POPULAR Computing WEEKLY

35p 17-23 February 1983 Vol 2 No 7

This Week

IBM Personal Computer

Boris Allan reviews the Personal Computer from IBM, the computer giant which has entered the home computer field for the first time. See page 10.

BBC In Education

Dan Mitchell presents a financial decision maker for the BBC A and B in our new educational series. See page 23.

Spirospectrum

John Dunford explains how to mimic the effects of a spirograph by using three simple routines on page 24.

ZX81 Ticket Machine

Nick Godwin presents a utility program to enable you to print out your own tickets for raffles, discos and dances. See page 21.

★STAR GAME★

Dragon's Lair on Dragon 32 by Ian Mercer. See page 8.

News Desk

Dragon slips a disc

TWO companies seem likely to produce disc systems for the Dragon 32 microcomputer in March — ahead of the official Dragon Data unit.

Premier Microsystems and Compusense both have disc systems ready for launch, the two products designed for markedly different applications.

Due out first, the Premier system is considerably cheaper. The disc interface, containing the disc operating system in Rom, supplied with instruction manual, is priced at £99.95 including VAT.

The system will run with most 5¼-inch, 3-inch or 8-inch disc drives — single density, single- or double-sided, 40- or 80-tracks. Up to four drives can be controlled at any time. Premier Microsystems will at first be offering a package of the disc interface and operating system plus a single 100K 40-track 5¼-inch Canon drive for less than £300 including VAT. A twin disc system will be priced around £500.

Continued on page 5



Spectrum sales top 200,000

SINCLAIR Research has sold more than 200,000 Spectrum computers in the nine months since the machine was launched.

Resulting from this success the company has announced more retail outlets for the Spectrum — it is now available in selected branches of Boots, Currys, Greens and John Menzies. The distribution organisation, Prism Microproducts, will also be supplying John Lewis, House of Fraser and Xerox stores.

"By Easter we expect to be selling between 12,000 and 15,000 Spectrums per week in the UK," said Current Products Division Managing Director, Nigel Searle.

Current monthly production of the Spectrum exceeds 50,000 units.

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SUPERBRAIN I, DD, £600. Tel: Northampton (0604) 413050.

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VIC 20, standard Ram, brand new, unused. £120. Tel: 01-455 6430.

DRAGON 32 or TANDY TRS-80 Colour? Lots of programs — lots of useful hints and information EVERY single month in "RAINBOW", an exciting new 200-page magazine from USA. Send £1.95 (plus large 56p s.a.e.) for sample issue to **ELKAN ELECTRONICS (Dept. PCW), FREEPOST, 11 Bury New Road, Prestwich, Manchester M25 6LZ** or telephone 061-798 7613 (24-hour service).

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See us at the ZX Microfair!

If you own a ZX81 or SPECTRUM — or if you're thinking of buying for the first time — **the ZX MICROFAIR is not to be missed!**

There's literally everything for the beginner, amateur, enthusiast and professional.

A fantastic range of products from both the established manufacturers and the newer ones!

There's a bring and buy sale and a complete show guide available on the day.

It's a good day out and the opportunity of learning everything there is to know about ZX Computers.

The facilities at the hall include Bar, Restaurant and lots of seating!

Make a note of it now, or write to Mike Johnston, 71 Park Lane, London N17 0HG for advance tickets (Cheques etc made payable to ZX MICROFAIR and please enclose S.A.E.)

At 80p for adults and 50p for kids (under 14) it must be a bargain!



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POPULAR Computing WEEKLY

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How to submit articles
Articles which are submitted for publication should not be more than 3,000 words long. The articles, and any accompanying programs, should be original. It is breaking the law of copyright to copy programs out of other magazines and submit them here — so please do not be tempted.

All submissions should be typed and a double space should be left between each line. Please leave wide margins.

Programs should, whenever possible, be computer printed.

We cannot guarantee to return every submitted article or program, so please keep a copy. If you want to have your program returned you must include a stamped, addressed envelope.

Accuracy
Popular Computing Weekly cannot accept any responsibility for any errors in programs we publish, although we will always try our best to make sure programs work.

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Editorial

The question of software libraries has been causing increasing concern among software houses, retailers and buyers in recent weeks.

Following our latest article on software libraries and copyright (*Popular Computing Weekly*, February 3-9), we have received a large number of letters arguing the case both for and against such libraries. We have also discovered a software library that has been hiring out cassettes against the wishes of the original publisher.

In an attempt to lay down some sort of guidelines, we have decided to accept advertisements only from those software libraries which use cassettes with the permission of the publishers. Software libraries which hire out cassettes without permission will not be allowed to advertise in *Popular Computing Weekly*.

We are taking this stand because we believe software libraries are an issue that needs to be tackled now. Hiring cassettes without the permission of the publishers may or may not be illegal — it is certainly hard to justify.

This is not to tar all software libraries with the same brush. A number of software libraries do obtain permission from, and negotiate royalties with, the companies whose cassettes they hire out. We have no quarrel with such organisations, we just wish all libraries operated on similar lines.

Next Thursday

How low can you fly without crashing? Find out in Foxbat, an exciting new game for the ZX Spectrum.

Also next week, details of how to win £10 in our Cruising competition.

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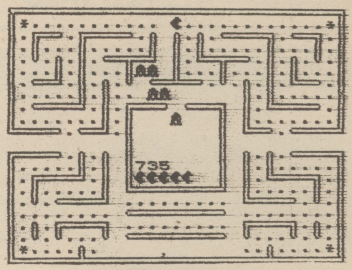
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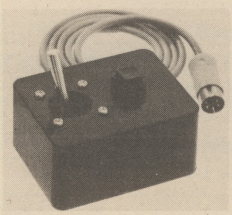
The Dragon Dungeon Club monthly newsletter is packed with news, reviews and information for the dedicated Dragon-basher. The Dungeon Master has discarded his scrolls and is busily hammering your letters and tips into his new word-processor. He will continue to need your tips, discoveries, reviews and "beefs" and will send out guidelines and payment rates to those of you who feel up to full-scale articles.

In the light of constant enquiries as to where local advice can be obtained, The Dragon would like to hear from any Dragon enthusiasts, who have set up formal or informal groups.

The March issue of *Dragon's Teeth*, due out late February, will include both hardware and software offers and Club Members registering before 31st March will be eligible to purchase Dragon badges and sweatshirt at very special prices.

Annual membership, including *Dragon's Teeth*, £6 (six-month trial subscription £3.25).

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Our stock of software is selective, rather than extensive, since we believe in value for money. Feed your Dragon on the best programs!

Utilities, including Editor/Assembler, coming into stock shortly and two new Dragon books. Current best-seller: *The Working Dragon 32*", £5.95.

Send for the current "Take Inventory" listing.

THE DRAGON DUNGEON

PO BOX 4, ASHBOURNE, DERBYSHIRE DE6 1AQ. TEL: ASHBOURNE 44626

Dragon discs

Continued from page 1

"The software in the disc operating system will appear to the user as an extension of the Dragon's Basic," explained Premier partner Peter Rihan. This will give new commands — *Save, Load, Save M* and *Load M* (for machine code), *Create* filename, and *Asign* old-filename/new-filename. When saving, the system will automatically re-create the file if necessary.

The Compusense Dragon disc system is more ambitious and, correspondingly, more expensive. For between £500 and £600, Compusense is offering a twin single-sided double-density 40-track 400K system together with disc interface and operating system. The disc interface incorporates an additional 64K Ram and an RS232 interface.

Compusense is also recommending that the system be used in conjunction with a 24 x 80 display intelligent terminal, which will cost in the region of £400. Says director Ted Opyrchal "To run any useful business programs you need a degree of expandability — 64K — full RS232 protocol and a proper display. Using the Flex operating system in our interface and a 24 × 80 terminal gives access to a whole range of 6809 software packages." Software available under Flex includes *Dynacalc, Database Manager, Micro Assembler* and the languages Cobol, Pascal and C.

"Our thousand-pound Dragon then begins to look like a system costing three times that amount," he said.

Micro industry group to get protection

A NEW group has been formed which aims to protect the interests of those in the microcomputer trade.

Membership of the body — called the Society of Computer Manufacturers, Agents and Dealers — is open to any company, partnership or sole trader commercially involved in the computer trade.

Acting secretary Nigel Backhurst explained that the group was set up to promote the interests of both hardware and software suppliers, big or small. Members so far include Atari, Bug-Byte, Buffer Micro Shop, Camputers and Tandy. Backhurst is actively campaigning for other companies to join the group.

The society will hold its first meeting on Saturday, March 5, at the 6th Form Centre, King Edward VII College, Warren Hills, Coalville, Leicestershire (3 miles from the M1 A50 junction). The meeting will begin at 11 am.

Among resolutions to be considered is one which urges that the society be "concerned about the activities of software libraries, [and] should take action on behalf of its members against them."

Any individual in the computer trade is welcome to attend this first open General Meeting.

More details from Nigel Backhurst, 108 Margaret Street, Coalville, Leicestershire (tel: 0530 33566).

Creative software says 'die'



PAUL ZUZELO flew in from California earlier this month to announce that his company — Creative Software — has signed an exclusive distribution and marketing deal with Audiogenic.

Creative Software, one of the leading US manufacturers of Vic20 cartridge software, is to sell its current Vic20 range and forthcoming Commodore 64 titles through the Reading-based company.

The American software producer employs a new technique in the manufacture of its cartridges. Instead of the game being in the form of a Rom 'chip' the program is held in a 'die' manufactured *onto* the printed-circuit board.

"This means," says Zuzelo, "we can put out a 16K die on-board for about the same cost as we can a conventional 8K Rom.

"In practice this won't mean that cartridge prices will come down — rather you will see the quality of the game go up."

Among the Vic20 games Creative Software will be marketing through Audiogenic are some of the biggest selling US titles — *Astroblitz, Trashman* and *Choplifter*.

6th ZX microfair

THE SIXTH ZX Microfair will be held on Saturday, February 26, at the usual venue — New Horticultural Hall, London SW1. It will be open from 10 am to 6 pm and entry will cost 80p for adults and 50p for kids under 14.

Over 100 exhibitors will be there and new tapes should be on sale for the first time from Quicksilva, Silversoft and Carnell.

Atari sues Philips

ATARI has embarked on another legal battle over copyright in the *Pac-Man* video game — this time with Philips.

The decision to go ahead with the action against the UK arm of the Philips multinational follows a successful similar legal move against Philips in the US.

Atari's other, better known, move against Commodore is due to be heard by the English courts in March.

US competition for Spectrum

THE vicious price war faced by Sinclair in the US takes another turn as Texas Instruments cuts a further £31 off the cost of its TI99/4A computer.

This will bring down its average American price, already rebated by the manufacturer until mid-April, to £98. This figure is close to the proposed price of the American 16K Spectrum of £95.

The TI99/4A sells for £199.95 in Britain.

Trojan sees the light

FOR £10 you can now buy a light-pen for the Dragon 32.

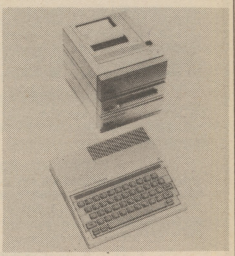
The unit plugs into the joystick port on the computer and is addressed from the keyboard using normal joystick commands.

The light-pen is produced by Trojan Products and comes complete with a cassette which includes full instructions and several demonstration programs showing how to incorporate the input from the device in a program.

"It uses quite a fast photo-transistor so it will be possible to use it in machine-code games.

"No specialised software is required and it can be used for X-Y plotting or data entry as well as in games. It can offer a much faster alternative to the keyboard," says Trojan's Geoff Jones.

Details from Trojan Products, 166 Derlwyn, Dunvant, Swansea.



TI's rival to the Spectrum

TEXAS Instruments' rival for the ZX81 — the TI99/2 (see *Popular Computing Weekly* Vol 12, No 4).

The machine, which will sell for between £70 and £80, has the advantages of 4K Ram as standard, plug-in Rom cartridge port and the range of inexpensive peripherals shown. The three add-on units shown in the stack are (top to bottom): HX-1000 four-colour printer/plotter, HX-2000 Wafer-tape high-speed micro tape drive unit and HX-3000 RS232 interface. The modules connect to the TI99/2 via a Hexbus interface connector at the rear of the machine.

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Micro software association

The proposal made in your letters column (December 30), to form a British Micro Software Authors' Association, is one that every software writer should take very seriously indeed.

Apart from matters of copyright, such a body may well be able to offer advice to new writers on how to deal with established software houses, how to prepare programs for publication in magazines (perhaps offering editors some welcome relief in the process), and possibly also reviewing and offering constructive criticism of software. In addition, it could advise on the sort of price, packaging and marketing method that might be appropriate to individual programs. The experience gained by individuals in these matters could thus be pooled and made available to others whose main interest, after all, is likely to be in *writing* programs rather than the process of *selling* them.

I would be most interested to hear from any software writers who may be interested in co-operating to form such an association (an SAE would be greatly appreciated).

Nick Godwin
4 Hurkur Crescent
Eyemouth
Berwickshire
Scotland

Taking issue with a smear

With regard to the software library issue, please do not tar all software libraries with the same brush. The *Monster Software Club* is probably one of the latest software libraries to advertise in your magazine. No, not just another library jumping on the band-wagon, the latest only because I have first gained permission to use the tapes that I list. I now list software for the Dragon from six producers — all tapes are used with the producers' permission and with royalties being paid.

A "legally" run library offers the following: for the members — access to a full library of software at a relatively small cost. For the software houses — we supply a ready made market for its software (I am after all purchasing software) plus royalties.

One of your correspondents (*Popular Computing Weekly*, February 3-9) suggests that you withhold any advertisements from software lending libraries. Perhaps he can tell me why I should be stopped from advertising?

In your view you stated: "Each cassette should display a message, in a prominent position on the outside, stating that it is a condition of sale that the cassette will not be hired or lent". I agree with this if the words "without permission" are added. But, if this does stop illegal lending, what about the Exchange Clubs and software banks?

A. Robinson
Monster Software Club
32 Lennox Drive
Lupset Park
Wakefield
West Yorkshire

Mr Robinson is quite correct in the points he makes in his letter. We have no quarrel with software libraries which obtain permission from, and pay royalties to, the software houses whose tapes they hire out. Unfortunately, not all software houses are as scrupulous as the *Monster Software Club*.

Co-ordinating action

While applauding your offer to co-ordinate the formation of the much-needed trade association of software houses, I would suggest that the primary answer to unauthorised hiring of programs lies in the *Sale of Goods Act 1979*. This clearly states that any contract of sale may be absolute or conditional.

Provided that the software supplier highlights the fact that the sale is "conditional" on his invoice (including in the terms a requirement for further payments, such as royalties in the event of hiring out to third parties), then the contract remains open-ended. Such a caveat, while not preventing the hiring of software purchased, would at least ensure that royalties would be claimable.

I can imagine that some of your readers will feel that all this "aggro" over tape libraries is a "spoil-sport" attitude on the part of the trade. To such readers, I would point out that if they want a regular supply of new programs then they should bear in mind the example of the book trade.

Peters Woods
The Dragon Dungeon
PO Box 4
Ashbourne
Derbyshire DE6 1AQ

The problem with *The Sale of Goods Act 1979* was highlighted by Gail Counsell in *Popular Computing Weekly*, February 3-9. While the contract of sale may indeed be either absolute or conditional, it does not "bind third parties". Thus the person who buys a tape direct from a software supplier can be bound by the contract, but if he subsequently sells the tape to a third party, that person will not be bound by the contract.

Then where's the fault?

I have been reading your magazine for a couple of months now and recently bought a Spectrum. I dug out my old books and tried *Under Pressure*. However, it did not work. I checked it through, but in the end I pulled the plug on it.

Now I have typed in *Missile Command* and checked it through four times, but it just keeps saying *B Integer out of range, 95;3*. Line 95 though is perfectly correct and so are all the others.

I suggest that you try out this program yourself and send me the correct version of it or I will stop buying your magazine. I only get it for the programs.

David Jackson
7 Theydon Gardens
Rainham
Essex RM13 7TU

I tried both programs before they were printed and I can assure you they do work. The listings were taken from cassettes of the programs after they had been tested, so we know they are correct. Enough people have also contacted us and said how much they enjoyed playing the games for us to be confident that the programs were printed correctly.

We do not claim to be infallible, but we take a great deal of trouble to try and ensure that the programs are printed accurately.

Dragon lovers

The following information may be of use to fellow Dragon lovers. The *Peeks* for the arrow keys are, *Left (343), Right (344), Up (341), Down (342)*. A value of 223 is returned for pressed and @ 255 not pressed. Using *If Peek (341) = 223* etc allows repeat keys for movement within games for those without joysticks and is much faster than the cumbersome *Inkey$* routine.

