Personal Computing Today

SEPTEMBER 1982
65p

NEW

ATARI versus TEXAS

We compare the two-which comes out on top?

PROGRAMS FOR THE ATOM, SPECTRUM, BBC TRS-80 AND ZX81

DRAGON'S FIRST

Will it burn up its rivals?

SOFTWARE CHECKLIST

What's in store for Tandy, Atom VIC and Atari

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Judging by your response to the first issue of *Personal Computing Today* it is just what the shop-shelves needed. And to help computing's new recruits further fathom out the computer scene this issue is packed with more information including machine reviews, hard and software reference lists, and three new regular features.

This month we are helping to broaden your programming horizons with the first of a regular feature on computer games. We know that there are hundreds of digitally dextrous games fanatics out there who want to write their own programs. But if you have only a little programming experience actually doing it can be difficult, very confusing and sometimes a plain pain in the neck.

GAMESBOARD will iron out the problems which face you in games theory. Each month it will with a particular type of game, or a certain part of games programming. Wargaming kicks the series off by showing you how to set about the arduous task of inventing a wargame. It explains what wargaming is all about, these vital things you need to include in your program, and how to do it.

For those of you who have not taken the plunge and bought a computer of your own, turn to our second new regular feature LOOK BEFORE YOU LEAP. One of the biggest problems facing a computer buyer is the overwhelming choice of machines. LOOK BEFORE YOU LEAP will pinpoint a dealer every month and we will report on the shop and the sort of service they offer.

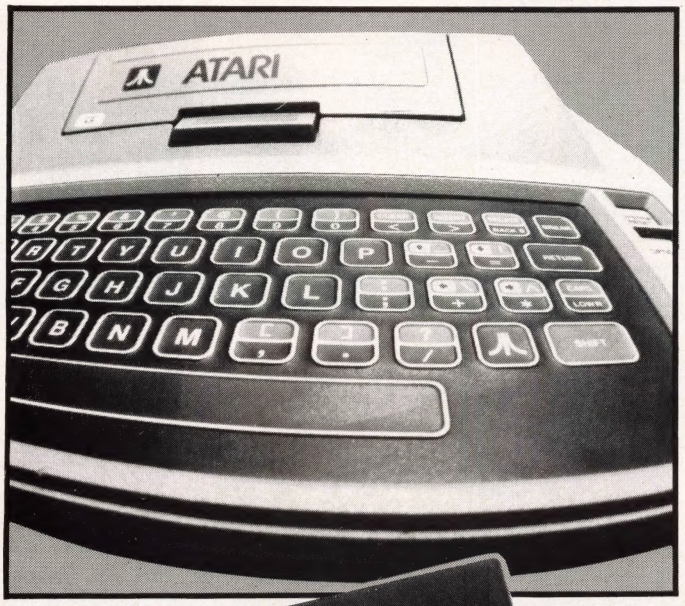
The High Street chain store, Micro C, is the first shop to step into the limelight and reveal how it operates, what machines it sells and the software backup it gives to its range. We want to show you what to expect when you walk into a computer shop, and dispell the myth that computers are available to the chosen few. You can try them out in the shop with the help of trained sales people.

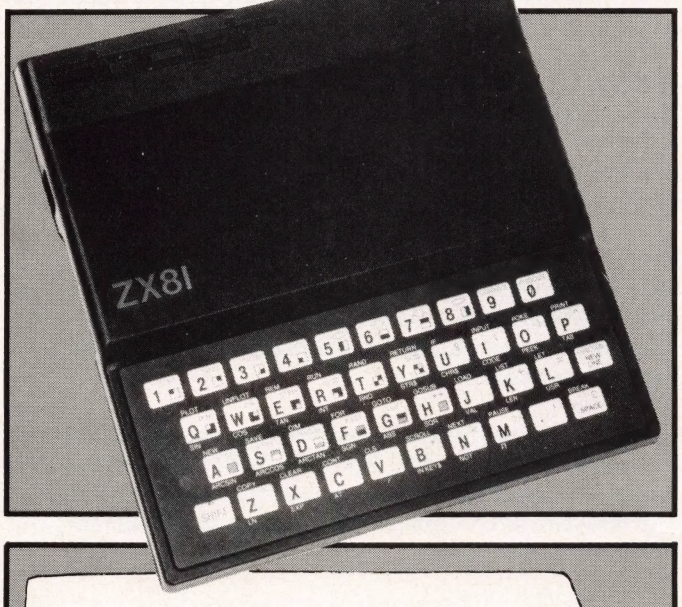
Our third regular feature starting this month is a READERS LETTERS page. This is where you have your say. Remember, Personal Computing Today is here to help you, so don't hesitate to pick up a pen and write to us with any suggestions about the magazine. The more we hear from you the better the magazine will be. Don't forget that Micro Answers is there for your benefit too. That is where we take trouble to reply to the many technical queries that boggle your minds in computing.

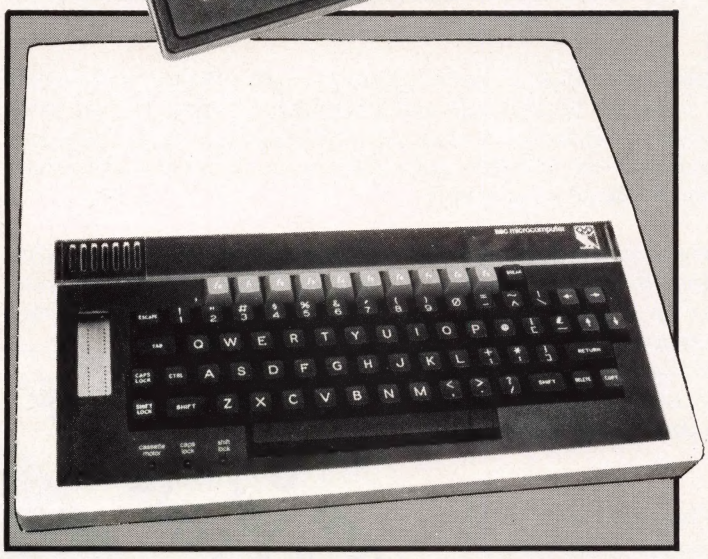
This month on the hardware side we are bringing you comparative review of two similarly priced and technically alike computers, the Atari 400 and the Texas Instruments 99/4A. In it we point out the two machines good and bad points to give you an idea of how the two fare in the comparison battle.

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If you would like to see your programs reach the masses through Personal Computing's pages don't hesitate to send them in. We are interested in publishing program listings and articles for any microcomputer. If you want to submit your work, please send it to us in type-written form and include the listing, breakdown of how the program runs, the variables used, any conversion tips, and any other useful information. All listings and articles published in Personal Computing will be paid for.

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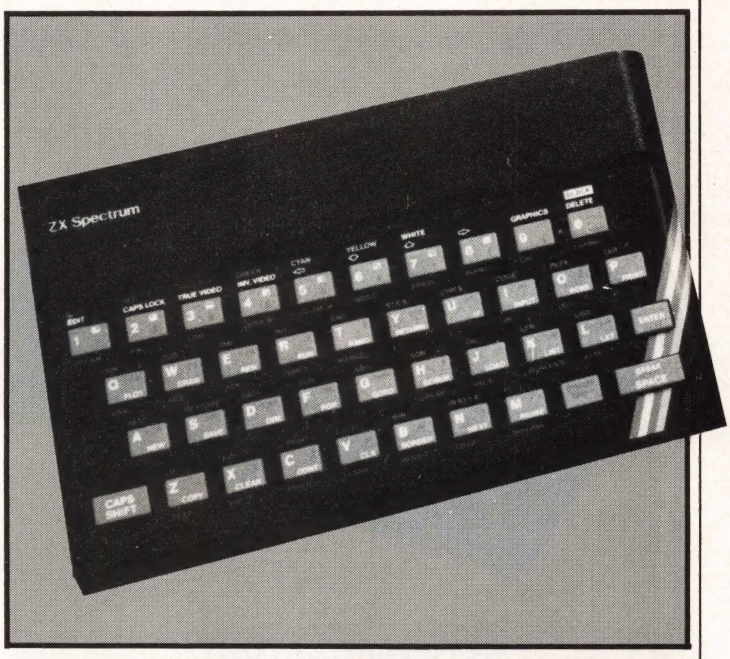
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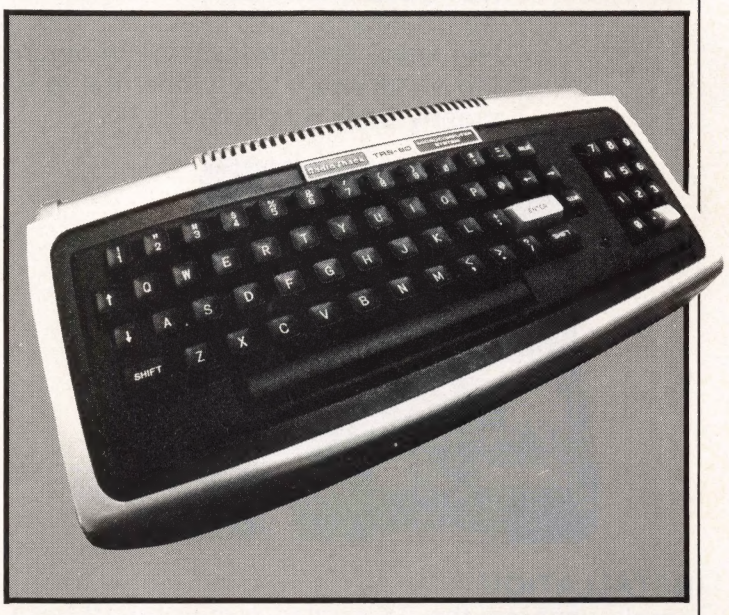
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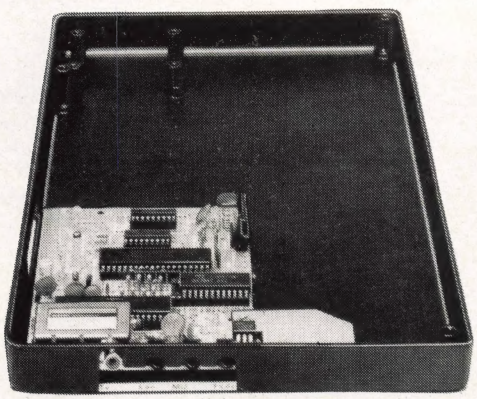
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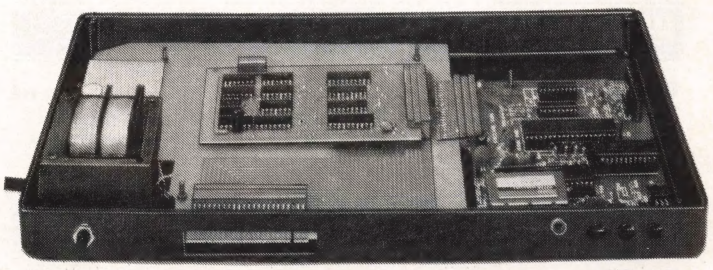


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Pirates Without Plunder

Talking of software it's a business which isn't always pristine clean.

If a piece of software is good and selling well there are certain shady characters about called software pirates. Preventing anybody from copying software, be it a game or business program, is very difficult even if the author owns the copyright,

So if you're not careful these pirates make hundreds of copies and then churn them out a very cheap price. A recent case involves Audiogenic, a software firm producing VIC – 20 games. According to the firm's managing director, Martin Maynard, Audiogenic claims to be the UK manufacturer and distributor of two games, Amok and Alien Blitz. But another film also claims the same. In fact, Arfon Microelectronics have been doing just that, and as a result solicitors letters have been flying back and forth between the two firms. Maynard said: 'There are very poor copyright laws here. If we were better put we might make a big legal stand because the laws are so vague.' He likened the situation to the video film industry where copies of the films are sold by the hundreds on the black market. 'Some form of Parliamentary Act is needed to protect copyright'. he said.

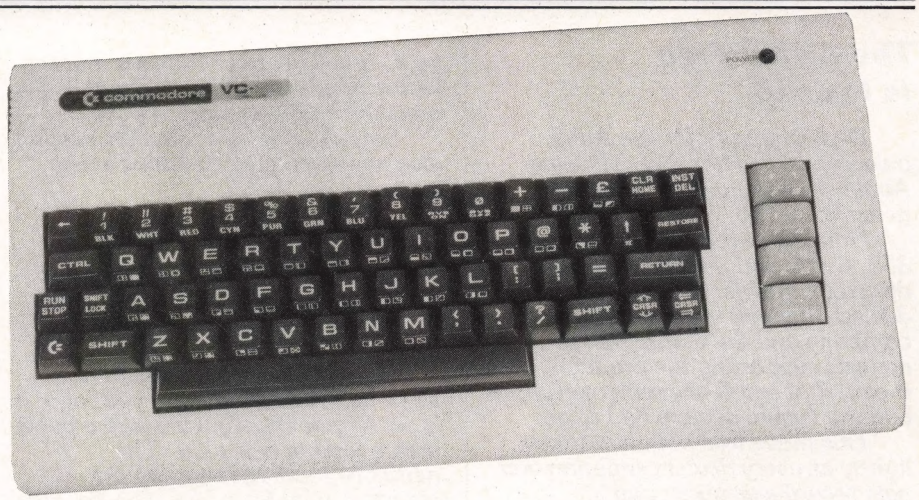
If firms can get away with producing cheap copied software, it does the buying public, the dealers and the original manufacturers no good at all and lowers industry standard. Unfortunately, the laws surrounding this subject are about as clear as mud. Let's hope that if the result of this case goes in favour of Audiogenic it will deter cowboy outfits from stooping to infringment of copyright.

More Support for VIC

Now that we're on the subject of VIC some good news for owners of the said machine.

Commodore's marketing manager John Baxter recently quoshed rumors that software and peripheral support for the VIC-20 would be left out in the cold when the firm's new computer range is in full production.

Now that the VIC-20 is more established, software and add ons are picking up after the slow start when the machine was released. An upgrade printed circuit board basically the heart of a computer) is on the cards. This will transform your VIC-20 into a souped-up version, the Commodore 64, soon to grace computer shop shelves. If you want to have the full facilities of the



Commodore 64 all you need do, in theory, is take your VIC-20 to your dealer and get him to replace the 20's pcb with the 64's pcb. And all for an estimated cost of £100, if Baxter gets his way.

Final release dates of Commodore's new range are being kept very quiet but indications are that the 64 and the tiny computer, the 10 will probably see the light of day by the end of the year.



Atari Price Slash

Since Atari took over its UK marketing early this year from Ingersoll, only now is the firm beginning to make its presence felt.

Last month Atari slashed harware prices for the second time this year. Now the more sophisticated computer, the Atari 800 costs just under £500 with a total price cut of £100. And the basic machine in the range the Atari 400 is down just under £200 from £300.

But don't get too excited, there is a snag. If you opt for the Atari 400 to use it as a proper computer, rather than a glorified games centre using plug-in cartridges, you need to buy a BASIC language cartridge package. That will set you back £50 but it does include a couple of Atari manuals explaining how the BASIC cartridge works. So in total you pay £250 for the basic computer system. I suppose every little counts. When Personal Computing Today went to press Atari was about to further drop prices on some of its range.

Atari isn't really out to swindle you. In fact, it's nice to see a computer manufacturer making a conscious effort to help its users with extra services.

Would-be programmers are the first to benefit form one of Atari's new schemes. The Atari Software Acquisition Program will provide the base for Atari users to pick the brains of the firm's technical staff and 'play' with the machines installed in the unit.

The aim behind Atari's idea is two-fold. First, to help out users with technical problems without charge or obligation. And second, to provide the facility for turning good software into excellent software which could be marketed by Atari through its own catalogue or the Atari Program Exchange.

That is an American project which accepted software from Atari users and the good stuff was sold through the Exchange, although in some cases it had to be slightly re-written. If the program is finally selected for inclusion in the catalogue not only does the author get the prestige surrounding it, but he also gets paid a royalty on sales of the program.

Any software submitted is automatically entered for a competition ocurring every three months. The best piece of software wins a section prize and is then entered in another competition to find an overall winner of the best Atari program of the year.

User clubs will be pleased to hear that Atari's other brainchild is aimed at them. The firm wants to stimulate interest in specialist user groups and will let clubs have special packs containing the Atari programmer's bible the De Re Atari, as well as demonstration discs and advance information on new product releases.

Anyone interested should contact Anthony Jones, product manager, Atari International UK, PO Box 59, Alperton Lane, Wembley, Middlesex HA0 1FJ.

The Apple Tree is Pruned

Dealer support for the Apple owners is set to improve following Apple UK's pruning of its dealer network by 230.

Now the authorised list consists of 352. Keith Hall, Apple UK's sales director explains: "We want to have dealers that will work with the company and are committed to actively supporting the product". This meant that small one man operations and the casual dealers had to go.

This move was not undertaken lightly as every dealers situation and past record was taken into consideration.

After putting each dealer up against this criteria it became clear that the people that had to go were the small, one man businesses that operated from home and the high street retailers which carried Apple computers as a side line. These people could not achieve the volume of trade or undertake adequate support and promotions that is necessary for a computer dealer to succeed in todays highly competative market. Buyers also suffered because these dealers lacked the technical expertise necessary to provide proper after-sales service.

Now we can expect a more knowledgeable and responsive service from the UK Apple dealers.

Toy Computers?

A new breed of computer manufacturer is springing up in the guise of toy makers.

Strange though it may seem the first to reveal its 32K colour 'family' computer was Dragon Data, the computing arm of giant toy maker Mettoy. And more recently the huge toy and electronic products firm Binatone announced its plan to undercut even Clive Sinclair by selling a £50 micro computer.

Just where Binatone has found the expertise to do this is a mystery but hopefully if the firm's dirt-cheap computer does get off the ground it will be better quality than its home television games centre.

Last year Binatone was selling a very basic first generation games centre supposedly of the Atari Video Computer System ilk. But there were no plans to support the machine with extra cartridges and new games and the system has since faded into oblivion. Perhaps the firm's programmers have been hidden away in a small, dark rooms putting their efforts into the new computer.

Binatone itself could shed little light on the matter. All its top-level staff were sunning themselves in Portsmouth preparing for the Round Britain Yacht Race but a spokesman said: 'It will be more than six months before anything is known about it. It's a twinkle in the chairman's eye'.

Sounds as if Clive Sinclair needn't lose any sleep over Binatone's new baby.

In the State of Texas

Software for the TI99/4A computer until now has been sparse but Texas is making a concerted effort to rectify this.

Having plugged the machine since its relaunch about a year ago, it is set to give the software side a boost with a load of new titles. The additions total 16 ranging from entertainment for adults who are kids at heart with Munchman, another re-hash of arcade favourite Pacman, to the more serious business of personal financial aid.

The nucleus of this new software stock is made up of 12 adventure games by Scott Adams, one of the first adventure computer games authors. Included in this batch are Voodoo Castle, Strange Odyssey and The Count, all of which are on ROM cartridge and cassette.

On cartridge comes the actual adventure program while the tape contains the characters and the scenario. This means that if you want to play another adventure at a later date all you have to buy is the tape and run it with the original cartridge.

All the new packs should sell for about £25, expensive, but if up to TI's usual standard the software should be good.

Spectrum Software Soon

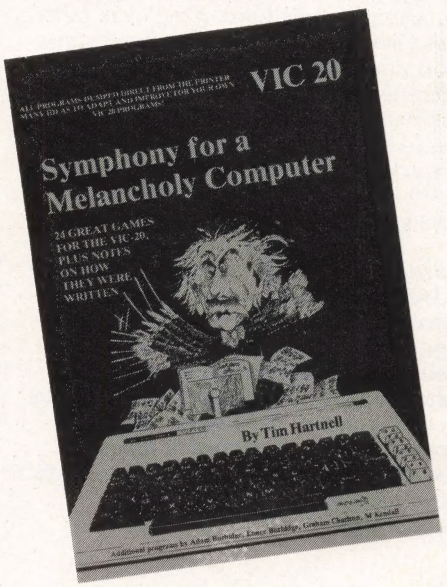
At last the much-awaited deliveries of ZX Spectrums are filtering through to customers desparate to find out whether they are over the moon or sick as a parrot with their new buy.

The only trouble is that software for Sinclair's special is thin on the ground. But not for much longer. Three software suppliers are in the throes of producing Spectrum programs.

Quicksilva is chomping at the bit to put its programmers to good practice. Ironically what's holding the firm back is the Spectrum itself — or lack of it to be more precise. But Nick Lambert of Quicksilva promises: 'We will produce some software as soon as we can. There will be newly written games for the machines, but in the same vein as our existing range'. ZX81 owners may know that Quicksilva (or QS) has a range of graphically good arcade games on its books.

Melbourne House has got a head start however, It's actually got its hands on one of the elusive machines and will release a bunch of programs to run on the Spectrum at the end of September or beginning of October. All the games are re-writes of Tandy TRS-80 software incorpporating 'very sophisticated, graphics in full colour'. Some of the versions on sale will be Strike Force, Penetrator and Gobbleman (or Pacman as it's more commonly known). They should cost about the £10 mark.

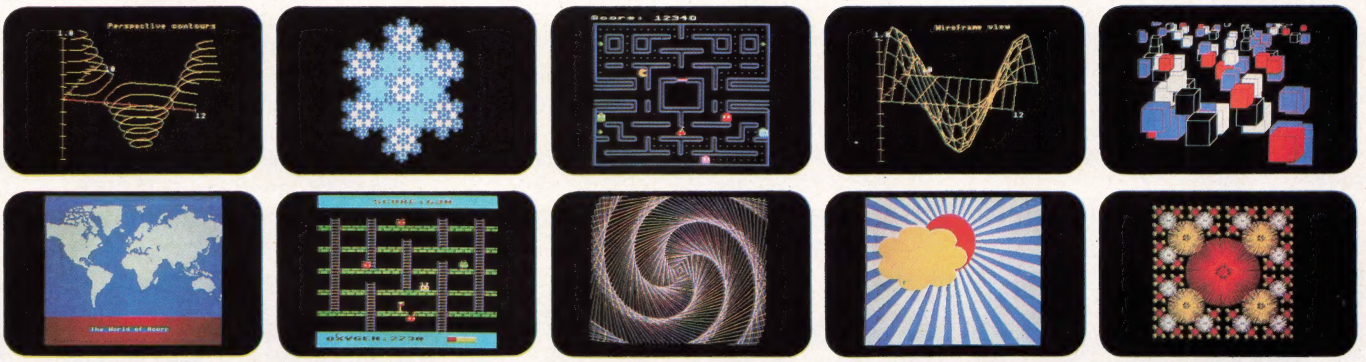
Liverpool based Bug Byte has a space invader game under development which should be available within a couple of months. it is apparently an exact copy of the arcade game, so green meanie freaks have something to look forward to.



Breakout in Books

Apologies are due to Tim Hartnell, for we neglected to mention that the wonderful Breakout program listed in last months issue was in fact from his book 'Symphony for a Melancholy Computer'. Sorry Tim.





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Don't let its size fool you.

If anything NewBrain is like the Tardis.

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

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

However, let the facts speak for themselves.

You get what you don't pay for.

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

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

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

Big enough for your business.

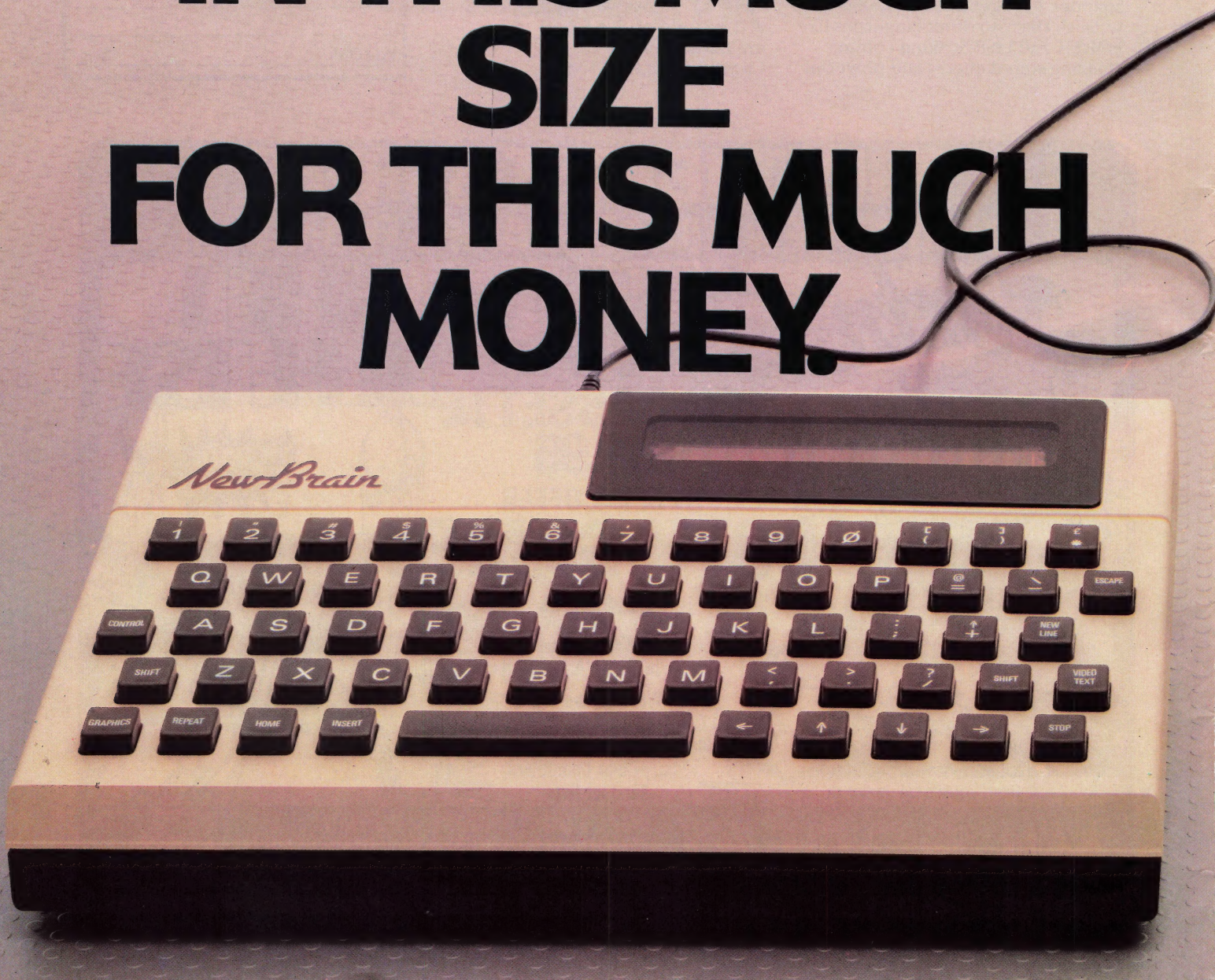
Although NewBrain is as easy as ABC to use (and child's-play to learn to use) this doesn't mean it's a toy.

Far from it.

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

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

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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.

