

A Database Publication

# electron

## user

Vol. 5 No 12 September 1988 £1.25

## INSIDE BASIC

New series unveils the mysteries of the Electron's rom

### BULLS AND COWS

The game you can play when the boss is away

### CRYPTON

Multi-screen scrolling arcade epic to type in

### LISTIF

Add a powerful new command to Basic

### FIRE

Become a firefighter in this educational challenge

**£500**

of prizes to be won in  
easy-to-enter contest



## Gallup Software Chart

Find out here all about the best-selling games currently topping the software chart.



## News

All the latest news and developments in the ever-expanding world of the Electron.

## Machine Code

Pete Bibby rounds off his popular series with a look at post-indexed addressing modes.

## Book Review

We turn over a new leaf and examine the latest Advanced User Guide.

## Fire! Fire!

Become a firefighter in this challenging educational game.

## Competition

More than £500 of prizes to be won by answering five simple questions about your micro.

## Rom Routines

Start of a great new series revealing hidden machine code routines within the Basic rom.

## Software

Our panel of expert games players put the latest releases to the test.

## Bulls and Cows

A game in ViewSheet - impossible? No! Here's one to play when your boss is away.

## Listif

Add a powerful new command to your Electron's Basic.

## Sprites

Roland Waddilove's back with more routines to help you write machine code arcade games.

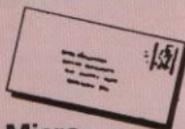


## Crypton

A superb multi-screen arcade game for you to enter and play.

## Pendragon

Hints and tips, plus your adventure problems solved by our expert.



## Micro Messages

Another selection of the brightest letters from our bulging mailbox.

## In Action

A type-in Oxo listing featuring artificial intelligence.

## Memory Map

Your micro's ram and rom from E00 up is covered in the final part of this popular series.

## Bargains galore!

Don't miss our special offers on Pages 44 and 45.

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# Gallup Software Chart



THIS MONTH	LAST MONTH	TITLE (Software House)	COMMENTS	PRICE
1	4	<b>BARBARIAN Superior</b>	If you are a fan of games which simulate physical combat, martial arts and the like, you will find Barbarian an excellent addition.	9.95
2	1	<b>SOCCER BOSS Alternative</b>	Alternative has eight titles in the charts this month and Soccer Boss is the highest. Excellent value, too, for this Football-Manager type game.	1.99
3	•	<b>REPTON THRU TIME Superior</b>	Not a surprise to see this one entering the charts. A must for anyone loathe to miss any Repton screen. As usual, plenty of puzzles and challenges.	6.95
4	2	<b>STAR FIGHT Alternative</b>	Into the great unknown – a fun and simple space shoot-'em-up. Not the most original concept, and this one doesn't offer anything new.	1.99
5	•	<b>ROUND ONES Alternative</b>	Breakout strikes again, with you controlling a B.A.L.L. – a Block Assault Laser Launch. The usual mystery blocks abound.	1.99
6	3	<b>COMBAT LYNX Alternative</b>	Going down the charts this month, but this wartime helicopter simulation sets a mission for the more adventurous. A good introduction.	1.99
7	10	<b>PSYCASTRIA Alternative</b>	An old favourite which is still in the charts – join in by shooting ammo dumps while avoiding the aliens in this scrolling shoot-'em-up.	1.99
8	18	<b>SPY CAT Superior</b>	Spycatcher spoof, with you trying to escape to Greenland to write your memoirs, on the way visiting No 10 and avoiding surveillance.	9.95
9	9	<b>FOUR GREAT GAMES Micro Value</b>	Vindaloo, Wet Zone, Rig Attack and Alphatron – your chance to play these again or add to your collection.	3.99
10	•	<b>FLIGHT PATH 737 Anco</b>	Making a comeback is this old flight simulator now priced as a budget game. Your task is to take your plane from the runway and land successfully.	2.99
11	17	<b>THAI BOXING Micro Selection</b>	Basically a martial arts game which continues to pop back into the charts. Proving to be very popular at the price.	1.99
12	11	<b>PAPERBOY Elite</b>	This arcade conversion is your chance to deliver your neighbour's daily papers with the maximum of damage – beware of dogs and cars though.	9.95
13	16	<b>TRIPLE DECKER 3 Alternative</b>	Compilations are popular, and at this price are excellent value. Here are Lunar Invasion, Jam Butty and Lunar Lander.	1.99
14	12	<b>AROUND THE WORLD IN 40 SCREENS Superior</b>	Repton's second appearance in the chart and still looming large. This time on a trek through the Orient, America, Africa, the Arctic and the oceans.	6.95
15	•	<b>BRIAN JACK'S CHALLENGE Mastertronic</b>	The only offering from the original advocate of budget games, Mastertronic. How many remember Jacks or the TV programme?	1.99
16	•	<b>STEVE DAVIS SNOOKER Blue Ribbon</b>	As long as Steve Davis continues to win snooker matches this game will also keep rearing its head. Buy it if you haven't already.	1.99
17	•	<b>TRIPLE DECKER Alternative</b>	The first trilogy from Alternative – features Grand Prix, Manic Mole and Day at the Races. Again worth buying if you don't have them.	1.99
18	8	<b>WAY OF THE EXPLODING FIST Mastertronic</b>	Martial arts is a perennial favourite both with software house and gamers. This is a good budget priced example of the genre.	1.99
19	•	<b>PLAY IT AGAIN SAM 2 Superior</b>	A more expensive compilation, but then all the games were full price – Repton 3, Craze Rider, Galaforce and Codename: Droid.	9.95
20	6	<b>TRIPLE DECKER 4 Alternative</b>	Latest in this compilation series and now falling in the charts. No criticism can be made of their value for money.	1.99

# electron user NEWS

## ***Pssst! Wanna way to win?***

*IF ALL else fails, try cheating. That's the advice to Electron users from Impact (0742 769950). The company has just launched a new range of poke discs for frustrated players of such classic titles as Elite, Ravenskull, Citadel and Xor.*

*In the first offering from the rapidly growing Impact Games Club, there are 20 pokes each on Vols 1 and 11 of Cheat it Again, Joe.*

*Impact's creator, Mark Botterill, said: "We believe these pokes will give gamers more fun than ever before as games they have given up on will suddenly become easy.*

*"With Elite, for example, you can destroy any enemy ship with just one lethal laser blast".*

*The pokes have been extensively tested to work with original and compilation versions of the 40 games they cover. Price £2.99 each.*

## **Electron to get top BBC Micro product**

A TOP new BBC Micro product from Permanent Memory Systems is to be converted for the Electron.

Called The Publisher it contains 64k of software and 16 high quality fonts that can produce documents direct from popular word processing programs. The problem

with bringing out an Electron version is that The Publisher is contained on prompts which the Electron does not support at present.

Gordon Cameron, managing director of PMS (03552 32796) said his company isn't equipped to perform the complicated conversion - but

says he knows a man who is.

"Dave Hitchens, an engineer at Pres, has got a system that enables the Electron to run the prompts and I'll be seeking his help in converting The Publisher", said Gordon Cameron.

"We hope to have it ready for the Electron & BBC Micro User Show in November at a price in the region of £40".

## **INNOVATION ROW JOINS BIG SHOW**

ALL the leading suppliers of Electron hardware and software are lined up for the big pre-Christmas showcase.

The Electron & BBC Micro User Show returns to the New Horticultural Hall, Greycoat Street, London, on November 11 to 13.

More than 70 exhibitors will be there, displaying all the latest Electron technology and offering a massive range of software and peripherals at special show prices.

And there will be no

shortage of free technical advice on tap from the experts at *Electron User*.

Innovation Row is a brand new section specially created for the show. It will feature the finalists in the 1988 Innovation Awards and visitors will be able to cast their votes for who they think should win.

The show will be open from 10am to 6pm, Friday and Saturday, 10am to 4pm on Sunday.

A money-saving advance ticket order form is on Page 16.

## **DUTCH TREAT**

DUTCH Electron users are holding their sixth annual exhibition and conference in Rotterdam on October 15.

Founded in April 1983, the Big Ben Club also includes users of other Acorn machines, though the Electron is strongest in Holland.

Believed to be the biggest group of Acorn enthusiasts outside the UK, the club now has more than 3,500 members and 1,500 people attended last year's show.

## **Superior tries a new line in compilations**

PLAY it Again Sam 3 will be released by Superior Software this month. It will include two games from another leading software house - marking the first time that Superior (0532 459453) has gone out-of-house for a compilation.

"This is a new policy on our

part", said Superior managing director Steve Hanson, "and one we shall pursue in order to maintain the high quality of our compilations".

Superior recently brought out a number of compilations for the Electron - Acornsoft Hits Vols 1 and 2, Superior Collection, and Play it Again

Sam Vols 1 and 2. All are available on tape priced £9.95, and some come on disc priced £11.95 and £14.95.

Out next month will be One Night in Bangkok, a 64-screen mixture of arcade adventure and 3D chess puzzles. Price £9.95 on tape, £11.95 on disc. November sees the launch

of Exile, a space adventure Steve Hanson forecasts will be the biggest selling game at Christmas.

Exile features the evil Triax, banished to a distant planet across the galaxy where the player has to investigate and destroy an underground laboratory.

# Barbarian starts a real life battle



MAY I as a lay preacher point out to the secretary of the West Midland Assemblies of God Churches (August 1988 Micro Messages) that it is Christian belief that God created human beings in his own image.

Furthermore He did not clothe them and was very annoyed to find them using fig leaves in lieu of clothing. Surely to object to the unclothed body is closely akin to blasphemy.

To descend to a less exalted plain, as an amateur photographer I see nothing titillating or erotic about the Barbarian illustration. Compare it if you will with what is shown daily in certain very popular newspapers or the photographs outside your local striptease club.

Lastly, I'm sure if Mr Clarke re-considers he will replace the reference to Michael Hesaltine, a highly cultured and intelligent politician, is unjust to all parties. The gentleman portrayed is surely one of Wagner's heroes. The lady however, must be one of the chorus - she's never one of the superb Wagnerian heroines. Definitely a Purcell type. - R.H. Hill, Essex.

## Ugly advert

I HAVE received the August 1988 issue of Electron User. This is the third copy I have received through the post in a transparent envelope displaying the most ugly pornographic advertisement by Superior Software. Who knows what my postman thinks - Dirty old man? L.H. Everith, Seaton, Devon.

## Why the fuss?

I HAVE recently bought Barbarian, and I think that it is an excellent game. I also think that a lot of people are making a big fuss about nothing. The adverts simply show a half-naked woman

LAST month's Electron User carried a letter from J. Clark of Wolverhampton complaining about the advertisement for Barbarian that has been carried on the back cover of recent issues.

Mr Clark, secretary of the West Midlands Assemblies of God Churches, said the advert was "offensive and particularly insulting to women".

We asked for your opinions and were deluged with letters - pro and con - regarding the way this sword-fighting game from Superior Software has been advertised.

Here is a selection of your views.

with her arms round a man. And hasn't anyone noticed that HE isn't wearing very much either?

And while people are complaining about all this, they have all forgotten about the game itself. It features two massive men, armed with swords, chopping each other to bits. Don't you think that this is what everyone should be worrying about? - Pak Charoenkul, Chelsea

## Disturbing

I WOULD like to support Mr Clark's letter concerning the Superior Software ad. I do not hide the fact that I too am a Christian and find the picture disturbing.

I realise that for those who do not believe in a loving but righteous God that this girl has every right to use her body as she pleases, but I would just ask that people consider that behind the curves and contours there is a human being with feelings, joys and sorrows and I just wonder how any father would feel if he looked and saw his daughter there.

Such a father would know inside how wrong it is to use a person in such a superficial manner.

We are surrounded these days by the top two per cent of most beautiful young women displayed in all their glory. It must sow seeds of discontent in the minds of men when they go home to their wives who occupy the other 98 per cent of the female population.

I just wonder if this could be one reason why the divorce rate is so high. - S.N. Allen, Leamington Spa

## Young view

I WAS not the only one disgusted by the back cover of your June and July issues of Electron User. The packaging for the cassette is even worse.

Every time I go to school with either issue to try out

Richard Hanson, managing director of Superior Software commented: "It is interesting to note that about half the comments complain about the advert, while the other half support our use of it.

"This fits with the feedback we have had from other sources and shows that it is very much a matter of opinion as to whether the advert is in bad taste - or, as we believe, an eye-catching but harmless and amusing picture that captures the fantasy-epic style of the game.

"An important point in our decision to use the same advertising photograph as Palace was that it enabled people to readily distinguish this Barbarian game from other similar titles around at the time.

"Our view that the advert is not in bad taste has been supported by the Advertising Standards Authority".

programs on its BBC Micro I have to hide the back cover because it is embarrassing. Electron User is not just an adult magazine, it is supposed to be for all ages.

It is a brilliant magazine but you spoiled it by putting this sexy advert in it. I am eight years old and know that I have to become aware of sexy things eventually, but why must I have to do that just because Superior Software is paying you lots of money to advertise Barbarian in a cheap noticeable way?

I bet there are lots of other children that find it yukky. Please don't put this advert in the September issue. - Robert Rountree, Great Bardfield, Essex

## Code of conduct

I AM surprised that the letter from J. Clark is the only complaint you have had about the Barbarian advert.

I wrote to the Advertising Standards Authority immediately after we received our June issue about the totally unnecessary use of the semi-nude female pictured in the advert.

I have received a lengthy reply which explained to me that the code of advertising was not being broken but that they would, however, be notifying the advertisers and publishers about my complaint.

