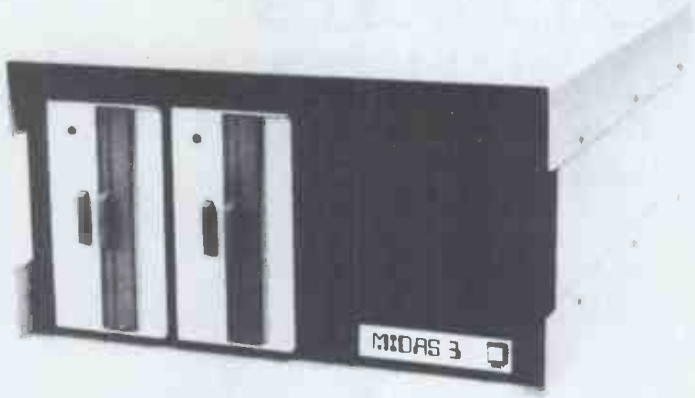

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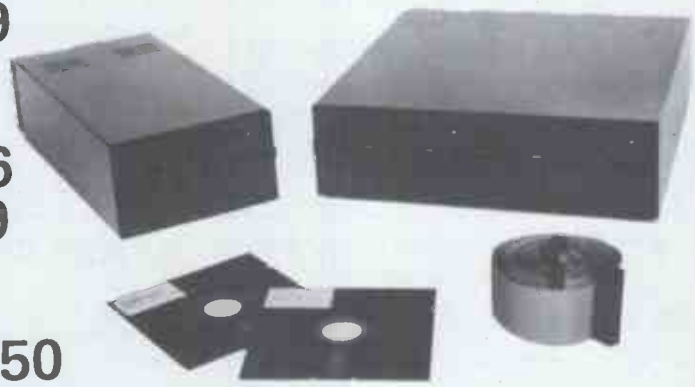

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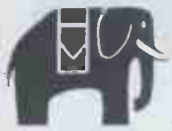

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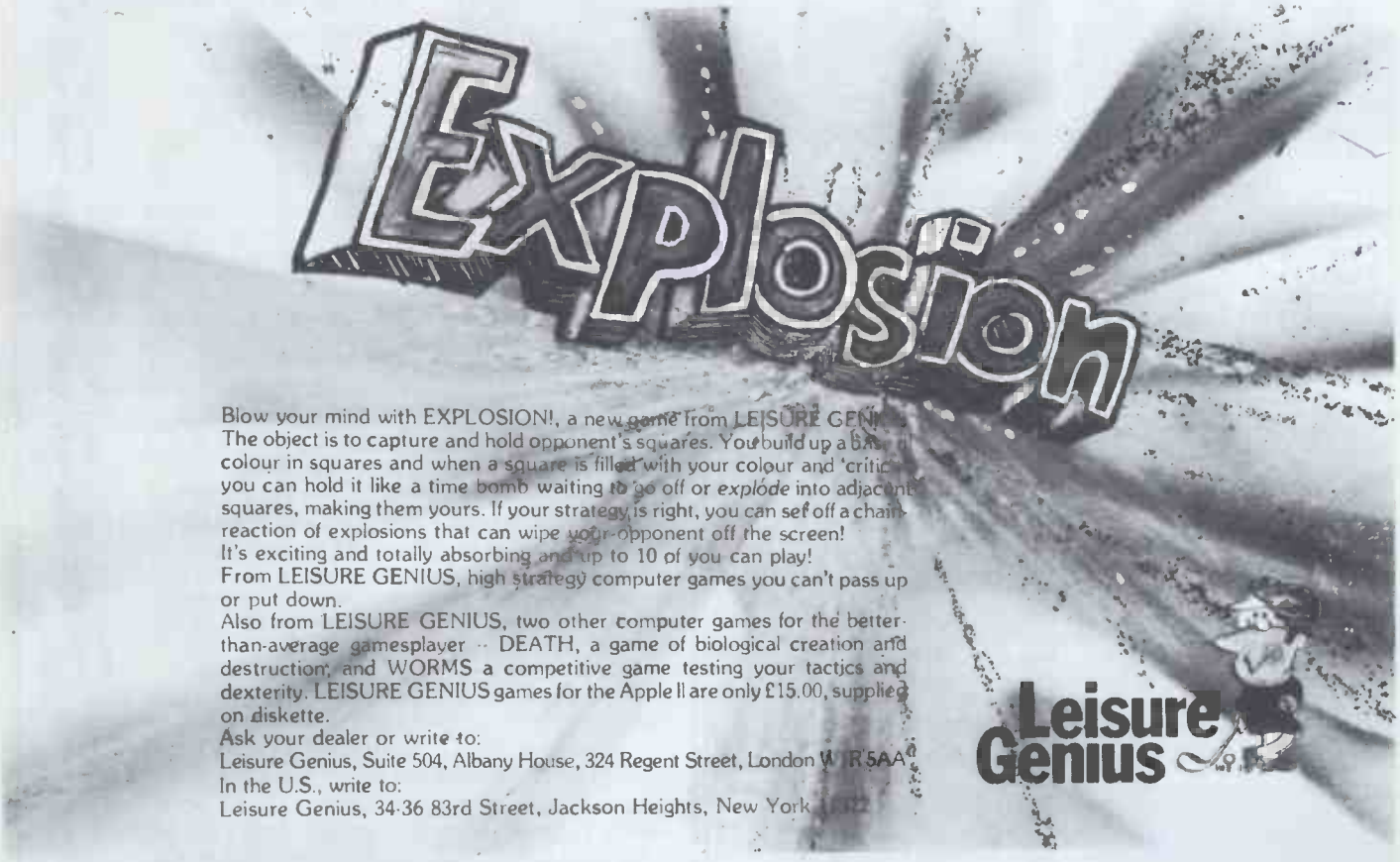