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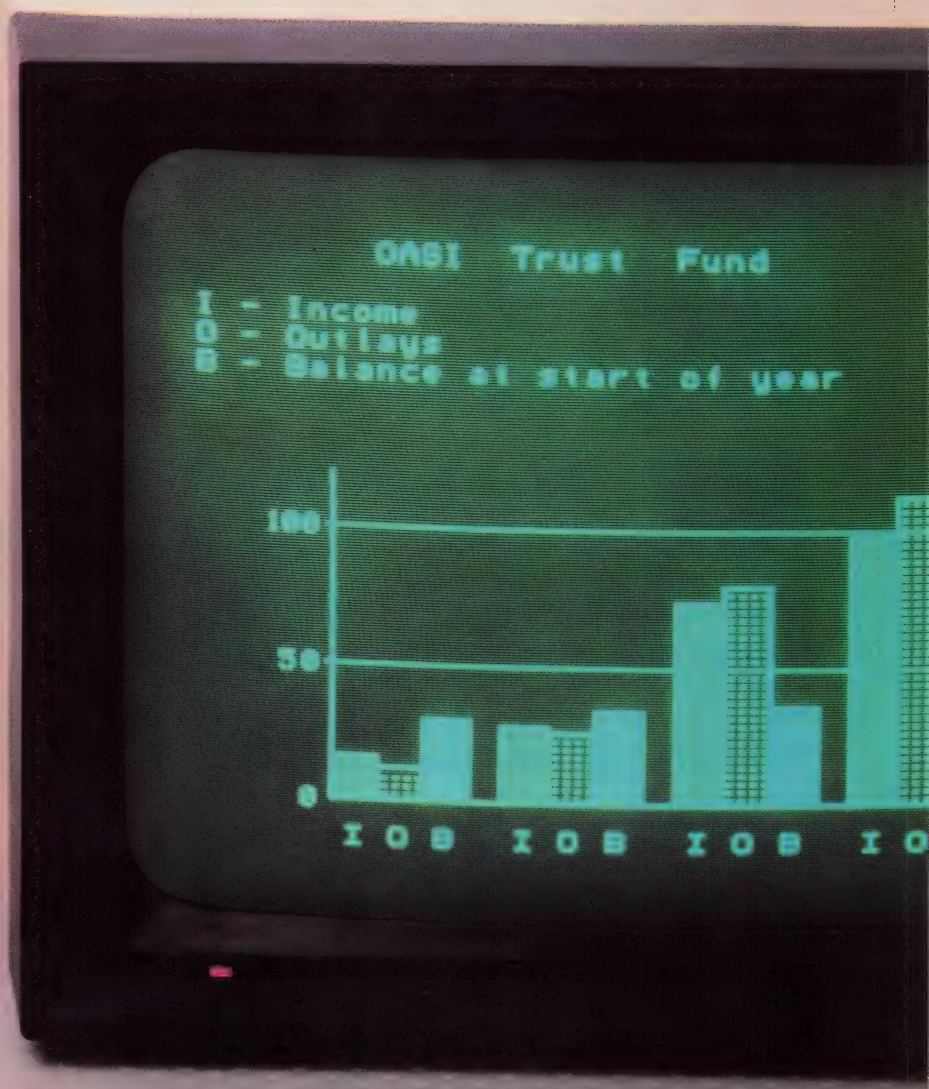
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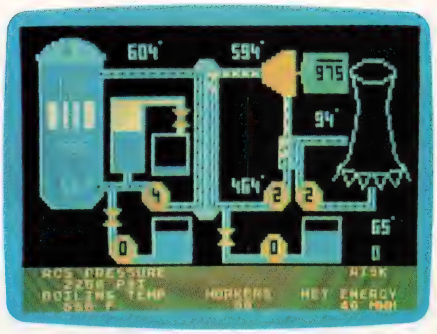
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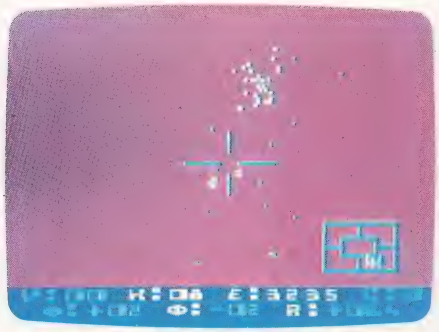
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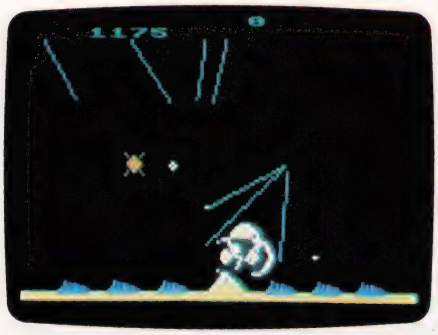
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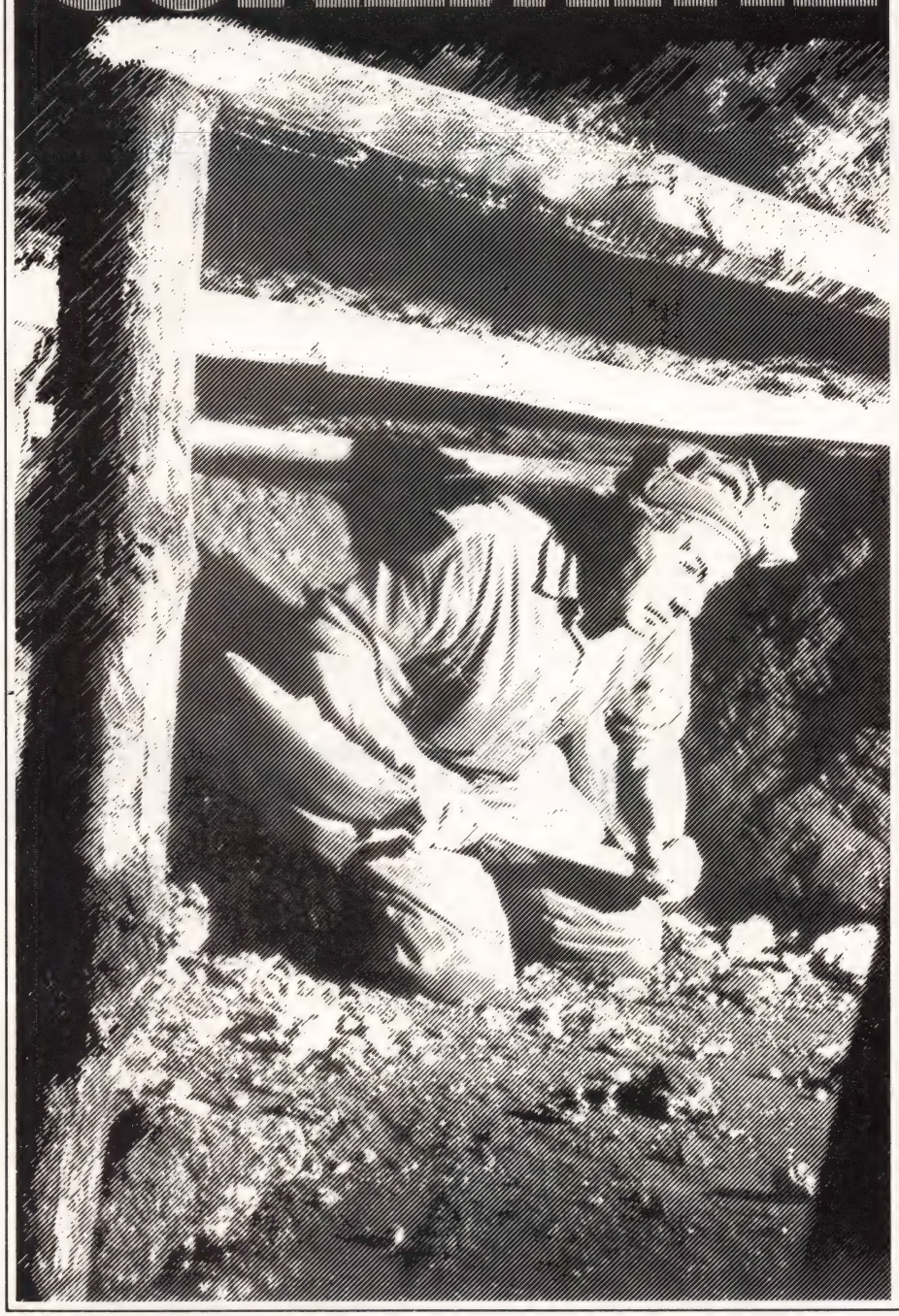
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SOFTWARE

WORKING DOWN A COALMINE



No need to carry a shovel to get stuck into this unique game from M. Evans. It's different, fast and a lot of fun.

This program is written for the ZX81 with 1K of memory, but it is eminently suitable for any machine with a memory mapped screen, which is just about all the micros on the home market. To run the program also requires an 'INKEY$' or 'GET' function, and for this reason cannot be run on the ZX80.

The concept of the game is very simple. Coal is buried below the surface of the ground, and has to be retrieved in the least number of goes. A marker moves at random below the ground and when a key is pressed a unit of earth is removed at the current position of the marker.

The position of the coal is determined by the first press of a key.

The game is over when the coal is removed. At the beginning of the game the level of play has to be entered, thus determining the length of time that the market remains at any position. At high levels the marker stays for longer periods and enables the coal to be mined by the "shaft" method. At low levels the marker stays for shorter periods and the coal is mined by the "open cast" method.

It sounds simple, even easy, but at certain levels is *impossible* to do. The object of the game is to manoeuvre your opponent into playing at one of the impossible levels and keep them in the dark about the reason why they cannot get out.

Quick Reactions

Success depends on the players' reactions. To remove the earth above the coal, a key must be hit while the marker is still *below* the coal. Therefore at high playing levels, when the marker remains below the coal for a longer period than the player takes to react, the coal will always be mined by the "shaft" method; at low levels of play the players will not be fast enough to hit a key while the marker is in the same position below the coal and the mining is at random! The twist to ▶

WORKING DOWN A COALMINE

the program is to make the progression between these two extremes non-uniform and acute and is done by checking that the marker position never repeats itself.

Now for the bad news: to run this program the ZX81 is operated in SLOW mode so that the screen does not flicker, and the marker can be seen! This means that it takes approximately 3/20ths of a second to recalculate the position of the marker, thus the step is very large compared to the difference between the minimum and maximum reaction time. The author can always get the coal out by the shaft method at level 7. The peak when it is very difficult to get the coal out occurs at level 5 and below level 5 it reverts to the true open cast method. If the ZX81 is operated in FAST mode it takes approximately 3/100ths of a second to recalculate the position of the marker. Most other machines oeprate at speeds close to this and they will therefore produce steps which are relatively small when compared with the minimum and maximum reaction time and will therefore provide an acceptable medium to play the game on.

When the program was first written it had six rows of ground; however, as usual, the program ran out of space. Therefore there are now six half rows of ground. Lines 26 to 30 locate the first non-blank row of ground. Line 32 then POKEs either a half blank or a whole blank depending on the original value of the square. If more space is available it would be simpler to revert to the original six rows of ground, thus when a non-blank is found it is replaced with a blank. Line 34 could then be removed (it currently replaces a black square for coal with a half black square) and line 36 would then check for a black square rather than a half black square prior to ending the game.

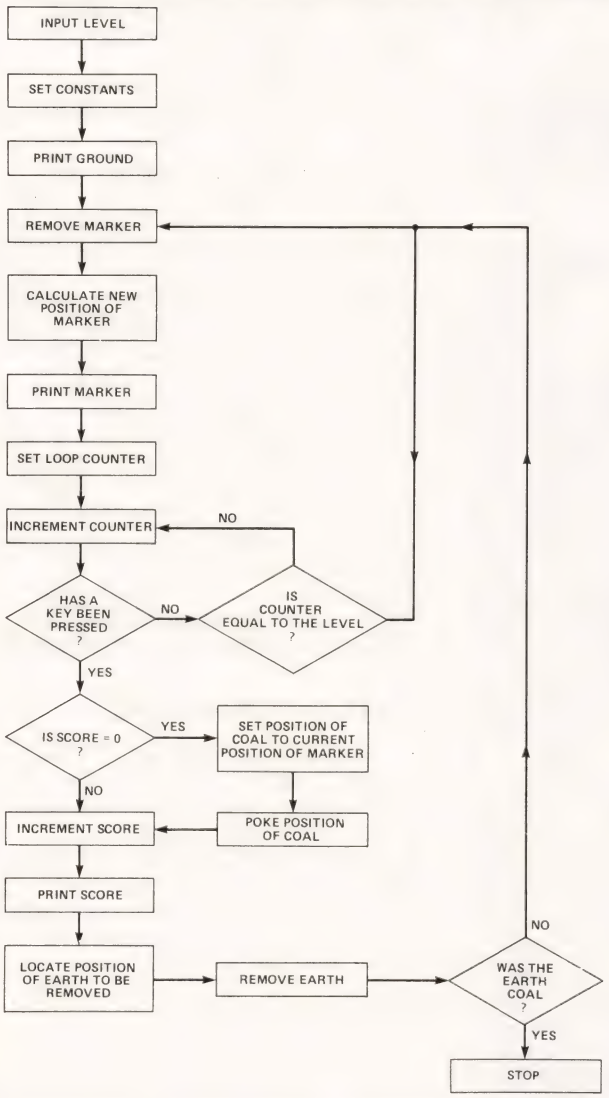
For ZX81 users here are a few suggestions to make still more interesting game. Alter the following lines to:

```
26 FOR R = P + C - 58 TO
    P + C + 41 STEP 33
36 IF Q< >131 AND Q< >3
    THEN GOTO 4
40 INPUT L
```

and delete line 42

The game will end when the coal is removed or when the ground is breached in the same place for the second time. A penalty could also be added to the score if the ground is not breached at the coal.

HOW IT RUNS



Line By Line Description Of Program

4	Removes marker from screen
6 - 8	Calculates new position of marker ensuring that the marker is not in the same position.
10	Prints new position of marker on the screen. A half square with black upper half
12 - 16	Waits for a key to be pressed. If a key is not pressed control is passed to line 4
18	Checks if first time a key has been pressed. If so sets the value F
20	Checks if first time a key has been pressed. If so POKEs position of coal, one black square
22	Increments score
24	Prints the level of the game and the score
26 - 30	Locates the row position of the earth to be removed
32 - 34	Removes the earth
36 - 38	Checks if the earth removed was the last piece of coal. If so stops. If not passes control to line 4
40 - 50	Sets constants
52 - 56	Prints the ground. 96 grey squares.

PROGRAM LISTING

```
 2 GOTO 40
 4 PRINT AT 3, C;" "
 6 LET C = C + INT (15*RND) + 1
 8 IF C > F THEN LET C = C - 16
10 PRINT AT 3, C;"■"
12 FOR Q = 1 TO L
14 IF INKEY$ = " " THEN NEXT Q
16 IF Q > L THEN GOTO 40
18 IF S = 0 THEN LET F = C + 8
20 IF S = 0 THEN POKE P + F,128
22 LET S = S + 1
24 PRINT AT  6,0;L;" - ";S
26 FOR R = P + C - 58 TO P + C + 8 STEP 33
28 LET Q = PEEK Q
30 IF Q = 0 THEN NEXT R
32 POKE R,(Q = 8)*9
34 IF Q = 128 THEN POKE P + F,131
36 IF Q< >131 THEN GOTO 4
38 STOP
40 PRINT "LEVEL?"
42 INPUT L
44 CLS
46 LET F = 23
48 LET P = 17121
```

HINTS ON CONVERSION

To run this program on another machine the following changes will have to be made. In lines 4, 10 and 24 a PRINT AT line, column; ... statement is used, this moves the print position to the line and column number specified. Lines are numbered from 0 (at top left) to 21, and columns from 0 (at top left) to 31. If only one character is printed, as in lines 4 and 10, the statement is interchangeable with a POKE statement on other machines. However on the ZX80/1 before a position can be PEEKed or POKEd in the screen display the space must first be reserved in the screen display. In line 4 the space has not been reserved and a POKE at this point will result in the variable store being POKEd which will almost certainly result in the program crashing.

The PRINT AT statement in line 24 is slightly different because more than one character is being printed. The line updates the current score. The print position for the score could be changed by cursor controls or the line could be left out altogether and the score printed at the end of the program.

15*RND in line 6 produces a random number between 0 and 15.

Line 8 in the program checks that the cursor position is in a specified range. The arbitrary range chosen is 16 and centred about the coal. The reason for 16 is that it is twice one quarter of the screen width. Initially the marker moves at random between columns 8 and 23. When a key is first pressed the position of the coal is then fixed, the marker then moves randomly about the coal. If the key was pressed when the marker was at position 8, the marker would then move randomly between 0 and 15. The value of the variable F is the upper range of the marker's movement and the coal is located at a position 8 less than F. The value of P is the address of the first grey square in the third (or sixth) row of "earth" units, less 8, and can be found from:

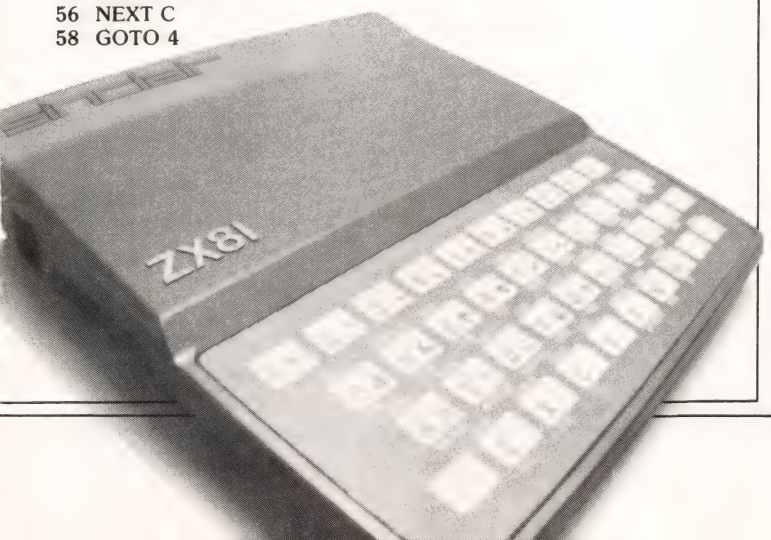
P = PEEK 16396 + 256*PEEK 16397 + 1	+ 3*33	- 8
Address of display file	three lines of screen display & newline	half of marker's movement

Thus by adding P and F the address of the coal can be found, as in line 20 when the black square representation of the coal is POKEd onto the screen.

Variables Used

C = Column in which marker is located
F = Column (+8) in which coal is located
L = Level of play
P = Address of display + 59
P = PEEK 16396 + 256*PEEK 16397 + 59
Q = Dummy variable
S = Score

```
50 LET S = 0
52 FOR C = -88 TO 7
54 PRINT "▒";
56 NEXT C
58 GOTO 4
```



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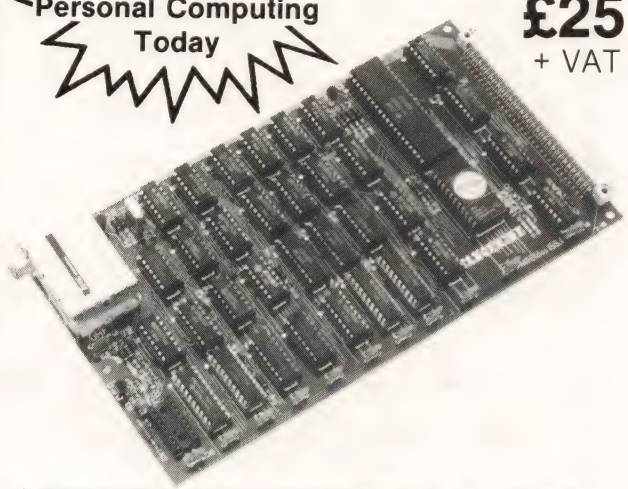
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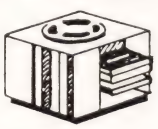


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The sky is cluttered with small asteroids and it is on one of these that the interplanetary terrorist is based. Can you get your ship, with little fuel left, beneath the scientist's shield before the plasma cannon's lethal laser beam blasts you and your craft to smithereens?

It's a difficult game to play and one requiring quick finger movement. Level One is hard to handle until you have mastered the controls. Level Three is the most taxing and provides you with maximum frustration. A word of advice — try to keep the lander upright as much as possible to counter gravity pulls.

The best strategy is to find a path as far as possible from the gunman and then hedge hop to the pad beneath the force field.

If you're feeling adventurous manoeuvre so that the gunman blasts a path through the asteroids for you. It's not advisable at Level One and can be dangerous at other levels.

The listing is very compact because all non-essential spaces have been omitted to fit the program into the BBC Model A Microcomputer.

So man the controls and happy landings.

HOW IT RUNS

20 — 40	Prints instructions 'land on the red pad' and 'Choose difficulty 1, 2, or 3'.
50	The VDU 26 command cancels the effect of the previous VDU 28 command to allow full use of of the screen.
60	Ensures that the difficluty level input is either 1, 2, or 3.
70 — 80	Define nine characters. The first character is used to represent the small asteroids and the other eight represent the different rotations of the lander.
90	Selects mode time for playing and clears screen.
100 — 140	Draw a frame about the playing area. There are three gauges at the top of the screen to assist the player. From left to right these are vertical velocity, horizontal velocity and fuel.
150 — 210	Draw the frames of the above by the For loop.
230	Prints the F into the the fuel gauge for identification.
240	First draws a line across the screen just below the gauges to complete the frame about the playing area, then paints in the base of the landscape.
250	Paints in the mountains.
260	Places a varying number of small asteroids on the screen depending on the difficulty chosen.
270	Draws in the landing pad.
280	Initialises most of the variables not yet defined.
290 — 370	The section which is executed continuously during the game achieving the motion on the screen.
290 — 310	Blank and update the veritcal velocity gauge.
320	Moves the lander to its new position. It has been specially designed to give a completely flicker free image.
330 — 340	Pass control to the appropriate procedure if a valid input is made.
350	Blanks out the plasma bolt, then updates its position and tests whether it has left the playing area or hit anything. If the test is positive then procedure E at line 550 is executed.
360	Plots the plasma bolt then provides for the effect of gravity on the lander and calculates the lander's new position.
370	Tests four points about the lander to see whether the lander has hit anything. It also tests whether the lander has left the playing area or whether it has been struck by a plasma bolt. If any of these conditions is true then the Repeat Until loop (lines 290 to 370) is executed.
390	Causes the lander to disintigrate if it has not landed lightly on the pad.
400 — 420	Clear the keyboard buffer then print the message "Press escape to step" for four seconds before they return control to line 10.
430 — 500	Defines the procedure T whose function is to turn the lander respecitively clockwise or anticlockwise if either the eight key or the nine key is pressed.
430 — 440	Select the character which represents the new orientation of the lander and update the variables DX and DY which direct any thrust appropriately. The rest of the procedure sets AX, AY, BX, and BY so that DX and DY will be altered correctly the next time the procedure is executed.
510 — 540	Define the procedure t which provides a burst of thrust when the nine key is pressed by altering the lander's horizontal and vertical velocities depending on DX and DY.
510	Emits a tone and leaves the procedure if there is no fuel left.
520 — 530	Deduct the correct amount of fuel and alter the landers vertical and horizontal velocity, then they update the horizontal velocity gauge.
540	Updates the fuel gauge.
560	Defines procedure which blots out anything the plasma bolt has hit, resets the bolt's position to the gun man's asteroid, and aims the bolt at the landers current position.

PROGRAM LISTING

```
10MODE7:CLEAR
20VDU28,5,24,35,0:PRINT:PRINT:PRINTCHR$(129);" Land on
   the red pad":PRINT:PRINT"Turn the lander clockwise
   with":PRINT:PRINT"the 8 key, anti-clockwise
   with":PRINT:PRINT"the 0 key."
30PRINT:PRINT"Press the 9 key for thrust
40PRINT:PRINT:PRINTCHR$(136);"Choose difficulty 1,2,or3"
50VDU26:d$ = GET$
60d = ASCd$ - 48:IFd<10Rd>3THENGOTO50
70VUD23,224,0,24,60,60,60,24,0,0,23,225,24,60,60,60,24,
   60,90,90,23,226,0,56,120,127,124,28,18,16,23,227,0,3,
   116,255,3,0,23,228,16,18,28,124,127,120,48,0,23,229,90,90,
   60,24,60,60,60,24
80VDU23,230,8,73,56,60,254,30,28,0,23,23,1,0,192,46,225,
   46,192,0,23,232,0,28,30,254,60,56,72,8
90MODE/
100MOVE31,15
110DRAW31,1015
120DRAW1247,1015
130DRAW1247,15
140DRAW31,15
150FORI = 58TO826STEP384
160MOVEI,1000
170PLOT1,280,0
180PLOT1,0, - 44
190PLOT1, - 280,0
200PLOT1,0,44
210NEXTI
220VDU19,2,1,0,0,0
230PRINTTAB(13,1);"F"
240MOVE31,940:DRAW1247,940:X = 1200:MOVE35,20:MOVE
   1234,20:PLOT85,X,RND(100) + 20:PLOT85,X + RND(50),
   20:UNTILX<135
260 = RND(1000) + 100:GY = RND(200:VDU5:MOVEGX,GY:
   PRINTCHR$(224):FORI = 1TO30*d:MOVERND(1000)
    + 140,RND(500) + 200:PRINTCHR$(224):NEXTI
270MOVERND(100) + 140,20:GCOL0,2:PLOT1,0,100:PLOT1
   ,20,0:PLOT1, - 40,0
280F = 180:VX = 0:VY = 0:UX = RND(3):UY = RND(3):AX = - d:
   BX = d:AY = - d:BY = - d:P = 225:p = P:LX = RND(1000) + 140:
   SX = GX:SY = GY:LY = 900:lx = LX:ly = LY:DX = 0:DY = d*2:
   m = 10
290REPEATVDU4:PRINTTAB(1,1);"      ";TAB(1,1);
300IFVY> = 0THENPRITN"  ";ELSEPRINT"v";
310PRINT;ABS(INT(VY)):VDU5
320GCOL0,2:MOVElx,ly:PRINTCHR$(p):GCOL0,1:MOVELX,
   LY:PRINTCHR$(P):GCOL2,1:MOVElx,ly:PRINTCHR$(p):
   p = P:lx = LX:ly = LY:A$ = INKEY$(0):*FX15,0
330IFA$ = "8"ORA$ = "0"THENPROCT
340IFA$ = "9"THENPROCT
350GCOL0,0:PLOT69,SX,SY:SY:SX = SX + UX:SY = SY + UY:
   IFPOINT(SX,SY)< >0ORSX>1200RSX<1000RSY>9000
   RSY<200THENPROCe
360GCOL0,3:PLOT69,SX,SY:VY = VY - d/4:LX = LX + VX:LY
   + VY
370UNTILPOINT(LX + 32,LY + 5) = 30RPOINT(LX + 15,LY - 32)>
   10RPOINT(LX-5,LY - 16) = 30RPOINT(LX + 32,LY + 5) =
   30RPOINT(LX + 15,LY - 32)>10R((LX + 32 - SX)  2 + (LY - 16
   - SY)  2) 1000RLX<400RLY>940
380MOVE1x,ly
390IFPOINT(LX + 32,LY-32)< >20RABS(VX) + ABS(VY)>
   5THENSOUND0, - 15,4,20:FORI = 1TO100:GCOL0,2:PRINT
   CHR$(224);:VDU8:GCOL0.0:PRINTCHR$(P);:VDU8:NEXTI
400*FX15,0
410VDU4:PRINT"PRESS ESCAPE TO STOP":TIME = 0:REPEAT
   :UNTITIME>400:GOTO10
420END
430DEF  PROCT:IFA$ = "0"THENP = P + 1:DX = DX + AX:DY =
   DY + AY:IFP = 233THENP = 225
440IFA$ = "8"THENP = P - 1:DX = DX + BX:DY = DY + BY:IFP
   THENP = 232
450IFDY> = 0THENAD = - d:BX = d ELSEIFDY<0THENAX = d
   BX = - d
460IFDX = d*2THENBX = d -  ELSEIFDX = - d*2THENAX = d
470IFDX> = 0THENAY = d:BY = - d
480IFDX<0THENBY = d:AY = - d
490IFDY = d*2THENAY = - d ELSEIFDY = - d*2THENBY = d
500ENDPROC
510DEF PROCt:IFF = 0THENSOUND1, - 5255,1:ENDPROC
520F = F - d:VX = VX + DX:VY = VY + DY:VDU4:PRINTTAB(7,1);
   "      ";TAB(7,1);:IFVX<0THENPRINT"<";ELSEPRINT">";
530PRINT;ABS(INT(VX))
540PRINTTAB(14,1);"      "; TAB(14,1)'F:VDU5ENDPROC
550DEF PROCe:MOVESX-32,SY + 16:PRINTCHR$(224):SX =
   GX:SY = GY:m = m + d:sq = SQR((LX - GX)  2 + (LY-GY)  2)
   /m:UX = (LX + 32 - GX)/sq:UY = (LY - 16 - GY)/sq
560IFm>50THENm = 50
570SOUND0, - 10,5,5:ENDPROC
```

HINTS ON CONVERSION

The program uses quite a few commands unique to the BBC Micro. VDU 5 and VDU 4 respectively join and separate the graphics and text cursors. When these cursors are joined the move command enables a character to be printed with its upper left most corner at any point on a 1280 by 1024 grid. If this is not possible on your machine then PRINT TAB(X,Y) may be used with X and Y scaled to your machines display; eg if your display is 40 by 25 then X will be INT(LX/32) and Y will be INT(LY/41).

POINT(X,Y) returns the logical colour of the pixel at (X,Y). It should be possible to simulate POINT with PEEK (the scalling mentioned above will also apply).

ASC(d$) is identical to CODE(d$).

VDU 28 defines a text window.

VDU 23 redefines the ASCII character whose code is the number following the 23. The new character is an 8 by 8 grid whose rth row is a representation in binary of the rth number following the code. Thus the syntax is VDU 23, code, row l, row 2, row 3, up to row 8.

PLOT 69,X,Y prints a point at location X,Y.

PLOT 1,x,y draws a line between locations (X,Y) and (X + x, Y + y) where (X,Y) is the present position of the graphics cursor.

PLOT 85,x,y fills a triangle with vertices (x,y) and the last two places visited by the graphics cursor.

*FX 15,0 clears the keyboard and sound buffers.

SOUND c, v, f, d causes a sound of duration d to be emitted by channel c (white noise if c = 0 and f = 4) while f and v determine frequency and volume respectively.

PROC and ENDPROC can be replaced by a GOSUB to the first line of the procedure, and a RETURN respectively.

REPEAT and UNTIL can be replaced by a single GOTO. Here is an example

```
10 REPEAT
20 ------
30 UNTIL condition is true
```

This can be replaced by (30 IF NOT(condition is true) THEN GOTO 10) TRUE and FALSE always return - 1 and 0 respectively.

MODE is used to switch between the various graphics modes of the BBC Micro. In mode 5 there are 4 logical colours which can be thought of as paint pots numbered from 0 to 3. Unless VDU 19 is used to change the colour of paint in a pot then these colours are black, red, yellow and white. GCOL 0,p selects the colour to be used from pot p. GCOL 2,p selects the colour from pot P where P = p added with the colour already on the screen. If you do not have an approximation of the GCOL command then you will have to abandon the special function of line 320. Delete line 220 and replace line 320 with:-

```
320 PRINT
    TAB(lx,ly);"  ":PRINT
    TAB(LX,LY);CHR$(P):
    p = P:lx = LX:ly = LY:A$ =
    INKEY$(0):*FX 15,0
```

LX , LY , lx , and ly should of course be scaled appropriately.

SOFTWARE

Variables Used

D$ = The level of difficulty required by the player.

D, is a numerical variable to which the level of difficulty is passed; it is used to modify, gravity, thrust, number of small asteroids, and the rate of increase of the speed of the plasma bolts.

I = For loop variable used in three loops in the program. It is defined at lines 150, 260, 390.

X = Draw the mountains at the bottom of the playing area.

GX and GY = the horizontal and vertical positions of the gunmans asteroid.

F, defined at line 280, = the fuel remaining.

VX and VY = The horizontal and vertical velocities of the lander respectively.

AX BX AY and BY = The numbers to be added to DX and DY when the lander is turned. The X and Y in the variables name determines which A or B is added to which D, and A is for an anticlockwise turn, whilst B is for a clockwise turn.

DX and DY together fix the direction of any burst of thrust by their addition to VX and VY respectively.