The start and end pointers for Basic are located at *Peeks* 25 to 28 and allow the loading of more than one program from tape. *Peek* 25 and 26 gives the start pointer — normal values are 30 and 1. Multiplying the first value by 256 and adding the second gives a decimal location of 7681 (default position with four pages of graphics reserved). *Peek* 27 and 28 gives the location two bytes to the right of the end pointer. To load multiple programs from tape use the method in the example, although your actual values will depend on the length of the programs:

```
Example:
1. Cload program A
2. Print peek (25);peek(26);peek(27);
peek(28)
Sample values: 30 1 42 138
3. Poke25,42:Poke26,136 rem 138-2
4. Cload program B
5. Renum so that start line is higher
than the highest line number in prog-
ram A.
6. Poke 25,30: poke 26,1 rem original
values
```

You should now be able to list both programs. Using this procedure repeatedly, I successfully combined six shortish games with a selection routine to enable my son to play any of the games without reloading. Care must be taken with variables of course, but a return to the selection routine and a *Clear* statement takes care of this.

Acknowledgements are due to E O Gilligand Jnr of Birmingham, AL 35226 USA for this pointer. The information was gleaned from his article on the Tandy Color Computer in the US magazine *80MICRO* November 1982.

Doug Dixon
15 Hawkins Way
Abingdon
Oxon OX13 6LB

Dragon's Lair

A new game for the Dragon 32 by Ian Mercer

The object of this game is to guide a magic cube through a series of interconnecting passages vaporising the dragons sleeping in their lairs, while attaining as low a score as possible.

You use the cursor keys to guide the magic cube (positioned in the top right-hand corner of the screen at the start) through the passages which contain four dragons (inverse "D"s) that rest on the various levels.

The floors and ceiling of the passages are lined with rocks which should be avoided. Collision with the rocks will add to your score and cause the cube to bounce off in a random fashion. Pressing a key will also add to your score.

In the harder levels, the path to the next passage is sometimes blocked. Pressing "D" in such cases will dig a hole directly below you, but use this with care because it adds 10 to your score. When all the dragons are vaporised they will be replaced ready for the next player.

Program notes

Line(s)	
30 to 100	Set variables
120	Print dragons
150	Goto subroutine to increase *x* and *y* according to inkey$
160 to 240	Check if something is hit and if so make a random bounce
250 to 300	Keyboard scan routine
310 to 470	Print score card
480 to 510	Subroutine to alter values of *x* and *y*
520 to 670	Print display



```
10 ' DRAGONS' LAIR BY I.D.MERCER
20 CLS
30 INPUT"HOW MANY PLAYERS WILL WANT TO   USE THE SAME CAVES";P
40 IFP>10 THENPRINT"10 PLAYERS AT MAXIMUM":GOTO 30
50 IF P<1 THEN30
60 INPUT"WHICH LEVEL(1-10,10 IS HARDEST)";L
70 DN=0:PN=0:L=11-L
80 SC=0
90 GOSUB520
100 X=61:Y=2
110 SET(X,Y,1)
120 PRINT@RND(29)+32,"d";:PRINT@RND(29)+225,"d";:PRINT@RND(14)+417,"d";:PRINT@RN
D(14)+432,"d";
130 D$=INKEY$:IF D$="" THEN130
140 GOTO280
150 ON D GOSUB490,480,500,510
160 RESET(X1,Y1):IFPOINT(X,Y)=0 THEN250
170 IF POINT(X,Y)=-1 THENRESET(X,Y):PLAY"T150;O1;V20;BBBBCCCC;V31;DDDDEEEE;V15;D
DCCBBAA":DN=DN+1:IFDN=4 THEN310
180 X=X1:Y=Y1
190 PLAY"T255;V10;O2GA"
200 DC=RND(4):IFDC=D THEN200
210 D=DC
220 OND GOSUB 490,480,510,500
230 SC=SC+1
240 GOTO160
250 SET(X,Y,1):D$=INKEY$:FORZ=1TOL:NEXTZ:IFD$="" THEN150
260 IF(D$="D") AND (Y<26) THENRESET(X,Y+1):SC=SC+10
270 SC=SC+1
280 D=(ASC(D$)AND 3)+1
290 IFD$="^" THEND=4
300 GOTO150
310 S(PN)=SC:SC=0
320 DN=0
330 RESET(X,Y)
340 PN=PN+1
350 F$=INKEY$:IFF$<>"" THEN350
360 IFPN<>P THEN100
370 CLS
380 HS=S(0)
390 FORI=0TOP-1
400 IF HS>=S(I) THENHS=S(I)
410 PRINT"PLAYER ";I+1;" SCORED ";S(I)
420 NEXTI
430 FORZ=1TO1000:F$=INKEY$:IFF$<>"" THEN430
440 PRINT:PRINT:PRINT"HIT ANY KEY FOR A NEW GAME"
450 IFP=1 THEN 470
460 PRINT@384,"WINNER SCORED";HS
470 F$=INKEY$:IFF$="" THEN470 ELSE20
480 X1=X:Y1=Y:X=X+1:RETURN
490 X1=X:Y1=Y:X=X-1:RETURN
500 X1=X:Y1=Y:Y=Y+1:RETURN
510 X1=X:Y1=Y:Y=Y-1:RETURN
520 CLS0
530 FORX=0TO63
540 SET(X,0,1):SET(X,28,1)
550 NEXTX
560 FORY=0TO27
570 SET(0,Y,1):SET(63,Y,1)
580 NEXTY
590 FORA=4TO24STEP4
600 R=RND(63):IFR<2 OR R>61  THEN600
610 FORB=1TO63
620 IFRND(L*10)=L ANDB>1 ANDB<62 THENSET(B,A+3,1)
630 IFRND(L*10)=L ANDB>1 ANDB<62 THENSET(B,A+1,1)
640 SET(B,A,1)
650 IFB=R THENRESET(B-1,A):RESET(B,A)
660 NEXTB,A
670 RETURN
```

Gradgrind grows from Greenock

***Boris Allan** reviews the new European version of IBM's Personal Computer.*

IBM has been very successful with its PC in the USA, partly because of the IBM user and dealer support. Unfortunately, if you buy a special import IBM PC from an unrecognised dealer, there will be no IBM-approved service back-up or advice.

The minimum configuration for the IBM PC in Britain is superior to the USA minimum, and so importers may not be even selling an equal configuration. The only way to get IBM Warranty is to purchase from an IBM Authorised Dealer, who will provide service and warranty back-up.

The machine I reviewed was provided by an IBM Authorised Dealer, the Byte Shop Ltd of Manchester (061-236 4737). The configuration was 40K Rom, 128K Ram, two 320K discs, keyboard, monochrome display, printer adapter, and printer, and is about £3,400. The absolute minimum system consists of 40K Rom, 64K Ram, a 160K disc, keyboard, monochrome display, and printer adapter, at about £2000.

The PC is being promoted as a friendly machine, and, from the promotional literature, is not aimed solely at the business or larger user. The leaflet aimed at those in research and education quotes Pasteur ("In the field of observation, chance favours the prepared mind" — though how do you prepare it?).



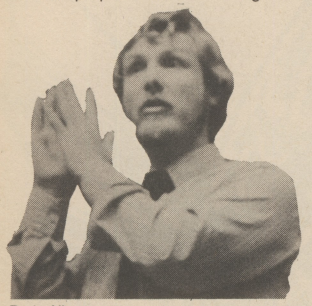
IBM's factory in Greenock where the new Personal Computer will be manufactured.

IBM claims that the PC can be used as a teaching aid, used in the teaching of computer science (with the wide variety of compilers available), used as a research tool, and as a word processor to maintain course notes. For the student, IBM claims that the PC has several advantages: it can provide a foundation for computer awareness, as a general learning tool, and for developing proficiency in languages such as Basic or Pascal.

IBM is probably going to try to get the PC on the Government's list of approved suppliers to schools, and as a British manufacturer — it will be making PCs in Greenock, in all probability for the whole of Europe — it might be seen as the equivalent of the Research Machines offerings.



The new Personal Computer's keyboard.



Boris Allan.

The equivalence of the RML 380Z/480Z and the IBM PC is more than at first would appear, because both these machines offer CP/M (a standard operating system) and thus have many off-the-peg programs available.

But the PC offers CP/M86 as well as ordinary CP/M, plus another operating system specially developed for the PC, called MSDOS (from Microsoft).

I approached the PC, therefore, as one who was not a businessman, was not a games-player (though there are games available, including at least two versions of Adventure), but as one who was going to use the PC in what is grandly termed education.

The Byte Shop recommended one book I did not have time to read, but glancing through, it seemed to be helpful — *IBM's Personal Computer* from QUE ON SYSTEMS (1982). The manuals I used were the *Basic Manual* (Microsoft January

Technical Specifications:

Microprocessor:	Intel 8088 (16 bit internally, 8 bit data bus at 5MHz)
Memory:	Minimum configuration is 40K Rom, 64K Ram, expandable to 0.5 megabyte
Operating System:	CP/M-86 and IBM PC DDS (ie MSDOS)
Disc Storage:	Minimum is 160K (single drive, single sided) expandable to 640K. (twin drive double sided)
Keyboard:	Qwerty standard, with numeric pad, 10 user function keys and special function keys. Provides upper and lower case, and special characters.
VDU:	Green screen monitor, 25 lines of 80 characters. A special colour monitor is needed for graphics
Printer:	Dot matrix, 80cps, bidirectional, with four sizes of print
Connections:	Keyboard, audio cassette, five expansion slots for additional memory modules, displays, printers, disk drives and communications, games adapters
Sound:	Built-in speaker, user programmable
Price:	Basic system around £2000

1983) and an operating system manual. Though there are many other languages available on the PC I concentrated on Basic because, in education, Basic is rightly the most important language.

I switched on, and the system booted. I was left at the *executive* level. I then studied the Basic manual to find how to enter Basic. It was at this stage that I found I had three levels of Basic from which to choose: Basic, Disc Basic, and Advanced Basic — in ascending order of facilities — and decided to load Advanced Basic.

I loaded from the instructions given with no problems, and entered my first line. My first line did not work, because (and I could not find where in the manual it said so) keywords in the Basic had to be separated by spaces from other parts of the statement (something Sinclairs do automatically, and which most computers do not mind).

Once I had realised the error of my lines, there was no further problem, apart from my fingers' inability to obey the spaces my mind was sending (I have the same problem on the Atom).

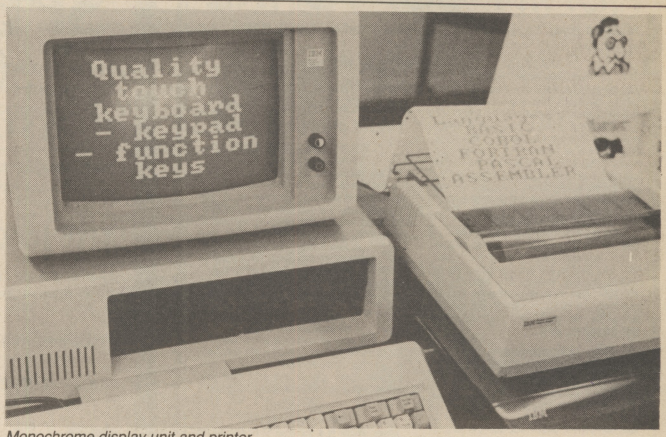
Advanced Basic is advanced, though not so advanced as BBC Basic. It has a good selection of numerical accuracies, easily used (integer, single precision, double precision, and constants); the logical connectives are the basic six connectives, far more than are normally provided (Not, And, Or, Xor, Imp, and Eqv); and there are many graphics commands, with differing resolutions (medium at 320x200, and high at 640x200).

When we consider graphics we can compare this to the RML machines with their excellent graphics facilities, and now *Gino* Graphics. Ultimately the IBM will be able (once the software has been written) to reach even higher levels of resolution, far higher than that of the RML machines.

I think this is so because the PC can easily have more than 512K Ram, without special commands being invented. To have a high resolution picture on the screen requires each dot on the screen to be stored in memory somewhere, the larger the dots (ie the lower the resolution) the less the memory that is required to store information on the screen. The IBM, with its 16 bit Intel 8088 chip, can point to *(address)* far more memory than the RML, with its 8 bit Z80 chip. The RML machines can always be tricked into pointing to more memory, but the whole process slows the machine down.

The IBM's 8088 chip is not, in my opinion, a particularly good 16 bit chip, but it does make the ability to use large amounts of Ram so much easier than 8 bit chips. The IBM is, generally speaking, not much faster than good 8 bit microcomputers, but memory space is becoming more important.

To use compilers (as against interpreters), space in memory is needed, if programs of a decent size are to be run. In conventional microcomputers (with a maximum of 64K), if one had 40K of Rom for the system (as does the IBM PC) then there would only be a maximum of 24K Ram available, unless the system is tweaked to make it appear as if more memory were available.



Monochrome display unit and printer.

I found the whole environment of the PC easy to use, the keyboard was as one would expect from IBM, as were the rest of the attachments: given that IBM seems to be committed to selling the IBM to education markets (something the Sirius I has not attempted, as far as I know) and given the back-up to the machine (but only through authorised dealers) then I can see the IBM being a strong competitor to the RML machines.

It is going to be interesting to see if some of the other 16 bit microcomputers (especially those using the Motorola 68000 series of chips) move into education, because it is where we should be moving. It is also going to be interesting to see if the BBC Tube connection to the Nat Semi 16032 becomes a viable option.

The IBM PC is an interesting machine, for all sorts of reasons. ■



Monochrome display, main processor unit, and keyboard.

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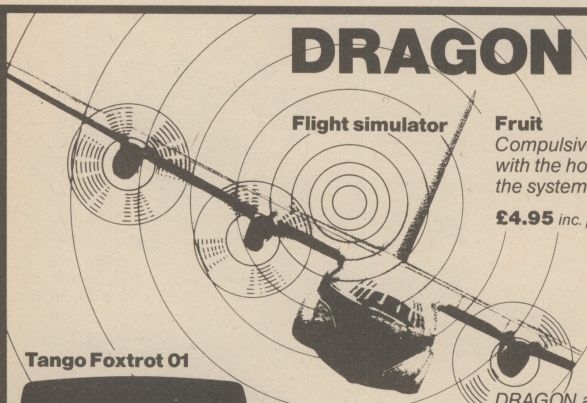
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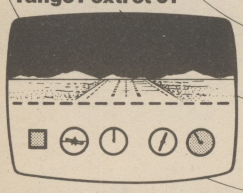
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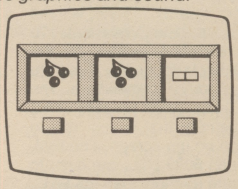
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Outlander

on Spectrum

This game could be described as a combination of Moonlander and a type of Space-invaders. The game relies mostly on the speed of the player before his fuel runs out and his ship drops out of the sky. There is a second 'sheet' which is progressed to after the first has been cleared.

If the game is found to be too easy (or too difficult) the fuel could be altered as required. Sometimes, on the first go, the ship blows itself up. Just run it again and it will continue to work.