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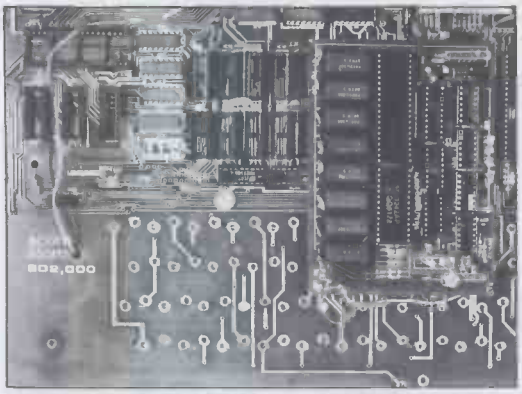

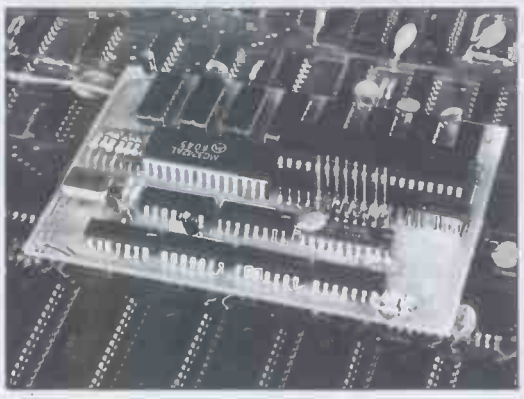

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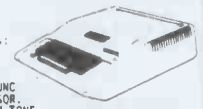

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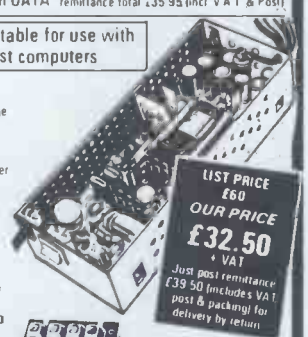

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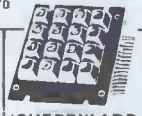

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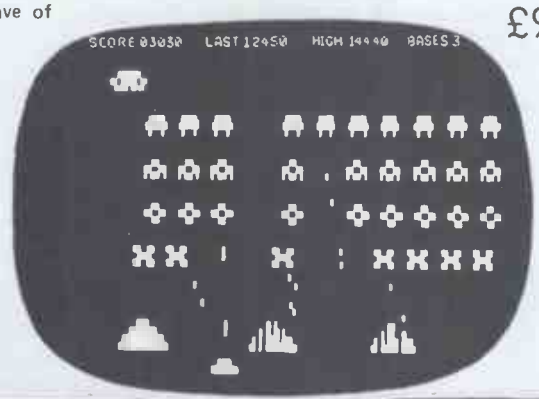

