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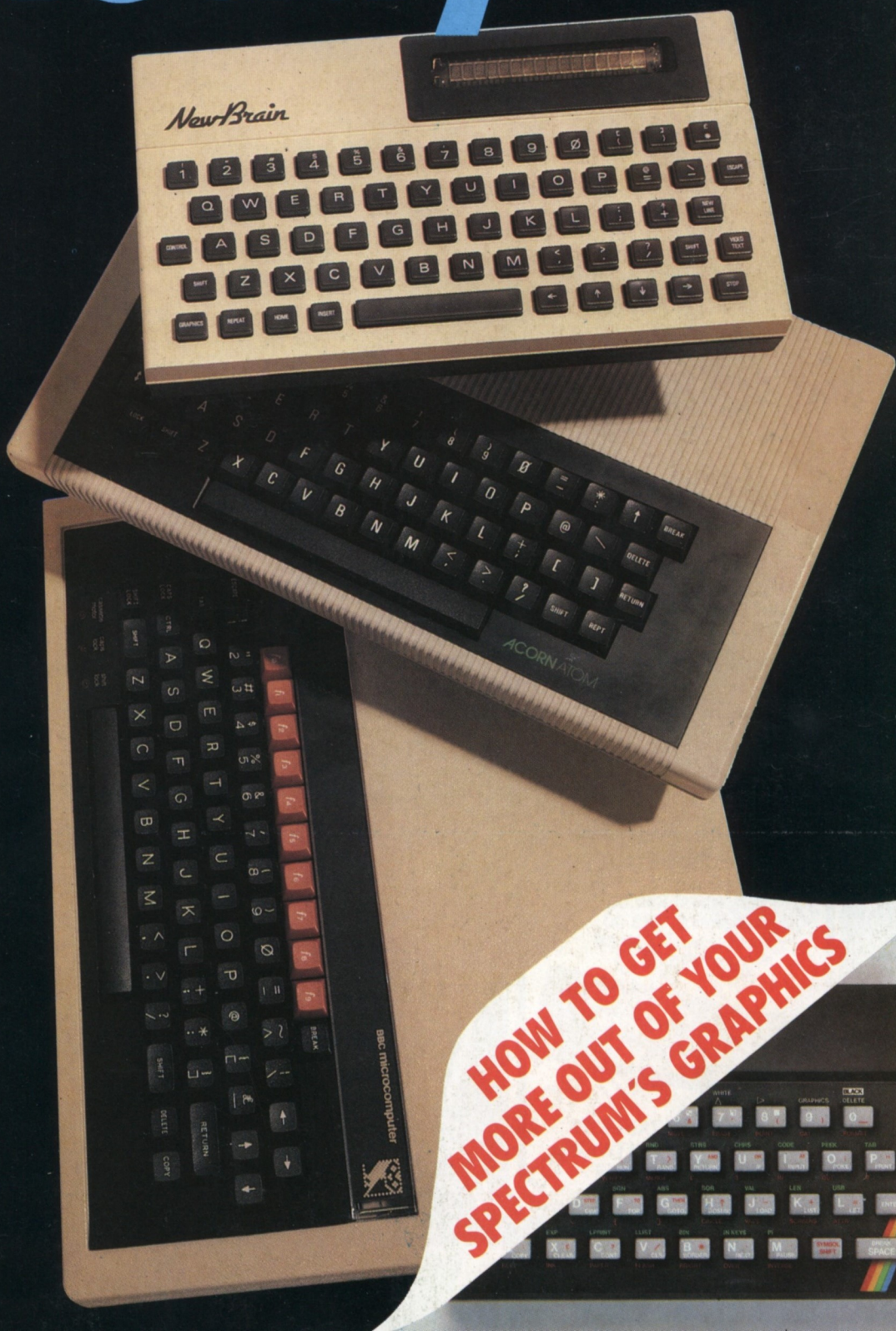

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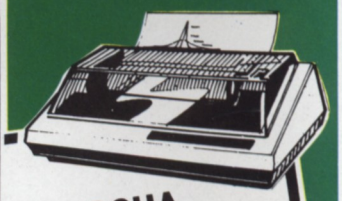

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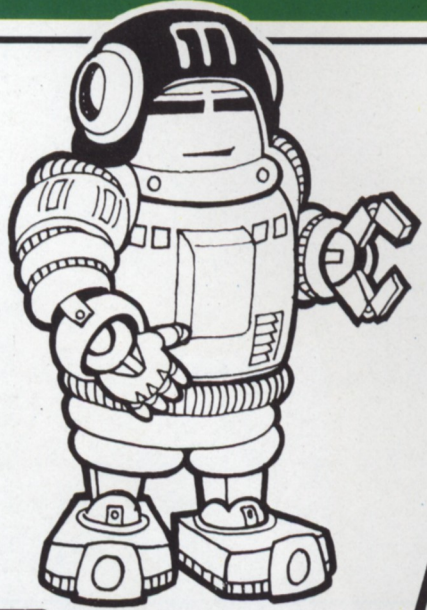

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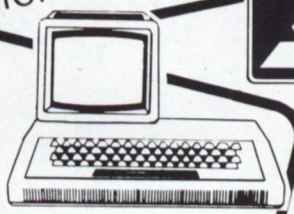

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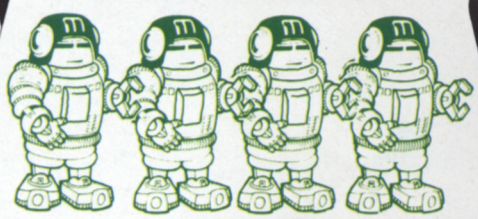

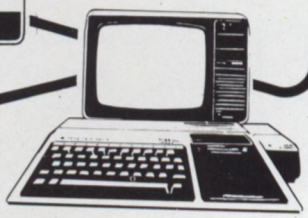

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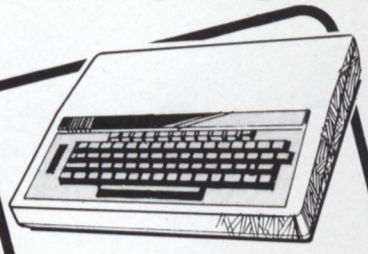

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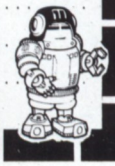

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The battle for the cheapest micro computer on sale began two months ago with consumer electronics firm Binatone's announcement of a £50 computer, but where will it all end?

Binatone's forthcoming micro computer sounds an extremely sophisticated little machine with features including a typewriter style keyboard, colour graphics and sound effects. The basic machine will come with 16K RAM on board selling for £49.95. It can be expanded to 64K RAM but the price for that add-on is as yet unknown. The specification for Binatone's baby includes the facility to use software written for a Tandy TRS-80 computer with the machine, as well as that of another so far un-named supplier. An interesting idea which can be developed.

Now the veteran pioneer of personal computing, Clive Sinclair, is making a bid to be the first manufacturer on the market with an under £50 computer. Through an associate firm he is reducing the cost of ZX81s to the golden price of £49.95.

The motives behind these two firms are similar. Both want to capitolise on the current personal computer boom — and who can blame them? That is Binatone's prime reason for the new computer. That's all very well, but what of the quality of the product? Binatone is not established in the computer manufacturing field. It's product range consists of a variety of consumer electronics, and includes a first generation, which means basic, television games centre. Last year Binatone had no plans to continue software support for the machine.

There is also nothing innovative in the computer it has announced. Computer technology has now reached the stage where it can be easily used to design a computer around, as long as the basic microprocessor is a good, tried and tested one providing standard functional facilities.

This is good news for the buying public because it boosts the competitive edge of the market, but does little for advancements in computing. The recently launched Dragon 32 is an example of this practice. There is nothing new in the workings of the computer, but it has just about anything a beginner or home user would want in a computer for a low price, £200.

Sinclair's motive is less obvious. Sinclair Research is an established name in the personal computing field and he wants to keep it that way. By letting another, unknown, firm launch the first micro under £50 he risks losing a stronghold, if only in reputation, on the market.

Whoever gets there first it will be interesting to watch the winner's progress and see whether other manufacturers will knock down prices of their own computers.

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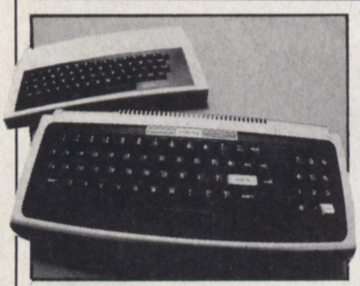



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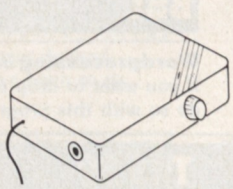

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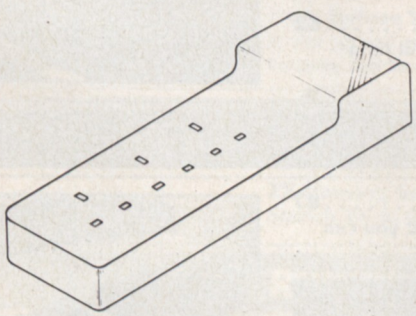

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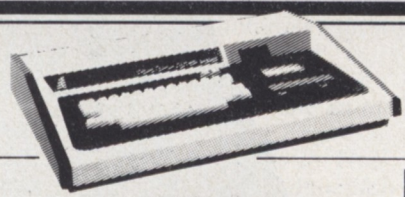

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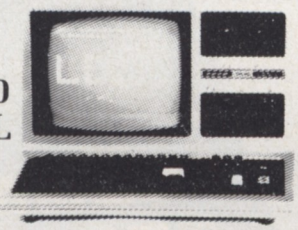

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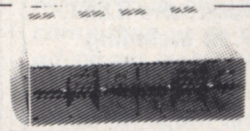

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Clive Beats Binatone to First £50 Computer

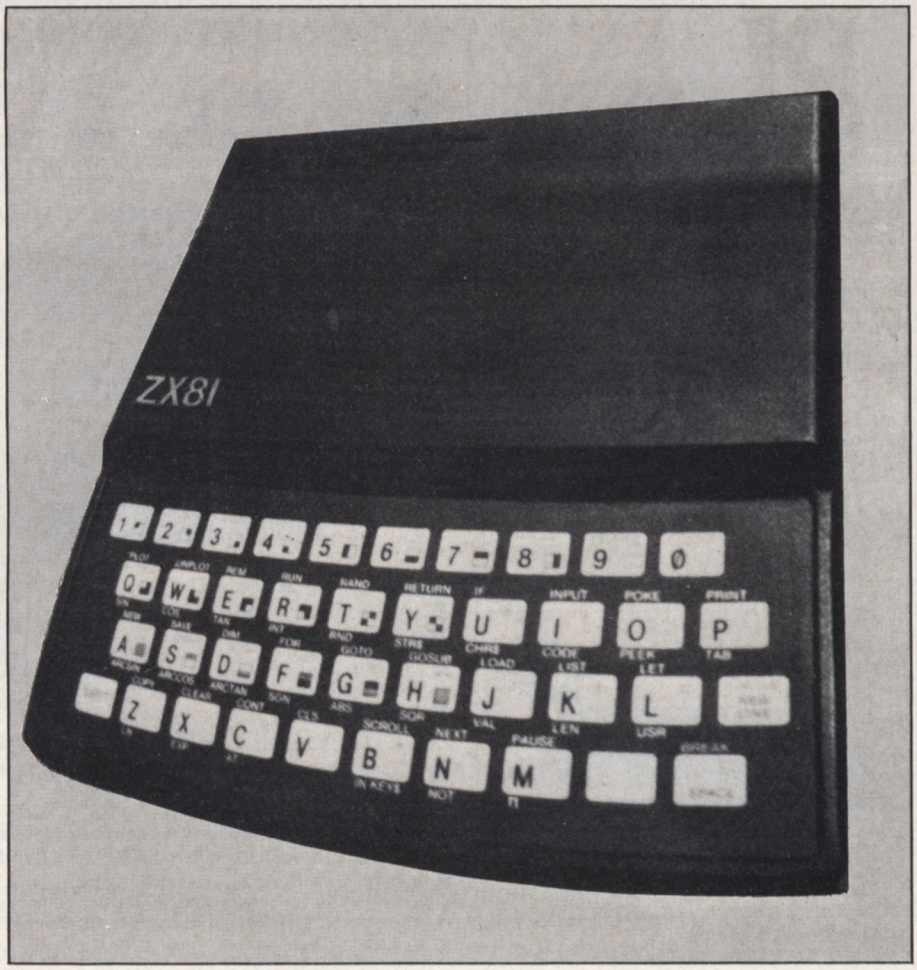
Sinclair Research has pipped Binatone to the post in bringing out the first micro computer under £50.

Although he is not setting the world alight with another brand new computer Clive Sinclair has knocked down the price of his top-selling micro computer, the ZX81, to £49.95 from £69.95 including VAT. The new prices took effect from August 9.

In the same swift move he has also changed his marketing plans to make the ZX81 more widely available. From that date the ZX81 was on sale through a number of high street retail outlets including Greens, the electrical shop located in most Debenhams stores, as well as Boots the chemists. All existing peripherals available for the machine are now on sale there too.

Clive Sinclair summed up his reasons for this change: 'The personal computer is no longer the preserve of the hobbiest, but is becoming as much a houshold item as a television or hi-fi'.

Also pulled in to aid Sinclair in this attack is a new distribution company called Prism Microproducts. It is responsible for supplying high street stores who have less than 20 outlets, with the ZX81 and its peripherals. So, if you have a computer orientated shop and fancy stocking the ZX81 contact Bob Denton, Prism Microproducts, 30/31 Islington Green, London N1, or phone him on 01-359-7481.



Hollywood's Video Star

Now video games are so popular that even Walt Disney Productions has been hard at work producing a film revolving around spectacular computer graphics.

The film, called TRON, is the first of its kind. Making extensive use of computer generated graphics and imagery, the film's producers have created a fantasy world inside a computer, where programs are the alter egos of their creators and video games are played out in real life.

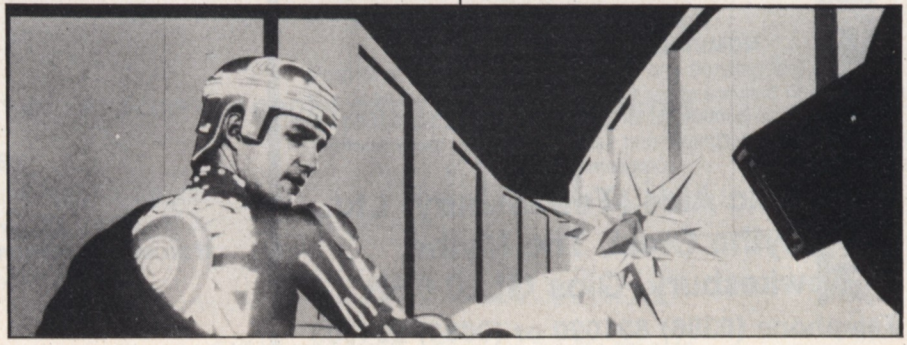
The plot revolves around the exploits of Kevin Flynn, who after leaving his job as a programmer for an American multi-national firm and becoming a video game expert, gets called back by two of his colleagues so that he can help them recover their programs from the control of the tyrannical MCP (Master Control Program).

In doing this Flynn gets transported very cleverly to the electronic world inside the computer where he proceeds to do battle with all and sundry in an effort to wrest control of the computer from the MCP.

Along his journey through this futuristic landscape he meets and is helped by Tron, a radical program that was written to destroy the MCP, Yori, who is a program written by Flynn's ex-girlfriend to simulate her laser experiments and Ram, an actuarial program who he meets in one of the video games. Together they fight, trick and zap their way to the MCP, in scenes of pure visual delight, for the final showdown.

Tron is fast action all the way through and should appeal to all ages, the graphics themselves are an experience all of their own. But you will have to wait until September to see it. It also contains a few 'in-jokes' that computer people will appreciate. One of the best is when Flynn meets a small energy pulse called Bit, who can only answer his questions yes or no.

All told the film is a superb piece of highly entertaining fantasy and the thought of all the work that must have gone into programming the computer graphics makes me want to hang up my light pen, burn my BBC Micro and take up something easy like sheep farming.



Computer Music At A Price

What has a nightingale and a smashing plate got in common? The answer is that you can use both of them to play tunes on the Fairlight CMI.

This is the ultimate marriage between computer and synthesiser technology. It even looks as if it might be equally at home on a businessman's desk or centre stage at Madison Square Gardens.

The Fairlight CMI, which stands for Computer Musical Instrument, can be programmed in one of two ways. First, you can play a sound into it via a microphone which the computer will then analyse digitally and transpose it onto its six octave keyboard. For an example of this listen to the plate smashing sequence in singer Kate Bush's hit single Babooshka.

Once the sound is in the Fairlight you can modify it or combine it with other sounds using the light pen or the alpha-numeric keyboard that come with the system. The second way to program the machine is to directly draw a wave shape onto the VDU and then use the machine's editing faciltiies to alter or add to it.

What this all adds up to is a synthesiser that creates any sound you dream up, or mimic any natural sound you play to it. The actual quality of the sounds which come out the other end are staggering. It is very hard to tell the difference between the original sound source and the Fairlight produced sound.

If you fancy having a complete orchestra in your living room, or want to record your household pets and play your way onto Top of the Pops, then all you need is the Fairlight CMI, a little time and a cool £18,000. One day it might be available at a sensible price. Not surprisingly only 26 have so far been sold.

Bumper Books

Following hot on the heels of the Getting Acquainted series of books computer author Tim Hartnell has another two under his belt.

The first is aimed at beginners who have joined the BBC Computer army and is titled 'Let Your BBC Micro Teach You to Program'. It is designed to take the reader from first principals of computing up to the more advanced features of the computer, including a chapter on mastering the graphics. The cost is £6.45 and it is available directly from the publishers Interface.

'Programming Your ZX Spectrum', will enlighten that computer's owners in many areas. The book offers a graded course in all aspects of Spectrum programming and contains over 100 routines and programs that are all guaranteed to run. It costs £6.95 and it too is available from Interface.

Sinclair Plugs Into Prestel

Bubbling up from the depths of Sinclair Research is another new development. It concerns the use of telesoftware as a method for distributing programs and information more cheaply and conveniently.

The idea revolves around using Prestel or a similar system like a catalogue into which you can plug your computer and 'download' programs that you want. That means you can put programs into your micro from another computer system. Sinclair sees cassettes and floppy discs as an outdated medium that is commonly subject to piracy and plagued with distribution and sales problems. The firm sees the future of personal computing relying on communication and hope that by providing cheap interfaces, modems and telesoftware facilities, they can allow the computer user to communicate and exchange information with various sources around the country.

The telesoftware concept will enable you at home to connect your computer, via a telephone, to the Prestel computer and use it as if it were a proper Prestel adapter. Set up on Prestel will be computer pages containing lists of software titles. If a user wishes to run one of these programs all he has to do is tell the computer to send him the program.

The Prestel computer then sends the program down the telephone line and the computer at the other end loads it as if it were loading from either tape or disc. The user's Prestel account is then debitted for the cost of the program and for the time spent using the system.

Once in the user's computer it can then be saved onto tape in the usual fashion. Also possible with this system is a software library. This will allow a user to 'download' a program into his machine, but not save it on tape or disc. The cost will be a lot cheaper than buying the program outright, as you only pay for the number of times you use it.

Hopefully, as well as giving greater power to the computer user, this system will provide a useful boost to the ailing Prestel scheme. Times and prices have yet to be announced, but as soon as they are you will read them here.

The Last Word . . .

Rounding up the news for this month are three new products that you can add to your computers. Starting off is the Peripheral Expansion System for the Texas TI 99/4A computer. This unit will allow you to plug up to seven peripherals into the single unit. It will hold memory expansions, interface cards and a single 51/4" disc drive, along with other plug in cards. For further information and prices contact your local Texas Instruments dealer.

ZX81 owners frantic for a new keyboard can turn to the Economic ZX81 keyboard. This keyboard fits on top of your original ZX keyboard and gives you a more positive feel to all of the keys. The key tops have been redesigned and repainted, using a total of seven different colours. Included with the keyboard is a separate function sheet, which can be fixed to the top of the ZX81 case. The cost is £11.95 inclusive, and details can be obtained from David Heartford, 91 High Street, Evesham, Worcestershire WR11 4DT.

Finally, Audiogenic has announced a new cartridge for the VIC-20 which professes to turn it into a full wordprocessor. The cartridge which contains the program and an extra 8K of memory retails for £125 including VAT. The program is based on the widely used, tried and tested, Wordcraft package and is called, not surprisingly, Wordcraft 20.

It embraces all the usual wordprocessing functions such as, scrolling screen, delete, insert, move and all the output functions. Documents can be output to either the VIC printer or any parallel or RS232 serial printers. Audiogenic can be contacted at

P.O. Box 88,
Reading Berkshire
or telephone
(0734) 595647.

Don't let its size fool you.

If anything NewBrain is like the Tardis.

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

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

However, let the facts speak for themselves.

You get what you don't pay for.

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

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

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

Big enough for your business.

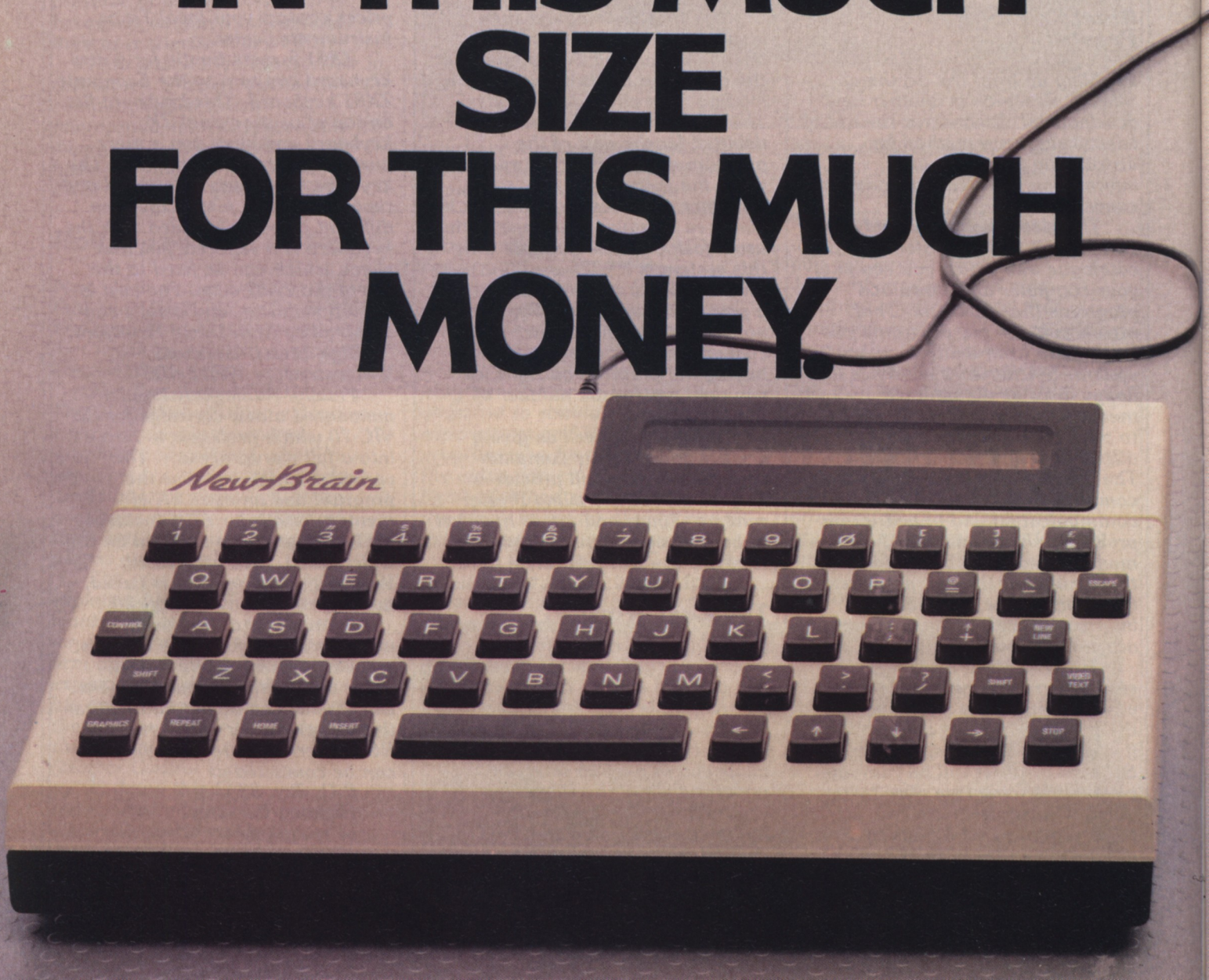
Although NewBrain is as easy as ABC to use (and child's-play to learn to use) this doesn't mean it's a toy.

Far from it.

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

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

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



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

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

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

Answers a growing need.

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

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

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

The range of peripherals on offer include dot matrix and daisy wheel printers, 9", 12" and 24" monitors plus 5¼" floppy disk drives (100 Kbytes and 1 Mbyte) and 5¼" Winchester drive (6-18 Mbytes).

As we said, this isn't a toy.

It doesn't stop here.

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

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

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

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

From now on the sky's the limit.

Software that's hard to beat.

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

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

Waste no more time.

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

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

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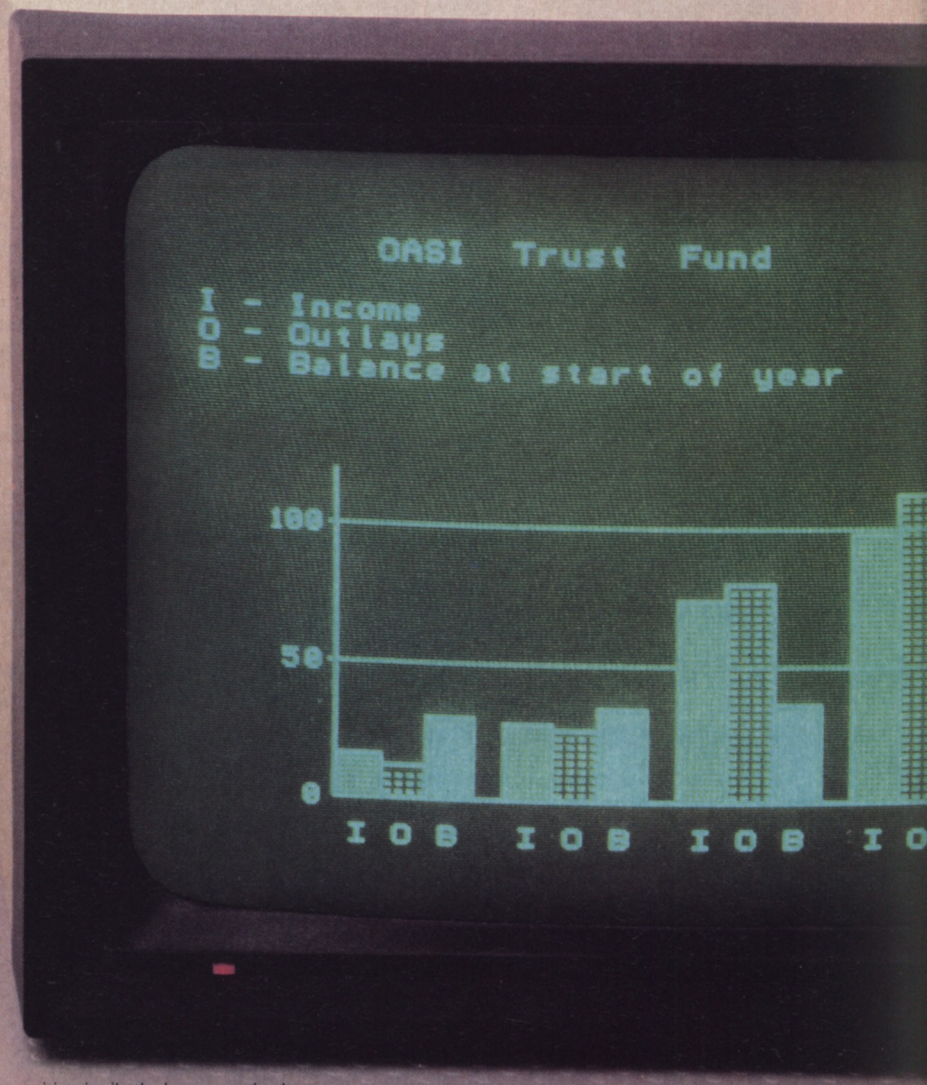

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NEWBRAIN

Personal Computing Today

Submitting Programs to Personal Computing Today

Have you written a program or article and would like to tell the world about it? Everyone likes to have a go at programming and we would love to look at your programming works of art to consider them for publication.

Remember we can only print what you want to read by knowing what you like. So the more you send us the better. We want to cover as many sorts of programs as possible too so whether yours is a game or a useful programming routine or aid don't hesitate to send it to us. We pay a standard fee for any programs published, if you need any incentive.

If you would like to submit a program for publication send it to: The Editor, Personal Computing Today, 145 Charing Cross Road, London WC1.

So that you know how we like to submit programs for use in the magazine printed below are guidelines which we would like you to follow.

What To Do

There are two kinds of program feature carried within our pages. The first is the brief "Micro-Spot": A page in total containing a brief description of the software, notes on its usage and a full listing.

These are designed to be short and to the point and are not primarily intended for the beginner in programming. Thus the explanation does not have to be totally explicit.

The second method of presentation is that of a full article. This can run anywhere in length from two pages to five pages and is formatted to a rigid style of presentation.

Because PCT is aimed at the newcomer to computing, our main software has to be well documented and explained. We have decided upon the following method of publishing programs and would ask authors to submit material in this form whenever possible.

1. The article is broken into four parts.
   (a) Introductory Text
   (b) Program Listing
   (c) How It Runs
   (d) Hints on Conversion

2. The Introductory Text should contain an explanation of what the program is designed to do, what is to be expected on-screen when it is run, any problems the author overcame in producing the program and any background necessary to enable our readers to use the listing. For example, if it is a game program, state the rules of the game, win condition, 'good score' level etc., etc.

3. Programs should preferably be run out on a printer straight from the computer. In this way less errors creep in. Otherwise typed or handwritten is acceptable but must be double-spaced and DOUBLE CHECKED!

4. How it Runs should be as near to a line-by-line, or block-by-block description of the program as is possible. In this way people can learn more easily how to produce programs of their own to your standards.

5. Each computer on the market has its own little foibles and oddities. No one knows those of your machine better than you. How would someone wishing to adapt your program go about untangling them? What special use have you made of your computer's special abilities? Graphics?

Always include a full list of variables, too.

NEXT MONTH

Spectrum/VIC 20 Graphics

To most poeple graphics are a very important function of their computer but high resolution facilities tend to make the inexperienced have a brain storm.

In an effort to overcome the difficulties people come across when programming in high-resolution mode next month we take the Spectrum and VIC 20 aside and compare the facilities of the two. Find out what the two computers have to offer graphically speaking. We will tell you what you can do with the facilities they offer, and compare just how easy, or difficult, both machines' graphics are to use. We'll help you solve you shape-making problems.

Micro Buying — Get it Right

Many people are on the brink of taking the plunge and entering the tide of computer owners but the wealth of machines now available at a reasonable price is bewildering and daunting. Personal Computing Today has come up with what we believe, from our readers viewpoint, is the 'ideal' personal computer.

We will make sure you get it right the first time round when you join the computer army. By taking our advice we hope you will make the right decision when micro buying. Pick up on the points we make to guide you in the right direction and watch out for the pitfalls.

TRS-80 Tipster

TRS-80 owners, whether recent or old timers, can make the most of our programming feature giving hints and tips. Iron out some of those old problems and discover how to improve your programs.

Space gamester addicts can wait with baited breath for an exciting TRS-80/Video Genie game, Saturn Attack. Collect valuable mineraloids from Saturn's surface but watch out for the deadly space sweepers planted by the enemy Titans which can destroy your probe. Can you and your computer survive the sweeping onslaught? Find out next month.

Piles of Programs

A useful program for VIC-20 owners who have experienced problems with their function keys. This short, sharp listing will fill you in on a neglected part of Commodore's baby. It enables you to assign a separate function up to eight characters long to each of the eight keys.

November brings autumn and bad weather but PCT will brighten up your days with a special analyses of teletext display on the BBC Microcomputer. This stands up where the BBC manual falls down and tells you how to make the most of your machine's high resolution graphics and use the functions supplied for teletext.

Our regular games programming series focuses on an ancient, traditional board game Ayo which is a version of one of the oldest known games called Mancala. It can be as simple as noughts and crosses or as tactically difficult as chess. It involves occupying and capturing your opponent's territory which consists of rows of cups. Sounds intriguing? Read November's PCT to find out more.

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YOUR LETTERS

This page is where you get the chance to put your opinions in print. Personal Computing Today welcomes letters from you on any aspect of microcomputing and views in general — as long as they're printable!

Please drop us a line to: The Editor, Personal Computing Today, 145 Charing Cross Road, London, WC2H 0EE.

Dear PCT
I have had a ZX81 for 6 months. But since I bought it I've had nothing but problems with it, and they are getting worse. At first my programs crashed when I was entering them. Then two months ago I received a 16K RAM pack. Due to the fault I am only able to get 5.4K out of the RAM. It is not the RAM because I have checked it on other ZX81s. Sometimes when typing in a program the cursor stops dead and the only solution is to pull out the plug. Also when loading machine code the computer will change the hex code into a character which isn't the right one.

E.G. Hex code	Character
C5	CLEAR

I have written to Sinclair in case it is a faulty ROM but I've had no reply and I sent the letter three weeks ago. Do you have any ideas on what the problem is? If so, how can I fix it?
K Driscoll
Merseyside

Editor's reply: Unfortunately it does sound like your machine has a bad ROM in it somewhere which means that you will just have to keep plugging away at Sinclair to remedy it.

Dear PCT
Congratulations on the introduction of a superb new computing magazine. Your method of software review is clear, concise and amusing.

As this will be a regular feature I would be interested, as would I'm sure, many other readers, on war games software. In particular, I was interested in one called "Conqueror" marketed by Algray for the 16K PET.

A review of this game would help me decide on a purchase.
D R Wilson
Humberside

Editor's reply: In future issues we will try and include as wide a variety of games and computers as possible. So keep your eyes peeled for a war game review.

Dear PCT
Having written a text program of my own I was interested in S A Barnett's program in your August 1982 issue.

It is not quite true to say you cannot input a line containing a comma. You can if you put the entry inside quotation marks. In fact, you need only type in the opening quotes. It is, however, a nuisance to have to remember to include the quotes and I have therefore used substantially the same method as S A Barnett.

There seem to be two mistakes in his program. Line 5 should be PRINT CHR$ (14) which is the TRS-80 "cursor on" command. There should be a closing bracket after the second B$ in line 40. I am a little puzzled why A$ is used for a second purpose in line 40. The following simpler line works just as well

```
40 IF A=8 THEN PRINT A$;: B$=LEFT(B$,LEN(B$)-1): GO TO 10
```

I am looking out for the next issue of the magazine with interest.
Peter Davy
Wakefield

Dear PCT
First, may I congratulate you on the first edition of your magazine, it proved both interesting and useful.

I am an owner of a ZX81 and intend to purchase a BBC Micro when finances permit.

I would be pleased if you could answer some queries of mine.

1. Will a ZX user quickly adapt to the BBC BASIC?
2. Do the cassette and TV cables come complete with the machine?
3. Are the LOAD and SAVE commands reliable even with a domestic recorder?
4. Does the manual give details on the machines assembler?
5. Is it true that on the Model B machine only 4 colours are available on the screen at the same time?

A Stead
Hull

Editor's reply: Once you have learned one version of BASIC it is very easy to change to another. One thing that might take some getting used to when you get your BBC machine is that you have to type the keywords in as opposed to putting them in with a single keystroke.

The BBC machine does come complete with cassette and TV cables, but you do have to fit plugs on the end of the cassette cable for your particular tape machine.

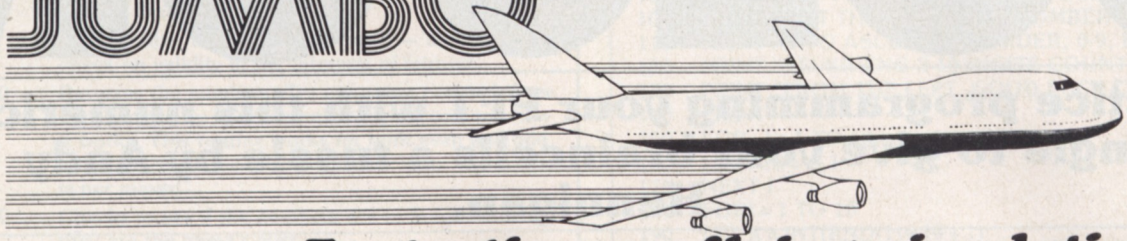
The BBC machine offers you two tape operations, one which loads and saves at 300 baud, and one which uses 1200 baud. If you have a reasonable quality tape recorder then both of these are reliable. However, if you are trying to load a 1200 baud tape from someone else's machine you might encounter some problems.

The machine's manual does give some basic information about the machine's assembler capacity but there will be another manual available shortly to deal purely with this.

In some modes the Model B will support up to 16 colours, notably Mode 7 and Mode 2.

INNOVATIVE
TRS 80-GENIE SOFTWARE
from the professionals

JUMBO



Fantastic new flying simulation

Occasionally a program comes along of such magnitude that it is hard to describe it, especially within the space allowable in an advertisement. Jumbo is such a program. There have, of course, been flying simulation programs before, but they have all rather fallen into the trap of trying to produce a graphic representation of the ground at some stage or other in the program, thus taking up space, and/or they have concentrated on the single act of flying. In other words, although one gets the feeling of flying a small aircraft, one is not going anywhere.

Jumbo is a fantastically accurate simulation of flying a Boeing 747. These planes are not small, and are not flown by eye. They are flown by eyes and instruments, and the instrument graphics in this simulation are really first class. As you may know, the primary instrument of an aircraft is the artificial horizon. This is simulated very well, and includes instrument landing approach indicators. Graphic maps of very high quality are produced and it is possible to fly in all of the British Isles including Southern Ireland, and to New York on the Eastern U.S. seaboard. The actual airports are at London, Birmingham, Manchester, Prestwick, Edinburgh, Belfast, Shannon and New York.

The program was written by two authors who combined their joint skills to produce a unique piece of software. The programmer got the last byte of performance out of the machine and the pilot the last drop of authenticity out of the simulation. Other simulation programs produce at best a similarity towards flying. With Jumbo you really feel that you are behind the controls.

The authors have used a number of gimmicks and programming techniques. For instance, it is possible to switch on an automatic pilot and to jump forward in time in increments of one minute or one hour — otherwise of course a flight from London to New York or vice versa would take some 8 hours to simulate. Whilst in this time skip the various controls are left as they are but fuel consumption and distance to go are taken forward at their correct rate.

A chart is supplied containing various items of data which you will need, including the take-off data for a 747 with various take-off weights, flap retractions, climb and cruise speeds and descent distances.

Realising that not everybody can fly a 747 and that there is even a large proportion of the population that cannot fly anything, two important items of assistance have been added. First of all is the documentation. This is split into two parts. The second is a "manual" on flying the 747. In other words, the instructions for running the program. The first part, however, is what amounts to an instruction manual for flying. It assumes that the user knows nothing about aircraft and although we do not purport that it gets anybody up to any sort of standard after it has been assimilated, the reader should have sufficient knowledge of flying and the theory of flight to fly in the program itself. The second feature of assistance to the novice pilot is a feature in the program which enables the user to practice landings. When the program is started, if one presses the P key, the aircraft is automatically put 11 miles out from London Airport approaching on an instrument landing.

The controls are pretty well complete, even to dive and wheel brakes. The flying track may be continuously monitored on the map display. Bearing and distance to your intended point of landing are available all the time. The instruments, incidentally, consist of:

Artificial horizon	Attitude	Fuel
Aileron indicators	Compass	Elapsed time
Indicated airspeed	Turn indicator	Distance to landing
Power setting	Flap indicator	Rate of climb
Elevators	Altimeter	

Six maps may be chosen, as follows:

Scotland, Northern England, Southern England, Ireland, Eastern U.S.A., The whole of the U.K.

