

60p

YOUR COMPUTER

AUGUST 1982

Vol.2 No.8

Can you survive ZX Demon's Domain?

Dragon reviewed

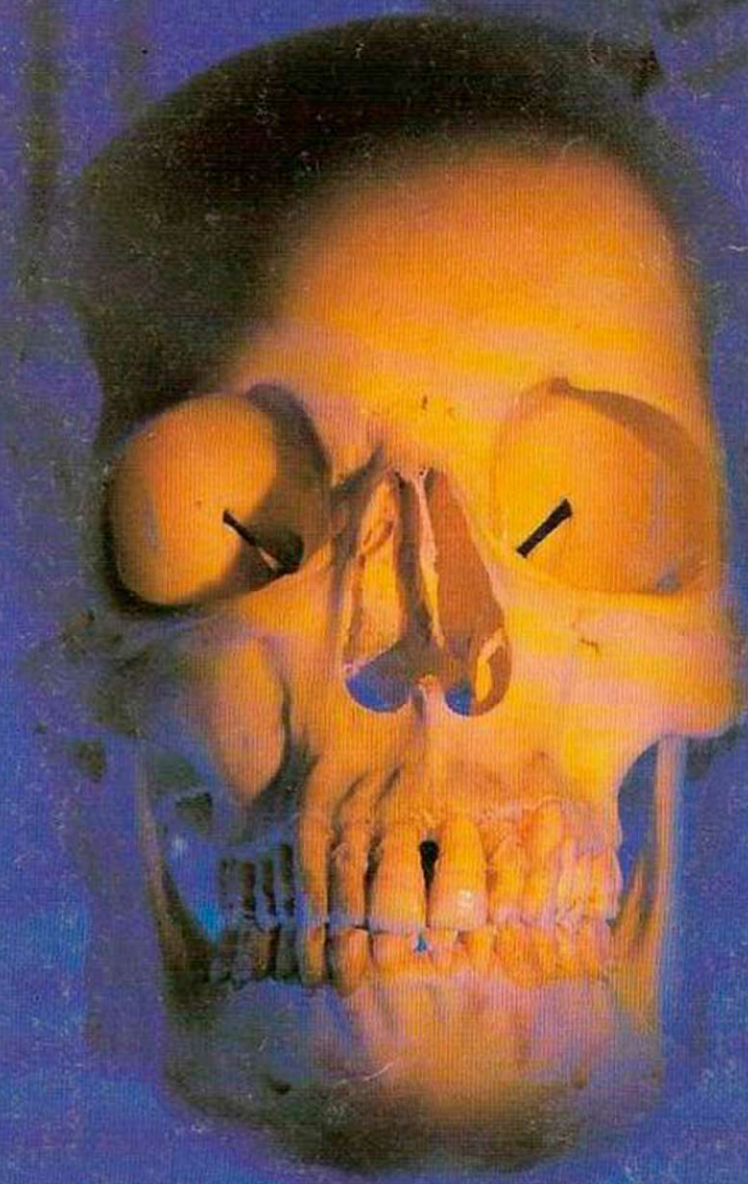
Vic duck shoot

BBC techniques

Spectrum sound

Atom file handling

Ecological modelling



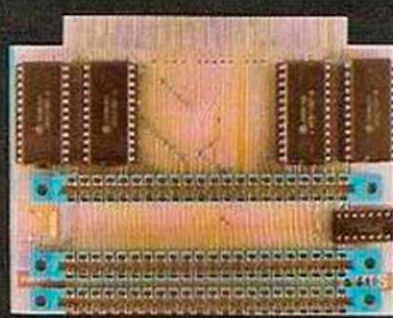
Win a Dragon

MORE MEMORY FOR MICROS!

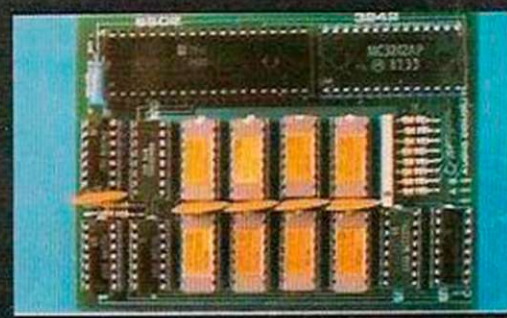
look at what we can offer:



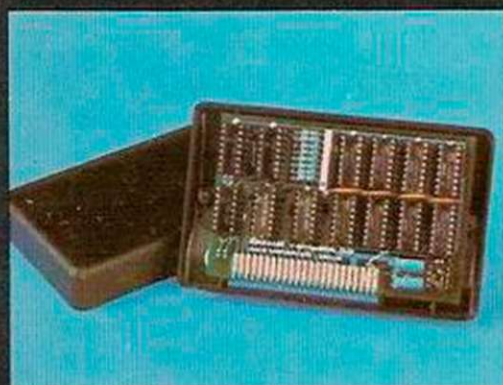
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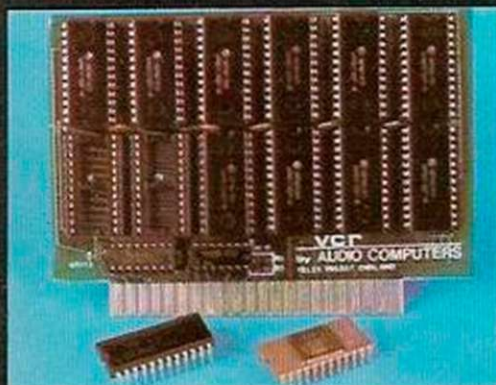


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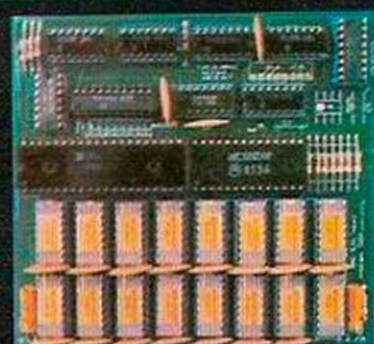
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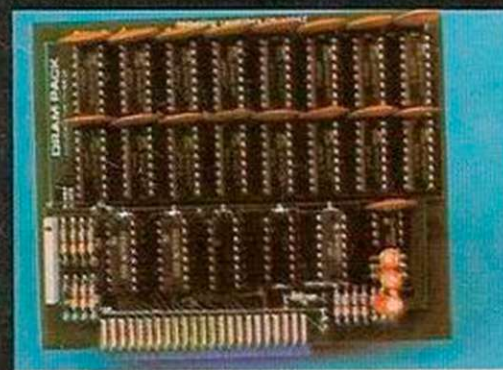


add up to 20k RAM + 16k ROM

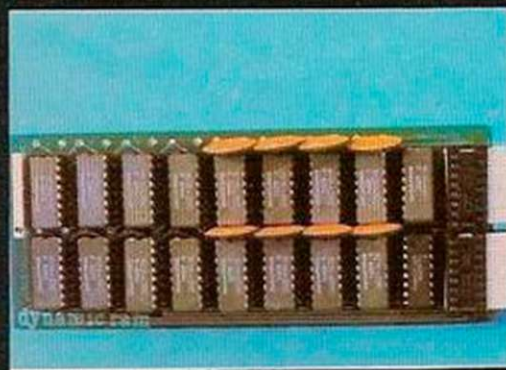
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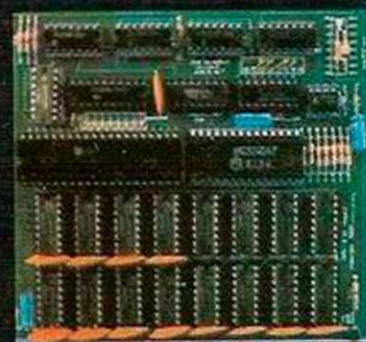
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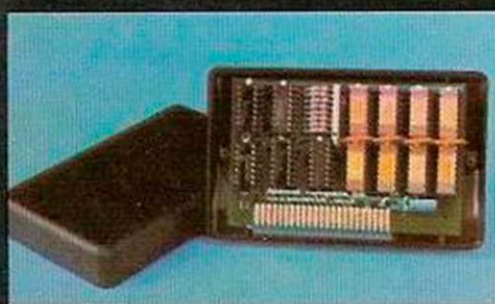
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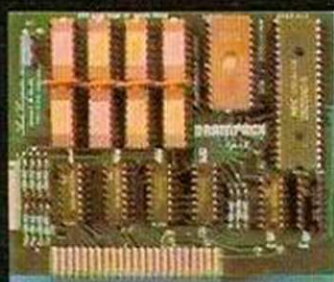
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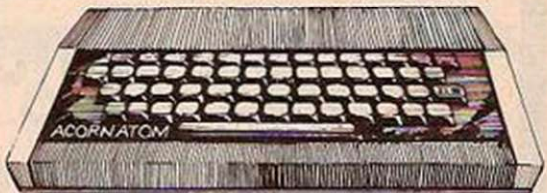
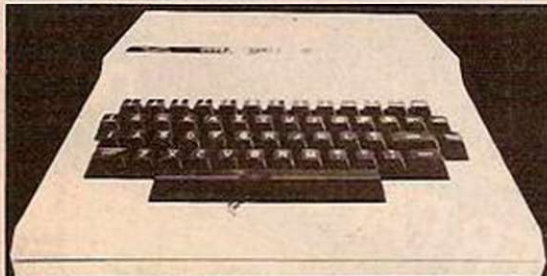
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YOUR COMPUTER

YOUR LETTERS:	13	DEMON'S DOMAIN:	36	ATOM FILE HANDLING:	62
ZX-81 Verify; BBC tips; Pet to Vic.		You must survive ordeals such as the hail of barbs and the crusher if you want to emerge unscathed from Joseph Nicholson's devilish game for the 16K ZX-81.			
NEWS:	14	INTERVIEW:	40	George Byrns presents the software you need to manipulate files in a database.	
New £70 printer; Binatone's £50 colour micro; BATS microdisc; first shots exchanged in £200 price war.		Tony Baden of Bug-Byte reveals how he turned a student hobby into a business which has sold over 500,000 cassette games.		ASIMOV AS DATABASE:	66
COMPUTER CLUB:	17	VIC DUCK SHOOT:	42	How a word-processing system can be adapted to a role as a database controller.	
This month we visit MC ² — Manchester's most energetic micro group.		Safe from irate game-keepers, <i>Your Computer</i> opens the duck-shooting season prematurely with David Prosser's sporting game for the would-be marksman.		RESPONSE FRAME:	69
DRAGON 32:	20	ECOLOGICAL MODELLING:	46	More answers to your technical queries.	
		Ecological relationships such as that between predator and prey can be simulated with William Masefield's program for the ZX-81.		FINGERTIPS:	71
Tim Hartnell evaluates Mettoy's 32K Dragon, a colour micro for just under £200.		BBC TECHNIQUES:	50	Our regular column for calculator enthusiasts.	
VIC MEMORY EXPANSION:	26	User-defined keys and the teletext mode are the subjects we cover this month in two comprehensive articles.		SOFTWARE FILE:	75
Some of the major units that can expand the Vic's insubstantial memory are assessed here by Boris Allan.		ZX-81 MACHINE CODE:	54	This month there are nine full pages of your programs for the ZX-81, Spectrum, BBC Micro, Vic, Atom, Sharp and others.	
SPECTRUM SOUND:	30	Part one of a new series which aims to make machine code accessible to the average Sinclair Basic user.		COMPETITION CORNER:	87
The Spectrum's critics maintain that its sound is only good for annoying bats. Tim Langdell's routines set the record straight.		BASIC TRANSLATIONS:	58	The result of the Golden Nugget puzzle and a new competition for a £15 book token. The Dragon 32 crossword falls between pages 18 and 19.	
		Tony Edwards offers more ideas and hints which open the door to easier translations.			

Cover photograph by Stephen Oliver.

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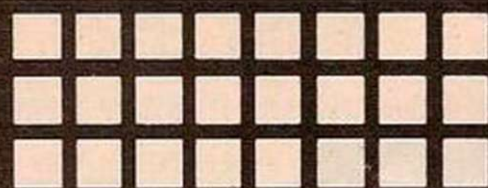
EDITORIAL

IN A CRUEL WORLD where peripherals such as printers and disc drives appeared to be the prerogative of only the big-spender, networking micros together to share such costly resources made sound economic sense. But now that colour micros complete with high-resolution graphics, printers and adequate storage will soon be available for less than £200, a question mark hangs over the future of "the network". Yet for major firms such as Sinclair Research and Acorn, their machines' potential to be networked is still considered important enough to figure prominently in their sales literature. This is obviously intended as an extra enticement, particularly to the educational market where spending cuts make austerity the rule and networking an attractive way round it.

Clearly then, given the recent falls in hardware prices, one might be forgiven for believing that networks are an outmoded idea. In reality, however, they are a good instance of a solution to a problem leading technology down a path it might not otherwise have taken — a path which leads to unexpected benefits as often as it leads to wasted time and money. Local-area networks have been the traditional domain of the low-cost micro. Now communication between more remotely-located machines should become an affordable prospect. An amateur group in Montreal has even formed a network linked by citizens' band radio.

In the States bulletin-board networks are becoming commonplace. With this kind of system you use your machine as a communications medium through which you can send and receive messages from fellow users. Networks will enable home computers to be used for tasks other than purely computing. Cheaper Modems bring in their train less expensive Prestel adaptors which in turn lead us to telesoftware and the advantages of being able to access large and remote databases with a small machine. Sinclair Research, with its sights set firmly on the software market, believes that its proposed £20 Prestel adaptor for the Spectrum will make downloading software directly from a Sinclair database the norm, and software piracy and distribution a thing of the past.

So, even if some of the original economic arguments for networking are no longer valid, there is every reason to assume that it is assured a future on different but equally important grounds.



Cambridge Computer Store

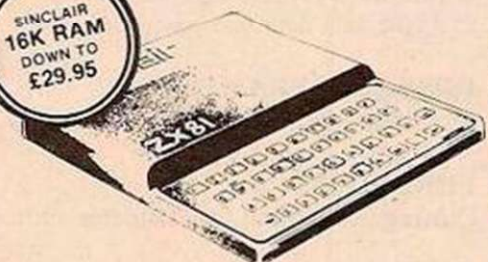
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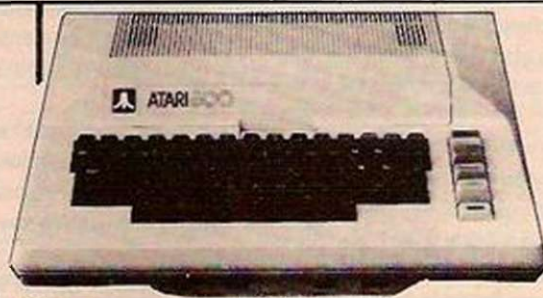
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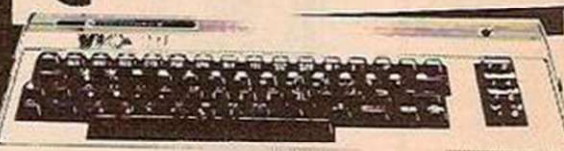
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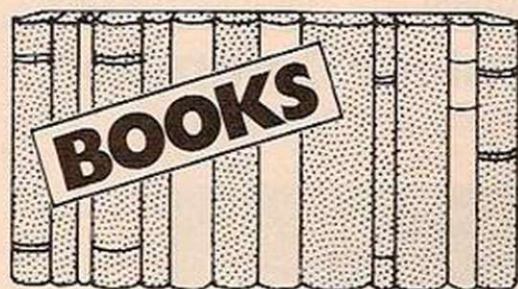
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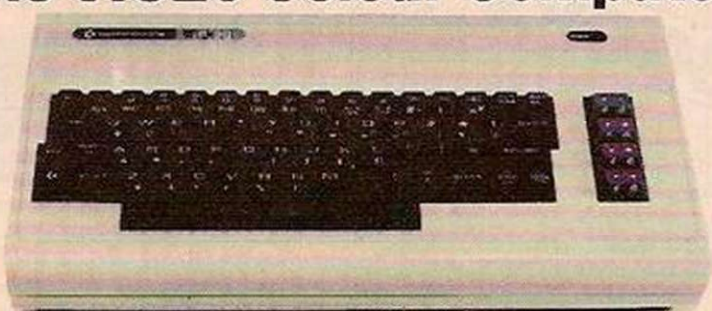
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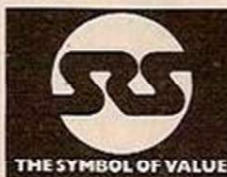
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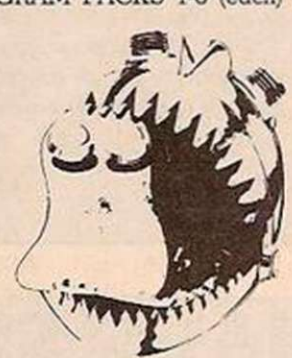
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YOUR LETTERS

FLEXIDISC FAN

Congratulations on your far-seeing flexidisc experiment; I hope we are to see many more. Here are a few notes on my own findings when attempting to Load the program.

First, being flexible, the disc tended to distort and slip on the normal turntable. This gave a variable frequency signal which can cause problems with the internal clock on the computer. This was easily overcome by Cellotaping the flexidisc to a thicker backing and further Cellotaping the assembly to the turntable. The method of transferring disc to tape was then used and immediately problems became apparent with the automatic level control on one type of music centre.

The signal was far too weak on playback and Loading unsuccessful. Changing to a stereo recorder having a VU meter with a range 0 to 6, and experimenting with different levels showed that level 3, i.e., the middle of the range, gave the best results.

A clear undistorted recording on TDK tape loaded successfully and back-up copies on C12 were made immediately utilising the cheap tape recorder normally used with the computer. The game itself is good fun to play and, as yet, unbeaten.

G L Smith,
Slough,
Berkshire.

FAIR PRESS?

As far as I am aware, Eric Deeson has not published the parameters by which he judges software. Perhaps he should include that information with every review. I accept that a large part of his reviews will be an expression of his personal opinion, and that certain elements must be a purely personal view, and cannot be quantified against a given scale, for example, format or screen layout, quality of graphics and novelty.

However, the quality of a pre-recorded tape is one factor which can be more accurately assessed, and I feel that Deeson's approach to this element of his reviews may require some modification. In the May review, Deeson writes: "A tape recorder for £18.50 from G J Henderson... is the Hong Kong-made Duetto, which had the task of loading all the programs for this review...".

In view of the known problems of the compatibility of cassette machines with the ZX-81, is it a fair test of ZX-81 software to use only one cassette machine, and to condemn all of a company's software if a sample fails on that particular machine? The two tapes from my company which he believed to be un-loadable were checked by five independent exhibitors at the ZX Microfair in Manchester and were loaded successfully by them.

Perhaps the quality of the record-

ing on the tape should be evaluated electronically, and if the tape fails to load on one machine, others should be tried.

Surely the main purpose of a software review is to impart information about a program to the buying public, which they would only be able to obtain themselves by buying the product. On this basis, I believe that a reviewer should persevere until he successfully loads a program, and can fulfil his main aim, and if that requires him returning tapes to a supplier for replacement, he should do so.

Martin Ridout,
Picturesque,
West Wickham,
Kent.

NO GUARANTEE

No doubt as in common with many other readers of your magazine, I purchased a full-size keyboard for my ZX-81. I removed the computer board from its casing and fixed it lovingly into my new keyboard. Away I went, fingers dashing all over the keyboard, everything was rosy.

Then one day my ZX-81 developed a fault; not to worry, it was "fully" guaranteed — or so I thought. According to Sinclair Research, I had invalidated my guarantee by opening and removing the computer board from its casing and it would cost me a minimum of £20 to have it repaired.

So to all those who have, or are contemplating purchasing a keyboard, you have or will have thrown away your "fully comprehensive" guarantee.

P J Shaw,
Reading,
Berkshire.

PURE ARTISTRY

The Pure Artistry program by John Marshall, *Your Computer* June, does have one disadvantage. Everywhere the spot goes it draws a line. Using the space bar in conjunction with the arrow keys produces a new set of values for Z and can be used to move the spot without drawing a line, or to erase a line already drawn.

The change makes use of the Reset command to darken the position behind the moving spot. Line 50 is not required. Lines 60, 70, 80 and 110 should be modified to Else 66, 76, 86 and 116 respectively.

The following new lines are required:

```
66 IF Z = 136 THEN 67 ELSE 70
67 Y = Y - 1: GOSUB 200
68 RESET (X, Y + 1): GOTO 30
76 IF Z = 144 THEN 77 ELSE 80
77 Y = Y + 1: GOSUB 200
78 RESET (X, Y - 1): GOTO 30
86 IF Z = 160 THEN 87 ELSE 90
87 X = X - 1: GOSUB 200
88 RESET (X + 1, Y): GOTO 30
116 IF Z = 192 THEN 117 ELSE 120
117 X = X + 1: GOSUB 200
118 RESET (X - 1, Y): GOTO 30
```

```
200 IF X < 0 THEN X = X + 1 ELSE IF
X > 127 THEN X = X - 1
210 IF Y < 0 THEN Y = Y + 1 ELSE IF
Y > 47 THEN Y = Y - 1
220 RETURN
```

The values of Z for diagonal movement are 168, 200, 208 and 176. This can easily be incorporated into the program if required.

K J Maris,
Cotgrave,
Nottingham.

PET TO VIC

Many people will have experienced the frustrating fact that Pet-produced data tapes will load on the Vic but not vice-versa. This can be remedied by the following procedure.

Before loading the program type the following, which is for the standard 5K Vic.

```
POKE 4096,0
POKE 41,16
CLR
```

For a Vic with 16K expansion type:

```
POKE 4608,0
POKE 40,1
POKE 41,18
CLR
```

I can assure you this method works as I have been using it for months without fail.

T Wilson,
Preston,
Lancashire.

BBC TIPS

Here are some discoveries I made using my newly-acquired BBC model A, which are not in the manual.

Peek and Poke are virtually redundant on the BBC Micro except for screen control. To find the character number of a character on the screen use:

```
PRINT ?(HIMEM + X + Y * 40)
```

where X equals the number of columns across and Y the lines down. To Poke the screen with, say, a 2 use:

```
?(HIMEM + X + Y * 40) = ASC "2"
```

Notice the equals sign instead of the usual comma. In Mode 7 (teletext) only a black and white text is apparently available. However, there are in fact six other colours, chunky graphics, double-height and flashing characters. To obtain the colours, you must Print a control character by using

```
PRINT CHR$(X)
```

or

```
VDU X:PRINT;
```

These codes are: 129, red; 130, green; 131, yellow; 132, blue; 133, magenta and 134, cyan. For instance:

```
PRINT CHR$(134); "Mark Stephens"
```

would print the name in cyan. For chunky teletext graphics, add 16 to the colour code that you want. Chunky graphics replace numbers, lower-case letters, and some symbols:

```
PRINT CHR$(150); "55"
```

would print two cyan rectangular graphics. For flashing letters:

```
PRINT CHR$(136);
```

To obtain double-height characters: PRINT CHR\$(141); "Your Computer"; PRINT CHR\$(141); "Your Computer" will print *Your Computer* in double-height characters.

Mark Stephens,
Portsmouth,
Hampshire.

VOYAGER ERRORS

There are two errors in Voyager Views in the July issue on page 82:

```
170 PLOT 6, SIN(RAD(Y + INC))
    X + M, etc
120 FOR X = R * 1.2 TO R * 2.5 STEP
    R * 0.06
```

These faults are by no means obvious, and they stop the program giving meaningful results. Also, how about a bit of colour? For example 50 VDU 19,1,0,0,0,0 110 VDU 19,1,3,0,0,0 will give yellow on a black background.

A S Day,
Fetcham,
Surrey.

TRANSFER CODE

In the June 1982 issue you published a program by Nick Godwin for transferring machine-code from Rem to RAMtop. It seemed to require about 1.5K. This program is 24 bytes long and does the job about 100 times faster. I am assuming that RAMtop has been Poked with 124 — that is, Poke 16389,124.

```
01 LD BC
14,00 Number of bytes to be
transferred
11,00,7D To 32,000 on
21,82,40 From 16514
ED,BO LD1R
C9 RET
```

To reverse the transfer exchange the addresses so

```
11 82 40
21 00 7D
```

John Nilson,
Redhill,
Surrey.

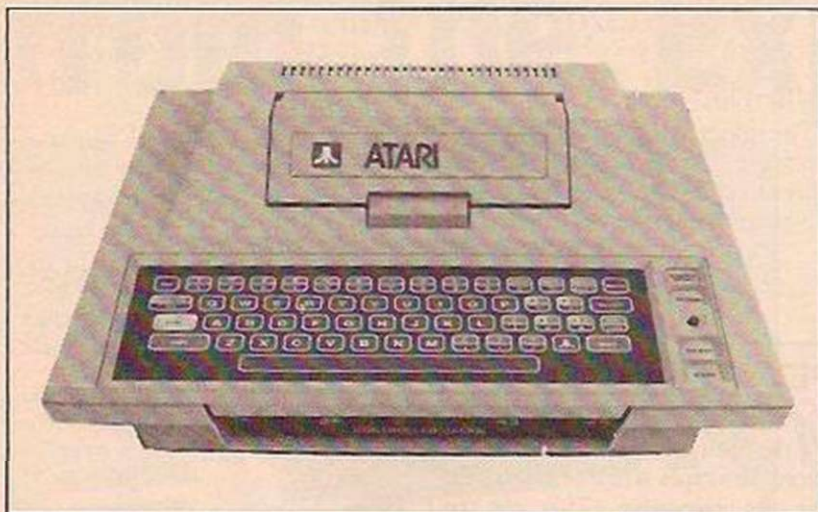
ZX-81 VERIFY

I do not own a Spectrum, but I do verify my programs on my ZX-81. If the Break key is pressed while in the load mode it will either: New, if part of a program is loaded; or Break if the program has loaded or if no program has loaded, giving a report code of 0/0.

Therefore, to verify a program follow this routine:

- Save the program
- Do not press New
- Load the program
- If the loading is completed satisfactorily — 0/0. If the loading failed then either pull out the ear plug then Break, Newline or wait until the screen displays the "I'm looking for a program" picture then Break, Newline. This will result in 0/0 then return the listing — try again.

P Alcock,
Castle Cary,
Somerset. ■



£50 Binatone will offer 16K, colour, sound and keyboard

BINATONE'S new machine may knock the bottom out of the micro market. At £49.95 for typewriter keyboard, 16K RAM, colour and sound it would be formidable enough, but the news that it is to be sold in the High Street through Woolworths, Argos, Rumbelows, as well as by mail order, should frighten Sinclair and that company's rivals.

Binatone is planning to sell 400,000 machines in the first year alone. This has raised fears of a

Japanese takeover of the British market. Binatone will make the machine in Hong Kong using Japanese components. The Binatone will use Tandy TRS-80 software and will be expandable up to 64K.

By January, when the Binatone is launched, at least six new machines will probably have beaten it to the market but Binatone is bound to be a strong contender because of its experience in selling consumer electronics products.

Price war is new game from Texas and Atari

TEXAS INSTRUMENTS and Atari have fired the first missiles of a price war that should make Space Invaders look like a vicar's tea party. Atari's 400 and the Texas TI-99/4A will sell for less than £200 — a saving of £100. With the new Dragon weighing in at the same price, there are now five similar computers —

Fry's software library

LEASING BUSINESS software packages for minis and mainframe computers is not uncommon. Alec Fry intends to emulate the practice, in a small way, with a ZX-81 and Spectrum software library. He means to offer a range of 30 programs for hire at £1 each per three-week period. The range will include games, utility and toolkit programs, all commercially produced and on sale elsewhere.

Several software companies are a little unhappy about the scheme. Apart from the scope it offers for copying programs, the scheme raises the delicate question of copyright. Fry aims to operate a payment system similar to that used by public libraries. The Public Lending Right meant that authors gained a copyright fee on books loaned out. At the rate of a few pence per hire this would be a small sop to any disgruntled software writer.

It is very difficult to ensure program security. Most commercial programs start by disabling break and interrupt keys. But with a degree of expertise it is usually possible to circumvent these and other measures. An American firm is even selling a program called Pick A Lock, which is designed to assist breaking and entry — into software, of course.

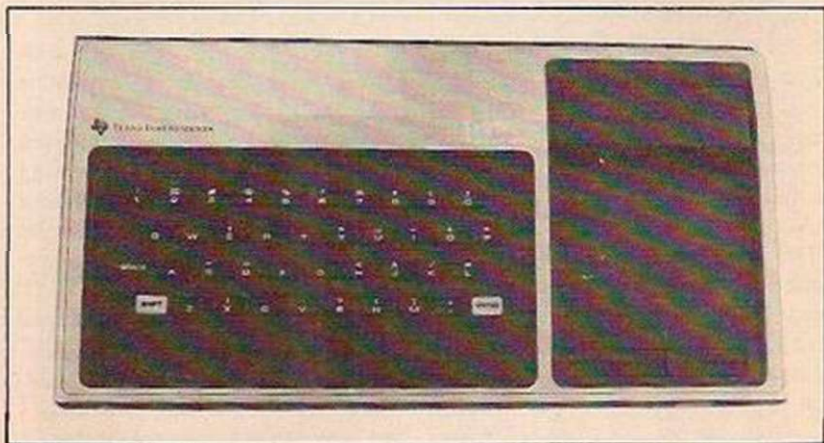
Midlands show

SINCLAIR users in the Midlands will be able to enjoy an exhibition at the Bingley Hall, Birmingham on Saturday, September 11. The new Spectrum will be on show, so if you are still waiting, at least you can see one.

including the Vic-20 and 48K Spectrum — battling for the public's favour. All offer colour and sound.

The Spectrum's strength is its memory, while the Atari and Texas rely on wide ranges of plug-in software cartridges — although the Dragon's ability to use certain Tandy Color Computer cartridges may diminish this advantage.

Ever since the *Your Computer* show where Vic-20s were on sale for £135, rumours have been rife that Commodore will drop its prices before launching new models this autumn.

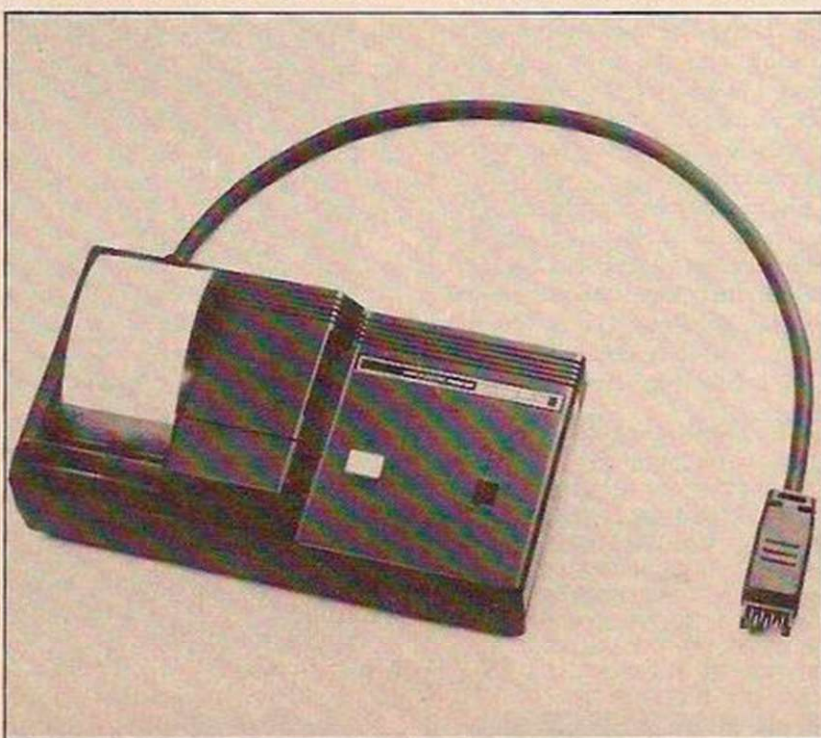


Spectrum is late for school

FIRST THE good news — twice as many Spectrums are now made as are needed to fulfil incoming orders. Now the bad news — the Sinclair claims that the backlog would be cleared and new orders satisfied within four weeks have proved un-

founded. Many who ordered the larger Spectrums have waited eight weeks or more. In addition to the problems with the printed-circuit board, Sinclair's power supply packs have also caused problems on the Spectrum.

Casio has now introduced a printer for pocket computers and its programmable calculators. The FP-10 mini printer is expected to sell for around £50 and is compatible with the FX-702P hand-held computer, the FX-601P and FX-602P calculators. Printout is at a rate of two lines a second, 20 characters a line. Sales enquiries to Casio Electronics Ltd, 1000 North Circular Road, London NW2 7JD. Telephone 01-450 9131.



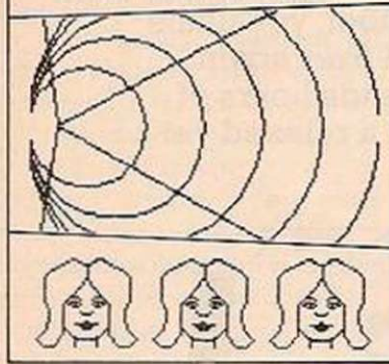
Sinclair Research has had to wait almost as long for the Government to fund schools purchasing the company's computers, as customers have for the delivery of Spectrums. Now the Industry Department have added the Spectrum to its approved list. Previously the Government would only pay half the cost if a secondary school bought a Research Machines 380-Z or a BBC Micro.

Once your Spectrum arrives there will be no shortage of software for it. Many programs — old favourites and new games — have just been launched. Ex-Sinclair engineer Richard Altwasser, interviewed in last month's *Your Computer*, has produced the Cambridge Colour Collection. 20 programs from Lunar Landing to Home Accounts are supplied on a cassette with a free book for £2.95. Available from Richard Altwasser, 22 Foxhollow, Bar Hill, Cambridge CB3 8EP.

Campbell Systems has produced a disassembler for £5.95 from 15 Rous Road, Buckhurst Hill, Essex IG9 6BL. Newsoft will allow you to add a few extra chips to your Spectrum with Roulette for £4.95 from 12 Whitebroom Road, Hemel Hempstead, Hertfordshire. Jega Software can offer Alien Command from 27 Hallcroft Avenue, Countesthorpe, Leicester LE8 3SL. Quicksilver charges £5.95 for QS Space Intruders, available from 92 Northam Road, Southampton SO2 0PB.

Green light for the cut-price Amber printer

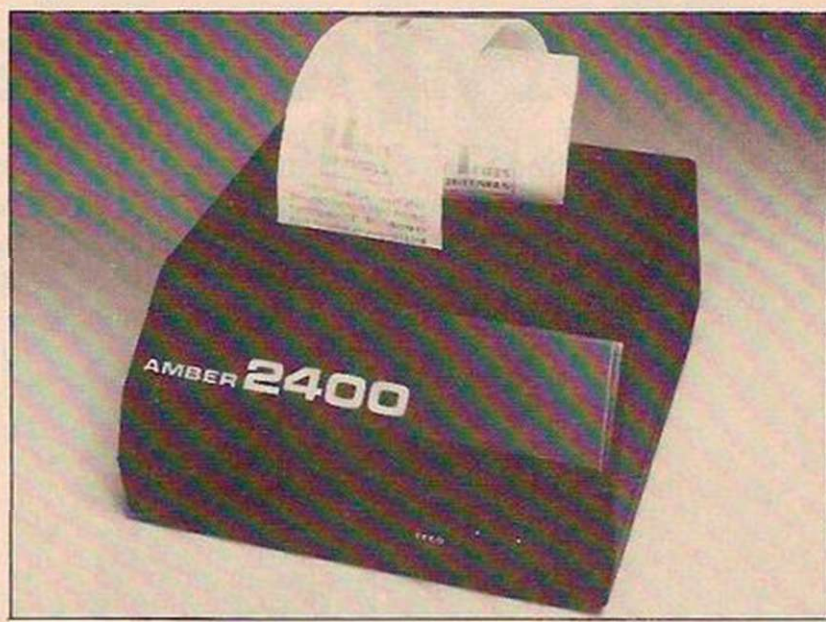
2400 PRINTER
 NORMAL CHARACTER SET
 DOUBLE WIDTH
 DOUBLE HEIGHT
 LARGE CHAR'S
 lower case alphabet



AT LAST, a reasonably-priced printer has appeared for a wide range of personal computers. Amber has produced a dot-matrix printer for £69.95 plus VAT, suitable for the Vic, BBC, Atom and others. The company aims to be able to interface with as many different micros as possible including the ZX-81 and Spectrum, although some will need a separate interface adaptor.

Looking rather like a calculator printer's output, the printout gives 24 characters a line on plain paper. This should prove more economical than Sinclair's thermal paper, while providing better quality print.

The Amber 2400 is supplied by Amber Controls, Central Way, Walworth Industrial Estate, Andover, Hampshire. Telephone 65951.



Maestro's Microdrive is beaten to the mark by Balkan BATS

SINCLAIR'S HOPES that his Microdrive would be the first rapid-access low-cost mass-storage device on the market have been smashed by the Hungarian-built BATS MCD-1.

The hardware for the Sinclair drive is now complete and a planned launch, later this year, just awaits some finishing touches to the operating system. Details of its mechanism remain secret.

In the meantime MCD-1, a micro cassette disc drive supplying 150K of memory, is already available for the Vic-20, Video Genie, TRS-80 and the ZX-81. Although the drive is cheaper than conventional disc drives, the cost of a complete system is far higher than cassette systems.

However, there is no doubt many users will consider the gain in saving and loading speed, as well as memory capacity, a worthwhile return for the extra outlay. Having used a disc it is difficult to muster the patience needed for cassette systems.

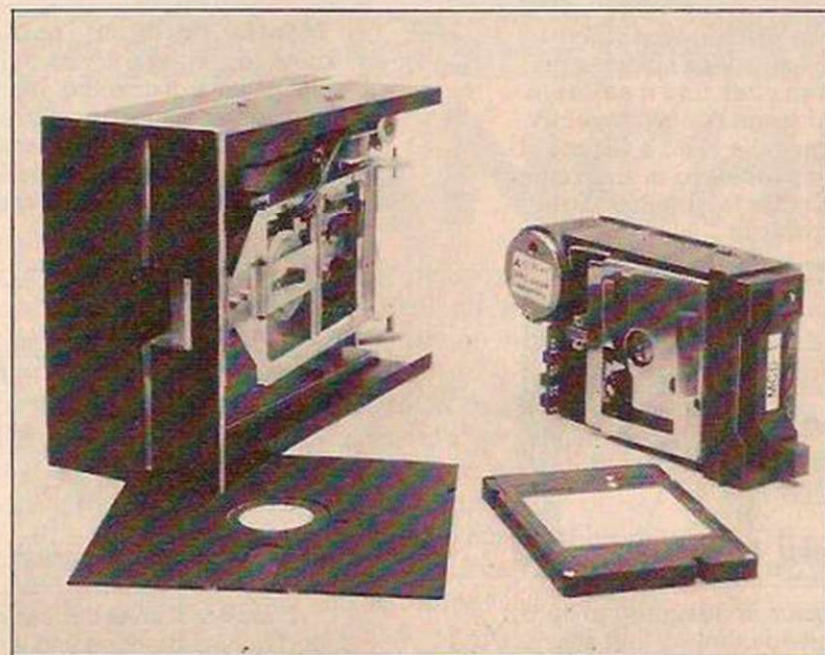
Many software suppliers believe

Audiogenic Vic cartridge

ANOTHER VIC-20 utility cartridge has appeared on the market — Audiogenic's programmer's aid, Buti, offers the usual range of facilities — such as Renumber and Trace — plus two new features.

Buti supplies an extra 3K of memory, hex-to-decimal conversion and a command which reformats the Vic to 3K or 8K memory configurations.

Retailing at £39.99, it is available from Audiogenic Ltd, PO Box 88, Reading, Berkshire or from Vic dealers.



that small discs will eventually replace cassettes as a medium for games.

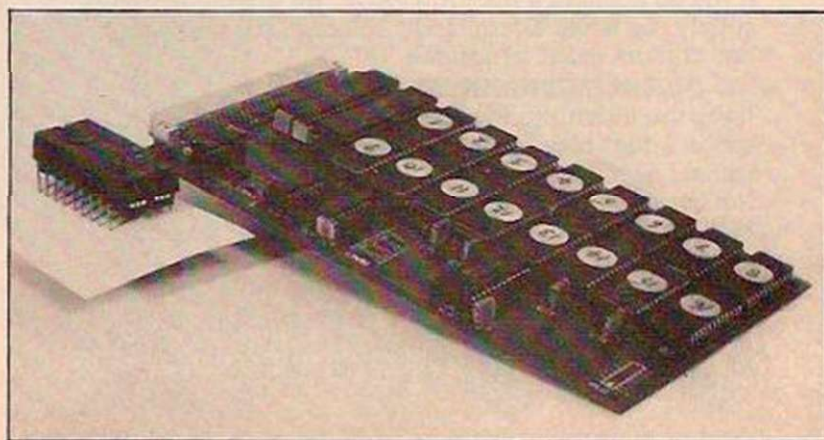
Macronics has beaten Sinclair Research to the post by offering drive and interface for the ZX-81 at £160. The package includes disc drive, interface card with disc-interface programs, an expansion motherboard to permit extra RAM and printer to be attached, connecting leads, and 2K RAM.

The drive, which is notably compact, runs a 3in. floppy disc encased in an audio-type cassette. BATS-NCI, the distributor, claims two advantages for it over other floppy disc drives. It maintains that the disc is better protected by a rigid cassette and the drive motor is said to be more robust.

BATS-NCI, which supplies a drive on its own for £60, can be contacted at 375b Regents Park Road, London N3 1DG. Telephone 01-349 4511. Macronics can be found at 26

Spiers Close, Knowle, Solihull, West Midlands B93 9ES. Telephone Knowle 3693.

Eric, stage left, is examining the Tangerine Users' Group latest add-on for the Microtan 65. The new EPROM storage card will accept 32/64K of 2716 or 2732 EPROMs allowing fast mass data of transfer of stored programs into user RAM. Programs can be accessed manually or automatically under software control. Up to four cards can be banked on the system rack. Available for £38 plus VAT from TUG, 16 Iddesleigh Road, Charminster, Bournemouth, Dorset BH3 7JR. Telephone 0202 294393.



ASK for more education

SOME USERS have criticised much of the available educational software for being insufficiently aware of teaching techniques and requirements. A teacher writing recently complained that there were too many drill-type programs. In response to this kind of criticism, several software companies have developed programs designed by people with classroom experience.

ASK Ltd has assembled an impressive battery of educational experts to design their programs, which are then implemented by programmers. It has released four games with an educational purpose for the Vic-20. Intended for children at primary school level, three of them are engrossing enough for those in other age brackets.

These cassettes cost £8.95 each and are available direct from ASK, London House, 42 Upper Richmond Road West, London SW14 8DD, or selected dealers. Telephone 01-876 0102.

Educational

£8.95
plus 55p p+p

Very Important Cassettes

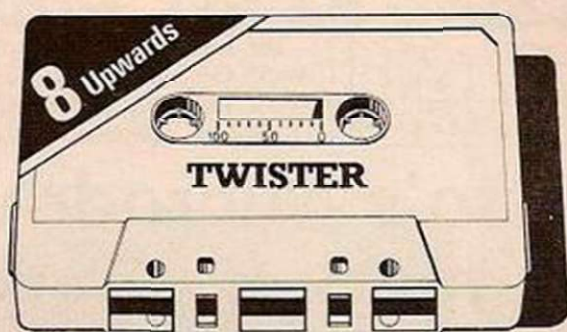
A.S.K. announce the first four programs in a series of educational cassettes for the VIC 20. These programs have been written by a team of teachers and professionally programmed specifically for use in the home.

They are of proven educational value, complementing work done at school, yet all the programs are designed to be fun to use – not just once, but over and over again.

We believe that these programs will give you and your family and friends hours of worthwhile enjoyment. They will help your children to learn at home in a relaxed yet stimulating way.



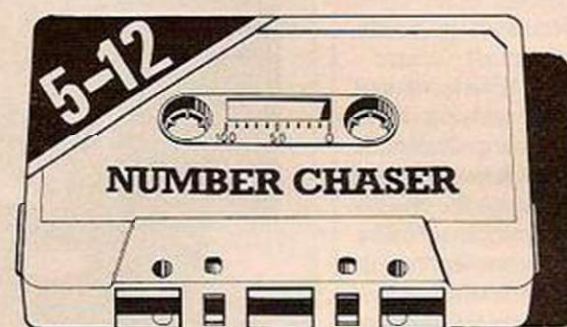
We Want To Count. A program for young children learning to count which involves the numbers 1 to 5. Children often find it easier to recite numbers than to count things correctly. Four different games give the child a variety of objects to count, and are presented in an exciting and stimulating way. Suitable for children aged 3 and upwards.



Twister. A geometric puzzle that will tie you in knots, testing and improving your thinking skills and powers of concentration. The purpose is to rearrange coloured squares so that no row or column contains a repeated colour. Set your own puzzle and test the whole family. Suitable for children aged 8 and upwards.



Facemaker. This program is designed to help improve spelling, expand vocabulary and sharpen observational skills. There are thousands of characterful faces you can make with the program. Perhaps someone you know? Suitable for children aged 5 to 12.



Number Chaser. A car race provides an opportunity to practice and improve estimating and multiplication skills. You can choose the level of difficulty you want making it different every time you play. Suitable for children aged 5 to 12.

Each cassette comes in an attractively labelled box together with a colour booklet which gives detailed loading instructions and tells you how to use the program.

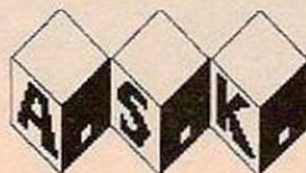
N.B. Because these programs make extensive use of computer memory and colour graphics, a 16K RAM PACK (or 8K RAM PACK for Numberchaser only) and colour T.V. are essential for their operation.

If you do not have a 16K RAM PACK, we will be pleased to supply one at the discounted price of £67.50 with your order for one or more A.S.K. programs.

NO QUIBBLE GUARANTEE

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YC8

COMPUTER CLUB

Computer Club is here to encourage you to start your own local computer club or, if one already exists, to join it and become involved. We would like to hear of anything which has made your club a success, or of any projects or programs you are developing.

Boris Allan discovered a CB freak using a UK 101 in a pub, and a monitor made out of a cardboard box — in true Blue Peter style — when he visited Manchester Computer Club.

MANCHESTER COMPUTER CLUB is so energetic that it has become known as MC². Twice a month the members meet at the University of Manchester Regional Computer Centre. The first Thursday in the month is a lecture, and the third a workshop.

When I arrived at a workshop session, having warned the secretary Dave Wade beforehand, nobody knew anything about my visit — “We’re very informal”.

I told one of the members, “I come from *Your Computer*”, to much merriment. They all thought that his computer was too stupid even to give simple orders.

Machines were scattered all round. Many looked out of the ordinary, particularly the one whose monitor had sides made out of cardboard boxes. Members own everything from ZX-81s to a home-brewed 6809. Advice was plentiful if slightly unhelpful, “Why don’t you buy a decent machine?”.

Ken Horton, a committee member, gave a talk on the possibilities of MC² members linking their computers over the telephone lines. MC² hopes to set up a bulletin board once the members decide how to send information down the telephone line.

After Ken’s talk, Peter Hill put up an idea for an MC² project — implementing a general system to produce adventure games for common microprocessors 6502, Z-80 and 6809. Fortified by general support, Peter went away to develop his ideas and report back to the next workshop.

Club members range from 14-year-olds to pensioners and although some work with computers, usually mainframes, others were



MANCHESTER

building surveyors or newspaper printers. At £5 per year and £2.50 for juniors for 20 meetings, the subscription is reasonably priced.

The meeting adjourned to a local hostelry where, with the landlord’s permission, Peter Fasoli plugged in his Computit UK101. He is a keen citizens’ band user as well as a computer freak and he demonstrated his disc-based record system for keeping track of citizens’ band handles, names and addresses.

MC² is friendly and knowledgeable. If you

live in the Manchester area, and want to find out more, contact Dave Wade, 28 Hazel Road, Altrincham, Cheshire. Telephone: 061 941 2486.

Local news

Blackburn

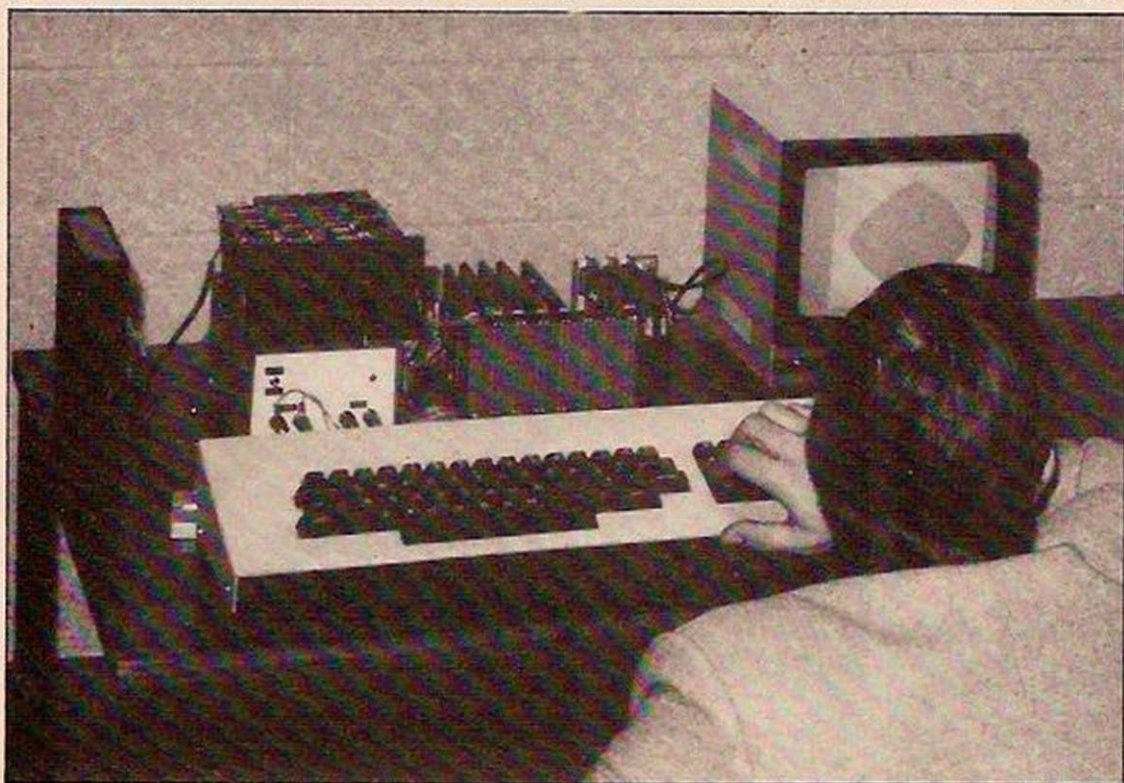
BLACKBURN Computer Club meets on the first Monday of every month. Dave Walsh the secretary is planning a monthly newsletter. More details from Mark Brumler, the membership secretary, Vulcan Hotel, Nab Lane, Blackburn, Lancashire. You can telephone Dave Walsh on 0254-661518 or Mark Brumler on 0254-52431 for venues.


Harlow

HARLOW Advice Centre hosts the Harlow Microcomputer Club every third Tuesday of the month. Bob Robson of 81 Stile Croft, Harlow, Essex will be pleased to send you information about the club. Telephone Harlow 20730.

Fife

FIFE Computer Club relies on its newsletter more than some of the metropolitan clubs do. Members have to travel long distances to attend meetings. Membership is, however, limited to people between the ages of 12 and 20. More details from Murray Simpson on 0334-72485.





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PERSONAL COM

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The recent improvements in the Genie system, including Extended Basic, sound unit and machine language monitor, make it the ideal system for the committed hobbyist, and an excellent and easy-to-use educational tool.

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If the sales hype for the new Dragon 32 is to be believed, it really is magic. Tim Hartnell looks at this new British rival to the Spectrum and rates the real keyboard and 32K RAM as good value for £200, despite flaws in the manual, and in the colour and maths ROMs.



A DRAGON FOR YOUR DUNGEON

METTOY'S NEW plaything may become a strong contender for the title of "most popular micro under £200". British-assembled and designed, around a Tandy Color Computer ROM, the Dragon will sell for slightly less than £200.

If the demand created by advertising can be satisfied Mettoy's High Street distribution should ensure that tens of thousands are sold before Christmas.

Full-size keyboard

For your money you get a fairly large but light-weight unit, with full-size typewriter keyboard. There are sockets for standard joysticks, Centronics parallel printer, ordinary television or a monitor, and a slot for plug-in cartridges. The computer loads and saves on ordinary cassette machines, using a surprisingly reliable interface.