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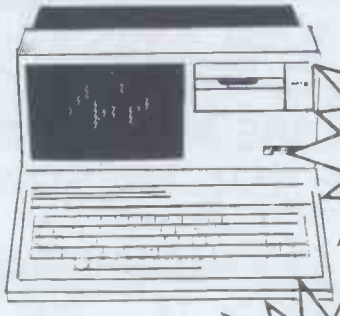

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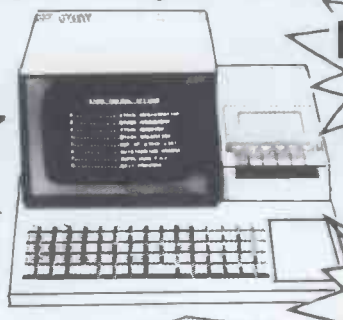

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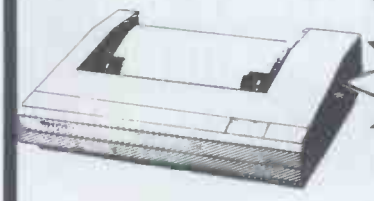

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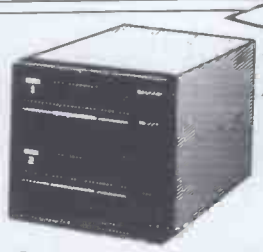

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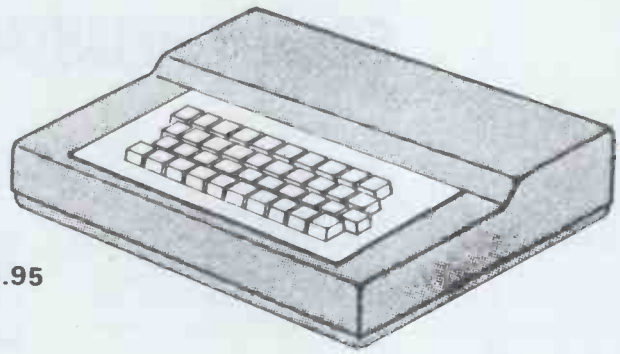

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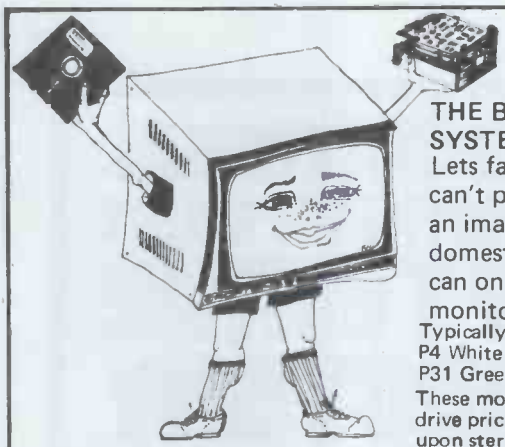

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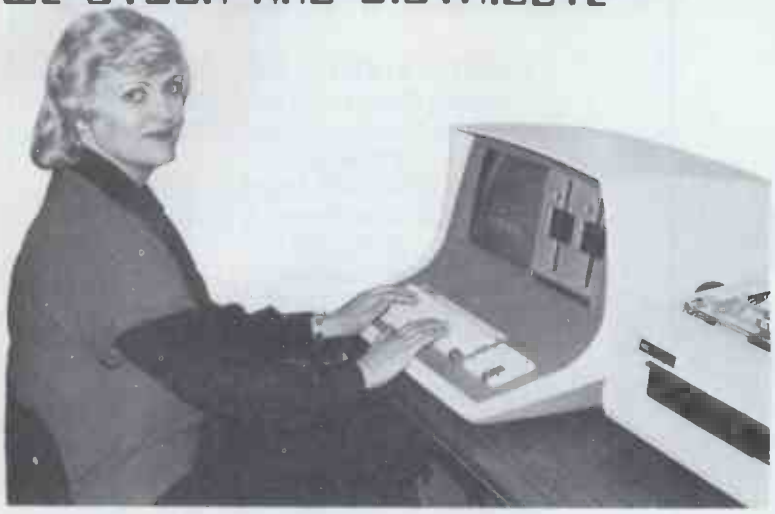