Route information and present position are shown on the map displayed. It is very difficult to think of any factor that the authors have overlooked. Even the quite meaningful thinning of the air with increasing height, which greatly affects the airspeed indicator in real life, is taken into consideration. Rather than having a fixed stalling speed, this continuously changes with the flight configuration, the weight, height and power setting, again as it does in real life.

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SOLGOR

Practice programming your PET with this numerical tangle to give your braincells a tussle by Andy Hennigan.



Solgor is a simple number game that is quite easy to program but requires a bit of thought to play. At the beginning of the game you are presented with the numbers 0 to 9 all shuffled up like this:

3 5 6 4 2 7 9 0 8 1

All you have to do is sort them into ascending order, 0 to 9, 'smallest on the left, greatest on the right' — hence the name. The catch is that you are only allowed to reverse the order of 2 to 10 digits counting from the left with each move. For example, if you decide to reverse the first three digits in the string of numbers above the result will be:

6 5 3 4 2 7 9 0 8 1

The game finishes when the numbers are in 'Solgor' order and you judge your performance by counting the number of moves it took.

The sample run shows one way of solving the arrangement given at the beginning. The easiest way to attack the problem is to join up neighbouring numbers without breaking up existing runs.

It is important to think ahead so that you can re-unite two numbers with almost every move. In the example only two moves (8 and 10) do not actually place any numbers in their correct sequential position.

If you get bored with the game you could make it more difficult by using the 26 letters of the alphabet instead. Another suggestion is to provide it with a store of words to shuffle so that your first problem is to spot the anagram, and then sort it our using the Solgor rules.

For the deep thinkers a very interesting exercise is to devise an algorithm to play the game — not as easy as it sounds.

HOW IT RUNS

Line By Line Description

150-220	Places the digits 0-9 randomly in the array. The array is first filled with "–1"s so that placing the loop can recognise vacant places.
250-300	Prints out the numbers and the input prompt "reverse ?". The player decides at this point how many to move.
320-340	Rejects fractions and numbers less than two or greater than ten.
350	The "number of goes" is increased — after the check on validity in the interests of fairness.
370-400	Reverses the numbers. Try executing two and three digit reverse by hand on paper if you can't see how it works. This routine works for both even and odd moves because the middle number in an odd reverse is not moved.
420-430	Checks to see if the numbers are in Solgor order. If they are the game's over.
450-510	Success at last! Prints an evaluation of you skill — or lack of it. The critiscim is perhaps a little harsh.
530-550	Offers the player another game.

```
>RUN

** SOLGOR !! **

All you have to do is sort out the string of numbers into
ascending order, 0-9, by reversing 2-10 digits counting from the
left. Good luck!
3 5 6 4 2 7 9 0 8 1
reverse ? 4
4 6 5 3 2 7 9 0 8 1
reverse ? 3
5 6 4 3 2 7 9 0 8 1
reverse ? 2
6 5 4 3 2 7 9 0 8 1
reverse ? 5
2 3 4 5 6 7 9 0 8 1
reverse ? 9
8 0 9 7 6 5 4 3 2 1
reverse ? 3
9 0 8 7 6 5 4 3 2 1
reverse ? 2
0 9 8 7 6 5 4 3 2 1
reverse ? 10
1 2 3 4 5 6 7 8 9 0
reverse ? 9
9 8 7 6 5 4 3 2 1 0
reverse? 10
SOLGOR !!!!!!!!
It took you 10 moves wihch is not so good.
Another game (Y/N) ? N
```

PROGRAM LISTING

```
10    REM ## SOLGOR. BP ##
20    REM ## THE NUMBER SORT GAME ##
30    REM ## ANDY J. HENNIGAN 1981 ##
40    REM
50    DIM N(10)
60    PRINT
70    PRINT"** SOLGOR !! **"
80    PRINT
90    PRINT "ALL YOU HAVE TO DO IS SORT"
100   PRINT "OUT THE STRING OF NUMBERS"
110   PRINT "INTO ASCENDING ORDER, 0-9, BY"
120   PRINT "REVERSING 2-10 DIGITS COUNTING"
130   PRINT "FROM THE LEFT. GOOD LUCK !"
140   PRINT
150   FOR  I=1 TO 10
160   LET N(I) = -1
170   NEXT I
180   FORI=1 TO 10
190   LET X=INT(RND(1)*10+1)
200   IF N(X)>-1THEN190
210   LET N(X)=I-1
220   NEXT I
230   LET G=0
240   PRINT
250   FORI=1TO10
260   PRINTN(I);
270   NEXT I
280   PRINT
290   PRINT
300   INPUT"REVERSE";R
310   PRINT
320   IFR<=10 AND R>1 AND R=INT(R) THEN 350
330   PRINT"NO GOOD, PLEASE TRY AGAIN"
340   GOTO 300
350   LET G=G+1
360   FORI=1TOINT(R/2)
370   LET P=N(I)
380   LET N(I)=N(R-I+1)
390   LET N(R-I+1)=P
400   NEXT I
410   FORI=1TO10
420   IF N(I)<>I-1 THEN 240
430   NEXT I
440   PRINT
450   PRINT"SOLGOR !!!!!!!!"
460   PRINT
470   PRINT"IT TOOK YOU";G;"MOVES WHICH"
480   IF G<5 THEN PRINT "MEANS YOU PROBABLY
      CHEATED."
490   IF G<10 AND G>=5 THEN PRINT"MEANS YOU ARE
      PRETTY GOOD."
500   IF G>=10 AND G<20 THEN PRINT "IS NOT SO
      GOOD."
510   IF G>=20 THEN PRINT "IS TERRIBLE."
520   PRINT
530   INPUT "ANOTHER GAME ? (Y/N) ";Q$
540   PRINT
550   IF Q$="Y" THEN 60
560   END
```



SOLGOR

HINTS ON CONVERSION



The Solgor program is written in Zilog BASIC 3.0, which is fast rather than fancy, and no special or peculiar features are used so you will have no problem running it in other dialects. The following points will help clear up any doubts.

- Arrays, strings and dimensioning N(10) is a ten element numerical array; Q$(1) is a one character string. Array elements are numbered from 1.
- RANDOMIZE, RND

RANDOMIZE reseeds the pseudo-random number generator; RND supplies the next number in sequence. Many versions of BASIC use RND(X) for both of these.

- INT(X)

An intrinsic function that returns the integer part of X. Eg., INT(3.8) is 3.

- "&"

The ampersand symbol "&" is a logical AND in IF...THEN statements. The word "AND" is often used instead.

- < > "not equals" (often =).
  < = "less than or equals".
  > = "greater than or equals".

The digits to be sorted are held in the array N(10), G is the number of goes you've had and R is the number of digits you want to reverse.

The program has been converted from zilog BASIC to MICROSOFT BASIC, so it is already in a standard form. The points to pay attention to when converting are firstly, the random number generation in line 190, as this is achieved in different ways on different machines. The statement shown in line 190 will generate a random number between one and ten.

The logical operator AND in lines 320,490,500 might have to be changed as some machines do not support this sort of comparison. The way to replace the AND statement is to reduce it to a number of IF...THEN statements to check whether the condition is true.

Finally, if you are converting this program to run on a VIC 20 then all you have to worry about is adjusting the PRINT statements so that the lines do not wrap around on the VIC's smaller screen.

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COMPUTER USERS CLUB

In Clubhouse this month we take a look at the Crawley Computer Club and also bring you a round-up of new, recently and soon-to-be-started computer clubs.

The Crawley Computer Club is a small group of amateur computer enthusiasts who live locally and meet to help each other out and exchange views on their favourite hobby, personal computing.

Their meetings are informal affairs as they find that this helps members discuss their problems and interests without constant interruption. From time to time they arrange special evenings where guest speakers come down and enlighten them on further facets of the computer field.

Membership is made up of people that come from all walks of life interested in computers. Some of the members are more interested in hardware, spending their time building interfaces and other wonderful gadgets to plug into their machines, whilst others are more interested in software, writing games and utilities. Some members have been experimenting with word processing and accounting. Most of the club members prefer to stick to BASIC as a language except a few of the more adventurous who have moved on to assembly code and PASCAL in order to give full range to their programming concepts.

The club does not specialise in one particular machine and the computers owned by the members range from ZX80/81s and Acorn Atoms at the low end, to the Apple II and the Video Genie at the top end. Most of the commercially available machines are well represented along with a few from enterprising people who have designed and built their own.

Don't be afraid to go along to the club for the first time, whether as a novice or as a seasoned campaigner, there are many people who will help you with your problems, or argue with you over the best way to POKE your machine.

Meetings take place twice a month on the first Tuesday of the month at the Broadfield Community Centre in Broadfield Barton, Crawley. The meeting starts at about 7.30pm and usually runs until about 10.00pm. Members bring along their own machines so that they can demonstrate their latest mind-boggling creations. On the third Tuesday of each month the club transfers its headquarters to a local hostelry, the Tavern on the Green in Pound Hill, Crawley, where the club members discuss any new developments in the salubrious surroundings of the bar, downing a few pints of the local brew. This could result in many interesting advances in computer technology that can't be remembered in the morning.

If you are interested in joining, the subscription for a year is £6 and the people to get in touch with are:

Max Clark
(chairman)
31 Hyde Heath
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Chris Seager
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43 Jewel Walk
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Club Call-Up

Leaving the Crawley Computer Club and heading north we encounter another alcoholically powered computer group, in the form of the VIC-Pet Computer Club. Members meet fortnightly in the Spread Eagle, Oakley Hay, near Corby, Northants and as the name suggests they concentrate on the Commodore range of computers. For further details contact:

P Wilson
26 North Cape Walk
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NN18 9DQ
Telephone: (0536) 742622

Moving on we travel to Blackburn in Lancashire where a new club is forming, The Club, which hasn't got a name yet, but plans to meet on the first Monday of each month at a yet undecided venue. The club is also hoping to publish a monthly journal and contributions are welcome from anyone, whether they are a member or not.



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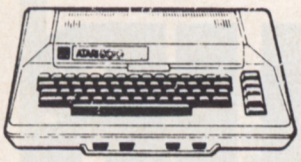

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2 large onions sliced
1 tsp worcestershire Sauce
2 tbsp oil Bottle Guinness
4 tbsp flour Salt Pepper

Coat steak in seasoned flour, fry in flameproof casserole, with lid in oil till brown. Put aside, fry sliced onions till golden. Place meat on top and season. Pour in Worcester sauce and 6oz stout. Cover and cook in oven at 140C (275F) for 2½ hours or until meat is tender.

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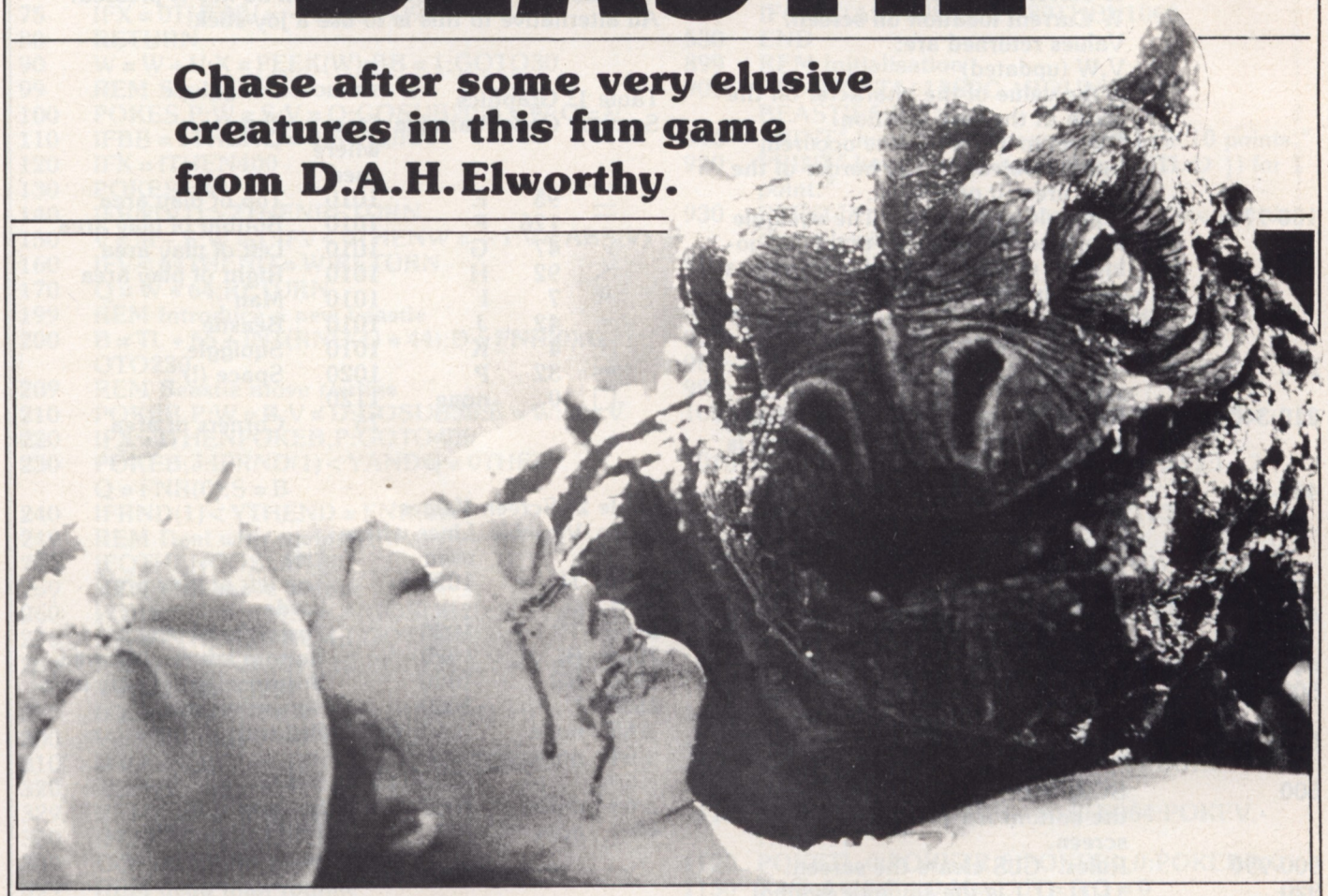
BOUNCING BEASTIE

Chase after some very elusive creatures in this fun game from D.A.H. Elworthy.



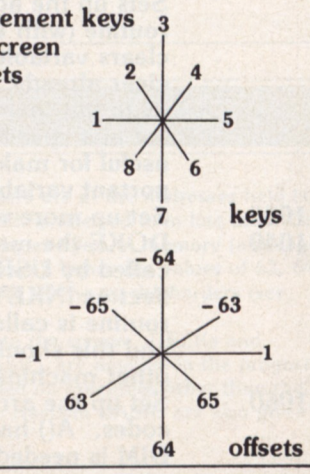
This game runs on a Nascom with BASIC and NAS-SYS, but can easily be adapted for any machine with BASIC and a memory-mapped display. The aim is to chase after the "beasties" and "squiggles". If you run into them, you score ten points and one point, respectively. However, if they hit you first, then your "man" is destroyed. You have three men in total.

Beasties appear somewhere along the top line of the play area on the screen, and then bounce provocatively around. Occasionally, they undergo a random change in direction, or release a squiggle. The probability of either of these events occurring depends on the skill level chosen, multiplied by a constant.

This constant is contained in line 1070; 0.05(1 in 20) has been found to give a satisfactory starting probability at a skill level of one. Once on the screen, a squiggle moves in a straight line at twice the speed of men and beasties, and may start to home in on you, with a probability of five times the value set up above. Fortunately there is only one squiggle on the screen at a time.

If you kill a beastie, probabilities are doubled. Whenever a man is killed, the current score and number of men left are shown on the screen. Movement is controlled by keys 1 to 8 (see figure 1), with 0 meaning stop. All other keys are ignored.

Figure 1: Movement keys & Screen offsets



NASCOM

BOUNCING BEASTIE

HOW IT RUNS

The program requires about 1½kbytes of memory.

10	Sets up FNR to generate random direction codes, and jumps to the initilisation routine.
20-90	Move subroutine. The parameters are: V direction code (i.e. value added to current location), W Current location on screen. Values returned are: V,W (updated) X the value of the character on the scren at the new location. BB set to 1 if a bounce occured, i.e. the object hit the border of the play area; 0 otherwise.
100-170	Squiggle subroutine. The squiggle is moved, and checks made for going out of play, and collision with a man. In the latter case, a jump is made to 400. Otherwise a normal return is made.
200	Introduces a new beastie to the screen.
210-340	Routines to move beastie, squiggle, man, and beastie again. A jump is made to 400 if a man is hit.
400-460	Dead man: checks for end of game. If so, jumps to 500. Otherwise shows score, waits, erases it, and either continues with a new beastie, or returns.
420	SCREEN10,7 puts the cursor at line 10, position 7
440	As line 420
500-530	Game over: gives final score, and tests for restart.
520	Test for a string starting with 'y' or 'Y'.
500	SCREEN1,15 puts the cursor at the bottom left corner of the screen.
900-990	Rules. CLS clears the screen.
920	[CTL D] is the squiggle symbol (see Table 1).
1000	Sets up the address of the USR routine (with DOKE), and clears variables. Actually they're clear already, but this line allows us to put them in BASIC's variable list in a specific order, which is useful for making fast access to important variables.
1010-1020	Set up more variables.
1030-1040	DOKE the machine code routine, called by USR(0). It has the same ffect as INKEY, GET, etc. The routine is called once, at line 300, and this should be changed on other machines.
1050-1060	Set up the array of movement codes. A() has dimension 8, so no DIM is needed.
1070	Sets up probability Y, and clears screen. A restart comes here.
1080-1120	Draws border around play area.
1130-1140	Initialises values, and starts the game.

If you find that using keys 1-8 is inconvenient, then change the input function called at 300, so that the keys that you use are converted to values in the range 49-56, corresponding to the ASCII codes of 1-8. A code of 0 should be returned if no key is pressed. An alternative to this is to use a joy-stick.

Table 1: Graphics

Symbol	Code	Variable	Lines where used	Use
═	95	E	1010	Top of play area
═	126	F	1010	Bottom of play area
/	47	G	1010	Left of play area
\	92	H	1010	Right of play area
Ω	7	I	1010	Man
*	42	J	1010	Beastie
≈	4	K	1010	Squiggle
[SPC]	32	P	1020	Space (!)
□	0	none	1120, 75	Corners of area

Table 2: Screen Values

Value	Variable	Lines where used	Use
2058	TL	1020	Top left of play area border
2103	TR	1020	Top right of play area
2954	BL	1020	Bottom left of play area
2999	BR	1020	Bottom right of play area
2530	U	1020	Screen centre
±65	none	1060, 200	See text
±64	none	1060,1 100,1110	See text
±63	none	1060	See text
44	none	200	TR-TL-1 = width of game area

Table 3: Variables not listed in tables 1 or 2

A()	Address offsets for various move directions
A	Address offsets for man movement, or 0 if stopped
D	" beastie "
Q	" squiggle ", or 0 if no squiggle
M,B,S	Locations of man, beastie and squiggle, respectively
L	Skill level
N	Score
T	Number of men left, including one on screen
V,W	Various temporary values
X	See program breakdown, line 20
Y	Probability
Z	Y times 5
BB	Bounced flag

PROGRAM LISTING

```
1     REM Bouncing beastie - D. A. H. Elworthy -June
      82
10    DEFFNR(X) = A(INT(RND(1) * 8 + 1)):GOTO900
19    REM Move subroutine.  Full details in text
20    W = W + V:BB = 0:X = PEEK(W)
30    IFX = PTHENRETURN
40    IFX = ETHENV = V + 128:GOTO90
50    IFX = FTHENV = V - 128:GOTO90
60    IFX = GTHENV = V + 2:GOTO90
70    IFX = HTHENV = V - 2:GOTO90
75    IFX = 0THENV = - V:GOTO90
80    RETURN
90    W = W + V:X = PEEK(W):BB = 1:GOTO30
99    REM Squiggle subroutine
100   POKES,P:W = S:V = Q:GOSUB20:S = W:Q = V
110   IFBB = 1THENQ = 0:RETURN
120   IFX = ITHEN400
130   POKES ,K
140   IFRND(1) > ZTHENRETURN
150   V = M - S:W = 1:IFV < 0THENW = - 1:V = ABS(V)
160   IFV < 64THENQ = W:RETURN
170   Q = W * 64:RETURN
199   REM Introduce a new beastie
200   B = TL + 65 + INT(RND(1) * 44):D = FNR(0):G-
      OTO230
209   REM Beastie move routine
210   POKEB,P:W = B:V = D:GOSUB20:B = W:D = V
220   IFX = ITHENPOKEB,P:GOTO400
230   POKEB,J:IFRND(1) < YANDQ = 0THEN
      Q = FNR(0):S = B
240   IFRND(1) < YTHEND = FNR(0)
249   REM Deal with squiggle, if any
250   IFQTHENGOSUB100
259   REM Man move routine
260   POKEM,P:W = M:V = A:GOSUB20:A = V:M = W
270   IFX = PTHENPOKEM,I:GOTO300
280   IFX = JTHENN = N + 10:POKEM,I:Y = Y * 2:Z
      = Z * 2:GOTO200
290   IFX = KTHENN = N + 1:POKEM,I:Q = 0
300   V = USR(0):IFV = 0THEN330
310   IFV < 49ORV > 56THENA = 0:GOTO330
320   A = A(V - 48)
329   REM Squiggle again
330   IFQTHENGOSUB100
340   GOTO210
399   REM dead man routine
400   T = T - 1:IFT = 0THEN500
410   Q = 0:POKES,P:POKEB,P:A = 0:M = U
420   SCREEN10,7:PRINT"Score:"N"Men left:"T
430   FORV = 1TO1000:NEXT:SCREEN10,7
440   PRINT" [30SPC ]"
450   IFQTHENRETURN
460   GOTO200
499   REM end of game
500   SCREEN1,15:PRINT:PRINT:PRINT"Final
      score"N
510   INPUT"Another game";AS
520   IF(ASC(AS)AND223) = 89THEN1060
530   END
899   REM Initialisation
900   CLS:PRINT" [15SPC ]BOUNCING
      BEASTIE":PRINT
910   PRINT"Jump on the beasties ( * ) for 10 points."
920   PRINT"Jump on the squiggles ( [CTL D ]) for 1
      point."
930   PRINT"You have three men.  Move them with
      the following keys:"
940   PRINT"  3"
950   PRINT" 2   4"
960   PRINT"1  .    5  0 stops movement."
970   PRINT" 8   6"
980   PRINT"  7"
990   PRINT"Good luck:":PRINT
1000  DOKE4100,3200:A = 0:B = 0:C = 0:D = 0:M = -
      0:Q = 0
1010  R = 0:S = 0:E = 95:F = 126:G = 47:H = 92:I = 7:-
      J = 42:K = 4
1020  P = 32:U = 2530:TL = 2058:TR = 2103:BL = 2954:
      BR = 2999
1030  FORV = 3200TO3210STEP2:READW:DOKE
      V,W:NEXT
1040  DATA25311,312,18351,10927, - 8179,233
1050  FORV = 0TO8:READA(V):NEXT
1060  DATA0, - 1, - 65, - 64, - 63,1,65,64,63
1070  INPUT"Skill level";L:Y = .05 * L:CLS
1080  FORV = TL + 1TOTR - 1;POKEV,E:NEXT
1090  FORV = BL + 1TO BR - 1:POKEV,F:NEXT
1100  FORV = TL + 64TOBL - 64STEP64:POKEV,G
      :NEXT
1110  FORV = TR + 64TOBR - 64STEP64:POKEV,-
      H:NEXT
1120  POKETL,0:POKETR,0:POKEBL,0:POKEBR,0
1130  T = 3:A = 0:C = 0:M = U:N = 0:Q = 0
1140  Z = 5 * Y:GOTO200
```

HINTS ON CONVERSION

The three tables give details of graphics, screen references, and variables.

Obviously, different machines run at different speeds. The BASIC used was NASCOM ROM BASIC. If the program is found to run too fast, I suggest that line 20 be renumbered 25, and this line entered:

20 FORAA = 1TOn:NEXT where n is a value which gives an acceptable speed.

The play area is 44 spaces wide, by 13 lines deep (excluding borders); the corners of the borders are at the addresses held in TL, TR, BL and BR, and the width is referred to in line 200. On the Nascom screen lines are 64 bytes apart in memory (although only 48 bytes of those 64 are shown); hence the values of 63, 64 and 65 used for movement, and in setting up the borders (see Table 2).

All PEEKs and POKEs are to the screen. DEEKs and DOKEs, peculiar to Nascom BASIC, are detailed in the program breakdown, and will not be needed on machines other than the Nascom. Commands specific to Nascom BASIC are also given in the How It Runs section.

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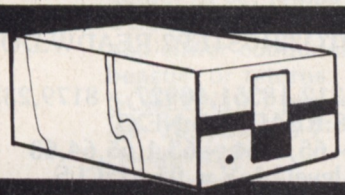

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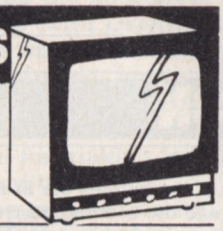
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TECHNIQUE

USER DEFINED GRAPHICS

Ever wondered how to make a Space Invader? David Harwood shows you how to get the most out of your Spectrum graphics.

Before starting to define characters on the Spectrum, we must first understand how numbers are stored in computers.

The Spectrum, and other computers, hold numbers in binary form, which is another name for base 2. We work with decimal numbers, base 10, where the digits can be from zero to nine. In base 2 the digits can either be one or zero.

The groups of one's or zero's, which are called bits (short for *binary digits*), are held in the computer in sets of eight, known as bytes.

A single byte can be any number, in decimal 0-255, in binary 00000000 to 11111111.

To change binary to decimal we must look at the position of the 1's. Let us look at an example (Fig. 1)

Figure 1

128	64	32	16	8	4	2	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
1	0	0	0	1	1	1	1

and see how this works. The first column is 2^0 so if there is a 1 in the first column, add 1 to our new decimal number. The second column is 2^1 so if there is a 2 in the second column, let us add 2 to our decimal number. The third column is 2^2 so if there is a 1 in the column, add 4 to our decimal number and so on up to 2^7.

We now have found out that 10001111 is 1 + 2 + 4 + 8 + 128 = 143.

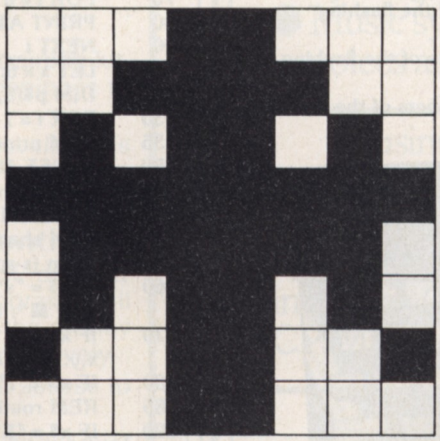
You may be asking yourself what has this got to do with defined characters. In order to define your own character, draw an 8 by 8 grid, and draw your character on this grid, shading in the required squares.

Each row of eight squares can now be thought of as a byte (eight-bit binary number) with a 1 representing a shaded square and a 0 representing an unshaded square.

Let us consider drawing an invader.

We can convert the invader character (Fig. 2) into eight bytes.

Figure 2



(0—unshaded: 1—shaded).
00011000 1st Byte
00111100 2nd Byte
01011010 3rd Byte
11111111 4th Byte
01111110 5th Byte
01011010 6th Byte
10011001 7th Byte
00011000 8th Byte

Binary numbers can be entered directly on the Spectrum by using the BIN command. If you type in PRINT BIN 10001111, the computer will print the decimal form of this number. You are allowed to use BIN in an INPUT statement.

Having converted the invader into binary numbers we must now assign it to a key, so that when we press this key in graphics mode we get the invader character. (Defined characters can be assigned to the letters A to U). In order to do this we must store the eight bytes at eight separate addresses (places in the memory). If, say, we pick the letter "i" to have the invader character, then USR"i" is the first address to store the first byte, USR"i" + 1 is the second address to store the second byte and so on. So for our invader character, type in:

```
POKE USR"i"     , BIN 00011000
POKE USR"i" + 1, BIN 00111100
POKE USR"i" + 2, BIN 01011010
POKE USR"i" + 3, BIN 11111111
POKE USR"i" + 4, BIN 01111110
POKE USR"i" + 5, BIN 01011010
POKE USR"i" + 6, BIN 10011001
POKE USR"i" + 7, BIN 00011000
```

Typing in "i" in graphics mode will now give you an invader character, which can be treated like any other character and is also able to be printed on the printer.

Fig. 3 shows this program.

On running it, you will be asked for the letter to be assigned the defined character, which is stored in A$, and then you will have to type in the eight binary numbers for that defined character.

The Program

Drawing characters on paper is very time consuming so I have included a program (Fig. 4) which allows you to design a character on the screen and then assign it to a certain key. On running the program, an 8x8 grid will be shown with a flashing pointer in the first box. You can either move over every box automatically or by using the cursor controls move to any point in the grid.

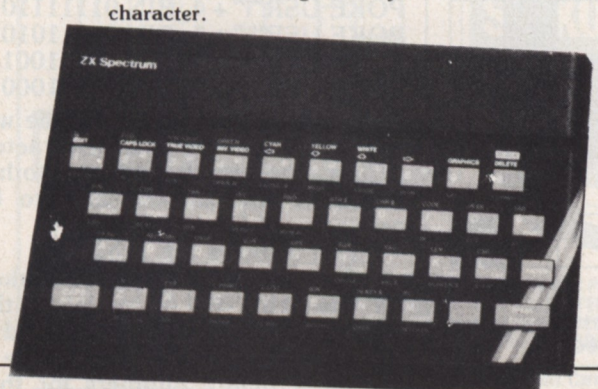
USER DEFINED GRAPHICS

HOW IT RUNS

Lines 10 – 50	Defines a box character for use in the grid.
Lines 70 – 90	Prints the 8 x 8 grid. (To get the box, press 'p' in graphics mode).
Line 110	Sets the screen position.
Lines 120 – 130	Sets up 8 binary numbers (value 0) into a string.
Line 135	Prints flashing cursor in first box.
Lines 150 – 250	Shades a square if 's' is pressed. Leaves a space if 'u' is pressed. Moves around the grid depending on what cursor keys you press.
Lines 190 – 200	Will print, from where you have moved, a shaded or unshaded square, according to what was there before. If these lines were not there you would get flashing cursors in every position where you went. Erase these lines to see what happens.
Line 210	Will add 1 to X if X$ = "6" and subtract 1 from X if X$ = "7".
Line 220	Will add 1 to Y if Y$ = "8" and subtract 1 from Y if Y$ = "5".
Lines 230 – 240	Will move you to the opposite square if you get to the edge of the grid.
Lines 255 – 263	Prints over the pointer.
Lines 264 – 320	Assigns your character to a chosen key.
Line 265	LINE L$ will await for a string input, although the quotes are not printed.
Line 300	CHR$ (CODE L$ + 47) is the character L$ in graphics mode.

List of Variables

T	Is a dummy variable, as it has no real purpose, only being used as a control in a loop.
A	Holds the value of the defined box character.
I	Used in a loop for printing the grid – a row at a time i number of lines down the screen.
X	Used to hold x (line) co-ordinate of the flashing pointer.
Y	Used to hold y (column) co-ordinate of the flashing pointer.
P$ (8,9)	Used to store the eight binary numbers of the defined character. (P$ (8,9) reserves 8 dimensioned strings, each of 9 spaces long. The first space is used to hold BIN, the other 8 are used to hold the binary number. We can then use VAL P$ (L) where t is 1 – 8, to work out the value of the string).
X$	Stores key pressed.
L$	Used to hold letter to be assigned new character.
C$	Used to hold yes or no, whether to finish or return to program.



HINTS ON CONVERSION

If you wished to change the program to your computer, providing it is capable of user defined characters, you would have to change lines 30 – 50, which define a box character (on the BBC micro, for instance, you would put: 30 VDU 23, 255, 255, 129, 129, 129, 129, 129, 129, 255) to suit your micro. Also lines 265 – 290 would have to be changed to whatever system your computer uses to create user defined graphics.

The string handling can be implemented on to your computer if you change line 130 to:

130 FOR t = 1 to 8: LET p$ (t) = "BIN": NEXT t

and then add the following line:

131 FOR t = 1 to 8: FOR s = 1 to &: LET p$ (t,s) = "0": NEXT s: NEXT t

PROGRAM LISTING

Figure 3

```
10 INPUT "Type in letter to be assigned character ";A$
20 FOR t = 0 to 7
30 INPUT "type in row ";r
40 POKE USR A$ + t,r
50 NEXT t
```

Figure 4

```
10    REM user defined characters
20    REM define a small bot to P
30    FOR t = 0 TO 7: READ a
40    POKE USR "P" + t,3: NEXT t
50    DATA 255,129,129,129,129,129,129,255
60    REM draw 8X8 grid
70    FOR i = 6 TO 13
80    PRINT AT i,12;"□□□□□□□□"
90    NEXT i
110   LET x = 6: LET y = 12
120   DIM p$(8,9)
130   FOR t = 1 TO 8: LET p$(t) = "BIN 00000000": NEXT t
135   REM print flashing marker
150   PAUSE 1000
153   REM scan keyboard
155   LET x$ = INKEY$
157   REM shade or leave a space depending on key held
      down (s-space u = unshaded)
160   IF x$ = "s" THEN LET p$(x – 5,y – 10) = "1": PRINT AT
      x,y;"■": LET y3y + 1
170   IF x$ = "u" THEN LET p$(x – 5,y – 10) = "0": PRINT AT
      x,y;"□": LET y = y + 1
180   IF x$ = "f" THEN GO TO 260
185   REM routine to move pointer around grid
190   IF x$ = "5" OR x$ = "6" OR x$ = "7" OR x$ = "8" THEN
      IF p$(x – 5,y – 10) = "0" THEN PRINT AT x,y;"□"
210   LET x = x + (x$ = "6") – (x$ = "7")
220   LET y = y + (x$ = "8") – (x$ = "5")
230   IF y = 20 OR y = 11 THEN LET
      y = 19* (y = 11) + 12* (y = 20): LET
      x = x + (y = 12) – (y = 19)
240   IF x = 5 OR x = 14 THEN LET x = 13* (x = 5) + 6* (x = 14)
250   GO TO 140
255   REM print over pointer
260   IF p$(x – 5,Y – 10) = "0" THEN PRINT AT x,y;"□"
263   IF p$(x – 5,y – 10) = "1" THEN PRINT AT x,y;"■"
264   REM routine to assign character to a key
265   INPUT "letter (a – v) to be assigned character "; LINE ($
270   FOR t = 0 TO 7
280   POKE USR l$ + t,VAL (p$(t + 1))
290   NEXT t
300   PRINT AT 20,0;"Here is the character ";CHR$ (CODE
      l$ + 47)
310   INPUT "Is this alright? (yes or no) "; LINE c$
320   IF c$(1) = "n" THEN LET x = 6: LET y = 12: GO TO 140
```

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TANDY COMPUTER CENTRE



LOOK BEFORE YOU LEAP

In the second of our regular series on computer dealers we look at the Tandy Computer Centre to find out what they can do for you if you want a TRS 80.

Tandy Computers is the only computer manufacturer to build up a chain of high street stores selling a complete range of its products.

The idea is based around a single concept to provide hardware, software and support for anybody who wants to use a TRS-80 computer in either business, hobby or educational applications. Now there are 18 Tandy Computer Centres throughout the country with plans to double this figure over the next year.

Inside a Tandy Centre you will find everything you need displayed neatly and accessibly which is a welcome change. These centres are set up as places where a person can go to find the right machine for the purpose they want, take advantage of support and trained on the computer. The one I saw looked as if the idea works. Each centre carries the full range of Tandy computers, starting at the small hand-held computer, through the Model I and III and the Color Computer, to the Model II machine, which is the business work horse. These are all fully supported with disc units and printers to suit anybody's needs.

The first striking thing when you go into a Tandy Centre is the range



of machines on display and being demonstrated. There are plenty of staff capable of showing you virtually any facet of the machines on show. Present at the centres are a computer marketing representative, who looks after the business side of the machines, a customer support representative, who is responsible for the software packages and the applications training, and an engineer. This means that on top of the normal sales staff there are people around who should be able to handle any problems that are thrown at them.

One great advantage with the Tandy shops is that they are a part of the organisation that develop and build the machines. This alleviates the problem that most computer buyers run across in trying to get information from a dealer who is usually out of touch with the supplier and under-informed about the product and its peripherals. This is solved in the Tandy shops where you can buy Tandys own range of accesories, such as printer ribbons, discs and cassettes, for all their machines.

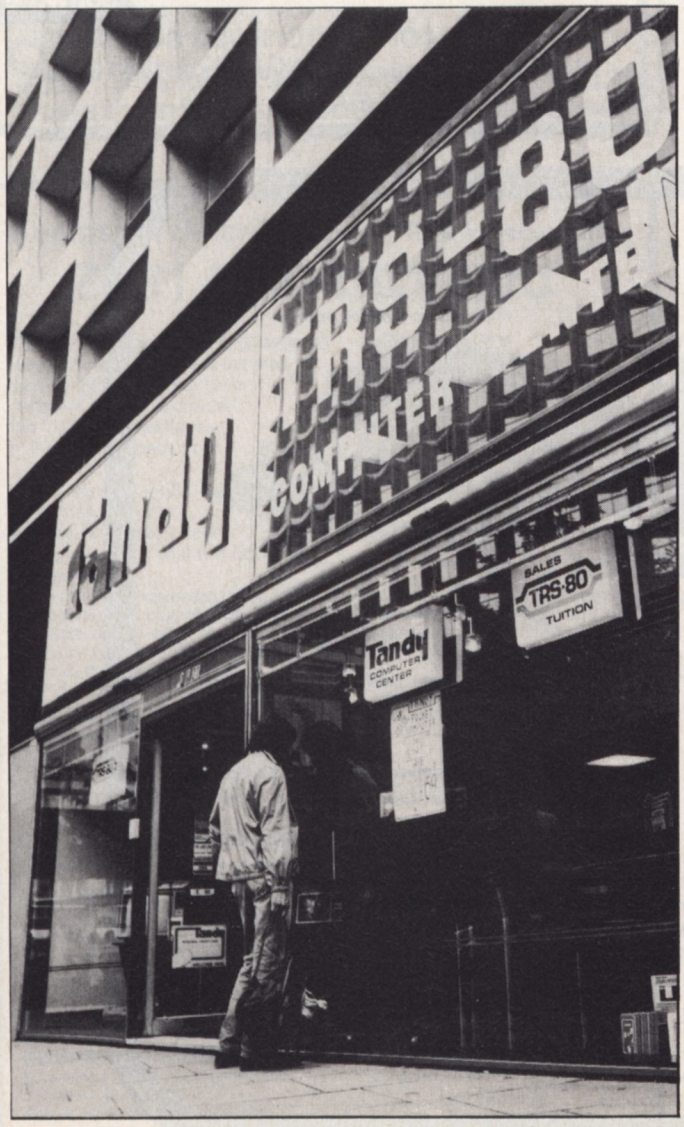
The TRS-80 range of computers rank high in support as far as software goes, and the Computer Centres really make the most of this. Apart from stocking and demonstrating their own range of software, they also have produced a massive directory of independent software which gives details of where you can buy it, what it does and on what machines it runs. This valuable document retails for under £1.00 and is obtainable from the shops.