The Dragon, which has 32K of memory, with 26K available to the user, was developed in Cambridge. The memory can be expanded to 64K. Most of the memory is available for the user; it is not consumed supporting the

machine — although each graphic page in the high-resolution modes takes around 1.5K. By contrast, the Vic-20 makes available less than 6K and the BBC model A operating in mode 4 less than 4K.

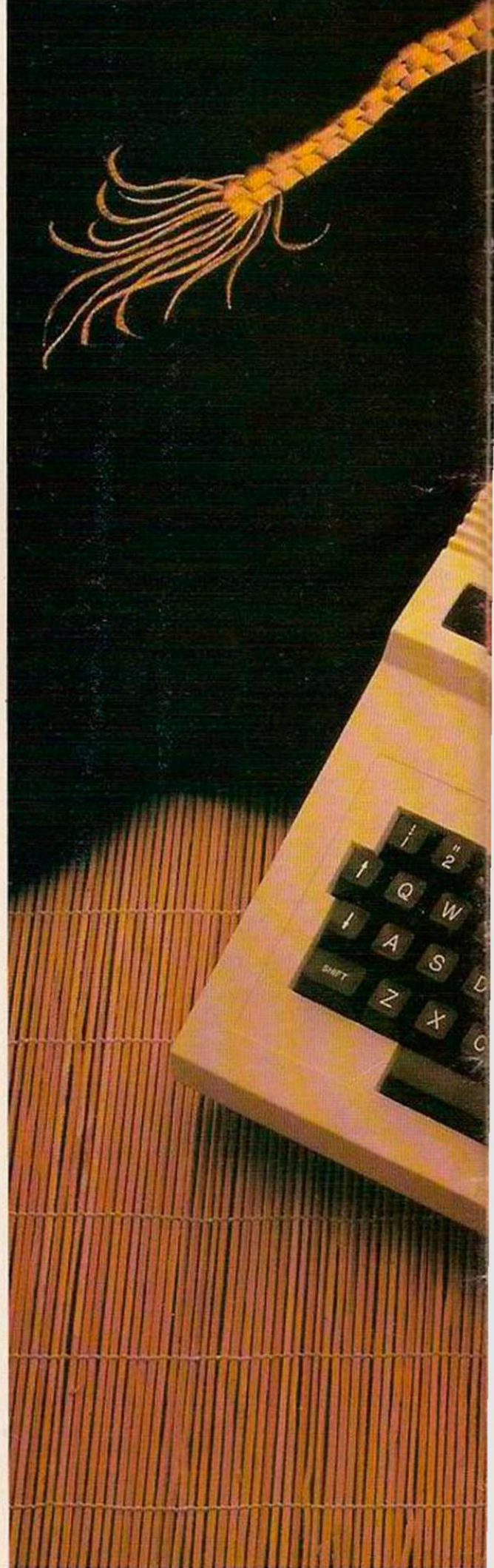
The Dragon offers an extensive colour Basic, with nine-colour display and high-resolution graphics, 256 by 192 in the highest mode, the same as the ZX Spectrum. There is a trade-off between the degree of resolution and the number of colours available. That is, the higher the resolution, the fewer the colours you can put on the screen at once. The Dragon can be used with a standard TV set or monitor and offers 16 rows of 32 characters display, fewer lines, but the same number of characters across, as the ZX-81 and Spectrum.

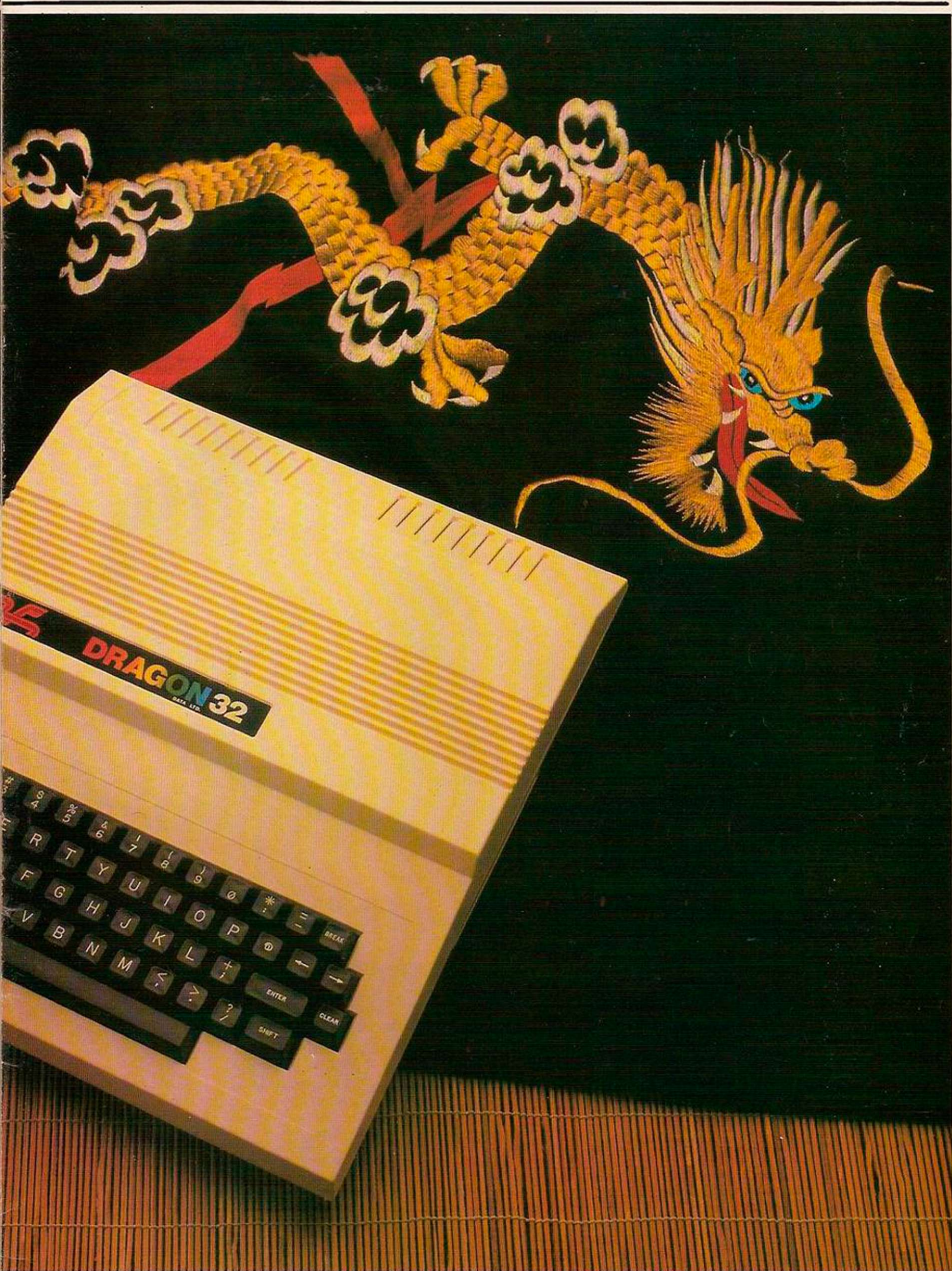
Levels of resolution

A range of preset colour chunky graphics is available. There are five levels of resolution, point-by-point drawing, with point-by-point colour, a feature not available on the Spectrum, with commands to obtain lines,

(continued on page 22)

REVIEW





(continued from page 20)

arcs and circles. There is also a fast-operating paint-in command to produce solid areas of colour.

Sound output is through the TV speaker. The manual claims five octaves, 225 tones, 155 tempos and 31 volume levels. The sound is clear, but the single voice limits its potential applications.

You can turn the cassette player off and on from the computer, which opens up the possibility of running a program which turns the cassette off and on at particular points. This has some good educational possibilities, such as having French words spoken from the tape as they are displayed on the screen.

Dragon did not announce the computer until the production lines were running, in the hope of avoiding supply problems. Dragon Data is offering the machine to almost anyone who will stock it, sidestepping the extraordinary control over retail outlets which other companies have exercised.

Will Dragon ensure that stockists know enough about the machine to help potential buyers, and those with after-sales problems?

The company has already produced software on cartridge, including educational and games packages. Cartridge games include Ghost Attack, a Pacman variant and arcade games such as Berserk, Cosmic Invaders and Meteoroids.

All cartridges cost £19.95, except for Ghost Attack which is £24.95. This software is expensive for a £200 computer. Eight programs could cost you as much as the computer.

Learning element

Games packs on cassette cost £8 each. The Dragon Special Selections are written in Basic whereas the cartridges are in machine code and are designed to be Listed on the screen, so you can follow through a program, to work out how it does what it does — adding an element of learning to straightforward games playing. You can learn how to construct a simple database such as a telephone list, operate a do-it-yourself calculator and try out a metric converter.

Unlike many programs available commercially, the Special Selections are totally transparent, so that you can follow every stage of the program and increase your knowledge of programming as you examine the listing.

Dragon also plans to introduce personal finance programs, and a Compuvoice cassette, that will allow you to add phonetic sounds, so you can make your computer speak with a regional accent if you have the patience to program it to do so. Hardware expansion plans include a disc operating system, a serial RS-232 port, and a major operating system.

The computer promises to be one of the first computers which has been properly marketed in the U.K., supported by software, standard hardware and peripherals and adequate distribution and supply. In many ways, it appears to be what the Vic-20 could have been, if Commodore has not been plagued with production problems, limited user memory and fairly coarse graphics.

Richard Wadman's manual takes the first-time user step by step through Dragon Basic

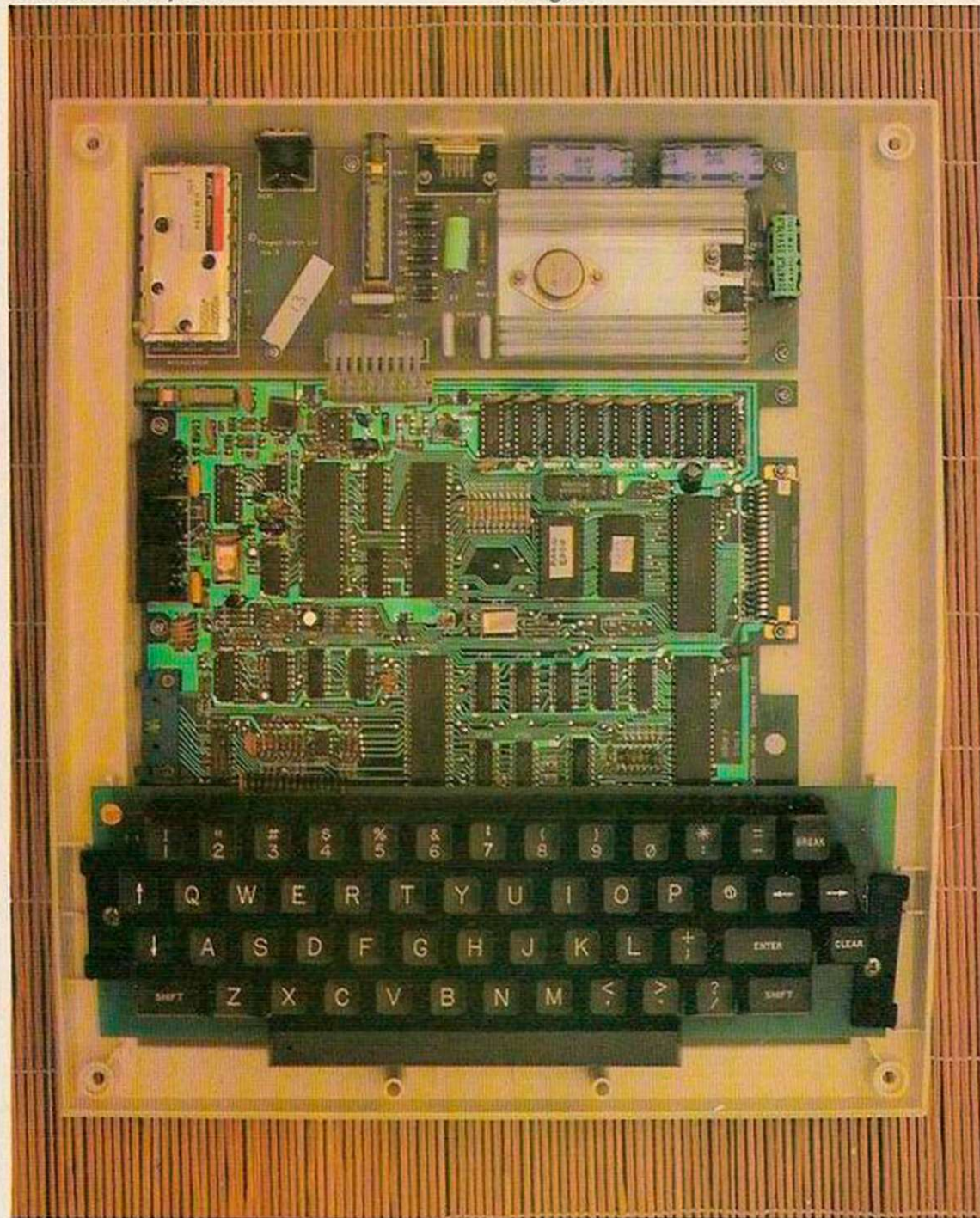
and programming. Unfortunately Wadman launches straight into difficult and boring mathematics.

The moving-graphics section is an improvement on the Spectrum manual. A joystick-controlled, space shoot-out game is listed and explained. However, the manual becomes very difficult to follow when it tries to explain how to use the colour. The trouble stems, in part, from Dragon's Basic. The colour is not particularly easy to use above mode 0, perhaps this is part of the price for buying an old off-the-shelf, ROM.

Dragon may have to rewrite the colour section of the manual to make it clearer.

Some of the graphics routines I tried crashed halfway through. Somehow, I had typed in something which meant the machine refused to enter any mode above mode 2. Dragon Data claimed the routines worked on five other machines. I tried the routines again a few days later, and discovered they ran perfectly.

As I was using a machine with an EPROM, there may have been some subtle error which hopefully will not be present in off-the-shelf Dragons.



CONCLUSIONS

- On a scale of 10, I would give it a seven or eight, with points being earned by the extensive Basic, the real keyboard, standard sockets, and wide availability.
- The Color and Edit commands are a drawback because they are complex and far more fussy than some other machines on the market.
- The manual has too formal an approach to some aspects of computing, and a bewildering method of explaining the colour.
- The maths in the ROM is a little odd, not even holding some powers of two exactly, like 2⁵.
- Software support from the machine's launch suggests an intelligent approach to

marketing, in which satisfying market demand is considered more important than involving the whole of the U.K. in a kind of product debugging exercise.

- The Dragon is more expensive than the Spectrum or Atom but the cost is justified by the keyboard and peripherals.
- The computer offers more memory for the price than any machine on the market other than the ZX Spectrum. The colours, although difficult to use, are good and clear, except for the red which was far from satisfactory.
- The cartridge software is as expensive as the Vic-20's.
- The keyboard, although it feels plasticky, is an enormous improvement over touch-sensitive ones, and at least has a space bar.

You can't get a Home Computer from Texas Instruments under 16 K RAM.

Make the right move into computing with the Home Computer from Texas Instruments. It gives you a large combined RAM/ROM capacity up to 110 K Byte and the ability to expand with a full range of peripherals and software. So as your knowledge of computers increases the TI Home Computer will grow with you.

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The TI-99/4A is a sophisticated computer designed not only for the beginner with its ease of operation, but also for the professional with its vast computing power through a 16 bit microprocessor. And it simply plugs into an ordinary household TV set.



With its high resolution graphics with 32 characters over 24 lines in 16 colours (256 x 192 dots), 3 tones in five octaves plus noise, and BASIC as standard equipment and options such as other programming languages—UCSD-PASCAL, TI-LOGO and ASSEMBLER—and speech synthesis, you'll find that the TI 99/4A more than compares with the competition. Especially when the starting price is around £200. When you want to solve problems there are over 600 software programs available worldwide—including more than 40 on easy-to-use Solid State Software® Modules.

After all, from the inventors of the microprocessor, integrated circuit and microcomputer, it's only natural to expect high technology at a realistic price.



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Don't let its size fool you.
If anything NewBrain is like the Tardis.

It may look small on the outside, but inside there's an awful lot going on.

It's got the kind of features you'd expect from one of the really big business micros, but at a price of under £200 excluding VAT it won't give you any sleepless nights.

However, let the facts speak for themselves.

You get what you don't pay for.

NewBrain comes with 24K ROM and 32K RAM, most competitors expect you to make do with 16K RAM.

What's more you can expand all the way up to 2 Mbytes, a figure that wouldn't look out of place on a machine costing ten times as much.

We've also given you the choice of 256, 320, 512 and 640 x 250 screen resolution, whereas most only offer a maximum of 256 x 192.

Big enough for your business.

Although NewBrain is as easy as ABC to use (and child's-play to learn to use) this doesn't mean it's a toy.

Far from it.

It comes with ENHANCED ANSI BASIC, which should give you plenty to get your teeth into.

And it'll also take CP/M® so it speaks the same language as all the big business micros, and feels perfectly at home with their software.

**NO OTHER MICRO
HAS THIS MUCH
POWER
IN THIS MUCH
SIZE
FOR THIS MUCH
MONEY.**



So as a business machine it really comes into its own.

The video allows 40 or 80 characters per line with 25 or 30 lines per page, giving a very professional 2000 or 2400 characters display in all on TV and/or monitor. And the keyboard is full-sized so even if you're all fingers and thumbs you'll still be able to get to grips with NewBrain's excellent editing capabilities.

When it comes to business graphics, things couldn't be easier. With software capabilities that can handle graphs, charts and computer drawings you'll soon be up to things that used to be strictly for the big league.

Answers a growing need.

Although NewBrain, with its optional onboard display, is a truly portable micro, that doesn't stop it becoming the basis of a very powerful system.

The Store Expansion Modules come in packages containing 64K, 128K, 256K or 512K of RAM. So, hook up four of the 512K modules to your machine and you've got 2 Mbytes to play with. Another feature that'll come as a surprise are the two onboard V24 interfaces.

With the aid of the multiple V24 module this allows you to run up to 32 machines at once, all on the same peripherals, saving you a fortune on extras.

The range of peripherals on offer include dot matrix and daisy wheel printers, 9", 12" and 24" monitors plus 5 1/2" floppy disk drives (100 Kbytes and 1 Mbyte) and 5 1/4" Winchester drive (6-18 Mbytes).

As we said, this isn't a toy.

It doesn't stop here.

Here are a couple of extras that deserve a special mention.

The first, the Battery Module, means you won't be tied to a 13 amp socket. And, even more importantly, it means you don't have to worry about mains fluctuations wreaking havoc with your programs.

The ROM buffer module gives you a freedom of another sort.

Freedom to expand in a big way. It gives you additional ROM slots, for system software upgrades such as the Z80 Assembler and COMAL, 2 additional V24 ports, analogue ports and parallel ports.

From now on the sky's the limit.

Software that's hard to beat.

A lot of features you'd expect to find on software are actually built into NewBrain so you don't need to worry about screen editing, maths, BASIC and graphics.

However, if you're feeling practical you can always tackle household management, statistics and educational packages. And because NewBrain isn't all work and no play, there's the usual range of mind-bending games to while away spare time.

Waste no more time.

To get hold of NewBrain you need go no further than the coupon at the bottom of the page.

With your order we'll include a hefty instruction manual so you'll know where to start, and a list of peripherals, expansion modules, and software so you'll know where to go next.

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	Printer	£466.00	
	Monitor 12"	£142.50	
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NEWBRAIN VC8

SURVEY

VIC EX

Expand that tiny memory and you could take advantage of all the Vic's good features. Boris Allan examines some of the leading manufacturers' memory extension boards and cartridges for the Vic-20.

THE FIRST question we asked when reviewing the Vic-20 memory-expansion units was, "How good is the idea?", and we judged that probably the best ideas were to be found in the Stack products — 3K memory and Storeboard. By their very nature, when cartridges are plugged into a socket, that is the end — nothing can be added. Both the Stack 3K RAM unit and the Storeboard have sockets at the rear to enable the user to add further accessories — in a similar manner to many of the ZX-81 add-ons.

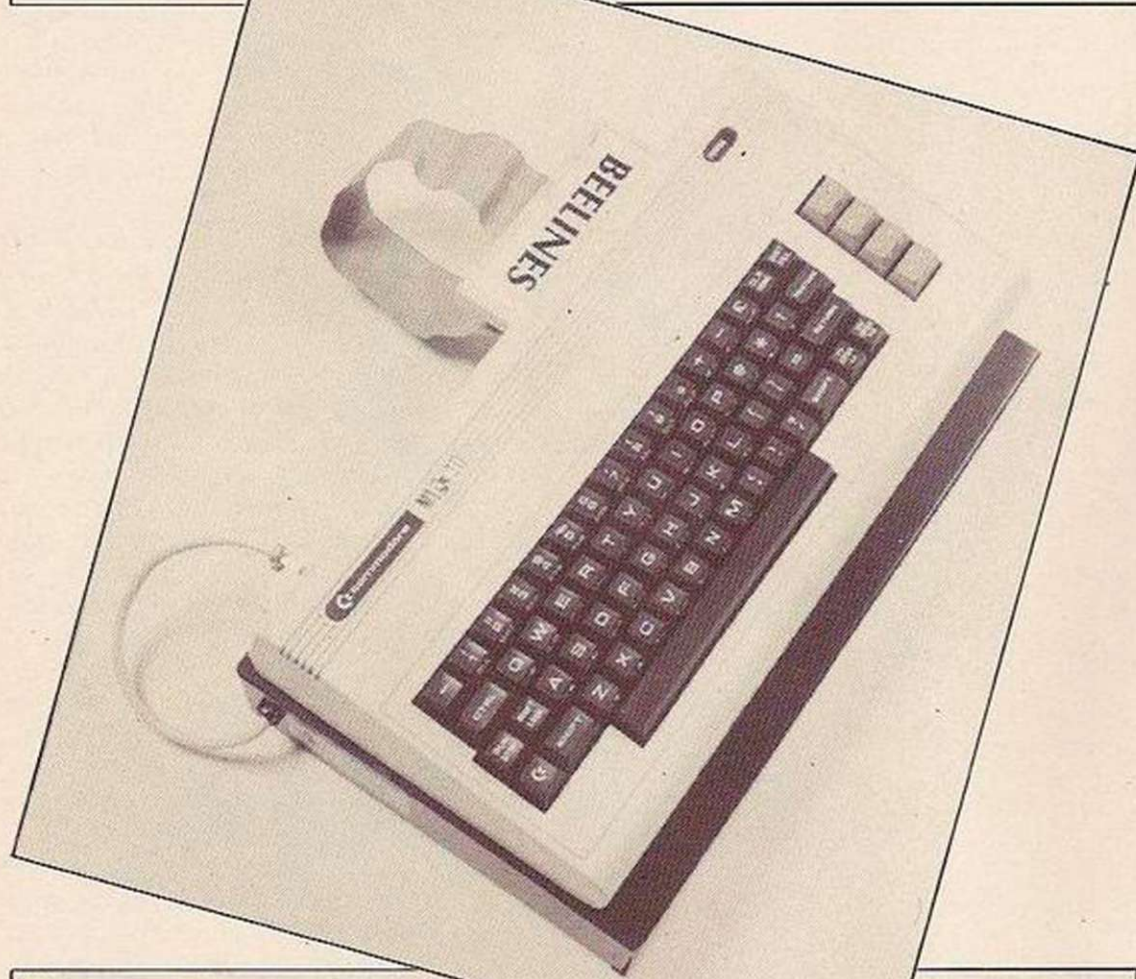
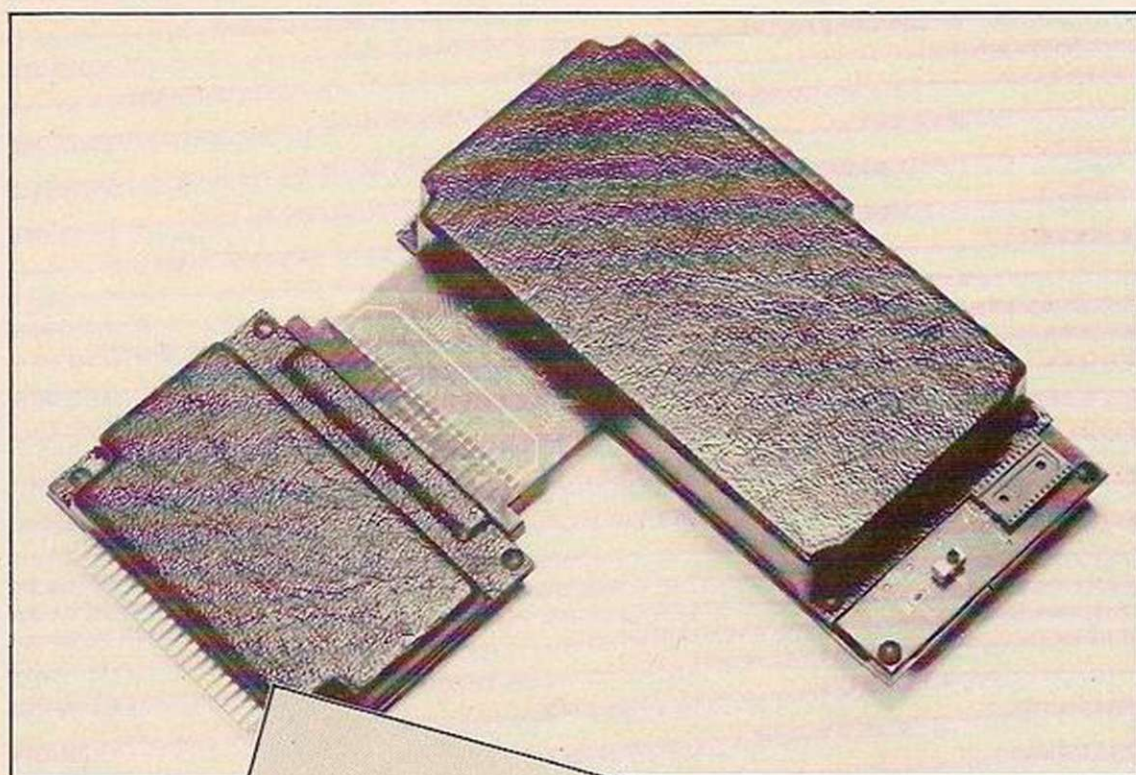
The quality of the conception behind the cartridges from Commodore and that from Arfon was not brilliant, but adequate. The Arfon expansion unit was large and not cleverly conceived. The Beelines Beebox, because of its design, tended to obscure the television if the television and the Beebox were on the same level. Generally, a set of staid products which are far from the forefront of design.

Ideas in practice

One can have a clever idea, and carry it out badly; equally one can have an ordinary idea, and execute it extremely well. The Stack products were clever ideas which suffered in practice. For example, there was not sufficient rigidity in the connection to the cartridge slot. The Stack Storeboard had a further complication, in that, though designed to take an extra 24K which is plugged into the board by the user, we were unable to open the case. Though it must be possible to open the Stack unit, our failure bodes ill for the ordinary user.

The Stack units seemed to be well constructed, and the printed-circuit boards seemed to be well prepared, but — on a personal note — we did not like the black leatherette covering of the Stack units.

The Arfon expansion unit needed little examination to reveal that it was solidly constructed — the case seemed to weigh a ton. It was here troubles started: we had been supplied with a case into which the Vic-20 is eased and the rear cartridge port has to engage with a well-produced printed-circuit board. So far, so good — even if a little tight — and then we realised that the case needed a lid on which the television should sit; an "optional" extra it would appear. Without it we were unsure where to put the TV. A well-made, if incomplete, piece of equipment. The Arfon cartridge



EXPANSION UNITS

Pictured together: Vic-20 in Arfon expansion; Commodore cartridges resting on Beebox; and Stack boards. Below, inside the Beebox. Top left, Stack; middle, Vic on Beebox; bottom, Commodore cartridges.



unfortunate for a device which is to add to convenience of use. To fit the Vic-20 into the unit was an awkward business as was arranging the cassette lead. To change the cartridge one either had to remove the television and lid, or not use the lid. It is not possible to address the slots by name, which is a pity, especially as it seems part of the design philosophy.

The Beebox worked as an expanded Vic-20, but did not work as a Prestel graphics machine. That is, a machine which uses Prestel graphics, but is not, as yet, connected to the Prestel system. Plugging the TV into the We could obtain nothing but snow on our screen when we tried the other variant.

Prestel graphics

The Prestel system worked fine on Beeline's monitor, but not on the television, even though standard Vic-20 graphics on the Beebox worked perfectly. Programming the new machine was not like programming the Vic-20, because none of the standard Vic characters were available, everything was in lower case, and shortened commands such as Pr had to be typed pR. When in Prestel mode the sound generator was unavailable, and so the Vic-20 was silent.

While trying to make the Beebox work, we went through the documentation carefully, and like much documentation it left a good deal to the imagination. The *Beebox-40 User Manual* has been produced — it appears — by a word processor, and so instead of proper diagrams there are pretend diagrams. A pretend diagram is one which is not drawn, but uses dashes, colons, and stars, to indicate lines. The use of such diagrams means it is more difficult for the reader to understand. We did not find the manual very useful, and would have liked at least one circuit diagram.

The Arfon documentation was better, without being fantastic — at least it had a diagram. The Stack documentation was interesting. It had a demonstration program, and more spelling mistakes than any other but it was still not enough — no circuit diagram, for example. The cartridges had no explanations, except for the one from Arfon — but none was really needed.

Though most people do not want circuit diagrams with the increasing sophistication of the ordinary user, more people soon will.

The final question must be, "Does the product do what is promised? What is promised?" For all cartridges we can say "yes". The Stack low-cost 3K RAM depends on what you consider to be low cost, and we felt that the advertising of the Storeboard

(continued on next page)

— the expansion unit has seven slots for such cartridges — seemed to be equally well constructed, as did the Commodore cartridges.

The Beelines Beebox is supposed to do two jobs: it increases the capacity of the Vic-20 and also it provides a 40-column facility with Prestel graphics. The Beebox is a black box slightly wider and deeper than the Vic-20, and about 2in. to 2.5in. high. The Vic-20 is supposed to sit on top of the box. Unfortunately, there is no provision for raising the TV, so the Vic and box obscure the television picture.

A connector is plugged into the Vic

cartridge port, and another connector is plugged into the user port: the television connection is either plugged into the box for Prestel graphics or into the Vic-20, with adjustment of memory switches for the expanded Vic with Vic graphics.

Cartridge connections

The cartridge connector on the Beebox seemed a poor piece of work: there were spaces in the top of the cartridge connector covered by a piece of wide plastic tape, which one could easily break accidentally. The metal teeth did not extend to the edge of the connector.

All the Commodore cartridges worked perfectly well, as did the Arfon cartridge and the Stack 3K memory but, as noted, we could not open the Stack Storeboard.

Our problems with the Arfon expansion unit were to do with inconvenience, which was

(continued from previous page)

might be misleading. In the advertisement it is claimed that you can power up the Vic-20 to a massive 32K, for "only £49", but beneath the price you read in smaller type "(plus VAT) for 3K". So you find you have to add 24K RAM yourself, and pay for it. I do not like such a hard sell of decent equipment.

The Arfon expansion unit is commonly pictured with a TV sitting atop, with the optional lid in use. This is not fair, because it is not the standard unit, and can easily confuse.

Beelines claims that the Beebox makes you "the owner of a pint that thinks it's a quart",

but later the company has a disclaimer which says that "no claim is made concerning the reliability of this product. Beelines . . . cannot assume liability or responsibility for any loss or damage arising from the use of this product . . ." The Sale of Goods Act might have something to say about such disclaimers, so do not be fooled — if a product is not reliable, it is not fit for the purpose for which it was sold, and you still have your rights in common law.

CONCLUSIONS

Remember how much each of these goodies costs, and compare its cost to the cost of a Vic-20 when you are

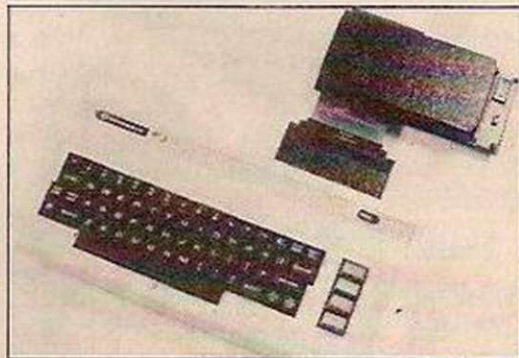
making your decision to buy.

Buy any of the cartridges, but you will not be able to expand without the cartridge possibly becoming redundant. The Stack products though insubstantial, are not too highly priced — note that I did not say "cheap".

The Arfon Expansion Unit is substantial, well-made, but expensive, and it is not as convenient as it might be — especially without the optional lid.

The Beelines' 40 characters are available only in Prestel mode.

Company	Units reviewed	Cost	Address
Arfon Electronics	Vic-20 Expansion Unit 3K RAM Cartridge	£85 plus VAT £26.04 plus VAT	Cibyn Industrial Estate, Caernarfon, Gwynedd. Tel: 0286 5005
Beelines	Beebox-40	£253 including VAT	Beelines Bolton Ltd, 124 Newport Street, Bolton BL3 6AB Tel: 0204 385299
Commodore	3K RAM Cartridge 8K RAM Cartridge 16K RAM Cartridge	£29.95 £44.95 £74.95	Commodore, Baker Street, High Wycombe, Bucks. Tel: Slough 79292
Stack Computing	Low Cost 3K Memory Storeboard	£25.99 £49.	Stack Computing, 290-298 Derby Road, Bootle, Merseyside Tel: 051 933 5511



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Last month Tim Hartnell majored on the Spectrum's graphic and colour capabilities. Now Tim Langdell tackles its sound facilities and develops further the colour theme.

LIKE THE ZX-81, the Spectrum was built down to a price and not up to a specification. This meant that Sinclair Research tried to assess how much you and I would be willing to pay for a micro with colour, sound and high-resolution graphics, and designed the Spectrum accordingly. It quickly becomes apparent when you explore your Spectrum's facilities that, to give you reasonable colour and graphics for the money, Sinclair Research seems to have skimmed on the sound capabilities. In fact, its sound is poor.

To produce sounds on the Spectrum you use an aptly-named command called Beep. This command is followed by two numbers, the first of which is the duration of the note in seconds, and the second the pitch of the note in semitones above middle-C. Thus,

BEEP 1, 0

sounds middle-C for a second,

BEEP 1, 1

sounds C-sharp for a second, and so on. The note can be from about 0.00125 seconds — any shorter and it is not audible — to around 10 seconds.

To be more accurate, notes from around 60 semitones below middle-C, which is the lowest pitch, to about 50 above can be up to 10 seconds long. From there upwards, the note has to be shorter, until at the maximum pitch of 69 semitones above middle-C the maximum duration is about four seconds.

The problem is, though, that the sound is extremely quiet. Even in a silent room it can be difficult to hear anything much higher or lower than the middle-C. The highest notes are virtually inaudible and perhaps this had led to the criticism that the Spectrum can produce pitches so high that they are only useful for annoying bats.

In fact the top pitch is about 13,300 Hz, or five and three-quarter octaves above middle-C. This is almost two octaves above the range of a piano but still, in theory, well within most people's hearing range. Certainly my bat is not at all bothered by the highest notes.

The very low volume must be considered a design fault and I hope Sinclair Research is already preparing a modification for future Spectrums.

The only way to make the sound louder is to take an output via either the microphone or ear socket at the rear of the Spectrum and feed this signal into the microphone socket of your hi-fi amplifier, or into a similar input of whatever amplifier you might have.

The signal from the ear socket is a little stronger than from the microphone socket. I found that the signal is reasonably strong and easily overloaded the input of my cassette player. Connecting it up to my hi-fi's microphone socket worked better because my Yamaha amplifier comes equipped with a volume control on its microphone input. By doing this I could obtain considerably louder sounds which were much richer in quality

than the sound coming from the Spectrum's own speaker.

The quality of sound varies a great deal, though, across the pitch range. The lowest notes sound like a series of clicks rather than music, and the highest ones tend to warble. Of about 10 octaves available, only about half are really usable for music — but that is not bad for a simple sound device such as this.

My main worry was that it was far from convenient to always position my TV, Spectrum and equipment near my hi-fi. It was also a major nuisance having to plug and unplug the cassette recorder whenever I wanted to load a program, or save one on to tape.

Enough of the criticisms — what can you do with the Beep command? Of course, it is possible to program simple tunes with it. The Spectrum manual suggests that you draw out staves and bar lines for music and having written your tune, you can make a note of the numbers which correspond to each note's pitch and duration. Yet that is not easy and

```

1 REM Composer © Tim Langdell
2 DIM d(50): DIM n(50)
3 LET r=0: LET u=1
4 BORDER 5: PAPER 1: INK 9: C
LS
10 PRINT "Enter your music by
    putting the note first and
    then its duration."
15 PRINT "You have two octaves
    starting at middle C. Enter
    C to G for the lower octave,
    c to g, is the higher one."
16 PRINT "You put it all in
    one line! (eg: c1e1f1d1)"
17 REM Duration 1 is one beat,
    2 is two beats, etc.
20 INPUT a$
30 FOR s=1 TO LEN a$ STEP 2
31 IF CODE a$(s) < 97 THEN GO TO
1000
32 IF a$(s) = "e" THEN LET r = 1
33 IF a$(s) = "f" THEN LET r = 1
34 IF a$(s) = "a" THEN LET r = - .5
35 IF a$(s) = "d" THEN LET r = .5
36 IF a$(s) = "g" THEN LET r = 1.5
    
```

presumes, perhaps wrongly, that you know something about writing music in notation.

How much better it would be if you could just play the Spectrum like an organ, or type in notes as letters rather than complex Beep commands. The listings in programs 1 and 2 allow you to do these two things. The first program simply uses the Inkey\$ command to read the keyboard. If you press key T it plays middle-C, key Y is a tone up, and so on. I leave you to improve the program's elegance and

SPECTRUM

```

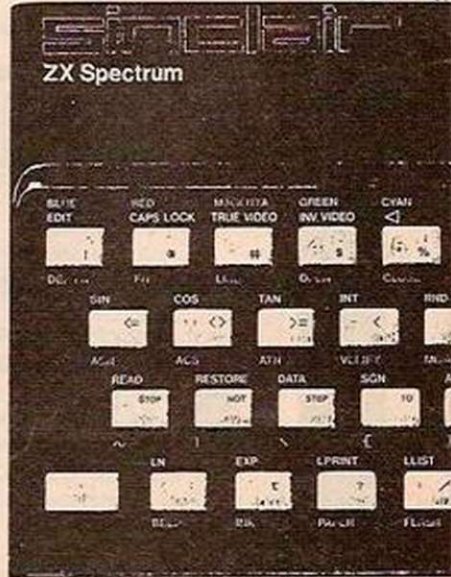
1 REM ORGAN: © Tim Langdell
2 BORDER 1: PAPER 4: INVERSE
1: CLS
3 PRINT "Chose one of three o
    ctaves; type 'a' to have middle
    C on the T key, 'u' for an oct
    ave higher, and 'd' for one lowe
    r."
4 INPUT q$: IF q$ = "a" THEN LE
T k=0
5 IF q$ = "u" THEN LET k = 12
6 IF q$ = "d" THEN LET k = -12
7 CLS
8 INPUT "Want vibrato?"; v$
9 IF v$ = "y" THEN GO TO 11
10 LET x = 0.3: GO TO 15
11 LET x = 0.03
15 PRINT: PAPER 0: INK 6: AT 3
4: "0": AT 3: "6": "H": AT 3: "8": "E": AT
3: "10": "R": AT 3: "12": "T": AT 3: "14": "Y":
AT 3: "16": "U": AT 3: "18": "I": AT 3: "20
": "0": AT 3: "22": "P": AT 3: "24": "F"
The
keyboard layout"
16 REM Use inv. video to get
inverse numbers:
17 PRINT AT 2: "5": "0": AT 2: "7": "8":
AT 2: "9": "6": AT 2: "10": "5": AT 2: "15":
0": AT 2: "19": "8": AT 2: "21": "0":
20 IF INKEY$ = "a" THEN STOP
21 IF INKEY$ = "t" THEN BEEP x, 0
+k
22 IF INKEY$ = "y" THEN BEEP x, 1
+k
23 IF INKEY$ = "u" THEN BEEP x, 2
+k
24 IF INKEY$ = "7" THEN BEEP x, 3
+k
25 IF INKEY$ = "u" THEN BEEP x, 4
+k
26 IF INKEY$ = "i" THEN BEEP x, 5
+k
27 IF INKEY$ = "9" THEN BEEP x, 6
+k
28 IF INKEY$ = "o" THEN BEEP x, 7
+k
29 IF INKEY$ = "0" THEN BEEP x, 8
+k
30 IF INKEY$ = "p" THEN BEEP x, 9
+k
31 IF INKEY$ = "r" THEN BEEP x, -
1+k
32 IF INKEY$ = "4" THEN BEEP x, -
2+k
33 IF INKEY$ = "e" THEN BEEP x, -
3+k
34 IF INKEY$ = "3" THEN BEEP x, -
4+k
35 IF INKEY$ = "w" THEN BEEP x, -
5+k
36 IF INKEY$ = "2" THEN BEEP x, -
6+k
37 IF INKEY$ = "q" THEN BEEP x, -
7+k
40 GO TO 20
    
```

Program 1.

```

1 REM Frequency envelope
2 BORDER 3: PAPER 6: CLS
10 INPUT "Start frequency?"; f
11 REM Try f=0
20 INPUT "Interval?"; i
21 REM Try i=1
30 INPUT "End frequency?"; fe
31 REM Try fe=3
40 FOR a=f TO fe STEP i
50 DRAW 20*i, 10*a: BEEP 0.03, a
60 NEXT a
70 DRAW 20, 0: BEEP 0.2, fe
90 FOR w=fe TO f STEP -1
90 DRAW 20*i, -10*w: BEEP 0.03,
w
100 NEXT w
    
```

Program 3.



```

40 LET n(y)=(CODE a$(s)-57)+12
+r)
41 LET y=y+1
42 LET r=0
43 NEXT s
44 LET y=1
45 FOR x=2 TO LEN a$ STEP 2
46 LET d(y)=VAL a$(x)/2
47 LET y=y+1
48 NEXT x
49 GO TO 200
50 STOP
100 IF a$(s)="F" THEN LET r=.65
101 IF a$(s)="G" THEN LET r=.65
102 IF a$(s)="B" THEN LET r=.65
103 IF a$(s)="A" THEN LET r=.65
104 LET n(y)=(CODE a$(s)-57-r)*
2
105 LET r=0
106 LET y=y+1
110 GO TO 43
200 FOR t=1 TO LEN a$/2
210 BEEP d(t)/2,n(t)
220 NEXT t

```

Program 2.

find a way to vary the duration of each note. You can store your tune for later play-back. Why not program in two keyboards as on a double manual organ?

The Spectrum allows you to program fractional changes in pitch. You could use this capability to tune your "organ" to another instrument, and you could also create other scales than the so-called even-tempered one obtained by Beeping whole pitch values. You can even create scales for oriental music which

uses more than just eight tones in a scale.

The second program allows you to type the notes as letters and the duration as numbers of beats — alternating notes and durations. This allows you to forget about the Beep command altogether and you no longer have to calculate what number the Spectrum recognises as which pitch. I have made upper-case letters stand for the notes from middle-C to the G above, and lower-case letters are for the next octave. You can, of course, alter this to your taste.

I have also made the basic beat half a second, which you can easily alter, too. Notice that you are entering your whole tune into a single string, so if you want you could save your masterpiece on cassette — remembering to use Goto and not Run upon reloading or you will clear your string.

Unlike the BBC machine, the Spectrum is not equipped for sound synthesis. So if you have used a ZX-81 with either the Stuart or Quicksilver sound board, you will be very disappointed with the Spectrum's abilities. The

```

1 REM Muscript
  @Tim Langdell
2 PAPER 1: INK 5: BORDER 5: C
LS
10 PLOT 0,151: DRAW 255,0
20 PLOT 0,143: DRAW 255,0
30 PLOT 0,135: DRAW 255,0
40 PLOT 0,127: DRAW 255,0
50 PLOT 0,119: DRAW 255,0
60 REM HALF BEAT NOTE
70 LET X=0
80 LET Y=BIN 00000100
85 LET Z=BIN 01111100
90 POKE USA "E",X
100 POKE USA "E"+2,BIN 00000111
110 POKE USA "E"+3,BIN 00000101
120 POKE USA "E"+1,Y
130 POKE USA "E"+4,Y
140 POKE USA "E"+5,Y
150 POKE USA "E"+6,Y
160 POKE USA "E"+7,Y
170 POKE USA "C",X
180 POKE USA "C"+1,BIN 00111100
190 POKE USA "C"+2,Z
200 POKE USA "C"+3,Z
210 POKE USA "C"+4,Z
220 POKE USA "C"+5,BIN 00111000
230 POKE USA "C"+6,X
240 POKE USA "C"+7,X
250 PRINT OVER 1;AT 3,3;"E";AT
  4,3;"C"
260 REM These are the chr$ on
  keys E and C.
270 BEEP 0.25,12

```

Program 6.

Spectrum can only produce a tone, composed of a series of clicks, and maintain the tone for a specified time.

With a sound board, and with other micros, you can alter the quality of the sound, change how fast the note builds up in frequency, or how fast it dies away — known as the frequency envelope. With the Spectrum you are limited to finding uses for the change in quality of the sound from clicks to warbles and simulating sound envelopes.

Programs 3 and 4 are examples of how you might experiment with frequency and duration envelopes. Such things are made possible by the fact that the Spectrum can accept fractions of a second for duration, and fractions of a semitone for pitches.

By experimenting with a variety of fractional changes in pitch and duration you can use For-Next loops to ramp up to a given tone, and ramp down from it again. Note in the examples in programs 3 and 4 that there are two ways you can speed up the transition from one pitch to the next; either by reducing the duration of the intermediary pitches, or by increasing the value of the Step command in the loop.

The former leads to a rather less musical sound, but the latter gives less smooth ramping. You will have to experiment with the values before arriving at useful sound shapes. Be warned, though, you will not be able to produce sounds in this manner which will match those from a synthesiser.

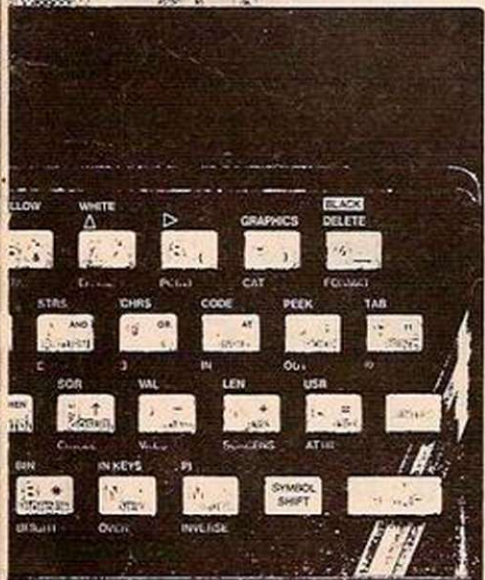
Program 5 illustrates how you can use the Spectrum to give sound effects for games. I have included a man-climbing-a-ladder routine, a bomb drop, and a phasor sound. None of these is up to arcade game standards, but can give you a useful added dimension to your games. Note that the bomb drop has the pitch descending rapidly from around 60 to 50, with the steps increasing in length as the bomb falls to give the impression that it is speeding up.

Program 6 shows a routine which uses the user-definable graphics facility to make pictures of notes on staves. It would be easy to extend this idea so that notes typed in with the Spectrum acting as an organ or as letters could be displayed as notes graphically. Key signatures and clefs could also be shown.

The next listing, program 7, gives a glimpse of how you might link sound and colour on

(continued on next page)

SOUNDS



```

1 REM duration/frequency
  envelope: @Tim Langdell
2 BORDER 2: PAPER 4: CLS
10 LET f=0.05
20 FOR i=0 TO 2 STEP 0.5
30 BEEP f,f: DRAW 300+i,20*f
40 LET i=i-0.005
50 NEXT i
60 DRAW 50,0: BEEP 0.5,2

```

Program 4.

```

1 REM Man climbs ladder
  @Tim Langdell
2 REM to create man CHR$
3 BORDER 4: PAPER 6: CLS
10 POKE USA "p",BIN 00011000
20 POKE USA "p"+1,BIN 00100100
30 POKE USA "p"+2,BIN 10011001
40 POKE USA "p"+3,BIN 01111110
50 POKE USA "p"+4,BIN 00011000
60 POKE USA "p"+5,BIN 01100100
70 POKE USA "p"+6,BIN 10000100
80 POKE USA "p"+7,BIN 00000100
90 REM Second man for movement
100 POKE USA "u",BIN 00011000
110 POKE USA "u"+1,BIN 00100100
120 POKE USA "u"+2,BIN 10011001
130 POKE USA "u"+3,BIN 01111110
140 POKE USA "u"+4,BIN 00011000
150 POKE USA "u"+5,BIN 01100100
160 POKE USA "u"+6,BIN 10000100
170 POKE USA "u"+7,BIN 00100000
200 REM Draw ladder
210 LET x=BIN 01000010
220 POKE USA "a",x
230 POKE USA "a"+1,x
240 POKE USA "a"+2,BIN 01111110
250 POKE USA "a"+3,x
260 POKE USA "a"+4,x
270 POKE USA "a"+5,x
280 POKE USA "a"+6,BIN 01111110
290 POKE USA "a"+7,x
300 FOR i=0 TO 21
310 PRINT AT i,10;"A": REM This
  is the graphic chr$ on key "A"
320 NEXT i
330 LET x=0: LET y=21: LET z=-1
340 FOR n=y TO x STEP z
350 PRINT AT n,10;"P": PAUSE 2-
  z: PRINT AT n,10;"U"
355 PAUSE 2-z
360 REM These are graphic chr$
  remember!
370 PRINT AT n,10;"A"
380 IF ABS z=z THEN GO TO 500
390 BEEP 0.02,30: BEEP 0.02,40
400 NEXT n
410 LET k=x: LET x=y: LET y=k:
  LET z=-z
420 GO TO 340
500 BEEP 0.01,(40-(n/2))
510 NEXT n: GO TO 330

```

```

1 REM Bomb drop @Tim Langdell
2 REM AN EXTERNAL AMPLIFIER
  WILL HELP
10 LET x=0.3
20 FOR N=60 TO 55 STEP -x
30 BEEP 0.05,N
40 LET x=x+0.1
50 NEXT N
60 REM Explosion (?)
70 FOR K=0 TO 20
80 BEEP 0.01,-10: BEEP 0.01,-5
90 NEXT K
1 REM Phasor 2 @Tim Langdell
10 LET x=0.0125
20 BEEP x,4: BEEP x,6: BEEP x,
  8: BEEP x,10: BEEP x,12: BEEP x,
  14: BEEP x,16: BEEP x,4: BEEP x,
  6: BEEP x,8
30 PAUSE 2: REM Waits for key
  press.
40 GO TO 10

```

Program 5.

(continued from previous page)

your Spectrum. It plays a random tune, plotting random colours as it does so.

My general conclusion must be that the Spectrum's sound is very limited and poorly designed. The fact that the sound is so very quiet using the internal speaker alone is very annoying. The sound is also used to give auditory feedback that a key has been pressed, although at switch-on the click made cannot really be heard.

You can alter the pitch of the keyboard beep by Poking location 23609, and I suggest that you try a value around 100. This gives a pleasant tone which can just be heard. This facility can be very useful when typing in large amounts of data. But it is a great pity that this keyboard beep is also amplified along with the sound if you add an external amplifier. The effect is very annoying when Inputting data into a program which is using the sound facility.

To avoid these beeps on your stereo, you would need to go through the tiresome routine of unplugging and plugging your jack plugs from the Spectrum. Perhaps Sinclair might consider making the keyboard sounder and the beep facility separate circuits on a later model, but certainly the company must think about making the internal amplifier much more powerful.

The Spectrum's sound is one of its more disappointing aspects, but with perseverance you will be able to put it to good use in games.

Let us now explore some more facets of this machine's colour graphics.

How many colours in a Spectrum? Seven, if you think of a rainbow? Or perhaps eight, if you accept Sinclair's insistence that black and white are colours? How about 64 or even 128 though? Well, it is possible to obtain considerably more than the basic eight colours on a Spectrum. The trick is to use a user-defined graphic which is like a miniature chess board in appearance, or to draw diagonal crosshatch lines across your TV "page" using the draw command.