Program notes

Lines

210	to	270	Set up the first sheet.
400	to	700	Are the main loop.
410	to	430	Detect whether the ship has hit anything by using the ATTR command.
550	to	570	Detect what the bomb has hit.
600	and	610	Move the ship.
1000	to	1150	Are the crash routines for the ship.
2000	to	2180	Are the routines for the bomb's collisions.
2500	to	2620	Include the landing and score lines which decide whether to go to another sheet or stop the game.
3000	to	3030	Are the lines for the end of the game.
5000	to	5700	Set up the screen for the second sheet and include the instructions.
6000	to	6500	Are the instructions for whole game.
8000	to	8250	Are the loops to define the characters.

```
  1 REM **************************
  2 REM  © Laurence Herniman
  3 REM              9:1:83
  4 REM **************************
  50 LET hscore=0: GO SUB 5000
 100 PAPER 0: BORDER 0: CLS
 110 PRINT AT 7,10; INK 7;"OUTLA
NDER"
 120 GO SUB 7000
 130 PAUSE 100
 140 PRINT AT 16,0; INK 7;"DO YO
U WANT INSTRUCTIONS? (Y/N)": INP
UT q$: IF q$="y" OR q$="Y" THEN
GO TO 6000
 150 BORDER 7: PAPER 7: CLS : IN
K 0
 155 LET score=0: LET sheet=1
 160 LET f=0
 165 PRINT AT 0,0,"SCORE:";score
;" ";AT 0,15;"HIGH SCORE:";hscor
e
 170 IF score>=1200 THEN LET hou
ses=11: LET fuel=500: GO TO 280
 180 LET houses=7: LET fuel=300
 195 LET sheet=1
 200 INK 4
 210 PLOT 0,70: DRAW 9,-7: DRAW
20,-10,-2*PI/5: DRAW 6,0,2*PI/3:
 DRAW 13,6: DRAW 0,4: DRAW 5,0
 220 DRAW 9,10,-9,-PI/2: DRAW 10,-
15: DRAW 8,-5: DRAW 2,-10
 230 DRAW 40,3,2*PI/3: DRAW -10,
5,-PI/2: DRAW 4,-16: DRAW 16,0: D
RAW 4,5: DRAW 10,5: DRAW 7,14,PI
/3
 240 DRAW 9,0: DRAW 10,0,-2*PI/3
: DRAW 10,-6: DRAW 15,-4: DRAW 1
0,7,PI/2: DRAW 5,-1
 250 DRAW 5,-4: DRAW 9,0: DRAW 3
,1: DRAW 3,4: DRAW 10,4: DRAW 1
4: DRAW 9,0: DRAW 7,7
 260 PRINT AT 13,6; INK 2;"B";AT
 16,13;"B";AT 16,14;"B";AT 13,18
;"B";AT 14,26;"B";AT 13,1;"B";AT
 12,30;"B"
 270 PRINT AT 19,12; INK 1; OVER
1;CHR$ 147
 280 INK 0
 290 LET x=1: LET y=0
 300 LET x=x+1: IF y=12 THEN PRI
NT AT 19,12; INK 2;CHR$ 147: IF
x=20 THEN GO TO 630
 400 REM
 401 REM **************************
 402 REM  MAIN LOOP
 403 REM **************************
 410 IF ATTR (x,y)=60 THEN GO TO
1000
 420 IF ATTR (x,y)=58 THEN GO TO
1100
 430 IF ATTR (x,y)=57 THEN GO TO
2500
 440 PRINT AT x,y;"A"
 450 BEEP .005,0.5
 460 PRINT AT x,y;" "
 470 IF fuel=0 THEN BEEP 0.005,6
: GO TO 390
 480 LET fuel=fuel-1
 490 LET fuel=fuel-1: PRINT AT 2
1,0;"FUEL:";fuel;" ": IF fuel=50
 THEN PRINT AT 21,9; FLASH 1;"FU
EL SUPPLY LIMITED"
 500 IF f=0 THEN LET g=x: LET h=
y
 510 IF INKEY$="o" THEN LET f=1
 520 IF f=1 THEN PRINT AT g,h;"
": LET g=g+1
 530 IF g=20 THEN PRINT AT g,h;"
": LET f=0
 550 IF ATTR (g,h)=57 THEN GO TO
 2200
 560 IF ATTR (g,h)=60 THEN GO SU
B 2000: PRINT AT 0,0;"SCORE:";sc
ore
 570 IF ATTR (g,h)=58 THEN GO SU
B 2100: PRINT AT 0,0;"SCORE:";sc
ore
 580 IF f=1 THEN PRINT AT g,h;"U
"
 600 LET y=y-(INKEY$="a" AND y>0
)+(INKEY$="s" AND y<31)
 610 LET x=x-(INKEY$="p" AND x>1
)+(INKEY$="l")
 620 IF y=31 THEN LET y=0: LET x
=x+1: BEEP 0.05,0.02
 630 IF x=20 THEN PRINT AT x,y;"
": GO TO 3000
 650 GO TO 400
 700 REM
 701 REM   END OF MAIN LOOP
 702 REM
1000 REM **************************
1001 REM SHIP COLLISIONS
1002 REM **************************
1010 FOR c=1 TO 20
1020 PLOT INK 2; (y*8+4),((21-x)*
8)
1030 BEEP 0.005,0.5: DRAW ((RND*
40)-y),(RND*50)-x
1040 NEXT c
1050 GO TO 3000
1100 PRINT AT x,y; FLASH 1;CHR$
146
1110 FOR b=1000 TO 10 STEP -10
1120 BEEP 0.005,b/50
1130 NEXT b
1140 PRINT AT x,y; FLASH 0;" ":
PAUSE 100
1150 GO TO 3000
2000 REM **************************
2001 REM   BOMB COLLISIONS
2002 REM **************************
2010 PRINT AT g,h;"C" : FOR b=1 T
O 20: BEEP 0.005,6: NEXT b: PRIN
T AT g,h;" " : LET score=score-25
: RETURN
2050 RETURN
2100 LET f=0: LET score=score+50
: PRINT AT g,h;"C": FOR b=1 TO 5
0: BEEP 0.005,4: NEXT b: PRINT A
T g,h;" " LET houses=houses-1
2180 RETURN
2200 PRINT AT 19,9; FLASH 1;"BAS
E DETROYED": AT 20,3;"SELF-DESTR
UCTION NECESSARY"
2210 PRINT AT 21,0; FLASH 0;"
"
2220 FOR n=1 TO 15
2230 BEEP 0.25,0.5
2240 PRINT AT x,y; FLASH 1;"C"
2250 NEXT n
2270 PRINT AT 19,0;"
                    "
2280 FOR i=0 TO 100: NEXT i
2290 PRINT AT x,y;" "
2300 GO TO 3000
2500 PRINT AT 7,10, INVERSE 1;"L
A N D E D"
2510 LET score=score+(100*sheet)
+(fuel*10)
2520 IF sheet=1 THEN PRINT AT 18
,12;CHR$ 144
2530 IF sheet>1 THEN PRINT AT 18
,12;CHR$ 144
2550 FOR b=50 TO 5000 STEP 50
2560 BEEP 0.01,b/100
2570 NEXT b
2580 PRINT AT 0,0;"SCORE:";score
2590 IF houses<0 AND score>=1200
 THEN GO TO 5300
2600 IF houses=0 AND score>=1200
 THEN GO TO 5000
2620 GO TO 3000
3000 FOR t=0 TO 100: NEXT t: PRI
NT AT 5,10; FLASH 1;"GAME OVER"
AT 14,; FLASH 1;"PRESS ANY KEY T
O START";AT 8,2;"PRESS 'I' FOR I
NSTRUCTIONS"
 "AT  if score<hscore  THEN LET hscore =
score
3010 IF INKEY$="" THEN GO TO 301
0
3020 IF INKEY$="i" THEN GO TO 60
00
3030 GO TO 150
5000 REM **************************
5002 REM   SECOND SHEET
5003 REM **************************
5010 FOR t=0 TO 300: NEXT t
5020 BORDER 6: PAPER 6: CLS
5050 LET sheet=sheet+1
5060 IF sheet>=3 THEN GO TO 5300
5100 PRINT AT 2,10;"WELL DONE"
5200 PRINT '''"YOU HAVE BEEN AWA
RDED THE M.M.C.-THE MEDAL FOR ME
RITABLE CONDUCTFOR THE DESTRUCTI
ON OF ALL ENEMYHOUSES AND THE CO
NSERVATION OF SCARCE
FUEL.  "ANOTHER MISSION HAS BEEN
 PLANNED"
5220 PRINT AT 0,0;"**************
**********";AT 21,0;"**
**************************"
5300 PRINT AT 20,4;"PRESS ANY KE
Y TO START"
5310 IF INKEY$="" THEN GO TO 531
0
5320 PAPER 7: BORDER 7: CLS
5330 INK 4
5400 PLOT 0,80: DRAW 6,-9: DRAW
9,0: DRAW 5,10
5410 DRAW 2,9: DRAW 2,12: DRAW 6
,9: DRAW 15,-24: DRAW -5,-10
5420 DRAW -3,-20,PI/4: DRAW -4,-
20: DRAW 6,-6: DRAW 10,0
5430 DRAW 10,12: DRAW 5,15: DRAW
 -6,5: DRAW 9,5: DRAW 6,4: DRAW
4,-4
5440 DRAW 2,-11: DRAW 8,0: DRAW
-5,-5,-PI/2: DRAW 9,-11,PI/2
5450 DRAW 6,0: DRAW 5,30: DRAW 1
0,15: DRAW -10,0,2*PI/3: DRAW -
10,13: DRAW 10,5
5460 DRAW 10,30: DRAW 5,-10: DRA
W 1,-13: DRAW 10,0
5470 DRAW 15,-10: DRAW -5,-30: D
RAW 4,-16: DRAW 11,0
5480 DRAW -5,-4: DRAW 2,-20: DRA
W 11,0
5490 DRAW 10,9: DRAW -2,20,PI/5:
 DRAW -8,11: DRAW 15,0
5500 DRAW 8,8: DRAW 15,20: DRAW
5,-20: DRAW 10,0
5510 DRAW 5,15: DRAW 8,15: DRAW
3,3: DRAW 3,-8: DRAW -5,-20
5520 DRAW 1,-21: DRAW 17,0: DRAW
 0,8: DRAW 8,0
5530 DRAW -7,9
5540 INK 2
5550 PRINT AT 12,1;CHR$ 145;AT 1
7,5;CHR$ 145;AT 14,9;CHR$ 145
5560 PRINT AT 16,11;CHR$ 145;AT
6,15;CHR$ 145;AT 13,18;CHR$ 145
5570 PRINT AT 11,21;CHR$ 145;AT
15,25;CHR$ 145;AT 12,28;CHR$ 145
;AT 11,30;CHR$ 145
5580 PRINT AT 12,29;CHR$ 145
5610 PRINT AT 16,19; INK 1;CHR$
147
5700 GO TO 150
5995 REM **************************
5996 REM   INSTRUCTIONS
5997 REM **************************
6000 BORDER 7: PAPER 7: CLS
6100 PRINT AT 0,9; INVERSE 1;" O
UTLANDER "
6110 PRINT AT 2,0;"USING THE KEY
S:"
6200 PRINT AT 3,3;"""A"" ......
 LEFT";AT 4,3;"""S"" ......... R
IGHT";AT 5,3;"""P"" ..... UP";
AT 6,3;"""L"" ..... DOWN";AT
 7,3;"""O"" ..... FIRE"
6230 PRINT AT 8,0;"Move your sh
ip (A) and try to destroy the e
nemy buildings (B) with your unl
imited bomb supply.Try not to da
mage the land as land is scarc
e and this results in a loss of
 points.Landing (D) earns you mor
e points and the larger the fu
el supply,the more points that a
re awarded on.Over 1200 sends yo
u onto the second sheet.Destroy
 all the buildings before you la
nd"
6450 PRINT AT 21,4;"PRESS ANY KE
Y TO START"
6460 IF INKEY$="" THEN GO TO 646
0
6500 GO TO 150
8000>REM **************************
8001 REM   U. D. G.
8002 REM **************************
8005 FOR d=1 TO 5: READ d$
8010 FOR n=0 TO 7
8020 READ a: POKE USR d$+n,a
8030 NEXT n
8040 NEXT d
8100 RETURN
8110 DATA "a",60,126,102,126,126
,24,60,126
8150 DATA "b",24,60,126,255,126,
102,126,126
8200 DATA "c",145,82,0,3,64,144,
66,66
8250 DATA "d",255,195,165,153,15
3,165,195,129
8260 DATA "j",0,0,0,20,8,8,8,8
9994 REM
9995 REM
```



Outlander
by Laurence Herniman

Boa-constructor

on BBC Micro

This is a deceptively simple game for the BBC Micro model A or B. The object of the game is to drive your snake around the screen eating Xs which add to your score and your snake's length. As you travel around after the Xs you must avoid the blocks which will appear, the sides and your own tail.

The program is quite well structured, having a main loop (lines 220-290) calling all the necessary procedures. As it stands the program will run on a model B. For use on a model A make the following changes:

Line 80,32200 to 15426
Line 610,31788 to 15404
Line 630, 31788 to 15404

The procedures are:

PROCINST . . . prints instructions.
PROCSCR . . . sets array values and prints screen boundaries.
PROCEX . . . prints Xs and obstacles.
PROCMOOV . . . resets array values, takes inkey and clears input buffer.
PROCDRA . . . prints snake's head.
PROCUNDRA . . . rubs out snake's last segment.

```
 10 MODE 7
 20 PROCINST
 30 CLS
 40 DIM A%(100,1):ST%=5:SA%=1:SU%=0:SCO%=0
 50 GOTO 190
 60 DEF PROCSCR
 70FOR B%=0 TO 5
 80LET A%(B%,1)=32200
 90NEXT B%
100 FOR D%=0 TO 39
110 PRINTTAB(D%,1)CHR$(255)
120 PRINTTAB(D%,23)CHR$(255)
130 NEXT D%
140 FOR LA%=0 TO 22
150 PRINTTAB(0,LA%)CHR$(255)
160 PRINTTAB(39,LA%)CHR$(255)
170 NEXT LA%
180 ENDPROC
190 PROCSCR
200 PROCEX
210 PROCMOOV
220 REPEAT
230PROCDRA
240PROCUNDRA
250PROCMOOV
260 TN%=(SCL%/(ST%*3))
270 SOUND 1,-15,(50/(ST%)),1
280 FOR TL%=1 TO TN%:NEXT
290 UNTIL ? A%(0,1)<>32 OR ST%>=50
300 IF ST%>=50 THEN PROCSCREEN:GOTO 220
310 IF ? A%(0,1)=88 THEN PROCEX:GOTO 220
320 PRINTTAB(10,10)"CRASH"
330 SCO%=SCO%+ST%
340 PRINTTAB(10,12)"YOU HAVE SCORED ";SCO%
350 INPUTTAB(10,13)"ANOTHER GAME",ANS$
360 IF ANS$="Y"THEN RUN
370 IF ANS$="N"THEN MODE 7:END
380 GOTO 350
390 END
400DEF PROCDRA
410 ? A%(0,1)=79
420 ENDPROC
430DEF PROCMOOV
440FOR B%=ST% TO 1 STEP-1
450LET A%(B%,1)=A%(B%-1,1)
460NEXT B%
470L$=INKEY$(1)
480 IF L$="Z"THEN SA%=-1:SU%=0
490 IF L$="X"THEN SA%=+1:SU%=0
500 IF L$=";"THEN SU%=+40:SA%=0
510 IF L$="@"THEN SU%=-40:SA%=0
520 *FX 11,0
530LET A%(0,1)=A%(0,1)+SA%
540LET A%(0,1)=A%(0,1)+SU%
550ENDPROC
560DEF PROCUNDRA
570 ? A%(ST%,1)=32
580ENDPROC
590 K%=A%(1,1)
600DEF PROCEX
610 LET ACC%=RND(880)+31788
620 IF ?ACC%=32 THEN ?ACC%=88 ELSE 610
625 FOR L%=1 TO OB%
630  LET UCC%=RND(880)+31788
640 IF ?UCC%=32 THEN ?UCC%=255 ELSE 630
645 NEXT
650 ST%=ST%+2
660PRINTTAB(10,23)"SCORE:";SCO%+ST%
670ENDPROC
680 DEF PROCSCREEN
690 SCO%=SCO%+ST%+100
700 ST%=3
710 CLS
720 PROCSCR
730 PROCEX
740 TIME=0:REPEAT:UNTIL TIME=300
750 ENDPROC
760 DEF PROCINST
770 PRINTTAB(10,2)CHR$(132);CHR$(141)"BOA-
    CONSTRUCTOR"
780 PRINTTAB(10,3)CHR$(132);CHR$(141)"BOA-
    CONSTRUCTOR"
790 PRINTTAB(10,5)"YOU MUST DRIVE YOUR
    SNAKE"
800 PRINTTAB(10,6)"AROUND THE SCREEN"
810 PRINTTAB(10,7)"YOUR CONTROLS ARE"
820 PRINTTAB(10,9)"Z-LEFT"
830 PRINTTAB(10,10)"X-RIGHT"
840 PRINTTAB(10,11)"+-DOWN"
850 PRINTTAB(10,12)"@-UP"
860 PRINTTAB(10,13)"YOU MUST EAT THE X'S"
870 PRINTTAB(10,14)"AND AVOID THE ";CHR$
    (255);"'S"
880 PRINTTAB(5,15)"YOU SCORE 2 POINTS FOR
    EACH X EATEN"
890 PRINTTAB(5,16)"AND A 100 POINT BONUS
    PER SCREEN"
900 INPUTTAB(10,23)"SKILL LEVEL 1 OR 2",
    SCL%:IF SCL%<1 OR SCL%>2 THEN 900
910 IF SCL%=1 THEN SCL%=10000:OB%=1 ELSE
    SCL%=100:OB%=2
920 PRINTTAB(10,24)CHR$(136)"HIT A KEY
    TO START":NN=GET
930 ENDPROC
```

Boa-constructor
by Daniel Webb

Reverse

on Dragon

Reverse

The game of Reverse is very competitive but easy to master. The idea of it is to trap the opponent's pieces between two of your own and thus gain pieces.

To make a move, enter the row then column and then enter. The program gives a running display of your and the computer's score. The computer takes a few seconds to decide its move. This program can be converted for other micros.

Program notes

10 to 80 Set up the board in array A and place the first four pieces in the middle of the board.
90 to 290 Work out the best move for the computer.
300 to 370 Enter players' moves and check them.
380 to 530 Print board and scores.
540 to 620 Check for pieces trapped by last move.
630 to 650 Print winner of game.