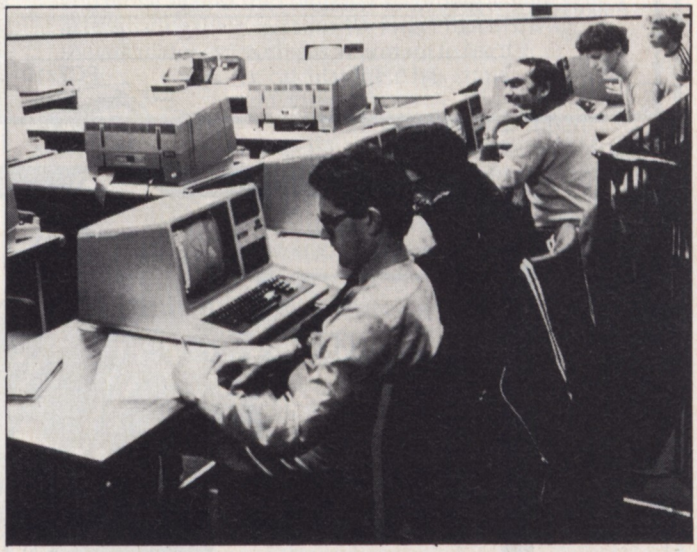
The support doesn't stop there though because at each Computer Centre there is a full classroom facility. This is used primarily to give courses to the business users, giving them training on the packages they have bought and on the computer concept in general. For the home or hobbiest user the classrooms are available for people to run 'teach ins' on Saturday mornings. You can get details of courses when you buy a machine.

These sessions are run by ordinary users who feel like sharing their knowledge with anybody who is interested. Each classroom is very well fitted out with different machines that can be interconnected to allow the teacher (or educator, as Tandy call them) to monitor what the pupils are doing and give them assistance through their computer screens.

For user groups Tandy produces a newsletter available through the shops and Tandy will actively participate in workshop schemes that the clubs run themselves as well as making the classrooms available.

If you are interested in buying a Tandy computer a visit to your local centre is very worthwhile and will give you a clear idea of what the machines can do and whether any of them are up your street.







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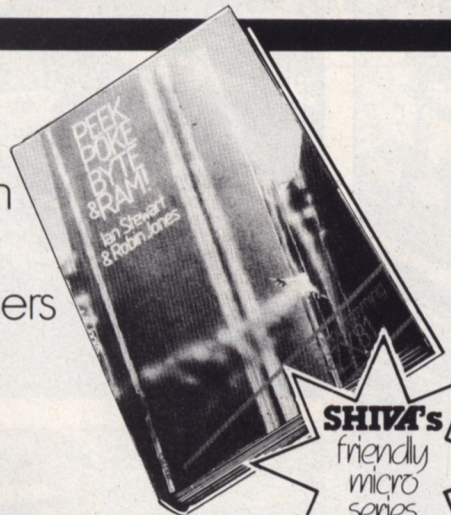

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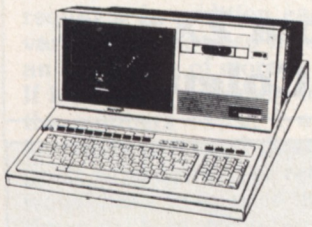

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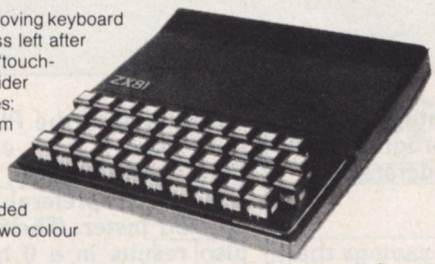

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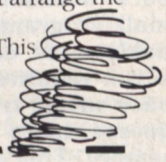
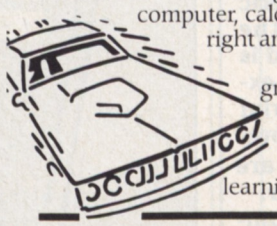


NUMBER CHASER. Designed to improve estimating and multiplication skills for 5-12 year olds. A car race where you move against the computer according to your skill at estimating the given sum. We forget that in the age of the calculator estimating is important to see if your computer, calculator etc has come up with the right answer.



Number Chaser has superb graphics and sound—you would not want more than a few of these in a classroom at any one time since the level of excitement, as well as learning, is very high.

FACEMAKER. This is designed to improve spelling, to expand vocabulary and also sharpen observational skills. Designed for 5-12 year olds this is an interactive program where you draw people's faces.

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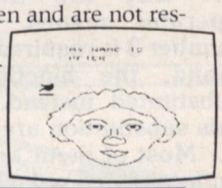
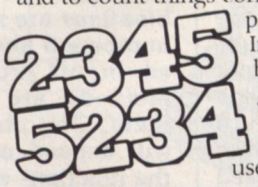


A beautifully crafted piece of software that will find many applications in school and at home. It will also be of special benefit to people teaching children who are slow to learn to read.

WE WANT TO COUNT. This is a program for children of three years and upwards who want to learn numbers and to count things correctly. There are four parts in the program with games-type graphics. In two of these you can select levels between one and five. This program has been designed to be extremely simple to operate so that, once loaded, children can use it entirely on their own.



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TECHNIQUE

MEMORY SAVING ON THE ZX81

Having trouble fitting your programs into a ZX81? Then follow these suggestions by Philip Coley.

The Sinclair ZX81 is an amazing machine, but as all users of the basic 1K unit know the memory space available only allows very small programs to be written. To enable more complex programs to be run requires the use of various space saving tricks so that you can squeeze more into the available memory. This article deals with the amazing uses for the function PI and the memory saving techniques they allow.

One of the largest users of storage space is the use of numeric literals within a program. The method in which these are stored is shown in diagram 1a. This is an example of a command line to print the letter A three spaces in. It shows that seven bytes or characters are required to store the number. Diagram 1b shows the same command line substituting PI for the number three, this shows a saving of six bytes, resulting in a 1/3 saving in space for the entire line. However the way the Sinclair system operates means that where a number 3 is required in a basic command, the function PI can be substituted instead. Examples of this substitution are shown in Table 1. Most of them are clear cut, but an interesting point is shown by the use of GOTO PI instead of the commonly used GOTO 10 at the end of a program. GOTOs in ZX81 BASIC do not have to specify the exact line to be gone to. Instead it first looks for the number and if that is not found it then looks for the first line number above it. As GOTO 10 usually means GOTO the beginning of a program, GOTO PI can be used instead and give a substantial saving in memory space. A normal line containing GOTO 10 will use 14 bytes, whereas GOTO PI uses 7 bytes, a saving of 50%. Therefore consistent use of PI to replace the number 3 in command lines will result in considerable savings in memory space. In addition, this method has the advantage of not radically altering the program and making it difficult to understand.



Further Savings

There are further space savings that can be made using PI. The various combinations of the other functions with PI produce several useful numbers. The various usable combinations are shown in Table 2. The numbers 0 and 1 are commonly used in all programs and different methods are shown to generate them. The choice of method used will depend on circumstances. All the functions except for NOT have a high priority for calculation and are dealt with first by the basic interpreter. If the number 0 is required in a calculation or in a evaluation statement like IF...THEN, then it is preferable to use SIN PI or TAN PI so as to avoid the use of brackets, which themselves use extra memory space. However in a line where the calculation of the PI function is the only sum, for example in a FOR...NEXT loop, then the use of NOT PI is preferable as it is calculated faster. The statement PI-PI also results in a 0 but as it uses 3 bytes of storage and has a low priority, it is not to be recommended.

If the number 1 is required then the statement SGN PI is nearly always to be preferred. It has a high priority and uses only 2 bytes of storage. This is to be compared with the 3 bytes required for the statement PI/PI and the time consuming division it requires.

The other two integer numbers which can be generated from two functions are –1 from COS PI and 3 from INT PI. These are self evident and can be used anywhere that these numbers would be required.

These numbers are so economical in their use of memory that further savings can be made by

removing unnecessary LET commands. In most programs a great deal of use is made of the LET command to set up variables, for instance LET A = 1. This example uses 15 bytes of memory space for the program and an additional 6 bytes for storage of the variable, a total of 21 bytes. Even if a space saving NOT PI is used instead of the number 1 a total of 16 bytes is still required. In addition each time the variable is specified in the program an extra byte of storage is required. If instead of assigning to a variable the numbers – 1, 0, 1 and 3 the PI functions are used directly at each point where they are required, they would have to be used more than 16 times each to use more space than an equivalent LET statement. In any program where these numbers are used it pays to use them directly if they needed less than 16 times. For example the two program lines:

10 LET A = SGN PI
20 FOR X = A TO 3

use 27 bytes for the program and 24 bytes for the variables, a total of 51 bytes. Whereas the line:

10 FOR X = SGN PI TO 3

uses only 18 bytes for the program and 18 bytes for the variables, an overall saving 15 bytes and if PI was substituted for the 3, a further 5 bytes would be saved.

Certain larger numbers can also be generated using functions and PI. Table 2 only shows the more useful in the sense that they do not use more than 3 bytes of storage each. Other numbers which could be generated can be stored more economically using other space saving techniques. The numbers can be used in BASIC commands or in calculations, although care should be taken to ensure that they are generated when required in a program. Only EXP PI and INT EXP PI will be calculated early due to their high priority. The use of PI results in a considerable saving of user memory in the ZX81. The program shown in figure 3 asks for your name and then prints Hello to you five times before asking if you wish to run it again. If you answer anything but "Y", it will then print out the total number of bytes of program space used for lines 3 to 99. Line 9999 is a useful routine which calculates the program space not counting itself. As the program stands it uses 167 bytes, by using the techniques in this article this can be reduced to 123 bytes, a saving of 26%. Try and modify it and see if you can reach this figure.

There is unfortunately a price to be paid. In this case memory saving can result in longer running times for programs. The sample program does not really show this, but in some programs it could be a problem. However the choice for most users lies between a program which will not fit in to the available memory or a program which works slowly after using these memory saving techniques. So if you wish to squeeze more out of your ZX81 try using these PI memory saving techniques in your programs.

Table 1

```
PRINT TAB PI;"A"
PLOT PI,PI
GOTO PI
GOSUB PI
PAUSE PI
DIM S(PI)
PRINT AT PI,PI;"A"
PRINT A$(1 TO PI)
FOR X = 1 TO PI
UNPLOT PI,PI
```

Table 2

PI	= 3.1415929
SIN PI	= 0
TAN PI	= 0
SGN PI	= 1
COS PI	= – 1
INT PI	= 3
NOT PI	= 0
PI – PI	= 0
PI/PI	= 1
PI + PI	= 6.2831853
PI* PI	= 9.8696044
INT EXP	
PI	= 23
EXP PI	= 23.140693
PI* * PI	= 36.46216

Figure 3.

```
3 PRINT AT 0,3;"NAME?"
10 INPUT A$
20 CLS
30 FOR X = – 1 TO 3
40 PRINT TAB 3;"HELLO";A$
50 NEXT X
60 PRINT AT 6,1;"AGAIN?"
70 INPUT A$
80 CLS
90 IF A = "Y" THEN GOTO 3
9999 PRINT PEEK 16396 + 256 *
PEEK 16397 – 16565
```

DIAGRAM 1A

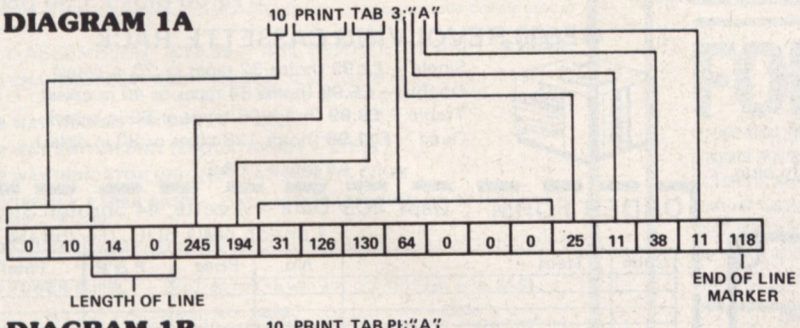
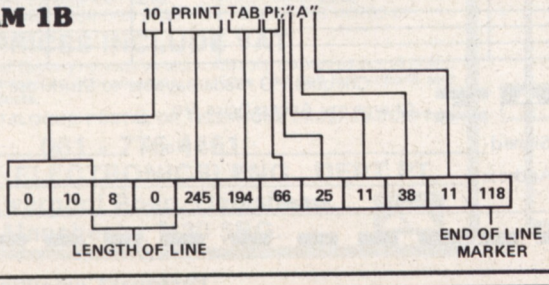


DIAGRAM 1B





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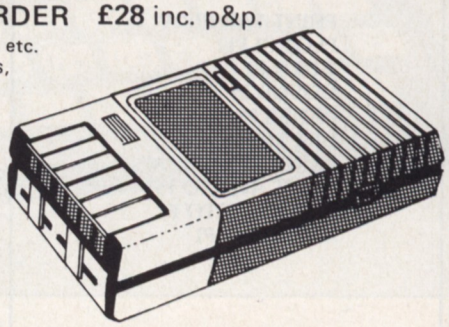

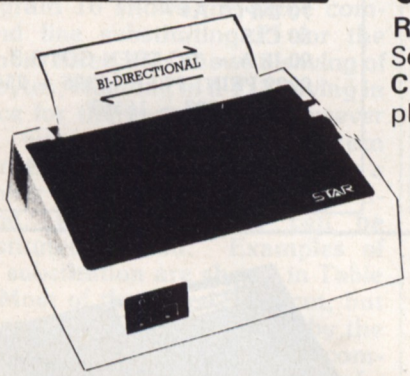

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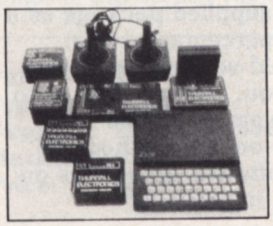

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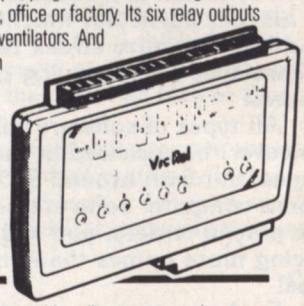

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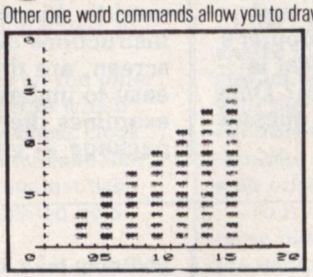

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SOFTWARE REVIEWS

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!

Each program is examined for ease of use, interest level, graphics, etc, and the reviews will be presented in a uniform manner to allow you to compare directly between alternatives.

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. One of our pet hates is when you have to LOAD twice; once just to read screens full of words and again to use the software. Pointless! Far better to supply a few Xerox sheets!

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.

We would very much like to hear from you, our readers, as to your comments (printable ones only please) on our methods of reviewing software. Any ideas on how we can improve it?

Title: Voyager 1
Type: Tape
Supplier: Avalon Hill
Machines TRS-80 Models I & II/TRS-80 Colour/Apple II/Atari 400, 800 32K/PET 32K
Price: £18.95

Released this year by Avalon Hill, Voyager I is one of the better 'seek and destroy' type of games. You are the only human aboard an alien spaceship that is infested by killer robots.

As you may have guessed, your mission is to either, destroy all the robots or, destroy all of the ships generators and escape yourself.

As you roam around the ships 144 locations, you are given a 3-Dimensional, "eye level", view of your locations. Using single keyboard entries, you move around the ship, you may take a laser gun if you happen upon one, turn left or right and move forward or backwards. Occasionally you will come across an elevator which will take you to a new level within the ship, should you require it. Scattered about the ship are generators which you may destroy or use to re-charge your laser gun. There is also an escape shuttle craft which you must locate before you dare destroy the final generator. During your wanderings you use up your energy, and this is shown on a chart, to the right of your display, together with the charge state of your laser gun and the ships generators. Should you chance upon one of the killer robots, you must hope that you are not too exhausted and that your laser gun is charged.

As well as a command to Abandon Ship, there is one other command that you may call upon. This is MAP! Pressing the M key clears the screen and gives you a graphic display of the rooms that you have searched as seen from above. Also shown on the screen are the number of robots remaining and any objects that you have discovered (eg. lasers, generators etc).

The program boasts a sound capability, but I could not make this facility work with my TRS-80 Model I, but this did not detract from my enjoyment of an excellent game that has many features not normally available on a single game. **D.B.**

Ratings Table

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

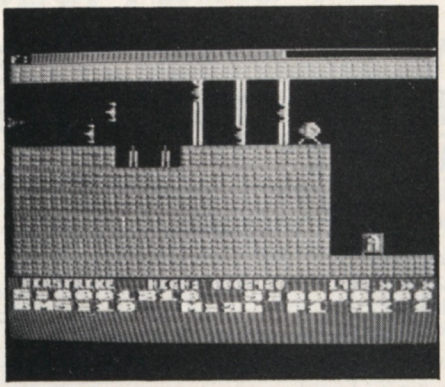
Title: Airstrike
Type: Tape
Supplier: Gemini Electronics
Machine: Atari 400/800
Price: £15.95

Airstrike is a version of the popular arcade game Scramble, whose format is very similar to the original arcade version, with a fighter craft flying horizontally across the screen through a series of caverns and mazes.

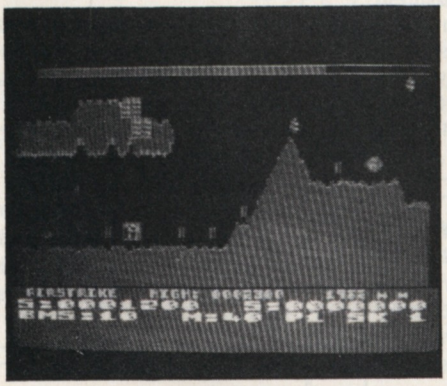
It is divided into three sections. The first section is made up of mountainous terrain which is defended heavily by surface to air missiles. Your mission is to fly throuh this section destroying these missiles while capturing fuel and ammunition dumps which are needed to replenish your ever dwindling supplies.

The second section is populated by fission bombs which are released by satellites and fall like rain across a central cavern through which you must pass. When you have completed these sections successfully you must then enter the labyrinth. To do this you must pass through a series of airlocks which can only be opened if you destroy their activating mechanism.

Once you have entered the first section of the labyrinth you then encounter enemy fighters which guard the airlocks. If you manage to complete this section you then start back at the beginning on a new level where the action is much meaner.



The airlock stage.



Flying across the mountainous terrain.

Airstrike is very difficult to play and unless you are a seasoned gamester takes a long time to master the controls.The best tactic to adopt is to con a friend, wife or lover into operating the smart bomb release button. Otherwise you literally haven't got enough hands to play the game — you need two just to manoeuvre the aircraft and operate the fire button to release missiles.

Despite this the program is well written and uses the Atari computer facilities to the full. I think that this program could easily achieve the cult status of the Atari Pac Man or Star Raiders.

Graphics in this program are up to the Atari computers usually high standard making it a delight to watch both for graphical representation and use of colour.

C.P.

Ratings Table

Program Quality	*****
Value for Money	****
Presentation On-screen	*****
Ease of Use	****
Crashproofing	****
Supplied Instructions	****
Overall	87%

Title: Chess
Type: Tape
Supplier: Sinclair Research
Machine: ZX81
Price: £6.95

Seeing how much of a chess game can be fitted into a limited memory seems to have become a game in itself amongst programmers. Psion has put in its bid with a comprehensive version for the 16K ZX81.

The game has all the standard features found on computer chess programs plus some extra features which make the game that little bit more acceptable. These are En Passant captures and Castling. Moves are input in standard algebraic notation and a diagram of the board labelling is given in the instructions.

This game also allows you to set up your own board positions and then play them out. This also means that you can change the game parameters in the middle of a game or even to change sides.

There are six levels of play with the lowest taking about five seconds to execute in full and the highest literally taking hours to think about and reply to a move. The screen display is adequate though not stunning, using letters to stand for the pieces.

Including as a bonus on the other side of the tape is a program which simulates the action of a chess clock. A welcome addition for someone like me who prefers playing against flesh and blood to being humiliated by a computer.

C.P.

Ratings Table

Program Quality	****
Value for Money	****
Presentation On-screen	***
Ease of Use	***
Crashproofing	***
Supplied Instructions	****
Overall	70%

Title: Acquire
Type: Tape
Supplier: Avalon Hill
Machines TRS-80 Models I & III/Apple II/PET
Price: £12.95

Acquire is a strategy game for 1 to 6 players, wehre the object is to start hotel chains and expand them by building further hotels around them. At the same time, each player may buy shares in any hotel chain, even those started by other players. The player with the most shares in the chain controls that chain, and may attempt to make a profit by merging his chain with others.

To try and describe this game is more difficult than playing it, as, with the computer doing all the calculations, and updating the displayed playing board, all that is left is for the player to plan his strategy. It is hard to define the type of audience that this game will appeal to, certainly not those who only play the 'arcade' games.

The game, which does not make use of any graphic features, is written in machine language and is, therefore, fast in its reaction time.

D.B.

Ratings Table

Program Quality	***
Value for Money	****
Presentation On-screen	**
Ease of Use	***
Crashproofing	***
Supplied Instructions	****
Overall	65%

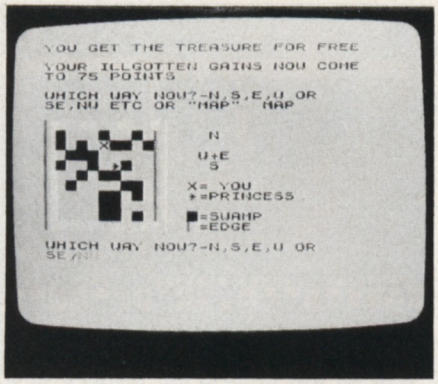
SOFTWARE REVIEWS

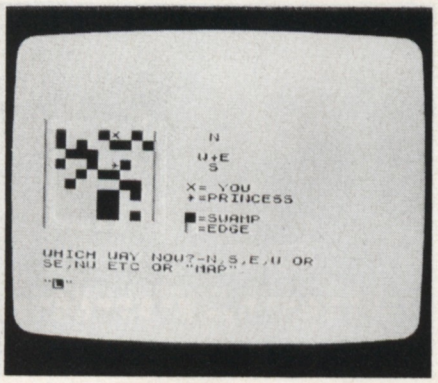
Title: **Perilous Swamp / Sorcerers Island**
Type: **Tape**
Supplier: **Sinclair Research**
Machine: **ZX81**
Price: **Tape £4.75**

Trapped in a swampy forest, dark slimy reeds surround you, deep black tar pits scattered in your path and many hideous creatures waiting in the shadows.

This is the scene that unfolds in front of you as you start the Perilous Swamp adventure. The tape has two adventures on it that run in the ZX81 with 16K memory expansion.

The adventures follow a fairly standard format, where you give the computer instructions how to move about the game map and the computer responds by giving you details of your surroundings, location, what treasure is there and what you have to do to take it. If you encounter a monster then you are given the option of fighting, running or bribing the creature to gain your freedom, or the treasure.





If you choose to fight then you are asked to pit a certain amount of strength points in the battle. The computer will then fight the battle with you and display the outcome. It is best to leave the bribery option till later in the game whn you are low on combat points. However, if you feel that you don't stand a chance you can try and run, which, if you are quick enough will save you.

The game is fun to play even with the limitations of the computer, which seems unfairly biased to the monsters. As you leave the swamp it shows your score in terms of how many righteous monsters died guarding treasure which was rightfully theirs.

C.P.

Ratings Table

Program Quality	***
Value for Money	****
Presentation On-screen	***
Ease of Use	****
Crashproofing	**
Supplied Instructions	***
Overall	63%

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LITTLE BLACK BOOK

Sick and tired of racking your brains for a friend's right 'phone number or address? Then try out David Berry's answer to the problem with this telephone and address book so that all those important numbers are at your fingertips. Put them into your Atom and stop the frustration of dialling the wrong number time and time again.

This is a suite of three programs for the Acorn Atom. Between them they set up, maintain and examine a cassette based telephone/address list; but with very minor modifications can be converted to suit your own database requirements.

The largest program requires a lower text space of 4K, and they all need a 3K upper text space (equivalent to mode 3 graphics capability).

They use many of the facilities and tricks available in Atom BASIC such as the use of the upper text space for data storage, and selective assembly of machine code routines.

Throughout this article the American pound sign (hash) — which usually indicates hexadecimal numbers-has been replaced by the British pound sign (£); and the program labels, normally inverted capitals, have been replaced with lower case underlined, e.g. x.

The first program "TELEWRITE", accepts data from the keyboard, entered on a "form" displayed on the screen. Each complete form is stored as a record in memory starting at address £8200; when the memory is full (or earlier on command) the data is downloaded to the cassette tape. This sequence may continue for as long as necessary setting up a series of "pages", each containing up to 2.5K bytes of data on the cassette.

The second program "TELEREAD", draws the same form on the screen then accepts one string as input, positioned on the form against the appropriate heading, by means of the cursor control keys. It then uses the string as a search string. The pages on the tape are loaded and searched one at a time, until a match is made, then the complete record is displayed.

"TELEAMM" completes the set by providing facilities for modifying and resaving pages of data. It is designed to be used in conjunction with "TELEREAD". First the entry to be changed is found using "TELEREAD" then, without clearing the memory or typing NEW, "TELEAMM" is loaded and run; the record address being preserved from one program to the other.

HINTS ON CONVERSION

The fact that the forms displayed by the programs are not saved on the data tape means that the programs can easily be modified to suit any other similar data storage and retrieval system. The simplest adaptations can be made by replacing my form with your own. If you do so you will need to keep the length of the headings to below nine characters, or have to change the cursor control and input string search routines in "TELEWRITE" and "TELEREAD" respectively. Additionally, if you vary the number of headings you will need to change the various loop parameters.

The following table lists the commands available to the user, obviously if you have a friend with the surname of .END you are going to have problems. Put another way: think of the commands as reserved words.

Command	Program	Effect
.END	all	Terminates run
.DSP	all	Displays contents of memory byte by byte.
.LDT	TELEWRITE, TELEAMM	Loads page of data to tape.
.CLR	TELEREAD	Clear memory (automatic in TELEWRITE).
.ALL	TELEREAD	Displays all records on current page.
.MVE	TELEAMM	Moves data pointer to address entered after prompt.
.ERR	TELEWRITE	Aborts current record input moves data pointer back to start of record to allow overwrite.

"TELEWRITE" will only accept commands entered as the first line of input (i.e. in the "SURNAME" position), except for .ERR which may be in any line except the first line.

The flashing "STOP TAPE" signs can be turned off by holding down the shift key. This key is also the one to press to change the displayed data during a .DSP sequence.

Prompts may be answered by "YES", "NO" or any string starting with "Y" or "N". Default is usually "N", so pressing the return key counts as a "NO". This is useful in a number of situations, notably when used simultaneously with the repeat key to step through all the records after the .ALL command.

If all this sounds confusing, that's because it is much more difficult to describe than demonstrate. The name of the game is "experiment" so if you think a particular command sequence should work give it a try — it probably will.

PROGRAM LISTING

"TELEWRITE" LISTING PROGRAM

```
 10 DIM B(12),LL(1)
 20 aH=0
 30 P.$12,'''''''"CLEARING MEMORY"
 40 A=£8200
 50 GOSUBz
 60 cP.$12
 70 PRINT"sp9 TELEPHONE LIST" ' "spll DATA INPUT"'
 80 PRINT" SURNAME" ' "INITIALS" ' " ALTNAME" '
    "STD CODE" ' "sp2 NUMBER" '
 90 PRINT"sp3 HOUSE" ' "sp2 STREET" ' ' "sp4 TOWN"
    ' "sp2COUNTY" ' "POSTCODE"
100 PRINT' "sp3 NOTES"
110 FOR V=0 TO 10; P.$£0B; N.
120 M=A
130 H=H+1
140 GOSUBw
150 INPUT $A
160 IF $A=".DSP" GOTOf
170 IF $A=".END" P.S12'''''''"TERMINATED!"; END
180 IF $A=".LDT" GOTOb
190 R=£20
200 U=£48
210 FOR V=1 TO 10
220 U=U+£20
230 ?£El=0
240 ?£DE=U
250 ?£El=£80
260 ?£8060=£09
270 ?£8128=R
280 IF V=6 THEN ?£8008=£20; U=U+£20
290 A=LEN(A)+1
300 GOSUBw
310 INPUT $A
320 IF $A=".ERR" A=M; H=H-1; G.c
330 R=?£8128
340 IF R=£A0 THEN R=£20
350 IF U=£E8 THEN !£DE=£80008108
360 NEXT V
370 A=A+LEN(A)+1
380 $A="EOR+"
390 A=LEN(A)+1
400 IF A>=£8AC4 P.S12''''''"MEMORY FULL"'; GOTOd
410 GOTOc
420 bP.$12'''''''
430 A=LEN(A)+1
440 d$A="E0P£"
450 PRINT" LOAD TAPE"
460 INPUT $B
470 IF CH$B<>£59 PRINT"TERMINATED!"; END
480 H=H-1
490 Q=FOUT" "
500 FOR N=$8200 TO £8BFF
510 BPUT Q,?N
520 IF ?N=0 THEN P."PAGE LOADED"'; GOTOe
530 NEXT N
540 eP.$7; D0
550 !£8140=£100F1413; !£8145=£05100114; FOR
    W=1TO30; WAIT; N.
560 !£8140=£20202020; !£8145=£20202020; FOR
    W=1TO30; WAIT; N.
570 UNTIL ?£B001<>£FF
580 P."DO YOU WANT TO LOAD MORE DATA"
590 INPUT $B
600 IF CH$B=£59 GOTOa
610 PRINT"TERMINATED!"; END
620 wS=35830-A
630 K=1
640 FOR J=4 TO 1 STEP -1
650 J?£81FA=S/K%10+£30
660 K=K*10
670 NEXT J
680 ?£81F9=£0D; ?£81FA=£3D
690 K=1
700 FOR J=2 TO 1 STEP -1
710 J?£81F5=H/K%10+£30
720 K=K*10
730 NEXT J
740 ?£81F4=£12; ?£81F5=£3D
750 RETURN
760 zP.$21; P=£2800
770 !£A0=£008C8200
780 [ \ CLEAR MEMORY 8200 TO 8BFF
790 :LLO LDX £A2; LDY £A3
800 :LL1 STA(£A0),Y; INY
810 BNE LL1; INC £A1; CPX £A1
820 BNE LL1; RTS
830 ]
840 LINK LL0
850 P.$6; RETURN
860 fP.$12
870 FOR C=£200 TO $A00 STEP £200
880 FOR D=£8000 TO $81FF
890 E=C?D
900 IF E<£80 E=E:£60
910 E=E-£20
920 ?D=E
930 NEXT D
940 DO UNTIL ?£B001<>£FF
950 NEXT C
960 A=M; H=H-1
970 GOTOc
```

(Note: 'sp4' means 4 blank spaces etc.)

TELEREAD PROGRAM LISTING

```
 10 @=0
 20 DIM M(63),N(10),LL(1)
 30 aP.$12
 40 P."sp9 TELEPHONE LIST" ' "sp11 DATA OUTPUT" '
 50 P."SURNAME?" ' "INITIALS?" ' "ALTNAME?" ' "STD
    CODE?" ' "sp2 NUMBER?" '
 60 P."sp3 HOUSE?" ' "sp2 STREET?" ' ' "sp4 TOWN?" '
    "sp2 COUNTY?" ' "POSTCODE?"
 70 P.' "sp3 NOTES?"
 80 INPUT $M
 90 IF $M=".END" P."TERMINATED!"; END
100 IF $M=".CLR" GOTOk
110 IF $M=".DSP" GOTOj
120 R=0
130 FOR Q=£8049 TO £81A9 STEP £20
140 R=R+1
150 IF Q=£8149 R=R-1
160 IF !Q<>£20202020 GOTOb
170 NEXT Q
180 P.$12''''''"FAULT — INPUT STRING NOT IN" '
    "CORRECT POSITION"
190 FOR Q=1 TO 250; WAIT; N.
200 GOTOa
210 bP.$12'''''"INPUT ACCEPTED"'
220 INPUT"NEW PAGE",$N
230 IF CH$N<>£59 A=£8200; G.d
240 h?£E1=0
250 F=FIN""
260 FOR G=£8200 TO £8BFE
270 ?G=BGET F
280 IF ?G=£23 G?1=BGET F; G.c
290 NEXT G
300 P.'"FAULT — EOP MARKER NOT FOUND"; END
310 cP.'"HIGHEST MEMORY LOCATION" ' "ON THIS
    PAGE=£",&G+1
```

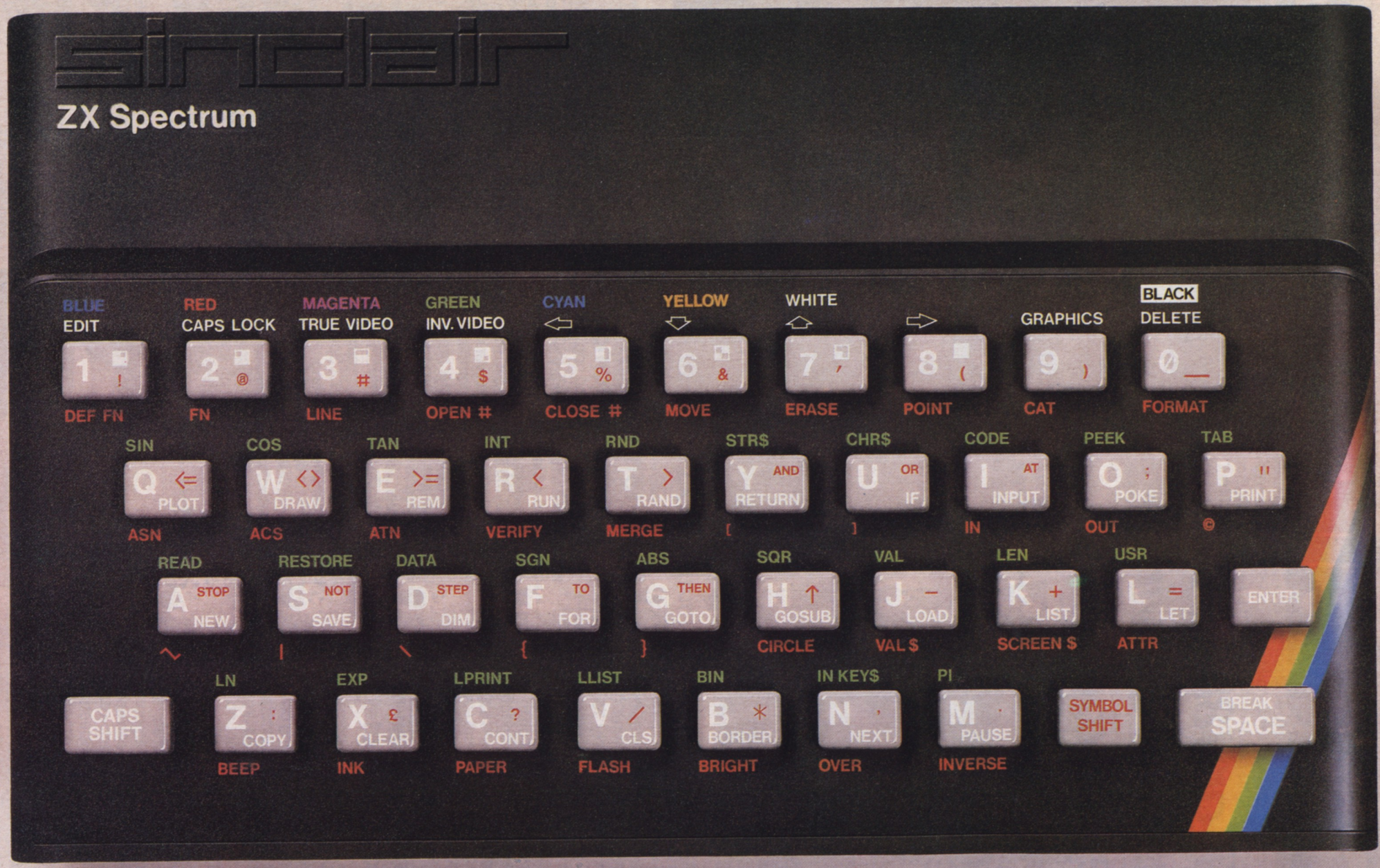
PROGRAM LISTING

```
320 P.$7; D0
330 !£8160 = £100F1413; !£8165 = £05100114
340 FOR Q = 1 TO 30; WAIT; N.
350 !$8160 = £20202020; !$8165 = £20202020
360 FOR Q = 1 TO 30; WAIT; N.
370 UNTIL ?$B001 < > £FF
380 A = £8200
390 dIF $A = "E0P£" OR $A = ".LDT" G.a
400 W = A
410 IF R = 1 GOTOg
420 FOR Q = 1 TO R - 1
430 A = A + LEN(A) + 1
440 NEXT Q
450 gIF $M = $A OR $M = ".ALL" G.e
460 DO
470 A = A + LEN(A) + 1
480 UNTIL $A = "EOR + "
490 B = A + LEN(A) + 1
500 IF $B = ".LDT" B = B + LEN(B) + 1; ?£81FF = £2A
510 IF $B = "EOP£" GOTOi
520 A = A + LEN(A) + 1; GOTOd
530 jPRINT' "NOT ON THIS PAGE"
540 FOR Q = 1 TO 150; WAIT; N.
550 PRINT $12' ' ''' "LOAD NEXT PAGE"
560 INPUT $N
570 IF CH$N < > £59 GOTOa
580 GOTOh
590 eA = W
600 PRINT S12"sp9 TELEPHONE LIST" ' "sp11 DATA OUT-
    PUT"
610 $N = "SURNAME";GOSUBf
620 $N = "INITIALS";GOSUBf
630 $N = "ALTNAME";GOSUBf
640 $N = "STD CODE";GOSUBf
650 $N = "NUMBER";GOSUBf
660 $N = "HOUSE";GOSUBf
670 $N = "STREET":GOSUBf
680 $N = "TOWN";GOSUBf
690 $N = "COUNTY";GOSUBf
700 $N = "POSTCODE";GOSUBf
710 $N = "NOTES";GOSUBf
720 T = 1
730 FOR J = 4 TO 1 STEP -1
740 K = W/T%£10
750 IF K < £A K = K + £39
760 J?£81FA = K - 9; T = T* £10; N.J
770 ?£81F8 = £0D; ?£81F9 = £3D; ?£81FA = £23
780 P.' "CORRECT"
790 INPUT $N
800 IF CH$N < > £59 A = A + LEN(A) + 1; GOTOd
810 P."ANOTHER SEARCH"
820 INPUT $N
830 IF CH$N = £59 GOTOa
840 PRINT"TERMINATED!"
850 END
860 f PRINT' $N,$A
870 A = A + LEN(A) + 1
880 RETURN
890 kP.$21; P = £2800
900 !£A0 = £008C8200
910 [ \ CLEAR MEMORY 8200 — 8BFF
920 :LLO LDX £A2; LDY £A3; TYA
930 :LL1 STA($A0),Y; INY
940 BNE LL1; INC £A1; CPX £A1
950 BNE LL1; RTS
960 ]
970 LINK LL0
980 P.$6; GOTOa
990 jP.$12
1000 FOR C = £200 TO £A00 STEP £200
1010 FOR D = £8000 TO £81FF
1020 E = C?D
1030 IF E < £80 E = E:£60
1040 E = E - £20; ?D = E
1050 NEXT D
1060 DO UNTIL ?£B001 < > ?£FF
1070 NEXT C; GOTOa
END
```

TELEAMM PROGRAM LISTING

```
10 DIM N(9); @ = 0
20 cQ = 0
30 IF W > G + 1 P.$7"OUTSIDE PAGE"; W = £8200; FOR
   J = 1TO150;WAIT;N.
40 DO; W = W + Q
50 P.$12' ' ' '$W' "M = "&W' "ALTER THIS STRING"
60 IF $W = "E0P£" P.' "END OF PAGE!"; W = £8200; END
70 INPUT $N
80 IF $N = ".END" P."TERMINATED!"; W = £2800; END
90 IF $N = ".MVE" IN."RECORD ADDRESS",W; GOTOc
100 IF $N".LDT" GOTOd
110 IF $N = ".DSP" GOTOe
120 Q = LEN(W) + 1
130 UNTIL CH$N = £59
140 M = £2800
150 INPUT"REPLACEMENT STRING",$M
160 D = LEN(M) - LEN(W)
170 IF G + 1 + D > £8BFF P."MEMORY EXCEEDED";
    W = £8200; GOTOb
180 IF D = 0 GOTOa
190 IF D > 0 X = G + 1; Y = W + LEN(W) + 1; Z = -1
200 IF D < 0 X = W + LEN(W) + 1; Y = G + 1; Z = +1
210 FOR L = X TO Y STEP Z
220 D?L = ?L
230 NEXT L
240 a$W = $M
250 INPUT"LOAD TAPE",$N
260 IF CH$N < > £59 GOTOb
270 dF = FOUT" "
280 FOR L = £8200 TO G + 1 + D
290 BPUT F,?L
300 NEXT L
310 P.$7; DO
320 !£8140 = £100F1413; !£8145 = £05100114; FOR J = 1TO30;
    WAIT; N.
330 !£8140 = £20202020; !£8145 = £20202020; FOR J = 1TO30;
    WAIT; N.
340 UNTIL ?£B001 < > £FF
350 bINPUT"MORE CHANGES"$N
360 IF CH$N = £59 IN."RECORD ADDRESS", W; GOTOc
370 PRINT"TERMINTED!"; END
380 eFOR C = £200 TO £A00 STEP £200
390 FOR D = £8000 TO £81FF
400 E = C?D
410 IF E < £80 E = E:£60
420 E = E - £20
430 ?D = E
440 NEXT D
450 DO UNTIL ?£B001 < > £FF
460 NEXT C
470 GOTOc
END
```




sinclair
ZX Spectrum
BLUE EDIT
RED CAPS LOCK
MAGENTA TRUE VIDEO
GREEN INV. VIDEO
CYAN
YELLOW
WHITE
GRAPHICS
BLACK DELETE
1 ! DEF FN
2 @ FN
3 # LINE
4 $ OPEN #
5 % CLOSE #
6 & MOVE
7 ' ERASE
8 (POINT
9) CAT
0 _ FORMAT
SIN COS TAN INT RND STR$ CHR$ CODE PEEK TAB
Q ≤ PLOT ASN
W ≠ DRAW ACS
E ≥ REM ATN
R < RUN VERIFY
T > RAND MERGE
Y AND RETURN [
U OR IF]
I AT INPUT IN
O ; POKE OUT
P " PRINT ©
READ RESTORE DATA SGN ABS SQR VAL LEN USR
A STOP NEW ~
S NOT SAVE |
D STEP DIM \
F TO FOR {
G THEN GOTO }
H ↑ GOSUB CIRCLE
J − LOAD VAL $
K + LIST SCREEN $
L = LET ATTR
ENTER
LN EXP LPRINT LLIST BIN IN KEY$ PI
CAPS SHIFT
Z : COPY BEEP
X £ CLEAR INK
C ? CONT PAPER
V / CLS FLASH
B * BORDER BRIGHT
N , NEXT OVER
M . PAUSE INVERSE
SYMBOL SHIFT
BREAK SPACE

Sinclair ZX Spectr

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

From only £125!



