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Personal Computing Today

MAY 1983
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Software is an all-important part of your computer and we want to make sure we give you the sort of programs you want to use with the machine you own.

And to do that we have to rely on you to a large extent. People have been religiously sending *Personal Computing Today* their programming creations for all manner of machines and every conceivable type of program. But that's not enough. We're not being greedy but we want more!

What we need are quality programs for all the popular micro computers which you own, or have access to. By that we mean the Spectrum, BBC, VIC-20, TI99/4a, Atom and Tandy TRS-80. Software coming in for those computers does so regularly and is often to a high standard.

But in past months more computers have seen the light of day and it is those that we would like to see software for. So if you own a Dragon 32, an Oric 1 or a Commodore 64 or any other new machine, and have tried your hand at writing programs for it why not share your experience with your fellow readers. Virtually anything goes from practical programs to use in the home, educational ones to keep the kids seriously occupied, to the zap-pow-wam fast action space games.

If you want to see your program in *Personal Computing Today* it would help us, and ultimately you to send it to us in the format in which it is published. That means with an introductory text explaining what your program's about and how you came to write it, How it Runs, Hints on Conversion, a clearly produced and unmarked computer print out (whenever possible) and most important of all a tape containing your program. We need that to be able to quickly test programs and find out whether or not they are suitable for publication.

A tape is also important for obtaining a good print out just in case you have been unable to supply one or we don't feel the quality is good enough. It also helps us if you submit your work in typewritten form, not handwritten. Sometimes it takes ages to decipher handwriting and that way mistakes creep in, although we do our best to keep them out.

Turn to one of the programs in this issue to see the way in which our programs are published and to get an idea of the sort of facts to include in them.

And if you do decide to submit your work for possible publication in *Personal Computing Today* send it to the editor, *Personal Computing Today*, 145 Charing Cross Road, London WC2H 00E and mark clearly on the envelope 'Program Submission'.

Any improvements to programs already published in PCT which you think would be helpful to other readers are only too welcome. We'll try and find space to pass on your hints and tips.

Enjoy reading our May issue of *Personal Computing Today* and see you all month.

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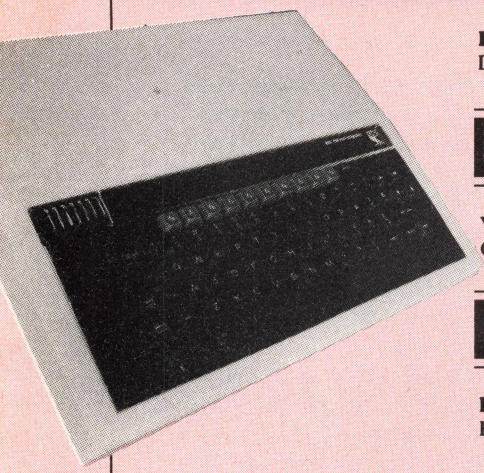

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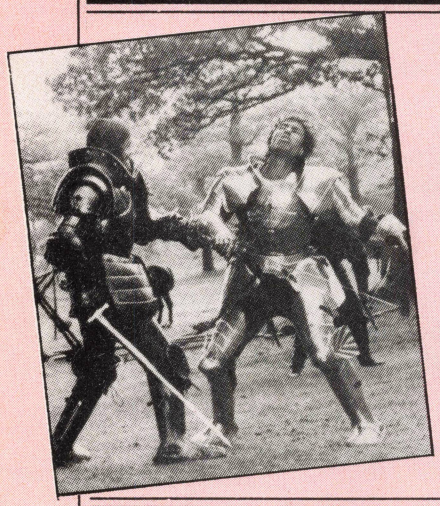

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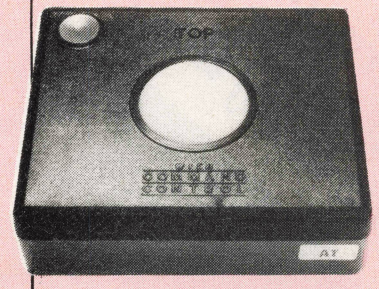

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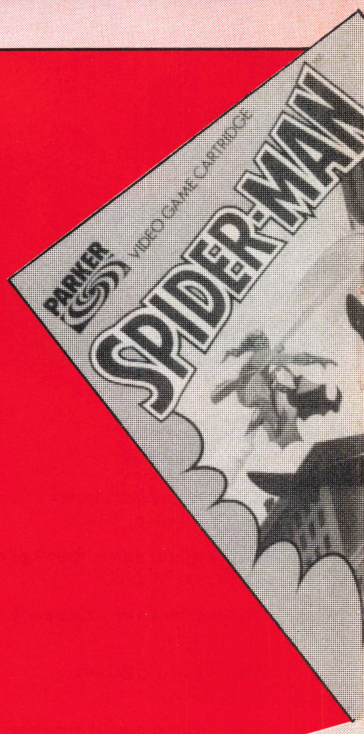



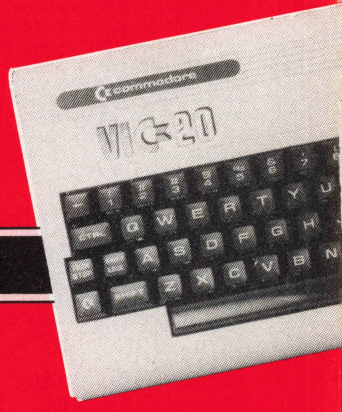

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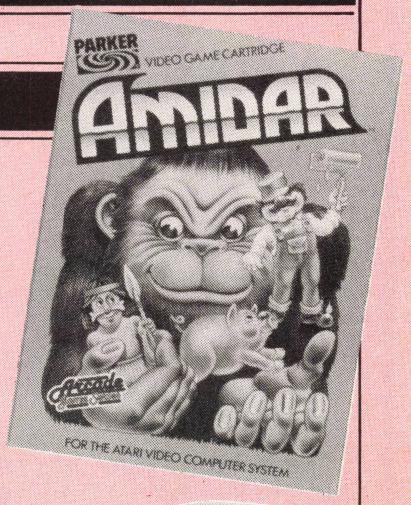



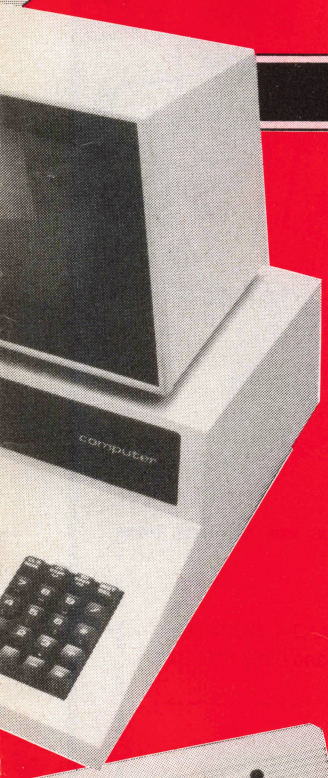

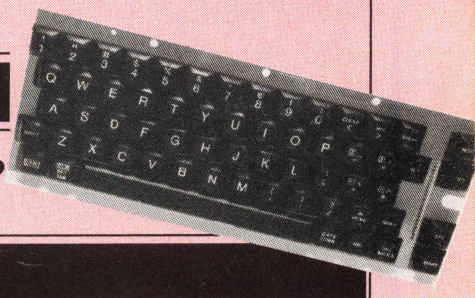



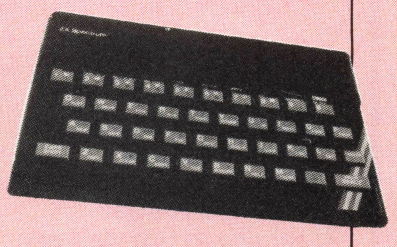

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"Learning to Use" is a new series of books which introduces newcomers to the most widely used micros in the marketplace.

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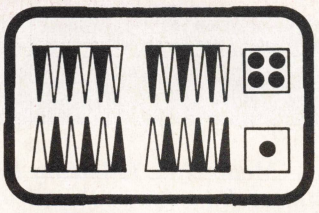

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NEWS

Mutilating Mutants

Fancy defending a vitally important power station from hoards of mutants? If so grab the controls of this intriguing game just released by Thorn EMI.

Available for the VIC-20 this game is one of the firm's range of Home Computer Software. The object of the game is to fend off the mutant herds invasion. You must keep the mutants at bay while you guide a specially developed weapon, the mutant slayer, into their underground burrows. That's the only way to get rid of the rascals.

In order to stop the mutant herd growing you have to lay a trap inside the burrows. You must lay explosive charges on the mutant queen and her eggs and set light to them before you are eaten by the mutants.

It was written by one of Thorn EMI Video Programmes' own programmers and is a game requiring skill and a lot of patience. Mutant Herd costs £00.00 and is available through Thorn EMIs retail distributors.

Further games are due out from Thorn EMI including a fast space action game entitled Fourth Encounter and Orc Attack in which you have to defend a castle from an attack by the Orc armies Watch PCT for more news of the games and read our software reviews pages for in-depth studies of programs.

If you are selling software and would like it to be reviewed by PCT's team of reviewers don't hesitate to send us a tape/disc and full instructions for us to do so.

Atari is backing up its VCS market with a super new advanced game playing system.

Called the Atari 5200 it will be on sale in the UK during the summer. The centre comes with 16K memory which means that the games software will resemble the original arcade versions much more closely.

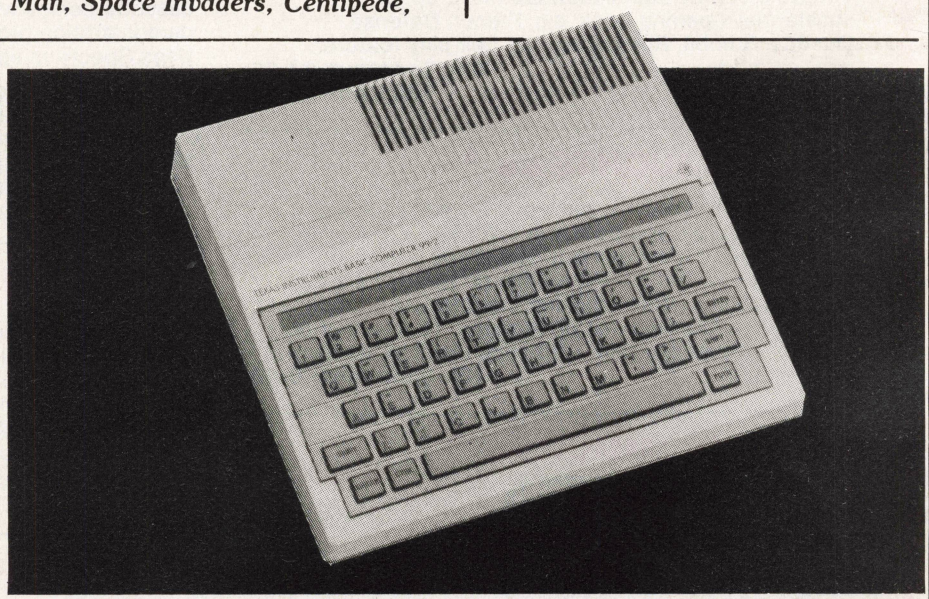
Thirteen cartridges for the 5200 system will be available when the machine is launched. Included in the list are classics like Pac-Man, Space Invaders, Centipede, Missile Command, Star Raiders and Galaxian.

Coming with the 5200 is a brand new type of joystick. There is also a new keypad with 12 buttons, a start and reset and pause buttons. According to Atari this type of controller gives greater accuracy and manoeuvrability and has the advantage of stopping a game to pause during play.

Later in the year Atari is planning to bring out yet another type of games controller in the form of the Trak-Ball, as well as a special converter which will enable you to play 2600 cartridges on the 5200 VCS system.

Plans are also afoot for an independent firm to supply a keyboard for the Atari VCS which will convert it into a computer. But details of this are currently very sketch. Atari itself is bringing out a new computer later in the year which is aimed at the small businessman. Turn to our special feature in this issue for the low down on the brightest and best VCS games.

New TI Computer



Not content with one home computer on the market Texas Instruments has just launched another.

The TI-99/2 is a £75 computer aimed at beginners. The idea behind the computer is to enable computer novices to learn to program in TI Basic and Basic supported assembly language. Texas anticipates their new computer will be bought as a first computer in the home and help in computer literacy. A spokesman for the firm said Texas sees it as also being like a second television in the home. That is, people will buy it as a learning tool to complement their first computer.

This 16 bit machine is reported to be an extremely fast computer. According to TI's general manager of the consumer division, Mike Lunch, the TI99/2 is 30 times faster than the ZX81 and seven times faster than the TI99/4A.

Unfortunately, there is no colour facility for the 99/2. Mike Lunch said: 'Putting colour on it would have raised the price considerably. We decided that the market that it is aimed at colour is not critical. It's more important to have all the other computing bits, like peripherals.'

Texas plans to have European versions of the 99/2 on sale some time between July and September. It will be on sale in America at the end of March. Texas is aiming the 99/2 at the ZX81/Spectrum market and say it is specifically for people who are interested in learning to program rather than for those who want an entertainment based home computer.

Software for the new computer is a fairly complicated business. The 99/4A plug-in cartridge software will not run on the 99/2. The cassette based software will run on the 99/2 and cassette based software currently being written for the 99/2 will be compatible with the 99/4A.

Meanwhile following the successful sales of the 99/4A during the special £50 cash-back offer which ended in January Texas has dropped the price to £150 and it is now selling for £149.95 in most retail outlets. Lunch said that sales increased by 10 times during the offer period demonstrating that the price cut was needed. During that time stocks of the machine had sold out completely by the end of November.

For further details on the new Texas machine contact the firm at Manton Lane, Bedford MK41 7PA or telephone 0234 67466.

Virgin Goes Into Games



Richard Branson the brains behind Virgin Records is turning his hand to video games.

Realising there is money to be made from computer games Branson has set up a new firm named Virgin Games. The new venture will concentrate its efforts on producing 'programs with a difference' for computers including the Atari, BBC, VIC-20, Commodore 64, Dragon, Oric 1, Spectrum and TI99/4A. The first of the games should be on sale in Virgin record stores and other retailers by June.

In charge of Virgin Games is Nick Alexander. He has substantial experience in the computer software market having worked for Thorn EMI where he was responsible for launching the firm's Home Computer software range in Britain and America.

Alexander is in the throes of finding good programmers and original games ideas. Why not get in touch with him if you think your creative flair could be put to good use?

He said of the firm's aims: 'We intend to build a Company that will not just chase the games market but will innovate and help the UK to take a new leading role in computer software as it once did in other entertainment software industries like music, films and books, fending off another American challenge.'

Virgin's marketing tactic will be 'aggressive' and 'professional' in an attempt to expand the industry's growth from the mail order columns into the High street. Nick Alexander can be reached at Virgin Games, on 01-221 7535 at 61/63 Portobello Road, London W11.

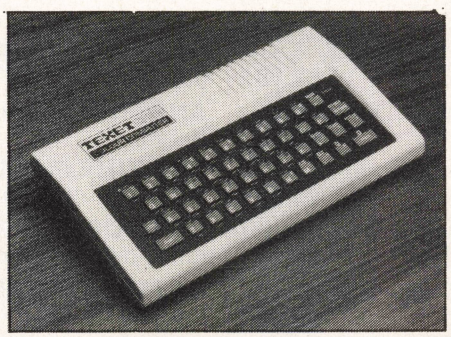
New £98 Colour Computer

A little-known firm Texet is the latest to jump on the under £100 colour computer bandwagon.

The company which began life in the calculator field has just taken its firt steps into the lusher pastures of the computer industry, with the TX8000. Retailing at £98 this Hong Kong developed computer features full colour graphics (eight colours in all) and 8K RAM as standard.

It has been on sale since the end of March and the firm hopes the computer will make inroads into sales of the Sinclair ZX Spectrum. A spokeswoman for Texet described the TX8000 as 'very similar to the Spectrum'. It has a rubber keyboard with 45 automatic repeat keys, 16 pre-defined single character graphics keys, single keyword or standard typing entry. The programming language used on the TX8000 is Microsoft Basic, the industry standard.

Expansion is catered for with a £52 board allowing up to 64K memory to be used. You can either plug the computer into a television or a monitor and it has a standard interface for a cassette recorder.



Plans are afoot to bring out a range of compatible firmware in the shape of a couple of joysticks, a printer interface and printer (selling at £129), light pens, cassette recorders and monitors.

To coincide with the launch of the TX8000 Texet has a range of software to run on the machine.

These programs will be aimed at the home user and consist of 30 odd games, educational programs and software in the home finance vein. The software has been written partly in the Far East and partly by British programmers. The TX8000 was developed in Hong Kong by a firm called Video Technology and it is from them that Texet has acquired the sole agents rights for the UK.

Texet has an impressive list of retail chains on their distributor network including John Menzies, Debenhams, Asda, Makro, Fine Fare, House of Frazer, Lewis's and Woolworths. So look in those stores for the TX8000. Specialist computer retailers will also be on the distributor list to make sure there are as many outlets for this new machine as possible.

Watch the pages of PCT for a review of the TX8000.

Oric Software

Following hot on the heels of the Oric 1's production is a brand new firm specialising in the computer's support.

Kenema Associates is now working hard to bring out a range of products for the much-talked about Oric 1 computer. First off on the software side of things is a multipurpose personnel records file. Definately one for the business user. This program allows you to store vast amounts of information concerning personnel and product details. Kenema has named the price as £15. Another piece of software is the Oric 1 Keyboard Trainer which does exactly as the name suggests as well as a number of games programs, details of which are yet to be released. Kenema was unavailable for comment when PCT went to press.

Another spin-off from the Oric will be a range of books devoted to the computer and its quirks. The most outrageous of all is the Oric 1 American T-shirt. Yes, this can be yours, if you own an Oric 1 and want to broadcast the fact. Unfortunately, Kenema are keeping their design secret at present so you will have to wait with batied breath to see the latest in computer fashion.

Kenema can be contacted on 0934 21315.

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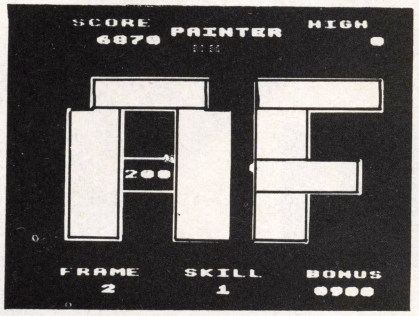

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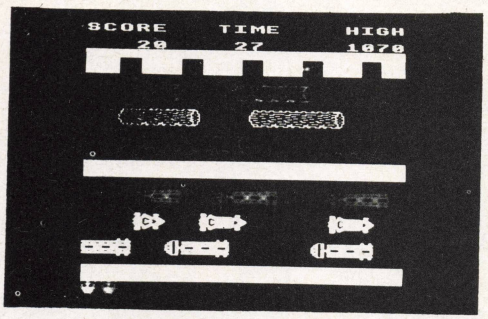

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Next month we'll tell you all there is to know about he latest computer games for a wide variety of computer from the ZX81 and Spectrum to the BBC, Dragon, VIC-20, Commodore 64 and TRS-80. All will be revealed in our six page special SOFTWARE REVIEWS feature. In PCT's usual style we will give you a price, machine and supplier details as well as a down to earth, realistic, honest and constructive review of each game with our Five Star ratings table for you to compare every piece of software.

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New Texet Computer On Test

Under scrutiny on the hardware side is the new TX8000 £98 colour computer, providing the manufacturer distributor Texet can supply the machine in time to meet our deadlines. So far it looks good but as everybody knows new computers have a habit of disappearing on the very day they have been promised to you. For more details of this low-cost computer read our News Update for the story. But, if all goes according to plan a review of this new, attractively priced computer will grace our pages.

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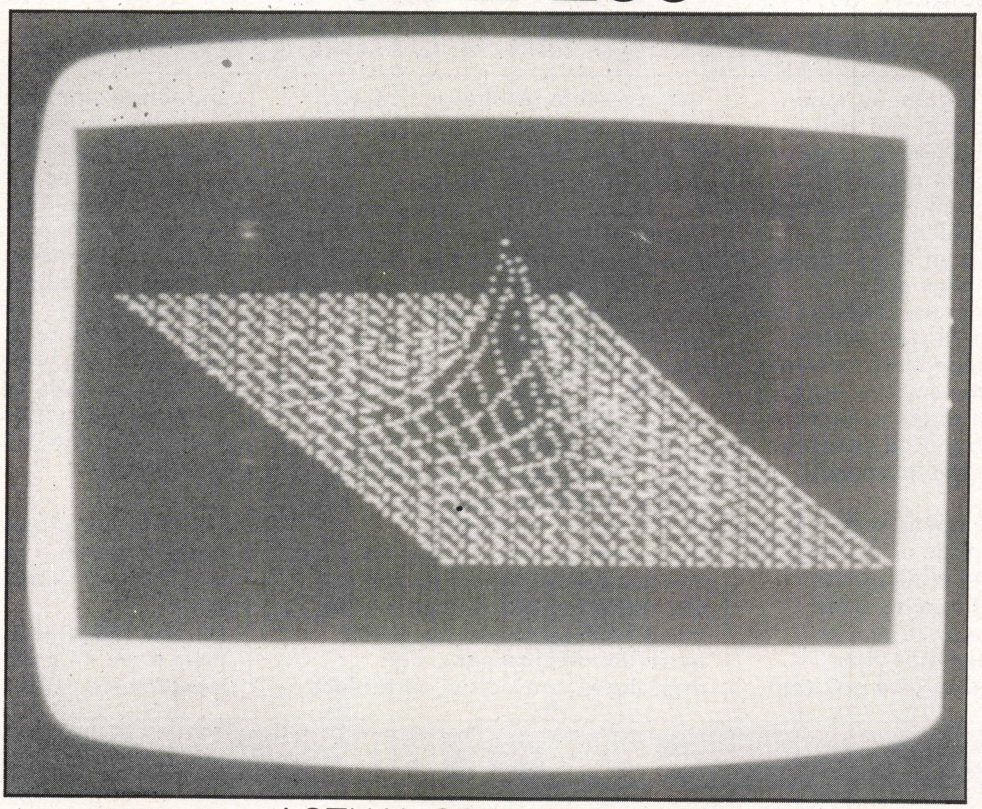

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BRAIN BOGGLER

Tone up your grey matter with this game of logic and strategy from Brian Hughes.

Brain Boggler is a game of logic and strategy based on the well known Mastermind board game. The original game is played on a board using coloured pegs to set up and crack a hidden code.

In this version for the Dragon 32, the coloured pegs are represented by coloured squares on the screen, which in turn acts as the board. Your opponent becomes the Dragon. At the start of each game it sets up a random code made up of the coloured squares and you have to systematically break this code.

The program opens with a little tune and a page of instructions telling which colours are available and how to input your guesses. It is wise at this point to make sure that your television is tuned to give you the best possible resolution of these colours, otherwise you might find it difficult to make out your own codes later on in the game.

When you have completed digesting this information then you can press the space bar to start the game. Having done this you will then be confronted with a blank screen onto which you can type your guesses.

The program accepts the initial letter of the colours as an input by way of an INKEY$ loop. With each guess the computer responds with a beep and then prints your chosen colour on the screen.

When you have input the four colours that make up your guess, the computer will compare your guess with its stored code and mark you accordingly. The marking is carried out with black and white squares.

A black square indicates that you have guessed the right colour in the right position, and a white square means that you have guessed a colour correctly, but have it in the wrong position.

You are allowed eight attempts at breaking the codes after which your ears will be assaulted by the Dragon's own victory melody and the elusive code will be revealed.

When playing the game you should remember two main points of strategy:

(1) That the program will quite happily set up a code where the same colour is used more than once.
(2) The black and white marking pegs have no positional significance at all.

HOW IT RUNS

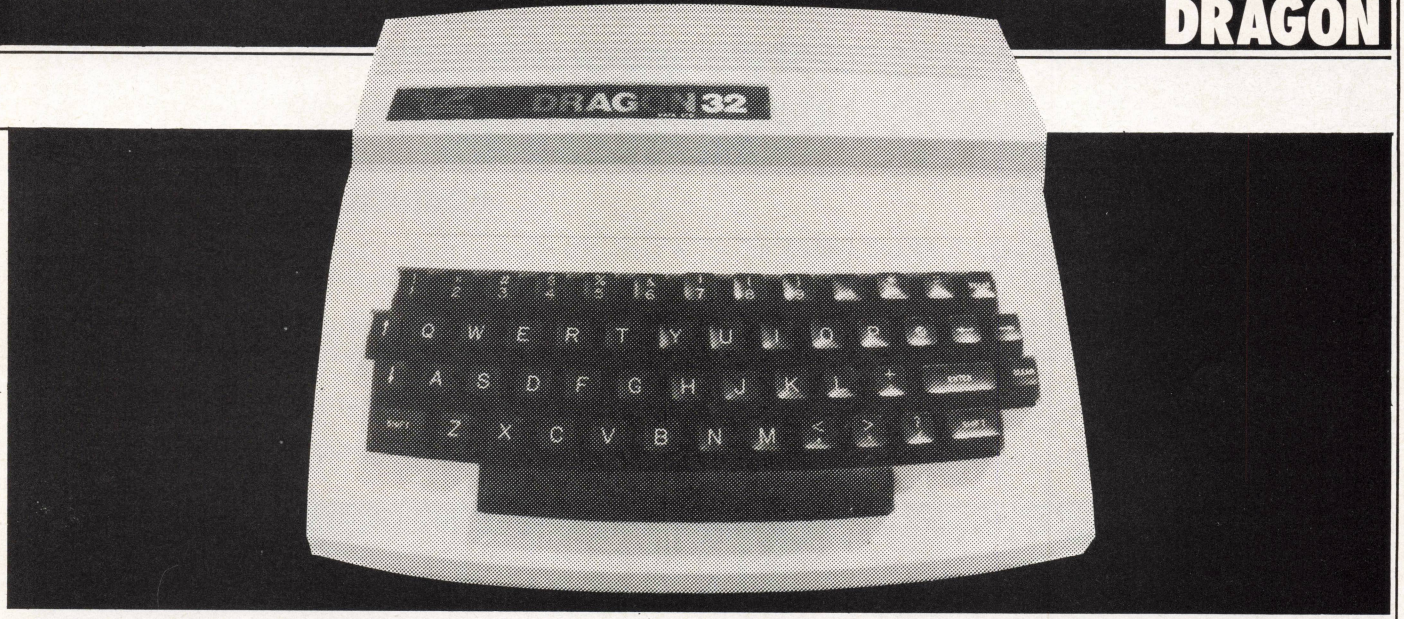
110-130	Sets up variables and stores new code in array C.
160-260	Accepts guesses and branches to routines 1000-7000 to print appropriate coloured squares on screen. Line 180 gives a bleep and line 170 branches to the marking routine after one line of four guesses has been input.
270-320	Checks for match between guesses input and the code stored in C.
330-370	Sorts array X so that all correct marks (black squares) print before partially correct marks (white squares).
390	Branches to win routine if answer is correct.
400-430	Prints out marks (black or white squares).
440	Branches to lose routine if end of screen has been reached.
460-470	Prints lose screen and plays tune.
480-560	Prints end screen and enquires whether another go is required.
800-830	Prints win screen and plays appropriate tune.
900	Prints title and block rectangle hiding code.
8000-8300	Updates marking array if match found.
9000-9760	Displays opening screen. Plays welcoming tune and awaits a key to continue.

HINTS ON CONVERSION

This program uses no special Dragon commands except the PLAY and SOUND functions. These could be easily removed from the program without affecting the overall logic.

The SOUND instruction in lines 180,410,420, simply emits a bleep to accompany the printing of a coloured square. The PLAY instruction in lines 460,820,9750 actually plays a tune; I have chosen "Colonel Bogey", "Congratulations" and "Here We Are Again".

Apart from these, if your BASIC supports the INKEY$ function and you can recalculate PRINT @ positions, bearing in mind that the Dragon has a 32 x 16 screen, then you should have no particular problems on conversion.



PROGRAM LISTING

```
100   DIM C(4),R(4),X(4):P = 0:F = 0
110   FOR I = 1 TO 4 STEP 1: C(I) = RND(8)
120   IF C(I) = 1 THEN C(I) = C(I) + RND(7)
130   NEXT I
140   GOSUB 9000
150   CLS
160   IF F = 4 THEN GOTO 270
170   A$ = INKEY$:IF A$ = "" THEN GOTO 170
180   SOUND 155,1
190   IF A$ = "Y" THEN GOSUB 1000
200   IF A$ = "B" THEN GOSUB 2000
210   IF A$ = "R" THEN GOSUB 3000
220   IF A$ = "W" THEN GOSUB 4000
230   IF A$ = "C" THEN GOSUB 5000
240   IF A$ = "M" THEN GOSUB 6000
250   IF A$ = "O" THEN GOSUB 7000
260   GOTO 160
270   P = P + 3:Z = 0:FOR I = 1 TO 4 STEP
      1:X(I) = 9:NEXT I
280   FOR I = 1 TO 4 STEP 1:Q = 0
290   FOR J = 1 TO 4 STEP 1
300   IF C(I) = R(J) THEN GOSUB 8000
310   NEXT J
320   NEXT I
330   IN = 0:FOR I = 1 TO 3 STEP 1
340   M = W + 1
350   IF X(I) > X(I + 1) THEN IN = 1:
      Y = X(I + 1):X(I + 1) = X(I):X(I) = Y
360   NEXT I
370   IF IN = 1 THEN GOTO 330
380   T = Q:FOR I = 1 TO 4 STEP 1:T = T + X(I):NEXT I
390   IF T = 4 THEN GOTO 800
400   FOR I = 1 TO 4 STEP 1
410   IF X(I) = 1 THEN PRINT @ P,CHR$(128): SOUND
      220,1
420   IF X(I) = 2 THEN PRINT @ P,CHR$(207): SOUND
      150,1
430   P = P + 4: NEXT I
440   IF P > = 448 THEN GOTO 460
450   P = P + 29: F = 0: GOTO 160
460   GOSUB 900:PLAY"T6L2CO1L2.AP4L4AB-
      O2CL2O3AAO2F"
470   PRINT @ 75,"bad luck"
480   PRINT @105,"the answer is"
490   FOR I = 0 TO 3 STEP 1
500   S = 143 + (C(I + 1) - 1) *16
510   PRINT @ 235 + (I *3),CHR$(128)
540   PRINT @ 450,"would you like another go?"
550   A$ = INKEY$:IF A$ = "" THEN GOTO 550
560   IF A$ = "Y" THEN RUN ELSE CLS:END
800   GOSUB 900
810   PRINT @ 73,"congratulations"
820   PLAY"T11L1GABO3L1.CO2L1G"
830   GOTO 480
900   CLS:PRINT @ 10,"brain boggler"
910   FOR I = 0 TO 11 STEP 1
920   PRINT @ 202 + I,CHR$(128)
930   PRINT @ 234 + I,CHR$(128)
940   PRINT @ 266 + I,CHR$(128)
950   NEXT I:RETURN
1000  PRINT @ P,CHR$(159):P = P + 4:F = F + 1:
      R(F) = 2:RETURN
2000  PRINT @ P,CHR$(175):P = P + 4:F = F + 1:
      R(F) = 3:RETURN
3000  PRINT @ P,CHR$(191):P = P + 4:F = F + 1:
      R(F) = 4:RETURN
4000  PRINT @,CHR$(207):P = P + 4:F = F + 1:
      R(F) = 5:RETURN
5000  PRINT @ P,CHR$(223):P = P + 4:F = F + 1:
      R(F) = 6:RETURN
6000  PRINT @ P,CHR$(239):P = P + 4:F = F + 1:R(F)
       = 7:RETURN
7000  PRINT @ P,CHR$(255):P = P + 4:F = F + 1:
      R(F) = 8:RETURN
8000  Z = Z + 1:Q = Q + 1
8100  IF Q > 1THEN Z = Z - 1:IF X(Z) = 1 THEN GOTO
      8300
8200  IF I = J THEN X(Z) = 1 ELSE X(Z) = 2
8300  RETURN
9000  GOSUB 900
9100  PRINT @ 34,"THERE ARE 4
      COLOURED SQUARES"
9200  PRINT @ 66,"HIDDEN BELOW"
9300  PRINT @ 98,"CAN YOU GUESS WHAT THEY
      ARE?"
9400  PRINT @ 130,"POSSIBLE COLOURS ARE:-
      RED,CYAN"
9500  PRINT @ 160,"BLUE, YELLOW,ORANGE,
      MAGENTA,WHITE"
9600  PRINT · 288,"TAKE A GUESS AT A COLOUR
      SIMPLY"
9700  PRINT @ 320,"BY PRESSING IT'S
      INITIAL LETTER"
9710  PRINT @ 359,"dragon's responses"
9720  PRINT @ 418,CHR$(207);" = RIGHT
      COLOUR;WRONG POSITION"
9730  PRINT @ 386, CHR$(128);" = RIGHT COLOUR
      AND POSITION"
9740  PRINT @ 450,"press the spacebar to start"
9750  PLAY"T2OL1.GL2EL1.DL2EO1L1...
      AP255O3L1.GL2EL1.DO2L2EO1L1..
      GP85O2L1.CDEDO1L2CBAL1.AL2B
      L1..C"
9760  IF INKEY$ = "" THEN GOTO 9760 ELSE RETURN
```

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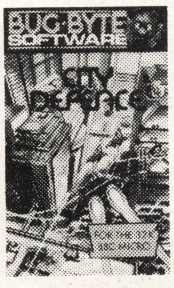

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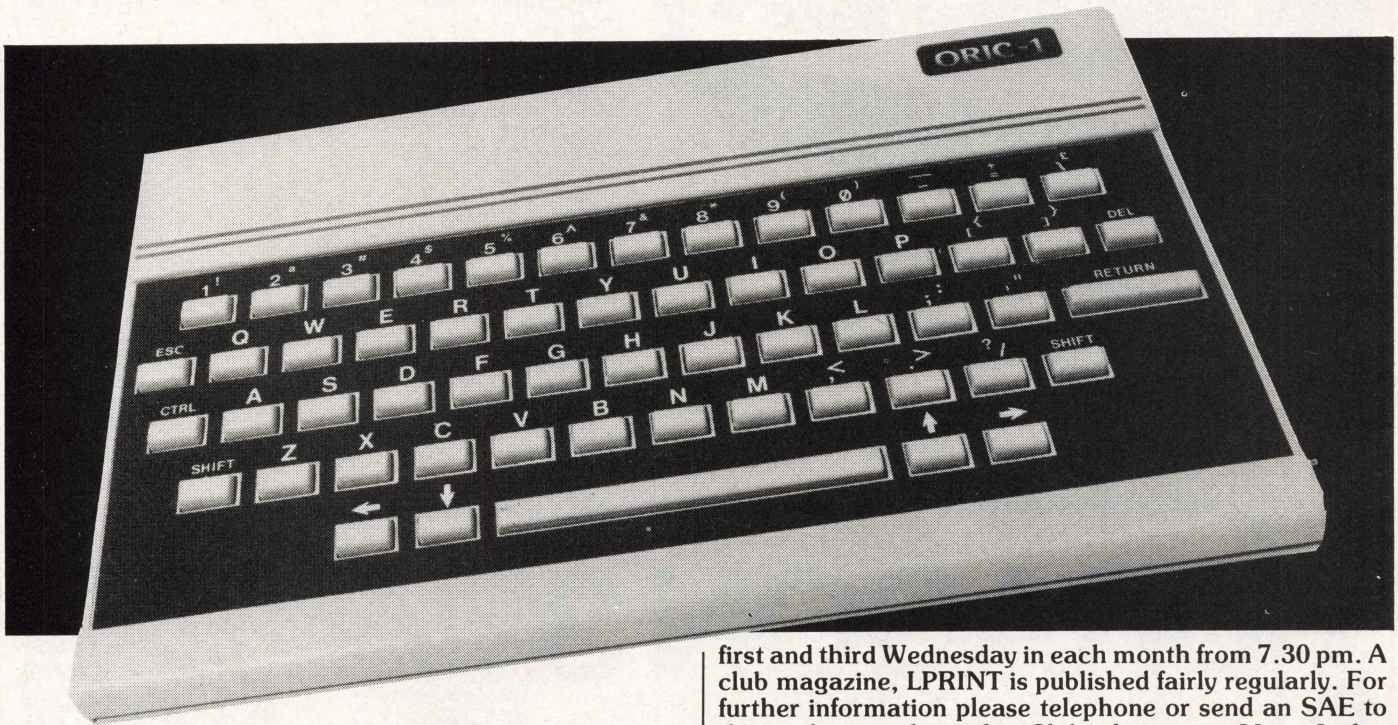


Dear Sir

Congratulations on producing a great magazine. I would be most pleased if you could supply me with a list of where I could get the new Oric 1 from around the Birmingham area.

Yours faithfully

Kevin Grigg

The best thing for you to do is contact Oric itself. They will provide you with the information you require and can be contacted on 0990 27641. We receive many similar letters to Kevin's but I am afraid it is impossible for us to answer such requests. If you have similar queries it is much better to get in touch directly with the manufacturer concerned as they have up-to-the minute information on their dealers and distributors.

Dear Sir

May I ask for the hospitality of your columns to pass on to your readers news of two user groups which are based in the Nottingham area.

First: the TRS-80/Genie Users Group of Nottingham, which has been running as a thriving society here for nearly three years, will be very happy to meet users in the area at Wilford Moderns Rugby Club House at any forthcoming meeting. Meetings are generally held on the first and third Wednesday in each month from 7.30 pm. A club magazine, LPRINT is published fairly regularly. For further information please telephone or send an SAE to the undersigned or the Club chairman, Marc Leduc Marcos Software, 30 Waterloo Road, Nottingham. Telephone: Nottingham 225165.

Second: the National Colour Genie User's group has now been formed, with Marc Leduc as chairman. Full particulars and a sample copy of the club magazine will be sent to anyone sending me a largeish SAE.

With many thanks

Geoffrey Hillier (5a Gregory Street, Lenton, Nottingham NG7 2LR.)

Dear Sir

I am writing in the hope that you will print my experiences. So that other readers will not fall into the same trap as me.

I own a BBC Micro, and ordered a 'Beebstick' joystick. I quite naturally assumed that it could be used for playing different commercially available games. I have contacted every software house, that I could find and the only one that makes any workable programs for this joystick is A + F Software, which sells two games.

I am personally very disappointed and I would like to make it clear to other readers, that it cannot be used for most games. I am sure that most people do not realise this. By warning people it may save them from suffering the same disappointment as me.

Yours sincerely

P Wilson

London W11

Dear Sir

After reading so many letters in various computer magazines complaining about the service people have received from manufacturers and dealers, I thought you might like to hear some praise for a change.

I bought one of the first Commodore VIC-20 computers to enter Britain in October 1981 and had no trouble with it at all until it was almost a year old when it developed a minor fault.

I contacted my dealer (Sigma Systems of Cardiff) who reported the fault to Commodore UK and within a few weeks, Commodore wrote to me offering me a replacement machine. This was brought to the dealer on the same delivery van which collected my old machine. As a bonus, my new computer was protected by a further one year's warranty!

I feel that service from a computer firm to this high standard is all too rare and deserves praise in your pages.

Yours faithfully
John Ryden
Mid Glamorgan

Dear Editor

In the wake of general criticisms of the new wave of British computers (re: delivery times/after sales service/customer relations etc) may I throw my own experience into the discussion.

I recently decided to buy a new micro and was interested in the new Jupiter Ace. I wrote to Jupiter Cantab with a few questions concerning the Forth language and got a comprehensive reply. Before Christmas I set up a 'computer fund' and on 27 December placed my order for the Jupiter Ace. If my office experience was anything to go by then the sales department received my order on the 4 January 1983. My Ace arrived eight days later (far in advance of the expected delivery period of 28 days) along with an unexpected demo tape.

A day later a letter arrived with answers to more questions I enclosed with my order. This letter was not 'mass-produced' but directly answered my queries, and was hand-written by Mr Steve Vickers.

The computer had no system faults, and I had no trouble loading the cassette. The manual (also written by Mr Vickers) was very entertaining and on that strength alone it has been difficult to put down.

Yours faithfully
Colin Miller
Eastleigh

Dear PCT

I am a young schoolboy and at the moment do not own a computer. I enjoy reading your magazine and think it is for those who look for quality in their literature. I think PCT is more professionally planned and set out than other magazine.

However, I feel more time and research should be spent on Micro Factfile, and the software checklists should be researched and updated more frequently. Often software advertised in your magazine does not appear in your checklists. I especially like your reviews on software, and also computers, and would like to see a review on the new Binatone computer in a future issue.

Yours faithfully
R Marsh

Editor's reply: **Thanks for your comments — readers' views are always taken very seriously.**

Dear Sirs

I read with interest you article 'Software Reviews'. The extra description and comments to those published elsewhere give a much better appreciation of the programs, their shortcomings and uses.

Also the standardised 'Ratings Table' gives ease of comparison between programs. So many other ratings tables vary the headings from review to review and make meaningful comparisons impossible.

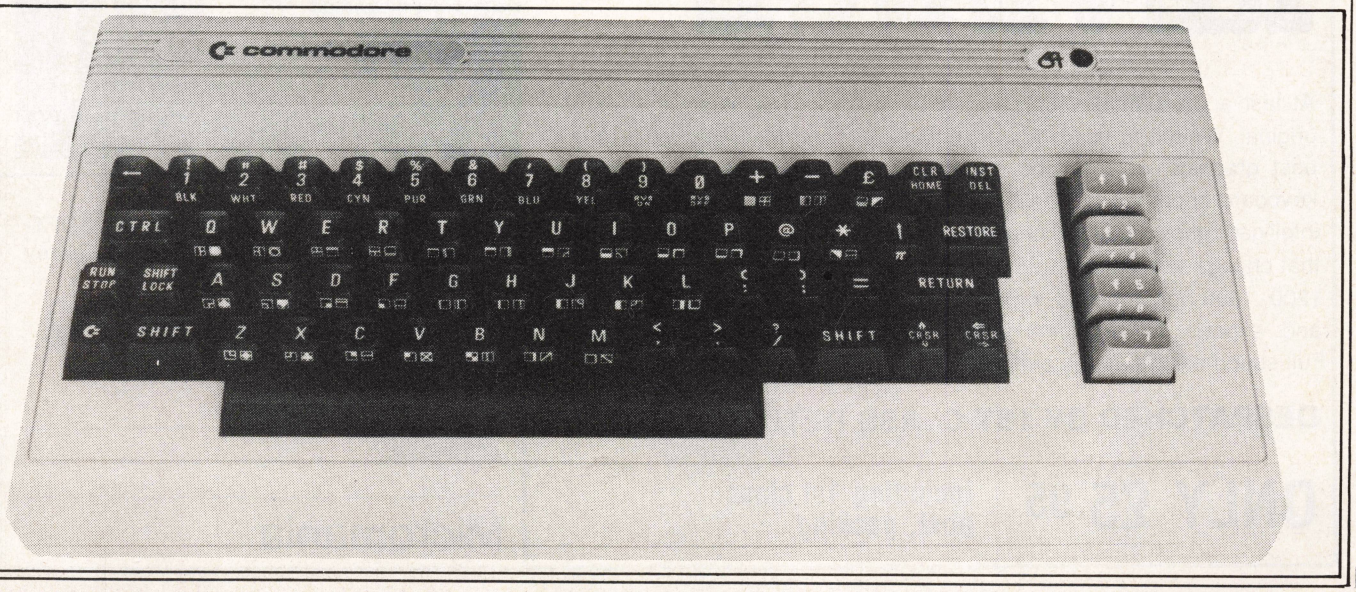
I have recently taken delivery of a Commodore 64 which I use with a C2N tape player. So far I have found it a very good machine. Of course the lack of software is hampering my experiencing its full capabilities but I am looking forward to them shortly becoming available.

I thought that with the '64' being such a new machine you may not have engaged anyone to review forthcoming programs. If you intend to review 64 software, as and when it becomes available, I would be very pleased to offer any assistance and service.

Thanks for a good magazine.

Yours faithfully
M Kendrick
Berkswell

Thanks very much for your offer to review the said software, I am only too pleased to add you name to our review team. If anyone else is interested don't hesitate to let me know.



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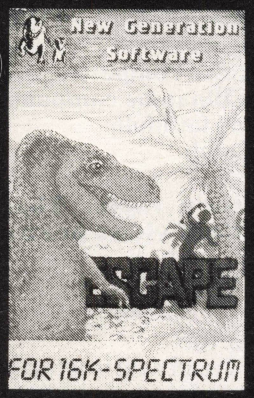

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ZX SPECTRUM

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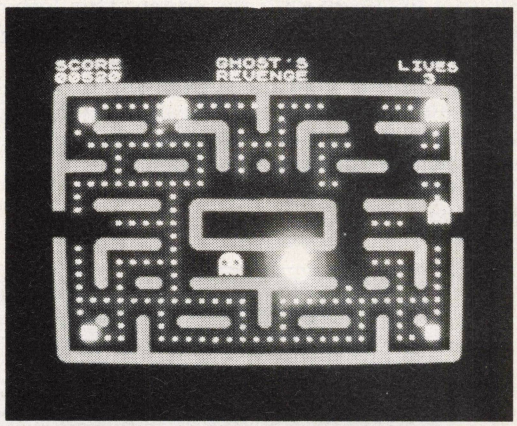

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INVISIBLE MAZE

This short maze game, written to put the newly arrived spectrum through its paces, reveals a small problem in testing information on the screen. Invisibility was indeed the problem, but not in the way I had anticipated.