P = The character code of the current image of the lander.

P, defined in line 280 = The previous value of P.

LX and LY respectively are the horizontal and vertical positions of the lander. They are also defined at line 280.

lx and ly = The previous values of LX and LY.

SX and SY = The horizontal and vertical positions of the plasma bolt.

UX an UY = The horizontal and vertical velocities of the plasma bolt.

m = Modify the speed of the plasma bolt.

A$ = Input a character from the keyboard and if it is an 8 or a 0 then the lander turns whilst if it is a 9 then a burst of thrust is imparted to the lander.

sq = Aim the plasma bolt at the lander and ensure that its speed is correct.



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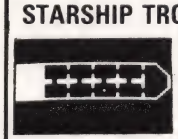
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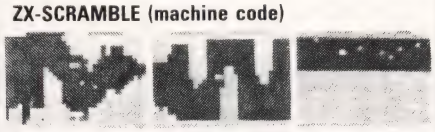
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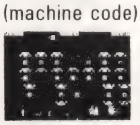


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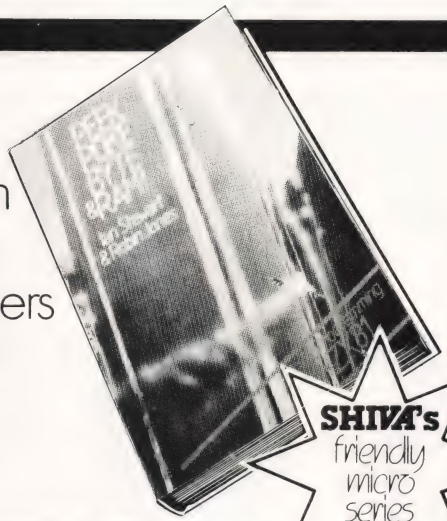


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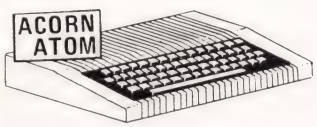
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COMPUTER USERS CLUB

This month an Atari users club shows what it is doing to further its cause in the form of a specially written adventure game.

Down at the Slough home of the Atari 400/800 Computer Club a meeting of computer minds will bring about a complex adventure game set in war-time Germany.

As you can guess from the club's name its members are only those with either of the Atari machines. The benefit of joining a club like this, is that there is a wealth of expertise available through different members who specialise in different aspects of the computer.

That's why several of the members are working on the adventure game project. The idea is to produce a game which will show off the Atari's facilities and market the final top quality version through the Silicon Chip shop, which is where the club meets.

The Game

Work is well under way on the initial part of the game. One person is writing the movement routines while another is working out a custom character and a third member is putting the finishing touches to the graphic display. All the different aspects of the program are discussed in an open forum where anybody can make suggestions as to how a certain part should be written or what a certain display should look like. The goal at the end of all this work is for the club to have a marketable group written piece of software which will bring in some extra revenue.

The game itself is a role playing adventure for a number of players and is based around an escape from a Colditz style prisoner of war camp. The idea behind it is very straightforward. You play the part of a prisoner trying to escape, and your task is aided by certain items of escape equipment which you can buy or sometimes find hidden in one of the huts.

The game board is made up of the compound in which is situated various huts and buildings. The depth of realism which the club is trying to achieve is commendable. This was highlighted in one of the discussion periods when a programmer outlined one of the hiding places he had designed in the church, a hole located underneath the font. It was then tactfully pointed out that it was very unlikely that the church in an all male prisoner of war camp would need a font unless there were some very strange under cover agents.

Also included in the ground plan was the concert hall, which as one member pointed out, had to have a big stage, because this is where all the best escape tunnels start. Your escape is hindered by the presence of guards, some whom can be bribed if it's worth your while. Unfortunately you can only find out whether the guard is crooked when you actually try to buy him off, so it doesn't always work.

Other Attractions

Working on the game takes up most of the clubs time but other activities include talks from club members or from invited expert guests. One such evening is planned where one of the top people from Atari (U.K.) is going to come down and reveal all. This is part of Atari's new scheme to help out user clubs whenever possible, giving them advice if it's needed and keeping them informed of the latest Atari product releases. If any Atari owner is interested in forming a new club contact the firm itself.

The Slough Atari Computer Club was formed in January by Colin Corne. He had bought an Atari 400 computer and decided that instead of struggling with it on his own he would find some like-minded individuals and form a users group.

The first meetings took place in the back room of a local pub and under the influence people discovered there was an interest in the machines. Later on the Silicon Chip shop in Slough High Street, which deals with the Atari range, offered them the use of its premises and equipment. This gave the club its current base where it meets every other Thursday evening.

Having the backing of a computer shop has paid the club dividends in many ways. When they meet there are usually three or four Atari systems they can use which is helpful if anyone doesn't yet own one. They also have access to a large screen television projector, which makes life considerably easier when it comes to running a presentation or demonstrating something on one of the machines.

Although virtually all the members own their own machines this is not a prerequisite for joining. The fees are £1 a night for adults and 50p for school children. Anybody interested in details about joining the group should write to the club president, Dave Bell, at 63 Alma Road, Windsor, Berkshire, or contact him during office hours at the Silicon Chip shop, telephone Slough 70639. ■

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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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PHOTOLIBRARY

Keep computerised records of all those holiday snaps with this useful program from J.H. Bamber

Have you ever spent an hour looking for that particular colour slide that you took on holiday two years ago? If so, this program is for you. It is written for the TRS-80 Lev.II, 16K, but should not be too difficult to adapt to other systems which can handle tape.

The program allows for the storage on tape of a number, title, and a list of characters that denote the subject matter for each photograph. To select the type of photo required when sorting, the program asks for two 'codes' which you detect, and then prints out each title that answers to both codes. As inputting data from tape is comparatively slow (it takes about five seconds for each photo), the program halts when the screen is full of information. This is to allow the user to get on with other business.

Data is processed in batches of 36 (called *films* for obvious reasons), each slide or neg. being given a number consisting of the "film" number plus a two digit number from 01 to 36. These are generated by the computer.

When It Runs

When the program is run, the screen will look like this:-

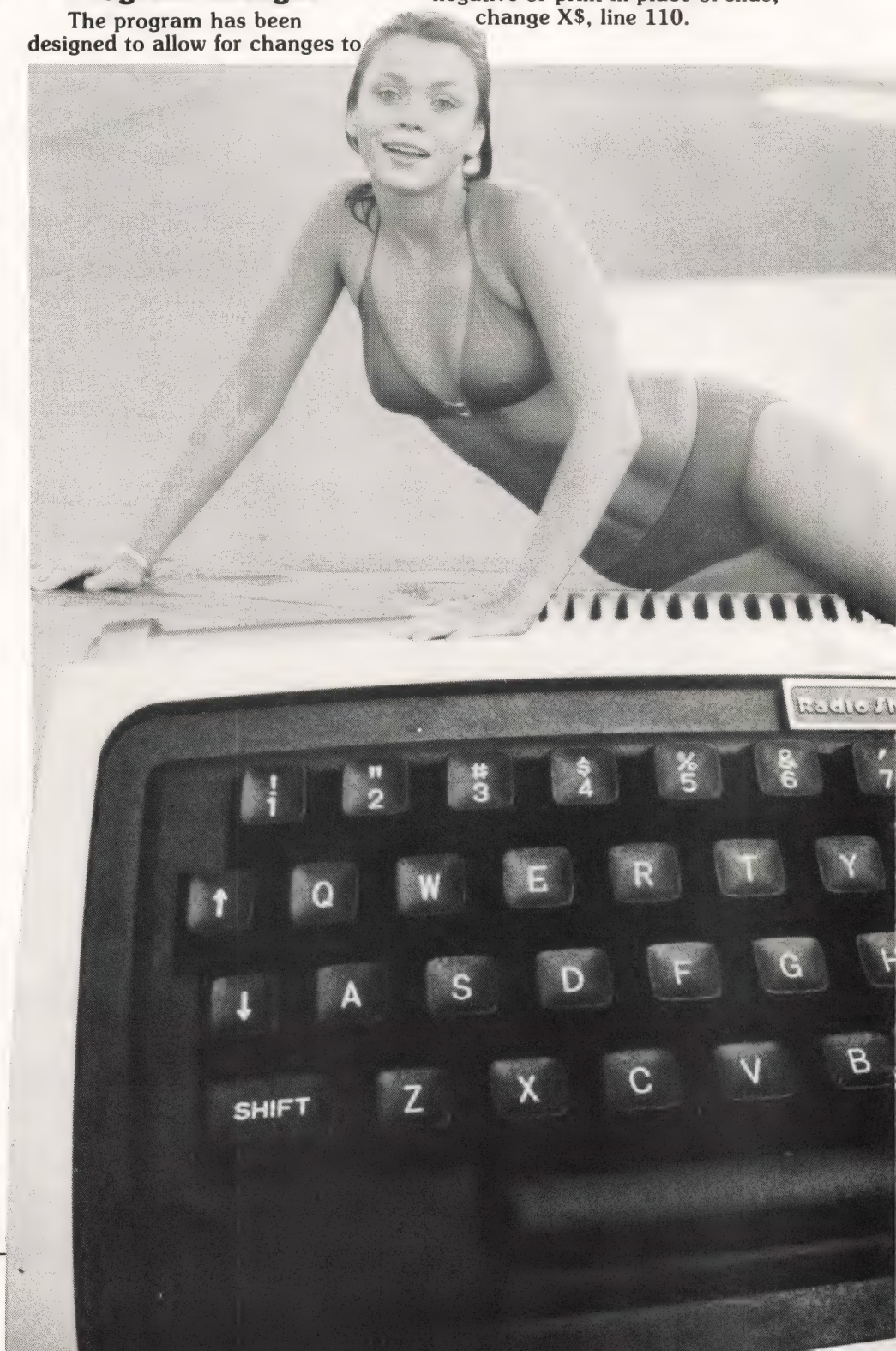
1) Input new data to memory.
2) Check new data in memory.
3) Store new data on tape.
4) Check tape against memory.
5) Sort slide from tape.
6) End program.
What now. Enter no.?

As every move is spelled out on the screen, little additional information is required. Keep titles to a reasonable length. Failing to do this will spoil the print-out at the sort stage. Space has been left for up to 10 letters in each code. When inputting new data for storage, always go through choices 1 to 4 in sequence. This will ensure accurate records.

The Tandy will ask for new film numbers, no. of last film on tape (it will be necessary to know the tape counter no. for the next film on tape). A good place to keep this information is on a card in the cassette case.

Program Changes

The program has been designed to allow for changes to fit other photographers needs. The film length can be changed by altering the value of L in line 110. If it is preferred to use the word negative or print in place of slide, change X$, line 110.



HOW IT RUNS

100 — 120 DIMENSIONS STRING ARRAYS AND SETS CONSTANTS.
130 — 200 MENU PRINTOUT.
210 — 230 USERS CHOICE ROUTINE.
250 PRINTS SUBJECT CODE AT TOP OF SCREEN.
260 INPUTS NUMBER OF NEW FILM
270 — 280 INITIALISES FOR NEXT LOOP. GENERATES PHOTO NUMBER. RIGHT$ INSTRUCTIONS DELETE THE SPACE THAT STR$ RETURNS AT LEFT OF STRING.
290 CLEARS BOTTOM OF SCREEN, INPUTS TITLE OF PHOTO.
300 — 320 INPUTS CODE CHARACTERS TO ARRAY, PLUS AN ASTERISK TO ALLOW FULL PRINTOUT AT SORT STAGE.
330 RETURNS LOOP, INFORMS USERS WHEN COMPLETE, WAITS, RETURNS TO LIST OF WHAT IS AVAILABLE.
340 PRINTS SUBJECT CODES AND HEADING.
350 STARTS LOOP, PRINT PHOTO NUMBER, TITLE & CODE CHARACTERS.
360 — 400 ASKS USER TO VERIFY DATA.
410 — 420 INPUTS CORRECTED DATA IF NECESSARY.
430 RETURNS LOOP.
440 INFORMS USERS WHEN COMPLETE, WAITS, RETURNS TO MENU.
460 — 480 CASSETTE INSTRUCTIONS.
490 RECORDS FILM NUMBER ON TAPE.
500 RECORDS PHOTO NUMBER, TITLE, & CODE ARRAYS ON TAPE.
510 — 530 CASSETTE INSTRUCTIONS.
540 WAITS, RETURNS TO MENU.
560 — 580 CASSETTE INSTRUCTIONS.
590 — 600 INPUTS FILM NO. FROM TAPE & VERIFIES RECORDING.
610 — 650 LOOP TO INPUT FROM TAPE & VERIFY, PHOTO NO., TITLE & CODE ARRAYS.
660 FINSHED & CORRECT INFORMATION, WAITS, RETURNS TO MENU.
670 — 690 FAULTY RECORDING INFORMATION, WAITS, RETURNS TO MENU.
710 — 760 SORT ROUTINE INSTRUCTIONS.
770 — 780 INPUTS CODES FOR PHOTO SELECTIONS AND LAST FILM ON TAPE NO.
790 — 800 CASSETTE INSTRUCTIONS.
810 — 820 PRINTS HEADING AND INITIALISES FLAGS.
830 INPUTS FROM TAPE FILM NO., STARTS LOOP, INPUTS PHOTO NO. TITLE, AND CODES.
840 — 850 LOOP TO CHECK EACH CHARACTER OF SUBJECT CODE, AND IF IT MATCHES C1$ or C2$ INCREMENT C BY 1.
860 PRINTS DATA IF BOTH CODES ARE PRESENT (C = 2), INCREMENTS X, IF SCREEN IS FULL (X = 12), WAITS, ON RETURN CLEARS SCREEN BELOW HEADING AND RE-INITIALISES X.
870 RETURNS LOOPS AND RE-INITIALISES C FOR NEXT CHARACTER CHECK.
880 CHECKS IF LAST FILM IF YES WAITS, RETURNS TO MENU.
890 RETURNS PROGRAM TO NEXT FILM ON TAPE.
900 END
2000 WAIT ROUTINE.
2040 SUB-ROUTINE TO PRINT SUBJECT CODES AT TOP OF SCREEN.
2150 SHORT PAUSE SUB-ROUTINE.



TRS 80
PHOTOLIBRARY



```
100   REM * PHOTOSORT BY J. BAMBER
110   CLEAR 2000 : Z$ = "0" : X$ = "SLIDE" : L = 36
      'FOR NEGS X$ = "NEG."
120   DIM T$(L), S$(L), SN$(L)
130   CLS : PRINT TAB(25); "PHOTOSORT" : PRINT
140   PRINT "1) INPUT NEW DATA TO MEMORY."
150   PRINT "2) CHECK NEW DATA IN MEMORY."
160   PRINT "3) STORE NEW DATA ON TAPE."
170   PRINT "4) CHECK TAPE AGAINST MEMORY."
180   PRINT "5) SORT";X$; "FROM TAPE."
190   PRINT "6) END PROGRAM."
200   PRINT : PRINT "WHAT NOW? ENTER NUMBER";
210   A$ = INKEY$ : IF A$ = "" THEN 210
220   B = VAL(A$) : IF B < 1 OR B > 6 THEN 210
230   ON B GOTO 250, 340, 460, 560, 710, 900
240   REM * INPUT NEW DATA TO MEMORY
250   GOSUB 2040 : PRINT @ 640, CHR$(31);"";
260   INPUT "ENTER FILM NUMBER"; F$
270   FOR J = 1 TO L : IF J < 10 THEN SN$(J) = F$
      + Z$ + RIGHT$(STR$(J),1)
280   IF J > = 10 THEN SN$(J) = F$ +
      RIGHT$(STR$(J),2)
290   PRINT @ 640, CHR$(31); "INPUT TITLE OF";
      X$;"NO. "; SN$(J);: INPUT T$(J)
300   PRINT "PRINT "TYPE IN CODE LETTER OF
      EACH SUBJECT CATEGORY"
310   PRINT "WHICH APPLIES TO THIS";X$;"(NO
      PUNCTUATION PLEASE)."
320   PRINT "THEN PRESS ENTER.";: INPUT S$(J) :
      S$(J) = "X" + S$(J)
330   NEXT : PRINT @ 640,CHR$(31); "THAT'S ALL,";:
      GOSUB 2000 : GOTO 130
335   REM * CHECK NEW DATA IN MEMORY
340   GOSUB 2040 : PRINT @ 640, X$; "NO."; TAB(28);
      "TITLE"; TAB(52); "CODES"
350   FOR J = 1 TO L : PRINT @ 704, CHR$(31);
      SN$(J); TAB(10); T$(J); TAB(52); S$(J)
360   PRINT "IS THIS CORRECT? (Y OR N) ";
370   A$ = INKEY$ : IF A$ = "" THEN 370
380   IF A$ = "Y" THEN PRINT CHR$(8); "YES" :
      GOSUB 2150 : GOTO 430
390   IF A$ < > "NO" THEN A$ = "": GOTO 370
400   PRINT CHR$(8); "NO" : GOSUB 2150
410   PRINT @ 768, "TYPE IN CORRECT DATA "; X$;
      "NO."; SN$(J)
420   INPUT "TITLE"; T$(J) : INPUT "CODES"; S$(J) :
      S$(J) = "X" + S$(J)
430   NEXT
440   PRINT @ 704, CHR$(31); "ALL CHECKED,";:
      GOSUB 2000 : GOTO 130
450   REM * STORE NEW DATA ON TAPE
460   CLS : PRINT "WIND PAST PREVIOUS DATA &
      NOTE TAPE COUNTER."
470   GOSUB 2000 : PRINT "PRESS RECORD & PLAY
      KEYS OF CASSETTE."
480   GOSUB 2000 : PRINT "RECORDING DATA."
490   PRINT # -1, F$
500   FOR J = 1 TO L : PRINT # -1, SN$(J), T$(J),
      S$(J) : NEXT
510   PRINT "DATA IS NOW ON TAPE." : GOSUB 2150
520   PRINT "PRESS CASSETTE STOP KEY." : GOSUB
      2150
530   PRINT "NOTE TAPE COUNTER FOR LATER
      USE."
540   GOSUB 2000: GOTO 130
550   REM * CHECK TAPE AGAINST MEMORY
560   CLS : PRINT "WIND TAPE TO START OF NEW
      FILM IN MEMORY." : GOSUB 2000
570   PRINT "PRESS PLAY KEY OF CASSETTE." :
      GOSUB 2000
580   PRINT "CHECKING NEW DATA TAPE."
590   INPUT # -1, F2$
600   IF F2$ < > F$ THEN 670
610   FOR J = 1 TO L : INPUT # -1, S2$, T1$, S1$
```

PROGRAM LISTING

```
620   IF S2$ < > SN$(J) THEN 670
630   IF T1$ < > T$(J) THEN 670
640   IF S1$ < > S$(J) THEN 670
650   NEXT J
660   PRINT "ALL CORRECT, PRESS CASSETTE STOP
      KEY." : GOSUB 2000 : GOTO 130
670   PRINT " X X BAD RECORDING X X WIND TAPE
      BACK TO START OF THIS"
680   PRINT "FILM AND ADJUST VOLUME CONTROL,
      OR RE-RECORD."
690   GOSUB 2000 : GOTO 130
700   REM * SORT FROM TAPE
710   CLS : PRINT " WHEN ASKED, INPUT THE TWO
      SUBJECT CODES WHICH WILL"
720   PRINT "SELECT THE TYPE OF" ; X$; "YOU
      REQUIRE. I.E. A & L FOR"
730   PRINT " CHILD PORTRAITS. IF YOU REQUIRE
      EVERY"; X$; "OF ONE"
740   PRINT "SUBJECT, ENTER THE SAME CODE
      LETTER TWICE. I.E. A & A"
750   PRINT "WILL DISPLAY EVERY CHILD PHOTO.
      TWO X'S WILL PRINT EVERY"; X$
760   GOSUB 2000 ; GOSUB 2040 : PRINT @ 640,
      CHR$(31);"";
770   INPUT "ENTER SUBJECT CODE NO.1"; C1$ :
      INPUT "CODE NO. 2"; C2$
780   INPUT "WHAT IS THE NUMBER OF THE LAST
      FILM ON TAPE"; LF$
790   CLS : PRINT "REWIND TAPE IF NECESSARY."
      :GOSUB 2150
800   PRINT "PRESS PLAY KEY OF CASSETTE."
      :GOSUB 2000
810   CLS: PRINT X$; "NO."; TAB(15); "TITLE";
      TAB(52); "CODES"
820   X = 0 : C = 0
830   INPUT # -1, F$ : FOR J = 1 TO L : INPUT #
      -1, SN$, T$, S$
840   FOR K = 1 TO LEN(S$) : IF MID$(S$,K,1) = C1$
      THEN C = C + 1
850   IF MID$(S$,K,1) = C2$ THEN C = C + 1
860   IF C = 2 THEN PRINT SN$; TAB(15);T$ ;
      TAB(52); S$ : C = 0 : X = X + 1 : IF X = 12 THEN
      GOSUB 2000 : PRINT @ 64, CHR$(31); "";: X = 0
870   NEXT K : C = 0 : NEXT J
880   IF F$ = LF$ THEN PRINT "THAT'S ALL," :
      GOSUB 2000 : GOTO 130
890   GOTO 830
900   END
1990  REM * PROGRAM PAUSE ROUTINE
2000  PRINT "PRESS ANY KEY TO CONTINUE."
2010  A$ = INKEY$ : IF A$ = "" THEN 2010
2020  RETURN
2030  REM * SUBJECT CODES
2040  CLS : PRINT TAB(25); "SUBJECT CODES"
2050  PRINT
2060  PRINT "A) CHILD", "H) SPORT", "O)
      LANDSCAPE", "V) WATER"
2070  PRINT "B) MALE", "I)BUILDINGS", "P) CLOSE-
      UP", "W) NIGHT"
2080  PRINT "C) FEMALE", "J) SEASIDE", "Q) BIRD",
      "X) MECHANICAL"
2090  PRINT "D) FAMILY", "K) HISTORICAL", "R)
      ANIMAL", "Y) SNOW & ICE"
2100  PRINT "E) GROUP", "L) PORTRAIT", "S)
      INSECT", "Z) INTERIOR"
2110  PRINT "F) WEDDING", "M) BOTANICAL", "T)
      NATURE", "1) BOATS ETC.
2120  PRINT "G) TRANSPORT", "N) FESTIVE", "U)
      MILITARY", "2) HOLIDAYS"
2130  PRINT STRING$(64, "+")
2140  RETURN
2150  FOR T = 1 TO 400 : NEXT : RETURN : REM *
      'SHORT PAUSE SUBROUTINE
```

HINTS ON CONVERSION

The TRS-80 V.D.U. screen is formatted in 16 lines of 64 spaces.

In this program all PRINT @ addresses are at the start of lines. Therefore PRINT @ / 64 + 1 will give the line number. The tabs should be adjusted to suit the screen width of the system being used.

Clear 2000 sets 2000 bytes of memory aside for string storage.

CLS clears screen and cursor home.

PRINT # -1, is the instruction to save data on tape.

INPUT # -1, is the instruction to input data from tape.

A$ = INKEY$ should be changed to GET A$, or the whole line to INPUT A$.

STRING$(64,"+") returns 64 plus signs.

A comma is the instruction to print at the next of 4, 16 space print zones.

CHR$(8) is backspace 1 space.

CHR$(31) puts the cursor at the specified PRINT @ address and clears the screen from that point down. If your system does not have it, a sub-routine to print the required number of blank lines and put the cursor at the print address should do the trick. But take care of automatic line scolling on the bottom line. This could spoil the display. The program runs in approx. 7K of memory, (film length, 36).

Variables Used

SN$(N) & S2$ = Slide No. and it's duplicate for tape verification.

T$(N) & T1$ = Title, and it's duplicate for tape verification.

S$(N) & S1$ = Subject, and it's duplicate for tape verification.

F$ & F2$ = Film No., and it's duplicate for tape verification.

C1$ & C2$ = Subject codes.

LF$ = Last film No.

C = Subject flag, if 2 print.

T, J & K = Loop indices.

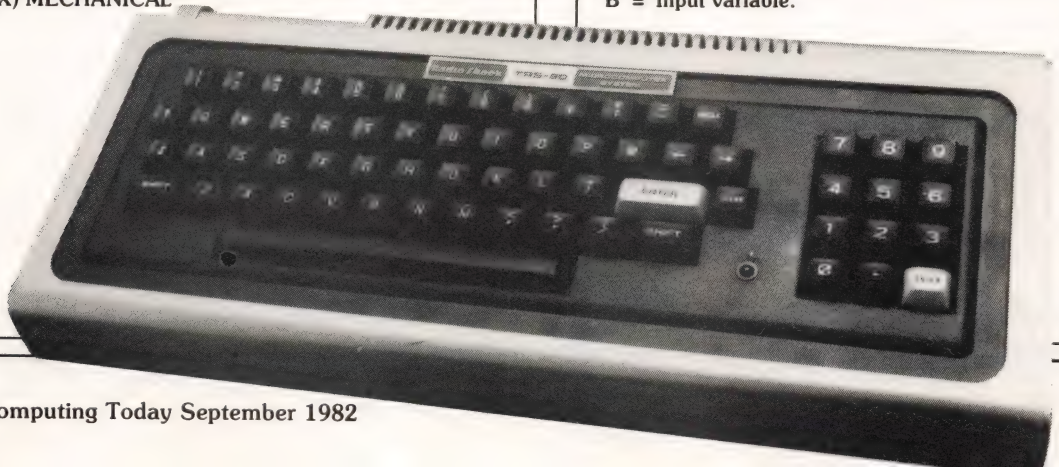
X = Number of lines printed.

Z$ = 0

X$ = Type of photo.

L = Film length.

B = Input variable.



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HAS VIC MATURED NOW ITS 64?

Commodore Business Machines recently announced a selection of new low-cost computers to extend the success of the VIC-20. Chris Palmer went to the firm's Slough HQ to see how the top end of the range machine, the Commodore 64, differs from its predecessor.

There is no doubt that the soon-to-be-released big baby from Commodore, the 64, is an impressive machine. Though still not in general production the final off-the-shelf version is almost complete, and it was at that stage that I saw it.

By the time this new computer is on sale some features might be improved but the basic machine will be the same.

When you first plug-in and switch on the Commodore 64 you are greeted with a Commodore message and are told immediately how much memory space you have free to use. The screen colours are a light blue border, blue background and light blue as the text colour. A definite improvement on the VIC-20's dazzlingly bright torquoise.

At first glance you could very well mistake the 64 for a VIC-20 except that the colour of the case is different and so is the logo. On closer examination around the edges of the case the real differences become apparent. On the right-hand side of the VIC-20 there is only one joystick port, but on the Commodore 64 there are two.

The cartridge space on the 64 takes up half the original space for insertion, the remainder being taken up by an internal modulator. This means that you can't use VIC cartridge software with the 64 because of the change in memory layout and lack of space.

Software

But don't despair. Both PET and VIC software can be run on the Commodore 64 with slight conversions. PET software can be converted to run on it because of the 64's 40 x 25 screen size, which is the same as the PET 3000 and 4000 series. The biggest problem comes when you deal with programs containing PEEK and POKE statements, because the memory locations are different on the 64. The BASIC used with the 64 is, thankfully, the same as that used with both the PET and VIC, the major difference being that the 64's sound and graphics capabilities far excede anything yet offered by those machines.

If you don't like the thought of converting programs yourself Commodore is coming to the rescue with a complete range of software specially written for the 64. Business programs include data bases, finacial planners, electronic spreadsheets (like the accounting package Visicalc) and word processors, as well as conversions from the massive range of PET titles.

For entertainment Commodore is planning to re-write the most popular VIC games making the most of the 64's improved facilities. I saw Starfighter on the 64 and although simple in concept it proved to be a challenging and addictive game.

Another leisure pack was a music program which allows you to select various voices and instruments for the computer, including flute, guitar and drums. You can either play tunes direct from the keyboard or play pre-programmed



melodies from the cartridge giving a very professional sound.

Developments for add-ons and peripherals are still at early stages but Commodore has some interesting things in the pipeline. Some of the VIC peripherals like disc, printer tape and modem are compatible with the 64, but additional interface cartridges are in progress.

These will allow you to use devices which can be plugged into the RS232 and IEEE ports for extra communications facilities. Two interesting cartridges that should be available are the PET emulator and the Z80 packs. The PET emulator is designed to allow Commodore 64 users to run the majority of programs written specifically for the PET, with little or no modification.

The Z80 cartridge will enable you to run programs written in a widely used microcomputer language called CP/M by giving it access to a second microprocessor, the Z80. This could mean that the Commodore 64 will be able to run other machines' software by plugging in the correct emulator cartridge.

As well as using the CP/M language other under development are PILOT, LOGO, FORTH and PASCAL which are already available for the PET and VIC. But most users will only be concerned with BASIC.

Because BASIC is the simplest language used in computing it has its drawbacks in programming. But a couple of special features added to the 64 mean that now games fanatics lives will be made much more exciting and a lot easier.

MOBS and pixel scrolling are what the enhancements boil down to. MOB stands for Moveable Object Block. This is a high resolution character created on a 24 x 21 grid which can be moved around the screen, in front of or behind any other character without disturbing it or erasing it. In effect it creates a three dimensional picture.

You are allowed up to eight MOBS on the screen which you can control by POKEing values into registers in memory. The computer will also scan the screen and tell you when your MOBS collide with each other or the scenary.

Pixel scrolling is the other useful but less spectacular feature. It allows you to move the screen in either a vertical or horizontal direction one pixel (one character dot) at a time.

Good Graphics

Unfortunately, there are some peculiar graphics features in particular the high resolution screen. The 64 has a 320 x 200 dot resolution screen but the problem is that there are no commands such as PLOT and DRAW in its operating system. This, coupled with the long-winded method of accessing the colour and sound suggests a number of ROM utilities will appear on the market when the 64 is finally released.