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

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

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

Professional power– personal computer price!

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

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

You have the facility to support separate data files.

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

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

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

Ready to use today, easy to expand tomorrow

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

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

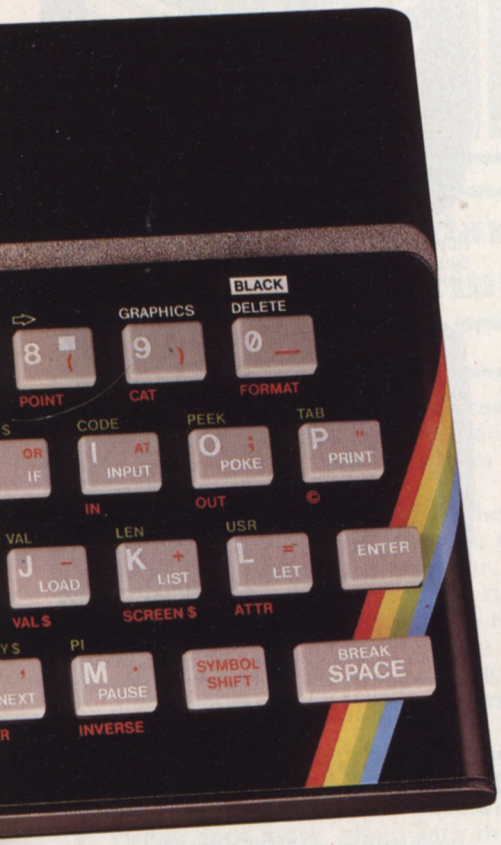
There's no need to stop there. The ZX Printer – available now – is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.



Key features of the Sinclair ZX Spectrum

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

um



RS232/network interface board

This interface, available later this year, will enable you to connect your ZX Spectrum to a whole host of printers, terminals and other computers.

The potential is enormous. And the astonishingly low price of only £20 is possible only because the operating systems are already designed into the ROM.

ZX Spectrum

Available only by mail order and only from

sinclair

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

The ZX Printer – available now

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

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

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

The ZX Microdrive – coming soon

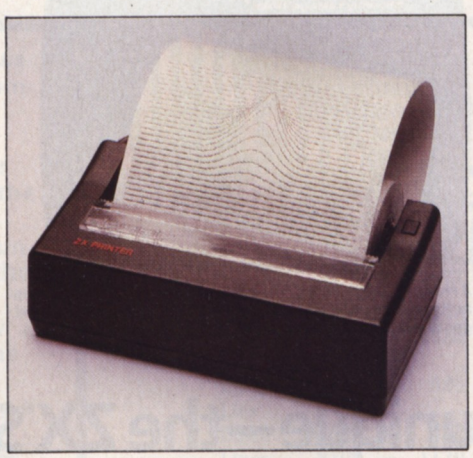
The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy.

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

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.





How to order your ZX Spectrum

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

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

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

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

Please tick if you require a VAT receipt ☐

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

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

*Please delete/complete as applicable

Signature

PLEASE PRINT

Name: Mr/Mrs/Miss

Address

PCT 810

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

ZX Spectrum software: how good and how soon?

The ZX Spectrum uses an enhanced version of Sinclair BASIC, fast becoming a world standard, and unlikely to be superseded. Unique features, such as one-touch keyword entry and syntax check and report, are increasingly attracting software originators.

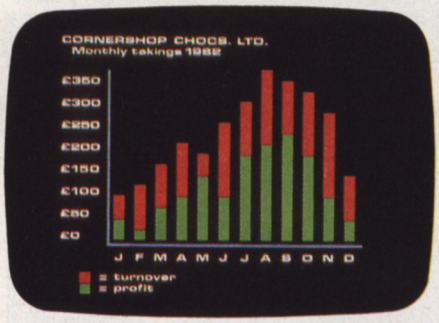
Building the software library is already far advanced, and a complete catalogue will be available in the next few months. Subjects will include sophisticated games, education, 'housekeeping', and business management. The more complex packages can, of course, be used to their best advantage with the full 48K RAM version of the ZX Spectrum.



The Sinclair ZX Spectrum can handle sophisticated games programs with high-resolution colour graphics and sound.



This major advance in computer technology maintains Britain's world-beating position in the field of personal computers.



A range of business software will soon be available, covering both specific applications (eg stock-control and payroll) and general business management systems (eg matrix models).



This second generation of Sinclair personal computers demonstrates continuing commitment. Advanced technology made the ZX80/81 family a price breakthrough: advanced technology makes the ZX Spectrum a breakthrough in price and performance.

Elegant, effective, unique—the ZX Spectrum design.

'Less than half the price of its nearest competitor – and more powerful.'

'These two pictures show how it's done. On the right is the PCB from the BBC Model A Microcomputer. On the left is the PCB from the ZX Spectrum.

'It's obvious at a glance that the design of the Spectrum is more elegant. What may not be so obvious is that it also provides more power.

'The ZX Spectrum has more usable RAM, and higher maximum RAM.

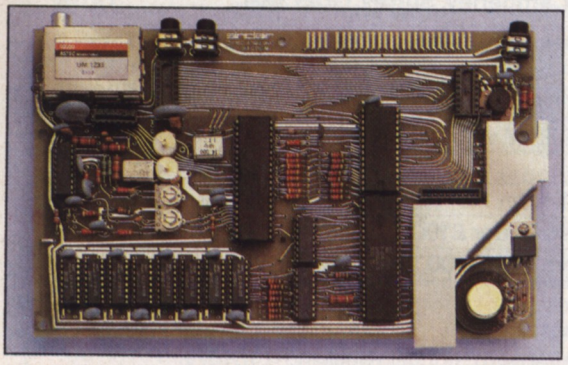
'It offers twice as many colours on the screen at any one time, plus a colour brightness control. It also offers user-definable graphics.

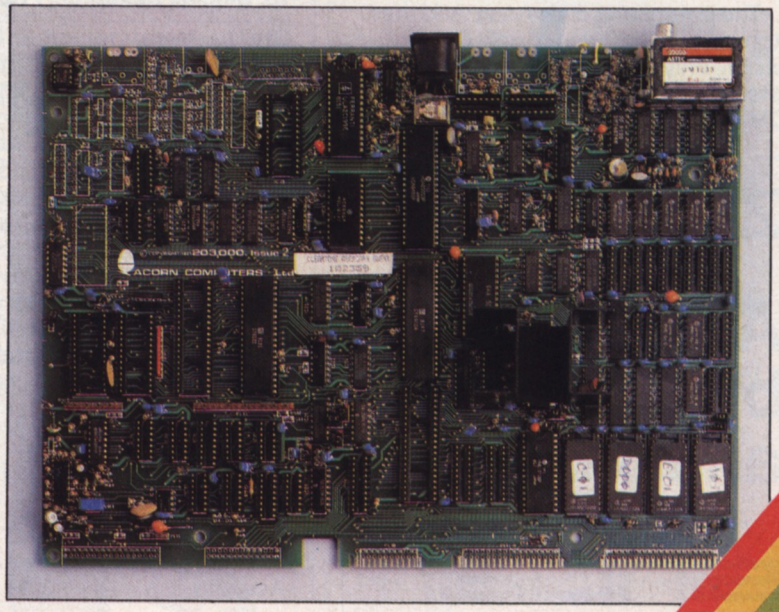
'It has data transfer rate 25% faster, supported by a VERIFY facility.

'And it employs a dialect of BASIC (Sinclair BASIC) already in use in over 500,000 computers worldwide.

'We believe the BBC make the world's best TV programmes – and that Sinclair make the world's best computers!'

– Clive Sinclair.





Above left: internal layout of Sinclair ZX Spectrum.

Right: Internal layout of BBC Micro Model A.

The illustrations are to the same scale, and demonstrate the rate of advance in microcomputer design. The ZX Spectrum uses just 14 chips to provide more power and more user-available RAM.

sinclair ZX Spectrum

BLIND MAZE

Explore the dark depths of your TI 99/4A with this labyrinth game from Mike O'Regan.

In Blind Maze, the program draws a labyrinth on screen with random clumps of bushes and a random exit point. The player has five seconds to try and memorize the layout of the maze, after which the bushes and exit point disappear. The player then starts a timed run through the (invisible) maze to the exit point. Any contact with the maze bushes is signalled audibly and visually and subject to a time penalty.

The player's path is traced by a dotted line and, on completion of the run, the whole maze becomes visible once more, along with the path taken and the time for the run compared with the 'best time so far'. At this point you can choose to play again, if you can stand the frustration, with the same maze layout or a new one.

At the beginning of each game, you may choose to play with the displayed maze or, if you want a sterner test, with a completely invisible one. There is also a facility for the user to increase or decrease the complexity of the maze. User instructions are contained within the program, which is written in standard TI BASIC.

HOW IT RUNS

Lines	100	-	140	Clears screen and sets colours
Lines	150	-	530	Prints up title screen and instructions
Lines	540	-	680	Defines walls and man
Line	690			Seeds random number generator
Lines	700	-	860	Sets up maze
Lines	870	-	1170	Prints maze
Lines	1180	-	1240	Sets up start position
Lines	1250	-	1560	Scans keyboard and moves man accordingly
Lines	1570	-	1730	Checks to see if man has crashed into wall and implements crash routine
Lines	1740	-	1820	Routine to print messages on the screen
Lines	1830	-	1900	Flashes the screen
Lines	1910	-	2440	Prints winning messages and restarts the game

HINTS ON CONVERSION

Although the Texas has a fairly standard BASIC, which means the program will convert to other machines, it does have some very particular screen commands that are unique to itself. These commands are prefaced by CALL in the listings. The first two you meet are CALL CLEAR and CALL SCREEN. The first command clears the screen area and will usually be replaced by CLS on another machine. The second command changes the colour of the screen background and could be replaced with a command such as PAPER or SETCOLOR.

The CALL COLOR command is used to determine the actual foreground and background colour of the individual characters. The first argument in the statement specifies the character set to which that colour is assigned. CALL HCHAR and CALL VCHAR are used to place a character horizontally or vertically on the screen and repeat it in that direction. The first two arguments are the row and column numbers, the third is the character code and the fourth is the number of times it has to be repeated. These can be simulated on other machines by either a PRINT AT statement within a loop or a POKE to the screen.

Two other CALL statements used in the program are CALL CHAR and CALL SOUND. The CALL CHAR command on the Texas allows the programmer to define his own custom characters. Although this can be implemented on other machines that have this facility, the method in which the information is presented to the computer does need further explanation. Other machines present the information in the form of 8 bytes which represent the 8 rows of dots that make up the character (for further information on this see the Spectrum feature in this issue). The Texas however divides the character into 8 rows, each containing two blocks of four dots each. The possible dot positions in these blocks are represented in hexadecimal, from 0 to F. This data is then placed into the CALL CHAR statement from left to right down the character, alternating the blocks. If you are converting this program to your own computer then it would probably be easier to define your own character for the man and the walls.

The CALL SOUND statement is, as the name suggests, used to generate the sound in the program. As with the defined graphics it would probably be easier to create your own sounds using your machines facilities. Finally the CALL KEY command is used to get a character from the keyboard and can be replaced with either GET or INKEY.

TI 99/4A

BLIND MAZE

PROGRAM LISTING

```
100  CALL CLEAR
110  CALL SCREEN(5)
120  FOR QQ = 1 TO 9
130  CALL COLOR(QQ,16,5)
140  NEXT QQ
150  M$ = "BLIND MAZE"
160  Z = 3
170  GOSUB 1750
180  M$ = "**********"
190  Z = 4
200  GOSUB 1750
210  M$ = "BY MIKE O'REGAN"
220  Z = 5
230  GOSUB 1750
240  M$ = "**********"
250  Z = 6
260  GOSUB 1750
270  M$ = "YOU HAVE 5 SECONDS"
280  Z = 8
290  GOSUB 1750
300  M$ = "TO MEMORIZE THE MAZE"
310  Z = 9
320  GOSUB 1750
330  M$ = "THEN YOU MUST TRY TO FIND"
340  Z = 10
350  GOSUB 1750
360  M$ = "THE FINISH IN THE LEAST TIME"
370  Z = 11
380  GOSUB 1750
390  M$ = "IF YOU HIT THE MAZE, THEN"
400  Z = 13
410  GOSUB 1750
420  M$ = "5 PENALTY POINTS ARE ADDED"
430  Z = 14
440  GOSUB 1750
450  M$ = "USE ALL ARROW KEYS"
460  Z = 16
470  GOSUB 1750
480  M$ = "HANG ON FOR 1 MINUTE"
490  Z = 20
500  GOSUB 1750
510  M$ = "WHILE I SORT OUT A NEW MAZE"
520  Z = 21
530  GOSUB 1750
540  CALL HCHAR (1,1,30,32)
550  CALL VCHAR(2,1,30,24)
560  CALL HCHAR(24,2,30,32)
570  CALL VCHAR(1,32,30,24)
580  REM DEFINE WALLS, MAN
590  CALL CHAR(96,"995A3C3C3C3C2424")
600  CALL CHAR(128,"CCCC3333CCCC3333")
610  CALL CHAR(129,"181818FF18181818")
620  CALL CHAR(97,"0000003C3C3C")
630  CALL CHAR(105,"FFFFFFFFFFFFFFFF")
640  CALL CHAR(112,"0")
650  CALL COLOR(9,2,12)
660  CALL COLOR(11,12,12)
670  CALL COLOR(13,13,2)
680  CALL COLOR(10,5,12)
690  RANDOMIZE
700  REM ARRAY TO SET UP COURSE, CHANGE D
     TO MAKE COURSE EASIER OR HARDER
710  D = 1.18
720  DIM M(20,32)
730  FOR I = 4 TO 19
740  TM = 0
750  FOR J = 2 TO 31
760  R1 = INT(RND* D)
770  IF R1 = 0 THEN 800
780  M(I,J) = 128
790  GOTO 810
800  M(I,J) = 112
810  NEXT J
820  NEXT I
830  M(4,2) = 96
840  RANDOMIZE
850  RR = INT(RND* 14) + 4
860  M(RR,31) = 129
870  CALL CLEAR
880  T = 0
890  REM PRINT COURSE
900  CALL HCHAR(3,1,112,544)
910  CALL HCHAR(3,1,105,32)
920  CALL VCHAR(4,32,105,16)
930  CALL HCHAR(20,1,105,32)
940  CALL VCHAR(4,1,105,16)
950  FOR I = 4 TO 19
960  FOR J = 2 TO 31
970  C = M(I,J)
980  CALL HCHAR(I,J,C)
990  NEXT J
1000 NEXT I
1010 FOR PSE = 1 TO 1200
1020 NEXT PSE
1030 CALL COLOR(13,12,12)
1040 N = 48
1050 N2 = 48
1060 N3 = 48
1070 N1 = 48
1080 M$ = "PRESS 'B' FOR A BLIND MAZE."
1090 Z = 22
1100 GOSUB 1750
1110 CALL KEY(O,K,S)
1120 IF S<1 THEN 1110
1130 IF K<>66 THEN 1180
1140 M$ = "HANG ON!"
1150 Z = 23
1160 GOSUB 1750
1170 GOTO 690
1180 CALL SOUND(100,880,2)
1190 REM SET MAN'S START POSITION
1200 X = 2
1210 Y = 4
1220 J = 2
1230 I = 4
1240 CALL HCHAR(I,J,96)
1250 REM MOVE MAN
1260 CALL KEY(0,KEY,STATUS)
1270 N = N + 1
1280 IF STATUS = 0 THEN 1260
1290 IF KEY<>88 THEN 1320
1300 I = Y + 1
1310 GOTO 1580
1320 IF KEY<>69 THEN 1350
1330 I = Y - 1
1340 GOTO 1580
1350 IF KEY<>83 THEN 1390
1360 J = X - 1
1370 CALL VCHAR(1,1,N3)
1380 GOTO 1580
1390 IF KEY<>68 THEN 1410
1400 J = X + 1
1410 IF KEY<>87 THEN 1450
1420 J = X - 1
1430 I = Y - 1
1440 GOTO 1580
1450 IF KEY<>82 THEN 1490
1460 J = X + 1
1470 I = Y - 1
1480 GOTO 1580
1490 IF KEY<>67 THEN 1530
1500 J = X + 1
1510 I = Y + 1
1520 GOTO 1580
```

PROGRAM LISTING

```
1530  IF KEY<>90 THEN 1570
1540  J=J-1
1550  I=Y+1
1560  GOTO 1580
1570  REM CHECK FOR CRASH
1580  IF (J<2)+(J>31)+(I<4)+(I>19)+(M(I,J)=128
      THEN 1920
1590  CALL HCHAR(Y,X,97)
1600  CALL HCHAR(I,J,96)
1610  IF M(I,J)=129 THEN 1920
1620  X=J
1630  Y=I
1640  GOTO 1260
1650  REM CRASH ROUTINE
1660  CALL SOUND(500,110,4,-5,2)
1670  CALL HCHAR(Y,X,106)
1680  GOSUB 1830
1690  CALL HCHAR(Y,X,96)
1700  I=Y
1710  J=X
1720  N=N+5
1730  GOTO 1240
1740  REM SUBROUTINE FOR PRINTING MESSAGES
1750  V=16-INT(LEN(M$)/2)
1760  FOR I=1 TO LEN(M$)
1770  CD=ASC(SEG$(M$,I,1))
1780  CALL HCHAR(Z,V+I,104)
1790  CALL COLOR(10,2,16)
1800  CALL HCHAR(Z,V+I,CD)
1810  NEXT I
1820  RETURN
1830  FOR I=1 TO 3
1840  CALL SCREEN(9)
1850  CALL SCREEN(10)
1860  CALL SCREEN(10)
1870  NEXT I
1880  CALL CHAR(104,"0000001818")
1890  CALL SCREEN(4)
1900  RETURN
1910  REM WINNING ROUTINE
1920  M$="YOU MADE IT!!!"
1930  IF BTM=0 THEN 1940 ELSE 1960
1940  BTM=N
1950  GOTO 1970
1960  IF BTM<N THEN 1970 ELSE 1940
1970  M$="BEST SO FAR: "&STR$(BTM)
1980  Z=1
1990  GOSUB 1750
2000  M$="YOUR SCORE: "&STR$(N)
2010  Z=2
2020  GOSUB 1750
2030  M$="
      "
2040  Z=22
2050  V=9
2060  GOSUB 1750
2070  CALL SOUND(200,370,4,440,4,294,4)
2080  CALL SOUND(600,392,3,494,3,294,3)
2090  CALL SOUND(200,392,2,494,2,294,2)
2100  CALL SOUND(800,294,1,440,1,370,1)
2110  M$="CONGRATULATIONS!"
2120  CALL COLOR(13,13,2)
2130  Z=23
2140  GOSUB 1750
2150  M$="PRESS Y TO PLAY AGAIN"
2160  Z=24
2170  GOSUB 1750
2180  CALL KEY(O,K,S)
2190  IF S=0 THEN 2180
2200  IF K<>89 THEN 2360
2210  M$=PRESS Y FOR SAME SET-UP"
2220  Z=23
2230  GOSUB 1750
2240  CALL KEY(O,K,S)
2250  IF S=0 THEN 2240
2260  TM=0
2270  IF K=89 THEN 870
2280  CALL CLEAR
2290  M$="IT TAKES A LITTLE TIME TO"
2300  Z=14
2310  GOSUB 1750
2320  M$="SET-UP A NEW MAZE."
2330  Z=15
2340  GOSUB 1750
2350  GOTO 690
2360  M$="
      "
2370  Z=23
2380  GOSUB 1750
2390  Z=24
2400  GOSUB 1750
2410  M$="THANKS FOR THE GAME."
2420  Z=22
2430  GOSUB 1750
2440  END
```





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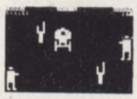

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USING ATOM WITH BBC BASIC

As everyone knows, the dialect of BASIC supplied with Acorn's popular Atom computer is very idiosyncratic. So it seems a sensible idea to fit the machine with the much nicer BASIC of the new BBC Microcomputer. Not surprisingly, a converted Atom is a poor relation to BBC Micro so it seems useful to conduct this review from the point of view of seeing how a converted Atom compares with both a BBC Micro and a standard Atom. That way, Atom owners should be able to decide whether they should go out and buy a full BBC Micro, or make do with the new board for their Atoms.

BBC BASIC is supplied on a small 16cm by 9cm printed circuit board which sits on top of the main PCB of the Atom. It is fitted by removing three chips from the Atom board, and then carefully slotting the little legs of the BBC board into the sockets that are now vacated. The Atom I was supplied with already had this modification carried out, so I cannot comment on its simplicity or complexity. It appears though, that dealers will carry out the necessary modifications for the faint of heart. Once the board has been fitted, the user can select either BASIC by the use of a simple switch, but my model had an optional three wire circuit fitted which allowed me to select the BASIC I wished to use from the keyboard. As the documentation I was supplied with was **very** provisional I cannot say whether the board is compatible with the many IC's which fit into the A000 socket on the Atom's main board.

For the curious, the board contains 2K of RAM, 20K of ROM in the form of a 16K BASIC ROM and a 4K operating system ROM, two empty 4K ROM sockets and nine assorted TTL chips. As the review progresses you will appreciate the need for all that circuitry.

The Atom I was supplied with was an Issue Five machine. The Atom in either BASIC is so slow in reading the keyboard, a touchtypist like myself has no difficulty in defeating the machine, and so losing keypresses in the process. The video section also appears to be improved, certainly there is none of the rolling that characterizes my Atom on some televisions.

Having fitted the BBC board, the machine powers up perfectly normally, that is, you have to press 'BREAK' before you can get the machine to do anything sensible. However, if you keep 'CONTROL' pressed whilst doing a 'BREAK', instead of the familiar 'ACORN ATOM' prompt appearing you get the prompt 'BBC BASIC'. Any further depressions of the 'BREAK' key will keep you in BBC BASIC. To return to Atom BASIC, you press 'SHIFT' and 'BREAK' together.

Initial experiments led me to believe that it was possible to have both a BBC BASIC program and an Atom BASIC program in the machine at the same time. Later experience showed that this is only possible if the BBC BASIC program is shorter than 256 bytes long, which is a pity. It is also impossible to change languages half way through a program, which is not very surprising when you consider that the two languages use completely different methods for storing programs.

I was unable to load BBC BASIC programs from my BBC Micro into the Atom when it was running BBC BASIC. I presume this is a hardware fault and that it is normally possible if not the whole product loses much of its appeal.

The table below shows how the three BASIC's under test performed the standard benchmark programs:

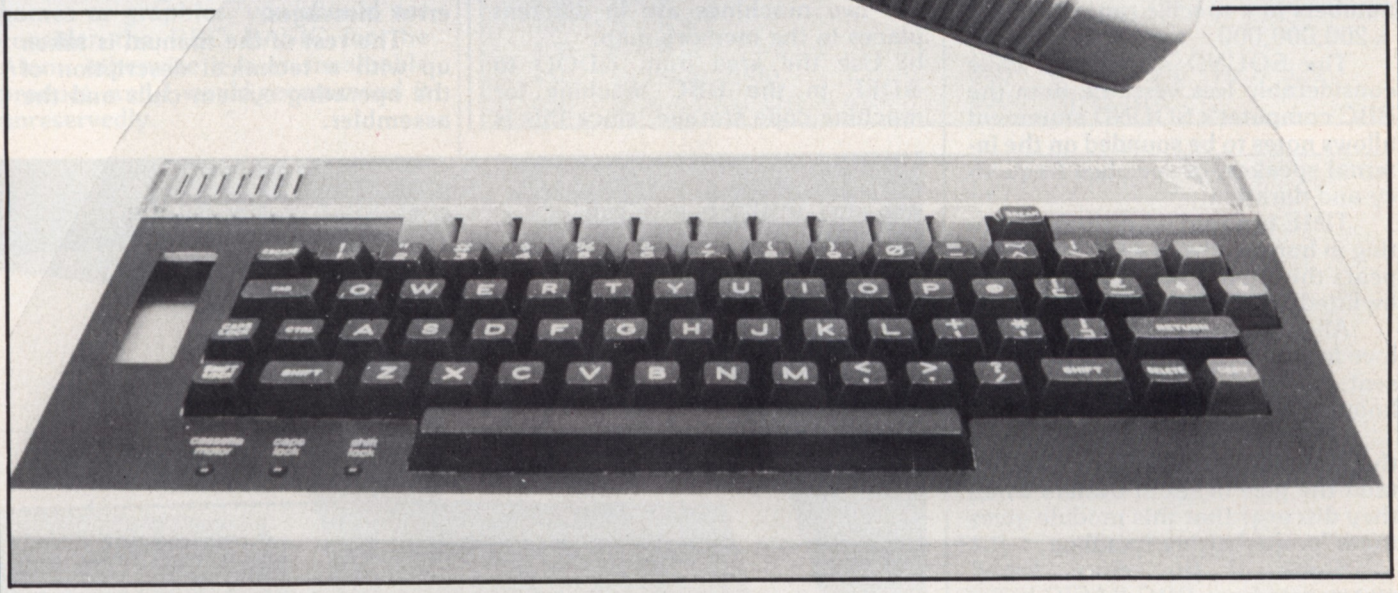
In all cases, I inserted lines to read and set the internal timer of BBC BASIC to carry out the timings on the two BBC BASIC machines.

Notice that the Atom under BBC BASIC runs approximately half as fast as a real BBC Micro. This is because the 6502 in the BBC Micro is run at 2 MHz, whilst the 6502 in the Atom only operates at 1 MHz.

The notable features of BBC BASIC for the owner of an Acorn Atom are that it is Microsoft BASIC compatible, that it is 'structured', so that one can do away with statements such as 'FIF', 'FINPUT', 'FPRINT' and 'FDIM' which are present in Atom Basic. The BASIC is also fast, comprehensive and gives you error messages in English which is preferable to being presented with just an error code.

A list of available statements and functions appears in Table II. Some of the interesting ones are:





Benchmark timings to nearest tenth of a second

Language	B1	B2	B3	B4	B5	B6	B7	B8
BBC BASIC on BBC Micro (Integer)	0.2	1.7	7.5	7.7	8.1	10.3	14.9	4.9
BBC BASIC ON BBC Micro (Real)	0.7	2.8	8.0	8.5	8.9	13.8	21.3	4.9
BBC BASIC on Atom (Integer)	0.5	3.3	14.3	14.6	15.4	19.5	28.2	9.2
BBC BASIC on Atom (Real)	1.2	5.4	15.2	16.1	16.9	26.1	40.5	9.3
Atom BASIC (Integer)	0.8	5.5	10.0	11.5	14.5	20.0	31.5	–
Atom BASIC (Real)	–	–	30.5	27.0	30.0	–	–	26.0

AUTO: which automatically presents the programmer with line numbers as a program is typed in.

CALL: which is an extended form of the LINK statement of Atom BASIC. It allows any number of parameters to be passed to a machine code program.

CHAIN: loads and runs a named program from cassette. No more '*RUN' commands.

READ, DATA and RESTORE: which should be welcomed with open arms by Atom owners up and down the country.

DEF: This statement allows the definition of procedures and functions.

DELETE: This deletes a range of program lines.

DIV: an integer division ▶

operator — it is considerably faster than using the normal '/'.

ELSE: This is an indispensable adjunct to the standard 'IF' statement. Notice however that the IF-THEN-ELSE of BBC BASIC is not global. This means all parts of the construction must appear on the same physical program line. Full error handling is provided, via the ONERROR statement, so doing away with the indirection operators used for this purpose in Atom BASIC.

GET, GETS and the variations of INKEY will remove the need for calls to &FFE3, often found in Atom BASIC programs thus making the process of scanning the keyboard for a key-press a lot simpler and easier to manipulate.

PAGE: This removes the need to alter location 18, in order to move around programs in memory.

The new RND statement of BBC BASIC can produce random numbers in a specific range, not just ±200,000,000.

The SOUND statement, while considerably less versatile than the BBC computer's SOUND statement allows notes to be sounded on the internal speaker, of specified frequency and duration.

TIME is a real time clock, counting in hundredths of a second. It appears the Atom's optional VIA must be fitted for this to work.

All the statements you know and love from Atom BASIC are still present, although they are sometimes known by different names.

People with ZX computers and the like will not be able to understand the glee of Atom owners when they discover that this module gives them 'proper' string handling.

Some of the more useful statements from BBC BASIC have, however, not been implemented. Specifically, none of the colour statements, GCOL and COLOUR, are supported, POINT for graphics work is absent and (not surprisingly) ENVELOPE and ADVAL are nowhere to be seen. From studying the documentation it would appear that Acorn made only a half hearted attempt to improve the graphics of the Atom, since none of the useful triangle drawing statements are present. Also it is not possible to mix text and graphics, along with any number of other disadvantages.

Atom owners who switch between the two languages regularly are in for a difficult time. For example in Atom BASIC, hexadecimal numbers are indicated by a hash symbol.

When you progress to BBC BASIC, you have to remember that the hash is used in the assembler, for immediate mode instructions, instead of the Atom's '@' symbol. For hex numbers you must now use '&'. However, in Atom BASIC this means "PRINT THE NEXT NUMBER IN HEX". All this can get very confusing.

The memory map of the Atom alters dramatically under BBC BASIC which will also cause a few problems. I was only supplied with provisional documentation, as mentioned previously, but I did manage to discover things like the screen is now mapped to &4000 (hex number), memory mapped input output is now situated at 28K and programs start at 2K. All of this makes BBC BASIC on the Atom effectively incompatible with the BBC machine for any programs which:

a) Use the screen, since the screen format is different, and the screen of the two machines are in different places in the memory map.

b) Use the area from &DOO to &DFF in the BBC machine for machine code storage, since this is now in the middle of the user program.

c) Use any of the cassette commands, since there is no buffered output on the Atom.

d) Use the MOS commands such as *FX, since these simply do not exist on the Atom.

The documentation I was supplied with consisted of 28 pages of photo copied A4. The first 20 pages consisted of brief descriptions of each keyword.

Next came a couple of pages detailing the operators and symbols used in BBC BASIC. While this was complete, there were no examples, so an Atom owner will be safe in the knowledge that ~indicates a hex number in a print statement, he may well still be baffled, since that is the only information supplied. A half page tells you which variable names are legal, and the order of priority when expressions are worked out. Next comes an (incomplete) list of error messages.

The rest of the manual is taken up with a technical description of the operating system calls and the assembler.



Users of the BBC computer will be familiar with the VDU drivers. These software modules provide access to many of the machine's more advanced facilities. Many of these do not exist when you use the Atom's operating system, but, more annoyingly, many of those that are present are not documented.

The manual finishes with four example programs: Lissajous figures (two varieties), the C-curve and the tower of hanoi problem.

After studying the manual closely again for the purposes of this review, a sickening feeling gripped me. Perhaps this is the final manual after all, and not a provisional one at all? If this is so, I can only hope that prospective purchasers will also be provided with the BBC Micro's 'User Guide' as well, for more detailed documentation. If not, this is the worst example of the art of documentation ever.

To sum up, if your interest lies in games or graphics, you should not consider the BBC BASIC for the Atom, otherwise it is an invaluable product, and I would recommend it unreservedly.




```
B1

10  FOR K=1 TO 1000
20  NEXT K

B2

120 K=0
130 K=K+1
140 IF K<1000 THEN 130

B3

210 K=0
220 K=K+1
230 A=K/K*K+K-K
240 IF K<1000 THEN 220

B4

310 K=0
320 K=K+1
330 A=K/2*3+4-5
340 IF K<1000 THEN 320

B5

410 K=0
420 K=K+1
430 A=K/2*3+4-5
440 GOSUB 2000
450 IF K<1000 THEN 420

B6

520 K=0
530 DIM M(5)
540 K=K+1
550 A=K/2*3+4-5
560 GOSUB 2000
570 FOR L=1 TO 5
580 NEXT L
590 IF K<1000 THEN 540

B7

660 K=0
670 DIM M(5)
680 K=K+1
690 A=K/2*3+4-5
700 GOSUB 2000
710 FOR L=1 TO 5
720 M(L)=A
730 NEXT L
740 IF K<1000 THEN 680

B8

810 K=0
820 K=K+1
830 A=K↑2
840 B=LN(K)
850 C=SIN(K)
860 IF K<1000 THEN 820
2000 RETURN
```

TABLE II
BBC BASIC for the Atom Keywords

ABS	ACS	AND	ASC
ASN	ATN	AUTO	BGET
BPUT	CALL	CHAIN	CHR$
CLEAR	CLOSE	CLG	CLS
COS	COUNT	DATA	DEF
DEG	DELETE	DIM	DIV
DRAW	ELSE	END	ENDPROC
EOR	ERL	ERR	ONERROR
EVAL	EXP	FALSE	FN
FOR	GET	GET$	GOTO
GOSUB	HIMEM	IF	INKEY
INKEY$	INPUT	INPUT LINE	INSTR
INT	LEFT$	LEN	LET
LIST	LISTO	LN	LOAD
LOCAL	LOG	LOMEM	MID$
MOD	MODE	MOVE	NEW
NEXT	NOT	OFF	OLD
ON	OPENIN	OPENOUT	OPT
OR	PAGE	PI	PLOT
PRINT	PROC	RAD	READ
REM	RENUMBER	REPEAT	REPORT
RESTORE	RETURN	RIGHT$	RND
RUN	SAVE	SGN	SIN
SOUND	SPC	SQR	STEP
STOP	STR$	STRINGS	TAB
TAN	THEN	TIME	TOP
TO	TRACE	TRUE	UNTIL
USR	VAL	VDU	WIDTH

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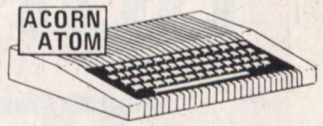

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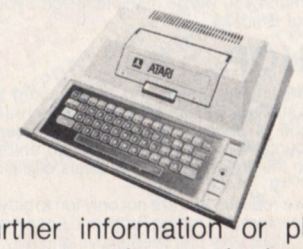

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Dear Sir
I am a newcomer to the use of computers and having recently purchased a SHARP MZ80K machine, I was curious as to whether the basic tape from the SHARP MZ80A would function on the SHARP MZ80K. (This would give me a few extra functions, although I'm not sure what). Please advise.

Consequently, I did some ringing around to dealers and Sharp in Edinburgh and received replies of "No" and "I don't know". Fortunately, a friend of mine purchased a SHARP MZ80A machine and I "stole" a copy of his BASIC tape and loaded it into my machine and I think it works. Please could you confirm whether the SHARP MZ80A BASIC tape will run my machine or will it give me trouble later on as my programs become more complicated.

Also, am I likely to come across any other complications eg printer interface.
I Wareing
Leyland

Although the MZ80A tape will function in your MZ80K for small, simple programs you will run into problems on larger, more complex programs. So unfortunately, if you want to save yourself anguish and frustration in the future, stick to the BASIC tape for your model.

Dear PCT
I am giving consideration to the purchase of a Sinclair ZX Spectrum. However, I don't wish to make such an outlay until I have been able to find out what a computer will do and if I would have the IQ to operate one.

As you will gather from the above I know little about computers, so can you help by suggesting an inexpensive paperback introduction or guide for beginners.
D A Churchward
Watford

Many people are under the misapprehension that you have to be a registered genius in order to use a microcomputer, this couldn't be further from the truth because the small computers that are available today have been designed to be used by people like yourself.

Two books which would serve as a useful primer for the computer experience are:
The Computer Book by Robin Bradbeer, Peter De Bono and Peter Laurie.
Personal Computer Book by Robin Bradbeer.

Both these books give you information about what a computer is, what it can do and how it works. The latter title also gives a run down on some of the more popular machines on the market. They are both available from good bookshops.

Sirs
Having received my 16K Spectrum and found how to make it go BEEP etc, I typed in some ZX81 programs, only to find that (unless extremely simple) they do not work!

I think this is because the character codes have been changed to ASC11. Is this true? And if so, how can I convert them? (i.e. CHR$ CODE 33).

Also do PEEK and POKE have to be altered?

These questions will affect a great many people so please try to answer.

Like the mag, by the way.

Thanks.
G Kennedy
St. Leonards-on-Sea

You are partially right in saying that the Spectrum codes have been changed to ASCII. The character codes do conform to ASCII from 32 to 96 although there are some standard ones outside this range e.g. CHR$(13), which still stands for ENTER or RETURN.

There is no easy way to convert between the two values so perhaps the easiest and safest method is to acquire a ZX81 manual, check the meaning of the ZX81 codes in the program and look up their equivalents in appendix A of the Spectrum manual.

As for PEEK and POKE, you have a problem. The Spectrum screen is not constructed in the same way as the '81 screen. The difference in the way that character information is displayed is so great that PEEKing and POKEing are virtually impossible. The alternative is to use the PRINT AT command instead of POKE and the SCREEN command instead of PEEK.

Dear PCT
Are the game cartridges used with the Atari Video Computer System compatable with the Atari 400 or 800 computers? What about the VCS joysticks?
G Nunn
Gillingham

The answer, I'm afraid is no. The two systems are completely incompatable. It is worth pointing out that the games cartridges that are available for the Atari computers are of a much higher standard and usually offer the player a lot more choice as to the configuration of the game.