Having now seen the picture on the cover of the game in your review section - which I consider even worse than the one on the back cover - I am writing direct to you to protest. - Mrs C.A. Walton, Wolverhampton

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HELLO and welcome to the last article in this short series on assembly language programming. This month we'll deal with some simple addressing techniques with very long names and learn a little about the assembler equivalent of Basic's IF.

The first addressing technique we'll deal with is post-indexed indirect addressing. Don't worry about the name, it's easier to understand than it looks.

We came across indirect and indexed addressing last time and post-indexed indirect addressing is just a combination of the two.

The indirect bit comes because rather than just state the address we want to start our indexing from, it's hidden away in two bytes in zero page.

Once the 6502 has teased out this base address from there, the indexing - using an index register to supply the offset - proceeds from there.

In other words, it's just like absolute indexed addressing except first we have to go round the houses, or more accurately zero page, to get the start address for our table of data.

A typical post-indexed indirect addressing instruction takes the form:

`LDA (&75),Y`

This tells the micro to load the accumulator with a value held in a table of data. The address of the first location of this data is hidden away in bytes &75 and &76 of zero page.

Once this has been found, the value in the Y register is added to that base address to give the final, effective address of the data we want. Figure 1 shows how it's done.

This may seem a bit long-winded, but it's very useful at times - otherwise it wouldn't be there, would it? Program 1 shows it in use

a rather contrived example that continues my obsession with the alphabet.

```

10 REM Program 1
20 REM Initialise
30 MODE 6
40 codeStart=&2000
50 P1=codeStart
60 ?&70=&80:&71=&21
70 oswrch=&FFEE
80 REM Poke data into me
90 dataStart=&2100
100 lowerStart=&2100
110 upperStart=&211A
120 FOR loop# TO 25
130 lowerStart+=loop#*97+Lo
op
140 upperStart+=loop#*65+Lo
op
150 NEXT loop
160 REM Choose upper or l
overcase
170 INPUT "upper or Lower
U/L: " choice$
180 REM Index selectedto
give right case
190 IF choice$="U" OR cho
ice$="u" THEN offset=26 ELSE
offset=0
200 G
210 LBY #offset \ determi
nes data set used
220 loop
230 LDA (&70),Y \ post-in
dexed indirect addressing
240 JSR oswrch
250 INY
260 CPY #offset+25
270 BNE loop
280 RTS
290 J
300 CALL codeStart
    
```

Don't let the length put you off, most of the program is good old Basic. The actual assembler code is quite short. The interesting bits start at line 60 which

puts the value &00 in location &70 and the value &21 in location &71.

Now from your memories of last month's discussion of indirection, you'll recall that given &70 in brackets, the 6502 has enough sense to realise that what you actually want is the address contained in the two bytes &70 and &71. So line 60 "seeds" the address &2100 in zero page.

Lines 90 to 150 of the program just put data into memory. There are two tables of data, the first starts at &2100 and consists of the ASCII codes for the lowercase letters of the alphabet, the second starts 26 bytes later at &211A and consists of the ASCII codes for the uppercase letters of the alphabet.

Figure 11 shows a schematic diagram of where the data is hidden.

The final lines before the assembler have the user choosing between uppercase or lowercase letters. It's not very well mugged, but you'll find that pressing U or u will give you an uppercase alphabet, any other letter lowercase. Which brings us to the assembler code.

Here the first thing that happens is that the Y register is loaded with whatever is held in *offset*. This is either 0 or 26 depending on your previous choice. Line 230 contains the post-indexed indirect addressing.

Here the brackets of:

`LDA (&70),Y`

tell the microprocessor that indirection is involved and that the address of a table of data is hidden in zero page at the two bytes starting at &70. As we've arranged these to be &00 and &21 - in the usual topsy-turvy, low byte, high byte fashion - it soon figures out that the data starts at &2100.

But not so fast! What about that Y? Well this is the offset, held in the Y register, which is to be added to the base address of the table - retrieved from &70 and &71 - to get the effective address of the data we want.

And as we've arranged for this value to be 0 or 26, it effectively points to either the start of the lowercase ASCII values at &2100 - &2100 + 0 - or the start of the uppercase values at &211A - &2100 + 26. I'll leave it for you to figure out how the loop itself works.

A typical run might give:

```

Upper or Lower U/L U
2000
2000 40 1A LBY #offset
2002 loop
2002 51 70 LDA (&70),Y
2004 20 EE FF JSR oswrch
2007 C8 INY
2008 C0 33 CPY #offset+25
200A 00 F6 BNE loop
200C 60 RTS
ABCDEFGHIJKLMNOPQRSTUVWXYZ
    
```

Straight on to our second



◀ From Page 9

the Ascii codes for A, B and C in the locations &2100, &2101 and &2102 respectively. (As you'll see, these addresses needn't have been contiguous, they could have been scattered over memory).

Next zero page is seeded with these three addresses so the bytes &70 to &75 contain the addresses of the locations holding the Ascii data. We say that they are vectors pointing to the data. Figure IV shows the start of play at this point.

So, the scene is set, the data is in position in memory and the pointers to it are lurking in zero page. Now the program enters the assembler and the X register is loaded with the value in *offset*. As it's written, line 110 has set this to 0.

The pre-indexed absolute addressing occurs at line 150. Here the:

```
LDA (base,X)
```

tells the chip that the accumulator is to receive data from an address vectored in zero page. The table of addresses begins at *base* - which we've set to &70 - and the offset from this base is held in the X register - which line 140 has loaded with 0.

The result of all this is that the effective address is found in the two bytes &70 and &71 (&70 + 0 is &70), which is &2100. So the accumulator is loaded with the data found at &2100. As this is 65 and the next instruction is a jump to *oswrch*, the result is that A appears on the screen.

What you'll see on the screen when you run the program is:

```
2000
2000 A2 00 LDX #offset
2002 A1 70 LDA (base,X)
2004 20 EE FF JSR #FFEE
2007 60 RTS
A
```

Play around with the program until you understand what's happening. Try changing *offset* in line 110 to 2 or 4. Can you think why

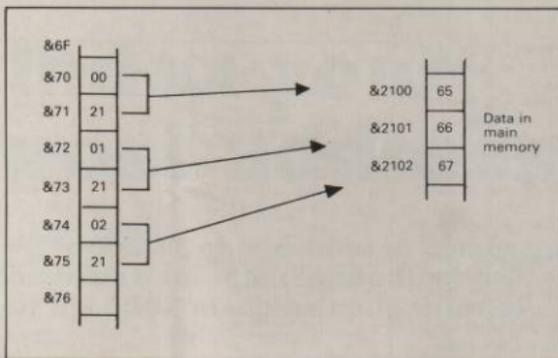


Figure IV: More letters and addresses

the value in the X register has to be an even number? And can you see the difference between post-indexed and pre-indexed addressing?

The first is useful to get at and move along tables of data in main memory (by way of a zero page indirection). The second picks one of a series of addresses held in zero page itself to point to a single location in main memory.

In the first the indexing begins after the start address of the table has been found - hence the post. In the second the indexing takes place first to decide which of several vectors in zero page is the required pointer to the effective address - hence the pre.

That, you'll be glad to know, is the last of the addressing techniques we'll be covering. And now back to Basic for a moment. Take a look at Program III.

```
10 REM Program III
20 MODE 6
30 pattern=670
40 ?pattern=ASC"
50 IF ?pattern=ASC" THE
N PRINT "=" ELSE PRINT "<"
"
```

It's fairly trivial. Depending on whether or not the Ascii code for an asterisk is in location &70, you get a cryptic message saying whether or not it's an

asterisk! Now I'm not saying that this is one of the Great Basic Programs of All Time, but it does have one thing that none of our assembler programs has.

It has the power of choice. Its actions vary with the circumstances. Should you change the value in &70 to the Ascii code for an asterisk then the message changes. We haven't attempted to give our machine code this ability to choose different courses of action. Program IV is an attempt to do this.

```
10 REM Program IV
20 MODE 6
30 codeStart=&2000
40 oswrch=FFEE
50 osnewl=FFEE
60 pattern=&70
70 ?pattern=ASC"
80 P?=codeStart
90 [
100 LDA #ASC"
110 CMP pattern
120 BEQ asterisk
130 LDA #ASC"<
140 JSR oswrch
150 LDA #ASC")
160 JSR oswrch
170 LDA #ASC"
180 JSR oswrch
190 JSR osnewl
200 RTS
210 .asterisk
220 LDA #ASC"
230 JSR oswrch
240 LDA #ASC"
250 JSR oswrch
260 JSR osnewl
270 RTS
280 ]
290 CALL codeStart
```

Now this looks fairly con-

vincing. After a brief Basic preamble setting up various values, the assembler is entered and the first instruction loads the accumulator with the Ascii code for an asterisk. The next instruction compares the value in the accumulator with that held in &70. This is followed by a jump, BEQ.

Should the values in the accumulator and the location be the same, then the result of the comparison is zero and the jump is taken to the label *asterisk*. From here the code just prints out the "=" message and returns to Basic.

Should the test fail then no jump occurs and the program goes on to perform the instructions straight after the BEQ. This results in "<" appearing and then the program returns to Basic.

At least that's the theory and it looks convincing. But try it and see. You'll find that the assembly fails with the message: *No such variable at line 120*.

Notice that I said it was the assembly that failed, not the code itself. While the code is correct - as we'll see in a moment - the poor assembler can't deal with it all in one go.

The problem lies in our reference to the label *asterisk* in line 120. When the assembler program comes across this for the

# Programming

first time it has no idea where *asterisk* is and grinds to a halt telling you so.

If you think about it, you'll see that until now all our leaps have been backwards to a label that the assembler had already come across. Here there's a forward leap to something that it's never heard of and the poor thing gives up in frustration.

The solution is to tell it not to worry, that it will eventually find the unresolved reference—as these forward labels are known in polite circles — and to carry on leaving a gap for the moment.

When it does find the recalcitrant label it is to make a note of the address, and later re-assemble the whole thing filling in the gaps in the light of this new information. This is known as two-pass assembly and it's shown in Program V.

Here the addition of lines 75, 95 and 285 have overcome the assembler's reservations and now the program works as desired. We've got our assembler programs taking decisions, choosing between two courses of action.

You'll see the forward references in the screen output when you run the program.

But now unfortunately, I've no choice but to bring this series to an end. We've come a long way since we began six months ago and as of yet we've hardly scratched the surface of assembly language programming.

Still for an introductory series we've covered a lot and you're now well grounded in the basics of assembly language and able to start programming on your own.

```

10 REM Program V
20 MODE 6
30 codeStart=82000
40 osvrc=8FFEE
50 osvnl=8FFEE
60 pattern=870
70 ?pattern=ASC**
75 FOR pass=0 TO 3 STEPS
80 PW=codeStart
90 [
95 OPT pass
100 LDA #ASC**
110 CMP pattern
120 BEQ asterisk
130 LDA #ASC**
140 JSR osvrc
150 LDA #ASC**
160 JSR osvrc
170 LDA #ASC**
180 JSR osvrc
190 JSR osvnl
200 RTS
210 .asterisk
220 LDA #ASC**
230 JSR osvrc
240 LDA #ASC**
250 JSR osvrc
260 JSR osvnl
270 RTS
280 ]
285 NEXT pass
290 CALL codeStart
    
```

## Program V

```

2000
2000
2000
2000 A9 2A LDA #ASC**
2002 C5 70 CMP pattern
2004 F0 13 BEQ asterisk
2006 A9 3C LDA #ASC**
2008 20 EE FF JSR osvrc
2009 A9 3E LDA #ASC**
2000 20 EE FF JSR osvrc
2010 A9 2A LDA #ASC**
2012 20 EE FF JSR osvrc
2015 20 E7 FF JSR osvnl
2018 60 RTS
2019 .asterisk
2019 A9 3D LDA #ASC**
201E 20 EE FF JSR osvrc
201E A9 2A LDA #ASC**
2020 20 EE FF JSR osvrc
2023 20 E7 FF JSR osvnl
2026 60 RTS
    
```

The output from Program V



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THE original Advanced User Guide was first introduced four years ago, instantly gaining status as the standard text for informed users of the Electron and BBC Micro.

At the time the Electron was Acorn's new baby, so new, that this first guide barely skimmed the surface of this remarkable little computer.

In fact, the Electron has more in common with early versions of its big brother than many imagine. Much of this stems from the fact that the Electron's OS 1.0 is a debugged version of the BBC Micro's OS 1.2 and its Basic is the greatly improved BBC Basic version II.

The New Advanced User Guide attempts to be all things to all men and women. In a weighty 442 pages, it covers the deeper features of the BBC Micro models, Master, Compact, B, B+ and Electron.

It opens in typical style with full description of assembly language and the Basic assembler. The full instruction set of the 6502 and its later derivatives — not used in the Electron — have been covered, each instruction given at least a page of explanation.

This makes the book an invaluable reference guide to 6502 assembly code in itself, although it does not aim to teach the language to the complete beginner.

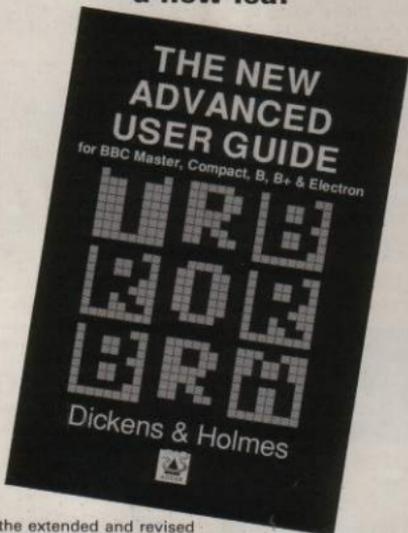
Having said that though, this is the sort of book that beginners would do well to avoid, lest they get bogged down by such heady subjects.