Program 8 shows how to create the graphic

```

1 REM      Interference
  @ Tim Langdell
2 BORDER 0
10 LET I=INT (5*RND)+1: LET P=
INT (5*RND)+1
15 IF I=P THEN GO TO 10
20 INK I: PAPER P: CLS
30 FOR A=0 TO 255 STEP 2
40 PLOT 128,55: DRAW -127+A,-3
50 NEXT A
60 FOR B=0 TO 175 STEP 2
70 PLOT 128,55: DRAW 127,-37+B
80 NEXT B
90 FOR C=0 TO 255 STEP 2
100 PLOT 128,55: DRAW 127-C,37
110 NEXT C
120 FOR D=0 TO 175 STEP 2
130 PLOT 128,55: DRAW -127,37-D
140 NEXT D
150 PAUSE 200: GO TO 10

```

Program 9.

```

10 REM      Kaleidos
  @ Tim Langdell
20 LET A$=""
30 PAPER 7: CLS
40 LET Y=INT (16*RND)
50 LET X=INT (11*RND)
60 LET Z=INT (8*RND)
70 GO SUB 90
80 GO TO 40
90 IF Z=0 OR Z=7 THEN GO TO 15
100 PRINT INK Z: AT 11-X,15+Y: A$
110 PRINT INK Z: AT 11-X,15-Y: A$
120 PRINT INK Z: AT 11+X,15+Y: A$
130 PRINT INK Z: AT 11+X,15-Y: A$
140 RETURN
150 PRINT INVERSE 1: AT 11-X,15+
Y: A$
160 PRINT INVERSE 1: AT 11-X,15-
Y: A$
170 PRINT INVERSE 1: AT 11+X,15+
Y: A$
180 PRINT INVERSE 1: AT 11+X,15-
Y: A$
190 GO TO 40

```

Program 10.

```

1 REM      Musicolage
  @ Tim Langdell
10 BORDER 1
20 LET NOTE=RND*20
30 LET DUR=RND*0.5
40 LET I=(RND*6)+1
50 PRINT INK I: AT 20-NOTE,60#D
UR: "
60 BEEP DUR,NOTE
70 GO TO 20

```

Program 7.

```

1 REM      128 COLOURS
  @ Tim Langdell
5 REM CHECKER PATTERN
10 FOR A=0 TO 6 STEP 2
20 POKE USR "A"+A,BIN 01010101
30 POKE USR "A"+A+1,BIN 10101010
30 NEXT A
40 FOR P=0 TO 7
50 FOR I=0 TO 7
60 FOR B=0 TO 1
70 PRINT PAPER P: INK I: BRIGH
T B: "AA"; P: I: NEXT B
80 NEXT I: NEXT P
90 REM FULL PAGE COLOUR:
100 FOR P=0 TO 7: FOR I=0 TO 7:
FOR B=0 TO 1
110 FOR Y=0 TO 31
120 PRINT PAPER P: INK I: BRIGH
T B: "AAAAAAAAAAAAAAAAAAAAAAAA
AAAA"
130 NEXT Y
140 POKE 23692,255: REM AUTO
SCROLL
150 NEXT B: NEXT I: NEXT P

```

Program 8.

character needed and demonstrates how you can mix the standard eight colours in pairs of adjacent pixels so that more than 100 colours or hues can be obtained. The second part of the program runs through the colours again, but this time each colour fills a video page — which gives a better colour result. You can Print Over these colours as you would the normal eight.

The Spectrum is also capable of some rather fancy pictures which resemble interference patterns in light. Program 9 gives an example of this, and randomly changes the Paper and Ink colours. You might try removing the CLS command so that the new Ink and Paper are written over the previous ones. This also gives a clear demonstration of the fact that you can draw in the 176 by 256 resolution, but colour is set at the 32 by 22 character-space level.

It is very interesting to see in this last program how one of the Spectrum's shortcomings can be an asset. You may have heard some people refer to the rather marked "dot crawl" on the Spectrum. This means that when you draw a few lines of one colour on top of paper of another colour, then the Ink lines seem to shimmer rather than being absolutely steady. In the last example, and in others too, this shimmering effect adds a very interesting dimension to the colour display.

Program 10 is a form of kaleidoscope using the graphics character obtained by pressing Shift 9 followed by Shift 8. The Ink of this is varied at random and the blocks of colour are printed symmetrically in four places around the screen. Lines 90 and 150 onwards rub out some of the pattern to avoid crowding — and make it more interesting.

The next program, number 11, I have called Snowflake. Lines 60 to 180 draw the snowflake and the other lines allow a new feature on the Spectrum to be realised. Usually the only way to change the Paper colour is to type in Paper x, where x is a number between 0 and 7, followed by CLS. This of course wipes off any pattern you had on the screen. By creating a string of spaces sufficient in number to fill the whole screen you can use the Print Over 1 command to change the Paper without destroying the pattern.

In this program the Paper is changed in this way at random. There is an alternative method for changing the Paper while retaining the

graphics by Poking the memory locations between 22528 and 23231 — the next 64 bytes refer to the bottom two lines of screen where the program is entered. These locations contain the attribute codes for the character positions on the screen. So if the position 0,0 is cyan, Paper 5, then Peek 22528 would return (8*5) 40.

You would need to use the Int command to determine the Paper colour already present. For example:

INT((PEEK a)/8) = colour code
where "a" is the address. You would then subtract 8* this value from "Peek a" and add 8* the code of the new colour to "Peek a".

Program 12 demonstrates a rather puzzling feature of the Spectrum. When I was trying to draw lines of the same colour across the television screen I discovered that although I only specified one colour, two were drawn on occasions. This program shows that what colours are drawn when only one has been requested depends on which Paper colour the lines are drawn against.

The first lines are two pixels apart whereas the lower lines are three apart. As you see, the upper ones are usually in the same, requested, colour whereas the lower lines are most frequently different colours. I have Over Printed a block of the Ink colour to show further aspects of the effect.

So that you do not think that this is a property of drawing lines across a single character square, I have included four lines which are first an even number and then an odd number of pixels apart. Whenever the lines are an odd distance apart, two colours occur. Moreover, the earlier demonstration shows clearly that you can draw more than one Ink in a single character square. This is a fault though, and I can see no way of drawing lines of a specified colour and position consistently.

```

1 REM      Snowflake
  @ Tim Langdell
10 LET T=0
20 INK 7: PAPER 3: CLS
30 LET A$="" : LET B$="" : REM
both single spaces
35 REM Creates screen full of
spaces
40 FOR K=0 TO 702: LET B$=B$+A
$: PRINT " ": NEXT K
50 CLS
60 FOR A=20 TO 80 STEP 10
70 LET U=0: LET R=PI
80 LET N=100
90 LET X=(R-U)/N
100 FOR U=0 TO R STEP X
110 LET E=A+COS (8*U)
120 LET X=E*SIN U
130 LET Y=E*COS U
140 PLOT 128+X,38+Y
150 NEXT U
160 LET T=T+1: IF T=101 THEN GO
TO 180
170 GO TO 110
180 LET T=0: NEXT A
190 LET C=INT (16*RND)+1
200 PRINT AT 0,0: PAPER C: OVER
1: B$
210 PAUSE 50: GO TO 190

```

Program 11.

```

1 REM 2 INKS PER CHR$ SQUARE?
  @ TIM LANGDELL
10 BORDER 1: CLS
20 FOR P=0 TO 7
30 FOR I=0 TO 7
40 IF I=P THEN NEXT I
50 INK I: PAPER P: CLS
60 PLOT 0,100: DRAW 255,0
70 PLOT 0,95: DRAW 255,0
90 PRINT OVER 1: AT 9,5: " "
100 PLOT 0,70: DRAW 255,0
110 PLOT 0,67: DRAW 255,0
120 PRINT OVER 1: AT 13,10: " "
130 PAUSE 100
140 NEXT I
150 NEXT P
200 PAPER 2: INK 5: CLS
210 PLOT 0,110: DRAW 255,0
220 PLOT 0,90: DRAW 255,0
230 PLOT 0,30: DRAW 255,0
240 PLOT 0,15: DRAW 255,0

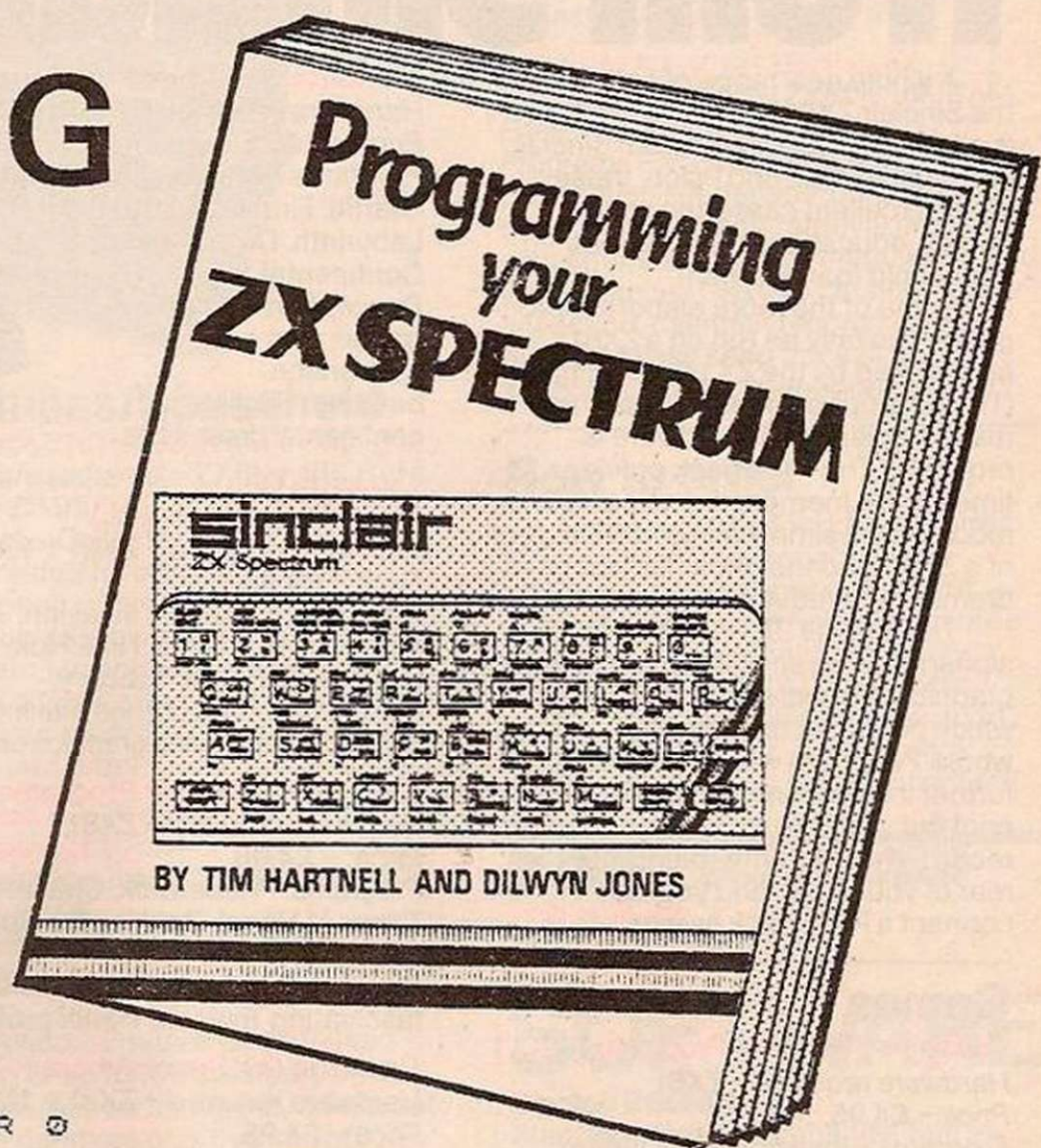
```

Program 12.

THE BOOK YOU'VE BEEN WAITING FOR!

Examines and explains
every function
on the ZX Spectrum

Just £6.95



Try this program from the book:

```
5 PAPER 0: CLS : BORDER 0
10 FOR X=0 TO 255
20 PLOT X,0
30 DRAW OVER 1;255-X*2,175
40 NEXT X
50 FOR Y=0 TO 175
60 PLOT 0,Y
70 DRAW OVER 1;255,175-Y*2
80 NEXT Y: REM © J. RUSTON
```

Takes you through programming your ZX Spectrum from first principles right through to such things as defining your own graphics, MERGE, READ/DATA, SCREEN\$, POINT and DRAW.

Interface,
Dept. YC
44-46 Earls Court Road,
London W8 6EJ.

Please send me the following:

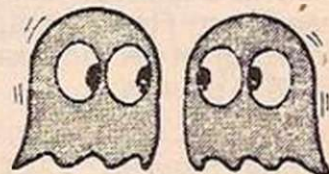
- Programming Your ZX Spectrum - £6.95
- A sample issue of INTERFACE, the monthly ZX magazine published by the National ZX Users' Club - £1.00
- Getting Acquainted with your ZX81 - £5.95
- 20 Simple Electronic Projects for the ZX81 - £6.45
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THIS BOOK IS TOTALLY ORIGINAL. IT IS NOT BASED ON ANY OTHER BOOK, & THE PROGRAMS ARE ALL NEW



User-defined graphics chapter tells you how to create your own DOTMAN game!

New ZX81 Software from Sinclair.

A whole new range of software for the Sinclair ZX81 Personal Computer is now available – direct from Sinclair. Produced by ICL and Psion, these really excellent cassettes cover games, education, and business/household management.

Some of the more elaborate programs can only be run on a ZX81 augmented by the ZX 16K RAM pack. (The description of each cassette makes it clear what hardware is required.) The RAM pack provides 16-times more memory in one complete module, and simply plugs into the rear of a ZX81. And the price has just been dramatically reduced to only £29.95.

The Sinclair ZX Printer offer full alphanumeric 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 instructions. So now you can print out your results for a permanent record. The ZX Printer plugs into the rear of your ZX81, and you can connect a RAM pack as well.

Games

Cassette G1: Super Programs 1 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Invasion from Jupiter. Skittles. Magic Square. Doodle. Kim. Liquid Capacity.

Description – Five games programs plus easy conversion between pints/gallons and litres.

Cassette G2: Super Programs 2 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Rings around Saturn. Secret Code. Mindboggling. Silhouette. Memory Test. Metric conversion.

Description – Five games plus easy conversion between inches/feet/yards and centimetres/metres.

Cassette G3: Super Programs 3 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Train Race. Challenge. Secret Message. Mind that Meteor. Character Doodle. Currency Conversion.

Description – Five games plus currency conversion at will – for example, dollars to pounds.

Cassette G4: Super Programs 4 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Down Under. Submarines. Doodling with Graphics. The Invisible Invader. Reaction. Petrol.

Description – Five games plus easy conversion between miles per gallon and European fuel consumption figures.

Cassette G5: Super Programs 5 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £4.95.

Programs – Martian Knock Out. Graffiti. Find the Mate. Labyrinth. Drop a Brick. Continental.

Description – Five games plus easy conversion between English and continental dress sizes.

Cassette G6: Super Programs 6 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £4.95.

Programs – Galactic Invasion. Journey into Danger. Create. Nine Hole Golf. Solitaire. Daylight Robbery.

Description – Six games making full use of the ZX81's moving graphics capability.

Cassette G7: Super Programs 7 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Racetrack. Chase. NIM. Tower of Hanoi. Docking the Spaceship. Golf.

Description – Six games including the fascinating Tower of Hanoi problem.

Cassette G8: Super Programs 8 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £4.95.

Programs – Star Trail (plus blank tape on side 2).

Description – Can you, as Captain Church of the UK spaceship Endeavour, rid the galaxy of the Klingon menace?

Cassette G9: Biorhythms (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – What are Biorhythms? Your Biohythms.

Description – When will you be at your peak (and trough) physically, emotionally, and intellectually?

Cassette G10: Backgammon (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £5.95.

Programs – Backgammon. Dice.

Description – A great program, using fast and efficient machine code, with graphics board, rolling dice, and doubling dice. The dice program can be used for any dice game.

Cassette G11: Chess (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Chess. Chess Clock.

Description – Fast, efficient machine code, a graphic display of the board and pieces, plus six levels of ability, combine to make this one of the best chess programs available. The Chess Clock program can be used at any time.



Cassette G12:

Fantasy Games (Psion)

Hardware required – ZX81 (or ZX80 with 8K BASIC ROM) + 16K RAM.

Price – £4.75.

Programs – Perilous Swamp. Sorcerer's Island.

Description – Perilous Swamp: rescue a beautiful princess from the evil wizard. Sorcerer's Island: you're marooned. To escape, you'll probably need the help of the Grand Sorcerer.

Cassette G13:

Space Raiders and Bomber (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £3.95.

Programs – Space Raiders. Bomber.

Description – Space Raiders is the ZX81 version of the popular pub game. Bomber: destroy a city before you hit a sky-scraper.

Cassette G14: Flight Simulation (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £5.95.

Program – Flight Simulation (plus blank tape on side 2).

Description – Simulates a highly manoeuvrable light aircraft with full controls, instrumentation, a view through the cockpit window, and navigational aids. Happy landings!

Education

Cassette E1: Fun to Learn series – English Literature 1 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Novelists. Authors.

Description – Who wrote 'Robinson Crusoe'? Which novelist do you associate with Father Brown?

Cassette E2: Fun to Learn series – English Literature 2 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Poets, Playwrights. Modern Authors.

Description – Who wrote 'Song of the Shirt'? Which playwright also played cricket for England?



Cassette E3: Fun to Learn series - Geography 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Towns in England and Wales. Countries and Capitals of Europe.

Description - The computer shows you a map and a list of towns. You locate the towns correctly. Or the computer challenges you to name a pinpointed location.

Cassette E4: Fun to Learn series - History 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Events in British History. British Monarchs.

Description - From 1066 to 1981, find out when important events occurred. Recognise monarchs in an identity parade.

Cassette E5: Fun to Learn series - Mathematics 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Addition/Subtraction. Multiplication/Division.

Description - Questions and answers on basic mathematics at different levels of difficulty.

Cassette E6: Fun to Learn series - Music 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Composers. Musicians.

Description - Which instrument does James Galway play? Who composed 'Peter Grimes'?

Cassette E7: Fun to Learn series - Inventions 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Inventions before 1850. Inventions since 1850.

Description - Who invented television? What was the 'dangerous Lucifer'?

Cassette E8: Fun to Learn series - Spelling 1 (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £6.95.

Programs - Series A1-A15. Series B1-B15.

Description - Listen to the word spoken on your tape recorder, then spell it out on your ZX81. 300 words in total suitable for 6-11 year olds.

Business/household

Cassette B1: The Collector's Pack (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £9.95.

Program - Collector's Pack, plus blank tape or side 2 for program/data storage.

Description - This comprehensive program should allow collectors (of stamps, coins etc.) to hold up to 400 records of up to 6 different items on one cassette. Keep your records up to date and sorted into order.

Cassette B2: The Club Record Controller (ICL)

Hardware required - ZX81 + 16K RAM.

Price - £9.95.

Program - Club Record Controller plus blank tape on side 2 for program/data storage.

Description - Enables clubs to hold records of up to 100 members on one cassette. Allows for names, addresses, 'phone numbers plus five lots of additional information - eg type of membership.

Cassette B3: VU-CALC (Psion)

Hardware required - ZX81 + 16K RAM.

Price - £7.95.

Program - VU-CALC.

Description - Turns your ZX81 into an immensely powerful analysis chart. VU-CALC constructs, generates and calculates large tables for applications such as financial analysis, budget sheets, and projections. Complete with full instructions.

Cassette B4: VU-FILE (Psion)

Hardware required - ZX81 + 16K RAM.

Price - £7.95.

Programs - VU-FILE. Examples.

Description - A general-purpose information storage and retrieval program with emphasis on user-friendliness and visual display. Use it to catalogue your collection, maintain records or club memberships, keep track of your accounts, or as a telephone directory.

How to order

Simply use the FREEPOST order form below and either enclose a cheque or give us your credit card number. Credit card holders can order by phone - simply call Camberley (0276) 66104 or 21282 during office hours. Either way, please allow up to 28 days for delivery, and there's a 14-day money-back option, of course.

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Please send me the items I have indicated below.

Qty	Cassette	Code	Item price	Total	Qty	Cassette	Code	Item price	Total
	G1: Super Programs 1	30	£4.95			E2: English Literature 2	45	£6.95	
	G2: Super Programs 2	31	£4.95			E3: Geography 1	46	£6.95	
	G3: Super Programs 3	32	£4.95			E4: History 1	47	£6.95	
	G4: Super Programs 4	33	£4.95			E5: Mathematics 1	48	£6.95	
	G5: Super Programs 5	34	£4.95			E6: Music 1	49	£6.95	
	G6: Super Programs 6	35	£4.95			E7: Inventions 1	50	£6.95	
	G7: Super Programs 7	36	£4.95			E8: Spelling 1	51	£6.95	
	G8: Super Programs 8	37	£4.95			B1: Collector's Pack	52	£9.95	
	G9: Biorhythms	38	£6.95			B2: Club Record Controller	53	£9.95	
	G10: Backgammon	39	£5.95			B3: VU-CALC	54	£7.95	
	G11: Chess	40	£6.95			B4: VU-FILE	55	£7.95	
	G12: Fantasy Games	41	£4.75			ZX 16K RAM pack	18	£29.95	
	G13: Space Raiders & Bomber	42	£3.95			ZX Printer	27	£59.95	
	G14: Flight Simulation	43	£5.95			Post & packing - only if ordering hardware		£2.95	
	E1: English Literature 1	44	£6.95						

TOTAL £ _____

I enclose a cheque/postal order to Sinclair Research Ltd for £ _____

Please charge my *Access/Barclaycard/Trustcard no.

*Please delete as applicable.

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 Address _____

NSA 11

CAN YOU ESCAPE the Demon's Domain? You must find your way through a maze where you are confronted by all sorts of dangers. Unsavory characters and gruesome tests conspire to ensure that you never gain your freedom.

The program is written with a master program and nine different subroutines. Each subroutine counts as one danger. When Move is displayed in the top right-hand corner of the screen you move around the maze by using the cursor keys, 5 to move left, 6 to move down, 7 to move up, and 8 to move right.

Demon's Domain can be made more fun by adding your own dangers. Here are a few hints if you want to customise the program.

Line 520 indicates the number of danger routines in the program. At the moment the number is 9, one for each subroutine. Therefore, if another routine were added the number would have to be altered to 10.

Each routine goes up in steps of 500. 1000 is the first routine, 1500 the second and so on. Therefore, another routine must start at 500 more than the last one. The last danger routine currently starts at 5000.

The routine at line 50 gives quite a long delay, then clears the screen. This is useful when instructions are printed at the beginning of each routine.

If a player passes the danger, he goes to either line 140 or line 200. Line 140 gives a delay, clears the screen, before going on to line 200. If he fails to negotiate the danger he goes to line 9995. This is the lose routine.

The program structure.

Line	Description
2-40	Initialise
50-80	Delay subroutine
100-140	Print instructions
200-290	Print domain
300-570	Make move Check for a win Witch Edna routine Fall into an abyss routine
1000-1170	The egotistical-gorilla routine
1500-1640	Hail of barbs routine
2000-2190	The mad mathematician
2500-2700	The doors routine
3000-3120	The crusher routine
3500-3690	The gruesome-gambler routine
4000-4200	Baron McDread routine
4500-4670	The maniacal memory-tester routine
5000-5260	Demon-driver routine
9995-9999	Lose routine



```

1 REM DEMONS DOMAIN
2 SLOW
3 RAND
10 LET A=11
20 LET B=0
30 LET C=0
40 GOTO 100
50 FOR E=1 TO 200
60 NEXT E
70 CLS
80 RETURN
100 PRINT "THE DREADER DEMONS
110 PRINT "THE SHORTEST R
OUTE MAY NOT," "BE THE BEST,"
120 PRINT "YOU MAY ONLY M
OVE NORTH SOUTH," "OR EAST,"
130 PRINT "ABANDON HOPE A
LL YE WHO ENTER."
140 GOSUB 50
200 PRINT "DEMONS COME!"
210 PRINT "
220 FOR E=1 TO 5
230 PRINT "

```

```

240 NEXT E
250 PRINT "EXIT
260 FOR E=1 TO 4
270 PRINT "
280 NEXT E
290 PRINT "
300 PRINT AT A,B;"
310 PRINT AT 0,25;"
320 IF INKEY$<" THEN GOTO 320
330 LET A$=INKEY$
340 IF A$<"6" OR A$>"8" THEN GO
TO 330
350 PRINT AT 0,25;" "AT A,B
360 LET A=A+(A$="6")-(A$="7")
370 LET B=B+(A$="8")
380 PRINT AT A,B;
390 LET D=PEEK (PEEK 16398+256*
PEEK 16399)
395 IF D<>136 THEN GOTO 530
400 PRINT "

```

DEMON'S DOMAIN

Once you have taken the first step on your journey through Demon's Domain there is no turning back — and only your wits and game-playing skills will save you from the gaping abyss which awaits all those who fail. The denizens of this subterranean realm will set you fiendish tasks and torment you with the hail of barbs and the crusher. Egotistical gorillas and mad mathematicians are ready and waiting for you. All hope abandon, ye who enter Joseph Nicholson's program for the 16K ZX-81.

```
410 LET E=INT (RND*2)
420 IF E=1 THEN GOTO 500
430 LET C=C+1
440 IF C<>5 THEN GOTO 310
450 CLS
460 PRINT "THE WICKED WITCH EDN
A" , "THINKS THAT THE GAME HAS B
EEN" , "TOO EASY FOR YOU AND SEN
DS YOU" , "BACK TO THE START"
470 LET A=11
480 LET B=0
485 LET C=0
490 GOTO 140
500 LET C=0
510 CLS
520 GOTO (INT (RND*9)*500)+1000
530 CLS
540 IF D=0 THEN PRINT "YOU FELL
INTO AN ABYSS"
550 IF D=42 THEN PRINT "YOU HAV
E ESCAPED FROM" , "DEMONS DOMAIN
.BUT NEXT TIME" , "YOU MAY NOT B
E SO LUCKY."
560 IF D=0 THEN GOTO 9995
570 STOP
1000 PRINT "THE SCOTTISH GORIL
L" , "TELL HIM HIS NAME" , "OR
BE DISMANTLED." , "A FLASH OF L
IGHTNING" , "REVEALS IT BRIEFLY."
1010 GOSUB 50
1020 LET E=INT (RND*4)
1030 IF E=0 THEN LET A$="RONALD"
1040 IF E=1 THEN LET A$="WINSTON"
1050 IF E=2 THEN LET A$="STANLEY"
1060 IF E=3 THEN LET A$="SIDNEY"
1070 PRINT AT 10*AND,25*AND,A$
1080 CLS
1090 PRINT "WHAT IS MY NAME ?"
1100 INPUT B$
1110 PRINT , "THAT IS ";
1120 FOR E=1 TO 50
```

```
1130 NEXT E
1140 IF A$=B$ THEN PRINT "RIGHT
YOU ARE SAVED"
1150 IF A$=B$ THEN GOTO 140
1160 PRINT "GRRR RIPP...CRACK..
"
1170 GOTO 9995
1500 PRINT "HELL OF BARBS" , "K
EEP STILL AND HOPE."
1510 FOR E=1 TO 50
1513 NEXT E
1516 CLS
1520 PRINT AT 15,15;"E"
1530 FOR E=0 TO 21
1540 FOR F=1 TO 3
1550 PRINT AT E,RND*30;"// "
1560 NEXT F
1570 NEXT E
1580 PRINT AT 15,15;
1590 LET E=PEEK (PEEK 16398+256*
PEEK 16399)
1600 IF E=151 THEN PRINT AT 0,0;
"SIZE";TAB 50R 9+50R 9+50R 9
1610 IF E=151 THEN CLS
1620 IF E=151 THEN GOTO 200
1630 PRINT "E"
1640 GOTO 9995
2000 PRINT "THE MAD MATHEMATICIA
N" , "YOU HAVE 10 SECONDS TO ANS
WER"
2010 GOSUB 50
2020 LET A$=""
2030 PRINT "QUESTION";AT 10,0;
2040 FOR E=1 TO 3
2050 LET A$=A$+CHR$ (INT (RND*9)
+29)+" "
2060 PRINT A$(E*2-1 TO E*2);
2070 NEXT E
2080 LET A$=A$+"0"
2090 PRINT AT 10,15;"=?"
2100 POKE 16436,255
2110 POKE 16437,255
2120 INPUT E
```

(continued on next page)

(continued from previous page)

```
2130 LET D=(65536-(PEEK 16436+(2
56*PEEK 16437))) / 50
2140 PRINT AT 5,0;"THAT TOOK ";D
;" SECONDS"
2150 IF D>10 THEN PRINT "YOU TOO
FOR LANS"
2160 IF VAL A$=E THEN PRINT AT 0
,14;"CORRECT"
2170 IF VAL A$<>E THEN PRINT AT
0,14;"WHAT IS WRONG"
2180 IF VAL A$<>E OR D>10 THEN G
OTO 9995
2190 GOTO 140
2500 PRINT "THE GROSS" , , , "BEHIN
D ONE IS A STARVING LION"
2510 FOR E=0 TO 2
2520 FOR D=4 TO 11
2530 PRINT AT D,E*7+2;" "
2540 NEXT D
2550 NEXT E
2560 PRINT AT 13,0;"CHOOSE"
2570 IF INKEY$<>" " THEN GOTO 257
0
2580 LET A$=INKEY$
2590 IF A$<"1" OR A$>"3" THEN GO
TO 2580
2600 LET F=INT (RAND*3)
2610 FOR E=0 TO 2
2620 FOR D=4 TO 11
2630 PRINT AT D,E*7+2;" "
2640 IF E=F AND D=7 THEN PRINT A
T D,E*7+2;" "
2650 NEXT D
2660 NEXT E
2670 IF F+1<>VAL A$ THEN PRINT A
T 13,0;"FORTUNE WAS SMILED ON Y
OU"
2680 IF F+1=VAL A$ THEN PRINT AT
13,0;"BARON CHOMP...MUNCH..."
2690 IF F+1<>VAL A$ THEN GOTO 14
0
2700 GOTO 9995
3000 PRINT "THE CRUSHER" , , , "ONLY
ONE LETTER WILL STOP HIM"; AT 21,
15;" "
3010 LET A$=CHR$ (INT (RAND*26)+3
8)
3020 FOR E=2 TO 21
3030 IF INKEY$<>" " THEN GOTO 303
0
3040 LET B$=INKEY$
3050 IF B$<"A" OR B$>"Z" THEN GO
TO 3040
3060 IF B$=A$ THEN GOTO 3110
3070 PRINT AT E,0;" "
3080 NEXT E
3090 PRINT AT 10,3;"YOU ARE CRUS
HER," , , A$;" WOULD HAVE STOP
PED HIM"
3100 GOTO 9995
3110 PRINT AT E-1,0;" SAFE
";CHR$ (CODE A$+128); " HAS STOPP
ED HIM"
3120 GOTO 140
3500 PRINT "THE GAUSSIAN GAMBLER"
, , , "HAS THOUGHT OF 2 NUMBERS (1
-99)" , , , "YOU HAVE TO SAY IF YOU
THINK THE " , , , "SECOND NUMBER IS H
IGHER OR LOWER" , , , "THAN THE FIRST
ONE."
3510 GOSUB 50
3520 LET D=INT (RAND*99)+1
3530 LET E=INT (RAND*99)+1
3540 IF E=D THEN GOTO 3530
3550 PRINT "THE FIRST NUMBER IS
";D;" IS THE SECOND NUMBER HIGH
ER (H) " , , , "OR LOWER (L) ?"
3560 IF INKEY$<>" " THEN GOTO 356
0
3570 LET A$=INKEY$
3580 IF A$<"H" AND A$<"L" THEN
GOTO 3570
3590 PRINT " , , , "YOU THINK IT IS "
3600 IF A$="H" THEN PRINT "HIGHER
"
3610 IF A$="L" THEN PRINT "LOWER"
3620 FOR F=1 TO 50
3630 NEXT F
3640 PRINT " , , , "IT IS " , E
3650 IF E>D AND A$="H" OR E<D AN
D A$="L" THEN GOTO 3680
3660 PRINT " , , , "HURRAH YOU "
3670 GOTO 9995
```

```
3680 PRINT "CURSES YOU "
3690 GOTO 140
4000 PRINT "BARON MORGAN" , , , "C
HALLENGES YOU TO A DUEL." , , , "TO
STAY ALIVE YOU MUST SHOOT" , , , "HI
M FIRST.PRESS ANY KEY TO SHOOT"
4010 GOSUB 50
4020 PRINT " BARON
YOU"
4030 FOR F=1 TO 7
4040 PRINT AT 4,14-F;" " ;TAB F+1
4;" "
4050 IF F=7 THEN GOTO 4100
4060 FOR E=1 TO 10
4070 NEXT E
4080 PRINT AT 4,14-F;" " ;TAB F+1
4;" "
4090 NEXT F
4100 IF INKEY$<>" " THEN GOTO 419
0
4110 PRINT AT 0,12;"SHOOT"
4120 FOR F=1 TO 5
4130 IF INKEY$<>" " THEN GOTO 417
0
4140 NEXT F
4150 PRINT AT 4,8;"-----"
"
4160 GOTO 9995
4170 PRINT AT 4,7;"-----"
"
4180 GOTO 140
4190 PRINT AT 0,0;"NEXT JUDGE
KILLS YOU"
4200 GOTO 9995
4500 PRINT "THE MANEVAL MEMORY
TESTER" , , , "MEMORIZE THIS TO PACI
FY HIM."
4510 GOSUB 50
4520 LET S=INT (5*RND+5)
4530 LET A$=""
4540 PRINT "I HOPE YOU GET IT WA
ONG"
4550 FOR E=1 TO D
4560 LET A$=A$+CHR$ (38+25*RND)
4570 NEXT E
4580 PRINT AT 10,12;A$
4590 FOR E=1 TO 2*D+0.5*D**2
4600 NEXT E
4610 CLS
4620 PRINT "WHAT WAS IT ?"
4630 INPUT B$
4640 IF A$<>B$ THEN PRINT " , , , B$
"
4650 PRINT " , , , A$ "
4660 IF A$=B$ THEN GOTO 140
4670 GOTO 9995
5000 PRINT "DEMON DRIVER" , , , "YO
U HAVE TO DRIVE" , , , "YOUR CAR BET
WEEN THE FIRES OF" , , , "HELL, WITHO
UT BURNING TO" , , , "DEATH BY HITTI
NG THEM."
5010 PRINT " " , , , "TO MOVE LEFT, "
" TO MOVE RIGHT"
5020 GOSUB 50
5030 FOR D=0 TO 8
5040 PRINT AT D,10;" "
5050 NEXT D
5060 LET E=PEEK 16396+256*PEEK 1
6397+1
5070 LET F=10
5080 LET G=F+2
5090 LET D=0
5090 PRINT AT 9,F;" " ;TAB (F+4);
" "
5100 LET F=F+INT (3*RND)-1
5110 IF F<0 THEN LET F=0
5120 IF F+4>31 THEN LET F=27
5130 LET G=G+(INKEY$="8" AND G<3
1)-(INKEY$="5" AND G>0)
5160 SCROLL
5170 PRINT AT 21,31;" "
5180 IF PEEK (E+G)<>8 THEN GOTO
5200
5190 GOTO 5250
5200 PRINT AT 0,G;" "
5210 LET D=D+1
5220 IF D<40 THEN GOTO 5090
5230 PRINT AT 21,10;" "
5240 GOTO 140
5250 PRINT AT 21,10;"YOU ARE "
5260 GOTO 9995
9995 GOSUB 50
9996 PRINT "DEMON DRIVER" , , ,
9997 FOR E=1 TO 20
9998 PRINT " "
9999 NEXT E
```

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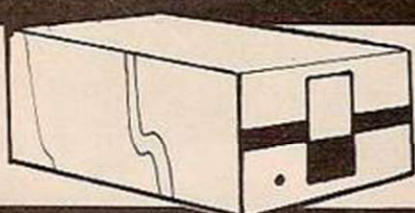
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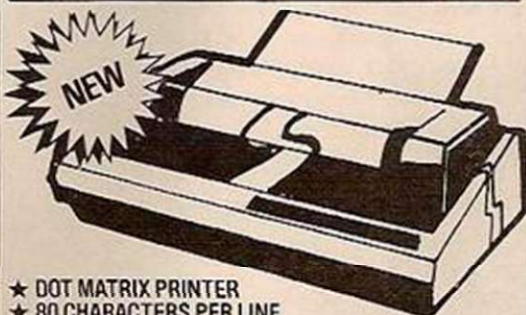
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INTERVIEW

THE BUSINESS OF M

A new recording star has emerged from the mists of the Mersey — Bug-Byte software has sold 500,000 cassette games already and doubles its sales every three months. Meirion Jones headed north to ask Tony Baden how he and Tony Milner turned a pastime into profit.

NO WONDER Tony Baden looks smug — if you had turned a student hobby into a million-pound business in just over a year so would you.

Two years ago he was studying Chemistry at Oxford when Tony Milner, a student in the next room, bought a ZX-80. They played with the machine and wrote a few programs before noticing that no-one seemed to be selling ZX-80 software.

A £3 classified advertisement paid dividends. To their surprise, the 40 cassettes they had recorded were all sold in two weeks so one night in the pub they thought up a company name, sent off the £1 fee, and Bug-Byte was born.

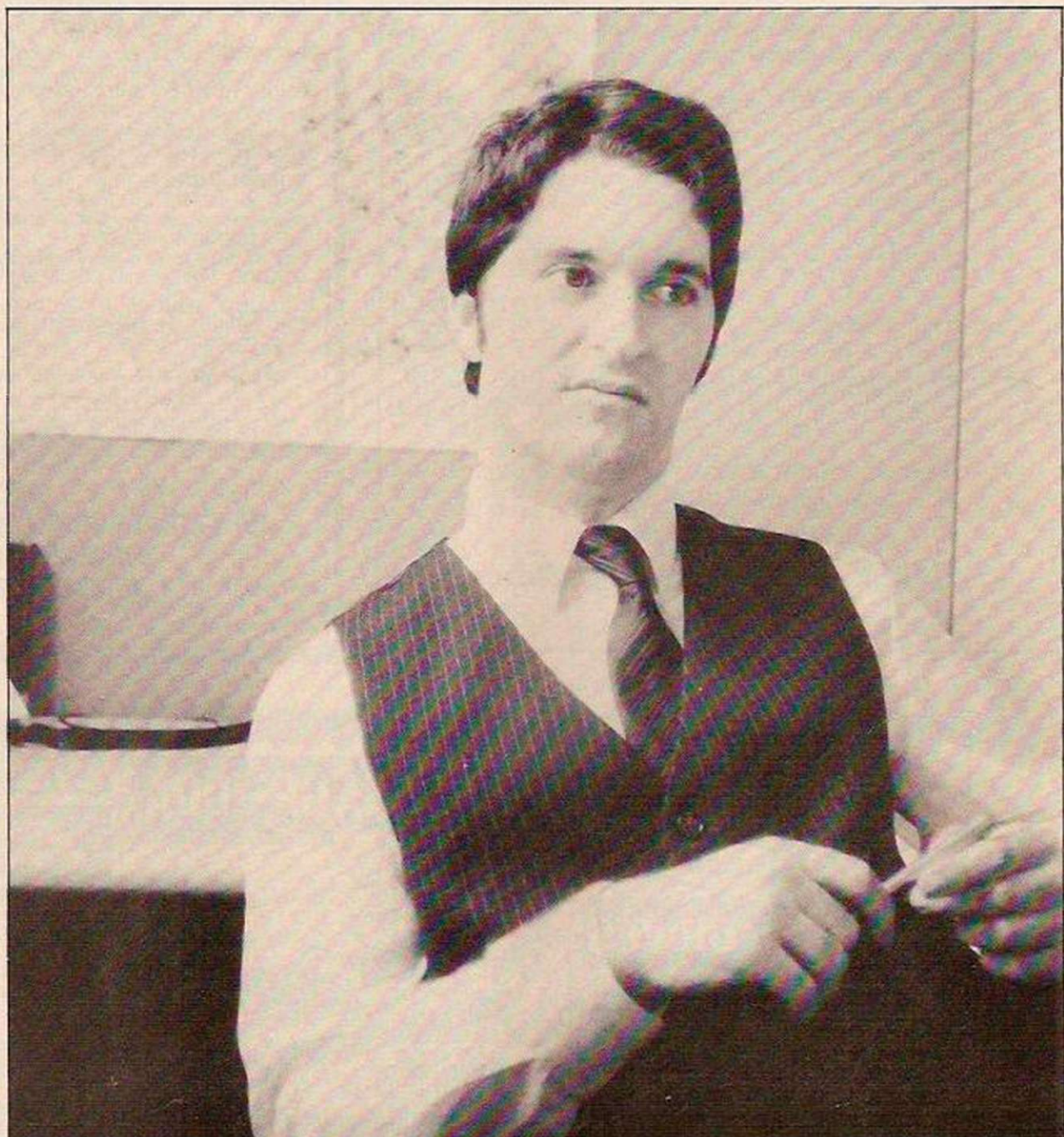
Tony Baden freely admits they made mistakes early on. "We had

'We had doubled our advertising and halved our sales'

some problems but people seemed to be more tolerant in those days". The company developed into a relatively profitable sideline while they continued their studies, but they did not think a student accommodation address would sound very confidence-inspiring, so they used an address in Coventry where Tony Milner hailed from.

As soon as they could acquire an Atom, the pair set about writing Acorn games. From the outside the operation was beginning to look professional. "At first we pretended we were bigger than we were". Just before Christmas 1980 Bug-Byte's sales reach £150 in one week and the potential of the business became clear to them.

Early in 1981, just months from the end of their college careers, the



two Tonys gambled on placing a full page advertisement for the ZX-80 tapes. Unfortunately Clive Sinclair chose the same month to launch his new ZX-81: "We had doubled our advertising and halved our sales", admits Baden.

The time had arrived for decisions. Undeterred by the advertising fiasco, they decided to become full-time partners in Bug-Byte when they left Oxford rather than pursue safe careers such as computer programming. "I'm glad I didn't", says Tony Baden. A third friend from Oxford was supposed to join them but "he never turned up".

'I wrote eight cassette games in one day once'

Tony Baden wanted to set up shop in his home town, so they moved into the Albany, Old Hall Street, Liverpool in July 1981. They quickly developed games software for the ZX-81. At first they produced all the programs themselves: "I wrote eight in one day once", but

gradually built up a team of outside programmers they could trust, who earned 20 percent royalties on sales of their games.

Tony Baden has abandoned programming to concentrate on running the business, leaving Tony Milner to the joys of machine-code. The best-selling programs are still originated inside the company, which now employs 12 people with an average age of 19 — including a programmer who is just 16. Games are developed on Apples and then translated to fit particular machines.

Bug-Byte still contracts out for particular programs which it needs — say, an invader program for a new computer — and is interested in buying up innovative software ideas, for cash now rather than the royal-

MAKING A MILLION

ties Bug-Byte used to offer. At the moment Bug-Byte buys games from about 20 regulars but "we always need more programmers".

At first Bug-Byte had to laboriously duplicate tapes but now after production of the originals manufacture is subcontracted under strict control. "We are so confident of the quality that we can guarantee our cassettes for a year — we don't get many returned", says Baden.

Bug-Byte is now selling 10 times as much as it was a year ago. "Our sales double every three months". He claims that the company has already sold 500,000 cassette games.

He does not have a very high opinion of the hardware manufacturers. "They've never really been helpful. We've had several problems with Acorn — we're not too happy with the BBC Micro". Bug-Byte's BBC was full of bugs when it finally arrived. As for the Spectrum: "We've had four of them — three don't work".

"We ignored the Vic for a while", Tony Baden admits. He feared that Commodore with its experience gained on the Pet would swamp the

'We've had four Spectrums — three don't work'

market with high-quality converted software. Commodore was surprisingly slow to produce an extensive range of software and when it materialised the prices were high enough to allow independent software houses to easily undercut them. Tony Baden is disappointed with the machine: "The Vic has not made the impression we expected", but he is looking forward to its successors, the Vic-10 and Vic-40/64.

Bug-Byte found it difficult to win Acorn approval for its software, and spent three months in fruitless negotiations with Sinclair to provide programs for the Spectrum. Now Sinclair plans to unleash a flood of 500 programs on to the market starting with a *Welcome* package which will be despatched with all new Spectrums from next week. Predictably Tony Baden is critical: "They are doing it the wrong way".

Baden believes that confidence must be created by building up a wide range of proven programs and then improving the packaging so

that they look attractive enough to stand out on a shelf in a store. Software is moving out of the small advertisements and into your local shops. He compares his business with the record industry — it is no coincidence that Bug-Byte cassettes have acquired album-style covers. Tony Baden extols the virtues of "better advertising, better presentation". He expects home computers to be sold in different shops from what you play in them — just as most record shops do not sell record players. Of course, chain stores will soon be selling both.

The home-computer software business is losing its innocence. Bug-Byte now employs an advertising agency and is considering racy television and radio commercials.

Baden has already signed up 100 dealers and hopes to have 500 within two years. He claims that Bug-Byte "provides the best service and back-up dealers can find". Negotiations with High Street chainstores to sell software over the counter are going well. Last Christmas despite a rogue batch of "2,000 rotten tapes" Bug-Byte did well. A major winter offensive is already planned.

"This year with six months preparation, sales could be phenomenal", says Baden. The hype, at least, is reminiscent of the record

industry. With manufacturers launching a new home computer every month for the foreseeable future, perhaps Tony Baden is not so rash in predicting that "every home will have one by the end of next year". The new Commodores and the Acorn Electron seem set to open up the market established by the ZX-80/81, the Atom, the Spectrum and now the Dragon. Nevertheless he believes that buyers will need to spend less to obtain the kind of machine they want. He cites the £50, 16K Binatone which will offer colour and sound.

Tony Baden expects people to spend "more on software than on hardware — at least the cost of the machine every year. In the same way that you have a record collection which costs more than your record player". He does not think the computer manufacturers will satisfy the demand. "They're very distant, so wrapped up in their hardware that they don't realise software is where it's at".

The recent Atari advertising blitz on television seems to show that some manufacturers have become aware that "software sells hardware".

So far Bug-Byte has grown almost unnoticed into a major supplier of games software, without having to

rely on loans or government grants. "Just the occasional overdraft". Now Bug-Byte is having to cope with the problems that success brings in its wake.

Baden hopes it will not be necessary to move too far from the Mersey: "I'd like to stay up here — I

'Every home will have a computer by the end of next year'

like Liverpool — but we may open a London office". He does not see why companies who make anything to do with computers should have to be based around Cambridge or just off the M4 to be taken seriously: "We should be judged on our products".

One group that are taking Bug-Byte seriously are software pirates. Imitation may be the sincerest form of flattery but it is not one that software publishers enjoy. Baden sees unauthorised copying of programs as a threat. Software libraries are now trying to exploit loopholes in the law to operate a lending service with cassettes.

Could you be trusted not to make a duplicate of a good game you had borrowed? Making it difficult to unlock the program does not help if a direct copy can be made on tape. Considering Tony Baden's regard for the record industry it should come as no surprise to hear that Bug-Byte is experimenting with techniques to make rerecording its own cassettes impossible.

"Software sales will be worth billions over the next few years and we intend to be undisputed market leaders", says Baden. So far Bug-Byte has avoided serious software but games alone should allow them plenty of scope in the immediate future.

The company must be a juicy target for a large group to take over. "I'm open to offers", quips Baden, "but have they got the expertise? — I don't think so".

Complete with natty waistcoat and an Osborne lying casually on a desk Tony Baden looks every inch a 1980s' boy wonder, but has it been at the cost of the 24-hour grind described by some refugees from the micro industry? "No — I've enjoyed it, I don't work all night". ■



Your marksmanship will decide whether the duck has any more than just a sporting chance in David Prosser's shooting game for the unexpanded Vic.

DUCK SHOOT is a semi-serious game for the unexpanded Vic-20. The player enters an angle through which a gun is turned and then fired. The higher the angle entered, the less distance the shell will cover from the gun. The shell can be made to cover different distances by varying the angle.

This can be an educational and recreational game. Young players become aware of the use of angles even though it is just a game to them. The program makes full use of colour graphics and accompanying sound effects. The behaviour of the shells is not as straightforward as at first it may seem.

When run, the program displays the title page while waiting for the user to press the f1 key. The computer, after producing a bleeping sound 10 times, will play a tune until the f1 key is pressed at the appropriate time.

After the f1 key has been pressed, a picture appears of a duck and moon on the right-hand side of the screen. Each time the game is played the moon and duck appear in different positions. Occasionally the duck will be well over to the right and the moon well over to the left, thus with three shots it is quite easy. On other occasions the user will have to shoot very accurately for the moon may block the path of the shell to the duck.

To score a point, the shell must hit the duck on the back. If the shell hits the duck anywhere else, an appropriate sound is output followed by a comment at the top of the screen. The duck moves a random quantity of spaces.

There are three shots to each game and five games are provided for. These can be changed easily by changing the lines indicated in the accompanying program documentation. If the shell hits the moon, the program automatically moves on to the next game, after producing some sound and graphics effects.

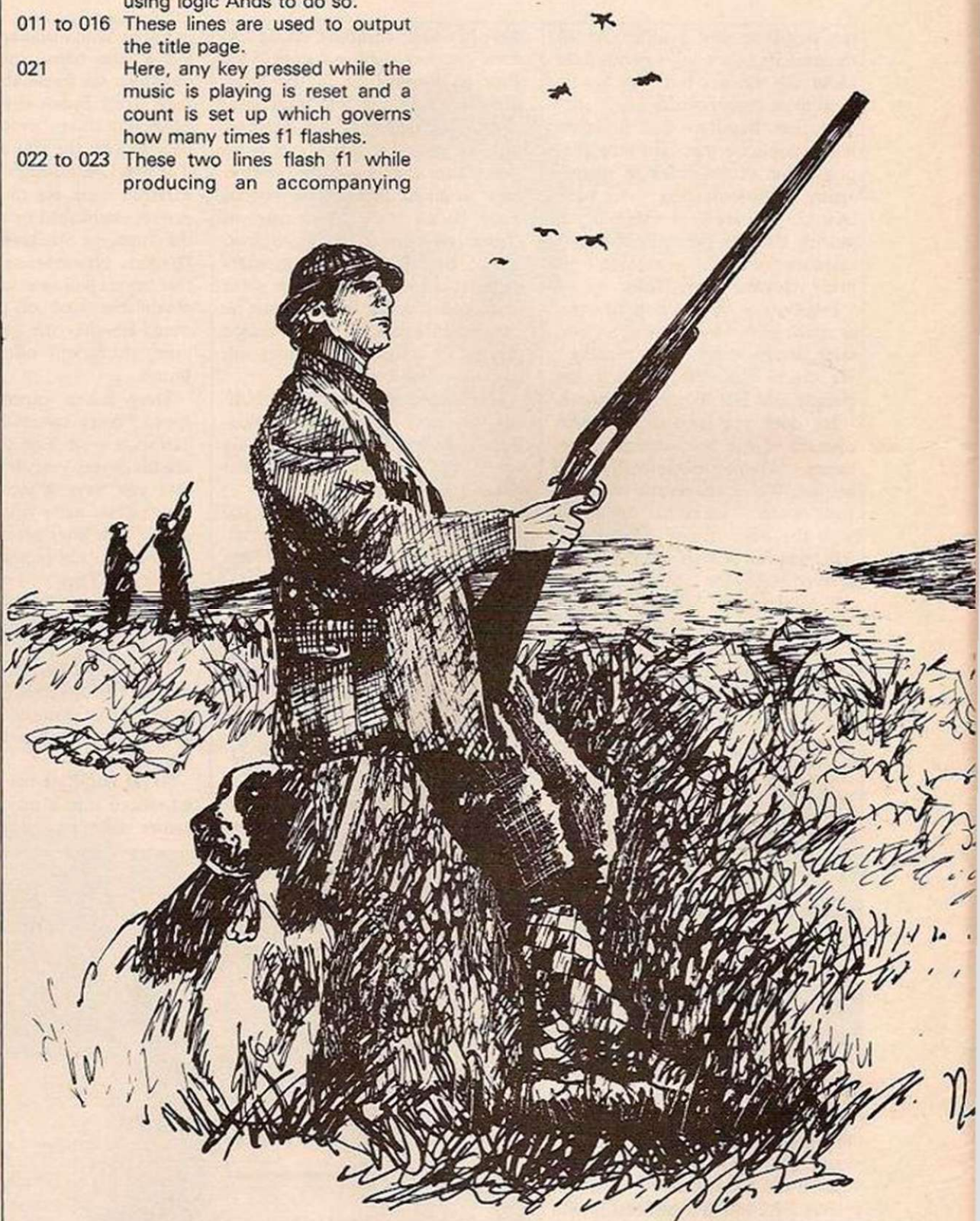
Possible improvements to the program could be made by defining your own graphics, with additional memory, to improve the detail. Instead of the present score system, you could amend it to take into account the quantity of shots which the player takes to hit the duck. Extra foul points could be implemented in case you shoot the moon. Those who feel the game is a little cruel, could change the duck into a battleship or something else. Sound effects and comments would have to be changed, but the bulk of the program would need no alterations.