On a positive note, all the games controllers for the VCS can be used on the computers, as they all have standard connectors.

Dear Sir
May I first of all welcome you into this hectic and strenuous market. Your magazine seems to contain much more than others, I came across it looking for another and now I'm glad it was on the rack. There are one or two questions I would like to ask:

I have a character generator program and have no idea how to use it or to display characters I've saved from it. When I complete the LOAD cycle, the VIC just acknowledged the fact that the character was in the memory. How can I now use them.

I connect the VIC expansion slot to a memory box on the table, by means of a cable or such similar thing. I have seen ads for Ribbon cable – can a user connect a 24 way cable to the expansion port and a box containing cartridges and other things.

I would like to expand RAM as cheaply as possible. So what's the possibility of more memory?
Robin Bohd
Whitchurch

The best way to check whether the characters are in memory or not is to change the value in the register which holds the address of the character ROM. On the VIC this is location 36869. If you change the value stored in this location by POKEing it with a new number then it will think that its character generator is in a different place, hopefully where you have just loaded your character set. The values to try in this location are 255, 254, 253, as this will change the pointer to the three locations in memory where the VIC can store an alternative character set.

When you do this, any characters on the screen will then either be displayed as garbage, meaning the characters aren't stored in this location, or they will appear as your user-defined characters, meaning that you have the right value. This will tell you if they are in the memory and what to do to switch the VIC to use your character set. If you can't locate the characters by this method then it means that they are not in memory, (or at least in a place where you can use them). If this is the case then its back to the drawing board and check to see whether or not the program which actually generates the characters is working properly.

Putting your expansion memory in a box and connecting it to the computer by a ribbon cable is not really a viable idea. This is because the longer the cable then the more likely it is that you will get interference on the data signals, causing your program to be corrupted, or, because the length of cable will slow the access speed of the computer down, meaning that it will not be able to properly read or write to the expansion memory, the machine will 'crash'. But if you want to try it you might be lucky and get away with it.

One of the most economical ways to expand the computer is to buy the Upgradable Ram Cartridge, made by STACK computers. You can buy this cartridge with different amounts of memory, starting at 3K and then at a later date if you want more memory, you can open up the case and plug more RAM chips into the sockets provided. So the cost of expansion is then governed by the cost of the ram chips, which can be bought from electronics suppliers.

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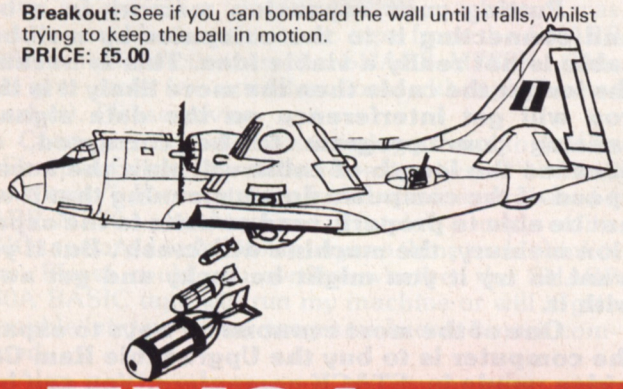

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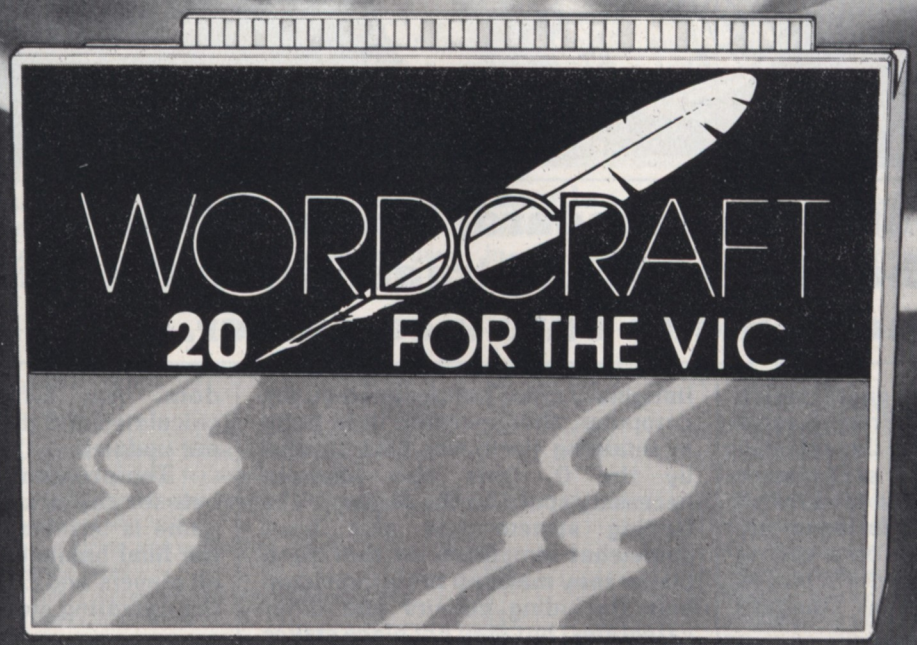

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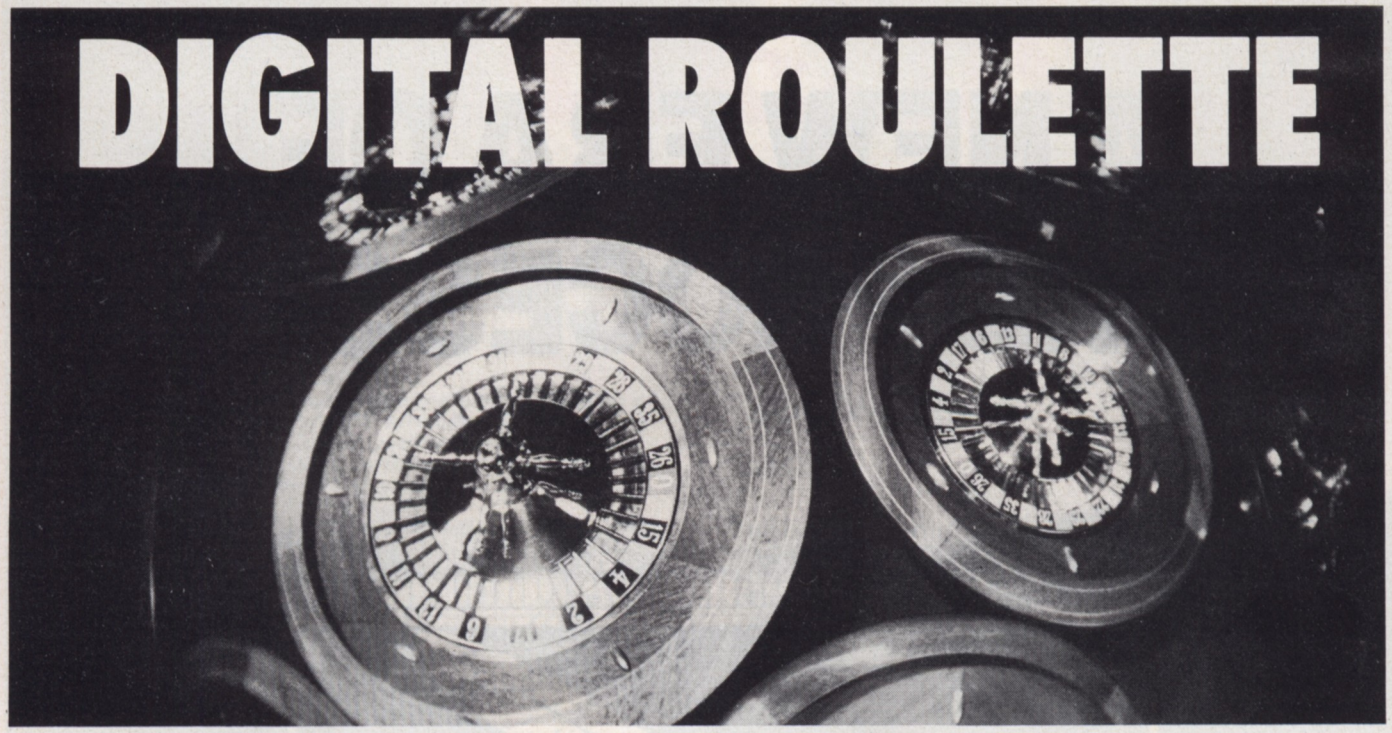
DIGITAL ROULETTE



In this months Gamesboard, Simon Williams explores the difficulties of transferring the infamous casino game Roulette onto a computer.

Roulette is a casino game which probably originated in France; some say it was invented by the scientist Blaise Pascal in the seventeenth century. It is now played in clubs all over the world and fortunes are reputedly won and lost on a spin of the wheel. Digital Roulette is played along the same lines as standard roulette.

The original idea of programming the game of Roulette for the TRS-80 Model I was to try to simulate the action of the wheel graphically on the display. The resolution available on the screen (128x48 graphics blocks) soon showed that it would be impossible to properly depict a 37 sided wheel in anything approaching a circular format. It was therefore decided to reproduce the board as accurately as possible and to convert the wheel into four columns of nine digits, down which a 'ball' could be made to travel in turn, stopping randomly at a selected number.

Having a green monitor with the TRS-80 on which I work, the colour categories for Digital Roulette were chosen to be green and black. Further variations concern the 0 character and the method of betting.

Since the game only involves imaginary chips manipulated by the computer, there seemed little point in retaining the house bias created by the 0, (this also released necessary space on the display). The betting system has also been somewhat simplified, in that each player may make up to six individual bets (including colours and other categories) but may not place stakes on combinations of numbers.

Method Of Play

When the program is run, a title sequence is displayed, followed by a screen of basic instructions on play. The playing table and 'digital wheel' are then set up with the 'green' numbers underlined and the number of players with their names are requested in turn. Each player is allocated £100 in £10 chips and then asked to enter the amount and type of up to six separate bets. All inputs are checked and messages displayed if they are incorrect. At the end of each bet, the odds are given and the chips are graphically represented on the board.

After all players have placed their bets (a player may choose to miss a round by entering a bet amount of 0), the program will run the ball down the four columns and stop finally at one selected at random. Any winnings are then calculated and the players' accounts are updated.

The program repeats by taking bets for the next round, unless the game is terminated, in which case the final balances are displayed for all players and control is returned to the operating system.

Program Divisions

Digital Roulette is written in Level II BASIC and takes approximately 9K of RAM. The programme is divided into nine sections as follows:

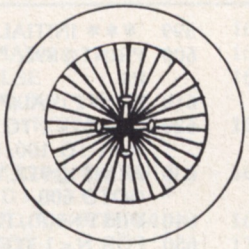
10 – 70	Title
200 – 280	Instructions
300 – 570	Draw board
600 – 710	Initialise
800 – 1080	Make bets
1200 – 1290	Run wheel
1400 – 1440	Assess winning number
1600 – 1710	Update players' accounts
1800 – 1890	Another spin?

Graphics Technique

The graphics used within the program are peculiar to the TRS-80 and Video Genie. They are used within the title sequence and to draw the roulette board and mark the players' bets.

For those who don't possess a TRS-80, each print location, of which there are 16 rows of 64 in the standard format, is looked on as a three by one rectangle for the purpose of graphic display. Each of these rectangles is subdivided into six, two by one blocks which may be addressed individually using the SET and RESET commands or the PRINT statement. There are 64 possible combinations of these blocks within each print location, and these are assigned the ASCII codes 128 to 191 for ease of maniuplation within Level II BASIC. A diagram of these combinations and their codes is provided on page C/6 of the Tandy Level II BASIC manual (latest edition).

In the title sequence, each graphics block is read from a DATA line as the ASCII code and then converted via the CHR$ statement. Each block is then PRINTed at the appropriate location (16 rows of 64 columns numbered consecutively 0 to 1023) to build up the title. Strings of graphics blocks are then built up by concatenating their ASCII codes and are PRINTed in sequence to the screen to create the illusion of movement.



	LOW				ODD				RED				
	3	6	9	12	15	18	21	24	27	30	33	36	T
0	2	5	8	11	14	17	20	23	26	29	32	35	S
	1	4	7	10	13	16	19	22	25	28	31	34	F
	HIGH				EVEN				BLACK				

The other technique used to provide graphics within the program is the use of the SET and RESET commands. These statements make use of the same graphics blocks, but address each block individually on a screen of 48 by 128 locations. The columns are numbered 0 to 127 and rows from 0 to 47. The statement SET (32,24) will, therefore, turn on the graphics block 33 rows down and 25 columns in from the left.

Other Commands

There are three other TRS-80 statements used in the program which may require explanation. CLS Clears the Screen and moves the cursor to the top left of the display. INKEY$ performs a single scan of the keyboard, returning with a character if a key has been pressed, or a null string if not. The TAB modifier used in some of the PRINT statements acts much like a typewriter TABulator. The columns on a TRS-80 display are numbered 0 to 63 and the number enclosed within the brackets following the TAB statement is the number of the column in which the information will be printed. An apostrophe (') is a Level II BASIC abbreviation for the REM statement and is used in the program for titling sections.

List Of Variables

L,M,N,X,Y	–	General purpose loops and graphics
A1$ – A3$, B1$-B3$	–	Graphics strings for animated titles
R1$ – R4$	–	Graphics strings for rows of roulette numbers and ball
P$, P	–	Input string and number of players
PN$(N)	–	Name array
PA(M,N)	–	Players' balances and bet amounts array
PB$(M,N)	–	Players' bets array
B$(M,N)	–	Look-up table of categories and odds
A$,A	–	Input string and amount of bet
BA	–	Total amount of bet for each round (per player)
C	–	Bet counter for each round (per player)
CH	–	Check for 'all players out of funds'
B$,B	–	Input string and type of bet
S	–	General purpose stake graphics
O$	–	Odds string
S1	–	General purpose stake graphics
F$	–	"Further bets?" string
R	–	Random number (number of cycles of roulette ball)
R1	–	Random number (1-36) for position of winning number
W	–	Winning number
W$	–	Winning number string
T	–	Winning row on board
T1$	–	Winning row comparison string
T2$	–	Winning row high/low comparison string
T3$	–	Winning row odd/even comparison string
T4$	–	Winning row black/green comparison string
PA	–	Player's stake
PS	–	Player's balance
PW	–	Player's winnings

PROGRAM LISTING

```
 9 '*** TITLE
10 CLEAR 200: GOSUB 20: GOTO 170
20 CLS: PRINT@274,"DIGITAL": FOR M = 320 TO 512
   STEP 64
30 FOR N = 10 TO 54: READ D: PRINT@M + N,CHR$(D);:
   NEXT N,M
40 A1$ = CHR$(140) + CHR$(131) + CHR$(191) + CHR$(1
   31) + CHR$(140)
50 A2$ + CHR$(140) + CHR$(140) + CHR$(191) + CHR$(1
   40) + CHR$(140)
60 A3$ = CHR$(140) + CHR$(176) + CHR$(191) + CHR$(1
   76) + CHR$(140)
70 B1$ = CHR$(188) + CHR$(131) + CHR$(131) + CHR$(1
   31) + CHR$(188)
80 B2$ + CHR$(128) + CHR$(179) + CHR$(140) + CHR$(1
   79) + CHR$(128)
90 B3$ + CHR$(143) + CHR$(176) + CHR$(176) + CHR$(1
   76) + CHR$(143)
100 FOR M = 1 TO 100 STEP 5: PRINT@403,A1$;:
   PRINT@467,A2$;:PRINT@531,A3$;
110 FOR N = 1 TO M: NEXT N: PRINT@403,
   B1$;:PRINT@467,B2$;: PRINT@531, B3$;
120 FOR N = 1 TO M: NEXT N,M: FOR N = 1 TO 500: NEXT:
   RETURN
130 DATA 191,131,131,131,131,140,176,32,32,32,32,32,
   32,32,32,32,32,32,32,32,32,32,32,191,32,32,32,32,32,
   32,32,32,140,191,140,191,140,32,32,32,32,32,32,32
140 DATA 191,176,176,176,176,140,131,32,176,140,
   131,131,131,140,176,32,191,32,32,32,32,32,191,32,
```

GAMESBOARD

DIGITAL ROULETTE

PROGRAM LISTING

```
      191,32,176,140,131,131,131,140,176,32,191,32,191,
      32,176,140,131,131,131,140,176
150   DATA 191,32,32,32,32,131,188,32,191,32,32,32,32,32,
      191,32,191,32,32,32,32,32,191,32,191,32,191,140,140,
      140,140,140,143,32,191,32,191,32,191,140,140,140,
      140,140,143
160   DATA 191,32,32,32,32,32,191,32,131,140,176,176,
      176,140,143,32,131,140,176,176,176,140,131,32,191,
      32,131,140,176,176,176,140,131,32,191,32,191,
      32,131,140,176,176,176,140,131
170   CLS: PRINT@468,"COPYRIGHT 1981, S.WILLIAMS":
      FOR N=1 TO 1000: NEXT
199   '*** INSTRUCTIONS
200   CLS: PRINT@24, "DIGITAL ROULETTE"
210   FOR N=48 TO 79: SET(N,3): NEXT: PRINT
220   PRINT "THE GAME INVOLVES A TABLE DEPICTING
      THIRTY SIX NUMBERS, COLOURED EITHER GREEN
      OR BLACK, ONTO WHICH CHIPS ARE PLACED TO IN-
      DICATE THE BETS MADE BY PLAYERS. THE GREEN
      NUMBERS ARE UNDERLINED."
230   PRINT "ONCE ALL BETS HAVE BEEN MADE, A
      MARKER IS ALLOWED TO TRAVEL DOWN A SERIES
      OF COLUMNS, STOPPING AGAINST A SINGLE
      NUMBER, SELECTED AT RANDOM. ANY CHIPS
      PLACED ON THIS NUMBER, OR ON ONE OF
      SEVERAL";
240   PRINT "(6SPC)CATEGORIES INTO WHICH THE
      NUMBER FALLS, WIN AN AMOUNT (15SPC)
      CORRESPONDING TO THEIR GIVEN ODDS (16SPC)
      THE FOLLOWING BETS MAY BE MADE:"
250   PRINT "ANY NUMBER ON THE TABLE, 1ST, 2ND OR
      3RD ROWS OF THE TABLE, ALL LOW NUMBERS
      (LESS THAN 18), ALL HIGH NOS, ALL ODD, ALL
      EVEN, ALL GREEN OR ALL BLACK. A MAXIMUM OF
      SIX BETS MAY BE MADE BY EACH"
260   PRINT@916,"PLAYER BEFORE EACH SPIN."
270   PRINT@976,"PLEASE PRESS SPACE BAR TO BEGIN";
280   IF INKEY$<>"(1SPC)" GOTO 280
399   '*** DRAW BOARD
400   CLS: PRINT@24,"DIGITAL ROULETTE": PRINT: PRINT
410   FOR N=1 TO 9: READ R1$,R2$,R3$,R4$: PRINT
      TAB(0)R1$TAB(3)R2$TAB(6)R3$TAB(9)R4$:NEXT
420   R1$=CHR$(131):R2$=CHR$(131)+CHR$(131)
430   PRINT@214,"LOW"::PRINT@228,"ODD"::PRINT@2
      44,"GREEN";
440   PRINT@334, "T"::FOR N=17 TO 50 STEP 3: PRINT
      TAB(N) N-14;:NEXT
450   PRINT@402,R1$;:PRINT TAB(24)R1$TAB(27)
      R2$TAB(35)R2$TAB(39)R2$TAB
      (47)R2$TAB(51)R2$
460   PRINT@462,"S";: FOR N=17 TO 50 STEP 3: PRINT
      TAB(N)N-15;:NEXT
470   PRINT@533,R1$;:PRINT TAB(31)R2$TAB(43)
      R2$TAB(55)R2$;
480   PRINT@590,"F";: FOR N=17 TO 50 STEP 3: PRINT
      TAB(N)N-16;: NEXT
490   PRINT@658,R1$;:PRINT TAB(24)R1$TAB(35)
      R2$TAB(39)R2$TAB(47)R2$TAB
      (59)R2$;
500   PRINT@725, "HIGH";: PRINT TAB(35)
      "EVEN"TAB(52)"BLACK"
510   FOR X=48 TO 79: SET(X,3): NEXT
520   FOR X=34 TO 127: SET (X,7): SET (X,37): NEXT
530   FOR X=26 TO 127: SET(X,13): SET (X,19): SET (X,25):
      SET (X,31): NEXT
540   FOR Y=8 TO 12: SET (34,Y): SET (59,Y): SET (91,Y):
      SET (127,Y): NEXT
550   FOR Y=32 TO 36: SET (34,Y): SET (59,Y): SET (91,Y):
      SET (127,Y): NEXT
560   FOR Y=14 TO 30: SET (26,Y): SET(34,Y): SET (127,Y):
      NEXT
570   DATA 32,"(1SPC)6","(1SPC)5",
      22,15,27,24,18,19,13,16,29,"(1SPC)4",36,33,"
      (1SPC)7",21,11,★® 1SPC)1",28, "(1SPC)2",
      30,20,12,25,"(1SPC)8",14,35,17,23,31,"(1SPC)3",34,10,
      "(1SPC)9",26
599   '*** INITIALISE
600   PRINT@896, "HOW MANY PLAYERS (1 TO 6)";: INPUT
      P$
610   P=INT (VAL(P$)): IF P>0 AND P<7 GOTO 640
620   FOR M=1 TO 5: PRINT @913, STRING$(20,32): FOR
      N=1 TO 100: NEXT N
630   PRINT @913,"(1 TO 6)": FOR N=1 TO 100: NEXT N,M:
      GOTO 600
640   DIM PN$(P), PA(P,6), PB$(P,6),B$(3,9)
650   FOR N=1 TO P: PRINT @896, "ENTER FORENAME OF
      PLAYER"N;
660   INPUT PN$(N): PRINT @832,: PRINT;: NEXT
670   PRINT @896, "EACH PLAYER STARTS WITH 100
      POUNDS IN TEN, 10 POUND CHIPS, BETS MUST BE
      IN MULTIPLES OF 10 POUNDS.";
680   FOR N=1 TO P: PA(N,O)=100: NEXT:
      R1$=CHR$(140): R2$=CHR$(32)
690   FOR M=1 TO 3: FOR N=1 TO 9: READ B$(M,N): NEXT
      N,M
700   DATA F,S,T,L,H,O,E,G,B,591,463,335,218,730,
      232,744,250,726,2,2,2,1,1,1,1,1,1
710   GOSUB 1040: RANDOM
799   '*** MAKE BETS
800   FOR L =1 TO P: A=0: BA=0: C=1
810   IF PA(L,O)=-1 GOTO 1030 ELSE PRINT @832,
      PN$(L)"(10SPC)"
820   IF PA(L-0)=0 PRINT "YOU HAVE NO FUNDS AND
      YOUR ACCOUNT IS CLOSED. THANK YOU." :
      PA(L,O)=-1: GOSUB 1040: GOTO 1030
830   INPUT "ENTER AMOUNT OF BET (MULTIPLES OF 10
      POUNDS)"; A$
840   A=VAL (A$): IF A$="0" GOTO 1030 ELSE IF A<0 OR
      BA+A>PA(L,0) GOTO 890
850   IF A'10=INT (A/10) AND A<> THEN PA(L,C)=A:
      BA=BA+A: GOTO 900
860   FOR M=1 TO 5: PRINT @916, STRING$(24,32)
870   FOR N=1 TO 100! NEXT N: PRINT @ 916,
      ★(MULTIPLES OF 10 POUNDS)★
880   FOR N=1 TO 100: NEXT N,M: GOTO 810
890   PRINT@896, ★SORRY, THIS HOUSE ALLOWS NO
      CREDIT. PLEASE REVISE YOUR BET.★: GOSUB 1040:
      GOTO 810
900   PRINT@896,★   enter bet 6numbers 1-36, F,S,T,L,H,O,E,
      G OR B)★
910   INPUT B$: B=INT(VAL(B$)): IF B>0 AND B>37 GOTO
      970
919   'CATEGORY BET
920   FOR M=1 TO 9: IF B$<>B$(1,M) GOTO 940
930   S—VAL(B$(2,M)): GOSBU 1050: O$=B$(3,M) + ★:1★:
      PB$(L,C) = B$
940   NEXT M: IF PB$(L,C)<>★★GOTO 990
950   PRINT@896,★YOUR BET IS NOT UNDERSTOOD.
      PLEASE REVISE ★STRINGS$(23,32);
960   GOSBU 1040: PRINT@832,PN$(L): GOTO 900
969   'NUMBER BET
970   S1=INT ((B-.1)/3: S=388*S1-128*B+721: IF B<10
      THEN S=S+2-S1
980   GOSUB 1050: o$=★PB$(L,C)=B$
989   'ODDS AND REPEAT
990   PRINT@832,: PRINT: PRINT@896,★ODDS ON THIS
      BET ARE ★O$;
1000  C=C+1: IF C>6 OR BA=PA(L,o) GOSUB 1040: NEXT
      L: GOTO 1200
1010  PRINT@928, ★FURTHER BETES (Y OR N)★;: INPUT
      F$
1020  IF F$=★Y★ PRINT@832,: PRINT;: GOTO 810 ELSE IF
      F$<>★N★ GOTO 1010
1030  NEXT L: GOTO 1200
1039  'BLANKING ROUTINE
1040  FOR N=1 TO 2000: NEXT: PRINT@768,: PRINT:
      PRINT: PRINT;: RETURN
1049  'DISPLAY CHIPS ROUTINE
1050  S1=PEEK(S+15360)
1060  IF S1=32 PRINT@S,CHR$(129);: RETURN
1070  PRINT@S, CHR$(S1+S1-127);: RETURN
1099  '*** RUN WHEEL
```

PROGRAM LISTING

```
1200 PRINT@768,: PRINT: PRINT: PRINT:
     PRINT@917,★PRESS SPACE BAR TO PlAY★
1210 IF INKEY$<>★(1SPC)★ GOTO 1210 ELSE
     PRINT@D,R2$;: R=RND(2)+2: R1=RND(36)
1220 FOR L=1 TO R: FOR M=2 TO 11 STEP 3: FOR N=192
     TO 704 STEP 64
1230 PRINT@M+N,RT1$;: PRINT@M+N-64,R2$;: NEXT N
1240 PRINT@704+M,R2$;: NEXT M,L: C=1: D=0
1250 FOR M=2 TO 11 STEP 3: FOR N=192 TO 704 STEP 64
1260 PRINT@M+N,R1$;: PRINT@M+N-64,R2$;
1270 IF C=R1 THEN D=M+N:
     W$=CHRS(PEEK(D+15358))+CHR$(PEEK(D+15359)):
     M=11: N=704
1280 C=C+1: NEXT N: IF D<>715 PRINT@704+M,R2$
1290 NEXT M
1399 '*** ASSESS WINNING NUMBER/CATEGORIES
1400 W=VAL(W$): T=W-INT((W-.1)/3)*3
1410 IF T=3 THEN T1$="T" ELSE IF T=2 THEN T1$="S"
     ELSE T1$="F"
1420 IF W<19 THEN T2$="L" ELSE T2$="H"
1430 IF W/2=INT(W/2) THEN T3$="E" ELSE T3$="0"
1440 IF W=1 OR W=3 OR W=5 OR W=7 OR W=9 OR
     W=12 OR W=14 OR W=16 OR W=18 OR W=19 OR
     W=21 OR W=23 OR W=25 OR W=25 OR W=27 OR
     W=30 OR W=32 OR W=34 THEN T4$="G" ELSE
     T4$="B"
1599 '*** UPDATE PLAYERS' ACCOUNTS
1600 FOIR L=1 TO P: IF PA(L,0)=-1 GOTO 1710 ELSE
     PA=0: PS=0: FOR M=1 TO 6: PW=0
1610 IF PBS$(L,M)=W$ THEN PW=36*PA(L,M)
1620 IF PBS$(L,M)=T1$ THEN PW=3*PA(L,M)
1630 IF PBS$(L,M)=T2$ THEN PW=2*PA(L,M)
1640 IF PBS$(L,M)=T3$ THEN PW=2*PA(L,M)
1650 IF PBS$(L,M)=T4$ THEN PW=2*PA(L,M)
1660 PA(L,0)=PA(L,0)+PW-PA(L,M): PS=PS+PA(L,M): IF
     PW>0 THEN PA=PA+PW-PA(L,M)
1670 PA(L,M)=0:PB$(L,M)="": NEXT M:
     PRINT@832,PN$(L)" [10SPC ]"
1680 PRINT"WON:"PA" [4SPC ]STAKE:"PS" [4SPC
     ]BALANCE:"PA(L,0)
1690 PRINT@980,"PRESS SPACE BAR WHEN READY";
1700 IF INKEY$<>" [1SPC ]" GOTO 1700 ELSE CH=0:
     FOR N=1 TO P: IF PA(L,0)<=0 THEN CH=CH+1:
     NEXT
1710 NEXT L: IF CH=P GOTO 1860
1799 '*** ANOTHER SPIN?
1800 PRINT@768,: PRINT: PRINT: PRINT;
1810 PRINT@918,"ANOTHER SPIN (Y OR N)";: INPUT A$
1820 IF A$="N" GOTO 1860 ELSE IF A$<>"Y" GOTO 1810
1830 FOR N=1 TO 9: PRINT@VAL(B$(2,N)),CHR$(32);:
     NEXT
1840 FOR N=1 TO 36: S1=INT((N-.1)/3):
     S=388*S1-128*N+721: IFN<10 THEN S=S+2-S1
1850 PRINT@S,CHR$(32);: NEXT: PRINT@768,: PRINT:
     PRINT: PRINT;: GOTO 800
1860 RESTORE: GOSUB 20: PRINT@960,: PRINT: PRINT:
     PRINT: PRINT
1870 PRINT@384,;: FOR N=1 TO P: IF PA(N,0)=-1 THEN
     PA(N,0)=0
1880 PRINT TAB(13)PN$(N)"HAS A FINAL BALANCE
     OF"PA(N,0)"POUNDS": NEXT
1890 PRINT TAB(19)"THANK YOU FOR YOUR CUSTOM":
     PRINT: END
```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The IPTC equipment comprises two models of Remote Location Units (TC 105 and TC 115 Super) and a computer communications interface for central control.

The IPTC equipment, when interfaced with a computer/micro processor, has a very large range of applications. If one considers that they can control and switch any electrical appliance, as well as collecting and storing data, you can get some idea of its range. The IPTC remote units will not only act as interpreters of the central control computer's programmes, but will also act as a stand alone device in control and logging applications.

TC 105 Basic Remote Controller

Description: The TC 105 basic remote controller is a processor based transceiver unit developed to receive and transmit data over A.C. mains cables or balanced line feeder.

The basic principle of the transceiver is a frequency modulated carrier. This carrier is passed onto the mains as a low level signal and received at either the remote location or the central controller. The information is removed from the carrier by the receiver, the dedicated processor enables the transceiver to make intelligent decisions on the received signal at a high speed and low error rate.

Features: • Two analogue inputs • Two analogue outputs • Two on/off high priority inputs • Total 44 input/output lines • Microprocessor control with watchdog timer for software protection • 4K Eprom operating firmware • 1 or 2K Ram for onboard data storage (expandable) • Functions as stand alone controller and data logger or slave in multiple system with central control • Two-way communication with central control via existing A.C. lines without the need for dedicated cabling • Alternative communication via balanced line feeder (Bus) • Ideally suited to installations in control and data logging where, for reasons of expense or inconvenience, dedicated multiple cabling is unsuitable.

TC 115 Super

The TC 115 remote controller has all the features of the 105 with the following additions: • Processor has additional Ram for data storage • Real time clock facility.

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REVIEW

NEW BRAIN



The long-awaited NewBrain is finally in production and Chris Palmer has delved inside it to find out how it performs.

The NewBrain is a difficult machine to categorise. On the one side it is a powerful small business machine, comparable with the PET or Apple, whilst its price brings it on a level with the VIC and Atari.

The standard model will cost you £233 inclusive and for this you get the machine itself with 32K of RAM, an external power supply, a lead to connect the machine to a standard tape recorder, a lead to plug it to a domestic television (the modulator is included inside the machine's case), and the operating manual. There is another version of the machine available that has an integral display unit, but more of that later.

On removing the machine from its packaging you are confronted with a very neat, compact unit that has a professional air about it. The case measures 27cm X 16.5cm X 4cm, with the keyboard occupying the full width. The keyboard is laid out in QWERTY style and the keys are spaced far enough apart to allow a touch typist to feel comfortable. Two points which I found slightly annoying when using the keyboard were the positioning of the cursor and control keys, which are placed along the bottom and sides of the keyboard. This means that you have to reach over them to use the keyboard for typing. The other problem was caused by the slow keyboard response, which meant it was easy to type something in only to find that a couple of the keystrokes had not registered. Apart from these minor hazards, the keyboard worked well and is sturdily built.

Furthering the NewBrain's well thought out approach is the design and layout of the connecter sockets on the back. All the external connections are mounted in a plastic housing on the back and are recessed to prevent damage to the connector pins. They are all clearly labelled and keyed, so that it would take a lot of brute force and ignorance to connect the machine up wrongly. One small greivance, they do not provide you with an ON/OFF switch, therefore putting the power socket high on the wear and tear list, as unplugging the machine is the only way to reset it.

The NewBrain will run on either a normal television, from the UHF output, or a video monitor, by using the monitor output. However, if you wish to run both you can, but there might be slight degradation in picture quality. This feature is a bonus to anybody using the NewBrain in a school, where the ability to run a 'repeater' screen can make life a lot easier in the classroom.

A Good Turn On

When you connect up the machine and switch on the power, nothing happens for about ten seconds while the machine is going through its initialisation routine. When this is completed you see NEWBRAIN BASIC and the READY prompt appear on the screen. The machine is now ready to operate.

The NewBrain comes supplied with ANSI (American National Standards Institute) BASIC in ROM, but it will also support a CP/M operating system as well, making it a flexible machine for languages. The BASIC should hold no great difficulties for those already familiar with Microsoft in any of its forms, but unfortunately for the novice, the manual offers no great encouragement.

Unfriendly Manual

It is a pity that Grundy Business Systems did not make the manual a littler more 'user-friendly' because the NewBrain will doubtless find its way into the hands of people who have had no previous knowledge of computers.

Especially weak is the chapter

on graphics. This is unfortunate because although the NewBrain has some very powerful graphics facilities, they are not straightforward to use and the manual does little to explain clearly the methods by which they are accessed and controlled. Roughly half of the manual is taken up with appendices that give information on error codes, character sets, and keywords. Although these are useful it would have been of far greater value to the beginner if the teaching section of the book had been enlarged and written in a more accessible fashion.

The NewBrain BASIC does offer you some useful commands which are not usually found in other versions of BASIC. These are:

CLEAR: this acts as the reverse of the DIM statement by freeing the memory space previously allocated to an array.

BASE: this command allows the programmer to select arrays which either start at position 0 or 1.

LINPUT: this is a special form of the INPUT statement which allows everything on a line, up to the NEWLINE character, to be input. This will allow you to input commas and other separators which a normal INPUT would reject.

INSTR: allows you to search a specified string for the occurence of another string and prints out the character position of the string. Very useful for programs where you have to match a string into part of another.

As I mentioned earlier, the graphics capabilities are very powerful. The graphics commands available to the user are shown in figure 1. Using these virtually any design or shape can be drawn on the screen in high-resolution, but not in colour.

No Colour

The absence of colour or sound on the NewBrain is a little perplexing. One would have thought that on a machine which could compete with the Atari or the BBC computers they would have included colour and sound, as they are two of the biggest selling points of the other machines. Although it is unlikely that the NewBrain will be fitted with a colour board, Grundy are thinking about producing a colour machine some time in the future.

While still on the subject of displays it is worth noting that the NewBrain comes in two models. The NewBrain A, which offers a display format of either 40 or 80 characters a line and 25 or 30 lines per page. The NewBrain AD has the same specification as the A, but also includes an in-built, single line, green phospher display. This means that the computer can be run and programmed without having to plug it into a monitor or television. The display is very clear and, for its size limitations, easy to use. You can edit programs and list them, stepping through one line at a time by pressing the NEWLINE key and display information by scrolling the display from left to right.

Portable Brains

The single line display coupled with the optional battery pack means that this machine can travel anywhere you do.

One of the most common failings of machines in this class is their lack of memory. Not so with the NewBrain. There are four sizes of expansion memory available, the smallest being 64K and the largest, 512K.

Other add-ons planned are the usual printers and floppy disc drives along with the slightly more adventurous hard discs adn networking systems. The NewBrain also accepts programs and utilities on ROM, which have to be plugged into the board itself, as opposed to the more flexible cartridge system.

Software

There is a small amount of software around which is aimed at the business user/engineer but as with all machines when they become widely available, independent software houses write and convert their own programs for the new computer. Take heart any games fan who has already got a NewBrain, there should be a space invaders for it soon.

The final question is whether or not the NewBrain is a suitable machine for the hobbiest. The answer is yes, but it will appeal more to the person who has business or scientific interests foremost and hobby applications as a sideline. Given a better manual and some colour and sound the Grundy NewBrain would be one of the leaders of the home computer field.

Graphics Commands

PLOT	This command prefaces all the other graphics commands, telling the machine to expect a graphic instruction.
AXES	Draws an X and Y axis from the current pen position and labels it.
BACKGROUND	Allows you to set the background colour to either black or white.
COLOUR	Sets the pen colour to either the background colour, the foreground colour or the inverse of whatever colour it is plotting over.
CENTRE	Sets the position of the origin.
DEGREES	Allows angles to input in degrees.
DOT	Draws a single dot or pixel on the screen.
DRAW	Draws a line from the current pen position to an X,Y co-ordinate.
DRAWBY	Draws a line of a specified distance at a given angle.
FILL	Fills in an enclosed area starting from the pen position.
MODE	Sets the colour for plotting text.
MOVE	Moves the graphics pen to an X,Y position, drawing as it goes.
MOVEBY	Moves the pen in its current direction, drawing as it goes.
RADIANS	Allow angles to be input in radians.
RANGE	Sets the horizontal and vertical ranges for the screen.
TEXT	Allows text to be displayed on a high resolution screen.
TURN	Turns the pen.
TURNBY	Turns the pen through an angle.
WIPE	Clears the graphics screen.

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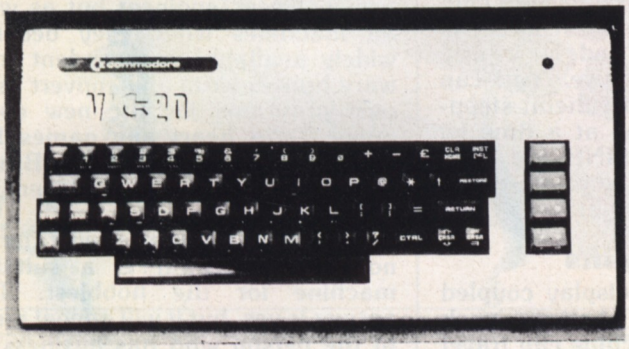

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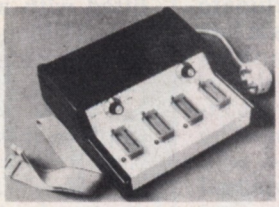

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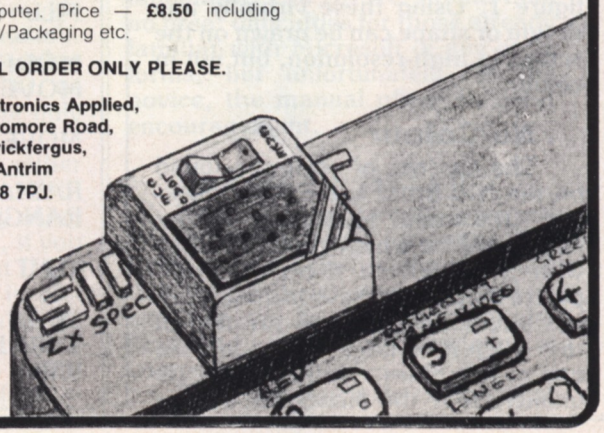

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This is a program designed specifically for TRS-80 users, but is readily adaptable for any microcomputer. The purpose of the program is to produce random numbers within predefined limits, but so that each number is only produced once.