The game is straightforward enough. There is treasure in a strongroom at the centre of the maze together with the guardian of the treasure, who moves around a lot and generally gets in the way of anyone approaching the strongroom. The player starts at the maze entrance, and it is necessary for him to gain access to the treasure in as few moves as possible. To make this more difficult, the walls of the maze are invisible! The roaming guardian will give some clue as to the direction and extent of the passageways, but don't bump into him, since he will squash you. Movement of the player's piece is controlled by the cursor keys (unshifted).

Moving The Characters

Like the ZX80 and ZX81, the Spectrum has a screen made up of 704 character squares, with top left square designated 0,0 ; the Row coordinate is given first, followed by the Column coordinate. The PRINT AT r,c statement will place a character or a graphic at the co-ordinates specified, while the SCREEN$ (r,c) function will report back with the single byte string found at the specified coordinate. In the program, the guardian moves automatically along the maze pathways, and reference to line 900 onwards shows the code for this. R1 and C1 hold the row and column coordinates. Variable A holds the direction of travel; 0,3,6,9 for North, East, South, West respectively. His present position is saved temporarily in variables SR and SC, and his new position is calculated (Lines 910 — 913). Is his new position valid? There might be a wall there, so the screen must be tested at this position for any character which is not a pathway. The pathway is the space character, code 32, and so in BASIC this becomes:—

IF SCREEN$ (R1,C1) = " " THEN PRINT . . . guardian at R1,C1 and a space at SR,SC and jump out of move guardian routine.

Unfortunately this will not work. In the original version of this program the invisible wall was contructed from graphic spaces (Code 128©, but SCREEN$() reports these as ordinary spaces and CODE(SCREEN$( )) reports with 32. In order to find out exactly what was happening this short program was run:

```
 5  REM SCREEN$ TEST
10  PAPER 7: INK 0: CLS
15  FOR R = 0 TO 7: READ N:
    POKE USR "A" + R,N: NEXT R
20  FOR N = 32 TO 164: PRINT
    AT 7,0; "CODE . . . . . ";N;" ";
    AT 9,0; "CHARACTER . . . ";CHR$(N);
    AT 11,0; "SCREEN$ . . . . . ";SCREEN$(9,15));
    AT 13,0;"CODE(SCREEN$).
    ";CODE(SCREEN$(9,15));
    " ":PAUSE 0: NEXT N
30  DATA 0,24,126,24,24,36,102,0
```

The results are rather sad. All the chunky graphics and the user-definable graphics report a null string in response to SCREEN$( ) and code 0 in response to CODE(SCREEN$( )). The program would not distinguish between a pathway (code 32) and a solid wall (code 143).

PEEK The Display File?

The layout of the Spectrum screen memory map is organised quite differently from that of the ZX80/81. This area of memory, known as the display file, is 6144 bytes in length. It is bit-mapped, which means that bits

within the bytes are set to 1 or 0 according to whether the associated pixel on the screen is to be illuminated or not. The resolution of the Spectrum screen is 256 on the X axis and 176 on the Y axis, which totals 45056 pixels. There are a further 4096 pixels on the botton two lines of the screen, but these are not generally intended for use by the users. The total number of pixels (and bits) is therefore 49152, which when divided by 8 gives the 6144 byte display file. Each character square on the screen is made up of 64 pixels, and so it takes 8 bytes of display file to store one character on the screen. To make matters even more complicated, these 8 bytes are not to be found in continuous order, but interleaved throughout the display file. Page 164 of the Spectrum manual mentions this briefly, in passing, as if it were of no concern to the user. PEEKing this display file is possible, but is rather a slow process.

The Problem Solved

Line 915 shows solution to the problem. Every character square on the screen has its own byte in memory to store the colour attributes assigned to that square. If the attributes of the maze pathway differ from the attributes of the wall, then we may distinguish between them. The Spectrum function ATTR(r,c) returns with the code for the attribute of the particular square under investigation. In the final version of the program, the invisible walls are spaces (code 32) and the solid walls are inverse spaces (code 143). The pathways are also spaces, but the attribute of the wall (invisible or otherwise) is 58, representing green ink on white paper, while the attribute of the pathway is 63, representing white ink on white paper.

The CODE (SCREEN()) function is still useful. On line 917 it tests the screen to see if the player's character (code 0) is present. Remember though, that 35 different characters will all return code 0, so that it must be used with care. One final note on the game. If any player gets fed up trying to negotiate a maze with an invisible wall, try typing in CHEAT: it works wonders!

PROGRAM LISTING

```
 5    REM THE INVISIBLE MAZE
 6    REM R. SARGENT AUG 1982
10    LET A = 6: LET Z = 0: LET P = 1: LET M = 0
12    POKE 23561,255: POKE 23562,255
50    BORDER 6: PAPER 7: INK 7: cls
102   DATA 0,0,31,2,10,19,2,21,24,3,5,6,3,24,25,4,16,17,5,3,4,
      5,9 ,14,5,17,18,5,24,25,7,3,4,7,9,11,7,17,18,7,20,22,7,24,
      25,8,18,19,9,4,5,12,16,22,12,24,25,14,10,11,14,16,20,
      14,28,30,16,9,14,16,16,20,17,2,4,17,9,14,17,17,19,19,2,
      31,13, 13,14,11,19,20,14,24,25,0,0,99
104   DATA 0,0,19,2,2,5,7,2,11,13,2,16,5,6,16,2,7,5,16,7,
      17,12,9,13,13,10,14,9,11,11,7,18,8,8,19,9,9,21,11,7,22,11,
      1,27,5,7,27,10,16,27,18,1,29,2,4,29,8,10,29,17,1,31,18,
      12,4,13,16,23,17,15,24,16,16,25,17,8,24,9,0,0,99
106   DATA 2,4,4,4,4,11,4,14,4,19,4,21,5,20,5,22,7,13,8,9,
      8,12,9,19,9,25,10,3,10,9,11,5,12,12,12,17,14,22,15,4,16,
      22,2,8,13,3,14,14,11,25,0,99
107   DATA 0,24,126,24,24,36,102,0,255,231,195,195,195,
      231,195,255
200   PRINT; INK 0; AT 20,3; "Welcome to the invisible maze";
      At 21,3; "Please wait."
201   LET I = 4: LET W = 32: GO SUB 515
202   PRINT AT 20,2; INK 4; "■"; AT 21,0; "■■■"; AT 20,0;
      "■"; AT 20,1; INK 0;CHR$ 144
209   FOR C  = 144 TO 145
210   FOR N = 0 TO 7: READ R: POKE USR CHR$ (C) + N,R:
      NEXT N: NEXT C
401   PRINT PAPER 7; INK 2;AT 9,14; "■"; AT 9, 16; "■"; AT
      10,13 + ;"■";AT 10,16; "■■";AT 11,14; "■";AT
      11,16;"■"
402   PRINT AT 10,15; INK 0;CHR$ 144 :PRINT AT 10,14; INK
      2; CHR$ 145 :LET R1 = 10: LET C1 = 15
406   PRINT ; INK 0; AT 21,3;"Press any key to continue.":
      PAUSE 0
408   PRINT AT 20,3; INK 0;"The guardian of the treasure ";AT
      21,3;" is about to take exercise.": PAUSE 100
410   LET I = 4: LET W = 32: LET P = 1: GO SUB 9050
412   PRINT ; INK 0; AT 20,3; "You may now attempt to
      rescue";AT 21,3;" the treasure. Moves made 0":BEEP 4,4
413   LET R2 = 20: LET C2 = 1: LET P = 1: LET A = 6
420   GO SUB 900
421   IF Z = 2 THEN GO TO 480
422   LET SC = C2: LET SR = R2
423   LET K$ = INKEY$: IF K$ = "C" OR K$ = "c" THEN LET
      I = 4: LET W = 143:PRINT ; INK 4;AT 18,14;"■";AT
      18,7;"■";AT 5,8;"■": GO SUB 515
424   IF K$ = "0" THEN GO TO 9999
425   IF K$ = "5" THEN LET C2 = C2 - 1
426   IF K$ = "6" THEN LET R2 = R2 + 1
427   IF K$ = "7" THEN LET R2 = R2 - 1
428   IF K$ = "8" THEN LET C2 = C2 + 1
429   IF K$ < "5" OR K$ > "8" OR K$ = "" THEN GO TO 420
430   LET M = M + 1: PRINT AT 21,29; INK 0;M
431   IF R2 = 10 AND C2 = 15 THEN PRINT AT 10,15;CHR$
      144;AT 11,15;" ": GO TO 460: REM WON
432   IF R2 = 7 AND (C2 = 14 OR C2 = 15 OR C2 = 16) THEN
      PRINT AT 8,15; INK 2; "■"
433   IF ATTR (R2,C2) = 63 THEN PRINT AT R2,C2; INK
      0 + CHR$ 144: PRINT AT SR,SC;" ": GO TO 420
434   IF CODE (SCREEN$ (R2,C2)) = 0 THEN GO TO 480: REM
      LOST
436   LET C2 = SC: LET R2 = SR: PRINT AT R2,C2; INK 0;CHR$
      144: GO TO 420
459   REM WON
460   PRINT; INK 0;AT 20,3; "YOU HAVE GAINED THE
      TREASURE";AT 21,3;"Will you try again? Y/N "
461   PRINT ; INK 0; FLASH 1;AT R2,C2;CHR$ 144: PAUSE
      200: GO TO 9998
479   REM LOST
480   PRINT ; INK 0;AT 20,3; "YOU HAVE BEEN EATEN !
      ";AT 21,3;"Will you try again? Y/N  "; FLASH 1;AT
      R1,C1;CHR$ 144;AT R2,C2;CHR$ 144: PAUSE 200:
      PRINT; FLASH 0; INK 0;AT R2,C2;" ";AT R1,C1;CHR$
      144: GO TO 9998
514   REM MAZE DRAWER SUB-R
515   RESTORE 100
518   READ R,S,F: IF F = 99 THEN GO TO 540
520   FOR C = S TO F: PRINT AT R,C;INK I;CHR$ W: NEXT C:
      GO TO 518
540   READ S,C,F: IF F = 99 THEN GO TO 560
550   FOR R = S TO F: PRINT AT R,C;INK I;CHR$ W: NEXT R:
      GO TO 540
560   READ R,C: IF C = 99 THEN RETURN
565   PRINT AT R,C; INK I;CHR$ W: GO TO 560
900   REM MOVE GUARDIAN SUB-R
907   LET SR = R1: LET SC = C1
910   IF A = 0 THEN LET R1 = R1 - 1
911   IF A = 3 THEN LET C1 = C1 + 1
912   IF A = 6 THEN LET R1 = R1 + 1
913   IF A = 9 THEN LET C1 = C1 - 1
915   IF ATTR (R1,C1) = 63 THEN PRINT AT SR,SC;" ";AT
      R1,C1; INK 0; CHR$ 144: PAUSE P: RETURN
917   IF CODE (SCREEN$ (R1,C1)) = 0 THEN LET Z = 2: PRINT
      AT SR,SC;" ":RETURN
918   LET C1 = SC: LET R1 = SR
920   IF A = 9 THEN LET A = 0: GO TO 907
922   LET A = A + 3: GO TO 907
9997  REM TIDY UP AND END
9998  PAUSE 0: IF INKEY$ = "Y" OR INKEY$ = "y" THEN
      RESTORE 100: GO TO 5
9999  POKE 23561,35: POKE 23562,5: BORDER 7: PAPER 7:
      INK 0: CLS
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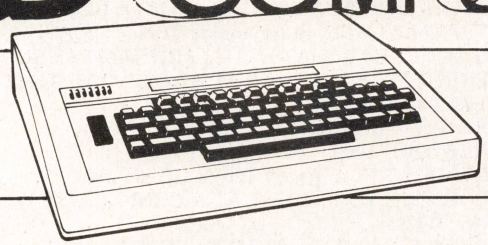

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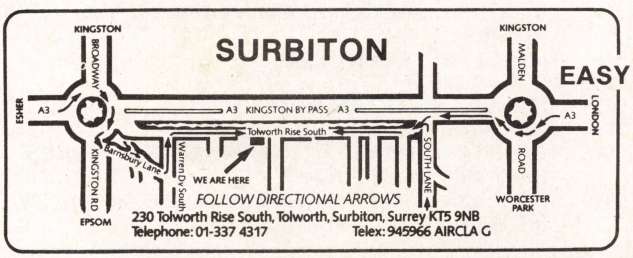

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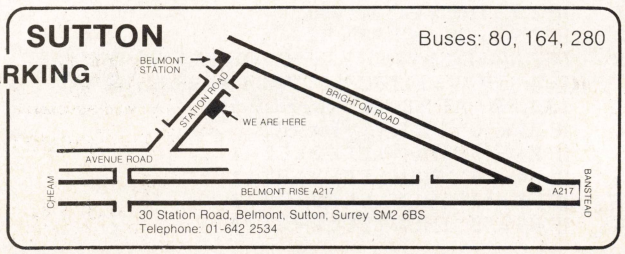

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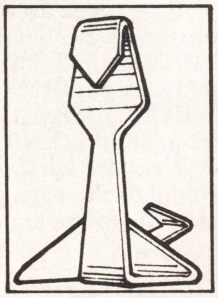

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KNIGHTS

A puzzling game based on a chess board is brought to you by Freda Perrow.



David Nixon, the magician, once performed a trick similar to the puzzle which forms the basis of this article.

He started by placing a Knight at a random position on a normal chess board and by moving the Knight in the normal chess manner managed to visit every position on the board without ever retracing his steps. He used no tricks and it is possible to do without being a member of the Magic Circle!

The puzzle as it is presented here has both error checking for illegal moves and also duplication of moves — so you can't cheat. I have not yet managed to fill all the squares on the board but then the fun would be over wouldn't it?

A note for newcomers on how the Knights are constructed may be appreciated.

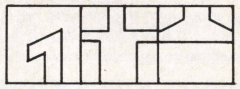
First three user defined characters are defined Viz.. CHR$232/233/231 for the left facing knight (KNIGHTL$) or CHR$229/230/231 for the right facing knight (KNIGHR$).

Next the cursor must be moved around to the correct positions using the following control codes.

CHR$ 8 ← CHR$ 9 →

CHR$ 10 ↓ CHR$ 11 ↑

If we just string the three defined characters together we would end up with a knight which looks like this.



What we have to do is . . . after the first CHR$ we move the cursor back one and down one and then after the 2nd CHR$ we move the cursor back one and down one. These actions are done using CHR$8 ← and CHR$ 10 ↓ respectively. Thus the left facing knight is...

KNIGHL$ = CHR$232 + CHR$8 + CHRS10 + CHRS233

+ CHR$8 + CHR$10 + CHR$231 and the right facing knight is . . .

KNIGHTR$ = CHR$229 + CHR$8 + CHR$10 + CHR$230 + CHR$8 + CHR$10 + CHR$231

More experienced readers may care to look more closely at DEFPROCCCHECK. This is the procedure for checking the colour of the square which you intend to move to and looks a bit long-winded. The reader may ponder on the fact that the Knight always moves onto the opposite colour to the one it is already on, and hence as long as the starting colour is known the rest of the moves can be 'clocked' between black and white. The INT function may be a clue to another way of doing it. However this is just food for thought as the program works well as it is.

Beginners Tips

The tips given below may be of use to the newcomer to the micro fraternity in particular BEEB owners.

Most micro owners find it very comforting whilst loading to hear that there is actually something coming out of the cassette recorder. What is required is a low-level output from the loud-speaker whilst maintaining the high level output required by the micro. If you are using the 3.5mm jack socket of your cassette it is very easy to achieve this using just one resistor.

When you plug in the jack socket you open a set of contacts in the cassette which mutes the internal loudspeaker. By connecting a resistor of about 1000 ohms across these contacts (as shown in figure 1) reduced volume from the L.S. can be obtained. The size of the resistor determines the volume. The higher it is the lower the volume and visa versa.



Which Recorder?

An additional note well worth mentioning is that many sources have recommended the Boots CR 325 cassette recorder for use with the BBC micro. I agree that this is an ideal unit but a note for the unwary... If you use two separate metal sleeved jack plugs (A 2.5mm for the remote motor control and a 3.5mm for the record) ensure that the two cases do not touch as this will cause the internal cassette fuse to blow.

There are two ways round this problem. The first is to use plastic sleeved jack plugs; the second is to obtain a plastic moulded plug which in fact has the two plugs moulded in one sleeve. I obtained this from an old microphone which had a remote stop/start facility.

The second tip is to ease checking of a program just entered. Rather than have a full screen of printed list, why not just have 2/3 of the lines at a time displayed? Try typing in the following:— *KEYO "MODE 4: VDU28,0,31,39,29:VDU14 M" The lines can then be scrolled using the shift key as normal.

Take It Or Leave It

The next two ideas are take it or leave it ideas — you either like them or you hate them. You decide. First a rather crude volume control for the BEEB.. A piece of thin card (approx.2" × 1¼") is slipped under the perspex strip and slid over the slots to reduce the volume and moved to the right to give normal output. It actually has an effect, so go on, give it a try — you've nothing to lose (and it won't invalidate the guarantee).

My final tip before I go is for poor typers like myself. When I am typing out a program from a magazine I am always losing my place, typing in things twice, missing bits out etc. I then tried reading the program out loud and recording it on the cassette at my own typing speed. It was then easy to let the recorder play it back whilst typing the program into the micro.

I found two advantages. The first being that you couldn't let up on your typing or you got left behind and had to stop the recorder, and the second advantage was that far fewer errors crept into the program.

Anyway if you like the idea give it a try by typing in "KNIGHTS".

HOW IT RUNS

Lines 50-170	Main body of the program.
Line 50	Sets the highest score to zero for first try.
Line 60	Selects graphics mode 1 and turns off flashing cursor.
Line 80	Sets dimension of an 8 × 8 array for board.
Line 90	Sets the colours; displays the instructions.
Line 100	Traps errors and ends game if 'ESCAPE' is pressed.
Line 110	Calls procedure to draw the board and positions Knight, for first move, after checking if move is legal.
Lines 120-150	Repeats Knight's movements until 64 moves have been made.
Line 160	Displays finish message.
Line 170	Resets micro to default mode.
Lines 190-320	DEFPROCINSTRUCTIONS
Line 200	Sets background(paper) colour to blue and print(ink) white.
Lines 210-260	Prints out instructions.
Line 270	Changes colour of print to blue/yellow.
Line 280	Prints Knight character.
Line 300	Waits 30 seconds or until space bar is pressed.
Line 310	Changes colour of background to black and print to white.
Lines 340-450	DEFPROCSETUP
Lines 350-440	Sets up user-defined shapes.
Line 450	Sets up the colour pallette.
Lines 460-480	See text. Sets up the Knights.
Lines 500-640	DEFPROCBOARD
Lines 510-570	Draws out the chess board.
Lines 570-590	Prints out figures 1 to 8 on bottom and RHS of board.
Lines 660-710	DEFPROCCALCULATE
Line 670	Calculates print position of the Knight.
Line 680	Checks what colour square next move is.
Line 690	Sets position X,Y in array to 1 (for colour check).
Line 700	Prints Knight facing right.
Lines 730-790	DEFPROCSHIFT
Line 740	Stores Knight's last position. Changes colour.
Line 750	Requests input for Knight's next move.
Line 760	Checks for legal move.
Lines 770-780	Prints flashing Knight on correct colour background.
Lines 810-840	DEFPROCCCHECK: Checks colour of square Knight wants to move to.
Lines 860-940	DEFPROCPLACE; Prints screen information and requests input move. Checks if you've been there before (CHEAT!)
Lines 960-990	DEFPROCSTORE; Displays score.
Line 1010	DEFPROCDONE: Prints finished message, plays tune and asks if another try required.

BBC

KNIGHTS

HINTS ON CONVERSION

Pre defined shapes could be used in place of the knights. Use GO SUBS / RETURN in place of procedures. BBC format on mode 1 is 40 × 32 characters; four colours.

A% HIGH SCORE
SF SQUARES FILLED (CURRENT SCORE)
X1 Y1 Tab position for printing of the Knights.
X Y Required positions on the 8 × 8 board.
C COLOUR OF SQUARE ON BOARD.
B% ARRAY FOR BOARD.



PROGRAM LISTING