Lastly, sound effects could be changed including different tunes at the beginning and throughout.

Line 300 has 89 characters in it, even though the Vic manual states only 88 are allowed per program line. This is achieved by replacing Print with its abbreviated form ?. This leaves four extra spaces at the end of the line, one of which is used for the extra character. If the line is now listed, the question mark is replaced by Print and the line uses up to 89 characters. By abbreviating in this way, much longer command lines can be created.

Line	Description
006	This sets the original screen colour to red with a red border.
007	This line sets up all the sound variable locations which are - V for the volume, S2 for the sound-box location, S3 being another sound-box location and finally NO which is the white-noise generator location.
010	The purpose of this line is to Poke coloured blocks both at the top and the bottom of the screen using logic Ands to do so.
011 to 016	These lines are used to output the title page.
021	Here, any key pressed while the music is playing is reset and a count is set up which governs how many times f1 flashes.
022 to 023	These two lines flash f1 while producing an accompanying

GAMES DUCK S



```

0 REM DAVID PROSSER
1 REM TU-4-5-82,
2 REM
3 REM
4 REM SHELDON HEATH.
5 REM
6 PRINT"DUCK SHOOT" : POKE36879,42
7 V=36879 : S2=V-3 : S3=V-2 : NO=V-1
10 FORX=0TO21 : POKE38400+X, (XAND7) : POKE7680+X, 160 : POKE38884+X, (XAND7) : POKE8164+X
160 : NEXT
11 PRINT"#####" : PRINT"##### DUCK SHOOT "
12 PRINT"#####" : PRINT"##### FOR " : PRINT"#####"
13 PRINT"##### VIC-20 " : PRINT"#####"
14 PRINT"BY DAVID PROSSER" : PRINT"BY SHELDON HEATH"
15 PRINT"#####ALABAMA" : PRINT"#####" : PRINT"#####"

```

HOOT



bleeping sound to attract the user's attention.

024 Line 24 scans the keyboard and tests if the f1 key has been pressed.

026 The data pointer is reset so that the tune can be played again.

030 The quantity of games to be played is set by this line.

035 In this line the screen and border colours are changed to those used in the game, which is a green border and a purple screen.

040 The shape of the moon and of the duck.

045 to 060 Produces the rest of the picture.

070 This line controls how many attempts the user has to shoot the duck.

100 SP controls the intensity of the plot. The higher the intensity, the slower the plot is.

111 The angle at which the shell is fired is calculated here.

160 This line is used to plot each shell in a different colour.

175 TE is used as a logic variable so that if TE equals -1 the rest of the If Then statement is obeyed. If TE equals 0 then it is not.

197 This line works out the user's score in the form of a percentage so that the user can control and alter the amount of games.

210 to 215 These line flash the Y and the N on and off while also outputting a bleeping sound.

350 The colour of the duck's tail is changed three times, after the shell has hit it.

415 If the shell hits the duck on the nose or on the chest, the output is the same, the beak flashes on and off. If the shell hits the duck in the chest, then PO, the position, needs to have 22 subtracted to set PO to the position directly below the beak.

420 This line causes the duck's beak to flash.

500 This subroutine plays a tune.

600 Subroutine to move the duck.

615 Another line using logic. If T2 equals -1 then the line is obeyed otherwise the rest of the line is ignored.

700 This line makes the screen shake.

```

16 PRINT "PRESS <F1> TO BEGIN."
20 POKEV, 15
21 POKE 198, 0: FORQ=1 TO 10
22 PRINT "*****<F1>": POKE 83, 225: FORDE=1 TO 150: NEXT: PRINT "*****<F1>"
23 POKE 83, 0: FORDE=1 TO 150: NEXT
24 GETA$: IFA$=CHR$(133) THEN 27
25 NEXTQ
26 GOSUB 500: GOT021
27 CD$="*****": CR$="*****"
30 FORGAME=1 TO 5
35 PRINT "GAME": POKE 36879, 77
40 M$="*****": DU$="*****": F%=RND(1)*11+9: P2%=RND(1)*8+11
45 PRINT LEFT$(CD$, 19), "*****": "*****": "*****": "*****": PRINT "*****"
50 PRINT "*****"
55 PRINT "*****" LEFT$(CR$, P2%): DU$
60 PRINT "*****" LEFT$(CR$, P2%): M$
65 POKEV, 15
70 FORATTEMPT=1 TO 3
75 PRINT "*****"
80 INPUT "*****ANGLE (20-90)": AN
85 IF AN<20 OR AN>90 THEN 75
90 POKENO, 130: FORDE=1 TO 200: NEXT: POKENO, 0
95 IF AN>86 THEN TE=-1
100 AG=91-AN: SP=AG/100
105 AN=AG/6.42598497
110 FORX=0 TO 22 STEP SP
111 Y=20*SIN(X/AN)
112 POKE 83, 231+Y: POKEV, 15-.65*Y
113 Y=22-Y
114 IF Y>22 THEN 170
115 Y=INT(Y): Y=22*Y
120 PO=7680+X+Y: C=30720+PO
125 IF PEEK(PO)=320RPEEK(PO)=46 THEN 160
130 POKE 83, 0: IFX<11 AND Y>330 THEN 170
135 IFY<330 THEN 250
140 IF PEEK(PO)=2540RPEEK(PO)=225 THEN 400
145 IF PEEK(PO)=123 THEN 335
150 IF PEEK(PO)=160 THEN 231
155 GOT0180
160 POKEC, ATTEMPT: POKEPO, 46
165 NEXT
170 POKE 83, 0
175 IF TE THEN PRINT "***** YOU SHOT YOURSELF !!": TE=0: GOT0700
180 NEXT ATTEMPT
190 NEXT GAME
195 FORDE=1 TO 1000: NEXT: PRINT "*****": POKE 36879, 42: PRINT "*****SCORE: *****"
197 PERCENT=NU/(GAME-1)*100
200 PRINT "***** YOU HAVE SCORED: *****PERCENT%"
210 POKEV, 15: FORQ=1 TO 5: PRINT LEFT$(CD$, 15): "*****ANOTHER GO(*****?)": POKE 83, 225
212 FORDE=1 TO 150: NEXT: POKE 83, 0: PRINT "*****"
215 FORDE=1 TO 150: NEXT: TE, 0: POKE 198, 0
216 GETA$: IFA$="" THEN 216
217 IFA$="Y" THEN RUN
218 IFA$<"N" THEN 210
219 END
231 PRINT "***** D E A D !! *****"
235 PRINT LEFT$(CD$, 14): "***** I.P. *****"
240 GOSUB 500: NU=NU+1
245 GOT0190
250 POKEV, 15
255 IF P2%-2 AND P2%-2 AND P2%<3 THEN PRINT "***** IT'S GONNA HIT ME !!": FORDE=1 TO 150: NEXT: T2=-1: GOSUB 600
300 FORX=5 TO 16: PRINT LEFT$(CD$, X) LEFT$(CR$, P2%) "*****" LEFT$(CD$, X+1) LEFT$(CR$, P2%): M$
305 POKE 83, X+237: FORDE=1 TO 20: NEXT: TE
310 NEXT
315 POKE 83, 0
316 PRINT "***** M I S S E D !! *****"
320 POKENO, 180: FORL=1 TO 1: FORM=9 TO 0 STEP -1: POKEV, M: FORM=1 TO 75: NEXT N
325 NEXT M, L: POKENO, 0: POKE 83, 0
330 GOT0190
335 PRINT "***** C H E E K Y !! *****"
340 POKEV, 15: FORL=148 TO 220 STEP .7: POKE 83, L: NEXT L: FORL=128 TO 200: POKE 83, L: NEXT L
345 FORL=200 TO 128 STEP -1: POKE 83, L: NEXT L: POKE 83, 0
350 FORI=0 TO 2: POKEC, I: FORDELAY=1 TO 500: NEXT: DELAY: NEXT
355 GOSUB 600: GOT0170
400 PRINT "***** O U C H !! *****"
405 POKEV, 15: POKE 83, 148: FORDE=1 TO 200: NEXT: TE: POKE 83, 0: FORDE=1 TO 60: NEXT: TE
410 POKE 83, 128: FORDE=1 TO 450: NEXT: TE: POKE 83, 0
415 IF PEEK(PO)=225 THEN PO=PO-22
420 FORI=1 TO 3: POKEPO, 225: FORDELAY=1 TO 500: NEXT: POKEPO, 254: FORDELAY=1 TO 500: NEXT: TE: LAY: NEXT
425 GOSUB 600: GOT0170
500 RESTORE
501 POKEV, 15
505 FORN=1 TO 26+EX: READN, D
515 POKE 83, N: POKE 83, N
520 FORDE=1 TO D*65: NEXT: TE
525 POKE 83, 0: POKE 83, 0: FORDE=1 TO 5*D: NEXT: TE
530 NEXT W: RETURN
535 DATA 187, 4, 187, 4, 201, 2, 201, 4, 201, 2, 195, 2, 195, 2, 183, 2, 163, 2, 175, 6, 163, 1, 175, 1, 183, 2
540 DATA 195, 2, 195, 2, 201, 2, 195, 2, 183, 2, 163, 3, 175, 1, 183, 2, 183, 2, 175, 2, 175, 2, 163, 6, 0, 12
600 PRINT LEFT$(CD$, 21) LEFT$(CR$, P2%) "*****"
605 DI=1
610 IF P2%>15 THEN DI=-1
615 IF T2 THEN T2=0: P2%=P2%+DI*4: GOT0625
620 P2%=P2%+DI*RND(1)*4
625 PRINT LEFT$(CR$, P2%): DU$: RETURN
700 POKEV, 15: FORX=15 TO 0 STEP -.3: POKE 36880, RND(1)*3+11: POKE 36881, RND(1)*2+37: POKE NO, 160+X
701 FORDE=1 TO 10: NEXT: TE, X: POKENO, 0: GOT0190
    
```

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William Masefield's ZX-81 program effectively simulates the spread of disease and the predator-prey relationship.

A NUMBER OF programs have been published, based on Life, in which a colony of cells is made to proliferate and ultimately die off. None that I have seen does much more than this. Yet with a little extra programming, it is possible to use the basic concept of Life to create a series of ecological and epidemiological models which, while not being perfect, can be used in a classroom to illustrate some of the elementary concepts in ecology.

The first model deals with the spread of a disease in, say, a woodland plantation, and the second models the predator-prey relationship, with spiders and flies as the protagonists.

Taking the first model, the program asks for the initial number of normal, healthy trees in the plantation — a maximum of 100 — then the number of trees that may be immune to the disease — a maximum of 100 less the number of healthy normal trees — and finally the number of diseased trees — 100 less the sum of the other trees.

The program then plants these trees randomly in a 10-by-10 matrix, using a different symbol for each kind of individual. The matrix is then displayed within a black border and the numbers of each kind printed alongside, together with the cycle number, which will be zero at the start — see figure 1.

On keying Newline, the first cycle is initiated. What the program does now is to interrogate each cell of the matrix in turn to find out what kind of tree, if any, occupies it, and what its neighbours are on the north, south, east and west sides.

For our purposes, the diagonal neighbours are not considered near enough to have any influence.

This is where the ideas borrowed from Life play a role: if the number of neighbours of a normal or immune tree are three or four, then the tree is overcrowded and dies; its matrix cell is reset to zero; if the number of neighbours is less than two, then the normal and immune trees reproduce — that is, a new tree of the same kind is placed at random in an empty cell of the matrix.

However, if the cell being interrogated is occupied by a diseased tree, the disease is

spread to a random matrix cell. Should that cell be empty or occupied by an immune tree, nothing happens, but if the cell has a normal tree, then that tree becomes diseased. Finally, diseased trees have a limited life-span, dying off after four cycles, whether overcrowded or not.

After interrogation of all the cells of the field, the new state of affairs is displayed, together with the counts of normal, immune and diseased trees in the field. These numbers are also stored for later display in histogram and tabular forms. The cycle is now repeated as many times as necessary until the disease dies out — which it will not do if there are no immune trees to start with, in which case the disease becomes endemic.

Figures 2 and 3 show the position after 10 and 20 cycles and figure 4 the final field for a run which started with 50 normal, 10 immune and five diseased trees. Obviously, the number of cycles will depend on the starting conditions, and on the randomness of the propagation process, but the general trend is always the same.

After cycling for the required time, the results of the experiment can be displayed as a

ECOLOGICAL MODELLING

```

5 REM ECOLOGICAL EXPERIMENTS,
6 REM COPYRIGHT U.R.MASEFIELD
1982
10 CLEAR
15 CLS
20 PRINT TAB 5;"ECOLOGICAL EXP
ERIMENTS"
30 PRINT
40 PRINT TAB 9;"PROGRAMME"
50 PRINT
60 PRINT "SPREAD OF DISEASE IN
A"
70 PRINT "WOODLAND PLANTATIO
N";TAB 26;"A"
75 PRINT
80 PRINT "SPIDERS AND FLIES"
90 PRINT "(PREDATOR AND PREY
)";TAB 26;"B"
120 INPUT A$
125 DIM A(120)
130 CLS
135 LET N$="PRESS NEWLINE TO CO
NTINUE"
140 IF A$="A" THEN GOTO 1000
150 IF A$="B" THEN GOTO 3000
170 STOP
200 REM "-----"
210 PRINT AT 3,2;"":AT 3,13;"
":AT 3,15;"CYCLE NO.":AT 14,2;"
":AT 14,13;"
220 PRINT AT 18,0;N$;" H FOR HI
STOGRAM, T FOR TABULATED RES-UL
TS, E FOR NEW EXPERIMENT, I
FOR PROGRAM INDEX"
230 FOR I=3 TO 12
240 PRINT AT 3,I;"":AT 14,I;"
"
250 NEXT I
260 FOR I=4 TO 13
270 PRINT AT I,2;"":AT I,13;"
"
280 NEXT I
285 PRINT AT 0,0;B$
290 RETURN
300 REM "-----"
310 FOR I=1 TO 10
320 LET A(I)=0
330 LET A(I+110)=0
340 NEXT I
350 RETURN
1000 CLS
1010 LET B$="SPREAD OF DISEASE I
N A WOODLAND"
1030 PRINT B$
1035 PRINT
1040 PRINT "ENTER NO. OF NORMAL
HEALTHY TREES (MAX. 100)";
1050 INPUT N
1060 PRINT N
1065 PRINT
1070 PRINT "NO. OF IMMUNE TREES
(MAX. ";100-N;")";
1080 INPUT M
1090 PRINT M
1095 PRINT
1100 PRINT "NO. OF DISEASED TREE
S (MAX. ";100-N-M;")";
1110 INPUT D

```

```

1120 PRINT D
1125 PRINT
1130 PRINT N$
1140 INPUT A$
1150 IF A$("<") THEN STOP
1200 REM "-----"
1210 CLS
1220 GOSUB 200
1230 DIM N(200)
1240 DIM M(200)
1250 DIM D(200)
1260 FOR J=1 TO N
1270 LET R=INT (RND*100+1)+10
1280 IF A(R)<0 THEN GOTO 1270
1290 LET A(R)=11
1300 NEXT J
1310 IF M=0 THEN GOTO 1380
1320 FOR J=1 TO M
1330 LET R=INT (RND*100+1)+10
1340 IF A(R)<0 THEN GOTO 1330
1350 LET A(R)=12
1360 NEXT J
1370 IF D=0 THEN GOTO 1430
1380 FOR J=1 TO D
1390 LET R=INT (RND*100+1)+10
1400 IF A(R)<0 THEN GOTO 1390
1410 LET A(R)=13
1420 NEXT J
1430 LET C=1
1431 GOSUB 1435
1432 GOTO 1520
1435 LET I=11
1436 LET N=0
1437 LET M=0
1438 LET D=0
1440 FOR J=4 TO 13
1445 FOR K=3 TO 12
1450 IF A(I)=11 THEN PRINT AT J,
K;"0";
1455 IF A(I)=12 THEN PRINT AT J,
K;"#";
1460 IF A(I)>12 THEN PRINT AT J,
K;"*";
1465 IF A(I)=0 THEN PRINT AT J,K
;" ";
1470 IF A(I)=11 THEN LET N=N+1
1475 IF A(I)=12 THEN LET M=M+1
1480 IF A(I)>12 THEN LET D=D+1
1482 LET N(C)=N
1484 LET M(C)=M
1486 LET D(C)=D
1490 LET I=I+1
1500 NEXT J
1510 NEXT K
1520 RETURN
1525 PRINT AT 3,24;C-1;AT 5,15;"
D NORMAL ";N;AT 6,15;" IMMUNE
";M;AT 7,15;" DISEASED ";D
1530 INPUT A$
1540 IF A$="N" THEN GOTO 1600
1550 IF A$="H" THEN GOTO 2200
1560 IF A$="E" THEN GOTO 1800
1570 IF A$="T" THEN GOTO 1900
1580 IF A$="I" THEN GOTO 10
1590 STOP
1600 REM "-----"
1610 LET N=0
1620 LET M=0

```

```

1630 LET D=0
1640 PRINT AT 5,26;"":AT 6,26;"
":AT 7,26;"
1650 FOR I=11 TO 110
1660 IF A(I)=0 THEN GOTO 1790
1670 LET Y=INT (A(I-10)/10)+INT
(A(I+10)/10)+INT (A(I-1)/10)+INT
(A(I+1)/10)
1680 IF (A(I)=11 OR A(I)=12) AND
Y>2 THEN LET A(I)=0
1690 IF A(I)=0 THEN GOTO 1790
1700 IF Y<2 THEN LET R=INT (RND*
100+1)+10
1710 IF A(I)=11 AND A(R)=0 THEN
LET A(R)=11
1720 IF A(I)=12 AND A(R)=0 THEN
LET A(R)=12
1730 IF A(I)>12 AND A(R)=11 THEN
LET A(R)=13
1740 IF A(I)>12 THEN LET A(I)=A
(I)+1
1750 IF A(I)=16 THEN LET A(I)=0
1790 NEXT I
1800 LET C=C+1
1808 LET C=C
1810 GOSUB 1435
1820 PRINT AT 3,24;C-1;AT 5,26;N
;AT 6,26;M;AT 7,26;D
1830 GOSUB 300
1840 GOTO 1530
1900 REM "-----"
1910 CLS
1920 PRINT AT 0,0;B$
1930 PRINT AT 1,0;"C N I D
C N I D"
1940 PRINT AT 15,0;N$
1950 PRINT AT 19,6;"H FOR HISTOG
RAM";AT 20,6;"E FOR NEW EXPERIME
NT"
1951 PRINT AT 21,6;"I FOR INDEX"
1960 FOR J=1 TO 16
1970 PRINT AT J,15;" ";
1980 NEXT J
1990 LET C=2
2000 FOR J=2 TO 16
2010 PRINT AT J,0;C-1;AT J,4;N(C
);AT J,8;M(C);AT J,12;D(C)
2020 LET C=C+1
2030 IF C>0 THEN GOTO 2160
2040 NEXT J
2050 FOR J=2 TO 16
2060 PRINT AT J,17;C-1;AT J,21;N
(C);AT J,25;M(C);AT J,29;D(C)
2070 LET C=C+1
2080 IF C>0 THEN GOTO 2180
2090 NEXT J
2100 INPUT A$
2110 IF A$="H" THEN GOTO 2000
2120 IF A$="I" THEN GOTO 2200
2130 IF A$="E" THEN GOTO 1800
2140 IF A$="T" THEN GOTO 10
2150 STOP
2160 PRINT AT J+1,0;"END"
2170 GOTO 2100
2180 PRINT AT J+1,16;"END"
2190 GOTO 2100
2200 REM "-----"
2210 CLS

```

(listing continued on page 48)

SPREAD OF DISEASE IN A WOODLAND

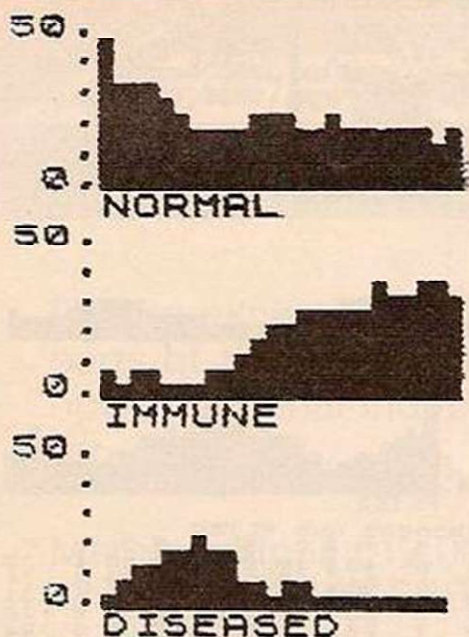


Figure 5.

SPREAD OF DISEASE IN A WOODLAND			
0	0	0	0
1	2	1	0
2	4	2	0
3	6	3	0
4	8	4	0
5	10	5	0
6	12	6	0
7	14	7	0
8	16	8	0
9	18	9	0
10	20	10	0
11	22	11	0
12	24	12	0
13	26	13	0
14	28	14	0
15	30	15	0
16	32	16	0
17	34	17	0
18	36	18	0
19	38	19	0
20	40	20	0
21	42	21	0
22	44	22	0
23	46	23	0
24	48	24	0
25	50	25	0

Figure 6.

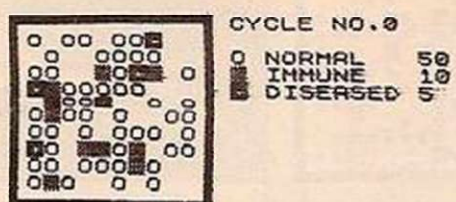


Figure 1.

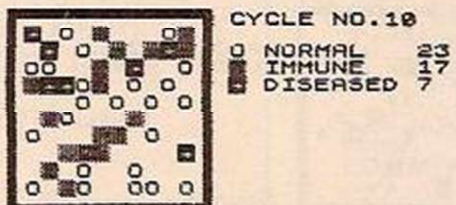


Figure 2.

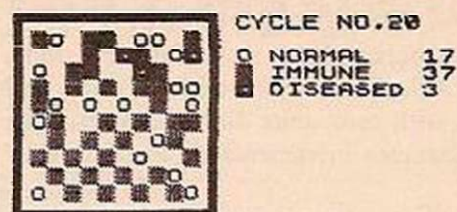


Figure 3.

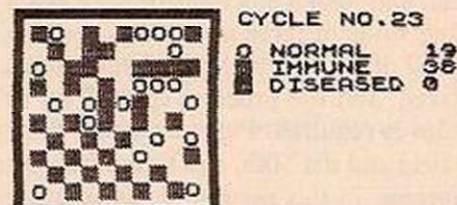


Figure 4.

histogram — figure 5 — or as a table of counts for pupils to make their own graphs — figure 6.

It is possible to elaborate this program so that the disease is spread only to immediate neighbours, for instance, or to prolong the life-span of diseased trees, and so on.

The second model concerns spiders and flies, and the prey and predator relationship. The basic idea is the same: the program asks for the initial number of flies — a maximum of 50 — and spiders — a maximum of 20 — and these are scattered at random in the 10-by-10 field. This initial field and the counts are displayed — figure 7.

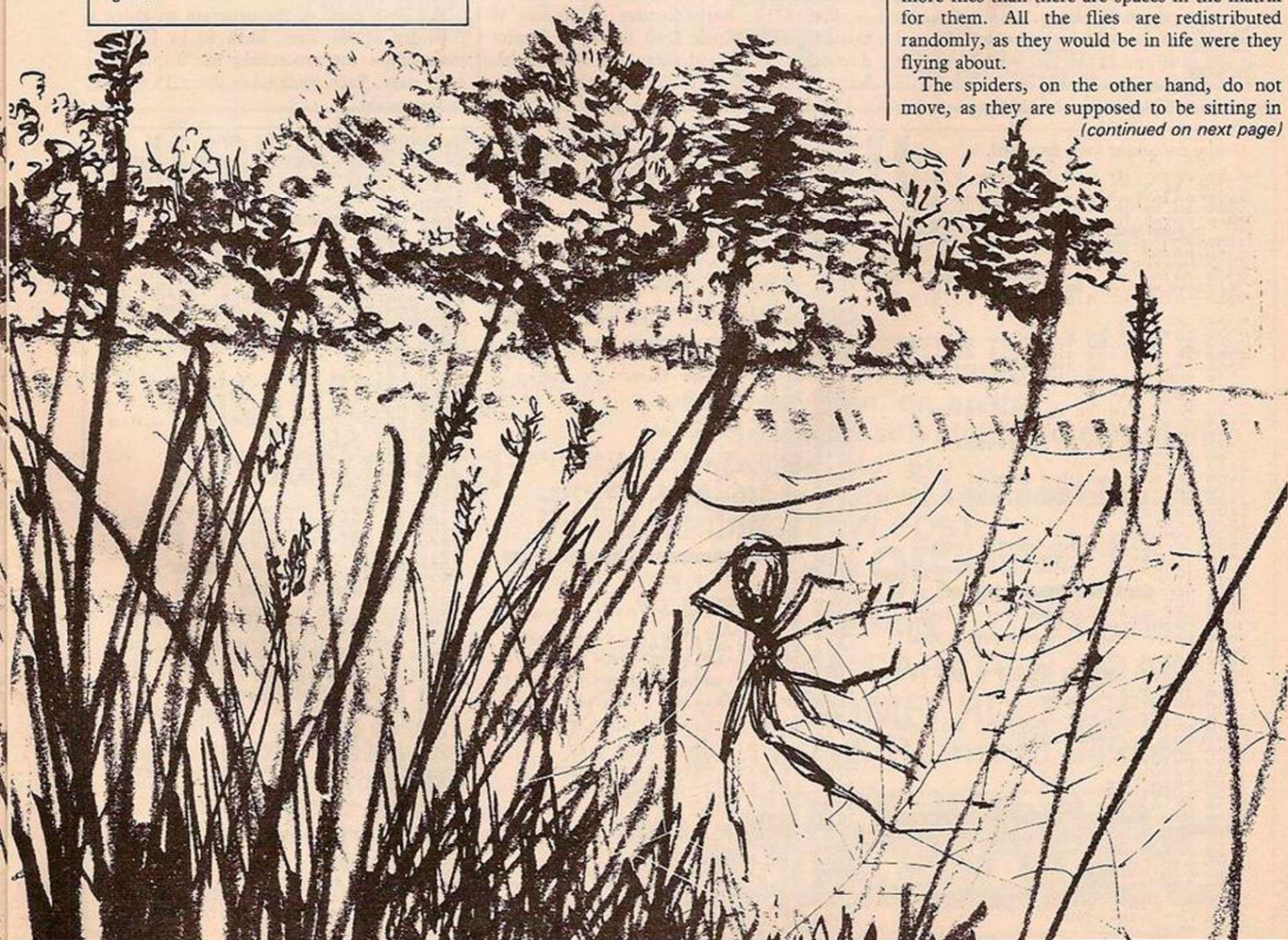
The same kind of interrogation of each cell is then carried out, but the manipulation is different: if a fly is unfortunate enough to be adjacent to a spider — north, south, east or west but not diagonally — then it is eaten. Otherwise, it is moved to another empty cell at random. A fly not adjacent to a spider is allowed to reproduce.

A constraint limits the number of new flies in each generation to half the number of parent flies, that is, a reproduction factor of 1.5, so that if there are 30 flies in one field, there will be 45 in the next.

Another limit ensures that there are not more flies than there are spaces in the matrix for them. All the flies are redistributed randomly, as they would be in life were they flying about.

The spiders, on the other hand, do not move, as they are supposed to be sitting in

(continued on next page)



(continued from previous page)

their webs. Each spider, at the start of its life, is given a store of food, valued at three units, but this is depleted by one unit per cycle, and a spider with zero units dies. However, each fly it consumes increments its food store by one unit.

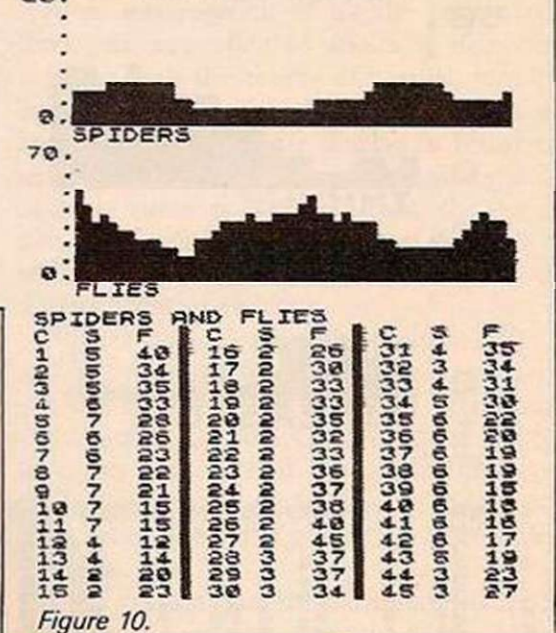
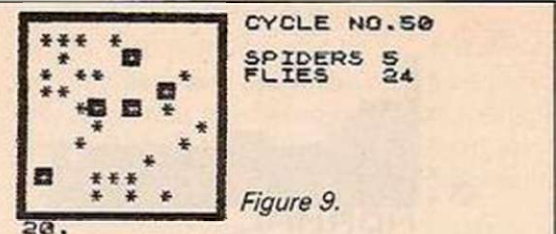
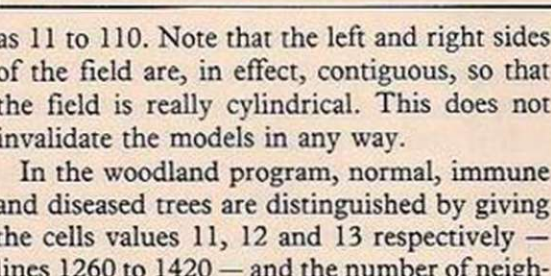
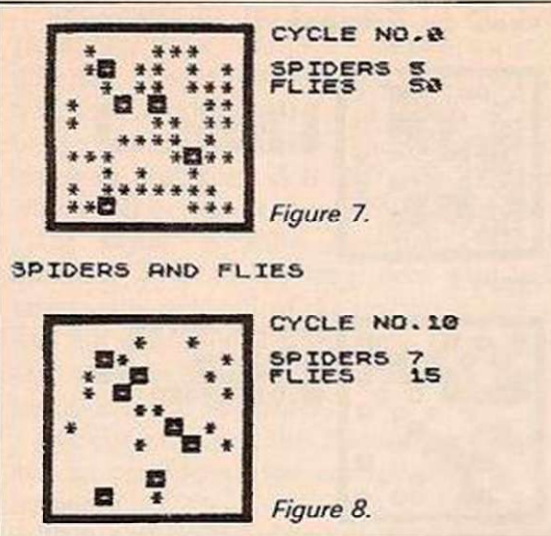
If a spider reaches a value greater than six, it reproduces, the offspring being set at random in the field, and both it and its parent are given the starting value of three units.

At the end of each cycle the field and counts are displayed, and the process repeated for as many cycles as required. Figures 8 and 9 show the 10th field and the 50th, and figure 9 shows the histograms. In this particular run, starting with 50 flies and five spiders, there has been a cyclic fluctuation in the populations and the peaks are staggered as they would be in nature.

Other starting figures will give different degrees of fluctuation and if there are too few flies or too many spiders at the start, the spiders can actually die out. It is assumed that the flies' food source is inexhaustible.

Although the displayed field is a 10-by-10 matrix, the actual field is 10-by-12. The reason for this is as follows: in the interrogation of, say, the *j*th cell, we have to look at the adjacent cells, *j*-10, *j*+10, *j*-1 and *j*+1 — the diagonal cells are not considered.

Now, if we wanted to interrogate cell 4, say, of a 10-by-10 matrix, we should have to look at cell 4-10, which does not exist and would crash the program. Similarly, cell 93+10, say, does not exist; so we have two rows of guard cells — 1 to 10 and 111 to 120 — which are not interrogated and are cleared on each cycle in lines 300 to 350, leaving the interrogated cells



as 11 to 110. Note that the left and right sides of the field are, in effect, contiguous, so that the field is really cylindrical. This does not invalidate the models in any way.

In the woodland program, normal, immune and diseased trees are distinguished by giving the cells values 11, 12 and 13 respectively — lines 1260 to 1420 — and the number of neighbours is determined by the sum of the tens digits in the adjacent cells — line 1760. The various operations on the cells are carried out in lines 1680 to 1790.

In the spiders and flies program, spiders are given an initial value of three — line 3350 — and this is decremented on each cycle by one, and incremented by one for each fly consumed — line 3710. Reproduction of spiders is carried out in lines 3740 to 3760. Reproduction is considered asexual in this model, but a sexual method could be incorporated.

Matrix cells with flies are given a value of

100 — line 3290 — which is a higher value than any spider is likely to reach. Flies' reproduction is carried out at line 3610 where the number of flies is increased by a factor of 1.5. It is interesting to experiment with other reproductive factors.

For both parts of the program an index is provided at the start, lines 40 to 170, and instructions for proceeding are displayed at each stage. Each cycle takes about 15 seconds in fast mode.

(listing continued from page 46)

```

2220 PRINT AT 0,1;"50";AT 7,1;"5
0";AT 14,1;"50"
2230 PRINT AT 5,2;"0";AT 12,2;"0
";AT 19,2;"0"
2240 PRINT AT 21,0;"E FOR NEW EX
PT I FOR INDEX"
2250 FOR I=0 TO 19
2260 PRINT AT I,3;"...";
2270 NEXT I
2280 PRINT AT 6,4;"NORMAL";AT 13
4;"IMMUNE";AT 20,4;"DISEASED"
2310 PRINT AT 6,3;"...";AT 13,3;"
"
2320 LET X=5
2330 FOR I=1 TO 0
2340 IF N(I)>50 THEN LET N(I)=50
2350 IF M(I)>50 THEN LET M(I)=50
2360 IF D(I)>50 THEN LET D(I)=50
2370 FOR J=32 TO N(I)+9/50+32
2380 PLOT X,J
2390 NEXT J
2400 FOR J=18 TO M(I)+9/50+18
2410 PLOT X,J
2420 NEXT J
2430 FOR J=4 TO D(I)+9/50+4
2440 PLOT X,J
2450 NEXT J
2460 IF N(I)=0 THEN UNPLOT X,32
2470 IF M(I)=0 THEN UNPLOT X,18
2480 IF D(I)=0 THEN UNPLOT X,4
2490 LET X=X+1
2500 NEXT I
2510 INPUT A$
2520 IF A$="E" THEN GOTO 1000
2530 IF A$="I" THEN GOTO 10
2540 IF A$="T" THEN GOTO 1900
2550 STOP
3000 REM SPIDERS AND FLIES
3005 CLS
3010 LET B$="SPIDERS AND FLIES"
3020 PRINT TAB 7;B$
3030 PRINT TAB 7;"(PREDATOR AND
PREY)"
3035 PRINT
3040 PRINT "ENTER INITIAL NO. OF
FLIES
(MAX. 50)";
3050 INPUT F
3060 PRINT F
3065 PRINT
3070 PRINT "ENTER INITIAL NO. OF
SPIDERS
(MAX. 20)";
3080 INPUT S
3090 PRINT S
3100 PRINT
3110 PRINT N$
3120 INPUT A$
3130 IF A$(">") THEN STOP
3200 REM INITIALISE CELLS
3210 CLS
3220 GOSUB 200
3230 DIM F(200)
3240 DIM S(400)
3250 FOR J=1 TO F
3270 LET R=INT (RND*100+1)+10
3280 IF A(R)<>0 THEN GOTO 3270
3290 LET A(R)=100
3300 NEXT J

```

```

3320 FOR J=1 TO 5
3330 LET R=INT (RND*100+1)+10
3340 IF A(R)<>0 THEN GOTO 3330
3350 LET A(R)=3
3360 NEXT J
3370 LET C=1
3380 GOSUB 3400
3390 GOTO 3540
3400 LET I=11
3410 LET S=0
3420 LET F=0
3430 FOR J=4 TO 13
3440 FOR K=3 TO 12
3450 IF A(I)=0 THEN PRINT AT J,K
"..."
3455 IF A(I)=0 THEN GOTO 3492
3460 IF A(I)<100 THEN PRINT AT J
,K;" ";
3470 IF A(I)<100 THEN LET S=S+1
3480 IF A(I)=100 THEN PRINT AT J
,K;"*";
3490 IF A(I)=100 THEN LET F=F+1
3492 LET I=I+1
3494 NEXT K
3500 NEXT J
3510 LET F(C)=F
3520 LET S(C)=S
3530 RETURN
3540 PRINT AT 3,24;C-1;AT 5,15;"
SPIDERS ";S;AT 6,15;"FLIES ";F
3550 INPUT A$
3560 IF A$=" " THEN GOTO 3600
3570 IF A$="H" THEN GOTO 4300
3580 IF A$="E" THEN GOTO 3000
3585 IF A$="T" THEN GOTO 4000
3590 IF A$="I" THEN GOTO 10
3600 STOP
3630 PRINT AT 5,23;" ";AT 6,23;"
"
3640 FOR I=11 TO 110
3650 IF A(I)=100 OR A(I)=0 THEN
GOTO 3770
3660 LET X=INT ((A(I-10)+A(I+10)
+A(I-1)+A(I+1))/100)
3670 IF A(I-10)=100 THEN LET A(I
-10)=0
3680 IF A(I+10)=100 THEN LET A(I
+10)=0
3690 IF A(I-1)=100 THEN LET A(I-
1)=0
3700 IF A(I+1)=100 THEN LET A(I+
1)=0
3710 LET A(I)=A(I)+X-1
3720 LET F=F-X
3730 IF A(I)<6 THEN GOTO 3770
3740 LET A(I)=3
3750 LET R=INT (RND*100+1)+10
3760 LET A(R)=3
3770 NEXT I
3780 FOR I=11 TO 110
3790 IF A(I)=100 THEN LET A(I)=0
3800 NEXT I
3810 LET F=F+INT (F/2)
3820 IF F=0 THEN GOTO 3880
3830 IF F>100-S THEN LET F=100-S
3840 FOR J=1 TO F
3850 LET R=INT (RND*100+1)+10
3860 IF A(R)=0 THEN LET A(R)=100
3870 NEXT J

```

```

3880 LET C=C+1
3890 LET 0=C
3900 GOSUB 3400
3910 PRINT AT 3,24;C-1;AT 5,23;S
;AT 6,23;F
3920 GOSUB 300
3930 GOTO 3550
4000 REM HISTOGRAM
4005 CLS
4010 PRINT B$
4020 PRINT "C S F C S F
C S F"
4030 PRINT AT 18,0;"PRESS NEWLIN
E IF TABLE NOT FULL";AT 19,6;"H
FOR HISTOGRAM";AT 20,6;"E FOR NE
W EXPERIMENT";AT 21,6;"I FOR IND
EX"
4040 FOR I=1 TO 16
4050 PRINT AT I,8;" ";AT I,18;" "
4060 NEXT I
4070 LET C=2
4075 LET P=0
4080 FOR K=1 TO 3
4090 FOR J=2 TO 16
4100 PRINT AT J,P+0;C-1;AT J,P+3
;S(C);AT J,P+5;F(C)
4110 LET C=C+1
4120 IF C>0 THEN GOTO 4220
4130 NEXT J
4140 LET P=P+10
4150 NEXT K
4160 INPUT A$
4170 IF A$=" " THEN GOTO 4075
4180 IF A$="H" THEN GOTO 4300
4190 IF A$="E" THEN GOTO 3000
4200 IF A$="I" THEN GOTO 10
4210 STOP
4220 PRINT AT J+1,P;" ";
4230 GOTO 4160
4300 REM INITIALISE
4310 CLS
4320 PRINT AT 0,0;20;AT 7,1;0;AT
18,0;70;AT 17,1;0;AT 8,3;"SPIDE
R";AT 18,3;"FLIES"
4330 PRINT AT 20,0;"PRESS T FOR
TABLE E FOR NEW EXPT";AT 21,5;"I
FOR INDEX"
4340 FOR J=0 TO 17
4350 PRINT AT J,2;"...";
4360 NEXT J
4400 PRINT AT 9,2;" ";AT 8,2;" "
4410 LET X=5
4420 FOR I=1 TO 0
4430 IF F(I)>70 THEN LET F(I)=70
4440 IF S(I)>20 THEN LET S(I)=20
4450 FOR J=28 TO S(I)+14/20+28
4460 PLOT X,J
4470 NEXT J
4480 FOR J=8 TO F(I)+14/70+8
4490 PLOT X,J
4500 NEXT J
4510 IF S(I)=0 THEN UNPLOT X,28
4520 IF F(I)=0 THEN UNPLOT X,8
4530 LET X=X+1
4540 NEXT I
4550 INPUT A$
4560 IF A$="E" THEN GOTO 3000
4570 IF A$="T" THEN GOTO 4000
4580 IF A$="I" THEN GOTO 10
4590 STOP

```



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USER-DEFINED

Mike Berry shows you how to prime those user-defined keys to eliminate some of programming's more laborious tasks.

COMPUTER TERMINALS used by professionals frequently have keys which can be set up by the programmer to generate functions which are used repeatedly. As a professional programmer, I was impressed to find that the BBC Micro provides such a facility.

User-defined keys are the red ones along the top of the keyboard labelled f0 to f9. Program 1's sole purpose in life is to set up the keys to perform useful tasks, leaving you to get on with more interesting problems. Keys are programmed by entering a command of the form *KEYn

followed by whatever you want the key to produce when you use it, the "n" is the number of the user-defined key. If you want to attach a Return to the end, you simply add the symbol "|", followed by the letter "M".

*Key0 Auto simply puts the keyword "Auto" on to the next line, where it waits for you to enter the starting line number and/or the increment. Although the default values for these are normally satisfactory, typing errors during program entry make it necessary to Escape from Auto so often that it is best to avoid including the line number and the "|M" on this key.

Just one touch of *Key1, Run|M starts your program.

The *Key2 Renumber|M command allocates new line numbers throughout your program, the defaults being 10 for the first line, and increments of 10 for subsequent lines. Statement numbers appearing in Goto and Gosub branches are cleverly adjusted for you. This facility is very useful as your program develops, and you keep cramming in extra code. It is also spectacularly fast.

Keywords preceded by an asterisk are, technically, commands. The command *Ca't on key 3 starts the cassette recorder. Your BBC computer will then read through the tape until you tell it to stop, by pressing Escape. While it does this, it checks the accuracy of what it is reading, and puts out messages similar to those you see while a program is being loaded. Thus, you can check that you have saved a program securely, before you lose it from the machine's memory.

*Key4 List|M is useful for program development. If you like to see your For-Next and Repeat-Until loops indented in the program listing, you could achieve this by altering this statement to

```
""KEY4 LIST0 7|M LIST|M"
```

Left untouched, the machine will, in response to a List command, scroll at impressive speed through the whole program listing. The normal way of combatting this is to press the N key simultaneously with the Ctrl key.

Thereafter, the machine will be in Page Mode, so only one screen full of program listing will be displayed at one time. To move on to the next page, you hit Shift. The VDU 14 instruction in *Key5 VDU14|M has exactly the same effect as Ctrl-N. Incidentally, VDU 15 turns the Page Mode off. This user-defined key is particularly handy because Page Mode is turned off every time you press Break or run your program.

Since you can load a program without specifying its name, and it is good practice to keep only one program per side of each cassette, inherent laziness suggests abandoning

names and making use of *Key6 Load ""|M.

When developing graphics programs, you probably find yourself constantly moving from a graphics mode to a program listing. This means that you either get whopping great print, or other unreadable text. So, *Key7 Mode 7|M puts you straight back into Mode 7, which is the teletext mode you started in, with good clear text.

The FX in *Key 8*FX137, 1|M or effects command is a direct instruction to the operating system. This particular one starts up the cassette recorder. This overcomes an irritating little habit of the BBC Micro to be always



KEYS

Figure 1.

```

10 REM Initialisation Program
   © Mike Berry 1982
20 *KEY0 AUTO
30 *KEY1 RUN|M
40 *KEY2 RENUMBER|M
50 *KEY3 *CAT|M
60 *KEY4 LIST|M
70 *KEY5 VDU14|M
80 *KEY6 LOAD""|M
90 *KEY7 MODE7|M
100 *KEY8 *FX 137,1|M
110 *KEY9 *FX 137,0|M
120 *KEY10 OLD|M
130 PRINT "Initialisation complete"
140 END
    
```

telling the cassette recorder to be off when you want it to be on, for example, when you want to rewind the tape after loading or saving a program.

*Key9, *FX 137,0|M turns the cassette motor off. Use it after you have rewound your tape.

*Key10 Old|M is the break key. After you use the break key to escape from nasty program error situations, you find that you have to re-activate your program by typing in Old. After your user-defined keys have been initialised as I suggest, the break key will produce the effect of Old as well as its usual function.

The BBC Micro has a very useful plastic strip above the keys, under which you can slide a strip of paper to label the user-defined keys. You can prepare the machine for a programming session with CH."" and Return. The initialisation program then loads and automatically runs. This only takes a few seconds, after which time the machine is set up in a thoroughly professional manner for the real business of programming.

You may have blocks of program code which crop up repeatedly in your program. It is a simple matter to attach all the common code to a user-defined key.

Another possible use is to store under each

key one of your favourite Sound routines. The sound facilities of the BBC Micro are very sophisticated, but making the best use of them does entail difficult coding of Envelope and Sound statements. It makes sense to keep these carefully contrived statements for your best sound effects, to be used in successive programs. Unfortunately, it is difficult to remember what they sound like. By storing them in a program similar to the one in program 1, you can put your routines on to the user-defined keys, and they try them until you find the most suitable for your purpose.

You could also use the user-defined keys for input during execution of your program. This could even out wear on the popular keys used for controlling movements during games, and could make it possible to input lengthy replies with minimum effort, for example in Adventure games.

What you store under a user-defined key does not have to be just one command or statement. You can store a multi-statement line, with semicolons, or string together a series of commands, each of which ends with a "|M". You can even program one user-defined key to define another user-defined key. If you reach the limit of how much you can store under one key, the machine will complain noisily. ■

7 TELETEXT MODE

The BBC Micro's teletext mode — a standard feature on every machine — presents many useful features if only the beginner can fathom its inner workings. John Thomas offers the key.

SOME VERY UNUSUAL effects can be obtained with the BBC's teletext character set. The set consists of control codes, 0-31, as in the other display modes — followed by an ASCII character set with lower case, a set of screen control codes, and a repeat of the ASCII set.

A list of the interesting screen control codes and their functions appears in table 1.

Eight colours including black or white text or block graphics as well as flashing and double-height characters are possible by prefixing any characters printed, with one of the special codes. The codes act for one line only

— until the next new line occurs — and are printed as spaces. To print characters of a specified colour, say, red, you must

```
PRINT CHR$ 129; X$
```

where X\$ represents any string. Anything printed in this line will appear in red but the effect does not continue on to the next line.

The block-graphics codes produce the standard teletext symbols found on the RML 380-Z and other computers. A list of the graphics, their codes and the characters they normally correspond to follow in table 2.

(continued on next page)

Table 2. Test program.

```

10 REM" Press space bar to continue
20 ONERRORGOTO360
30 MODE 7
40 PROCPOKE
50 PROCTELE
60 VDUL4:END
70 DEF PROCTELE
80 C=32
90 REPEAT
100 IF(C-32)MOD24=0 PRINT"Graphic",
   "ASCII code", "Character"
110 CL=(C-32)MOD6
120 VDU(129+CL),157,154,151,156,C,
   (129+CL),157,135:PRINTC;SPC(10);
   CHR$C
130 REM" Test for space bar.
140 REPEAT UNTIL INKEY$8=" "
150 C=C+1
160 Until C 255
170 ENDPROC
180 REM" Colour REMs
190 DEPROCPEEK
200 P+PAGE
210 T=TOP
220 FORA = P TO T
230 PRINTA-PAGE,?A,CHR$(ABS((?A
   31ANDA 127(?"A))
240 REPEAT UNTIL INKEY$8=" "
250 NEXT
260 ENDPROC
270 DEFPROCPOKE
280 FORN=1 to 3
290 READA
300 A=A+PAGE
310 ?A=129:?(A+1)=157:?(A+2)=131
320 NEXT
330 DATA6,240,304
340 ENDPROC
350 REPORT:PRINT" at line ":ERL:VDU14:
   END
    
```

This program lists all printable characters and their equivalent graphics. It is listed in List07 so do not insert spaces except where the "" symbol occurs. As the program uses the BBC Poke it must be entered very carefully. ProcPoke was used in development and lists the contents of the memory which the program occupies with its address relative to Page. ProcPoke demonstrates coloured Rems. ProcPoke and ProcPoke may be left out altogether — the program will still run on.

(continued from previous page)

Flashing characters are a relatively simple matter. Chr\$ 136; is printed before the character required to flash. This code will make anything printed after it on the same line flash, behaving similarly to the other codes, and does not affect the following line. However, another ASCII code, Chr\$ 137 will cancel the flash.

Double-height characters are caused by code 141 and may be cancelled by code 140. In order to produce a full word in double-heights, it must be printed twice. For example, to print "Hello" in double-height-
PRINT CHR\$ 141; "Hello"; CHR\$ 141; "Hello"
must be used.

Code 154 only acts on block graphics and it produces distinct pixels instead of the normal contiguous pixels.

Chr\$ 158 has even more esoteric effects. This screen control code does not appear on the screen but causes the last graphics symbol printed to be repeated in the same character cell as Chr\$ 158.

Either VDU or Chr\$ may be used to produce the teletext effects and there is no real difference in memory terms between the two except when multiple effects are required. For example

```
PRINT CHR$ 130; CHR$ 136; CHR$ 141;
"Colour"; CHR$BC; CHR$ 136; CHR$
141; "Colour"
```

will produce the word "Colour" in double-height, flashing green. The following routine uses four bytes less — VDU and Chr\$ are tokenised and use only one byte each — and is more concise, involving less typing.

```
VDU 130, 136, 141; PRINT "Colour";
VDU 130, 136, 141; PRINT "Colour"
```

Different background and foreground colours are also possible.

Printing a colour code followed by Chr\$ 157

followed by another colour code will produce a line with the first colour as the background and any characters in the foreground colour
VDU 129, 157, 131

will turn anything in a following Print statement into yellow on a red background.

A further property of the teletext mode is that, since any character on the screen may be copied to the lowest line by the editing cursor, all the features of the graphics may act actually within listings.

Suppose you wanted a Remark with red, double-height, flashing characters on a light-blue background. By using

```
VDU 134, 157, 129, 141, 136
```

as a direct command, five characters are printed on the screen below the VDU command and above the next > symbol. These characters cannot be seen but can be copied into the Rem statement by moving the editing cursor to the line below VDU and using the copy key. Note that the open quote must be used since some of the special characters are recognised by the Basic as tokens and will be converted into full keywords unless the quote is used. No closing quote is required except in Print statements where this technique may be used to show in the listing what will actually appear on the screen instead of showing a list of meaningless numbers and characters.

Teletext mode uses only 1K of memory and has a resolution of 80 by 75.

```
VDU 129, 157, 131
```

will turn anything in a following Print statement into yellow on a red background, and all eight colours can be produced, flashing and in double-height. On the model A with only 3K of user memory in the higher graphics modes — 10K for the screen and 3.5K for the machine operating system — this is especially significant.

Table 3. Demonstration program.

```
1 REM (C) John Thomas 1982. Teletext
display demonstration
10 *FX4,1
11 REM cursor and COPY keys produce
ASCII codes
20 *FX11,1
21 REM Turn off auto repeat
25 *KEY10OLD:M
26 REM Programs BREAK key
30 MODE 7
40 ON ERROR GOTO 60
50 Y=12:SP=11
60 PROCCL
70 INPUTLINE " " "Enter message: "MS$
80 IFMS$="" MS$=" Moving display
teletext demonstration. Copyright J T
1982.
Cursor keys may be used to change the
speed of motion and to alter the display's
altitude. Press ""C"" to alter colours."
90 PROCLINE
100 MS$=STRING$(35," ") + MS$
+STRING$(35," ")
110 DS$=MS$
120 REPEAT
130 PRINTTAB(3,Y);CHR$141;LEFT$(
DS$,35)
140 PRINTTAB(3,Y+1);CHR$141;LEFT$(
DS$,35)
150 DS$=MID$(DS$,2)
160 I$=INKEY$SP
170 IFI$="C" PROCCL:PROCLINE
180 IFI$=CHR$139ORIS=CHR$138
PROCHEIGHT
190 IFI$=CHR$136ORIS=CHR$137
PROCSPEED
200 PROCSTATUS
210 UNTILEND$=1
220 GOTO 110
230 DEFPROCCOL
240 *FX11,50
250 CLS
260 PRINT"Colours available are:"
270 PRINT'TAB'(10);"(1) Red"
280 PRINT'TAB'(10);"(2) Green"
290 PRINT'TAB'(10);"(3) Yellow"
300 PRINT'TAB'(10);"(4) Blue"
310 PRINT'TAB'(10);"(5) Magenta"
320 PRINT'TAB'(10);"(6) Cyan"
330 PRINT'TAB'(10);"(7) White"
335 PRINT'TAB'(10);"(8) Flashing fore-
ground"
340 PRINT""Press foreground colour . . .":
FC=VALGET$+128:IFFC<129ORFC>
135 GOTO340 ELSE PRINT FC-128
350 PRINT""Press background colour . . .":
BC=VALGET$+128:IFBC<129ORBC>
136 GOTO350 ELSE PRINT BC-128
360 *FX11,0
370 ENDPROC
380 DEFPROCLINE
390 CLS
400 PRINTTAB(0,Y);VDUBC,157,FC
410 PRINTTAB(0,Y+1);VDUBC,157,FC
420 ENDPROC
430 DEFPROCHEIGHT
440 Y=Y+ABS(I$=CHR$139)*VPOS 2)+
(I$=CHR$138)*(VPOS 23)
450 PROCLINE
460 ENDPROC
470 DEFPROCSPEED
480 SP=(SP-1)*ABS(SP 0)*ABS(I$=
CHR$136)+ABS(I$=CHR$137)*
(SP+1)
500 ENDPROC
510 DEFPROCSTATUS
520 PRINTTAB(0,Y+2);"Y="";Y;SP(5);
"Delay="";SP;SP(5)
530 ENDPROC
```

Table 1. Useful teletext codes.