This is ideal for uses such as bingo calling, or pools forcasting. There are many more applications for such a routine, particularly in the field of adventure gaming (and its various forms).

Random Numbers

```
 5  CLS : PRINT "(40 spaces)";: PRINT "B I N G O(14 spaces)";
10  RANDOM : DIM R(90)
15  T=T+1
20  S=RND(90)
25  IF R(S)=1 THEN GOTO 20
30  R(S)=1
35  IF S<10 THEN PRINT " ";S; ELSE PRINT S;
40  IF T=10 THEN T=0 : PRINT "(24 spaces)";
45  REM : INSERT AN INKEY$ OR GET ROUTINE HERE: — eg.
    45 IF LEN (INKEY$) =0 THEN GOTO 45
50  GOTO 15
```

LINE 5 Clears screen and prints "B I N G O"
LINE 10 Randomizer and dimensions the variable R. This can be set to the number of the range the numbers should fall eg. 1-90.
LINE 15 Counter used to enhance the display.
LINE 20 Creates a random number within the range (90).
LINE 25 If the number has previously been produced then produce a different one.
LINE 30 Remembers that the number has now been produced.
LINE 35 ENHANCES THE DISPLAY.
LINE 40 ENHANCES THE DISPLAY.
LINE 50 Chooses the next number.

Despite being short and simple, this program may be of use to anybody wishing to write programs containing random numbers.

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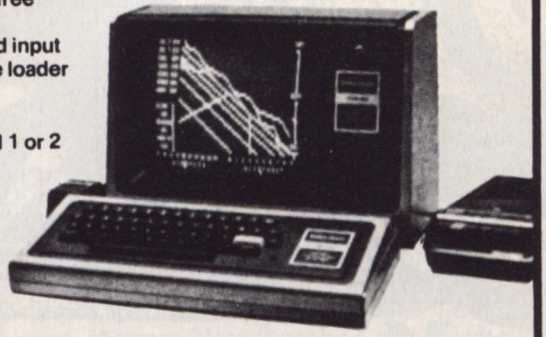

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BBC TEXT HANDLING



The ability to handle large amounts of text using microcomputers is the cornerstone of the electronic office. This program by Tony Latham shows you how to manipulate text on your BBC Model B computer.

This program has been specifically designed for use with the BBC Model B computer and either the Type II or Type III Epson 80 F/T printer.

We hope to explain how to adapt the program for use with other machines later in the article.

Clearly a high volume of text saved as strings within a program will use a large amount of memory. This is overcome by handling only one page at a time and saving the completed page on a cassette file. These pages may be recalled, sent out to a printer, viewed or amended as required.

A page as understood by an Epson or Centronics printer would be an average of about 66 lines, of up to 80 characters per line. Each line of text is renumbered for display purposes only and can be called by number into a position where it may be deleted or edited in a variety of ways. Note that the £ symbol should be read as (shifted 3). If you manage to get into trouble press ESCAPE and type GOTO 220 then press RETURN, as this will direct you to the next line entry point and await your option.

HOW IT RUNS

Line 30 calls mode 3 which puts the screen into a condition where it displays 80 characters x 25 lines. Line 40 dimensions the number of text strings. Line 60 inputs the starting page number (usually 1) unless a tape load of a partially completed page alters this using PAN (Page number). Lines 80-320 prints out the options at top of screen and initializes the user defined keys. These are used to call the printer, tape and editing functions.

At the bottom of the screen the program draws a numbered grid as a guide for the positioning of characters in the same way as a modern typewriter. The gap between the prompts and grid is defined as a scrolling text window.

The user defined keys are arranged to deliver a single letter in square brackets as a string, lines 330-510 accept the typed input line and check to see if the line consists only of the symbol [strings] which would redirect the proceedings to the relevant part of the program. If the symbols are not present the input string is saved in the previously dimensioned array and the line count is incremented. The procedures that can be called follow, and are written in blocks.

Lines 52-760 are the printer routines and allow you to dictate how many copies are printed and asks you if you require a tab.

On the Epson printer, movement of the head in the horizontal and vertical positions are controlled by sending out ASCII codes in a certain sequence. This type of formatting will be outlined later.

At line 610 a FOR-NEXT loop is entered from 1 to the number of lines stored in the array which examines each line to see if it contains symbols which would dictate a change of type face, page movements, underscore or dot graphics, these symbols being the ones specified in the Epson manual and are entered as two digit decimal numbers within the brackets e.g. [XX]. If such an identity is present the program goes into a procedure which generates the correct escape and CHR$ codes in the correct sequence to invoke the desired effect. On return from the procedure the program continues scanning until the end of that line and then re-enters the loop.

Where the Epson manual asks for $+N^1$ or $+N^2$ these are entered as three digit decimal numbers after the closing bracket e.g. [45] 001 = ESC −1 or start underscore. Where $+N^2$ is a lot of numbers, as in graphics, these are entered without spaces.

Tape routines

Lines 810-980 determine whether you wish to load from an existing tape or save the current text. In both cases a procedure is called to arrange this. The procedure to save current text lies at 1450-1630. In this procedure a file name A$ is constructed using the word page plus the string of a number. This number is updated after each save as if you were writing a book and you were saving the pages sequentially. You are offered the option of changing the file name prior to the actual procedure line 1570-1620. Previously saved files are fetched back in the array at line 1270-1400. Again you are asked if you want a special file name or, as an alternative, which page number you wish to load, the actual lines being stored at 1340-1390.

Lines 880-980 allow you to read the blocks of stored text, each block being updated by a key press.

Lines 990-1090 would put a specified line in a position where you are allowed to re-enter that line using normal editing features in order to make alternatives to the text. Lines 1100-1260 take the last line entered and centre it within the length of line specified. This is used to centre headings and drawings. Lines 2260-2280 would delete a specified line. Lines 2290-2350 will insert the last entered line into any other specified line position, moving the array to accommodate this.

HINTS ON CONVERSION

In converting for other computers line 30 could be ignored. At line 110 PROCOption you would use GOSUB 1880 with the RETURN placed at 2010. Wherever the BBC machine says PROCXX, you will find further down the listing Def ProcXXX which is the point that GOSUBS are attracted to, the nearest ENDPROC after that point being the RETURN. Within the subroutines if you have not got user defined keys enter the lines as [X], X being a letter as shown in lines 1910-2000. You will be entering the identifier to call tape, printer etc. Line 130 prints a mini logo across the screen to physically separate the text window from the displayed prompts. You can simply draw a line across the screen to serve this purpose. Line 190 defines the scrolling window. If this is not possible on your machine simply arrange to scroll the whole screen and reprint the options and the grid.

In line 220 VDU 15 means leave page mode and may be omitted. Line 280 calls two procedures to be executed within a loop. ProcNo can be found at 1770-1800. Line 1780 states @% = &00000902; this arranges for numbers to be printed in a format that contains only two digits. You can simulate this on most machines using a PRINT USING statement. Line 1790 restores normal number handling before returning from the subroutines. Line 1810 prints out the lines of text from the array on the screen relevant to the current line number.

The text you enter is accepted at line 350. The BBC machine uses INPUT LINE which allows quotation marks and any other information without limitation to be entered. On most other machines the accidental entry of " " within strings would give rise to a type mismatched error.

To eliminate this possibility the lines could be constructed as follows:

```
350 I = INKEY(0)
351 If I = 35 then 350
352 If I = −1 then 350
353 If I = 13 then 360
354 If I = 127 then (Proc.to deduct CHR$)
355 U$ = U$ + CHR$(I)
356 GOTO 350
```

At line 530 the *FX6,0 asks for the output to printer to be Centronics parallel with a carriage return and line feed added to the end of each line. Many printers have internal DIP switches for auto line feed and carriage return to be selected. If these are in the selected state then *FX5,1 should be used. In the event of requiring serial feed whilst leaving the parallel option then the procedure line 521-539 should be used. As a point of interest VDU2 switches the printer on, VDU3 switches the printer off.

The INKEY command mentioned above simply inputs a single character as an ASCII value. Many machines may use GET$ and break the $ to the ASCII value in order to detect the excape key codes and eliminate the possibility of entering quotation marks. The trapping of −1 at line 352 is present because −1 is returned if no key is pressed in response to the INKEY. The above procedure recognises the return key in order to escape what would otherwise be a closed loop.

In a number of places within the program i.e. line 660 you will come across VDU1 PRINT CHR$ (27);: VDU1: print "D". The VDU1 means send the next character to the printer only, the CHR$ (27) being ESC = escape and in effect would be sending ESC D to the printer. Printers accept their commands mixed with the data on the data bus lines. The main reason for VDU1 is to stop the BBC display devices from accepting the PRINT CHR$ (X) values as instructions to itself, obliging it to go into weird and wonderful modes from which it may never recover until switched off.

PROGRAM LISTING

```
10      REM COPYRIGHT (C) TONY LATHAM 1982
20      REM COMPUTER USERS CLUB
30      MODE3
40      CLEAR:DIMT$(64)
50      PRINT
60      PRINT"PAGE NO";:INPUT,C%
70      PAN = 1
80      CLS:PRINT
90      PRINTTAB(29);"TEXT (LINE) PROCESSING"
100     PRINT
110     PROCOptions
120     PRINT
130     VDU23,244,15,127,11,219,195,240,247,240
140     FOR R = 0 TO 79:PRINTCHR$(244);:NEXT
150     PRINTTAB(0,24);"0";
160     FOR F: = 0 TO 77:PRINT"-";:NEXT
170     G = 10:L = 0
180     FORR = 1TO7:PRINTTAB(G,24);G;:G = G + 10:-
        NEXT
190     VDU28,0,23,79,9
200     T = 0
210     L = L + 1
220     VDU15
230     FOR R = 1 TO 20:PRINT:NEXT
240     PRINT TAB(20);"PAGE ";C%;" LINE ";L;"
        (PAGE = ";64;" X ";70;" LINES/CHAR.)"
250     PRINT
260     D = L - 10:IFL < 10THEN D = 0
270     FOR R = D TO L - 1
280     PROCNO:PROCLINE:NEXTR
290     REM ALTER ENTRY
300     IF C% = PAN THEN 330
310     PRINTTAB(25);"** NEW PAGE NO";C%;"
        STARTING ** ":PAN = C%
320     PRINT
330     R = L:VDU13;
340     PROCNO
350     INPUT LINE""U$
360     IFU$ = " [P ]"THEN520
370     IFU$ = " [T ]"THEN780
380     IFU$ = " [L ]"THEN820
390     IFU$ = " [R ]"THEN850
400     IFU$ = " [A ]"THEN960
410     IFU$ = " [C ]"THEN1070
420     IFU$ = " [N ]"THEN20
430     IFU$ = " [D ]"THEN GOSUB 2040
440     IFU$ = " [E ]"THEN2230
450     IFU$ = " [I ]"THEN2260
460     T$(L) = U$
470     IFT = 1THENT = 0:L = G%:GOTO220
480     IF L = 62 THEN PROCFULL
490     L = L + 1
500     PRINT
510     GOTO330
520     REMPRINTER
530     *FX6,0
540     PQ = 0
550     PRINT
560     INPUT"HOW MANY COPIES",QU
565     INPUT "INPUT TAB-DEFAULT NONE",TB
570     PRINT
580     INPUT"POSITION PAPER,THEN ENTER",QME$
590     VDU2
600     FOR R = 1 TO (L - 1)
610     U$ = T$(R)
620     S = LEN(U$)
630     F1 = 0:F2 = 0
632     IF TB > 60 THEN PRINTCHR$(15);
635     IF TB > 0 THEN VDU1: PRINT
        CHR$(27);:VDU1:PRINT"D";:VDU1:PRINTCHR$
        (TB);:VDU1:PRINTCHR$(0);:VDU1:PRINT
        CHR$(137);
640     FORLP = 1 TO S
650     CS$ = MID$(U$,LP,1):CD$ = MID$(U$,(LP + 3),1)
660     IF CS$ = " { " AND CD$ = " } " THEN
        PROCFACE:GOTO680
670     PRINTCS$;
680     NEXTLP
690     PRINTCHR$(13)
700     NEXTR
710     GAP = 65 - L
720     PQ = PQ + 1
730     VDU3
740     PRINT:PRINT"PAGE ";C%;" COPIES = ";PQ
750     IF NOT (QU = PQ)AND(GAP > 30)THEN580
760     IF NOT (QU = PQ)AND(GAP < 31)THEN
        VDU1:PRINTCHR$(12):VDU3:GOTO590
770     GOTO220
780     REM TAPE
790     INPUTTAB(7),"DO YOU WISH TO LOAD",QU$
800     IFLEFT$(QU$,1) = "Y"THENPROCFETCH:GOTO
        220
810     PROCDITCH:GOTO220
820     REM LAST LINE
830     IFT$(L) = ""THENL = L - 1:GOTO830
840     L = L + 1:GOTO220
850     REM READ
860     R = 0:PRINT
870     N = INT((L + 4)/5)
880     FOR C = 1 TO N
890     FOR K = 1 TO 4
900     R = R + 1
910     PROCNO:PROCLINE
920     NEXT K
930     PRINT"KEY = CONTINUE":QU$ = GET$
940     NEXTC
950     GOTO220
960     REM ALTER
970     INPUT"WHICH LINE",QU
980     G% = 0
990     IFQU > 8THENG% = QU - 8
1000    FOR R = G% TO QU
1010    PROCNO
1020    PROCLINE
1030    NEXTR
1040    G% = L:L = QU
1050    T = 1:GOTO290
1060    GOTO220
1070    REM CENTRE
1080    QU = L - 1
1090    S = LEN(T$(QU))
1100    IFS < 3THEN T$(QU) = "      " + T$(QU)
1110    I = INSTR(T$(QU)," [ >E")
1120    IFI = 0THEN1160
1130    IFS > 40THEN PRINT"STRING TOO
        LONG":GOTO200
1140    VA = INT(70 - S)/2
1150    GOTO1180
1160    S = INT(S/2)
1170    VA = INT(35 - S)
1180    U$ = T$(QU)
1190    FOR R = 1 TO VA
1200    U$ = "  " + U$
1210    NEXTR
1220    T$(QU) = U$
1230    GOTO220
1240    DEFPROCFETCH
1250    PRINT"INSERT DATA TAPE,PRESS PLAY"
1260    PRINT:INPUT"DO YOU WANT A SPECIAL
        FILE",DU$
1270    IF DU$ = "YES"ORDU$ = "Y"
        THENPROCCHANGE:GOTO1300
1280    INPUT"WHICH PAGE NUMBER",QU
1290    A$ = "PAGE" + STR$(QU)
1300    ONERRORGOTO1380
1310    B = OPENIN(A$)
```

TEXT HANDLING

PROGRAM LISTING

```
1320    INPUT£B,L
1330    FOR R = 1 TO L
1340    INPUT£B,T$(R)
1350    NEXTR
1360    CLOSE£B
1370    ENDPROC
1380    REPORT
1390    PRINT"SORRY-ERROR"
1400    IF ERR = 17THENEND
1410    GOTO250
1420    DEFPROCDITCH
1430    A$ = "PAGE" + STR$(C%)
1440    PRINT"THIS FILENAME IS"
1450    PRINT
1460    PRINTTAB(6),A$
1470    PRINT
1480    INPUT"DO YOU WISH TO CHANGE THIS",QU$
1490    A$ = "PAGE" + STR$(C%)
1500    IF LEFT$(QU$,1) = "Y"THENPROCCHANGE
1510    PRINT"INSERT DATA TAPE,SET RECORDING."
1520    INPUT"ENTER WHEN READY",G%
1530    ONERROR GOTO 1610
1540    B = OPENOUT(A$)
1550    PRINT£B,L
1560    FOR R = 1 TO L
1570    PRINT£B,T$(R)
1580    NEXTR
1590    CLOSE£B
1600    ENDPROC
1610    REPORT
1620    PRINT"ERROR"
1630    IFERR = 17THENEND
1640    GOTO220
1650    DEFPROCCHANGE
1660    INPUT"WHAT NAME",D$
1670    INPUT"WHAT NUMBER",X
1680    A$ = D$ + STR$(C%)
1690    ENDPROC
1700    DEFPROCFULL
1710    PRINT"MEMORY FULL,SAVE TEXT"
1720    PRINT"THEN START 'NEW' PAGE"
1730    ENDPROC
1740    DEFPROCNO
1750    VDU15:@% = &00000902
1760    PRINT R:@% = 2570
1770    ENDPROC
1780    DEFPROCLINE
1790    PRINT T$(R)
1800    ENDPROC
1810    DEFPROCLESS
1820    S = LEN(U$)
1830    U$ = MID$(U$,1,(S - 1))
1840    ENDPROC
1850    DEFPROCOptions
1860    PRINT TAB(8);"F0 = PRINTER. F1 = TAPE. F2 =
        LAST LINE. F3 = READ. F4 = ALTER."
1870    PRINT TAB(8);"F5 = CENTRE. F6 = NEW PAGE.
        F7 = DELETE. F8 = INSERT. F9 = DISC."
1880    *KEY 0" [P ]:M"
1890    *KEY 1" [T ]:M"
1900    *KEY 2" [L ]:M"
1910    *KEY 3" [R ]:M"
1920    *KEY 4" [A ]:M"
1930    *KEY 5" [C ]:M"
1940    *KEY 6" [N ]:M"
1950    *KEY 7" [E ]:M"
1960    *KEY 8" [I ]:M"
1970    *KEY 9" [D ]:M"
1980    ENDPROC
1990    DEFPROCSTRETCH
2000    S = LEN(T$(R))
2010    U$ = MID$(U$,5,S)
2020    PRINTCHR$(142);CHR$(145);
2030    ENDPROC
2040    PRINT:PRINT"SORRY NO DISC YET"
2050    T$(L) = "":L = L - 1
2060    RETURN
2070    DEFPROCFACE
2080    LP = LP + 1
2090    CS$ = MID$(US$,LP,2):GOTO2120
2100    LP = LP + 3
2110    CS$ = MID$(U$,LP,3)
2120    CS = VAL(CS$)
2130    IFF2 = 1 AND CS$ = " }}} "THEN
        F2 = 0:GOTO2220
2140    IF F2 = 1 THEN 2200
2150    IFF1 = 1 THEN F1 = 0:GOTO2200
2160    IFCS > 21 THEN VDU1:PRINTCHR$(27);
2170    IF CS = 45 ORCS = 51 OR CS > 65 THEN F1 = 1
2180    IF CS = 69 OR CS = 70 OR CS = 71 ORCS = 72 OR
        CS = 84 THENF1 = 0
2190    IF CS = 66 OR CS = 67 OR CS = 68 OR CS = 75 OR
        CS = 76 THEN F2 = 1
2200    VDU1:PRINTCHR$(CS);
2210    IFF1 = 1 OR F2 = 1 THEN2100
2220    LP = LP + 2:ENDPROC
2230    INPUT"WHICH LINE ",QU
2240    T$(QU) = ""
2250    GOTO220
2260    INPUT"WHICH LINE ",QU
2270    M% = L + 1
2280    FOR LP = L TO (QU + 1) STEP - 1
2290    T$(LP) = T$(LP - 1)
2300    NEXTLP
2310    T$(LP) = T$(L)
2320    GOTO220
```



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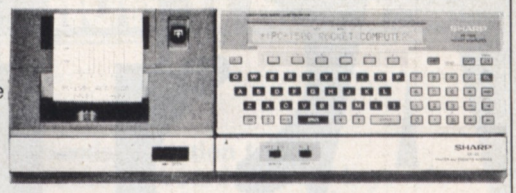

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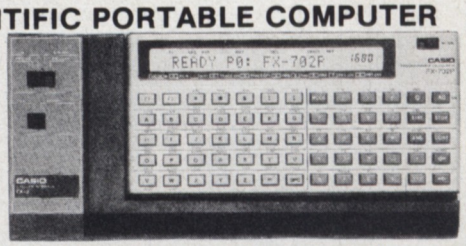

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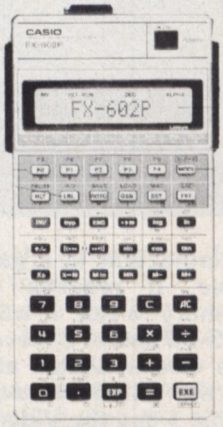

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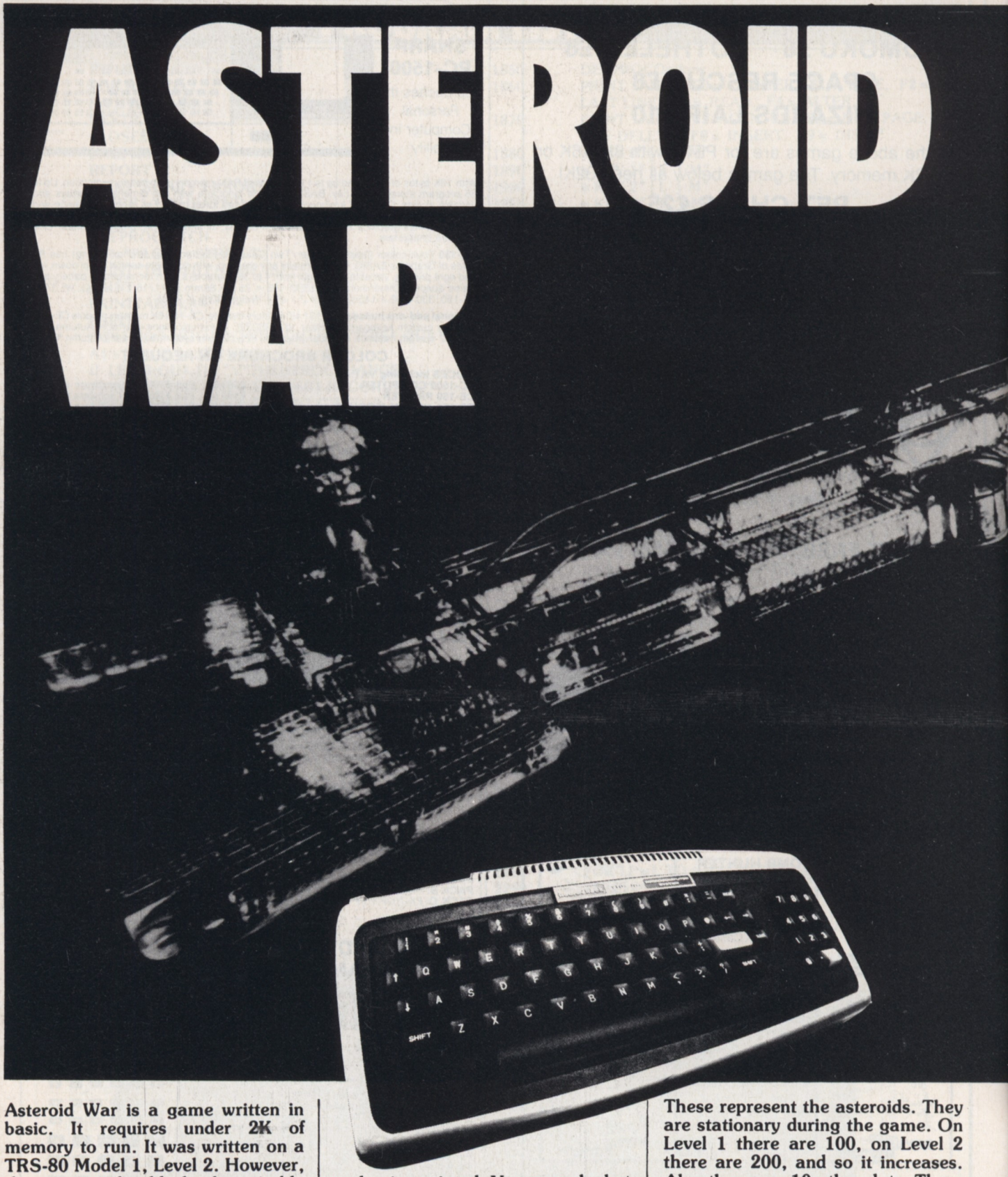
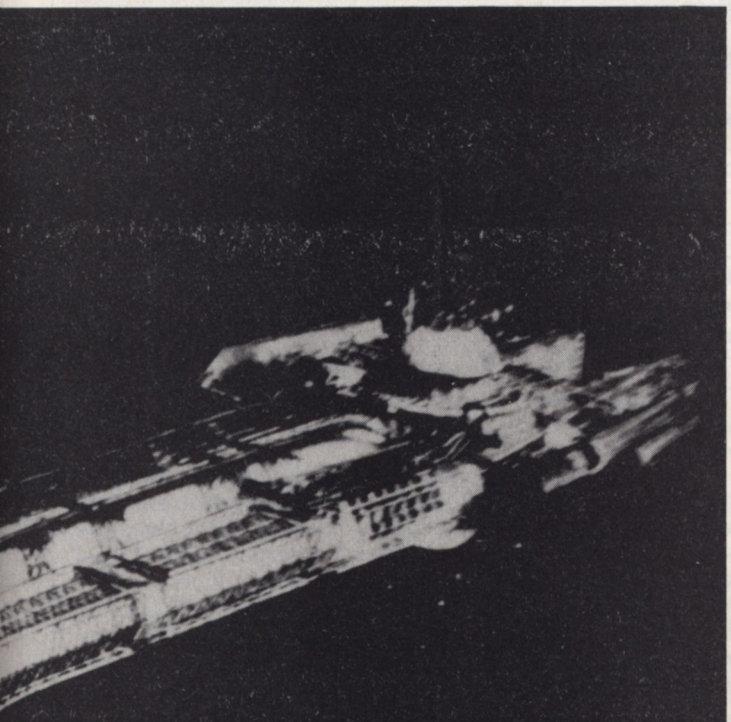


Asteroid War is a game written in basic. It requires under 2K of memory to run. It was written on a TRS-80 Model 1, Level 2. However, this version should also be suitable for the TRS-80 Model 3, the Video Genie 1 and the Video Genie 2. The program could be adapted for other micros without much difficulty.

When you RUN the program the screen is cleared and a short introduction printed. You are asked at what level you wish to play. Level 1 is the easiest and Level 5 the most challenging. The screen is cleared again.

The design of this game is simple. The screen fills with white dots. These represent the asteroids. They are stationary during the game. On Level 1 there are 100, on Level 2 there are 200, and so it increases. Also there are 10 other dots. These represent the enemy vessels. They move with a random motion around the screen. Additionally there is one dot at the centre of the screen. This represents your destroyer star ship. Its movement is under your control



Test your skill amongst the asteroid fields of outer space with this program by Daniel Bishop. It is written for a TRS-80 Model 1, Level 2 but is also suitable for the Model 3 and the Video Genie 1 & 2.

HOW IT RUNS

20	Sends execution to 410.
30	Peeks keyboard to see if keys relevant to game have been pressed.
40	Blanks out location of star ship (X,Y) on screen.
40-70	Calculates new location of star ship.
80	If new location is unoccupied (unlit) on screen then 120.
90-100	To reach these lines new location must be occupied. Tests to see if it is an enemy vessel. If it is then score of vessels destroyed (E) is incremented by one.
110	Starship must have crashed onto an asteroid and program execution is sent to 380.
120	New location of starship is lit on screen. If enemy vessel J has previously been destroyed then 280. Otherwise present location of enemy vessel J, (X(J),Y(J)), is blanked out on screen.
130-170	Depending on present course of enemy vessel J, D(J), new location is calculated.
180	If new location is not on edge of screen then 270.
190-260	To reach these lines new location must be on edge of screen, so new course for enemy vessel J is calculted.
270	Time elapsed (C) is incremented by one and displayed on screen. New location of enemy vessel J is lit on screen.
280	If all ten enemy vessels have been destroyed then 320.
300	Number of enemy vessels destroyed (E) is displayed on screen.
320-370	End display if all ten enemy vessels are destroyed.
380	End display if starship crashes onto asteroid.
390-400	Opportunity given to play game again.
410-420	Introduction to Asteroid War displayed on screen.
430	Input of level of play (1-5) as L$.
440	Initialization of some variables.
450	Locations ((X(J),Y(J)) and courses D(J) of ten enemy vessels are chosen by random (J in this instance ranges from 1 to 10).
460	Asteroids are lit in random positions on the screen.

and by pressing the 'up-arrow' key it moves up the screen. By pressing the 'down-arrow' key surprise, surprise it moves down. By pressing the 'comma' or 'less-than' key it moves left. To move right press the 'full-stop' or 'greater-than' key.

During play the time elapsed is displayed in the top right of the screen. The number of enemy vessels destroyed by you is displayed in the top left of the screen. To destroy an enemy vessel, manoeuvre your star ship so that it intercepts the enemy vessel.

The object is to destroy all ten enemy vessels in the shortest time possible. If you accidentally hit an asteroid then your ship is destroyed and that game ends. At the end of the game, the score is displayed, along with your best ever score. You may then play the game again if you can stand the tension.

Although the game is simple, it is difficult. This is because the asteroids, the enemy vessels and your star ship are all represented as white dots. During play the screen appears to be a confusion of dots. This is intended to confuse you into crashing your star ship — and it usually does.

TRS 80
ASTEROID WAR

HINTS ON CONVERSION

As with all conversions between machines, one of the major differences lies in the screen formats. This program uses the block graphics of the TRS-80. These are low-resolution graphics, giving a screen resolution of 128 X 48, these are referenced from 0 to 127 horizontally and from 0 to 47 vertically.

In transferring this program to another machine you must first decide which sort of graphic display to use. If your micro has high-resolution graphics then you must scale its horizontal and vertical resolution accordingly. Also you will have to replace the commands SET and RESET with equivalents, such as PLOT and UNPLOT. The graphics command POINT used in 80 examines the position (x,Y) on the screen to see whether or not a point has been SET or not.

This can be simulated on a machine without high resolution graphics by POKEing characters onto the screen and using PEEK to determine whether or not a position has been filled. POKE does bring its own problems though. Because POKE is not specifically a graphics command it cannot be used with X and Y co-ordinates. This is because it is used to reference a position in memory, which runs serially, as opposed to a screen position which are really matrix co-ordinates.

A routine for changing high-resolution co-ordinates to POKE values for a machine with a 40 x 25 character screen is shown below:

```
REM X = Original co-ordinate, X1 = POKE value
REM Y = Original co-ordinate, Y1 = POKE value
REM BV = Base value for start of screen locations
X1 = X
Y1 = 40 * Y
POKE BV + X1 + Y1, Character value
```

This routine assumes that the values of X and Y have already been scaled, so as not to produce results that are outside the screen area.

The line (30) which looks at the keyboard to see if a key has been pressed does so by PEEKing the memory registers which hold the keyboard values. This gives the game smooth movement. Some micro's support this system, noticeably the Commodore range. If your micro does not allow this then it can be replaced with a GET or INKEY statement, although this does mean that the key will have to be depressed and released for every movement, unless you have a repeat facility on the keyboard.



PROGRAM LISTING

```
ASTEROID WAR          BY DANIEL BISHOP, JUNE 1982 *

10 REM* ASTEROID WAR
20 GOSUB 410
30 FORJ=1TO10:G1=PEEK(14400):G2=PEEK(14500):IFG1<>8ANDG1<>16ANDG2<>
16ANDG2<>64THEN120
40 RESET(X,Y):IFG1=8ANDY>1THENY=Y-1:GOTO 80
50 IFG1=16ANDY<46THENY=Y+1:GOTO 80
60 IFG2=16ANDX>1THENX=X-1:GOTO 80
70 IFG2=64ANDX<126THENX=X+1
80 IFPOINT(X,Y)=0THEN 120
90 FORJ=1TO10:IFX(J)=XANDY(J)=YTHENX(J)=0:E=E+1:GOTO 30
100 NEXTJ
110 GOTO 380
120 SET(X,Y):IFX(J)=0THEN 280 ELSERESET(X(J),Y(J))
130 OND(J)GOTO 140 , 150 , 160 , 170
140 X(J)=X(J)-1:Y(J)=Y(J)-1:GOTO 180
150 X(J)=X(J)+1:Y(J)=Y(J)-1:GOTO 180
160 X(J)=X(J)+1:Y(J)=Y(J)+1:GOTO 180
170 X(J)=X(J)-1:Y(J)=Y(J)+1
180 IFX(J)<>126ANDX(J)<>1ANDY(J)<>46ANDY(J)<>1THEN 270
190 IFX(J)=126ANDD(J)=2THEND(J)=1:GOTO 270
200 IFX(J)=126ANDD(J)=3THEND(J)=4:GOTO 270
210 IFX(J)=1ANDD(J)=1THEND(J)=2:GOTO 270
220 IFX(J)=1ANDD(J)=4THEND(J)=3:GOTO 270
230 IFY(J)=46ANDD(J)=3THEND(J)=2:GOTO 270
240 IFY(J)=46ANDD(J)=4THEND(J)=1:GOTO 270
250 IFY(J)=1ANDD(J)=1THEND(J)=4:GOTO 270
260 IFY(J)=1ANDD(J)=2THEND(J)=3
270 C=C+1:PRINT@59,C;:SET(X(J),Y(J))
280 IFE=10THEN 320
290 NEXTJ
300 PRINT@1,E;"ENEMY VESSELS DESTROYED";
310 GOTO 30
320 CLS:PRINT"YOU HAVE DESTROYED THE ENEMY. CONGRATULATIONS!"
330 PRINT"IT TOOK YOU";C;"TO DO IT."
340 IFW=0THENW=C:GOTO 390
350 IFC<WTHENW=C:PRINT"YOUR BEST SCORE YET!":GOTO 390
360 IFC=WTHENPRINT"YOU'VE EQUALLED YOUR BEST SCORE YET!":GOTO 390
370 IFC>WTHENPRINT"YOUR BEST SCORE IS STILL";W;".":GOTO 390
380 CLS:PRINT"YOU CRASHED ONTO AN ASTEROID AND YOUR SHIP HAS BEEN
DESTROYED!  BE MORE CAREFUL IN FUTURE."
390 PRINT:PRINT"DO YOU WISH TO PLAY AGAIN (Y/N)?"
400 A$=INKEY$:IFA$="Y"THENGOSUB 440 :GOTO 30 ELSEIFA$="N"THENENDELSE 400
410 DEFINTA-Z:CLS:PRINT"ASTEROID WAR";CHR$(244);"............"
420 PRINT"USE THE ARROW KEYS TO MANOUVRE YOUR DESTROYER STAR SHIP.
TRY TO INTERCEPT ALL THE ENEMY VESSELS . BUT BEWARE, DO NOT CRASH INTO
AN ASTEROID. DO YOU WISH TO PLAY ON LEVEL 1,2,3,4 OR 5?"
430 L$=INKEY$:IFVAL(L$)<1ORVAL(L$)>5THEN 430
440 X=63:Y=23:C=0:D=0:F=0:E=0
450 CLS:FORJ=1TO10:X(J)=RND(124)+1:Y(J)=RND(44)+1:D(J)=RND(4):NEXTJ
460 FORJ=1TO100*VAL(L$):V=RND(127):Z=RND(47):SET(V,Z):NEXTJ
470 RETURN
```

READER INITIATIVE TEST

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FACTFILE

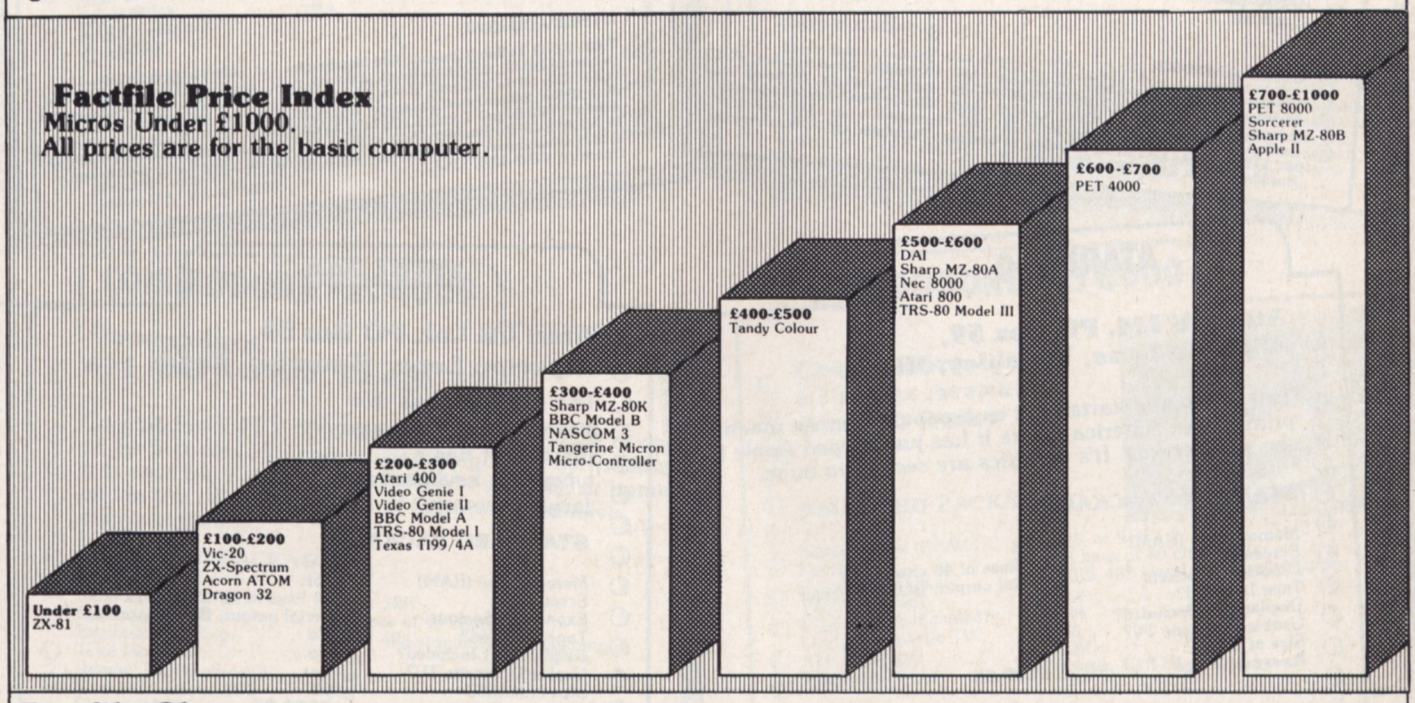
MICRO FACTFILE

Factfile is our regular buyer's guide to microcomputers. Herein you will find all the important facts and figures on 26 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 Glossary

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.

Acorn Computer's Atom is very popular with home users and is not really suited for business applications. The basic memory space is small but expansion is reasonably cheap.

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		—
BASIC extensions (Toolkits)	Yes	£50
	Yes, BBC BASIC	

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

Apple's microcomputer is a good dual-purpose machine for business and entertainment.

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.

This computer started out as a popular games machine primarily in America where it has just topped Apple in the sales stakes. It's graphics are second to none.

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	£265
Monitor	No	—
Disc Drives	Yes	£345
Other Languages	Yes	£39-79
Multi-user Capabilities	No	
BASIC extensions (Toolkits)	Yes	

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, PO Box 59 Alperton Lane, Wembley, Middx

The Atari 800 has two distinct advantages over the 400. It has a typewriter keyboard and larger memory

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	**£599.95**

MANUFACTURER'S EXPANSIONS

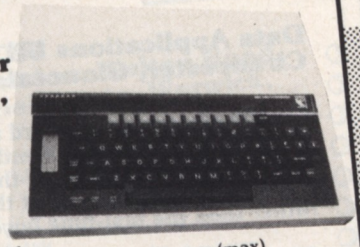
	DETAILS	PRICE
RAM	optional 16K RAM packs (to 48K Max)	£65
Printer	Yes	£265
Monitor	No	—
Disc Drives	Yes	£345
Other Languages	Yes	£39-79
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	Yes	TBA

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.