```
  10 REM *******KNIGHTS*******
  20 REM ****FREDA  PERROW****
  30 REM *TERRICOMS SOFTWARE**
  40 REM ***COPYRIGHT(1983)***
  50 A%=0
  60 MODE1:VDU23;8202;0;0;0;:SF=1
  70 CLEAR
  80 DIM B(8,8)
  90 PROCSETUP:PROCINSTRUCTIONS
 100 ON ERROR GOTO 1020
 110 PROCBOARD:PROCSTART:PROCCALCUL
ATE
 120 REPEAT
 130 PROCSHIFT:PROCCALCULATE
 140 SF=SF+1:PROCSCORE
 150 UNTIL SF=64
 160 PROCDONE
 170 MODE7:END
 180 :::::::::::::::::::::::::::::
:::
 190 DEFPROCINSTRUCTIONS
 200 COLOUR3:COLOUR130:CLS
 210 PRINTTAB(1,2)"T E R R I C O M
S  S O F T W A R E (C)"
 220 PRINTTAB(1,3)"================
========================"
 230 PRINTTAB(12,6)"K N I G H T S"
 240 PRINTTAB(12,8)"============"
 250 PRINTTAB(5,11)"THE IDEA OF THI
S PUZZLE IS TO FILL"''"ALL THE SQUAR
ES  <BOTH BLACK AND WHITE>"''"WITH K
NIGHTS.  THEY CAN MOVE AS IN CHESS"''
"YOU MUST NOT GO BACK ONTO A SQUARE
THAT"''"YOU HAVE ALREADY VISITED THA
TS CHEATING!"'''
 260 PRINT" TO START THE PUZZLE YOU
 MAY PLACE THE"''"    KNIGHT ANY-WHE
RE ON THE BOARD. "
 270 COLOUR 1
 280 PRINTTAB(7,6);KNIGHTR$TAB(30,6
);KNIGHTL$
 290 PRINTTAB(7,29)"PRESS SPACE-BAR
 TO START. "
 300 W=INKEY(3000)
 310 COLOUR128:COLOUR3:CLG
 320 ENDPROC
 330 :::::::::::::::::::::::::::::
::
 340 DEFPROCSETUP
 350 VDU23,224,255,255,255,255,255,
255,255,255
 360 VDU23,225,&01,&01,&01,&01,&01,
&01,&01,&01
 370 VDU23,226,&C0,&C0,&C0,&C0,&C0,
&C0,&C0,&C0
 380 VDU23,227,&FF,0,0,0,0,0,0,0
 390 VDU23,228,0,0,0,0,0,0,0,&FF
 400 VDU23,229,0,0,0,0,&30,&60,&F8,
&EE
 410 VDU23,230,&FF,&E7,&70,&38,&FF,
&18,&3C,&3C
 420 VDU23,231,&7E,&7E,&FF,&FF,0,0,
0,0
 430 VDU23,232,0,0,0,0,&0C,&06,&1F,
&77
 440 VDU23,233,&FF,&E7,&0E,&1C,&FF,
&18,&3C,&3C
 450 VDU19,1,12,0,0,0,19,2,4,0,0,0
 460 KNIGHTR$=CHR$229+CHR$8+CHR$10+
CHR$230+CHR$8+CHR$10+CHR$231
 470 KNIGHTL$=CHR$232+CHR$8+CHR$10+
CHR$233+CHR$8+CHR$10+CHR$231
 480 ENDPROC
 490 :::::::::::::::::::::::::::::
::
 500 DEFPROCBOARD
 510 A$=STRING$(3,CHR$224):B$="    "
 520 CLS:PRINT:FOR A=1TO4:FOR B=1TO
3
 530 PRINTCHR$(225);A$;B$;A$;B$;A$;
B$;A$;B$;CHR$(226):NEXTB
 540 FORD=1 TO 3
 550 PRINTCHR$(225);B$;A$;B$;A$;B$;
A$;B$;A$;CHR$(226):NEXTD:NEXTA
 560 PRINT" ";STRING$(24,CHR$227)
 570 PRINTTAB(1,0);STRING$(24,CHR$2
28)
 580 FOR I=0 TO 7:PRINTTAB(1*3+2,26
);I+1:NEXT I
 590 FORI=0 TO 7:PRINTTAB(26,I*3+2)
;I+1;:NEXTI
 600 ENDPROC
 610DEFPROCSTART
 620PRINTTAB(0,28);"WHERE WOULD YOU
 LIKE THE KNIGHT?"''"GIVE THE VERTIC
AL POSITION FIRST. "
 630 PROCPLACE
 640 ENDPROC
 650 :::::::::::::::::::::::::::::
::
 660 DEFPROCCALCULATE
 670 X1=(Y-1)*3+2:Y1=(X-1)*3+1
 680 COLOUR 1:PROCCCHECK:COLOURC
 690 B(X,Y)=1
 700 PRINTTAB(X1,Y1);KNIGHTR$
 710 ENDPROC
 720 :::::::::::::::::::::::::::::
::
 730 DEFPROCSHIFT
 740 XX=X:YY=Y:COLOUR128:COLOUR3
 750 PROCPLACE
 760 IFX=XX+2 AND Y=YY+1 OR X=XX+2
AND Y=YY-1 OR X=XX-2 AND Y=YY+1 OR X
=XX-2 AND Y=YY-1 OR X=XX+1 AND Y=YY+
2 OR X=XX-1 AND Y=YY+2 OR X=XX+1 AND
 Y=YY-2 OR X=XX-1 AND Y=YY-2 THEN770
 ELSE SOUND2,-15,150,5:PRINTTAB(30,1
6)"TRY-AGAIN":GOTO750
 770 COLOUR2:COLOURC
 780 PRINTTAB(X1,Y1);KNIGHTL$
 790 ENDPROC
 800 :::::::::::::::::::::::::::::
:
 810 DEFPROCCCHECK
 820 IF X=1ANDY=1 ORX=3ANDY=1 ORX=5
ANDY=1 ORX=7ANDY=1 ORX=2ANDY=2 ORX=4
ANDY=2 ORX=6ANDY=2 ORX=8ANDY=2 ORX=1
ANDY=3 ORX=3ANDY=3 ORX=5ANDY=3 ORX=7
ANDY=3 ORX=2ANDY=4 ORX=4ANDY=4 ORX=6
ANDY=4 ORX=8ANDY=4THEN C=131:ENDPROC
 ELSEC=128
 830 IF X=1ANDY=5 ORX=3ANDY=5 ORX=5
ANDY=5 ORX=7ANDY=5 ORX=2ANDY=6 ORX=4
ANDY=6 ORX=6ANDY=6 ORX=8ANDY=6 ORX=1
ANDY=7 ORX=3ANDY=7 ORX=5ANDY=7 ORX=7
ANDY=7 ORX=2ANDY=8 ORX=4ANDY=8 ORX=6
ANDY=8 ORX=8ANDY=8THEN C=131:ELSEC=1
28
 840 ENDPROC
 850 :::::::::::::::::::::::::::::
:::
 860 DEFPROCPLACE
 870 PRINTTAB(28,4)"PRESS ESCAPE"TA
B(29,7)"WHEN BEAT!"
 880 PRINTTAB(32,12)"-DOWN"TAB(32,1
4)"-ACROSS"
 890 PRINTTAB(28,18)"THE HIGHEST"
 900 PRINTTAB(28,20)"SCORE IS  ";A%
 910 X=GET:PRINTTAB(30,12)SPC(1):PR
INTTAB(30,14)SPC(1):PRINTTAB(30,16)S
PC(9):IF X<49OR X>56 THEN SOUND 2,-1
5,150,5:GOTO 910 ELSE X=X-48:  PRINTT
AB(30,12);X
 920 Y=GET:IF Y<49 OR Y>56  THEN SO
UND 2,-15,150,5:GOTO 910ELSE Y=Y-48:
PRINTTAB(30,14);Y:VDU7
 930  IF B(X,Y)=1 THEN SOUND2,-15,1
50,5:PRINTTAB(30,16)"OCCUPIED ":GOTO
910
 940 ENDPROC
 950 :::::::::::::::::::::::::::::
:::
 960 DEFPROCSCORE
 970 COLOUR3:COLOUR128
 980 PRINTTAB(0,30);"SQUARES FILLED
 = ";SF;"  SQUARES LEFT = ";64-SF
 990 ENDPROC
1000 :::::::::::::::::::::::::::::
:
1010 DEFPROCDONE
1020 COLOUR 1
1030 IF SF=64 PRINTTAB(0,28);"WELL
DONE!! WOULD YOU LIKE TO TRY AGAIN?"
ELSE PRINTTAB(0,28);"OH  WELL!! WOUL
D YOU LIKE TO TRY AGAIN?"
1040 IF SF>A% THEN A%=SF
1050 PRINTTAB(0,30);SPC(38)
1060 FOR A=1 TO 50:SOUND1,-15,RND(1
00)+100,1:NEXT
1070 A$=GET$
1080 IF A$="Y" OR A$="y" THEN GOTO
70
1090 IF A$="N" OR A$="n" THEN GOTO
170 ELSE 1070
1100 :::::::::::::::::::::::::::::
::::
```

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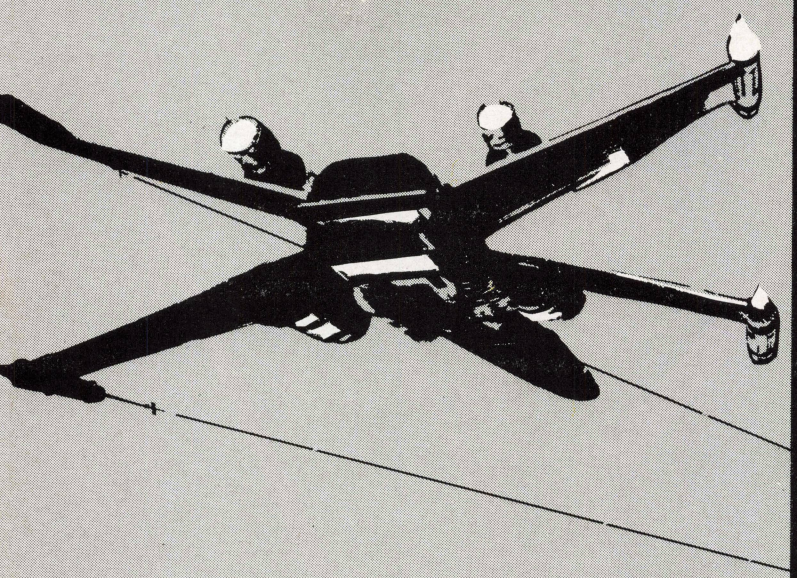

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Spectrum Zap makes good use of the computer's colour and graphics facilities and will provide you with hours of exasperating entertainment. People who have played this game swear that the difficulty level is high and although written in BASIC, report that the action is suitably fast and furious.

ZX REACTOR – 16K

Another 16K Spectrum game for the adventurous which comes on the same tape as the above. Now the player has to dice with death when he defuses a number of reactors which have reached the critical stage. They have to be defused in sequence and if you don't get to them within the set time limit your man gets blown up in the explosion. A testing but fun game too.

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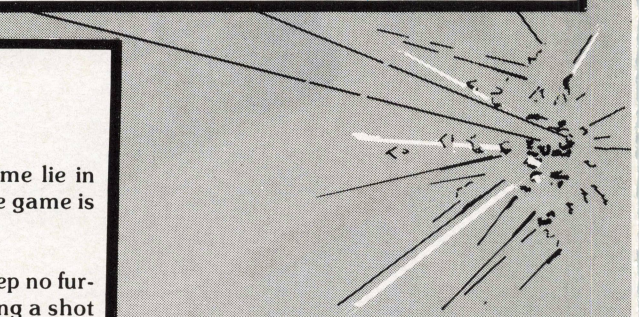

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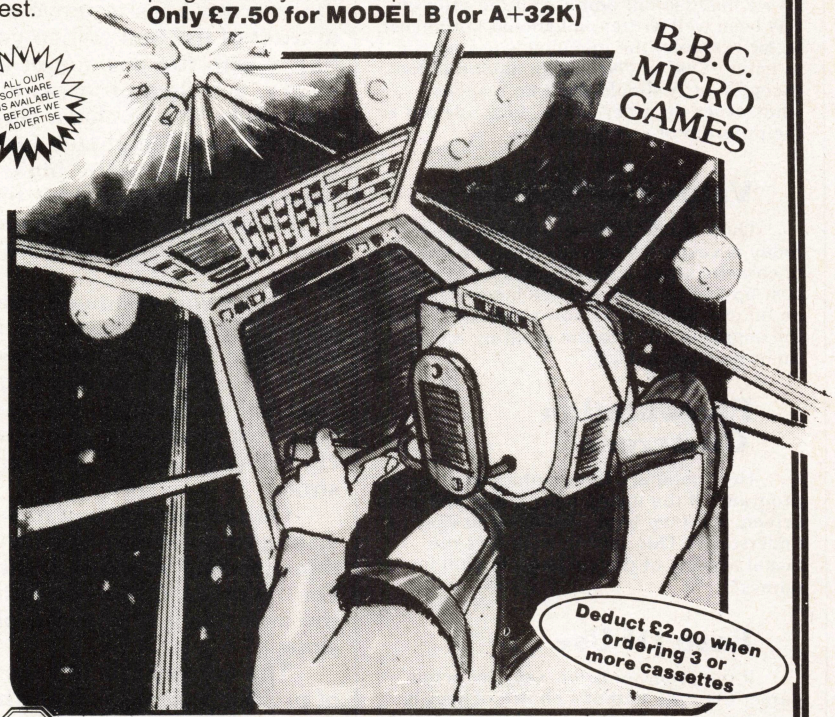

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SOFTWARE REVIEWS

This is the place to find out more about the software for your micro. Each month we review a hat-full of tapes and bring you the results.

Each month PCT will be presenting pages of reviews of the computer programs currently available. We have engaged a team of reviewers, each of whom is a seasoned user of his/her particular machine — and has the crazy streak that means they enjoy playing computer games!

All types of software will, however, be reviewed in these pages; but with around 85% of all home-computer software being of the playful variety, you will be seeing more games than anything else!

Our 'Ratings Table' headings are:

Program Quality

Here we're looking to see how well written the program is, and how well it exploits the computer's capabilities. Also, how logical is the structure of the program? Does it require the user to make guesses to use it?

Crashproofing

We all hit the wrong key sometimes, do we not? Go on, admit it. If the program has been well written, all should not be lost. If, for example, the machine is asking you to enter "Yes" or "No", then any other key except Y or N should illicit no response whatsoever. In other words, how tolerant is the program of us humans?

Value For Money

Quite frankly, some software on sale today is vastly overpriced. With the low cost of cassette tapes, why *should* simple games cost up to £12 per tape? We judge this one on an overall basis — how much work have the suppliers put into the program and is the price reasonable?

Presentation On-screen

How good are the graphics used in the program? If the instructions are provided on screen, are they both readable and easy to understand? This section examines the visual aspects of the package — vital for games!

Ease Of Use

If the program is for, say, an 'action' game, then the author's choice of keys is very important. Try playing "Invaders" with the movement keys reversed, and the "Fire" button right next to 'Reset'! There are many, many ways in which life can be made easy for the program user. We want to see them *all* used!

Supplied Instructions

Regardless of whether the instructions come on sheets of paper, or are presented as text on-screen, they should be as clear and as concise as possible.

Ratings are done on a "Five stars is excellent, one is hopeless" basis, with the reviewer then scoring the supplied package as a whole on a percentage scale.

Title: Golf
Type: Tape
Supplier: Salamander Software
Machine: Dragon 32
Price: £7.95

This version of golf is perhaps the nearest you will ever get to actually playing the real thing on your micro. The game offers you nine different hole layouts and by playing through this course twice you achieve the standard 18 hole course.

Each hole is split into two parts. The first part is your tee off. In this, the tee, fairway and the hole are all displayed in high resolution on the screen. You line up your shot by using the up and down arrow keys to move a cursor in front of the ball. When you are happy with the position of your stroke, you then progress to a menu selection of clubs. Having made the choice of club for that shot you return to the high resolution display and hit the ball. This procedure continues until you manage to get the ball onto the green.

When you eventually reach the green, the display switches to an expanded high resolution picture of the hole and its surrounding hazards. Once again you move the cursor to position the shot and choose your club to make the stroke.

On the fairway you have displayed an arrow indicating the direction and strength of the wind. On the green this arrow indicates the direction and strength of the slope.

The fairway has its own share of problems to overcome, these are the rough, hazards and out of bounds. If your ball lands in the rough then there is a good chance that you will 'top' your next shot and therefore lose a stroke on your opponent. The hazards are trees and bunkers, if you land the ball in one of these then it will stop dead. Needless to say that it is very difficult to recover from these situations. If you play your ball into one of the out of bounds areas, then the ball will be judged as lost and you will have to play a new ball from the position where you took your last shot.

The game can be played by either one or two players, using the Stableford point system. At the beginning of the game you can input your own handicap, or have the computer randomly assign you one.

Overall this game is a very good implementation of a difficult to represent sport. I think it would be very difficult to tire of the challenge which this game represents. My one criticism is that there isn't a nineteenth hole to retire to when you have finished a game.

Ratings Table

Program Quality	* * * *
Value for Money	* * * *
Presentation On-screen	* * * * *
Ease of use	* * *
Crashproofing	* * * *
Supplied Instructions	* * * *
Overall	80%

N.A.

Title: Cosmos
Type: Tape
Supplier: The Software House
Machine: BBC A & B
Price: £5.95

If you have played the Galaxians type of arcade games, then you'll like Cosmos. Written in a combination of Basic and Hi-Res, Cosmos gives you three lives with the space bar letting you start another game.

Cosmos uses red and yellow aliens on a black background, with two different types of alien. Your score is shown at the top of the screen, with the highest score you have reached.

To shoot down and destroy the aliens as they advance on you, use the space bar and then the arrows to move out of their way. But using the keyboard with the BBC machine is certainly slower than using a paddle or joystick with other machines. . . So you need to have very fast reflexes to reach a high score.



If you think its easy, sit down and try to reach a large score. You'll find it needs nimble fingers to succeed.

Another value for money game at only £6 including VAT.

Ratings Table

Program Quality:	* * *
Value for Money:	* * * *
Presentation On-screen:	* * *
Ease of use:	* * * *
Crashproofing:	* * *
Supplied instructions:	* * *
Overall:	66%

N.A.

Title: **Space Castle**
Type: **Tape / disc**
Supplier: **Microdeal**
Machine: **TRS-80 Models I & III**
Price: **£11.95**

Very impressive opening titles in Space Castle promise an exciting arcade style game that, for me, didn't materialize.

In the centre of your screen is a graphic representation of the alien SPACE CASTLE. Surrounding it are three revolving shields which you must penetrate before you can attack the space station itself. Orbiting with the shields are a number of alien space mines which, periodically, break out of orbit and seek to destroy you.

You have complete control over your ship, being able to revolve it to the port or starboard, fire the thrust rockets or blast with your cannon, which seems to have a limitless supply of ammunition.

The object of the game is to gain points by blasting your way through the energy fields to attack the castle. Whilst doing this you have to avoid being hit by one of the mines or one of the castle's energy bolts which it can release should there be a direct line of fire between it and you.

The sound effects are limited, though I did think that the effect of the mines exploding was effective.

My overall rating of this game was low as I found that, at least for me, it wasn't demanding enough to make it addictive.

Ratings Table

Program Quality:	* * *
Value for Money:	* *
Presentation On-screen:	* * *
Ease of use:	* * * *
Crashproofing:	* * * *
Supplied instructions:	* * *
Overall:	55%

Title: **3D Tunnel**
Type: **Tape**
Supplier: **New Generation Software**
Machine: **Spectrum**
Price: **£5.95**

This game is like no tube journey you've ever been on! Imagine yourself as the driver of a wayward London tube train careering along an unknown tunnel and you'll be some way towards playing this game.

Once you've LOADed the game, you are presented with a menu of options, including a choice of two well-known makes of joystick (Kemptson and AGF Hardware), 'spare', which is a general joystick arrangement, as well as the option to use the keyboard controls. To start the game, you have to choose between a fast, medium or slow speed; and if you're after a relaxed time at the keyboard, I'd recommend the slow speed!

The idea of the game is to travel down a tunnel and kill the various wildlife that you find there. Amongst these creatures are spiders, toads, bats, rats and the occasional tube train. Various points are allocated to these creatures, and if you successfully manage to get them in your sights, your score is incremented by this amount. Dodging a tube train is given the highest number of points; and rightfully so in my opinion — I never managed to dodge it once!

It is hard to offer advice concerning tactics for the game since the creatures appear on different levels of the tunnel, i.e. spiders hang from the ceiling and rats crawl along the floor. However, I must say that the game improved 100% once played with a joystick; the keyboard controls are a little difficult to manipulate easily.

The graphics used to describe the various furry (or not so furry) animals are also very good, as is the representation of a tube train. The only thing that bothered me slightly was the use of the colour in the tunnel. It wasn't the impression of the tunnel that made me feel slightly 'heady', but the moving colours on the eyes — not a game for tired eyes.

The complete game can be played on the 48K Spectrum — but for those of you with the smaller Spectrum, you can play each phase of the game spearately. You can travel down the tunnel, zap the various creatures (only one per phase), but in the 16K version there is no tube train. However, when you consider the memory restrictions of the 16K Spectrum, New Generation have done very well to make the program available to all Spectrum users.

When I spoke to the author of the program, he told me that when you have journeyed down the tunnel, killed any number of creatures and dodged the odd tube train, you eventually emerge in the cold light of day, and are greeted with a message of congratulations. I'm only telling you this because all I ever got was a message emphasising my failure, and a quick note that I needed more practise!

Ratings Table

Program Quality:	* * * *
Value for Money:	* * * *
Presentation On-screen:	* * * *
Ease of use:	* * *
Crashproofing:	* * * *
Supplied instructions:	* * *
Overall:	90%

R.M.

Title: **Ghost Hunter**
Type: **Tape / disc**
Supplier: **Arcade Plus through Creative Software**
Machine: **Atari 400 / 800**
Price: **Tape = £19.95; disc = £22.95**

One of the Pac-man type games not to be wpied off the market by Atari is Ghost Hunter. This is a rival game which will be appreciated by those paranoids who enjoy spending their leisure time being pursued by threatening creatures.

The format of the game is much as you might expect; a complex labyrinth haunted by ghosts, who

wander the passages looking for the animated mouth which (very unflatteringly) represents you, the player.

You have to run from them, eating the yellow dots on your way. When you reach the 'power pills' in each of the four corners of the maze, gobble it up if there are any ghosts in your vicinity. Then revenge is yours and very sweet it is. You become the chaser and now can eat up the ghosts for extra points.

Ghost Hunter is certainly not innovative, and I don't imagine it was supposed to be. Where it scores is in the execution; it's very, very fast, making it a very difficult game to play. Let your concentration wander for a moment and you will find yourself surrounded by ghosts ready to mercilessly devour you. You'll also find that your pursuers perform the sort of vanishing trick that would make Sebastian Coe turn pale and give up.

The best tactic to adopt is the hide and seek approach. Eat a pill and then lie in wait to ambush passing ghosts. As in the arcade game you won't be pursued until you are actually spotted so it is possible to hide from unsuspecting meanies.

One fault lies in the scoring. At the end of the two player game only the second players final score is left on the screen and unless the first player makes a rapid mental note of his final score at the end of his last life it is impossible to tell who has won.

Ratings Table

Program Quality:	* * * *
Value for Money:	* * *
Presentation On-screen:	* * * *
Ease of use:	* * * *
Crashproofing:	* * * *
Supplied instructions:	* * * *
Overall:	85%

J.P.

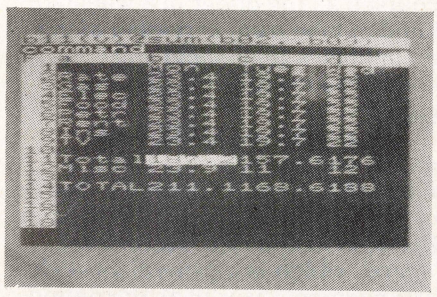
Title: **Rabbit Calc**
Type: **Tape (also available on disk)**
Supplier: **Rabbit Software**
Machine: **VIC 20 with 16K**
Price: **£19.99**

The most popular program in the world for micro-computers must be Visicalc, the financial package that seems to have sold more Apples than any other program. But although Visicalc is a fantastic program, it needs far more memory than normally available on the smaller machines. Now there is a British program that offers you many of the features of Visicalc at far lower cost.

Unlike many programs for the VIC, with Rabbit Calc read the instructions first. Then load the program. Otherwise you will be confused and end up contacting Rabbit Software and complaining about the program.

Rabbit Calc produces a giant worksheet that can be up to 99 rows long by 26 columns. With the maximum available in practice being the product of rows and columns making no more than 400. Still a very large worksheet.

You name your columns by creating what is known as a 'label' and each of them can be up to nine characters long. Each column can have an almost unlimited number of digits, but only five are displayed, though you can calculate on nine. By operating shift and return you can see all the digits and the calculation that is being made.



Rabbit Calc gives you the facility to add, multiply, divide, subtract and replicate any two boxes. So you can enter all your information and let Rabbit Calc do all the hard work, and the sums.

The 'F' control tells you how much free memory is left. While 'W' for window regulates the number of columns you are displaying. If you display fewer columns, you can move around far quicker. 'B' gives you the option of clearing or deleting in cursor, while 'C' clears all the information on the labels. When you type 'R', you can replicate-duplicate-any of the labels, values or formulae. Other facilities include 'S' for storage and the 'Go' to feature from Visicalc.

Error checking systems prevent you from doing stupid things that might cause the program to crash. Once you have defined the size of the sheet you are working on, if you try to send information to a non-existent label column, it is rejected. Equally trying to make the program crash is virtually impossible. It may give an overflow error message, but to indicate one the values would have to be after all the calculations greater than the power of 37. At this high power even millions appear almost insignificant, so in practice it is crashproof.

Ratings Table

Program Quality:	* * * *
Value for Money:	* * * *
Presentation On-screen:	* * * *
Ease of use:	* * *
Crashproofing:	* * * *
Supplied instructions:	* * *
Overall:	86%

Title: **Death Satellite**
Type: **Tape**
Supplier: **A & F Software**
Machine: **12K ATOM**
Price: **£6**

Death Satellite is an adventure game for those who love to be driven mad by frustration. As far as I have been able to tell, one would need a copy of the listing to solve the elusive mystery.

Apparently your Time Machine, having run out of fuel, has deposited you upon a deserted satellite full of terrible ways to die. In a bid to secure more fuel for your machine you must explore the surrounding rooms and decipher their secrets. You are given only the barest of help and it is up to your quickness of mind to discover the command words to assist you in your quest.

For further confusion the program logic seems to break down in one or two places. For example, only very occasionally I might add, after reversing your direction of travelling you do not end up at your previous travel point. A nasty thought has just occurred to me — perhaps it is a built in device to drive you mad. Also, again very occasionally, the game restarts automatically, leaving you staring in slight confusion at the command to "Type RUN for new game".

All in all an interesting game that should appeal to all those who love text only Adventures.

Ratings Table

Program Quality:	* * * *
Value for Money:	* * * *
Presentation On-screen:	* * *
Ease of use:	* * * *
Crashproofing:	* * * *
Supplied instructions:	* * *
Overall:	75%

P.S.

QUESTION

WHERE CAN I BUY

NEWBRAIN 'A' 32K	FOR	**£268.00**
NEWBRAIN 'AD' 32K	FOR	**£298.00**
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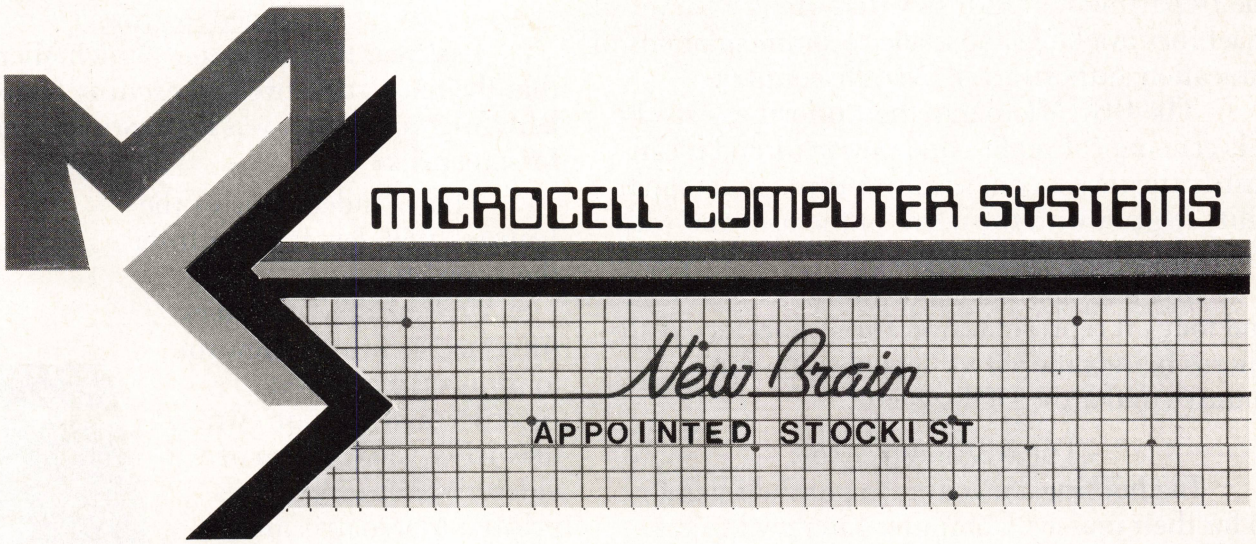

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Three out of every four computers going into schools are BBC Micros. Is there a lesson to be learned by every user?

As part of the current government subsidised scheme aimed at introducing micros to schools, the Department of Industry undertook a survey of machines available and made recommendations to education authorities all over the country.

The BBC Micro met their priorities exactly: it is economical yet fast and powerful, and it can justify the investment involved, through its capability to grow with the needs of the user and with the rapid changes in technology.

Teachers and education authorities agreed, and today it represents over three-quarters of all micros being ordered for schools across the country under the DOI scheme.

The BBC's choice too.

In choosing a machine to put their name to for their massive Computer Literacy Project, the BBC had the same set of priorities as the DOI. The BBC Micro is now an integral part of that project, which includes books, software, courses and a number of major television series, one of which, "Making the Most of the Micro" is now being broadcast.

All this for only £399.

The BBC Micro is light and compact. It generates high resolution colour graphics, and is capable of synthesising music and speech using its own internal speaker. The keyboard uses a conventional layout and typewriter feel.

The most sophisticated version (called Model B) is available for only £399. (There is also a basic model available, the Model A, at £299.)

Designed to grow.

Last year the magazine "Which Micro?" said that the most attractive and exciting feature of the BBC Microcomputer was its 'enormous potential for expansion'.

This is indeed one of the features that sets it aside from the competition.

For example, as well as interface sockets to allow you to connect to a cassette recorder, and to your own television, you can also use video monitors, disc drives, printers (dot matrix and daisy wheel) and paddles for games or laboratory use.



You can also plug in ROM cartridges containing games with specialist application programs.

The Tube. A unique feature.

The Tube, which is unique to the BBC Micro, provides for the addition of a second processor via a high speed data channel. The possibilities are enormous. For example, the addition of a second

3MHz 6502 processor with 64K of RAM doubles processing speed. While a Z80 with 64K of RAM opens the door to a fully CP/M* compatible operating system, with all the benefits for business applications.

Linking up with other computers.

The BBC Micro also offers a facility of immense potential value to schools, colleges and businesses. It's called Econet® – a system which uses telephone cable to link with other BBC Micros. A number of machines can then share the use of expensive disc drive and printer facilities.

Make full use of Prestel & Teletext.

With special adaptors you will not only be able to turn your TV set into a Prestel terminal and Teletext receiver, but you can also take data and programs direct from these services. (The programs, which are known as telesoftware, are already being broadcast by BBC's Ceefax service.) This is another first for the BBC Micro.

BASIC plus.

A sophisticated version of BASIC has been chosen for the BBC Micro, which incorporates features normally found only in more advanced high level languages. However, there is also a facility allowing access through a simple command to another language – for example, PASCAL, FORTH and LISP.

*Trademark of Digital Research.



A full range of software.

Applications software for the BBC Micro already cover a very wide field. Packages covering games, education and business applications are available on cassette. All developed to the same high standards set by the hardware.

The best possible back-up.

Your BBC Micro comes with the backing of the BBC and an extensive dealer and service network.

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How to buy your BBC Micro.

If you are a credit card holder and would like to buy a BBC Micro B, or if you would like the address of your nearest stockist, just phone 01-200 0200.

Alternatively, you can buy a Model B directly by sending off the order form below to: BBC Microcomputers, c/o Vector Marketing, Denington Estate, Wellingborough, Northants, NN8 2RL.

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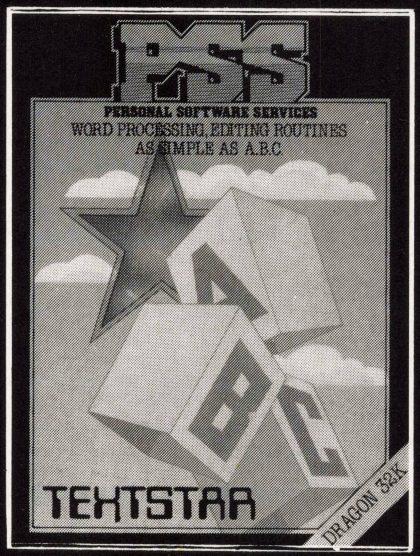

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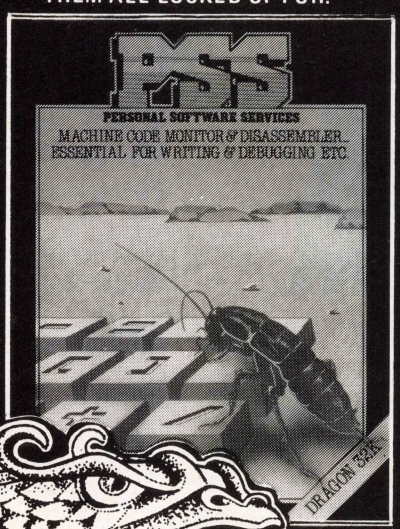

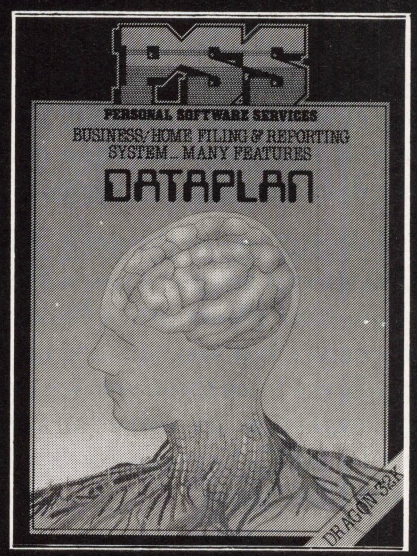

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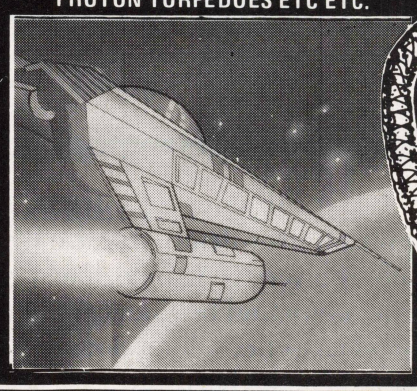

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GEMINI ELECTRONICS

LOOK BEFORE YOU LEAP

Set in the heart of Manchester we find Gemini Electronics, the target for our dealer special.

In this month's Look Before you Leap we leave behind the sanctity of London and head for the uncharted regions north of Watford. The subject for our dealer scrutiny this month in Gemini Electronics. Situated not far from Manchester's Piccadilly station, Gemini look to provide a comprehensive service for home computer users in Manchester and the North.

Gemini's offices and shrowroom are located on the second floor of an inauspicious building, thus giving the customer who visits them the impression of walking into someone's back room to look at his computer. This helps to alleviate the fear usually associated with walking into a bright modern computer showroom and being confronted by salesman eager to take your money.

The first thing you notice when entering their premises is the emphasis placed on the Atari range of computers and games machines. The walls are festooned with many weird and wonderful titles for the 400/800 and the VCS. It really is a case of 'if it's worth having for the Atari, we'll stock it'. All the games that Gemini stock are thoroughly tested before they meet the public's gaze, ensuring that you can get a full demonstration before parting with any money.

Complementing the Atari computers are the Commodore VIC-20 and the 64. The software support for these machines, while not as comprehensive as for the Atari, is quite respectable.

Competitive Prices

Prices on the whole are a few pounds cheaper than manufacturers recommended, with Gemini preferring not to play the price slashing game, concentrating instead on providing a good back up service. The heart of Gemini's support is the service centre situated just across the landing from the showroom. Here they have four full-time hardware engineers and one software engineer who look after all the repairs and servicing on the computers.

With a view to further diversifying their sales base Gemini will also be carrying the Sinclair ZX81 and the Spectrum, as well as some of the new generation video game/computers. First up in this field is the American made Collecovision.

This games machine offers excellent graphics along with some very good arcade games, including the ever popular Donkey Kong and the mind shattering Zaxxon. For those of you who have already encountered Zaxxon will be interested to find out that there is a version of this game soon becoming available for the Atari 400/800 computers. By October the Collecovision will also have a computer keyboard addition which looks like turning it into a very powerful computer indeed.

A Galaxy Of Games

Complementing the Collecovision will be another two games machines/computers, the Creativision and the Vectrex, the latter, featuring the new Quadra Scan screen display and a system of multicolour screen overlays. Needless to say that Gemini will be supporting both of these with a full range of cartridge software. The Collecovision should weigh in at about £149.00 and this price includes the Donkey Kong cartridge.

Another interesting product which Gemini should be stocking is an add on computer keyboard for the Atari VCS. The keyboard should cost around £99.00 and contains 3K of additional RAM which will be expandable, and a Z80 processor. The keyboard will attach to the VCS by means of an adaptor cartridge which will fit into the cartridge slot on the VCS. Gemini will also be extending their service facilities to provide in-house servicing on all these new products.

Demos On Video

Gemini have also implemented an idea which is quickly gaining favour in shops who are beseiged by crowds of interested software buyers waiting to have a demonstration of a piece of software. What they have done is videotaped example runs of the most popular pieces of software and these are shown constantly when the shop gets crowded and people cannot be seen individually.

Finally, Gemini are setting up a software lending library for computer and VCS software. For obvious reasons the only software which will be included is that which is based on cartridge. If you want to get in touch with Gemini, their address is 50 Newton Street, Off Piccadilly, Manchester M1 2EA and their telephone number is 061-236-3083

Our apologies go to Micro Style for the publication of a photo of the shop opening featuring a Dragon 32 computer, in our last dealer spot about the Vision Store.

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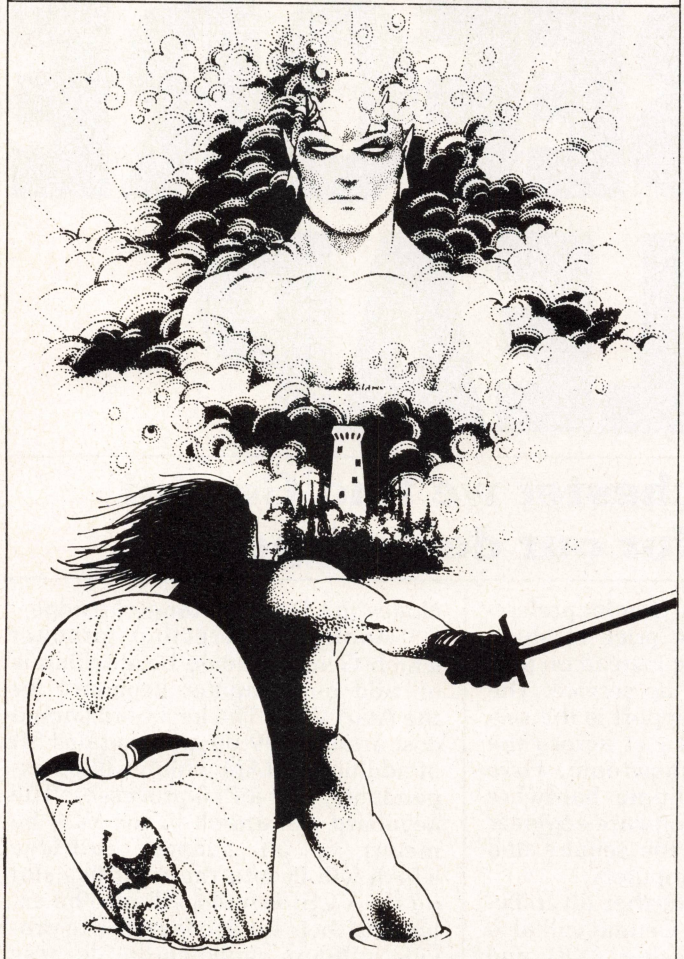

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from J.K. GREYE ENTERPRISES
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The 'Judges' decision is final and no correspondence will be entered into. All business associates of Carnell Software, and their relatives, are disqualified from entry. A copy of the rules of the Volcanic Dungeon championship will be supplied with the entry form.

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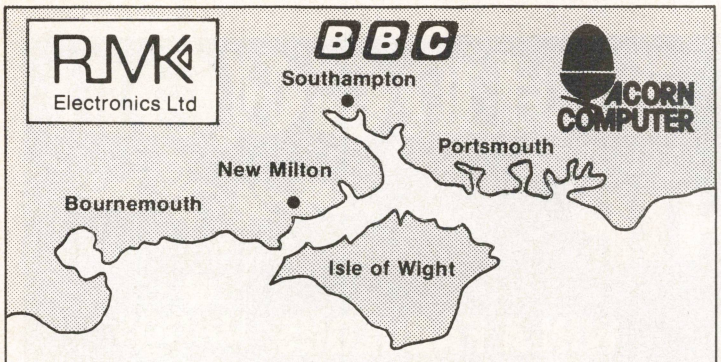

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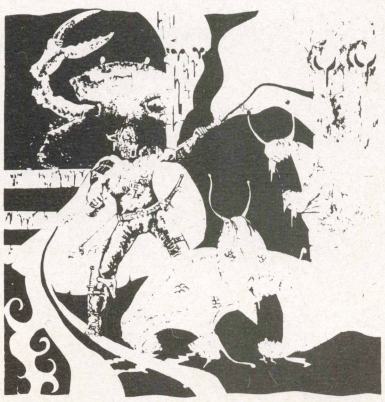

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PERIPHERALS

ADD ONS

This month we look at bits and pieces to use with your Atari, TRS-80 and Atom.

ATARI TRACBALL

Anybody who has played Missile Command in an arcade will be familiar with the action of a Tracball. It is a large plastic ball which is set into the console of the machine. You use it to move objects in any direction on the screen thus making it a fast and accurate way of positioning your playing piece or cursor.

The Wico Tracball is set in a solid black plastic base. The ball itself is made out of a very tough phenolic compound, making it heavy enough to spin easily, but responsive enough to allow very accurate positioning. The fire button is set in the base at the front left edge of the unit. It performed adequately although I found rapid fire a problem because of the raised lip which surrounded the button.

The Tracball was tested using both the Atari 400 computer and the Atari VCS games machine. It will work with any software which is written to use standard Atari switch type joysticks. It worked better with games such as Galaxian where you could spin the ball to move your spaceship across the screen very quickly, firing as you go. With games such as Megamania, which require a far greater degree of control, it was not as accurate as a joystick. However having said this I have had many hundreds of gaming hours using a joystick, as compared to only a few with the Tracball, so this might explain the problems I had with control.

One problem that cropped up when using the Tracball was that it appeared to cause interference on the TV display. Admittedly the Tracball and the VCS console were placed very close to the television so this should not be a problem in normal usage. On the whole I think that the Tracball would be a useful addition to any game player's set-up although I think it would be better complementing a joystick as opposed to replacing it.

The Tracball costs £56.95 and the review model was supplied by Vision Store, 3 Eden Walk Precinct, Kingston-on-Thames, Surrey.

B-KEY 400

The B-Key 400 must rate as perhaps the most useful item you could ever buy for your Atari 400 computer. The B-Key replaces the slow and ponderous touch-sensitive keyboard on the 400 with a fast and smooth moving-key unit.

The B-Key fits snugly into the computer's case instead of the flat membrane. It is supplied in kit form and to assemble it all you have to do is to clip the keytops onto the push switches which are already mounted on the base. This takes about five minutes and included with the unit's instructions is a diagram showing each key's position. The instructions for fitting the unit were comprehensive and they included a series of pictures annotating each step of the process.

One criticism of the unit was the edge connector. It was not as robust as I would have liked, especially since fitting the edge connector was a tricky operation and one could easily end up damaging the pins on the end of the connector.

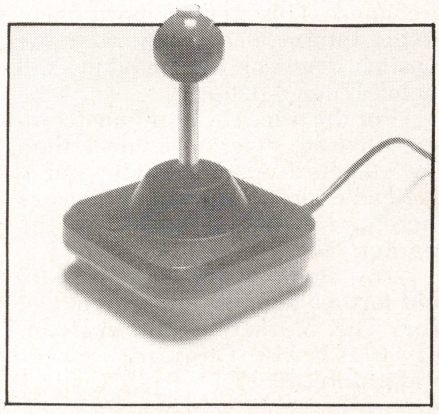
Apart from this slight failing the keyboard worked well, each key gave a smooth and positive response and was fast enough to make touch typing possible.

The B-Key 400 costs £79.95 and the review model was supplied by Vision Store, 3 Eden Walk Precinct, Kingston-on-Thames, Surrey.

RED BALL JOYSTICK

The Red Ball Joystick is designed to replace the standard Atari type joysticks. Its design is based heavily on the arcade style joysticks, featuring a solid steel shaft, eight-way switch configuration and dual fire buttons. The joystick was a little large for hand-held use, but functioned well when placed on a hard surface.

The dual fire button feature was controlled by a small slide switch mounted on the base. By moving this switch you can elect to use either the fire-button on the base of the unit or the button on the top of the stick. It is useful having this option as the different positions suit certain styles of games than others. I did find that using the stick mounted button was a lot harder than using the base mounted one because it was difficult to maintain a good grip on the ball and fire at the same time.

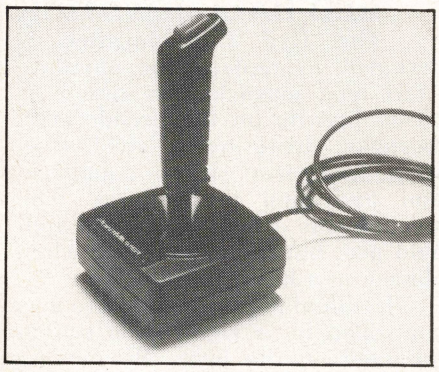


The joystick, while only having a very short arc of travel, did have a positive action and the whole construction of the unit gave the impression of being built to last.

The Red Ball joystick costs £21.95. The review model was supplied by Computers For All, 72 North Street, Romford, Essex. It is made by Wico and is one of the Command Control range.

POINTMASTER

The Pointmaster is another joystick designed for use with the Atari systems. It is constructed entirely of plastic and features a moulded grip with a single fire button mounted on the top. The central column assembly is set in a moulded plastic ball, which provides the pivot for the joystick's movement. Once again this joystick works far better when placed on a hard surface, its base making it uncomfortable to hold for extended periods.



The plastic construction of the joystick tended to make the joystick feel stiffer than it actually was and the ominous creaking which came from the base did not instill confidence in the unit's longevity.

The top of the column was set at an angle which positioned the thumb naturally over the fire button, making it very easy to fire although a little bit more travel in the fire button movement would have been appreciated. This central positioning of the button also meant that the joystick could be used equally well by left handed people.

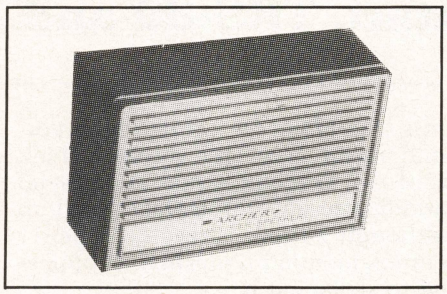
For the price the Pointmaster offers slightly superior control than the standard Atari joystick, but if you can afford to spend a little extra there are better joysticks on the market.

The Pointmaster costs £14.95 and further details can be obtained from TEK Marketing, Burrel Road, St Ives, Huntingdon, Cambridgeshire. PE17

TANDY TRS-80

MINI AMPLIFIER SPEAKER

This functional grey box is designed to give your Tandy a voice. Well not so much a voice, but you can program the Tandy to give you sound effects from the cassette port. By plugging this unit into the cassette lead from your computer you can amplify the signals leaving your computer.



The unit features an inbuilt speaker, volume control, input jack and external speaker/ear piece jack. It is powered by a nine volt battery which lasts for a reasonably long time, except if you wind the volume up to the ear cracking levels. Doing this will considerably shorten the battery life.

Operationally, this amplifier did its job adequately but not brilliantly.

The Archer amplifier/speaker costs £7-49 and is available from Tandy Computer Centres.

JOYSTICK CONTROLLERS

These are the official joysticks for use with the Tandy Color Computer. They are based on the potentiometer arrangement whereby each joystick is linked to two rotary potentiometers.

This system makes them ideal for exactly positioning objects on screen but unfortunately they seem to be finding the majority of their usage with games which would be better off with a switch type of joystick.

The joysticks comprise a small black plastic base with the control column set in the centre. The fire button is situated on the leading edge.

The base of the unit could have been sculpted to fit better into the hand but it was quite usable as it stood. The joystick column offered a little resistance to movement. This was good as most of these types of joysticks are sloppy, however I get the impression that this stiffness was caused by the joysticks being new and they would soon loosen up with wear.

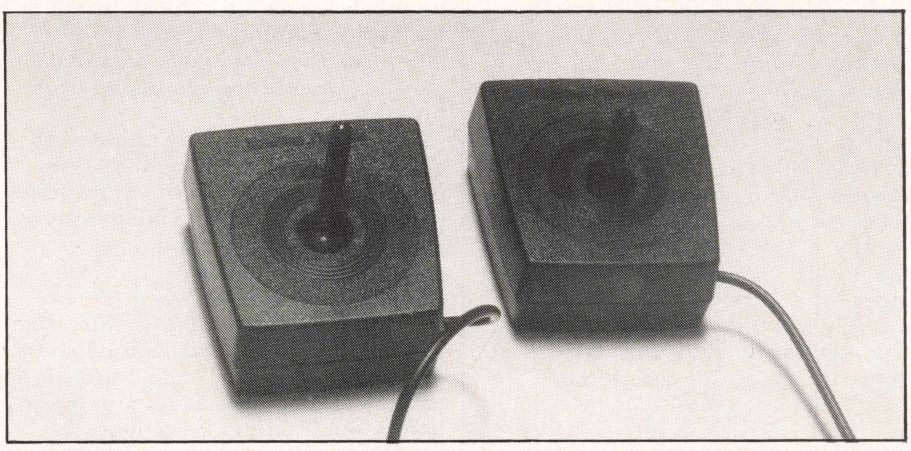
The joysticks performed well, providing accurate and positive positioning on screen. The Joystick Controllers, which incidentally will fit the Dragon 32, cost £19-95 a pair and are available from Tandy Computer Centres.

X-PAD GRAPHIC TABLET

This graphics tablet enables you to copy drawings from paper directly onto the computer's screen. The unit consists of the tablet, an interface box and a special pen. The interface box connects into the expansion port on the side of the Tandy Color Computer. Once this is done then the unit becomes active and you can start to use it.

The manual contains many example programs on how to read the information from the tablet and convert it onto the screen. These programs cover virtually every use of the X-Pad, including examples of direct copy, start and endpoint drawing and menus.

The pen supplied with the unit



has a pressure sensor built into the nib thus making it possible to detect when the pen is just at rest on the tablet's surface, or whether it is being used to write. This also makes it possible to indicate to the computer the start of a line and the end of line, leaving the computer to 'join the dots'.

The tablet comes supplied with a template which has positions marked in it for colour changes, editing commands, and alphanumeric symbols, all of which can be programmed in the software.

The accuracy of the unit was acceptable and this could be further improved by altering the software. However, at £249.00 this unit represents an expensive luxury as opposed to an essential for the home computer user. The X-Pad is available from Tandy Computer Centres up and down the country.

ATOM

16/32K RAM BOARD

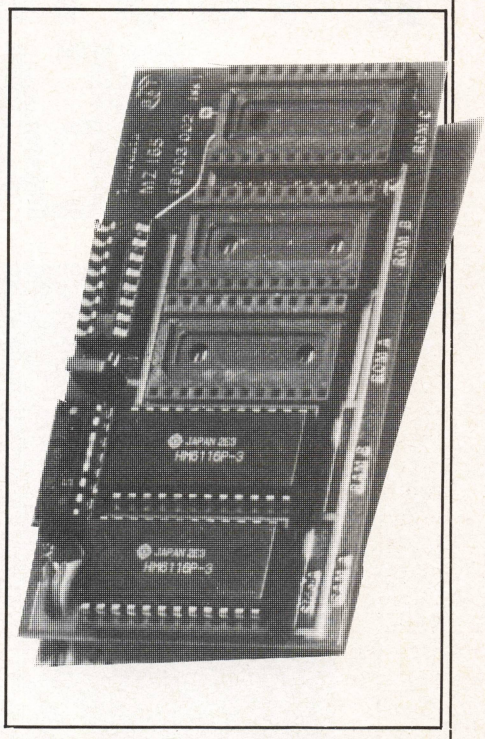
Timedata's RAM expansion board is designed to fit inside the Atom's case and provide the user with either an extra 16K or 32K of RAM.

It comes partially built, leaving you to fit the edge connectors and wire it into the Atom. The board is socketed to accept up to 16 RAM chips. The review model came fitted with 8 4816 chips and costs £69.50.

The instructions supplied with the unit were comprehensive, but could have benefited with a few photographs to show the installation process. They were also slightly confusing as to which version of the board you had actually received. And seeing as different boards need different links and solder joints to be made this could spell disaster. Unless you are good with a soldering iron I would leave the installation of the unit to someone who is an expert especially since an unnoticed drop of solder in the computer can wreck the machine. The 16/32K boards cost between £59.50 — £96.50 and are available directly from Timedata, 16 Hemmells, High Road, Laindon, Essex SS15 6ED.

ATOM ROAM BOARD

The ROAM board is a 'piggy back' mounting PCB which gives the Atom 4K of CMOS RAM and 3 24-pin IC sockets wired to accept Atom utility ROMs. The unit is controllable under software, allowing you to select either the 4K of RAM or one of the ROMs to reside in the Atom's utility address space between A000-AFFF.



The unit comprises a small printed circuit board fitted with five 24-pin ZIF sockets. Two of these are already fitted with 6116 RAM chips and the other three have been left vacant for any utility ROMs.

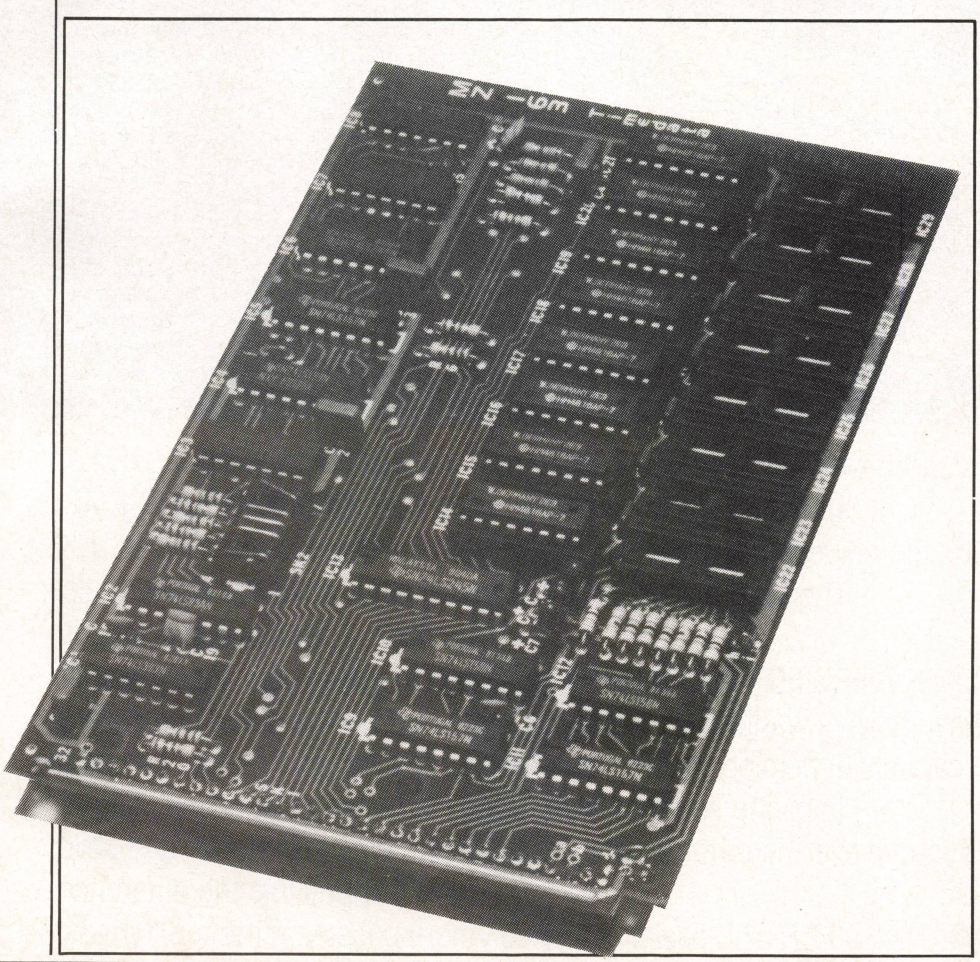
The instructions which are supplied with the unit are fairly straight forward, but as with the 16/32K expansion board they could have benefited from a series of photographs showing the installation procedure. Once the board is installed it is a simple process to select which chip will appear in the Atom's utility socket. One benefit of having the 4K RAM is that a program can be loaded or written into it and then even if the chip is switched out and another switched in it will still retain the information.

The Atom ROAM board costs £35.00 and is available from Timedata, 16 Hemmells, High Road, Laindon, Basildon, Essex SS15 6ED.

Our thanks go to all firms who have supplied review equipment.

Next month we are bringing a more general feel to Add-On Action, featuring peripherals for a wider variety of machines. There'll be something to suit everybody.

We are pleased to receive products to review from suppliers – and also to hear any readers suggestions about Add-On Action.



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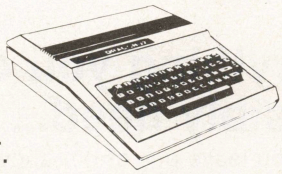

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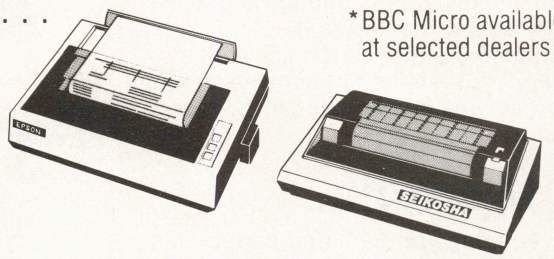

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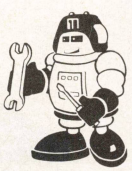

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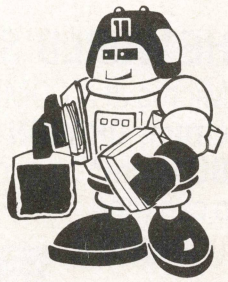

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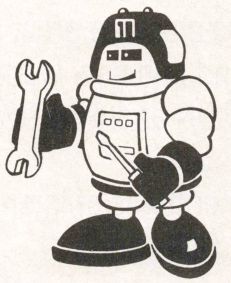

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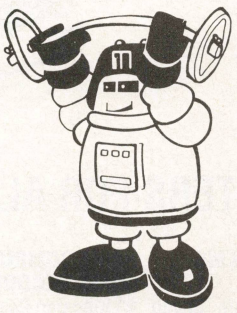

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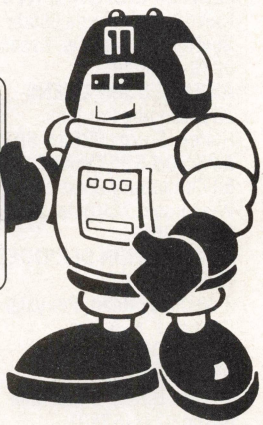

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ZX81 TASWORD

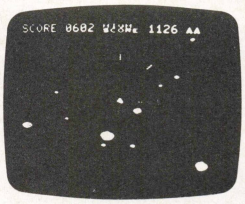
Tasword for the ZX81 (16K) is still available at £6·50. No demonstration cassette available but send 50p (refundable against your subsequent purchase of ZX81 Tasword) for a copy of the manual.

ARCADIA

ASTEROIDS, INVADERS, ASTRO SLED & SPACE FIGHTER.

ASTEROIDS

A classic version of the clasic game. Feature packed with thrust, hyperspace, rotate, multiple bolts, etc. This exciting program is written in m/c and employs hi-res graphics and double size screen techniques for maximum effect.



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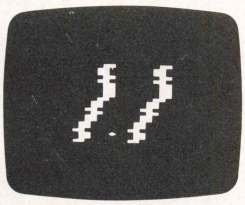

INVADERS

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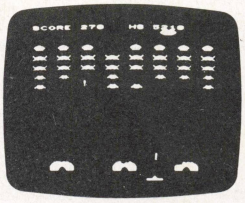
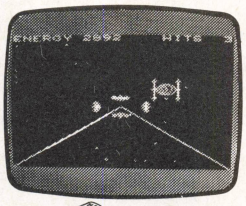


SPACE FIGHTER

A space dog-fight simulator which, like Asteroids, is written in machine code and uses hi res. Guide your fighter through tight loops and turns to centre the elusive alien craft in your sights.
With 10 skill levels.



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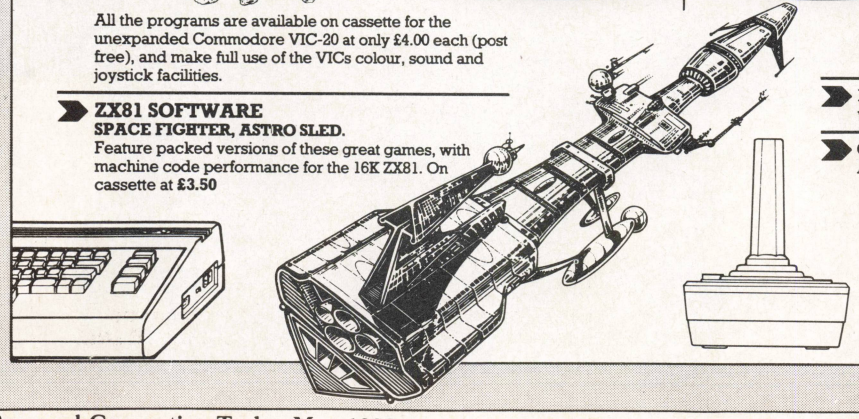

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CHASE

Can you outwit the aliens? Grant Privett's program will stretch your skills.



The game of Chase requires not only speed and agility in the control of your man, but also the ability to analyse the positions of the aliens on the screen quickly enough to plan your next move.

Initially you are required to input some measure of your talent or ineptitude. Following this, a large rectangular border is drawn on the screen and blocks are randomly strewn within it. The aliens are then placed in the corners of the rectangle and your man at the centre. After a brief count-down the chase is on and the aliens will be out to get you.

By using the cursor keys for left and right, and the A and Z keys for up and down you have to avoid contact with the aliens for as long as possible. When an alien encounters a block then one of two things will happen. If you are lucky they are mutually destroyed and the alien will be sent back to its starting position. Alternatively it will wait for you to move in a direction in which it can continue to pursue you. The relative frequency of these two responses and the total number of blocks strewn on the screen is related to the claim you made for yourself at the beginning of the program.

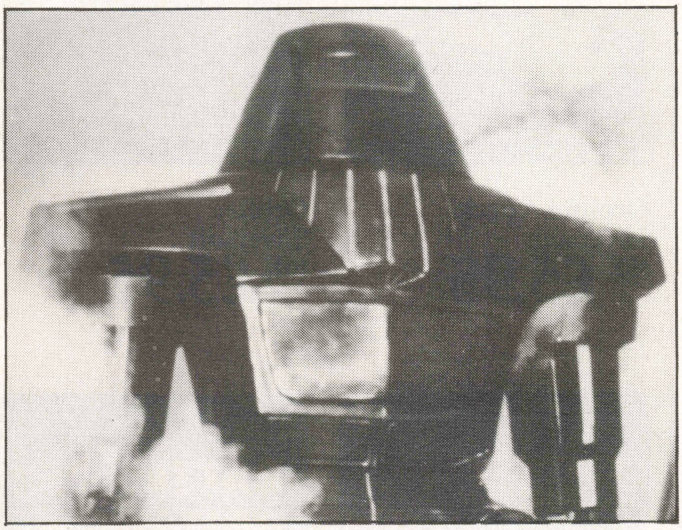
The object of the game is simply to survive as long as you can. To survive more than 100 seconds indicates you should change level. When you do succumb to the aliens the time for which you survived is displayed. REM statements have been omitted throughout to ensure maximum speed of operation.

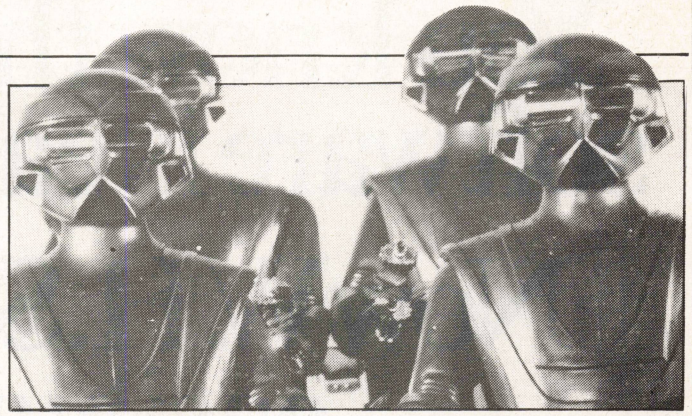
HOW IT RUNS

10-120	Sets up defined character set in memory.
130-140	Sets up variable table and creates arrays.
150-250	Prints credits and instructions.
260-290	Inputs degree of ability and calculates difficulty.
300	Clears screen and sets initial direction.
310-360	Rectangle drawn and blocks strewn.
370	Coordinates for aliens origins.
380-400	POKEs aliens into starting coordinates.
410	Sets up temporary aliens coordinates.
420-430	Countdown.
440	Start clock.
450-880	Move man and aliens.
890-940	Prints time survived/new game.

Variables Used

A	Current direction choice.
B1-B2	Temporary alien coordinates.
B3	Screen reference location.
B4	Probability function (adjust to taste).
B5	Screen row length.
QQ	Previous direction choice.
R( ),N( )	Present alien coordinates.
RA( ),NA( )	Coordinates of alien origins.
R,N	Man coordinates.
A$	Keyboard Input.
Z%	Skill Level.
I	General purpose variable.





HINTS ON CONVERSION

This program was written for use with a memory mapped screen display. For this reason it is clearly a simple matter to convert from one such machine to another. For users of machines not having this facility it is probably best to write an equivalent program from scratch utilising the features of your own machine and using the program listing as a guide.

Clearly the conversion problem may be broken down into three main considerations; screen dimensions, screen location and character identity. The border drawn in lines 310-320 encompasses the area below the first line. Any character may be used to make up the border since those locations are not examined in the course of play. The screen dimensions are used throughout the program. The depth of your screen should replace 23's, and B5, declared in line 140, should be changed to your screen width.

The screen origin used above is that the top left corner is row 1, column 1 therefore the location one row above is row 0, column 0. This location, which is never POKEd, is taken as a reference point and is declared in line 140.

PROGRAM LISTING