Following the assembly language section is an introduction to the operating system and a very detailed set of memory maps.

Without doubt the most useful part of the new guide

# Authoritative, but not all embracing

Mark Smiddy turns over  
a new leaf



is the extended and revised coverage of the operating system. It is in this particular area that the book specialises and where it really comes into its own.

The entire series of operating systems has been described in great detail. To make this necessarily complex subject a little easier to understand, the guide has been divided into 24 sections, each covering part of the hardware and the operating system calls provided to interface with it.

The design of the back cover allows it to fold inside the front of the book, this leaf containing a potted guide to the contents and summary of all of the operating system routines, addresses and vectors.

One of the finest features

written machine code written on an Electron should even work on Acorn's new Risc machine running the 6502 emulator, with little or no modification. I know of no other manufacturer who can boast that.

As far as the Electron is concerned, the real failing of this new text lies in its coverage of the hardware, where there are some startling differences between individual micros.

The design of the Electron centers around a large uncommitted logic array (ULA) designed specifically by Acorn.

This special chip handles all the hardware specific functions such as video, memory access, cassette interfacing and keyboard handling.

In the other BBC Micros these functions are handled by a variety of complex chips.

There is hardly a mention of the Electron's hardware in the entire book. Others do fill this gap, but I feel that in a book of this price it is a glaring omission.

One of the few pieces of Electron hardware covered is the Plus 1's cartridge port, although this is only given a passing mention because it is essentially the same as the one used in the BBC Master.

The detailed information given should be of use to anyone wishing to design cartridge type hardware add-ons for their computer, a user port for instance.

Although the book is not as Electron orientated as its cover might suggest, I found it to be a thoroughly good read and a worthwhile addition to my collection.

The text is clear and concise with diagrams thrown in where necessary. The author's style is authoritative without being at all condescending.

As good as it no doubt is, anyone who has already bought the original Advanced User Guide would be well advised to look long and hard at this one before buying.

of all Acorn machines is their upward compatibility with later designs. A precursor of this compatibility is that the programmer must use the operating system to perform special functions at all times.

Acorn even goes as far as providing routines to access the hardware registers and operating system variables. This means even if particular items change their locations in the overall memory map, properly written machine code will always work.

To this end the new guide provides a complete overview and comparison of the different operating systems now in use.

Surprisingly, correctly

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# FIRE! FIRE!

**PETER DAVEY**  
presents a  
**fascinating**  
**educational**  
**word game**  
for children

```

10 REM Fire! Fire!
20 REM By Peter J Davey
30 REM (c) Electron User
40 REM *DO NOT RENUMBER*
50 REM
60 REM
70 ON ERROR MODE6:REPORT:
PRINT at line "ERL:END
80 DIM w1$(2),w2$(2),x1(22),x2(2)
90 PROCinit:RESTORE1340
100 MODE5:VDU23,1,0;0;0;0;
19,3,6;8;19,0,4;0;:PRINTTAB(
4,1);:PROCdbl("Fire!Fire!");
PROCname:GCOL3,1;GCOLD,12;V
DUS:MOVExl,576;PRINT;eng$;6
COL3,3;PLOT69,ex1+40,580;VDU
4:COLOUR2:PRINTTAB(0,5);name
$
110 PROChouse:MOVED,580;DR
AW1280,588
120 REPEAT countI=countI+1
130 VDU28,0,31,19,25:COLOU
R130:COLOUR1:CLS:VDU26:GCOLD
,3;MOVE4,4;DRAW4,220;DRAW127
6,220;DRAW176,4;DRAW4,4;MOV

```

```

E672,220;DRAW672,4;MOVE4,144
:DRAW1276,144;MOVE4,80;DRAW1
276,80
140 IFScl<0 sct=0
150 COLOUR1:COLOUR128:PRIN
TTAB(1,28);:Complete the fra
me:COLOUR2:PRINTTAB(9,5);S
core:;scl; 'COLOUR1:COL
OUR130
160 PROCframe:PROCinput
170 IF I$=TRUE PROCcorrect
:GOTO220
180 PROCvj:PROCwpc:PROCfr
ane:PROCinput
190 IF I$=TRUE PROCcorrect
:GOTO220
200 PROCvj:PROCwpc:PROCfr
ane:PROCinput
210 IF I$=TRUE PROCcorrect
:GOTO220 ELSE PROCw:PROCwro
ng
220 PROCwpc:frameX=0;UNTI
L fin$
230 PROCanother
240 IF I$ GOTO90 ELSE MODE

```

```

6:END
250 DEFPROCframe
260 frameX=frameX+1
270 IF frameX=1 f1$(134)+(
countX-1)*10) ELSE330
280 RESTOREf1X
290 READ AS
300 IFA$=END countI=RE
STORE1340;GOTO290
310 a$=AS
320 FOR J$=0 TO 2:READ BS,
CS:w1$(J)=BS:w2$(J)=CS:NEX
T
330 PRINTTAB(1,24+(frameX
2));w1$(frameX-1);PRINTTAB(1
,24+(frameX2));w2$(frameX
1)
340 ENDPROC
350 DEFPROCinit
360 LX=0;JL=0
370 sct=0
380 finX=FALSE:frameX=0;f1
$=0;wong$=0;countI=0
390 s1X=20;crX=75;s1X=0
400 a$=
410 FOR J$=0 TO 2:w1$(J)=
"w2$(J)";:NEXT
420 VDU23,224,15,13,16,48,
48,112,112,227,23,225,192,19
2,255,135,135,135,135,255,23
,226,0,0,255,255,255,255,255
,255,23,227,127,255,255,255,
255,255,7,3,23,228,255,240,2
40,240,255,255,128,0,23,229,
255,63,63,63,255,255,60,24
430 eng$=CHR224+CHR225+C
HR226+CHR28+CHR28+CHR28+CHR
28+CHR227+CHR228+CHR229.
440 ex1=1088
450 REM POS OF ENGINE
460 ENDPROC
470 DEFPROCinput
480 OSL("FX21")+FX202,48
490 COLOURS:COLOUR128:PRIN
TTAB(4,22);:COLOUR2:TIME
=0;t1=0;S$=""
500 REPEAT K$=INKEY$
510 T$=TIME DIV 100:IF T$<
>t1 t1=T$:TX=PROCTIME ELSE t1
I$=T$
520 IF K$>31 AND K$<127 S$
=S$+CHRK$:PRINTTAB(6,22);SP

```

```

CT3:PRINTTAB(6,22);S$
530 IF K$=127 AND LEN S$ S
$=LEFT$(S$, (LEN S$)-1):PRINT
TAB(6,22);SPC14:PRINTTAB(6,2
2);S$
540 UNTIL K$=13 OR TIME DI
V 100=>22
550 IF S$=a$ I$=TRUE ELSE
I$=FALSE
560 PRINTTAB(6,22);SPC10:P
RINTTAB(17,1);
570 COLOUR1:COLOUR130;s1=0
580 ENDPROC
590 DEFPROCcorrect
600 COLOURS:COLOUR128:PRIN
TTAB(1,22);Well Done ;name
$;:FORdelay=110500:NEXT
610 FORsol=15602045STEP8:5
OUND1,-15,soL,1:NEXT:VDUS
620 sct$=sct+(10 DIV frameX
)
630 GCOL3,1;MOVEex1,576;PR
INT;eng$;GCOL3,3;PLOT69,ex1+
40,580
640 ex1=ex1+640IVframeX
650 GCOL3,1;MOVEex1,576;PR
INT;eng$;GCOL3,3;PLOT69,ex1+
40,580
660 IF ex1<=288 THENPROctH
ere
670 VDU4:PRINTTAB(0,22);SP
C(20)
680 ENDPROC
690 DEFPROCwrong
700 IF frameX=3 VDUS:GCOL3
,1;MOVEex1,576;PRINT;eng$;GC
OL3,3;PLOT69,ex1+40,580;VDU4
:PROCxplode:scl=scl+5(ex1DI
V100);:S$=1888;VDUS:MOVEex1,
576;PRINT;eng$;GCOL3,3;PLOT6
9,ex1+40,580;VDU4
710 ENDPROC
720 DEFPROCdbl(sbl$)
730 FORI$=1 TOLEN(sbl$,1)
740 T$=ASC(MID$(sbl$,I,
1));A$=10;X$=870;Y$=0;CALLLF
FF1
750 FORJ$=0 TO1:VDU23,255
760 FORK$=2109:VDU1(670+4
J$+K$DIV2);:NEXT
770 VDU255,10,0;NEXT
780 VDU11,11,9;NEXT

```

## Fire! Fire!

Roland Score: 0

Complete the frame  
->pie

shepherds	man
custard	eyed

**FRED the fireman often sits in Tumbletown Fire Station for hours on end waiting to be called for assistance. Unfortunately, he has come down with a nasty bout of flu, and you have agreed to stand in for him.**

Suddenly the phone, rings - someone's house is on fire, and it is quite some distance away. The aim of this educational game is to drive the fire engine to the house in time to put out the fire.

When you first start the game two words are displayed at the bottom of the screen. They combine with the answer to create a well

known catch phrase.

For instance, if Grand and Hunt are displayed the answer would be National: Grand National, National Hunt. Get the connection?

You have approximately 20 seconds to answer, and your remaining time is indicated by the rays of a sun slowly being drawn.

Answering correctly will increase your score and move your engine toward the house. If you fail, another two words will appear below providing further clues to the same answer.

In total, three sets of

words, or frames are displayed. Each time you guess incorrectly your potential score and engine movement is reduced.

If you fail to answer on the third frame you will have been too slow to save the house and it will burst into flames. If that happens three times poor Fred will be forced to sack you and thus end the game.

The words contained in this program are only intended to be examples. They are not aimed specifically at any age range, and changing them is quite simple. The data statements

from line 1320 to 1630 hold all the words. The format is:

```
1400 DATA Answer,word 1 frame 1,word 2 frame 1,word 3 frame 2,word 2 frame 2,word 1 frame 3,word 2 frame 3
```

Be careful to stick to the same start line number, or the program will not work properly. If you want more words than I have included add away until you run short of memory.

The only thing you must remember is to place END as a single data statement on its own as shown in line 1640, to tell the program there are no further words.

```

790 ENDPROC
800 DEFPROChouse
810 GCOLB,2:MOVE32,512:MOV
E256,512:PLOT85,32,784:PLOT8
5,256,784:GCOLB,1:MOVE32,784
:PLOT85,144,768:GCOLB,2:MOVE
64,784:MOVE224,784:PLOT85,14
4,744
820 GCOLB,3:MOVE64,512:MOV
E96,512:PLOT85,64,576:PLOT85
,96,576
830 GCOLB,0:MOVE128,544:MO
VE224,544:PLOT85,128,576:PLO
T85,224,576:MOVE148,608:MOVE
124,608:PLOT85,168,672:PLOT8
5,224,672:MOVE64,648:MOVE128
,648:PLOT85,64,672:PLOT85,12
8,672
840 GCOLB,1:MOVE144,544:DR
AW144,576:MOVE208,544:DRAW20
8,576:MOVE128,566:DRAW144,56
6:MOVE208,566:DRAW244,566:MO
VE128,544:DRAW224,544:DRAW22
4,576:DRAW128,576:DRAW128,54
4
850 MOVE160,608:DRAW224,60
8:DRAW224,672:DRAW160,672:DR
AW160,608:MOVE160,648:DRAW22
4,648:MOVE192,648:DRAW192,67
2:MOVE64,648:DRAW128,648:DR
A128,672:DRAW64,672:DRAW64,6
80:MOVE64,662:DRAW128,662
860 ENDPROC
870 DEFPROCexplode
880 wrong=wrong+1
890 COLURS:COLUR128:PRIN
TTAB(1,22):Wrong :name$:PR
INTTAB(1,23):Answer$:a$
900 MOVEND(288),RND(256)+
512:MOVEND(288),RND(256)+51
2
910 FOR K1=1 TO 100
920 GCOLB,RND(4):PLOT85,RN
D(288),RND(256)+512
930 SOUND0,-15,RND(8),1
940 NEXT
950 PRINTTAB(0,22):SPC(40)
960 VDU28,0,15,4,7:COLUR1
28:CLS:VDU26:COLUR130
970 IF wrong=3 PROCend
980 PROChouse
990 ENDPROC