To page 15

From page 14

```
1 REM REVERSE FOR DRAGON 32
2 REM BY M.HOMEWOOD (C) '82

1Ø CLS: PRINT @ 11, "REVERSE"
2Ø DIM A (1Ø,1Ø): FORB=1 TO 1Ø:FORC=1TO 1Ø
3Ø SOUND C+B,1
4Ø IF B<>1 AND C<>1 AND B<>1Ø AND C<>1Ø THEN
   A(B,C) = ASC (".")
5Ø NEXT C,B:P=Ø:R=Ø
6Ø A(5,5)=ASC ("x"):(AC6,6)=ASC("x"): A(6,5)
  =ASC("O"):A(5,6)= ASC ("O")
7Ø INPUT "DO YOU WANT TO GO FIRST"; Q$
8Ø CLS: GOSUB 38Ø
9Ø PRINT @ 11, "REVERSE"
1ØØ IF ASC (Q$)<>ASC ("N") THEN 3ØØ
11Ø PRINT @ 336, "MY MOVE"
12Ø S=ASC ("O"): T = ASC("X"): H=Ø
13Ø FOR A = 2 TO 9: FOR B=2 TO 9
14Ø IF A(A,B)<>ASC (".") THEN 26Ø
15Ø Q=Ø: FOR C=-1TO1: FOR D=-1TO1:
   K=Ø:F=A:G=B
16Ø IF A(F+C,G+D)<>S THEN 18Ø
17Ø K=K+1:F=F+C:G=G+D: GOTO 16Ø
18Ø IF A(F+C,G+D)>T THEN 2ØØ
19Ø Q=Q+K
2ØØ NEXT D,C
21Ø IF F=2 OR F=9 OR G=2 OR G=9 THEN Q=Q*2
22Ø IF F=3OR F=8 OR G=3 OR G=8 THEN Q = Q/2
23Ø IF (F=2 OR F=9) AND (G=3 OR G=8) OR (F=3
   OR F=8) AND (G=2 OR G=9)
THEN Q = Q/2
24Ø IF Q<H OR Q=Ø OR (RND(1Ø)>3 AND Q=H)
25Ø H=Q: M=A: N=B
26Ø NEXT B,A
27Ø IF H=Ø AND R=Ø THEN 63Ø
28Ø IF H=Ø THEN 3ØØ
29Ø GOSUB 54Ø: GOSUB 38Ø
3ØØ PRINT @336, "YOUR GO"
31Ø PRINT @ 384
32Ø S=ASC ("X"): T= ASC ("O") : INPUTR
33Ø IF R=Ø THEN 36Ø
34Ø IF R<11 OR R>88 THEN 33Ø
35Ø M=INT(R/1Ø) +1:N=R-1Ø * INT (R/1Ø)+1
36Ø GOSUB 54Ø
37Ø GOSUB 38Ø: GOTO 11Ø
38Ø PRINT @32: SOUND 4, RND (5)
39Ø C=Ø:H=Ø
4ØØ PRINT "  12345678  "
41Ø FOR B=2 TO 9, PRINT B-1;
42Ø FOR D=2 TO 9
43Ø IF A(B,D)=ASC("X") THEN PRINT "X";
44Ø IF A(B,D)=ASC ("O") THEN PRINT "O";
45Ø IF A(B,D)=ASC (".") THEN PRINT ".";
46Ø IF A(B,D)=ASC ("X") THEN C=C+1
47Ø IF A(B,D)=ASC ("O") THEN H=H+1
48Ø NEXT D
49Ø PRINT; B-1
5ØØ NEXT B
51Ø PRINT "  12345678"
52Ø PRINT: PRINT:PRINT "L HAVE ";C; "   YOU
   HAVE ";H
53Ø RETURN
54Ø FOR C=-1TO1
55Ø FOR D=-1 TO 1
56Ø F=M:G=N
57Ø IF A (F+C,G+D)<>S THEN 59Ø
58Ø F=F+C:G=G+D: GOTO 57Ø
59Ø IF A(F+C,G+D)<>T THEN 62Ø
6ØØ A(F,G)=T: IF M=F AND N=G THEN 62Ø
61Ø F=F-C:G=G-D: GOTO 6ØØ
62Ø NEXT D,C: RETURN
63Ø GOSUB 38Ø
64Ø IF C>H THEN PRINT"I WON, ";C;"-";H
65Ø IF H>C THEN PRINT "YOU WON,";H;"-";C
```

Reverse
by Michael Homewood

Horizontal Graphs

on Vic-20

This program requires a Vic printer. It asks you how many items of data you want to input and then the title of the graph, then you type in the data with separate titles for each column. When you have finished it prints out a graph on the printer.

Program notes

Lines
21 to 70 Input all the data.
100 to 150 Work out the scale.
200 to 260 Print out the graph.

Horizontal Graphs
by Alan Blackham

```
  4 REM ********************
  5 REM * ALAN BLACKHAM'S *
  6 REM *HORIZONTAL GRAPHS*
  7 REM *   (01/10/82)    *
  8 REM ********************
 10 POKE36879,8
 20 REM **INPUT NUMBER OF ITEMS OF DATA**
 21 PRINT"■■■HOW MANY ITEMS OF DATA"
 22 INPUT N$
 24 N=VAL(N$)
 25 IFN<1ORN>50THENPRINT"■■INVALID INPUT!":GOTO 20
 26 IFINT(N)<>NTHENPRINT"■■WHOLE NUMBERS PLEASE.":
    GOTO 20
 27 DIM N(N),T$(N)
 28 PRINT"■■THE TITLE OF THE GRAPH"
 29 INPUT G$
 30 REM ** INPUT DATA **
 40 FORI=1TO N
 45 PRINT"TITLE FOR COLUMN ";I
 46 INPUT T$(I)
 47 IFLEN(T$(I))>10THEN PRINT"■PLEASE USE LESS
    THAN 11 CHARICTARS.":GOTO 45
 50 PRINT"■ENTER ITEM ";I
 52 INPUT N$
 55 N(I)=VAL(N$)
 60 IFN(I)<0THEN PRINT"■INVALID INPUT":GOTO 50
 70 NEXT I
100 REM ** WORK OUT THE SCALE **
110 FORI=1TO N
120 IF N(I)> N1 THEN N1=N(I)
130 NEXT I
150 SC=N1/55
200 REM * DRAW THE GRAPH *
202 OPEN1,4:CMD1:REM PRINTER
215 T=LEN(G$)/2
216 PRINTTAB(40-T);G$
217 PRINTTAB(40-T);
218 FOR II=1TOT*2
219 PRINT"■";:NEXT:PRINT
220 FORI=1TO N
225 PRINT T$(I);TAB(11);
230 FOR II=1TO N(I)/SC
240 PRINT"o";:NEXT II:PRINT" ";N(I)
250 NEXT I
255 REM * SWITCH OF PRINTER *
260 PRINT#1:CLOSE1

READY.
```

Flashy Cls

on ZX81

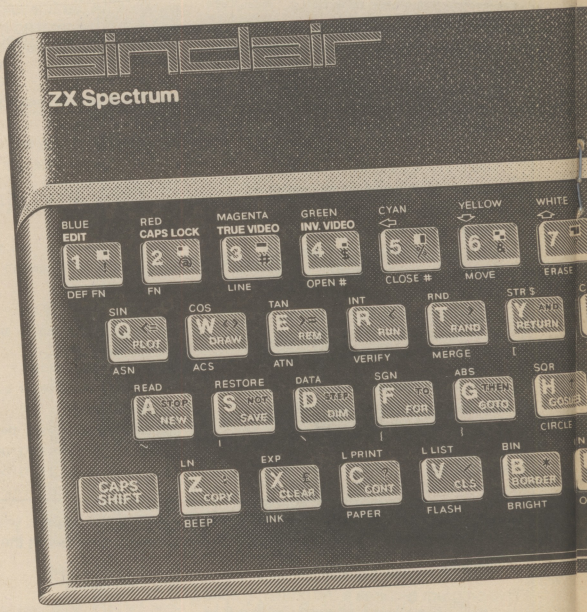
This machine code routine provides a very fast and spectacular *Cls* for the 16K ZX81. It occupies 24 bytes and is stored in a Rem statement at line 1. After the loader program has been entered run it and enter the hexadecimal codes; then delete lines 10 to 60.

The routine is called by using *Print at usr* 16514,0: the reason for this is because after the machine code has been run the

Sinclair ZX Spectr

16K or 48K RAM... full-size moving-key keyboard... colour and sound... high-resolution graphics...

From only £125!



First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power– personal computer price!

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

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

You have the facility to support separate data files.

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

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

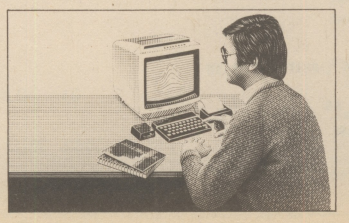
You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.

Ready to use today, easy to expand tomorrow

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

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

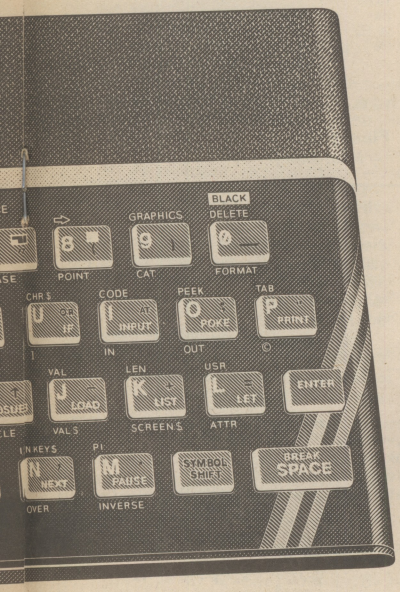
There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.



Key features of the Sinclair ZX Spectrum

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

rum



ZX Spectrum software on cassettes – available now

The Spectrum software library is growing every day. Subjects include games, education, and business/household management. Flight Simulation...Chess...Planetoids...History...Inventions...VU-CALC...VU-3D...Club Record Controller...there is something for everyone. And they all make full use of the Spectrum's colour, sound, and graphics capabilities. You'll receive a detailed catalogue with your Spectrum.

ZX Expansion Module

This module incorporates the three functions of Microdrive controller, local area network, and RS232 interface. Connect it to your Spectrum and you can control up to eight Microdrives, communicate with other computers, and drive a wide range of printers.

The potential is enormous, and the module will be available in the early part of 1983 for around £30.

sinclair

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

The ZX Printer – available now

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

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

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



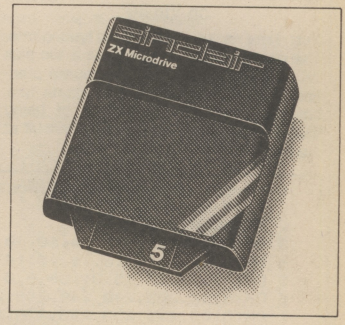
The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing by providing mass on-line storage.

Each Microdrive can hold up to 100K bytes using a single interchangeable storage medium.

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

A remarkable breakthrough at a remarkable price. The Microdrives will be available in the early part of 1983 for around £50.



How to order your ZX Spectrum

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

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

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

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

Please tick if you require a VAT receipt ☐

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

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable

Signature

PLEASE PRINT

Name: Mr/Mrs/Miss

Address

POC 902

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

Print position will still be the same as before so this resets it back to 0,0.

The program uses 24 lines but you can make it less by *Poking* 16522 with the number of lines you wish to clear. One disadvantage of this program is that it won't work after *Scroll* has been used.

If you want to clear the screen of characters that have been *Scroll*ed, you should use *Print at usr* 2602, *usr* 16514. This calls the *Cls* subroutine in the Rom and is faster and more economical than the Basic command *Cls*.

```
 1 REM 24 zeros
10 LET A$=""
20 FOR X=16514 TO 16537
30 IF A$="" THEN INPUT A$
40 POKE X,16+CODE A$+CODE A$(2)-476
50 LET A$=A$(3 TO )
60 NEXT X
```

Hex code	Mnemonic
3E 00	LD A,0
16 3F	LD D,63d
2A 0C 40	LD HL,(16396)
06 18	LD B,24d
15	DEC D
0E 20	LD C,32d
23	INC HL
72	LD (HL),D
0D	DEC C
20 FB	JR NZ-5
23	INC HL
10 F6	DJNZ-10
BA	CP D
20 ED	JR NZ-19
C9	RET

Flashy Cls
by Mike Dipol

Alien Attack

on Vic-20

Yes, here is another space type game. The game, designed to run on a Vic plus 3K, is based on the time-honoured practice of alien destruction. This game has, however, the dubious honour of being easy to start with and absurdly difficult at the end.

The scenario is quite simple. You pilot a small craft which moves from side to side along the top of the screen. The "—" key changes its direction of travel. Alien ships appear at various times at the bottom of the screen and creep upwards. If they get you in range they will destroy you, so you must bomb them before they reach you. The space bar drops the bombs. If you hit the centre of the alien, it is completely destroyed.

If you hit either side of the alien, one of two things can happen. First, the wing of the alien is destroyed, leaving a bent but still lethal foe. Or, the bomb will hit the alien's force field and explode. This will leave debris which will explode any bomb that hits it.

The more aliens you destroy, the faster they come. In order to maximise the speed of the game, no sound is used. My best score is 41 aliens, how about you?

```
 1 POKE51,255:POKE52,19:POKE55,255:POKE5
   6,19:CLR
 2 DATA0,0,0,8,8,8,8,8
 3 DATA24,24,24,24,24,60,60,60
 4 DATA0,0,0,16,16,16,16,16
 5 DATA9,11,15,15,31,63,0,0
 6 DATA144,208,240,240,248,252,0,0
 7 DATA126,255,255,255,255,153,24,0
 8 DATA0,0,0,0,24,24,24,24
 9 DATA24,24,24,24,24,24,60,60
10 DATA24,25,31,31,31,24,24,24
11 DATA126,255,255,255,255,60,24,24
12 DATA24,152,248,248,248,24,24,24
13 DATA0,0,24,126,255,255,66,0
14 DATA0,24,24,24,24,24,0,0
15 DATA0,12,28,60,56,48,0,0
16 DATA1,144,4,80,2,88,0,33
17 DATA0,0,76,16,72,48,180,64
18 DATA128,2,64,8,0,64,4,0
19 DATA200,129,0,8,0,2,97,0
20 DATA24,24,24,24,24,24,24,24
21 DATA0,0,0,0,0,0,0,0
22 DATA0,0,0,0,24,24,24,24
23 FORI=0TO512
24 POKE5120+I,PEEK(32768+I):NEXTI
25 FORI=0TO167
26 READX:POKE5632+I,X:NEXTI
27 POKE36869,253:POKE36879,110
28 DATA0,0,0,24,24,24,24,24
29 S$="—↑|■■■|←—"
30 PRINT"■":M$="      ALIEN ATTACK":P$="
   ■■■■■■■■■■":GOSUB89
31 M$="  WRITTEN FOR VIC-20":P$="
   ■■■■■■■■■■":GOSUB89
32 M$="      BY A.E.WEBB":P$="
   ■■■■■■■■■■■■■■":GOSUB89
33 M$="    INSTRUCTIONS?":P$="■■■■■■■■■
   ■■■■■■■■":GOSUB89
34 GETA$:IFA$=""THEN34
35 IFA$="Y"THEN94
36 TI$="000000"
37 DD=1:SS=7680:OF=30720:SC=0
38 SP=SS:PRINT"■"
39 POKESP,32
40 SP=SP+DD
41 IFSP=7680THENDD=1
42 IFSP=7701THENDD=-1
43 DE=300-SC*5:IFDE<0THENDE=0
44 IFTI>DEANDFL=0THEN59
45 POKESP,75:POKESP+OF,1
46 FORXX=SP+22TOSP+220STEP22
47 IFPEEK(XX)=65ORPEEK(XX)=71THEN71
48 NEXT
49 GETA$
50 IFA$="←"ANDSP<>7680ANDSP<>7701THENDD
   =-DD:GOTO39
51 IFA$=" "ANDFL=0THENFL=1:Q9=SP:BP=Q9+22
52 IFFL=0THEN39
53 POKEBP,32
54 BP=BP+22
55 IFPEEK(BP)<>32THEN62
56 POKEBP,76:POKEBP+OF,1
57 IFBP<(Q9+462)THEN39
58 POKEBP,32:FL=0:GOTO82
59 S$="—↑|■■■|←—"
60 IFRND(1)<.3THENS$="|| —■■■|├ \"
61 POKEBP,32:PRINT"■■■■■■■■■■■■■■■■■■■■
   ■■■■■"TAB(RND(1)*20)S$:TI$="000000":GOTO4
62 IFPEEK(BP)<>65ANDPEEK(BP)<>71THEN67
63 POKEBP,78:POKEBP-1,79:POKEBP+1,80:
   POKEBP+21,81:POKEBP+22,82:POKEB+23,78
64 FORLL=1TO20:NEXT
65 POKEBP,32:POKEBP-1,32:POKEBP+1,32:
   POKEBP+21,32:POKEBP+22,32:POKEBP+23,32
66 FL=0:SC=SC+1:GOTO82
67 IFPEEK(BP)<>66ANDPEEK(BP)<>70ANDPEEK(BP)
   <>64ANDPEEK(BP)<>84THEN70
68 IFRND(1)<.5THENPOKEBP-22,78:FL=0:
   GOTO82
69 POKEBP,78:POKEBP+22,79:FL=0:GOTO82
70 POKEBP,32:FORII=1TO20:NEXT:POKEBP,
   RND(1)*4+78:FORII=1TO50:NEXT:FL=0:GOTO82
71 FORPP=XXTOSP+22STEP-22
72 POKEPP,82:POKEPP+OF,1:NEXT
73 POKESP,81
74 FORPP=XX-22TOSP+22STEP-22
75 POKEPP,32:NEXT
76 PRINT"■■■■YOU DESTROYED";SC
77 POKE198,0
78 PRINT"■PRESS SPACE FOR MORE"
79 GETA$:IFA$=""THEN79
80 IFA$=" "THENPOKE198,0:FL=0:GOTO36
81 END
82 DE=300-SC*5:IFDE<0THENDE=1
83 FORI=1TOINT(TI/DE)
84 S$="—↑|■■■|←—"
```

```
 85 IFRND(1)<.3THENS$="|| _■■■|\"
 86 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■"TAB
    (RND(1)*20)S$
 87 NEXT:TI$="000000"
 88 GOTO39
 89 O$="":FORD=1TOLEN(M$)
 90 O$=RIGHT$(M$,D)+S$
 91 PRINTP$:O$:FORDE=1TO50:NEXT
 92 O$=RIGHT$(M$,D)+"    ■■■■|    "
 93 PRINTP$:O$:FORDE=1TO50:NEXT:NEXT:
    RETURN
 94 PRINT"■YOU PILOT A SPACE-SHIP.....■"
 95 PRINT"■IT MOVES CONSTANTLY    ACROSS
    THE TOP OF THE  SCREEN."
 96 PRINT"■THE '←' KEY CHANGES    THE
    DIRECTION OF THE  SHIP."
 97 PRINT"■ALIENS...→|  & _|_"
 98 PRINT"          _"_    |\"
 99 PRINT"■MOVE UP THE SCREEN.    PRESS
    THE SPACE BAR TOBOMB THEM."
100 PRINT"■■PRESS SPACE FOR MORE"
101 GETI$:IFI$=""THEN101
102 PRINT"■WHEN THEY GET NEAR THETOP
    THEY WILL SHOOT ATYOU IF THEY GET THE
    CHANCE."
103 PRINT"■THEY NEVER MISS...."
104 PRINT"■A HIT ON THE CENTRE   OF THE
    ALIEN DESTROYS IT..."
105 PRINT"■A HIT TO EITHER SIDE  OF AN
    ALIEN MIGHT GET THROUGH THE
    PROTECTIVESHIELDS"
106 PRINT"■AND HIT THE ALIEN BUT THE
    ALIEN WILL STILL  BE LETHAL"
107 PRINT"■■PRESS SPACE FOR MORE"
108 GETI$:IFI$=""THEN108
109 PRINT"■A BOMB HITING THE     SHIELDS
    WILL EXPLODE  LEAVING DEBRIS WHICH
    WILL";
110 PRINT" DETONATE BOMBS   FALLING ON
    THE SAME   PATH."
111 PRINT"■■PRESS SPACE TO START"
112 GETI$:IFI$=""THEN112
113 GOTO36
```