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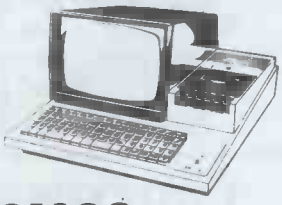

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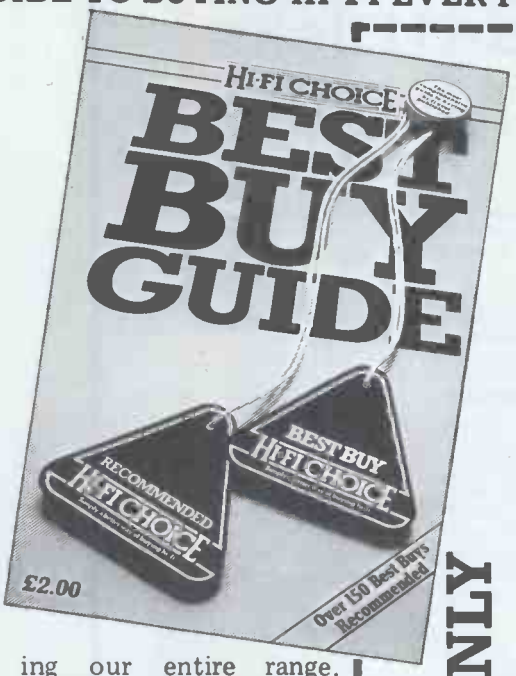

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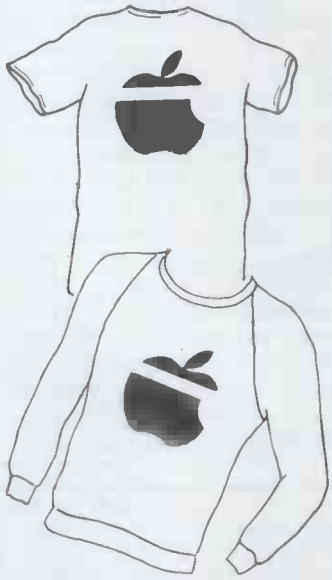

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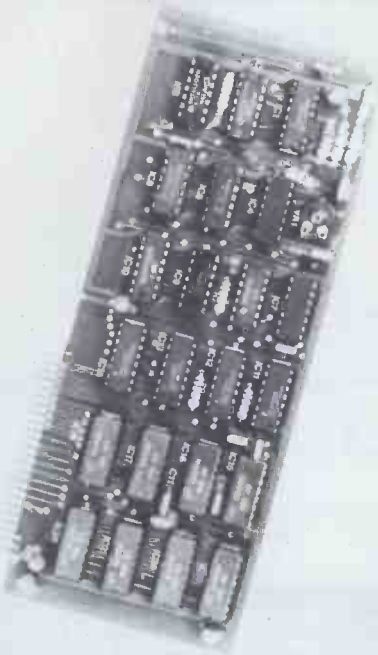

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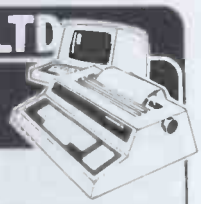

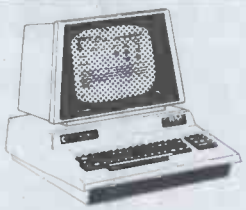

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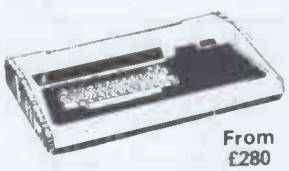

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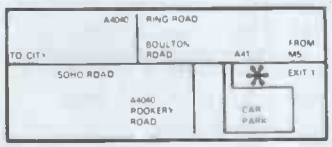

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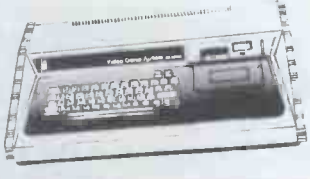