```

```

1000 DEFPROCthere
1010 VDU4:PROCgt
1020 COLUR2:COLUR128:PRIN
TTAB(5,17):Well Done!
1030 COLUR3:PRINTTAB(2,19)
:You have stopped!
1040 PRINTTAB(0,20):SPC(20)
1050 PRINTTAB(5,20):The F
ire..
1060 COLUR2:PRINTTAB(9,5):
Score$:scx$
1070 fin$=TRUE
1080 ENDPROC
1090 DEFPROCanother
1100 *FX21,0
1110 PRINTTAB(1,23):"Anothe
r game?Y/N"
1120 REPEAT UNTIL GET
1130 IF GET=89 IX=TRUE:ENDP
ROC
1140 IF GET=78 IX=FALSE:ELS
E 1120
1150 ENDPROC
1160 DEFPROCend
1170 PROCbt
1180 COLUR2:COLUR128:PRIN
TTAB(5,17):Bad Luck!!
1190 COLUR3:PRINTTAB(2,19)
:You havn't been!
1200 PRINTTAB(0,20):SPC(20)
1210 PRINTTAB(0,20):"quick
enough to put"
1220 PRINTTAB(3,21):"out th
e fires."
1230 COLUR2:PRINTTAB(9,5):
Score$:scx$
1240 fin$=TRUE
1250 ENDPROC
1260 DEFPROCw
1270 FORsc=156TO108STEP-8:
SOUND1,-15,sc,1:NEXT:ENDP
ROC
1280 DEFPROCbt:RESTORE1320
1290 FORst=1T011:READ p$,d$
: SOUND1,-15,p$,d$:NEXT:ENDP
ROC
1300 DEFPROCgt:RESTORE1330
1310 FORst=1T08:READ p$,d$
: SOUND1,-15,p$,d$:NEXT:ENDP
ROC
1320 DATA 52,7,0,0,52,7,0,0
,52,4,52,4,68,5,68,7,52,7,48
,4,52,7
1330 DATA 81,3,101,3,117,3,
129,5,117,4,129,5,117,4,129,
10
1340 DATA pie, shepherds,ma
n,custard,eyed,meat,chart
1350 DATA ball,wolley,point
,tennis,cock,foot,room
1360 DATA star,death,wars,f
ilm,trek,pop,dust
1370 DATA band,rubber,stand
,elastic,leader,big,aid
1380 DATA user,electron,bas
e,micro,port,acorn,friendly
1390 DATA star,jig,mill,chai
n,dust,circular,fish
1400 DATA fish,cod,fingers,
place,cakes,mackerel,pte
1410 DATA ice,chor,cream,bl
ack,cube,cracked,lolly
1420 DATA rose,red,bud,gold
en,pink,white,tree
1430 DATA head,big,band,ach
y,land,bald,line
1440 DATA so,suppose,far,ho
pe,good,say,long
1450 DATA soap,soft,box,bz,
h,flakes,washing,bubble
1460 DATA say,they,much,don
t,out,couldn't,on
1470 DATA 40,years,bean,qu
ite,england,very,school
1480 DATA pack,back,up,lunc
h,off,ice,iti
1490 DATA net,fishing,ball,
goal,curtains,hair,weight
1500 DATA board,black,room,
hard,game,card,meeting
1510 DATA man,police,slaugh
ter,fire,power,super,hole
1520 DATA paper,newsp,plates
,toilet,bag,tissue,hat
1530 DATA engine,steat,driv
er,fire,house,traction,overh
aul
1540 DATA mail,order,ro
yal,bag,daily,box
1550 DATA metal,corroded,al
loy,iron,ore,sheet,rails
1560 DATA window,fridge,box
,bay,sill,saah,leash
1570 DATA water,hot,mill,se

```

```

a,works,fresh,ski
1580 DATA time,tea,table,ho
liday,share,school,machine
1590 DATA farm,pig,house,sh
eep,land,country,labour
1600 DATA food,dog,potion,h
ot,hall,fast,stuff
1610 DATA plant,house,pot,n
uclear,hire,industrial,house
1620 DATA flour,plain,mill,
wholened,bag,potatote,jar
1630 DATA dog,sheep,collar,
aisation,bowl,collie,brush
1640 DATA END
1650 DEFPROCname
1660 COLUR1:PRINT"" type
in your name"" and then
press"" RETURN."
1670 *FX21,0
1680 COLUR2:INPUT""="no
name$:IF name$="" THEN name$=""
No name"
1690 name$=LEFT$(name$,8)
1700 VDU28,0,15,19,4:CLS:VD
U26
1710 ENDPROC
1720 DEFPROCtime
1730 VDU29,1200,900;
1740 MOVErat,0
1750 MOVE10,10
1760 GCOLB,2
1770 st$=t+1
1780 a=(st-1)*2+PI/siX
1790 X(st)=rat+COS(a)
1800 Y(st)=rat+SIN(a)
1810 MOVE0,0
1820 PLOT85,X(st),Y(st)
1830 VDU29,0;0;
1840 ENDPROC
1850 DEFPROCwipe
1860 GCOLB,0
1870 LOCAL iX,iY
1880 FOR iX=900+rAt TO 900-
rAt STEP-4
1890 iY=SQR(ABS(rAt+rAt-(iX
-900)*(iX-900)))
1900 MOVE 1200-iX,iY
1910 DRAW 1200-iX,iY
1920 NEXT
1930 MOVE 1200,900
1940 GCOLB,3
1950 ENDPROC

```



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4. Who is the adventure expert in Electron User?
5. What word appears under the Y key?

electron  
user

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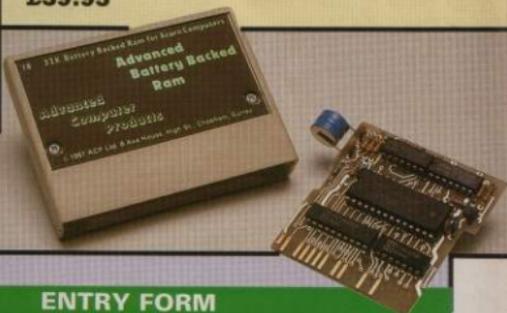
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ANSWERS

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_
- 3 \_\_\_\_\_
- 4 \_\_\_\_\_
- 5 \_\_\_\_\_

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

\_\_\_\_\_

POSTCODE

Please supply 5.25in disc/3.5in disc  
(delete as applicable)

Return to: PRES Competition, Electron User, Europa House, Adlington Park, Adlington, Macclesfield SK10 4NP.

Where would we be without the Basic rom? If it wasn't there, the Electron would be no more than a useless box full of silicon chips, resistors and capacitors.

But how many Electron users really know what is going on inside it when we enter and run a program? If we know how it works we can make better use of it and tap its many hidden facilities.

This series of articles will document some of the many hundreds of sub-routines within the Basic rom, and also show how to call them from within your own programs.

To make the most of the information provided you'll need to know a fair amount of 6502 machine code, as the only way of calling the routines is from within a machine code program. However, I'll try to keep the code to a bare minimum.

This month I've written a short program to demonstrate how Basic - and you - can list a program in memory. To see it in action enter Program Lister and run it - not forgetting to save it first just in case you make a typing slip and the micro crashes.

You'll be prompted for the filename of a Basic program to load. Enter the name of the one you want to list and it will be loaded from disc or tape. When this is done it will be printed on the screen.

The program is loaded to &3000, so you can change PAGE to &3000 and list it to check that it really is there. Now let's see how the utility works.

First you need a thorough understanding of the way Basic stores its programs in memory. Each line is separated by a carriage return character, &0D. This marks the program start and each successive line.

After the carriage return comes the line number, which is stored in two bytes. Hot on its heels is the length of the line, and as it's always less than 256 bytes long

# A matter of routine



## ROLAND WADDILOVE starts a new series on how to take best advantage of your micro's rom routines

only one byte is used. Finally comes the actual text of the line.

All the Basic keywords like PRINT, INPUT, REPEAT and so on are tokenised - reduced to a single byte. Everything else is stored as Ascii characters. The only exception is line numbers following GOSUBS and GOTOs, which are also compacted.

To list a program, we need to print the line numbers and Ascii characters, expand the keyword tokens, and decompact the line numbers if there are any GOSUB or GOTOs.

Figure 1 shows a short Basic listing and the bytes stored in memory. You can see from this how the lines are compacted to conserve

memory, and also speed up program execution.

Five subroutines in the Basic rom are used to list the program. The first, called *pinum5*, is used to print out the line number and is located at &9923.

To use the number must first be transferred to Basic's integer workspace at &2A - *IntA*. The code will look something like this:

```
LDA linenum
STA &2B
LDA linenum+1
STA &2A
JSR pinum5
```

where *linenum* is the address of the line number. Note that it is stored high byte first followed by the low byte - completely the

wrong way round as far as the 6502 is concerned, as normally 16 bit numbers are stored low byte, high byte. The bytes have to be swapped round when transferred to *IntA* at &2A.

After outputting the line number the rest of the text is printed. Each byte is examined to see if it is &8D or &0D. If not, it is sent to *ptoken* at &B50E.

This routine will decide whether the byte is an ordinary Ascii character or a Basic token and either output the character or print the whole Basic keyword. Quite a useful little sub-routine.

The two special cases, &0D and &8D are handled in different ways. The former indicates the end of the cur-

rent line, so we move on to the next. The latter indicates that the following three bytes contain a compacted line number.

If this is the case it is decompact and transferred to *IntA* using *getlna* at &97DF. Once there it can be printed by calling *plnum0*, a similar routine to the one used for the line number.

The only thing I haven't mentioned is Basic's pointer *PTRA* at &0B/0C. This is used - along with an index at &0A - by Basic to keep track of where it's up to when running a program.

When we call *getlna* we need to set *PTRA* to point to the compacted line number.

If you look at the listing you'll see that I've used *PTRA* to keep track of where I'm up to in the listing just like Basic, so everything is already set up for *getlna*.

The only drawback is that you must save the value of *PTRA* and *index* at the start of the program and restore them before returning to Basic.

Program Lister simply demonstrates a few rom routines. However, there is plenty of scope to develop it into a powerful utility.

For instance, how about highlighting all Basic keywords in colour? Or printing them in inverse on the printer. You could try outputting separate statements on a fresh line for easy reading.

Or adapting the routine to list programs directly from disc without first loading them into memory. Or spooling them. Or ... the possibilities are endless.

Routine	Input parameters	Output parameters
<i>getlna</i> =&97DF Get tokenised line number	<i>PTRA</i> points to number	<i>IntA</i> =number, <i>PTRA</i> points to next character
<i>plnum0</i> =&991F Print line number	<i>IntA</i> =line number	None
<i>plnum5</i> =&9923 Print line number in field of five spaces	<i>IntA</i> =line number	None
<i>ptoken</i> =&B50E Print byte as character or Basic keyword	A register=byte	None

The rom routines used

10 REM Program Lister	330 LDA #830:STA PTRA+1	650 JSR ptoken
20 REM By R.A.Weddilove	340	660 INC index
30 REM (c) Electron User	350 !Main loop	670 JMP nextchar
40 MODE 6	360 !loop	680 !print line num
50 !MEM=&E3000	365 !skip 1st &0D	690 !tokenline
60 PROCassemble	370 INC index	700 JSR getlna
70 INPUT "Filename";name\$	380 LDY index	710 JSR plnum0
80 OSCLI "LOAD '"+name\$+'"	390 LOA (PTRA),Y	720 JMP nextchar
3000	400 !end of program?	730 !print CR/LF
90 CALL code	410 CMP #FF	740 !endline
100 END	420 BEQ exit	750 JSR osascii
110	430 !Put line num inIntA	760 !PTRA --> next line
120 DEF PROCassemble	440 STA IntA+1	770 CLC
130 osascii=&FFES	450 INY	780 LOA index
140 PTRA=&0B	460 LOA (PTRA),Y	790 ADC PTRA
150 index=&0A	470 STA IntA	800 STA PTRA
160 IntA=&2A	480 !Print line number	810 LDA #0
170 getlna=&97DF	490 JSR plnum5	820 STA index
180 plnum=&991F	500 !point to text start	830 ADC PTRA+1
190 plnum5=&9923	510 INC index	840 STA PTRA+1
200 ptoken=&B50E	520 INC index	850 JMP loop
210 FOR pass=0 TO 2 STEP2	530 INC index	860
220 PS=&000	540 !get next character	870 !back to Basic
230 COPT pass	550 !nextchar	880 !exit
240 !code	560 LDY index	890 PLA:STA PTRA+1
250	570 LOA (PTRA),Y	900 PLA:STA PTRA
260 !Save current PTRA	580 !is it end of line?	910 PLA:STA index
270 LOA index:PHA	590 CMP #0D	920 RTS
280 LOA PTRA:PHA	600 BEQ entline	930 !
290 LOA PTRA+1:PHA	610 !or tokenised Linenum?	940 NEXT
300 !PTRA=&E3000	620 CMP #0D	950 ENDPROC
310 LOA #00:STA index	630 BEQ tokenline	
320 STA PTRA	640 !print char or token	

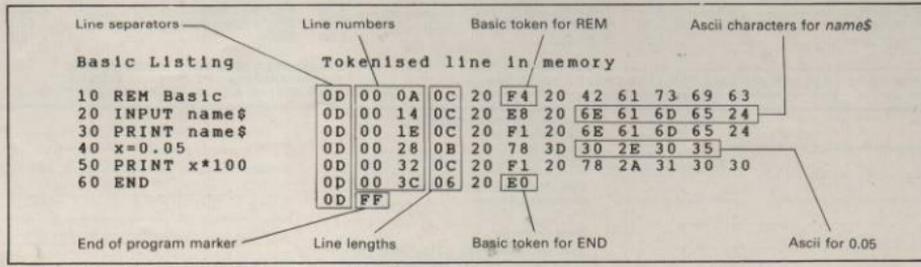


Figure 1: A Basic listing and its tokenised form as stored in memory



# 21st. Software



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## Brain-teasing software

Programs: *The Times Computer Crosswords* Volume 1/2/Jubilee Puzzles

Price: £14.95 (disc) £9.95 (tape)

Supplier: Akom/Pres, 6 Ava House, High Street, Chobham, Surrey GU24 8LZ

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DURING the past 58 years The Times Crossword has become part of the great British tradition in cerebral eccentricity. Indeed, for many people it has become part of their way of life. I know at least one friend who feels that his day has not really begun until he has completed that morning's Times crossword.

I suppose it was only a matter of time before these magnificent word puzzles found their way on to the micro. They have now arrived in all their glory with 60 crossword puzzles on each of volumes one and two, and 56 puzzles on the Jubilee edition.

In fact, the Jubilee Puzzles should become a valuable collector's item, as they feature one superb crossword taken each year from 1932 to 1987 inclusive. The effort involved to bring all these crosswords to your computer is quite a feat in itself.