```
10 REM PWA 1982
20 REM ***** 3K EXPANSION REQUIRED
30 S=38876:WN=S+1:WS=S+2
40 POKE51,0:POKE52,28:POKE55,0:POKE56,28
50 FORL=0TO511:POKE7168+L,PEEK(32768+L):NEXT
60 DATA255,255,255,255,255,255,255,255
70 DATA16,56,16,124,16,16,40,68
80 DATA24,60,126,255,255,255,255,255
90 DATA24,60,114,94,94,114,60,24
100 DATA24,60,78,122,122,78,60,24
110 FORL=0TO39:READX:POKE7640+L,X:NEXT
120 POKE38363,255
130 SC=7680:CF=30720
140 N=0:R=0:A=0:B1=0:B2=0:B5=22:B3=7657:QQ=0:FORI=1TO4:R(I)=0:N(I)=0:NEXT
150 PRINT"■■TAB(8)"CHASE■"
160 PRINT"AN ORIGINAL PROGRAM BY     GRANT PRIVETT"
170 PRINT"■ADAPTED FOR VIC-20 BY       ALLEN WEBB"
180 FORL=1TO3000:NEXT
190 PRINT"■YOU,THE SMALL MAN (◣◢■),STAND IN AN ARENA.
THEALIENS (■■) ARE OUT TO EAT YOU."
200 PRINT"■THE CURSOR KEYS MOVE  YOU LEFT AND RIGHT.
THE 'A' KEY MOVES YOU NORTH.":
210 PRINT" THE 'Z' KEY    SOUTH.
220 PRINT"■THE BLOCKS WILL HIDE  YOU BUT WILL BE SLOWLYDESTROYED."
230 PRINT"■HOW LONG CAN YOU LAST?"
240 PRINT"■PRESS A KEY TO START"
250 GET0$:IF0$=""THEN250
260 PRINT"■■■DEGREE OF DIFFICULTY■":PRINT"INPUT ABILITY 1-4":N=12:R=10
270 PRINT"4-REAL GROOVER":PRINT"1-CRETINOUS OAF"
280 GETA$:Z%=VAL(A$):IFZ%<1ORZ%>4THEN280
290 B4=1.1^(1.1*Z%)+2
300 PRINT"■":QQ=RND(1)*8+1
310 FORI=SC+22TOSC+462:POKEI,59:POKECF+I,5:POKE(I+462),59:POKE(CF+I+462)
,5:NEXT
320 FORI=SC+44TOSC+462STEPB5:POKEI,59:POKEI+CF,5:POKEI+21,59:POKEI+CF+21
,5:NEXT
330 FORI=1TOINT(120/Z%+3):LO=SC+22+RND(1)*462
340 IFPEEK(LO)<>59THENPOKE(LO),61:POKELO+CF,6
350 POKEV,15:POKEWN,150:FORL=1TO10:NEXT:POKEV,0:POKEWN,0
360 NEXT
370 NA(1)=3:RA(1)=2:NA(2)=3:RA(2)=21:NA(3)=22:RA(3)=2:NA(4)=22:RA(4)=21
380 FORI=1TOZ%:C2=62:IFI=2ORI=4THENC2=63
390 POKE(B3+B5*NA(I)+RA(I)),C2:POKE(B3+B5*NA(I)+RA(I))+CF,2: NEXT
400 POKE7931,60:POKE7931+CF,3
410 FORI=1TO4:N(I)=NA(I):R(I)=RA(I):NEXT
420 FORL=1TO4:PRINT"■SECONDS TO GO";4-K
430 POKEV,15:POKES,200-10*K:FORD=1TO20:NEXT
440 FORI=1TO900:NEXTI,K:PRINT"■                              ":TI$="000000"
450 POKEV,0:POKES,0
460 GETA#:IFA$=""THENA=00:GOTO520
470 AA=ASC(A$):IFAA=29THENA=3
480 IFAA=17THENA=2
490 IFAA=65THENA=4
500 IFAA=90THENA=1
510 IFN(J)<>NORR(J)<>RTHEN520
520 POKE7666,126:POKE7669,126:POKE7674,126:POKE7677,126
530 POKE7667,126:POKE7668,126:POKE7675,126:POKE7676,126
540 POKE(B3+B5*N+R),32:ONAGOTO590,650,660,600
550 A=RND(1)*4+1:GOTO520
560 N=N+1:R=R-1:IFN<23ANDR>1THEN680
570 N=N-1:R=R+1:IFN>2ANDR<B5THEN680
580 GOTO560
590 N=N+1:IFN<23THEN680
600 N=N-1:IFN>2THEN680
610 GOTO590
620 N=N+1:R=R+1:IFR<B5ANDN<23THEN680
630 N=N-1:R=R-1:IFN>2ANDR>1THEN680
640 GOTO620
650 R=R-1:IFR>1THEN680
660 R=R+1:IFR<B5THEN680
670 GOTO650
680 PE=PEEK(B3+B5*N+R):IFPE=62ORPE=63THEN890
690 POKE(B3+B5*N+R),60:POKE(B3+B5*N+R)+CF,3:QQ=A
700 FORJ=1TOZ%:C2=62:IFJ=2ORJ=4THENC2=63
710 POKE(B3+N(J)+B5+R(J)),32
720 IFN(J)<NTHENB1=N(J)+1:GOTO750
730 IFN(J)>NTHENB1=N(J)-1:GOTO750
740 B1=N(J)
750 IFR(J)<RTHENB2=R(J)+1:GOTO780
760 IFR(J)>RTHENB2=R(J)-1:GOTO780
770 B2=R(J)
780 IFPEEK(B3+B5*B1+B2)=32ORPEEK(B3+B5*B1+B2)=42THEN840
790 IFPEEK(B3+B5*B1+B2)=60THEN890
800 IFRND(1)>B4THEN830
810 POKE(B3+B5*B1+B2),32:N(J)=NA(J):R(J)=RA(J)
820 POKEV,15:FORD=240TO140STEP-Z%:POKES,D:NEXT:POKEV,0:GOTO880
830 GOTO850
840 N(J)=B1:R(J)=B2
850 POKE(B3+B5*N(J)+R(J)),C2:POKE(B3+B5*N(J)+R(J))+CF,2:NEXT
860 POKE7666,114:POKE7667,96:POKE7668,96:POKE7669,114
870 POKE7674,76:POKE7675,6:POKE7676,6:POKE7677,76
880 GOTO460
890 PRINT"■YOU SURVIVED FOR":INT(TI/60);"SECS."
900 PRINT"■■MORE Y/N"
910 GETI$:IFI$=""THEN910
920 IFI$="N"THENEND
930 IFI$="Y"THEN260
940 GOTO910
```

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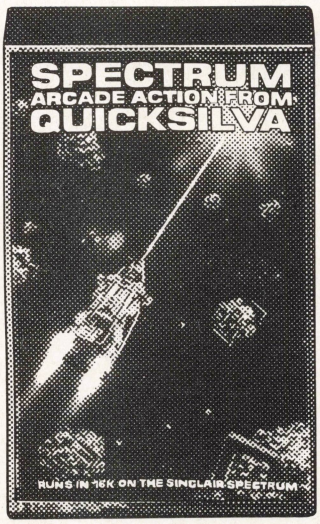

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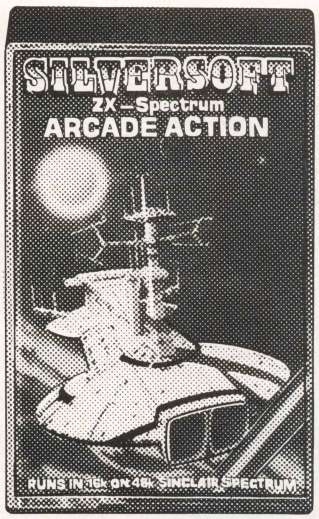

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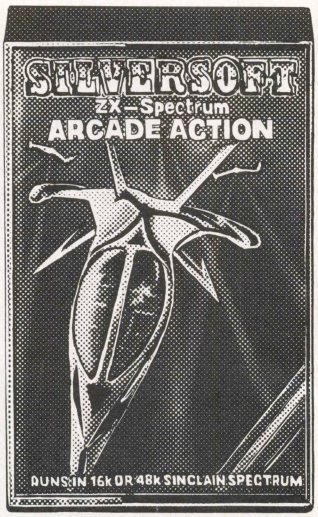

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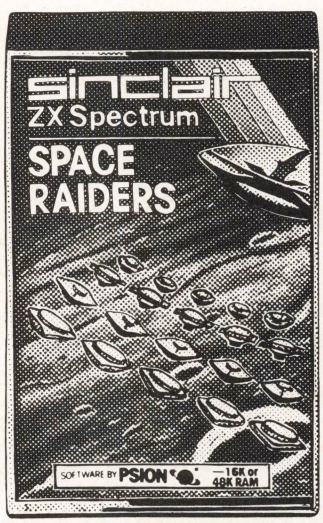

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ATARI 400
COMPETITION

VIDEO GAMES WIN AN ATARI

Win an Atari 400 and read our full reviews of the brightest, and best Atari VCS compatible video games.

ABOUT THE ATARI 400

The Atari 400 is an all-purpose home computer. Not only can you blow up green meanies to your heart's content but you can also use it for office purposes, like storing accounts information and employees records. In the home you can use it as an instant recipe book, manage your personal finances, store telephone numbers and addresses, as well as to help you learn foreign languages, compose music and teach yourself to touch type.

A basic 400 comes with 16K RAM memory as standard. This can be expanded but you have to get a specialist to insert the extra memory boards which can bring the memory capacity up to 48K. Colour is also standard on the 400 with 16 different colours available, each offering eight intensities. Sound presents no problem as there are four sound 'voices' providing you with the buzzing and bleeping now so familiar in computer and video games. If that's not enough you can buy extras in the form of graphic accessories and peripherals like printers and tape recorders for program loading and saving.

One slight drawback of the 400 is the keyboard. It has a sensory surface which makes keying-in a bit haphazard because you can't actually 'feel' your way.

To overcome that when you successfully press a key it emits a 'bleep'. The keys are also slightly raised around the edges to make them easier to use. Mistakes are still easier to make. There are 57 keys on the keyboard which is about usual for similar computers, as well as four function keys and 29 graphics keys.

Atari graphics are second to none and are of course high resolution which means you can create very clearly defined characters on the screen.

You can program your 400 using either Atari BASIC, Microsoft BASIC (the industry standard), Pilot, Pascal, Forth and Assembler. The Atari 400 costs just £159.99.



During the last year Atari's range of 400 and 800 computers has increased its UK sales substantially. Excellent software for both versions of the machine is readily available from numerous distributors country-wide. And now's your chance to win an Atari 400 for nothing.

The Atari 400 is the cheapest computer in Atari's range but it still offers the much-acclaimed graphics which have done so much for the computer's success. It is the natural upgrade for people who have not yet ventured into the world of computing but have been weaned on non-programmable video computer system like the Atari VCS or the Acetronic MPU2000.

Some confusion surrounds the name given to the Atari VCS and many people believe that it is a computer. It's not. The 'video computer system' has some great games developed for it but they are outshone both speed and graphics-wise by the Atari 400.

The essential difference between the two systems is that with the Atari VCS you can only use pre-programmed ROM cartridges. Atari 400 owners can write their own programs to run on the computer because the circuit boards contain both ROM (Read Only Memory) and the vital RAM (Random Access Memory). RAM is computer memory which you can read from (i.e. call up the pre-programmed information on a TV screen) and write into (place information into the computer's memory banks, store it and re-call data at a later stage.)

Because of this the Atari VCS has obvious limitations. Atari's own software has for a couple of years been of a very high standard — imaginative and well-written. The firm's programmers are expert at overcoming the memory limitations imposed on them and have succeeded in producing very worthwhile software.

It's interesting to note that firms which are now bringing out VCS compatible software were, for the most part, set up by ex-Atari employees.

An important point to note is that you cannot use your VCS cartridges with an Atari 400 computer — and vice versa. They are totally incompatible.

SOFTWARE

A galaxy of games has been written for the Atari both by the computer's manufacturer and independent suppliers. Here is a review of the very latest game from Atari's range, Galaxian.

GALAXIAN

So fast and furious is Atari's Galaxian that there is no time to pause for thought while the attacking hoardes are in mid-flight.

This is the latest of Atari's arcade series and is a replica of the very popular video game found in amusement arcades and pubs up and down the country.

Galaxian is essentially a souped-up version of space invaders and without doubt has the same addictive effect on players. Once played forever hooked. The principal of both games is the same. You must wipe out a fleet of aliens with a throbbing laser gun at the same time dodging their relentless fire. You can move the laser canon to right and left activating your weapons with the red fire button.

The alien fleet consists of four species — **Drones, Emissaries, Hornets** and **Commanders.** When in stationary formation they are worth 30, 40, 50 and 60 points respectively. If you shoot them dowm in mid-flight their points value rises. **Drones** are then worth 60, **Emissaries** 80 and **Hornets** 100. These cause hairy death-dicing situations which are difficult to get out of, but worse still are the **Commanders** in flight. A **Commander** without an escort scores you 150, with one escort 200, with two escorts 300 and if you wipe out both escorts and then the **Commander** a mammoth 800 is added to your score.

A good strategy to adopt is to pick off the aliens which swoop down kamikaze style from each end of the formation. If you let these go you will find the others rapidly follow suit and the Commanders will begin their attack. If you miss an alien they return to the formation at the top of the screen. As you wipe out an entire wave of aliens the next wave attacks you faster and more furiously. It's easy to get hemmed in by four or five aliens' fire leaving your canon no escape route. Certain and sudden death.

There are 10 levels of difficulty and a beginners version in which the aliens don't fire at you for the first 16 waves. In that game you get the chance to learn the laser moving technique. If inexperienced it's worth playing this easy version.

For one or two players Galaxian is available from stockists for £29.99. A great version of the original arcade game which is bound to pump adrenlin into you veins. A word of warning, don't play Galaxian when you're near anyone who is trying to concentrate. The noises from the game are infuriating after a while and sounds like World War III if the volume control is set too loud.

How to Win Your Atari 400

It's simple. All you have to do is don your thinking cap and hit upon a original and creative **idea** for a computer program. You can dream up your program to fit in any one of four categories. The categories are ARCADE GAME, STRATEGY GAME, ADVENTURE GAME, EDUCATIONAL PROGRAM.

Your entry must consist of a detailed typewritten, or clearly hand-written in double spacing, scenario of the program idea. If you enter any of the games categories you must write a scenario of your idea complete with rules, ideas for graphics characters, names, score system.

If you come up with a good idea for an educational program you must write a detailed description of it, with as much information as possible. In both cases diagrams/pictures would be useful.

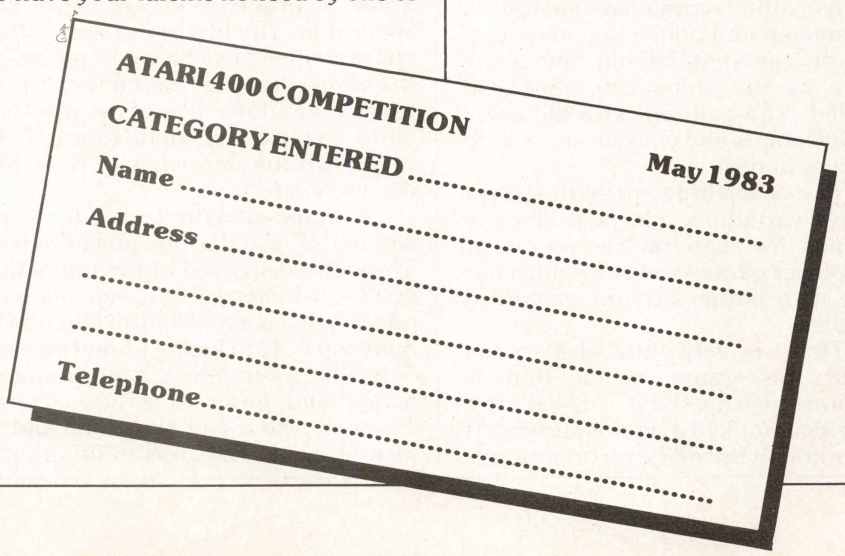
What we don't want to see are loads of re-vamped versions of Space Invaders, Pac-man or Hangman. We want you to show your individuality and let your imagination run riot to produce an original game.

Having a hand in the judging will be Atari's software development team and this could be your chance to have your talents noticed by one of the leading home computer manufacturers. There can only be one winner and he/she will be picked from the best of each category.

Your entry will only be accepted with the coupon on this page so make sure you cut it out and attach it firmly to your entry (don't forget to read the rules carefully). Remember to mark on the envelope PCT/ATARI 400 COMPETITION and the category you have entered. If you enter more than one category you must send them in separate envelopes.

RULES OF ENTRY

1. This competition is open to all UK and Northern Ireland readers of Personal Computing Today except employees of Argus Specialist Publications Ltd, their printers, distributors, employees of Atari International and their distributors or anyone associated with the competition.
2. All entries must be submitted with the coupon from the magazine — photocopies will not be accepted.
3. As long as the correct coupon is used for each entry there is no limit to the number of entries you may submit.
4. All entries must be postmarked before the closing date 31st May 1983.
5. No correspondence will be entered into regarding the result of the competition and it is a condition of entry that the Editor's decision is final.
6. The winner will be notified by post and the result of the competition will be published in a future issue of Personal Computing Today.
7. Entries will only be accepted with PCT Atari 400 Competition marked in block capitals on the envelope. You must also mark the category you have entered on the envelope.



ATARI VCS

VIDEO GAMES REVIEW

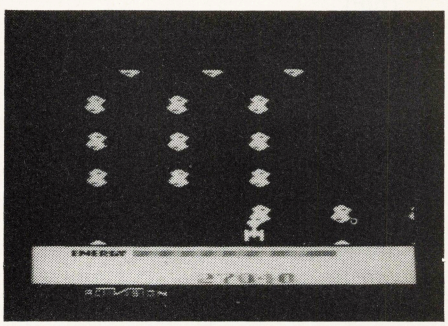
Megamania

There is only one word to describe this cartridge, compulsive. If you have a VCS and you like zapping flying objects this cartridge will stretch your brain, reflexes and coordination to the extreme.

Megamania, like all the best games, is based around a simple concept. You have a missile base at the bottom of the screen and above you fly the objects that you have to destroy. Not ordinary aliens these. The cast list for Megamania reads like an explosion in a general store, with wave after wave of attacks from hamburgers, cookies, bugs, radial tyres, diamonds, steam irons, bow ties and space dice.

Each different variety of object constitutes a wave and each wave has a different attack pattern that changes as the game progresses. For example the first wave of cookies attack in a slow three piece zig-zag pattern but in later waves this becomes tighter and faster. Part of this game's appeal lies in learning how each wave attacks and deriving a strategy for dealing with them.

When you have battled your way through the first eight shapes then they reappear in different attack formations, speeding up and dropping faster bombs as they go.



To make life even more limited you only have a limited energy supply with which to combat a wave. If you survive, the remaining energy is counted up and added to your score, one energy unit having the same value as the ships you have just battled. You gain an extra life every 10,000 points and you can store up to six lives in reserve.

The cartridge provides four games variations and two difficulty settings. You can have either one or two player games and can equip your base with either straight or guided missiles.

There is very little else to say about this game except that is definately the best of all the cartridges looked at in this survey. At the moment the office records stands at 287190 by a certain deputy editor from one of our sister magazines, ETI. Your humble scribe at the moment is second with 213080. Megamania can easily be classed as a 'must' cartridge for any VCS owner. The producer is Activision and price is £29.95.

E.T.

At Last! amid a flurry of advertising and copyright notices our favourite alien has arrived on the television screen. No not another pirate video cassette, but E.T. the video *game*.

Almost as soon as E.T. was released in America Atari tied up all the rights to present this character in video game form. But unfortunately the result of all this I'm afraid is a run of the mill adventure game which relies heavily on the E.T. euphoria to give it any worth.

The story line of the adventure is based loosely on the film with you helping E.T. gather the missing parts of his intergalactic telephone for him to 'phone home' and be rescued by his ship. During the game you move the E.T. character through various inter-related scenes in search of the telephone fragments which are hidden in pits. To collect the pieces you have to let E.T. fall down a pit, collect the phone fragment and then fly him out using his special powers of levitation.

During the course of your search you encounter various other characters from the film, such as Elliot, the little boy who befriends E.T.) a scientist and an FBI agent. Depending on which skill level you choose any one or all three will feature in the game play. Elliot will help you gain bonus points and will also recharge you is you run out of energy.

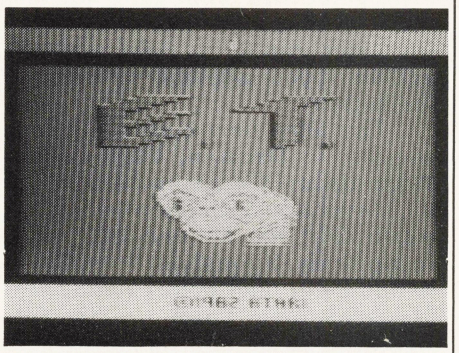
The scientists will capture E.T. and take him to the Institute of Science to study him. This is not too great a problem except with his spaceship. The FBI agent is a nastier character because he steals pieces of the phone that E.T. has collected and hides them down one of the pits. He can also steal any candy that E.T. is holding, thus depriving E.T. of his reserve energy.

Contained in the scenes through which E.T. wanders are power zones. These are displayed at the top of the screen whenever E.T. encounters one. They have a variety of functions, allowing E.T. to locate phone pieces, call Elliot, eat candy, send humans away, and jump to a new scene. There is also a call ship zone and a pick up zone. E.T. has to find these before he can signal his ship and be rescued.

The cartridge offers three versions of the game. One where all the characters are present, one with only Elliot and the FBI agent and one with just E.T. and Elliot.

Everybody who played the game found that it was virtually impossible to complete it on anything but the third variation with just Elliot and E.T. This I found frustrating and along with the complexity of the formation which you have to assimilate I think that this could alienate a lot of younger players. It is surprising that Atari made the game like this as I imagine a large percentage of prospective buyers for this game will be children.

Overall I was not that impressed although the graphics were good, especially the opening picture of E.T. as previously mentioned the producer is Atari and the cartridge costs £29.99 from usual Atari stockists.

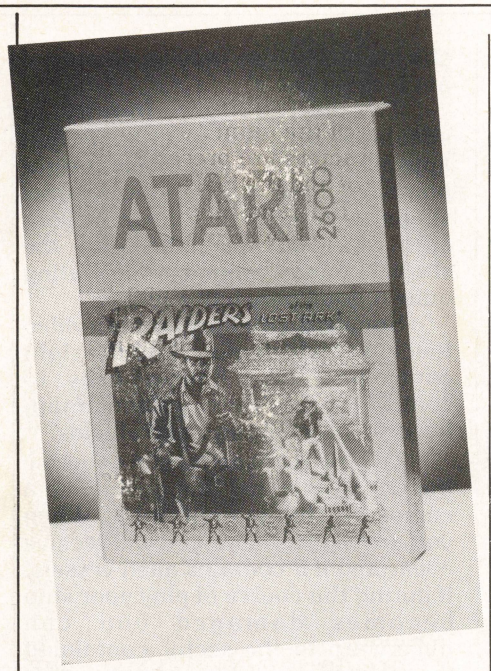


Raiders of the Lost Ark

Following closely on the heels of Atari's E.T. cartridge comes another Spielberg blockbuster film tie-in, Raiders of the Lost Ark. In the game you take the part of Indiana Jones and guide him through numerous scenes and dangers to find the fabled Lost Ark of the Covenant.

You start the game in an entrance hall and from there you move to different scenes, collecting treasures and artifacts along the way. Although the games is for a single player you need joysticks to operate it. One controls Indy's movements and the other is used for selecting and dropping items which you carry.

The objects which you are holding are displayed on a status line at the bottom of the screen, along with a small dot which indicates which object you are using. Some of the objects which you can get are a gun, Indy's whip and a parachute. Some of these objects are necessary to defend yourself against the



menaces which lurk along your path, and others are used to gain access to certain parts of the adventure.

The manual that is supplied with the cartridge is split into two parts. The first part gives you basic information on how to play the game and the second offers you hints and tips for conquering some of the problems to encounter. With the manual split like this it allows you to play the adventure from scratch, giving you the satisfaction of solving problems on you own.

Raiders of the Lost Ark is a lot more taxing and demanding an adventure than E.T. which is enhanced by the workings of the game being weaved around the storyline of the film. It should appeal to both the novice adventurer and the experienced player. If you actually finish the adventure there is still the challenge of scoring more points. Atari is the supplier and it costs £29.99.

Atlantis

In the far off waters of some mythical ocean lies Atlantis, the fabled lost city of the deep. All seems idyllic and the city prepares to drift into the history books. This is fine until some marauding fleet of nasties take offence at the Atlantan way of life and decide to express their opinion by wiping Atlantis off the face of the Earth.

So starts the game of Atlantis in which you have to help defend the city against the Gorgon attack.

At the bottom of the screen beneath the ocean is displayed the city of Atlantis. Raised above the water are your defences. In the centre is the Acropolis command post and on either side of the screen are sentry posts. You elect to fire from one of these three installations by moving the joystick into the corresponding position and pressing the fire button.

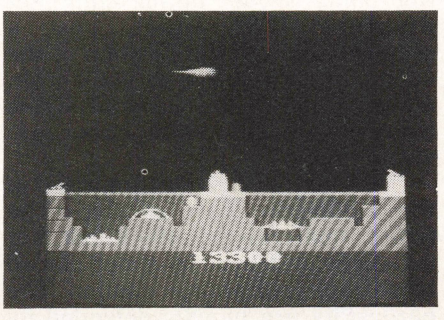
The Gorgon fleet traverses the skies above you. As each ship completes one pass it drops to a lower level, nearer your city. If the ship is not destroyed before it reaches the fourth level then it will fly across the city firing its death ray and will destroy one of your installations. When you have lost all but your sentry posts the game ends.

If you manage to complete an attack wave then your bonus points and score is calculated. The next wave to attack you now moves at an increased speed.

You are faced with three different kinds of enemy ship. The two largest move at the normal speed for that wave and score either 100 or 200 points depending on which base you shoot them from. The third ship is a wild card. This ship is the bandit bomber. It flies faster than the other ships but when destroyed it also destroys any other ships that happen to appear on-screen. Once again it is worth either 1000 or 2000 points depending on which base you fire from.

As a game, Atlantis works well. The quality of the graphics, colour and sound are good and some of the effects such as the death ray and the explosions are particularly impressive. The cartridge offers you four versions opf the standard game, including a two option game in which one joystick controls the left sentry post and the other the right.

My one criticism is that the difficulty of the game does not increase smoothly. By the fourth wave, the ships started moving a lot faster and shooting them down became more a matter of luck than judgement. Atlantis was the brainchild of releative newcomer to the market Imagic. It costs £27.95.



Spiderman

Battle your way up the side of a sky scraper, bash the baddies, outwit the evil Green Goblin and stop the super bomb from exploding. This is the small task that confronts you as you slip into your Spiderman gear and swing off across the city.

This new Parker cartridge has you controlling Spiderman on mission against the Goblin and his henchmen. Using the joystick you attempt to move Spiderman up the side of a building to reach the superbomb at the top. You move by firing your web onto the side of the building and climbing up it.

To shoot your web you move the joystick to point in the direction you want to move and then press the fire button. When you release the button your web will stick where it has reached. This requires a lot of stick and you will fall to a painful death, unless you can fire a web onto another part of the building as you drop.

To further impede your progress the Green Goblin's henchmen move about behind the windows. If one crosses behind your web he will cut it, causing you to fall. You can kill the henchmen and increase your point score by swinging in front of them.

When you reach the top of the building you have to negotiate a maze of girders which leads to the superbomb. On these the Goblin has placed time bombs which, if crossed, will break your web sending you plummeting earthwards. If you swing in front of these then you can defuse them and increase your points.

When you finally near the superbomb the Green Goblin appears and flies backwards and forwards trying to sever your web. If you manage to pass the Goblin you are then left with the task of firing your web onto the superbomb's casing so as you can swing across it and defuse the bomb.

To complete the game you have three Spidermen and a limited supply of web fluid for each one. If you complete one building you then move to the side of a new building and begin again, using your remaining supply of Spidermen and web fluid.

There are six different game variations on the cartridge, three one player and three two player, each offering different degrees of difficulty.

This game looked easy at first but soon proved to be a challenge.

Spiderman is amongst the second batch of games to be released by Parker for the VCS. It is on sale through retail outlets and costs £29.95.

ATARI VCS
VIDEO GAMES REVIEW

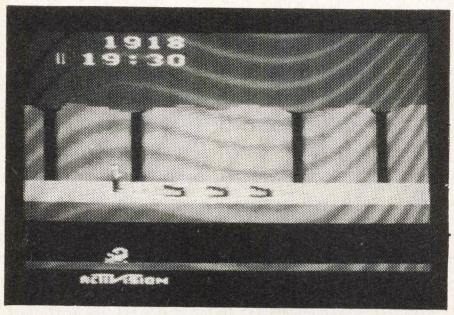
Pitfall

Activision's Pitfall cartridge continues the trend of games away from the alien blasting genre towards more down to earth, but no less, exciting, subjects. The game of Pitfall concerns the adventures of a jungle explorer called Pitfall Harry and his quest for hidden treasures deep in the heart of the jungle. You guide Harry through a series of hazards using the joystick.

The screen display is split into two parts, above and below ground. You start of at the left and side of the screen and move across it from left to right. As you reach the right edge you move into the next scene.

The game contains 255 different scenes in all, some containing hazards, some containing treasure and some both. The VCS sets you a twenty minute time limit to finish all 255 scenes. You have three lives with which to complete the course.

The hazards you have to surmount in the game include crocodile infested lakes, disappearing tar pits, deadly snakes and bush fires. Some of these will kill you and others will just rob you of points. The joystick moves you left and right and the fire button makes you jump in the direction you are heading. To get anywhere in the game you will have to develop a precise joystick manner, as jumping onto vines, crocodiles and logs require split second timing of the fire button and joystick movements.



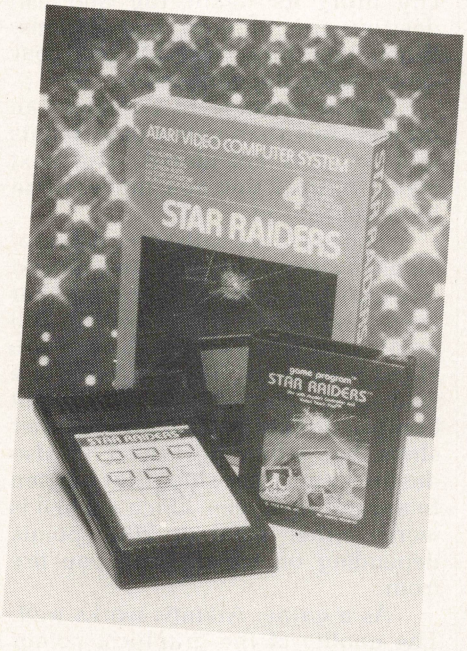
By moving to the underground level you can travel the equivalent of three screens in one, but beware, the lower reaches of the jungle are populated by a particulary nasty breed of scorpion.

At first I thought the game was a little weak, being repetitive and a little predictable. After about fifteen minutes though I realised that I was becoming addicted, finding that it needed a lot more concentration and speed that I had first assumed. The game also has the added advantage that even when you have completed all 255 scenes there is still the challenge to do it faster and end up with more points.

Activisions Pitfall cost £29.95 and is available from stockists.

Star Raiders

It is very difficult to make a balanced judgement of this game having already experienced the original version for the Atari computers. For those of you who have not yet encountered the computer version this is the story.



You are sitting at the controls of a powerful space fighter patrolling the far reaches of the galaxy. Suddenly your galactic scanner shows the dreaded Krylon fleet moving in to attack on your starbase. A quick flip through hyperspace and you confront the Krylon fleet. From now on it is a test of your piloting skills as you engage the enemy ships in a series of deep space dogfights.

For this game the television screen becomes the cockpit window of your ship. Below it is the control panel, displaying the ships energy reserve, damage control status and an indication of how many enemy ships are still at large. To the right of this panel is your attack computer display. This gives you a representation of the position of the enemy ships relative to your craft, allowing you to line up your sights before the enemy ships come into visual range.

The Krylon fleet is comprised of three different types of ship. The fighter and cruisers attack fast, but are easily destroyed by a well placed blast from your photon cannon. The battlestars are heavily defended by shields and so can only be destroyed at close range.

The battles are fought in simulated 3D. The alien ships first appear on the screens as bright points of light which quickly take shape as they swoop down of your craft. As you steer the ship the starfield moves around you, creating quite a good perpective image.

Supplied with the game is a video touch pad which plugs into the right controller. This houses keys to control forward view, galactic map, hyperwarp, computer and shields.

To move between sectors you use hyperwarp, having first positioned a cursor on the galactic map. When you arrive in a sector you will receive a warning if it contains alien vessels. If during the course of play your ship becomes damaged you can hyperwarp to the sector containing the starbase — that is of course if it has not been destroyed by the Krylons — and refuel and repair your ship. The game ends when either you are destroyed or you rid the galaxy of the Krylon menace forever.

If you have never seen the computer versions then I imagine that the VCS version of Star Raiders will provide with a lot of fun and satisfaction. The computer version does offer a greater depth to the actual game play and far better graphics.

Atari is the supplier and it costs £29.99.

Demon Attack

Despite the appallingly concocted photograph on the box which looked like it was made from Airfix dinosaur kits with wings and rockets glued on, Demon Attack turned out to be a good game.

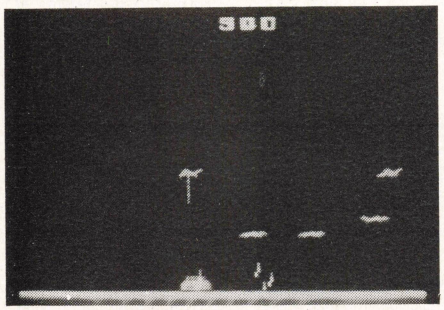
Basically it is a variation on the theme of Invaders. Your laser base traverses the bottom of the screen whilst above you three demons appear and try their best to remove you from the scheme of things. Like all Imagic games the quality of the sound and graphics are superb. Particularly impressive on this one is the way the demons appear above, their constituent parts flying in from both sides of the screen and assembling themselves as you watch.

During the course of each frame you will only have three demons on screen at any one time, and only one of these will drop bombs, though this one makes up for its partners by throwing down anything up to 20 bombs at a time at you. As you progress to further levels the demons

split in two when they are hit, forming two smaller demons. If you hit one of this new pair of demons the other will fly home in on you whilst emitting a shrill shriek.

The game has ten different options, four single player and six double player. You can also select straight or guided missiles for your laser base.

The game progresses at a fast and furious rate and it requires no small amount of manual dexterity and hand-eye coordination to survive on the higher levels. All in all a good game. An Imagic game which sells for £27.95.



Amidar

'First you're a gorilla in a maze pursued by wild warriors! The gorilla wants to colour in the maze and the warriors want to do in the gorilla.'

So starts the instructions for the game of Amidar. Hopefully this will give you some idea of the off-beat theme which this game has. Using the joystick you guide a gorilla round a maze, painting coloured lines as you go. As soon as you complete four sides of a box you get a bonus of 50 points. Also travelling round the maze are five warriors and if one of them catches you, you lose one of your three lives. When you have completely filled in the playing area you proceed to the next round.

In this round you control a paint roller and the warriors are replaced by pigs. If you complete this level then the game recycles, confronting you with six warriors/pigs who move faster than on the preceding levels.

If, during the course of the game, you manage to fill in all four corners of the maze, the pursueing creatures turn into chickens. When in this state you can chase and eat them, scoring yourself an extra 100 points for each one caught. Rather like Pacman this phase only lasts for a short period of and the creatures revert to their normal state and continue the chase.

The joystick button acts as a panic button. If the warriors are closing in on you, a quick press of the button will turn them into shadows of their former selves, enabling you to slip by them without being caught. However you have to be quick because this state will only last for a short while.

Although the cartridge is based on the arcade version of the game it lacked some of the features of the original. For instance it did not include the banana dropping screen in which you can cause a banana to drop onto your player and earn bonus points.

Also left out was the drawing system used on the paint roller screen. On the arcade version you could only draw a line from a completed square and if you went over the boundary of another square then the line you were drawing reverted to its original colour and you had to start drawing it again.

On the whole I was disappointed with this version of the game. I found it slow and unresponsive. The graphics were below Parker's usual standard and this lost the game vitually all of its visual appeal.

If it appeals to you Amidar is on sale from Parker stockists and retail outlets for the price of £29.95.



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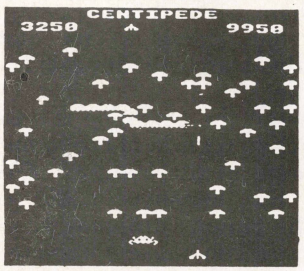
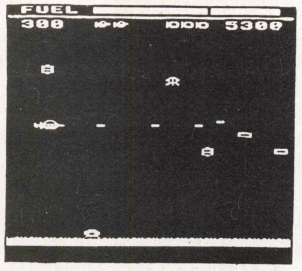


CENTIPEDE (32K) £6.50

Incredible arcade type game featuring mushrooms, snails, flies, spiders and the centipedes of course. Excellent graphics and sound. 6 skill levels, hi-score, rankings, bonuses, and increasing difficulty as the spiders become more active and the number of mushrooms increases.



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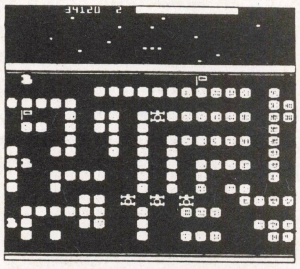

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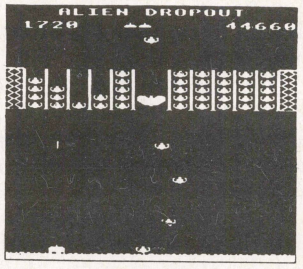

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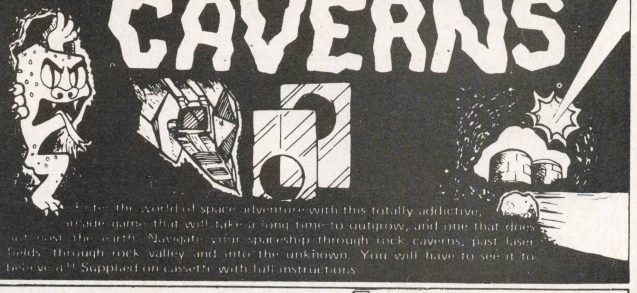

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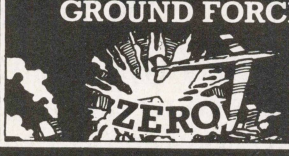

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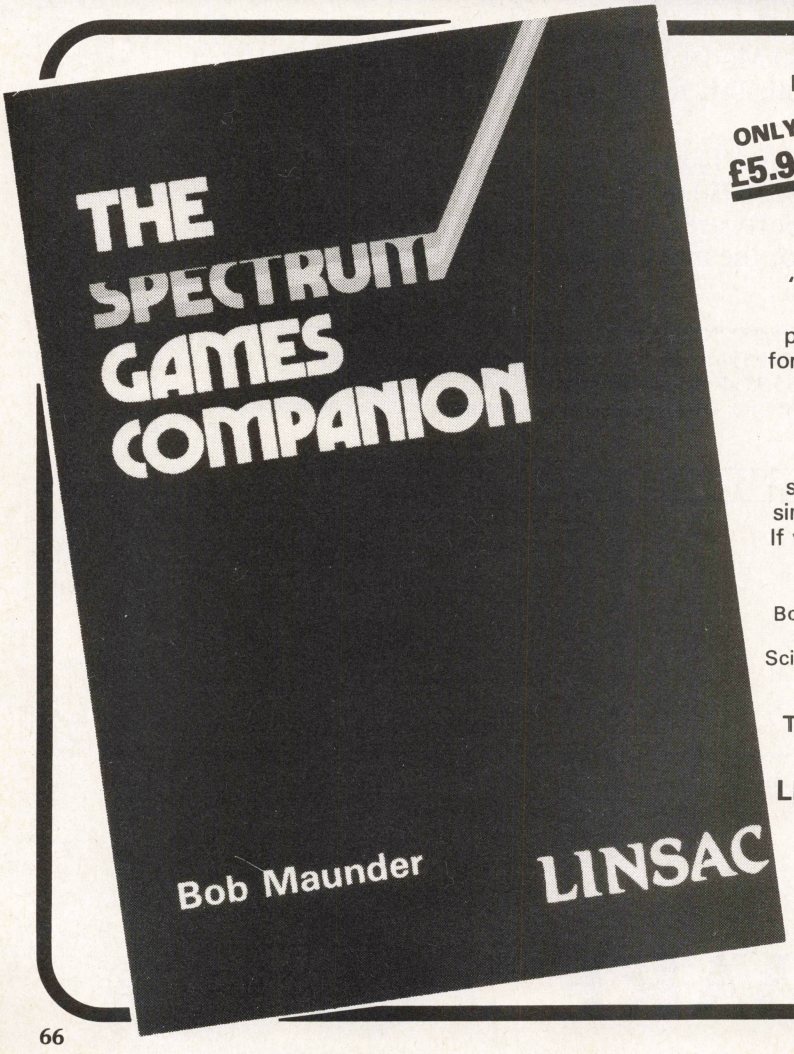

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Bob Maunder is co-author of 'The ZX80 Companion' and author of 'The ZX81 Companion'. He is a Senior Lecturer in Computer Science at Teesside Polytechnic, holds an MSc degree in Computer Science, and is a Member of the British Computer Society.

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This program enables the user to type machine code programs directly from the keyboard without the assistance of a monitor or similar program. The result is a machine code program that can be operated upon just like a BASIC one. You can use all the facilities of the BASIC editor already provided in your machine's ROM and you can use the all normal BASIC commands, such as DELETE, CSAVE, CLOAD, LIST and RUN, to operate on your program. When the program has been typed in it can be saved to tape using CSAVE and reloaded later using CLOAD. Although these programs will act like BASIC when RUN, they will run as machine code with all the advantages this brings.

The program is written for TRS-80 Level I or III and Video Genie I or II. With 16K of memory or more you will be able to handle machine code of up to 4K. The destination addresses of the machine code program are not important, nor need the program be relocatable to function. If the machine code occupies the same memory addresses as the BASIC program, then the program will sort things out when run.

Machine Code Programs

Many magazines publish machine code which is suitable for use on these machines and many of these can be entered with this program. To use them you must be able to recognise the two different methods of presenting this type of program listing. All machine code programs are published as listings using hexadecimal notation, but you need not bother with understanding this notation because in using this program you simply type in the hex codes as published.

The first method of presenting machine code is as a block of hexadecimal numbers like this:-

```
7000  01  00  00  CD  60  00
7008  CD  33  00  C3  00  70
```

Sometimes the lines contain 16 two digit codes. The first is the address (in hex) in which the first two digit code is to be stored and has four digits and the rest of the line contains two digit machine codes. It is only these codes which concern us here. Also published alongside the code will be the *start address* and the *entry point.*

These are four digit hex numbers and these are some times represented with &H in front or H behind to indicate that they are in hex. We are only interested in the four digits so ignore these characters. For the program shown above, the start is at 7000H and the entry point is 7006H. Some times the start and entry addresses are the same.

The second method of presenting machine code looks very complicated because the assembly code and line numbers are also present, but do not worry because again we are only interested in the two digit machine code and the start and entry addresses. As an example the code given above would be written as is shown in figure one.