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CHIP CHAT

CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT CHIP CHAT

Peripatetic conferences are all the rage now, it seems: first the SDP and now Caxton Software, the firm set up by *PCW*'s ex-editor David Tebbutt and his partners (see 'Newsprint'). The Caxton press launch was held in London's Caxton Hall (geddit?) where, after a glass of wine, the assembled hacks trooped upstairs to a grandiose room to hear the three Caxtonites speak. Unfortunately, their words were drowned by a loud and persistent hammering from above, where a workman was apparently removing the roof. Eventually, after half the ceiling had fallen on Tebbo's head, the party trooped back to the first room to resume proceedings in a more audible atmosphere... One of our informers bumped into 'Bogey' at a recent press conference and was delighted to see the Bogart look-alike sporting a badge saying 'Robin Bradbear'. Pausing only to let our hack's laughter subside, Robin announced that his nickname at school used to be 'Breadbin'. We'll stick to 'Bogey'... Talking of Bradbeer reminds us of our prophesy that 'Squire' Allason's robot of the same name would soon be running *Printout*. The day cannot be far off when this happens as the magazine's latest issue carries on its masthead the cryptic and doubly inappropriate credit, 'Gentleman's Gentleman: Bradbeer'... In the interests of bringing you the latest in office technology, your trusty reporters journeyed to the darkest Midlands to see the International Business Show at the National (why not International?) Exhibition Centre, a series of enormous aircraft hangars appropriately sited next to Birmingham airport. Compared to this year's Hanover Trade Fair, it seemed remarkably untechnological. The craze at Hanover was all for computerised briefcases which run about the office on rails, or for robot postboys which trundle down the corridors delivering the mail and *laughing* in a most sinister way if they bumped into you. At the IBS, your reporters found themselves passing mile after mile of photocopiers and filing cabinets and were on the point of dying of exhaustion when they happened upon the Riso stand. Riso? A Japanese company, proper name Riso Kagaku Corporation, which will probably never become a household name in the office *(What? — Ed)*. Riso makes a fabulous do-it-yourself silkscreen printing outfit called the Print Gocco B6, which was being demonstrated by a group of business-suited Japanese men, probably the company's board of directors, who, despite their imperfect command of English, showed more enthusiasm for their product than was being shown by the rest of the IBS exhibitors put together. It's about time we all took a leaf out of the Japanese's book and put a bit of fun into our business exhibitions, which seem to become ever more dreary... To be truthful, there were quite a number of computers around at the IBS. An interesting trend seems to be developing among minicomputer manufacturers in their attempts to get into the micro market. Several are now offering what they call 'microcomputers' but which, on closer examination, offer rather fewer facilities than a SuperBrain, say, or a Tuscan, yet cost three times as much... Editor Rodwell has recovered (just) from the nearest you can get to a nervous breakdown without actually breaking down — he's just written a book (about micros, of course) in six weeks flat, to be published by W H Allen just before Christmas. To add to his problems, he masochistically wrote it using Cromemco's 'word processing' package. He's still curiously reluctant to let us know the title, though... Here's a thought, from Digital Research's software manager Bob Eichenlaub: 'I sometimes think that some software companies have a whole department working on how to describe bugs in their products as "new features"...' And no, he certainly wasn't talking about MP/M... Also from Digital Research, some ideas on getting round the vexed problem of software theft (known euphemistically as 'piracy'): you can charge a lot for it and package it well so that users regard it as a valuable asset; enclose an official-looking licence to show that you're concerned about theft; and use serial numbers but don't insist on embedding each user's name in the software as this makes selling a drawn-out process. Digital Research also admitted that dealers were among the biggest software thieves. OEMs and distributors tend not to, partly because they've a lot to loose if they're caught stealing software and partly because they're easy to trace. But dealers are less likely to be caught and are the hardest to keep a track of. End users, too, are difficult to monitor and almost impossible to prosecute, but DR seems less worried about them than it does about dealers.