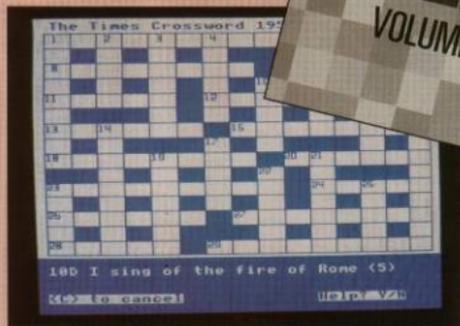
I remember stolidly typing in a crossword compiler from the October 1986 issue of *Electron User* and being astounded at the clever programming used by its author. However, that was child's play compared to the labours of David Akenhead who is the creator of this fine collection.

This software is not just for the expert crossword solver, thanks to comprehensive instruction booklets and four graded levels of play. In fact you need not solve the crosswords at all, but simply investigate, clue by clue, the construction of each puzzle.

The Times Computer Crosswords could also have an educational application within the sphere of vocabulary extension at GCSE level English.

Reading the instructions is an essential prerequisite to play, as the programs operate some clever options. The booklets contain a glossary of convention indicators and abbreviations used within the puzzles, as well as an introduction to the devices used in cryptic crosswords.

Upon loading the disc or cassette



you are presented with an introductory page and then asked to insert the puzzle number of your choice. With over 170 crosswords to choose from, in these three packages, you are rather spoilt for choice!

I suggest that all players attempt puzzle number one to begin with, as a blow by blow analysis is contained within the instruction booklet. This also gives an insight for novices into the construction and convention indicators used within such a puzzle.

Upon choosing your crossword the grid is assembled in stunning clarity, a score line is set to zero and an invisible clock begins timing your progress.

The instruction *Insert clue number* appears, with the accompanying option of down or across. You are now operating at level one and the clue appears together with the words *Help? Y/N*.

If you enter N you may then go ahead and attempt to solve the clue, for which you will be awarded 50

points for a correct solution or a time penalty if incorrect.

If you answer Yes, you proceed to level two of the program and a marker option is presented. If this is accepted you may enter any letters you know and fill any spaces in that answer with chevrons.

You may of course, return to that clue later in the game. If however, you solve it at this level, 40 points are awarded.

Should you decline the marker option the program assumes you require more help. Now at level three you may ask for a convention indicator and may solve the clue for 30 points or mark as before.

However, if you are still stuck, you are offered the solution to that clue, which, if accepted, is printed in the grid and 30 points are deducted from your score.

Conversely, you may continue to level four where the first letter of the

Turn to Page 22 ▶

◀ From Page 21

answer is printed in the grid. This gives you the opportunity to solve the clue for 10 points.

You may leave the game at any level, in which case the screen clears to reveal an analysis of your performance. This appears in terms of time taken, the number of clues solved by both yourself and the computer, the score and an assessment of your expertise in the categories: Beginner, average, good, very good and expert.

You are also offered the option of viewing the entire solution before progressing to another puzzle or leaving



the program. The graphic representation in these puzzles is attractive and precise and computer response time is extremely fast.

This must be the crossword

equivalent to White Knight or Colossus Bridge. To be compared to those two masterpieces in serious games programming is a true testament to the quality of The Times Computer Crosswords.

Whether you are of championship status in the art of solving cryptic crosswords or a novice to this genre, these packages represent excellent purchases.

**Nic Outterside**

Presentation .....	9
Documentation .....	9
Ease of use .....	9
Value for money .....	10
Overall .....	9

## Challenging adventure

*Program: The Taroda Scheme*  
*Price: £7.99 (3.5in disc Electron, 5.25in disc BBC Micro)*  
*Supplier: Heyley Software/Pres, 6 Ava House, High Street, Chobham, Surrey GU24 8LZ*  
*Tel: 0276 72046*

THE Taroda Scheme is the fourth of Heyley's adventures originally released for the BBC Micro to be converted to run on the Electron with standard disc systems.

It comes on disc in plain packaging with an extremely useful leaflet which gives background information and provides an atmospheric and amusing introduction to the adventure. Comprehensive Help sheets are also available.

The Taroda Scheme is set in the year 10340 AD, long after the destruction of Earth. Taroda was one of many

planets colonised by humans centuries previously. It is now an important source of methane gas and an ore known as strykalite, which is exported as barbecue lighting fuel to the planet Sartravaag.

Your fairly mundane mission is to make the five-yearly check on the system of Taroda to ensure that all is well. As you can probably guess, it isn't going to be!

You begin your adventure on the bridge of your spacecraft on its journey to Taroda. A quick glance at the vide-screen shows that something large and ominous is on a collision course with your ship.

This beginning is something akin to Robico's Enthar Seven or The Hunt, as you scramble together belongings and find a safe way to leave your doomed craft. I suggest you thoroughly SEARCH the desk in your quarters, take the shower operating unit from the bathroom and gain some sustenance before escaping.

On the planet you will soon discover the first of many corridors which could pose a really suffocating problem. In order to continue, you must find a plan and read it carefully. This is a variation of the Snark tunnel problem in Acornsoft's Kingdom of Hamil.

Room descriptions and messages are lengthy and well written, and you only have to examine the items which are presented in magenta text.

Everything about this adventure

contains a refreshing smattering of wry comedy. The only time this sank to the depths of lavatorial humour was when I discovered a suction toilet in the bathroom, "to avoid those low gravity accidents".

However, the following is a prime example of good response to correct input: "As the soup touches your tongue it liquefies and trickles down your throat. Suddenly something hard and angular sticks in your mouth and you spit it out, choking violently. A wave of deja-vu hits you, with an image of a cold stone room".

I must admit that I loved the idea of the MentOp system which allows for ESP thought processes to operate equipment. I also chuckled at the kick-erboots for which an intergalactic soccer thug would give his one remaining tooth. It is sobering to later find a compact disc as an item of antiquity.

The Taroda Scheme has more than 230 locations, nearly 100 objects and 200 messages, and should provide a real challenge to any discerning adventurer.

Problem construction is excellent, although the parser seems rather limited, especially regarding synonyms for the nouns, and I did discover a few spelling mistakes.

However, with a little more polish and development, Heyley could soon challenge Robico, Level 9 and Infocom as serious producers of micro adventures.

**Pendragon**

Presentation .....	6
Atmosphere .....	8
Frustration factor .....	8
Value for money .....	9
Overall .....	8



## Breaking out again

**Product:** Round Ones

**Price:** £1.99

**Supplier:** Alternative Software, Unit 3-6,

Baileysgate Industrial Estate, Pon-

tefract, West Yorkshire.

**Tel:** 0977 797777

ONCE upon a time, just about at the dawn of time as far as computers are concerned, there was a simple, but addictive little arcade game called Breakout. In it you controlled a bat and had to hit a ball which bounced off various blocks and destroyed them.

The Breakout idea vanished into the wilderness for about five years, but has now re-appeared in a number of guises. Alternative's Round Ones - actually called Spheroids on the title screen - is the latest addition and comes in at the budget end of the market.

In this latest version, the bat has become a Block Assault Transport and the ball is a Block Assault Laser Launch (Gettit?). Many of the blocks are simple and require one hit by the

ball to destroy them. Others, coloured yellow, require two or more hits.

Red blocks increase the speed of the ball while black ones release a driblet. Catching these can increase the size of the bat (although it might reduce it at other times) or they may cause the entire screen to explode - I'll leave it for you to discover which driblet does what.

Destroying all of the blocks on one screen will move you to the next. When you have completed eight screens the next set is automatically loaded from the cassette. There are some 100 or so to master in all.

The second and subsequent sets of screens introduce new hazards. Lasers fire at you and multi-coloured confictors can cause havoc with the ball. Your force field protection will come in very useful, but this is in limited supply and must be used sparingly.

It's a tough game, so the programmers have supplied you with nine badly needed lives. It took me ages to master just the first screen, and I frequently lost the balls one after



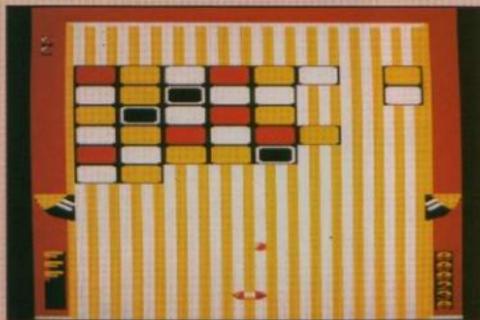
the other in record time. Fortunately there is an option to alter game speed.

The quality of Alternative's games has certainly improved recently and Round Ones will make a worthy addition to your collection.

I have one major gripe about the game, which features some really clever multi-coloured backgrounds. They look superb, but can act as an almost total camouflage for the ball. I feel the game would have been better with simple plain coloured backgrounds. Oh, and I must mention the awful music, it's painful to listen to.

**Rog Frost**

Graphics.....	7
Sound.....	4
Playability.....	8
Value for money.....	9
Overall.....	8



## Science fiction jaunt

**Program:** Stranded!

**Price:** £7.99 (3.5in disc Electron, 5.25in disc BBC Micro)

**Supplier:** Heyley Software/Pres, 6 Ava House, High Street, Chobham, Surrey GU24 8LZ

**Tel:** 0276 72046

STRANDED - not to be confused with the Micropower adventure of the same name - is Heyley's latest release and was originally programmed for the Acorn Archimedes.

It follows the tradition of The Taroda Scheme reviewed opposite, and is a

science fiction jaunt set in the far future.

The improved loading and response time impressed me, as did the excellent opening scenario. It is obvious that Howard Roberts has been back to the drawing board and come up with a real gem this time.

Once again you begin the adventure trying to escape from a spacecraft in orbit around a strange planet. You are imprisoned in a hold of the Starfreighter Etoile, with a fat guard keeping a very close eye on you.

It took a lot of experimentation and over an hour of key tapping before I

gave up in exhaustion at my failure to escape from the hold. I eventually resorted to Heyley's generous Help sheet and discovered that I had a fair amount of waiting to do.

I feel that without such help, many novice adventurers would have given up this taxing adventure as a bad job. Stranded is definitely not for the faint-hearted.

Having made my escape I then explored the rest of the spacecraft, killing the crew along the way, before crash landing on the surface of the

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alien planet. But first ensure that you are carrying the photon-emitter and the blueprints.

It is only then that the fun really does begin. I discovered some quite off-the-wall ideas in this game which were somewhat reminiscent of Level 9's *The Worm in Paradise*. Indeed the whole adventure is sprinkled with humour, which has become something of a Heyley trademark.

For instance, in order to carry the hole you must first possess the anti-common sense. You will have to build an escape craft called appropriately enough, a tin can. A box of anger also

has a quite obvious use.

This adventure kept me awake for many hours and was the cause of some rib-tickling chuckles. However response to incorrect input was often sobering. I was often told off by the computer for being too brief: "What sort of English is that? I don't think you are taking full advantage of the full sentence parser, are you?"

However, despite my praise of this game I still have a few criticisms concerning the development of Heyley's parser. It seems crazy that upon typing in REST, the game went into Restore mode.

Equally when I typed PUSH BUTTON at the wrong location, the response was "Nothing happens"

rather than "I cannot see a button here". Perhaps this is nit-picking, but maybe I am right in suggesting that Heyley employ a few more proof readers to correct such embarrassments.

Stranded is a large adventure with constant disc access to allow more than 220 locations and 450 messages. It is undoubtedly the best that Heyley have produced to date.

**Pendragon**

Presentation	6
Atmosphere	8
Frustration factor	9
Value for money	9
Overall	8

## Blasting bargain

Product: *Anarchy Zone*

Price: £2.99

Supplier: Atlantis, 28 Station Road, London SE25 5AG.

Tel: 01-771 8642

AFTER four years you might imagine that every possible variation of the space shoot-'em-up scenario had been used. However, here comes yet another action packed, if-it-moves-blast-it type game with a slightly different slant on those old favourites, *Space Invaders* and *Galaxians*.

It's called *Anarchy Zone*, and is released on the Atlantis budget label. This time the Galactic Government Dictatorship has divided up the galaxy into separate zones, and within these space travellers must restrict their flight paths to predefined routes.

Anyone straying from these narrow space lanes is liable to be fired on, and guess who has wandered into deep space? Yes, you have, and you are now under attack by wave after wave of all manner of alien vessels, all armed to the teeth with lasers, bombs and missiles.

The screen is split into two areas. The larger one is where the action takes place, while the smaller contains the score, power and remaining bonus.

You start off with your ship at the bottom of the display, and an alien battle fleet streams on to the screen, guns ablaze. You can move left and right and blast them with your own laser.

This may seem pretty ordinary so far, but where this game is different is that while the aliens swarm round the screen you can circle them, climbing up the sides of the screen and zooming across the top to attack them

from the rear. Some aliens require several hits before they explode, and some seemingly indestructible ones will have you scratching your head trying to work out how to destroy them - if you can take your hands off the keyboard, that is.

On wiping out a wave of aliens a new one appears with a different battle formation without giving you time to get your breath back, and it's into battle again.

At the start of each new zone a pass-



word is given, and this can be used to skip screens you've already mastered. This prevents the game from becoming tedious as you can continue from the screen you were finally destroyed in last time.

The graphics are excellent, with brightly coloured alien ships and an attractive control panel on the right. The sound effects are good, too.

The action is fast and furious and I was quite surprised at the speed achieved on a standard Electron - no need for a Turbo board here, it's quite

fast enough for me, thank you.

At only £1.99 this must rate as a superb bargain arcade game that mustn't be missed. If you like fast action arcade games you'll be quite at home with this and I can thoroughly recommend it.