Code	Effect
127	Delete
128	space
129	red text
130	green text
131	yellow text
132	blue text
133	magenta text
134	light-blue text
135	white text (Copy)
136	turns flash on (left cursor key)
137	Cancels flash (right cursor key)
138	(down cursor key)
139	(up cursor key)
140	Cancels double-height
141	Turns on double-height
142	
143	
144	
145	red graphics
146	green graphics
147	yellow graphics
148	blue graphics
149	magenta graphics
150	light-blue graphics
151	white graphics
152	rubs out following text on one line
153	Cancels pixel graphics
154	Turns on pixel graphics
155	
156	removes background — opposite of Chr\$ 157
157	fills line white/colour
158	repeats graphics when spaces/screen commands occur
159	

Change colour — effective for one line only — if used before Chr\$157 will affect background otherwise will affect foreground

Codes produced by cursor keys and Copy key after *FX4,1

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Table 1.

Code	Mnemonic	Basic equivalent
6	LD B N	LET B = N
14	LD C N	LET C = N
22	LD D N	LET D = N
30	LD E N	LET E = N
38	LD H N	LET H = N
46	LD L N	LET L = N
1	LD BC NN	LET BC = NN
17	LD DE NN	LET DE = NN
33	LD HL NN	LET HL = NN
4	INC B	LET B = B+1*
12	INC C	LET C = C+1*
20	INC D	LET D = D+1*
28	INC E	LET E = E+1*
36	INC H	LET H = H+1*
44	INC L	LET L = L+1*
3	INC BC	LET BC = BC+1
19	INC DE	LET DE = DE+1
35	INC HL	LET HL = HL+1
5	DEC B	LET B = B-1*
13	DEC C	LET C = C-1*
21	DEC D	LET D = D-1*
29	DEC E	LET E = E-1*
37	DEC H	LET H = H-1*
45	DEC L	LET L = L-1*
11	DEC BC	LET BC = BC-1
27	DEC DE	LET DE = DE-1
43	DEC HL	LET HL = HL-1
9	ADD HL BC	LET HL = HL+BC
25	ADD HL DE	LET HL = HL+DE
128	ADD A B	LET A = A+B*
129	ADD A C	LET A = A+C*
130	ADD A D	LET A = A+D*
131	ADD A E	LET A = A+E*
132	ADD A H	LET A = A+H*
133	ADD A L	LET A = A+L*
144	SUB A B	LET A = A-B*
145	SUB A C	LET A = A-C*
146	SUB A D	LET A = A-D*
147	SUB A E	LET A = A-E*
148	SUB A H	LET A = A-H*
149	SUB A L	LET A = A-L*
120	LD A B	LET A = B
121	LD A C	LET A = C
122	LD A D	LET A = D
123	LD A E	LET A = E
124	LD A H	LET A = H
125	LD A L	LET A = L
71	LD B A	LET B = A
79	LD C A	LET C = A
87	LD D A	LET D = A
95	LD E A	LET E = A
103	LD H A	LET H = A
111	LD L A	LET L = A
62	LD A N	LET A = N
60	INC A	LET A = A+1*
61	DEC A	LET A = A-1*
112	LD (HL) B	POKE HL, B
113	LD (HL) C	POKE HL, C
114	LD (HL) D	POKE HL, D
115	LD (HL) E	POKE HL, E
116	LD (HL) H	POKE HL, H
117	LD (HL) L	POKE HL, L
119	LD (HL) A	POKE HL, A
54	LD (HL) N	POKE HL, N
70	LD B (HL)	PEEK HL, B
78	LD C (HL)	PEEK HL, C
86	LD D (HL)	PEEK HL, D
94	LD E (HL)	PEEK HL, E
102	LD H (HL)	PEEK HL, H
110	LD L (HL)	PEEK HL, L
126	LD A (HL)	PEEK HL, A
194	JP NZ NN	
195	JP NN	
202	JP Z NN	
201	RETURN	

Loathe to leave the safety and comfort of Sinclair Basic, the ZX-81 user all too often misses out on the simplicity, speed and economy of machine-code programming. With the first part of this new series, Kathleen Peel aims to coax the timorous ZX owner out of his Basic refuge by demonstrating just how uncomplicated machine-code can be. She clears up the normal confusions by giving the Basic equivalent of every piece of code she discusses.

AS YOU ACQUIRE programming skills, you become aware of the limited speed and profligate use of memory in Basic. Real progress can be achieved by the use of machine code.

The sub-set of 14 commands which I define in this article will enable you to write small machine-code routines. Subsequent articles will expand the sub-set, gradually presenting a more exact picture of the Z-80 processor. Table 1 gives the mnemonics and Basic equivalent.

You can buy a piece of software called an assembler which takes the mnemonic instructions, which you can understand, and creates the machine code, which initially you will not understand. So effectively, it is a middle language between what the machine recognises and what the human recognises.

Start from the premise that the Z-80 processor has six variables and they are called B, C, D, E, H and L. These variables can only hold a number and that number has to be within the range 0 to 255, codes 6, 14, 22, 30, 38, 46. The variables can be grouped as pairs BC, DE and HL thus enabling them to hold a larger number, 0 to 65,535, codes 1, 17, 33. The variables and pairs of variables can be increased, codes 4, 12, 20, 28, 36, 44, 3, 19, 35, and decreased, codes 5, 13, 21, 29, 37, 45, 11, 27, 43, by one. You can also add to HL either BC, code 9, or DE, code 25.

If you wish to load a number into variable B, the number that follows the code 6, ld B N, is the number to be loaded into B. Similarly with code 17, ld DE NN, the two numbers following code 17 are the numbers to be loaded into the variable DE. N represents a single number; NN two numbers. If either value is zero it must still be included. If the processor expects two numbers, that is what you must give it. For example:

Basic Mnemonic Machine code

LET DE=16514 LD DE NN 17 130 64

LET BC=17152 LD BC NN 1 0 67

Notice that I have equated

16514 = 130 64

and 17152 = 0 67

In NN code the second number is always multiplied by 256 to get its value.

16514 = 130 + 64*256

17152 = 0 + 67*256

Somewhere inside the processor is another

Table 2.

Mnemonic	Machine code	Address	
JP NN	195	130 64	The examples all
JP Z NN	202	130 64	jump to Address 16514
JP NZ NN	194	130 64	(130 + 64*256 - remember?)



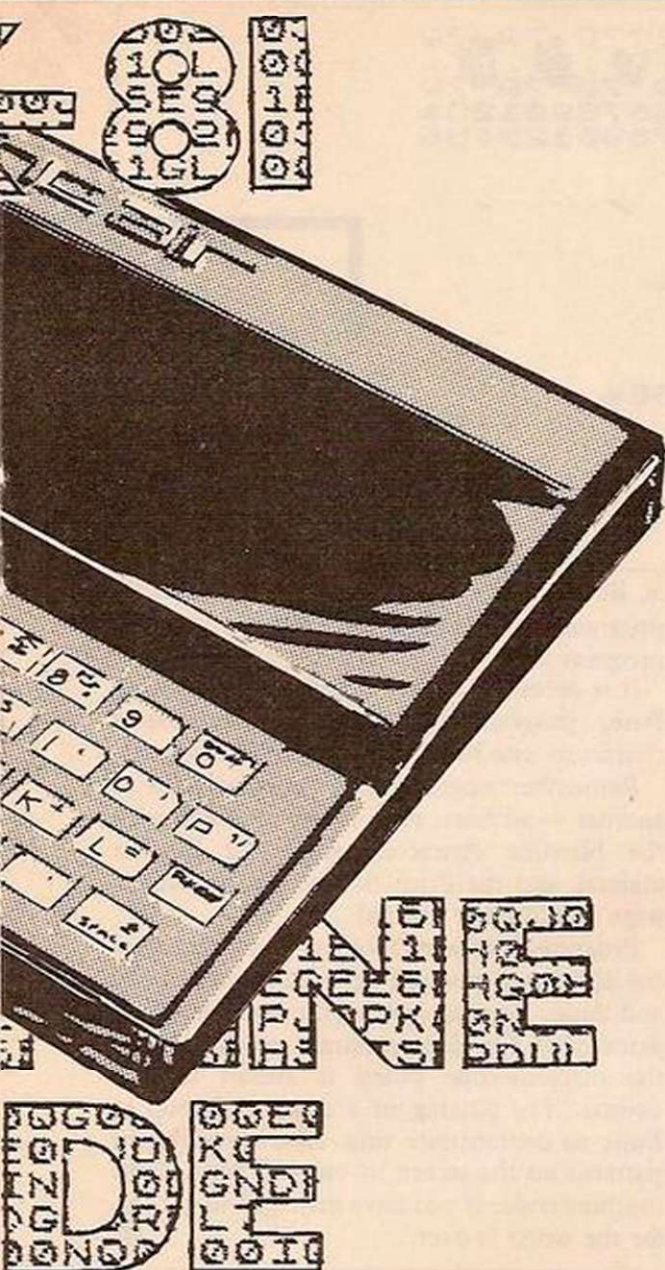
variable, A for accumulator. It is the only variable which can be added to, codes 128 to 133, or subtracted from, codes 144 to 149, one of the other variables. We can also put the contents of any one of the variables into A, codes 120 to 125, or put the contents of A into another variable, codes 71, 79, 87, 95, 103, 111. A can be made to equal any number between 0 and 255, code 62, and lastly A can be increased, code 60, or decreased, code 61, by one.

The last variable F, flag, will be defined by the following relationship. I hope you have noticed an asterisk by some of the codes. This indicates that after this operation a test is performed to see if 0 has occurred as a result of the operation.

Basic Mnemonic Machine code

LET B=B-1 DEC B 5

Variable F is adjusted on completion of this operation as follows:



Address	Machine code	Mnemonic	Basic
16514	33 30 65	LD HL NN	1 LET HL = 16670
16517	70	LD B (HL)	2 LET B = PEEK HL
16518	35	INC HL	3 LET HL = HL + 1
16519	126	LD A (HL)	4 LET A = PEEK HL
16520	128	ADD A B	5 LET A = A + B
16521	79	LD C A	6 LET C = A
16522	6 0	LD B N	7 LET B = 0
16524	201	RET	8 PRINT C
Add two numbers			
<i>Program 2.</i>			
16514	33 30 65	LD HL NN	1 LET HL = 16670
16517	70	LD B (HL)	2 LET B = PEEK HL
16518	35	INC HL	3 LET HL = HL + 1
16519	126	LD A (HL)	4 LET A = PEEK HL
16520	144	SUB A B	5 LET A = A - B
16521	79	LD C A	6 LET C = A
16522	6 0	LD B N	7 LET B = 0
16524	201	RET	8 PRINT C
Subtract two numbers			
<i>Program 3.</i>			
16514	33 30 65	LD HL NN	1 LET HL = 16670
16517	70	LD B (HL)	2 LET B = PEEK HL
16518	35	INC HL	3 LET HL = HL + 1
16519	78	LD C (HL)	4 LET C = PEEK HL
16520	62 0	LD A N	5 LET A = 0
16522	129	ADD A C	6 LET A = A + C
16523	5	DEC B	7 LET B = B - 1
16524	194 138 64	JP NZ NN	8 IF B <> 0 THEN GOTO 6
16527	79	LD C A	9 LET C = A
16528	6 0	LD B N	10 LET B = 0
16530	201	RET	11 PRINT C
Multiply two numbers			
<i>Program 4.</i>			

AND MEMORY ECONOMY

```

1 REM 12345678901234567890123
45678901234567890123456789012345
67890123456789012345678901234567
89012345678901234567890123456789
0123456789012345678901234567890
2 REM *****
200 CLS
250 LET C=USR 16514
300 STOP
500 FAST
601 FOR K=16514 TO 16654
810 SCROLL
820 INPUT J
830 POKE K,J
840 PRINT AT 7,0;K;TAB 8;J
850 NEXT K

```

Program 1, above, and right, program 1a.

```

1 REM 12345678901234567890123
45678901234567890123456789012345
67890123456789012345678901234567
89012345678901234567890123456789
0123456789012345678901234567890
200 CLS
210 SLOW
220 FOR K=2 TO 7
230 PRINT AT K, 8; "*"
240 NEXT K
250 LET C=USR 16514
300 STOP
500 FAST
601 FOR K=16514 TO 16654
810 SCROLL
820 INPUT J
830 POKE K,J
840 PRINT AT 7,0;K;TAB 8;J
850 NEXT K

```

If B is equal to 0 let variable F = Z for zero, if B is not equal to 0 let variable F = NZ for non-zero.

Variable F is only altered by those operations marked with the asterisk. Machine code does not have line numbers, so there is no equivalent to Goto a line number as in a Basic. Your Z-80 processor can jump to any place in memory, called an "address". When you start to load the example machine-code programs in

your ZX-81, you will see the numbers of the code that you are typing in. Scroll up the screen. Next to the code number is a five-digit number, the address of your typed-in code. It starts at 16514 and increases by one every time you enter in a new piece of code.

You can jump to any address if the F variable equals Z or you can jump to an address if the F variable equals NZ. That is, was the last test a zero or non-zero?

The form of these commands is in table 2. One further piece of the variable jigsaw is required to enable you to write machine-code programs and that is an understanding of the difference between direct and indirect statements.

A direct statement with a pair of variables would be: load variable with a number, normally an address. An indirect statement with a

(continued on next page)

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IT IS USUALLY possible to program efficiently without recourse to logical arithmetic and many programmers are happy to leave it that way. Unfortunately, if you are in the translation business and the original programmer has used logical arithmetic you are obliged to follow suit. This may leave you in an area of your Basic with which you are not familiar and with a machine that insists on being illogical. So let us look at some possible problems.

The logic of the Pet, TRS-80 and Genie is standard with the logical values being integers of -1 for true and 0 for false, but the Apple uses 1 for true and 0 for false. This would seem to be no more than an inconvenience but unfortunately there is a more subtle difference in the way machines deal with individual bits. The line

```
10 IF (X<7) AND (Z<>7) THEN 100
```

will work on most machines and is in fact a very powerful programming tool. Yet if that works, what about the following line?

```
20 IF PEEK (59410) AND 4 THEN 2000
```

It works on a Pet — to see if the space bar has been pressed — but an equivalent line

```
30 A = PEEK (49152) AND 128 THEN 2000
```

on an Apple will not extract a bit from an I/O

```
10 PRINT " 'AND' BINARY LOGIC TEST"
20 PRINT "ENTER VALUE OF X"
30 INPUT X
40 PRINT "ENTER VALUE OF Y"
50 INPUT Y
60 A=X AND Y
70 PRINT "THE LOGICAL 'AND' VALUE
   OF";X; "AND";Y; "IS";A
80 GO TO 10
```

Program 1. Binary logic test.

port. This is because on the TRS-80, Genie and Pet the logical operators And, Or, and Not operate on individual bits, but on the Apple they do not. Consequently line 30 always returns a value of A=1 regardless of the actual value in location 49152. On the Apple

```
A=X AND Y
```

is interpreted as

```
A=(X<>0) AND (Y<>0)
```

Confused? Program 1 is a test program to use on your computer to see how it handles logical arithmetic. Use this program to see how your machine reacts using various line 60s.

The logical operators on Sinclair machines are different again. On the ZX-80 true is -1 and false is 0, but on the ZX-81 true is 1 and false is 0. The rules for logical arithmetic on these machines are quite different and you are referred to table 1.

Sinclair owners will know that their version of logical arithmetic lacks a Not function. They cannot use the line

```
10 IF NOT X=10 THEN GO TO 100
```

but it can easily be mimicked with

```
10 IF X-10 THEN GO TO 100
```

which, on a Sinclair, does the job required.

Most games include an element of chance and this is provided by the computer's random-number generator. The first sign of such use often appears at the start of a program when the seed of the generator is reset to ensure a new series of random numbers. The statement used will be

Randomise, Random, Rand or Ran. The Pet and Apple set the seed with RND(-X). Your instruction book will tell you how to reset the seed value on your machine.

Having set this, the computer will call for a random number, when it needs one, with RND. RND is almost universal, but the results returned are not and could cause some

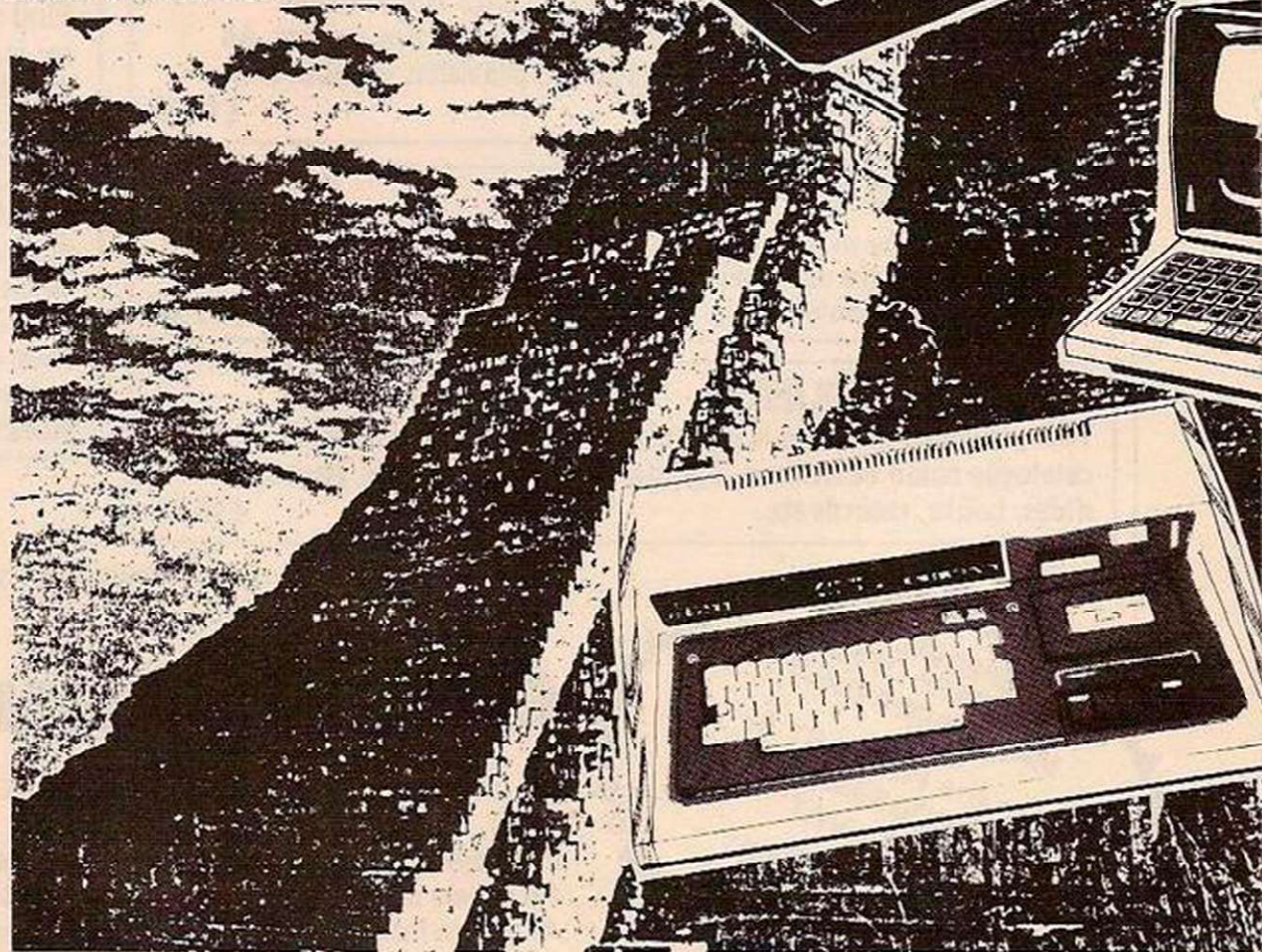
difficulty in translation. When a program requires a random number, there is a range into which it must fall and different machines handle these ranges differently. For a translation key, see table 2.

If your machine does not have a random function, you must create one and use it as a subroutine. There are a number of complex random-number algorithms but usually a simple one is adequate for games programs. My suggestion is program 2, which returns a pseudo-random number between 0 and 1 as R.

Cursor-control characters are the bane of a translator's life. They sit in other people's

BASIC TRANSLATION AND THE FINAL HURDLES

This month Tony Edwards offers a miscellany of ideas to help you past the pitfalls which lurk in even the simplest-looking Basic translation.



Random number	Pet	Apple	TRS-80 or Genie	ZX-81
$0 < x < 1$	RND(1)	RND(1)	RND(0)	RND
$0 < x < N$	N*RND(1)	N*RND(1)	RND(N)	N*RND
$A < x < B$	$A + (B-A)*RND(1)$	$A + (B-A)*RND(1)$	$A + RND(B-A)$	$A + (B-A)*RND$

Table 2.

programs, Chr\$, and are completely opaque. They cause the computer to do strange things depending on the code in parenthesis behind them — but to the uninitiated there is no way of breaking the code. Codes 32 to 126, except on Sinclair machines, are usually standard ASCII codes which were dealt with last month and codes above 126 are usually graphics symbols — also dealt with last month.

The exceptions are the Genie and TRS-80 where codes above 191 are space-compression codes which cause a number of spaces to be printed, the number of spaces being found by the formula

$$\text{number} = \text{code} - 192$$

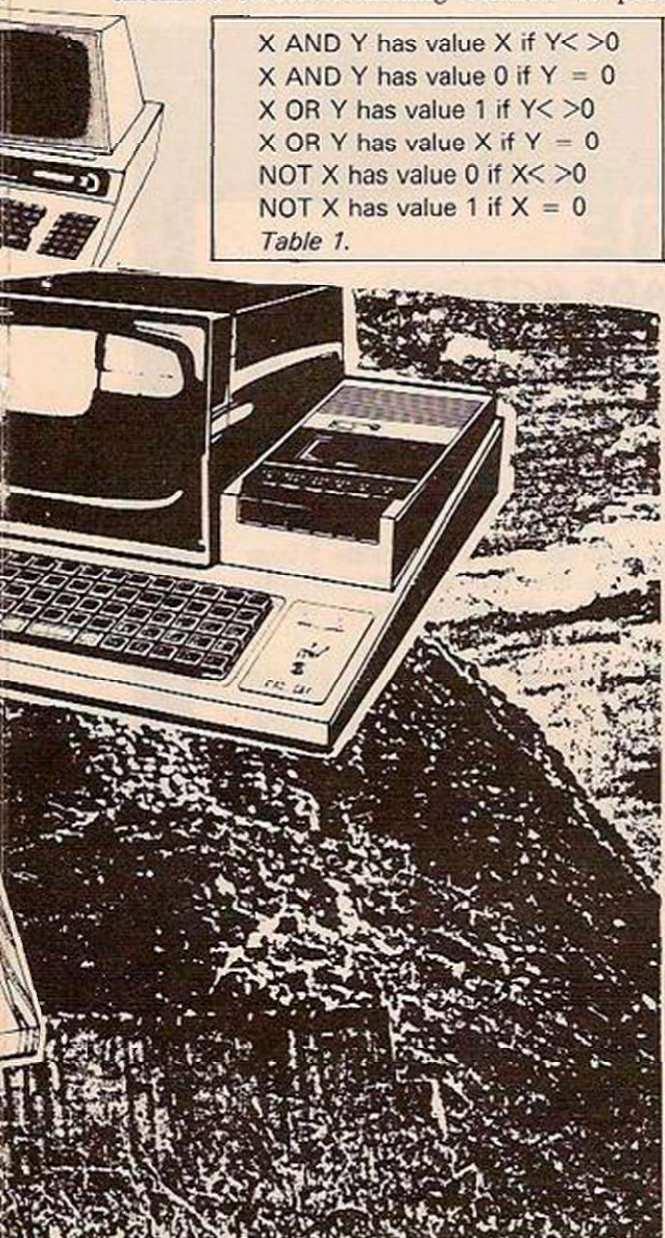
These are useful in formatting or in erasing characters no longer wanted on the screen.

The codes which cause most trouble are those which move the cursor about and clear parts of the screen. These are covered by the translation key in table 3. An exception is the TRS80's Chr\$(23) which causes characters printed to become double-sized. The Apple cursor controls are seldom used in programs as they must be preceded by the escape character, Chr\$(27).

Both games and business programs use extensive screen-formatting controls to pro-

X AND Y has value X if $Y < > 0$
 X AND Y has value 0 if $Y = 0$
 X OR Y has value 1 if $Y < > 0$
 X OR Y has value X if $Y = 0$
 NOT X has value 0 if $X < > 0$
 NOT X has value 1 if $X = 0$

Table 1.



duce a neat appearance. The Chr\$(X) controls and space-compression characters mentioned are part of this formatting but another essential part is the Print At, or Print @ statement. These and similar statements cause a character or string of characters to be printed at a particular position on the screen.

Sinclair machines identify the screen position with two co-ordinates so that

```
PRINT AT 3, 7, "#"
```

prints a hash at row 3 of column 7. The TRS-80 and Genie identify 1,024 screen positions so, as the screen is 64 characters wide, the same effect is produced by

```
PRINT @ 3*64 + 7, "#"
```

Apple owners do not have this facility but do not need it as they can use

```
VTAB3:HTAB7:PRINT "#"
```

to produce the same effect. VTab tabulates vertically and HTab tabulates horizontally.

At this stage readers who own Pets will be wondering what they can do as their machines do not have this feature. They can use a mixture of cursor controls and spaces to produce the same effect. For example, PRINT CHR\$(19), CHR\$(17), CHR\$(17), CHR\$(17), "#"

but this is not very elegant so I offer program 3 which provides Pet owners with a Print @ facility.

This is a Basic program which Pokes a machine-code program into the second cassette buffer. It should be safe enough there but if you want it somewhere else, it is relocatable without change. It is written for new-ROM

```
10 PRINT "INPUT RANDOM NUMBER SEED"
11 INPUT S
.
.
.
.
1000 REM PSEUDO-RANDOM NUMBER GENERATOR
1010 T = S/3001
1020 I = INT(T)
1030 R = T-I
1040 S = S + 17
1050 RETURN
```

Program 2. Pseudo-random number generator.

```
100 DATA 32,154,208,169,19,32,210,255,230,97
110 DATA 164,97,169,29,166,98,240,8,202,32
120 DATA 210,255,224,0,208,248,136,208,245,96
130 FOR X = 826 TO 855
140 READ Y
150 POKE X,Y
160 NEXT
```

Program 3. Pet Print @ routine.

Pets so users of old-ROM machines should make the following changes:

- Line 100, change 154 to 167
- Line 100, change 97 to 179
- Line 110, change 97 to 179
- Line 110, change 98 to 180

The line

```
POKE 1, 58:POKE 2,3
```

is used to initialise the program and then it is used with the statement

```
X = USR(A):PRINT A$
```

where A is the screen position and A\$ is the string to be printed.

This article started with logical arithmetic and in case you thought you had seen the last of it I am going to finish with it. A number of computers, including the Apple and the Pet, have a Wait statement which is useful. This causes the program execution to halt until some preset condition is achieved. The statement has the form

```
WAIT X,Y,Z
```

and the computer will wait until the contents of location X — usually a port — And Y Exclusive Or Z gives a non-zero result. It does not matter that this is such a mess because if your machine has no such function you do not need to understand it — just translate it. If you have an INP function you can mimic

```
10 WAIT X,Y,Z
```

with

```
10 IF INP(X) = 2 THEN 20:GO TO 10
```

This function is usually used to halt Basic until some action is taken with hardware so it can be mimicked with Inkey\$ if you have one using the loop:

```
100 A$ = INKEY$:IF A$ = "" THEN 100
```

which causes the machine to halt until a key is pressed or if you do not have Inkey\$ a normal Input will stop Basic until you enter some dummy value.

Next month, in the final part of this series, I shall deal with the methods used to translate from one dialect to another when the dialects are so different as to make direct translation impossible. The method presented is capable of translating from one language to another and an example of such a translation will be given.

Action	Pet	TRS-80 II and Genie	TRS-80 III	ZX-81
Clear screen	(147)	—	(27)	—
Clear to end of line	(22)	(30)	(23)	—
Clear to start of line	(150)	(29)	—	—
Clear to end of screen	—	(31)	—	—
Cursor up	(145)	(27)	(254)	(112)
Cursor down	(17)	(26)	(255)	(113)
Cursor left	(157)	(24)	(252)	(114)
Cursor right	(29)	(25)	(253)	(115)
Cursor home	(19)	(28)	—	—

Table 3. Chr\$ codes.

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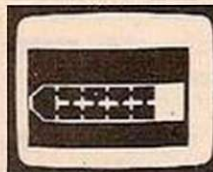
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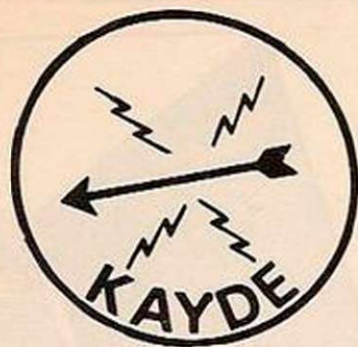
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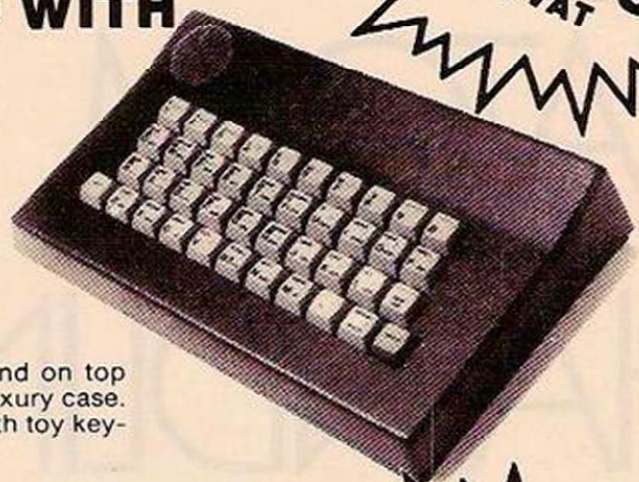
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SOFTWARE

ATOM FILE HANDLING

DATABASES are collections of information designed to allow you quick and easy access to the necessary data. A simple database sits in the corner of every office in the country, in the guise of a filing cabinet.

The more powerful the management system of the database is, the more choice you have of ways of interrogating the information base. Typical databases would be personnel records, payroll, scientific results, sales figures and mailing lists organised into files. A sophisticated database consists of a suite of programs accessing and working on many different files to provide the user with information.

Files are the nuts and bolts, and they can be classified as sequential, indexed or random access. Sequential file structures, sometimes known as serial files, have their information stored as records in memory, one after the other, head to tail. One important advantage of this style is the simple structure which makes program writing easier and less time-consuming.

Once you have created the file you must make it easy to use. File management is carried out by a trio of assembler routines euphemistically known as SID. These three routines perform the search, insert and delete functions that are necessary. The search routine is a simple linear search, that is to say it starts at the beginning of the file and works its way through each record, searching on the first three characters of each record.

If the search is successful the record will be printed out, if not the search flag will be conditioned and an appropriate message displayed on screen. Remember this search is conducted on a particular record's label, so as long as the key is unique you do not have to worry whether the rest of the record is similar to others. For example, you could use the last three digits of an invoice number as a label and the goods, price and date as the rest of the record. If the key cannot be guaranteed, just prefix each record with a three digit number from, say, 000 to 999 giving 1,000 unique labels but at the cost of a three-byte overhead for each record.

This search routine is also utilised by the insert and delete routines — not surprisingly since in order to delete a record you first need to find its position in the file. The search flag

George Byrns' trio of assembler routines provides the search, insert and delete functions that you need to handle the files which make up your Acorn Atom database.

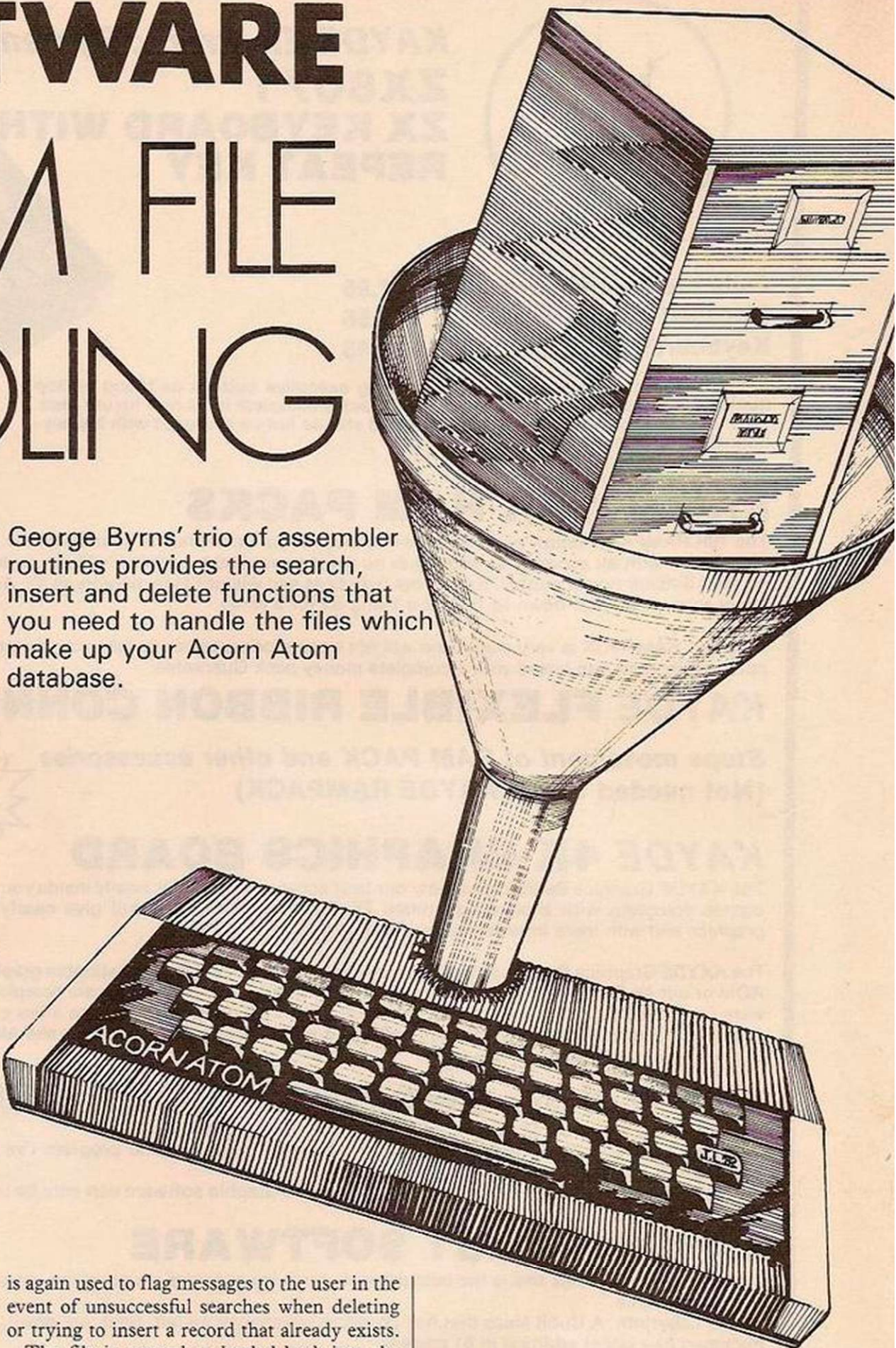
is again used to flag messages to the user in the event of unsuccessful searches when deleting or trying to insert a record that already exists.

The file is created or loaded back into the upper text space with the pointers to the file base set at # 8205 thus allowing space for the file parameters Filelen and Recordlen to be saved with the file. With only 6K of storage you need to be fairly concise. Naturally, with a disc drive, the program could be developed into a really powerful tool, as this would load the files in a matter of seconds, giving the capability to search through vast amounts of information in a minute or so.

The program is menu-driven and upon selection of a function a jump to the appropriate subroutine is performed along with error checking. To end a function and return to the menu the colon is recognised as end of function.

Suppose an estate agent had set up a file of all the properties on the market. Details listed could include the area of the city, detached or semi-detached, number of bedrooms, central heating and price. A prospective buyer might come into the office and ask for all properties in a particular area of the city, or request details of four-bedroom detached properties, in a specific area and with central heating. Here the multi-search comes into play.

This routine performs a global search on up to three target strings simultaneously and returns all the records that satisfy the search parameters. The target strings can be any



length, subject to the maxima defined by the user, and it does not matter whether the requested order is the same as that occurring in the file.

In the estate agent's case, the multi-search function would be selected and the area or post-code entered in response to the first question. A colon would then be entered in answer to the next question since only one attribute need be searched. Following this all the properties in the specified area would be printed. The second example would be just as easy to perform with the results duly printed out within a few seconds.

This routine is a more sophisticated version of the simple linear search which should become obvious from the flow diagrams and assembly listing and offers a great deal of flexibility in the way a file can be interrogated. There is plenty of scope for development. For example, you could search for and manipulate numerical data to provide tables, totals and averages.

The program could be used for holding details of club membership — streamlining membership renewal and mailing of newsletters, general mailing lists, cataloguing and cross-referencing journals or even as a language translator. I intend to develop the program further by providing the ability to search by fields if desired and incorporate relational testing of data.

Any 6502-based system with the necessary free space in zero page could run this program, but remember Atom Basic has its peculiarities. "\$" is the string address operator and it specifies that the value following it is the address of the first character of a string. \$A is analogous to A\$ in other Basics.

The query "?" operator can be considered to be the equivalent to Peek and Poke depending upon its context. The "!" sign can also be considered as a Peek or Poke but this time instead of operating on a single byte it operates on a word and in Atom Basic a word is four bytes long. The apostrophe used in Print and Input statements generates a carriage return followed by a line feed.

```

1  REM  FILE HANDLING PROGRAM  G.BYRNS
5  N = 64
10 DIM LL(30),R(N),S(N),T(N)
15 FOR I = 1 TO 30; LL(I) = -1; NEXT I
98 FOR I = 1 TO 2; DIM P(-1)
99 PRINT #21
100 C
      INSERT ASSEMBLY CODE
998: ]
999 NEXT I; PRINT #6; REM TURN SCREEN BACK ON
1005 !#84=0
1006 INPUT " ARE YOU USING AN EXISTING FILE ", #R
1007 IF #R = "Y" THEN #87 = #8202; #84=#8201
1009 REM PLACE BASE ADDRESSES OF STRINGS INTO ZERO PAGE LOCATIONS
1010 #85 = R; #86 = R&#FFFF/256
1015 #87 = R; #88 = R&#FFFF/256
1020 #89 = S; #90 = S&#FFFF/256
1025 #91 = T; #92 = T&#FFFF/256
1500 PRINT #12, " MENU"
1510 PRINT "1.....INSERT DATA"
1520 PRINT "2.....SEARCH FOR DATA"
1530 PRINT "3.....MULTI-SEARCH"
1540 PRINT "4.....DISPLAY COMPLETE FILE"
1550 PRINT "5.....DELETE COMPLETE FILE"
1560 PRINT "6.....CREATE FILE"
1570 PRINT "7.....CLOSE FILE"
1600 INPUT A; REM INPUT CHOICE
1610 IF A<1 OR A>7 THEN GOTO 1600
1620 GOSUB ((A*1000)+1000)
1700 GOTO 1500; REM GO BACK TO MENU
2000 INPUT "TYPE IN DATA" #R
2010 IF LEN(R)>N OR LEN(R)>#87 THEN PRINT "RECORD TOO LONG"; GOTO
2000
2020 IF #R = ":" THEN RETURN
2030 LINK LL5
2040 IF #96>0 THEN PRINT "RECORD ALREADY EXISTS"
2050 GOTO 2000
3000 INPUT "TYPE IN 3 CHARACTER LABEL" #R
3010 IF LEN(R)>3 THEN GOTO 3000
3020 IF #R = "CH:" THEN RETURN
3030 LINK LL0
3035 IF #96 = 0 THEN PRINT "NO SUCH RECORD "; GOTO 3000
3040 PRINT #(#83*256 + #82)
3050 GOTO 3000
4000 C = 0
4010 INPUT "TYPE IN SEARCH LABEL" #R
4020 IF LEN(R)>#87 OR LEN(R)>N THEN PRINT " TOO LONG"; GOTO 4010
4030 #89 = LEN(R); C = 1
4040 INPUT "TYPE IN SECOND LABEL" #S
4050 IF #S = "CH:" THEN GOTO 4085
4055 IF LEN(S)>#87 OR LEN(S)>N THEN PRINT "TOO LONG"; GOTO 4040
4060 #90 = LEN(S); C = 2
4065 INPUT "TYPE IN THIRD LABEL" #T
4070 IF #T = "CH:" THEN GOTO 4085
4075 IF LEN(T)>#87 OR LEN(T)>N THEN PRINT "TOO LONG"; GOTO 4065
4080 #91 = LEN(T); C = 3
4090 LINK LL14
4095 PRINT "PRESS ANY KEY TO CONTINUE"; LINK #FF03; RETURN
5000 J=0; PRINT #14; REM TURN PAGED MODE ON
5010 FOR I = 0 TO #84-1
5020 PRINT #(#8205 + J)
5030 J = J + #87
5040 NEXT I; PRINT #15; REM TURN PAGED MODE OFF
5050 LINK #FF03; RETURN; REM WAIT FOR ANY KEY TO BE TURNED ON
6000 INPUT "TYPE IN THREE CHARACTER LABEL" #R
6010 IF LEN(R)>3 THEN GOTO 6000
6020 IF #R = "CH:" THEN RETURN
6030 LINK LL9
6040 GOTO 6000
7000 INPUT "TYPE IN RECORD LENGTH" #B
7010 IF B>64 THEN GOTO 7000
7020 #87 = B
7030 DO
7040 INPUT " TYPE IN DATA " #R
7050 #89 = LEN(R)
7060 LINK LL5
7070 UNTIL #R = "CH:"
7080 RETURN
8000 #8202 = #87; #8201 = #84; @ = 1
8010 PRINT " *SAVE DATA FILE FROM 8200 TO "
8020 PRINT # 8205 + #87*#84,
8999 END

```

Search								
LL0	Start	LDA #0	Filebase			ADC #87	Record Len	
		STA #2	Point			STA #2	Point	
		LDA #0				BCC LL6	Insert	
		STA #6	Clear search flag	LL6	Insert	INC #3	Point + 1	
		LDA #1	Filebase + 1			LDY #0	File Len	
		STA #3	Point + 1			LDX #7		
		LDX #4	File Len	LL7	Look	LDA(#5),Y	Object	
		BEQ LL3	Out check for zero length file			STA(#2),Y	Point	
LL1	Look	LDY #2				INY		
LL2	Asain	LDA(#2),Y				DEX		
		CMP(#5),Y				BNE LL7		
		BNE LL4	Next record	LL8	Out	RTS		
		DEY						
		BPL LL2	Asain	LL9	Delete	Delete Routine		
		LDA #FF				JSR LL0	Search	
		STA #6	Set flag if found			BEQ LL13	Out if not found	
LL3	Out	RTS				DEC #4	File Len	
LL4	Next Rec	DEX				DEX		
		BEQ LL3	End of file ?	LL10	Add Rec Len	BEQ LL12	Done any entries left ?	
		CLC				LDA #2	Point	
		LDA #7	File len			CLC		
		ADC #2	Point			ADC #7	Record Len	
		STA #2	Store into Point			STA #8	Temp-point	
		BCC LL1				LDA #0		
		INC #3	Increment Point + 1			ADC #3	Point + 1	
		JMP LL1				STA #9	Temp-point + 1	
		Insert Routine			LL11	Look	LDY #7	Rec Len
LL5		LDY #0				DEY		
		LDA #58				LDA(#8),Y	Temp-point	
		CMP(#5),Y				STA(#2),Y	Point	
		BEQ LL8	Check for finish character - a colon			CFY #0		
		JSR LL0	Search			BNE LL11	Loop	
		BNE LL8				DEX		
		LDX #4	File Len			BEQ LL12	Done	
		BEQ LL6	Insert			LDA #8	Temp-point	
		CLC				STA #2	Point	
		LDA #2	Point			LDA #9	Temp-point + 1	

(continued on next page)

(continued from previous page)

		STA 83	Point + 1	LL19	Next Char	INY	
		JMP LL18	Jump to Add Rec Len			CPY 90	String Len
LL12	Done	LDA #FF				BNE LL18	Again
LL13	Out	RTS		LL20	Found	DEC 92	Success Count
						BEG LL22	Print Record
	Multi Search					LDA 91	Temp X store
LL14	Initialise	LDA 84	File Len			TAX	
		BEG LL13	Out check for zero file			INX	
		STA 93	Temp-file len			LDA 97,X	Fetch next object
		LDA 324	Low byte of C			STA 85	
		STA 92	Success Count			INX	
		LDA 80	Filebase			LDA 97,X	
		STA 82	Point			STA 86	
		LDA 81	Filebase + 1			INX	
		STA 83	Point + 1			LDA 97,X	
LL15	Start Over	LDX 00				STA 90	Object length
		LDA 97,X	Fetch first object			STX 91	Temp X store
		STA 85	Object			JMP LL16	Begin
		INX				DEC 93	Temp-file len
		LDA 97,X	Object + 1	LL21	Next Record	BEG LL25	Out
		STA 86				LDA 324	
		INX				STA 92	Success count
		LDA 97,X				CLC	
		STA 90	String Len			LDA 82	Point
		STX 91	Temp X store			ADC 87	Rec Len
LL16	Begin	LDA 82	Point			STA 82	
		STA 88	Temp-point			LDA 83	Point + 1
		LDA 83	Point + 1			ADC 80	
		STA 89	Temp-point + 1			STA 83	
LL17	Look	LDY 00				JMP LL15	Start Over
LL18	Again	LDA(88),Y	Temp-point	LL22	Print Record	LDY 00	
		CMP #13	Carriage return	LL23	Cont.	LDA(82),Y	Point
		BEG LL21	Next Record			CMP #13	Carriage return ?
		CMP(85),Y	Object			BEG LL24	Done
		BEG LL19	Next Char			JSR FFF4	Print char to screen
		CLC				INY	
		LDA 88	Temp-point			BNE LL23	Cont.
		ADC 81	Temp-point + 1	LL24	Done	LDA 324	
		LDA 89				STA 92	Restore success count
		ADC 80				JSR FFFD	CR/LF
		STA 89				JMP LL21	Next Record
		JMP LL17	Look	LL25	Out	RTS	

The zero-page locations.

Filebase	80	Record Len	87
Filebase + 1	81	Temp-pointer	88
Pointer	82	Temp-pointer + 1	89
Pointer + 1	83	String Len	90
File Len	84	Temp X store	91
Object	85	Success count	92
Object + 1	86	Temp file len	93

Figure 1. The linear search.

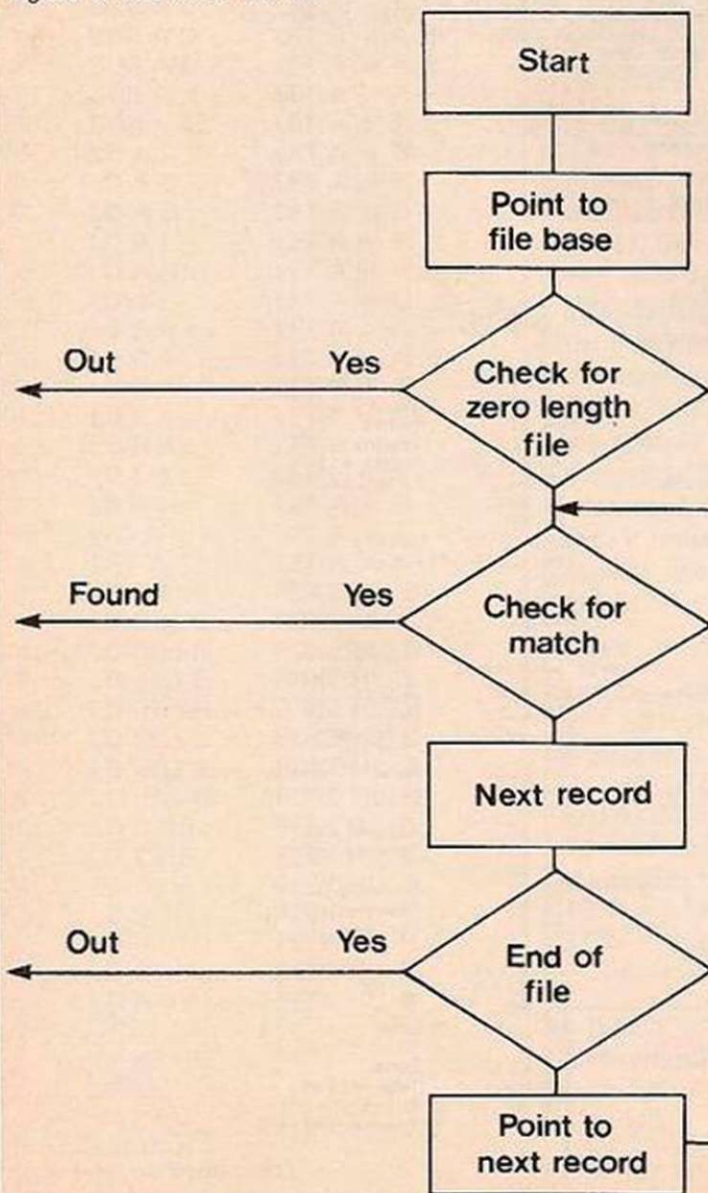
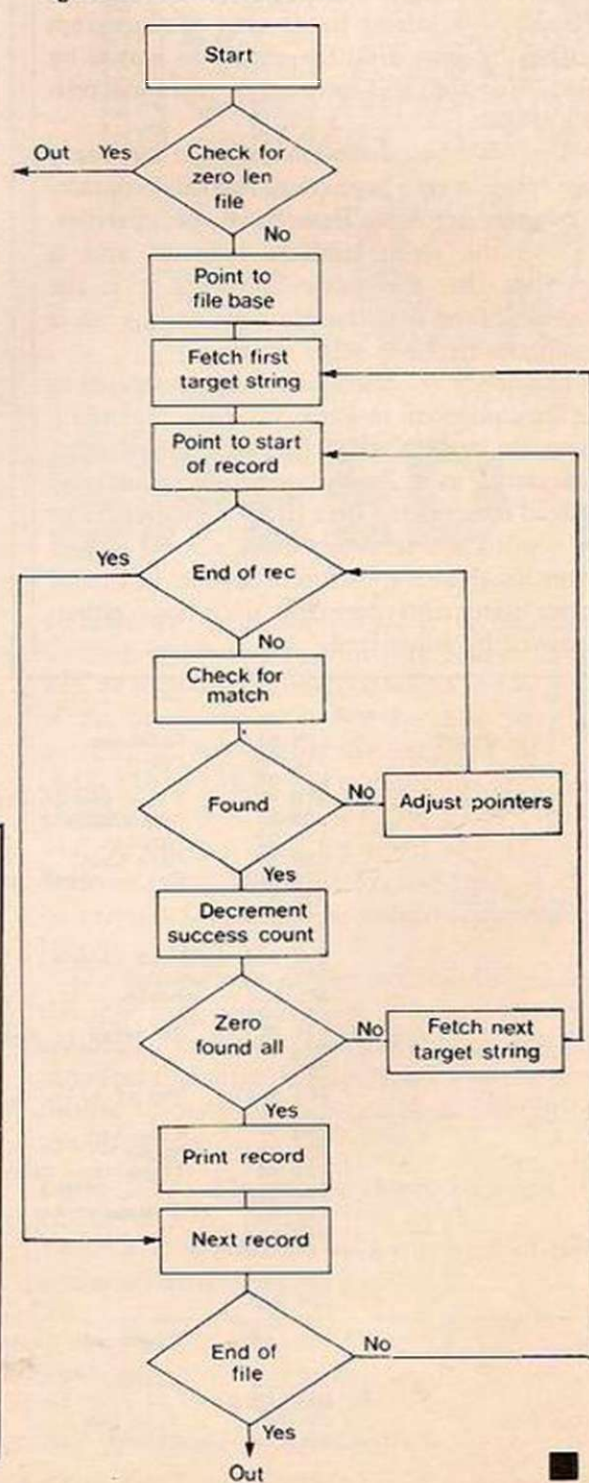
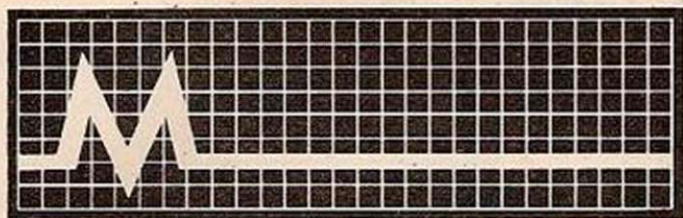


Figure 2. The multi-search.