Alien Attack
by Alan Webb

Ruler

on Spectrum

In this program for the 16K ZX Spectrum, you attempt to rule a small country. Each year you will be asked to make several decisions which will influence your country's economy. The idea of the game is to build up as large a fortune as possible while remaining popular. After nine years in office (if you get there), there will be an election. You may stand in it if your score permits it. There are full instructions in the program.

The game includes no graphics and can, if played skilfully, go on a long time.

Decisions to be made each year:

The amount: of land to buy and to sell, of corn to buy, sell and sow (the corn not used is fed to the people).

The number of people: to work in the fields
to work on the dyke (this determines the amount of corn destroyed by floods).
to guard the fields (preventing thefts) and
to recruit in the army.

All the figures concerning the division of the population are put back to zero each year. The taxes which may, in later stages of the game, exceed ten but are, at the beginning, low to avoid revolutions. You have to decide whether to invade or whether to leave the country (if you do, you will be given your score).

Two things that are not included in the instructions are: if your popularity falls below 30 percent, there is a risk of having a revolution and if the density is higher than 300 people per acre, your harvest will be reduced. (You start with a population of 7,500 living on 200 acres — that is, a density of 37.)

Most of the things in this game depend entirely on your decisions but a few have an element of luck. These include the harvest, the war results and the election results.

```
Ruler
  1 PAPER 1: INK 7: BORDER 1: C
LS
  2 PRINT TAB 10;"RULER""""Can
 you govern a country wisely and
 keep the people happy while bui
lding up a fortune?""Press 1
 for more instructions or any o
ther key to play"
  3 IF INKEY$="" THEN GO TO 3
  4 IF INKEY$="1" THEN GO TO 50
0
  5 CLS
  10 LET i=0: LET f=0: LET c=150
00: LET l=200: LET p=7500: LET s
=2000: LET dc=0: LET sc=0: LET p
s=60: LET w=1: LET yr=1
  20 LET cp=INT (RND*20)+20: LET
 cp=INT (RND*5)+1
  25 PRINT "STATUS REPORT : YEAR
 ";y
  26 IF i=1 THEN PRINT "ARE YOU
 acres of your land have been
 invaded"
  27 IF i=2 THEN PRINT ""You hav
e conquered your enemy"
  28 IF i<>0 THEN PRINT "ARE YO
 people were killed"
  30 PRINT "Floods destroyed ";
dc;" KG of corn""Thieves stole
 ";sc;" KG of corn""You have:"
;m;" gold pieces""; l;" acres of
 land""; s;" KG of corn""Land cos
ts ";cp;" gp per acre""Corn cos
ts ";cp;" gp per KG""The popula
tion is";p;"people in your fav
our"
  35 LET i=0
  40 INPUT"Land to sell";ls: I
NPUT "Land to buy";lb: INPUT "C
orn to sell";cs: INPUT "Corn to
 buy";cb: INPUT "Corn to sow";csw
: INPUT "People to work in the f
ields";pf: INPUT "People to work
 in the dyke";pd: INPUT "People
 to work on the dyke";pd: INPUT
 "People to guard the fields";p
g: INPUT "Taxes";t: LET i=1: LET
 e=0
  41 INPUT "Do you want to invad
e?";e$
  45 IF csw+cs>s OR pf+pg+pd+pa>
p OR ls>l THEN PRINT "You must h
ave made an error": GO TO 40
  50 LET l=l+lb-ls: LET s=s+cb-c
s: LET m=m+(lp*ls)-(lp*lb)+(cp*c
s)-(cp*cb)
  60 LET c=c-csw
  65 LET dc=0
  66 IF RND<.8 AND c$()"Y" THEN
LET dc=-(INT ((RND*((5000-pd)+RN
D*1000))/100)): LET sc=INT (RND*
((pf/3)+RES w/7)): LET t=t+dc: L
ET p=p-kp: LET i=1
  75 IF c$="Y" THEN LET w=INT (
(RND*(pa+(RND*1000)))/100): LET
kp=INT (RND*(pa/4)): LET i=2: LE
T p=p-kp: LET i=i+w
  76 LET dc=INT (RND*(((2500+((1
-200)*10))-pd)/5)): LET sc=INT (
RND*(((1500+((l-200)*10))-pa)/5)
): IF dc<0 THEN LET dc=0
  80 IF sc<0 THEN LET sc=0
  90 LET c=c-(dc+sc)
  100 IF p>c THEN LET np=p-(INT (
RND*(p-c)+(RND*100))): LET dp=np
  110 IF p<c THEN LET dp=p+(INT (
RND*((c-p)+(RND*100))))
  115 LET p=np
  117 LET dp=0
  120 LET h=INT ((((cs*pf)*((l-(p
/5000)))+(INT (RND*1000))/100)*I
F p/l>300 THEN LET h=INT (h/((
p/l)-200)))
  125 LET m=m+INT (t*(p/100))
  130 LET po=INT ((((pf/10)+(c/100
0)+(RND*50)/(1+w/2))-(kp/20)): IF
 po>100 THEN LET po=100
  135 IF RND>.5 AND RND>.9 THEN L
ET e=1: LET p=p-INT (RND*1000):
LET c=c-INT (RND*5000):
  140 LET t=h
  150 IF (po+(pa/1000))<30 AND RN
D*(po/10)<1 THEN GO TO 500
  155 LET y=y+1
  156 IF m<0 THEN CLS : PRINT "Yo
ur bankrupt"  STOP
  160 INPUT "Do you want to leave
 ";a$: IF a$="y" OR a$="Y" THEN
GO TO 400
  165 CLS
  166 BEEP .5,0
  168 IF INT (y/10)=(y/10) THEN G
O SUB 1000
  170 IF (y/10)<>INT (y/10) THEN
GO TO 20
  180 GO TO 400
  300 CLS : PRINT "There has been
 a revolution"
  305 LET z=RND
  310 IF z>.5 THEN PRINT "but you
 have escaped alive": LET m=0
  320 IF z<.5 THEN PRINT "and you
 have been executed""BAD LUCK"
  330 GO TO 410
  400 CLS
  410 LET s=INT ((c+p+m)*(po+(l/2
))/100000)
  420 IF e$()"y" THEN PRINT "Scor
e";s
  430 IF e$="y" THEN PRINT "Press
 at score is ";s: LET e$="": GO T
O 1500
  440 STOP
  500 CLS : PRINT "To be a succes
sful ruler you need to know s
everal facts.theseare:-""That
 for the population to grow,you h
ave to feed everybody more than
 1 KG of corn a head.""That the
 entire population works""that
 the harvest is determined by
 the corn sown,the amount of  lan
d owned,the number of people work
ing in the fields and by a cert
ain amount of luck.""That your
 popularity is determi-ned by th
e amount of food the  people re
ceive ,the change in populatio
n by the taxes and by the war r
esults.""The final score is de
termined bythe population,money
,land,corn and popularity.""La
nd prices range from 20-30 gp""
Corn prices from 1-5 gp"
  501 PRINT : PRINT : PRINT : PRI
NT : PRINT : PRINT : PRINT : PRI
NT
  505 PRINT : PRINT : PRINT TAB 1
0;"GOOD LUCK!""TAB 5;"Press any
key to play"
  510 PAUSE 0: CLS : GO TO 10
  900 CLS
  1010 PRINT "Next year,your coun
try will have:a first general e
lection""Do you want to
 stand in them ?";a$: IF a$()"y"
 THEN CLS : RETURN
  1020 CLS : PRINT "You have ";m;
" gold pieces""How much do
 you want to spend onthe elec
tion campaign (max.20000);": INPU
T me: IF me>20000 OR me<m THEN
GO TO 1020
  1025 LET m=m-me
  1030 RETURN
  1500 IF s<300 THEN GO TO 2000
  1510 BEEP .5,15: BEEP .5,12: BEE
P .5,10: BEEP .1,5
  1515 BEEP .5,5: BEEP .5,10: BEEP
 .5,12: BEEP .5,15: BEEP .7,15
  1520 CLS
  1530 PRINT TAB 7 ; FLASH 1;"GENE
RAL  ELECTIONS"
  1540 LET e=INT ((po+(.19)+INT ((
RND*10)+.5))+(me/1000)+.50)
  1550 IF e>150 THEN PRINT "CONGRA
TULATIONS""You recieved ";e;"
% of the votes""FOR ns=30 TO 20
 STEP -.02,n: NEXT n: CLS : GO T
O 20
  1560 PRINT "Bad luck,only ";e;"
% of the""population voted for
 you.": BEEP .4,-20: STOP
  2000 PRINT "As your score wasn't
 that good you were unable to s
tand in the elections.""Congra
tulations though,for sur- viving
 as dictator for ";y;" years.
""The money you spent on the
 election campaign will be
 returned to you."
  2010 LET m=m+me
  2020 LET s=INT ((c+p+m)*(po+(l/2
))/100000)
  2030 PRINT "This makes your scor
e";s
```

Ruler
by Christian Livingstone & Piers Ludlow

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Ticket machine

***Nick Godwin** presents a program for issuing computerised tickets.*

One practical use to which the ZX81 with printer attached can be put may be of interest to organisers of local events. This is the computerised ticket machine.

The program listed here is for a very simple general purpose ticket, and illustrates the principle. More complex and versatile programs can fairly easily be adapted from it to suit individual needs (for example, the inclusion of a half-price facility for children, etc).

The first part of the program sets up the ticket. Enter the number of lines of text required in the main body of the ticket. Each line is centred when the ticket is printed, so all it needs is for each line of text to be entered, one by one.



Next, the computer asks for *DATE?* which should be entered as you want it displayed. Alternatively, if the date is not applicable to the particular event, enter *newline*. The same applies to *TIME?*

Finally, enter the price, in pounds. If the amount is less than one, then the ticket will display the price in pence (eg, for the "Community Promotions" example, I entered 1.25, and for the "Borders Computer Group" I entered 0.25; both events are entirely imaginary, by the way).

After this, the computer displays the cue: "OK?", and you should check the display on the screen to make sure all is as you want it to appear on the tickets. If not, press "N" and *Run* again, otherwise any other key is interpreted as Yes. From then on every key depression will *Lprint* a ticket. The tickets are numbered (if you want to start at 100, change line 410).

Stop the program by pressing *Break*. *Print* T will then display the total value of tickets sold, so you can check the till. *Print* N displays the last ticket number.

```
   EYEMOUTH COMMUNITY PROMOTIONS
            PRESENTS
     "NO HASSLES IN HURKUR"
            A FARCE
        BY NICHOLAS NOBODY
     AT THE COMMUNITY CENTRE
            *  *  *
SUNDAY 5TH DECEMBER        7.30 PM
3                          £ 1.25
--------------------------------
   EYEMOUTH COMMUNITY PROMOTIONS
            PRESENTS
     "NO HASSLES IN HURKUR"
            A FARCE
        BY NICHOLAS NOBODY
     AT THE COMMUNITY CENTRE
            *  *  *
SUNDAY 5TH DECEMBER        7.30 PM
4                          £ 1.25
--------------------------------
   BORDERS COMPUTER GROUP
        COMPUTER FAIR
   25TH TO 27TH NOVEMBER
      TOWN HALL, DUNS
        ADMIT ONE
            *  *  *
1                          25 PENCE
--------------------------------
   BORDERS COMPUTER GROUP
        COMPUTER FAIR
   25TH TO 27TH NOVEMBER
      TOWN HALL, DUNS
        ADMIT ONE
            *  *  *
2                          25 PENCE
--------------------------------
   BORDERS COMPUTER GROUP
        COMPUTER FAIR
   25TH TO 27TH NOVEMBER
      TOWN HALL, DUNS
        ADMIT ONE
            *  *  *
3                          25 PENCE
--------------------------------
```

```
 110 PRINT "TICKET MACHINE";AT 2
1,0;"TITLE - HOW MANY LINES?"
 120 INPUT L
 130 DIM A$(L,32)
 140 CLS
 150 FOR J=1 TO L
 160 PRINT AT 21,0;"LINE ";J
 170 INPUT X$
 180 LET X=INT ((32-LEN X$))/2+1
 190 LET A$(J,X TO )=X$
 200 PRINT AT 2*J-2,0;A$(J)
 210 NEXT J
 220 PRINT AT 21,0;"DATE? "
 230 DIM D$(32)
 240 INPUT D$
 250 PRINT AT 2*J,0;D$;
 260 PRINT AT 21,0;"TIME?"
 270 INPUT X$
 280 LET D$(32-LEN X$ TO )=X$
 290 PRINT AT 2*J,0;D$
 300 PRINT AT 21,0;"PRICE?"
 310 INPUT P
 320 LET P$=("£ " AND P>=1)+STR$
P
 330 IF LEN P$>2 THEN IF P$(LEN
P$-1)="." THEN LET P$=P$+"0"
 340 IF P$(1)="0" THEN LET P$=P$
(2 TO )
 350 IF P$(1)="." THEN LET P$=P$
(2 TO )
 360 LET P$=P$+(" PENCE" AND P<1
)
 370 PRINT AT 2*J+2,31-LEN P$;;P
$
 380 PRINT AT 21,0;"OK?    "
 390 PAUSE 4E4
 391 POKE 16437,255
 400 IF INKEY$="N" THEN RUN
 410 LET N=0
 420 LET T=0
 430 PRINT AT 21,0;"READY"
 440 PAUSE 4E4
 441 POKE 16437,255
 445 CLS
 450 FOR J=1 TO L
 460 PRINT A$(J)
 470 PRINT
 480 NEXT J
 490 PRINT TAB 14;"*  *  *"
 510 PRINT AT 18,0;D$
 520 PRINT
 530 LET N=N+1
 540 LET T=T+P
 550 PRINT N;TAB 31-LEN P$;P$
 560 COPY
 570 LPRINT ,,"----------------
----------"''''''''
 580 GOTO 440
```

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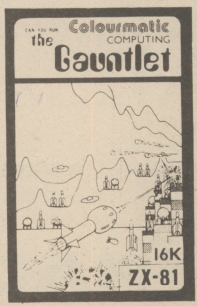
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Shall I buy or rent it?

***Dan Mitchell** presents a financial decision-maker for the BBC model A or B.*

This program, for the BBC Model A or B, helps you to make decisions like "should I buy a £400 video to save the rental charges of £180 a year?"

The first information required by the program is *Initial Investment*, ie the cost of the item being bought. Then you have to input the amount of time, in years, you think the product will last — for a video 2/3 years is enough, for other investments 5/7 years is a reasonable life expectancy.