**Roland Waddilove**

Sound	8
Graphics	9
Playability	9
Value for money	10
Overall	9

A GAME in ViewSheet? "Impossible", I hear you cry. Well, improbable perhaps, but it's certainly possible if a little thought, patience and ingenuity is applied to the task.

Bulls and Cows is a variation of that old board game in which you have to guess a hidden secret code made up of coloured pegs.

In this ViewSheet version a four-digit secret code is input by another player while you're not looking, and you are allowed a set number of tries in which to guess both the digits and their correct positions within the code.

(ViewSheet has no random number generator function, so the micro is unable to generate the code itself).

Once the code is entered ViewSheet will score your guesses properly according to the rules of the game. One bull will be awarded for every digit found in the right place, and one cow for every correct digit, but in the wrong place. You get nothing for a digit not in the code.

Duplicity is not allowed - that is, you won't get both a bull and a cow for a correct digit found in the right place.

There are one or two

# When the boss is away . . .

**CHRIS NIXON attempts to reveal the lighter side of a very popular business package with a simple game written entirely in ViewSheet**

minor restrictions or differences from the original game. Firstly, no digits in the code may be repeated, as this would confuse the formulae responsible for scoring.

Secondly, you can change as many or as few of the digits at a time as you wish, as each change to a slot is counted as one guess.

You are allowed 32 guesses before losing the game, which in fact is the

equivalent of eight guesses of four digits each.

The game is won as soon as you have scored four bulls, and if you want to make it harder you can change the number of guesses allowed. I'll explain how to do this later.

To set up the game enter ViewSheet with \*SHEET and type in the listing. For those who missed our four-part ViewSheet series which started in the March 1988 issue of *Electron User*, you simply start at the top of the listing and move the slot cursor to the coordinate shown on the left using Func+E/X/S/D for up, down, left and right.

Then enter - exactly as shown - the contents for that slot on the right. Work down the listing until everything is entered, and you should have a sheet which in Mode 3 looks like Figure 1.

It will help if you press Func+V twice to tell ViewSheet to move down to the next slot automatically.

Bulls and Cows is now ready to be played in Mode 6, so the secret code contained in the range E5-E8 cannot be seen.

There is nothing to stop anyone from cheating, but it defeats the object of the



game and will spoil the fun.

To add your own or a friend's code, move the slot cursor to E5, type the first digit and press Return. Then move to the slot below, and enter the second digit. Repeat this for the two remaining digits and you are almost ready to play.

Immediately before playing each game the *Guesses* counter must be reset to zero. To do this, move to slot E1 and press Func+P to delete it. This will already be blank after entering the listing, but it's a good idea to practice the reset operation now.

Next, move to slot C15 and delete it with Func+P and type:

C15=E1

Now move back to E1 and enter the digit 1. This is used by slot C15, which simply adds slot E1 to itself each time a value is entered into the sheet, effectively creating a counter.

Bulls and Cows is now ready to play, so press Escape and make sure ViewSheet is in Mode 6 before re-entering edit mode to begin the game.

The screen should now

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Slot	Contents
A1	BULLS &
A2	-----
A5	PEG 1
A6	PEG 2
A7	PEG 3
A8	PEG 4
A11	BULLS:
A12	COWS:
A15	GUESSES
A16	GAME IS
A17	GAME IS
B1	COWS BY
B2	-----
B4	YOUR
B5	0
B6	0
B7	0
B8	0
B11	F5F8
B12	G5G8-F5F8
B15	MADE:
B16	WON:
B17	LOST:
C1	CHRIS

Slot	Contents
C2	-----
C4	GUESS:
C16	IF (B5=E5,1,0)
C17	IF (C15=33,1,0)
D1	NIXON
D2	-----
E3	ANSWER:
E4	-----
E5	3
E6	5
E7	7
E8	8
F3	BULLS:
F4	-----
F5	IF (B5=E5,1,0)
F6	IF (B6=E6,1,0)
F7	IF (B7=E7,1,0)
F8	IF (B8=E8,1,0)
G3	COWS:
G4	-----
G5	(B5=E5)+(B5=E6)+(B5=E7)+(B5=E8)
G6	(B6=E5)+(B6=E6)+(B6=E7)+(B6=E8)
G7	(B7=E5)+(B7=E6)+(B7=E7)+(B7=E8)
G8	(B8=E5)+(B8=E6)+(B8=E7)+(B8=E8)

# Game

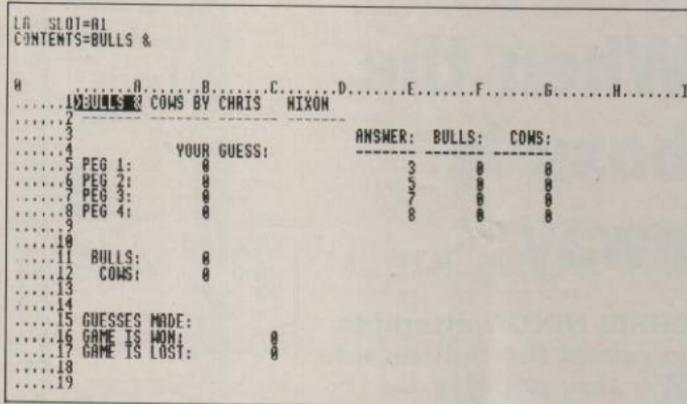


Figure 1: The screen display after entering the listing

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look like Figure 11, and you can see that the secret code is hidden off the edge of the screen window.

Move the slot cursor to B5, and enter your first guess. Type it in digit by digit, pressing Return after each one. Wait for the slot cursor to advance before typing the next digit, or ViewSheet will not register the entry.

It's best to wait until all four digits have been entered before looking at the bulls and cows score in slots B11 and B12, because these will be changing as you enter each digit, and may contain incorrect information until the final digit has been typed in.

Always check slot C16, the *Game is won* flag. It will always contain a zero unless four bulls have been scored, in which case it will change to a one.

This is your only prompt that you have won the game, apart from seeing if the Bulls slot at B11 has reached four. ViewSheet cannot cease execution — unlike Basic — so although you could carry on playing after this point, the results would be meaningless.

Also remember to check slot C17, the *Game is lost* flag. As soon as you have had 32 guesses — or eight

lots of four guesses — this slot will change from a zero to a one. Again, this can be ignored as ViewSheet is incapable of stopping you from playing.

You'll probably find a piece of paper useful for keeping track of your previous guesses. Due to ViewSheet's lack of indirection pointers there was no easy way to display the progress of the game on the sheet itself — each guess must be overtyped on top of the previous entry.

To change the number of guesses allowed, move to slot C17 and press Copy. The slot contents will

appear in the editing line, and should look like this:

```
IF(C15=33,1,0)
```

Move to the 33 using the right arrow key, and overtype this value with the number of guesses you would like. I suggest trying to keep this as a multiple of four, plus 1, to keep things sensible. Press Return to enter the alteration back into the sheet.

After winning or losing a game, always reset the sheet exactly as described earlier. If the steps are carried out in the wrong order, the GUESSES counter may hold an incor-

rect value at the start of the next game.

The techniques used in Bulls and Cows are more advanced than those covered in our recent ViewSheet series, and unfortunately I haven't the space to go into how the game works here.

However, I can thoroughly recommend the book ViewSheet and ViewStore — A Dabhand Guide from Dabs Press, reviewed in the June 1988 issue of *Electron User*.

It's an excellent guide to understanding the IF structures at the core of the game.

Perhaps this application has opened your eyes a bit more as to just what is possible with ViewSheet.

This feature was intended primarily to illustrate the flexibility of decision-making from within a spreadsheet. But it was also my intention to surprise a few sceptics who would otherwise have laughed at the idea of producing a playable game in ViewSheet.

Although it is ill-suited and crude when applied to the task of producing games, why not try and write one yourself? We'd be fascinated to see the results.

At any rate, you will certainly learn a lot — more or less painlessly — about the more powerful aspects of this extremely versatile language.

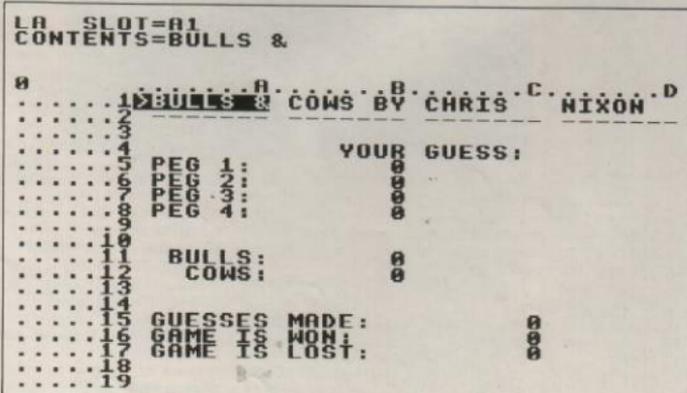


Figure 11: Starting the game

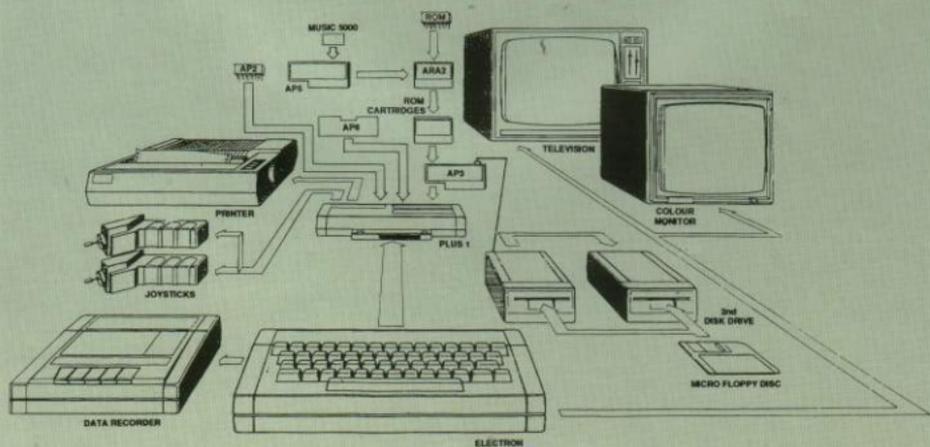
# PRES

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PRES continues to provide and develop new products for Acorn computers. A continuing policy is a 'master plan' of upward compatibility. Many users ask us if it is still worthwhile upgrading their Electron or should they change to a second-hand BBC or Master 128, most users still tell us how delighted they are with their Electrons. To satisfy all users we try to remove as much of the possible 'risk' by designing products that will go on (at least in part) with the user to Acorn computers. i.e. An AP3 disc drive could be connected to a BBC or Master 128, the files saved on AP3 using Acorn's ADFS can be read on a BBC (fitted with ADFS), a Master 128 or even an Archimedes! . . . The mouse & music upgrades use BBC hardware, only the software has been modified . . . ABR, AQR & ARA2 were all designed for use on the Master 128 . . . Adding a 2nd processor (Turbo board & 'Co-Pro adaptor') to AP5, although relatively expensive to an Electron, provides a fully-fledged Acorn upgrade for a BBC or Master!

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£55.00 Ex VAT; £66.70 Inc VAT

### SOME COMMON QUESTIONS WE ARE ASKED BY ELECTRON USERS

**Q**

How do I expand my basic Electron?

**A**

Firstly you will need a Plus 1. This is the main expansion unit for the Electron providing the necessary ports for add-ons. PRES produces the Plus 1 unit under license from Acorn.

**Q**

What is the best way to upgrade my computer to use discs?

**A**

We are sure the best way is to add the Advanced Plus 3. It plugs into the Plus 1 and provides all the advantages of the original Acorn Plus 3 plus other benefits. The Plus 3 & the A.P. 3 are the biggest selling and most widely used disc system on the Electron.

**Q**

Is it worth upgrading my Electron when I may want to upgrade to a BBC/Master computer in the future?

**A**

An ongoing policy of PRES has been to provide BBC compatibility to the Electron wherever possible. Therefore cartridge products like ARA2, ABR, & AQR were all designed for the Master & the Electron. The disc drives we supply (inc. the one supplied with AP3) are all BBC & Master compatible & the files created using the ADPS in the AP3 can even be read by the Archimedes!

**Q**

Is there any way of adding extra memory to my computer?

**A**

On a BBC computer when you want to add extra memory (and also extra speed) a second processor is

used. Although initially more expensive on an Electron; the nett result is a peripheral that is not dedicated to the Electron and can go on to be connected to a BBC machine (through AP5, it is even possible to connect a Master Turbo board!)

**Q**

How do I use ROM's in my Electron?

**A**

There are several ways we can offer... ARA2, a cartridge that plugs into the Plus 1 allowing two ROMs to be inserted... AP6, an internal upgrade for the Plus 1 providing 5/6 ROM/RAM sockets... Sideways RAM, for storing ROM images.

**Q**

What is Sideways ROM/RAM?

**A**

In Acorn BBC, Master & Electron computers there resides a block of 16K memory (0 & 8000). The particular block can be one of 16 banks that the MOS can instantly call on as part of the ROM filing system. In these banks could be basic, a disc filing system, View or RAM i.e. ABR or AP7.

**Q**

How do I add a printer?

**A**

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# Easy reader

Getting lost in listings? JOHN GERAGHTY's utility will help you track down those elusive, irritating bugs

SCANNING long, complex listings looking for lines where a particular variable or Basic keyword is used is a time-consuming, not to mention frustrating and eye straining task.

It's a job we all have to do occasionally, as it is quite rare that a program works first time.

Where did I use that INPUT command? On which lines is the variable x used? Where did I put that procedure definition?