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PROJECT ASIMOV AS A DATABASE

A VAST AMOUNT of work has been done on mainframe computers to find efficient ways of accessing parts of a collection of data in order to produce lists or reports that are useful to organisations or individuals. Data in this sense is a resource that is stored, manipulated and output from the computer for a multitude of tasks.

Extending programs

Word processors originally grew out of the need to write and edit source code for big mainframe computers. In the same way a microcomputer word-processing program can be used for other purposes than simply writing and printing text. Word processors like Asimov can be extended into database systems by adding commands.

Asimov will not be a true database management language. A database language should allow you to interrogate a collection of information in any way that you determine, rather than by one of a few limited routes built into a program.

Information held in a computer may take many forms. Data is conceptualised as letters or numbers, truth values, references or program instructions; but it is in fact only a stored value. A program instruction may have exactly the same binary value as a relative address or the letter 'k'. The description given to the stored value is an attribute of the data. A data attribute identifies an area of RAM and provides information as to how the contents of that RAM should be treated.

Implicit attributes

Attributes may be implicit; for example, the second byte of a machine-code instruction is an address rather than the instruction to the Central Processor Unit. Alternatively, the data attributes may be explicit and very high level, the information listed in figure 2 is grouped in

John Dawson's Asimov word processor can offer some of the facilities of a database. Here he shows how these techniques could be used to classify a cellar of wine.

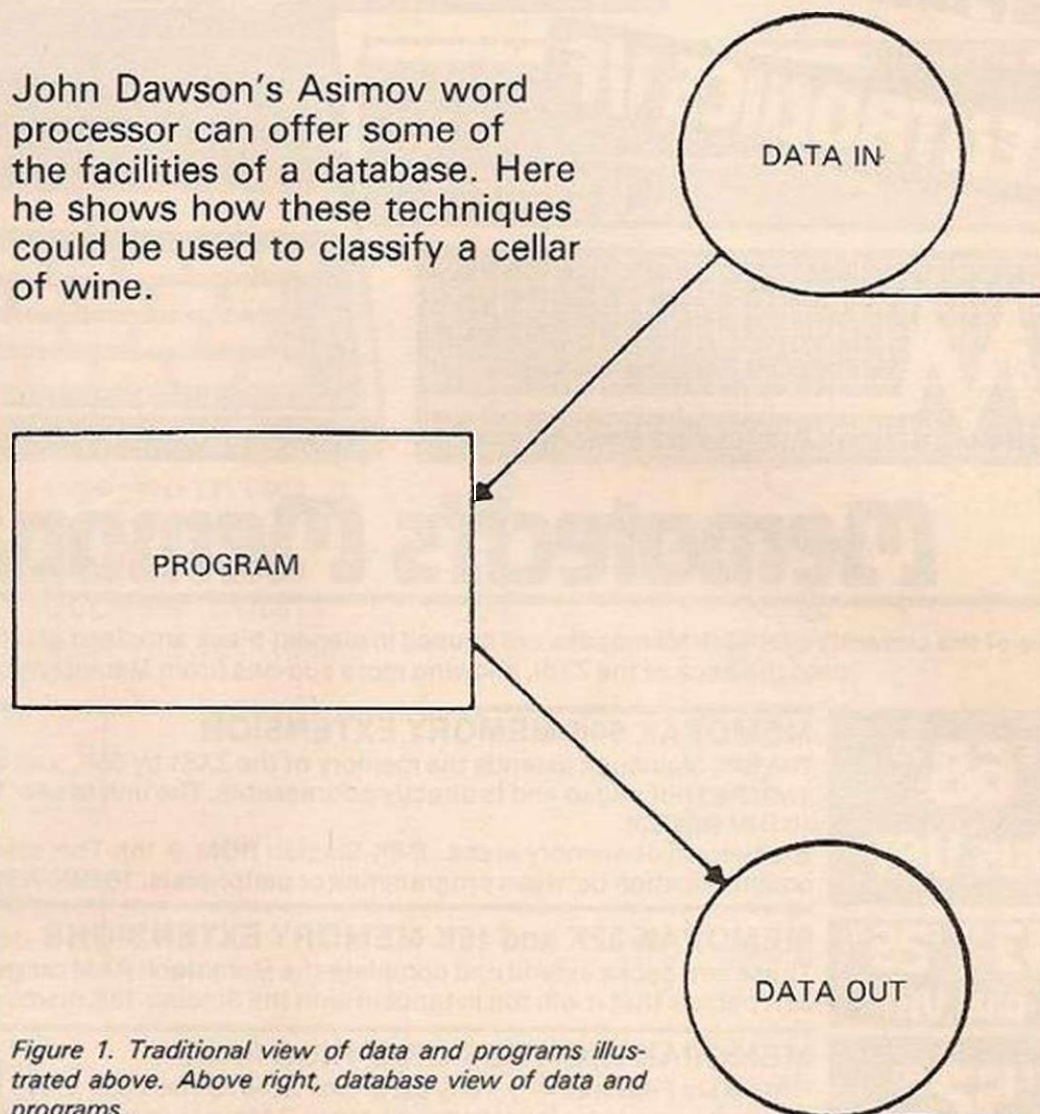


Figure 1. Traditional view of data and programs illustrated above. Above right, database view of data and programs.

a structured form and each record starts with a control line:

[.....
which contains a number of attributes of the data which follows.

The control line may contain 15 characters and the instructions in the extended version of Asimov will allow a user to search through a file of records, selecting those in which the control line matches a selection of attributes.

This pseudo-database approach means that sorting through the records can be done only by examining that line and not by looking at names or other pieces of information within the record.

Fine French wine

Fr in the control means that the wine comes from France; but suppose I want to know whether the collection contains any Cotes du

Definitions.

File — A file is a collection of records and will normally be a text in its own right. A file will be kept up to date by editing the text using Asimov. A combined text and record file is formed by retrieving the records first and then writing or appending the text.

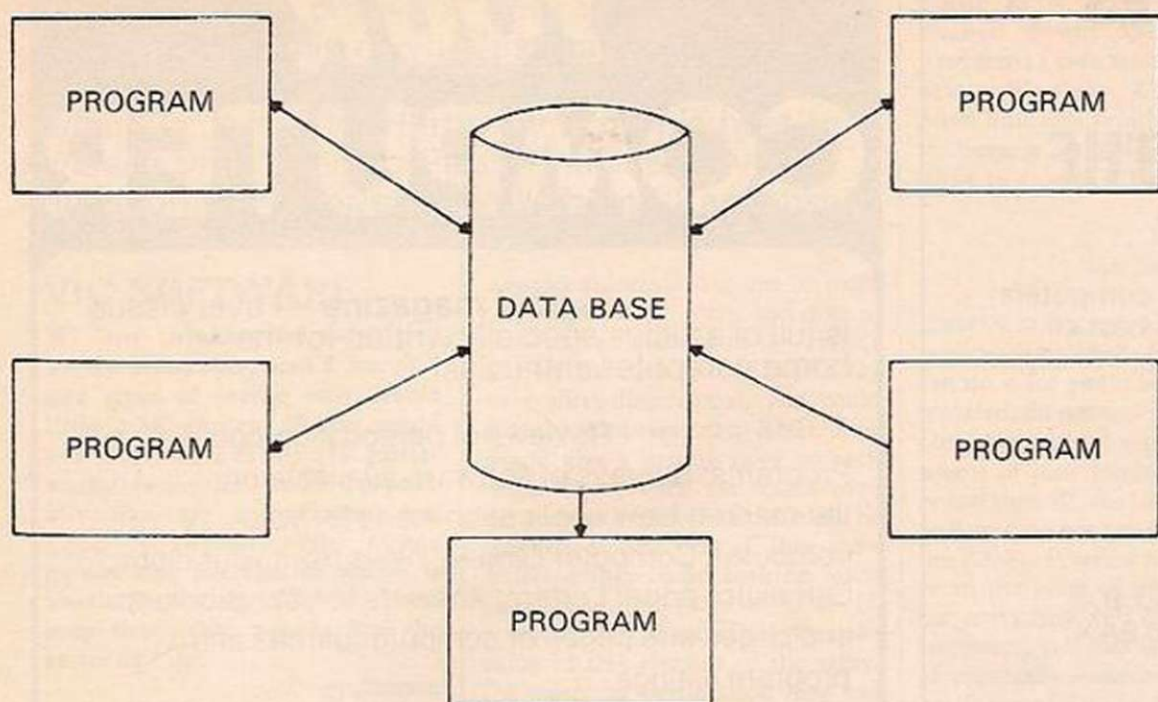
Record — A record is a number of fields. The start of each field is identified uniquely within the record and the fields are linked or related to each other. For example, Rhone wine is manufactured in France and

these two pieces of information will be linked in a record of a Rhone wine. Note however, that Rhone wine must be French; not all French wines are made in the Rhone area.

Field — The most basic part of the whole collection of information. Each field is terminated by a carriage return character to speed data input for name and address lists. Consequently each field is one paragraph long.

Figure 2.

```
[DUMMY.....
^1 Name
^2 Year
^3 Country of Origin
^4 Grape
^5 Shipper
^6 Date bought
^7 Bottles left
^8 Tasting notes]
```



HANDICAPPED COMPETITION

In Information Technology Year, *Your Computer* is sponsoring a competition to aid the handicapped. The competition, which is divided into two sections, is to design a device which helps disabled people to use a microcomputer to overcome their handicaps. All entrants to the competition must write up to 2,000 words describing such a device. In addition, entrants over the age of 18 will be expected to show a prototype device in action. More information about the competition and its rules will be found in *Your Computer*, April edition. The competition closes on August 31.

Luberon, the only way to find out is to print all the French wines. It is possible to find the words Cotes du Luberon with the Find command in Asimov and then print the record from there, but that is still not a real database.

The commands are nevertheless a useful and powerful way of storing, manipulating and retrieving information.

Some word processors allow you to write an address list and then generate standard letters with personal names incorporated into the letter. Asimov does not include this facility because it was designed to help write articles and books. The quality of the typeface produced by dot-matrix printers is legible and acceptable for draft articles or, for clubs and campaigns where the primary need is to distribute information.

Mailmerge facility

In adding a mailmerge facility to Asimov it proved possible to provide extended instructions that could be embedded into a text and edited with the normal word processor commands. This provided a more flexible system for people to use. Writers about wine could use extended Asimov to store information such as

Name
Country of origin (CoO)
Region within the CoO
Type of grape

Red or White
Wine shipper's name or where bought
Date bought
Cost
How many bottles left
Tasting notes (free format comments)

There are a number of uses for this information. The writers may wish to access the tasting notes for a single wine or a class of wines in the course of preparing an article or may wish to write to a shipper enquiring whether such and such a wine is still available.

They may wish to produce a catalogue of their stock, listing the wines according to various features — White Burgundy, or all the wines from California.

Each of these uses requires the data contained within the collection to be accessed and printed by the computer in different ways.

In addition to the instructions in figure 3 a couple of others are necessary to separate the text from the record file but these are trivial.

Missing instructions

Many instructions are missing that would be considered essential in a true database language. Boolean operators should allow you to carry out NOT and OR comparisons on the data to achieve selections such as:

Print all the Red OR White Spanish wines
The present control line is a permanent And function for example Print those records that are French And Red would look like
[FR.R.....]

A proper database language would allow you to add columns of figures extracted from the file of records, to select records that fell within a range of criteria — all the wines bought between 1975 and 1980 — or to answer questions such as — How many wines did we buy in 1976?

Nevertheless, the power of simple commands should not be disregarded and one crucial element in the design of any collection of information is safe — the data is in a form suitable for further analysis by more sophisticated procedures. Sorting a selection of records in a file into a particular order according to some attribute, the name of the wine, for example, should be comparatively straightforward.

Figure 3.

This list of instructions will provide easy, flexible and powerful ways of intermixing and listing data and text. The characters at the head of each descriptive paragraph are arbitrary and specific to Asimov — another program could use entirely different codes. The codes should be easy to remember and not intrude into your normal writing.

>

Search through the files and find the next record that matches the current control line.

\$n

Repeat instruction which forms part of a Repeat While loop. The instruction has no effect in its own right except to mark a position in the text. The \$n instruction must be matched with a <n instruction. This pair of instructions causes the computer to jump to the character following the \$n instruction while the End of File (EoF) flag is False. The EoF flag is set false at the start of the merge print function. The Repeat While pair can be used to print all the records in the file that match the current control line if a > instruction is included in the loop. Repeat While pairs may be nested.

?

Set of EoF flag to false. This instruction allows you to make more than one search through a file of records in the course of printing a document. For example, if you want to produce a list of all the Italian red wines in the collection the text could look like this:

List of Italian Reds and French White wines at 18 August 1982.

ITALIAN REDS

[IT.R.....]

\$1 > ^1^2^7

<1

FRENCH WHITE

[FR.W.....]

\$2 > 1 2 7

<2

End of list

When the program has completed printing the first selection of Italian red wines it will continue to print the heading for the next section and will then restart its search through the file for all the French white wines.

^ x

Print the field in the current record that corresponds to x. Each field may be of unlimited length and is terminated by a <Return> character. A record may have up to 62 fields — the identifier following the field marker is supplied automatically by ASIMOV when a record is typed. You may have only one record in the computer, comprising a number of standard paragraphs for flat leasing, for example, which are called up as necessary.

[.....]

Sets the control line to the characters inside the square brackets. A full stop is a "wildcard" and will match with any character so that an "empty" control line of 15 full stops will print all the records.

?

Print the current serial number. A variable is set to zero at the start of a print merge operation and this variable is incremented and printed at the present position of the printer. This instruction is useful for numbering items in a catalogue or list.

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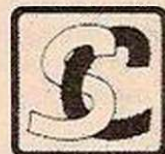
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YC/8

RESPONSE FRAME

Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

VIC SOFTWARE

■ I am thinking of buying a Vic-20 computer, and I am sick and tired of seeing only feeble little 3.5K games. Please could you inform me of any 16K games available for the Vic-20. I especially like the complicated but good Adventure and space games like Starfighter which is available for the TRS-80. I am sure that other people feel the same as I do.

Gregg Barnett,
Adbaston, Stafford.

IF AVAILABILITY of software is one of the main factors influencing your choice of computer, I suggest you look at the software first, and pick up the computer from that. The Vic-20, the TI 99/4A and the Atari 400 are now very close in price, and all offer computer power with plug-in cartridges. Atari's Star Raider is possibly the most impressive game on the market, but reviews of the same company's answer to Pacman have been far from favourable. Whichever machine you buy, you will have to accept some compromise — price against facilities, available software against ease of programming. The new Dragon 32 has at least five cartridges already available, and this may well be worth considering. Software for the Spectrum is already available, and the quality of the first programs I have seen suggests that you may be able to satisfy your game-playing needs with a Spectrum. To repeat my first suggestion, rather than criticise a particular machine for not having the programs you want, look for the games you want, and then see which machine supports them best.

FA CUP DRAW

■ An idea came to me when the FA Cup Draw was made. I could do my own computerised FA Cup draw. I immediately set about this, thinking of different ways to accomplish it. I have an idea on how to select a random football team, but the more I think about this, the longer the program seems to become. Also, after two teams have been drawn together, how do you ensure that the same two teams do not reappear again?

John A Stonier,
Welwyn Garden City, Hertfordshire.

IT IS DIFFICULT to give you specific advice, as I do not know how you have set the program up. However, if you base it on arrays, and the draw is held within an array, you could

consider dimensioning one or more extra depth in the array, and store in this extra dimension a unique number for each team. If the array were three-dimensional, you could allot the third element to RND. This would give a unique value to each team. Then, when the teams were drawn together these values could be checked. If, and only if, they were different they could both be made equal to a third value of RND. If, however, they already held the same value in this element of the array, the computer would know they had already been drawn together.

INTRODUCTORY BOOKS

■ I recently purchased a ZX-81 to help my daughters who are 11 and nine to acquire skills in using and understanding computers. It was not as easy as I had thought and now the computer is seldom used. I find the instruction book rather hard work. I have my first copy of *Your Computer* with so many advertisements for books for novices such as myself, I am wondering if you can advise me at all. The choice is bewildering.

Sue Bougard,
Harestock, Winchester.

THIS IS almost as difficult a question to answer as "Which is the best computer?", and made more difficult for me as I have written a few of the books which are among the bewildering number available. I will try to be impartial, which is difficult in the circumstances. In my opinion the books which you should consider as first-timers' books include, but are not necessarily limited to *ZX-81 Basic Book* by R Norman, *The ZX-81 Pocket-Book* by Trevor Toms, and *Getting acquainted with your ZX-81* by Tim Hartnell. When you've covered the material in these books, you could look at *The Explorer's Guide to the ZX-81* by Mike Lord, and *Byteing Deeper into your ZX-81* by Mark Harrison.

LOOSE ADAPTOR

■ When my Sinclair ZX-81 arrived it worked perfectly for about two months and then the 9V DC input plug from the adaptor to the computer became loose, and the slightest jog cleared the screen. I took it back, and received a replacement. Since then it has become loose a further three times. The problem is that the only thing that holds the adaptor plug in place is a strip of metal with a

bump in it. This is gradually pushed down, and causes the problem. I was wondering if any other Sinclair ZX-81 owners have had this trouble, and if so, if there is anything that can be done to stop this happening?

P Bradbery,
Westkingsdown,
Near Sevenoaks, Kent.

FIRSTLY, IT is a very simple matter to replace the socket. Any electrician can do it for you. Once you have it replaced, do not continue to pull the plug in and out. I suggest that is the source of your trouble. Disconnect, or just turn off, the power unit at the wall, and do not touch the socket on the ZX-81. It seems to me you must be in the habit of pulling the plug out every time you finish using the computer, and this is a certain way of eventually ensuring it will work itself loose. So, in brief, find an electrician to replace it with the best socket he has, and then once you have the unit working, do not pull the plug out again.

ATARI OWNER

■ Is there no-one out there in microland who has an Atari? As it is totally *Your Computer's* fault that I am now a pauper, I think you should help me. I knew nothing about computers until I foolishly bought a copy of your magazine. Then I was hooked. One question: can I use a cassette recorder with my micro other than the Atari one, or is it dedicated to the output, like the Vic-20 one?

Howard G Angel,
Harrogate, North Yorkshire.

YOU ARE NOT the only Atari owner. I have one, and so do tens of thousands of other people in the country. And now that the price of the 400 has dropped, there are certain to be more and more owners as time goes on. Yes, you do need to use the Atari cassette recorder, which is designed specifically and solely for the Atari computer. Although this is a disadvantage in terms of the cost, it is considered worthwhile by many because the load/save reliability of dedicated cassette machines tends to be higher than those which accept just any standard domestic recorder. My Atari recorder, for example, is considerably more reliable than my ZX-81/domestic recorder hook-up.

RANDOM MOVE

■ I own a 16K ZX-81 and I am writing two programs that involve the random movement of two characters around a maze. What I cannot work out is how to change the direction of the character at random when it comes to either a three- or four-node junction. I was wondering whether you could help me?

Nick Flint,
Salisbury, Wiltshire.

ASSUMING YOUR moving object is at locations Y,X. To move up, as you know, you subtract one from Y; adding one to Y to move down. Subtract one from the X value, and the object moves to the left, add one and it moves to the right. There are, in effect, four choices, and a few lines of code can be written to choose one of the four, and then make the necessary alterations in the value of Y and X. Try this routine, and then see if you can adapt it for your own program. The vital lines are 40, 50 and 60. It can easily be adapted for three directions.

```
5 REM MAZE DECISIONS
10 LET X=10
20 LET Y=10
25 LET A=X
26 LET B=Y
30 PRINT AT Y,X;"■"
40 LET K=INT(RND/4)
50 LET Y=Y-(K=0)+(K=1)
60 LET X=X-(K=2)+(K=3)
70 PRINT AT B,A;"..."
80 GOTO 25
```

ALIEN EXPLODES

■ I have a ZX Spectrum on which I am expanding my programming knowledge. My problem is trying to fire a missile from a base, and if it hits an alien, making that alien explode. I have heard this is something to do with graph co-ordinates, but on trying to apply this to a program, I have had no success.

Jason Hodges,
Brentwood, Essex.

YOU HAVE NOT said exactly what your problem is, but I guess you want to know how the missile knows it has hit an alien. You can use the ATTR function which can tell when the missile is just about to run into a character cell which contains an alien. ATTR, which is used in the form ATTR(Y,X), where the Y is the co-ordinate down the screen, and the X is the co-ordinate across it. You are printing the missile with Y and X as

```
PRINT AT Y,X;"■"
```

You need to write a few lines to check the attributes of the square Y,X before the missile is printed there. The number actually produced by ATTR depends on whether the character is flashing or not, whether it is bright or not, and the colours of the Ink and Paper at that position. Because ATTR seems to me to be a little unpredictable in practice, it seems best to set up a routine to print out the results of ATTR before you finally decide what value you wish to test for. The absence of a value produced when the missile moves over a blank background is not recommended. Instead of this, test for the presence of a particular value. You can do this when writing a program by including a temporary line of the type

```
PRINT AT 0,0;ATTR(Y,X)
```

then watching what happens to this value when the missile is just about to move into a cell occupied by an alien. ■



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FINGERTIPS

Fingertips is our regular calculator column covering calculator news, programming hints and examples of unusual applications. The column is written and compiled by calculator enthusiast David Pringle who is glad to hear of any of your ideas. *Your Computer* pays £6 for each of your contributions published.

THIS MONTH I am going to stand down and hand the column over to four contributors, two of whom are from a growing band of overseas correspondents. You may note three of the programs are written for the Casio calculators. This reflects the majority of the Fingertips mail-bag — so Texas Instruments, Hewlett-Packard and Sharp users should wake up, and start submitting some of their more inspirational material.

The program will give the distance from your town to any location in the world in miles, or kilometres if required, writes Andrew Shelbourne of Chesterfield, Derbyshire. I am a radio enthusiast and it is often useful to know how far a broadcasting station is from my location. It is written to run on the FX-180p.

You could also work out approximately how long a journey is or just use it out of interest. It proves to be much more accurate than the scales given on maps and atlases. The program must be used in conjunction with the index of an atlas to find the exact longitudes and latitudes.

The calculation is based on the formula:

$$\cos D = \sin La \cdot \sin Lb + \cos La \cdot \cos Lb \cdot \cos Lo$$

Where D is the angle of area between two points; La is the latitude of first town; Lb is the latitude of second town; Lo is the difference in longitude between a and b. This formula was obtained from the *Radio communication handbook*, Volume 2 page 11.23 printed by the Radio Society of Great Britain. The flowchart in figure 1 shows how to use the program. A final note, if the latitude of either town is south of the equator, it should be negative. For example, Capetown is 33° 59' south. Therefore enter it as -33° 59'. The flowchart may seem complicated but after a few calculations it becomes easy and one will remember whether a co-ordinate should be negative or not.

After entering the program, put
69.06 kin 4
1.151 kin 5
and your latitude in k memory 1. For example:

53°999 15°999 kin 1

For distance in kilometres, put
111.2 kin 4 1.853 kin 5

Mode 0 P1	13 kout 1	25 ENT
01 ENT	14 COS	26 ×
02 +	15 ×	27 kout 4
03 ENT	16 kout 2	28 =
04 =	17 COS	29 Min
05 kin 3	18 ×	30 kout 6
06 kout 1	19 kout 3	31 inv °999
07 SIN	20 COS	32 ENT
08 ×	21 =	33 ×
09 ENT	22 COS ⁻¹	34 kout 5
10 kin 2	23 kin 6	35 =
11 SIN	P2	36 M+
12 +	24 inv °999	37 Mr

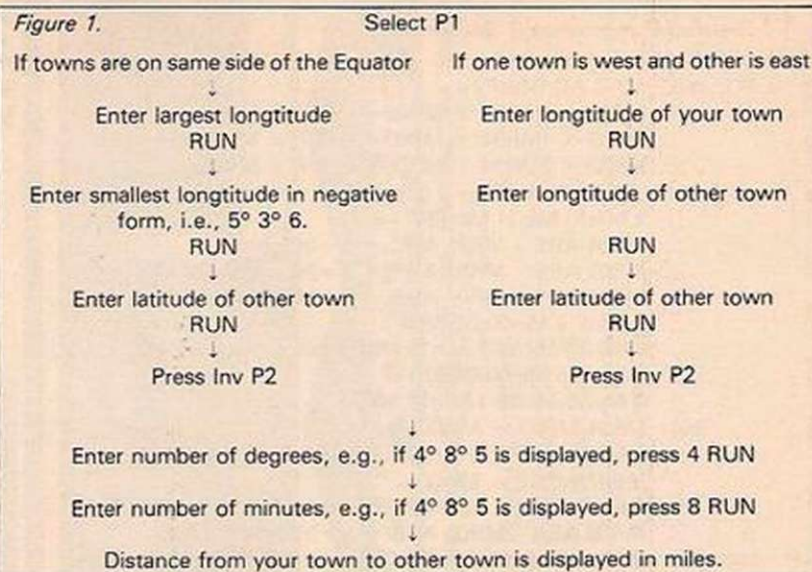
Here is the old favourite game of mastermind, but this time for the PC-1211 pocket computer, writes Robin Ager of Wimbledon, London SW19. The idea of the game is to guess the computer's four-digit number, each of which can be the numbers 1 to 9. No numbers appear twice in the computer's code.

The computer marks correct numbers in the correct place and correct numbers in the wrong place.

The program uses 564 steps. When typing in the program do not type semi-colons after the line numbers.

This jackpot program for the Casio FX-602P was originally written for the FX-502P, and after purchasing the FX-602P, I altered it a little, and improved the read-out, writes Fred de Heer of IJmuiden in the Netherlands.

Before entering the program MODE 3, invMAC, MODE 2, MODE .20 must be executed, to put the calculator in the correct format. For end-



ing an Alpha-statement in the WRT mode, FST is used instead of invA1, which works as well.

The words in the Alpha-statements in the program are written without commas for separation, as well as the two-digit numbers in the normal status. With most inverse button-functions, inv is deleted on the program.

In the program, several extra RAN# functions have been added to reduce the possibility of repetition of combinations, after you have played for a time. Since it uses 502 steps and 22 data registers, the program can only be used in the

FX-602P, and possibly in a calculator of the 700-series.

After inserting the program, followed by Mode 1, the jackpot is initiated with P9 — twice, if the credit counter equals 0 and reads out the following:

```

10 ■ — —
   ↑   1 2 3 ← reel number
credits
  
```

P0 decreases the credit counter by 1 and starts the jackpot, displaying a digit for reels 1, 2 and 3, followed by WIN: X

if the combination is a winning one.

The win may be collected, P0 or EXE, or can be gambled, P4, after

(continued on next page)

```

1: "A" CLEAR
3: INPUT "ENTER A NUMBER(1-1000)"; X: X=X/1000
4: M=0: FOR Y=1 TO 4
5: T=147*X: T=T-INT(T): X=T: T=INT(T*10)
10: IF T=0 THEN 5
15: A(Y)=T
16: NEXT Y
17: IF (A=B)+(B=C)+(C=D)+(A=C)+(B=D)<>1 THEN 20
18: GOTO 4
20: M=M+1: INPUT "ENTER YOUR GUESS "; Z
22: W=0: R=0
23: FOR Y=0 TO 5 STEP -1
25: Z=Z/10: J=(Z-INT(Z))*10: Z=INT(Z)
28: A(Y)=J
30: NEXT Y
40: FOR Y=1 TO 4
45: FOR Q=5 TO 8
50: IF A(Q)=A(Y) LET W=W+1
55: NEXT Q
57: IF A(Y)=A(Y+4) LET R=R+1
60: NEXT Y
85: W=W-R
90: IF R=4 THEN 200
95: PRINT "RIGHT PLACE="; R; " WRONG="; W
110: GOTO 20
200: BEEP 3: PAUSE "WELL DONE YOU GUESSED IT"
210: FOR Y=1 TO 3
212: PAUSE "*****": PAUSE "***** EXCELLENT *****"
220: PAUSE "IT TOOK YOU "; M; " GOES"
222: NEXT Y
225: INPUT "WANT TO PLAY AGAIN(Y/N)"; U$
230: IF U$="Y" THEN 4
240: END
  
```

Robin Ager's Mastermind program.

FINGERTIPS

The matrix inverter by G Devilee.

MODE .25

```
PO: lbl0 MAC AC GSBP7
      MR01 x (MR05 x MR09 - MR08 x MR06) -
      MR02 x (MR04 x MR09 - MR07 x MR06) +
      MR03 x (MR04 x MR08 - MR07 x MR05) =
      "DET=$" HLT x=0 goto1
      1 Min10 Min14 Min18
      MR04 ABS - MR01 ABC = x=>0 goto2
      MR07 ABS - MR01 ABS = x=>0 goto3 goto4
      lbl2 MR07 ABS - MR04 ABS = x=>0 goto3
      0 MinF 3 Min00 GSBP1
      0 Min10 Min14 1 Min11 Min13 goto4
      lbl3 0 MinF 6 Min00 GSBP1
      0 Min10 Min18 1 Min12 Min16
      lbl4 MR04/MR01 = Min00
      0 MinF GSBP2 3 +/- Min00 GSBP6
      MR07/MR01 = Min00
      0 MinF GSBP2 0 Min00 GSBP6
      MR08 ABS - MR05 ABS = x=>0 goto5 goto6
      lbl5 3 MinF 6 Min00 GSBP1
      12 MinF 15 Min00 GSBP1
      lbl6 MR02/MR05 = Min00
      3 MinF GSBP2 6 +/- Min00 GSBP6
      MR08/MR05 = Min00
      3 MinF GSBP2 0 Min00 GSBP6
      MR03/MR09 = Min00
      6 MinF GSBP2 6 +/- Min00 GSBP6
      MR06/MR09 = Min00
      6 MinF GSBP2 3 +/- Min00 GSBP6
      9 Min00 MR01 GSBP5 MR05 GSBP5 MR09 GSBP5
```

```
9 Min00 MinF 1 +/- Min22 GSBP7 goto0
      lbl1 "NO INVERSE" HLT goto0
      P1: 18 Min1F
      lbl1 1 M+F M+1F M+00
      ind MRF ind Min1F ind MR00 ind MinF ind MR1F ind Min00
      MRF/3 = FRAC x=0 goto2 goto1
      lbl2
      P2: 18 Min1F
      lbl1 GSBP3 x=0 goto2 goto1
      lbl2 6 M+F
      lbl3 GSBP3 x=0 goto4 goto3
      lbl4
      P3: 1 M+1F M+F
      MR00 x ind MRF = ind Min1F
      MR/3 = FRAC
      P4: 6 M+00
      lbl1 1 M+F ind MRF +/- + GSBP8
      MRF/3 = FRAC x=0 goto2 goto1
      lbl2
      P5: 1/x MinF x GSBP8
      MRF x GSBP8 MRF x GSBP8
      P6: 18 MinF GSBP4 GSBP4
      P7: lbl0 1SZ MR00 - MR1F = Min19/3 + 4 1/x = F1X0 MinF
      MR19 - 3 x MRF + 3 = Min19 MR1F
      "A ar22 (arF, ar19)" x=0 goto1 goto2
      lbl1 HLT ind Min00 goto3
      lbl2 PAUSE PAUSE ind MR00 F1X8 HLT
      lbl3 MR00 - 9 - MR1F = x=0 goto4 goto0
      lbl4
      P8: 1SZ ind MR00 = ind Min00
```

(continued from previous page)

which the combination win can be doubled or nothing.

If there is no winning combination in the display, each reel can be held with P1, P2 or P3. The hold can be cancelled with P4. Reels cannot be held with a winning combination or twice in succession.

Combination	Win	Combination	Win
9-9-9	50	3-3-3	14
9-9-8	50	3-3-8	14
8-8-8	24	2-2-2	10
7-7-7	20	2-2-8	10
7-7-8	20	1-1-1	10
6-6-6	18	1-1-8	10
6-6-8	18	0-0-0	8
5-5-5	18	0-0-8	8
5-5-8	18	-0-0	4
4-4-4	14	-0-0	2
4-4-8	14		

9-9-9 is the jackpot and adds 50 credits and another 50 which can be gambled.
 P0 Start/collect win
 P1 Hold reel 1
 P2 Hold reel 2
 P3 Hold reel 3
 P4 Gamble win/cancel hold
 P9 Initiate/reset credit counter

This program runs on the Casio FX-602P and inverts a three-by-three matrix using the Gauss-Jordan method, writes G Devilee, Voorburg also in the Netherlands.

The user enters
 A0 (1.1) - A0 (3.3)
 to evaluate the determinant and the inverse matrix. When the determinant equals 0 then
 "NO INVERSE"

is displayed. When the determinant does not equal 0, then an inverse is possible and

A-1 (1.1) - A-1 (3.3)
 is displayed. The total number of steps used is 444.

Finally, another brain teaser,
 Let $g(n) = n+2 (n-5)$

and

$$c = \left[\log \left(\frac{10}{3} \right) \right]^2$$

Can you write a program which will find the roots of

$$f(n) = 1 - 2 \exp \left[\frac{-g^2(n)}{c^2} \right]$$

from first principles. ■

Fred de Heer's jackpot game.

```
P0 invA1, ;, FST, MR04, X=0, GOTO0, GOTO7, LBL0, MR05, X=0, GOTO9,
-, 1, =, Min05, GSBP5, 0, Min04, 3, Min00, LBL1, GSBP5, RAN#,
RAN#, Xy, 1, 1, X * Y, ÷, RAN#, -, X=0, GOTO1, -, 1, =, INT, IND,
Min00, -, MR12, =, X=0, GOTO1, MR06, X=0, GOTO2, π, MinF, MR07,
Min1F, X = F, GOTO3, Min01, LBL3, MR08, M+1F, X=F, GOTO4, Min02,
LBL4, MR09, M+1F, X=F, GOTO2, Min03, LBL2, DSZ, GOTO1, GSBP5,
MR06, X=0, GOTO5, MR1F, ÷, 3, =, X=F, GOTO5, 0, Min06, MRF,
Min09, Min08, Min07, GOTO6, LBL5, 1, M-06, LBL6, MR03, MinF,
MR02, X=F, GSBP6, MR04, X=0, GSBP7, MR04, X=0, GSBP7, MR04,
X=0, GOTO7, invA1, WIN:, space, #, FST, HLT, LBL7, GSBP8, LBL9

P1 invA1, ;, FST, MR06, X=0, GOTO1, invA1, HOLD, →, ar03, →,
ar02, →, ar01, FST, MR03, Min09, RAN#, M-06, LBL1, GSBP5

P2 invA1, ;, FST, MR06, X=0, GOTO1, invA1, HOLD, space, ar03, -,
ar02, →, ar01, FST, MR02, Min08, RAN#, RAN#, M-06, LBL1, GSBP5

P3 invA1, ;, FST, MR06, X=0, GOTO1, invA1, HOLD, space, ar03, -,
ar02, →, ar01, FST, MR01, Min07, RAN#, M-06, LBL1, GSBP5

P4 invA1, ;, FST, MR04, X=0, GOTO0, 0, MINF, invA1, Gamble:,
space, ar04, FST, RAN#, RAN#, x, 35, =, INT, Min00, LBL4, MRF,
X!, invA1, N, FST, 2, M+F, DSZ, GOTO5, LBL8, 0, invA1, ;,
othng, FST, GOTO9, LBL5, MRF, X!, 1, M+F, invA1, E, FST,
DSZ, GOTO6, 1, invA1, ;, ven, FST, GOTO9, LBL6, MRF, X!, 1,
M+F, invA1, N, FST, DSZ, GOTO7, GOTO8, LBL7, MRF, X!, 1,
M+F, invA1, D, FST, DSZ, GOTO4, 2, invA1, ;, ouble, FST, LBL9
x, MR04, =, Min04, X=0, GOTO1, GOTO2, LBL1, 1, M-04, GOTO2,
LBL0, MR06, X = 0, GOTO2, invA1, ar05, space, ■, Cancel, FST,
π, Min09, Min08, Min07, LBL2, GSBP8

P5 IND, GOTO0, LBL2, invA1, ar05, space, ■, space, ar03, -, space,
-, space, FST, GOTO9, LBL1, invA1, ar05, space, ■, space,
ar03, -, ar02, -, space, FST, GOTO9, LBL0, RAN#, invA1, ar05,
space, ■, space, ar03, -, ar02, -, ar01, FST, GOTO9, LBL3,
invA1, ar05, space, ■, space, space, -, space, -, space, FST,
LBL9

P6 MR01, X=F, GOTO1, -, 8, =, X=0, GOTO4, LBL1, -, 9, =, X=0,
GOTO3, GOTO2, LBL3, 50, M+05, invA1, JACKPOT, space, #, FST,
PAUSE, LBL2, MR11, M+F, IND, MRF, Min04, LBL4

P7 MR01, X=0, GOTO1, 0, GOTO2, LBL1, MR02, X=0, GOTO3, 2, GOTO2,
LBL3, 4, LBL2, Min04

P8 MR04, X=0, GOTO1, X=0, GOTO2, GOTO3, LBL2, invA1, Collect:,
space, #, FST, M + 05, LBL3, 0, Min06, Min04, LBL1, GSBP5

P9 MR05, X=0, GOTO1, 0, Min05, GOTO2, LBL1, i, Min09, Min08,
Min07, 50, Min19, 24, Min18, RND1, Min17, 18, Min16, Min15, 14,
Min14, Min 13, RND1, Min12, Min11, Min05, LBL2, invA1, ar05,
space, ←, Credit, FST, 8, Min10, AC, Min06, 3, Min00, GSBP5
```

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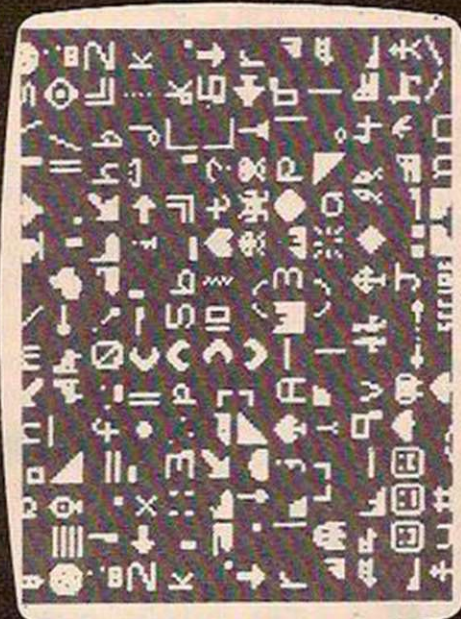
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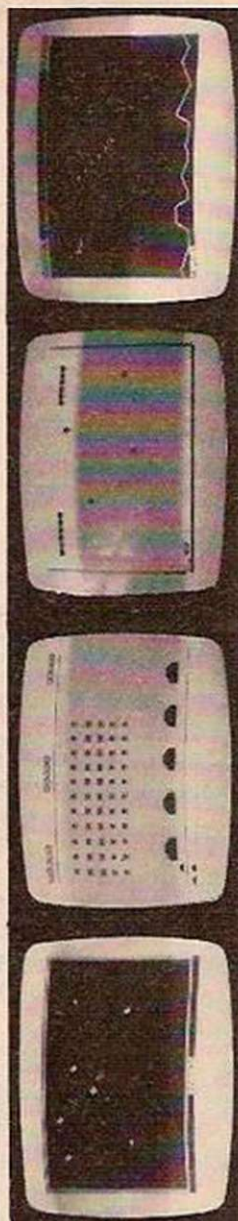
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Dungeons

J Chalmers,
East Grinstead,
West Sussex.

ZX-81

MUCH HAS BEEN written about the speed and memory efficiency of ZX-81 machine code, although not many, long, solid machine-code programs have been published. Dungeons sets out to remedy this situation by providing an easily expandable, relatively lengthy maze game. The program occupies less than 2K, but more than 1K of RAM, and is expandable to occupy much more if you so wish.

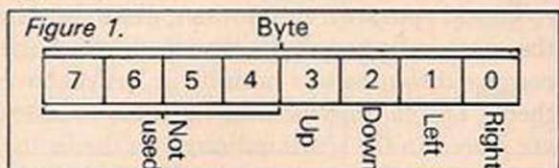
It produces a maze of rooms, each with up to four doors. There are a total of 100 rooms on a 10-by-10 grid, and the player must decide which room to move to, by selecting either up, down, left, or right. He can only move in this direction, however, if there is a door. The aim is to reach what is known as the Zero Room — the top left-hand room on the square grid.

The program is constructed using program modules, each module performing a specific task and being called when needed by a command routine. Using this modular approach eases program design, and allows for unlimited expansion possibilities. The various modules must perform the following tasks:

■ Construct the maze

- Display to the player, a plan view of the room he is in
- Perform the player's commands, up, down, etc.
- Keep a score

In the maze program, only the lower nybble of each byte within the maze area is used. This nybble describes the room; how many doors it has and where they are, in the format shown by figure 1, where a 1 represents a wall, and a 0 represents a door. If the nybble were to have the value 7, or 0111 binary, for example, this would indicate a wall in every direction except up, where there is a door.



Using this system of coding a maze can be set up simply by allocating each byte in the area of memory reserved for the maze, with a number between 0 and 15 — 0 to F. If these values are allocated randomly, a random arrangement of rooms can be constructed.

When the program is run, first the maze is set up. The random values for each room are chosen. As there is no easy way of producing random numbers in machine code, this is done using the Basic RND function. The values

obtained are Poked into RAM between 16514 and 16614, the area reserved for the maze.

When all the values have been stored, the program jumps into machine code. The first routine to be executed is called "perimeter", and makes sure that a wall exists all around the maze so that the player keeps within its confines.

The second routine is called "legalise", and is the real maze producer. Its job is to look at each room in turn, and make sure that if a player goes, say, through a door on the right, he comes into the next room through a door on the left. When this routine has been completed, the maze is set up and ready to be wandered through.

The next routine to consider is the "print-room" routine which prints a plan view of the room which the player is in. The variable which holds the address of the player's position, is the system variable Seed at 4032. The room that the player starts in is chosen randomly by line 80 of the Basic program, which uses Rand to store the selected address in Seed. The data needed to print the walls and doors which make up a room, is stored between 4151 and 41AE.

The print-room routine decides which strings it should print by looking at the byte specified by Seed, and testing it using the bit instructions. It then calls a subroutine called "print data", which picks up each item of data from the chosen string, and prints it using the RST 10 instruction. A string is terminated by the presence of a 1B character.

Now that a plan of the room has been displayed, the next thing to do is print the scores.

(continued on next page)

Address	Code	Comment	Address	Code	Comment
ZX81 "DUNGEONS" By J.Chalmers 1982			16743 (4167)	82 83 83 81 00 00 82 83 83 81 1B	<DATA>
16614 (40E6)	06 0A	Ld b,0A	16754 (4172)	82 83 83 83 83 83 83 83 83 81 1B	<DATA>
	21 82 40	Ld hl,4082	16765 (417D)	05 76 05 76 82 76 00 76 00 76 07	<DATA>
'PERIMETER' #1	CB DE	Set 3,(hl)		76 05 76 05 1B	
	23	Inc hl	16791 (418D)	05 76 05 76 05 76 05 76 05 76 05	<DATA>
	10 FB	Djnz #1		76 05 76 05 1B	
	06 0A	Ld b,0A	16797 (419D)	85 85 81 00 00 84 85 85 1B	<DATA>
	11 0A 00	Ld de,000A	16806 (41A6)	85 85 85 85 85 85 85 85 1B	<DATA>
	21 82 40	Ld hl,4082	16815 (41AF)	B2 B4 B8 BA B8 1B	<DATA>
#2	CB CE	Set 1,(hl)	16821 (41B5)	A7 B4 B2 A7 B8 1B	<DATA>
	19	Add hl,de	16827 (41BB)	B9 B7 AE AA B8 1B	<DATA>
	10 FB	Djnz #2	16833 (41C1)	#11 7E	Ld a,(hl)
	06 0A	Ld b,0A		FE 1B	CP 1B
	21 8B 40	Ld hl,408B	'PRINT DATA'	C8	Ret z
#3	CB C6	Set 0,(hl)		D7	Rst 10
	19	Add hl,de		23	Inc hl
	10 FB	Djnz #3		18 F8	Jr #11
	06 0A	Ld b,0A	16841 (41C9)	#12 CD BB 02	Call 02 BB
	21 DC 40	Ld hl,40DC	'GET KEY'	3E FF	Ld a,FF
#4	CB D6	Set 2,(hl)		BD	CP 1
	23	Inc hl		20 F8	Jr nz #12
	10 FB	Djnz #4		#13 CD BB 02	Call 02 BB
16657 (4111)	06 64	Ld b,64		44	Ld b,h
	21 82 40	Ld hl,4082		40	Ld c,01
'LEGALIZE' #9	CB 46	Bit 0,(hl)		51	Ld d,c
	CC 2F 41	Call z 412F		14	Inc d
	CB 4E	Bit 1,(hl)		28 F7	Jr z #13
	CC 37 41	Call z 4137		CD BD 07	Call 07 BD
	CB 56	Bit 2,(hl)		7E	Ld a,(hl)
	CC 3F 41	Call z 413F		C9	Ret
	CB 5E	Bit 3,(hl)	16863 (41DF)	2A 32 40	Ld hl,(4032)
	CC 47 41	Call z 4147		E5	Push hl
	23	Inc hl		CB 5E	Bit 3,(hl)
	10 E9	Djnz #9	'PRINT ROOM'	21 51 41	Ld hl,4151
	C9	Ret		28 03	Jr z #14
	00	NOP		21 5C 41	Ld hl,415C
	11 01 00	Ld de,0001		E5	Push hl
	19	Add hl,de	#14	01 00 01	Ld bc,0100
	CB 8E	Res 1,(hl)		CD F5 08	Call 08 F5
	18 16	Jr #10		E1	Pop hl
	11 FF FF	Ld de,FFFF		CD C1 41	Call 41 C1
	19	Add hl,de		E1	Pop hl
	CB 86	Res 0,(hl)		E5	Push hl
	18 0E	Jr #10		CB 56	Bit 2,(hl)
	11 0A 00	Ld de,000A		21 67 41	Ld hl,4167
	19	Add hl,de		28 03	Jr z #15
	CB 9E	Res 3,(hl)		21 72 41	Ld hl,4172
	18 06	Jr #10	#15	E5	Push hl
	11 F6 FF	Ld de,FFF6		01 00 0A	Ld bc,0A00
	19	Add hl,de		CD F5 08	Call 08 F5
	CB 96	Res 2,(hl)		E1	Pop hl
#10	AF	XOR A		CD C1 41	Call 41 C1
	ED 52	Sub c hl,de		E1	Pop hl
	C9	Ret		E5	Push hl
16721 (4151)	07 03 03 84 00 00 07 03 03 84 1B	<DATA>		CB 46	Bit 0,(hl)
16732 (415C)	07 03 03 03 03 03 03 03 84 1B	<DATA>			

(listing continued on next page)

SOFTWARE FILE

(continued from previous page)

This is done by calling the print-scores routine at 424E. Data for this routine is stored between 41AF and 41C0, while the actual scores are stored in system variables; Spare 1 at 4021 is the number of moves made; Spare 2 a at 407B is the bombs left, and Spare 2 b at 407C is the tries made. The actual mechanics of printing the scores involve first loading the b register with 00, and then loading the c register with the actual score. When this has been done, the bc register pair contains the score, and a call is made to a ROM subroutine which conveniently prints the contents of this register pair as a decimal.

A player can move up, down, to the left, or to the right, using the arrowed cursor keys, 5, 6, 7, and 8, providing there is a door to move through. If there is no door, he has the option of using force and can blow a hole into a wall using a bomb. He does this by first pressing the A key and then the arrow key indicating the direction of blast required.

Only four bombs are available, and the number remaining is printed as part of the score. If a player thinks he is in the Zero Room, he can press the Newline key and have a try. If he is correct, a message will appear indicating such, otherwise the game continues and the tries score is incremented.

The perform-keypress module starts at location 4297, and is the longest routine of them all. Its job is to determine which key has been pressed, and act on it. Its operation is straightforward in that the accumulator is

loaded with the value of the key which has been pressed, or if no key has been pressed, it waits for one, and the program works its way through the various commands available until it finds the one which matches the key press; it then executes the command and returns to the command subroutine. If it cannot find a command which matches the key press, a jump is made back to 4297, and the routine waits for another keypress before trying again.

The command subroutine calls all the program modules in sequence and increments the moves made counter. By having this routine at the end of the program, it can be seen that the game can be easily expanded by adding a few subroutines of your own. Using the upper nybble of each maze element, it would be possible, for example, to put various items of treasure, or terrible beasts, into various rooms and thus create an Adventure-style game.

To add your own subroutines, place them in the space indicated on the listing and move the command routine to a position in RAM above them. The call instructions for these routines are placed in the space indicated on the listing within the command routine. When adding calls in this manner, make sure that the jump relative byte is correctly adjusted so that it still jumps to the second call instruction, indicated by the label #31.

To add commands is just as easy and is achieved by changing the instruction at #32 to 20 XX 00 where XX is the number of bytes needed to jump forward to reach the beginning

of your new command test. When your test is finished you must either perform a return or a jump instruction. If the key test proved positive, i.e., the player pressed the key you were checking for, and you therefore perform the required function, a return should be used to get back to the command routine.

If, however, the key test proved negative, you should use a jump instruction to return to 4297. If you are unsure of how to add a command, I suggest that you study the commands which the program already uses such as up, bomb, or try, and follow a similar pattern of construction.

Before loading the program into memory, you must make room for it by setting up a Rem statement containing 680 letter Es. To relieve boredom and frustration from this tedious task, I would recommend that it is done while the computer is in fast mode. When the Rem statement is complete, enter the hex loader program and Run it.

In response to the prompt, enter the hex digits given in the listing, two characters at a time, for example 06 FF D0 0C and so on, and follow each pair with a press of Newline. When complete, enter the Basic part of Dungeons which will overwrite the hex loader, and save the whole thing. When saved, be brave and Run it.

When you have the program working properly, here are a few tips on play: avoid using too many bombs, you may need them to break into the zero room; if a bomb does not destroy a wall, the wall must be one of the outer ones.