```
                    100; THIS IS A DEMONSTRATION PROGRAM
                    110; IT PRODUCES  FLASHING ' * 'S
                    120          ORG 7000  ; IDENTIFIES START
7000  010000        130          LD BC,0   ;
7003  CD6000        140          CALL 60H  ;
7006  3E2A          150 ENTRY    LD, A,' * '  ; LOADS A ' * '
7008  CD3300        160          CALL 33H  ;
700B  C30070        170          JP 7000H  ; LOOPS
```

Figure 1.

Do not be afraid of the apparent complexity of this listing. It contains a lot of information that we need not worry about, and can be ignored. All the information following the ';' on each line is simply the assembly language equivalent of the BASIC REM statement, and can be safely ignored.

The rest of the listing is divided into two sections by the line number (100 to 170) down the centre. To the right is the program in assembly language and to the left is the program in machine code. We need only the machine code, so use only the first two columns. Concentrating on these two columns we see that it is just like the previous example, a four digit number followed by a line of two digit numbers. As before we only use the two digit numbers.

The main problem with this type of listing is that the start and entry addresses are not usually given. They must be found in the listing. The start address is the first ▶

MACHINE CODE IN BASIC

number in the first column (in the example 7000) and the entry point is the number in the first column of the line containing the word ENTRY (in this example 7006). If no ENTRY is indicated you can assume that the entry address is the same as the start address.



Using the Program

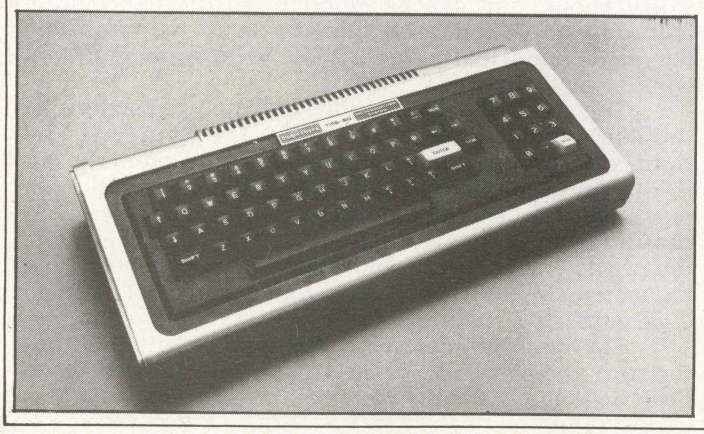
Type in the BASIC program as shown in the listing, and immediately save it onto tape. You will need this as a back up when you convert your next machine code program.

The program cannot be run as published, as it is only a skeleton program for you to modify using simple BASIC statements to customise for the machine code program you are interested in. List the lines up to 1200 and you will notice some gaps in the line number sequence. These are for your own additions. Lines 11 to 109 are for you to add REM statements or PRINT statements of your choice to identify the program you will be typing in.

Line 110 contains two strings, one named START$ and the other named ENTRY$. These are dummies and you should EDIT line 110 to remove the XXXX's and insert the addresses of start and entry points from the published listing. Remember there are only four digits for each, so ignore &H and H.

The next line number gap is 120 to 1110. It is here that you begin typing. Start each line with a line number and DATA. Then type in all the machine codes (remember two digits) with a comma after each code, except at the end of a line. The lines can be eight, sixteen or any other number of codes long. You are in fact entering BASIC DATA lines and if you have any difficulty with this then look up the DATA statement in your machine's instruction book. Line 1119 contains a single '*' as data and should always be left untouched as it signifies the end of the data.

If you were entering the program as shown above, then lines 110 to 1119 should LIST as:-



```
110  START$ = "7000": ENTRY$ = "7006": PRINT "PLEASE
     WAIT. . . ."
115  IF START$ = "XXXX" OR ENTRY$ = "XXXX" GOTO
     9998
120  DATA 01, 00, 00, CD, 60, 00, 3E, 2A
130  DATA CD, 33, 00, C3, 00, 70
1119 DATA *
```

If you make typing errors while adding these lines use your editing commands to make corrections, or rewrite the line as you would a BASIC line (after all it is a BASIC line at this stage). Take great care in typing these codes as they are easily mistyped. Also, check them carefully before trying to run the program. Make sure you save the program before running it. Faulty machine code programs have a habit of destroying or losing resident BASIC programs and if you have typed in a long program then it is simply not worth the risk of losing it through not checking it.

Once you have saved a copy then you are ready to run your machine language program. Simply type RUN, followed by RETURN or ENTER. The PRINT statements in the beginning of the program should appear together with a request to wait, together with entry address of your machine code program. Write this down as you may need it later. It will look different to the one you entered in line 110 as it is in decimal notation, not hexadecimal. There will now be a pause while the program operates. This may take some time if a long machine code program is being entered. What happens is that the machine, using BASIC, is placing the machine code instructions into its memory. This is a complex task and the BASIC program may be in a part of the memory in which it is trying to place the machine code. If this is the case things must be moved about. Just sit back and let the computer do the work.

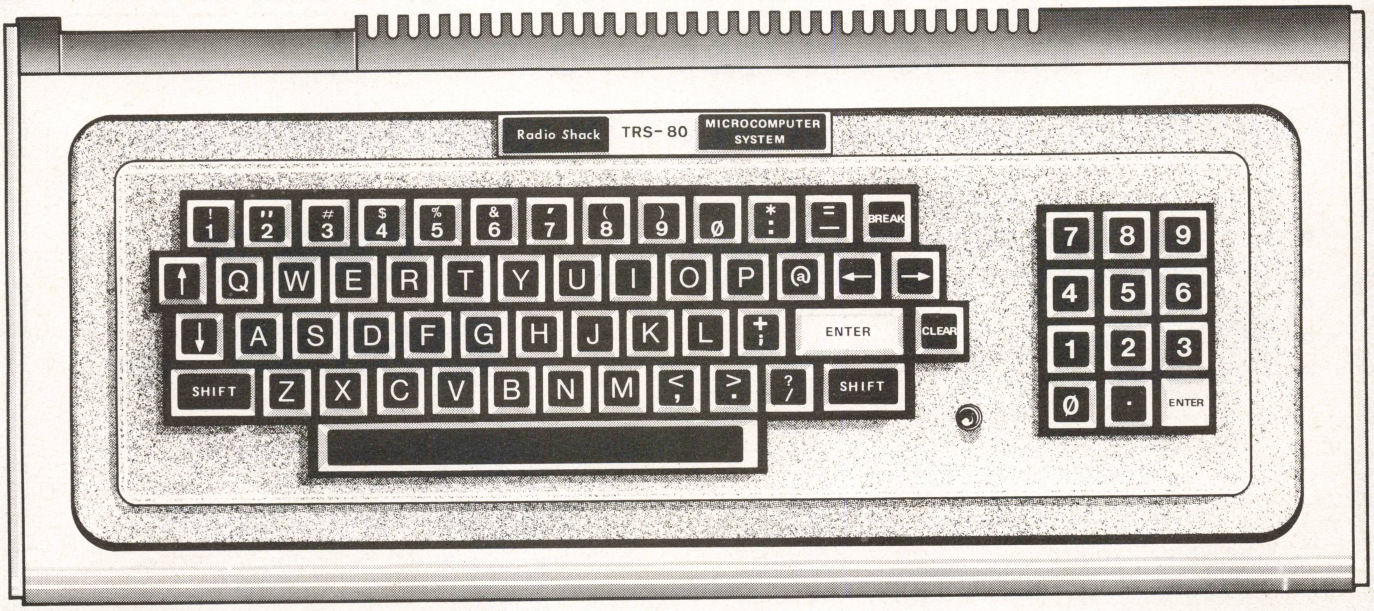
The first time you run the program after each loading, you must use the command RUN and put up with the wait. For subsequent runs, just enter GOTO 9900 to implement machine code, or if you are really adventurous, try using the system commands by entering SYSTEM and answering " *?" prompt with / <entry point address>. The entry point address is the one you copied down at the start of the run. Once you have a running program free of errors CSAVE it on a tape for future use.

Problems

If you try to RUN the program without editing line 110 or without adding DATA the program will indicate an error. If you enter more than 4K of machine code, when the program is run you will get an OM ERROR. On RUNning for the first time you should get the prompt "PLEASE WAIT. . . . . " and after a pause the screen will

HOW I

Line 10	Clears the screen and assigns a small amount of high memory for the storage of strings.
Lines 1200 to 1235	Read the machine codes from DATA statements and after converting them to decimal notation pokes them into the top 4k of memory (from 28661 to 32757)
Lines 1300 to 1380	Poke a machine code routine into the memory above the required machine code which causes the required machine code to be relocated from a start at 28661 to a start at its correct address.



clear. Any problems occurring before this clearing of the screen are in the BASIC program, and any occurring after this are in the machine code program (most likely typing or copying errors).

Machine Code errors do strange things. The computer sometimes will go off and do its own thing or sit waiting for some input it has not asked for. Whatever mistakes have been made in the code, your computer will not be damaged. The worst that can happen is that you will have to switch off and on again, and start again. This is why you should save the BASIC version. If you try to RUN a program entered this way and cannot regain control try the following steps until one gives you back control:-

(a)Press any key
(b)Press <break>
(c)Hold down <break> for 5 seconds
(d)Press <Clear>
(e)Press the reset button
(f) Switch off.

After regaining control you should see if the BASIC program still exists (by using LIST) and if the machine code is still in residence (by using SYSTEM <enter>/<entry address>). After such a crash you should re-check the published machine code program against the DATA statements.

T RUNS

Lines 5000 to 5002	Cause the machine code program (including the block jump) to run. The statement A = USR(0) causes the machine to leave BASIC and operate the machine code program starting at the address poked in the previous line.
Lines 9000 to 9503	Contain subroutines to convert hexadecimal codes to decimal. Four digit code conversion starts at 9000 and two digit at 9500.
Lines 9000 to 9002	Are a fast method of re-running the program again using A = USR(0) statement. This causes control to jump directly to the machine code program start address.

PROGRAM LISTING

```
10    CLS:CLEAR10:PRINT "MACHINE CODE IN BASIC"
110   START$ = "XXXX":ENTRY$ = "XXXX"
115   IFSTART$ = "XXXX"OR ENTRY$ = "XXXX"GOTO9998
1119  DATA *
1120  A$ = START$:GOSUB9000
1125  S = C
1130  A$ = ENTRY$:GOSUB9000
1140  PRINT"ENTRY ADDRESS IS";C:G = C
1150  PRINT"PLEASE WAIT ...."
1200  FORI = 28661TO32757
1210  READB$:IF B$ = " * "GOTO1300
1220  GOSUB9500
1230  POKEI,D:IFI = 32757GOTO9999
1240  NEXT
1300  L = I - 28661:IFL = 0GOTO9997
1310  POKEI,33: POKEI + 1,245: POKEI + 2,111:
      POKEI + 3,17
1320  A = S: GOSUB9700
1330  POKEI + 4,A1: POKEI + 5,A2: POKEI + 6,1
1340  A = L:GOSUB9700
1350  POKEI + 7,A1: POKEI + B,A2
1360  POKEI + 9,237: POKEI + 10,176:
      POKEI + 11,195
1370  A = G:GOSUB9700
1380  POKEI + 12,A1: POKEI + 13,A2
5000  A = I:GOSUB9700
5001  CLS:POKE16527,A2: POKE16526,A1
5002  A = USR(0):(END)
9000  B$ = LEFTS(A$,2):GOSUB9500
9001  C = 256 * D
9002  B$ = RIGHT$(A$,2):GOSUB9500
9003  C = C + D:RETURN
9500  N = ASC(B$) - 48:IFN > 9THENN = N - 7
9501  D = N* 16
9502  N = ASC(RIGHT$(B$,1))-48:IFN >
      9THENN = N-7
9503  D = D + N:RETURN
9700  A2 = INT(A/256):A1 = A - A2 * 256:RETURN
9990  A = G:GOSUB9700
9991  CLS:POKE16527,A2:POKE16526:A1
9992  A = USR(0):END
9997  PRINT"YOU HAVE NOT ENTERED A
      PROGRAM:END
9998  PRINT "YOU HAVE NOT ENTERED
      'START' AND 'ENTRY' ADDRESSES:END
9999  PRINT "OM ERROR":END
```

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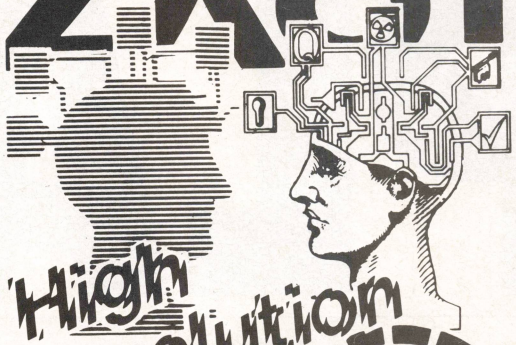

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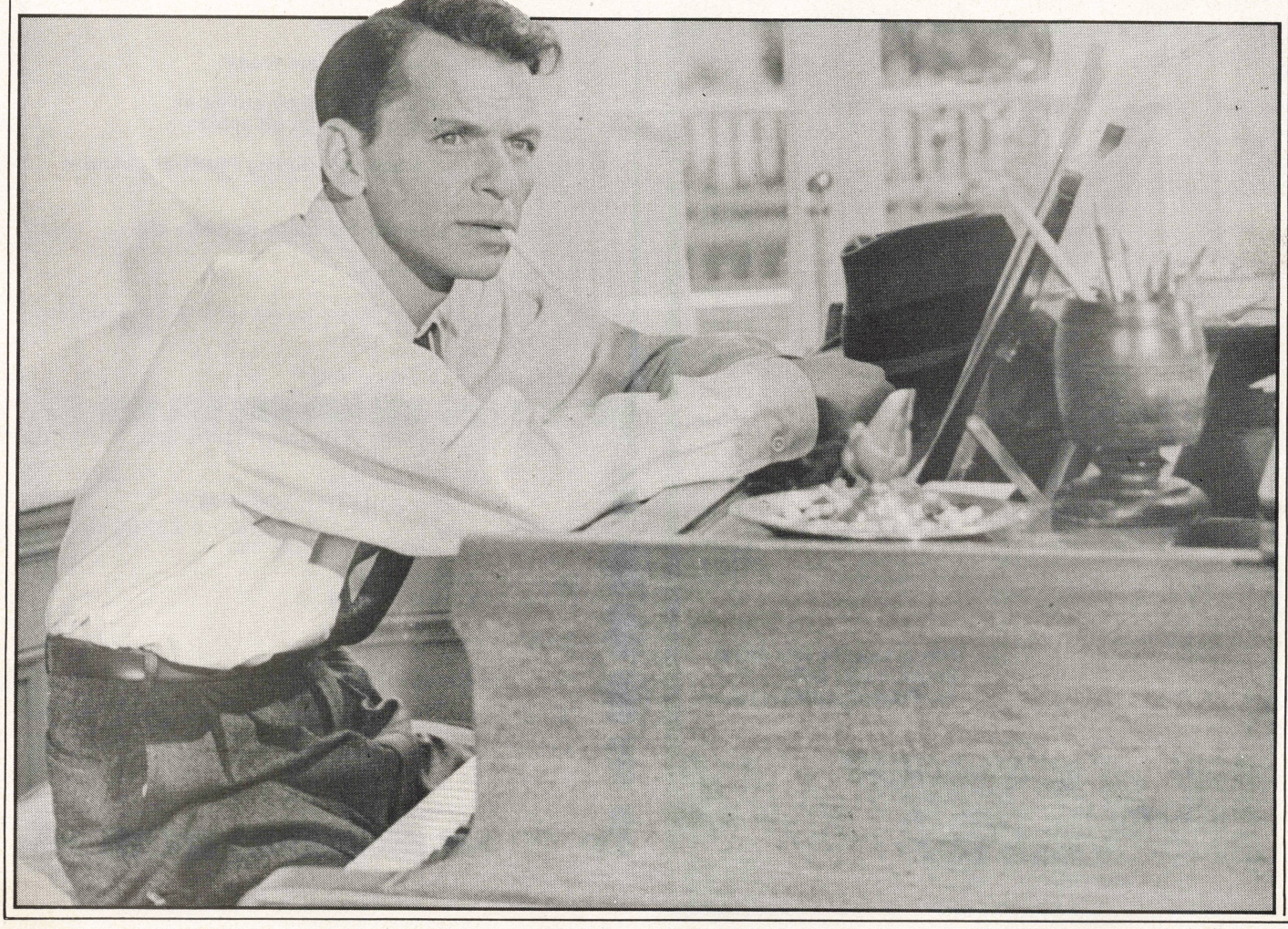
When you run the program, the computer will ask you to select Play or REPLAY mode. If you select PLAY the computer will display a picture of the keyboard and show you which keys are used for which notes. Now type in your tune and the computer will play it.

If you enter REPLAY mode, the computer will play your tune back to you. When entering the tune you can stop at any time by pressing the "O" key.

The program works by setting up an array, G$( ), which is 250 positions long and it is in this that the computer records the keys which make up the tune. In lines 350-560 the program analyses the keypress and assigns the actual note value to the next position in the array. When REPLAY mode is entered the program steps through the array and plays each note in turn.





HOW IT RUNS

10-20	Sets up keyboard.
30-90	Selects PLAY or REPLAY mode.
100-200	Selects and displays tempo.
210-300	Displays graphic representation of keyboard on screen.
310-340	Start of note input routine.
350-560	Note analysis routine.
570-580	Play note and end loop.
590	End of play loop.
600-630	Reply routine.
640	End

HINTS ON CONVERSION

Player should readily convert to the other two Sharp computers without any problems. For other computers it is a case of replacing the TEMPO and MUSIC commands with the equivalent commands for your own computer. If your computer does not have an equivalent TEMPO command then this function can be simulated by a FOR/NEXT loop placed at line 575.

Apart from these commands the program is written in standard Microsoft BASIC.

PROGRAM LISTING

```
 10 REM PLAYER
 20 CONSOLE C40:PRINT:PRINT:PRINT:PRINT
 30 PRINT"PRESS P TO PLAY
    PRESS R TO REPLAY"
 40 GET A$
 50 IFA$=""THEN 40
 60 PRINT:PRINTA$
 70 IF A$="P" THEN 100
 80 IF A$="R" THEN 600
 90 PRINT:PRINT"TRY AGAIN!":GOTO40
100 PRINT:PRINT"NOW CHOOSE TEMPO
    PRESS 1 TO 7":PRINT
110 GET T:IF T<1 THEN 110
120 IF T>7 THEN T=7
130 IF T=1 THEN PRINT"LARGO"
140 IF T=2 THEN PRINT"LENTO"
150 IF T=3 THEN PRINT"ADAGIO"
160 IF T=4 THEN PRINT"MODERATO"
170 IF T=5 THEN PRINT"ALLEGRO"
180 IF T=6 THEN PRINT"MOLTO ALLEGRO"
190 IF T=7 THEN PRINT"PRESTO"
200 TEMPOT:PRINT:PRINT
210 PRINT"     A S   F G   J K L   : ]"
220 PRINT"     ┌─┬─┬─┬─┬─┬─┬─┬─┬─┬─┐"
230 PRINT"     │ ■ ■ │ ■ ■ ■ │ ■ ■ ■ ■ │ ■ ■ ■ │"
240 PRINT"     └─┴─┴─┴─┴─┴─┴─┴─┴─┴─┘"
250 PRINT"     │A │B │■ │D │E │F │G │A │B │C │D │■ │"
260 PRINT"     └──┴──┴──┴──┴──┴──┴──┴──┴──┴──┘"
270 PRINT"     Z X C V B N M , . / ?"
280 PRINT"           ↑"
290 PRINT"        middle"
300 PRINT"           C"
310 PRINT:PRINT"NOW PLAY THAT TUNE!"
320 DIM G$(250)
330 FOR N=0 TO 250
340 GET N$
350 IF N$="" THEN G$(N)="RO"
360 IF N$="Z" THEN G$(N)="-A"
370 IF N$="X" THEN G$(N)="-B"
380 IF N$="C" THEN G$(N)="C"
390 IF N$="V" THEN G$(N)="D"
400 IF N$="B" THEN G$(N)="E"
410 IF N$="N" THEN G$(N)="F"
420 IF N$="M" THEN G$(N)="G"
430 IF N$="," THEN G$(N)="A"
440 IF N$="." THEN G$(N)="B"
450 IF N$="/" THEN G$(N)="+C"
460 IF N$="?" THEN G$(N)="+D"
470 IF N$="A" THEN G$(N)="-#G"
480 IF N$="S" THEN G$(N)="-#A"
490 IF N$="F" THEN G$(N)="#C"
500 IF N$="G" THEN G$(N)="#D"
510 IF N$="J" THEN G$(N)="#F"
520 IF N$="K" THEN G$(N)="#G"
530 IF N$="L" THEN G$(N)="#A"
540 IF N$=":" THEN G$(N)="+#C"
550 IF N$="]" THEN G$(N)="+#D"
560 IF N$="O" THEN 590
570 MUSIC G$(N)
580 NEXT
590 PRINT"END":PRINT:GOTO 30
600 PRINT:PRINT"REPLAYING!"
610 FOR N=0 TO 250
620 PRINTG$
630 GOTO 570
640 END
```

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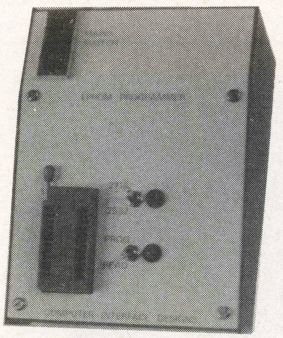

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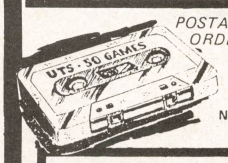

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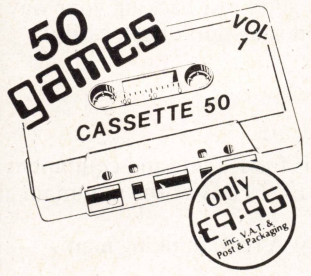

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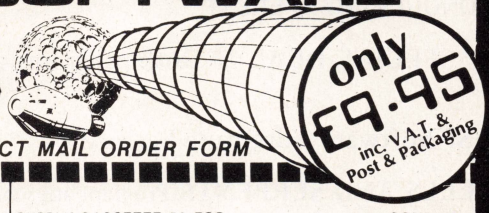

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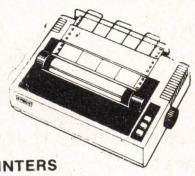

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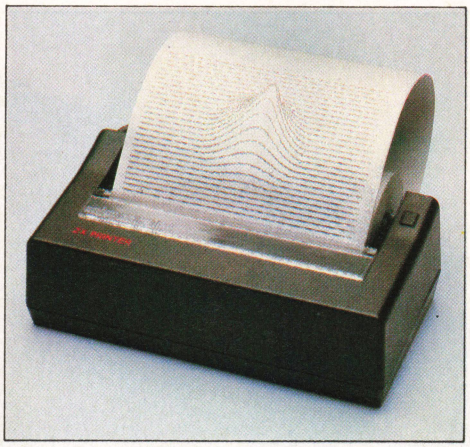



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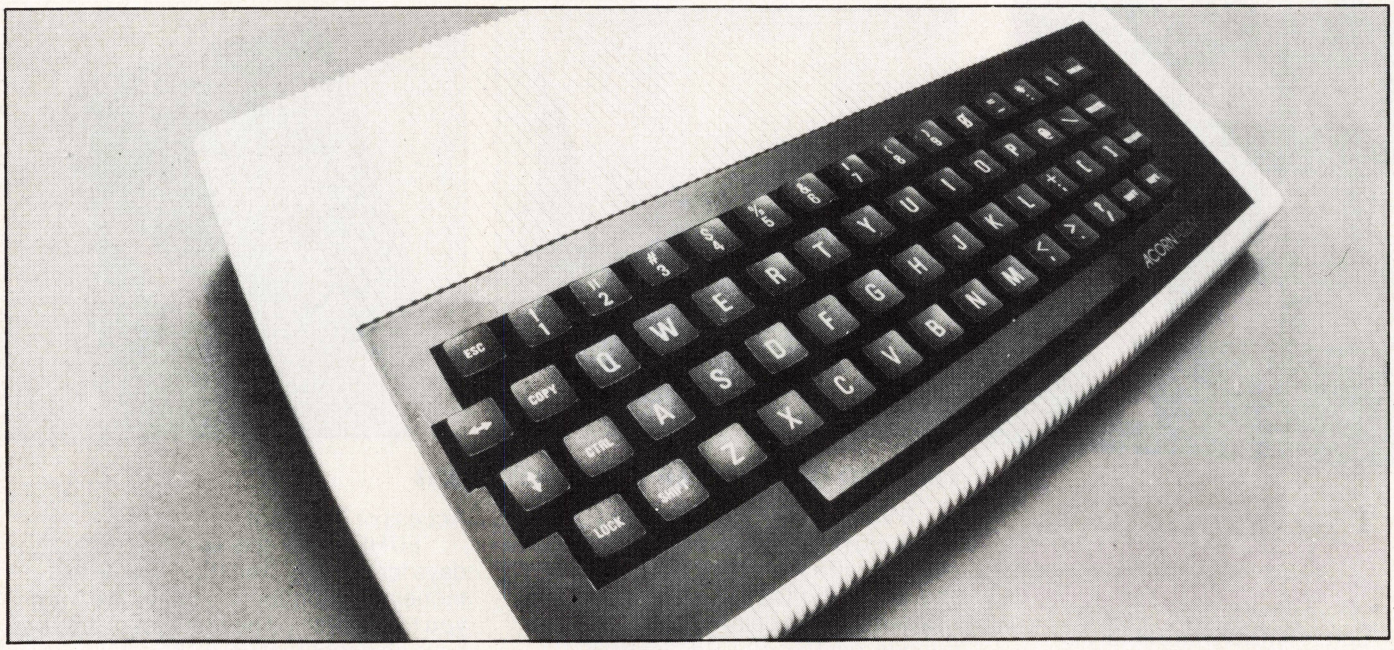
Count the hay days and high days on your Atom with Barry Pickles' program.



Here is a program that is useful in every home — a perpetual calendar. (Actually, its not really perpetual, but it will outlast your micro!). The program has been written without abbreviations and is fully commented for the sake of clarity. It should convert without much difficulty to other machines, if the notes are followed. It runs on an Atom in 1½k but, if abbreviations are used and the REMs deleted, it will fit into 1K. Special attention should be paid to spaces within strings, otherwise proper formatting will not take place, and, for this reason, I have included a lower-case S in the print statements to indicate significant spaces.

HOW IT RUNS

Line 5	Sets print format so that numeric output is printed in column width of 0 (normally 8) and begins description.
Line 10	Continues description and DIMensions (reserves) 8 bytes to store string Q.
Lines 15&20	Requests month and year for which calendar is required and checks for validity.
Line 40	Checks for February. If so, jumps to subroutine c at line 270 before returning to allocate string Q and transfer control to line 60.
Line 45	Checks for 30-day months; If so, sets D = 30 and jumps to sub-routine a at line 200, before returning control to line 60.
Line 50	Must be a 31-day month; Sets D = 31 and proceeds as line 45.
Lines 60&70	Work out where the first day of the month falls, from Sunday (E = 0) to Saturday (E = 6).
Lines 80-90	Clears screen and homes cursor, after turning it off. Formats and prints header text. If date printing is not to start on a Sunday, jumps to subroutine b at line 265.
Lines 100&105	Sets print field width to 4. Prints all dates in that month checking for Saturdays, in which case 2 lines are skipped before printing continues. When done, checks if printing finished at the start of a new line. If so, control passes to line 120.
Line 110	Fills up blank days to Saturday.
Line 120	End routine.
Lines 200-260	**Subroutine a:** Allocates string Q (NB Line numbers are significant in this section).
Line 265	**Subroutine b:** Fills up the beginning of the calendar print until it reaches 1st of month, as determined by the value of E.
Line 270	**Subroutine c:** Checks for leap years and allocates 28 or 29 to D.

Note: If output to a printer is required, insert PRINT $2 at the start of line 80 and PRINT $3 at the start of line 120 — these are CTRL-B and CTRL-C characters respectively.



HINTS ON CONVERSION

Labels are used throughout to speed up execution. These can be replaced by actual line numbers in GOTO/GOSUBs. String Q may not need dimensioning in your BASIC. The Atom screen is 32 columns x 16 lines and the output has been formatted accordingly. @ sets the column width and all numeric output is printed right-justified from the end of each column. The statement ?224 = n moves the cursor to the nth position on the current line. This is the same as PRINT AT or TAB in most BASICs. PRINT$12 clears the screen and homes the cursor. CLEAR 0;PRINT $30 does the same but also turns the cursor off. A single apostrophe (') generates a carriage return and linefeed. Most BASICs use a single PRINT command instead. Note that the Atom will continue printing on the same line unless told otherwise — this is the opposite of the way that most BASICs work!

The Atom does not have READ or DATA and subroutine a (lines 200-255) provides an equivalent. Using READ/DATA will considerably shorten this routine. If your BASIC does not support a DO...UNTIL construct, replace with a FOR...NEXT loop.

Also note that in assignments, LET is optional on the Atom, as is the THEN in an IF...THEN construct.

Finally, the arithmetic is in integer form and is straightforward, except for the expression ABS(E%7) in line 70. This gives the **remainder** (as a positive integer) after a division by 7. Thus, if E = 4, the expression would return a value of 3.

List Of Variables Used

$TOP	=	General response string
$Q	=	Month string
@	=	Column width for numeric output
A	=	Year
D	=	Number of days in month
E	=	First day of Month (0 = Sunday; 6 = Saturday)
M	=	Month number
X	=	General counter
Y	=	Year number

PROGRAM LISTING

```
1     REM - calendar
2     REM - J.B.Pickles 1981
5     @=0;PRINT$12"THIS PROGRAM WILL PRINT A"'
10    PRINT"CALENDAR FOR ANY MONTH IN THE"'
      "20TH. CENTURY"";DIM Q8
15e   INPUT"MONTH NO(1 TO 12)"M
16    IFM<1 ORM>12;PRINT"NO SUCH
      MONTH"';GOTOe
20f   INPUT"YEAR"A;Y=A-1900
21    IFY<0 ORY>99;PRINT"20TH CENT. ONLY"';GOTOf
30    REM - SET UP DAYS IN MONTH
40    IFM=2;GOSUBc;$Q="FEBRUARY";
      GOTOg
45    IFM=4 ORM=6 ORM=9
      ORM=11;D=30;GOSUBa;GOTOg
50    D=31;GOSUBa
59    REM - CALCULATE DAY OF 1ST OF MONTH
60g   IFM>2;M=M-2;GOTOh
65    Y=Y-1;M=M+10
70h   E=(26*M-2)/10+1+Y+Y/4+19/4-2*19;E
      =ABS(E%7)
79    REM - PRINT HEADERS
80    CLEAR0;PRINT$30;?224=10;PRINT"calendar"'
85    PRINT"MONTH:"$Q;?224=23;PRINT"YEAR:"A
87    FOR X=1 TO 32;PRINT" * ";NEXT X
90    PRINT"ssSUNssMsssTsssWssTHsssFssSAT"';IFE
      <>0;GOSUBb
100   @=4;FOR X=1 TO D;PRINT X;E=E+1;
      IFE=7;E=0;PRINT''
105   NEXT X;IFE=0;GOTOd
109   REM - FORMAT PRINT END
110   DO;E=E+1;PRINT"ss * *";UNTIL E=7
120d  INPUT"ANOTHER"$TOP;IF?TOP=CH"Y";RUN
125   PRINT $12;END
199   REM - FIND MONTH STRING
200a  GOTO(200+M*5)
205   $Q="JANUARY";RETURN
215   $Q="MARCH";RETURN
220   $Q="APRIL";RETURN
225   $Q="MAY";RETURN
230   $Q="JUNE";RETURN
235   $Q="JULY";RETURN
240   $Q="AUGUST";RETURN
245   $Q="SEPTEMBER";RETURN
250   $Q="OCTOBER";RETURN
255   $Q="NOVEMBER";RETURN
260   $Q="DECEMBER";RETURN
264   REM - FORMAT PRINT START
265b  FOR X=1 TO E:PRINT"sss * ";NEXT X;RETURN
269   REM - CHECK FOR LEAP YEARS
270c  FOR X=0 TO 100 STEP 4
      ;IFY=X;D=29;X=101;GOTOz
275   D=28
280z  NEXT X;RETURN
```

SOFTWARE

MORTGAGE & SAVINGS



Plan your mortgage and savings payments and benefit from W. Crump's experience.

With interest rates changing so frequently these days, I found it very difficult to keep track of my mortgage repayments. Most Building Societies give examples of alternative amounts and periods whenever the interest changes, but somehow this never quite gives me the arrangement that I require.

This also applies to Monthly Savings Schemes and Lump Sum Investment Schemes. I therefore decided to write my own program to do these sums for me, the following is the result.

The program was written for a PET but could easily be modified to suit most machines. The full listing uses 4.7K RAM, but if all the REM statements are removed this reduces to 4K RAM. The program is in three parts and each could, if necessary, be written separately, thus reducing the memory requirements even further.

Primarily for the PET

The Sums

If your maths are not up to it leave this section out. I will not attempt to derive the formula from first principles as that would need an article of its own. Instead I will give the formula together with a short explanation.

HOW IT RUNS

The listing is entitled "Compound Interest Progams". It consists of three programs linked by a menu.

The Menu is located at lines 111-170
The Mortgage program is at 171-850
Monthly savings program at 853-1090
Lump Sum Investment at 1093-1300

Each of the programs will run independently of each other (even without the menu). Thus as already suggested they could be entered separately if space or fatigue is a problem.

The interest rate 'I' in the mortgage program is found by trial and error. This is done using a loop at line 360. As listed the loop is in STEPs of 0.1% and this takes about 45 seconds to complete the search. If you wish to speed up the program then the step value should be increased, this will of course reduce the accuracy of the results.

The value 'Q' is the number of times per year that the interest is added. Different organisations have different arrangements for this. Some add interest monthly (12 times per year), some quarterly (4 times per year) and some annually. In general the more frequently the interest is added the better off you will be. Try different variations to test this.

Some safety has been built into the program, but it is not foolproof. So if you put silly numbers in you will get silly answers out.

The "wouldn't it be nice" factor can be fully explored and mortgages made to disappear at the press of a key.

1) The ordinary Building Society Mortgage is given by:—

$$P\left[1+\frac{I}{100}\right]^{N} = 12R\left[1-(1+\frac{I}{100})^{N}\right]$$

where P = Principal sum borrowed
I = Interest rate per annum %
N = Number of years involved
R = Repayments in pounds per month

By rearranging the formula and given any three of the above values then the unknown value can be calculated.

2) The second and third parts of the program are very similar. They deal with monthly savings and lump sum investments. It will therefore suffice to give a generalisation.

$$T = S\left[1+\frac{I}{100\,Q}\right]^{NQ}$$

Where S = Lump sum or monthly savings
I = Interest rate per annum %
N = Number of years involved
Q = The number of times per year that the interest is added.
T = Total amount after 'N' years

HINTS ON CONVERSION

This program can be easily converted to run on a VIC-20 having been specifically written for the PET. The only problems you might encounter are with the screen formats. For conversion onto the VIC 20 all the control characters can be left in the PRINT statements and the line length altered to fit the smaller screen. If you are converting it onto another computer then it would be best to remove all these characters totally and reformat the program for your own screen.

PROGRAM LISTING

```
101 REM**********************************
103 REM***COMPOUND INTEREST PROGRAMS**
105 REM**********************************
107 REM**
109 REM**
111 REM*MAIN MENU*
113 REM*
120 PRINT"□"
130 PRINT"□□□□□□ENTER □1■ FOR MORTGAGE PROGRAM"
140 PRINT"□□□□ENTER □2■ FOR MONTHLY SAVINGS PROGRAM"
150 PRINT"□□□□ENTER □3■ FOR LUMP SUM SAVINGS PROGRAM"
160 GET X:IF X<1 OR X>3 THEN 160
170 ON X GOTO 200,900,1120
189 REM**********************
191 REM**MORTGAGE PROGRAM**
193 REM**********************
195 REM*
197 REM*REQUEST DATA*
199 REM*
200 PRINT"□"
205 PRINT SPC(12)"□□□MORTGAGE PROGRAM■"
210 PRINT"□□□□□□ENTER ANY □THREE■ OF THE FOLLOWING FOUR
    VALUES"
220 PRINT"□□□□ENTER '0' FOR THE UNKNOWN VALUE"
230 INPUT"□□ANNUAL INTEREST RATE % ";I
240 INPUT"□□PRINCIPAL SUM BORROWED IN POUNDS";P
250 INPUT"□□MONTHLY REPAYMENTS IN POUNDS ";R
260 INPUT"□□TERM OF THE LOAN IN YEARS ";N
270 IF I=0 ANDP>0 ANDR>0 ANDN>0 THEN 350
280 IF P=0 ANDI>0 ANDR>0 ANDN>0 THEN 540
290 IF R=0 ANDI>0 ANDP>0 ANDN>0 THEN 630
300 IF N=0 ANDI>0 ANDP>0 ANDR>0 THEN 740
310 PRINT"□□□   INCORRECT ENTRY"
320 PRINT"□   PRESS ANY KEY TO RETURN TO MENU"
330 GET A$:IF A$=""THEN 330
340 GOTO 200
345 REM*
347 REM*TO FIND INTEREST RATE 'I'*
349 REM*
350 PRINT"□□□THIS WILL TAKE ABOUT 45 SECONDS
360 Y=100000:A=12*R
370 FOR I=0.1 TO 100 STEP 0.1
380 IF (P*I)/(100*A)>1 THEN 420
390 X=1+(I/100)
400 Y1=ABS((P*X↑N)-A*((1-X↑N)/(1-X)))
410 IF Y1<Y THEN I1=I:Y=Y1
420 NEXT I
430 IF Y=100000 THENPRINT"□VALUES OUT OF RANGE":GOTO 850
440 I$=STR$(I1):I$=LEFT$(I$,4)
450 PRINT"□□GIVEN:- PRINCIPAL= "P
460 PRINT"□□□□□□□□□□REPAYMENTS= "R
470 PRINT"□□□□□□□□□□NO OF YEARS= "N
480 PRINT"□□□THEN:- INTEREST RATE= "I$"%"
490 GOTO 850
535 REM*
537 REM*TO FIND THE PRINCIPAL SUM 'P'*
539 REM*
540 A=12*R
550 X=1+(I/100)
560 Y=(1-X↑N)/(1-X)
570 P=(A*Y)/(X↑N)
572 P$=STR$(P):P$=LEFT$(P$,8)
580 PRINT"□□□□GIVEN:- REPAYMENTS= "R
590 PRINT"□□□□□□□□□□NO OF YEARS= "N
600 PRINT"□□□□□□□□□□INTEREST RATE= "I"%"
610 PRINT"□□THEN:- PRINCIPAL= "P$" POUNDS"
620 GOTO 850
625 REM*
627 REM*TO FIND REPAYMENTS 'R'*
629 REM*
630 X=1+(I/100)
640 Y=((1-X↑N)/(1-X))
650 A=(P*X↑N)/Y
660 A$=STR$(A):A$=LEFT$(A$,7)
670 R$=STR$(A/12):R$=LEFT$(R$,6)
680 PRINT"□□□□GIVEN:- PRINCIPAL= "P
690 PRINT"□□□□□□□□□□NO OF YEARS= "N
700 PRINT"□□□□□□□□□□INTEREST RATE= "I"%"
710 PRINT"□□□THEN:- MONTHLY REPAYMENT="R$ " POUNDS"
720 PRINT"□□□□□□□□□□ANNUAL REPAYMENTS="A$ " POUNDS"
730 GOTO 850
735 REM*
737 REM*TO FIND NO OF YEARS 'N'*
739 REM*
740 A=12*R
750 X=1+(I/100)
760 Y=1-((P*I)/(100*A))
770 IF Y=>1 OR Y=<0 THEN N$="PERIOD > 100":GOTO 800
780 N=(LOG(1/Y)/LOG(X))
790 N$=STR$(N):N$=LEFT$(N$,5)
800 PRINT"□□□□GIVEN:- PRINCIPAL= "P
810 PRINT"□□□□□□□□□□INTEREST RATE= "I"%"
820 PRINT"□□□□□□□□□□REPAYMENTS= "R
830 PRINT"□□□THEN:- PERIOD OF THE LOAN= "N$" YEARS"
840 GOTO 850
845 REM*
847 REM*PROGRAM POINTER*
849 REM*
850 PRINT"□□□TO RETURN TO MAIN MENU TYPE 'M'"
860 PRINT"TO RERUN THIS SECTION TYPE 'B'"
870 GET A$:IF A$="M"THEN 120
880 IF A$="B"THEN 200
890 GOTO 870
895 REM**********************************
897 REM**FIXED MONTHLY SAVINGS PROGRAM*
899 REM**********************************
900 PRINT"□"
905 PRINT SPC(3)"□□□FIXED MONTHLY SAVINGS■"
910 INPUT"□□□□□□ENTER AMOUNT SAVED PER MONTH";S
920 INPUT"□□□□ENTER TERM IN YEARS";N
930 INPUT"□□□□ENTER ANNUAL INTEREST RATE %";I
940 PRINT"□□□□ENTER FREQUENCY AT WHICH INTEREST IS    ADDED.
950 INPUT"□□□EG 12 FOR MONTHLY,4 FOR QUARTERLY, 1    FOR YEARLY ETC.";Q
955 PRINT"□□□OK THIS WILL TAKE ABOUT"N" SECONDS"
960 T=0
970 FOR X=0 TO (N*12)-1
975 W=INT((N-(X/12))*Q)
980 T=T+S*((1+I/(100*Q))↑W)
990 NEXT
1000 T$=STR$(T):T$=LEFT$(T$,8)
1020 PRINT"□□□GIVEN:- SAVINGS PER MONTH="S"POUNDS"
1030 PRINT"□□□□□□□□□□INTEREST RATE= "I" %"
1040 PRINT"□□□□□□□□□□ADDED AT"Q"INTERVALS PER YEAR"
1050 PRINT"□□□THEN:- AFTER"N"YEARS"
1060 PRINT"□□□□□□□□□□CAPITAL WILL= "T$" POUNDS"
1070 PRINT"□□□TO RETURN TO MAIN MENU TYPE 'M'"
1080 PRINT"TO RERUN THIS SECTION TYPE 'B'"
1090 GET A$:IF A$="M"THEN 120
1100 IF A$="B"THEN 900
1110 GOTO 1090
1115 REM**********************************
1117 REM**LUMP SUM SAVINGS PROGRAM**
1119 REM**********************************
1120 PRINT"□"
1125 PRINT SPC(10)"□□□LUMP SUM INVESTMENT■"
1130 INPUT"□□□□□□ENTER SUM INVESTED";S
1140 INPUT"□□□□ENTER TERM IN YEARS";N
1150 INPUT"□□□□ENTER ANNUAL INTEREST RATE %";I
1160 PRINT"□□□□ENTER FREQUENCY AT WHICH INTEREST IS    ADDED.
1170 INPUT"□□□EG 12 FOR MONTHLY,4 FOR QUARTERLY, 1    FOR YEARLY ETC.";Q
1180 T=0
1190 T=S*((1+I/(100*Q))↑(N*Q))
1194 T$=STR$(T):T$=LEFT$(T$,8)
1200 PRINT"□□□GIVEN:- LUMP SUM="S"POUNDS"
1210 PRINT"□□□□□□□□□□INTEREST RATE= "I" %"
1220 PRINT"□□□□□□□□□□ADDED AT"Q"INTERVALS PER YEAR"
1230 PRINT"□□□THEN:- AFTER"N"YEARS"
1240 PRINT"□□□□□□□□□□CAPITAL WILL= "T$" POUNDS"
1250 PRINT"□□□TO RETURN TO MAIN MENU TYPE 'M'"
1260 PRINT"TO RERUN THIS SECTION TYPE 'B'"
1270 GET A$:IF A$="M"THEN 120
1280 IF A$="B"THEN 1120
1290 GOTO 1270
```

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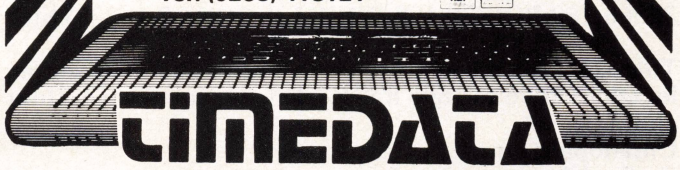

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Programming Vic 20	1.95
30 Hr ZX81 Basic	5.50
Atari Basic	5.95
TRS80 Assy Lang	9.25
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(PCT), DUCHY HOUSE, 6 LOWER AYLMER SQ., ST AUSTELL, CORNWALL **Tel: 0726 64463**

TECHNICAL ENQUIRIES

MICROANSWERS is Personal Computing Today's Technical Enquiries Service. Each month we will endeavour to answer your questions on the subject of micro-computing. We would love to hear of your problems (honest!) as it is certain that if you are having trouble then other users of your machine will also be suffering.

So here's your chance to lighten your burden by sharing your troubles with Personal Computing Today's panel of experts.

Address your letters to:
"Micro Answers"
Personal Computing Today
ASP Ltd
145 Charing Cross Road
London WC2H 0EE

If you wish a personal reply, please enclose a stamped addressed envelope *and the reply coupon from this page*. This is to enable us to give priority to regular readers of PCT.

Dear PCT
Many VIC owners with more than 3K of additional RAM may be finding it quite impossible to use the character generator due to the relocation of various vectors in RAM. For instance the screen moves from 7680 to 4096. To relocate the screen to 7680 use the following short program:

```
POKE 648,30:POKE 642,32:POKE 36869,240:POKE
36866,150:POKE 0,108:POKE 1,0: POKE 2,192:SYS(0)
```

This will relocate the screen to 7680. This now leaves locations 4096 to 7696 free for defining your own custom character set.
Christopher Pucci
Staffordshire.

Dear Editor
Having introduced myself to the world of computing via an early, now apparently obsolete, ZX80 I progressed to the VIC 20. I proceeded to explore the world of colour, sound, peeks, pokes — you know, all the standard stuff. I then wrote a Connect 4 program — beautiful colour, nice noises, but "eric" (VIC's nickname) was slow to respond. 'Ah!' I thought, 'now is the time to move into machine code. What book should I buy?' Having already been ripped off for £5.95 by Tim Hartnell's "Getting Acquainted With Your VIC 20" (which incidentally should have been called 'teach yourself debugging', as it contains some excellent practice material), I studied the market carefully and picked VIC revealed. My son by this time had become a competent programmer and he started to debug this book, his first triumph being on page 218, the Joystick control which needed the following amendments:

```
Line 30 S0=_ ((S and 4)=_ 0): switch0
     40 S1=_ ((S and 8)=_ 0): switch1
```

Hope this is of use to someone out there.

I then proceeded to read the section on the microprocessor several times until it began to sink in, my aim being to include a short machine code program in my BASIC program for Connect 4 to enable it to respond quicker (and another question — Where do you locate it so as not to interfere with BASIC?).

I decided to buy the machine code monitor from Commodore believing that all would be revealed to me. It took me some time to realise that some Vicmon commands respond without a space between the command and the address but that G(Go) definately does not. It did cross my mind that a fool's guide to machine code would be a best seller as most computer authors seem to be intent on missing out obvious (to them) information.

Having inserted the Monitor, dutifully read the booklet, which incidentally will not teach you programming, I keyed in the sample program. Fantastic! It printed a screen full of each character in double quick time. I was really impressed and proceeded to try to access the code from an SYS command inserted into a basic program (more luck than judgement that they did not corrupt each other). After a number of attempts I succeeded by realising that the start of the machine code program requires a SEI (Set Interrupt Disable Status) and then a CLD (Clear Decimal Mode) and a RTS at the end of the program (return from subroutine). Don't ask me why but it does.

This was a breakthrough. I thought I would purchase the recommended book 6502 Programming by Leventhal. The man is an obvious genius but unfortunately I am not. I bought the Programmers Reference Guide. Having acquired all this hardware and software I thought I must be able to write a program and I did. I wrote a program that moved an asterisk across the screen, I thought it didn't work, it took me half an hour to realise that the b-----THING moved so fast I couldn't see it, so I slowed it down. But that defeats the whole object of the exercise.

I am sure that you can tell from this letter that I am totally confused. The interrupt command on VICMON is fascinating but how and where do these characters come from?

Please, please help. I would be eternally grateful,
Yours confused,
Alan Pedder.

Unfortunately no book springs to mind that will take you from complete beginner to machine code genius in easy steps. At the moment it is still a slog up the hard way. Possible sources of help could be your local computer club. If you do not already belong to one it could be worth your while in finding out where your nearest is and enrolling. I imagine there will be someone there who has come into machine code the hard way and would be able to ease your progress with a few helpful suggestions.

Dear PCT
You are constantly reminding us to Buy British, but I have reservations.

My son is 16 years and a computer 'nut'. He is taking his A level Computer Studies at Hyde 6th Form College this year. Last August I ordered a Sinclair Spectrum computer for him. Approximately 14 weeks later it was delivered. Within two weeks it was malfunctioning and returned to Sinclair. Meanwhile I learned that Timex, Dundee had something to do with the manufacture of

Sinclair computers. Last year my son's digital watch had been returned to Timex, Dundee no less than five times for repair, and on two of these occasions it was sent back to us still malfunctioning. In view of this we requested a refund from Sinclair to which they agreed. (This has still to be received by us and if not received within the next ten days we shall sue through County Court).

On the strength of the promised refund from Sinclair I ordered a BBC model B computer from N.S.C. Computer Shops, 29 Hanging Ditch, Manchester at a cost of over £400. Not only was it my son's Christmas present but it was also a necessary requirement to produce a program for his forthcoming A level.

He quickly found the computer was malfunctioning on mode 7 (serial number 138744) N.S.C. Shops changed it for a second computer on 29 December (serial number 139739). This was faulty the moment it was plugged into the mains and was changed for a third machine (serial number 140749). Within days a fault developed and it was changed for a fourth computer on 26 Jan. (serial number 137518).

Two days later it failed completely to output to the TV screen, and today 31 January I am returning it to N.S.C. Computer Shops requesting a full refund of the purchase price, as I am not prepared to accept a fifth replacement.

Yours sincerely,
R. Castree,
Cheshire.

Dear PCT
I have recently been looking at various microcomputers with a view to using one in the office of our Church which is now quite large and growing rapidly. The uses to which one could be put include information storage (eg. address lists), account keeping and budgeting, and word processing. I have been shown an excellent system; 96K Ram computer, VDU, dual-drive floppy discs, daisy-wheel printer, and a word processing program that costs over £4000. Looking at other micros it seems that one could buy a £200 home computer, add extra RAM and the necessary peripherals, and put together a system for under £2000. Somewhere, there must be a snag, so I would like to ask the following technical questions:—

1. How powerful need a micro be to function as a useful word processor? eg. what can a Commodore 8096 with Wordcraft 80 do that a VIC 20 with Wordcraft 20 cannot?
2. What size RAM would be useful for my requirements?
3. What differences are there in the quality of the print of a good dot-matrix and a daisy-wheel printer? Can the former be used to print letters of business quality?
4. Does any kind of balance need to be kept between the Ram size available on discs and the Ram size of the micro itself?
5. What are the advantages of dual- over single-disc drive?

Yours sincerely,
David R. Dewey,
Sheffield.

To answer your questions in order. First it is not a question of a micro's power as to its suitability as a wordprocessor. The two main factors that should influence your choice of micro for this purpose is screen size and quality of keyboard.

For instance while the Wordcraft package on the VIC 20 is a usable word processor it is a little restrictive because the VIC-20 only has a 22 column screen. This forces the package to use a system of scrolling windows in order to display all the text you are working on. The basic requirement for a wordprocessor micro is that it should have at least a 40 column screen.

The size of RAM you require is influenced by two things. First the length of the documents you want to prepare using the system, the longer the document, the larger amount of RAM you will need onboard to store it in. The second factor concerns the method by which the program is supplied. If it is supplied on tape or disc then you will need some of the machine's own RAM memory to store the program on.

As a rule you should look for at least 32K of RAM either in the computer or able to be added to the computer, for your wordprocessor.

The difference in quality between matrix and daisy-wheel printers is quite noticeable. The former is usually used in a business sense for producing bills and invoices where the quality is not a concern. However a good matrix printer will cost you between £300-£500, whereas good daisy-wheels will cost £1500+. It really is a question of what your budget dictates.

The difference in RAM size of the disc and the computer is not generally a concern, as long as you have followed the suggestions about the basic RAM size of your machine.

The advantage of dual over single discs is that you can have a greater amount of disc information on tap. A single disc system is not restrictive provided you do not mind the extra hassle of changing the discs in the drives.

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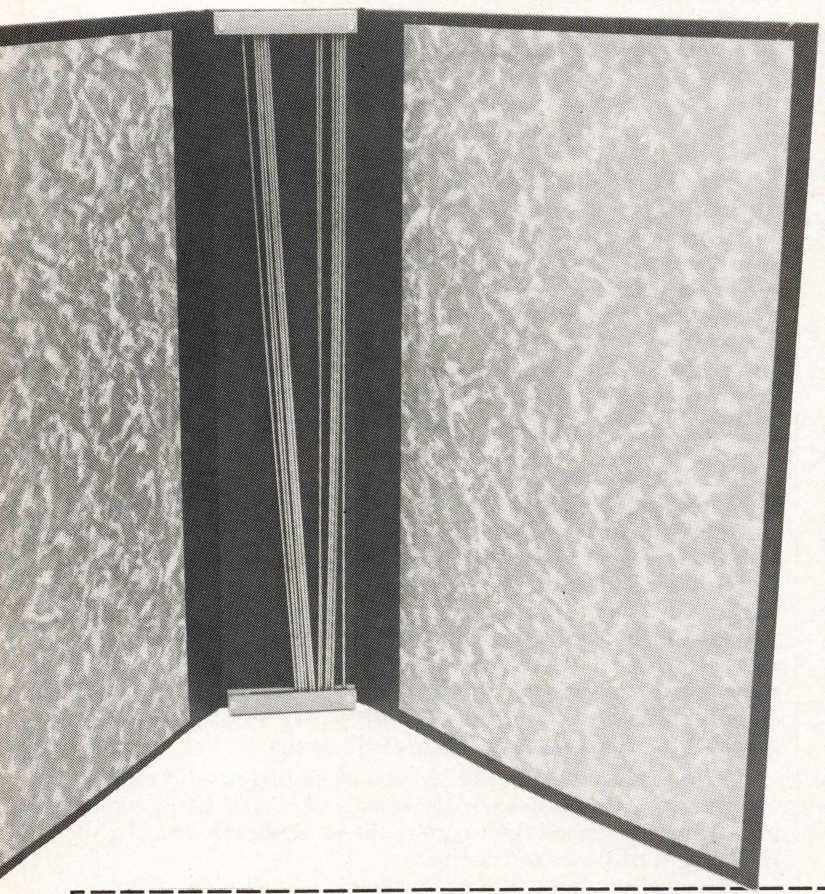

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FACTFILE

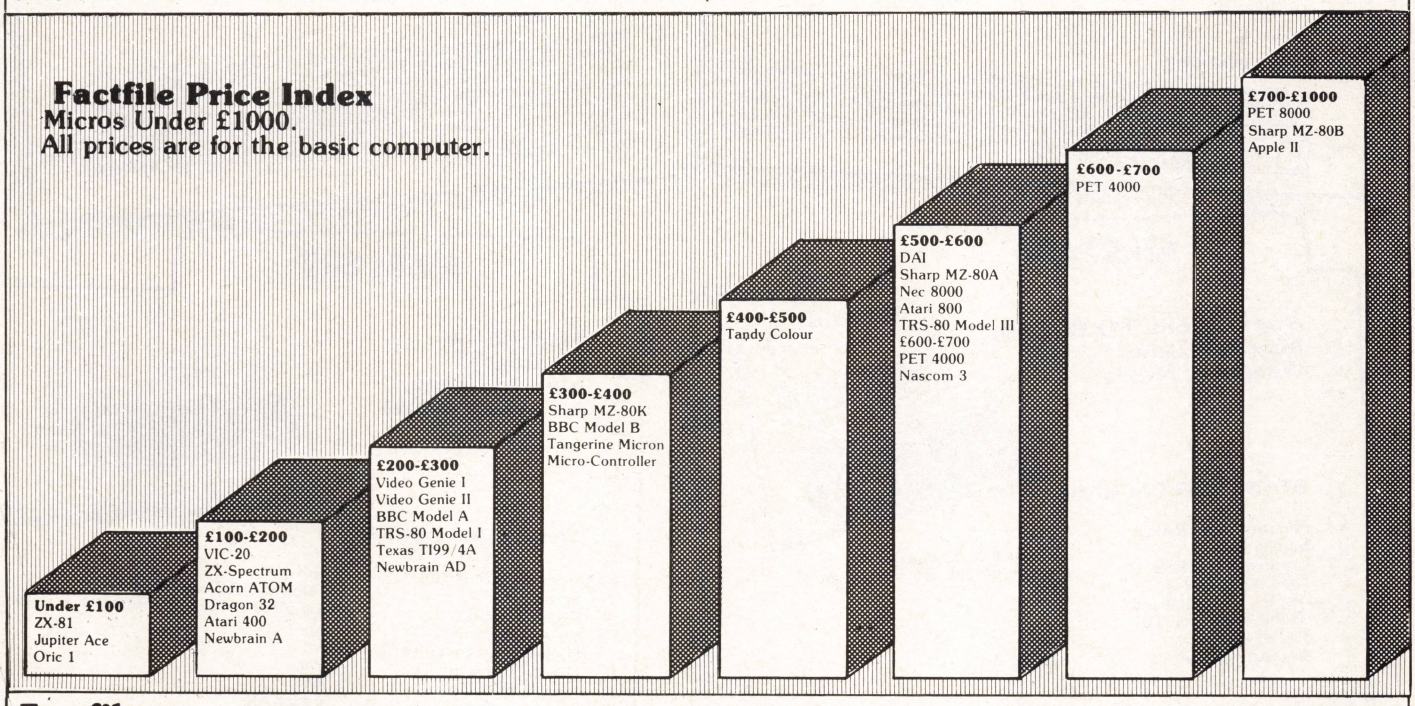
MICRO FACTFILE

Factfile is our regular buyer's guide to microcomputers. Herein you will find all the important facts and figures on 28 of the most important micros on the market under £1000. The idea is that you are able to directly compare what different manufacturers are offering you and how much they are charging you for it. Many brochures and adverts bury the reader in a mass of irrelevant facts and figures, which make it difficult to judge one against the other.

Factfile sorts it all out for you!

Just look down the price index to discover which machines are in your price-range and then consult the 'cards' on each. All the information is in a standard form and has all been checked by our technical staff. The section is presented alphabetically.

As new machines become available, we will add them into the FACTFILE as soon as we can.



Factfile

RAM: Stands for Random Access Memory and it is in there to accept the user's programs. Amount of memory is measured in "thousands of bytes" or "K" ie, 8K. A byte is a computer 'word' or single piece of information, made up of eight 'bits' which are just 1 or 0. Hence you need thousands of bytes to store a reasonable size program, since each letter, number, full stop, comma, line number, etc, uses up computer 'words' quite rapidly.

As a guideline – you can get about 50 program lines into 1K and 250 into 8K. This is a rough estimate – don't take it literally! The figures are not straight multiples, because you need to allow the machine space to work on your listing, once you've typed it in.

ROM: Read Only Memory. The machine can look and see what is stored in the memory, but it cannot alter the contents, nor store anything new. Generally used for control programs, where the micro consults the memory to see what to do next at various points in the program. Languages, such as BASIC, are stored in ROM and allow the machine to interpret what you type in, in terms of its own 'machine code'.

SIZE OF BASIC: The number of bytes occupied by the BASIC language is important, as it is an approximate guide to the BASICs versatility. The more powerful the language, the easier it should be to use.

BUS CONNECTION: A socket on the micro which allows it to be linked up to various add-ons. This can take the form of many various items, ie, expansion box, printer, disc drives, plotting device. In short a BUS is an information 'window' through which the micro communicates with the outside world.

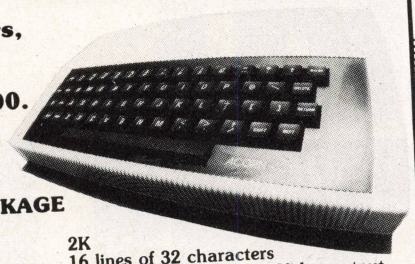
SERIAL/PARALLEL OUTPUT: This refers to the manner in which the micro transmits data to other units. If it puts out information in a long string, one bit after another, down a single wire or connector, it is a serial output. Parallel output is where pins or wires carry information simultaneously and are 'read' together as a block by whatever it is the micro is communicating with.

VIDEO OUTPUT: an output which will drive a monitor, as opposed to a TV set, allowing it's use as a screen for the computer.

FACTFILE

ACORN ATOM

Acorn Computers,
4A Market Hill,
Cambridge.
Tel: 0223-245200.



STANDARD PACKAGE

Memory Size (RAM)	2K
Screen Size	16 lines of 32 characters
Expansion Sockets	BUS connector, Printer, Video output
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8K
Average Price	**£140 kit, £174.50 built**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	12K internal, 32K external options	£45-149
Printer	Yes	£232
Monitor	No	—
Disc Drives	Yes	£299
Other Languages	Yes	£11.50
Multi-user Capabilities	Yes	—
BASIC extensions (Toolkits)	Yes, BBC BASIC	£50

OTHER ADD-ONS:

Centronics-type connector, Technomatic Ltd, 17 Burnley Road, London NW10, £8.50; **TMS 5100 Talking Board,** GM Microtronics Ltd, Unit 14, Godinton Way Industrial Estate, Godinton Road, Ashford, Kent, £82.95; **DUO-1 64K add-on,** Audio Computers, 87 Bournemouth Park Road, Southend-on-sea, SS5 2JJ, £64 kit, £70 built; **MZ163 RAM expansion boards,** Timedata Ltd, 57 Swallowdale, Basildon, Essex SS15 5BZ, £59.50-76.

APPLE II

Apple Computer (UK) Ltd,
Finway Road,
Hemel Hempstead,
Herts, HP2 7PS



STANDARD PACKAGE

Memory Size (RAM)	48K
Screen Size	24 lines of 40 characters
Expansion Sockets	BUS connections
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8 or 12K
Average Price	**£812**

MANUFACTURER'S EXPANSIONS

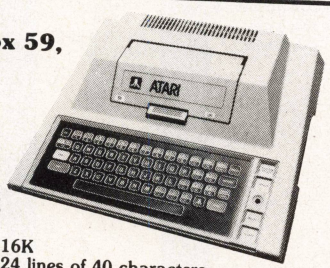
	DETAILS	PRICE
RAM	No	—
Printer	Yes various	£200-1700
Monitor	Yes	£134
Disc Drives	Yes	£379
Other Languages	Yes	£84-500
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	Yes	£26

OTHER ADD-ONS:

TMS 5100 Talking Board, GM Microtonics Ltd, Unit 14, Godinton Way Industrial Estate, Godinton Road, Ashford, Kent, £82.95; **Multifunction Card,** Datex Micros, 193 Touring Road, Worthing, W. Sussex, £85; **5¼" Winchester disc drive,** Independent Computer Engineering Ltd 16/18, Littleton Road, Ashford, Middlesex, TW15 1UQ; **16K RAM Board,** DDP Research & Marketing, 17 Novel Square, Basildon, Essex, SS13 1LP, £75; **U-port, 8 serial interfaces,** U-Microcomputers, Ltd, Winstanely Industrial estate, Long Lane, Warrington, Cheshire, WA2 8PR, £195.

ATARI 400

Atari UK Ltd, PO Box 59,
Alperton Lane,
Wembley, Middx.



STANDARD PACKAGE

Memory Size (RAM)	16K
Screen Size	24 lines of 40 characters
Expansion Sockets	Serial output, BUS connector
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8K
Average Price	**£199.95**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	Yes	£199.90
Monitor	No	—
Disc Drives	Yes	£299.99
Other Languages	Yes	£39-79
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	Yes	TBA

OTHER ADD-ONS:

TMS 5100 Talking Board, GM Microctonics Ltd, Unit 14, Godinton Way Industrial Estate, Godinton Road, Ashford, Kent, £82.95

ATARI 800

Atari UK Ltd,
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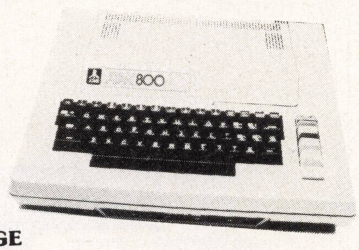
Wembley, Middx



STANDARD PACKAGE

Memory Size (RAM)	16K
Screen Size	24 lines of 40 characters
Expansion Sockets	Serial output, BUS connector
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8K
Average Price	**£399.95**

MANUFACTURER'S EXPANSIONS

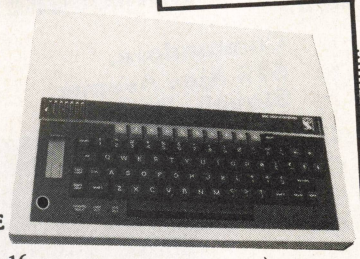
	DETAILS	PRICE
RAM	optional 16K RAM packs (to 48K Max)	£65
Printer	Yes	£199.99
Monitor	No	—
Disc Drives	Yes	£299.99
Other Languages	Yes	£39.79
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	Yes	TBA

OTHER ADD-ONS:

TMS 5100 Talking Board, GM Microtonics Ltd, Unit 14, Godinton Way Industrial Estate, Godinton Road, Ashford, Kent, £82.95; **Carrying case,** CJE Microcomputer, 25 Henry Avenue, Rustington, W. Sussex, BN16 2PA, £18.50

BBC MICROCOMPUTER

BBC Model A,
BBC Microcomputer
Systems,
PO Box 7,
London W3 6JX.



STANDARD PACKAGE

Memory Size (RAM)	16
Screen Size	32 lines of 40 characters (max)
Expansion Sockets	Parallel serial output, analogue output, Bus connection
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	16K
Average Price	**£299**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	up to 32K	£100
Printer	TBA	—
Monitor	Yes	£200
Disc Drives	TBA	—
Other Languages	TBA	—
Multi-user Capabilities	Yes	—
BASIC extensions (Toolkits)	TBA	—

OTHER ADD-ONS:

Disc drives, single and dual, Cumara Ltd, 35 Walnut Street Close, Guildford, Surrey GU1 4UN, Tel: 0483 50321, £199-799; **BBC Cassette Recorder,** Microage Electronics, 135 Hale Lane, Edgeware, Middx, £28; **Colour Monitor,** PortaTel Conversions Ltd, 25 Sunbury Cross Centre, Staines Roach West, Sunbury-on-Thames, Middx, TW16 7BB, £299; **Floppy Disc Controller Kit,** Midwich Computer Co Ltd, Newitt House, Northgate Street, Bury St. Edmunds, Suffolk IP33 1HQ, £42.50; **Analogue Joystick, Light Pen,** Stack Computers, 290-298 Derby Road, Bootle, Liverpool.

BBC MICROCOMPUTER

BBC Model B
BBC Microcomputer
Systems,
PO Box 7,
London W3 6JX



PACKAGE

Memory Size (RAM)	32
Screen Size	30 lines of 80 characters
Expansion Sockets	Serial and parallel output, analogue output, printer BUS connection
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	16K
Average Price	**£399**

MANUFACTURER'S EXPANSIONS

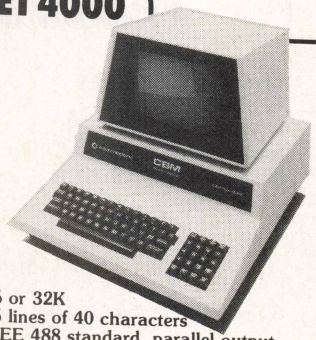
	DETAILS	PRICE
RAM	No	—
Printer	TBA	TBA
Monitor	No	—
Disc Drives	TBA	TBA
Other Languages	TBA	TBA
Multi-user Capabilities	Yes	—
BASIC extensions (Toolkits)	TBA	TBA

OTHER ADD-ONS:

Disc drives, single and dual, Cumara Ltd, 35, Walnut Tree Close, Guildford, Surrey GU1 4UN, Tel: 0483 503121, £199-799; **BBC Cassette recorder,** Microage Electronics, 135 Hale lane, Edgware, Middx, HA8 9QP, £28; **Colour Monitor,** Portatel Conversions Ltd, 25 Sunbury Cross Centre, Saires Road West, Sunbury-on-Thames, Middx, TW16 7BB, £299; **Floppy Disc Controller Kit,** Midwich Computer Co Ltd, Hewitt House, Northgate Street, Bury St. Edmunds, Suffolk, IP33 1HQ, £42.50; **Carrying Case,** CJE Microcomputers, 25 Henry Avenue, Rustington, W. Sussex, BN16 2PA, £18.50.

COMMODORE PET 4000

Commodore,
675 Ajax Avenue,
Slough, Berks



STANDARD PACKAGE

Memory Size (RAM)	16 or 32K
Screen Size	25 lines of 40 characters
Expansion Sockets	IEEE 488 standard, parallel output
Tape Included?	Yes
Display Unit Included?	Yes
Usable Domestic TV?	No
Size of BASIC	12K
Average Price	**£632.50, £799.25**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	Yes several	£454-1604
Monitor	N/A	—
Disc Drives	Yes	£396
Other Languages	Yes, single or dual	£454-1029
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

Universal Interface, Technomatic Ltd, 17 Burnley Road, London NW10, £149; **TMS 5100 Talking Board,** GM Microtronics Ltd, Unit 14, Godinton Way industrial Estate, Ashford, Kent, £82.95; **64K DRC Module,** Audio Computers, 87 Bournemouth Park Road, Southend-on-sea SS5 2JJ, £70 kit, £80 built.

COMMODORE PET 8000

Commodore,
675 Ajax Avenue,
Slough, Berks



STANDARD PACKAGE

Memory Size (RAM)	32K or 96K
Screen Size	25 lines of 80 characters
Expansion Sockets	IEEE 488 standard, parallel output
Tape Included?	Yes
Display Unit Included?	Yes
Usable Domestic TV?	No
Size of BASIC	12K
Average Price	**£980, £1374**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	Yes various	£454-1604
Monitor	N/A	—
Disc Drives	Yes single or dual	£454-1029
Other Languages	Yes	—
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

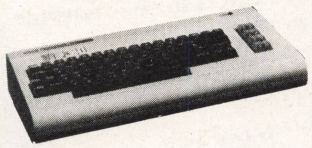
OTHER ADD-ONS:

Universal Interface, Technomatic Ltd, 17 Bunley Road, London NW10, £149; **TMS 5100 Talking Board,** GM Microtronics Ltd, Unit 14, Godinton Way industrial Easte, Godinton Road, Ashford, Kent, £82.95; **64K DRC Module** Audio Computers, 87 Bournemouth Park Road, Southend-on-sea SS5 2JJ, £70 kit, £80 built.

FACTFILE

COMMODORE VIC20

Commodore,
675 Ajax Avenue,
Slough, Berks



STANDARD PACKAGE

Memory Size (RAM)	5K
Screen Size	23 lines of 22 characters
Expansion Sockets	BUS connection, Disc, Printer, Serial output, joystick
Tape Included?	Yes
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8K
Average Price	**£129.99**

MANUFACTURER'S EXPANSIONS

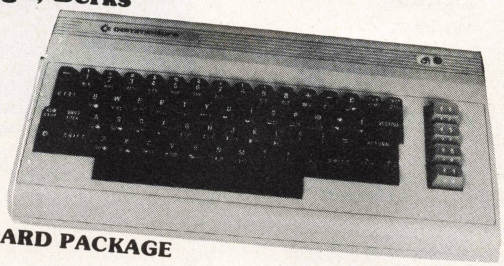
	DETAILS	PRICE
RAM	3K,8K,16K expansion options	£30,£45,£75
Printer	Yes	£270
Monitor	No	—
Disc Drives	Yes	£396
Other Languages	Yes	£38.95
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

VCR-20, 20K RAM cartridge, Audio Computers, 87 Bournemouth Park Road, Southend on Sea SS5 2JJ, £39 kit, £45 built; **Expansion Board,** 3K-16K, Arfon Microelectronics Ltd, Gibyn Industrial Estate, Caernafon, Gwynedd, Wales LL55 2BD, £220. Languages: VIC Forth, Adda Computers, 154 Victoria Road, Acton, London, W3.

COMMODORE 64

Commodore,
675 Ajax Avenue,
Slough, Berks



STANDARD PACKAGE

Memory Size (RAM)	64K
Screen Size	25 lines of 40 characters
Expansion Sockets	BUS, Serial, Video
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8K
Average Price	**£350**

MANUFACTURER'S EXPANSIONS

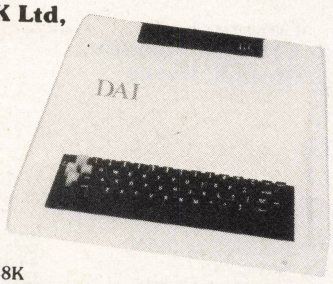
	DETAILS	PRICE
RAM	No	—
Printer	Yes	£230-276
Monitor	No	—
Disc Drives	Yes	£299
Other Languages	Yes	—
Multi-user Capabilities	Yes	—
BASIC Extensions	Yes	—

OTHER ADD-ONS:

Light Pen, 4 slot motherboard, Joystick, RS232 Interface, Stack Computers, 290-298 Derby Road, Bootley Liverpool. 051-933 5511.

DAI

Data Applications UK Ltd,
16B Dyer Street,
Cirencester,
Gloucestershire,
GL7 2PF



STANDARD PACKAGE

Memory Size (RAM)	48K
Screen Size	24 lines of 60 characters
Expansion Sockets	BUS connection, Serial output, joystick socket
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	16K
Average Price	**£575**

MANUFACTURER'S EXPANSIONS

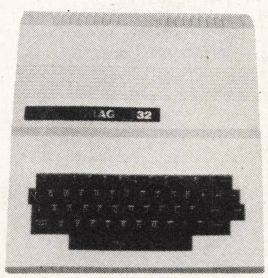
	DETAILS	PRICE
RAM	No	—
Printer	No	—
Monitor	No	—
Disc Drives	Yes	TBA
Other Languages	No	—
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	Yes, maths pack	£149

OTHER ADD-ONS:

None Reported

DRAGON 32

Dragon Data Ltd
Queensway,
Swansea
Industrial Estate,
Swansea, SA5 4EH



STANDARD PACKAGE

Memory Size (RAM)	32K
Screen Size	16 lines of 32 characters
Expansion Sockets	Yes
Display Unit Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	16K
Average Price	**£199**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	—	—
Printer	No	—
Monitor	No	—
Disc Drives	No	—
Other Languages	Yes	—
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

Joystick, Light Pen, 4 slot motherboard, Stack Computers 290-298 Derby Road, Bootle, Liverpool. 051-933 5511.

JUPITER ACE



Jupiter Cantab
22 Foxhollow
Bar Hill
Cambridge
CB3 8EP

STANDARD PACKAGE

Memory Size (RAM)	3K
Screen Size	24 lines of 32 characters
Expansion Sockets	Not known
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	Resident language is FORTH at 8K
Average Price	**£89.95**

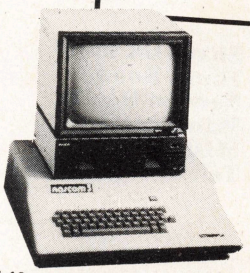
MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	TBA	—
Printer	TBA	—
Monitor	TBA	—
Disc Drives	TBA	—
Other Languages	TBA	—
Multi-User Capabilities	TBA	—
BASIC extensions (toolkits)	TBA	—
	N/A	—

OTHER ADD-ONS:

None Reported.

NASCOM 3



Lucas Logic, NASCOM Microcomputers Division, Welton Road, Wedgenock Industrial Estate, Warwick, CV34 5PZ. Tel: 0926-497733

STANDARD PACKAGE

Memory Size (RAM)	0-48K
Screen Size	25 lines of 40 or 80 character
Expansion Sockets	Parallel & serial outputs, BUS connections
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8-10K
Average Price	**£549**

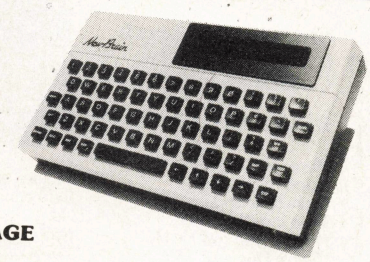
MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	up to 48K (max)	£130
Printer	Yes	£215-1285
Monitor	Yes	£99-120
Disc Drives	Yes, single or dual	£470-685
Other Languages	Yes	£50
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	Yes	-15-50

OTHER ADD-ONS:

Olivetti disc drives, single and dual, Kram Electronics, Victoria House, 17, Highcross St., Leicester, LE1 4PF, £179-349; **A/D Board,** 10, Research Ltd, 6, Laleham Avenue, Mill Hill, London NW7 3HL, £120 + VAT; **Hobbit – mini-cassette system,** Ikon Computer Products, Kiln Lane, Laugharne, Covnathen, Dyfed, £99 + VAT; **Disc drives, single and dual,** Micro-Spares, 19, Roseburn Terrace, Edinburgh, EH12 5N9, £199-279.

NEWBRAIN



Grundy Business Systems Ltd, Grundy House, Somerset Road, Teddington TW11 8TD.

STANDARD PACKAGE

Memory Size (RAM)	32K
Screen Size	25 lines of 40 or 80 characters
Expansion Sockets	Printer, serial, video, data bus
Tape Included?	No
Display Unit Included?	No (Single line option on model AD)
Usable Domestic TV?	Yes
Size of BASIC	18K
Average Price	**£199 model A, £299 Model AD**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	64 – 512K,	£75 – £445
Printer		
Monitor		
Disc Drives	NYA	—
Other Languages	NYA	—
Multi-user	NYA	—
BASIC extensions	NYA	—

OTHER ADD-ONS:

None Reported.

ORIC 1



Oric Products International, Coworth Mansion, Coworth Park, London Road, Sunninghill, Ascot, Berkshire, SL5 7SE.

STANDARD PACKAGE

Memory Size (RAM)	16K, 48K
Screen Size	28 X 40
Expansion Sockets	Yes
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8K
Average Price	**£99, £169**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	N/A	—
Printer	TBA	—
Monitor	No	—
Disc Drives	TBA	—
Other Languages	N/A	—
Multi-user Capabilities	No	—
BASIC extensions	TBA	—

OTHER ADD-ONS:

FACTFILE

SHARP MZ-80A

**Sharp UK Ltd,
Thorn Road,
Newton Heath,
Manchester
M10 9BE
Tel: 061-205 2333**



STANDARD PACKAGE

Memory Size (RAM)	48K
Screen Size	25 lines of 40 characters
Expansion Sockets	BUS connector
Tape Included?	Yes
Display Unit Included?	Yes
Usable Domestic TV?	No
Size of BASIC	12K
Average Price	**£549**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	Yes	£450-800
Monitor	N/A	—
Disc Drives	Yes, dual	£600
Other Languages	Yes	£45
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

None Reported

SHARP MZ-80B

**Sharp UK Ltd,
Thorn Road,
Newton Heath,
Manchester M10 9BE**



STANDARD PACKAGE

Memory Size (RAM)	64K
Screen Size	25 lines of 40 or 80 characters
Expansion Sockets	BUS connector
Tape Included?	Yes
Display Unit Included?	Yes
Usable Domestic TV?	No
Size of BASIC	16K
Average Price	**£990**

MANUFACTURER'S EXPANSIONS

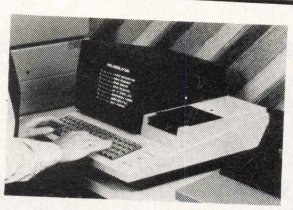
	DETAILS	PRICE
RAM	Yes	£120
Printer	Yes	£450-800
Monitor	N/A	—
Disc Drives	Yes, dual	£600
Other Languages	Yes	£45
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

Multi-vision and triple-vision, Datron Micro Centre, 2 Abbeydale Road, Sheffield S7 1FD, £35-79

SHARP MZ-80K

**Sharp UK Ltd,
Thorn Road,
Newton Heath,
Manchester
M10 9BE**



STANDARD PACKAGE

Memory Size (RAM)	48K
Screen Size	25 lines of 40 characters
Expansion Sockets	BUS connector
Tape Included?	Yes
Display Unit Included?	Yes
Usable Domestic TV?	No
Size of BASIC	12K
Average Price	**£350**

MANUFACTURER'S EXPANSIONS

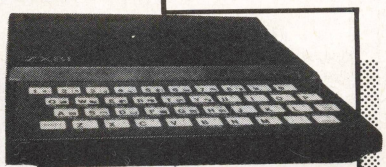
	DETAILS	PRICE
RAM	No	—
Printer	Yes	£450-800
Monitor	N/A	—
Disc Drives	Yes, dual	£600
Other Languages	Yes	£45 upwards
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

None Reported

SINCLAIR ZX 81

**Sinclair Research,
6 Kings Parade,
Cambridge CB2 1SN**



STANDARD PACKAGE

Memory Size (RAM)	1K
Screen Size	24 lines of 32 characters
Expansion Sockets	BUS connections
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8K
Average Price	**£49.95 built**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	16K RAM pack	£29.95
Printer	ZX Printer	£59.95
Monitor	No	—
Disc Drives	No	—
Other Languages	No	—
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

Memory expansion unit 16K or 64K, Memotech Ltd, 3 Collins St, Oxford OX4 1XL, £39.95-79; Memory Expansion 64K, Downsway Electronics (UK) Ltd, Dept M, Downsway House, Epsom Road, Ashtead, Surrey; £59.95; **Key Bleep Unit,** Microtronix, 3 Buxton Avenue, Coulton, Nottingham, N94 3RR, £8.85 kit, £9.95 built; **Maximem 1.1,** East London Robotics, Finlandia House, 14 Darwell Close, East Ham, London, EB4 BT, £93.50; **Music Synthesiser + 16 line control port,** William Stuart Systems Ltd, Dower House, Billicicay Road, Herongate, Brentwood, Essex CM13 3SD, £19.50; **Full-size keyboard,** Protos Computer Systems, Frome Computing, 20 Ashtree Road, Frome, Somerset, BA11 2SF, £64.95; **ZX99 Automatic tape control,** Data-cassette, 44, Shroton Street, London NW1 6UG, £59.95.

SINCLAIR ZX SPECTRUM

Sinclair Research,
6 Kings Parade,
Cambridge, CB2 1SN



STANDARD PACKAGE

Memory Size (RAM)	16-48K
Screen Size	24 lines of 32 characters
Expansion Sockets	BUS connections
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	10K
Average Price	**£125 or £175**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	48K RAM for 16K version	£60
Printer	ZX Printer	£59.95
Monitor	No	—
Disc Drives	ZX Microdrive	TBA
Other Languages	No	—
Multi-user Capabilities	No	TBA
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

Memory Expansion 32K, Downsway Electronics (UK) Ltd, Dept M, Downsway House, Epsom Road, Ashtead, Surrey; £42.50

TANDY TRS 80 I

Tandy Corporation,
12th Floor,
Tameway Tower,
Walsall,
West Midlands
WS1 1LA.



STANDARD PACKAGE

Memory Size (RAM)	4 or 16K
Screen Size	16 lines of 32 or 64 characters
Expansion Sockets	BUS connection
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8 or 12K
Average Price	**£229 or £339**

MANUFACTURER'S EXPANSIONS

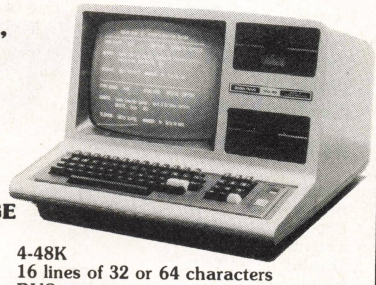
	DETAILS	PRICE
RAM	32K extra in expansion unit	£349
Printer	Yes	£239-1200
Monitor	Yes	£100
Disc Drives	Yes	£369
Other Languages	Yes	£100
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	Yes	£100

OTHER ADD-ONS:

Disc drives, single and dual, Cumana Ltd, 35 Walnut Tree Close, Guildford, Surrey GU1 4UN, £199-799; **Olivetti disc drives single and dual,** Kran Electronics, Victoria House, 17 Highcross St., Leicester LE1 4PF, £179-349; **48K internal RAM,** General Northern Microcomputers, (GNOMIC) 46 Middle Street, Blackhall, Marlepool, Cleveland, £70 + VAT; **32K RAM card,** Audio Computers, 87 Bournemouth Park Road, Southend on Sea, SS5 2JJ, £40 kit, £46 built.

TANDY TRS 80 III

Tandy Corporation,
12th Floor,
Tameway Tower,
Bridge Street,
Walsall,
West Midlands,
WS1 1LA



STANDARD PACKAGE

Memory Size (RAM)	4-48K
Screen Size	16 lines of 32 or 64 characters
Expansion Sockets	BUS connection, parallel & serial output
Tape Included?	No
Display Unit Included?	Yes
Usable Domestic TV?	No
Size of BASIC	16K
Average Price	**£599-1799**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	16K modules	£70
Printer	Yes various	£239-1200
Monitor	N/A	—
Disc Drives	Yes	£600
Other Languages	Yes	£100
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	Yes	£100

OTHER ADD-ONS:

Disc drives, Cumara Ltd, 35, Walnut Tree Close, Guildford, Surrey GU1 4UN, £199-799; **Olivetti disc drives single and dual,** Kram Electronics, Victoria House, 17, Highcross St, Leicester LE1 4PF, £179-349; **48K internal RAM,** General Northern Microcomputers, (GNOMIC), 46 Middle Street, Blackhall, Hartlepool, Cleveland, £70 + VAT; **32K RAM card,** Audio Computers, 87 Bournemouth Park Road, Southend on Sea, SS5 2JJ, £40 kit, £46 built.

TANDY COLOUR

Tandy Corporation,
12th Floor,
Tameway Tower,
Bridge Street,
Walsall,
West Midlands
WS1 1LA



STANDARD PACKAGE

Memory Size (RAM)	16-32K
Screen Size	16 lines of 32 characters
Expansion Sockets	Serial output, ROM pack, joystick socket
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8-16K
Average Price	**£499**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	Yes various	£239-1200
Monitor	No	—
Disc Drives	Yes	£439
Other Languages	No	—
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

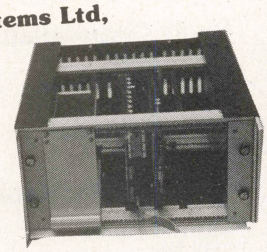
OTHER ADD-ONS:

Olivetti disc drives single and dual, Kram Electronics, Victoria House, 17 Highcross St., Leicester LE1 4PF, £179-349.

FACTFILE

TANGERINE MICRON

Tangerine Computer Systems Ltd,
The Science Park,
Milton Road,
Cambridge
CB4 4BH



STANDARD PACKAGE

Memory Size (RAM)	8K
Screen Size	16 lines of 32 characters
Expansion Sockets	Parallel & serial output, BUS connection
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	10K
Average Price	**£395**

MANUFACTURER'S EXPANSIONS

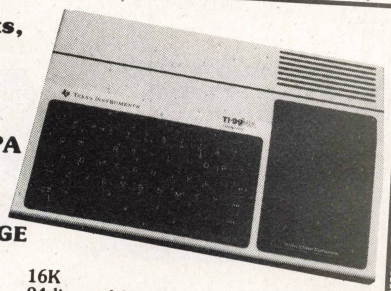
	DETAILS	PRICE
RAM	48K in system rack	£144
Printer	No	—
Monitor	No	—
Disc Drives	Yes	TBA
Other Languages	Yes	£40
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

Sound Board and Graphics Board, Bulldog Video Ltd, 52, Nash Square, Birmingham, B42 2EX, £49-£179; **Toolkit,** Microtanic Software, 235, Friern Road, Dulwich, London, OBD, £22.50.

TEXAS TI 99/4A

Texas Instruments,
European
Consumer
Division,
Manton Lane,
Bedford MK41 7PA



STANDARD PACKAGE

Memory Size (RAM)	16K
Screen Size	24 lines of 32 characters
Expansion Sockets	ROM pack, Bus connector, joystick, socket
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	14K
Average Price	**£199**

MANUFACTURER'S EXPANSIONS

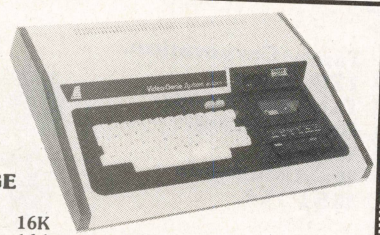
	DETAILS	PRICE
RAM	up to 48K (max)	£300
Printer	Yes	£275
Monitor	No	—
Disc Drives	Yes	£300
Other Languages	Yes	£50-£100
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	Yes	£100

OTHER ADD-ONS:

Speech Synthesiser, Texas Instruments, £46.60; **Terminal Emulator II,** Texas Instruments, £37.80; **RS232 Interface,** Texas Instruments.

VIDEO GENIE I

Lowe Electronics,
Bentley Bridge,
Chesterfield Road,
Matlock,
Derbyshire,
DE4 5LE



STANDARD PACKAGE

Memory Size (RAM)	16K
Screen Size	16 lines of 64 characters
Expansion Sockets	BUS connector
Tape Included?	Yes
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	12K
Average Price	**£279**

MANUFACTURER'S EXPANSIONS

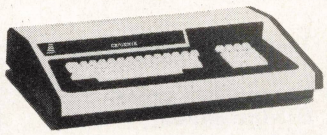
	DETAILS	PRICE
RAM	optional 48K in expansion unit	£200
Printer	Yes	£210
Monitor	Yes	£69-99
Disc Drives	Yes, single and dual	£220-375
Other Languages	No	—
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

Disc drives, single and dual, Cumara Ltd, 35 Walnut Tree Close, Guildford, Surrey GU1 4UN, £199-799; **Olivetti disc drives single and dual,** Kram Electronics, Victoria House, 17 Highcross St, Leicester LE1 4PF, £179-349; **EG3014 Expansion box with 16K/32K RAM,** Swanley Electronics, 32 Goldsel Road, Swanley, Kent BR8 8EZ, £199-213 **48K Internal RAM,** General Northern Microcomputers, GNOMIC, 46 Middle Street, Blackhall, Martlepool, Cleveland, £70 + VAT: **32K RAM Card** Audio Computer, 87 Bournmouth Park Road, Southend-on-sea, SS5 2JJ, £40 kit, £46 built.

VIDEO GENIE II

Lowe Electronics,
Bentley Bridge,
Chesterfield Road,
Matlock,
Derbyshire DE4 5LE



STANDARD PACKAGE

Memory Size (RAM)	16K
Screen Size	16 lines of 32 or 64 characters
Expansion Sockets	BUS connector
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	13K
Average Price	**£299**

MANUFACTURER'S EXPANSIONS

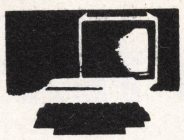
	DETAILS	PRICE
RAM	optional 48K in expansion unit	£200
Printer	Yes	£210
Monitor	Yes	£69-99
Disc Drives	Yes, single and dual	£220-375
Other Languages	No	—
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

Disc drives, single and dual, Cumana Ltd, 35, Walnut Tree Close, Guildford, Surrey, Gul 4UN, £199-799; **Olivetti disc drives single and dual,** Kram Electronics, Victoria House, 17 Highcross St, Leicester LE1 4PF, £179-349; **EG3014 Expansion box with 16K/32K RAM,** Swanley Electronics, 32 Goldsel Road, Swanley, Kent BR8 8EZ, £199-213; **48K internal RAM,** General Northern Microcomputers, GNOMIC, 46 Middle Street, Blackhall, Hartlepool, Cleveland, £70 + VAT; **32K RAM Card** Audio Computers, 87 Bournemouth Park Road, Southend-on-sea, SS5 2JJ, £40 kit, £46 built.

THE DRAGON GOES FORTH





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(3) Access to basic commands from Forth – hence a Forth 'word' may be defined as a basic command – making it easy to draw those complex graphic character in basic – and then manipulate them at high speed from Forth.
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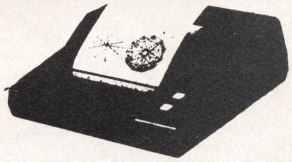

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ADDRESS

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	INTERFACE MODULE	15.96	
ZX Spectrum ☐ ZX81 ☐ Please tick		FINAL TOTAL	

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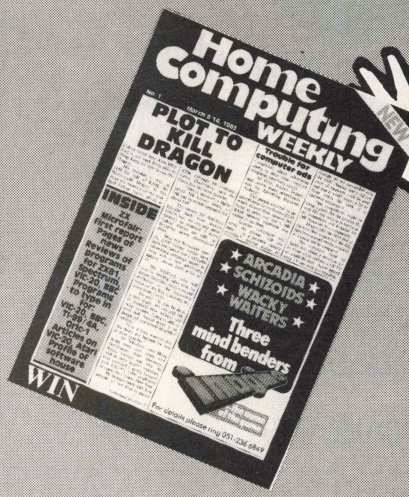
IT'S HERE!



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SOFTWARE LISTING

Looking for a program to buy? Look no further! If it's available, it's listed here in our exclusive and comprehensive software checklists.

Looking through any computer magazine can be a bewildering experience if you're in search of a program. Count the hundreds of ads and thousands of titles on sale and it would be easy to lose heart!

We've tried to sort out the confusion, and the sheer numbers, to present an easily understood list for each machine. Where possible, we have eliminated duplications, so that the same tape with a different label is not listed twice. Rather it should be credited once, with as many suppliers as we could find.

Table Codes

In order to fit as many programs as possible into our pages, we have had to use codes for some columns, considerably shortening the wording.

The information given for each program is: Title, memory required to run it, company producing it, whether tape/cartridge or disk, type and supplier and price.

The codes we have used are:

Program Type

GM = Game
BS = Business routine
UT = Utility (ie. programming aid)
DO = Domestic
ED = Educational

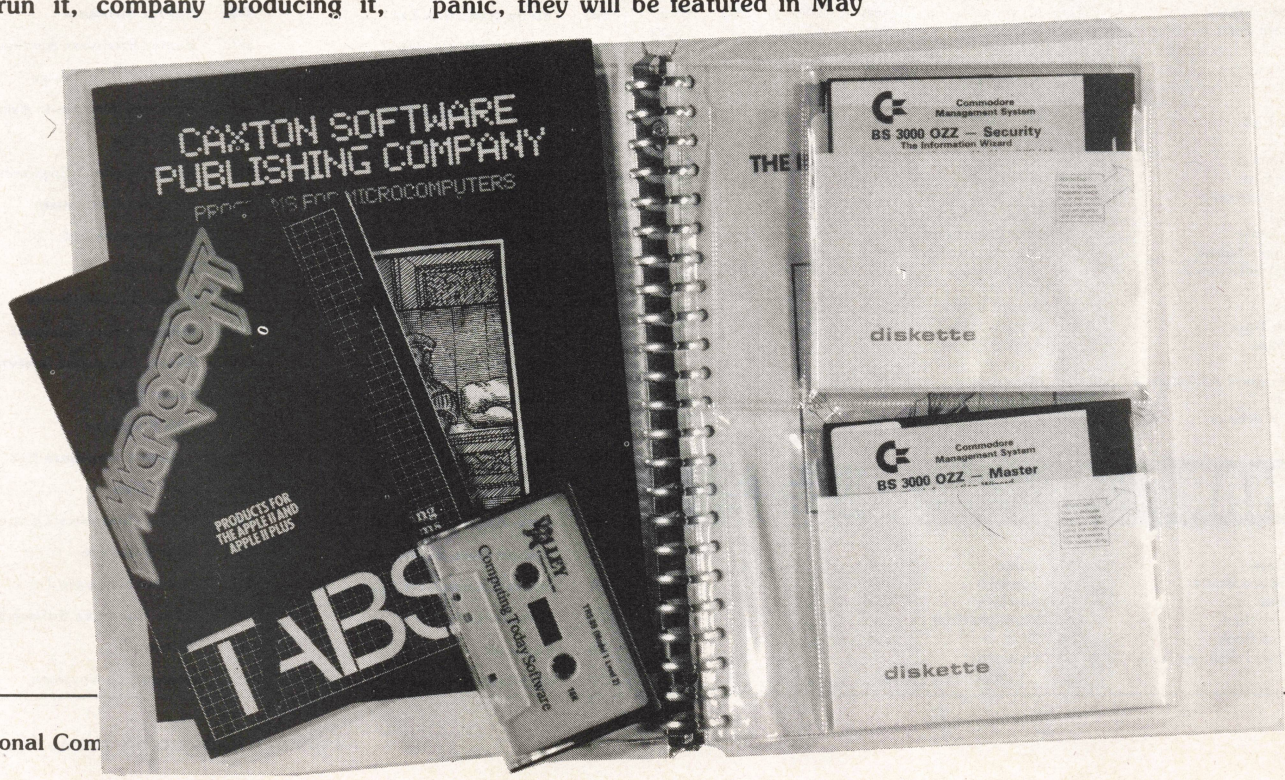
How Sold

R = Cartridge (may include memory)
C = Tape (cassette)
D = Disc (for expanded systems)
L = Listing (sold as print-out)

Due to overwhelming response we have been forced to alternate machines included in our checklist each month. Out this month are the Atom, Texas and Vic 20. But don't panic, they will be featured in May for you to make your software selection. Also we have had to drop the addresses from our dealer list, but don't worry, you should be able to find these addresses from adverts or back issues of PCT.

Not Here?

To companies whose products are not listed herein we can only say TELL US ABOUT IT! This applies particularly to the smaller retailer who may sell only half a dozen or so programs for one machine. If you produce software for *any* of the machines on the market today, then we would love to include your wares in our checklists. Send it in to us, marked for the attention of the Editor (in our format *Please*!) or ring Chris Palmer on 01-437 1002 as soon as possible.



REFERENCE

SOFTWARE LISTING

DRAGON

Title	Program Type	Program Produced By	Memory Reqd	How Sold	Supplier Codes	Prices
Arcade Action	Gm	Apex S/W	32K	C	JT	£3.95
Astroblast	Gm	Dragon Data	16K	R	R KY	£19.95
Alcatraz II	Gm	Micro deal	16K	C	KY	£8.00
Berserk	Gm	Dragon Data	32K	R	DN,KY	£19.95
Black Sanctum	Gm	Dragon Data	16K	C	KY	£7.95
Breaker	Gm	Wizard S/W	32K	C	KU	£3.50
Calixto Island	Gm	Dragon Data	16K	C	KY	£7.95
Computavoice	Ut	Dragon Data	16K	C	KY	£7.95
Cosmic Invaders	Gm	Dragon Data	32K	R	DN	£19.95
Cyrus Chess	Gm	Dragon Data	16K	R	KY	£19.95
Devil's Island	Gm	Apex S/W	32K	C	JT	£4.95
Defense	Gm	Microdeal	16K	C	KY	£8.00
Dragon Mountain	Gm	Dragon Data	16	C	KY	£7.95
Dragon Invaders	Gm	Microdeal	16K	C	KY	£8.00
Dragon Selection 1	Gm	Dragon Data	32K	C	DN	£7.95
Dragon Selection 2	Ut	Dragon Data	32K	C	DN	£7.95
Examples from the Manual	Ut	Dragon Data	32K	C	DN	£7.95
Escape	Gm	Microdeal	16K	C	KY	£8.00
Flag	Gm	Dragon Data	16K	C	KY	£7.95
Flipper	Gm	Microdeal	16K	C	KY	£8.00
Forbidden City	Gm	Apex S/W	32K	C	JT	£4.95
Fruita	Gm	Wizard S/W	32K	C	KU	£6.50
Galleons	Gm	Wizard S/W	32K	C	KU	£5.00
Gamestape 1	Gm	Apex S/W	32K	C	JT	£1.95
Gamestape 2	Gm	Apex S/W	32K	C	JT	£2.95
Gamestape 3	Gm	Apex S/W	32K	C	JT	£2.95
Ghost Attack	Gm	Dragon Data	32K	R	DN	£24.95
Graphic Animator	Ut	Dragon Data	32K	C	DN	£7.95
Haunted House	Gm	Apex S/W	32K	C	JT	£3.95
Island Adventure	Gm	Apex S/W	32K	C	JT	£3.95
Invaders Revenge	Gm	Microdeal	16K	C	KY	£8.00
Jerusalem Adventure	Gm	Microdeal	16K	C	KY	£8.00
Lightpen	Ut	Microdeal	16K	C	KY	£12.00
Madness and the Minotaur	Gm	Dragon Data	32K	C	DN,KY	£7.95
Mansion Adventure	Gm	Microdeal	16K	C	KY	£8.00
Meteoroids	Gm	Dragon Data	32K	R	DN,KY	£19.95
Personal Finance	Do	Dragon Data	32K	C	DN,KY	£7.95
Pharaoh's Curse	Gm	Apex S/W	32K	C	JT	£4.95
Program Pack 1	Gm	Microdeal	16K	C	KY	£8.00
Program Pack 2	Gm	Microdeal	16K	C	KY	£8.00
Program Pack 3	Gm	Microdeal	16K	C	KY	£8.00
Quest	Gm	Dragon Data	32K	C	DN	£7.95
Racer Ball	Gm	Microdeal	16K	C	C	£8.00
Scarfman	Gm	Microdeal	4K	C	KY	£8.00
Space War	Gm	Microdeal	16K	C	Ky	£8.00
Space Monopoly	Gm	Microdeal	16K	C	KY	£8.00
Sirius IV	Gm	Wizard S/W	32K	C	KU	£6.50
Sixth Sense	Gm	Kent Computer Co	32K	C	Ky	£9.95
Starship Chaleon	Gm	Dragon Data	16K	R	KY	£19.95
Special Selection 2	Gm	Dragon Data	16K	C	KY	£7.95
Triplet	Gm	Wizard S/W	32K	C	KU	£5.50
Typing Tutor	Ed	Dragon Data	16K	C	KY	£7.95
3-D Maze	Gm	Apex S/W	32K	C	JT	£3.95
Williamsburg Adventure	Gm	Microdeal	16L	C	KY	£8.00
Wizard	Gm	Wizard S/W	32K	C	KU	£6.50
Word Processor	Bs	Juniper Comp	32K	C	LA	£25.00

SHARP

3-D Basic	Gm	Kuma	6K	C	AX,AO,AB	£6.32
3-D Space Battle	Gm	Sumlock	48K	C	DN	£8.00
Acrobat	Gm	Sumlock	48K	C	DN	£6.33
Address Book	Gm	Highlight S/W	4K	C	CC,AB	£4.60
Address Book	Do	DCS	48K	C	JQ	£3.00
Address/Telephone Book	Do	Plymouth Computers	6K	C	OG	£4.99