These are all questions we ask ourselves when typing in and debugging long listings, and it's a problem that the utility presented here - Listif - is designed to overcome.

To create the utility first enter the listing and save it (don't use the filename LISTIF). Run it to create a special Basic program which is automatically saved to disc or tape.

Load this single-line Basic program as you would any other Basic listing and enter:

CALL PAGE\*17

to initialise some hidden machine code stored within the line.

Now you can either type

in your program at the keyboard or merge it from disc or tape on to the end of the Listif utility with:

OSCLTLOAD x "+STR"(TOP-2)

where x is the name of the program to load.

Using Listif is easy: Suppose you want to list all the lines containing INPUT statements - you would type:

LISTIFINPUT

And to print out all the lines containing the variable total you would enter:

LISTIFtotal

The machine code is hidden in a special line zero which is written to tape or disc. The code is unusual because certain byte values can't be used as they would mess up the screen display. Also the code must be relocatable, so it is self-modifying.

Now you can make more efficient use of your time and track down those elusive commands and variables with ease using this powerful and flexible utility.

```

10 REM LISTIF
20 REM By John Geraghty.
30 REM (c) Electron User
40 MODE6
50 PROCassemble
60 PRINT " Press <RET>
to save LISTIF"
70 +FXZ1
80 REPEAT UNTIL GET=13
90 +SAVE LISTIF B00 C01
100 END
110 :
120 DEF PROCassemble
130 brkvector=B202
140 break:=brkvector AND &
FFFF
150 onswl=BFFEF
160 oswrch=BFFEE
170 input=B700
180 List_token=B69
190 if_token=B67
200 Line_no_arg=B2A
210 liststart=B0B
220 page=B18
230 liston=B1F
240 error_pointer=BFD
250 ifstring_length=B70D
260 line_length=B701
270 :
280 REM in BASIC2 rom
290 decode=B97E6
300 print_line_no=B0923
310 print_line_ref=B991F
320 print_keyword=B050E
330 basic_re_entry=B8AFA
340 :
350 FOR pass=0 TO 2 STEP 2
360 PT=B00B
370 C0PT pass
380 create_line_0
390 EQU0=FF00000D
400 EQU0=2B0D3AF4
410 EQU0=37312B00
420 EQU0=E7C93E3E
430 EQU0=B15
440 :
450 L0X #chk_for_listif W0
80100
460 STX brkvector
470 L0X page
480 STX brkvector+1
490 RTS
500 :
510 .chk_for_listif
520 PNA
530 TPA
540 PNA
550 TPA
560 PNA
570 :Syntax error?
580 L0Y #0
590 LDA (error_pointer),Y
600 CMP #B10
610 BNE notlistif
620 DEY
630 .listchk
640 INY
650 LDA input,Y
660 CMP #ASC" "
670 BEQ listchk
680 CMP #list_token
690 BNE notlistif
700 .if_chk
710 INY
720 LDA input,Y
730 CMP #ASC" "
740 BEQ if_chk
750 CMP #if_token
760 BEQ listif
770 .notlistif
780 PLA
800 PLA
810 TAY
820 PLA
830 JMP break
840 :
850 :---set up.
860 .listif
870 lneed to alter PAGE*65
C to achieve relocatable
880 ipreserve_Y
890 STY line_no_arg
900 LDA #0
910 STA liststart
920 LDA page
930 STA liststart+1
940 LDY #B5C
950 STA (liststart),Y
960 restore_Y
970 LDY line_no_arg
980 IPAGE*65C holds the hi
-byte of the address in the
next instruction
990 STY ifstring_base+1
1000 :
1010 :
1020 :
1030 :
1040 :
1050 INX
1060 .get_ifstring_length
1070 INX
1080 INY
1090 LDA input,Y
1100 the following address
contains 13, (=CR), can't u
se immediate
1110 CMP #B0D
1120 BNE get_ifstring_length
1130 STX ifstring_length
1140 :
1150 :---main routine.
1160 .check_a_line
1170 LDY #1
1180 LDA #FF
1190 BML escape
1200 LDA (liststart),Y
1210 BPL notTOP
1220 .escape
1230 .escape condition deal
t with by re-entry routine.
1240 JMP basic_re_entry
1250 :---end here if TOP re
sced or escape pressed.
1260 :
1270 .notTOP
1280 LDY #3

```

Turn to Page 32 ▶

## ◀ From Page 31

```

1290 .get_line_length
1300 INY
1310 LDA (linestart),Y
1320 vcompare with #13...
1330 CMP #80D1
1340 BNE get_line_length
1350 STY line_length
1360 v---perform INSTR function.
1370 .instr
1380 LDY line_length
1390 DEC line_length
1400 LDY ifstring_length
1410 .instr_loop
1420 DEX
1430 BEQ list_the_line
1440 DEY
1450 CPY #3
1460 BEQ nextline
1470 LDA (linestart),Y
1480 lnote ifstring_base+1
is altered at start of list f routine.
1490 .ifstring_base

1500 CMP #700,X
1510 BNE instr
1520 BEQ instr_loop
1530 :
1540 .nextline
1550 v---linestart pointer>
>>next line.
1560 LDY #3
1570 LDA (linestart),Y
1580 CLC
1590 ADC linestart
1600 STA linestart
1610 BCC check_a_line
1620 INC linestart+1
1630 lvalways branch back...
1640 BNE check_a_line
1650 :
1660 v---list line number f
rst.
1670 .list_the_line
1680 LDY #1
1690 LDA (linestart),Y
1700 STA line_no_arg+1
1710 INY
1720 LDA (linestart),Y
1730 STA line_no_arg

1740 JSR print_line.no
1750 LDA listo
1760 BEQ no_space
1770 LDA #ASC ' '
1780 JSR osvchr
1790 .no_space
1800 v---now rest of line..
1810 LDY #3
1820 .listloop
1830 INY
1840 .ref_return
1850 LDA (linestart),Y
1860 BNE token
1870 vcompare with #13...
1880 CMP #80D1
1890 BEQ endlst
1900 veliminate non_printab
inst.
1910 CMP #ASC ' '
1920 BCC listloop
1930 JSR osvchr
1940 lvalways branch back...
1950 TYA
1960 BNE listloop
1970 .token

1980 lcheck for special tok
en signifying coded line nu
mber following G0T0, G0S0B,
or THEN...
1990 CMP #80B5
2000 BEQ line_ref
2010 JSR print_keyword
2020 BEQ listloop
2030 BNE listloop
2040 .line_ref
2050 JSR decode
2060 TYA
2070 PHA
2080 JSR print_line.ref
2090 PLA
2100 TAY
2110 lvalways branch back...
2120 BNE ref_return
2130 .endlst
2140 JSR osvnew
2150 BNE nextline
2160 BEQ nextline
2170 v---
2180 EQU0 #FF0005
2190 :
2200 J:NEXT-ENDPROC
    
```

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IN the February 1988 issue of *Electron User* I presented a powerful sprite editor, and over the following five months provided a host of useful machine code sprite print routines, map drawing and scrolling techniques.

All can be used to write your own fast-moving, all-action, shoot-'em-up arcade games.

Many readers have asked for further information on this complex topic, so here are several more utilities to go with this popular series of articles.

First I'll start with the problem of storing the sprites in data statements. Program 1 in the March 1988 issue converted a sprite created with the editor into data statements which could then be EXECed on to the end of a Basic listing. A typical sprite would look like:

```
9000 REM SPRITE
9010 REM X=6/Y=32
9020 DATA 15,15,8,0,56,56,4
0,40,40,40,40,40,40,40,40
40,40,40,40,40,40,40,40,40
40,56,56,8,0,15,15,15,0,0
240,240,0,0,255,255,136,136
139,139,138,138,138,138,139
139,136,136,255,255,0,0,240
,240,0
9030 DATA 0,15,15,15,0,0,0
240,240,0,0,255,255,0,0,15
15,0,240,240,0,15,15,0,255
255,0,0,240,240,0,15,15,1
5,15,0,0,240,240,0,0,255,255
0,0,15,15,0,240,240,0,15,15
0,0,255,255,0,0,240,240,0,0
,15,15
```

```
9040 DATA 15,15,0,0,240,240
0,0,255,255,17,17,29,29,21
21,21,21,29,29,17,17,255,255
0,0,240,240,0,15,15,15,15
,1,1,193,193,65,65,65,65,65
65,65,65,65,65,65,65,65,65
5,65,65,65,65,193,193,1,1
,15,15
```

This is fine, and the data will work with all the sprite print routines — but not the map print programs and I'll come to this later.

To store the data in memory you would use a chunk of code like:

```
10 FOR I=1 TO 6*32
20 READ %P%
30 P%=P%+1
30 NEXT
```

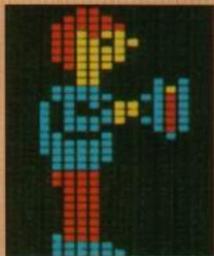
where P% is pointing at the

# More ammo for your arcades

## ROLAND WADDILOVE is back with more utilities for his sprites series

memory address at which you want to store your sprite data.

The only disadvantage of storing data in this form is that it's very tedious to type in, and the more data there is the more boring the task



becomes.

In order to cut down on the typing I used a slightly more compact method of storing sprite data in Basic listings in later articles and this caused some confusion.

Take a look at the same sprite as before, and see how much shorter the listing is:

```
9000 REM SPRITE
9010 REM X=6/Y=32
9020 DATA 8080F0F,28283838,
28282828,28282828,28282828,2
8282828,38382828,F0F000,F0F
,F0F,8080FFF,8A8A000,8080
8A8A,FFF8088,F0F0000,F0F00
F0,F0F,FFF,F0000F0F,F0
F0F0F,FFF0000,F0F0000,F0F0
000,F0F,F0F,FFF,F0000F0F,F
0F00F,FFF0000
9030 DATA F0F0000,F0F0000,
F0F,F0F,11111FFF,15151010,1
D101515,FFFF1111,F0F0000,F0
F0000,1010F0F,4141C1C1,41414
141,41414141,41414141,41414
141,C1C14141,F0F0101
```

This form of data requires

a slightly different method of reading and storing it in memory. You could use a routine like:

```
500 FOR I=1 TO 6*32 STEP 4
510 READ a$
520 !P%=EVAL("B"+a$)
530 P%=P%+4
540 NEXT
```

where P% points to the address at which you wish to store the code, or use an assembler macro like:

```
500 DEF FNdata
510 RESTORE
520 FOR I=1 TO 6*32 STEP 4
530 READ a$
540 [ OPT pass
550 EQU EVAL("B"+a$)
560 ]
570 NEXT
580 %pass
```

To create this new compact form of data we



require a new data maker. The technique used is very similar to the original program, so you may find it easier to load this if you have it and simply alter any lines that are different.

A common problem that

```
10 REM Data Maker II
20 REM by R.A.Waddilove
30 REM (c) Electron User
40 MODE 6
50 INPUT "Sprite file na
me: sprites$
60 OSCLI"LOAD "+sprites$+
000"
70 PRINT "Sprite loaded"
80 INPUT "Data file name
: name$
90 OSCLI"SPool "+name$
100 XX=7800:YY=7801
110 LX=9820:a$="9820DATA"
120 PRINT"9000REM "sprites$
130 PRINT"9010REM X";XX;"
/";YY
140 FOR I=X+8002 TO 8001+XX
+YY STEP 4
150 a$="B+STR$";!I%
160 IF LEN(a$)>230 PRINT a
$:LX=LX+10:a$=STR$LX+DATA"
ELSE a$="a$+";
170 NEXT
180 IF RIGHTS(a$,1)="" PR
INT LEFT$(a$,LEN(a$)-1)
190 *SPool
```

some readers experience is that when they design their own sprites and incorporate them into the code the sprite is corrupted. The most likely cause of this is forgetting to set the size before calling the print routine. The code looks like:

```
LX# 4
LY# 24
JSR print
```

where the 4 and 24 are the width and height as printed out by the datamaker. You have to alter these two parameters if you design a different size sprite.

The sprite data used by

Turn to Page 34 ▶

◀ From Page 33

the various print routines presented in the series print the character byte by byte, starting at the top left corner and printing the first vertical column, followed by the second, then the third and so on.

The map print routines are totally different and some readers experienced difficulty creating the data in the right format.

The blocks used to build up a screen are a fixed size – always a multiple of eight pixels in height, but any width. The blocks all sit exactly on character rows too and this is so the fastest possible print routine can be used.

When sprites are fixed on character rows and unable to move, it's possible to greatly simplify the print routine. You can use very

compact code like:

```
LDY #width*8-1
.loop
LDA data,Y
STA screen,Y
DEY
BPL loop
```

where *width* is the sprite's width in columns – printed by the data maker – *data* is the address of the sprite data, and *screen* is the screen address to print the sprite.

The code here will only print one character row of the block, so you would have to increment *screen* by



&140 to move the screen address down to the next character row, and *data* by the width of the sprite times eight – *width*\*8.

As the data created by the editor is stored in columns and the map print routine works in character rows we need to convert the data.

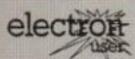
Yet another utility comes into play here – a sprite data converter shown below. To

use it, first design and save your sprite as usual.

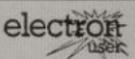
Now run the converter to rearrange the data format. Finally, chain the data maker to create the data statements. These can then be EXECed on to the end of a Basic listing.