Next, you must input the savings that accrue from the initial investment, ie buying a £400 video will save you £180 a year rental charges for the three-year life of the machine.

Finally, you should input what accountants term the "interest rate". This is based largely on the rate of inflation and takes account of the devaluation of your money, in real terms, over the years. A figure of around 8-10 percent would be reasonably accurate at the moment.

The program will now run, producing three columns of data. Column one shows the savings for each year, while column two balances the cumulative savings against the initial investment — when the sign in this column changes from negative to positive your investment has "broken-even".

The third column needs a full explanation. Basically, money saved in future years is not worth as much as money now — inflation takes its toll! The program calculates, or "discounts", future savings, giving its value in today's money.

The total discounted cash savings are then subtracted from the initial investment. The remaining sum is called the "Nett present value" of the investment at the interest rate originally chosen. A positive NPV means a good investment, a negative NPV should be avoided.

A further figure of particular interest to economists is the interest rate at which the investment gives a NPV = 0, this is the investment's "internal rate of return" — a measure of how good an investment is — and can be used to compare a number of roughly similar projects.

The program was written avoiding commands special to the BBC microcomputer and should thus be easily transferrable to other machines. A limited amount of error-trapping has been incorporated, but this could be extended if desired.

This is the first in a series of BBC/Educational articles designed for use by schools, teachers, students and small businesses. Each week we shall concentrate on a different aspect of education/business. If you have any programs suitable for this series please send them to BBC/Education, *Popular Computing Weekly*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

Program notes

Lines 70-220 accept the input data and perform a minimum level of validity checks.
Lines 270-380 calculate the *Nett Present Value* of the investment, for the period stated and at the interest (discount) rate selected at the input stage.
Line 410 prints the project's *INTERNAL RATE OF RETURN*, but only when a repeated recalculation of the NPV gives a figure within £1 of zero.
Lines 420 and 430 and lines 470 and 480 set the interest rate on the first NPV recalculation to an artificially high/low value.
Line 440 or 450 calculates a new interest rate on the second and all subsequent NPV recalculations.
Lines 490-510 store in a temporary variable *T* the previously used interest rate; set a new rate based on the difference between the previous two rates; and direct the program to recalculate the next NPV.
Lines 520-540 print the table of results to screen or printer, at the interest rate initially input.
Lines 570-660 trap certain errors due to faulty data.

```
>L.
   10 REM INVESTMENT DECISION-MAKER
   20 REM c.1982 D.MITCHELL
   30 CLS:MODE 7
   40 ON ERROR GOTO 570
   50 DIMM(20):DIM R(20):DIM S(20)
   60 PRINT:PRINT
   70 INPUT "INITIAL INVESTMENT "P
   80 IF P<=0 THEN PRINT "  !! INCORRECT INVESTMENT !!"
:PRINT:GOTO 70
   90 P=0-P
  100  INPUT "LIFE OF PROJECT IN YEARS " N
  110 IF N<1 THEN PRINT"  !! LIFE LESS THAN 1 YEAR !!":
PRINT:GOTO 100
  120 IF N>20 THEN PRINT"  !! LIFE GREATER THAN 20 YRS.
 !!":PRINT:GOTO 100
  130 N=INT(N)
  140 PRINT
  150 FOR I=1 TO N
  160 PRINT "INPUT YEAR ";I;" INCOME";
  170 INPUT M(I)
  180-IF M(I)<0 THEN PRINT "  !! INCOME IS NEGATIVE !!"
:PRINT:GOTO 160
  190 NEXT I
  200 PRINT
  210 INPUT "INPUT INTEREST RATE % ",RA
  220 IF RA<0 THEN PRINT "  !! NEGATIVE INTEREST RATE !
!":PRINT: GOTO 210
  230 CLS:PRINT:PRINT:PRINT:PRINT
  240 PRINT "INTEREST RATE IN THIS D.C.F.IS ";RA;"%"
  250 PRINT
  260 C=0:X=0
  270 R=(RA+100)/100
  280 V=0:PB=P
  290 FOR I=1 TO N
  300 R(I)=R^I
  310 S(I)=M(I)/R(I)
  320 S(I)=(INT(S(I)*100+.5))/100
  330 V=V+S(I)
  340 PB=(INT(PB+M(I))*100+.5))/100
  350 IF C=0 THEN GOSUB520
  360 NEXT I
  370 PV=(INT((P+V)*100+.5))/100
  380 IF C=0 THEN PRINT:PRINT "NETT PRESENT VALUE IS =
£ ";PV:PRINT TAB(25);"**********"
  390 C=C+1
  400 IF C=1 PRINT:PRINT
  405 IF C<3 THEN IF ABS(PV)<=1 THEN END
  410 IF ABS(PV)<=1 THEN PRINT "INTERNAL RATE OF RETURN
 = ";(INT(RA*100+.5))/100;"%":PRINT TAB(25);"**********
":END
  420 IF PV >1 AND  C<2 THEN GOTO 470
  430 IF PV <-1 AND C<2 THEN GOTO 480
  440 IF PV>1 THEN R1=R1+ABS((R1-T)/2)
  450 IF PV<-1 THEN R1=R1-ABS((R1-T)/2)
  460 GOTO 490
  470 R1=RA*100:GOTO 490
  480 R1=RA/10:GOTO 490
  490 T=RA:RA=R1
  500 IF RA<=0 THEN PRINT "NO POSITIVE RATE OF RETURN":
PRINT TAB(25);"**********":END
  510 GOTO 270
  520 IF X=0 THEN PRINT:PRINT TAB(2); "SAVINGS(£)";TAB(
14);"NET.SAV(£)";TAB(27);"D.C.F.(£)"
  530 IF X=0 THEN PRINT TAB(4);"-----------------------
--------"
  540 PRINT M(I),PB;TAB(27);S(I)
  550 X=X+1
  560 RETURN
  570 CLS:PRINT:PRINT
  580 PRINT"****************************************"
  590 PRINT"****************************************"
  600 PRINT:PRINT
  610 PRINT"    DATA BEING ENTERED IS FAULTY"
  620 PRINT:PRINT TAB(12);"IN SOME WAY"
  630 PRINT:PRINT
  640 PRINT"****************************************"
  650 PRINT"****************************************"
  660 PRINT:PRINT:PRINT TAB(7);"PLEASE RE-RUN PROGRAM"

  670 END
>*KEY0 SAVE"DCF"!M!M
>
```

Whirligigs and whorls

***John Dunford** presents three simple routines to mimic the effects of a spirograph.*

Most people will be familiar with the famous Spirograph and the patterns that can be formed with it. This program follows exactly the same principle.

Program one produces a simple example of how the Spirograph technique is used. You can experiment by changing the number in line 30. Each number will result in a slightly different pattern.

Program two, and its variants, go one step further to produce a more complicated pattern. By changing line 10 in program two, to give different boundaries and steps, other interesting patterns can be formed. Try this for example:

```
10 FOR n=.1 TO .9 STEP .2
```

Now type in:

```
10 FOR n=.1 TO -.9 STEP -.2
20 LET a=n PI
30 READ Z: INK Z
170 NEXT n
180 DATA 5,3,4,2,1
```

The program has been laid out so that the individual drawing steps can be clearly identified.

For something completely different, type in program three and run. Now change line 80 to read:

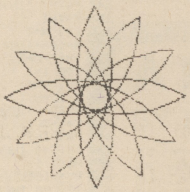
```
80 FOR n=167 TO 0 STEP -16
```



The ZX Spectrum being used at Sutton Primary School, Cambridgeshire.

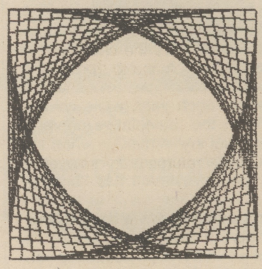
Program Two

This is the basic program



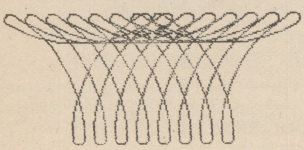
```
30 LET a=-.508*PI
40 PLOT 120,140
50 DRAW -32,-120,a
60 DRAW 88,88,a
70 DRAW -120,-32,a
80 DRAW 120,-32,a
90 DRAW -88,88,a
100 DRAW 32,-120,a
110 DRAW 32,120,a
120 DRAW -88,-88,a
130 DRAW 120,32,a
140 DRAW -120,32,a
150 DRAW 88,-88,a
160 DRAW -32,120,a
```

Program Three

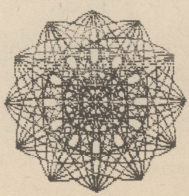


```
10 FOR n=0 TO 174
20 PLOT n,0: PLOT n,175
30 NEXT n
40 FOR n=0 TO 174
50 PLOT 0,n: PLOT 175,n
60 NEXT n
70 LET a=0
80 FOR n=167 TO 0 STEP -8
90 LET a=a+8
100 PLOT 0,n: DRAW a,-n
110 DRAW n,a
120 DRAW -a,n
130 DRAW -n,-a
140 NEXT n
```

Program One

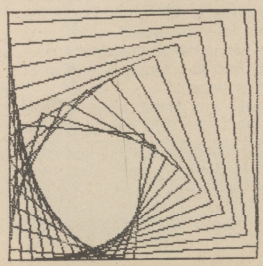


...and this is the more complicated pattern.



```
10 FOR n=66 TO 173 STEP 15
20 READ z: INK z
30 PLOT n,40
40 DRAW 50,87,-PI/3
50 DRAW 4,-7,-PI
60 DRAW -100,0,-PI/3
70 DRAW 4,7,-PI
80 DRAW 50,-87,-PI/3
90 DRAW -8,0,-PI
100 NEXT n
110 DATA 1,2,3,4,4,3,2,1
```

This is with line 80 changed



Dictionary

MODULE 3: *Lines 2000-2210*
The purpose of this module is to display the dictionary of characters page by page and to move a cursor around the page allowing the user to specify characters for a number of simple operations.
Commentary
2060 The fairly involved figures which are to be included in the string to be *Draw*n simply specify that each character to be drawn will be placed 32 pixels to the right of the last, or at the start of the screen and 45 pixels down if the end of a line has been reached. This allows for the full 32*32 grid on which the character was designed plus room for a moving cursor.
2080 While the variable S records the absolute position of the character currently pointed to within the dictionary, S1 is used to indicate the position of the cursor on the screen.
2100-2130 A flashing cursor routine which uses the value of the loop variable I to set the colour with which the cursor is *Draw*n and thus needs only the one line to *Draw* and re*Draw* to invisibility.
2150 The cursor move line, based on the left and right arrowed keys.
2160 Input of "D" will result in the deletion of the character to which the cursor is pointing from the dictionary.
2170 Input of "C" adds the character to which the cursor is pointing to the current character set.
2180-2190 The up and down arrows are used to move to the previous or following page of the dictionary.
2200 Input of "Q" returns program execution ot the menu.
Testing
Since no characters have yet been loaded from tape, it is difficult to test this module but since there are almost bound to be errors in entering it we shall adopt the temporary expedient of entering some simple specimen characters with the following line:

```
8888 LET D$ = "BM + 1, + 0;R0;":FOR H
= 0 TO 7:LET E$ = "":FOR I = 0 TO
13:LET E$ = E$ + D$:LET DI$(H * 14 + I)
= E$:NEXT I:NEXT H:LET DI = 110
```

This line, provided that the program has been initialised, can be called in direct mode or even called as a subroutine from the initialisation module and will load the dictionary with 112 characters which are actually sets of 14 lines of increasing length traversing the 32*32 pixel space diagonally from the top left corner.

Having run line 8888, calling up this module should display the first page of the dictionary and allow the full range of functions specified in the commentary.
MODULE 4: *Lines 2500-2590*
Having begun to build up a character set from the main dictionary, this module allows the user to display the current state of the character set.

Commentary
2580 Input of "D" while the character set is being displayed will result in the character set being deleted. Note that this is achieved simply by setting CI to zero — there is no need to physically wipe out the character set. Pressing any key other than "D" will return to the menu.
Testing
You should now be able to create a character set from the main dictionary and display that character set. ■

Module 3

```
2000 REM************************
2010 REM DISPLAY DICTIONARY
2020 REM************************
2030 LET S=0
2040 PMODE 4,1:PCLS:SCREEN 1,0
2050 FOR I=S TO S+31
2060 DRAW "BM"+STR$(32*(I-S)-8*INT((I-S)/8)
)+","+STR$(45*INT((I-S)/8))+";"+DI$(I)
2070 NEXT I
2080 LET S1=S-32*INT(S/32)
2090 LET T$=INKEY$:IF T$<>"" THEN GOTO 2150
2100 FOR I=1 TO 2
2110 DRAW "C"+STR$(I)+";BM"+STR$(32*(S1-8*INT
(S1/8))+8)+","+STR$(45*INT(S1/8)+40)+";E3;F3"
2120 FOR J=1 TO 25:NEXT J
2130 NEXT I
2140 GOTO 2090
2150 LET S1=S1-(T$=CHR$(9))+(T$=CHR$(8)):LET
S1=S1-(S1<0)+(S1>31)
2160 IF T$="D" THEN FOR I=S+S1 TO DI-1:LET
DI$(I)=DI$(I+1):NEXT I:LET DI=DI-1:GO TO 2040
2170 IF T$="C" THEN IF CI<=40 THEN LET CHAR$
(CI)=DI$(S+S1):LET CI=CI+1
2180 IF T$=CHR$(10) THEN LET S=S-32*(S<128):
GOTO 2040
2190 IF T$=CHR$(94) THEN LET S=S+32*(S>31):
GOTO 2040
2200 IF T$="Q" THEN RETURN
2210 GOTO 2090
```

Module 4

```
2500 REM************************
2510 REM DISPLAY CHARACTER SET
2520 REM************************
2530 PMODE 4,1:PCLS:SCREEN 1,0
2540 FOR I=0 TO CI
2550 DRAW "BM"+STR$(32*(I-8*INT(I/8)))+","
+STR$(32*INT(I/8))+";"+CHAR$(I)
2560 NEXT I
2570 LET T$=INKEY$:IF T$="" THEN GOTO 2570
2580 IF T$="D" THEN LET CI=0
2590 RETURN
```

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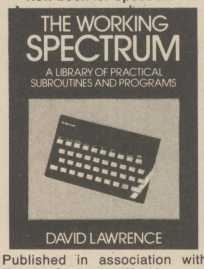
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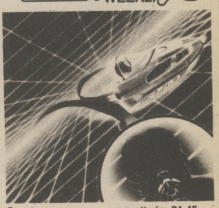
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ZX81 MUSIC, no add-ons needed, 20 notes can be recorded on tape. Send £5.50 to Stephen Newton, 5 Freegrove Road, Holloway, London N7 9JN.

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BBC/SEIKOSHA GP-100 SCREEN DUMP, super program to dump your screen contents in Mode 4. Cassette with instructions £4.99 including P&P. Hole, 10 Elizabeth Way, Stowmarket, Suffolk IP14 5AX.

FROM OLD KENT ROAD TO MAYFAIR. The famous board game for the BBC Micro (32K), short and standard game options, Gamesave facility, up to six players including the computer who will consider deals and offer exchanges, £6. I.A.S. Software, Dept. PCW, 31A Hillfield Drive, Heswall, Merseyside.

SPECTRUM GRAPH PLOTTER. Draws pie-charts, bar-charts, line plots and scatter diagrams. Fits 16K. Tape of five routines and five demonstrations, including instructions, for £5, or sae for details. TopGraph Software, 106 Blundell Road, Luton, Bedfordshire LU3 1SP.

TRS 80 MODEL I, Level II 16K, VDU, cassette, lower case mod, software, etc. Offers. Also Epson MX70 Printer, with interface to TRS80, £220. Tel: Windsor 54499.

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Free readers entries to buy or sell a computer. Ring 01-930 3266 and give us the details.

Spectrums for sale

48K SPECTRUM + £30 software and books. £170 ono. Tel: 061-794 1696.

SPECTRUM Memory Upgrade for issue 1, 32K unwanted gift. £20. Tel: 0823 73507.

ZX SPECTRUM 48K, brand new, includes tape recorder, many magazines. £150. Ashford, Kent 0233 37283.

48K SPECTRUM, £20 software. £160 ono. Tel: (0329) 664200.

SPECTRUM 48K + sound board + joystick. £90 software. £210 ono. Tel: 0206 330932.

48K SPECTRUM, brand new. £165 + books + programs. Will agree price. Mr Cumliffe. Tel: Manchester 061-445 4732.

SPECTRUM 48K £175. Sinclair chess, Inca Curse, Flight simulation and Space Raiders and others. ZX81 and Vic programs. All Acorn software. Games. Contact John Abell. Tel: (0332) 559233 after 4.30 pm.

48K SPECTRUM + soundboard and joystick + leads + about £70 software. £210 ono. Tel: (0206) 330932.

FIVE ZX SPECTRUM GAME CASSETTES. All originals, £18 + five rolls ZX printer paper, £8. Tel: (0236) 29808 (after 5 pm).