(listing continued from previous page)

21 9D 41	Ld hl,419D	Door data	4F	Ld c,a
28 03	Jr z #15	Jump if no door	AF	Xor a
21 A6 41	Ld hl,41A6	Wall data	D7	Rst 10
#16 E5	Push hl		CD 98 0H	Call 0A98
01 00 02	Ld bc,0200		CD 97 42	Call 4297
CD F5 08	Call 08F5	Print at	22 32 40	Ld (4032),hl
E1	Pop hl		C9	Ret
7E	Ld a,(hl)	Print right hand	CD C9 41	Call 41C9
FE 1B	Cp 1B	wall or door data	01 08 08	Ld bc,0808
28 0F	Jr z #17		29 32 40	Ld hl,(4032)
06 09	Ld b,09		FE 21	Cp 21
#18 AF	Xor a		20 06	Jr nz #20
D7	Rst 10		CB 4E	Bit 1,(hl)
10 FC	Dj nz #18		20 02	Jr nz #20
7E	Ld a,(hl)		2B	Dec hl
D7	Rst 10		C9	Ret
3E 76	Ld a,76		#20 FE 22	Cp 22
D7	Rst 10		20 06	Jr nz #21
23	Inc hl		CB 56	Bit 2,(hl)
C3 23 42	Jp 4223		20 02	Jr nz #21
#17 E1	Pop hl		09	Add hl,bc
CB 4E	Bit 1,(hl)		C9	Ret
21 7D 41	Ld hl,417D	Door data	#21 FE 23	Cp 23
28 03	Jr z #19	Jump if no door	20 07	Jr nz #22
#19 21 8D 41	Ld hl,418D	Wall data	CB 5E	Bit 3,(hl)
E5	Push hl		20 03	Jr nz #22
01 00 02	Ld bc,0200		ED 42	Sub c,hl,bc
CD F5 08	Call 08F5		C9	Ret
E1	Pop hl		#22 FE 24	Cp 24
CD C1 41	Call 41C1		20 06	Jr nz #23
C9	Ret		CB 46	Bit 0,(hl)
16974 (424E)	01 00 0F	Ld bc,0F00	20 02	Jr nz #23
"PRINT SCORES"	CD F5 08	Call 08F5	23	Inc hl
	21 AF 41	Ld hl,41AF	C9	Ret
	CD C1 41	Call 41C1	#23 FE 26	Cp 26
	06 00	Ld b,00	20 34	Jr nz #24
	38 21 40	Ld a,(4021)	38 7B 40	Ld a,(407B)
	4F	Ld c,a	FE 00	Cp 00
	AF	Xor a	CB	Ret z
	D7	Rst 10	3D	Dec a
	CD 98 0H	Call 0A98	32 7B 40	Ld (407B),a
	3E 76	Ld a,76	CD C9 41	Call 41C9
	D7	Rst 10	28 32 40	Ld hl,(4032)
	D7	Rst 10	FE 21	Cp 21
	21 B5 41	Ld hl,41B5	20 04	Jr nz #25
	CD C1 41	Call 41C1	CB 8E	Res 1,(hl)
	06 00	Ld b,00	18 06	Jr #26
	38 7B 40	Ld a,(407B)	#25 FE 22	Cp 22
	4F	Ld c,a	20 04	Jr nz #27
	AF	Xor a	CB 96	Res 2,(hl)
	D7	Rst 10	#26 18 06	Jr #28
	CD 98 0H	Call 0A98	#27 FE 23	Cp 23
	3E 76	Ld a,76	20 04	Jr nz #29
	D7	Rst 10	CB 9E	Res 3,(hl)
	D7	Rst 10	#28 18 06	Jr #30
	21 B5 41	Ld hl,41B5	#29 FE 24	Cp 24
	CD C1 41	Call 41C1	28 DE	Jr nz
	06 00	Ld b,00	CB 86	Res 0,(hl)
	38 7C 40	Ld a,(407C)	#30 E5	Push hl

SOFTWARE FILE

```

CD E6 40 Call 40E6
E1 Pop hl
C9 Ret
#24 FE 75 C9 75 'Try'
#32 C2 97 42 Jp nz,4297
E5 Push hl
21 7C 40 Ld hl,407C
34 Inc(hl)
E1 Pop hl
3E 82 Ld a,82
8D C9 1 Ret nz
C0 Ret nz
3E 40 Ld a,40
BC C9 h Ret nz
C0 Ret nz
C1 Pop bc
C1 Pop bc
C9 Ret
*****
Add here your own routines
17175 (4317) CD E6 40 Call 40E6 (Perimeter)
#31 CD DF 41 Call 41DF (Print rooms)
'COMMAND ROUTINE' CD 4E 42 Call 424E (Print scores)
*****
Here you add the calls to your own routines
CD 90 42 Call 4290 (Keypress)
21 21 40 Ld hl,4021
34 Inc(hl)
18 F1 Jp #31

```

```

HEX LOADER PROGRAM
1 REM EEEEEEEEEEEEEEE ETC
5 FAST
10 POKE16510,0
20 LETX=16614
30 INPUTA$
40 POKE X,16*CODER$+CODER$(2)-476
50 SCROLL

```

```

60 PRINTX,A$
70 LETX=X+1
80 IFX=17192THENSTOP
90 GOTO30
BASIC PROGRAM FOR DUNGEONS
5 CLS
10 PRINT"DUNGEONS, PLEASE WAIT WHILST THE"
20 PRINT"MAZE IS CREATED"
30 RAND
40 FORI=16514TO16613
50 POKEI,INT(RND*16)
60 NEXTI
70 CLS
80 RAND 16613-INT(RND*25)
90 POKE16417,0
100 POKE16507,4
110 POKE16508,0
120 LETI=USR17175
130 PRINTAT1,14;"WELL DONE"
140 PRINTAT4,14;"PRESS A KEY TO"
150 PRINTAT6,14;"PLAY AGAIN"
160 IFINKEY$<>" "THENGOTO160
170 IFINKEY$=" "THENGOTO170
180 RUN

```

To increase difficulty, change line 50 to read: POKE I,INT(RND*6)+10

Word processor

Nigel Langley,
Weeping Cross,
Stafford.



THE PROGRAM is a word processor written entirely in BBC Basic for the model B or, like mine, a model A which you have upgraded yourself, to include the printer interface and the extra 16K of DRAM. When all unnecessary spaces are removed the program will reside in less than 2K bytes.

The best mode to operate a word processor in is mode 0, as it has 80 columns, as do many printers, and has 32 lines of text of which I have used 31 for the work area.

However, in mode 0 the BBC computer holds the video data in eight bytes per character and printers will only accept ASCII codes. To overcome this problem I have set aside a section of RAM, just below the video

RAM, and use this to store the ASCII code for the data on the screen.

Full screen editing is enabled by the use of *f*4,2, which makes the cursor-control keys generate numerical values. Other editing facilities are insertion and close-up, which although slow make the program a very usable tool.

The hash symbol calls insertion Proc; the double bar calls close-up Proc; and Escape calls the menu Proc.

Line 10 puts page mode on.

Line 20 alters the interlace timing, effectively moving the display down by one line upon the next mode change.

Lines 80 to 130 set up my parallel display memory and set it to 820 (spc).

PROCOpt is the default PROC as set by line 220. This sets up the menu.

PROCwrite takes the code from PROCget and either dumps it on the screen, or moves into the edit modes. It is important that CHR\$(87F)

(delete) is ignored as it ruins the edit operation. PROCwrite also keep the parallel video memory updated.

PROCprint carries out the control of the printer. It takes data out of the parallel video RAM one byte at a time and dumps it in the printer's buffer.

PROCinsert and PROCclose are the procedures that make the word processor so versatile. They carry out large amounts of memory management in the parallel video RAM, after which they transfer the results on to the screen.

PROCget is my universal keyboard reading procedure. It handles the cursor controls, manages the address pointer of the parallel video RAM and returns any other key values which are entered. Again this could easily be replaced by an assembler routine using OSRDCH.

PROCsave and PROCload are standard methods of loading and storing sections of memory; in this case the parallel video memory.

```

10 VDU14
20 XFX144,255
30 MODE0
40 PRINT TAB(20,10);"WORDPROCESSOR"
50 PRINT TAB(19,12);"IN B.B.C. BASIC"
60 PRINT TAB(10,15);"Written by Nigel Langley."
70 REM***N.C.J.LANGLEY, 7/5/82.
80 HIMEM=9808
90 W=12287
100 FOR X=HIMEM TO W
110 ?X=820
120 NEXT X
130 X=HIMEM
140 CLS
150 PRINT TAB(15,0);"WordProcessor-toP line is mode select:"
160 AS=INKEY$(500)
170 PROCopt
180 GOTO 170
190 END
200 DEFPROCopt
210 LOCAL AS,A
220 ON ERROR GOTO 230
230 VDU30:PRINT SPC(70)
240 VDU30
250 PRINT TAB(15,0)"1=WRITE,2=SAVE,3=LOAD,4=PRINT "
260 AS=GET$
270 A=EVRL AS
280 IF A>4 OR A<1 GOTO 230
290 ON A GOTO300,310,320,330
300 PROCwrite:GOTO 230
310 PROCsave:GOTO 230
320 PROCload:GOTO 230
330 PROCprint:GOTO 230
340 ENDPROC
350 DEFPROCwrite
360 VDU30:PRINT SPC(70)
370 VDU30:PRINT" # for insertion routine. # for close up routine."
380 *FX4,2
390 PROCget
400 IF A=87F THEN X=X-1
410 IF A=80D THEN VDU31,0,(VPOS+1):GOTO 460
420 IF A=87F GOTO460
430 IF A=124 PROCclose:GOTO 490
440 IF A=35 PROCinsert:GOTO 490
450 PRINT CHR$(A):?X=A
460 IF POS=79 AND VPOS=30 GOTO 480
470 GOTO 390
480 ENDPROC
490 DEFPROCprint
500 LOCAL A,X,Y
510 VDU30
520 PRINT SPC(70)
530 VDU30:W=12287
540 PRINT TAB(15,0)"PRINTING!"
550 VDU1,80F,1,80D
560 FORV=HIMEM TO W
570 Y=7X
580 VDU1,Y
590 NEXT X
600 ENDPROC
610 DEFPROCinsert
620 LOCAL A,T
630 VDU30:PRINT"INSERTION-move cursor to insertion Point, then Press space bar"
640 PROCget
650 IF A<820 GOTO 640
660 VDU30:PRINT SPC(70):VDU30
670 PRINT"Now enter the Phrase for insertion (END WITH #). PRESS ANY KEY."
680 AS=INKEY$(10000)
690 VDU30
700 PRINT SPC(70)
710 VDU30
720 AS=""
730 A=GET
740 PRINT CHR$(A)
750 IF A=35 OR POS=79 GOTO 780
760 AS=AS+CHR$(A)
770 GOTO 730
780 VDU30,10
790 FORT=W TO X STEP-1
800 ?(T+LENAS)=?T
810 NEXT T
820 FORT=1TO(LENAS)
830 ?(X-1+T)=ASC(MID$(AS,T,1))
840 NEXT T
850 FORT=HIMEM TO W-1
860 PRINT CHR$(?T)
870 NEXT T
880 ENDPROC
890 DEFPROCsave
900 VDU30:PRINT SPC(70):VDU30
910 PRINT"PRESS RECORD THEN RETURN."
920 VDU21

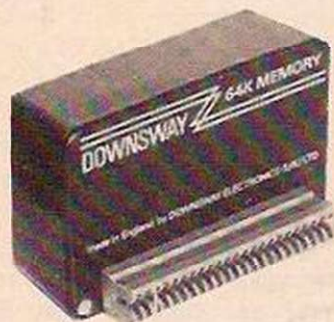
```

(continued on page 79)

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ZX81 16K SOFTWARE ZX81

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SOFTWARE FILE

(continued from page 77)

```

930 *SAVE"TEXT" 2650 2FFF 2650
940 VDU6
950 ENDPROC
960 DEFPROCload
970 LOCAL Z
980 VDU30:PRINT SPC(78):VDU30
990 PRINT"PRESS PLAY."
1000 VDU21
1010 *LOAD"TEXT"
1020 VDU6
1030 VDU31,0,1
1040 FORZ=HIMEM TO W
1050 IF Z=127 THEN Z=32
1060 PRINT CHR$(Z);
1070 IF POS=79 AND VPOS=30 GOTO 1090
1080 NEXT Z
1090 ENDPROC
1100 DEFPROCclose
1110 LOCAL R,Z
1120 VDU30:PRINT"Position the cursor at the end of the area you are closing. TH

```

```

IN PRESS SPACE."
1130 PROCget
1140 IF A<X20 GOTO 1130
1150 VDU30:PRINT SPC(78)
1160 VDU30:INPUT"How many spaces do you wish to close",A
1170 FOR Z=X TO W
1180 Z(Z-A)=Z
1190 NEXT Z
1200 VDU30,18
1210 FOR Z=HIMEM TO W
1220 IF POS=79 AND VPOS=30 GOTO 1240
1230 PRINT CHR$(Z);
1240 NEXT Z
1250 ENDPROC
1260 DEFPROCset
1270 A=GET
1280 X=POS+(VPOS-1)*80+HIMEM
1290 IF A=136 VDU31,(POS-1),VPOS:GOTO 1270
1300 IF A=137 VDU31,(POS+1),VPOS:GOTO 1270
1310 IF A=138 VDU31,POS,(VPOS+1):GOTO 1270
1320 IF A=139 VDU31,POS,(VPOS-1):GOTO 1270
1330 ENDPROC

```

Earth invader

Bharat Patel,
Oldham,
Greater Manchester.

VIC-20

EARTH INVADER runs on an unexpanded Vic-20. The game uses good colour and sound, and needs skill, quick reactions and is by no means easy.

The Vic draws a maze and then plays a tune; the maze is different every time it is run. You are a soldier who has to manoeuvre up to the fortress in the upper-left corner and break through its walls without crashing into the maze. During the adventure an Earth Invader will roam about, gradually swallowing the maze, and so making life a little easier.

Many asteroids will appear during the journey at random positions. These must be

carefully avoided or you will be blown up. When you have reached the fortress you have to break in and save the lonely princess who has been so far kept hostage by the Earth Invader.

The next task of the soldier is to move on top of the Invader and by pressing f, destroy it. This will need very quick reactions. After that you will have your Earth Invader adventure. You have about one minute to accomplish this and the time will be found ticking away at the top of the screen.

To move around use the following keys: up, O; down, L; right, P; and left, I. To fire press F.

The program consists mainly of Peeks and Pokes. Line 50 switches all speakers and volume off. Line 180 changes the colour of screen to black and border to red. It clears the screen and sets the cursor colour to white. Lines 200 to 208 set up the variables and draw

the fortress and the princess. Lines 290 to 500 pick random positions and print blocks on each line for the maze. Lines 505 to 612 play a tune using the Read and Data statements. Lines 700 to 775 move the soldier and produce asteroids at random positions and also register whether there has been any collision or score.

Lines 800 to 900 make a crash when a collision occurs between the soldier and the maze or an asteroid. Lines 910 to 932 give various endings depending on the state of play and the time. Lines 950 to 1200 give the changing circle effect after reaching the princess. Variable K is a test to see whether the soldier has reached home and so he can continue to run after and shoot at the invader. Lines 1200 to 4010 make various sounds and symbols when firing and when on target: lines 4000 onwards are used when time runs out, making flashes and sounds.

EARTH INVADER

```

10 REM#EARTH INVADERS**BY (BHARAT PATEL)
50 FORI=36874T036878:POKEI,0:NEXT:POKE36879,255:K=0
55 PRINT"
56 PRINT"*****EARTH INVADERS*****"
57 PRINT"
60 PRINT"***** HIT SPACE TO PLAY"
70 GETS:IF S=C:" THEN70
80 PRINT"*****THANK-YOU" FOR0=1T0400:NEXT0
180 PRINT"Q" POKE36879,10
200 P=7724:WIN=100:V=36878
205 POKEP+5,90:POKE38444+5,4
207 POKEP-17,114:POKEP-18,114:POKEP-16,114
208 POKEP+4,107:POKEP+6,115:POKEP+26,113:POKEP+27,113:POKEP+28,113
210 REM-DRAW MAZE-
290 FORI=1T08
300 X=INT(RND(1)*22)+1:POKE7680+X,102
330 Y=INT(RND(1)*15)+7:YY=INT(RND(1)*2)+0
340 POKEP+Y,102:POKEP+YY,102
350 CC=INT(RND(1)*15)+7:POKE7768+CC,102
360 DD=INT(RND(1)*15)+1:POKE7790+DD,102:POKE38510+DD,3
370 RT=INT(RND(1)*2)+0
380 TR=INT(RND(1)*22)+1:POKE7790+22+TR,102
390 TY=INT(RND(1)*22)+1:POKE7812+22+TY,102:POKE38554+TY,6
400 EW=INT(RND(1)*22)+1:POKE8054+EW,102:POKE8076+3+TR,102:POKE8142+DD,102
410 AW=INT(RND(1)*22)+1:POKE7856+AW,102:POKE7878+TR,102:POKE7900+DD,102
420 GJ=INT(RND(1)*22)+1:POKE7922+GJ,102:POKE7944+EW,102:POKE7966+TY,102:POKE386
86+TY,5
430 UI=INT(RND(1)*22)+1:POKE7988+UI,102:POKE8010+GJ,102:POKE38730+GJ,6
500 WE=INT(RND(1)*22)+1:POKE8076+WE,102:POKE8120+10+WE,102:POKE8142,102:NEXTI
503 REM-MUSIC-
505 POKE36878,0
510 READP
512 POKE36878,10
515 IF P=-1 THEN700
520 READD
525 POKE36875,P:POKE36876,P
528 FORB=1T0D#30:NEXTB
530 POKE36875,0:POKE36876,0
535 GOTO510
600 DATA187,4,187,4,201,2,201,4,201,2,195,2,195,2,183,2,163,2,175,6,163,1,175,1
610 DATA183,2,195,2,195,2,201,2,195,2,183,2,163,3,175,1,183,2,175,2,175,2,163,6
612 DATA -1,-1
650 REM#INVADER+SOLDIER*
700 H=8164+19:Z1=7910:0=7680
706 POKEH,43
707 O1=INT(RND(1)*506):IF O1=49 THEN707
708 POKEO+01,42
709 PRINT"*****TIME="WIN:POKE7680+16,32
710 POKEP+5,90
711 IFPEEK(H)=90 THEN950
712 POKEH,43:POKEP+5,90:POKE38444+5,4
713 POKEZ1,88:FOR S1=1T010:NEXTS1:REM-Z1=INVADER
714 Z2=INT(RND(1)*5)+1:IFZ2=2 THENPOKEZ1,32:Z1=Z1-1:POKEZ1,88
715 IFZ2=3 THENPOKEZ1,32:Z1=Z1+1:POKEZ1,88
716 IFZ2=4 THENPOKEZ1,32:Z1=Z1+2:POKEZ1,88
717 IFZ2=1 THENPOKEZ1,32:Z1=Z1-2:POKEZ1,88
718 POKE36878,10:POKE36875,190:FORI=1T0100:NEXTI:POKE36878,0
719 IFZ1>8185 THENZ1=7910
720 IFZ1<7680 THENZ1=7910
723 POKEH,43
724 GETA:IF A="I" THENPOKEH,32:H=H-1
730 IF A="P" THENPOKEH,32:H=H+1
740 IF A="O" THENPOKEH,32:H=H-2
742 X1=PEEK(197)
750 IF A="L" THENPOKEH,32:H=H+2
751 IFPEEK(H)=88 ANDX1=42 ANDK=1 THEN2500
752 IFX1=42 THEN2000:REM-TEST FOR FIRING
760 IFPEEK(H)=102 THENPOKEH,86:POKE36878,0:GOTO800
765 IFPEEK(H)=42 THENPOKE36878,10:GOTO800
766 IFPEEK(H)=90 THEN950
770 WIN=WIN-1:IFWIN=99 THENPOKE7680+15,32
771 IFWIN=9 THENPOKE7680+14,32:POKE7680+13,32
772 IFWIN=-1 THEN4000
774 POKEH,43
775 GOTO707
800 POKEH,86:FORK=1T010:POKE36878,10:POKE36876,190:FORI=1T0275:POKE36878,0:REM-
CRASH-
810 POKE36875,150:NEXTK:POKE36878,0:FORI=1T01000:NEXTI
900 POKE36879,170
910 PRINT"
911 PRINT"***** GAME OVER*****"
912 PRINT"***** HARD CHEESE*****"
914 POKE36879,170:PRINT"*****YOU TOOK"00-WIN"SECS TO *****REACH BASE*****GOT092
4
924 PRINT"*****"
925 PRINT"*****"
928 POKE198,0
930 PRINT"***** ANOTHER GO***** INPUTY:IF Y="YES" OR Y="Y" THENPOKE36878,0:POKE3687
5,0
932 IFV="Y" THENRUN
932 S=D:STOP
940 REM--FIRE NOISE--
950 PRINT"POKE36878,0:POKE36878,10
1000 FORB=1T050:POKEH,81:FORP=1T010:NEXTBP:POKEH,87:POKE36875,150:POKE36877,1
60
1100 POKE36878,0:POKE36878,10:POKE36875,200:NEXT
1200 K=1:POKE36878,0:GOTO711
2000 POKEZ1,88:FOR S2=1T030:POKEV,0:POKEC075,250:POKEH,87:POKEH,81:POKE36878,0
NEXTS2
2100 POKEH,32:GOTO711
2500 FORS3=1T090:POKE36878,10:POKE36875,200:POKEH,90:POKEH,81:POKE36878,0:NEXT
S0T0914
2600 POKEZ1,32:GOTO914
4000 PRINT"***** THE END *****"
4001 FORS0=200T0250:POKE36879,50:POKE36876,10:POKE36876,205:FORA=1T020:NEXTSA
4002:POKE36878,0:NEXTS0:POKE36879,27
4010 PRINT"***** HARD CHEESE*****"

```

Basic renumber

R Eglin,
Hayling Island,
Hampshire.

SPECTRUM

THIS SIX-LINE program can be stored on tape and when required can be merged with

current program already in the computer. All you need is the first six lines free in your program. Since most people start at line 10 you should have no problem.

My program uses the addresses of the two variables NXTLIN which is obtained from PEEK 23637 + 256 * PEEK 23638 and program variables which is obtained from

PEEK 23627 + 256 * PEEK 23628

The former gives start address for renumbering and the latter provides the halt signal for the end of the program. To merge with your existing program already in the computer, select Merge and type "renumber", thus Merge "renumber". Start the tape, and press
(continued on page 81)

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ZX81

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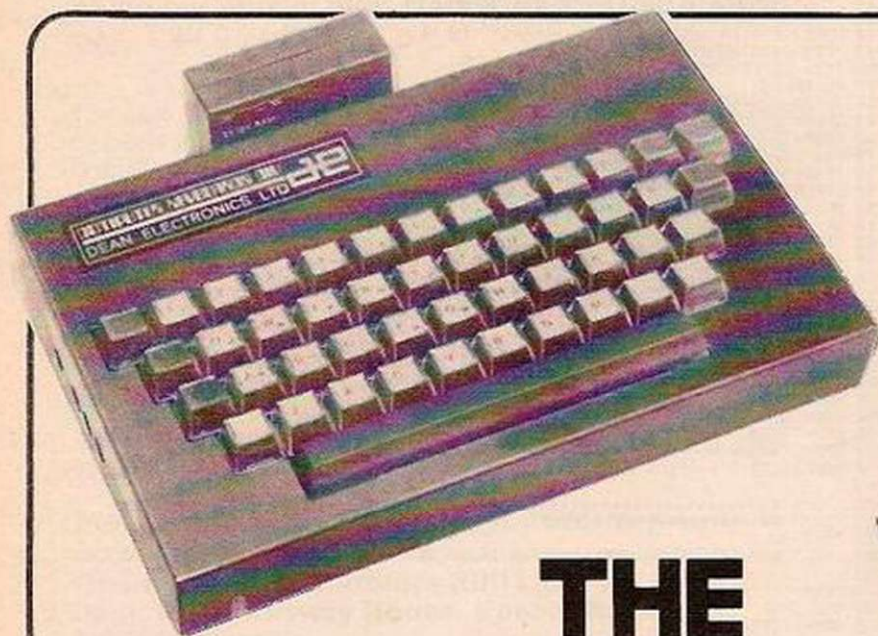
You no longer need type in long REM's Hex loader, Hex dump, Hex clear, Hex save, USR run. A REM is reserved with 693 spaces in it. To load in your Hex just type starting address, a space then your Hex code-hit newline and sit back. To check on your code use the Hex dump. Enter start address, finish address and then watch it scroll up. Code no good? Hex clear will clear the REM between two addresses. USR run will run the machine code from a given address.

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SOFTWARE FILE

(continued from page 79)

enter. When you have finished, List and you will see the program installed above yours. Select Run and you have renumbered your program.

You can select the first line number and the step by changing line 2, but obviously the first line must be more than 6. When you have finished renumbering, you should delete the line Save "renumber", also to prevent the

renumber program working everytime you run, change the first line to read Goto 30, which will now be the first line of your program or you can of course delete the renumber program altogether after use, but if you are anything like me — always adjusting programs — you will find it useful to leave in.

```
1 Let Z = 23627 : GOTO 5 : Rem R EGLIN
renumber Spectrum
2 For X = 20 to 9970 STEP 10 :
```

```
IF M = Peek Z + 256 * Peek (Z + 1) then stop.
3 Poke M, Int (X/256) : Poke (X + 1), X - 256 *
Int (X/256)
4 Let M = M + 2: let A = Peek M + 256 * Peek
(M + 1):
Let M = M + A + 2 : Next X
5 Let M = Peek (Z + 10) + 256 * Peek (Z + 11) :
GOTO 2
6 Save "renumber".
```

3D triangle

D Konig,
Hexham,
Northumbria.

BBC

THIS PROGRAM will run on the BBC model A microcomputer and possibly on the model B. It simulates the random movement through three dimensions of a triangle. It can also be made to leave a trace of itself on the screen. The background and foreground colours are user-definable in accordance with the tables on page 55 of the *Provisional User Guide*. The user also has the choice of just bouncing triangles or a trace leaving a bouncing triangle.

When the program is running pressing the space bar will stop the action; pressing X will continue it; pressing C will clear the screen but continue as before; pressing E will escape from the program.

```
100 REM***3-D TRIANGLES AND PATTERNS***
110 REM***BY D.KONIG AND P.MCCOWIE***
115 REM***** (C) 14/5/1982*****
120 MODE7:FORI=1TO2:PRINTTAB(5,10+I)CHR#141"PATTERNS AND TRIANGLES":NEXT
130 B%=INKEY(500):MODE4:VDUI9,1,3,0,0,0,19,2,1,0,0,0
140 PRINTTAB(1,3)"WHEN ROUTINE BEGINS PRESS:"PRINTTAB(1,5)"<SPACE> TO PAUSE."
150 PRINTTAB(1,7)"<X> TO CONTINUE."PRINTTAB(1,9)"<E> TO END"
160 PRINTTAB(1,11)"WHICH BACKGROUND COLOUR ?":INPUTTAB(1,13)"(0-15) ".BC
170 IFBC<0ORBC>15THEN160
180 PRINTTAB(1,13):SPC(10)
190 PRINTTAB(1,11)"WHICH FOREGROUND COLOUR ?":INPUTTAB(1,13)"(0-15) ".FC
200 IFFC<0ORFC>15THEN190
210 PRINTTAB(1,11)"DO YOU WANT A PATERN OR TRIANGLE ?"
220 PRINTTAB(1,13):SPC(10):INPUTTAB(1,13)"(P-1) ".F#:IFF#="P"THENZ=1ELSEZ=2
230 MODE4:VDUI9,1,FC,0,0,0,19,2,BC,0,0,0:A=RND(30):B=RND(30):C=RND(30)
240 D=RND(30):E=RND(30):F=RND(30):X1=400:Y1=400:X2=700:Y2=500:X3=500:Y3=700
250 GCOLOR,1:MOVEX1,Y1:DRAWX2,Y2:DRAWX3,Y3:DRAWX1,Y1
260 A%=INKEY(1):IFA#=" " THENPROCFAUSE
270 IFA#="C"THENCLS
280 IFA#="E"THENEND
290 IFX1>1280ORX1<0THENA--A
300 IFX2>1280ORX2<0THENC--C
310 IFX3>1280ORX3<0THENE--E
320 IFY1>1024ORY1<0THENB--B
330 IFY2>1024ORY2<0THEND--D
340 IFY3>1024ORY3<0THENF--F
350 MOVEX1,Y1:GCOLOR,2:DRAWX2,Y2:DRAWX3,Y3:DRAWX1,Y1
360 SOUND1,-15,X1/5,1:SOUND2,-15,X2/5,1:SOUND3,-15,X3/5,1
370 X1=X1+A:Y1=Y1+B:X2=X2+C:Y2=Y2+D:X3=X3+E:Y3=Y3+F:GOTO250
380 DEFFROCPAUSE
390 IFGET#<"X"THEN390:#FX 15,0
400 ENDPROC
```

Permutations

David Guest,
Selly Park,
Birmingham.

GENIE

MY SUBROUTINE can be used in any program that needs to use a large number of permutations, such as the recent *Your Computer* competition with six trolls in six caves.

Each permutation is individually generated

so very little memory space is needed. The program was written for a Video Genie, but is easily adapted for other machines. The two short demonstration programs are to demonstrate its use and function.

```
900 REM ** PERMUTATION GENERATING SUBROUTINE
910 REM ** THE P'ITH PERM OF NUMBERS 1,2,...N IS
920 REM ** GENERATED IN A(1),A(2),...A(N)
930 REM ** THE VALUE OF P IS DESTROYED IN PROCESSING
940 REM ** J,K,L,Q,R,B(1),B(2),...B(N) ARE USED AS WORK VARIABLES
950 REM ** THERE ARE N FACTORIAL POSSIBLE PERMS SO
960 REM ** P SHOULD BE IN RANGE 0 TO N!-1
970 REM ** P=0 GIVES IDENTITY PERM 1,2,...N
980 REM
990 REM ** INITIALISE A(1),A(2),...A(N)
1000 FOR J=1 TO N:A(J)=J:NEXTJ
1010 L=1
1015 REM ** START OF LOOP
1020 IF P=0 THEN RETURN
1030 IF L=N THEN RETURN
1040 L=L+1
1050 Q=P/L
1060 R=P-Q*L
1070 P=Q
1080 IF R=0 THEN 1020
1090 REM ** ROTATE L ELEMENTS R PLACES TO RIGHT
1100 FOR J=1 TO L
1110 K=J+R : IF K>L THEN K=K-L
1120 B(K)=A(J) : NEXT J
1130 REM ** COPY B INTO A
1140 FOR J=1 TO L:A(J)=B(J) :NEXTJ
1150 GOTO 1020
```

```
1 REM ** DEMONSTRATION PROGRAM 2
5 REM
10 DEFINT A-Z
20 DIM A(7),B(7)
30 INPUT N
35 IF N=0 THEN STOP
40 LIM=1: FOR J=2 TO N:LIM=LIM*J: NEXT J
50 FOR PP=0 TO LIM-1
55 P=PP
60 PRINTPP,
70 GOSUB 1000
80 FOR J=1 TO N:PRINTA(J); :NEXTJ
90 PRINT
100 NEXT PP
110 GOTO 30
1 REM ** DEMONSTRATION PROGRAM 1
5 REM
10 DEFINT A-Z
20 DIM A(7),B(7)
30 INPUT N
40 INPUT P
50 IF P < 0 THEN STOP
60 PRINT P
70 GOSUB 1000
80 FOR J=1 TO N:PRINTA(J); :NEXTJ
90 PRINT
100 GOTO 40
```

Graphics strings

Julian Stradling,
Portsmouth,
Hampshire.

ZX-81

THREE PROBLEMS I have always found with complicated ZX-81 graphic displays are:

- If Break is pressed, then any following command will clear the screen, losing the display.
- Changes in the display are relatively slow, and
- Changes in the display using Print At etc., are

sequential — it would look far neater in many cases if the whole of the screen changed at once.

These problems are overcome to a certain extent by storing the display in a dimensioned string and by using

```
LET S$(X TO Y) = "whatever"
```

which is slightly quicker than

```
PRINT AT X,Y;"whatever"
```

When the changes have been made, using

```
PRINT AT 0,0;S$
```

will print the whole of the display at once. The advantages of this method of screen display are

illustrated in the Patience program shown.

Line 15 stores the screen in S\$ — 704 characters long. If a 24-line screen were used, then this would read Dim S\$(768), and a Poke 16418,0 would be inserted before the print statement in line 355. Line 3 warns that there will be a delay of anything up to 20 seconds while the machine shuffles the cards and draws the screen.

The screen display consists of seven depot piles numbered 1 to 7, each containing five cards, a foundation pile marked with an

(continued on next page)

SOFTWARE FILE

(continued from previous page)

inverse F, and a face-down stock pile marked with an inverse S.

The bottom card of each depot pile is exposed. Any exposed card may be placed on to the top card of the foundation pile, so long as it differs from that card by one. For

example, a seven may be placed on a six or an eight, but not on any other card — irrespective of suit. This is done by pressing the number, 1 to 7, of the corresponding depot pile.

Kings are high, aces are low, and neither may be placed on the other. When the patience becomes blocked, a card may be dealt from the

stock pile on to the foundation pile by pressing S. This will decrease the number of cards in the stock pile by one.

You win if you manage to clear all seven depot piles. You lose if you are blocked, and have run out of stock cards. In either case, pressing S will display your score.

```

1 SLOW
2 PRINT AT 8,12;"██████████"
3 PRINT AT 18,0;"WHEN YOU PRE
SS A KEY, THE SCREEN WILL BLANK O
UT FOR ABOUT 20 SECS"
4 PRINT AT 21,10;"██████████"
5 IF INKEY$="" THEN GOTO 5
6 RAND
7 LET E=0
10 FAST
12 LET A$="A23456789TJQK"
13 LET B$="S1098"
15 DIM S$(704)
20 DIM C(4,13)
25 DIM N(7)
30 LET Z=17
35 DIM U(17)
37 DIM P(7,5)
38 DIM Q(7,5)
40 DIM W(17)
45 FOR I=32 TO 704 STEP 32
50 LET S$(I-31 TO I)="██████████"
55 NEXT I
60 FOR I=1 TO 17
65 GOSUB 1E3
70 LET U(I)=S
75 LET W(I)=T
80 LET S$(32*I+34 TO 32*I+60)="
85 NEXT I
90 FOR I=4 TO 13 STEP 3
95 LET S$(32*I+2 TO 32*I+28)="
100 NEXT I
105 FOR I=286 TO 414 STEP 32
110 LET S$(I TO I+2)=" "
115 LET S$(I+288 TO I+298)="██████"
120 NEXT I
125 FOR I=1 TO 7
130 FOR J=1 TO 5
135 GOSUB 1E3
140 LET P(I,J)=S
145 LET Q(I,J)=T
150 LET S$(J*96+I*4-34)=A$(Q(I,
J))
155 LET S$(J*96+I*4-2)=B$(P(I,J
))
160 NEXT J
165 LET N(I)=5
170 LET S$(I*4-1)=CHR$(156+I)
175 LET S$(I*4+639)=CHR$(156+I)
180 LET S$(576+I*4)=A$(Q(I,5))
185 LET S$(544+I*4)=B$(P(I,5))
190 NEXT I
195 LET S$(255)="██"
200 LET S$(543)="██"
210 SLOW
300 LET A=W(Z)
305 LET B=U(Z)
310 LET Z=Z-1
315 LET S$(286)=A$(A)
320 LET S$(416)=A$(A)
325 LET S$(318)=B$(B)
330 LET S$(384)=B$(B)
350 IF INKEY$<>" " THEN GOTO 350
355 PRINT AT 0,0;S$
361 PRINT AT 19,30;Z
365 LET Z$=INKEY$
370 IF Z$="S" THEN GOTO 500
375 IF CODE Z$>CODE "7" OR CODE
Z$<CODE "1" THEN GOTO 365
380 LET Y=VAL Z$
385 IF N(Y)=0 THEN GOTO 2E3
390 IF ABS (Q(Y,N(Y))-A) <> 1 THE
N GOTO 2E3
395 PRINT AT 21,13;". .OK. ."
400 FOR I=N(Y)*3-1 TO N(Y)*3+3
405 LET G=I*32+Y*4-2
410 LET S$(G TO G+2)="██████"
415 NEXT I
420 LET A=Q(Y,N(Y))
425 LET B=P(Y,N(Y))
430 LET N(Y)=N(Y)-1
435 IF N(Y)=0 THEN GOTO 315
440 FOR I=N(Y)*3+1 TO N(Y)*3+3
450 LET G=I*32+Y*4-2
455 LET S$(G TO G+2)=" "
460 NEXT I
465 LET S$(96*N(Y)+96+Y*4)=A$(Q
(Y,N(Y)))
470 LET S$(96*N(Y)+64+Y*4)=B$(P
(Y,N(Y)))
475 GOTO 315
500 IF Z>0 THEN PRINT AT 21,13;
". .OK. ."
502 IF Z>0 THEN GOTO 300
505 LET E=1
510 GOTO 2E3
999 STOP
1000 LET S=INT (RND*4+1)
1010 LET T=INT (RND*13+1)
1020 IF C(S,T)=1 THEN GOTO 1E3
1030 LET C(S,T)=1
1040 RETURN
2000 LET O=0
2010 FOR I=1 TO 7
2020 LET O=O+N(I)
2030 NEXT I
2040 IF O=0 THEN GOTO 2100
2050 IF Z=0 AND E=1 THEN GOTO 20
70
2060 GOTO 350
2070 PRINT AT 15,12;"HARD██████LUCK"
;AT 17,7;"YOU LOST BY ";O;" CARD
.
2080 IF O<>1 THEN PRINT "S"
2090 STOP
2100 PRINT AT 15,12;"WELL██████DONE"
;AT 17,0;"YOU WON WITH ";Z;" STO
CK CARD";
2110 IF Z<>1 THEN PRINT "S";
2120 PRINT " LEFT"
2130 STOP

```

Sharp hints

Peter Redford and
Jonathan Bryant,
Stockport,
Cheshire.

MZ-80K

HERE IS A selection which should prove of use to MZ-80K users.

To change the computer to lower case. POKE 4464,1
To change the computer to upper case. POKE 4464,0

To make a program run itself when loaded — use just before saving.
To disable the Break key.

To enable the Break key.

To blank out the screen.
To restore the screen.
To change the LED to red.

POKE 10682,1
POKE 6636,0
POKE 8767,0
POKE 8768,0
POKE 8769,0
POKE 6636,205
POKE 8767,218
POKE 8768,133
POKE 8769,19
POKE 59555,0
POKE 59555,1
POKE 57347,4

To change the LED to green. POKE 57347,5
To display quotations on to the screen. POKE 6350,0
To return to normal. POKE 6350,34
To make program line 1 into line 0. POKE 18440,0
To make line 0 into line 1. POKE 18440,1
To return to Basic after using the command Bye. GOTO \$1200
To return to Basic after using the command Bye. This keeps the program which was in the computer before Bye was used. GOTO \$124A

SOFTWARE FILE

Speed ball

Michael Rigby,
Morecambe,
Lancashire.

ZX-81

THIS PROGRAM is written entirely in machine-code with two lines of Basic used to store and run the program. It can be used with only 16K as the screen must be memory-mapped.

When run, a moving ball will appear from a

random position along the side of the screen. You must manoeuvre a cross, which is controlled by keys 5, 6, 7, 8 to cover the ball. The number of points gained is displayed at the bottom of the screen.

After the 354 characters have been entered, the machine-code can be stored using the following program which allows more than one code to be entered at one time.

10 LET A\$ = "

```
20 LET B = 16549
30 IF A$ = " THEN INPUT A$
40 SCROLL
50 PRINT B; "; A$ (TO 2)
60 POKE B (CODE A$-28) * 16 + (CODE A$ (2)
- 28)
70 LET B = B+1
80 LET A$ = A$ (3TO)
90 GOTO 30
```

The program is terminated by pressing Newline.

```
16549-2A 0C 40.....LD HL.(400C)
11 07 02.....LD DE.0207
19.....ADD HL,DE
EB.....EX DE,HL
21 82 40.....LD HL.4082
01 09 00.....LD BC.0009
ED 80.....LDIR
18.....DEC DE
ED 53 3C 40.....LD (403C).DE
E5.....PUSH HL
21 0A 00.....LD HL.000A
19.....ADD HL,DE
EB.....EX DE,HL
01 0A 00.....LD BC.000A
E1.....POP HL
ED 80.....LDIR
18.....DEC DE
ED 53 3E 40.....LD (403E).DE
3E 83.....LD A.83
CD 02 42.....CALL 4202
0E 14.....LD C.14
3E 85.....LD A.85
D7.....RST 10
3E 00.....LD A.00
05 1F.....LD B.1F
16501-D7.....RST 10
10 FD.....DJNZ,FD
3E 05.....LD A.05
D7.....RST 10
0D.....DEC C
20 F0.....JR NZ,F0
3E 03.....LD A.03
CD 02 42.....CALL 4202
11 19 0A.....LD DE.0A19
ED 53 41 40.....LD (4041).DE
3A 34 40.....LD A.(4034).DE
CB 3F.....SRL A
06 7F.....LD B.7F
F2 01 41.....JP P.4101
78.....LD H,A
D6 14.....SUB 14
47.....LD B,A
7C.....LD A,H
18 F4.....JR F4
90.....SUB B
3C.....INC A
57.....LD D,A
3E 02.....LD E.02
DA 01.....LD B.01
16548-DA.....CP D
20 04.....JR NZ.04
3E 14.....LD A.14
18 07.....JR 07
3E 14.....LD A.14
BA.....CP D
20 05.....JR NZ.05
3E 15.....LD A.15
32 2C 41.....LD (412C).A
3E 02.....LD A.02
BB.....CPE
20 04.....JR NZ.04
3E 1C.....LD A.1C
18 07.....JR 07
```

```
3E 1F.....LD A.1F
BB.....CPE
20 05.....JR NZ.05
3E 1D.....LD A.1D
32 2D 41.....LD (412D).A
14.....INC D
1C.....INC E
CD E5 41.....CALL 41E5
7E.....LD A.(HL)
FE 08.....CP 08
28 1E.....LD R,Z.1E
2A 3E 40.....LD HL.(403E)
7E.....LD A.(HL)
FE 25.....CP 25
16700-7E.....LD R,Z.03
34.....INC (HL)
18 05.....LD R,05
35 1C.....LD (HL).1C
2B.....DEC HL
18 F3.....JR F3
3A 57 41.....LD A.(4157)
FE 5B.....CP 5B
28 02.....JR Z.02
D6 05.....SUB 05
32 57 41.....LD (4157).A
18 9A.....LD R,A
3E 00.....LD (HL).00
0E 0F.....LD C.0F
0D.....DEC C
20 FD.....JR NZ,FD
10 F9.....DJNZ,F9
36 08.....LD (HL).08
ED 53 43 40.....LD (4043).DE
CD BB 02.....CALL 02BB
7C.....LD A,H
2F.....CPL
95.....SUB L
ED 56 41 40.....LD DE.(4041)
FE 29.....CP 29
20 01.....JR NZ.01
10.....DEC E
FE 19.....CP 19
16756-20 01.....JR NZ.01
1C.....INC E
FE 21.....CP 21
20 01.....JR NZ.01
15.....DEC D
FE 31.....CP 31
20 01.....JR NZ.01
14.....INC D
7A.....LD A,D
FE 13.....CP 13
20 01.....JR NZ.01
15.....DEC D
FE 01.....CP 01
20 01.....JR NZ.01
14.....INC D
78.....LD A,E
FE 1F.....CP 1F
20 01.....JR NZ.01
1D.....DEC E
FE 03.....CP 03
20 01.....JR NZ.01
1C.....INC E
```

```
CD E5 41.....CALL 41E5
ED 53 41 40.....LD (4041).DE
37.....SCF
11 22 00.....LD DE.0022
ED 52.....SBC HL,DE
16806-EB.....EX DE,HL
21 95 40.....LD HL.4095
0E 04.....LD C.04
C5.....PUSH BC
01 04 00.....LD BC.0004
ED 80.....LDIR
EB.....EX DE,HL
01 1D 00.....LD BC.001D
09.....ADD HL,BC
EB.....EX DE,HL
C1.....POP BC
0D.....DEC C
20 F0.....JR NZ,F0
ED 5B 43 40.....LD DE.(4043)
2A 3C 40.....LD HL.(403C)
7E.....LD A.(HL)
FE 14.....CP 14
20 10.....JR NZ.10
06 04.....LD B.04
2A 3C 40.....LD HL.(403C)
36 1C.....LD (HL).1C
2B.....DEC HL
10 FB.....D,NZ,FB
3E 00.....LD A.00
32 57 41.....LD (4157).A
C9.....RET
FE 1C.....CP 1C
28 04.....JR Z.04
16860-35.....JPC (HL)
C3 06 41.....JP 4106
36 25.....LD (HL).25
2B.....DEC HL
18 DE.....LD DE
25 00.....LD H.00
5A.....LD L,D
CB 25.....SLA L
CB 25.....SLA L
CB 25.....SLA L
CB 25.....SLA L
CB 14.....RL H
CB 25.....SLA L
CB 14.....RL H
06 00.....LD B.00
4A.....LD C,D
09.....ADD HL,BC
4B.....LD C,E
09.....ADD HL,BC
ED 4B 0C 40.....LD BC.(400C)
09.....ADD HL,BC
C9.....RET
06 20.....LD B.20
07.....RST 10
10 FD.....DJNZ,FD
16903-C9.....RET
1 REM TIME=2000BALLS=0000
-354 ZEROES
2 RAND USR 16549
```

Faster graphics

Jonathan Brazier,
London E2.

ZX-81

POTTERING ALONG on my ZX-81, I have discovered a device which speeds up moving graphics by some four or five times without venturing into the tortuous world of machine-code. It is based on the fact that any number of At instructions may be included in one Print instruction, even if the co-ordinates are identical or overlap. The program makes it clear, of course, it only works for horizontally-moving objects if you want the object's track erased as it goes. With a little ingenuity the increase in speed is well worth the extra typing.

```
5 PRINT AT 0,0:" SLOW "
10 FOR F=1 TO 30
20 PRINT AT 10,F;" "
30 NEXT F
35 PRINT AT 0,0:" FAST "
40 PRINT AT 10,1:" AT 10,1:"
" AT 10,2:" AT 10,3:" AT
" AT 10,4:" AT 10,5:" AT 10,6:" AT
" AT 10,7:" AT 10,8:" AT 10,9:" AT
" AT 10,10:" AT 10,11:" AT 10,12:"
" AT 10,13:" AT 10,14:" AT 10,15:" AT
" AT 10,16:" AT 10,17:" AT 10,18:"
" AT 10,19:" AT 10,20:" AT 10,21:"
" AT 10,22:" AT 10,23:" AT 10,24:" AT
" AT 10,25:" AT 10,26:" AT 10,27:"
" AT 10,28:" AT 10,29:"
50 GOTO 5
```

Loony lander

Roger Valentine,
Staines,
Middlesex.

PET

THIS IS the most appalling computer game ever. It combines the worst of Invaders with the worst of Breakout to create an abysmal Lunar landing-type scenario. Perhaps its only redeeming feature is that it is so incredibly difficult to gain a decent score that you quickly tire of playing it, and so might use your computer for something more useful.

It is written for a 40-column Pet, but if you really think it is worth the effort converting it to another machine, I shall explain all the screen-Pokes. There are no machine-dependent features other than the screen-mapping, apart from the few Pet cursor controls, which are also explained.

The object is to land your space-craft — or aeroplane, the graphics are so poor that it does not matter which — on a rubble-laden runway. Before you land, you must clear the runway completely by destroying the rubble with either bombs or missiles.

You have five aircraft, each with unlimited

armaments, and the planes fly from left to right — they wrap-round the right-hand side of the screen — until they either hit something or land safely. Each block of rubble destroyed with a bomb scores one point. Missiles are fired horizontally and will also wrap-round the screen, so they must always destroy the next block of rubble in your flight-path.

The problem is that destroying a block of rubble with a missile scores -20 points, and you must have a total of more than 20 for the missile button to be operative. Press Space to drop a bomb, and Shift/Space to launch a missile.

The 40-column Pet has 1,000 screen positions, with 32768 the address of the top left-hand corner. The program will run on any micro with a memory-mapped display by altering the value of P in line 5 — e.g., to 7680 for the Vic — and inserting suitable values in place of the following:

■ 480 to 999 in line 20: these are numbers representing approximately the bottom half of the screen.

■ 500 in line 25: line 25 ensures greater density of rubble at the lower part of the display, so any number close to the lower limit of J in line 20 will do.

(continued on next page)

SOFTWARE FILE

(continued from previous page)

■ 999 in lines 85, 1030 and 2010: the number which, when added to P, represents the bottom right-hand corner of the machine's screen.

The characters Poked to the screen are, in most cases, arbitrary but as these are Pet codes and not ASCII, I will explain what they represent. Note that Vic codes are the same as Pet's:

- Lines 20 and 1010: any character to illustrate the rubble. 247 equals an inverse space.
- Line 40: five characters representing the shape of the plane. 182-PL is the number of the plane, in inverse video.
- Line 75 and elsewhere: 32 equals a space — as in ASCII.
- Line 1000: a single character bomb.
- Line 1010: any explosion pattern, ending with a space.

- Line 2020: a missile or minus sign.
- Lines 6005-6030: a more elaborate explosion pattern.
- The Pet cursor controls are:
 - Line 15: clear screen.
 - Line 50: cursor left/space/space/home. This ensures that a single-digit number will completely over-write a dual-digit.
 - Lines 6220 to 7000: Home/down/down.
 - Line 7020: The R and E are in inverse.

```
5 P=32768
10 O1=41 O2=42 O3=43 O4=44 O5=45 O6=53
15 PRINT "LORE=" SC=0 PL=5
20 FOR J=480 TO 999 STEP 2: POKEP+J, 247
25 J=J-RND(1)*J/500
30 NEXT
35 IF=0
40 G=0: S=0: (5-PL)
45 POKED+01, 91 POKED+02, 64 POKED+03, 182-PL POKED+04, 91 POKED+05, 64
50 PRINT SC: " " S: TAB(6):
55 IF S=0 THEN P=0: E
60 GET: IF=0: "THEN P=1
65 IF=0: H=1 (168) AND SC=20 THEN GOSUB 1000
70 IF P=1 THEN GOSUB 1000
75 POKED+01, 32: O=0+1
80 IF PEEK(O+05)=247 THEN G=0
85 IF O+05=P+999 THEN G=0
90 GOTO 45
1000 POKEP, 81: BN=BP+40
1010 IF PEEK(BN)=247 THEN POKEBN, 42 POKEBN, 163 POKEBN, 42 POKEBN, 32 POKEBN, 32: BP=0+
05 BF=0: SC=SC+1
1020 POKEP, 32: BP=BN
1030 IF P=P+999 THEN BF=0
1040 RETURN
2000 NP=0+05+1
2010 IF PEEK(NP)=247 THEN P=P+999 THEN 2100
2015 IF P=P+999 THEN 2100
2020 POKEMP, 45
2030 POKEMP, 32
2040 NP=NP+1: GOTO 2010
2100 POKEMP, 42 POKEMP, 32 POKEMP, 42 POKEMP, 32
2110 SC=SC-20
2120 RETURN
6000 FOR K=1 TO 5
6005 POKED+01, 42 POKED+02, 42 POKED+03, 42 POKED+04, 42 POKED+05, 42
6010 POKED+02, 163 POKED+03, 163 POKED+04, 163
6015 POKED+01, 163 POKED+02, 32 POKED+03, 32 POKED+04, 32 POKED+05, 163
6020 POKED+01, 42 POKED+02, 163 POKED+03, 163 POKED+04, 163 POKED+05, 42
6025 POKED+02, 42 POKED+03, 42 POKED+04, 42
6030 POKED+01, 32 POKED+02, 32 POKED+03, 32 POKED+04, 32 POKED+05, 32
6200 NEXT
6210 PL=PL-1: IF PL=0 THEN 55
6220 PRINT "YOU FAILED! ALL 5 PLANES LOST FOR ONLY " SC: " POINTS!"
6230 IF SC=20 THEN PRINT "K! PATHETIC!"
6240 GOTO 7020
7000 PRINT "WELL DONE! YOU LANDED PLANE NUMBER", 6-PL
7010 PRINT "WITH A SCORE OF", SC
7020 PRINT "RE-RUN" : E=0: END
7030 GET:
7040 IF=0: "R" THEN RUN
7050 IF=0: "E" THEN PRINT " " : END
7060 GOTO 7030
```

Calculator

Malcolm Taylor,
Riyadh,
Saudi Arabia.

ZX-81

THE PROGRAM is intended for those who have a 16K ZX-81, but wish they had a printing calculator. It will keep a running total of up to 100 entries, which may be simply numeric or any of the ZX-81 keyboard maths functions.