SOFTWARE DEALERS

Supplier Code		Supplier Code	
AA	Micro Centre Ltd	CD	Omega Plus
AB	Micro and Video Palace	CE	Southern Software
AC	Laskys	CF	Sigma Systems
AD	Datarite Terminals Ltd	CG	Planet Software
AE	Vincelord Ltd	CH	Brighton Gamer
AF	MicroComputerLand	CI	Picturesque
AG	Comart Ltd	CJ	ACS Software
AH	Cream Computer Shop	CK	Chrisalid
AI	Microvalue	CL	MED
AJ	Molimerx Ltd	CM	Simple Software
AK	GW Computers Ltd	CN	Buffer Micro Shop
AL	Acornsoft Ltd	CO	Pixel Productions
AM	Acorn Computers	CP	Computics Microsoft
AN	Microcomputers Products Int.	CQ	KW Software
AO	Xitan Systems	CR	Sideline Freepost
AP	KGB Micros Ltd	CS	IQ Services
AQ	Broadside	CT	Willow Software
AR	Software Ltd	CU	Level 9 Computing
AS	Lucas Logic Ltd	CW	Cambell Systems
AT	Atlantic Micro System	CX	Microdeal
AU	TCL Software	CY	Prof. F H George
AV	I A S	CZ	J Wolstencroft
AW	Intelligent Artefacts Ltd		
AX	Kuma Computers	DA	Ground Control
AY	Microstore	DB	Mick Bignell
AZ	London Retail	DC	Giltrole Ltd
BA	Micro-Spares	DD	Deep Thought Software
BB	CAPS Ltd	DE	Silversoft
BC	Maplin	DF	Michael Orwin
BD	Caxton Software	DG	Hisoft
BE	Cornshall Ltd	DH	The Soft Option
BF	Micro Technology	DJ	Microcomputer Spacedrome
BG	Elcon Research Ltd	DK	Spider Software
BH	Avalon Hill Games	DL	Xavier Business Systems
BI	Call Apple (UK)	DM	Camden Electronics
BJ	Lifeboat Associates	DN	Sumlock Electronic Services
BK	L & J Computers	DO	Microstyle
BL	Peach Tree Software	DP	Small Systems Engineering
BM	ACT (Microsoft) Ltd	DQ	Woodland Software
BN	Personal Computer Palace	DR	Telesystems Ltd
BO	Sinclair Software	DS	Macronics
BP	Leicester Computer Centre Ltd	DT	Hewson Consultants
BQ	TABS Ltd	DU	Silicon Office Services
BR	IBR Microcomputers	DV	Sirton Computer Systems
BS	Computer Plus	DW	Psion Ltd
BT	The Essential Software Co.	DX	JRS Software
BU	Guestel	DY	Calisto Computers Ltd
BV	Lowe Electronics	DZ	Micro Gen
BW	Gate Micro System Ltd	EA	Anglia Computer Centre
BY	Almarc Data Systems Ltd	EB	SBD Software
BZ	Interam Computer Systems Ltd	EC	Abacus Software
CA	Terodec Ltd	ED	Qdos Business Software
CB	Poolsoft	EE	dK'tronics
CC	Highlight Software	EF	Computech Systems

Agent 007	Gm	DCS	24K	C	JQ	£3.00
Air Bomber	Gm	Plymouth Computers	6K	C	OG	£4.99
Aladdin's Cave	Gm	Kuma		C	AX,CH	£6.32
Aldebaren I	Gm	Sharpsoft	20K	C	CH	£5.85
Alien Attack	Gm	Sumlock	48K	C	DN	£6.50
Alien Attack	Gm	J Wolsencroft	24K	C	CZ	£4.60
Analysis Book	Bs	Microtek	48K	C	EQ	£95.00
Animate	Gm	Kuma	48K	C	AX,AB,AO	£9.20
Apollo Front Panel	Bs	Kuma	20K	C	AX	£14.35
Apolloword	Bs	Kuma	48K	C	AX,AC,AO	£28.70
Apolloword	Bs	Kuma	48K	D	AX,AC,AO	£63.25
Ardensoft Toolkit	Ut	Kuma	20K	C	AX	£40.25
Artillery/Biorythms	Gm	DCS	24K	C	JQ	£3.00
Asteroids	Gm	Sharpsoft	20K	C	CH	£5.85
Astor Dodge	Gm	Kuma		C	AX,CH	£6.32
Astor Shoot	Gm	Sumlock	48K	C	DN	£6.33
Auto Cross	Gm	Highlight S/W	6K	C	CC,AB	£4.60
Backgammon	Gm	Highlight S/W	10K	C	CC,AB	£5.75
Bank Account	Do	Highlight S/W	6K	C	CC,AB	£4.60
BASIC-C	Ut	DCS	24K	C	JQ	£16.00
BASIC-B	Ut	DCS	24K	C	JQ	£12.00
Basic Compiler	Ut	Sharp	48K	C	AB	£34.50
Basic Extensions	Ut	Kuma	20K	C	AX,AO,AB	£14.95
Basic Mod	Ut	DCS	20K	C	JQ	£5.00
Basic Plus	Ut	Kuma		C	AX	£13.80
Battleships	Gm	DCS	24K	C	JQ	£3.00
Bean Feast	Gm	DCS	24K	C	JQ	£3.00
Bingo Caller	Gm	DCS	48K	C	JQ	£3.00
Bio-Rhythm	Gm	Highlight S/W	6K	C	CC,AB	4.60
Block QC	Gm	Sharpsoft	20K	C	AB	£3.50
Block Stop	Gm	J Wolstencroft	24K	C	CZ	£4.60
Blockade	Gm	Kuma	48K	C	AX,AO,AB	£6.32
Bomb Run	Gm	Sumlock	48K	C	DN	£7.50
Bomber	Gm	Kuma	6K	C	AX,AO,AB	£6.32
Breakout	Gm	Kuma	48K	C	AX,AO,AB	£6.32
Breakout	Gm	Sharpsoft	20K	C	AB	£5.75
Bridge	Gm	Highlight S/W	22K	C	CC	£12.95
Broadwater Economic Simulations	Ed	BES	16K	C	KX	£28.75
Brownian Motion	Ed	Kuma		C	AX	£12.00
Bytesaver	Ut	DCS	20K	C	JQ	£4.00
CPM	Ut	Chrystal	48K	C	AX,AO	£172.50
Calc II	Bs	Kuma	20K	C	AX,AO,FZ	£39.65
Camelot	Gm	Kuma	48K	C	AX,AC,AB AO,FZ	£6.32
Carols	Gm	Kuma	48K	C	AX,AO,AB	£6.32
Cash Book	Bs	Microtek	48K	C	EQ	£95.00
Cash Flow Projection	Bs	NCG Ltd	36K	C	KW	£95.00
Castle Bloodstone Adventure	Gm	Sumlock	48K	C	DN	£17.25
Casino	Gm	Kuma		C	AX	£6.32
Catch 2000/Invader	Gm	Kuma	12K	C	AX,AO,AB	£6.32
Cesil III	Ed	Kuma	20K	C	AX	£17.20
Chase	Gm	Highlight S/W	6K	C	CC,AB	£5.75
Chess	Gm	Kuma	12K	C	AX,AO,FZ,CH	£12.00
Children's Maths	Ed	Kuma		C	AX	£6.32
Chrystal Basic	Ut	Chrystal	48K	C	AX,AO	£46.00
Code Breaker	Gm	Plymouth Computers	15K	C	OG	£4.99
Colditz	Gm	Sharpsoft	20K	C	CH	£8.46
Combat	Gm	Highlight S/W	6K	C	CC,AB	£5.75
Combat	Gm	Kuma	12K	C	AX,AO,AB	£6.32
Commands	Gm	Sharpsoft	20K	C	AB	£5.85
Composer	Gm	Highlight S/W	6K	C	CC,AB	£5.75
Concentration	Gm	Kuma	12K	C	AX,AO,AB	£6.32
Conflict	Gm	Sumlock	48K	C	DN	£6.33
Connect 4	Gm	Highlight S/W	6K	C	CC,AB	£4.60
Connect Four	Gm	DCS	24K	C	JQ	£3.00
Cosmiad	Gm	Highlight S/W	10K	C	CC,AB	£5.75
Cosmiad	Gm	Kuma	12K	C	AX,AC,AO,AB	£9.20
Count and Add	Ed	Highlight S/W	22K	C	CC,AB	£5.75
Cribbage	Gm	Kuma	12K	C	AX,AO	£12.00
Critical Path Analysis	Bs	NCG Ltd	36K	C	KW	£40.00
Cricket	Gm	Kuma		C	AX	£6.32
Cursed Chambers	Gm	J Wolstencroft	48K	C	CZ	£5.75
Data Bank	Ut	DCS	48K	C	JQ	£6.00
Data Base	Bs	Kuma	48K	C	AX,AO	£33.95
Data File	Gm	Gamer	48K	C	CZ	£29.95
Defender	Gm	Plymouth Computers	20K	C	OG	£4.99
Deferment Allowances	Bs	DCS	32K	C	JQ	£3.00
Demons Castle	Gm	DCS	48K	C	JQ	£3.00
Demon Drive	Gm	DCS	24K	C	JQ	£3.00
Disassembler	Ut	Kuma	20K	C	AX,AO,AB	£12.00
Donky Derby	Gm	Kuma	12K	C	AX,AO,AB	£6.32
Double Precision Basic	Ut	Sharp	48K	C	AB	£28.75
Double Precision Basic	Ut	Sharp	48K	D	AX	£46.00
Drunken Driver	Gm	Highlight S/W	6K	C	CC,AB	£5.75
Dybug	Ut	Kuma		C	AX	£16.65
Editor Assembler	Ut	Sharp	48K	C	AB	£15.50
Editor Assembler	Ut	Sharp	48K	D	AX	£51.75
Editor/Disassembler	Ut	DCS	20K	C	JQ	£12.00
Election '84	Gm	Sharpsoft	20K	C	CH	£8.45
Electronic Organ	Gm	Kuma	12K	C	AX	£6.32
Electronic Organ	Gm	DCS	48K	C	JQ	£3.00
Electrons I	Ed	Kuma		C	AX	£12.00
Electrons II	Ed	Kuma		C	AX	£12.00
Empire II	Gm	Sharpsoft	20K	C	AB	£5.85
Enigma	Gm	Kuma	12K	C	AX	£6.32

SOFTWARE DEALERS

EG	Electronics Experts	GJ	Computer Concepts
EH	Artic Computing	GK	Program Power
EI	Knights TV & Computers	GL	Syrtis Software
EJ	Microage Electronics	GM	Lutterworth Software
EK	Holly Products	GN	Collins Computing
EL	I O Systems	GO	Datafax
EM	Merton Electronics	GP	CCSoft
EN	Davinci Computer Shop	GQ	Microx
EO	Calco Software	GR	Pro Software
EP	Richard Francis	GS	Sussex Software
EQ	Microtek Ltd	GT	Rose Cassettes
ER	Diskwise Ltd	GU	Axis
ES	Control Technology	GV	PR Software
ET	Comp Shop	GW	Bridge Software
EU	Micro Computer Prods	GX	Video Software Limited
EV	GW Computers	GY	J M Steadman
EW	C/WP Computers	GZ	Transform Ltd
EX	Metrotech Mail Order	HA	Baust Computing Consultants
EY	Microsystems Ltd	HB	University Computers
EZ	Superior Systems Ltd	HC	Educare
FA	Control Universal Ltd	HD	Simon Software
FB	Pete & Pam Computers	HE	Docimodus
FC	Zenith Data Systems	HF	M C Associates
FD	Commodore Information	HG	Addictive Games
FE	Logic Computers	HH	J K Greye Software
FF	Overseas Computer	HI	John Prince
FG	Blyth Computers	HJ	Titan Programs
FH	Taurus Computer Design	HK	Micro Computer Software
FI	HITEC (Austria)	HL	Phipps Associates
FJ	Graffcom Systems	HM	Gemini Electronics
FK	Electronic Aids (Tewkesbury)	HN	The Vic Centre
FL	BUG-BYTE	HP	R & R Software
FM	Learning Computer Systems	HQ	Town Book & Toys
FN	Jentech Services Ltd	HR	Screen Scene
FO	Work Force	HS	Software Masters
FP	Twickenham Computer Centre	HT	John Prince Software
FQ	Sbd Software	HU	Nick Godwin
FR	Beebug	HV	A.Parsons
FS	RAM Computer Services Ltd	HW	Bryants (Educational) Software
FT	Ozwise Computers	HX	Abersoft
FU	Compusense	IC	Ogre Games & Software
FV	The Avery Computer Company	ID	Tridata Micro's Ltd
FW	Hilderbey Ltd	IE	Plympton Computer Services
FX	Micromedia	IF	Electronics Applied
FY	Wida Software	IG	Emjay
FZ	Superior Systems Ltd	IL	V&H Computer Services
GA	Eletec Serives Limited	IM	AVC Software
GB	Anglo American Software	IN	Computator
GC	Castle Electronics	IO	Ohmega Electronics
GD	Quicksilva	IP	A.V.O. Software Distribution
GE	A&F Software	IQ	Big Softie
GF	SRS Microsystems	IR	Adamsoft
GG	Stirling Microsystems	IS	Microcomputer Applications
GH	Microtanic Software	IT	I.J.K. Software
GI	Lander Microsystems	IU	Aardvark Software

REFERENCE

SOFTWARE LISTING

SHARP

Title	Program Type	Program Produced By	Memory Reqd	How Sold	Supplier Codes	Prices
Escape Forth	Gm	J Wolstencroft	24K	C	CZ	£4.60
Evasion	Gm	Kuma	6K	C	AX,AO	£6.32
Executive	Gm	Kuma	6K	C	AX,AB	£9.20
Exploring Africa	Gm	Kuma	6K	C	AX,AB	£6.32
F DOS	Ut	Sharp	48K	C	AB	£57.50
Fall Out	Gm	Kuma	6K	C	AX,AO	£6.32
Finance	Bs	DCS	20K	C	JQ	£3.00
Fireballs	Gm	Kuma	6K	C	AX,AB	£6.32
Fishing	Gm	Sumlock	48K	C	DN	£8.50
Football League	Do	Plymouth Computers	10K	C	OG	£4.99
Football Manager	Gm	Highlight S/W	10K	C	CC,AB	£5.75
Forth	Ut	Kuma		C	AX	£40.20
Foundry Package	Bs	Microtek	48K	C	EQ	POA
Four in a Row	Gm	Kuma	6K	C	AX,AO,AB	£6.32
Fox and Geese	Gm	Highlight S/W	6K	C	CC,AB	£4.60
French Vocab	Ed	DCS	20K	C	JQ	£3.00
Fruit Machine	Gm	Kuma	6K	C	AX,AO,AB	£6.32
Fruit Machine	Gm	DCS	20K	C	JQ	£3.00
Full Accounting	Bs	Microtek	48K	C	EQ	POA
Games Pack 1	Gm	Sumlock	48K	C	DN	£8.50
Games Pack 2	Gm	Sumlock	48K	C	DN	£8.50
Gamestape 1	Gm	DCS	48K	C	JQ	£8.00
Gamestape 2	Gm	DCS	48K	C	JQ	£8.00
Gamestape 3	Gm	DCS	48K	C	JQ	£8.00
Gamestape 4	Gm	DCS	48K	C	JQ	£8.00
Geography	Ed	DCS	20K	C	JQ	£3.00
Guess Word	Gm	Kuma	6K	C	AX,AB	£6.32
Hangman	Gm	Kuma	6K	C	AX,AO,AB	£6.32
Hangman	Gm	DCS	20K	C	JQ	£3.00
Head On	Gm	Highlight S/W	10K	C	CC,AB	£6.90
Head On	Gm	Kuma	6K	C	AX,AO,AB	£6.32
Head On	Gm	Sharpsoft	20K	C	CH	£5.85
Hissing Sid	Gm	Kuma		C	AX	£6.32
Home Budget I	Do	Kuma	6K	C	AX,AC,AO,AB	£6.32
Hunter Killer	Gm	Kuma	48K	C	AX,AB	£6.32
I Spy	Ed	Highlight S/W	22K	C	CC	£5.75
Instant Addition And The Fou Rules	Ed	Kuma		C	AX	£6.32
Intruder	Gm	Kuma	48K	C	AX,AO,AB	£6.32
Invaders	Gm	Kuma	20K	C	FZ	£6.30
Invoice Control	Bs	David Computer Software	48K	C	JQ	£6.00
J S Line 4	Gm	Kuma	48K	C	AX,AB	£6.32
Junior Maths and Stepping Stones	Ed	Kuma		C	AX	£6.32
Juntori	Gm	Sharpsoft	20K	C	AB	£5.85
Kentucky Derby	Gm	Kuma		C	AX	£6.32
Knights Commander	Ut	Knights	48K	C	AX	£28.75
Knights Commander	Ut	Knights	48K	D	AX	£74.75
Knights Fortran	Ut	Knights	48K	C	AX	£34.50
Knights Wee Pascal	Ut	Knights	48K	C	AX	£23.00
Large Display	Gm	Kuma	48K	C	AX	£6.32
Las Vegas	Gm	Sharpsoft	20K	C	AB	£5.85
Ledger	Bs	NCG Ltd	40K	C	KW	£90.00
Letterwriter WP	Bs	David Computer Software	48K	C	JQ	£10.00
Life	Gm	Kuma	48K	C	AX,AO,AB	£9.20
Linear Programming	Bs	NCG Ltd	20K	C	KW	£45.00
LP Gas Flow	Bs	DCS	20K	C	JQ	£3.00
Lunar	Gm	Kuma	48K	C	AX,AO,AB	£6.32
Lunar Lander	Gm	Kuma	48K	C	AX,AO,AB	£6.32
MZ Othello	Gm	Kuma	48K	C	AX	£12.00
Machine Code Editor	Ut	DCS	24K	C	JQ	£14.00
Machine Code Editor	Ut	DCS	48K	C	JQ	£14.00
Madness	Gm	J Wolstencroft	24K	C	CZ	£4.60
Mailing List	Bs	DCS	48K	C	JQ	£6.00
Maniac	Gm	Highlight S/W	6K	C	CC,AB	£5.75
Man on the Run	Gm	Sumlock	48K	C	DN	£6.33
Map of England	Gm	Kuma	48K	C	AO	£6.32
Map of Englad	Gm	Kuma	48K	D	AX	£12.00
Marauders	Gm	Plymouth Computers	13K	C	OG	£4.99
Mastermind	Gm	Highlight S/W	6K	C	CC,AB	£4.60
Mastermind	Gm	Kuma	48K	C	AX,AO,FZ,AB	£6.32
Match the Character	Ed	Highlight S/W	22K	C	CC,AB	£4.60
Match the Word	Ed	Highlight S/W	22K	C	CC,AB	£5.75
Maths	Ed	Highlight S/W	22K	C	CC	£5.75
Maths 1	Ed	DCS	48K	C	JQ	£3.00
Maths 2	Ed	DCS	48K	C	JQ	£3.00
Maths 3	Ed	DCS	48K	C	JQ	£3.00
Maths 4	Ed	DCS	48K	C	JQ	£3.00
Maths 5	Ed	DCS	48K	C	JQ	£3.00
Maths 6	Ed	DCS	48K	C	JQ	£3.00
Melody	Gm	Kuma	48K	C	AX	£6.32
Memory Tests	Ut	Kuma	20K	C	AX,AO,AB	£6.32
Minefield	Gm	Kuma	48K	C	AX	£6.32
Missle Defence	Gm	Sumlock	48K	C	DN	£8.50
Missile Defence	Gm	Plymouth Computers	18K	C	OG	£4.99
Miz-Maze	Gm	Kuma	48K	C	AX,AO	£6.32
Monkey Climb	Gm	Kuma	48K	C	AX,AO	£6.32
Moonlander	Gm	Highlight S/W	10K	C	CC,AB	£5.75
Mortar Attack	Gm	Kuma	48K	C	AX,AO	£6.32
Munchie Men	Gm	Plymouth Computers	22K	C	OG	£4.99
Music Composer/Editor	Ed	Kuma	48K	C	AX,AC,AB	£12.00
Multiple Regression	Ed	NCG Ltd	24K	C	KW	£65.00
Narpex	Ed	Kuma		C	AX	£28.70
Newton/Conservation	Ed	Kuma		C	AX	£12.00
Number Advance	Gm	Plymouth Computers	3K	C	OG	£4.99
Oil Strike	Gm	Plymouth Computers	14K	C	OG	£4.99
Pac Man	Gm	Kuma		C	AX	£9.20
Pascal	Ut	Sharp	48K	C	AB	£34.50
Patience	Gm	Kuma	48K	C	AX,AO	£6.32
Payroll	Bs	Microtek	48K	C	EQ	£65.00
Payroll	Bs	NCG Ltd	40K	C	KW	£150.00
Payroll 81-C	Bs	Sumlock	48K	C	DN	£74.75
Payroll 81-D	Bs	Sumlock	48K	D	DN	£74.75

SOFTWARE DEALERS

IV	James Hager
IW	Simon Hessel Software
IX	Mayday Software
IY	Persoft
IZ	Micro-Aid
JA	Hexagon Software
JB	N. Darwood Ltd
JC	Futura Software
JE	Ultra-Tech Services
JF	Mr. Laird
JG	Gary Smith
JH	Aquarius Software
JI	Precision Software Engineering
JJ	Spectre Soft
JK	Cornhill Services
JM	Morris Associates (Computing)
JN	Terminal Software
JO	Mossoft Microcomputer Software
JP	Romik
JQ	David Computer Software
JR	Creative Software
JS	Allrian Data Services
JT	Apex Trading Ltd
JU	TX Software
JV	Hopesoft
JW	GT Software
JX	Garland Computing
JY	Corona Software
JZ	MP Software & Services
KA	Ludinski Computer-Assisted Learning
KB	B.B.C. Publications
KC	Miking S/W
KD	Inverse
KE	Alan Turnbull
KF	Chromasoft
KG	Llamasoft
KH	Superior Software
KI	Earthshock Software
KJ	Bridge Software
KK	ME&P Micro Products
KL	Calpac Computer Software
KM	KCET Software
KN	Software for All
KO	Rucksoft
KP	Liverpool Computer Centre
KQ	W.E. Hunt
KR	ABC Software
KS	Rainbow Software
KT	Chalksoft
KU	Wizard Software
KV	Data-Brain Software
KW	NCG Ltd
KX	Broadwater Economic Simulations
KY	Kent Computer Company
KZ	Cases Computer Simulations
LA	Juniper Computer
LB	J.K. Gosden Software
LC	Computersmith
LD	Pro Software
NP	Program Direct
NR	Foilkade
NT	Digital Fantasia
NU	Database Software
NV	CJE Microcomputers
NW	Eduquest
NX	Davansoft
NY	Square Software
NZ	Salamander Software
OA	Anirog Computers
OB	Golem Ltd
OC	A Lane (Software)
OD	ASP Software
OE	Micromail
OF	Canal Computing
OG	Plymouth Computers
OH	T. Smith Software
OI	Oxford Computer Publishing
OJ	Economic Software

Payroll	Bs	Tridata	48K	D	ID		£170.00
Pelmanism	Gm	Sumlock	48K	C	DN		£5.75
Physics 1	Ed	DCS	48K	C	JQ		£3.00
Physics 2	Ed	DCS	48K	C	JQ		£3.00
Picture Count	Ed	Highlight S/W	22K	C	CC,AB		£5.75
Pilot	Ut	Kuma		C	AX		£17.25
Poker	Gm	Kuma	48K	C	AX,AO,AB		£6.32
Polaris	Gm	Sumlock	48K	C	DN		£6.50
Pontoon	Gm	Kuma	48K	C	AX,AO,AB		£6.32
Poseidon	Gm	Highlight S/W	6K	C	CC, AB		£5.75
Poster Printer	Bs	DCS	48K	C	JQ		£3.00
Princess & Monster Maze	Gm	Kuma	48K	C	AX,AB		£6.32
Program Filing Index	Bs	Kuma	20K	C	AX		£6.32
Quadrax	Gm	Kuma	48K	C	AX,AO,AB		£6.32
Quest	Gm	J Wolstencroft	48K	C	CZ		£4.60
Race Track	Gm	Kuma	48K	C	AX,AO,AB		£6.32
Racing	Gm	Kuma	48K	C	AX		£6.32
Raider	Gm	Kuma	48K	C	AX,AO,AB		£6.32
Ram Test	Ut	DCS	48K	C	JQ		£3.00
Reactor	Gm	Kuma	48K	C	AX,AB		£6.32
Reportwriter WP	Bs	David Computer Software	48K	C	JQ		£8.00
Rhymes	Gm	Kuma	48K	C	AX,AB		£6.32
Road Alignment	Bs	Canal Computing	16K	C	OF		£60
Road Hunter	Gm	Kuma	48K	C	AX,AO,AB		£6.32
Rocket	Ed	Kuma		C	AX		£6.32
Roulette	Gm	Sumlock	48K	C	DN		£6.33
Scramble	Gm	Sumlock	48K	C	DN		£7.50
Semaphore	Ed	Plymouth Computers	21K	C	OG		£4.99
Semi Conductors I	Ed	Kuma		C	AX		£12.00
Semi Conductors II	Ed	Kuma		C	AX		£12.00
Shape Match	Gm	Kuma	48K	C	AX,AO		£6.32
Shapes	Ed	Highlight S/W	22K	C	CC,AB		£5.75
Sharp Demo	Gm	Kuma	48K	C	AX,AO		£6.32
Show Jumping	Gm	Kuma	48K	C	AX,FZ		£6.32
Shudo	Gm	Kuma	48K	C	AX		£6.32
Simon	Gm	Kuma	48K	C	AX		£6.32
Slave Interpreter	Ut	Kuma		C	AX		£16.65
Smugglers	Gm	DCS	20K	C	JQ		£3.00
Snakes and Ladders	Gm	Kuma	48K	C	AX,AO		£6.32
Solid State Non VAT Accounts	Ed	Kuma		C	AX		£33.90
Solid State VAT Accounts	Ed	Kuma		C	AX		£33.90
Sound Effects	Ut	DCS	20K	C	JQ		£3.00
Space Battle	Gm	Kuma	48K	C	AX,AO,AB		£6.32
Space Invaders	Gm	Kuma	48K	C	AX,AO,AC,AB		£6.32
Space Bomber	Gm	Sumlock	48K	C	DN		£7.00
Space Mission	Gm	Plymouth Computers	7K	C	OG		£4.99
Space Pursuit	Gm	Kuma	48K	C	AX,AO,AB		£6.32
Space Rescue	Gm	Sumlock	48K	C	DN		£7.50
Space Invaders	Gm	Sumlock	48K	C	DN		£7.50
Squash	Gm	Plymouth Computers	6K	C	OG		£4.99
Star Trek	Gm	Kuma	10K	C	AX,AC,AO		£6.32
Star Wars	Gm	DCS	20K	C	JQ		£3.00
Stella Adventure	Gm	Sumlock	48K	C	DN		£15.50
Stock Control/Invoicing	Bs	Microtek	48K	C	EQ		£316.00
Stock Control	Bs	NCG Ltd	36K	C	KW		£40.00
Stock Control	Bs	David Computer Software	48K	C	JQ		£6.00
Stomper	Gm	Kuma	10K	C	AX,FZ,AB		£6.32
Stomper/Minefields	Gm	Sharpsoft	20K	C	AB		£5.85
Stoneville Manor Adventure	Gm	Sumlock	48K	C	DN		£10.35
Submarine	Gm	Kuma	10K	C	AX,AO		£6.32
Structural Analysis	Bs	Canal Computing	16K	C	OF		£60
Sundry Creditors	Bs	David Computer Software	48K	C	JQ		£6.00
Superdiary	Ut	DCS	20K	C	JQ		£3.00
Super Simon	Gm	Kuma	48K	C	AX,AO		£6.32
Supercopy	Ut	Kuma	20K	C	AX		£12.00
Superfire	Gm	Kuma	48K	C	AX		£6.32
Supermouse	Gm	Kuma	48K	C	AX,CH		£6.32
Swordmen	Gm	Kuma	48K	C	AX,AO		£9.20
Tank Wall	Gm	Kuma	48K	C	AX,AO		£6.32
Tank Practice	Gm	DCS	48K	C	JQ		£3.00
Target Practice	Gm	DCS	48K	C	JQ		£3.00
Tape Copier	Ut	DCS	20K	C	JQ		£4.00
Tenpin Bowling	Gm	Kuma	48K	C	AX,AO		£6.32
Timetabling Aid	Ed	Kuma	20K	C	AX		£22.45
Towering Inferno	Gm	Sharpsoft	20K	C	CH,AB		£5.85
Towers	Gm	DCS	48K	C	JQ		£3.00
Towers of Hanoi	Gm	Kuma	48K	C	AX		£6.32
Track Layer	Gm	Kuma	48K	C	AX,CH		£6.32
Trader Smith	Gm	Kuma	48K	C	AB		£6.32
Tudor Village	Gm	DCS	48K	C	JQ		£3.00
Trench Mortars	Gm	DCS	48K	C	JQ		£3.00
Tycoon	Gm	Kuma	48K	C	AX,AO		£6.32
Typewriter	Do	DCS	48K	C	JQ		£3.00
Typing Test/Tutor	Bs	DCS	20K	C	JQ		£6.00
UFO	Gm	Kuma	6K	C	AX,AC		£6.32
Video Draughts	Gm	DCS	48K	C	JQ		£3.00
War at Sea	Gm	DCS	48K	C	JQ		£3.00
Waves I	Ed	Kuma		C	AX		£12.00
Waves II	Ed	Kuma		C	AX		£12.00
Wizards Quest Adventure	Gm	Sumlock	48K	C	DN		£10.50
Wordpro	Bs	Kuma	48K	C	AX,AC		£45.45
Wordpro	Bs	Kuma	48K	C	AX,AC		£91.95
Wordprocessor LW	Bs	DCS	48K	C	JQ		£10.00
Wordprocessor RW	Bs	DCS	48K	C	JQ		£8.00
Utility Tape 1 — Maths	Ed	DCS	48K	C	JQ		£8.00
Utility Tape 2 — Maths/Physics	Ed	DCS	48K	C	JQ		£8.00
Y Geirfa	Ed	DCS	20K	C	JQ		£3.00
Zen Dos	Ut	Kuma	4K	C	AX		£66.16
Zen Editor Assembler	Ut	Kuma	20K	C	AX,AO,AB		£22.45
Zenmod	Ut	Kuma	4K	C	AX,AB		£12.00
Z-80 Disassembler	Ut	Sumlock	48K	C	DN		£12.00

TRS-80

A-Maz-Ing	Gm	Molimerx	4K	C	AJ		£6.33
Acquire	Gm	Avalon Hill	16K	C	IA		£13.95
Adventure I	Gm	Adventure Int.	16K		AJ		£13.77
Adventure III	Gm	Adventure Int.	16K	C	AJ		£13.77
Adventure III	Gm	Adventure Int.	16K	D	AJ		£13.77
Adventures No I	Gm	Cload Inc	16K	C	IA		£11.95
Advanced Programming Aid	Ut	Kansas	16K	C	IH		£12.50
Adventureland	Gm	Adventure Int.	16K	C	IS		£12.50
					AJ		£18.99
					OH		£15.25
Adventure Mysterious	Gm	Adventure Int.	16K	C	AJ		£10.06
Adventure Mysterious	Gm	Adventure Int.	32K	D	AJ		£13.50
Aid, Basic	Ut	J.K. Gosden S/W	16K	C	LB		£9.00
Air Raid	Gm	MA	16K	C	IS		£7.50
Air Traffic Control	Gm	MA	16K	C	IS		£9.50
Airflight Simulation	Gm	Instant S/W	16K	C	GB,AB		£9.95
Airmail Pilot	Gm	Instant S/W	16K	C	GB,AB		£8.50
Ajedit	Bs	Molimerx	32K	C	AJ		£49.95
Aladdin	Ed	Bryants S/W	16K	C	HW		£3.75
Alien Armada	Gm	Molimerx	16K	C	IS		£11.50
					AJ		£10.06
Alien Armada	Gm	Molimerx	32K	D	AJ		£13.23
Alien Attack Force	Gm	Instant S/W	16K	C	GB,AB		£8.50
Alien Attack	Gm	Kansas	16K	C	IH		£9.50
Alien Defence	Gm	Soft Sector Mkting	16K	C	IS		£11.50
					GB		£15.50
Alien Defence	Gm	Soft Sector Mkting	16K	D	IA		£11.95
All Stars	Gm	Instant S/W	16K	D	GB		£26.50
					AB		£28.95
All Turret Gunner	Gm	Instant S/W	16K	C	GB,AB		£8.50
Amateur Log	Ut	Molimerx	32K	D	AJ		£18.40
Amazing Maze							
Touchdown	Gm	Kansas	16K	C	IH		£7.50
Angel Worms	Gm	Adventure Int.	8K	C	AB		£14.35
Animation	Ut	Molimerx	16K	C	AJ		£17.20
Animation	Ut	Molimerx	32K	D	AJ		£20.65
Android Nim	Gm	Molimerx	16K	C	IS		£7.50
					AJ		£10.06
Arcade Invaders	Gm	Kansas	16K	C	IH		£9.50
Arcade Scramble	Gm	Kansas	16K	C	IH		£9.50
Armoured Patrol	Gm	Adventure Int.	16K	C	IS		£15.00
					GB		£15.00
Armoured Patrol	Gm	Adventure Int.	16K	D	AB		£18.99
Ascertain	Ut	Kansas	16K	C	IH		£6.25
Assembly Package	Ut	Molimerx	32K	D	AJ		£74.75
Asteroids	Gm	Molimerx	16K	C	AJ		£10.06
Asteroids	Gm	Molimerx	32K	D	AJ		£13.50
Astro Navigator	Gm	Molimerx	16K	C	AJ		£14.95
Astroball	Gm	Molimerx	16K	C	AJ		£13.77
Astrolog	Ed	Molimerx	16K	C	AJ		£10.93
Astronomical Calendar	Ed	Molimerx	16K	C	AJ		£10.93
Asylum	Gm	Med Systems	16K	C	IS		£9.50
					BT		£12.00
Atlantian Odyssey	Gm	Guild	16K	C	IS		£11.50
					GB		£19.75
Atlantian Odyssey	Gm	Guild		D	GB		£21.50
					GB,BT		£10.95
Attack Force	Gm	Big 5 S/W	16K	C	IS		£11.50
					OH		£11.25
BI Nuclear Bomber	Gm	Instant S/W	16K	C	GB		£12.50
					BT		£12.95
					OH		£11.50
BQ81	Bs	Baust Computing	48K	D	HA		£79.95
Back 40	Gm	Molimerx	16K	C	AJ		£10.06
Back 40	Gm	Molimerx	32K	D	AJ		£13.50
Back 40 III	Gm	Adventure Int.	16K	C	AB		£14.35
Backgammon	Gm	Adventure Int.	16K	C	IS		£7.50
					AB		£7.99
Backgammon	Gm	Kansas	16K	C	IH		£8.50
Balrog Sampler	Gm	Adventure Int.	16K	D	AB		£33.70
Bandito	Gm	Acorn	16K	C	AJ		£7.49
Barricade	Gm	MA	16K	C	IS		7.50
Bandit/Maze Chase	Gm	Kansas	16K	C	IH		£7.50
Banner	Ut	Kansas	16K	C	IH		£7.50
Basic Bidding	Gm	Bryants S/W	16K	C	HW		£9.00
Basic Compiler Accel.	Ut	Microsoft	16K	C	AJ		£22.94
Basic Compiler Accel. 3	Ut	Microsoft	16K	C	AJ		£45.95
Basic Compiler Accel. 3	Ut	Microsoft	16K	D	AJ		£49.95
Basic Insert	Ut	Molimerx	16K	C	AJ		£10.95
Basic Insert	Ut	Molimerx	32K	D	AJ		£14.39
Basic Programming System	Ut	Instant S/W	16K	C	AB		£12.50
Basketball	Gm	Molimerx	16K	C	AJ		£10.95

SOFTWARE LISTING

TRS-80

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes	Prices
Basketball	Gm	Molimerx	32K	D	AJ	£14.39
Battle Bastogne	Gm	MA	16K	C	IS	10.50
Battle St. Vith	Gm	MA	16K	C	IS	10.50
Battle of Britain	Gm	Molimerx	16K	C	AJ	£15.55
Battle Ground	Gm	Instant S/W	16K	C	GB,AB	£8.50
Bearings	Ed	Bryants S/W	16K	C	HW	£3.75
Bedchest III	Gm	Adventure Int.	16K	C	AB	£20.95
Beewary	Gm	Molimerx	16K	C	IS	£7.50
					AJ	£10.06
Beginner's Russian	Ed	Instant S/W	16K	C	GB,AB	£8.50
Biorhythm	Ed	Molimerx	16K	C	AJ	£8.63
Biorhythms	Do	Kansas	16K	C	IH	£7.50
B-I Nuclear Bomber	Gm	Avalon Hill	16K	C	IA	£11.95
Blackboard	Ut	Molimerx	16K	C	AJ	£10.06
Blackjack Master	Gm	Molimerx	16K	C	AJ	£21.15
Blackjack Master	Gm	Molimerx	32K	D	AJ	£25.42
Blink 1	Ut	Molimerx	32K	D	AJ	£17.00
Blockade	Gm	Molimerx	16K	C	AJ	£7.48
Bradley Estate Mystery	Gm	Ogre	16K	C	IC	£10.00
Bridge Partner	Gm	MA	16K	C	IS	£13.50
Bridge 2.0	Gm	MA	16K	C	IS	£13.50
Bright & Early	Ed	Molimerx	16K	C	AJ	£8.90
Build High Knights Tour	Gm	Kansas	16K	C	IH	£7.50
Business Analysis	Bs	Instant S/W	16K	C	GB	£59.25
Business Analysis	Bs	Instant S/W	16K	D	GB,AB	£82.00
Buzzword	Ed	Molimerx	16K	C	AJ	£5.75
Byte Saver	Ut	Kansas	16K	C	IH	£6.25
CTN Stock	Bs	Baust Computing	48K	D	HA	£79.00
Calendar	Ut	Molimerx	16K	C	AJ	£10.29
Car Doctor	Do	Kansas	16K	C	IH	£7.50
Cash Register	Bs	Molimerx	16K	C	AJ	£10.29
Catalogue	Do	Bryants S/W	16K	C	HW	£3.75
Character and Monster Generator	Gm	Ogre	16K	C	IC	£12.00
Checker King	Gm	Personal S/W	16K	C	AJ	£16.10
Chemical Formulae	Ed	Molimerx	16K	C	AJ	£10.95
Cheque Book	Dm	Molimerx	16K	C	AJ	£15.53
Chess Partner	Gm	MA	16K	C	IS	£9.50
Claws	Ed	Bryants S/W	16K	C	HW	£3.75
City Encounters	Ut	Molimerx	16K	C	AJ	£17.20
Climate Comp	Bs	Instant S/W	16K		AB	£20.50
Cload Cassette	Gm	Cload Inc	16K	C	IA	£5.75
Cloze	Ed	Bryants S/W	16K	C	HW	£3.75
Cluster War	Gm	J.K. Gosden S/W	16K	C	LB	£11.00
Code Breaker	Gm	Molimerx	16K	C	AJ	£7.49
Combat	Gm	Adventure Int.	16K	C	AB	£12.50
Company Director	Gm	Molimerx	16K	C	AJ	£17.19
Compression Utility	Ut	Instant S/W	16K	C	GB	£15.75
					AB	£16.50
Comproc	Ut	Molimerx	16K	C	AJ	£15.80
Comput-A-Organ	Ed	Molimerx	16K	C	AJ	£6.85
Computer Acquire	Gm	Adventure Int.	16K	C	IA	£10.15
Computer Acquire	Gm	Avalon Hill	16K	C	IA	£17.25
					OH	£13.50
Computer Pools	Do	Molimerx	16K	C	AJ	£16.68
Conflict	Gm	MA	16K	C	IS	£10.50
Conflict 2500	Gm	Avalon Hill	16K	C	IA	£12.95
Consequest of Chester Wood	Gm	Adventure Int.	16K	C	AB	£18.99
Constellation	Ed	Molimerx	16K	C	AJ	£14.30
Constellation	Ed	Molimerx	32K	D	AJ	£17.83
Conv/CPM	Ut	Molimerx	32K	D	AJ	£20.70
Convoy Raider	Gm	Avalon Hill		C	IA	£10.95
					OH	£11.50
Cop 16K	Ut	Molimerx	16K	C	AJ	£12.95
Copsys	Ut	Molimerx	16K	C	AJ	£12.95
Corplan	Gm	Molimerx	16K	C	AJ	£32.79
Cosmic Fighter	Gm	Big 5 S/W		C	IA	£10.95
Cosmic Fighter	Gm	MA	16K	C	IS	£11.50
					OH	£11.25
Cosmic Patrol	Gm	Instant S/W	16K	C	GB,AB	£12.50
Cosmic Patrol	Gm	Instant S/W	16K	D	GB,AB	£16.25
Cowboys	Gm	P.C.S.	8K	C	IE	£4.25
Creole Lobster Catcher	Gm	Molimerx	16K	C	AJ	£10.06
Cribbage Player	Gm	MA	16K	C	IS	£9.50
Cribbage	Gm	Molimerx	16K	C	AJ	£14.38
Crocodiles	Ed	Bryants S/W	16K	C	HW	£3.75
Cross Reference	Bs	Molimerx	16K	C	AJ	£8.45
Crowley Manor	Gm	MA	16K	C	IS	£15.00
Crown of CWL IMDRAS part 1	Gm	Ogre	16K	C	IC	£10.00
Crown of CWL IMDRAS part 2	Gm	Ogre	16K	C	IC	£10.00
Crusaders	Gm	Molimerx	16K	C	AJ	£13.51
Cube Hunt	Gm	Molimerx	16K	C	AJ	£10.35
DLDIS	Ut	Instant S/W	16K	D	GB	£15.50
					AB	£16.50
DSM	Ut	Racet Computers	32K	D	AJ	£46.00
D-Day	Gm	MA	16K	C	IS	£10.50
Danger in Orbit	Gm	Instant S/W	16K	C	AB	£12.50
Danger in Orbit	Gm	Instant S/W	16K	D	GB	£15.50
Daredevil	Gm	Instant S/W	16K	C	IA	£8.50
Dark Void	Gm	Molimerx	16K	C	AJ	£10.06
Darts	Gm	Molimerx	16K	C	AJ	£10.06
Data Base Management	Bs	Hubert Howe	32K	C	AJ	£28.75
Data Base Management	Bs	Hubert Howe	32K	D	AJ	£32.20
Datadisk	Bs	Kansas	32K	D	IH	£24.50
Data File	Bs	Kansas	16K	C	IH	£9.50
Datestone of Ryn	Gm	Automated Simulation	16K	C	GB	£13.50
Datestone of Ryn	Gm	Automated Simulation	16K	C	IS	£14.50
Dataquiz	Ut	Bryants S/W	16K	C	HW	£3.75
Day of the Week	Bs	Molimerx	4K	C	AJ	£5.75
Death Dreadnaught	Gm	MA	16K	C	IS	£10.50
Deathmaze	Gm	MA	16K	C	IS	£10.50
Deathmaze 5000	Gm	Med Systems	16K	C	IA	£10.95
Decision Master	Ut	Sytonic S/W	32K	D	GB	£35.50
Decimal Dan	Ed	Bryants S/W	16K	C	HW	£3.75
Defence Command	Gm	Big 5 S/W	16K	C	IS	£11.50
					GB,BT	£10.95
					OH	£11.25
Defend	Gm	Molimerx	16K	C	AJ,CH	£14.95
Defend	Gm	Molimerx	32K	D	AJ	£18.40
Deflections	Gm	Adventure Int.	8K	C	AB	£14.35
Delay	Ut	Kansas	16K	C	IH	£6.25
Demo II	Gm	Instant S/W	16K	C	IE	£6.50
Descriptive Statistics	Bs	Molimerx	16K	C	AJ	£15.40
Differential Equations	Bs	Molimerx	16K	C	AJ	£16.10
Direction Finder	Ed	Molimerx	16K	C	AJ	£15.40
Disassembler	Ut	Molimerx	16K	C	AJ	£10.35
Disassembler	Ut	Buy Byte	16K	C	GB	£8.25
					AB	£8.50
Diassembler	Ut	Kansas	16K	C	IH	£8.50
Disc Directory	Ut	Molimerx	32K	D	AJ	£20.13
Disc Editor	Ut	Instant S/W	16K	D	GB	£30.50
Disc Scope	Ut	Instant S/W	16K	D	GB	£15.50
Discaid	Ut	Molimerx	32K	D	AJ	£19.49
Discator	Ut	Molimerx	32K	D	AJ	£29.90
Displus	Ut	J.K. Gosden S/W	16K	C	LB	£10.00
Dnieper River Line	Gm	Avalon Hill	32K	C	IA	£12.95
Dnieper River Line	Gm	Avalon Hill	32K	D	IA	£17.55
Doctor Chips	Gm	Instant S/W	16K	C	GB	£12.50
Doctor Chips	Gm	Instant S/W	16K	D	GB	£14.75
Domes of Kilgari	Gm	MA	16K	C	IS	£11.50
Dominoes	Gm	Molimerx	16K	C	AJ	£9.15
Dominoes	Gm	Molimerx	32K	D	AJ	£12.65
Doomwatch	Do	Kansas	16K	C	IH	£7.50
Dosort	Ut	Molimerx	32K	C	AJ	£27.60
Double Take 3741	Ut	Molimerx	64K	D	AJ	£44.85
Double Up	Ut	Kansas	16K	C	IH	£6.25
Dragon Quest	Gm	Instant S/W	16K	C	IS	£10.50
Dragon Quest	Gm	Instant S/W	16K	D	GB	£17.50
Dragons of Hong Kong	Gm	Adventure Int.	32K	C	AB	£18.99
Draughts	Gm	Molimerx	16K	C	AJ	£14.95
Draughts	Gm	Molimerx	32K	D	AJ	£18.40
Draw and Graphics Resolver	Bs	Molimerx	16K	C	AJ	£10.95
Dreamworld	Gm	Molimerx	16K	C	AJ	£10.06
Driver	Gm	Molimerx	4K	C	AJ	£6.33
Duel-n-Droids	Gm	Molimerx	16K	C	IS	£9.50
Dungeon Escape	Gm	Computer Shack	16K	C	GB	£11.95
Dungeon Escape	Gm	Computer Shack	16K	D	GB	£15.50
Duplex	Ut	J.K. Gosden S/W	16K	C	LB	£14.00
Dynamic Device Driving	Ut	Instant S/W	16K	D	GB	£20.50
Dynamic Device Driving	Ut	Instant S/W	16K	C	GB	£15.50
					AB	£16.50
Early Numbers	Ed	Bryants S/W	16K	C	HW	£3.75
Edas	Ut	Molimerx	32K	D	AJ	£53.49
Edit	Ut	Molimerx	16K	C	AJ	£20.13
Editor Assembler Plus	Ut	Molimerx	16K	C	AJ	£24.95
Editor Assembler and Debugger	Ut	Kansas	16K	C	IH	£19.50
Edjust	Ut	Molimerx	32K	D	AJ	£18.40
Eights	Gm	Emjay	16K	C	IG	£7.00
Electric Accountant	Bs	Molimerx	48K	D	Aj	£28.75
Electronic Breadboard	Ut	Instant S/W	16K	C	GB	£39.75
					AB	£40.95
Elemental Maze	Ed	Molimerx	16K	C	Aj	£10.93
Eliminator	Gm	Adventure Int.	16K	C	IS	£15.00
					OH	£15.50
Eliminator	Gm	Adventure Int.	16K	d	AB	£18.99
Emperor	Gm	Molimerx	16K	C	AJ	£15.53
Empire	Gm	MA	16K	C	IS	£10.50
Empire of the Overmind	Gm	Avalon Hill	48K	C	IA	£17.95
Enhanced Basic	Ut	Molimerx	16K	C	AJ	£27.60
Enhanced Basic	Ut	Molimerx	32K	D	AJ	£31.05
Epson Patch	Ut	Molimerx	16K	C	Aj	£13.80
Epson Patch	Ut	Molimerx	32K	D	Aj	£17.25
Escape from Tramm	Gm	Adventure Int.	16K	C	IS	£15.00
					AB	£18.99
Everest Explorer	Gm	Molimerx	16K	C	AJ	£10.06
Escape	Gm	Kansas	16K	C	IH	£7.50
Everest Explorer	Gm	Molimerx	32K	D	AJ	£13.50
Everyday Russian	Ed	Instant S/W	16K	C	GB,AB	£8.50
F for Freddie	Gm	Kansas	16K	C	IH	£9.50
Facto Bingo	Ed	Bryants S/W	16K	C	HW	£3.75

Facto Finder	Ed	Bryants S/W	16K	C	HW	£3.75
Fairytale Adventure	Gm	Molimerx	16K	C	AJ	£10.06
Fastgammon	Gm	MA	16K	C	IS	£14.00
Family Tree	Do	Molimerx	32K	D	AJ	£20.70
Farmer Brown	Gm	Molimerx	16K	C	AJ	£7.49
Fed	Ut	Molimerx	32K	D	AJ	£27.60
Fetch	Ut	Molimerx	32K	D	AJ	£15.53
File Handling for Cassette	Ut	Molimerx	16K	C	AJ	£15.93
File Handling for Disc	Ut	Molimerx	32K	D	AJ	£28.75
Filter Package	Ut	Molimerx	32K	D	AJ	£40.25
Financial Analysis	Bs	Molimerx	32K	D	Aj	£46.00
Find it Quick	Ut	Instant S/W	16K	D	GB	£39.75
					AB	£40.95
Flight Path	Gm	Instant S/W	16K	C	GB,AB	£8.50
Flight Plan	Ut	Molimerx	32K	D	AJ	£20.70
Flippy	Gm	MA	16K	C	IS	£10.50
Flight Simulator	Gm	MA	16K	C	IS	£20.00
Flying Circus	Gm	Instant S/W	16K	D	AB	£24.50
					GB	£25.00
Forbidden City	Gm	Fantastic S/W	16K	D	IA	£24.95
Forbidden Planet	Gm	Fantastic S/W	48K	D	IA	£24.95
Forest of Mordor	Gm	Molimerx	16K	C	AJ	£8.63
Fortran	Ut	Molimerx	32K	D	AJ	£74.75
Fortress	Gm	Soft Sector Mkting	16K	D	IA	£15.50
Fortress	Gm	Soft Sector Mkting	16K	C	IA	£11.95
Fortress	Gm	MA	16K	C	AJ	£10.50
Fox and Hounds	Gm	Molimerx	16K	C	AJ	£7.48
French Vocabulary	Ed	Molimerx	16K	C	AJ	£17.19
Frog	Gm	Adventure Int.	16K	C	AB	£12.50
Frog	Gm	Kansas	16K	C	AJ	£7.48
Frogs/Logic	Gm	Kansas	16K	C	IH	£7.50
Galatic Empire	Gm	Adventure Int.	16K	C	IS	£10.50
					AJ,AB	£9.78
Galatic Firebird	Gm	Kansas	16K	C	IH	£9.50
Galactic Revolution	Gm	Adventure Int.	16K	C	AB	£18.99
Galactic Revolution	Gm	Adventure Int.	16K	C	IS	£10.50
Galactic Trader	Gm	Adventure Int.	16K	C	IS	£10.50
Galactic Trader	Gm	Adventure Int.	32K	D	AB	£18.99
Galaxy Invasion	Gm	Big 5 S/W	16K	C	IS	£11.50
Gamesaver	Ut	J.K. Gosden S/W	16K	C	LB	£6.50
Game Of Life	Gm	MA	16K	C	IS	£6.50
Gammon Challenger	Gm	MA	16K	C	IS	£10.50
Gammon Challenger	Gm	Molimerx	16K	C	AJ	£10.06
Gammon Challenger	Gm	Molimerx	32K	D	AJ	£13.51
Gauntlet of Death	Gm	Programmer's Guild	16K	C	GB	£15.50
Gauntlet of Death	Gm	Programmer's Guild	16K	C	GB	£15.50
G.C.E. O'Levels						
Tape 1	Ed	Bryants S/W	16K	C	HW	£9.00
Tape 2	Ed	Bryants S/W	16K	C	HW	£9.00
Gencop	Ut	Molimerx	16K	C	AJ	£10.06
Geography Explorer	Ed	Instant S/W	16K		AB	£40.95
Ghost Town	Gm	Adventure Int.	16K	C	IS	£12.50
					AB	£18.99
					OH	£15.25
Golfers Challenge	Gm	MA	16K	C	IS	£10.50
Golden Voyage	Gm	Adventure Int.	16K	C	IS	£15.00
					AB	£18.99
					OH	£15.25
Golf	Gm	Molimerx	32K	D	AJ	£17.19
Good Games No.I	Gm	Cload Inc	16K	C	IA	£11.95
Guns of Fort Defiance	Gm	Avalon Hill	32K	C	IA	£12.95
Guns of Fort Defiance	Gm	Avalon Hill	32K	D	IA	14.95
Gun World	Gm	Ogre	16K	C	IC	£10.00
Graphics Assembler	Ut	Kansas	16K	C	IH	£7;50
Graphs	Ed	Bryants S/W	16K	C	HW	£3.75
Graphit	Ut	Molimerx	48K	D	AJ	£19.55
Gridref	Ed	Bryants S/W	16K	C	HW	£3.75
Hellfire Warrior	Gm	MA	16K	C	IS	£21.00
Highway Code	Do	Bryants S/W	16K	C	HW	£3.75
HMS Impetuous	Gm	Adventure Int.	32K	D	AB	£18.99
Home Budget Planner	Bs	Emjay	16K	C	IG	£8.00
House of 30 Gables	Gm	Instant S/W	16K	C	AB	£8.50
Hyperlight Patrol	Gm	Fantastic S/W	16K	D	GB	£11.25
ID Mailing List	Ut	Instant S/W	16K	D	GB	£19.50
					AB	£20.50
IRV	Ut	Instant S/W	16K	D	GB	£23.75
IRV	Ut	Instant S/W	16K	C	IS	£16.50
					AB	£20.50
Infinite Startrek	Gm	Kansas	16K	C	IH	£9.50
Inventory Control	Bs	MA	16K	C	IS	£11.00
Inventory Control	Bs	MA	32K	D	IS	£50.00
Inventory'S'	Bs	MA	16K	C	IS	£17.00
Invoicing	Bs	Tridata	48K	D	ID	£140.00
Instant Calculator	Do	MA	16K	C	IS	£8.50
Interlude	Gm	Syntonic S/W		C	GB	£20.25
Interlude	Gm	MA	16K	C	IS	£14.00
Invaders From Space	Gm	MA	16K	C	IS	£10.50
Invasion Orion	Gm	Automated Simulation		C	IS	£18.50
Invasion Orion	Gm	Automated Simulation		D	GB	£15.75
Investor's Paradise	Gm	Instant S/W	16K	C	AB	£8.50
Jabbertalky	Gm	Automated Simulation	16K	D	GB	£18.95
Jet Fighter Pilot	Gm	Instant S/W	16K	C	GB,AD	£12.50
Jumbo	Gm	Molimerx	16K	C	AJ	£17.25
Jumbo	Gm	Molimerx	32K	D	AJ	£19.55
Jumbles	Ed	Bryants S/W	16K	C	HW	£3.75
KFS-80	Ut	MA	32K	D	IS	£75.00
Keyboard 80	Do	MA	16K	C	IS	£7.50
KVP	Ut	MA	16K	C	IS	£10.50
KVP Disk	Ut	MA	16K	D	IS	£18.50
Keyspeed	Ut	Kansas	16K	C	IH	£6.25
Kid's Gallery	Gm	Instant S/W	16K	C	AB	£8.50
Kid Venture I	Gm	MA	16K	C	IS	£12.50
Kreigspiel II	Gm	MA	16K	C	IS	£10.50
Kwik-key	Ut	T. Smith Software	16K	C	OH	£5.25
Label	Gm	Instant S/W	16K	C	GB	£18.75
					AB	£20.50
Labyrinth	Gm	Med Systems	16K	C	IA	£11.75
					BT	£10.95
Labyrinth	Gm	MA	16K	C	IS	£10.50
Laser Defence	Gm	Med Systems	16K	C	GB	£11.95
Laser Defence	Gm	Med Systems	16K	D	GB	£14.50
LED	Ut	Molimerx	48K	D	AJ	£19.55
Life Two	Gm	MA	16K	C	IS	£7.50
Little Red Riding Hood	Gm	Adventure Int.	16K	C	AB	£14.35
Local Call for Death	Gm	Adventure Int.	32K	D	AB	£18.99
Lords of Karma	Gm	Avalon Hill	40K	D	IA	£14.95
Lord of the Rings	Gm	Kansas	16K	C	IH	£9.50
Lost Dutchmans Gold	Gm	MA	16K	C	IS	£9.50
Lunar Lander	Gm	Adventure Int.	16K	C	IS	£11.50
					AB	£12.50
Lunar Lander	Gm	Adventure Int.	16K	D	AB	£18.99
Lprint	Ut	Kansas	16K	C	IH	£6.25
Mach 1	Ut	J.K. Gosden S/W	16K	C	LB	£9.00
Mach 4	Ut	J.K. Gosden S/W	16K	C	LB	£14.00
Magic Paper Calculator	Do	MA	16K	C	IS	£9.50
Mail File	Ut	Instant S/W		D	GB	£75.25
Maillist Mod III	Bs	MA	48K	D	IS	£55.00
Martian Adventure	Gm	Emjay	16K	C	IG	£12.00
Master Cab	Ut	Bryants S/W	16K	C	HW	£3.75
Master Directory	Ut	Instant S/W	16K	D	GB	£21.00
Master Reversi	Ut	Instant S/W	16K	D	GB	£23.75
Matchmaker	Gm	Adventure Int.	16K	C	AB	£14.35
Maths Master	Ed	Instant S/W	16K	C	AB	£8.50
Maxi-Micro Manager	Bs	Adventure Int	48K	R	AB	£84.50
MDOC	Ut	J.K. Gosden S/W	16K	C	LB	£7.50
Memdump	Ut	MA	16K	C	IS	£6.00
Mentor	Ut	J.K. Gosden S/W	16K	C	LB	£16.00
Mean Checkers	Gm	MA	16K	C	IS	£11.50
Merge	Ut	Kansas	16K	C	IH	£6.25
Merge	Ut	T. Smith Software	16K	C	OH	£7.00
Meteor Mission	Gm	Big 5 S/W	16K	C	IA	£10.95
Meteor Mission II	Gm	MA	16K	C	IS	£11.50
Microcosm I	Gm	Basic & Beyond	16K	C	IA	£11.95
Microcosm 2	Gm	Basics & Beyond	16K	C	IA	£19.95
Microcosm 3	Gm	Basics & Beyond	16K	C	IA	£19.50
Microtype	Do	Kansas	16K	C	IH	£12.50
Midway Campaign	Gm	Avalon Hill	16K	C	IA	£10.95
Minicrossword	Ed	MA	16K	C	IS	£12.50
					OH	£11.50
Minotaur	Gm	Instant S/W	16K	C	AB	£8.50
Missile Attack	Gm	Adventure Int.	16K	C	AB	£12.50
Mission Impossible	Gm	Adventure Int.	16K	C	IS	£12.50
					AB	£18.99
					OH	£15.25
Model 1 to 3	Ut	Kansas	16K	C	IH	£8.50
Monopolist	Gm	Baust Computing	4K	C	HA	£7.95
Monopolist	Gm	Baust Computing	4K	D	HA	£10.95
Morloc's Tower	Gm	MA	16K	C	IS	£14.50
Mortgage Calculator	Do	MA	16K	C	IS	£5.00
Mountain Shoot	Gm	Adventure Int.	16K	D	AB	£18.99
Multiple Choice Creation	Ed	Kansas	16K	C	IH	£12.50
Multiprint	Ut	Kansas	16K	C	IH	£8.50
Music Master	Gm	Instant S/W		C	GB,AB	£8.50
Musical Yat-C	Gm	Adventure Int.	16K	C	AB	£12.50
Money Box	Ed	Bryants S/W	16K	C	HW	£3.75
Mystery Funhouse	Gm	Adventure Int.	16K	C	IS	£12.50
					AB	£18.99
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Nominal	Bs	Tridata	48K	D	ID	£170.00
Norton Forth	Gm	Adventure Int.	32K	D	AB	£33.70
North Atlantic Raiders	Gm	Tridata	16K	C	IA	£11.95
Number Bonds	Ed	Bryants S/W	16K	C	HW	£3.75
Number Series	Ed	MA	16K	C	IS	£12.50
Nuke War	Gm	Avalon Hill	16K	C	IA	£10.95
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Office Accouting	Bs	MA	16K	C	IS	£15.00
Oil Tycoon	Gm	Instant S/W	16K	C	AB	£8.50
					GB	£9.95
Old McDonald's Farm	Gm	Adventure Int.	16K	C	AB	£14.35
Olympic Decathlon	Gm	MA	16K	C	IS	£15.50
On Guard	Ed	Bryants S/W	16K	C	HW	£3.75
Pascal-80	Gm	MA	48K	D	IS	£75.00
Paraform	Ut	Molimerx	32K	D	AJ	£18.98
Patience	Gm	Bryants S/W	16K	C	HW	£3.75

REFERENCE

SOFTWARE LISTING

TRS-80

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes	Prices
Pinball Bounce/Robots	Gm	Kansas	16K	C	IH	£7.50
Pirate Adventure	Gm	Adventure Int.	16K	C	IS	£12.50
					AB	£18.99
					OH	£15.25
Pilot	Ut	MA	16K	C	IS	£23.00
Pits of Angband	Gm	Kansas	16K	C	IH	£9.50
Planet Miners	Gm	Avalon Hill	16K	C	IA	£10.95
					OH	£11.50
Planetoids	Gm	Adventure Int.	16K	C	IS	£15.00
					AB	£12.50
Plus Sound	Ut	Kansas	16K	C	IH	£7.50
Pre Flight	Do	MA	16K	C	IS	£7.50
Programmer and Primer	Ut	Instant S/W	16K	C	AB	£8.50
Programmer's Converter	Ut	Instant S/W	16K	C	AB	£8.50
Pontoon	Gm	Kansas	16K	C	IH	£8.50
Pork Barrel	Gm	MA	16K	C	IS	£6.50
Punctuation	Ed	Bryants S/W	16K	C	HW	£3.75
Purchase	Bs	Tridata	48K	D	ID	£170.00
Pyramids of Doom	Gm	Adventure Int.	16K	C	IS	£12.50
					AB	£18.99
					OH	£15.25
QSL Manager	Do	Instant S/W	16K		AB	£16.50
Quick Change	Bs	Baust Computing	16K	C	HA	£9.95
Quick Change	Bs	Baust Computing	16K	D	HA	£12.95
Random Dungeons	Gm	Ogre	16K	C	IC	£10.00
Random Dungeons	Gm	Ogre	4K	C	IC	£5.75
Renumber and Compress	Ut	Instant S/W	16K	C	AB	£8.50
Renumber	Ut	MA	16K	C	IS	£6.50
Re-Number	Ut	Kansas	16K	C	IH	£6.25
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Repeat	Ut	Kansas	16K	C	IH	£6.25
Rescue	Ut	Kansas	16K	C	IH	£6.25
Rescue At Rigel	Gm	MA	16K	C	IS	£18.50
Road Alignment	Bs	Canal Computing	16K	C	OF	£60
Road Safety	Ed	Bryants S/W	16K	C	HW	£3.75
Robot Attack	Gm	Big 5	16K	C	IS	£11.50
Roots	Do	MA	32K	D	IS	£17.00
RPN Calculator	Do	MA	16K	C	IS	£7.50
RSM 2 Monitor	Ut	MA	16K	C	IS	£16.00
RSM 2D Monitor	Ut	MA	16K	D	IS	£20.00
SDM	Gm	Adventure Int.	16K	C	AB	£20.12
Sales	Bs	Tridata	48K	D	ID	£170.00
Santaparavia	Gm	Instant S/W	16K	C	AB	£8.50
Sargon II	Gm	MA	16K	C	IS	£20.50
Sargon II Disk	Gm	MA	32K	C	IS	£23.50
Savage Island I	Gm	Adventure Int.	16K	C	IS	£12.50
					AB	£18.99
					OH	£15.25
Savage Island II	Gm	Adventure Int.	16K	C	IS	£12.50
					AB	£18.99
					OH	£15.25
Scarfman	Gm	Cornsoft	16K	C	IS	£11.50
					OH	£11.25
Scientific Calculator	Ed	MA	16K	C	IS	£14.50
Screen Print	Ut	Kansas	16K	C	IH	£6.25
Screenhold	Ut	MA	16K	C	IS	£6.00
Seadragon	Gm	MA	16K	C	IS	£15.00
Sea Wolf	Gm	Kansas	16K	C	IH	£9.50
Sea Wolf	Gm	Molimerx	16K	C	AJ	£10.06
Sea Wolf	Gm	Molimerx	32K	D	AJ	£12.65
Semi Conductor Theory	Ed	MA	16K	C	IS	£9.50
Showdown	Gm	Adventure Int.	16K	C	AB	£12.50
Silverflash	Gm	Adventure Int.	16K	C	AB	£12.50
Simutec	Gm	Adventure Int.	16K	C	AB	£12.50
Simplify It	Ut	MA	32K	D	IS	£12.00
Six Microstories	Gm	Adventure Int.	32K	D	AB	£14.35
Skirmish 80	Gm	Instant S/W	16K	C	IA	£8.50
Sky Warrior	Gm	Adventure Int.	16K	C	IS	£11.50
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Space Intruder	Gm	Adventure Int.	16K	C	AB	£14.35
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ST-80	Ut	MA	16K	C	IS	£34.00
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Strange Odyssey	Gm	Adventure Int.	16K	C	IS	£12.50
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Structural Analysis	Bs	Casual Computing	16K	C	OF	£60
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Super Breakthrough	Gm	Kansas	16K	C	IH	£8.50
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What Next?	Gm	Baust Computing	4K	D	HA	£6.95
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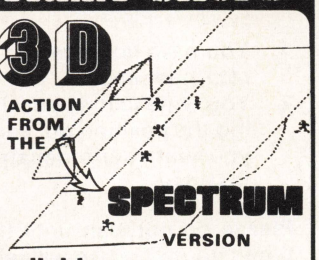

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SINCLAIR USER FEBRUARY 1983

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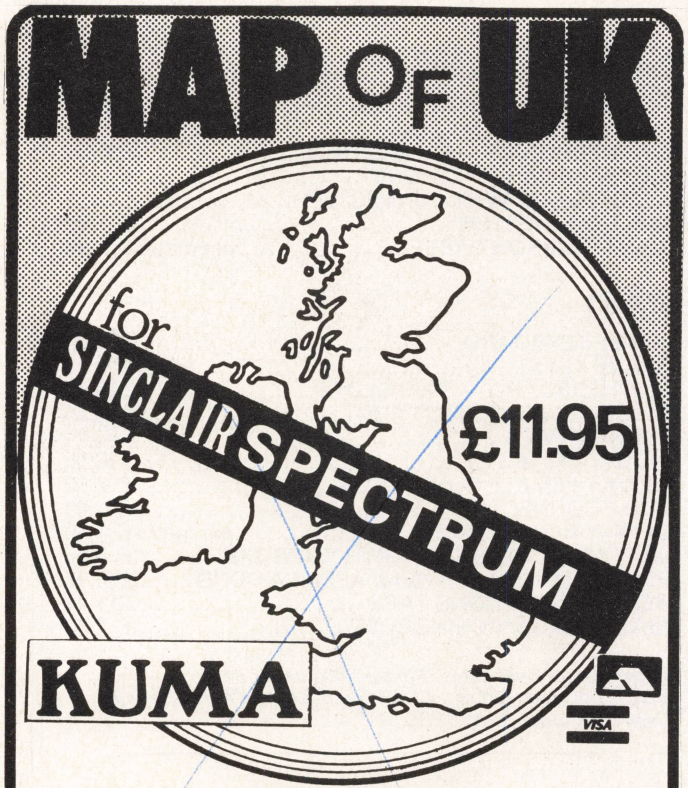

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The program usefully demonstrates how ? (POKE) can be used to address the screen and animate games. Lines 45 and 46 both use ? to change the score. The whole game is driven by a FOR/NEXT loop which counts through 50 teacups. Your score is based on the number of teacups you have successfully caught. 15-20 is good score and anything above that is considered superhuman!

The game will fit into the standard Atom with 2K of memory and no floating point. To enable it to run in this memory size I have used abbreviated forms of the following commands.

P. — PRINT
F. — FOR
N. — NEXT
E. — END

It is interesting to note that this program started life as a dodging game, the object of which was to dodge the falling bombs. However this turned out to be too easy. It seemed more of a challenge to try and catch them and this only needed a slight alteration to the program. It just shows how, when writing a game, your ideas often change.



PROGRAM LISTING