The Commodore 64's graphics are advanced but don't be afraid to use the POKE command to get the most out of them. All the colour, sound and graphics controls take the form of registers in the memory so you have to use the POKE command. But once you have got used to the locations and control codes the dividends it pays are well worth the struggle.

Colour quality of the machine I used is a great deal better than the VIC-20 and comparable if not better in some cases to the Atari computers. The Commodore 64 offers 16 colours which you can assign to the border, the screen background and the characters. These colours are listed in figure 1.

COMMODORE 64 COLOUR SET.	
BLACK	ORANGE
WHITE	BROWN
RED	LIGHT RED
CYAN	GREY 1
PURPLE	GREY 2
GREEN	LIGHT GREEN
BLUE	LIGHT BLUE
YELLOW	GREY3

figure 1

Background and border colours are stored in two separate registers. Character colours are stored by placing them as control charactes inside the quotes of a PRINT statement. The 64 also keeps the two areas of memory devoted to the screen, one to hold the data for the



character to be displayed and one to store the data for the colour of that character.

Stunning though the graphics may be it is on sound generation where this machine scores points. On the 64 the sound is superb. The production quality is far better than any comparable machine and the depth of control is staggering.

This is all thanks to SID. SID stands for Sound Interface Device which is a custom designed chip giving you three voices, each covering nine octaves with full tone modulation and wave form selection for each. The way in which you control these voices owes more to synthesiser technology than computer developments.

The parameters you have to play with when you set up a sound on your 64 are as follows. First, set one of four waverforms — triangle wave, which gives you a mellow flute like sound, sawtooth wave, which gives a bright brassy sound, pulse wave producing a wide variety of tone qualities and finally, noise. This produces percussive sounds as well as standard wind and surf noises.

Second, you set the ADSR, which stands for Attack Decay Sustain Release. This tells the computer how to alter the volume of the note after it has been triggered. Once this is done set the overall volume and lastly, give it the note you want to be played.

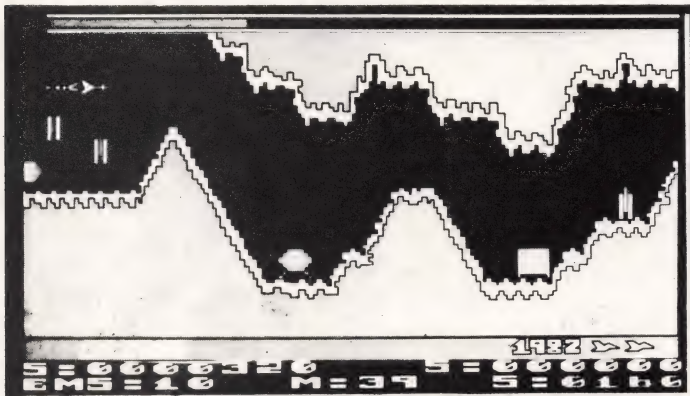
The result of this is that the 64 can be turned into a very flexible and impressive sounding synthesiser, if you are willing to put a little work into it.

If the final production models of the Commodore 64 are as good as the pre-production version it will be accepted in many parts of the computer world. It will especially appeal to those who have some programming experience and who wanted to produce high class screens and ear-catching sounds, but were thwarted by the restricted capabilities of their computers.

At the other end of the scale, for those who have barely ventured into computing is the VIC-10. It was originally designed by Commodore purely as a games playing machine with limited memory capacity. It will have the same sound and graphics capablities as the Commodore 64 but its BASIC might be contained on a separate cartridge rather than within the memory chip.

The VIC-10 has a touch sensitive keyboard which will allow it to accept overlays such as a piano keyboard to use with a music cartridge.

It could prove a serious rival to the ZX Spectrum when it finally hits the streets. *Personal Computing Today* will give the VIC-10 a thorough going over in a future issue to keep you posted on Commodore's latest moves. Prices of both computers are not yet fixed.



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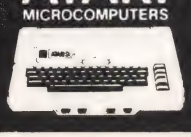
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MICRO C

LOOK BEFORE YOU LEAP

Buying computers and peripherals can be a taxing experience. In our regular feature we look at the dealers and what they offer.

One of the most important things for a person thinking of buying a computer is being able to look at and use different models before making their choice.

At the Micro C shop in London's Hampstead Road this is catered for admirably. On display in the shop were complete VIC, Atari and Texas systems alongside the bigger machines such as Pet's and Sirius's. The staff are all capable of demonstrating the machines and drawing comparisons between different models, so that the buyer ends up with the best machine for the purpose he intended.

The machines were well designed in comfortable and friendly settings. Each machine was complemented by its manuals and sales literature as well as peripherals such as cassette drives, printers and disc's. The staff have no objection to people trying out their own programs or just using the machine, provided the shop does not turn into a high class arcade. This sort of attitude helps to quiet the fears that most people have about going to this sort of shop and of being pounced on and forced to buy something before they are even let near the machines.

Micro C sells a wide range of software to complement the machines. For the VIC they have titles from Comodore, Audiogenic and Rabbit. Atari software from Thorn EMI, Atari Program Exchange (APX) and Atari. The Texas is a little bit lacking in independent software, but as soon as some becomes available Micro C will stock it.

It is refreshing to note that they attempt to vary the range for each machine by not only carrying software from the computer manufacturers, but also stocking software from independant suppliers. The staff will run through a piece of software with you before you buy it just to make sure you are familiar with the program and are happy that it does what you want. This helps to prevent the annoying problem of buying a piece of software and, getting home only to find it will not run on your machine or it isn't what you wanted in the first place.

Curry's Micro C itself pursue an intensive search for new software titles and each week produce an update bulletin which is sent round to all their dealers so that they are aware of what they will be stocking over the following weeks.

If they are out of stock of an item they should be able to get it in within a week. As well as the normal guarantee offered by the manufacturer Micro C also offer their own, which includes exchange machines and quick turn around on repairs.

After you have bought your machine there is a wide range of backup available to you, ranging from a vast selection of books, through various peripherals, to a helpful voice on the end of a telephone if you get stuck.

The whole home computer set up at Micro C seems to be aimed at making your transition from a computer novice to a competent user as smooth and trouble-free as possible. Some of the shops have compiled lists of local people involved with user groups and these names are made available to anybody who wants to become involved in the social side of computer use. They are also working on a scheme by which people can hire program cartridges in a similar fashion to the video cassette clubs that are the vogue at the moment.

Because the staff are mostly computer enthusiasts themselves they are well aware of the problems confronting the people which come into the shop and will go to great lengths to sort them out.

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FEATURE

ATARI Vs TEXAS

With the large number of low-cost computers now available for the home user it is often difficult to see which machines offers the most. Here *Personal Computing Today* puts two of the contenders in the spotlight.

The battle for supremacy in the home computer field is now hotting up, with all the main manufacturers aiming to have competitive machines selling for about £200.

The Atari 400 and the Texas TI 99/4A have both been around for at least a year and have both had their prices cut to make them more competitive in this area. Here we attempt to put both machines in perspective and find out just what they offer and how they compare.

The Atari 400 sells for about £199.95 and for this you get the computer console, which includes the keyboard, the processor and the memory. Also included in this price is the power supply and the operating manual. As it stands this can't be used as a computer because it has no BASIC language. This is available on cartridge separately, along with two other manuals, for £50.00.

The Texas TI 99/4a retails for around the £200.00 mark and this price includes the keyboard unit, containing the processor and the memory, a power supply, two manuals and a modulator. Because both machines use ordinary domestic televisions as displays the modulator is an essential part of the system, as this converts the signal that is produced by the computer into a form that can be used by the television. On the Atari 400 the modulator is included inside the keyboard case.

An equally important part of the package is the supplied documentation. Both machines fair well in this standing. The Texas computer has a users reference guide, which gives you details of how to set the machine up and also how to use its special features and language. The second Texas manual is entitled Beginners BASIC and takes the form of a tutorial on the BASIC computer language, with special reference to the Texas machine.

For the purposes of this comparison it is assumed that the Atari 400 has been bought with the BASIC cartridge. This brings the Atari manuals to a total of three. The manual which comes with the standard machine is an operators manual and is similar to the Texas in that it gives you information on how to plug the machine in and information on how to use the peripherals. Once again you get a BASIC tutorial that will teach you to program in Atari BASIC but also you get a reference guide which provides information on the syntax and method of operation of all the Atari commands.

In appearance the Atari machine has a futuristic look about it, with a recessed keyboard well to the front and a raised section at the back. The front of the raised section is ▶

hinged to allow access to the single cartridge slot, where the BASIC cartridge or the game packs are placed. Underneath the front lip of the keyboard are the four games controller ports. Into these can be plugged joysticks, paddles or keypads.

The styling of the Texas machine is vaguely reminiscent of the Bang & Olufsson range of Hi Fi equipment. The top of the case is finished in brushed aluminium and the sides are a matt black plastic. The keyboard sits at the left hand side of the machine and to its right is the slot which the command module cartridges slide into. One of the games ports is situated on the back of the machine and the other on the left side.

Both machines have provisions made for using a cassette tape recorder to load and save programs. The Atari has its own model which is dedicated to the computer. This means that it is not a standard tape recorder but has been modified to be used specifically for storing programs. For the Texas you can buy a set of leads which will enable you to plug it in to any normal tape deck. This system, although cheaper and more convenient for the user, does bring problems, because most domestic tape recorders have separate volume and tone controls it is sometimes difficult to remember the different settings that were used to record different pieces of software, thus making loading them back into the computer a tedious process.

The first difference that strikes you, when you look at both machines is that they have different keyboards. The Atari has a touch sensitive, membrane keyboard and the Texas has a moving key typewriter style keyboard. For a long time membrane keyboards have been criticised for their lack of sensitivity and the innaccuracies which can develop through using them. On the 400, Atari has conceded these failings in the basic concept but has taken steps to make life easier for the user by providing ridged surrounds to every key and including an audible buzz to signify when a key has been properly depressed.

Both keyboards layouts are in standard QWERTY format but unfortunately the Texas keys are a little too close together, making touch typing hard. The Texas also has a control key and a function key which allows for multiple assignments to some of the other keys. The Atari has a CTRL key and a reverse key.

The Atari also has four keys set to the right of the keyboard. These are: SYSTEM RESET, OPTION, SELECT and START. These keys are mainly associated with the games cartridges and tapes. They are all recessed into the case so they cannot accidentally by pressed.

Finally, both machines have the facility to accept cartridges. On the Atari they are slotted in the top of the machine underneath the hinged cover. The mounting of these cartridges is very solid and unlikely to wear, as are the cartridges themselves, which have an ingenious locking cover that protects their edge connecters. On the Texas machine they are pushed through a cover which is situated on the right of the machine. Both these systems work well and are unlikely to cause problems with cartridge wear or reliability.

The processing power of the Atari lies with the 8-bit 6502 chip whilst the Texas uses the 16-bit 9900 chip. The difference between an 8-bit micro and a 16-bit are that in theory the 16-bit can address more memory and carry out calculations a lot faster. Unfortunately due to some weird memory organisation inside the Texas it in fact turns out to be a lot slower than almost every other micro in its price range. This is not such a great disadvantage for somebody just starting to program, but could provide a lot of headaches for people who wish to do more than just simple programs.

Both machines come with 16K memory as standard, which is a sensible amount for beginner and expert alike. There is no provision made for memory expansion on the Atari but some firms do produce internal boards which will take the RAM total up to 32K. The memory on the Texas can be expanded externally to 48K but this also requires the purchase of the TI Extended Basic cartridge because the resident basic can access the extra memory.

Other languages are available for the Atari and the Texas. The Atari offers PASCAL, which is a structured programming language and Microsoft BASIC, which is a different dialect of the BASIC that the machine uses. The Texas has an extended basic cartridge which adds a number of extra commands and features to the basic machine and also the TI LOGO language, which has been specially developed as an easy to learn programming utility for children.

BASIC on the Atari is closer to the normal BASIC found on other machines like the PET and the Apple. The majority of the commands operate in the normal fashion and where Atari have included specialised commands such as SETCOLOR or DRAWTO they are pretty self explanatory as to their action. All the commands can be entered in a short hand form, such as L. for LIST or PL. for PLOT.

One of the big disadvantages with the Atari BASIC is that it cannot handle string arrays of more than one dimension, in the normal way. Usually if you wanted to store a number of items of data in a computer you would set up an array. This allows you to manipulate the data as if it were held in a matrix and access pieces of data by giving their co-ordinates. What the Atari does if it has to handle data in this way is to place all the data end to end to produce one large piece of data which you then have to sift through to find the information you are looking for.

The Texas BASIC allows you to use multi-dimensional





string arrays, but does have a few deficits of its own. Most noticeable is the absence of those two commands PEEK and POKE, which are the prime weapons in most advanced programs. This coupled with the unnecessarily long-winded method of editing can make slightly more advanced programming a chore.

One of the major uses for these sort of micro's nowadays is games playing. This brings us to the topic of screen graphics and sound.

Both machines work in colour and they both offer some form of high resolution capability. The competition in this field is slightly unfair as the Atari 400 offers perhaps the best quality graphics facilities of any home computer around. Both machines have 16 display colours (see fig. I) but the Atari has the ability to display those colours in any one of 16 different brightnesses giving you access then to 256 different colour hues.

You need not be restricted by the character sets present in the machines because they both enable you to define your own characters. One point in the Texas's favour is that the way of doing this is outlined in the manual and there is a subprogram already in the machine that will handle all the tricky stuff. However, on the Atari you have to trick the machine and indulge in some quite serious PEEKing and POKEing.

Quality of games on both machines is very high, this being helped by the inclusion of a system called Player Missile Graphics on the Atari and Sprites on the Texas. These are large, user definable graphics that can be moved about the screen very smoothly by just telling the computer where to put them. Once again the Atari requires a lot of POKEing and a good knowledge of the machine before this can be achieved, though on the Texas this can be made a lot easier if you have the extended BASIC cartridge plugged in.

To complement their graphics capabilities the two machines can produce a wide range of sounds, ranging from pure tones to white noise. Atari once more have the edge here, giving the user greater control over the actual sounds by including a distortion value as one of the parameters in the SOUND statement. In its defence though the Texas does offer a five octave range to the Atari's three and it also includes a parameter to control the duration of the note played.

The Texas has an interesting system of controlling its sound and graphics features. Each function is set up as a subprogram which is accessed with a CALL command. The subprograms and their functions are listed in figure 2.

One important factor which is generally overlooked by people who buy computers is the ease of which you can edit programs. It can be very frustrating, if, after entering a long line you then have to go through a lengthy series of control key operations just to change one letter.

The Atari uses an on screen editor. This editor allows you to move the cursor anywhere on the screen and edit any line that is displayed there. If the line is not already on the screen it can be listed and then edited. The advantage of this system is that it will also allow you to edit statements that are not part of a program, but have just been typed directly onto the screen. This is invaluable if you just want to try out several different values in a statement without having to write a program for it.

The Texas however uses a different system. Before you can actually edit a line you have to use the EDIT command to put the machine into edit mode. Once you have the line displayed that you wish to change you can then use various function keys to carry out the alterations. This system is a little slow and difficult to master at first. Combined with the machine's unforgiving nature towards spaces on lines make it unwieldy for the programmer to use. In its favour, it does provide a collection of programmers utilities such as renumbering and auto line numbering which, on the Atari, have to be added in the form of software utilities.

On the subject of software, this highlights another major difference between the two machines. The Atari has a wealth of software available from both the manufacturer and independant suppliers. The Texas however has the software made by the manufacturer with only about one independent supplier writing software. The software that is available for both machines is of a very high standard, especially the cartridge games.

In conclusion, despite the pros and cons of each machine they both make good beginners machines. However the Atari is the better choice for anybody who already has some programming experience, or for the beginner that will want to explore the home computer to its fullest.

figure 1

COLOUR COMPARISONS

ATARI	TEXAS
Grey	Transparent
Gold	Black
Orange	Medium Green
Red-Orange	Light Green
Pink	Dark Blue
Purple-Blue	Light Blue
Blue I	Dark Red
Blue II	Cyan
Light Blue	Medium Red
Turquoise	Light Red
Green-Blue	Dark Yellow
Green	Light Yellow
Yellow-Green	Dark Green
Orange-Green	Magenta
Light-Orange	Grey
	White

figure 2

TEXAS SUBPROGRAMS

Call Clear	—	Clears entire screen
Call Colour	—	Sets foreground and background colour
Call Screen	—	Changes screen colour
Call Char	—	User-definable character routine
Call Hchar	—	Horizontal character repetition
Call Vchar	—	Vertical character repetition
Call Sound	—	Plays tones or noise
Call Gchar	—	Gets a character from the screen
Call Key	—	Gets a character from the keyboard
Call Joyst	—	Reads joystick positions

Personal Computing Today

Have you written a program or article and would like more people to use it and benefit from 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.

Why not send them to us, no matter what machine you have written it for and regardless of its length and complexity. Not all complex programs are good ones so don't be put off if you think your program won't come up to scratch.

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 hope you will follow.

Submitting Programs to Personal Computing

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 PC 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 conditions, '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 Issue

October's Personal Computing Today will bring you a bundle of news and reviews kicking off with the Atom and plug-in BBC BASIC board.

Many people in the know have condemned the BBC Model A computer as being too limiting a machine. Some think that the old favourite Acorn Atom used with the BBC BASIC board beats the Model A into a cocked hat. Our main review takes a long hard look at the upgraded Atom and finds out just what the expanded and improved system is like and whether it is better than the Model A. Atom BASIC has confounded many a programmer so perhaps now, thanks to the BBC board their problems are over. And only for an extra £50.

New micro computers are being launched at the speed of light these days but one which has taken about two years to get off the ground is the NewBrain. Made by Grundy Business Systems this portable and powerful computer is soon to hit the streets and is currently in full production. We are dissecting the brain's of this newest computer to discover what lies inside and how it performs in comparison to other similar microcomputers on sale.

Another recent addition to the shop shelves, the Spectrum, gets a look-in too. Graphics have foxed hoards of people so we decided to sort out user defined graphics on the machine. We will clear the fog that has blurred your vision and show the Spectrum's graphics in their true colours.

More Programs

Programs galore for you to run on your machines. If you want to get to grips with word processing on the BBC micro now's your chance. This is an excellently written program and very clearly laid out so it will be easy to tackle. One for the slightly more serious user though.

On the more light-hearted side is an entertaining program for the Nascom computer going by the unlikely name of Bouncing Beastie...we will leave it to your imagination as to the nature of this program. To improve your programming and taking you into the unplumbed depths of machine code is a digital clock program running on the ZX81. A concise little number here fitting into 1K of memory space.

The second in our games programming series which began this month is the literally money-spinning game Roulette. If gambling has always been a weakness in you then now's your chance to do it on the cheap. In gamesboard you are shown how to program a roulette game in easy to understand, step by step sections.

Don't forget our Readers Letters page where you get the chance to air your news and views on anything and everything to do with computing. If you need technical help make the most of our Micro Answers page. There's a special priority reply slip which you can fill in and send off with your query. Already we have had massive response and are replying as soon as possible. Make sure you don't miss out. It's on sale from the beginning of September.



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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 PC 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: **Dog Daze**
Type: **Tape**
Supplier: **Atari Program Exchange (APX)**
Machine: **Atari 400/800**
Price: **£14.00**

Give a dog a bone and it should keep him happy but this species always tries to get rid of them.

Dog Daze makes a welcome change from man's worst enemy the space invader and requires just as much concentration and digital dexterity to win.

This two player Atari game is completely new in concept and theme. Both players control differently coloured dogs which are moved around the screen in any direction using joysticks.

It looks deceptively simple at first when just two dogs appear on the screen followed by a randomly placed fire hydrant. The object of the game is for each dog to mark his territory, in this case the fire hydrants, so that each one establishes his ground.

There are two ways of doing this, firstly to run your dog up next to the hydrant which magically makes it change colour. Secondly, try a more devious method and fire your dog's bone at the hydrant. Here's where your aim needs to be accurate as you line your dog up with the hydrant, and press the fire button to send the bone sailing smoothly towards the target.

If your aim is true the hydrant changes to your colour and you gain a point. but if you miss, your bone will either stick to the opponent's hydrant or to the side of the screen and you will have to collect it to use it again.

As soon as you have captured one hydrant then another will appear randomly.

The scoring is displayed on a row of 16 hydrants on the top of the screen. These gradually change colour depending on how many hydrants each player has captured, the winner being the first person to change all these to their own colour. You can set variations on the game, such as a time limit or filling the screen with hydrants before you start, if you want to increase the difficulty.

The graphics and sound are both used very well on this game and it should appeal to anybody old enough to hold a joystick.

C.P.

Ratings Table

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

Title: Escape From Pulsar 7
Type: Tape/disc
Supplier: Molimerx
Machine: Tandy TRS-80 Models I and III
Price: Tape £10.06/disc £13.51

Escape from Pulsar 7 smaks of the laudable film 'Alien' which sent waves of suspense through hundreds of people.

You are the sole survivior of the crew of the space freighter Pulsar 7, the rest of the crew having been killed by a now savage creature that was being transported to your home planet as a specimen for the galatic zoo. It's transformation from a harmless animal into a wild beast was the result of over-exposure to a dangerous ore.

The object of the game is to survive. You, the captain, have to avoid the deadly, vicious creature and successfully flee the frail freighter.

All the standard adventure word commands are used in the game including SAVE, TAKE, EXAMINE, DROP, and GO. On-screen display and format follow usual adventure games so that the top of the screen describes your location, and tells you what objects are in the area. The bottom of the screen is where your keyed-in instructions and the program's responses are displayed.

Molimerx has labelled its adventure series with the 'mysterious' tag presumably because that is what they are to many adventurers. All are written in machine code which is a programming language that speeds up the program's action. A full 16K of RAM (Random Access Memory) is utilised and in this game lower case is fully supported. A couple of notable omissions from Escape From Pulsar 7 are graphics and sound which detract from the program.

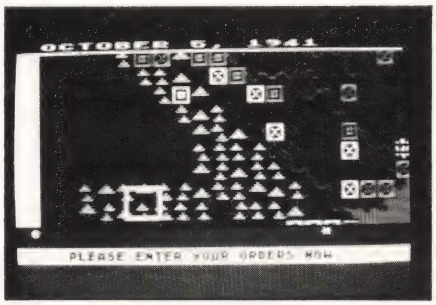
A further seven Molimerx adventure games are planned this year and I look forward to being challenged by them. Let's hope they keep up the excellent work.

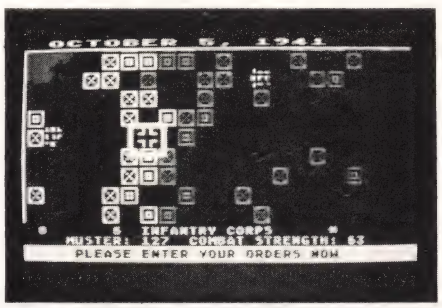
D.B.

Ratings Table

Program Quality	★★★★★
Value for Money	★★★★
Presentation On-screen	★★★
Ease of Use	★★★★
Crashproofing	★★★★
Supplied Instructions	★★★
Overall	90%

Title: Eastern Front
Type: Tape
Supplier: Atari Program Exchange
Machine: Atari 400/800
Price: £22.50





Eastern Front successfully overcomes the usual lack of quality graphical representation and painful screen size restrictions that most computer wargames suffer from.

Atari computer graphics facilities transform it into a taxing and attractive strategy game.

The screen display is produced with multi-coloured hi-resolution graphics so that the board covers roughly 10 screen areas over which you can move the cursor while scrolling the screen in any direction.

My two critisisms of the game are the lack of information given when the computer carries out the moves and the inability to save the game on tape.

This game should appeal to dedicated wargamers because of its intricacy and depth, but it would be a useful extension to your machine's game capabilities even if wargames have never appealed to you before.

C.P.

Ratings Table

Program Quality	★★★★★
Value for Money	★★★★
Presentation On-screen	★★★★★
Ease of Use	★★★★
Crashproofing	★★★★
Supplied Instructions	★★★
Overall	83%

Title: Defend
Type: Tape/disc
Supplier: Molimerx
Machine: Tandy TRS-80 Models I and III
Price: Tape £14.95/disc £18.40

Transferrring popular arcade video games to computer often results in a mediocre quality game.

Defend is no exception to this rule. This attempt to convert the acrade game Scramble on the TRS-80 is a fair attempt but does not do justice to the original game. It lacks the high graphics quality and the colour provided on arcade games.

But the concept of the game is the same. You man the controls of a space ship flying on a horizontal path above undulating landscape lined with rockets and alien blasters. Actually in this game it is the landscape and objects which move past the ship, not vice versa.

The four arrow keys give you control over the movement of your ship in eight directions, a diagonal movement also being possible. You have to shoot down as many enemy ships as possible. These you find flying straight at you belting out constant fire.

Your space ship is equipped with a variety of weapons, a laser gun which you activate by pressing the space bar. In addition you can use smart bombs by pressing the @key. Be selective using these as you only have three to start with.

Smart bombs are very useful as they make all the alien ships on the screen impotent. If you reach the 10,000 mark you atomatically receive one extra smart bomb. Don't collide with them or you will lose one of your five ship lives.

Advance warning of the forthcoming dangers is given to you at the top of the screen.

Three levels of play effect such things as speed, number of aliens, and number of missiles on the screen and the game incorporates sound effects. Defend is suitiably different to warrant consideration and I found it taxing to play the highest level but boredom set in quickly.

D.B.

Ratings Table

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

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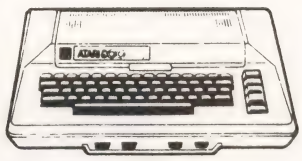
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TECHNICAL ENQUIRIES

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

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Dear PCT
What are the advantages of high-resolution graphics and which computers have the option of using them? It seems to me that they are only much good for writing games programs with better graphics. Is it difficult to use high-resolution graphics?
M. Underwood
Bolton

High resolution-graphics usually refers to the ability of a computer to generate points or lines on the screen that are a single dot or one pixel wide. The command set of the machine will include commands such as PLOT, DRAW or POINT to allow you to use this facility.

Machines which offer this utility in their basic form are the ZX Spectrum, the Atari 400/800, the Atom, the Apple, the BBC computer, the DAI, the Sharp MZ-80B and the Tandy Colour Computer. Other micro's can have this feature added to them, such as the PET and the VIC-20.

Generally ease of use depends on the computer's command facilities. The Atari is easy to use, but the BBC's high resolution graphics are not.

Dear PCT
I am a recent proud owner of a Model B BBC Microcomputer, but as it is my first computer I am finding the going a bit slow. It struck me that I would learn a lot more about programming and computers in general if I could get together with other owners and exchange ideas.

Do you know of a computer club specially for the BBC computers or if not, how do I go about setting one up?

I am sure your feelings are shared by many microcomputer owners around the country and it is for this reason that we are running a regular club feature each month. With respect to your predicament on your BBC computer I suggest that you get in touch with Tony Latham who runs the Computer Users Club. This club has been set up to help users of the BBC machines and will be able to help you with your problems and advise you on the best way to get the most out of your machine. The address is Computer Users Club, 72 Sidmouth Road, Welling, Kent and their telephone number is 01-304 3910.

Dear PCT
I am what you might call a computer dabbler, I have a ZX81 and recently saw in another magazine something about a language called CP/M. As I haven't a clue what it means or does perhaps you could enlighten me. It's so confusing when computing people always talk in such strange terms. Help!
Edward Potter
Solihull

I quite agree with what you say about the confusion caused by computer jargon. CP/M is mentioned in our feature about the new Commodore 64. CP/M is a universal programming language which is used on micro-computers based around the Z80 microprocessor.

The theory of CP/M is that you ought to be able to run a program written in the language on any of the Z80 based machines. But don't get too excited. In practice, it doesn't always work. Although the ZX81 is based on a Z80 chip CP/M has never been used on it because it is primarily a disk based system.

PRIORITY REPLY

September 1982 Issue

Personal Computing Reader Enquiry Service

Name .....

Address .....

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Dear PCT
I haven't got a computer but am in the process of buying one. So far I am considering several of the cheaper ones available. I am puzzled about the type of keyboard to go for. I have heard that the sensory surface ones are not very good and it is much better to get a computer with a proper typewriter keyboard.

Please can you tell me what the difference between the two is and whether I would be better to go for one with a proper keyboard?

The main difference between touch sensitive keyboards and typewriter style keyboards is the speed at which you can type on them. On a typewriter style keyboard you know when you have pushed a key down because you can actually feel the movement, with the touch keyboards you usually have to rely on an audible beep or click which is produced by the computer's software. This means that touch typing is out of the question

The ZX81 keyboard must rate bottom I'm afraid because it feels like you are typing on a piece of soggy cardboard. In my opinion the best keyboard is the one found on the Atari 400 because each key has a ridge round it, thus enabling you to sense when your finger is actually over the key. One to look out for is the new VIC-10. This has a bubble keyboard where each key is represented by a bubble which sticks up above the surface of the keyboard, giving it a very positive feel.

Dear PCT
I have got an Acorn Atom with the full memory space and saw in your first issue that Acorn is bringing out a board which will enable you to use BBC BASIC on the Atom.

What are the advantages of this BASIC, will it mean that I will no longer have to put up with the peculiar Atom BASIC that I've grown to know and love?
J. Wood
Carshalton

You will be pleased to hear that in the October issue of Personal Computing Today we are running a feature on using the BBC BASIC board with the Atom. So watch out for the full details – the magazine will be on sale from the first Friday in September.

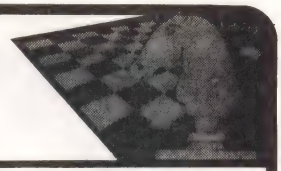
In the meantime here is a brief answer to your query. The main advantages of this unit are that it gives you access to both versions of the BASIC. This means that programs which you already have for the Atom can still be used by switching out the BBC BASIC. Conversely, you will be able to run software written for the BBC computer, although it might require some alterations because the operation of the machines does differ.