The screen is automatically cleared when full, and the program is menu-driven to allow alteration of any line number; review of previously scrolled-off entries; clear and restart or continue.

```
10 REM "CALCULATOR"
15 REM "COPYRIGHT M.J.H.TAYLOR
1982"
20 GOTO 110
30 REM SET UP HEADINGS
40 CLS
50 PRINT "LN"; TAB 4; "ITEM"; TAB
20; "TOTAL"
60 PRINT "-----"
70 PRINT
80 PRINT
90 PRINT "-----"
100 RETURN
110 PRINT TAB 5; "PRINTING CALCU
LATOR"
120 PRINT TAB 5; "-----"
130 PRINT
140 PRINT
150 PRINT "YOU MAY ENTER ANY MA
THEMATICAL " "FUNCTION. REVIEW FR
OM ANY LINE " "BY ENTERING " "R" ".
CLEAR ALL " "ENTRIES BY ENTERING
" "S" ". ALTER " "ANY LINE BY ENTE
RING " "A" ".
160 PRINT
170 PRINT "PRESS " "NEW LINE" " T
O START"
180 INPUT A$
190 GOSUB 40
200 REM SET UP FOR MAX 100 ENTR
IES
210 DIM B$(100, 12)
220 DIM C(100)
230 FOR I=1 TO 100
240 GOTO 800
250 LET B$(I)=R$
260 REM SPECIAL CONDITION FOR
COUNT NUMBER ONE
270 IF I=1 THEN LET C(I)=VAL B$
(I)
280 IF I=1 THEN GOTO 300
290 LET C(I)=C(I-1)+VAL B$(I)
300 PRINT I; TAB 4; B$(I); TAB 20;
C(I)
310 REM LIMIT NUMBER OF ENTRIES
PER PAGE TO 12
320 IF I/12=INT (I/12) THEN GOS
UB 40
330 IF I/12=INT (I/12) THEN PRI
NT AT 5,0; I; AT 5,4; B$(I); AT 5,20
; C(I)
340 NEXT I
350 PRINT
360 PRINT AT 2,0; "WHICH LINE DO
YOU WISH TO ALTER?"
370 INPUT D
380 IF D>I THEN GOTO 310
390 PRINT AT 3,0; "ENTER NEW VAL
UE OF LINE " ; D; "
400 INPUT F$
410 LET B$(D)=F$
420 GOSUB 40
430 IF D=I-1 THEN LET C(D)=C(D-
1)+VAL F$
440 IF D=I-1 THEN GOTO 550
450 FOR G=D TO (I-1)
460 IF G=1 THEN LET C(G)=VAL B$
(G)
470 IF G=1 THEN GOTO 520
480 LET C(G)=VAL B$(G)+C(G-1)
490 REM LIMIT NUMBER OF ENTRIES
PER PAGE TO 10
500 IF G>=I-10 THEN GOTO 520
510 GOTO 530
520 PRINT G; TAB 4; B$(G); TAB 20;
C(G)
530 NEXT G
540 GOTO 580
550 PRINT D; TAB 4; B$(D); TAB 20;
C(D)
560 PRINT
570 PRINT
580 GOTO 750
590 PRINT AT 2,0; "FROM WHICH LI
NE NUMBER?"
600 INPUT D
610 GOSUB 40
620 LET T=(I-D-1)
630 IF T>10 THEN LET T=10
640 FOR J=0 TO T
650 PRINT D+J; TAB 4; B$(D+J); TAB
20; C(D+J)
660 NEXT J
670 PRINT
680 PRINT
690 GOTO 750
700 GOSUB 40
710 LET I=I-1
720 PRINT I; TAB 4; B$(I); TAB 20;
C(I)
730 GOTO 340
740 REM SET UP CUES
750 PRINT AT 18,0; "ENTER " "C" "
TO CONTINUE"
760 PRINT "ENTER " "S" " TO CLEAR
ALL ENTRIES"
770 PRINT "ENTER " "A" " TO ALTER
ANY LINE"
780 PRINT "ENTER " "R" " TO REVIE
W"
790 REM SET UP RESPONSE TO CUES
800 INPUT R$
810 IF R$="C" THEN GOTO 700
820 IF R$="S" THEN GOTO 190
830 IF R$="A" THEN GOTO 360
840 IF R$="R" THEN GOTO 590
850 GOTO 250
860 STOP
870 SAVE "CALCULATOR"
880 GOTO 1
```

Board-game

N D Willink,
Exeter, Devon.

ZX-81

FOR THOSE interested in how the ZX-81 can play games other than chess or draughts, this 16K program will be of some interest.

The rule of the game is that no fruit of the same kind can be in an adjacent square.

```
20 LET S=0
30 LET GO=0
40 LET K$=" "
50 FOR N=5 TO 15
60 PRINT AT N,8; K$
70 NEXT N
80 DIM A(7,7)
90 FOR N=2 TO 6
100 FOR M=2 TO 6
110 LET A(M,N)=3
120 PRINT AT 2*M+2, 2*N+5; " "
130 NEXT M
140 NEXT N
150 FOR N=1 TO 5
160 LET GO=0
170 LET K$=" "
180 FOR M=5 TO 15
190 PRINT AT N,8; K$
200 NEXT M
210 LET A(7,7)=3
220 PRINT AT 2*N+2, 2*N+5; " "
230 GOTO 200
300 PRINT AT 21,0; "ORANGE OR AP
PLE"
310 INPUT C$
320 PRINT AT 21,0; "
330 IF C$(1)="O" THEN LET X=1
340 IF C$(1)="A" THEN LET X=2
350 IF A(U+1,U2)=X OR A(U,U2+1)
=X OR A(U-1,U2)=X OR A(U,U2-1)=X
THEN GOTO 340
360 GOTO 400
400 LET A(U,U2)=X
410 IF X=1 THEN PRINT AT 2*U+2,
2*U2+5; "O"
420 IF X=2 THEN PRINT AT 2*U+2,
2*U2+5; "A"
430 LET Z=INT (RND*2)+1
440 LET M=INT (RND*4)+2
450 LET N=INT (RND*4)+2
460 IF A(M,N)=3 AND (A(M+1,N) <
Z AND A(M-1,N) < Z AND A(M,N+1) <
Z AND A(M,N-1) < Z) THEN GOTO 600
470 FOR M=2 TO 6
480 FOR N=2 TO 6
490 IF A(M,N)=3 AND (A(M+1,N) <
Z AND A(M-1,N) < Z AND A(M,N+1) <
Z AND A(M,N-1) < Z) THEN GOTO 600
500 NEXT N
510 NEXT M
520 LET K=K+1
530 IF K=10 THEN GOTO 700
540 GOTO 500
550 IF Z=1 THEN PRINT AT 2*M+2,
2*N+5; "O"
560 IF Z=2 THEN PRINT AT 2*M+2,
2*N+5; "A"
570 LET A(M,N)=Z
580 IF S=1 THEN GOTO 500
590 GOTO 200
600 PRINT AT 21,0; "I GIVE UP YO
U WIN"
610 GOTO 200
```

SOFTWARE FILE

No question

Tim Miller,
Appleby-in-Westmorland,
Cumbria.

ATOM

THIS SHORT routine is written in Atom Basic and overcomes the problem of the sometimes misleading question mark which is generated by Basic's Input statement. A response such as "Enter amount : " is much more suitable than "Enter amount ?".

When the Atom encounters the word Input,

it first jumps to a subroutine in the operating system to print out a prompt. The address of this subroutine is determined by the contents of addresses #209 and #208 as a 16-bit address.

All this program does is alter these addresses to a free area of memory at #80 in RAM where a machine-code routine replaces the original values of #209 and #208 and jumps back to the Input routine without printing a prompt. This in effect means that the last character printed in Basic becomes the prompt.

Although the program is simple, it is handy because of its length. The more complicated method of achieving this, which Acorn gives, is not only more than twice as long but uses three more of the precious 26 Atom variables.

```
10 REM * SUBROUTINE TO REMOVE INPUT PROMPT
20 P = # 80; [LDA@82; STA# 208; LDA@254; STA# 209; RTS;]; Z = # FE940080
30 REM * DEMONSTRATE USE
40 PRINT "ENTER AMOUNT :"; !# 208 = Z; INPUT A
50 END
```

Sounds of alarm

David Harmes and David Martin,
Chesterfield,
Derbyshire.

VIC-20

THIS IS A basic program for an alarm clock for the Vic-20 with 3.5K. It starts by asking you when the alarm should sound — TIS is a 24-hour clock. Then you must enter the time at which the clock should start. The information is then displayed on the screen.

In lines 34 and 330 in the inverted commas — "f1" and "f7" — just press the corresponding function key. Press "f1" to switch the alarm off when the alarm is rung. Press "f7" when the alarm is not on to change the setting of the alarm. Note that 2.35 am should be entered in the form: 023500.

```
1 PRINT "□"
3 PRINT CHR$(5)
4 POKE 36879, 8: GOSUB 100
10 INPUT "□□□ CORRECT TIME "; TI$
20 PRINT "□"
25 PRINT "□□□ TIME"
30 PRINT "□□□□□□"; LEFT$(TI$, 2); " : "; MID$(TI$, 3, 2); " : "; RIGHT$(TI$, 2)
31 PRINT "□□□ ALARM"
33 PRINT "□□□□□□"; LEFT$(AL$, 2); " : "; MID$(TI$, 3, 2); " : "; RIGHT$(TI$, 2)
34 GETA$: IFA$ = "F7" THEN GOSUB 400
36 IF AL$ = TI$ THEN GOSUB 200
40 PRINT "□□□□□ VIC ALARM"
110 INPUT "□□□□□ ALARM TIME "; AL$
120 RETURN
200 POKE 36878, 15
210 PRINT "□" /
220 POKE 36874, 250: FORN = 0 TO 500: NEXT N
320 POKE 36874, 0: FORN = 0 TO 500: NEXT N
330 GETA$: IFA$ = "F1" THEN POKE 36878, 0: RETURN
340 GOTO 220
400 PRINT "□"
410 INPUT "ALARM TIME "; AL$
420 PRINT "□": RETURN
```

Search and replace

Darren Ilston,
Stockport,
Cheshire.

ZX-81

SEARCH AND replace will search the screen for a character you specify and replace it with any other. Load this machine-code routine into a Rem Statement no shorter than 23 bytes long. Search and replace runs in a 16K ZX-81 only.

Z-80 assembly listing Hexadecimal dump
LD HL, (D.FILE). 2A 0C 40.
LD B, 24d. 06 19.
DEC HL. 2B.
INC HL. 23.
LD A, (HL). 7E.
CP 118. FE 76.
JRNZ, + 3. 20 03.
DJNZ - 8. 10 F8.
RET. C9.
CP CHR.\$ (n). FE CHR.\$ (n).
JRNZ - 13. 20 F3.
LD, (HL), CHR.\$ (x). 36 CHR.\$ (x).
JR - 17. 18 EF.

If this machine-code routine is loaded into a Rem statement, then Poking the values:
16530, CHR.\$, (n)

where CHR.\$ (n) means the character to be searched for.

16534, CHR.\$, (x)

where CHR.\$ (x) means the character to be replaced.

Test timer

J Laidlaw, Aberdeen.

MZ-80K

I WROTE THIS program to make use of the fact that the MZ-80K's internal clock can be Poked to count to an accuracy of one-sixtieth of a second although, unfortunately, the hour

count is lost and the minute count's maximum is 24. The program is short, occupying approximately 0.7K, and will run on all MZ-80Ks whatever the memory size.

```
10 X=4465:Y=4466:REM cursor positions
20 PRINT "□ Reaction timer - hit a key"
30 GET A$: IF A$="" GOTO 30
40 TI$="000000" REM set clock to zero
50 FOR Z=1 TO 3
60 READ A,B:REM alter clock to count
70 POKE A,B:REM to 1/60 of a sec.
80 NEXT Z
90 PRINT "□"
100 FOR Z=1 TO INT(RND(1)*2000):NEXT Z
110 POKE A,B:REM start clock
120 POKE 53248+Z/2,109:REM disk law
130 GET A$: IF A$="" GOTO 130
140 A$=TI$:REM time taken to react
150 POKE X,8:POKE Y,20
160 PRINT "Your time: "; LEFT$(A$, 2);
170 PRINT " : "; MID$(A$, 3, 2);
180 PRINT " : "; RIGHT$(A$, 2)
190 POKE X,11:PRINT "Continue? (Y/N)"
200 GET A$
210 REM restore data and resume
220 IF A$="Y" THEN RESTORE:GOTO 40
230 REM return clock to normal and end
240 IF A$="N" THEN TI$="000000":END
250 GOTO 200
260 DATA 57351,116,57359,9,57349,2
```

Micro maestro?

J P McGowan,
Huddersfield,
West Yorkshire.

ZX-81

THIS PROGRAM produces "music" on your ZX-81. I am not absolutely sure how it works, but when the computer changes from fast mode to slow and vice versa, it makes a click in the cassette output port. If an amplifier is attached the oscillations can be heard. If you are without an amplifier you could use a tape recorder to tape it and then play it back.

For a lower note you can add the following lines:

```
15 REM
25 REM
```

Here is the main program listing:

```
10 FAST
20 SLOW
30 RUN
```

Words of wisdom

F K Carver,
Plymouth,
Devon.

ATOM

THIS PROGRAM is a very simple and easy-to-use substitute for a proper word processor and can be used by anyone who can use the Atom editing facilities. It is important that the first three lines are typed in exactly as shown.

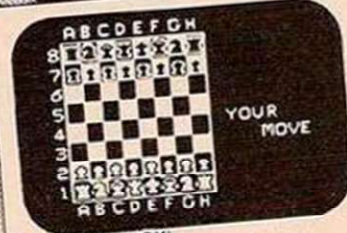
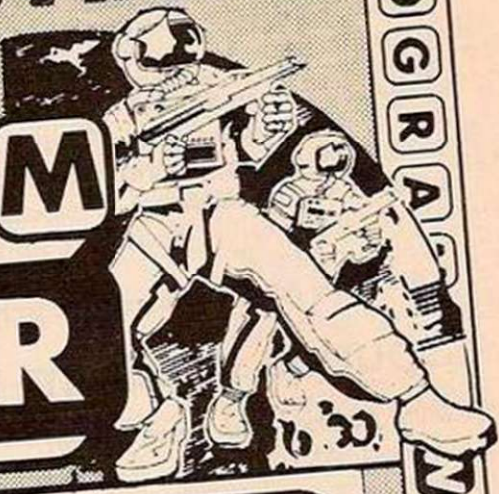
To use the program, input your text anywhere after line 3 and it can be edited, added to, and so on, by using the standard Atom editing function. To print, type Control-B then run the program.

```
1 I=?18*256+#46;D0D0
2 P.$?I;I=I+1;U.?I=13
3 P.';I=I+3;U.I)=TOP;E.
4
5 FKC ATOM 'CHEAP WORDPRO'
6 =====
7
8 TO USE PUT YOUR OWN TEXT
9 ANYWHERE AFTER LINE 3 AND IT
10 CAN BE EDITED, ADDED TO ETC.
11 BY USING THE STANDARD ATOM
12 EDITING FUNCTIONS.
13
14 TO PRINT TYPE CONTROL-B THEN
15 RUN THE PROGRAM ABOVE
```

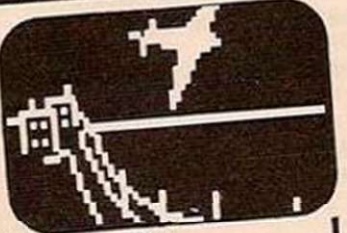
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● FIND	WHILE	CURSOR X, Y	VECTOR
VAR	ENDWHILE	BEEP X, Y	ZERO
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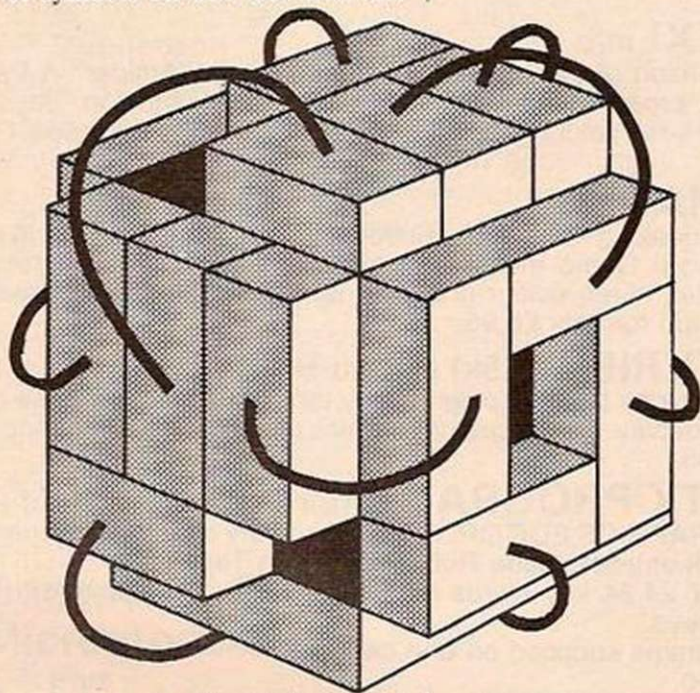
COMPETITION CORNER

POWER CUBE

BY ANTHONY ROBERTS

AMONG THE Klingon's treasures that you so cleverly won in our competition in April, is a puzzling little cube which could provide fabulous amounts of free energy should you just be able to connect it up correctly.

There are 12 connectors, each of which connects a pair of symbols on one face with the

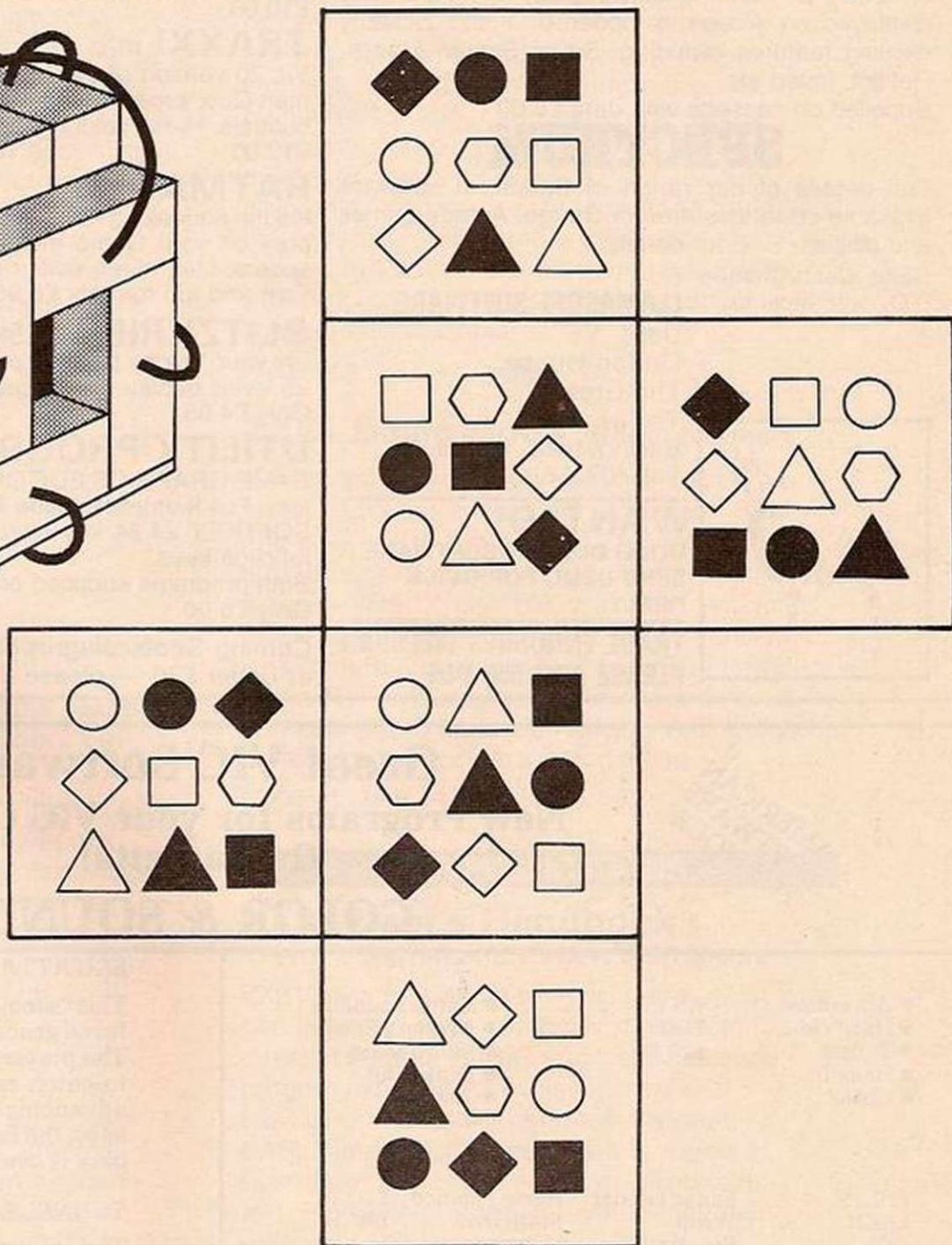


same pair of symbols on an adjacent face of the cube — as the picture shows. When they are all in place, one symbol is left exposed on each face — and if it is not the same symbol left on every face of the cube, you will have short-circuited it and the resulting explosion will destroy everything for miles.

Here is the unfolded plan of the cube. What symbol should be left?

A £15 book token will be awarded to the first correct solution drawn from the competition bag. All entries must be at the *Your Computer* offices by the last working day in August. The name of the winner, the solution, and a competition report will be published in the October issue of *Your Computer*.

If you want to set a competition for Competition Corner, remember that the simplest solution should be calculable by a short program rather than by any other form of reckoning.



Competition results

THE NUMBER OF correct entries for the Vic expansion system competition in June made the choice of a winner as hard as ever. We finally awarded the Arfon motherboard to J W Brawn of Highfield, Willow Lane, Goxhill, South Humberside, for his "One good Vic deserves a mother".

Several other competitors felt that their Vics suffered from maternal deprivation. As Matthew Lewis explained "Vic needs mother — bored without her", while, on a different *Solution to the June crossword.*



tack, Jane Finlatson revealed that "My children are bored with their mother and want to expand".

Some puns were more groan-provoking than others. John Keogh claimed "I Arfon got a good memory" and J Williams expressed the Vic owner's plight with "A Vic's 'arf off without an Arfon". Others that caught the eye were R White's "Such inflation becomes stimulation without aggravation" and Sue Dealler's sinister "VICious micros have more byte".

The Golden Nugget problem attracted comparatively few entries. If you noticed that the number of nuggets collected on leaving the park is the cube of the number of trips through the park, it was easy to arrive at a solution without a computer: the answer, 32, is the cube root of the final number of nuggets collected. Programming for a solution is

straightforward once you have worked out a formula for the number of pearls collected from the island on each trip through the park.

Several programs found the simplest line, using only three variables. Since the number of coins used and the number of bags is the same, a single variable can serve for both.

The winning solution drawn from the hat was sent in by Peter Hall of 10 Spean Drive, Aspley Hall, Nottingham:

```

10 LET B = 0
20 LET N = 0
30 LET B = B + 1
40 LET P = B * (B - 1)
50 LET N = N + 3 * P + 1
60 IF N = 32768 THEN GOTO 80
70 GOTO 30
80 PRINT B; "COINS"

```

B = number of bags; N = number of nuggets; P = number of pearls.

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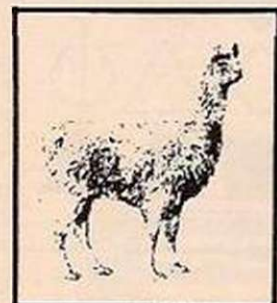
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VIC-20 by Jeff Minter

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COMPUTER NEWS

JUNE PUBLICATIONS

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A P Stephenson

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0 408 01184 X 160 pages £3.95

Beginner's Guide to Microprocessors

E A Parr

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- A beginner's book suitable for the reader with an interest in microprocessors but with little previous knowledge.

Avoiding the sensational aspects of the subject that have been a feature of so many books, Andrew Parr gets down to fundamentals. After an introduction to computers in general he explains in detail how the microprocessor works, its software and programming, and how it is integrated with peripherals to form a complete microcomputer system.

Later chapters describe applications of microprocessors in control systems, robots, small business computer systems, etc. There is also a survey of microprocessor families (Z80, 8080, 6800 and 6502), and an appendix covers the various number systems used in microprocessor work.

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0 408 01204 8 128 pages £4.95

ZX81 Basic Book

Robin Norman

Covers the basic 1K version, the additional facilities offered by the 16K expansion RAM and how to use the Sinclair ZX printer. There are 14 original programs for you to run on the machine (for 1K and 16K versions), and for those confused by computer jargon (and who isn't?) there is a glossary of technical terms. Robin Norman assumes no initial knowledge of computing and his undemanding writing style is perfect for a beginner's introduction.

0 408 01178 5 176 pages £4.95

JULY PUBLICATIONS

ZX81 User's Handbook

Trevor J Terrell and Robert J Simpson

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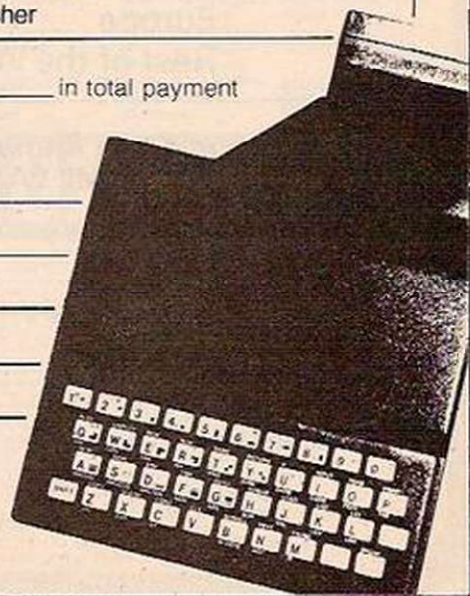
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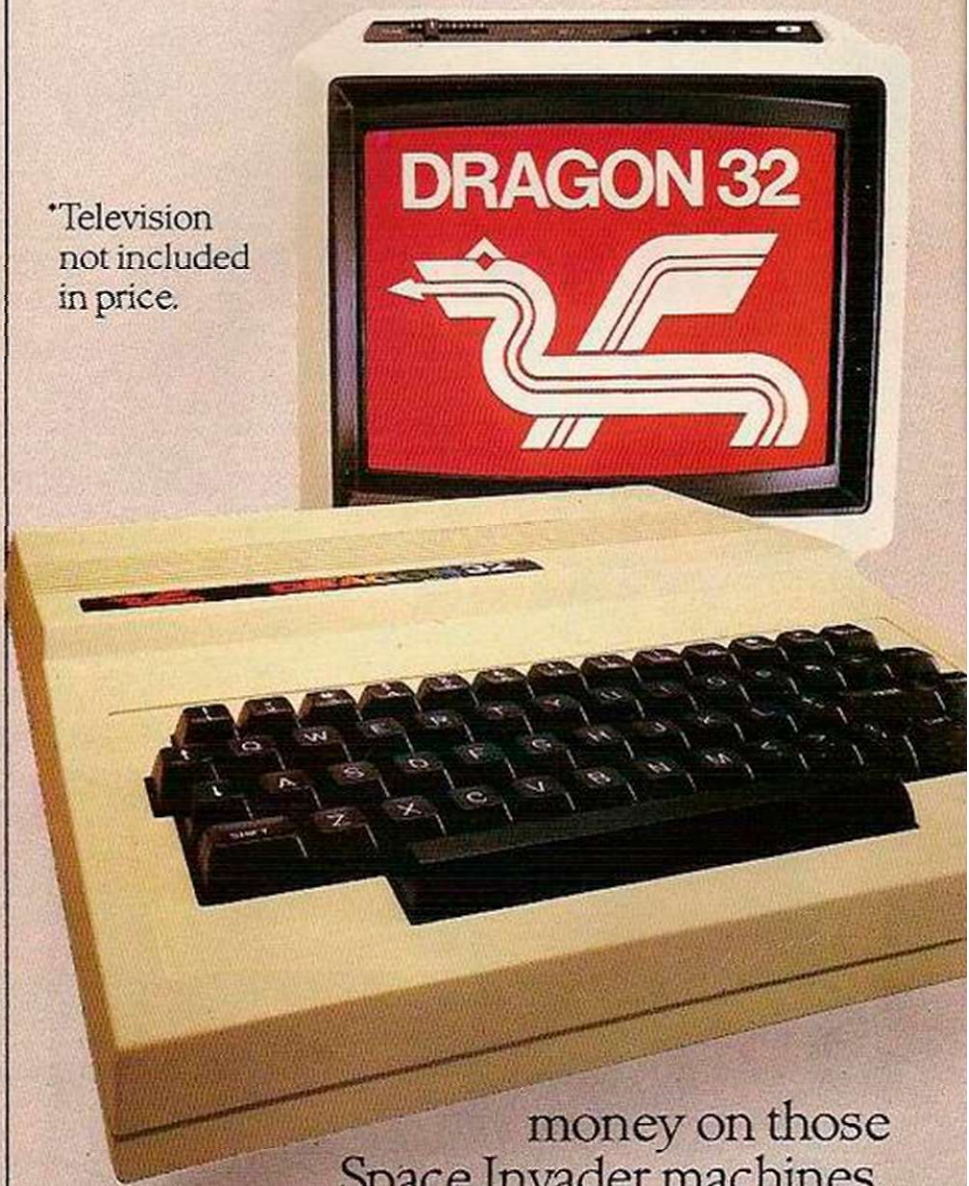
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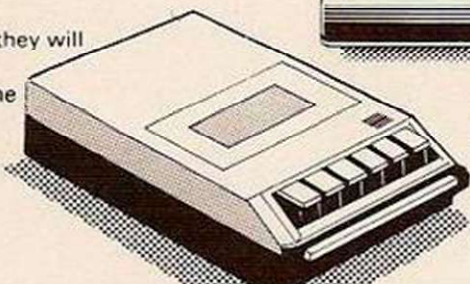
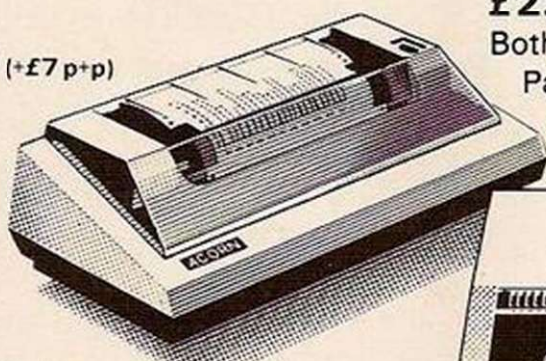
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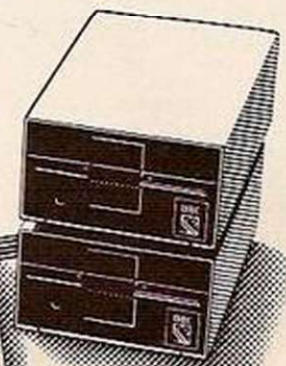
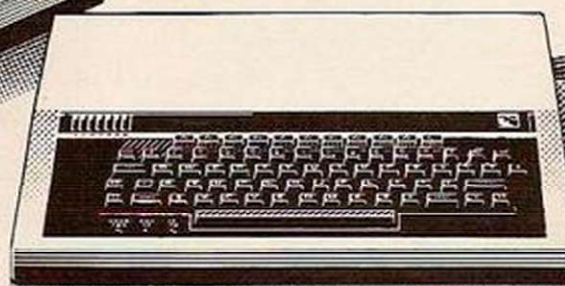
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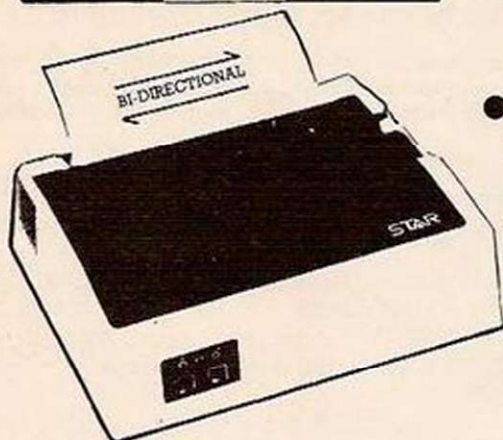
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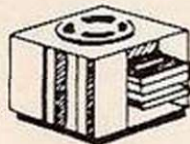
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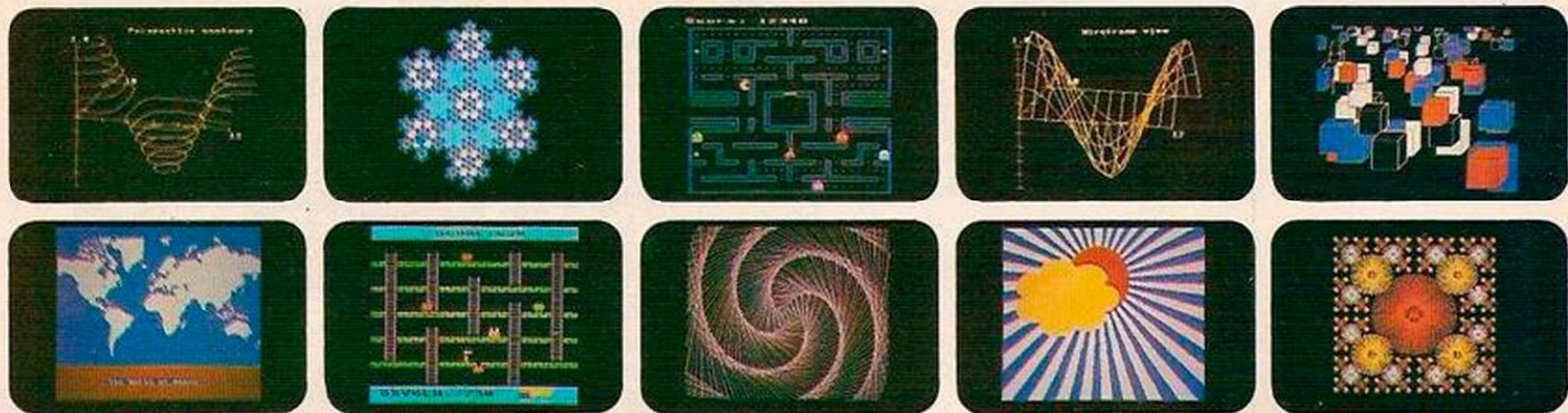
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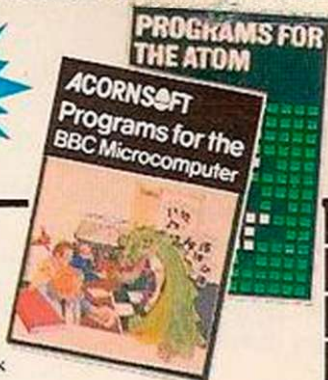
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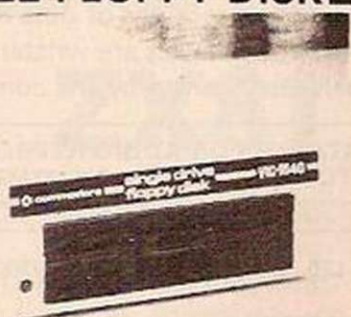
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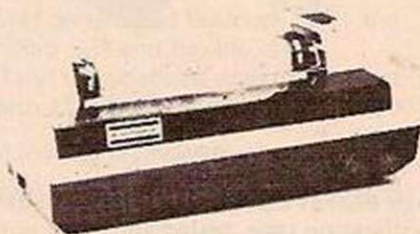
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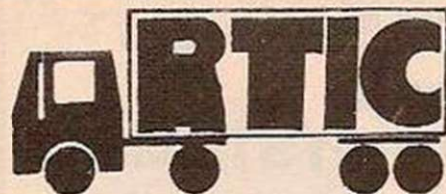
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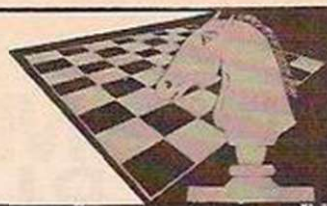
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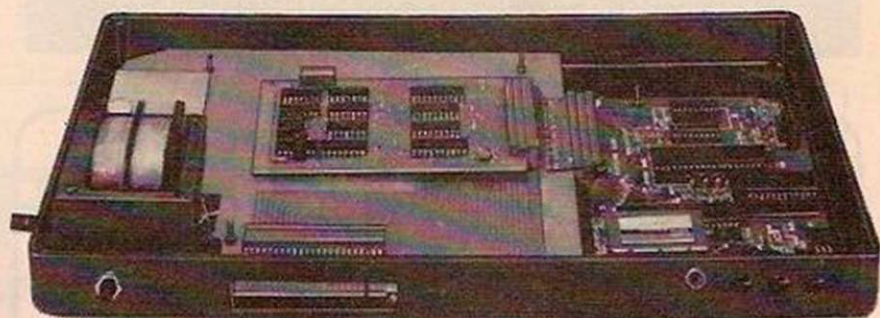
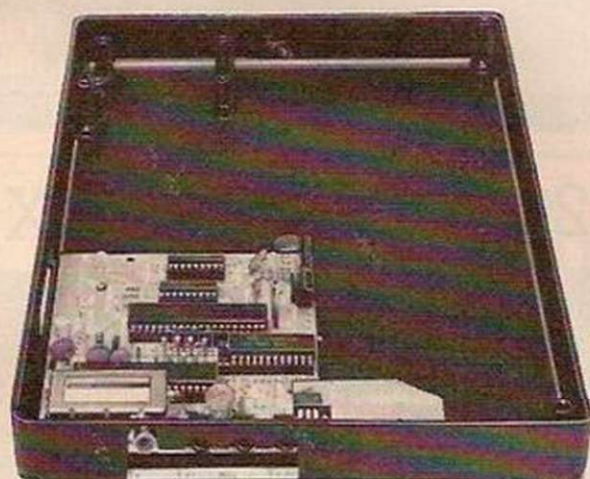
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FAMILY BUDGET FIGURES

	DEC	JAN	FEB	MAR	APR	MAY
MORTGAGE	167	167	167	167	167	167
PHONE	42			35		
GAS			62			31
SELECT.		43			35	
CAR	63	71	65	51	70	65
INSUR.	12	12	12	12	12	12
RATES			235			
TOTAL	284	293	544	275	284	27

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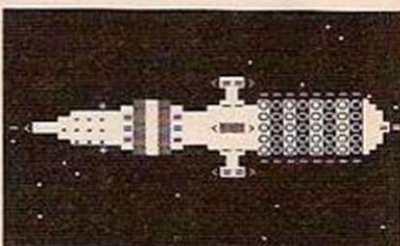
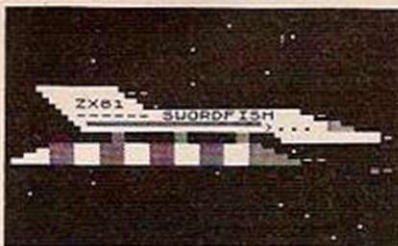
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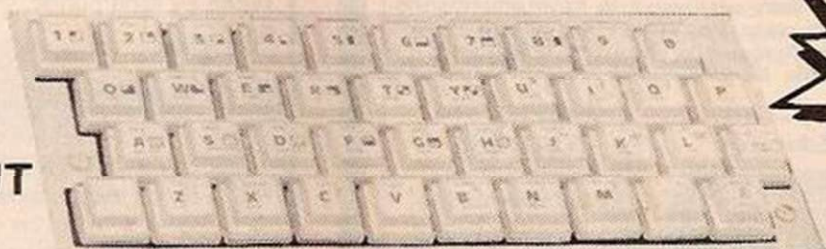
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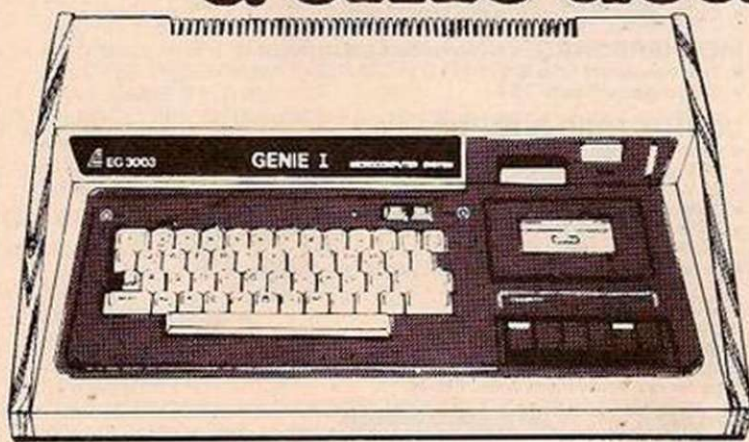
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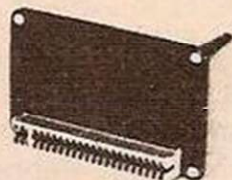
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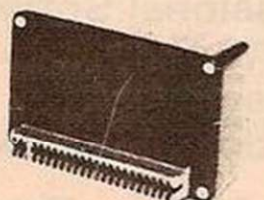
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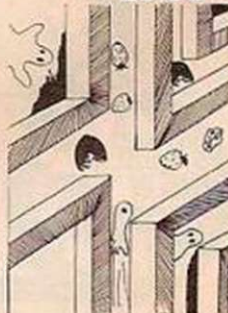
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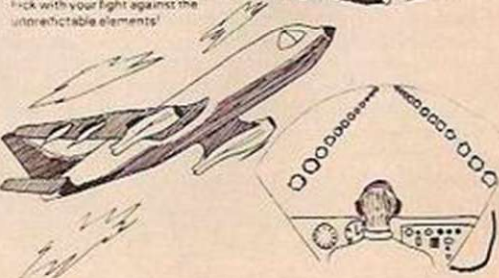


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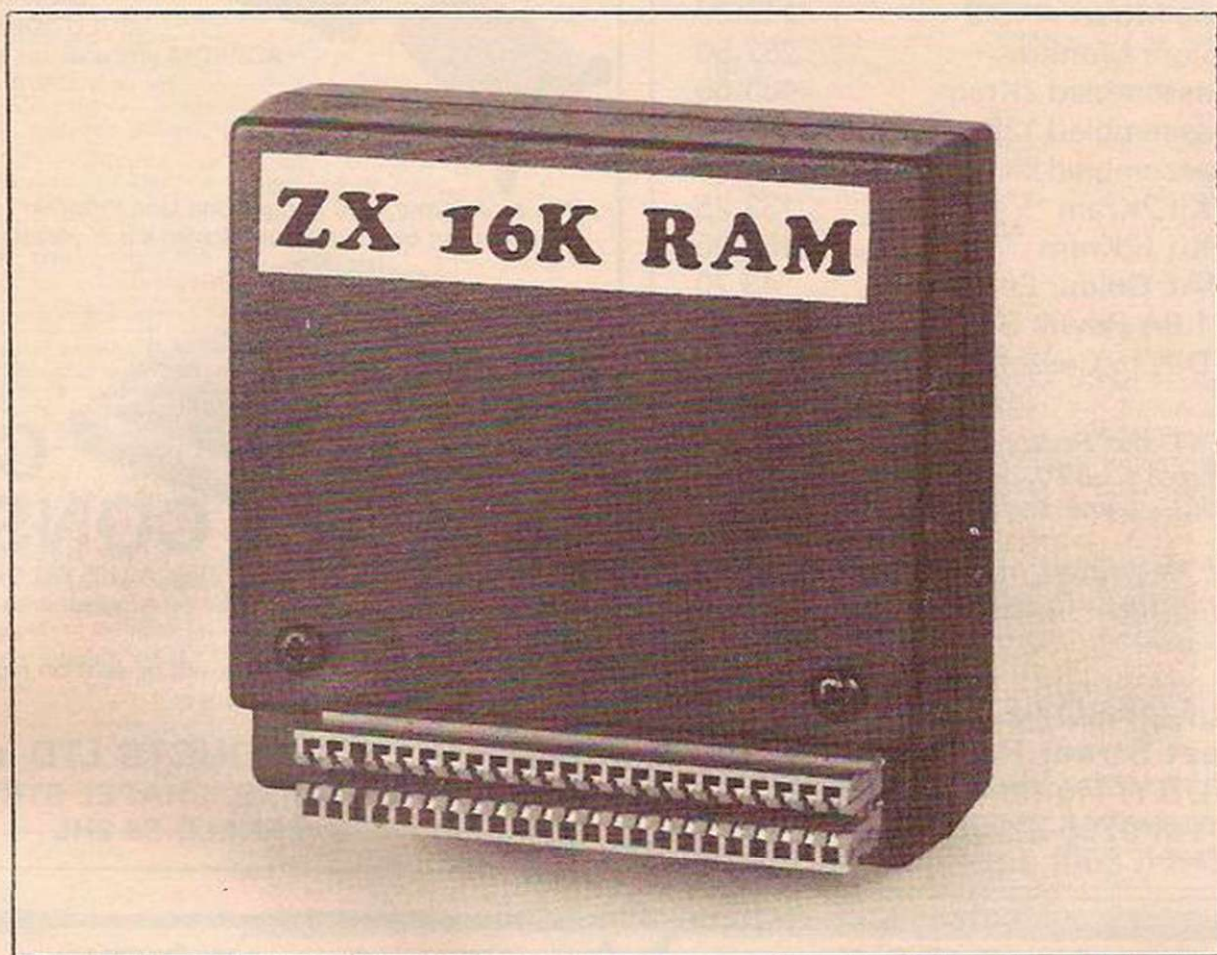
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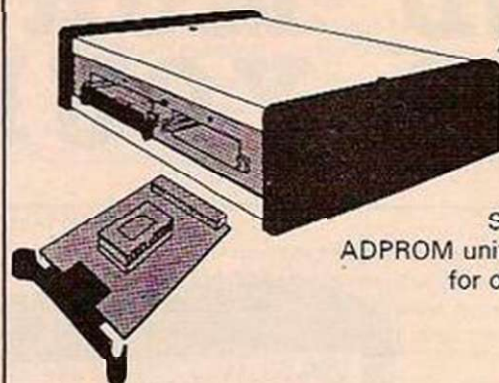
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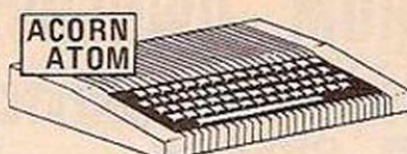
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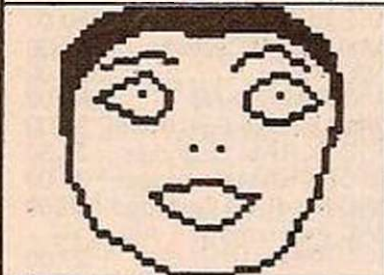
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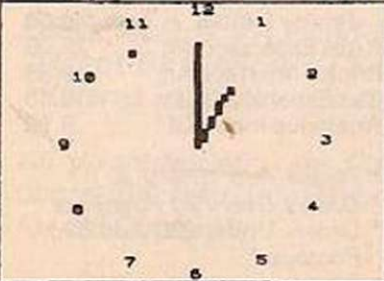


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Software



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AND THE ZX81

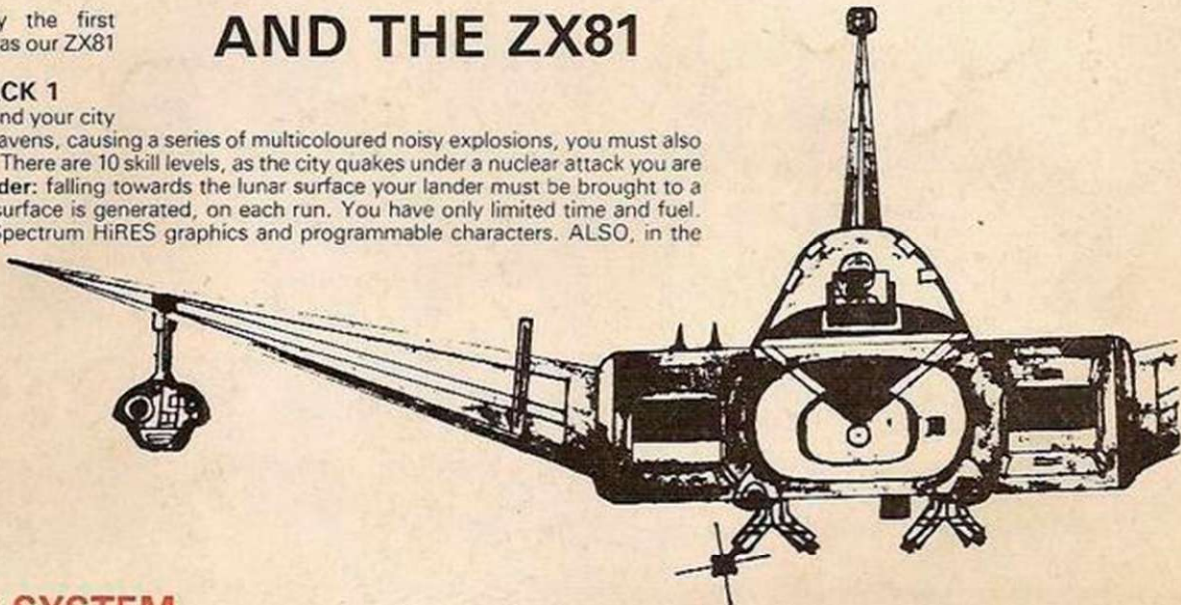
Available since July 1st, probably the first Spectrum Software in the world (as was our ZX81 software), here it is:

SPECTRUM ARCADE PACK 1

featuring: **Missile Commander**: defend your city against ICBM's streaming from the heavens, causing a series of multicoloured noisy explosions, you must also deal with marauding enemy bombers. There are 10 skill levels, as the city quakes under a nuclear attack you are given an on screen score. **Lunar Lander**: falling towards the lunar surface your lander must be brought to a safe halt on the green moon, a new surface is generated, on each run. You have only limited time and fuel. This program makes full use of the Spectrum HiRES graphics and programmable characters. ALSO, in the same package, **AVALANCHE**, a breakout game where knocked bricks don't just disappear they drop — on you! **PATTERN**, spectral Kolaidoscope. **PLANO**, turns the Spectrum in to a musical instrument. These programs use m/code and exploit the fullest Sound and Hi resolution graphics potential from your Spectrum.

£5.00 (the entire package)

Available end of August: **ARCADE PACK II**, featuring two more all time favourite Video Arcade games.



16K PACK 123

ZX BUSINESS SYSTEM

Now installed in many businesses, comes with PURCHASE, SALES LEDGER for 100+ entries per week, does daybook analysis, VAT incl. and excl., totals, password protection plus many more excellent features. You also get a STOCK CONTROL, MAIL LIST and PHONEBOOK. Easy to use, designed for everyday small businesses. Includes instruction book and tape. £17.00 incl. VAT. And does the job of systems costing hundreds of pounds.

ZX AUTOCODER

Writing machine code? Some love it, some hate it but AUTOCODER just gets on with it. Helping you produce machine code programs from BASIC. Easy to use and very helpful. Converts PRINT, PRINTAT, IF THEN, GOTO, GOSUB, LET INKEY\$, POKE, PEEK, CLS, etc. ALL £5.00 incl.

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ZX VIDEO GAMES

This latest package of software to be released must surely be the most amazing available in the world. It features on one cassette all the fast action machine code games that other companies would sell for £5.00 each, but we are able to bring you all the following Machine Code Arcade games for that price. Not only are they excellent value for money but they are of the finest quality available for the ZX81. ZXVG contains:

UFO BOMBER

You are on a mission to destroy enemy fuel pumps and installations, eight directions of movement through caves, fuel dumps and over rocky lunar terrain. You drop smart bombs and can strafe with your gun that fires streaming laser shells. This game is completely addictive, and gives you on screen and Hi scores.

SPACE INVADERS

This is not our "version", this is just like the real thing, with four types of crawling invaders, defences that crumble as they are hit, UFO's for extra scores, Onscreen scoring and Hi scores. This game is brilliant!

GALAXIANS

Wave after wave of sweeping invaders drop their bombs at you. Your only hope is to dodge and destroy them. This is a most addictive game, and we guarantee that this game will make your ZX81 really come to life.

This game pack contains some other exciting machine code games, but you'll have to get a copy to find out what they are!

We absolutely guarantee that this will be the best value pack of video games software you have ever had, for quantity and quality. To make sure, just ask someone who has had this pack, enquire at your local computer shop, or send off for it to us.

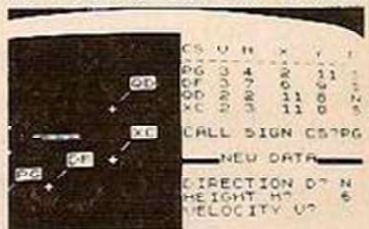
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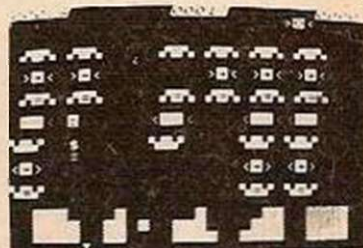
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AIR TRAFFIC CONTROL: Animated radar screen of busy airport shown. You must bring planes into land; **INVADERS SELFPLAY**; **PHONEBOOK** — keep friends' and relatives numbers on cassette. **COMPUTER DATING**, who will it pick for you and those around you for a laugh. **ADVENTURE ATLANTIC**: you may become very rich or marooned forever. **BREAKOUT: SQUASH**: **LANGUAGE TRANSLATOR**: translates any European language to any other. **COMPUTAPUNT**: predict horse races and football pools with you ZX. **INDISCO**, video roadracer. **DRAUGHTS** computer chequers, with kings. **BATTLESHIPS**, nautical naval battle at home. **MASTERMIND**: brain teaser, see if you can beat a microelectronic mind.
THIS MASSIVE PACK OF SOFTWARE IS ONLY £5.00

Air Traffic Control (ZX81)



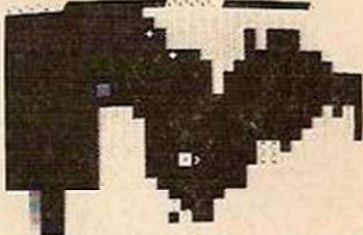
Space Invaders (ZX81)



Draughts (ZX81)



UFO Bomber (ZX81)



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