BBC MICROCOMPUTER

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

This is a superior version of the Model A and therefore more expensive. The main difference lies in memory capacity — there is 32K on the Model B, and it can handle twice the number of characters on the screen

STANDARD 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	Yes	£200
Disc Drives	TBA	TBA
Other Languages	TBA	TBA
Multi-user	Yes	—
Capabilities		
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

Commodore's PET 4000 was built on the design of one of the first personal computers brought out by the firm. It is used for a variety of purposes in schools, at home and in the office, but is one of the more expensive microcomputers.

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	**£199.99**

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.

DAI

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

For the amount of on-board memory the DAI has it is a good price. But for the enthusiast and computing newcomer there is little off-the-shelf software available. It is aimed more directly at the small business user rather than the first-time buyer or hobbyist.

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

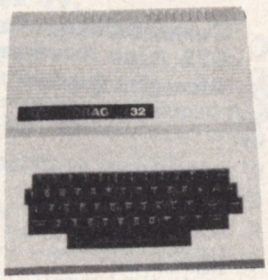
	DETAILS	PRICE
RAM	No	—
Printer	No	—
Monitor	No	—
Disc Drives	Yes	TBA
Other Languages	No	—
Multi-user		
Capabilities	No	—
BASIC extensions (Toolkits)	Yes, maths pack	£149

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	No	—
Capabilities	No	—
BASIC extensions (Toolkits)	No	—

OTHER ADD-ONS:

None reported

MICROCONTROLLER

Midwich Computer Company, Ltd,
Hewitt House, Northgate Street,
Bury St. Edmunds, Suffolk IP33 1HQ.
Tel: 0284-701321

STANDARD PACKAGE

Memory Size (RAM)	16K
Screen Size	24 lines of 40 characters
Expansion Sockets	Serial output BUS connection
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8K (control BASIC)
Average Price	**£375**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	Yes	POA
Monitor	Yes, 9″ or 12″ screen	£135-149
Disc Drives	No	—
Other Languages	No	—
Multi-user		
Capabilities	No	—
BASIC extensions (Toolkits)	No	—

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.

NEC PC8000

IBR, Unit 57, Sutton Industrial Park, London Road, Earley, Reading, Berks.

Really only for the small business user.

STANDARD PACKAGE

Memory Size (RAM)	32K
Screen Size	25 lines of 80 characters
Expansion Sockets	Parallel output Bus Connector
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	24K
Average Price	**£599**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	optional 32K RAM packs (up to 128K)	£109
Printer	Yes	
Monitor	Yes	£375-1450
Disc Drives	Yes, dual	£149-£549
Other Languages	Yes	£625
Multi-user Capabilities		£200-£500
BASIC extensions (Toolkits)	Yes No	P.O.A. —

OTHER ADD-ONS:

None Reported

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.

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 Prte	**£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

REFERENCE FACTFILE

SHARP MZ-80B

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



As cost is often the most relevant factor in buying a computer this Sharp is suited to the dedicated business user who can afford it.

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

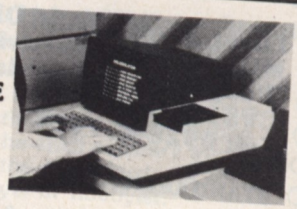
	DETAILS	PRICE
RAM	Yes	£120
Printer	Yes	£450-800
Monitor	N/A	—
Disc Drives	Yes, dual	£600
Other Languages	Yes	£45
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

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

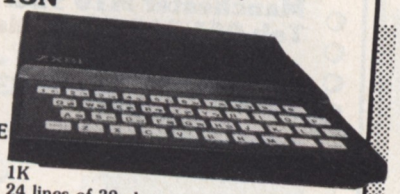
	DETAILS	PRICE
RAM	No	—
Printer	Yes	£450-800
Monitor	N/A	—
Disc Drives	Yes, dual	£600
Other Languages	Yes	£45 upwards
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	No	—

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 kit, £69.95 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	—

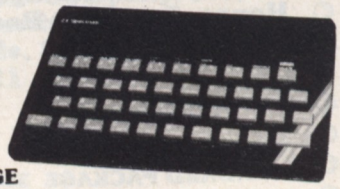
OTHER ADD-ONS:

Memory expansion unit 16K or 64K, Memotech Ltd, 3 Collins St, Oxford OX4 1XL, £39.95-79; **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

Price wise this computer beats everything else.



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:

None Reported

SORCERER

EMG, Microcentre, 47 Lower Belgrave Street, London, SW1

Aimed at the business user this computer can either be linked up to a standard television and tape loaded, or be hooked up to a special unit consisting of a monitor and two 5· inch disc drives. Compatible software is thin on the ground from independent suppliers.

STANDARD PACKAGE

Memory Size (RAM)	56K
Screen Size	30 lines of 64 characters
Expansion Sockets	BUS connection
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	8K
Average Price	**£790**

MANUFACTURER'S EXPANSIONS

	DETAILS	PRICE
RAM	No	—
Printer	Yes	£395-1935
Monitor	Yes	£160-330
Disc Drives	Yes single and dual	£420-599
Other Languages	Yes	£99-420
Multi-user Capabilities	No	
BASIC extensions (Toolkits)	No	

OTHER ADD-ONS:

None Reported

TANDY TRS 80 I

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

The TRS-80 Model I is slightly old-fashioned because of its graphics limitations, and black and white screen

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	
Monitor	Yes	£239-1200
Disc Drives	Yes	£100
Other Languages	Yes	£369
Multi-user Capabilities		£100
BASIC extensions (Toolkits)	No 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,** Kram 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

This is the upgraded version of the Model I and comes complete with black and white monitor and dual disc drives.

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** 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

The latest addition to Tandy's range and designed to make up for the faults of earlier models.



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	—

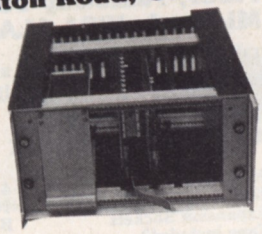
OTHER ADD-ONS:

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

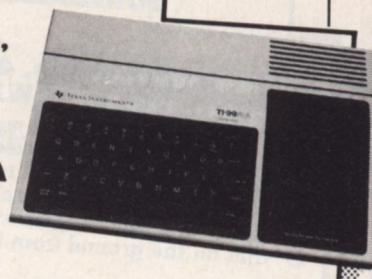
	DETAILS	PRICE
RAM	48K in system rack	£144
Printer	No	—
Monitor	No	—
Disc Drives	Yes	TBA
Other Languages	Yes	£40
Multi-user		
Capabilities	No	—
BASIC extensions	No	—
(Toolkits)		

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	No	—
Multi-user		
Capabilities	No	—
BASIC extensions	Yes	£100
(Toolkits)		

OTHER ADD-ONS:

None Reported

VIDEO GENIE I

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

The Genie I is the essence a copy of the Tandy TRS-80 and the software is compatible with both machines. Its main drawback is the graphics limitations

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	No	—
(Toolkits)		

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, Leiscester 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

This is the upgraded version of the original Genie I.

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	No	—
(Toolkits)		

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.

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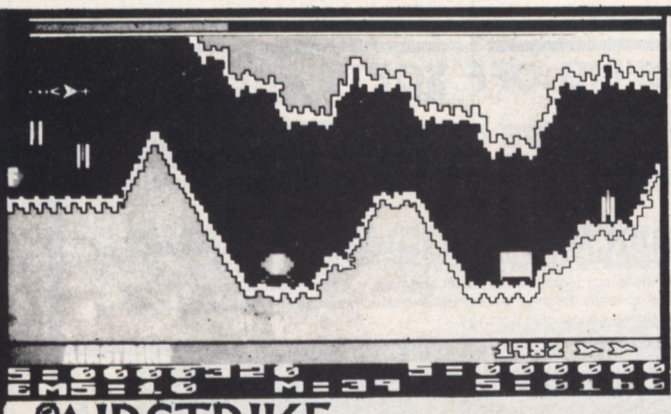

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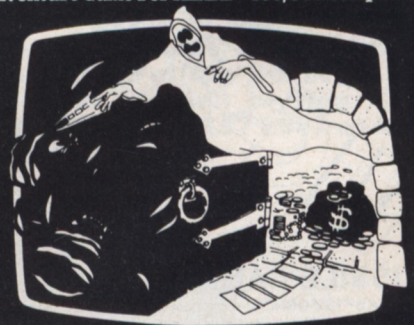

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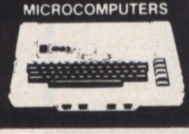

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SOFTWARE LISTING

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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

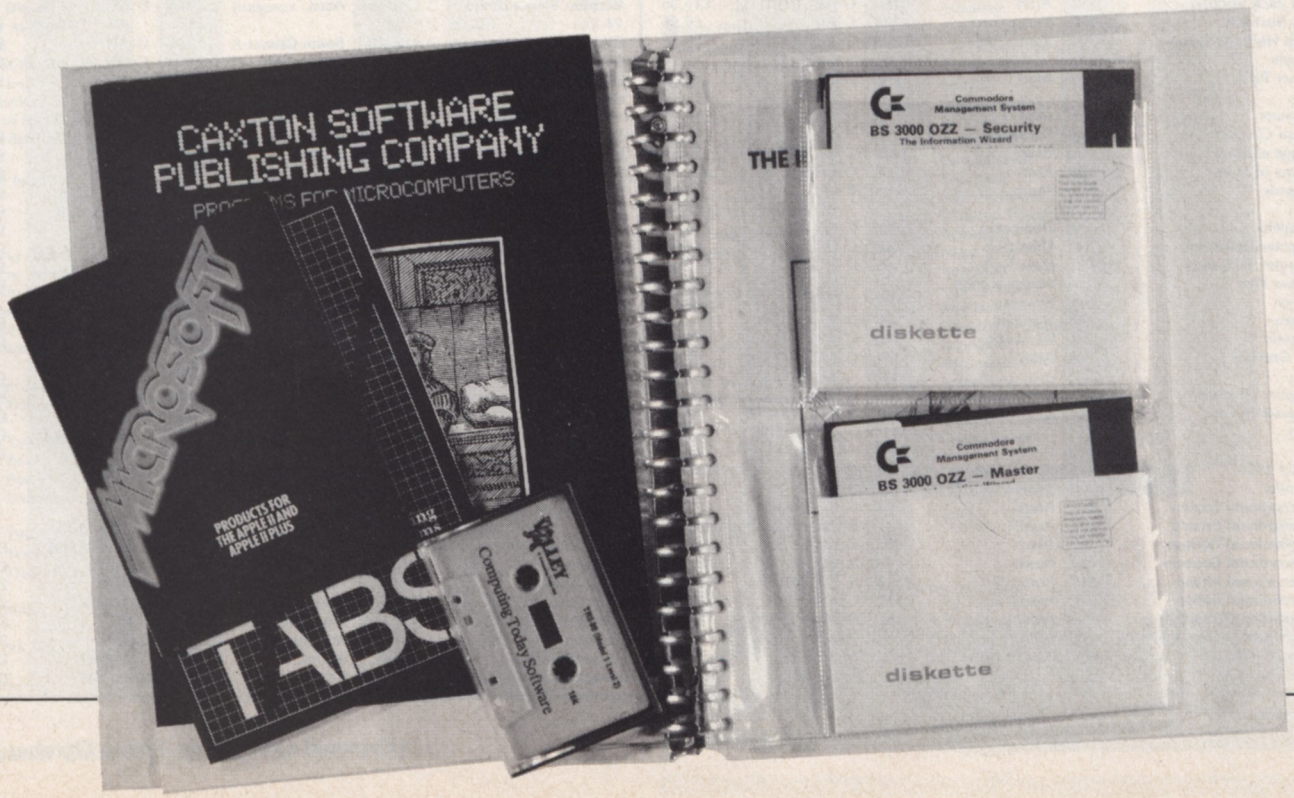
How Sold

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

These tables are repeated throughout the listings to save you having to turn back and forth repeatedly. Once you've found the program you want, check the supplier code with the list of companies at the end of the article for address and telephone number.

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

ATARI 400

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes	Price
3-D Supergraphics	Ut	United S/W of America	48K	C	BC	£29.95
3-D Supergraphics	Ut	United S/W of America	48K	D	AB	£39.95
6502 Disassembler	Ut	Quality S/W	16K	C	BC	£8.95
6502 Disassembler	Ut	Quality S/W	16K	D	BC	£11.95
747 Landing Simulation	Gm	Atari	24K	C	GC	POA
					AB,IK	£16.75
Adventureland	Gm	Adventure Int.	24K	C	BC	£14.95
					AB	£16.50
Action Quest	Gm	J.V. S/W	16K	C	HM	£19.95
Action Quest	Gm	J.V. S/W	16K	D	HM	£19.95
Adventures 1-12	Gm	Adventure Int.	32K	C	CH	£16.50
Air Strike	Gm	English S/W	16K	C	CH,HM	£15.95
Ali Baba	Gm	Quality S/W	32K	D	HM	£22.95
Alpha Fighter	Gm	Dinacomp	24K	C	AB,IK	£11.99
Analog Adventure	Gm		32K	D	BC	£34.95
Angle Worms	Gm	Adventure Int.	8K	C	AB,IK	£12.50
Ants Hill	Gm	Atari	8K	C	GC	POA
					AB	£11.25
Armoured Patrol	Gm	Adventure Int.	16K	C	AB	£16.50
Assembler Editor	Ut	Atari		R	AB,HM	£39.95
Assembler	Ut	Quality S/W	16K	C	BC	£14.95
Assembler Editor	Ut	United S/W of America	16K	R	BC	£34.50
Asteroids	Gm	Atari	16K	R	AC, BC,CH, HM,IK	£29.95
					BC	£18.95
Atari Word Processor	Bs	Atari	32K	C	AB	£95.95
Atari Word Processor	Bs	Atari	32K	C	BC	£85.00
Atari Word Processor	Bs	Atari	32K	D	HM	£99.95
Atari World Graphics	Ut	United S/W of America	48K	D	BC	£43.95
Avalanche	Gm	Atari	16K	C	GC	POA
					CH	£13.95
					AB	£16.75
Babel	Gm	Atari	16K	C	GC	POA
					AB,IK	£16.75
Balrog Sampler	Gm	Adventure Int.	32K	C	AB	£24.95
Basic A Plus	Ut	OSS S/W	48K	D	BC	£52.50
Basic A Plus and Operating System A	Ut	OSS S/W	48K	D	BC	£99.50
Basic Program Compress.	Ut	Atari	32K	D	AB	£16.75
Basic Utility/Renumber	Ut	Atari	16K	C	AB	£16.75
Basics of Animation	Ed	Santa Cruz	24K	D	BC	£10.95
Basics of Animation	Ed	Atari	16K	C	BC	£9.95
Basics of Animation	Ed	Santa Cruz	16K	C	AB	£13.95
Basketball	Gm	Atari	16K	C	AC,HM,IK	£24.50
Basketball	Gm	Atari	16K	R	AB,BC,IK	£29.95
Beneath the Pyramids	Gm	Chrystal	48K	C	CH,AB,IK	£19.99
Black Jack	Gm	Atari	16K	C	GC	POA
					AC,BC	£8.95
					AB,HM,IK	£9.95
Black Jack Shooter	Ed	Atari	16K	C	AB	£16.75
Bob's Business	Bs	Santa Cruz	16K	C	AB	£9.95
British Heritage Jigsaw Puzzle	Gm	Thorn EMI	16K	C	BC,HM,IK	£19.95
Bumper Pool	Gm	Atari	16K	C	GC,IK	POA
					AB	£11.25
Calculator	Bs	Atari	24K	D	BC,IK	£16.95
Canyon Climber	Gm	Datasoft	16K	D	HM	£20.00
Caverns of Mars	Gm	Atari	16K	C	BC,HM,IK	£24.50
Caverns of Mars	Gm	Atari	16K	C	BC,HM,IK	£24.50
Centipede	Gm	Atari	16K	R	GC	POA
					BC,HM,IK	£29.95
Champelo	Gm	Dinacomp	16K	C	AB,IK	£10.99
Character Generator	Ut	Data Soft	16K	C	BC	£9.97
Character Generator	Ut	Data Soft	16K	D	BC	£12.50
Checker Kim	Gm	Personal S/W	16K	C	BC	£15.95
Chicken	Gm	Synapse	16K	C	HM	£19.95
Chicken	Gm	Synapse	16K	D	£19.95	
Chrystals	Gm	Dinacomp	24K	C	AB,IK	£9.99
Code Cracker	Gm	Atari	8K	C	GC	POA
					AB	£11.25
Computer Acquire	Gm	Avalon Hill	16K	C	GB	£17.25
Computer Chess	Gm	Atari	16K	R	GC	POA
					CH,AC,HM	
					AB,BC	£24.95
Conflict 2500	Gm	Avalon Hill		C	GB,AB	£12.50
Controller	Gm	Avalon Hill	32K	D	BH	£17.95
Conversational French	Ed	Atari	16K	C	AC,BC,IK	£32.50
Conversational French	Ed	Atari	16K	R	AB,HM,IK	£39.95
Conversational German	Ed	Atari	16K	C	AC,BC,IK	£32.50
Conversational German	Ed	Atari	16K	R	AB,HM,IK	£39.95
Conversational Italian	Ed	Atari	16K	R	AB,HM,IK	£39.95
Conversational Italian	Ed	Atari	16K	C	AC,BC,IK	£32.50
Conversational Spanish	Ed	Atari	16K	R	AB,HM,IK	£39.95
Conversational Spanish	Ed	Atari	16K	C	AC,BC,IK	£32.50
Convoy Raider	Gm	Avalon Hill	16K	C	BH	£10.95
					GB,AB	£12.50
Cribbage and Dominoes	Gm	Thorn EMI	16K	C	CH,BC,HM ,IK	£14.95
Cross Fire	Gm	On Line	16K	C	HM	£19.95
Cross Fire	Gm	On Line	32K	D	HM	£19.95
Crush, Crumble, Chomp	Gm	Avalon Hill	16K	C	GB,IK	£15.50
Crush, Crumble, Chomp	Gm	Avalon Hill	16K	D	GB,IK	£17.95
Crypts of Terror	Gm	In Home S/W	16K	C	CH,HM	£19.95
Curse of Crawley Manor	Gm	Adventure Int.	16K	C	AB	£16.50
Cypher Bowl	Gm	Artsci Inc.	32K	D	BC	£22.45
DI Nuclear Bomber	Gm	Avalon Hill	16K	C	BH	£10.95
Darts	Gm	Thorn EMI	16K	C	CH,BC,HM IK	£19.95
Data Management S/W	Bs	C E S/W	48K	D	AB	£101.00
Data Management System	DO	Atari	32K	D	AB	£20.50
Datestone of Ryn	Gm	Avalon Hill		D	GB,IK	£15.50
Datestone of Ryn	Gm	Avalon Hill		C	BC	£14.95
					GB,IK	£13.50
Deflections	Gm	Adventure Int.	8K	C	AB,IK	£12.50
Disc Fixer	Ut	Atari	16K	D	AB	£22.50
Display List	Ed	Santa Cruz	16K	C	BC	£9.95
Display List	Ed	Santa Cruz	16K	D	BC	£10.95
Dnieper River	Gm	Avalon Hill	48K	C	BH	£15.95
					CH	£14.50
Domination	Gm	Atari	24K	C	GC	POA
					AB	£16.75
Dos 2	Ut	Atari	32K	D	AB	£21.95
Dragon of Hong Kong	Gm	Adventure Int.	32K	C	AB	£16.50
Eastern Front	Gm	Atari	16K	C	CH	£24.95
Eastern Front	Gm	Atari	16K	D	AB	£30.25
Empire of the Overmind	Gm	Avalon Hill		C	BH	£17.95
					CH	£18.95
Empire of the Overmind	Gm	Avalon Hill		D	GB,AB	£24.95
Escape from Tramm	Gm	Adventure Int.	16K	C	AB	£16.50
European Capitals	Ed	Atari	16K	C	AC,BC	£8.95
					AB,HM,IK	£9.95
European Scene Jigsaw Puzzle	Gm	Thorn EMI	16K	C	BC,HM,IK	£19.95
Extended WSNA	Ut	Atari	16K	C	AB	£19.00
Fantasy land 2041	Gm	Chrystal	48K	C	CH,AB,IK	£34.99
Fastgammon	Gm	Quality S/W	16K	C	BC	£9.95
Forest Fire	Gm	Dinacomp	24K	C	AB,IK	£15.99
Frog	Gm	C E S/W	16K	C	AB	£9.95
Frogger	Gm	On Line	16K	C	HN	£22.95
Frogger	Gm	On Line	32K	D	HN	£22.95
Galactic Chase	Gm	Spectrum	16K	C	AB,BC,HM	£15.99
Galactic Chase	Gm	Spectrum	16K	D	AB	£20.25
Galactic Chase	Gm	Spectrum	16K	D	BC,HM	£17.95
Galactic Empire	Gm	Adventure Int.	32K	C	BC	£14.95
					AB,IK	£16.50
Galactic Guest	Gm	Chrystal	48K	C	CH,AB,IK	£19.99
Galactic Trader	Gm	Adventure Int.	32K	C	AB,CH,IK	£16.50
Galaxy	Gm	Avalon Hill	16K	C	BH	£12.95
Galaxy	Gm	Avalon Hill	16K	D	BH	£14.95
Ghost Hunter	Gm	Arcade Plus	16K	C	HM	£19.95
Ghost Hunter	Gm	Arcade Plus	16K	D	HM	£22.95
Ghost Town	Gm	Adventure Int.	24K	C	BC	£14.95
					AB,IK	£16.50
Giant Slalem	Gm	Dinacomp	16K	C	AB	£11.99
Golden Voyage	Gm	Adventure Int.	24K	C	BC	£14.95
					AB	£16.50
Gomoku	Gm	Artsci Inc	16K	C	BC	£14.95
Graph it	Ut	Atari	16K	C	AC,BC,IK	£11.95
					AB,HM	£13.95
Graphic Sound Demo	Gm	Atari	16K	D	GC	POA
					AB	£16.75
Graphics Machine	Ut	Santa Cruz	16K	C	AB	£13.50
Guns of Fort Defiance	Gm	Avalon Hill	32K	C	BH	£12.95
HMS Impetuous	Gm	Adventure Int.	32K	C	AB	£16.50
Hangman	Gm	Atari	16K	C	AC,BC	£8.95
					AB,HM,IK	£9.95
Hickory Dickory Dock	Gm	Thorn EMI	16K	C	BC,HM,IK	£19.95
Home Financial Mg'ment	Dm	Thorn EMI	16K	D	HM	£29.95
Horizontal/Vertical Scrolling	Ed	Santa Cruz	16K	C	AB	£13.95
House of Usher	Gm	Chrystal	48K	C	AB,CH,IK	£19.99
Humpty Dumpty/Jack & Jill	Gm	Thorn EMI	16K	C	BC,HM,IK	£19.95
Intruder Alert	Gm	Dinacomp	16K	C	AB,IK	£15.99
Invasion Orion	Gm	Avalon Hill		C	GB,IK	£13.25
Invasion Orion	Gm	Avalon Hill		D	GB,IK	£15.75
Invitation to Prog I	Ed	Atari	16K	C	AB,HM,IK	£15.95
Invitation to Prog. II	Ed	Atari	16K	C	GC,IK	POA
					AB,BC,HM	£22.95
Invitation to Prol. III	Ed	Atari	16K	C	AB,BC,HM IK	£22.95
Jawbreaker	Gm	On Line	16K	C	HM	£19.95
Jawbreaker	Gm	On Line	32K	D	HM	£19.95
Jawbreaker	GM	On Line	48K	D	BC,IK	£22.95
Jumbo Jet Lander	Gm	Thorn EMI	16K	C	BC,HM,IK	£29.95
K Dos	Ut	K Bite	32K	D	BC	£53.95
Kids I	Ed	Santa Cruz	16K	C	AB	£9.95
Kids II	Ed	Santa Cruz	16K	C	AB	£9.95
Kingdom	Gm	Atari	16K	C	AC,BC	£8.95
					AB,HM,IK	£9.95
Krazy Shoot Out	Gm	K Bite	16K	C	BC,CH,HM	£29.95
Lazerwords	Gm	Chrystal	16K	C	AB	£19.99
Letter Writer	Bs	CE S/W	16K	C	AB	£19.95
Little Chrystal	Gm	Chrystal	48K	C	CH,AB	£26.99
Little Red Riding Hood	Gm	Adventure Int.	16K	C	AB	£12.50
Local Call for Death	Gm	Adventure Int.	32K	C	AB	£16.50
Lords of Karma	Gm	Avalon Hill	48K	C	CH,BH	£12.95
Lords of Karma	Gm	Avalon Hill	48K	D	CH,BH	£14.95

Lunar Lander	Gm	Adventure Int.	16K	C	AB,IK	£16.50
Macro Assembler	Ut	Atari	32K	R	BC,HM	£59.95
Matchmaker	Gm	Adventure Int.	16K	C	AB	£12.50
Micro Chess	Gm	Personal S/W	16K	C	BC	£15.95
Microsoft Basic	Ut	Atari		C	AB,BC,HM	£59.95
Midway Campaign	Gm	Avalon Hill	32K	C	AB	£12.50
Mind Bogglers	Gm	Versa Computing	16K	C	BC	£8.95
Mini Wordprocessor	Ed	Santa Cruz	32K	C	AB	£9.95
Minotaur	Gm	Atari	24K	C	GC	POA
					AB	£11.25
Missile Command	Gm	Atari	16K	R	BC,AC,CH HM,IK	£29.95
Mission Asteroid	Gm	On Line	40K	D	HN	£17.95
Mission Impossible	Gm	Adventure Int.	24K	C	BC	£14.95
					AB,IK	£16.50
Monarch	Gm	Dinacomp	16K	C	AB,IK	£10.99
Moon Probe	Gm	Dinacomp	16K	C	AB,IK	£9.99
Mortgage Loan Analysis	Ed	Atari	16K	C	AB,BC,HM IK	£13.95
Mountain Shoot	Gm	Adventure Int.	16K	C	AB	£16.50
Mountain Shoot	Gm	Analog S/W	16K	C	BC	£10.95
Mouskattack	Gm	On Line		D	CH,IK	£22.95
Movie Scenes	Gm	Atari	16K	C	BC	£9.95
Moving Maze	Gm	Dinacomp	16K	C	AB,IK	£9.99
Murder at Awesome Hall	Gm	Channel 8 S/W	16K	C	HN	£12.95
Music Composer	Gm	Atari	16K	R	AC,BC	£32.50
					AB,HM,IK	£35.95
Mystery Funhouse	Gm	Adventure Int.	24K	C	BC	£14.95
					AB,IK	£16.50
Nautilus	Gm	Synapse	32K	C	HM	£20.00
Nomino's Jigsaw	Gm	Dinacomp	24K	C	AB,IK	£15.99
Norton Forth	Gm	Adventure Int.	32K	C	AB	£24.95
Nuke War	Gm	Avalon Hill	16K	C	BH	£10.95
Old McDonald's Farm	Gm	Adventure Int.	16K	C	AB	£12.50
Operating System A Plus	Ut	OSS S/W	48K	D	BC	£52.50
Outlaw Howitzer	Gm	Atari	24K	C	GC	POA
					AB	£16.75
Pacific Coast Highway	Gm	Datasoft	16K	C	HN	£20.00
Pacific Coast Highway	Gm	Datasoft	16K	D	HN	£20.00
Pac-Man	Gm	Atari	16K	R	GC,IK	POA
					BC,HM	£29.95
Page Flipping	Ed	Santa Cruz	16K	C	BC	£9.95
Page Flipping	Ed	Santa Cruz	16K	D	BC	£10.95
Personal Finance	Gm	Atari		R	BC,HM,IK	£49.00
Pilot (Educator)	Ut	Atari	16K	C/R	AB,BC,HM	£79.95
Pirate Adventure	Gm	Adventure Int.	24K	C	BC	£14.95
					AB,IK	£16.50
Planet Miners	Gm	Avalon Hill	24K	C	BH	£10.95
Player Missile Graphics	Ed	Santa Cruz	24K	D	BC	£19.95
Player Missile Graphics	Ed	Santa Cruz	24K	C	BC	£18.95
					AB	£19.95
Poker & Solitaire	Gm	Artsci Inc.	16K	C	BC	£10.95
Program Pack I	Ut	Avalon HIll	16K	C	GB	£3.50
Protector	Gm	Synapse	32K	C	HN	£19.95
Purchase Ledger	Bs	Atari	48K	C	AB,IK	£149.95
Pyramid of Doom	Gm	Adventure Int.	24K	C	BC	£14.95
					AB,IK	£16.50
QS Forth	Ut	Quality S/W	24K	D	BC	£44.90
Quest for Power	Gm	Chrystal	48K	C	CH,AB	£26.99
Race in Space	Gm	Analog S/W	16K	C	BC	£14.95
Race in Space	Gm	Analog S/W	16K	C	HN	£15.95
Race in Space	Gm	Analog S/W	16K	D	HN	£15.95
Raster Blaster	Gm	Budgeco	32K	C	HN	£22.95
Rescue at Rigel	Gm		32K	C	BC,IK	£22.45
Reversi	Gm	Artsci Inc	16K	C	BC	£14.95
Rings of the Empire	Gm	Dinacomp	16K	C	AB,IK	£15.99
Rotate and Tilt	Gm	Thorn EMI	16K	C	BC,HM	£14.95
Sales Ledger	Bs	Atari	48K	C	AB,IK	149.95
Sands of Mars	Gm	Chrystal	48K	C	CH,AB,IK	£26.99
Savage Island I	Gm	Adventure Int.	24K	C	BC,IK	£14.95
					AB	£16.50
Savage Island II	Gm	Adventure Int.	24K	C	BC	£14.95
					AB,IK	£16.50
Scram	Gm	Atari	16K	C	GC,IK	POA
					AB,CH,HM	£17.50
Shooting Arcade	Gm	Datasoft	16K	C	HM	£20.00
Shooting Arcade	Gm	Datasoft	16K	D	HM	£20.00
Shooting Gallery	Gm	Analog S/W	16K	C	BC	£15.95
Shooting Gallery	Gm	Analog S/W	16K	D	BC	£15.95
Six Microstories	Gm	Adventure Int.	32K	C	AB	£12.50
Sky Warrior	Gm	Adventure Int.	16K	C	AB	£16.50
Slime	Gm	Synapse	16K	C	HM	£20.00
Snooker and Billiards	Gm	Thorn EMI	16K	C	BC,HM,IK	£19.95
Sound Editor	Gm	Atari	16K	C	GC	POA
					AB	£16.75
Sound Tutorial	Ed	Santa Cruz	16K	C	AB	£13.95
Space Ace	Gm	London S/W	16K	C	HM	£19.95
Space Ace	Gm	London S/W	16K	D	HM	£19.95
Space Invaders	Gm	Atari	16K	R	AB,CH,H-M,BC,IK	
Space Tilt	Gm	Dinacomp	16K	C	AB,IK	£29.95
Space Trap	Gm	Dinacomp	24K	C	AB,IK	£9.99
Space Trek	Gm	Atari	24K	C	GC	POA
					AB	£13.50
Star Raiders	Gm	Atari	16K	R	HM,AC,BC CH,IK	£29.95
Star Trek 3.5	Gm	Adventure Int.	32K	C	BC	£14.95
					AB	£16.50
Star Warrior	Gm	Epyx	32K	C	BC,IK	£28.95
States and Capitals	Ed	Atari	16K	C	AC,BC,IK	£8.95
					AB,HM	£9.95
Statistics I	Gm	Atari		C	AC,BC,IK	£11.95
					AB,HM	£13.95
Stock and Bonds	Gm	Avalon Hill	32K	C	BH	£12.95
Stone of Sisythus	Gm	Adventure Int.	32K	C	AB	£24.95
Strange Odyssey	Gm	Adventure Int.	24K	C	BC,IK	£14.95
					AB	£16.50
Stud Poker	Gm	Dinacomp	16K	C	AB,IK	£10.99
Submarine Commander	Gm	Thorn EMI	16K	C	BC,HM,IK	£24.50
Summer	Gm	Chrystal	16K	C	AB	£11.99
Sunday Golf	Gm	Adventure Int.	16K	C	AB,IK	£16.50
Super Breakout	Gm	Atari	16K	C	AC,HM,IK	£24.50
Super Breakout	Gm	Atari	16K	R	AB,IK	£35.95
Tack Trek	Gm	Atari	24K	C	GC	POA
					AB	£13.50
Tank Trap	Gm	Quality S/W	16K	C	BC	£8.95
Tank Trap	Gm	Quality S/W	16K	D	BC	£11.95
Tanktics	Gm	Avalon Hill	32K	C	CH	£16.95
Tari Trek	Gm	Quality S/W	16K	C	BC	£8.95
Tari Trek	Gm	Quality S/W	16K	D	BC	£11.95
Tele Link	Gm	Atari	16K	R	HM,IK	£21.50
Tele Link	Ut	Atari	16K	R	AB,IK	£19.95
Telelink	Ut	Data Soft	16K	R	BC,IK	£14.95
Terrie	Gm	Atari	32K	C	GC	POA
					AB	£16.75
Text Wizard	Ut	Data Soft	16K	D	AB	£99.95
The Count	Gm	Adventure Int.	24K	C	BC,IK	£14.95
					AB	£16.50
Threshold	Gm	On-Line	32K	C	HM,IK	£24.95
Thunder Island	Gm	Analog S/W	16K	C	BC	£10.95
Touch Typing	Ed	Atari	16K	C	AC,BC,IK	£14.95
					AB,HM	£15.95
Tournament Pool and 8 Ball Pool	Gm	Thorn EMI	16K	C	CH,BC,HM IK	£19.95
Track Attack	Gm	Broada Bond	32K	D	HM	£32.95
Triple Blockade	Gm	Dinacomp	16K	C	AB,IK	£12.99
Tumble Bugs	Gm	Datasoft	24K	D	HM	£19.95
Two Heads of the Coin	Gm	Adventure Int.	32K	C	AB	£16.50
Ulysses	Gm	On-Line	40K	D	HM	£24.95
Video Easel	Gm	Atari	16K	R	GC,IK	POA
					AB,BC,HM	£24.50
Visicalc	Bs	Personal S/W	32K	D	BC,IK	£119.95
Voodoo Castle	Gm	Adventure Int.	24K	C	BC,IK	£14.95
					AB	£16.50
Voyager	Gm	Avalon Hill	32K	C	CH,BH	£12.95
Waterloo	Gm	Chrystal	48K	C	CH,IK	£32.99
Wizard and the Princess	Gm	On Line	48K	D	CH,IK	£22.95
World War III	Gm	Chrystal	48K	C	CH,AB,IK	£19.99

BBC

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes	Prices
Algebraic Manipulation	Ut	Acornsoft	16K	C	AL,GA	£9.95
Asteroid Belt	Gm	Electronics Appplied	16K	C	IF	£4.50
Bounty Pirates	Gm	Aztec S/W	16K	C	IB	£5.50
Characters	Ut	Computer Concepts	16K	C	GJ	£6.67
Characters & Envelope Definer	Ut	Electronics Applied	16K	C	IF	£4.50
Code Race	Gm	Computer Concepts	16K	C	GJ	£6.67
Creative Graphic Pack	Ut	Acornsoft	16K	C	AL,GA	£9.95
Crossed Words	Ed	Aztec S/W	16K	C	IB	£6.50
Database	Bs	Computercat	16K	C	IJ	£11.95
Desk Diary	Bs	Acornsoft	16K	C	AL	£9.95
Early Warning	Gm	A&F Software	16K	C	GE	£6.00
Eldorado Gold	Gm	Program Power	32K	C	GK	£7.99
Graph and Charts Pack	Bs	Acornsoft	16K	C	AL,GA	£9.95
Hangman	Gm	Aztec S/W	16K	C	IB	£5.50
Lisp	Bs	Acornsoft	16K	C	AL,GA	£16.85
Minefield	Gm	A&F Software	16K	C	GE	£6.00
Multifile	Bs	Bug Byte	16K	C	EA	£25.00
Othello	Gm	Computer Concepts	16K	C	GJ	£8.95
Peeko Computer	Bs	Acornsoft	16K	C	AL,GA	£9.95
Lisp	Ut	Acronsoft	32K	C	AL,GA£16.85	
Mission Impossible	Gm	Aztec S/W	16K	C	IB	£6.50
Monsters	Gm	Acornsoft	32K	C	AL,GA	£9.95
Othello	Gm	Computer Concepts	32K	C	GJ	£8.95
Othello	Gm	Computercat	16K	C	IJ	£8.95



REFERENCE

SOFTWARE LISTING

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes	Prices
Peeko Computer	Ut	Acornsoft	32K	C	AL,GA	£9.95
Philosopher's quest	Gm	Acronsoft	32K	C	AL,GA	£9.95
Princess	Gm	Aztec S/W	16K	C	IB	£6.50
Snake	GM	Computer Concepts	32K	C	GJ	£6.67
Snapper	Gm	Acornsoft	32K	C	AL,GA	£9.95
Space Warp	Gm	Bug Byte	32K	C	GA,EA	£11.50
Squash	Gm	Aztec S/W	16K	C	IB	£5.50
Teacher's Toolkit	Ed	Wida Software	32K	C	FY	£30.00
Touch Typist	Ed	Computercat	16K	C	IJ	£9.95
Towns of Britain	Ed	Aztec S/W	16K	C	IB	£6.50
Wordwise	Gm	Computer Concepts	32K	C	GJ	£74.75
Valley, The	Gm	CT Software	32K	C	PF	£9.95
Algebraic Manipulation	Ut	Acronsoft	32K	C	AL,GA	£9.95
Backgammon	Ut	Bug Byte	32K	C	EA	£8.00
Characters	Ut	Computen Concepts	32K	C	GJ	£6.67
Chess	Gm	Bug Byte	32K	C	EA	£11.50
Code Race	Ut	Computer Concepts	32K	C	GJ	£6.67
Creative Graphics	Ut	Acornsoft	32K	C	AL,GA	£9.95
Defender	Gm	Acornsoft	32K	C	AL,GA	£9.95
Desk Diary	Bs	Acornsoft	32K	C	AL,GA	£9.95
FORTH	Ut	Acornsoft	32K	C	AL	£16.85
Golf	Gm	Bug Byte	32K	C	GA,EA	£7.00
Graph and Charts Pack	Bs	Acronsoft	32k	C	AL,GA	£9.95

SHARP MZ-80K

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes	Prices
3-D Basic	Gm	Kuma	6K	C	AX,AO,AB	£6.32
Address Book	Gm	Highlight S/W	4K	C	CC,AB	£4.60
Aladdin's Cave	Gm	Kuma		C	AX,CH	£6.32
Aldebaren I	Gm	Sharpsoft	20K	C	CH	£5.85
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
Asteroids	Gm	Sharpsoft	20K	C	CH	£5.85
Astro Dodge	Gm	Kuma		C	AX,CH	£6.32
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 Compiler	Ut	Sharp	48K	C	AB	£34.50
Basic Extensions	Ut	Kuma	20K	C	AX,AO,AB	£14.95
Basic Plus	Ut	Kuma		C	AX	£13.80
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
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
Brownian Motion	Ed	Kuma		C	AX	£12.00
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
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
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
Connect 4	Gm	Highlight S/W	6K	C	CC,AB	£4.60
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
Cricket	Gm	Kuma		C	AX	£6.32
Cursed Chambers	Gm	J Wolstencroft	48K	C	CZ	£5.75
Data Base	Bs	Kuma	48K	C	AX,AO	£33.95
Data File	Gm	Gamer	48K	C	CZ	£29.95
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
Election '84	Gm	Sharpsoft	20K	C	CH	£8.45
Electronic Organ	Gm	Kuma	12K	C	AX	£6.32
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
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
Fireballs	Gm	Kuma	6K	C	AX,AB	£6.32
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
Fruit Machine	Gm	Kuma	6K	C	AX,AO,AB	£6.32
Full Accounting	Bs	Microtek	48K	C	EQ	POA
Guess Word	Gm	Kuma	6K	C	AX,AB	£6.32
Hangman	Gm	Kuma	6K	C	AX,AO,AB	£6.32
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 Four 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
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
Life	Gm	Kuma	48K	C	AX,AO,AB	£9.20
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
Madness	Gm	J Wolstencroft	24K	C	CZ	£4.60
Maniac	Gm	Highlight S/W	6K	C	CC,AB	£5.75
Map of England	Gm	Kuma	48K	C	AO	£6.32
Map of Englad	Gm	Kuma	48K	D	AX	£12.00
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
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
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
Music Composer/Editor	Ed	Kuma	48K	C	AX,AC,AB	£12.00
Narpex	Ed	Kuma		C	AX	£28.70
Newton/Conservation	Ed	Kuma		C	AX	£12.00
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	Tridata	48K	D	ID	£170.00
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
Pontoon	Gm	Kuma	48K	C	AX,AO,AB	£6.32
Poseidon	Gm	Highlight S/W	6K	C	CC, AB	£5.75
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
Reactor	Gm	Kuma	48K	C	AX,AB	£6.32
Rhymes	Gm	Kuma	48K	C	AX,AB	£6.32
Road Hunter	Gm	Kuma	48K	C	AX,AO,AB	£6.32
Rocket	Ed	Kuma		C	AX	£6.32
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