Also it is uncertain whether or not the BBC board will give you access to the BBC's high-resolution graphics, but seeing how much memory these take up this might not be a bad thing.



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LISTING

TRANG

TRANG

Move quickly and carefully and keep your wits about you. S. Draper's TRANG is a pretty nasty character to have running around your ATOM!

TRANG is a game for the Acorn ATOM in which you are chased across a rock-strewn wilderness by a ravenous man-eating monster known as the TRANG. Since the TRANG is large and heavy you are able to move faster than he does over open ground (though less so on the higher playing levels). You must, however, make many detours around the numerous rocky outcroppings, whereas the TRANG, when hungry enough and on a hot trail, is able to eat rocks and so pass through them as though they were not there.

In order to escape the monster's advances you (represented by a white character which begins at the top left of the screen) must reach your home base at the bottom right of the screen. The TRANG (which starts in the bottom left) is a rather stupid creature and will always head straight for you rather than trying to cut you off from your target, and so should prove defeatable for the quick-witted player with good hand-eye co-ordination.

The controls are as follows:
CURSOR UP/DOWN – move down
CURSOR LEFT/RIGHT – move up.
– move left.
– move right.

Two of these keys may be used together in order to obtain diagonal motion.

It will be noticed, on studying the program, that the statement P.$T. (Line 7) is meaningless unless some characters are stored at "TOP". This is the title block as in the original, a large 'chunky' title block but in either case *some* string should be stored, and the program should be *SAVEd between ##2900 and the end of the title string.

HOW IT RUNS

PROGRAM STRUCTURE

STATEMENT	FUNCTION	ACTION
Line 5	Set high score	Zero high score at beginning
Lines 7-10	Input	Gets playing level from player
Lines 12-57	Screen	Places 200 randomly positioned rocks on the screen as well as the player, his base, and the TRANG.
Lines 60-190	Gameloop	Moves the player and the TRANG – the ratio of speeds depends on B/A
Line 195	Endloop	Tests to see if you are caught or have reached your target.
Line 200	Delay	Provides short end-of-game delay.
Lines 210-225	Result	Prints out results and score updating the high score if necessary.
Line 230	Restart	Waits for a keypress then restarts.
Lines 3000-3100	Subroutine B	Gets player's controls and moves him accordingly – it also tests to see if he moves off the screen or into some object.
Lines 4000-4070	Subroutine C	Moves the TRANG one square towards the player and tests to see if the player is caught.



PROGRAM LISTING

```
  5 S=0
  7 aP.$12$T.";IN."PLAYING LEVEL (1-10)"B;A=2;B=12-B
 10 IFB<20RB>11G.a
 11 Z=#8000;T=Z+5888
 12 CLEAR4;COLOUR0
 13 F.I=1TO200
 14 Y=(A.R.%24)*8;X=(A.R.%32)*8
 15 F.K=Y TO Y+7
 20 ?(#8000+X/8+32*K)=225
 25 N.;N.;O=5887;L=32;M=5856
 40 F.I=1TO8
 50 Z?(0+I*L)=85
 52 Z?(-L+I*L)=68
 56 Z?(M+I*L)=216
 57 N.
 58 E=0
 59 F=0
 60 DO
 65 D=B;W=A
 70 dIFD=0U.0
 80 GOS.b
 90 D=D-1;E=E+1
 95 IF F=1G.e
100 IF W=0G.d
110 GOS.c
120 W=W-1
130 G.d
195 eU.F=1;E=E+15
200 F.I=1TO100;WAIT;N.
210 CLEAR0;@=4
212 P.$12'$T."
215I FU<>T A.Z<>T P. "CONGRATULATIONS, YOU
     ESCAPED THE TRANG." '
216 IFZ=T OR U=T P."NEVER MIND, BETTER LUCK
     NEXT" ' "TIME." '
217 C=30*(12-B);IFU<>T A.Z<>T C=C*150/E;G.9
218 C=C*E/40
219 9P.' "YOU SCORED "C" POINTS" '
220 IFC>S P."A NEW RECORD!!!" ';S=C;G.f
225 P. "THE RECORD SCORE IS "S"
230 fP. "PRESS 'SPACE' TO CONTINUE." '; LINK #FFE3;G.a
3000 bV=0;? #B000=#D3;IF? #B001&1=0V=V+1
3020 ? #B000=#D2;IF? #B001&1=0V=V-1
3030 H=0;? #B000=#D8; IF? #B001&1=0H=H-1
3040 ? #B000=#D6; IF? #B001&1=0H=H+1
3060 U=Z+H-256*V
3070 IF?U=255OR U<#8000 OR U>#9800 R.
3080 IF Z%32>U%32+1 or Z%32<U%32-1;R.
3090 F. I=0TO7
3100 Z?(I*L)=0;U?(I*L)=68;N.
3115 IF T=U or U=38687; F=1;J=D;R.
3120 Z=U;R.
4000 cH=SGN(F.(Z%32-T%32))
4010 V=SGN(FLT(Z-T-Z%32+T%32))
4020 U=T+H+256*V
4030 F.I=0TO7
4040 T?(I*l)=0;U?(I*L)=216;N.
4060 T=U;IF T=Z;F=1;J=W
4070 R.
```

HINTS ON CONVERSION

Conversion Hints

This program makes use of the Atom's memory mapped graphics to POKE characters onto the screen. For the purposes of conversion two things should be noted about this. The first is that the Atom's POKE command is simply the symbol ? – eg. – POKE 32768,X would be ?32768=X in Atom BASIC. Secondly the board is a 32x24 grid with one character in each square. However, on the Atom one POKE does not correspond to one character as with most other systems, and so a rather complex plotting method was employed in the Atom version. For other systems this may be simplified by converting the Atom screen co-ordinates and then from these to the POKE nos. required by your system. Taking Lines 4030 to 4040 as an example it is required to plot a TRANG character at screen location T. To do this in, for instance PET BASIC, we could replace the existing lines with the following –

```
4030 X=T-32*INT(T/32):Y=(T-32768)/32
4040 POKE (32768+X+40*Y), 82: POKE
(32768+X+H+40*(Y+V)),81
```

Note here that 32768 is the location of the PET screen and 81 is the number of the PET character to be used for the TRANG.

Other things to notice when converting are that the # character in Atom BASIC means hexadecimal, that GOS.A means GOSUB the line beginning with the character "A", and that the variable @ may be ignored.

Note for converting screen POKEs that the other lines that need changing (besides 4030-4040) are 15-25, and 3090-3100.

Lines 3000-3040 perform a keyboard scan and may be replaced by a GET command on many systems, LINK # FFE3 (line 230) waits for a keypress, and the operator % means 'remainder on division by' – on some systems it may be replaced by MOD, on others it may be simulated as in the above example (for calculating X in line 4030 as, in Atom BASIC, this could have been done by X=T%32).

LIST OF VARIABLES USED

I,J,K.D,W	Temporary storage variables.
A	Speed of the TRANG.
B	Speed of the player.
C	Score.
E	Number of turns taken.
F	End of game flag – set by subroutines B or C if the player reaches the base or is eaten.
H	Horizontal movement of player or TRANG.
L	Screen constant (No. of spaces per line).
O	Position of player's base.
S	High score.
T	Position of the TRANG.
U	Player's new position.
V	Vertical movement of player or TRANG.
Z	Player's present position.

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The fully built keyboard requires ABSOLUTELY NO SOLDERING, as the keyboard is supplied with flexible connectors which simply plug into the existing sockets.

Alternatively, the keyboard is available as an easy to build kit at a considerable saving in cost.

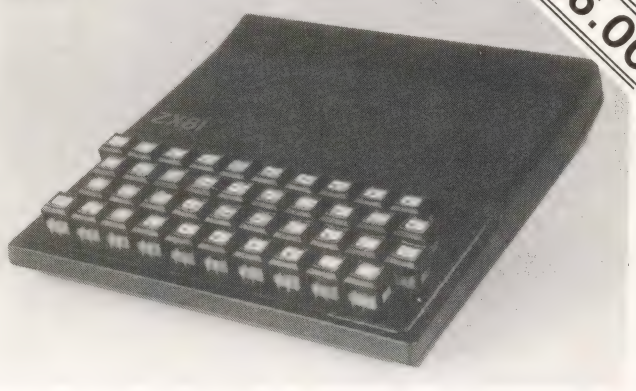
Other ZX81 products available include a user port with 16 I/O lines at £16.50 built, keyboard bleeper which fits inside the case at £8.95 built and a repeat key kit at £3.95.

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THE COMPUTER GOES TO WAR



In the first of our regular series on games and computers, E.A. Parr shows how to start a war from your keyboard — and live to tell the tale!

The date is June 23rd 1980 at 4.50am, and just over the East/West border from the West German town of Fulda, the mechanised forces of the USSR and the GDR are involved in combined exercises. NATO command have been informed but due to Russian/Chinese clashes in Vietnam they move to first state readiness.

At 4.55am NATO Monitoring Stations report an increase in radio traffic and German radar operators see aircraft break away from the exercise and cross the border. The USAF bases are alerted but it is unlikely that planes will be airborne in time.

At 5.00am combined GDR and USSR forces cross the border meeting little resistance from startled border troops. NATO Command watch aghast, aware that it will take hours to mobilise their scattered troops. Roads are already blocked with refugees and the phones start to ring in Washington as the first battle of the next war starts.

It is a muggy summer evening, the date 2nd July 1644, the place a Yorkshire hillside between the villages of Tockwith and Long ▶

Marston. On a long ridge called Marston Hill three Roundhead armies under Manchester Fairfax and Leven face two Royalist armies under Newcastle and Prince Rupert drawn up behind a ditch on the level ground below the hill. Clouds gather and a thunderstorm starts as the Roundhead cavalry comes down the hill to start the largest battle of the English Civil War: Marston Moor.

•

These two scenarios are not history lessons or plots for a book, but the openings of two popular wargames. To anyone used to boardgames such as 'Monopoly', the first encounter with a wargame can be mind boggling. First there are the rules — pages upon pages of them; second is the difficulty of remembering all the nuances of play and combining all the forces at your disposal into a coherent plan. Both of these problems stem from the basic air of such games; to simulate real life as far as possible and demonstrate what happened, what *might* have happened and what *could* happen. It must be said though that once the rules have been mastered they can be positively habit forming and leave no way back to Monopoly thereafter!

Recently the author became involved with microprocessors in the course of his work, so it was not long before investigations started on how the home computer could be used in these belligerent activities. The indications were that the microprocessor could bring about a major step forward in realism (?!).

Blenheim

To see how the computer can help the wargamer we will look first at one particular game in some detail. This is "Blenheim" by World Wide Wargames of Chelmsford (to whom thanks are given for permission to reproduce parts of the game herein). This game simulates the battle of Blenheim in 1704 between the English and allied forces under Marlborough and the French forces under Tallard. The English forces were outnumbered and playing "an away match", but managed nonetheless to win. This game was chosen because it is relatively straightforward, with rules that are easily understood by the beginner (some wargame rules need a law degree to follow!). The resolution of combat falls naturally into a computer program, and other facets of the game are easily incorporated.



Most important, though, it is a game the author enjoys playing!

"Blenheim" is played on a map of the battlefield. The map is divided into hexagons to regularise movement and combat. Terrain plays a large part in the resolution of combat, and important features are represented on the map, to the degree that it becomes a work of art in its own right!

The forces involved in the combat are represented by card markers which convey information about the forces capabilities.

Combat strength represents the strength of the unit. Movement allowance is the maximum number of hexagons a unit can move on each game turn. In some games with modern mechanized warfare, the combat strength is split into an attack strength and defence strength to cover different types of machinery.

Blenheim is played in 12 "turns", each comprising two sections; one for each player. These sections fall into four "phases" as below:-

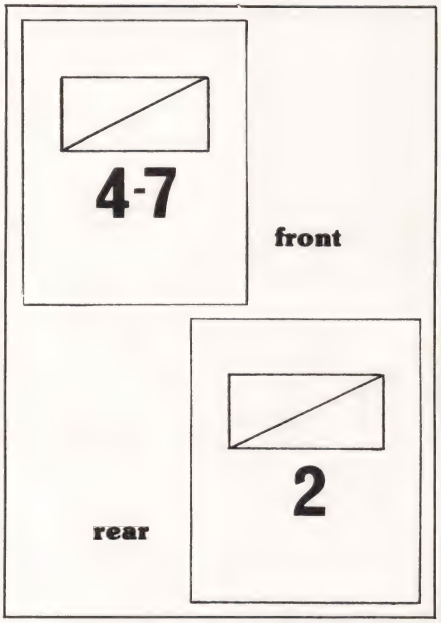
One game turn
Player A i) Attempts to rally demoralised troops
ii) Artillery fire
iii) Movement
iv) Combat of adjacent units
Player B 4 phases as Player A

One aspect of wargaming that new players find hard to accept initially is the introduction of chance into a game purporting to be a simulation. The reason for this is that there is no such thing as a foregone conclusion in warfare. You can be reasonably sure that the stronger your force the more probable the result but you cannot be *absolutely certain*.

COMBAT RESULTS TABLE

Die Throw	Combat Odds									
	1–5+	1–4	1–3	1–2	1–1	2–1	3–1	4–1	5–1	6–1+
1	1/0	0/0	2/1	1/2	0/1	0/2	0/2	0/3	0/4	0/4
2	1/0	1/0	0/0	2/1	1/2	0/1	0/2	0/2	0/3	0/4
3	2/0	1/0	1/0	0/0	2/1	1/2	0/1	0/2	0/2	0/4
4	3/0	2/0	1/0	1/0	0/0	2/1	1/2	0/1	0/2	0/3
5	4/0	2/0	2/0	2/0	1/0	0/0	2/1	1/2	0/1	0/2
6	4/0	4/0	4/0	2/0	1/0	1/0	0/0	2/1	1/2	1/2





In the combat phases of a move, each separate fight is resolved using the above table. The attacking forces are adjusted according to the terrain and added up to give a total attack strength. All the defending units are similarly totalled to give a "defence strength". The ratio attacker/defender is calculated (rounded for the defender) and a dice rolled. The result is looked up on the table and each result is represented as a pair of numbers, separated by a slash.

These numbers represent loss of strength — the left hand number to the attacker, the right hand number to the defender. The unit markers have reduced strengths on the inverse side; and a unit suffering losses is flipped over. When forced to take another loss it is eliminated from the game. The losing side in each fight is forced to retreat; if it is unable to do so it too is eliminated. For example, in this situation we have an attacking strength of 9 + 9 + 5 = 23 and a defending strength of 9, a ratio of 2:1. The dice roll is a 4, which gives 2/1. The attacker loses two steps and the defender 1 step. The defender has no choice, his strength infantry is reduced. The attacker chooses to flip the 5 strength cavalry and the centre 9 strength infantry. Because the attacker suffered worse, the three attackers' pieces retreat one hex.

(Units that have suffered losses *can* be regenerated, again on the chance roll of a dice.)

The combat resolution in Blenheim is actually simple by comparison with some. A common method is to use two dice. These generate numbers in the range 2 to 12 with a rough Gaussian distribution centred on a roll of seven.

Dreadnought

An example of this is to be found in a game called Dreadnought by the large wargame firm SPI. This is an excellent game of naval combat in which a ship has four basic characteristics; attack strength, defence strength, range and speed.

If, say, the Bismark is firing at the Hood, the Bismark's attack strength is adjusted for range and facing (ie how many guns can be brought to bear). It is then further adjusted for other factors such as the ship itself being fired at (which gives the shakes to the crew) and other friendly ships firing (which affects the 'sighting' of the shot).

Two dice are rolled, and the at- ▶

tack strength converted to "damage points" by means of a CRT. The damage points are converted to a ratio with the Hood's defence strength, and two dice rolled again. The damage is now read off a second CRT.

This gives a very realistic (and exciting) game, but is obviously a bit laborious. Imagine the dice rolls involved in reproducing the Battle of Jutland!

Wargames, therefore, are both reasonable simulations and exciting games. They do suffer, however, from a certain amount of chart flicking and dice rolling which slows up the action. Enter the microprocessor, stage left!

Computer Games

There would seem to be three areas where the computer can assist the wargamer. These are dispensing with the dice and charts (let's call that Game Mechanics); increasing realism; and finally providing an opponent for solo play. The latter is quite important as most games involve a deal of double bluff with dummy attacks and feints.

Game mechanics are very easy to implement. Generation of random numbers is something a computer can do almost without thinking (ask the DVLC at Swansea!) and the CRTs can easily be stored in matrices. Add a bit of chrome in the form of VDU inputs and messages (The 5th Cavalry has been wiped out) and we have the basis of a computer program.

The author has committed the game mechanics of three games to program. The games of Blenheim and Marston Moor (from WWW) have been written in Z80 machine code running on an unexpanded Nascom. Dreadnought, with its two large CRTs, was written in Tiny Basic.

These all work in basically the same way. The VDU normally displays a title page giving the CRT options open to the player. For Blenheim these are:-

Artillery
Melee
Rallying of demoralised troops

The players select the required option and the computer asks the relevant questions. For example, in Artillery it would ask the range; for a Melee it would ask the strengths and terrain. With all the data in, it computes and displays the result, then returns to the title page. The operation is several times faster and much less bother than rolling dice. Game mechanics programs should be relatively easy to write for most wargames.

Too Much Intelligence?

Wargames suffer from a shortcoming known as the "Eyeballs in the Sky". In real life you know very little about what your own troops are doing, let alone what your opponent is up to. By its very nature a wargame shows you everything. The realism of a wargame could be improved by the use of a computer to fog the information you receive.

An excellent set up would be two players with two maps and a computer. Each player's map shows how he views the battle, but the computer holds the true state of affairs. The computer will hand out information when the players would get it in real life. For example a tank could stay hidden in a wood until somebody tripped over it. If it moved it might be spotted, if it fired it certainly would.

The players would now have real problems. If a player wanted to find out what was over that hill he would have to send out a patrol. If it did not report back, he would be left wondering if it found the enemy, or whether it was just a simple communication failure. All good nail biting stuff.

This type of program is obviously a couple of orders of magnitude higher in complexity than a game mechanics program. The problems would seem to be related to the large amount of data rather than the subtleties of the calculation. The author has dabbled with this type of program but has yet to produce a working version.

Death To Computers!

Finally, we have the computer program as an opponent. The problems here are similar to the problems encountered writing chess programs. The programmer would need to be a good programmer and an excellent wargamer. The author, regretfully, is neither. Computer programs for solo play would be very saleable commodities.

The Wargaming magazines in the States rely heavily on "feedback" cards to sound out readers opinions, and a recent survey by Strategy and Tactics magazine showed that around 25% of players owned or had access to a TRS-80 computer. It would seem that at least one US games company (Avalon Hill) is producing game mechanics and solo programs for sale.

Computers have been used by the military for training purposes for several years. The facilities are now available for the amateur, and the author would be interested to hear from anyone working on similar lines.

Wargames are mainly produced in this country by:-

World Wide Wargamers,
Eton Lodge,
Highwood,
CHELMSFORD,
Essex.

Sim Pub U.K.,
Crown Passages,
ALTRINCHAM,
Cheshire.
(Agents for SPI games)

Avalon Hill,
650 High Road,
N. Finchley,
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The author would like to thank WWW and SPUK for permission to use details from their games.



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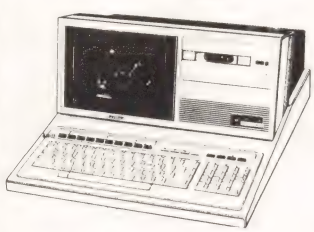
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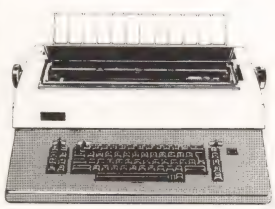
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YOUR LETTERS

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 read the first issue of your magazine and am delighted to see that you show an interest in the Texas Instruments computer. Other magazines that I have read seem to want little to do with this under-rated machine.

I hope that a few TI BASIC programs will be printed in future issues. They would be the first that I have seen in a popular magazine.

I would also like to make several comments about your reports on the TI computer in 12 of the Best.

Firstly the Texas manuals are easily worth more than the 62% that you have given them. Even more so when the Video Genie manuals are given an exagerrated mark of 88%. It took me at least an hour to learn how to load a "system" program from the manuals for our school Genies.

Your 'Factfile' article states that no other languages are available for the '99'. Thes is wrong as cartridges are available to make PASCAL, LOGO and 9900 assembler that no languages are available for the '99'. This is wrong as cartridges are available to make PASCAL, LOGO and 9900 assembler language available. Also the RS232 interface and the speech synthesiser has been omitted from the article.

Thank you for a good new magazine.

James Davies
Nottingham

Dear PCT

I bought the first issue of your magazine today and am very pleased with what I see. There are already many computer magazines on the market, but yours has effectively taken the good bits and moulded them into something worth reading.

Enclosed is an article I have written and I would be grateful if you would consider publishing it in a future issue of Personal Computing Today.

I have access to a ZX81 and a BBC 32K 'B' computer, and I will soon be able to use a ZX-Spectrum. If you would like different opinions, views, ideas please do not hesitate to write to me.

Roy Walker
Milton Keynes

Editors reply: Thank you very much for sending in your article and your offer of help. I am always interested in readers comments and ideas because that is the way to find out what you want from the magazine. So keep the comments coming.

Dear PCT

After reading the first issue of your new magazine Personal Computing Today, I would like to say congratulations. At last we have a magazine designed for the beginner, as well as the expert. I particularly like the way in which you have included sections on "How it Runs" and "Hints on Conversion" within the program listings.

Your software review is very good too, and I am interested in obtaining the program 'Cosmic Aliens' to run on my PET. Unfortunately you have omitted the address of the suppliers (Supersoft) from your article. Could you please let me know how I can get in touch with them. Perhaps in future editions you might include the suppliers address with the Software Reviews. Also, will you be featuring the PET in your Software Checklist?

Well done on producing a magazine with something for everyone. Keep up the good work and best wishes for the future.

Christopher McKieron
Stockport
Cheshire

Editors reply: We are considering including both PET and Apple software in Software Checklist but it really depends on the response from suppliers and the number of pages it would take up.

The address of Supersoft is First Floor, 10-14 Canning Road, Wealdstone, Harrow, Middlesex, HA3 7SJ. Telephone: 01-861 1166.

Dear PCT

I am fairly new to microcomputing and I have found your new magazine very interesting and useful (even if "WORM" doesn't run properly).

I have an Acorn Atom and I am very pleased with it. But I am sure I am not the only beginner who finds it extremely difficult to obtain the right codes for POKEing characters and graphics onto the screen.

I have therefore written a small program that displays codes and POKEd characters, which is enclosed. This simple listing has certainly made life easier for me, and I am sure many more beginners could use it, so I hope you can publish it.

Finally your dictionary is an excellent idea, but can you avoid using too much jargon in your articles. We novices get lost.

Andy Bonfiglioli
Brighton
Sussex

Glad to hear you enjoyed the first issue Andy and thanks for the Atom listing. We hope more people will follow your example.

Sorry about the use of jargon in the articles but some does inevitably creep in despite our efforts. An interesting experiment to try is to find a convenient computer expert and ask him to talk for more than five minutes about computers, without using words like Bit, Byte and RAM. Usually they can make about a minute without drying up.

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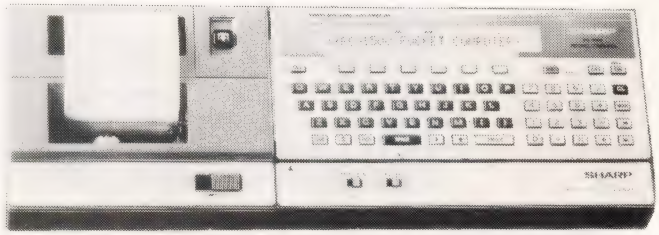


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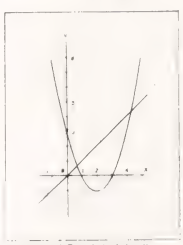
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ZX REACTOR

ZX-REACTOR

Pit your wits against the power of the atom in this fast moving Spectrum game by Chris Palmer.

This program was written for the standard ZX-SPECTRUM. It is an amalgamation of two different game concepts, the worm style game and the number pickup game. The game is set in a mythical nuclear power station where nine reactor cores are about to go critical. Your task is to move round them in numerical sequence and deactivate them. It is notjust a case of applying manual dexterity on the keyboard because you have to plan your route carefully so as not to isolate reactor with the trail you leave.

The skill level setting at the beginning of the program adjusts the amount of time you have to complete your task. Level 1 is the most difficult and level 9 is the easiest.

The program shows one way in which you can examine different positions on the screen using the ATTR command in, order to determine their contents. In line 115 the value of the contents of the position you want to move into is assigned to the variable SCAN. This is then examined in the subroutine at lines 3000 to 3055 where the appropriate action is taken.

The movement is controlled by four keys on the keyboard. The I key which moves you upward, the J key for left, the L key for right and M key for down. If you are left handed you might find it easier to use four keys on the left of the keyboard, if so then change the routine between lines 2010 and 2040 to your new keys. All the keys repeat.

PROGRAM LISTING

```
  10 CLS : PAPER 0: INK 6: BORDE
R 1
  15 GO SUB 7000
  20 DIM a (9,2) : DIM m$ (3,30)
  23 LET m$(1) = "RAN OUT OF TIME"
: LET M$(2) = "DEFUSED THE WRONG
    REACTOR": LET M$(3) = "CROSSED
YOUR TRAIL"
  25 LET x = 1: LET Y = 1: LET scan =
0: LET number = 1
  30 FOR i = 1 TO 9
  40 LET a (i,1) = INT (RND*16) + 2
  50 LET a (i,2) = INT (RND*28) + 2
  60 NEXT i
 100 GO SUB 1000
 110 GO SUB 2000
 115 LET scan = ATTR (x,y)
 117 GO SUB 3000
 118 IF number>9 THEN GO TO 4000
 120 PRINT INK 5; BRIGHT 8;AT X,
y; "■"
 130 LET time = time - 1
 135 IF time<1 THEN LET ms = 1: GO
 TO 6000
 140 PRINT AT 0,0; "TIME LEFT = "
; time ; "  "
 200 GO TO 110
1000 FOR : = 1 TO 9
1010 PRINT FLASH 1;AT a (i,1), a(i
,2) ; i
1020 NEXT i
1030 RETURN
2000 LET a$ = INKEY$
2005 IF a$ = "" THEN LET fl = 2: RET
URN
2010 IF a$ = "i" THEN LET x = x - 1
2020 IF a$ = "m" THEN LET x = x + 1
2030 IF a$ = "j" THEN LET y = y - 1
2040 IF a$ = "l" THEN LET y = y + 1
2045 LET fl = 0
2050 RETURN
3000 IF fl = 1 THEN RETURN
3010 IF scan = 134 THEN GO TO 3100
3020 IF scan = 5 THEN LET ms = 3: GO
 TO 6000
3055 RETURN
3100 IF x = a (number, 1) AND y = a (nu
mber, 2) THEN LET number = number + 1
: RETURN
3120 GO TO 5000
4000 CLS : PRINT " CONGRATULA
TIONS !!!"
4010 PRINT : PRINT "YOU DEFUSED
THE REACTORS"
4020 PRINT : PRINT " WITH " ; time
;" TIME UNITS TO GO"
4030 PRINT : PRINT : PRINT " PLA
Y AGAIN (Y OR N)"
4040 LET a$ = INKEY$: IF a$ = ""THEN GO TO 4040
4050 IF a$ = "y" THEN GO TO 10
4055 IF a$ = "n" THEN STOP
```



```
4060 GO TO 4040
5000 FOR i = 1 TO 20 STEP 5
5010 CIRCLE OVER 1; y*8 + 4, (21 - x) *
8 + 4, i
5015 CIRCLE INVERSE 1;y*8 + 4, (21 -
x)*8 + 4,i
5020 NEXT i
5030 LET ms = 2: GO TO 6000
6000 CLS
6010 PRINT AT 2,5;"YOU FAILED !!
!"
6020 PRINT AT 4,5;"BECAUSE YOU"
;m$ (ms)
6030 PRINT AT 10,5; "PRESS Y TO
START AGAIN"
6040 LET a$ = INKEY$: IF a$ = "y" TH
EN GO TO 10
6050 GO TO 6040
7000 PRINT "      ZX - REACTOR"
7010 PRINT : PRINT " YOU HAVE A
LIMITED TIME"
7020 PRINT : PRINT " TO DEFUSE T
HE CRITICAL REACTORS"
7030 PRINT : PRINT " IN THEIR NU
MERICAL SEQUENCE."
7040 PRINT : PRINT " YOU MUST NO
T CROSS THE TRAIL"
7050 PRINT : PRINT : INPUT "DIFF
ICULTY 1 - 9 ";D
7060 LET time = d*100
7070 CLS : RETURN
```

HOW IT RUNS

10			Sets colours
20	-	25	Sets variables
30	-	60	Sets up reactor positions
100			Goes to reactor print routine
110	-	200	Main loop
1000	-	1030	Reactor print routine
2000	-	2050	Scans keyboard
3000	-	3055	Checks to see whether trail has been crossed or a reactor has been encountered
3100	-	3120	Checks reactor sequence
4000	-	4060	End of successful run
5000	-	5030	Explode reactor
6000	-	6050	Unsuccesful run
7000	-	7070	Instructions



HINTS ON CONVERSION

The main difficulties you will encounter in converting this program are the different screen formats and the way that the data is handled on the screen. For machines that do not have a PRINT AT facility this could be replaced with POKE statements. The ATTR command in line 115 reads values from the position on the screen, specified by the coordinates X and Y. The value that is obtained is then checked in the routine starting at line 3000. This could easily be replaced with a PEEK statement and the values changed accordingly.