```
 1  CLEAR0;S=0;C=0;?#E1=0
 2  P.$30"(5SP) CUPS (7SP) SCORE"'
 4  K=33260;?K=255
 8  F.C=0TO50
10  P=A.R.%32+32832
20  F.T=0TO13;L=T*32+P
21  IF?#B002&64=0K=K+1;?K=255;?(K-1)
    =192;IFK=33279K=K-1
22  IF?#B001&128=0K=K-1;?K=255;
    K?1=192;IFK=33248K=K+1
23  ?33248=192;?33279=192
25  WAIT;WAIT;WAIT
30  ?L=123;?(L-32)=192
35  IF L>33247;?L=192
40  N.
45  IFK=L P.$7;S=S+1;?32790=S/10+48
    ;?32791=S%10+48
46  ?32778=C/10+48;?32779=C%10+48
48  N.;E.
```

MICROTERMS

Get to grips with terminology in this month's issue dictionary. A quick reference guide to common computer jargon.

Address
A label or name (usually a *binary* or *hexadecimal* number) specifying a particular *memory* location.

Array
A special variable that is used to hold large amounts of string or numeric information in a row and column format.

Assembly Language
Means of representing *program* statements in mnemonics and conveniently handling *memory* addressing by use of symbolic terms.

BASIC
Beginner's All Purpose Symbolic Instruction Code. An easy to learn, widely used computer language.

Bit
A single *binary* digit, representing either a 'one' or a 'zero'.

Bug
An error in *software*.

Byte
A *binary* number, usually of eight *bits*. It can represent a number from 0 to 255 (8-bit byte) as there are 256 possible combinations of "ones" and 'zeros" eight bits long.

Cartridge
A self-contained unit storing either ROM or RAM which plugs into a computer to expand the memory or provide a program.

Character Set
The list of letters, numbers and symbols that you can use to write programs and display information.

CP/M
A standard disc operating system that in theory allows software packages to be run on different machines. It stands for Control Program for Microcomputers.

Cursor
Character or graphic symbol used by the computer to denote where it's printing. Also used as a prompt to input information or a command.

Data
Simply, information. The raw material that the computer processes.

Debug
To correct the errors in a *program*.

Disc
Magnetic storage device allowing fast random access to a large volume of *data*. A full-size hard disc will hold, say, 5 *megabytes* or more; a smaller *floppy disc* typically holds from 80 to 250 *kilo* bytes but in either case the capacity is being increased all the time.

Display Mode
Means of indicating the form in which the computer's output will appear on the *VDU* screen. It is either text only, text and graphics or graphics only. The display mode is usually represented by a number and the difference between these numbers indicates the change in the display capabilities of the screen, for instance on the BBC computer Mode O gives a higher resolution than Mode 1.

DOS
Disc Operating System. This refers to the piece of computer code that controls the action of the disc drive. On some machines this code has to be loaded into the machines memory and on others it is present in the *ROM* onboard the disc drive. The DOS tells the disc drive how to load and save programs on the disc as well as carrying out any disc management functions such as updating the directory.

Dummy Variable
This is a variable that is defined at the beginning of a program that has no use until later on in the program.

EPROM
Erasable Programmable Read Only Memory. When programming, writing typically takes one minute and erasing, by ultra-violet light, 10 minutes or longer.

Get
A BASIC command. It tells the computer to search the keyboard and bring back the value of the first key pressed.

Gosub
A BASIC command telling the computer to go to a subroutine within a program.

Gcol
A colour command used in BBC Basic.

Hard Copy
A computer printout or listing on paper.

Hardware
All the electronic and mechanical components making up a computer system.

Hex
Shortened version of hexadecimal, meaning '6 plus 10', which is a funny way of saying 16. It refers to the number system with a base of 16. This uses 0 to 9 and then A to F of the alphabet to represent its 16 digits. Two hex digits can be conveniently used to represent a byte (eight bits).

High Resolution
This means that you can pinpoint one dot on a screen rather than one square, giving you graphical pictures of much greater detail and accuracy.

Instruction
A set of *bits* which causes the *CPU* to carry out a particular task in a program.

Interface
Circuit which connects different parts of a system together and performs any processing of signals in order to make transfer possible (ie serial-parallel conversion).

I/O
Input/Output. A computer generally has one or more *ports* through which it communicates with 'the outside world' — *peripheral* devices such as a *keyboard*, video display *(VDU)*, *printer* etc. An I/O port may be just an input or just an output or it can be bidirectional.

Kilo (K)
Normally means 1000, but stands for1024 (2^{10}) when referring to memory.

Language
A repertory of commands — symbols, expressions etc, used to 'call up' the instructions or procedures a *processor* can execute.

Location
Physical position; *memory* location is the same as *address*.

Loop
Program technique where one section of program (the loop) is performed many times over.

Machine Language (or Code)
The lowest (and most tediously detailed)

level of *program instructions*. All higher level coding must be converted to *machine language* (by *compiler* or *interpreter)* before a *processor* can obey it.

Memory Map
Chart showing how *memory* is used by a computer. The arrangement of *data* and *program* within the memory.

Menu
A set of options displayed on-screen by a computer program from which the computer user can make a selection to implement.

Modulator
A device, included in every good hobby computer, which takes the computer's output and converts it to an RF signal on a suitable TV channel, giving you a cheap, convenient visual display.

Monitor
(1) The first level of computer *operating systems:* the *program* which turns *machine code* commands into action, managing input, output etc.
(2) A TV-type device which is specially constructed to handle video signals from a computer that does not have a *modulator*.

Parallel / Serial
Denotes the manner in which the computer's output is sent to its peripheral devices. Serial means that the information is passed out one byte after another and it uses a system of special characters to signify control codes of the device. Parallel communications are sent out along a series of wires using the high or low state of the wire to indicate which bits are set and therefore making up a byte.

Pascal
A very powerful, structured computer language, available on a variety of microcomputers.

Peek
This BASIC command reads a value from a location in the computer memory. It can be used to access either RAM or ROM.

Peripheral
Device attached to a computer, eg *printer, plotter, disc* unit, but not necessarily essential to its use.

Pixel
The single dot that is used to create characters displayed on the VDU. Also the smallest display unit when using high resolution graphics.

Poke
This command places a value in a location of the computer's memory. It can only be used to access RAM or control registers.

Port
Terminal which the *CPU* uses to communicate with the outside world.

Print At
A BASIC command telling the computer where to begin printing.

Print Out
Same as *hardcopy*.

Program
A set of *instructions,* which tells the computer to perform a sequence of tasks also called software.

PROM
Programmable Read Only Memory. Proms are a special form of *ROM,* which can be individually programmed by the user.

Qwerty
The traditional typewriter keyboard layout adopted by computer designers.

RAM
Random Access Memory. *Data* may be written to or read from any location in this type of memory.

Register
A general-purpose *memory,* or set of memory *locations,* built into the *microprocessor* itself. Sometimes, particular registers may be designated for a specific purpose.

RND
In BASIC this stands for RANDOM and instructs the computer to select random numbers, it is often used in games programs. Because the numbers thrown up are mathematically related to the number preceding they are called pseudo-random numbers, not true random-numbers.

ROM
Read Only Memory. *Memory* device which has its *data* content established as part of manufacture and cannot be changed.

Routine
A whole *program* or part of a program designed to perform a single function or action.

RS232
A communications *interface* used for *modems* and for serial *printers*.

Sequential File
This is a data file that can be created on either a disc or a cassette system. As its name suggests, the information is stored one piece after another. If this information is to be changed or modified in any way then the whole file has to be read back into memory and then written back again once the changes have been made.

Software
The different kinds of *program* required to work a computer.

Source Code
Program written in one of the *high-level languages* and requiring *compilation* into *machine language* before use.

String
A sequence of characters used in a program.

Subroutine
A part of a *program* which performs a specific task and which is available for use elsewhere in a program, as often as you like.

Syntax
The grammar of a programming *language*.

Tab
Really stands for tabulate and allows you to automatically put figures and/or words into columns, forming a table.

Toolkit
Name given to a piece of code that runs in a computer independantly of any other programs and adds commands to the machines language to make the process of programming or debugging easier. Commands such as Renumber, Auto and Trace are common in toolkits. Toolkits take the form of a program that is loaded into the machine on power-up or a chip that is inserted on the circuit board which is then initialised by a SYS or USR call from the operator.

Variable
A symbol used in programming which is assigned a numeric memory address. You can change the value of variable at will to suit the program you are writing.

VDU
Visual Display Unit. Usually a TV set in hobby computers, but may be a video monitor which accepts the output directly from the computer.

Z80
Widely used microprocessor. It is used in the ZX81, Spectrum and TRS-80.

6502
Another widely used microprocessor. It is the heart of the PET, Apple and Atari computers.

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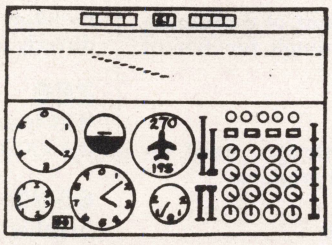

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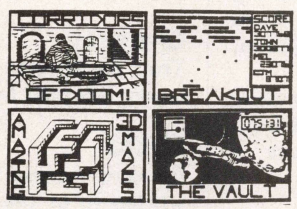

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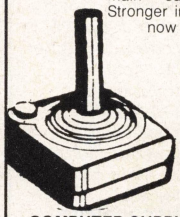

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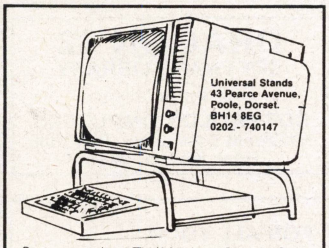

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