16K SPECTRUM. Unwanted Christmas present, £100, with manual plus all leads. Tel: St Albans 33671, after 4 pm.

48K SPECTRUM, all leads and manual, some software, £160. Tel: Worthing 45200.

16K SPECTRUM, complete with manuals, packaging and games (including Arcade Scramble), printer paper (not printer), magazines. Worth nearly £150, sell for £120. Tel: 0747 2627 evenings.

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48K SPECTRUM + over £150 of software, best available, + magazines and books, £250. Tel: Sapcote 2998 — Ian.

ZX SPECTRUM, 16K + £30 of software + books, £140. Tel: 061 330 6406.

ZX SPECTRUM, 48K + printer, original packaging + 10 rolls of paper including original roll, no waiting for delivery, software mags, in excellent condition, £240 ono. Tel: Basildon 288271 (6-9 pm only).

SPECTRUM, 48K, hardly used, unwanted Christmas present, £160. Tel: 01-773 0495 (evenings).

16K SPECTRUM + sound amplifier, £20; software including Space Invaders and Asteroids etc + manual computer book, £135. Tel: 01-574 6689.

SPECTRUM 48K with printer + 10 rolls of paper + Campbell systems, master file, flight simulator, 2 books and magazines, £225. Tel: Hereford 57550.

SPECTRUM 16K, games and graphic software, 3 months, £115 ono. Griffin, 061-434 1939 (5 pm).

ZX SPECTRUM 48K, 6 weeks old + tape recorder and chess software and book, £185. Tel: Cheltenham 580465.

48K SPECTRUM, as new, sound amplifier, £40 of software, cost £225, will accept £180. Tel: Greenhithe (0322) 846355 after 5 pm.

FOR ZX SPECTRUM. £55 will buy a Spectrum printer with over five M/C arcade games for the 16K machine. Tel: Harpenden 69152.

48K SPECTRUM, perfect condition, unused printer, six rolls paper, games, books, compiler, £200. Tel: Sicklesmere (028 486) 375 evenings.

THREE SPECTRUM games cassettes, 2, 3 + 4. All for £10. Tel: 01-451 1770, Dave after 7 pm.

ZX SPECTRUM, 2 months old + 12 games + book £100. Tel: 01-581 5288.

SPECTRUM 48K + printer, 6 rolls of paper, 2 cassettes (Horizon), magazines, leads etc £215. Tel: 01-864 7953 evenings.

SPECTRUM 16K + full-sized keyboard and case, 2 cassettes £160. Tel: 0622 63217.

SPECTRUM 16K, two months old, £95. Tel: 01-958 2826.

48K SPECTRUM with over £50 software. £170. Tel: 01-855 3192.

ZX81s for sale

ZX81 16K Ram pack, DK Tronics keyboard and over £60 software. £100. Tel: 01-855 3192.

ZX81 + 16K Ram, books and magazines, £50. Tel: Hornchurch 58572.

16K ZX81 + add-on keyboard, £60. Tel: Burgess Hill 3887.

16K ZX81 + books, magazines, over 200 programs, very good condition. £61. Tel: 01-890 5824.

ZX81 16 RAM, leads + manual, 2 books. £50. Tel: Gerrards Cross 887771.

ZX81 + Ram pack, 4K graphics Rom + 2 extra books + £30 software. £85. Tel: Shaw 842748.

ZX81, 16K, fuller keyboard and software, £80. Tel: 0947 603645.

ZX81 16K and carrying case, in excellent condition with leads, manual, PSU etc + over £70 software including Maogs, Galaxions, Pimania + over £15 magazines. Only £100 ono. Tel: Pontefract (0977) 707883.

FOR SALE, ZX81 16K with Kayde keyboard + 24 bit input/o port for joysticks etc, some software, mainly arcade games, magazines + books, cost £220, £80. Tel: 01-458 2291.

16K ZX81 + **PRINTER,** good condition with £30 of software, one book + manuals, £100. Tel: (0924) 275509 after 4 pm.

ZX81 16K, keyboard, I/O Port, Speech, Graphic Rom, Printer, games, software. Offers. Tel: Wickford 2996 (after 5 pm).

ZX81 16K, 3 months old, £60 of software including 3D Monster Maze, £75 ono. Tel: 041-423 2095 (after 4 pm).

ZX81 16K, full keyboard + case, printer + paper, 3K graphic Rom, joystick + interface, learning lab, books + software, £160 ono. Tel: Harlow (0279) 24668.

ZX81 16K, £75 of software, £75 ono. T. Rees, 55 Forest Road, London N9.

ZX81 16K plus some software, £50 ono. Tel: 0706 227672 (after 5 pm).

ZX81, 16K + £30 software, Learning Lab, £55. Tel: 01-969 1206.

ZX80, 8K Rom, 16K Ram, cassette leads, 10-game cassettes, 7 books, £55. Tel: 01-986 0989.

16K ZX81, books, magazines and cassettes, £70. Tel: 01-346 2470.

ZX81, 16K + 8 tapes, 3D-Defender, Tomb of Dracula and more, many magazines and 2 books, £60. Tel: 01-699 5354.

ZX81 16K RAM + full-size keyboard + 12 tapes, £120. Tel: 01-390 1467.

ZX81 16K complete, also some software, £60 ono. Tel: Weybridge 49307 evenings.

16K RAM PACK SINCLAIR ZX81, £18. Tel: 0241 54106, late afternoon or evening.

ZX81, 16K, £30, ZX printer £50 + 10 professional software. Cost £81, will sell for £50 + books + magazines, £5. Tel: High Wycombe 28951 (10 am to 1 pm, Monday to Friday).

ZX81, 16K + books, £50. Tel: 01-800 5381.

ZX81 16K + Fuller keyboard and books, software £50. Tel: 051-922 1745.

ZX81 + 16K Ram + 15 cassettes and books, £80. Steven Vale, 021-458 1802 (evenings).

ZX81, 16K + fuller keyboard, leads, adapter + £40 software, £70. Tel: 061-445 6808 evenings.

ZX81, 16K + Kempston click keyboard + T.T.L. work station + DK graphic Rom (not fitted) learning lab. + manual + six tapes, two books, £100. Tel: 0457 62376 after 6 pm.

ZX81, 16K, in original packing plus machine code book, £45. Tel: Northwood 26894 after 5.30 pm.

Acorns for sale

ACORN ATOM, 12K Ram, 12K Rom, power supply, V.I.A., £100 software, £140. Tel: 061 681-2875.

ACORN ATOM, 12+12K and all fittings including tool box, £200 software, £50 books. Offers. Tel: 01-992 8249.

ACORN ATOM, 8K Rom + 12K Ram + power supply unit and cassette recorder £110. Tel: (0942) 712412.

ACORN ATOM, 12K + 12K + W/P, floating point Rom + £75 software + tape deck, £170. Tel: Egham 36162, Mr G. Williams.

ACORN ATOM, 12K + 12K, manual, power pack, leads, software. Excellent condition, £120. Wanted: BBC Computer Model B. Tel: 0480 72440.

BBC MICRO MODEL A. 32K, mint condition, little used, including software, leads + cassettes, £229 ono. Tel: Hull 849517.

ACORN ATOM, 12K + 16K, floating point, Rom and toolbox, via chip, P.S.U. £100 of software. Good condition, £220 ono. Tel: 0725 20609 (after 6 pm).

ACORN ATOM, 8K + 12K, PSU, £100. Tel: Ashton-in-Macclesfield 712412.

ACORN ATOM. 12K+16K, including floating point Rom + tool box Rom, Via chip, PSU, £100 of software, good condition, £250. Tel: (0725) 20609 after 5 pm.

ACORN ATOM. 12K+12K floating point Rom, word pack Rom, VIA and joystick, leads, manuals plus books, software including Database, Pacman, Galaxians etc, as new, in original box, £150. Tel: Bolton (0204) 77701.

BBC MODEL B + disc filing system, micro Vitek colour monitor + Acorn software. Telephone Camran 01-864 4581 (afternoon).

ATOM 12K + 12K + programmes + books, £180, will take ZX81 16K in part payment. Telephone Leyland 32964.

ATOM 13K RAM, 16K Rom, floating point, tool box, VIA £90 software including Chess, £175 ono. Telephone Stourport 5263.

LOTS OF new software, Acorn Soft for Acorn Atom, £250 worth, split or sell lot for £110. Tel: 01-578 6186.

BBC MICRO MODEL A, 32K joysticks, VIA chip, software and magazines, £295. Tel: 0834 811094.

ACORN ATOM 12K Ram, 12K Rom (including floating point, power supply unit, all leads, cassettes, recommended cassette deck), plus leads and books, £295 ono. Canford Cliff 0202 709502.

ACORN ATOM 12K Rom/Ram V.I.A. + £100 of software, £140. Tel: 061-681 2875 evenings.

ATOM, 12K Ram, 12K Rom, Acorn-built floating point Rom, P.S.U., 13 programs + others. Manuals, leads, etc, £175 ono. Tel: 01-366 5777 (evenings).

Commodores for sale

VIC20 + 16K. As new, boxed + 7-month guarantee + super expander program aid + cassette unit + software + Introduction to Basic Part 1, £380 ono. Tel: 01-888 6910 after 5 pm.

VIC20 with 16K Ram database and games cassettes, six weeks old, £150. Tel: Coventry 0203 317789.

VIC20 + cassette unit and joystick, super expander cartridge + PacMan cartridge + cassettes + Intro to Basic Part 1, £200 ono. Tel: 01-600 0818 extension 268, Mr Young.

VIC20 with C2N cassette, 6 Rom cartridge and other software worth £200 + books + magazines £190. Tel: 01-995 6792.

VIC20 + C2N cassette deck, super expander, Omega Race, Rat Race cartridges + introduction to Basic Part I + joysticks £30 software, £200 ono. Tel: Orpington 23466.

PET Z001, 8K. Good condition + keyboard + screen + cassette, £200 ono. Tel: Hitchin 31829, Mr Bailey, 88 Swanstand, Jackmans Estate, Letchworth, Herts.

COMMODORE PET 2001, 8K, original Roms, integral cassette + lots of programs, including Micro Chess, £225. Tel: Brentwood 231490.

VIC20, six months old, £100. Tel: 01-743 3748.

VIC20 + cassette unit, five months old + joystick, Vic Revealed + software, £140 ono. Tel: Northampton 714886.

VIC20 + cassette unit, 3-slot 8K Motherboard + 3K super expander + VIC 4th + cartridges , software and books + joysticks. Offers over £250. Tel: 0383 734731.

VIC20, cassette recorder, 3K super expander cartridge, Pacman cartridge, lots of cassette software including Minad, Alian, Berserk, Galaxians, Asteroids, £225. No offers. 866 5135 evenings.

VIC20 + cassette unit and high res cartridge +cassettes and magazines, £150. Tel: Oxford 50435 (evenings/weekends).

VIC20 CASSETTE UNIT, 16K Ram, joystick, program ref guide + software, 3 months old, £230. Tel: 01-592 7887 after 6 pm.

VIC20 + cassette unit and joystick. PacMan, Adventure Land cartridges + other cassettes, £200. Tel: 061-794 6826.

VIC20, cassette deck, super expander, 16K Ram, joystick, program reference manual, £80 of software, £290 ono or separate. Tel: 01-467 5242 (evenings).

For sale

ORIC 48K. Brand new, £170 or swap for 16K Spectrum + £60 ono. Tel: 01-405 6911 (before 4 pm), extension 321, Craig Pickering.

ATARI 400, 32k Ram + sound + graphics, £275 new + £130 of necessary peripherals, important demos. £125 of games, one year old, £290. Tel: Winchester 883736.

MICROFAN 65K TANNEX, lower case, graphics, Ascii keyboard, 19in. WAC case, £150. Litchfield (05432) 52824 evenings.

DRAGON 32: £45 of software, £180 ono. T. Forrest. Tel: Stafford 56107.

UK 101. 8K Ram, Segmon printer interface £125; 610 expansion board, 24K Ram, disc interface £125; 10 amp PSU 5 volt + 12 £20. Mr Alderton. Tel: Sheffield 20571.

TRS 80, Model I Level II + Tandy cassettes + software (lots). Newly serviced £240. Tel: 01-891 2761.

TRS 80, Model I Level II, 16K with VDU, cassette recorder, software £150. Tel: Brixham 7988.

DRAGON 32 + joysticks, nearly new £170. Tel: 051-922 1745

ZX PRINTER, perfect condition, guarantee, + 3 extra paper rolls £55. Tel: Swindon (090671) 2750.

BURROUGHS B8, + separate disc drive, offers to Mr Coggins. Telephone Barnsley 298531.

SEIKOSHA G.P.80 PRINTER, features include single, double, graphic printload, RS232 interface, selectable board/rate. Mint condition, including manual and leads, £150. Tel: Wigan 832678 after 5 pm.

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COMMODORE 40 40 DUAL DISC DRIVES, holds 174K per drive. Manual and leads. Many discs + programs, games, WP, etc., £450 (cost £680). Tel: 01-748 9064 evenings.

ARE YOU interested in Synthesiser, and/or CB radio? For exchange for any home computer — not Sinclair. Synthesiser two months old only. Tel: 01-853 0021.

MICROLINE 80 PRINTER and optional RS 232 interface + paper roll holder £170 ono. Super board III with segmond and software including Word Wizard word processor program £90. Tel: 0753 654431.

TUG SOFTWARE EDITOR ASSEMBLER, £12; Dive Bomber, £5. Tel: 0252 871731 after 6 pm.

COMPUKIT VIC101, 8K micro computer, £110. Tel. 021-421 4925.

GRUNDY NEWBRAIN A, unwanted gift, in mint condition, complete with manual, beginners' guide and tape, cost £241, will accept £210. Tel: Ryton 089422 5189, C. Dixon.

DRAGON 32, two months old. Swap for Spectrum or sell for £150. Tel: 01-654 8027 (evenings). Tel: 01-639 8616 (work), Mr Osborne.

FOUR APPLE II PLUS + disc drive, monitor, lots of software. Offers. Tel: 01-359 2465.

VIDEO GENIE, 16K, level II basic, cursor control keys + integral cassette recorder + level meter + software, manuals and mags, including Microsoft edit./assembler + 911, green screen monitor, £250. Tel: 021-745 5684.

SHARP PC1211, printer and manuals, £80 ono. Tel: 01-668 8541.

Wanted

WANTED VIC 1515 PRINTER or similar. Tel: 0603 409966 anytime.

WANTED. XZ81 (prefer 16K). Good working order, with instruction manual. Tel: 066 475-358 (Leicester).

WANTED ZX SPECTRUM 48K. Will pay £150 ono. Tel: Frome (0373) 64197 (6 pm-9 pm).

WANTED COMMODORE PRINTER cash. Tel: 992 8249.

WANTED ZX81, 16K RAM, leads, manuals etc + software £50. Tel: Coventry 0203 403799. Mr Brown after 6 pm.

VIC20 COMPUTING MAGAZINES WANTED. Volume 1. Tel: 0902-892911.

WANTED. 16K Ram pack for Vic20, and price. Paul Irven. Tel: 01-890 9853.

WANTED. Sinclair ZX Printer, about £30 to £40. Tel: 0691 830072.

WANTED: Sharp 7280K, 48K. Cash waiting. Tel: Wigan (0942) 38988.

TANK ATAK or Spiders of Mars, cartridge for Vic20. Tel: 0438 811634 after 6 pm.

PR SPECTRUMK JOYSTICK. Less than £20. Does not need mother board. Tel: 061-998 5763.

POPULAR COMPUTING WEEKLY, 29 July, issue 15, wanted, £1 offered. Telephone 01-607 1602.

BBC MODEL B, Essex area preferred. (0702) 346003.

WANTED: VIC Super Expander, around £25. Phone 01-840 3610 (evenings).

WANTED. Acorn Atom, under £100. Tel: 01-874 2585.

ZX81, 16K Ram with tapes etc. Tel: 861 956 (Wigan).

WANTED — BBC Model A. Tel: St Albans 62465 after 6 pm.

WANTED RAT RACE CART. Offers. Advenger or any others. Tel: Chesham 786573.

WANTED Monitol to fit ZX Spectrum. Tel: Durham 43362.

WANTED Commodor 8000 Series, micro, disc unit +printer. Tel: 0325 60543.

WANTED: Sinclair printer, £35. S. Bradshaw. Tel: Rainford 3767.

WANTED: ZX81 16K Ram, £45. Tel: 01-764 4640 (after 5 pm).

VIC20 16K RP in exchange for 8K RP and programmers aid cartridge or machine code monitor. Tel: Peter on 01-942 0808.

WANTED. Colour monitor to fit ZX Spectrum. Price negotiable. Tel: Durham 43362.

WANTED. Sinclair Printer. Must be in good condition. Tel: Winchester 62198.

WANTED APPLE II EURO PLUS, with manuals. Tel: 0604 720106 (after 6 pm).

WANTED. MZ80K games to swap + exchange. Tel: 0532 496595.

WANTED. ZX81 8K. Will pay £40. Tel: 01-764 4640.