The CIRCLE command used in the routine at 5000 is particular to the Spectrum and a suitable alternative explosion routine could be substituted for a different micro. Other points to be wary of are the INKEY statement, which can be replaced with GET on most micros that don't support this. Also the statements for producing random numbers might be different. The statement in line 40 produces a number between 2 and 17. The statement in line 50 produces numbers between 2 and 29.

New ZX81 Software from Sinclair.



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

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

The Sinclair ZX Printer offer full alphanumerics and highly-sophisticated graphics. A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. So now you can print out your results for a permanent record. The ZX Printer plugs into the rear of your ZX81, and you can connect a RAM pack as well.

Games

Cassette G1: Super Programs 1 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Invasion from Jupiter. Skittles. Magic Square. Doodle. Kim. Liquid Capacity.
Description – Five games programs plus easy conversion between pints/gallons and litres.

Cassette G2: Super Programs 2 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Rings around Saturn. Secret Code. Mindboggling. Silhouette. Memory Test. Metric conversion.
Description – Five games plus easy conversion between inches/feet/yards and centimetres/metres.

Cassette G3: Super Programs 3 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Train Race. Challenge. Secret Message. Mind that Meteor. Character Doodle. Currency Conversion.
Description – Fives games plus currency conversion at will – for example, dollars to pounds.

Cassette G4: Super Programs 4 (ICL)
Hardware required – ZX81.
Price – £4.95.
Programs – Down Under. Submarines. Doodling with Graphics. The Invisible Invader. Reaction. Petrol.
Description – Five games plus easy conversion between miles per gallon and European fuel consumption figures.

Cassette G5: Super Programs 5 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Martian Knock Out. Graffiti. Find the Mate. Labyrinth. Drop a Brick. Continental.
Description – Five games plus easy conversion between English and continental dress sizes.

Cassette G6: Super Programs 6 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Galactic Invasion, Journey into Danger. Create. Nine Hole Golf. Solitaire. Daylight Robbery.
Description – Six games making full use of the ZX81's moving graphics capability.

Cassette G7: Super Programs 7 (ICL)
Hardware required – ZX81.
Price: – £4.95.
Programs – Racetrack. Chase. NIM. Tower of Hanoi. Docking the Spaceship. Golf.
Description – Six games including the fascinating Tower of Hanoi problem.

Cassette G8: Super Programs 8 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Star Trail (plus blank tape on side 2).
Description – Can you, as Captain Church of the UK spaceship Endeavour, rid the galaxy of the Klingon menace?

Cassette G9: Biorhythms (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – What are Biorhythms? Your Biohythms.
Description – When will you be at your peak (and trough) physically, emotionally, and intellectually?

Cassette G10: Backgammon (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £5.95.
Programs – Backgammon. Dice.
Description – A great program, using fast and efficient machine code, with graphics board, rolling dice, and doubling dice. The dice program can be used for any dice game.

Cassette G11: Chess (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Chess, Chess Clock.
Description – Fast, efficient machine code, a graphic display of the board and pieces, plus six levels of ability, combine to make this one of the best chess programs available. The Chess Clock program can be used at any time.

Cassette G12: Fantasy Games (Psion)
Hardware required – ZX81 (or ZX80 with 8K BASIC ROM) + 16K RAM.
Price – £4.75.
Programs – Perilous Swamp. Sorcerer's Island.
Description – Perilous Swamp: rescue a beautiful princess from the evil wizard. Sorcerer's Island: you're marooned. To escape, you'll probably need the help of the Grand Sorcerer.

Cassette G13: Space Raiders and Bomber (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £3.95.
Programs – Space Raiders. Bomber.
Description – Space Raiders is the ZX81 version of the popular pub game. Bomber: destroy a city before you hit a sky-scraper.

Cassette G14: Flight Simulation (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £5.95.
Program – Flight Simulation (plus blank tape on side 2).
Description – Simulates a highly manoeuvrable light aircraft with full controls, instrumentation, a view through the cockpit window, and navigational aids. Happy landings!

Education

Cassette E1: Fun to Learn series – English Literature 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Novelists. Authors.
Description – Who wrote 'Robinson Crusoe'? Which novelist do you associate with Father Brown?

Cassette E2: Fun to Learn series – English Literature 2 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Poets, Playwrights. Modern Authors.
Description – Who wrote 'Song of the Shirt'? Which playwright also played cricket for England?



Cassette E3: Fun to Learn series – Geography 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Towns in England and Wales. Countries and Capitals of Europe.
Description – The computer shows you a map and a list of towns. You locate the towns correctly. Or the computer challenges you to name a pinpointed location.

Cassette E4: Fun to Learn series – History 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Events in British History. British Monarchs.
Description – From 1066 to 1981, find out when important events occurred. Recognise monarchs in an identity parade.

Cassette E5: Fun to Learn series – Mathematics 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Addition/Subtraction. Multiplication/Division.
Description – Questions and answers on basic mathematics at different levels of difficulty.

Cassette E6: Fun to Learn series – Music 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Composers. Musicians.
Description – Which instrument does James Galway play? Who composed 'Peter Grimes'?

Cassette E7: Fun to Learn series – Inventions 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Inventions before 1850. Inventions since 1850.
Description – Who invented television? What was the 'dangerous Lucifer'?

Cassette E8: Fun to Learn series – Spelling 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Series A1-A15. Series B1-B15.
Description – Listen to the word spoken on your tape recorder, then spell it out on your ZX81. 300 words in total suitable for 6-11 year olds.

Business/household

Cassette B1: The Collector's Pack (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £9.95.
Program – Collector's Pack, plus blank tape or side 2 for program/data storage.
Description – This comprehensive program should allow collectors (of stamps, coins etc.) to hold up to 400 records of up to 6 different items on one cassette. Keep your records up to date and sorted into order.

Cassette B2: The Club Record Controller (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £9.95.
Program – Club Record Controller plus blank tape on side 2 for program/data storage.
Description – Enables clubs to hold records of up to 100 members on one cassette. Allows for names, addresses, 'phone numbers plus five lots of additional information – eg type of membership.

Cassette B3: VU-CALC (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £7.95.
Program – VU-CALC.
Description – Turns your ZX81 into an immensely powerful analysis chart. VU-CALC constructs, generates and calculates large tables for applications such as financial analysis, budget sheets, and projections. Complete with full instructions.

Cassette B4: VU-FILE (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £7.95.
Programs – VU-FILE. Examples.
Description – A general-purpose information storage and retrieval program with emphasis on user-friendliness and visual display. Use it to catalogue your collection, maintain records or club memberships, keep track of your accounts, or as a telephone directory.

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	G2: Super Programs 2	31	£4.95	
	G3: Super Programs 3	32	£4.95	
	G4: Super Programs 4	33	£4.95	
	G5: Super Programs 5	34	£4.95	
	G6: Super Programs 6	35	£4.95	
	G7: Super Programs 7	36	£4.95	
	G8: Super Programs 8	37	£4.95	
	G9: Biorhythms	38	£6.95	
	G10: Backgammon	39	£5.95	
	G11: Chess	40	£6.95	
	G12: Fantasy Games	41	£4.75	
	G13: Space Raiders & Bomber	42	£3.95	
	G14: Flight Simulation	43	£5.95	
	E1: English Literature 1	44	£6.95	

Qty	Cassette	Code	Item price	Total
	E2: English Literature 2	45	£6.95	
	E3: Geography 1	46	£6.95	
	E4: History 1	47	£6.95	
	E5: Mathematics 1	48	£6.95	
	E6: Music 1	49	£6.95	
	E7: Inventions 1	50	£6.95	
	E8: Spelling 1	51	£6.95	
	B1: Collector's Pack	52	£9.95	
	B2: Club Record Controller	53	£9.95	
	B3: VU-CALC	54	£7.95	
	B4: VU-FILE	55	£7.95	
	ZX 16K RAM pack	18	£29.95	
	ZX Printer	27	£59.95	
	Post & packing – *only* if ordering hardware		£2.95	

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DRAGON 32

REVIEW



Last month a brand new firm launched itself into the microcomputer market with a little beast by the name of the Dragon 32. But Personal Computing Today discovered that this high-memory, low-cost computer is not as easy to get to grips with as the manufactuers claim.

The Dragon's heart may be fiery but its flames are doused by the complicated though comprehensive teach yourself BASIC manual that comes with the machine.

Intended to be an easy-to-use computer it turned out to cause problems for computer literates let alone computer beginners. Dragon Data decided to make the machine on a commendable concept: keep it simple but powerful. Though the computer itself has many good features and is certainly value for money at the price of £200 for 32K on-board memory, the manual becomes difficult to follow and is unnecessarily turgid.

The Welsh firm Dragon Data is the new computer arm of giant toy manufactuer Mettoy. It had the right idea in making a computer to the Dragon's specifications and price which shows forethought and business sense for a firm not traditionally involved with the computing industry.

At first glance the Dragon 32 is enough to make your heart beat with anticipation at plugging it into a television set although it looks 'plasticky'. The standard configuration is 32K RAM memory based on a 6809E microprocessor, which is a more advanced one than those used in microcomputers like the Atom, Spectrum and BBC Microcomputer. All it really means is that it speeds up the computer's operations.

It can be plugged directly into the aerial socket of a standard colour television. A beginner has no problems breathing life into the Dragon because all the sockets and ports are clearly marked on the computer unit in simple, easy to understand words.

Once plugged in and switched on you will see it runs in full colour and has advanced graphics to high resolution standard. That means you can obtain graphics to a high degree of accuracy and detail. You can use any of nine different colours including black, blue, green, red, yellow, buff, orange, cyan and magenta. Once you have mastered the graphics, and it does take some doing, you have the facility to draw lines, circles, arcs, irregular shapes, join up different points, and paint in patches of colour. There are also five levels of resolution which means that you can obtain graphics of a differing level of accuracy and detail.

Sound is incorporated in the Dragon's facilities and you can obtain it by using a special sound command which makes the programmer's life much simpler. Altogether there are five octaves available, 255 tones, 155 tempos and 31 different volume levels, giving you a comprehensive and wide variety of musical options.

One point in the Dragon's

Full Size Keyboard

favour is that the sound is emitted through the television, not merely via a loudspeaker within the computer as in the ZX Spectrum. The sounds on the Pacman games cartridge produced by Dragon Data realistically emulate those of the original acrade game.

Anothe hotspot on the Dragon is its keyboard. It has a full size qwerty typewriter style keyboard with full-travel keys. So often low-cost microcomputers are designed with inadequate, difficult to handle keyboards more reminiscent of calculator buttons than computer keys.

The only trouble was that the Dragon which fell into our hands had a faulty keyboard. It was installed at slightly the wrong angle resulting in the left-hand keys sticking in the shift position for upper case characters.

By the time the Dragon is in full production, come mid-August, the

assemblers will have overcome this problem. Dragon Data guarantees that the keys will only give way after a mammoth 20 million depressions — the soft of hammering only an enthusiastic family could give it.

Apart from certain keys sticking on occasions the most frustrating thing about using the Dragon is the editing facility. If you make a mistake as you type in a program you can use the back-space key to delete the error and insert the correction. But only until you press the ENTER key to progress to the next line. After that you have to go through a laborious procedure of entering the EDIT mode.

Once in it you can pick out the line you want to correct, but have to retype the entire line. When corrected you must leave the EDIT mode and return to normal. It is longwinded but keeps you on your toes. For a beginner though it will cause problems.

In the face of the assets of the DRAGON 32 it's a shame that the manual brings you down to earth with a bump. Reading through it is like wading through three feet of mud.

User Manual

The introduction starts off simply enough and the diagrams showing how to put the machine's leads into the right socket is very clear. But it goes downhill from there. Initially the 160 page manual teaches you how to use the keyboard and what the keys represent, and explains the different operating modes.

But on page three of the first chapter you are introduced to such daunting names as unary minus and exponentiation, with concatenation following closely on its heels . The mere sound of these is enough to put off a computing newcomer for life, and they could have been introduced in passing later in the manual.

Software Support

Throughout the manual the author gives you demonstration programs to try your hand at as you progress through the book. But many of these are verbose and complicated in their explanations.

It might improve once Dragon Data has completed and released its software range because this will include a variety of cassettes designed to 'learn as you go'. Called the Dragon Special Selection range they will cost £8 each. Written in Basic they are claimed to be laid out simply and clearly so that the user can learn in a step-by-step method. For instance the games programs on Tape 1 can be listed and copied so that the learner can see by example and trial how they are arrived at.

With Tape 2 you are shown how to compile a simple database like a telephone directory, address book, or metric converter. Again the user can see how these programs work and build up his knowledge from it.

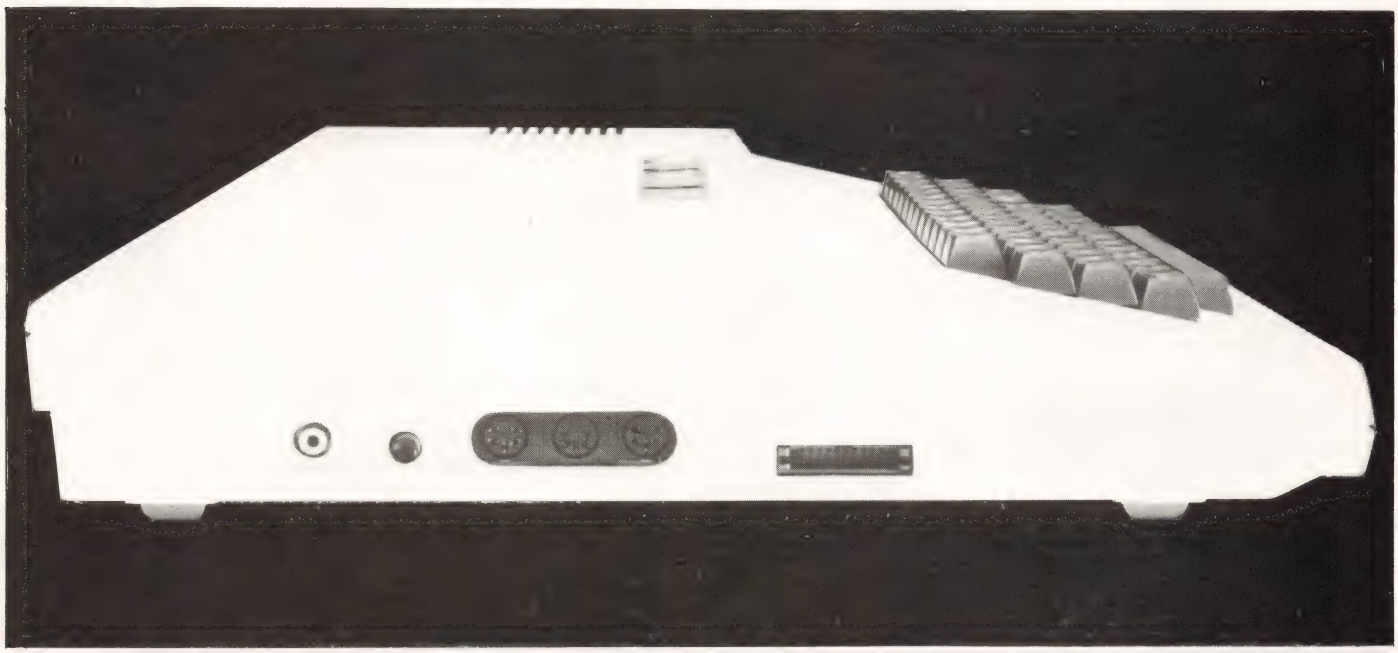
At present the software supply is limited but Dragon Data has adventurous plans to bring out a wide range from games in the popular arcade style to the more serious business of household accounts, personal finace and an unusual phonetic sounds package. Educational software is also planned including language courses.

The standard of the pre-production software is fair to good. The Pacman game's features were all there with good graphics and fast action. But the Japanese joystick controller Dragon Data supplied was unresponsive. Unfortunately the joysticks use a different method of control and different connections to most other joysticks, which means it is unlikely that you will be able to use other makes. There were a few bugs in the Pacman program notably the tendancy for the chaser to disappear off the bottom centre of the maze for no apparent reason, and re-appear at the top of the maze, more often than not right into the mouth of a chaser.

If Dragon Data can iron out the slight defects of the computer by the time it is on general release other low-cost microcomputers will find they have a rival on their hands despite the appearance it gives of jumping on the merry-go-round to cash in on computer sales.

If you are the first-time user can bear with the BASIC manual it is a good computer for the price. Dragon Data is supporting it with software and starting a Dragon Users' Club complete with newsletter to keep members up-to-date on the very latest Dragon hard and software developments.

The Dragon 32 will be on sale through national distributors like high street electrical chains, specialist stores and large department stores. Ironically toy shops are not included on the retail outlet list.



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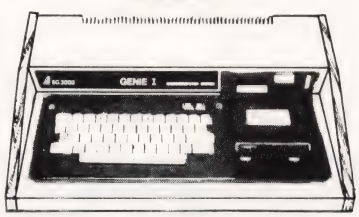
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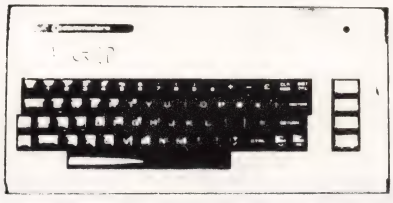
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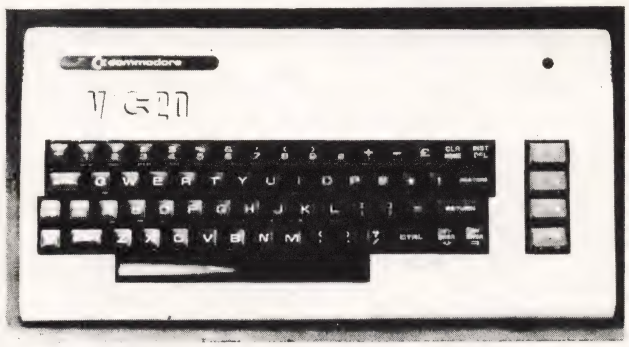
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MICROSPOT

TUG O'WAR

Paul Ralphes has written this simple program which fits within 1K of memory space.

Even on your television screen you'll find the moon is as slippery as it looks high up in the night sky.

In this two player game Tug O War the moon's face is being fought over. A large, amiable moon face appears in the middle of the screen. The object of this short program is that each player must move, by fair means or foul, the moon face to his own side of the television screen.

On the right-hand side of the screen an inverse 0 appears, and an inverse one is displayed on the left-hand side. Let battle commence by the players hitting key I, E or 0 as soon as you see the input prompt looming on the screen. The first person to hit their key has the upper hand and can move the moon one space towards his home side. So you must be quick off the mark to beat your opponent.

This is a very simple games program which is easy both to key in and play. It will help you to learn more about your computer and open the door to more ambitious programs.




```
5    LET A = 13
10   PRINT AT 12,0;"inverse 1";AT 12,30;"inverse 0"
100  PRINT AT 10,A;"graphic Q,space, W";AT
     11,A - 1;(graphicQ,space,space,space,W)
     ;AT 12,A - 1;"(graphic space,A,space,A,space)";AT
     13,A - 1;"(graphic space,G,G,G,space"
     ;AT 14,A - 1;"(graphic R,space,space,space,E)";AT
     15,A;"(graphic R,space,E)"
110  FOR B = 1 TO INT (RND*100) + 30
120  NEXT B
130  INPUT A$
135  IF A$ = "1" THEN LET A = A - 1
137  IF A$ = "0" THEN LET A = A + 1
140  CLS
170  IF A = 2 OR A = 2( THEN GOTO 200
190  GOTO 10
200  IF A = 2 THEN PRINT AT 10,0;
     "HUMAN (inverse 1)  WINS"
210  IF A = 26 THEN PRINT AT 10,0;
     "HUMAN (inverse 0) WINS"
220  PAUSE 100
230  PRINT AT 14,5;"AGAIN?(Y/N)
240  INPUT Z$
245  CLS
250  IF Z$ = "Y" THEN RUN
```

Microspots are our regular "quick-action" program hints. They are designed to be short, useful and adaptable. However, they are not necessarily aimed at the complete beginner and therefore we advise readers to read through each very thoroughly before attempting to enter and use the program.
We will pay £20 for each Microspot submitted by readers that makes it into print! Address your envelope to "Microspot, Personal Computing, 145 Charing Cross Road, London WC2H 0EE".
Keep 'em short and keep 'em coming!

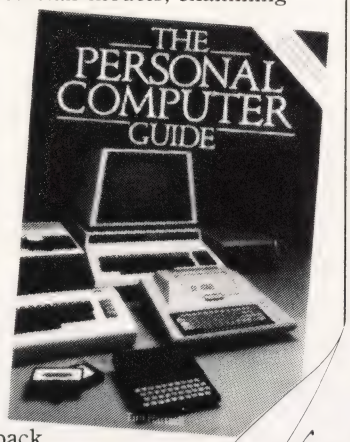
THE PERSONAL COMPUTER GUIDE

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ATARI 400 A.M. Computer (16K)	**£199.00**
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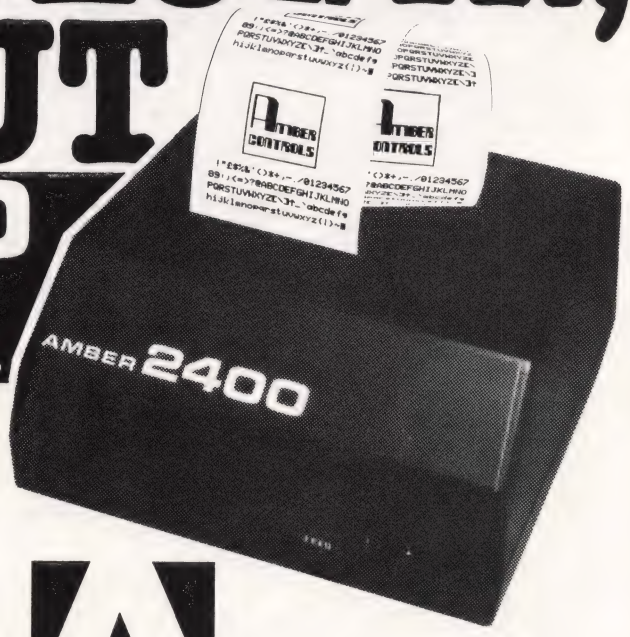
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AMBER 2400 MATRIX PRINTER

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AMBER CONTROLS LTD.

Central Way, Walworth Industrial Estate, Andover, Hampshire.

REFERENCE

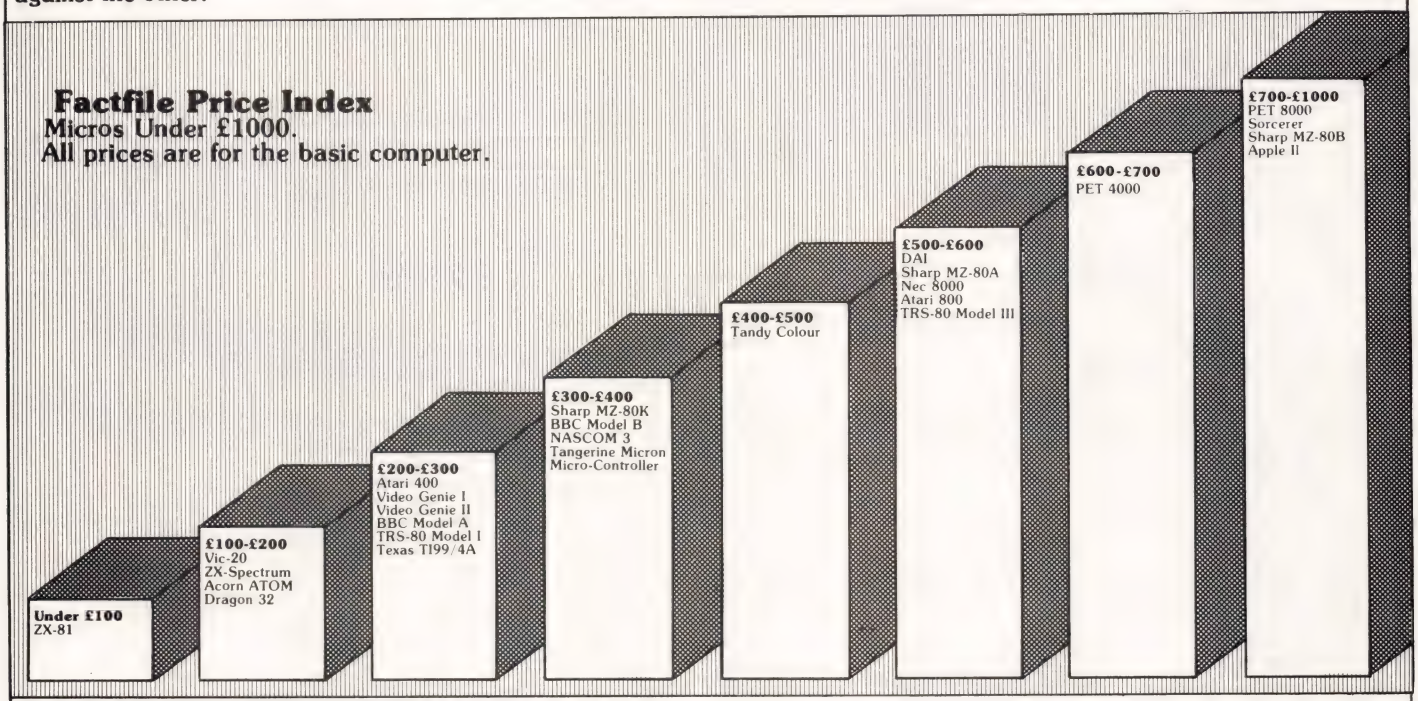
MICRO FACTFILE

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 REFERENCE

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	
Monitor	No	£265
Disc Drives	Yes	—
Other Languages	Yes	£345
Multi-user		£39-79
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

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	
Monitor	No	£232
Disc Drives	Yes	—
Other Languages	Yes	£299
Multi-user		£11.50
Capabilities	Yes	
BASIC extensions (Toolkits)	Yes, BBC BASIC	—
		£50

OTHER ADD-ONS:

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

APPLE II

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

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

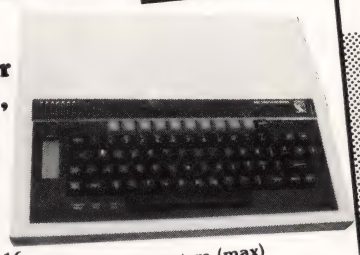
	DETAILS	PRICE
RAM	No	—
Printer	Yes various	£200-1700
Monitor	Yes	£134
Disc Drives	Yes	£379
Other Languages	Yes	£84-500
Multi-user		
Capabilities	No	—
BASIC extensions (Toolkits)	Yes	£26

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.

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	No	—
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	No	—
Disc Drives	TBA	TBA
Other Languages	TBA	TBA
Multi-user Capabilities	Yes	—
BASIC extensions (Toolkits)	TBA	TBA

OTHER ADD-ONS:

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

COMMODORE PET 4000

Commodore, 675 Ajax Avenue, Slough, Berks

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.

REFERENCE

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

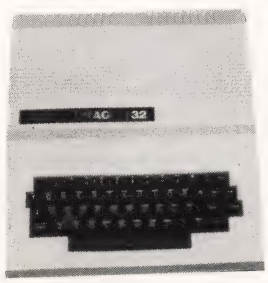
	DETAILS	PRICE
RAM	No	—
Printer	No	—
Monitor	No	—
Disc Drives	Yes	TBA
Other Languages	No	—
Multi-user Capabilities	No	—
BASIC extensions (Toolkits)	Yes, maths pack	£149

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 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. —

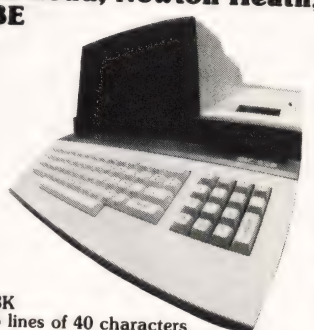
OTHER ADD-ONS:

None Reported

SHARP MZ-80A

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

There is little to choose between this and the earlier Model K.



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

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

FACTFILE REFERENCE

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

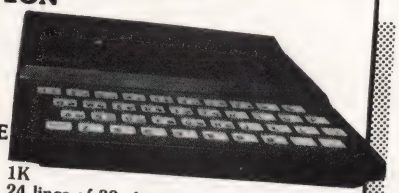
	DETAILS	PRICE
RAM	No	–
Printer	Yes	£450-800
Monitor	N/A	–
Disc Drives	Yes, dual	£600
Other Languages	Yes	£45 upwards
Multi-user		–
Capabilities	No	–
BASIC extensions (Toolkits)	No	

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	–

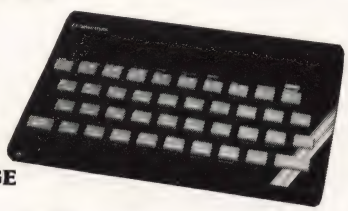
OTHER ADD-ONS:

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

OTHER ADD-ONS:

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

TANDY TRS 80 III

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

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

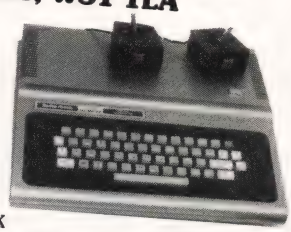
OTHER ADD-ONS:

Disc drives, Cumara Ltd, 35, Walnut Tree Close, Guildford, Surrey GU1 4UN, £199-799; **Olivetti discdrivesingle and dual,** Kram Electronics, Victoria House, 17, Highcross St, Leicester LE1 4PF, £179-349; **48K** Hartlepool, Cleveland, £70 + VAT; **32K RAM card,** Audio Computers, 87 General Northern Microcomputers, (GNOMIC), 46 Middle Street, Blackhall, 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	—

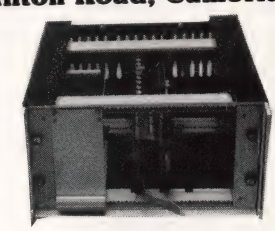
OTHER ADD-ONS:

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

TANGERINE MICRON

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

Tangerine's micro started life as a hobbyist's macine



STANDARD PACKAGE

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

MANUFACTURER'S EXPANSIONS

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

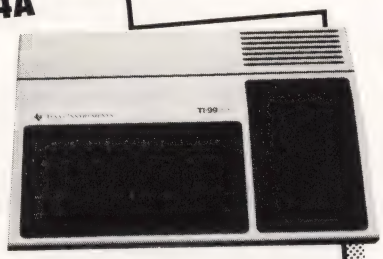
OTHER ADD-ONS:

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

REFERENCE

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		—
BASIC extensions (Toolkits)	No	£100
	Yes	

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	
Monitor	Yes	£210
Disc Drives	Yes, single and dual	£69-99
Other Languages	No	£220-375
Multi-user Capabilities		—
BASIC extensions (Toolkits)	No	—
	No	—

OTHER ADD-ONS:

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

VIDEO GENIE II

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

This is the upgraded version of the original Genie I.