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes	Price
Slave Interpreter	Ut	Kuma		C	AX	£16.65
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
Space Battle	Gm	Kuma	48K	C	AX,AO,AB	£6.32
Space Invaders	Gm	Kuma	48K	C	AX,AO,AC,AB	£6.32
Space Pursuit	Gm	Kuma	48K	C	AX,AO,AB	£6.32
Star Trek	Gm	Kuma	10K	C	AX,AC,AO	£6.32
Stock Control/Invoicing	Bs	Microtek	48K	C	EQ	£316.00
Stomper	Gm	Kuma	10K	C	AX,FZ,AB	£6.32
Stomper/Minefields	Gm	Sharpsoft	20K	C	AB	£5.85
Submarine	Gm	Kuma	10K	C	AX,AO	£6.32
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
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 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
Tycoon	Gm	Kuma	48K	C	AX,AO	£6.32
UFO	Gm	Kuma	6K	C	AX,AC	£6.32
Waves I	Ed	Kuma		C	AX	£12.00
Waves II	Ed	Kuma		C	AX	£12.00
Wordpro	Bs	Kuma	48K	C	AX,AC	£45.45
Wordpro	Bs	Kuma	48K	C	AX,AC	£91.95
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

TRS 80

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes	Price
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.	24K	D	AB	£18.99
Adventure Mysterious	Gm	Adventure Int.	16K	C	AJ	£10.06
Adventure Mysterious	Gm	Adventure Int.	32K	D	AJ	£13.50
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	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	IA	£11.95
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	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	GB	£15.50
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		C	IA	£12.00
Atlantian Odyssey	Gm	Guild		C	GB	£19.75
Atlantian Odyssey	Gm	Guild		D	GB	£21.50
Attack Force	Gm	Big 5 S/W	16K	C	IA	£10.95
BI Nuclear Bomber	Gm	Instant S/W	16K	C	GB	£12.50
					BT	£12.95
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	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
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
Basketball	Gm	Molimerx	32K	D	AJ	£14.39
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	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
Bright & Early Build High	Ed	Molimerx	16K	C	AJ	£8.90
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
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
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
Computer Pools	Do	Molimerx	16K	C	AJ	£16.68
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
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 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	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
Crown of CWL IMDRAS part I	Gm	Ogre	16K	C	IC	£10.00
Crown of CWL IMDRAS part 2	Gm	Ogre	16K	C	IC	£10.00
Cube Hunt	Gm	Molimerx	16K	C	AJ	£10.35
Curse of Crawley Manor	Gm	Adventure Int.	16K	D	AB	£18.99
DLDIS	Ut	Instant S/W	16K	D	GB	£15.50
					AB	£16.50
DSM	Ut	Racet Computers	32K	D	AJ	£46.00
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	D	GB	£15.50
Dataquiz	Ut	Bryants S/W	16K	C	HW	£3.75
Day of the Week	Bs	Molimerx	4K	C	AJ	£5.75
Deathmaze 5000	Gm	Med Systems	16K	C	IA	£10.95
Decision Master	Ut	Sytonic S/W	32K	D	GB	£35.50

REFERENCE

SOFTWARE LISTING

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier	Codes & Prices
Decimal Dan	Ed	Bryants S/W	16K	C	HW	£3.75
Defence Command	Gm	Big 5 S/W		C	IA	£10.95
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
Disassembler	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
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
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	GB	£13.25
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	AJ	£10.93
Dungeon Escape	Gm	Computer Shack	16K	C	GB	£11.95
Dungeon Escape	Gm	Computer Shack	16K	D	GB	£15.50
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	GB	£15.50
Eliminator	Gm	Adventure Int.	16K	D	AB	£18.99
Emperor	Gm	Molimerx	16K	C	AJ	£15.53
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	D	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
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
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
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	Molimerx	16K	C	AJ	£7.48
Frogs/Logic	Gm	Kansas	16K	C	IH	£7.50
Galactic Empire	Gm	Adventure Int.	16K	C	AJ,AB	£9.78
Galactic Empire	Gm	Adventure Int.	32K	D	AB	£18.99
Galactic 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	AJ	£9.78
Galactic Trader	Gm	Adventure Int.	16K	C	AJ	£9.78
Galactic Trader	Gm	Adventure Int.	32k	D	AB	£18.99
Galaxy Invasion	Gm	Big 5 S/W	16K	C	IA	£10.95
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.	24K	D	AB	£18.99
Golden Voyage	Gm	Adventure Int.	24K	D	AB	£18.99
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
Gridref	Ed	Bryants S/W	16K	C	HW	£3.75
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	GB	£19.50
					AB	£20.50
Infinite Startrek	Gm	Kansas	16K	C	IH	£9.50
Invoicing	Bs	Tridata	48K	D	ID	£140.00
Interlude	Gm	Syntonic S/W		C	GB	£20.25
Interlude	Gm	Syntonic S/W		D	GB	£23.50
Invasion Orion	Gm	Automated Simulation		C	GB	£13.25
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
Jumbles	Ed	Bryants S/W	16K	C	HW	£3.75
Keyspeed	Ut	Kansas	16K	C	IH	£6.25
Kid's Gallery	Gm	Instant S/W	16K	C	AB	£8.50
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
Laser Defence	Gm	Med Systems	16K	C	GB	£11.95
Laser Defence	Gm	Med Systems	16K	D	GB	£14.50
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
Lunar Lander	Gm	Adventure Int.	16K	C	AB	£12.50
Lunar Lander	Gm	Adventure Int.	16K	D	AB	£18.99
Lprint	Ut	Kansas	16K	C	IH	£6.25
Mail File	Ut	Instant S/W		D	GB	£75.25
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
Merge	Ut	Kansas	16K	C	IH	£6.25
Meteor Mission	Gm	Big 5 S/W	16K	C	IA	£10.95
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
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.	24K	D	AB	£18.99
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
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.	24K	D	AB	£18.99
News 80	Bs	Baust Computing	48K	D	HA	POA
Night Flight	Gm	Instant S/W	16K	C	GB,AB	£8.50
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
Nuke War	Gm	Avalon Hill	16K	C	IA	£10.95
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
On Guard	Ed	Bryants S/W	16K	C	HW	£3.75
Patience	Gm	Bryants S/W	16K	C	HW	£3.75
Payroll	Bs	Tridata	48K	D	ID	£170.00
Perfect Pong	Gm	Instant S/W	16K	C	GB,AB	£12.75
Personal Bill Paying	Do	Instant S/W	16K	C	AB	£6.50
Personal Accounts	Do	Kansas	16K	C	IH	£9.50
Pinball Bounce/Robots	Gm	Kansas	16K	C	IH	£7.50
Pirate Adventure	Gm	Adventure Int.	24K	D	AB	£18.99
Pits of Angband	Gm	Kansas	16K	C	IH	£9.50
Planet Miners	Gm	Avalon Hill	16K	C	IA	£10.95
Planetoids	Gm	Adventure Int.	16K	C	AB	£12.50
Plus Sound	Ut	Kansas	16K	C	IH	£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
Punctuation	Ed	Bryants S/W	16K	C	HW	£3.75
Purchase	Bs	Tridata	48K	D	ID	£170.00
Pyramids of Doom	Gm	Adventure Int.	24K	D	AB	£18.99
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
Re-Number	Ut	Kansas	16K	C	IH	£6.25
Repeat	Ut	Kansas	16K	C	IH	£6.25
Rescue	Ut	Kansas	16K	C	IH	£6.25
Robot Attack	Gm	Big 5	16K	C	IA	£10.95
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
Savage Island I	Gm	Adventure Int.	24K	D	AB	£18.99
Savage Island II	Gm	Adventure Int.	24K	D	AB	£18.99
Scrafman	Gm	Cornsoft	48K	C	IA	£11.95
Screen Print	Ut	Kansas	16K	C	IH	£6.25
Sea Wolf	Gm	Kansas	16K	C	IH	£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
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	D	AB	£18.99
Slag	Gm	Adventure Int.	16K	C	AB	£14.35
Smartwork	Gm	Instant S/W	16K	C	IA	£8.00
Space Castle	Gm	Instant S/W	16K	C	IA	£11.95
Space Intruder	Gm	Adventure Int.	16K	C	AB	£14.35
Space Shuttle	Gm	Instant S/W	16K	C	AB	£12.50
Star Fighter	Gm	Adventure Int.	16K	C	AB	£20.95
Star Scout	Gm	Adventure Int.	16K	C	AB	£14.35
Star Trek 3.5	Gm	Adventure Int.	32K	D	AB	£18.99
Space Trek	Gm	Instant S/W	16K	C	IA	£6.50
Speechparts	Ed	Bryants S/W	16K	C	HW	£3.75
Spellsort	Ed	Bryants S/W	16K	C	HW	£3.75
Spelltest	Ed	Bryants S/W	16K	C	HW	£3.75
Starlord	Gm	Bryants S/W	16K	C	IC	£10.00
Storybuilder	Ed	Bryants S/W	16K	C	HW	£3.75
Stock	Bs	Tridata	48K	D	ID	£170.00
Stock or Bonds	Gm	Avalon Hill	16K	C	IA	£12.95
Stone of Sisythus	Gm	Adventure Int.	32K	D	AB	£33.70
Strange Odyssey	Gm	Adventure Int.	24K	D	AB	£18.99
Sunday Golf	Gm	Adventure Int.	16K	D	AB	£18.99
Surveyor's Apprentice	Ed	Instant S/W	16K	C	AB	£8.50
Super Breakthrough	Gm	Kansas	16K	C	IH	£8.50
Super Copy	Ut	Kansas	16K	C	IH	£9.50
Super Nova	Gm	Big 5	16K	C	IH	£10.95
Swamp War	Gm	Instant S/W	16K	C	AB	£12.50
Swords and Socery	Gm	Kansas	16K	C	IH	£9.50
System Master Monitor	Ut	Kansas	16K	C	IH	£17.00
System to Basic	Ut	Kansas	16K	C	IH	£8.50
TL DIS	Ut	Instant S/W	16K	C	AB	£12.50
TRS Test	Ut	Instant S/W	16K	C	AB	£8.50
Tables Test	Ed	Bryants S/W	16K	C	HW	£3.75
Tanktics	Gm	Avalon Hill	16K	C	IA	£15.95
Targetsounds	Ed	Bryants S/W	16K	C	HW	£3.75
Teacher's Aid	Ed	Instant S/W	16K		AB	£34.50
Temple of the Sun	Gm	Instant S/W	16K		AB	£16.50
The Count	Gm	Adventure Int.	24K	D	AB	£18.99
The Mean Checkers Machine	Gm	Adventure Int.	16K	C	AB	£14.35
The Congo Mission	Gm	Bryants S/W	16K	C	IC	£10.00
The Quest	Gm	Bryants S/W	16K	C	IC	£12.00
The Secret Wilderness	Gm	Ogre	16K	C	IC	£6.50
Toolkit	Ut	Kansas	16K	C	IC	£12.00
Towers	Ed	Bryants S/W	16K	C	HW	£3.75
Treasure Quest	Gm	Adventure Int.	16K	C	AB	£14.35
Tunnels of Fahad	Gm	Adventure Int.	16K	C	AB	£12.50
Two Heads of the Coin	Gm	Adventure Int.	32K	D	AB	£18.99
Typing Teacher	Ed	Instant S/W	16K	C	AB	£8.50
Typewriter	Ut	Kansas	16K	C	IH	£6.25
Ultra Man	Ut	Instant S/W	16K		AB	£21.50
Utility II	Ut	Instant S/W	16K	C	IA	£8.50
Valley	Gm	CT Software	16K	C	PF	£9.95
Valley of the Kings	Gm	Instant S/W	16K	C	IC	£10.00
Venture	Gm	Horizon S/W	16K	C	IA	£11.95
Voodoo Castle	Gm	Adventure Int.	24K	D	AB	£18.99
Voyager	Gm	Avalon Hill	16K	C	IA	£12.95
What Next?	Gm	Baust Computing	4K	D	HA	£6.95
What Next?	Gm	Baust Computing	4K	C	HA	£3.95
Word Processor	Bs	Kansas	16K	C	IH	£19.50
Word Watch	Ed	Instant S/W	16K	C	IA	£6.50
Yahtzee	Gm	Kansas	16K	C	IH	£8.50
Your Life Score	Do	Bryants S/W	16K	C	HW	£3.75
Zossed in Space	Gm	Adventure Int.	16K	D	AB	£14.35
Zossed in Space	Gm	Adventure Int.	16K	C	CH	£10.00

VIC20

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes	Prices
3-D Maze	Gm	Adcom	8K	C	AB	£7.50
3-D Maze	Gm	Hi-Tech	3K	C	FZ	£8.30
					CF,AO	£8.62
A-Maz-Ing	Gm	Audiogenic	8K	C	AA,CH,HM	£6.99
Alien	Gm	Commodore	3K	R	FZ,AB,GF	
					CF,DM,CH	
					FD,FP,AA	£19.95
Alien Attack	Gm	Adcom	5K	C	AB	£7.00
Alien Attack	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Alien Blaster	Gm	Paysoft	5K	C	FP	£5.25
Alien Blitz	Gm	Audiogenic	3K	C	AA,HM	£7.99
Alien Blitz	Gm	Audiogenic	5K	C	CH	£7.99
Alien Maze	Gm	Adcom	8K	C	AB	£7.50
Alien Maze	Gm	Hi-Tech	3K	C	FZ	£8.30
					CF,AO	£8.62
Alien Wars	Gm	Hi-Tech	3K	C	FZ	£8.30
					AY	£7.80
					CF,AO	£8.62
Amok	Gm	Audiogenic	5K	C	AA,HM	£6.99
Ant Raiders	Gm	PR Software	3K	C	HN	£7.95
Asteroid Belt	Gm	Adcom	8K	C	AB	£7.50
Asteroid Belt	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Asteroids	Gm	Bug Byte	5K	C	HN	£8.99
Avenger	Gm	Commodore	3K	R	FZ,AB,GF	
					CF,DM,CH	
					FD,FP,AA	£19.95
A.V.I.T.W.	Gm	Bug Byte	5K	C	HN	£8.99
Balloon Bomber	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Blitz	Gm	Commodore	3K	C	FD	£4.99
Car Drive	Gm	Adcom	5K	C	AB	£7.00
Car Drive	Gm	Hi-Tech	3K	C	FZ	£8.30
					AY	£7.80
					CF	£8.62
Car Race	Gm	Adcom	5K	C	AB	£7.00
Car Race	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Charset 20	Gm	Adcom	8K	C	AB	£8.00
Charset 20	Gm	Rabbit S/W	3K	C	AH	£4.99
Chess	Gm	Commodore	3K	R	HN	£24.95
Cloudburst	Gm	Audiogenic	3K	R	HN	£19.99
Code Breaker	Gm	Adcom	5K	C	AB	£5.00
Code Breaker	Gm	Rabbit S/W	3K	C	AH	£2.99
Cosmic Battle	Gm	Adcom	5K	C	AB	£8.00
Cosmic Battle	Gm	Rabbit S/W	3K	C	AH	£4.99
Crazy Balloon	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Defenda	Gm	Llamasoft	5K	C	HN	£9.95
Deflection	Gm	Adcom	5K	C	AB	£7.00
Deflection	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Dragon Maze	Gm	Adcom	8K	C	AB	£7.50
Dragon Maze	Gm	Hi-Tech	3K	C	FZ	£8.30
					CF,AO	£8.62



REFERENCE

SOFTWARE LISTING

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier Codes	Prices
Dune Buggy	Gm	Rabbit S/W	3K	C	AH	£4.99
Duplicate	Gm	Paysoft	5K	C	FP	£5.25
Fire Trek	Gm	Hi-Tech	3K	C	AY	£7.80
					FZ	£8.30
					CF,AO	£8.62
Fly Snatcher	Gm	PR Software	3K	C	HN	£7.95
Frogger	Gm	Rabbit S/W	8K	C	AH	£7.99
Game Graphics & Graphics Editor	Ut	Soft Toys	3K	C	IG	£8.00
Games Tape I	Gm	Titan	3K	C	HJ	£5.00
Grand Prix	Gm	Hi-Tech	3K	C	FZ, 8.30 AY	£7.80
Gun Men	Gm	Hi-Tech	3K	C	AY	£7.80
					FZ	£8.30
					CF,AO	£8.62
Hangman	Gm	Paysoft	5K	C	FP	£5.25
Hangman Maths	Gm	Audiogenic		C	AA,HM	£7.99
Hesdon	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Highways Plot	Gm	Adcom	8K	C	AB	£5.00
ICBM	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Invader Fall	Gm	Hi-Tech	3K	C	FZ	£8.30
					CF,AO	£8.62
Indi 500	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Intro. to Basic I	Ed	Commodore	3K	C	AA,AB	£14.95
Invader Fall	Gm	Adcom	8K	C	AB	£7.50
Invader Fall	Gm	Audiogenic	3K	C	AA	£6.99
Jelly Monsters	Gm	Commodore	3K	R	AB,CF,DM GC,GF,AA CH	£19.95
Jungle	Gm	Adcom	5K	C	AB	£6.00
Jungle	Gm	Rabbit S/W	3K	C	AH	£4.99
Kiddy Checkers	Gm	Audiogenic	3K	C	AA,HM	£6.99
Lunar Lander	Gm	Adcom	5K	C	AB	£7.00
Lunar Lander	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Lunar Maths	Ed	Titan	3K	C	HJ	£6.00
Machine Code Monitor	Ut	Commodore	3K	R	AA,AB	£34.95
Machine Code Monitor	Ut	Commodore	3K	R	GF	POA
Master Wits	Gm	Audiogenic	3K	C	AA,HM	£6.99
Maths Hurdler/Monster Merge	Gm	Audiogenic		C	AA,HM	£7.99
Maze Men	Gm	Titan	3K	C	HJ	£6.00
Memory Pack	Ut	Commodore	16K	R	FZ	£74.95
Memory Pack	Ut	Commodore	3K	R	FZ	£24.95
Memory Pack	Ut	Commodore	8K	R	FZ	£44.95
Meteor Run	Gm	Anglo American	3K	R	HN	£24.99
Meteroid	Gm	Adcom	5K	C	AB	£10.00
Missile Command	Gm	Adcom	3K	C	HN	£7.95
Missile Commander	Gm	Hi-Tech	3K	C	CF	£8.62
Moak	Gm	Audiogenic	5K	C	CH	£6.99
Mole Attack	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Music Maker	Gm	Adcom	5K	C	AB	£10.00
Naval Attack	Gm	Titan	3K	C	HJ	£7.00
Naval Battle	Gm	Hi-Tech	3K	C	CF,AO,FZ	£8.62
New York	Gm	Paysoft	5K	C	FP	£5.25
Night Flight	Gm	Rabbit S/W	3K	C	AH	£4.99
Othello	Gm	Hi-Tech	3K	C	FZ	£8.30
					CF	£8.62
					AO,AY	£7.80
Pack Man	Gm	Hi-Tech	3K	C	FZ	£8.30
					AO	£8.62
					AY	£7.80
Programmer's Aid	Ut	Commodore	3K	R	AA,AB	£34.95
Rabbit Functions	Ut	Rabbit S/W	3K	C	AH	£4.99
Rabbit Writer	Ut	Rabbit S/W	16K	C	AH	£9.99
Rat Race	Gm	Commodore	3K	R	HN	£19.95
Renaissance	Gm	Audiogenic	3K	R	HN	£19.99
Road Race	Gm	Commodore	3K	R	FZ,AB,GF CF,DM,CH, GC,FD,FP AA	£19.95
Robot Zap	Gm	Paysoft	5K	C	FP	£5.25
Rugby Game	Gm	Adcom	5K	C	AB	£7.00
Rugby Game	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Seawolf/Bounceout	Gm	Audiogenic		C	AA,HM	£8.99
Simple Simon	Gm	Audiogenic	5K	C	AA,HM	£6.99
Six Program Pack; War Game, Smash Out, Black Jack, Logic, Pick Up Game, Alarm Clock	Gm	PR Software	3K	C	GV	£7.50
Ski Run	Gm	Rabbio S/W	3K	C	AH	£4.99
Skier	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Skimetts	Gm	Audiogenic	3K	C	AA	£6.99
Slot Machine	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Soft Toys 1	Gm	Soft Toys	3K	C	IG	£6.50
Soft Toys 2	Gm	Soft Toys	3K	C	IG	£6.50
Soft Toys 2	Gm	Soft Toys	5K	C	IG	£8.00
Space Defence	Gm	Adcom	5K	C	AB	£10.00
Space Defender	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Space Division	Gm	Audiogenic	3K	C	AA	£6.99
Space Invaders	Gm	Hi-Tech	3K	C	CF,AO,FZ	£8.62
Space Storm	Gm	Rabbit S/W	3K	C	AH	£6.99
Space Wars/Battle Zone	Gm	Titan	3K	C	HJ	£6.00
Spiders from Mars	Gm	Audiogenic	5K	R	CH,AA	£24.99
Spiders of Mars	Gm	Anglo American	3K	R	GB	£25.90
Star Battle	Gm	Commodore	3K	R	AA,CH,AB CF,DM,GC	£19.95
Star Wars	Gm	Audiogenic	3K	C	AA	£6.99
Star Wars II	Gm	Titan	3K	C	HJ	£7.00
Stella Shootout	Gm	Adcom	5K	C	AB	£15.00
Stunt Cycle	Gm	Coloursoft	5K	C	FP	£7.75
Sub Attack/Missile Command	Gm	PR Software	3K	C	HN	£7.95
Submarine	Gm	Hi-Tech	3K	C	CF,AO,FZ	£8.62
Super Breakout	Gm	Adcom	5K	C	AB	£7.00
Super Breakout	Gm	Coloursoft	5K	C	FP	£7.75
Super Breakout	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Super Expander High Resolution Pack	Ut	Commodore	3K	R	AA,AB,FZ	£34.95
Super Lander	Gm	Commodore	3K	R	AA,AB,FZ CF,CH,DM FD,FP,GF	£19.95
Super Moonlander	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Super Slot	Gm	Commodore	3K	R	CH,GC,AA DM,AB,FZ FD,CF	£19.95
Super Snake	Gm	Adcom	5K	C	AB	£7.00
Super Snake	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Super Worm	Gm	Rabbit S/W	3K	C	AH	£4.99
The Alien	Gm	Audiogenic	8K	C	CH,AA	£7.99
Treasure Carrying	Gm	Hi-Tech	3K	C	CF,AO	£8.62
UFO Shooting	Gm	Adcom	5K	C	AB	£7.00
UFO Shooting	Gm	Hi-Tech	3K	C	CF,AO	£8.62
VIC Code Monitor	Ut	Commodore	3K	R	FZ	£34.95
VIC Forth	Ut	Datatronic	3K	R	Hn	£38.95
VIC Graf	Ut	Datatronic	3K	R	Hn	£28.95
VIC Men	Gm	Coloursoft	5K	C	FP	£7.00
VIC Stat	Ut	Datatronic	3K	R	Hn	£29.95
VICalc	Ut	Audiogenic	3K	C	AA, HM	£6.99
Vicgammon	Gm	Bug Byte	8K	C	CH	£7.00
Vicmen	Gm	Anglo American	3K	C	GB	£7.00
Vicmen	Gm	Bug Byte	5K	C	CH	£7.99
Vic Cube	Gm	Hi-Tech	3K	C	CF,AO	£8.62
Wall Street	Gm	Audiogenic	3K	C	AA,HM	£6.99

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SOFTWARE SUPPLIERS LIST

Supplier Code

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30 Dundas Street
Endinburgh EH3 6JN
031 556 7354

AB Micro and Video Palace
62-64 Kensington High Street
London W8
01 937 8587

AC Laskys
7-9 Queensway
London W23RX
01 200 0444

AD Datarite Terminals Ltd
Caldare House
144-146 High Street
Chadwell Heath
Essex RM6 6NT
01 590 1155

AE Vincelord Ltd
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26 Charing Cross Road
London WC2
240 0213/0217

AF MicroComputerLand
Shropshire House
2-10 Capper Street
London WC1E 6JR
01 637 4078/948 6411

AG Comart Ltd
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(0480) 215005

AH Cream Computer Shop
Rabbit Software
380 Station Road
Harrow
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863 0833

AI Microvalue
Computer Interfacing & Equipment Ltd
The Micro Spares Shop
19 Roseburn Terrace
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(031) 337 5611

AJ Molimerx Ltd
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Town Hall Square
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(0424) 220391/223636

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AK GW Computers Ltd
55 Bedford Court Mansions
Bedford Avenue
London WC1
01 636 8210/631 4818

AL Acornsoft Ltd
4a Market Hill
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CB23NJ
0223 316039

AM Acorn Computers
Fulbourne Road
Cherry Hinton
Cambridge

AN Microcomputers Products Int.
Rm PCW
8 Cambridge House
Cambridge Road
Barking
Essex 1G11 8NT
591 6511

AO Xitan Systems
23 Cumberland Place
Southampton S01
0703 38740

AP KGB Micros Ltd
14 Winsor Road
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Berks
Slough (0753) 38581/38319

AQ Broadside
2 The Spinney
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AR Software Ltd
387 8832/388 9927

AS Lucas Logic Ltd
Nasco Microcomputers
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Welton Road
Wedgnock Industrial Estate
Warwick CV34 5PZ

AT Atlantic Micro System
70-72 Honor Oak Park
London SE23 1DY
01 699 2202

AU TCL Software
59/61 Theobalds Road
London WC1
405 5240/2113

AV I A S
Cambridge Road
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Herts
0223 207689

AW Intelligent Artefacts Ltd
Cambridge Road
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0223 207689

AX Kuma Computers
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0628 71778

AY Microstore
327 Kings Road
London SW3
352 9291

AZ London Retail
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London SW16 6SH
01 677 2052/7341

BA Micro-Spares
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Edinburgh EH12 5NG
031 337 5611

BB CAPS Ltd
28 The Spain
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Hampshire
GU32 3LA

BC Maplin
PO Box 3
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Essex
0702 552911/554155

BD Caxton Software
Publishing Co.
10-14 Bedford Street
Covent Garden
London WC2
01 379 6502

BE Cornshall Ltd
32-34 Great Peter Street
London SW1

BF Micro Technology
Royal Sussex Assembly Rooms
The Pantiles
Tunbridge Wells
Kent
0892 32116

BG Elcon Research Ltd
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Cambridge CB3 8EZ
0954 81825

BH Avalon Hill Games
650 High Street
North Finchley N12
445 3044

BI Call Apple (UK)
c/o SBD Software, Freepost
Richmond
Surrey
940 5194

BJ Lifeboat Associates
PO Box 125
London WC2H 9LU
836 9028

BK L & J Computers
192 Honey Pot Lane
Queensbury
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Middx HA7 1EE
204 7525

BL Peach Tree Software
International
(Susan Jane)
MSA House
99 King Street
Maidenhead
Berks
0628 71011

BM ACT (Microsoft) Ltd
Freepost
Birmingham B16 8BR
(David Low)
021 454 8585

BN Personal Computer Palace
4-6 Castle Street
Reading
Berks
0734 589249

BO Sinclair Software
Sinclair Research Ltd
6 Kings Parade
Cambridge
CB2 1SN
0276 66104

BP Leicester Computer Centre Ltd
67 Regent Road
Leicester
LE16YF
0533 556268

BQ TABS Ltd
Sopers House
Chantry Way
Andover
Hants
SP10 12U
0264 58933

BR IBR Microcomputers
Suttons Industrial Park
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Earley
Reading
0734 664111

BS Computer Plus
47 Queens Road
Watford
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WD1 2LH
0923 33927

BT The Essential Software Co.
Dept BT (Visconti Ltd)
47 Brunswick Centre
London WC1
866 5445

BU Guestel
8-12 New Bridge Street
London EC4
583 2255

BV Lowe Electronics
Chesterfield Road
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Derbyshire DE4 5LE
0629 4995

BW Gate Micro System Ltd
The Nethergate Centre
35 Yeaman Shore
Dundee
0382 28194

BY Almarc Data Systems Ltd
Great Freeman Street
Nottingham
NG3 1FR
0602 52457/8/9

BZ Interam Computer Systems
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46 Balham High Road
London SW12
675 5325/6/7

CA Terodec Ltd
Unit 58
Suttons Park Avenue
Earley
Reading
0734 664343/6

CB Poolsoft
17 Blatchington Road
Saford
East Sussex
0323 890604

CC Highlight Software
3 Nether Court
Halstead
Essex
0787 475714

CD Omega Plus
2c Graham Road
London E8 1BZ

CE Southern Software
PO Box 39
Castleigh
Hants SO5 5WQ

CF Sigma Systems
54 Park Place
Cardiff
Cardiff 21515/34869

CG Planet Software
10 Norton Drive
Eaton
Norwich

CH Brighton Gamer
24 Gloucester Road
Brighton
Sussex
0273 698424

CI Picturesque
6 Corkscrew Hill
West Wickham
Kent BR4 9BB

CJ ACS Software
7 Lidgett Crescent
Roundhay
Leeds

CK Chrisalid
13 High Street
Berkanstead
Herts
74569

CL MED
1736 Church Hill Road
Thurmaston
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Leic. 704492

CM Simple Software
15 Havelock Road
Brighton
Sussex
0273 504879

CN Buffer Micro Shop
374A Streatham High Road
London SW16
769 2887

CO Pixel Productions
39 Ripley Gardens
London W1 48HF

CP Computics Microsoft
1 Bell Lane
Wheatley
Oxford
OX9 1XY

CQ KW Software
155 Ronginglow Road
Sheffield
S11 7PS

CR Sideline Freepost
Oxford OX2 8BR

CS IQ Services
Canal House
Ardrigshaig
Argyll
Scotland
0546 3212

CT Willow Software
PO Box 6
Crediton
Devon
EX17 1DL

CU Level 9 Computing
229 Hughenden Road
High Wycombe
Bucks

CV J Purves
12 Stobhill Road
Gorebridge
Midlothian
EH23 4PL

CW Cambell Systems
Rous Road
Buckhurst Hill
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IG9 6BL

CX Microdeal
Deal House
Bridges
Bodmin
Cornwall

CY Prof. F H George
Bureau of Information Science
Commerce House
High Street
Chalfont St Giles
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CZ J Wolstencroft
Sagar Fold
Preston
Chipping (09956) 327

DA Ground Control
Alfreda Avenue
Hullbridge
Essex SS5 6LT
Southend (0702) 230324

DB Mick Bignell
01 953 8385

DC Giltrole Ltd
Dept PCW, PO Box 50
Rugby
Warks CV21 4DH

DD Deep Thought Software
20 Chauntsingers
Alton
Hants

REFERENCE

SOFTWARE DEALERS

DE Silversoft (Dept PCW)
40 Empress Avenue
Ilford
Essex

DF Michael Orwin
26 Brownlow Road
Willesden
London NW10

DG Hisoft
60 Hallam Moor
Liden
Swindon
Wiltshire

DH The Soft Option
Bamberplan Ltd
PO Box 11
Cranbrook
Kent
058080 310

DJ Microcomputer Spacedrome
3 Westholm
London NW11
01 458 5845

DK Spider Software
98 Avondale Road
South Croydon
Surrey
01 680 0267

DL Xavier Business Systems
7 North Lane
Clayton
Scarborough
Yorkshire
(0723) 583509

DM Camden Electronics
(Systems Division)
462 Coventry Road
Small Heath
Birmingham
021 773 8240/021 772 5718

DN Sumlock Electronic Services
Royal London House
198 Deansgate
Manchester
M3 3NE

DO Microstyle
29 Belvedere
Lansdowne Road
Bath
(0225) 334659

DP Small Systems Engineering Ltd
2-4 Canfield Place
London NW6
01 328 7145

HM Gemini electronics
2-4 Enfield Place
London NW6
01-328-7145

DQ Woodland Software
103 Oxford Gardens
W10 6NF
01 960 4877

DR Telesystems Ltd
PO Box 12
Great Missenden
Bucks
HP16 9DD

DS Macronics
26 Spiers Close
Knowle
Solihull
West Midlands
B93 9ES

DT Hewson Consultants
Dept PCW
7 Graham Close
Blewbury
Oxon
(0235) 850075

DU Silicon Office Services
240 Durants Road
Enfield
Middx
EN3 7AZ
01 805 0903

DV Sirton Computer Systems
Unit 14
29 Willow Lane
Mitcham
Surrey
01 640 6931

DW Psion Ltd
2 Huntsworth Mews
Gloucester Place
NW1 6DD

DX JRS Software
19 Wayside Avenue
Worthing
Sussex
Worthing 65691 (evenings and weekends only)

DY Calisto Computers Ltd
119 John Bright Street
Birmingham B1 1BE
021 632 6458

DZ Micro Gen (Dept PCI)
24 Agar Crescent
Bracknell
Berks
0344 27317

EA Anglia Computer Centre
88 St. Benedicts Street
Norwich
NR2 4AB
0603 26002

EB SBD Software
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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.

ASCII
American Standard Code for Information Interchange — representing letters, numbers etc by 128 permutations of a 7-bit code.

Assembly Language
Means of representing *program* statemetns 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'.

Buffer
(1) An area of memory designated to hold *data* being transferred between devices working at different speeds, eg the fast processor and the slower *keyboard, printer* or *disc*.
(2) An electronic device in a signal path designed to allow signals to pass in one direction but to hold back unwanted voltages in the opposite direction, which might damage the sending apparatus.

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 which contains either ROM or RAM and 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 its printing. Also used as a prompt when the computer is expecting you to input information or a command.

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

Database
An organised collection of information held either in the computer or on disc that can be accessed by the user.

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.

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

Execute
To perform a sequence of *program* steps.

Firmware
Instructions or *data* permanently stored in *ROM*.

Flag
A linen object that one salutes — but sailors use them to send messages. So do computers. A flag is an indicator signal (usually just one *bit)* that generally signals a condition.

Graphics
Literally — drawings; a method of producing graphs or pictorial figures on a suitable output device, usually a video montior (TV set for most hobby computers) but sometimes a chart recorder or printer.

Hard Copy
A computer printout or listing on paper.

Hardware
All the electronic and mechanical components making up a 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.

IEEE
Institute of Electronic and Electrical Engineers (in USA) — a body which has set a number of standards for more orderly interchange of information between various electronic devices, including computers.

Instruction
A set of *bits* which causes the *CPU* to carry out a particular task. Usually a basic or fundamental command understood by the *microprocessor*.

Interface
A connection between two or more items of equipment along which data and controlling signals are passed.

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 output or it can be bidirectional.

Kilo (K)
Normally means 1000, but stands for 1024 (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. Higher-level languages are easily understood by mere humans and computers designed to work with such languages (*BASIC*, for example) use an *interpreter* to change this into the *machine code* under which the processor operates.

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

Logo
Child oriented computer language with easy to use graphics facilities which is available on the TI99/4A computer.

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

Machine Language (or Code)
The lowest (and 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.

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 — even if you don't understand what's on the screen!

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*.

Non Volatile
Memory which will retain *data* content after power supply is removed, eg *ROM*.

Octal
Base 8 number system. Character set is decimal 0-8.

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

Peek
This 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.

Pointer
In the *microprocessor,* or in *memory* external to it, pointers can be *registers* allocated to listing memory *address* — they 'point' to memory locations.

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.

Printer
A device for producing typed or printed copy *(hard copy).*

Print Out
Same as *hardcopy.*

Program
A set of *instructions,* either in *mnemonics,* in *digital (binary)* form or in a *high-level language,* which tells the computer to perform a sequence of tasks.

Program Counter
Register in the *microprocessor* which keeps track of which part of the program is being *executed.*

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

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

Reset
Simply — go back to the start, do not pass GO, do not collect 200 bytes. A switch whereby computer control is returned to the *monitor* or low-level *operating system* and all internal *variable* values are changed to zero. This may be the only way of getting out of some endless *loop* which has arisen from a programming error.

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.

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.*

Run
Instruction to *execute* a *program.*

Serial
Transfer of *data* one *bit* at a time.

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.

Subroutine
A part of a *program* which peforms 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.*

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.

Volatile
Memory devices that will lose *data* content if power supply removed (ie *RAM).*

Word
Parallel collection of *binary* digits much as *byte.*

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

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

9900
This is a family of Texas Instruments chips. They are used as the processor in the 99/4A machine.



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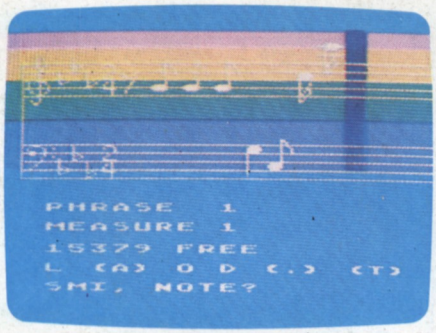

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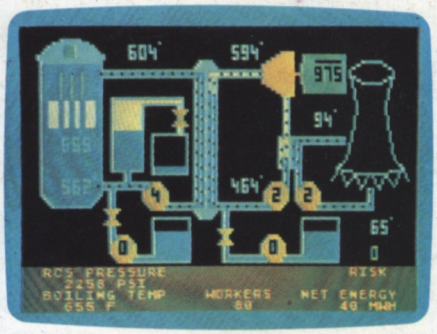

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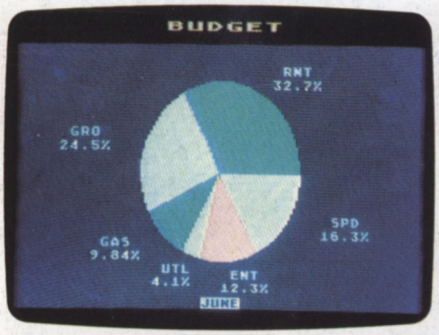

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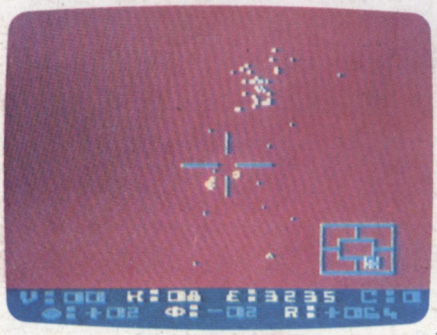

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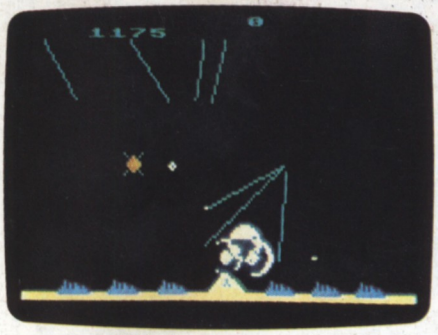

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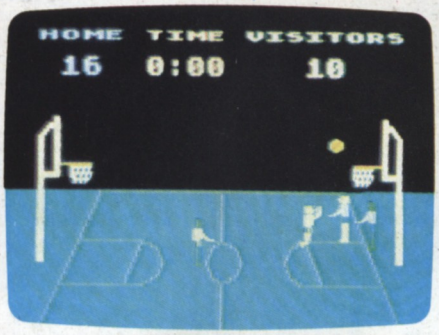

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