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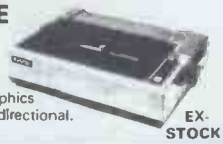

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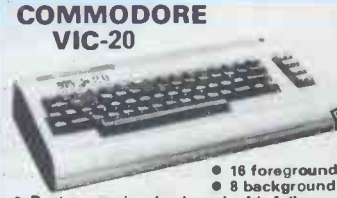

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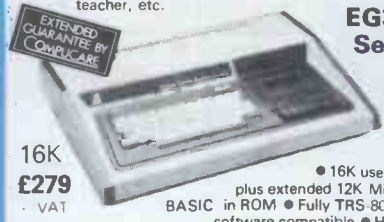

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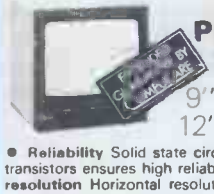

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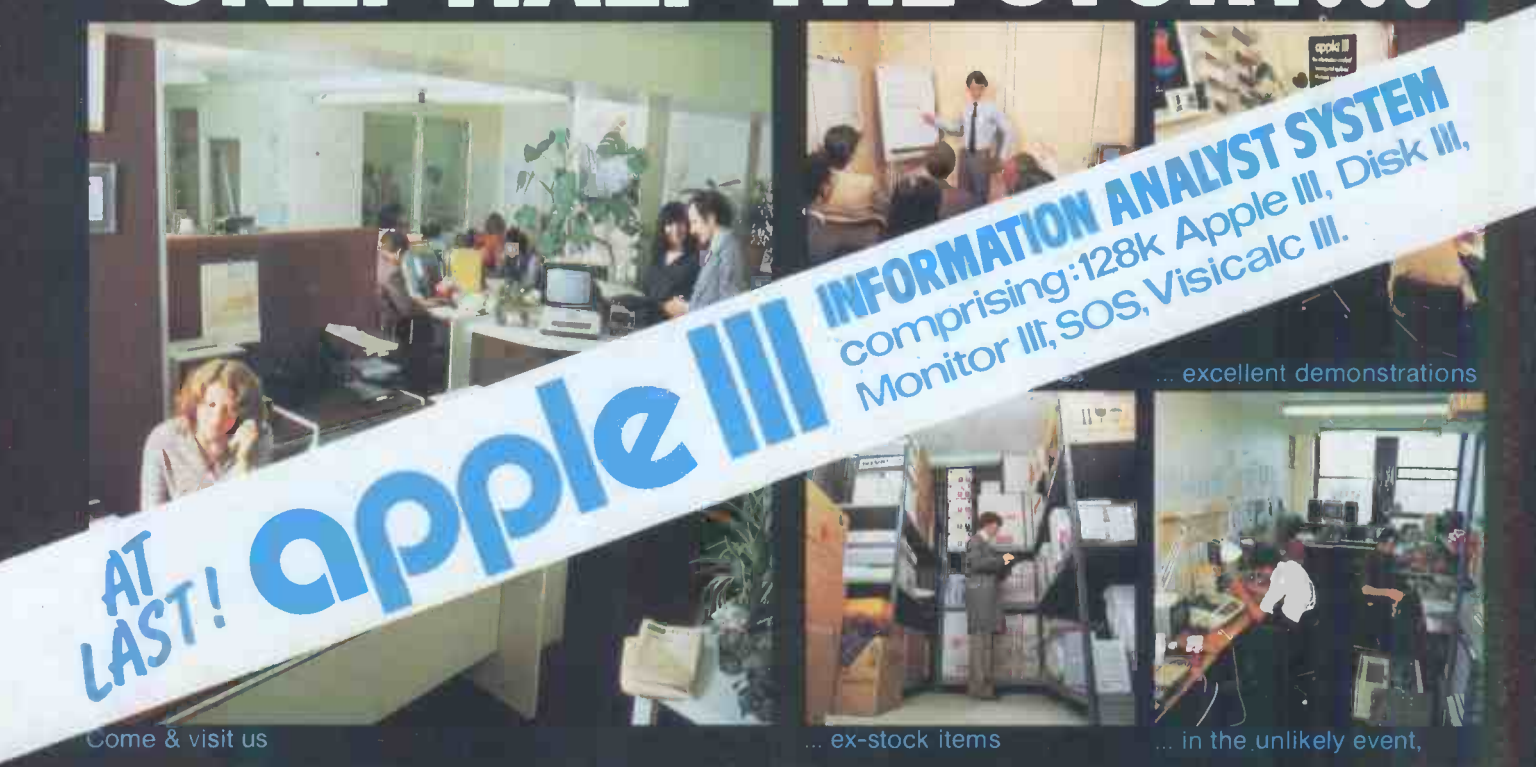

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