STANDARD PACKAGE

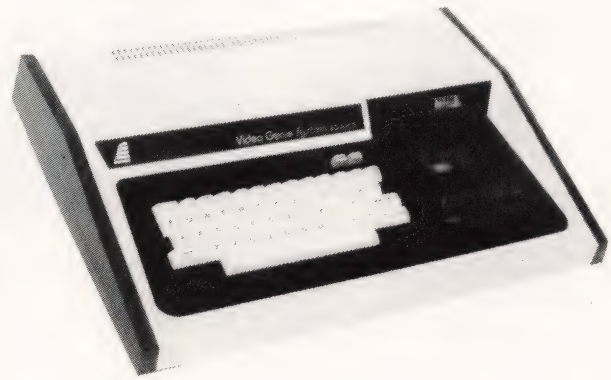
Memory Size (RAM)	16K
Screen Size	16 lines of 32 or 64 characters
Expansion Sockets	BUS connector
Tape Included?	No
Display Unit Included?	No
Usable Domestic TV?	Yes
Size of BASIC	13K
Average Price	**£299**

MANUFACTURER'S EXPANSIONS

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

OTHER ADD-ONS:

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





SHARP MZ-80K/MZ-80A/MZ-80B VIC 20, SINCLAIR SPECTRUM, BBC, TEXAS T1994A, ATARI.

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RUBIK SOLVER
It's not our policy to offer games but we make an exception here for a program to solve the cube from ANY position. Shorthand notation makes learning the solution by heart possible for most active brains. **£12.95**

THE CATALOGUER
This dedicated database is ideal for use in any situation where a catalogue could be utilised. E.g. stamp collection, coins, photos, slides, books, records etc. **£19.95**

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Purchases — other	

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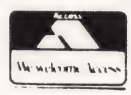
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Signature .....

Date .....

SOFTWARE LISTING

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

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

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

Table Codes

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

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

The codes we have used are:

Program Type

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

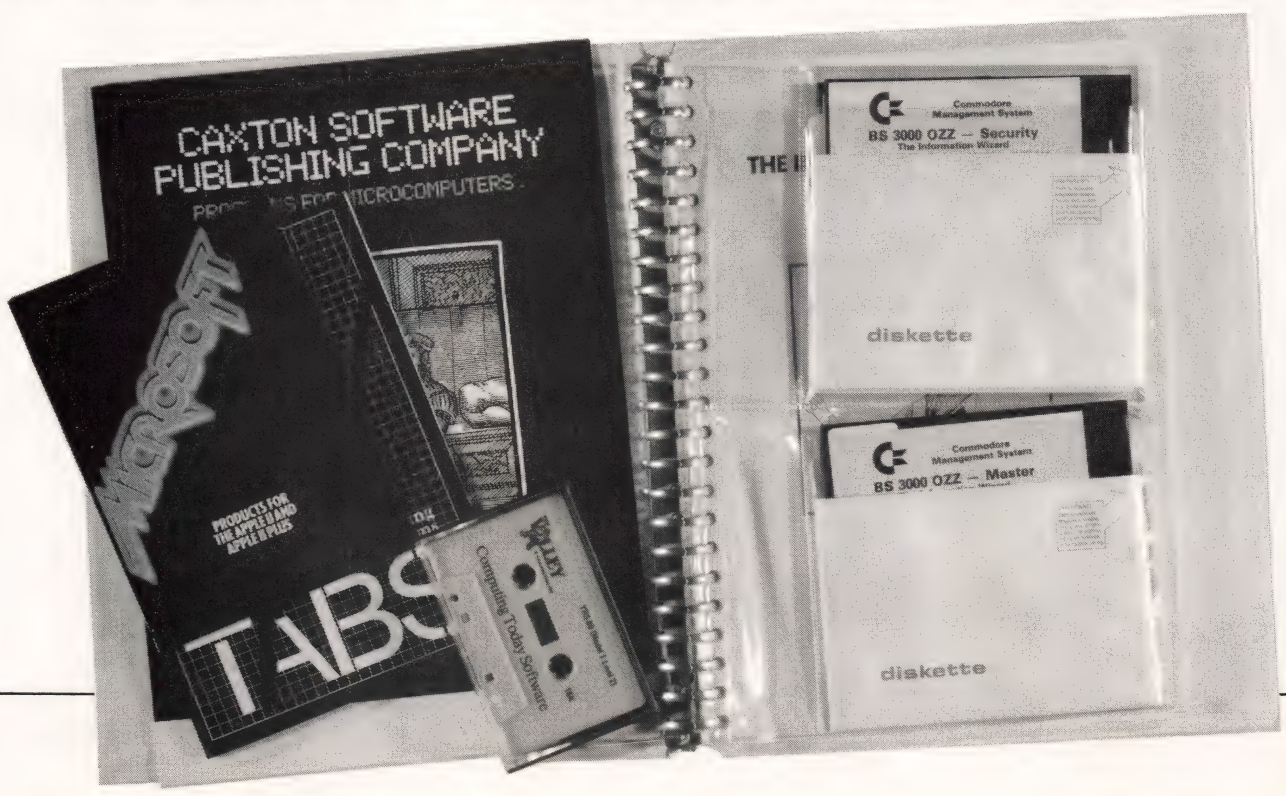
How Sold

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

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



ZX81

Title	Program Type	Program Produced By	Memory Req'd	How Sold Supplier	Codes & Prices
1K Chess	Gm	Artic	1K	C EH	£2.95
1K Games Pack	Gm	Artic	1K	C BT,EH	£6.00
1K Maths	Ed	Mr Purves	1K	C CV	£3.50
1K Super Trio	Gm	Software Masters	1K	C AO	£7.95
16K Maths	Ed	Mr Purves	16K	C CV	£3.50
3-D Labyrinth	Gm	dK'tronics	16K	C EE	£3.95
3-D Monster Maze	Gm	J K Greye	16K	C CN	£4.95
Adventure	Gm	Anglo American	16K	C GB	£6.00
Adventure A	Gm	Artic	16K	C EH,BT,CN	£6.00
				AB	£8.00
Adventure B	Gm	Artic	16K	C EH,BT,CN	£7.00
				AB	£8.00
Adventure C	Gm	Artic	16K	C AB,CH,BT,EH	£8.00
Adventure I	Gm	Abbersoft	16K	C CN	£9.95
Around Europe in 80hrs	Gm	S W Hessel	16K	C CN	£4.25
Asset Stripper	Gm	Micro Games	16K	C CN	£4.50
Asteroids	Gm	Quicksilva	16K	C CN	£5.50
Bagatelle	Gm	Cambell Systems	1K	C CN	£4.00
Bank Account	Bs	Transform	16K	C GZ	£8.75
Bank Account	Bs	Transform	32K	C GZ	£10.75
Battle of Britain	Gm	Micro Games	16K	C CN	£4.50
Beam Analysis	Bs	Hilderbay	16K	C FW	£25.00
Breakout	Gm	Anglo American	16K	C GB	£4.50
Breakout	Gm	Bug Byte	1K	C CN	£3.50
Budget & Address Book	Do	Mr Purves	16K	C CV	£4.00
Budget Programs (2)	Bs	Hilderbay	16K	C FW	£17.00
Bumper 7	Gm	Software Masters	1K	C AO	£4.95
Cassette G10 Backgammon	Gm	Psion	16K	C BO,DW	£5.95
Cassette G11 Chess	Gm	Psion	16K	C BO,DW	£6.95
Cassette G12 Perilous Swamp Sorceror's Island	Gm	Psion	8K	C BO,DW	£4.75
Cassette G13 Space Raiders Bomber	Gm	Psion	16K	C BO,DW	£3.95
Cassette G14 Flight Simulation	Gm	Psion	16K	C BO,DW	£5.95
Cassette G2 Feet/Metres Conversion Rings Round Saturn Secret Code Mind Boggling Silvelte Memory (Educ)	Gm	Psion	16K	C BO,DW	£4.95
Cassette G3 Train Race Challenge Secret Message Mind That Meteor Character Doodle Currency Conversion	Gm	Psion	16K	C BO,DW	£4.95
Cassette G4 Down Under Submarines Doodling With Graphics Invisible Invader Reaction Petrol Conversion	Gm	Psion	16K	C BO,DW	£4.95
Cassette G5 Martian Knockout Graffiti Find the Mate Labyrinth Drop a Brick Continental (Educ)	Gm	Psion	16K	C BO,DW	£4.95
Cassette G6 Galactic Invasion Journey into Danger Create Nine Hole Golf Solitaire Daylight Robbery	Gm	Psion	16K	C BO,DW	£4.95
Cassette G7 Race Track Chase Nim Tower of Hanoi Docking the Spaceship Golf Fascinating Tower of Hanoi (problem)	Gm	Psion	16K	C BO,DW	£4.95
Cassette G8 Tower Trail Blank	Gm	Psion	16K	C BO,DW	£4.95
Cassette G9 Bio-Rhythms Your Bio-Rhythms	Gm	Psion	16K	C BO,DW	£6.95
Catacombs	Gm	J K Greye	16K	C CN	£4.95
Centipede	Gm	dK'tronics	16K	C EE,CN	£4.95
Centipede (Graphics)	Gm	dK'tronics	16K	C EE	£4.95
Champions Quiz	Ed	Rose Cassettes	16K	C CN	£4.50
Chess	Gm	Micro Gen	16K	C DZ	£6.50
Chess II Special	Gm	Artic	16K	C EH	£45.00
Computer Count ZX	Bs	Silicon Tricks	16K	C CN	£7.95
Constellation	Gm	Anglo American	16K	C GB	£8.00
Counter	Gm	Pizzel	16K	C CN	£5.50
Critical Path Analysis	Bs	Hilderbay	16K	C FW	£15.00
Damsel & the Beast	Gm	Anglo American	16K	C GB	£6.50
Damsel & the Beast	Gm	Bug Byte	16K	C CN	£6.50
Data Base	Bs	Mr Purves	16K	C CV	£10.00
Data Base	Ut	Cambell Systems	16K	C CN	£10.00
Death Isle	Gm	Buffer	16K	C CN	£4.50
Defender	Gm	Quicksilva	16K	C CN	£5.50
Deflex	Gm	dK'tronics	16K	C EE	£3.95
Dictator	Gm	Anglo American	16K	C GB	£9.00
Dictator	Gm	Bug Byte	16K	C CN	£9.00
Diggles Kitchen	Do	Micro Computer SW	16K	C HK	£4.99
Double Breakout	Gm	Beam Software	1K	C BT	£6.00
Dragon Maze/Life	Gm	Software Masters	16K	C AO	£6.95
Encounter	Gm	Pixel	16K	C CO	£5.50
Fast Life	Gm	dK'tronics	16K	C EE	£3.95
Financial Package	Bs	Hilderbay	16K	C FW	£8.00
Football Manager	Bs	Addictive Games	16K	C HG	£7.95
				CN	£9.95
Forth Compiler	Ut	Artic	16K	C EH	£35.00
GB Ltd	Gm	S W Hessel	16K	C CN	£5.25
GCE Maths	Ed	Rose Cassettes	16K	C CN	£4.50
Galaxian	Gm	Artic	16K	C EH,BT	£6.50
				AB	£5.50
Galaxy Warrior/Star Trek	Gm	Artic	16K	C EH,BT	£6.50
				AB	£5.50
Games Pack I	Gm	Silversoft	16K	C CN	£4.95
Geography	Ed	Psion	16K	C BO,DW	£6.95
Gold	Gm	Hilderbay	16K	C CN,FW	£8.00
Greedy Gulch	Gm	Phipps Associates	16K	C HL	£5.00
Gulp	Gm	Cambell Systems	16K	C CN	£4.00
Hedgehog & Co	Gm	Buffer	1K	C CN	£3.00
High Res. Graphics	Gm	Macronics	16K	C CN	£4.00
History	Ed	Psion	16K	C BO,DW	£6.95
House of Gnomes	Gm	Anglo American	16K	C GB	£7.00
Inheritance	Gm	S W Hessel	16K	C CN	£4.25
Invaders	Gm	Anglo American	16K	C GB	£4.00
Invaders	Gm	Bug Byte	16K	C CN	£4.00
Invaders	Gm	Quicksilva	16K	C CN	£5.50
Inventions before 1850	Ed	Psion	16K	C BO,DW	£6.95

Junior English I	Ed	Rose Cassettes	16K	C	CN	£4.50
Junior English II	Ed	Rose Cassettes	16K	C	CN	£4.50
Junior Maths I	Ed	Rose Cassettes	16K	C	CN	£4.50
Junior Maths II	Ed	Rose Cassettes	16K	C	CN	£4.50
Kingdom of Nam	Gm	Micro Games	16K	C	CN	£4.50
Knockout Whist	Gm	Anglo American	16K	C	GB	£4.00
Labyrinth	Gm	Axis	16K	C	CN	£5.95
Labyrinth	Gm	Software Masters	16K	C	AO	£5.95
Language Dictionary	Ut	Hewson	16K	C	DT	£3.75
Life	Gm	Artic	2K	C	BT	£3.00
Line Renumber	Ut	Hewson	16K	C	DT	£4.95
Love and Death	Gm	Automata	1K	C	CN	£5.00
Machine Code Monitor						
Disassembler	Ut	Micro Gen	16K	C	DZ	£3.95
Magic Cube	Gm	Cambell Systems	16K	C	CN	£4.00
Magic Mountain	Gm	Phipps Associates	16K	C	HL	£5.00
Man Page	Gm	Newsoft	16K	C	CN	£4.00
Master Maths IV	Ed	LCL	16K	C	CN	£5.00
Master Maths V	Ed	LCL	16K	C	CN	£5.00
Mathematics	Ed	Psion	16K	C	BO,DW	£6.95
Maths Pack	Ed	Artic	4K	C	BT	£11.00
Matrix Planner	Bs	G Asher	16K	C	CN	£6.00
Mazogs	Gm	Bug Byte	16K	C	CN	£9.00
Mini Space Invaders	Gm	Hewson	1K	C	DT	£3.95
Mission Impossible	Gm	Buffer	16K	C	CN	£4.50
Multifile	Ut	Anglo American	16K	C	GB	£17.50
Music & Composers	Ed	Psion	16K	C	BO,DW	£6.95
Music/Breakout/Invaders	Gm	Macronics	1K	C	CN	£7.95
Nasty Invaders	Gm	Giltrole	16K	C	DC	£4.95
Nasty Mountain	Gm	Giltrole	16K	C	DC	£4.95
Nightmare Park	Gm	Software Masters	16K	C	AO	£6.95
Novelists & Authors	Ed	Psion	16K	C	BO,DW	£6.95
Nowotnik, Demolition and Tenpin	Gm	Phipps Assoc	16K	C	HL	£5.00
Numerology	Gm	Carnell	16K	C	CN	£4.50
O Level Chemistry	Ed	Calpac	16K	C	CN	£4.95
O Level French	Ed	Rose Cassettes	16K	C	CN	£4.50
Optimisation Package	Bs	Hilderbay	16K	C	FW	£20.00
Oracle's Cove	Gm	Doric	16K	C	CN	£6.95
Passwords	Gm	Giltrole	16K	C	DC	£3.95
Payroll	Bs	Hilderbay	16K	C	AB,FW	£25.00
Pharaoh's Tomb	Gm	Phipps Associates	16K	C	HL	£5.00
Phipps Adventures I	Gm	Phipps Associates	16K	C	CN	£5.00
Pilot	Gm	Hewson	16K	C	DT	£5.95
Planet Lander	Gm	Hewson	1K	C	DT	£3.75
Poets & Playwrites	Ed	Psion	16K	C	BO,DW	£6.95
Program Merge	Bs	ACS	16K	C	CN	£5.50
Program Pack I	Gm	Bug Byte	1K	C	CN	£3.50
Program Pack I	Ut	Anglo American	16K	C	GB	£3.50
Program Pack II	Gm	Bug Byte	16K	C	CN	£4.50
Program Pack II	Ut	Anglo American	16K	C	GB	£3.50
Program Pack III	Gm	Bug Byte	1K	C	CN	£3.50
Program Pack IV	Gm	Bug Byte	16K	C	CN	£4.50
Program Pack V	Gm	Bug Byte	16K	C	CN	£4.50
Program Pack IV	Gm	Bug Byte	16K	C	CN	£4.50
Program Store	Bs	ACS	16K	C	CN	£5.50
Program Store Toolkit	Bs	ACS	16K	C	CN	£5.50
Programmer's Toolkit	Ut	Hewson	16K	C	DT	£6.50
Purchase Ledger	Bs	Transform	16K	C	GZ	£8.75
Purchase Ledger	Bs	Transform	32K	C	GZ	£10.75
QS Asteroids	Gm	Quicksilva	4K	C	GD	£5.50
QS Defenders	Gm	Quicksilva	4K	C	GD	£5.50
QS Invaders	Gm	Quicksilva	8K	C	GD	£5.50
QS Scramble	Gm	Quicksilva	4K	C	GD	£5.50
Revamped Chess	Gm	Micro Gen	16K	C	DZ	£6.50
Revise Chemistry	Ed	Sci-Soft	16K	C	CN	£7.50
Revise Maths	Ed	Sci-Soft	16K	C	CN	£5.50
Revise Physics	Ed	Sci-Soft	16K	C	CN	£7.50
Sales Ledger	Bs	Transform	16K	C	GZ	£8.75
Sales Ledger	Bs	Transform	32K	C	GZ	£10.75
Scramble	Gm	Quicksilva	4K	C	GD	£5.50
Screenkit I	Bs	Picturesque	16K	C	CN	£4.95
Secret Valley	Gm	Newsoft	16K	C	CN	£6.50
Secret of Tenworth Manor	Gm	Hilderbay	16K	C	AB	£14.95
Shop Window	Bs	Cambell Systems	16K	C	CN	£7.00
Sorcerer's Castle	Gm	Micro Gen	16K	C	DZ	£3.95
Space Intruders	Gm	Hewson	4K	C	DT	£5.95
					CN	£4.95
Space Invaders	Gm	Macronics	16K	C	CN	£4.95
Space Invaders	Gm	Macronics	1K	C	CN	£3.95
Space Invaders	Gm	dK'tronics	16K	C	EE	£4.95
Space Invaders/Planetoids	Gm	Software Masters	16K	C	AO	£6.95
Space Trek	Gm	Beam Software	16K	C	BT	£8.00
Spellbound	Ed	Transform	16K	C	GZ	£3.75
Spelling	Ed	Psion	16K	C	BO,DW	£6.95
Star Quest	Gm	Pixel	16K	C	CN	£5.50
Star Trek	Gm	Buffer	16K	C	CN	£4.50
Star Trek	Gm	Bug Byte	16K	C	CN	£5.00
Star Trek	Gm	Macronics	16K	C	CN	£3.95
Star Trek	Gm	Silversoft	16K	C	CN	£4.95
Sargon Chess	Gm	Hilderbay	16K	C	AB	£22.50
Statistics	Bs	Hewson	1K	C	DT	£3.75
Stock Control	Bs	Hilderbay	16K	C	AB,FW	£25.00
Subspace Striker	Gm	Pixel	16K	C	CO	£5.50
Super Breakout	Gm	Essential S/W	1K	C	CN	£6.00
Super Invasion	Gm	Beam Software	1K	C	BT	£6.00
Super Invasion	Gm	Essential S/W	1K	C	CN	£6.00
Super Program I						
Pints/Litres Conversion						
Invasion from Jupiter						
Skittles						
Magic Square						
Doodle						
Kim						
Liquid Capacity	Gm	Psion	16K	C	BO,DW	£4.95
Super Wumpus	Gm	Silversoft	16K	C	CN	£4.95
Ten Exciting Games	Gm	Beam Software	1K	C	BT	£6.00
Test Pack	Ed	Mr Purves	16K	C	CV	£7.50
The Bible	Gm	Automata	1K	C	CN	£5.00
The Collector's Pack	Do	Psion	16K	C	BO,DW	£9.95
The Fast One	Bs	Cambell Systems	16K	C	CN	£15.00
The Plug Record Recorder	Do	Psion	16K	C	BO,DW	£9.95
Time Bandits	Gm	Newsoft	16K	C	CN	£4.50
Time Ledger	Bs	Hilderbay	16K	C	FW	£15.00
Trader	Gm	Pixel	48K	C	CO	£9.50
Very Nasty Mountain	Gm	Giltrole	16K	C	DC	£6.95
Video Index	Bs	Video Software	16K	C	CN	£9.95
Video-add	Bs	Video Software	16K	C	CN	£5.95
Videograph	Ed	Video Software	16K	C	CN	£5.95
Videomap	Ed	Video Software	16K	C	CN	£5.95
Videoplan	Bs	Video Software	16K	C	CN	£5.95
Videoview	Do	Video Software	16K	C	CN	£5.95
Volcanic Dungeon	Gm	Carnell	16K	C	CN	£4.50
Vucalc	Bs	Psion	16K	C	BO,DW	£7.95
Vufile	Bs	Psion	16K	C	BO,DW	£7.95
Wordpack	Ed	Wida Software	16K	C	FY	£19.00
ZX Bomber	Gm	Micro Gen	16K	C	DZ	£3.95
ZX Breakout	Gm	Micro Gen	16K	C	DZ	£3.95
ZX Bug	Gm	Artic	16K	C	BT,EH	£7.00
ZX Chess I	Gm	Artic	16K	C	CN,EH,BT	£6.50
ZX Chess II	Gm	Artic	16K	C	CN,BT	£13.00
					EH	£9.95
ZX Forth	Ut	Artic	16K	C	AB	£35.00
ZX Graphical Chess	Gm	Artic	16K	C	CN	£13.00
ZX Othello	Gm	MOI	16K	C	CN	£6.95
ZX Scramble	Gm	Micro Gen	16K	C	DZ	£3.95
ZX Space Invaders	Gm	Micro Gen	16K	C	DZ	£3.95
ZX81 Chess	Gm	Software Masters	16K	C	AO	£6.90
ZXAS	Bs	Bug Byte	16K	C	CN	£5.00
ZXDB	Bs	Bug Byte	16K	C	CN	£6.50
ZXMC	Bs	Picturesque	16K	C	CN	£6.50
Zombie/Sword of Peace	Gm	Artic	16K	C	BT,EH	£6.50
					AB	£5.50
ZOR	Gm	Pixel	16K	C	CO CN	£5.50

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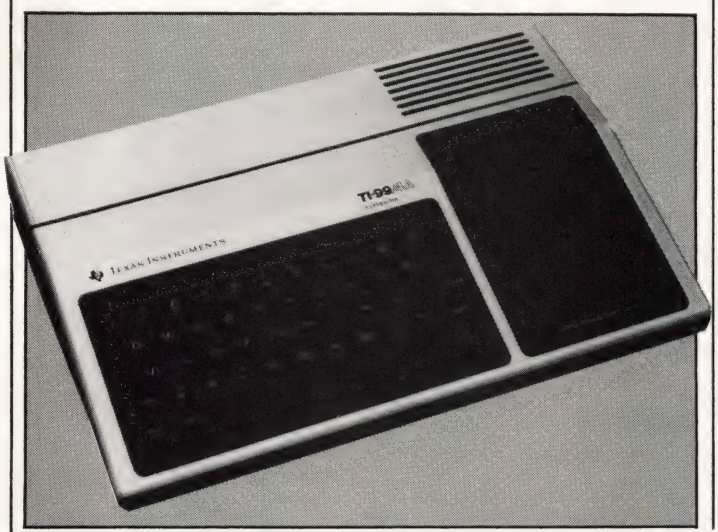
Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier	Codes & Prices
A-Maz-Ing	C	Game Texas	8K	R	AB,CH	£24.00
Addition, Subtraction I	C	Educ Texas	8K	R	AB	£35.00
Addition, Subtraction II	C	Educ Texas	8K	R	AB	£35.00
Attack	C	Game Texas	8K	R	AB	£30.00
Adventure Land	Gm	Texas	8K	C	AB	£24.95
Beginning Grammar	C	Educ Texas	8K	R	AB	£20.00
Blackjack Poker	C	Game Texas	8K	R	AB	£24.00
Blasto	C	Game Texas	8K	R	AB	£25.00
Car Wars	C	Game Texas	8K	R	AB,CH	£25.00
Chequebook Manager	C	Bus Texas Max	16K	D	AB	£19.00
Connect 4	C	Game Texas	8K	R	AB	£24.00
Early Reading	C	Educ Texas	8K	R	AB	£35.00
Editor Assembler	C	Util Texas	8K	R	AB	£115.00
Electrical Eng'g Library	C	Bus Texas Max	16K	C	AB	£24.00
Electrical Eng'g Library	C	Bus Texas Max	16K	D	AB	£35.00
Extended Basic	C	Util Texas	8K	R	AB	£100.00
Ghost Town	Gm	Texas	8K	C	AB	£24.95
Golden Voyage	Gm	Texas	8K	C	AB	£24.95
Graphing Package	C	Dom Texas Max	16K	C	AB	£14.00
Graphing Package	C	Dom Texas Max	16K	D	AB	£19.00
Hangman	C	Game Texas	8K	R	AB	£24.00
Household Money Management	C	Dom Texas	8K	R	AB	£25.00
Hunt The Wumpus	C	Game Texas	8K	R	AB,CH	£25.00
Hustle	C	Game Texas	8K	R	AB	£30.00
Mailing List	C	Bus Texas Max	16K	D	AB	£60.00
Market Simulation	C	Bus Texas	32K	C		£9.00

REFERENCE

SOFTWARE LISTING

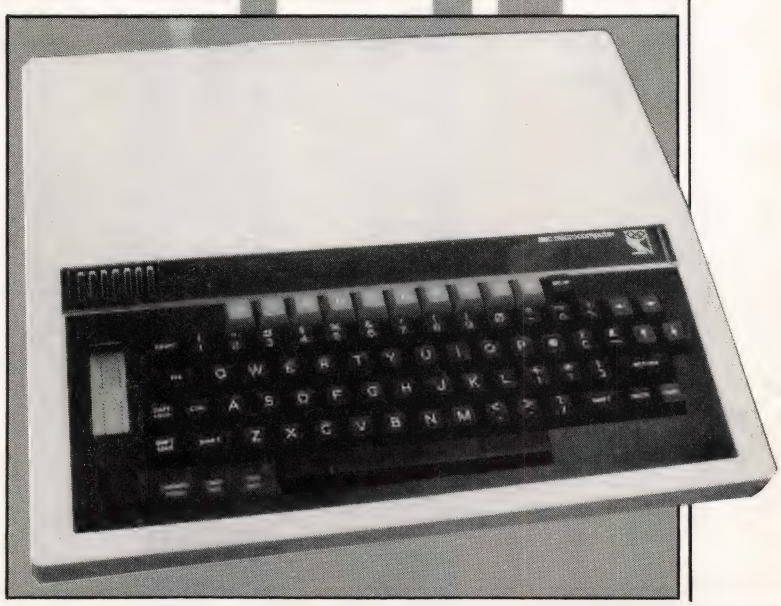
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Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier	Codes & Prices
Market Simulation	C	Bus Texas	32K	D	AB	£19.00
Maths Routine Library	C	Educ Texas Max	16K	C	AB	£24.00
Maths Routine Library	C	Texas Max	16K	D	AB	£35.00
Mind Challenges	C	Game Texas	16K	R	CH	£24.95
Minimemory	Ut	Texas	8K	R	AB	£89.95
Minimemory	Ut	Texas	8K	C	C	£89.95
Mission Impossible	Gm	Texas	8K	C	AB	£24.95
Multiplication	C	Educ Texas	8K	R	AB	£35.00
Munchman	Gm	Texas	8K	R	AB	£29.95
Music Makers	C	Dom Texas	8K	R	AB	£35.00
Music Maker	C	Educ Texas	16K	D	AB	£14.00
Music Skills Trainer	C	Educ Texas Max	16K	C	AB	£19.00
Music Skills Trainer	C	Educ Texas Max	16K	D	AB	£24.00
Mystery Funhouse	Gm	Texas	8K	C	AB	£24.95
Number Magic	C	Educ Texas	8K	R	AB	£18.00
Oldies but Goodies	C	Game Texas Max	16K	C	AB	£9.00
Oldies but Goodies	C	Game Texas Max	16K	D	AB	£14.00
Othello	C	Game Texas	8K	R	AB	£40.00
Personal Financial Aid	Do	Texas	8K	C	AB	£9.95
Personal Record Keeping	C	Dom Texas	8K	R	AB	£50.00
Personal Report Generator	C	Dom Texas	8K	R	AB	£70.00
Physical Fitness	C	Dom Texas	8K	R	AB	£20.00
Pirate Adventure	Gm	Texas	8K	R	AB	£39.95
Pre-School Learning Fun	C	Educ Texas	8K	R	AB	£17.00
Programming Aids I	C	Util Texas	16K	C	AB	£9.00
Programming Aids I	C	Util Texas	16K	D	AB	£14.00
Programming Aids II	C	Util Texas	16K	D	AB	£24.00
Programming Aids III	C	Util Texas	16K	D	AB	£19.00
Pyramid of Doom	Gm	Texas	8K	C	AB	£24.95
Savage Island I	Gm	Texas	8K	C	AB	£29.95
Savage Island II	Gm	Texas	8K	C	AB	£29.95
Saturday Night Bingo	C	Game Texas Max	16k	C	AB	£14.00
Soccer	C	Game Texas	8K	R	AB,CH	£30.00
Speech Editor	C	Util Texas	8K	R	AB	£35.00
Statistics	C	Dom Texas	8K	R	AB	£45.00
Strange Odyssey	Gm	Texas	8K	C	AB	£24.95
Structural Eng'g Library	C	Bus Texas	16	C	AB	£24.00
Structural Eng'g Library	C	Bus Texas Max	16K	D	AB	£35.00
TI Logo	Ut	Texas	48K	R	AB	£160.00
TI Invaders	C	Game Texas	8K	R	AB,CH	£40.00
TI Trek	C	Game Texas Max	16K	D	AB	£14.00
Teach Yourself Extended Basic	C	Educ Texas	32K	C	AB	£20.00
Teach Yourself Extended Basic	C	Educ Texas	32K	D	AB	£29.00
Teach Yourself Basic	C	Educ Texas	32K	C	AB	£30.00
Teach Yourself Basic	C	Educ Texas	32K	D	AB	£40.00
Terminal Emulator	C	Util Texas	8K	R	AB	£57.00
The Count	Gm	Texas	8K	C	AB	£24.95
Tombstone City	C	Game Texas	8K	R	AB,CH	£40.00
Tunnels of Doom	C	Game Texas	8K	R	AB,CH	£40.00
UCSD PASCAL 4	Ut	Texas	48K	D	AB	£380.00
US Football	C	Game Texas	8K	R	AB	£24.00
Video Chess	C	Game Texas	8K	R	AB,CH	£50.00
Video Games I	C	Game Texas	8K	R	AB,CH	£25.00
Video Games II	C	Games Texas	8K	R	AB	£25.00
Voodoo Castle	Gm	Texas	8K	C	AB	£24.95
Yahtzee	C	Game Texas	8K	R	AB	£30.00
Zero Zap	C	Game Texas	8K	R	AB	£24.00