FOR VIC 20. Super expander, machine code monitor + programs aid cartridge. Tel: 051-546 0675, Stewart.

ZX81 REQUIRED. Second-hand. Several wanted. Tel: (0283) 35170.

48K SPECTRUM WANTED for exchange Acorn Atom, expanded to 12K Rom + 12K Ram and floating point expansion and power supply and all leads etc, £100 programs. Tel: 01-789 4260.

WANTED ZX81, 16K + software, approximately £45 or swap for reflectorgraph Pro reel to reel tape recorder. (Cambridge area only). Tel: Barkway 779.

WANTED. BBC Model B, guaranteed and boxed, willing to pay £240. Mr C. Nwandsike, 19 Derrycombe House, Fifth Floor, Brunel Estate, London W2.

WANTED: 16K Sinclair Ram pack, £10. Tel: Calne (0249) 812038 after 5 pm. (Wiltshire).

WANTED: Atari 800 32K or 48K. Must be in good condition. Tel: 01-571 1309 (Kilkey) after 7 pm.

SUPER EXPANDER for Vic20 in exchange for the Court Cart. Tel: Flint 61897 evenings.

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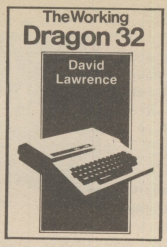
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The Working Spectrum

(228 page book)
The first well-documented collection of serious programs for the ZX Spectrum. Programs include a Basic Renumber which can handle Gotos and Gosubs, a character dictionary, a file-handler, several utility programs and a few games. Each program is built up out of re-usable subroutines.

£5.95*



The Working Dragon 32

This is a companion volume to The Working Spectrum and includes several new features such as a Text Editor and a Music Composer and Editor. Other programs help you use the Dragon 32 as an accountant, for more advanced high resolution graphics, as a home tutor for education and for playing games. Each of the programs and subroutines is explained line by line to help develop your own programming skills.

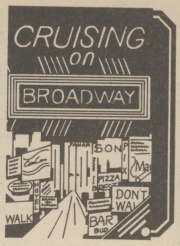
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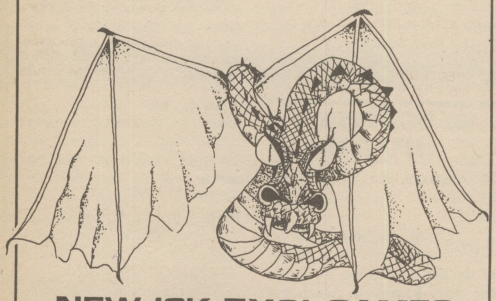
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PROBLEM MAY BE IN OVERHEATING

D Holmes of Old Lane, Golcar, Huddersfield, West Yorkshire writes:

Q I have a Sinclair Spectrum and two major problems. The first is that I cannot get colour on my Hitachi television, and even when I do get it on another television, it is usually slightly blurred. Is it the television, or the PAL unit that is wrong?

Secondly, when using my television on a black and white set, after about twenty lines the display goes from a dark grey background to a light grey background, and is sometimes hardly legible. Can you help me with these two problems please?

A There have been problems with the Spectrum colour display. Some televisions sold on the British market are slightly out of phase. This does not matter with a normal television reception, but a computer is more fussy. On the first issue, of Spectrum PCBs, there is a small hole in the bottom that gives access to a tiny screw. Careful adjusting of this with a non metallic object should improve the situation. On the second issue, of PCBs, there is no external access, which means taking the top off your Spectrum. The screw is slightly left of centre.

In your case, however, I think that the problem is something else, because of the second point you raise. This is more akin to problems that develop because of overheating. Do you find that your program corrupts after your computer has been left on for a while? Either this or it simply *News* itself from time to time. If either of these things happens then you will have to return your Spectrum.

YES, AND HERE IS ITS ADDRESS

David Cox of Huntigfield, Egham, Surrey, writes:

Q I have seen a company called Ground Attack, which had a Ram pack reviewed for the ZX81. I cannot find an address for Ground Attack. Can you help?

A Yes, here it is.

Ground Attack.
Alfreda Avenue,
Hullbridge,
ESSEX.

If you write to them I am sure they will be happy to send you details of what you want.

MEMORY IS SPLIT INTO AREAS

Paul Chisholm of West Bromwich, Birmingham, writes:

Q Can you explain memory mapping to me? I have seen it mentioned several times in computer magazines, and know it is to do with what a computer stores in its addresses. But I do not know whether the memory map for a Vic20 with 16K is the same as say a Spectrum with 16K, or does the Spectrum have the same memory map as a 48K Spectrum?

A A memory map is the order in which the computer stores all the things that go to make up its memory. With most home computers, including the Vic and the Spectrum, this is an area of 65,535 addresses (64K). More addresses can be added, but they could not all be used at once. The memory is divided into areas, some for use by the Rom and the rest by the Ram.

A Z80 chip, as on the Spectrum, will always take up the first 16K of space, even if it is not all used (the ZX81 uses only 8K of Rom). The Vic and similar 6502-based computers use the very top 16K of memory.

Even if a computer can potentially use 64K, only some of that may be taken up. Thus an unexpanded Spectrum will use 16K of space for Rom, and 16K of the space for Ram, and the rest is unused. All computers use some of the Ram for the screen and the systems variables. This is 1.5K on a Vic, and about 7K on a Spectrum. So a 16K Spectrum will have 9K user Ram available, and a 48K, 41K user Ram.

Each area, Rom, systems variable and user Ram takes up a specific part of the memory. Things such as a calculator stack, *Gosub* stack and variables also have an allocated position. These are always stored in the same order, but the actual addresses that they occupy will change as the program gets larger. The order of these in the Spectrum is given on page 165. It is a pity that not all manuals give a memory map to help the user.

A computer will always have its own unique memory map. The main changes are usually to do with how far into the possible Ram memory the on-board Ram extends.

EASY GOING FOR FASTER GAMES

Jane Spencer of Highfields, Durham, writes:

Q I have a BBC Model B and am learning quite well. However, I have tried to write some games programs but would like them to be faster. Is there a compiler available for the BBC B and if so, how much is it and where can I get it?

A Yes, there is a compiler written by Jeremy Ruston. It comes complete with a listing as well as a cassette. It is available from Interface, 44-46 Earls Court Road, London W8 6EJ for £34.95.

NO INDEPENDENT LITERATURE

D Holyoake of Upper Elmers End Road, Beckenham, Kent, writes:

Q Could you please tell me whether there is a manual or any literature available for the Research Machines 380Z, as these are the computers used in my O-level studies course.

A I have not been able to find any independent literature on the 380Z. Neither Foyles nor Georges had anything that I could find. It must be pointed out that as the 380 is used solely as an education machine, so it does not have the normal back-up associated with machines commonly found in the home market sector.

The only thing you can do is get in touch with Research Machines yourself and ask them. They do a range of manuals which they can supply you with, for between £3 and £6. All you need to do is contact their sales department and tell them what you want. You will probably find them quite hard going, as they are written for teachers who already have a good knowledge of computing, and are not 'user friendly'. Research Machines is at P.O. Box 75, Mill Street, Oxford (phone 0865 249791).

WHETHER OR NOT TO BUY

Thomas Van Dahl of Park Lane Rise, North London, writes:

Q I have a Vic20 and I am quite happy with it. I am considering buying a light pen for it, but I am not sure how it works or if one is worth buying. I have not seen many programs for them.

A A light pen works by using a photo-resistor. This has an emitter and a collector. A window in the photo-transistor collects the light as it passes between the emitter and collector. This changes the resistance. A high value will be returned for a dark or black area, and a low value will be returned for a white or light colour. This is how a bar code is read. The duration of the value returned will, of course, give you the thickness of the line.

Whether or not you should buy one is up to you. I think that at the moment you might find it better to wait until more programs are available. On the other hand you might regard it as a challenge to write your own.

Is there anything about your computer you don't understand, and which everyone else seems to take for granted? Whatever your problem *Peek* it to Ian Beardsmore and every week he will *Poke* back as many answers as he can. The address is *Peek & Poke, PCW,* Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

Ziggurat



Falling off a log

Working out the extent to which a population growing at a rate of 1.495 will have grown after a certain number of years, using a computer, is not difficult. It is, however, a waste.

As I have noted, the growth of population at a constant rate is called *exponential* growth. This means that although the *rate* of increase is the same, the actual *absolute* differences are ever increasing. For example, at a constant rate of inflation of 10 percent (a rate of growth of 1.10), in one year £100 will have become £110 (an absolute difference of £10). And in two years the amount will be £121 (a further increase of £11).

The less wasteful way of dealing with such growth takes a hint from the term "exponential" and uses logarithms. Different computers use different ways of expressing logarithms, some call them Log, others Ln, and there are other variants. In instant mode (or in a program) enter:

```
X=LOG(1.495): Z=19*X: T=EXP(Z): PRINT T
```

to which the output from the *Print* is 2080.57. If you check this against the result of successive multiplications of 1.495, then you will find that the two numbers are in agreement.

Try entering:

```
X=LOG(5): Y=LOG(6): Z=X+Y:T=EXP(Z)
```

and then investigate the values of *X*, *Y*, *Z* and *T*, by use of *Print*. *X* is 1.6094, *Y* is 1.7918, *Z* is 3.4012 and *T* is 30.0000. What we have is the multiplication of the numbers 5 and 6 by use of logarithms (*Exp* corresponds to what is called the antilogarithm in school mathematics).

If you enter *Print T−30* (on the computer I am using) the answer is −2.9802E−8, so that *T* must actually be about 29.99999997. As my machine only prints out 9 significant digits (and the value 29.99999997 has 10 digits) it rounds to 30.

To use logarithms, therefore, is to incorporate some slight inaccuracy, but the advantage of the method is that it is shorter.

The slight inaccuracy in the logarithm function (and there has to be an inaccuracy in some cases) is reflected in another provided function in most versions of Basic.

The function is the "power" function usually written as ** or ↑, where, if *N* is the number and *P* is the power, *N***P* is the equivalent of N^P, or *N***N** . . . **N* where there are *P* terms in the expansion.

If we enter:

```
A=2*X: B=EXP(A): PRINT B
```

then we find that *B* is 25, that is, 5*5. In the above line *X* is the number, and 2 is the power. When the Basic translator in the computer meets *N**P it works out *EXP(P*LOG(M))* — which is why *P* may not turn out to be a whole number. (What is *N* times *N*, 2.5 times?)

To investigate the degree of inaccuracy in calculating powers try something like:

```
1000 FOR I=1 TO 30: PRINT I*I−I**2: NEXT I
```

and you will find that sometimes it is exact and sometimes it is not. This inexactitude comes about in two ways — the conversion to the logarithm is not exact and numbers are not usually held exactly by the computer.

You may have heard that certain micro-computers have 9 to 10 digit accuracy, and that others have an accuracy of about 7 digits (most calculators seem to have 8 to 10 digits accuracy). How is it possible to work this out? If a computer stores the number part (rather than the relative size/exponent part) in 32 bits (ZX81, Pet, Apple II, etc) then the largest whole number it can store is about 2^{32}. We have to find what that number is, and then how many digits there are in that number.

The number is given by *EXP(32*LOG(2))*. To find how many digits that is, we calculate *32*LOG(2)$LOG(10)* which is 9.636. ■

Boris Allan

Puzzle

Pricing the blues

Puzzle No. 43

Once, in his early years, Picasso popped down to his local art supplies emporium to replenish his stock of painting materials. He was particularly short of blue paint. Crayons were 50F, brushes were 700F and the tubes of blue paint were 300F.

He returned with 100 items, having spent 10,000F. If he bought at least one brush, crayon and tube of paint, how many of each did he buy?

Solution to Puzzle No 38

The lowest palindromic perfect square with an even number of digits is: 698896 (836^2).

The program generates successive squares and the sub-routine checks to see if the square is palindromic. Lines 10, 20, 100, and 110 ensure that only squares with an even number of digits are considered.

```
 10 LET L = 10
 20 LET U = 10
 30 FOR N = INT (SQR L) + 1 TO U − 1
 40 LET S = N*N
 50 LET S$ = STR$ S
 60 GOSUB 200
 70 IF T <> 0 THEN GOTO 90
 80 PRINT N,S
 85 STOP
 90 NEXT N
100 LET L = L*100
110 LET U = U*10
120 GOTO 30

200  Rem palindromic check
210 LET T = 0
220 FOR P = 1 TO LEN S$/2
230 IF S$(P) <> S$(LEN S$ − P+ 1) THEN LET T =
    T + 1
240 NEXT P
250 RETURN
```

Winner of Puzzle No 38

The winner is: P M Devereau, Worley Road, St Albans, Herts, who receives £10.

Top 10

Atari

1(2)	Air Strike	(English Software)
2(7)	Rear Guard	(Adventure International)
3(4)	Astro Chase	(First Star)‡
4(–)	Star Raiders	(Atari)*
5(–)	Preppie	(Adventure International)
6(6)	Soccer	(Thorn EMI)*
7(–)	Centipede	(Atari)*
8(–)	Lunar Lander	(Adventure International)†
9(–)	Computer Chess	(Atari)
10(8)	Chop Lifter	(Broderbund)¶

*Cartridge. †24K cassette. ‡32K cassette. ¶48K disc.
(Figures compiled by Calisto Computers, Birmingham 021-632 6458)

Spectrum

1(1)	The Hobbit	(Melbourne House)*
2(3)	Penetrator	(Melbourne House)*
3(4)	Flight Simulation	(Psion)
4(2)	Time Gate	(Quicksilva)*
5(6)	Football Manager	(Addictive Games)*
6(–)	VU-3D	(Psion)*
7(7)	Arcadia	(Imagine)
8(9)	Hungry Horace	(Psion/Melbourne House)
9(8)	3D Tanx	(DK 'Tronics)
10(–)	Centipede	(DK 'Tronics)

*Requires 48K.
(Figures compiled by Buffer Micro Shop, London 01-769 2887)

ZX81*

1(3)	King Kong	(Tony Barber)
2(2)	Flight Simulation	(Psion)
3(1)	3D Defender	(JK Greye)
4(4)	Gulp II	(Campbell Systems)
5(8)	Football Manager	(Addictive Games)
6(9)	Centipede	(Llamasoft)
7(7)	Gauntlet	(Colourmatic)
8(6)	Adventure 1	(Abbersoft)
9(10)	ZXAS	(Bug-Byte)
10(5)	Sea War	(Panda)

*All 16K.
(Figures compiled by Buffer Micro Shop, London 01-769 2887)

Vic20

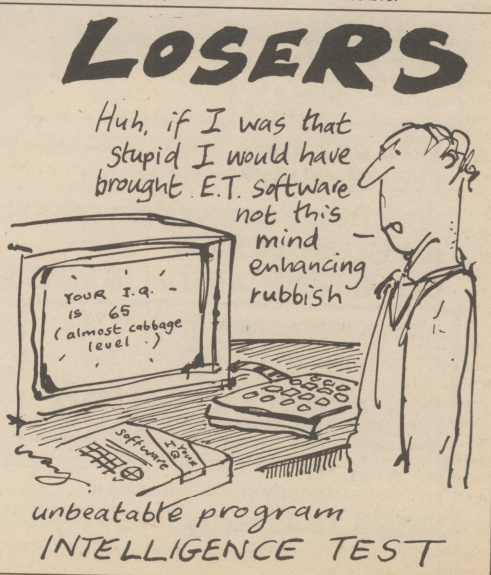
1(1)	Andes Attack	(Llamasoft)†
2(5)	Gorf	(Commodore)*
3(9)	Myriad	(Rabbit)
4(8)	Martian Raider	(Romik)
5(7)	Grid Runner	(Llamasoft)
6(3)	Frog	(Interceptor Software)
7(10)	Moons of Jupiter	(Romik)
8(6)	Scramble	(Rabbit)
9(2)	Abductor	(Llamasoft)
10(4)	Alien Attack	(Interceptor Software)

*Cartridge. †Requires 8K or 16K.
(Figures compiled by the Vic Centre, London 01-992 9904)

Books

1(3)	Assembly Language Programming for the BBC Micro, *Birnbaum*	(Macmillan)
2(2)	Spectrum Machine Language for the Absolute Beginner, *Tang*	(Melbourne House)
3(1)	Creative Graphics on the BBC Microcomputer, *Cownie*	(Acornsoft)
4(5)	Basic Programming on the BBC Micro, *Cryer*	(Prentice Hall)
5(4)	Programming the 6502, *Zaks*	(Sybex)
6(–)	Understanding Your Spectrum, *Logan*	(Melbourne House)
7(–)	Z80 Assembly Language Programming, *Leventhal*	(Osborne)
9(–)	Programming the 6809, *Zaks*	(Sybex)
9(8)	Graphs and Charts on the BBC Micro, *Harding*	(Acornsoft)
10(10)	Forth Programming, *Scanlon*	(Sams)

(Figures compiled by Watford Technical Books, Watford 0923 23324)
(Last week's position in brackets)



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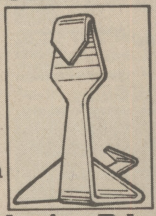
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