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
Characters	Ut	Computer Concepts	16K	C	GJ	£6.67
Code Race	Gm	Computer Concepts	16K	C	GJ	£6.67
Creative Graphic Pack	Ut	Acornsoft	16K	C	AL,GA	£9.95
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
Lisp	Bs	Acornsoft	16K	C	AL,GA	£16.85
Minefield	Gm	A&F Software	16K	C	GE	£6.00
Mulitfile	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
Polecat	Gm	A&F Software	16K	C	GE	£6.00
Spacemaze	Gm	Program Power	32K	C	GK	£6.84
Time Trek	Gm	Program Power	32K	C	GK	£9.14
Algebraic Manipulation	Ut	Acornsoft	32K	C	AL,GA	£9.95
Backgammon	Ut	Bug Byte	32K	C	EA	£8.00
Cat and Mouse	Gm	Program Power	16K	C	GK	£5.69
Characters	Ut	Computen Concepts	32K	C	GJ	£6.67
Chess	Gm	Bug Byte	32K	C	EA	£11.50
Chess	Gm	Program Power	16K	C	GK	£9.14
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
Disassembler	Ut	Program Power	16K	C	GK	£6.84
Elorado Gold	Gm	Program Power	32K	C	GK	£7.99
FORTH	Ut	Acornsoft	32K	C	AL	£16.85
Golf	Gm	Bug Byte	32K	C	GA,EA	£7.00
Gomoku	Gm	Program Power	16K	C	GK	£4.54
Graph and Charts Pack	Bs	Acornsoft	32K	C	AL,GA	£9.95
Lisp	Ut	Acornsoft	32K	C	AL,GA	£16.85
Monsters	Gm	Acornsoft	32K	C	AL,GA	£9.95
Munchyman	Gm	Program Power	16K	C	GK	£6.84
Othello	Gm	Computer Concepts	32K	C	GJ	£8.95
Peeko Computer	Ut	Acornsoft	32K	C	AL,GA	£9.95
Philosopher's quest	Gm	Acornsoft	32K	C	AL,GA	£9.95
Snake	Gm	Computer Concepts	32K	C	GJ	£6.67
Snapper	Gm	Acornsoft	32K	C	AL,GA	£9.95
Spacemaze	Gm	Program Power	32K	C	GK	£6.84
Space Warp	Gm	Bug Byte	32K	C	GA,EA	£11.50
Startrek	Gm	Program Power	16K	C	GK	£9.14
Teacher's Toolkit	Ed	Wida Software	32K	C	FY	£30.00
Time Trek	Gm	Program Power	32K	C	GK	£9.14
Wordwise	Gm	Computer Concepts	32K	C	GJ	£74.75
Valley, The	Gm	CT Software	32K	C	PF	£9.95



ATARI 400

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier	Codes & Prices
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	£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	£11.99
Analog Adventure	Gm		32K	D	BC	£34.95
Angle Worms	Gm	Adventure Int.	8K	C	AB	£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	£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	£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	£24.50
Basketball	Gm	Atari	16K	R	AB,BC	£29.95
Beneath the Pyramids	Gm	Chrystal	48K	C	CH,AB	£19.99
Black Jack	Gm	Atari	16K	C	GC	POA
					AC,BC	£8.95
					AB,HM	£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	£19.95
Bumper Pool	Gm	Atari	16K	C	GC	POA
					AB	£11.25
Calculator	Bs	Atari	24K	D	BC	£16.95
Canyon Climber	Gm	Datasoft	16K	D	Hm	£20.00
Caverns of Mars	Gm	Atari	16K	C	BC,HM	£24.50
Caverns of Mars	Gm	Atari	16K	C	BC,HM	£24.50
Centipede	Gm	Atari	16K	R	GC	POA
					BC,HM	£29.95
Champelo	Gm	Dinacomp	16K	C	AB	£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	£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	£32.50
Conversational French	Ed	Atari	16K	R	AB,HM	£39.95
Conversational German	Ed	Atari	16K	C	AC,BC	£32.50
Conversational German	Ed	Atari	16K	R	AB,HM	£39.95
Conversational Italian	Ed	Atari	16K	R	AB,HM	£39.95
Conversational Italian	Ed	Atari	16K	C	AC,BC	£32.50
Conversational Spanish	Ed	Atari	16K	R	AB,HM	£39.95
Conversational Spanish	Ed	Atari	16K	C	AC,BC	£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	£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	£15.50
Crush, Crumble, Chomp	Gm	Avalon Hill	16K	D	GB	£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	£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	£15.50
Datestone of Ryn	Gm	Avalon Hill		C	BC	£14.95
					GB	£13.50
Deflections	Gm	Adventure Int.	8K	C	AB	£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	£9.95
European Scene Jigsaw Puzzle	Gm	Thorn EMI	16K	C	BC,HM	£19.95
Extended WSNA	Ut	Atari	16K	C	AB	£19.00
Fantasy land 2041	Gm	Chrystal	48K	C	CH,AB	£34.99
Fastgammon	Gm	Quality S/W	16K	C	BC	£9.95
Forest Fire	Gm	Dinacomp	24K	C	AB	£15.99
Frog	Gm	C E S/W	16K	C	AB	£9.95
Frogger	Gm	On Line	16K	C	Hm	£22.95
Frogger	Gm	On Line	32K	D	Hm	£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	£16.50
Galactic Guest	Gm	Chrystal	48K	C	CH,AB	£19.99
Galactic Trader	Gm	Adventure Int.	32K	C	AB,CH	£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	£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	£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	£9.95
Hickory Dickory Dock	Gm	Thorn EMI	16K	C	BC,HM	£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	£19.99
Humpty Dumpty/Jack & Jill	Gm	Thorn EMI	16K	C	BC,HM	£19.95
Intruder Alert	Gm	Dinacomp	16K	C	AB	£15.99
Invasion Orion	Gm	Avalon Hill		C	GB	£13.25
Invasion Orion	Gm	Avalon Hill		D	GB	£15.75
Invitation to Prog I	Ed	Atari	16K	C	AB,HM	£15.95
Invitation to Prog. II	Ed	Atari	16K	C	GC	POA
					AB,BC,HM	£22.95
Invitation to Prol. III	Ed	Atari	16K	C	AB,BC,HM	£22.95
Jawbreaker	Gm	On Line	16K	C	HM	£19.95
Jawbreaker	Gm	On Line	32K	D	HM	£19.95
Jumbo Jet Lander	Gm	Thorn EMI	16K	C	BC,HM	£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	£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	£16.50
Macro Assembler	Ut	Atari	32K	R	BC,HM	£59.95

REFERENCE

SOFTWARE LISTING

Title	Program Type	Program Produced By	Memory Req'd		How Sold Supplier	Codes & Prices
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	£29.95
Mission Asteroid	Gm	On Line	40K	D	Hm	£17.95
Mission Impossible	Gm	Adventure Int.	24K	C	BC	£14.95
					AB	£16.50
Monarch	Gm	Dinacomp	16K	C	AB	£10.99
Moon Probe	Gm	Dinacomp	16K	C	AB	£9.99
Mortgage Loan Analysis	Ed	Atari	16K	C	AB,BC,HM	£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	£22.95
Movie Scenes	Gm	Atari	16K	C	BC	£9.95
Moving Maze	Gm	Dinacomp	16K	C	AB	£9.99
Murder at Awesome Hall	Gm	Channel 8 S/W	16K	C	Hm	£12.95
Music Composer	Gm	Atari	16K	R	AC,BC	£32.50
					AB,HM	£35.95
Mystery Funhouse	Gm	Adventure Int.	24K	C	BC	£14.95
					AB	£16.50
Nautilus	Gm	Synapse	32K	C	HM	£20.00
Nomino's Jigsaw	Gm	Dinacomp	24K	C	AB	£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	Hm	£20.00
Pacific Coast Highway	Gm	Datasoft	16K	D	Hm	£20.00
Pac-Man	Gm	Atari	16K	R	GC	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	£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	£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	Hm	£19.95
Purchase Ledger	Bs	Atari	48K	C	AB	£149.95
Pyramid of Doom	Gm	Adventure Int.	24K	C	BC	£14.95
					AB	£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	Hm	£15.95
Race in Space	Gm	Analog S/W	16K	D	Hm	£15.95
Raster Blaster	Gm	Budgeco	32K	C	Hm	£22.95
Rescue at Rigel	Gm		32K	C	BC	£22.45
Reversi	Gm	Artsci Inc	16K	C	BC	£14.95
Rings of the Empire	Gm	Dinacomp	16K	C	AB	£15.99
Rotate and Tilt	Gm	Thorn EMI	16K	C	BC,HM	£14.95
Sales Ledger	Bs	Atari	48K	C	AB	149.95
Sands of Mars	Gm	Chrystal	48K	C	CH,AB	£26.99
Savage Island I	Gm	Adventure Int.	24K	C	BC	£14.95
					AB	£16.50
Savage Island II	Gm	Adventure Int.	24K	C	BC	£14.95
					AB	£16.50
Scram	Gm	Atari	16K	C	GC	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	£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	£29.95
Space Tilt	Gm	Dinacomp	16K	C	AB	£9.99
Space Trap	Gm	Dinacomp	24K	C	AB	£12.99
Space Trek	Gm	Atari	24K	C	GC	POA
					AB	£13.50
Star Raiders	Gm	Atari	16K	R	HM,AC,BC	
					CH	£29.95
Star Trek 3.5	Gm	Adventure Int.	32K	C	BC	£14.95
					AB	£16.50
Star Warrior	Gm	Epyx	32K	C	BC	£28.95
States and Capitals	Ed	Atari	16K	C	AC,BC	£8.95
					AB,HM	£9.95
Statistics I	Gm	Atari		C	AC,BC	£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	£14.95
					AB	£16.50
Stud Poker	Gm	Dinacomp	16K	C	AB	£10.99
Submarine Commander	Gm	Thorn EMI	16K	C	BC,HM	£24.50
Summer	Gm	Chrystal	16K	C	AB	£11.99
Sunday Golf	Gm	Adventure Int.	16K	C	AB	£16.50
Super Breakout	Gm	Atari	16K	C	AC,HM	£24.50
Super Breakout	Gm	Atari	16K	R	AB	£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 Trerk	Gm	Quality S/W	16K	D	BC	£11.95
Tele Link	Gm	Atari	16K	R	HM	£21.50
Tele Link	Ut	Atari	16K	R	AB	£19.95
Telelink	Ut	Data Soft	16K	R	BC	£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	£14.95
					AB	£16.50
Threshold	Gm	On-Line	32K	C	HM	£24.95
Thunder Island	Gm	Analog S/W	16K	C	BC	£10.95
Touch Typing	Ed	Atari	16K	C	AC,BC	£14.95
					AB,HM	£15.95
Tournament Pool and 8 Ball Pool	Gm	Thorn EMI	16K	C	CH,BC,HM	£19.95
Track Attack	Gm	Broada Bond	32K	D	HM	£32.95
Triple Blockade	Gm	Dinacomp	16K	C	AB	£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	POA
					AB,BC,HM	£24.50
Visicalc	Bs	Personal S/W	32K	D	BC	£119.95
Voodoo Castle	Gm	Adventure Int.	24K	C	BC	£14.95
					AB	£16.50
Voyager	Gm	Avalon Hill	32K	C	CH,BH	£12.95
Waterloo	Gm	Chrystal	48K	C	CH	£32.99
Wizard and the Princess	Gm	On Line	48K	D	CH	£22.95
World War III	Gm	Chrystal	48K	C	CH,AB	£19.99

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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
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
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
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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
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					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
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Six Program Pack:	Gm	PR Software	3K	C	GV	£7.50
War Game						
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Ski Run	Gm	Rabbit S/W	3K	C	AH	£4.99
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Spiders from Mars	Gm	Audiogenic	5K	R	CH,AA	£24.99
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Super Breakout	Gm	Coloursoft	5K	C	FP	£7.75
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Super Lander	Gm	Commodore	3K	R	AA,AB,FZ	
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					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	
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					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 Men	Gm	Coloursoft	5K	C	FP	£7.00
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 LISTING



ATOM

Title	Program Type	Program Produced By	Memory Req'd	How Sold	Supplier	Codes & Prices
3-D Asteroids	Gm	Program Power	5K	C	GK	£6.85
747 Flight Simulator	Gm	Bug Byte	12K	C	CH,GA,GB	£8.00
Adventure	Gm	Program Power	12K	C	CH,GK	£9.15
Adventures	Gm	Acornsoft	12K	C	EJ	£30.00
Air Attack	Gm	Program Power	12K	C	CH,GK	£9.15
Air Attack	Gm	Program Power	12K	C	GK	£7.95
Alien Maze	Gm	Program Power	8K	C	GK	£5.69
Astrafire	Gm	Program Power	5K	C	GK	£4.54
Astro Birds	Gm	Program Power	12K	C	CH,GK	£9.15
Atom Adventure	Gm	Acornsoft	12K	C	GA,AL	£11.50
Atom Breakout	Gm	Bug Byte	4K	C	HO	£4.00
Atom Business Games	B/G	Program Power	12K	C	GK	£7.99
Atom Business Cassette	Bs	Acornsoft		C	AL	£7.50
Atom Business Pack	Bs	Acornsoft		C	AY,FA	£11.50
Atom Chess	Gm	Acornsoft	12K	C	GA,EA,AL	£11.50
Atom Chess	Gm	Program Power	12K	C	GK	£11.44
Atom Forth	Ut	Acornsoft		C	GA,EJ,AL	£11.50
Atom Invaders	Gm	Bug Byte	12K	C	HO	£8.00
Atom Life Category	Bs	Acornsoft		C	AL,GA	£11.50
Atom List	Ut	Acornsoft		C	AL	£17.25
Atom Store	Bs	Program Power	12K	C	GK	£9.15
Atom Synthesiser	Gm	Acornsoft	12K	C	AL,GA	£11.50
Atomic Cube	Gm	A&F S/W	12K	C	GE	£4.95
Backgammon	Gm	Bug Byte	7K	C	GA	£7.00
Chess	Gm	Bug Byte	12K	C	CH,GA,GB	£9.00
Chess	Gm	Program Power	12K	C	GK	£9.15
Constellation	Gm	Program Power	12K	C	GK	£7.99
Constellation	Ed	Program Power	12K	C	GK	£7.99
Cowboy Shootout	Gm	Program Power	12K	C	CH,GK	£7.99
Cylon Attack	Gm	A&F S/W	12K	C	GE	£4.95
Dambusters	Gm	Program Power	10K	C	GK	£5.69
Data Base	Ut	Acornsoft	6K	C	EJ,FZ,FA,GA	£11.50
Death Satelite	Gm	A&F S/W	12K	C	GE	£6.00
Demon Dungeon	Gm	Program Power	5K	C	GK	£6.85
Derby, Blitz and Rat Race	Gm	Program Power	12K	C	GK	£6.84
Desk Diary	Bs	Acornsoft	12K	C	FA,EJ,AL,GA	£11.50
Disassemble Program	Ut	Program Power	4K	C	GK	£6.85
Dragon's Lair	Gm	Program Power	12K	C	GK	£6.85
Early Warning	Gm	A&F S/W	12K	C	GE	£4.95
Easy Talker	Ed	Acornsoft	16K	C	AW	£5.00
Escape	Gm	A&F S/W	8K	C	GE	£4.95
Fall of Rome	Gm	Program Power	12K	C	GK	£7.99
Forth Tape	Ut	Acornsoft		C	FA	POA
Forth, Theory & Practice	Bs	Acornsoft		C	AL	£6.00
Fruit Machine	Gm	Bug Byte	8K	C	HO	£4.00
Galactica	Gm	Program Power	12K	C	GK	£5.69
Galaxian	Gm	Bug Byte	12K	C	CH,GA,GB	£8.00
Galaxian War and Invasion	Gm	Program Power	2K	C	GK	£6.84
Golf	Gm	Bug Byte	6K	C	HO	£5.00
Games Pack 1:	Gm	Acornsoft		C	AY,FA,GA	£11.50
Asteroids			10K		EJ,AL,CH	
Sub Hunt			6K		FZ	
Break Out			4K			
Games Pack 10:	Gm	Acornsoft	2K	C	AY,FA,GA	£11.50
10 Games for minimum					EJ,AL,CH,	
Atom					FZ	
Games Pack 11:	Gm	Acornsoft	12K	C	AY,FA,GA	£11.50
Missile Base					EJ,AL,CH	
Snooker					FZ	
Dominoes						
Games Pack 2	Gm	Acornsoft		C	AY,FA,GA	
Dog Fight			10K		EJ,AL,CH	
Mastermind			4K		FZ	
Zombie			4K			
Games Pack 3:	Gm	Acornsoft		C	AY,FA,GA	£11.50
Rat Trap			10K		EJ,AL,CH	
Lunar Lander			6K		FZ	
Black Box			10K			
Games Pack 4:	Gm	Acornsoft		C	AY,FA,GA	£11.50
Star Trek			8K		EJ,AL,CH	
Four Row			12K		FZ	
Space Attack			10K			
Games Pack 5:	Gm	Acornsoft		C	AY,FA,GA	£11.50
Invaders			10K		EJ,AL,CH	
Wumpus			3K		FZ	
Reversi			4K			
Games Pack 6:	Gm	Acornsoft		C	AY,FA,GA	£11.50
Dodgems			10K		EJ,AL,CH	
Simon			8K		FZ	
Amoeba			6K			
Games Pack 7:	Gm	Acornsoft		C	AY,FA,GA	£11.50
Life Forms			8K		EJ,AL,CH	
Ballistics			10K		FZ	
Snake			10K			
Games Pack 8:	Gm	Acornsoft		C	AY,FA,GA	£11.50
Star Date			8K		EJ,AL,CH	
Gomoku			8K		FZ	
Robots			10K			
Games Pack 9:	Gm	Acornsoft		C	AY,FA,GA	£11.50
Snapper			8K		EJ,AL,CH	
Minotaur			12K		FZ	
Babies			8K			
High Stats	Bs	Program Power	12K	C	GK	£7.99
Hyper Fire	Gm	Program Power	12K	C	GK	£9.15
Introductory Pack	Ed	Acornsoft	3K	C	GA,FA,AL	£23.00
Invader Force	Gm	Program Power	12K	C	GK	£9.15
Invaders	Gm	Bug Byte	12K	C	CH,GA,GB	£8.00
Labyrinth	Gm	Bug Byte	12K	C	HO	£6.95
Last Run	Gm	Bug Byte	7K	C	HO	£3.00
Lunar Lander	Gm	Program Power	12K	C	GK	£7.99
Lunar Lander	Gm	Bug Byte	12K	C	HO	£5.50
Martians	Gm	Program Power	12K	C	GK	£7.99
Maths Pack 1:	Ed	Acornsoft	4K	C	EJ,FA,FZ,AL, GA	£11.50
Maths Pack II:	Ed	Acornsoft	6K	C	EJ,FA,FZ, AL,GA	£11.50
Maze Ball	Gm	Program Power	12K	C	GK	£5.69
Microbudget	Bs	Program Power	12K	C	GK	£9.15
Mine Field	Gm	A&F S/W	6K	C	GE	£4.95
Missile Command	Gm	A&F S/W	12K	C	GE	£4.95
Mode 4 VDU	Ut	Program Power	12K	C	GK	£7.99
Munchy Man	Gm	Program Power	5K	C	GK	£5.69
Music Box	Gm	Program Power	12K	C	GK	£7.99
Peeko Computer	Ed	Acornsoft	6K	C	GA,FA,AL	£11.50
Pinball	Gm	Bug Byte	6K	C	HO	£4.50
Polaris	Gm	A&F S/W	12K	C	GE	£3.95
Polecat	Gm	A&F S/W	12K	C	GE	£4.95
Pontoon	Gm	A&F S/W	12K	C	GE	£3.95
Programmer's Toolkit	Gm	Program Power		C	GK	£28.15
Reversi	Gm	Program Power	8K	C	GK	£5.69
Rhino and Wiggle	Gm	Bug Byte	10K	C	HO	£5.00
Robot Control	Ed	Acornsoft	16K	C	AW	£35.00
Robot Nim	Gm	A&F S/W	6K	C	GE	£3.95
Sketch Pad Program	Gm	Program Power	5K	C	GK	£5.69
Softscreen	Ut	Computer Concepts	12K	C	GJ	£11.50
Space Fighter	Gm	Program Power	12K	C	GK	£9.15
Space Invaders	Gm	Computer Concepts	12K	C	GJ	£7.80
Space Storm	Gm	Program Power	4K	C	GK	£5.69
Star Trek	Gm	Program Power	5K	C	GK	£6.85
Star Trek	Gm	Bug Byte	12K	C	HO	£5.00
Statistics Pack	Ut	Bug Byte	12K	C	HO	£20.00
Stockbroker	Gm	Program Power	5K	C	£4.54	
Super Race Track	Gm	Program Power	12K	C	GK	£5.69
Squares, Simon and Parachute	Gm	Bug Byte	7K	C	HO	£5.00
Tangle	Gm	A&F S/W	6K	C	GE	£3.95
The Soft VDU	Gm	Acornsoft	8K	C	AY,FA,GA, EJ,AL,CH,FZ	£11.50
The Park	Gm	Program Power	12K	C	GK	£5.69
Time Tutor	Ed	A&F S/W	6K	C	GE	£3.95
2K Programs (1)	Gm	Bug Byte	2K	C	HO	£4.50
2K Programs (2)	Gm	Bug Byte	2K	C	HO	£4.50
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Typist	Ut	Bug Byte	6K	C	HO	£4.00
UFO Bomber	Gm	Bug Byte	7K	C	HO	£4.00
Utility Pack 1	Ut	Acornsoft	2K	C	FA,GA,AL,GA	£11.50
Warlords	Gm	Program Power	12K	C	GK	£7.99
Word Pack ROM	Ut	Acornsoft	8K	C	AL,EJ,GA	POA
Word Processing Pack	Bs	Acornsoft	8K	C	FA	POA
Word Tutor	Bs	Acornsoft	12K	C	GA,EJ,FA,AL	£11.50
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You: "Yes, I know we could do with a new washing machine. But the new Dragon 32 Computer is much more important. It's the first computer actually designed for all the family - and it costs under £200!"

Her: "**++??!!@££??! fortune!"

You: "No, I'm not being selfish. Computers are for the whole family - and they're going to play a big part in the children's future."

Her: "Oh?"

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THE FIRST FAMILY COMPUTER.

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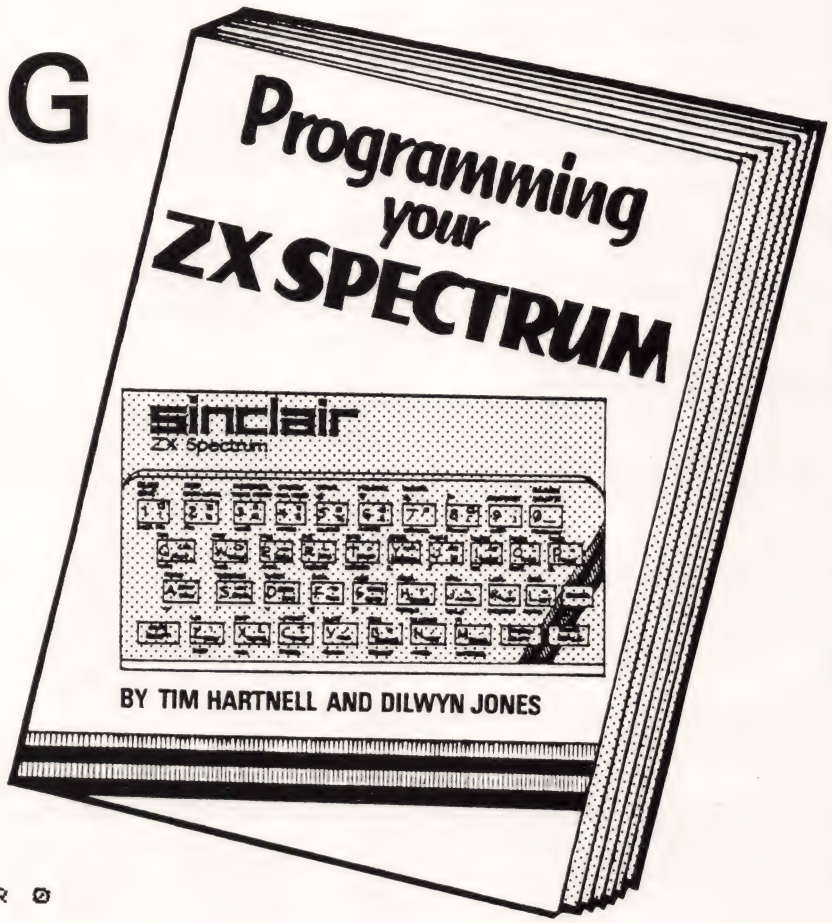
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MICROTERMS

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* statements in mnemonics and conveniently handling *memory* addressing by use of symbolic terms.

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

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

Binary:
Numbering system with the base 2, using the digits 0 and 1 instead of the *decimal* series 0 to 9. All digital computers work on *data* and *instructions* presented as *binary* numbers.

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*.

Bus
(Sometimes spelt Buss). Basically, the multiple wiring common to several parts of a computer and the number of channels therein — eg a 16-bit bus addressing 64K *memory* locations or a 20-way bus addressing 1 *megabyte*. Bus is now generally identified with the pattern of connections to the plugs and sockets whereby optional units (eg more memory) may be connected to a computer.

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.

Compiler
Software which converts *high level language* statements into either *assembly language* statements, or into *machine code*.

CUTS
Computer Users Tape System. Definition of system for storing *data* on cassette tape as series of tones to represent *binary* 1's and 0's.

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

Debug
To correct the errors in a *program*.

Disc (Disk)
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.

Execution Time
The time taken to perform an *instruction*.

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 monitor (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).

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*.

Instruction Set
That set of fundamental *instructions* which control a *microprocessor's* or computer's basic set of possible operations. In general, the larger the instruction set the more powerful the microprocessor.

Interpreter
An interpreter is a *software routine* which accepts and *executes* a *high level language program*, but unlike a *compiler*, does not produce intermediate *machine code* but converts each instruction as received.

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

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

Keyboard
A device, similar to a typewriter, which is used to code *alphanumeric* characters in

a form that the computer can recognise. The usual method of interacting with a microcomputer for hobbyists.

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*.

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

Machine Language (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.

Memory Mapped I/O
A technique of using *I/O* facilities by addressing I/O *ports* as if they were *memory locations*.

Micro (also u)
Prefix signifying one millionth. Also used descriptively of something very small.

Micro Program
Program inside a *CPU* which controls the actions performed by the CPU chip itself.

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*.

n-sec
Nanosecond, one-thousand-millionth of a second.

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.

Parallel
A method whereby *data*, so many *bits* wide, can be transferred simultaneously over a group of wires — one wire per bit. An 8-bit system requires eight wires. In effect, the bits are transferred 'in parallel'.

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

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

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 performs a specific task and which is available for use elsewhere in a program, as often as you like.

Syntax
The grammar of a programming *language*.

TTY
Teletype.

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*.

Word Processor
A computer with *software* for entering, editing, storing, formatting and printing text, rather than processing figures.

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