That should keep you going for quite some time. If you have any further problems, don't hesitate to write.

```
10 REM Sprite Converter
20 REM By R.A.Waddilove
30 REM (c) Electron User
40 MODE 6
50 INPUT "File to load:"
name$
60 OSCLI"LOAD "name$"+
80"
70 MODE 5
80 AX=B5BCD
90 BX=B002
100 FOR XI=0 TO ?B001-1
110 FOR YI=0 TO ?B001-1
120 ?(AX+XI*8+YI*140*(YI?16)
)+YI*MOD8)=?BX
130 BX=BI+1
140 NEXT
150 NEXT
170 AX=B5BCD
180 BX=B002
190 FOR YI=0 TO ?(B001-1)
IV 8
200 FOR XI=0 TO ?B001*8-1
STEP 4
210 !BX=(A2+XI*8+YI*140)
220 BX=BI+4
230 NEXT
240 NEXT
250 MODE 6
260 INPUT "File to save:"
name$
270 OSCLI"SAVE "name$"+
800 "+STR$"+BX
```



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# How's your Crypton factor?

Explore the subterranean world of caves and caverns in this superb game by **KEITH OWENS** and **PHIL ORD**

A LONG, long time ago a prince called Crypton was cursed by an ancient sorcerer and doomed to wander endless labyrinths and caves, to find his earthly remains.

You must guide him, to achieve everlasting peace. Many traps lie in store, and cunning pitfalls may foil his endless wanderings.

His bones, cast far and wide through the sorcerer's maze, must all be collected so that Crypton can reassemble his body and end the curse.

The maze is littered with boulders which over the years have been worn into perfect spheres which can be dislodged to gain access to sealed-off passageways.

But tread carefully – they are placed in such a way that a single wrong move will block a vital portion of the maze, dooming Crypton. You have 10 minutes in which to complete your task.

At slightly over 10k, Crypton will stretch your powers of deduction and concentration to their limits.

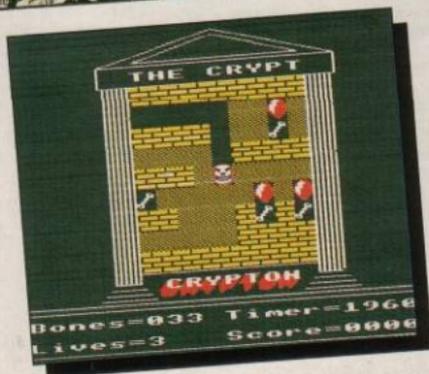
It will delight, annoy, tantalise and even enrage

you as you struggle to find a solution. But it's not impossible, and every screen can be completed without the loss of a single life.

Crypton does not rely on a random number generator for its puzzles – each screen has been individually created and tested thoroughly to ensure that success is possible.

## CONTROLS

Z Left  
X Right  
: Up  
/ Down



```

10 REM Crypton
20 REM By Keith Owen
30 REM and Phil Ord
40 REM (c) Electron User
50 REM
60 IF PAGE<=6E00 THEN 110
70 VDU21
80 *KEY0 *TAPE:MF0R I:=0
TO TOP-PAGE STEP4:IX!&E00=IX
:PAGE:NEXT:MPAGE=6E00:MOLO:M
RUN:FIM
90 *FX158,0,128
100 END
110 MODES:VDU23,1,0;0;0;0;
120 VDU23,255,192,192,192,
192,0,0,0
130 RESTORE1150:FORI=0 TO
175:READI?&C00:NEXT
140 PROCass:PROCdraw
150 s:=0:RESTORE270:FORI=0
TO 24:READI?&900:NEXT
160 RESTORE1160
170 REPEAT
180 FORI=64000 TO &4640:PI
=1:NEXT
190 FORI=64044 TO &457C ST
EP40:READAS:FORX=0 TO 31:K?I
=EVAL(MID$(AS,K+1,1)):NEXT:N
EXT
200 FORI=0 TO 2:READI?&904
:NEXT
210 CALLScreen
220 I690A=639393931:CALLGa
ne:GOSUB280:IF I690A=6130303
0 GOTO240
230 IF ?IIV>48 PROCmap:CA
LLorint:GOTO220
240 s:=s+1:UNTIL?IIV=48 0
R s:=3
250 IF ?IIV=48PRINTTAB(6,1
0)"GAME OVER"ELSE PRINTTAB(7
,9)"CRYPTON"TAB(6,13)"COMPLE
TED"
260 PRINTTAB(8,17)"SPACE"

```

Turn to Page 47 ▶

# Adventures by Pendoragon

AMID the webs of mystery and aura of times yet to come, I have discovered many a new adventure for the Electron within the Crystal Cave this month.

Perhaps the top news is that Heyley Software has recorded all of its BBC Micro disc adventures to run on any standard Electron fitted with a 5.25in disc system.

Pirate's Peril and The Ultimate Prize are reasonable introductions to the larger scope that disc adventures have to offer. However, I must unequivocally recommend Dreamtime and The Taroda Scheme which are absolute delights in large scale adventuring.

Heyley has also converted its new Archimedes science fiction adventure, Stranded!, which will give many a sleepless night to any intrepid adventurer.

All Heyley adventures offer exclusive Help sheets for those who become truly

## Treasures from the Crystal Cave

stuck. At only £7.95 each, these games should not be missed.

To order send a cheque or postal order to Heyley Software, 24 Ley Hey Road, Marple, Stockport, SK6 6PQ.

Many readers will already have bought a copy of Database Publications' Adventure Anthology, advertised recently in this magazine.

Five adventures in one package for less than £5 must be a bargain in anyone's book. These are super little escapades and ideally suited to beginners to this genre of escapism.

The release of a major Robico adventure is due

within the next couple of months. My appetite is indeed whetted after a recent audience with the King of Llantrisant, Robert O'Leary, which suggested that the enigmatic Blazing Star may yet be released for the Electron.

Geoff Larsen is currently working on his seventh Electron adventure, due for pre-Christmas release. Geoff discussed at some length his ideas for his next adventure during the Manchester Electron & BBC Micro User Show.

I was enthralled at his explanation concerning the detailed preparation in penning each adventure, and his preliminary ideas for this one were superb. I await its release with baited breath.

Releases from Topologika continue to tumble forth for adventurers with 64k Electrons and Plus 4 or Pegasus disc interfaces. Watch this space for further updates, though shame on you if you haven't yet played Return to Doom.

I also hope you have all noticed that Epic's Quest for the Holy Grail, Kingdom of Klein, Castle Frankenstein and Wheel of Fortune are now available at rock

bottom prices. I often load one of these games for another play through, such is their classic longevity. If you haven't got any of these gems, now is the time to order.

Adventure Soft (UK) is also offering its entire range of more than 20 Scott Adams and Digital Fantasia games, including such goodies as Adventureland and Circus Adventure, at less than half price. So stock up now before the winter sets in and the Christmas releases start appearing.

This month I include a map of the space maze from The Hunt which has puzzled experienced and novice adventurers alike. In future months I shall be mapping mazes from Classic Adventure and Kingdom of Hamil, among others.

May I also put out a plea for complete solutions to either version of Denis through the Drinking Glass, the awful Lord of the Rings and Scott Adams' Golden Voyage. Suppliers of such missives will be duly rewarded from my treasure chest of adventure games.

Until the sands of time run through, happy adventuring.

### Adventurer's Glossary (continued from last month)

- Mandrake:** Take it confidently, without hesitation.  
**Manuscript:** Read it carefully.  
**Map:** Examine and read carefully. May need translation.  
**Mattress:** Usually very springy and can be used to cushion a fall.  
**Medallion:** A magical talisman.  
**Merlin:** A mystical and magical ally.  
**Mermaid:** Often will provide magical artifacts.  
**Mill:** Explore every inch of this building, especially the store room and the balcony.  
**Miller:** Usually friendly and a useful source of information.  
**Mirror:** Save your position before you dare look into it. Can be used for deflecting laser fire.  
**Monkey:** A very useful pet, but you will have to catch it first.  
**Monocle:** Wear and use to see through opaque substances.  
**Mountain:** Climb and explore for entrances, especially in The Hobbitt.  
**Mummy:** Not your daddy's wife, but something even more dreadful.  
**Mushroom ring:** Magical, so make a wish and wait.  
**Music Box:** Play this to frighten dangerous animals.



## Readers' Hall of Fame

### *Circus* - Miss S.A. Lockyer (continued from last month)

E, E, drop bar, enter tent, N, E, climb ladder, cut tightrope, D, take cable, W, N, W, enter cannon, pull lever, N, drop hacksaw, take spanner, take snorkel, take can, E, mend generator, E, take handle, W, start generator, syphon petrol, W, S, walk road, S, S, fill tank.

N, N, walk field, N, drop snorkel, drop can, enter tent, W, W, enter closet, take whip, S, E, E, N, E, E, enter cage, crack whip, enter trapdoor. S, examine panel, push button, enter hatch. W, take blueprint, read blueprint, E, short terminals. N, N, U, W, W, W, N, W, enter cannon, pull lever, N, take keys, S, walk road, S, enter car, drive car. The end.

### *Castle Frankenstein* - Emma Rutherford (continued from last month)

Return to the castle and push the table in the kitchen. Climb down and GET HAMMER. Walk to the cloakroom and retrieve the rope, then go upstairs and read Frankenstein's notebook which you will find in the library.

Now journey west one location to the annex, PULL RING and cross the rope bridge. Go E and enter the building. Drop the bottle of water, generator and flask in the laboratory. Drop the rope, rod and hammer by the metal ring which is south of the storeroom.

Leave the castle and enter the door with the metal ring. Wear the gas mask and go W to the sulphur pits. Go W again to the top of the steps.

At the metal ring, DROP SCRAP of food, PULL RING

and lead the monster back to Frankenstein's laboratory. Pour the water into the flask and start the generator. Now you have revived the monster you will need his assistance to pull the ring below the experiment room. Quickly venture to the rope bridge and cut the rope with the knife.

Go down the steps as far as you are able then, HAMMER ROD and TIE ROPE. Climb down the rope until you reach the metal ring, when you should again TIE ROPE. Journey down until you reach the cave west of the waterfall.

JUMP IN to the waterfall and sink to the bottom of the pool. Now travel: E, S, S, E, S, E, S, S, W, W, W, N, N, E, E, E, S, W, S, E, U, U, N. You are back at the inn and have successfully completed the adventure.

### *Castle of Riddles* - First part of a solution by Roger Asher

NW, W, get coin, E, NE, NW, S, get lamp, N, SE, SW, ON, N, N, NE, N, SE, N, W, NE, get rod, drop coin, N. Wait until the bear is at the south end, then: N, NE, NW, N, D, get paint, SW, NW, get hang, get towel, N, get book, get tiara, get candle, S, S, throw book, S, S, NE, get emerald.

NW, N, NW, N, N, sit, sit, sit, D, get figure, dig, N, N, NE, N, SE, N, look, off, drop figure, drop emerald, drop tiara, open can, on, N, N, W, W, W, W, throw can, S, S, S, get box, S, S, N, W, W, W, W, rub mirror, N, get vase, W, get coin, get bucket, get bucket, get bucket.

E, NE, nose, N, get portrait, pounds, N, U, U, E, jump, off, U, D, N, drop hang, get cushion. Wait until warned. Bail boat, drop cushion, on, N, N, NE, N, SE, N, look, off, drop portrait, drop coin, drop vase, drop bucket, on, E, E, N, E, get case, NW, N, get onyx, N. (More next month)

## Problems Solved

This month I am going to give help to readers who have made enquiries about some older adventures. Some were originally released more than four years ago and have long since been deleted from suppliers' lists. However, it is obvious that copies are still circulating and adventurers are becoming banjaxed at various points in them.

Micropower's **Adventure** continues to pose difficulties for a number of readers. Matthew Johnson, John Townley and Alec Mitchell have all written to me in recent months asking how to escape from the desert.

The solution is simple, if a little strange: Drop a treasure then say STEAL

whichever treasure was dropped. However, you must ensure that you are carrying the keys when you attempt this, as you will be thrown into a dungeon as punishment for your theft.

Barbara Gibb and Helen Knight must rub the lamp in the Black room to be transported to the magician's room in the same game.

Scott Adams **Adventureland** has created difficulties for Michael Tudor and Joanne Johnstone, who are newcomers to adventuring. You need the mud if you are to collect the bees, and after getting the eggs you must enter the tree and DROP EGG.

Meanwhile, Joanne is also having problems with **Hampstead**. You should not waste your money in the

betting shop nor on purchasing the Sony Walkman, Joanne. You must explore the heath to find a bench, which will in turn lead you to discover a credit card.

In **Arrow of Death**, Richard Barlow must turn the coat-of-arms three times to reveal the secret passage. He should later examine the purse to find the coins to pay the beggar.

The treasures in **Castle of Riddles** continue to evade many readers. They can be found at the following locations: The Ming vase in the damp chamber, the onyx in the black maze, the diamond in riddle room six, the portrait in riddle room four and the figurine will be discovered in the tunnel.

A point of interest to anyone playing **Adven-**

turesoft's **Gremlins** is that if the Gremlins follow you, go straight to the cinema and start the projector.

In **Epic's Kingdom of Klein**, Michelle Hurds and Lee Langford should THROW BONE before the stone arch in order to get rid of the dog. Michelle and Lee must also use the umbrella as a parachute when jumping off the cliff.

I had to dust off some old maps of **Ring of Time** in order to answer queries from Daniel Gilbert and Graham Funnell. You must cut the picture to reveal the safe, Daniel, and wear the necklace to get past the cowed figure, Graham.

Next month, due to popular demand, I will feature a much enlarged Problems Solved column.

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**Utilities:** Machine code maths and sprite print routines, letterhead designer. **Programming:** Machine code beginners' tutorial part 1. **Games:** Shove Penny, Hiss, beer kit handbook. **Features:** Cheat mode for Acornsoft Snapper, hardware projects, using Viewsheet, adventure hints and tips.

### April 1988 issue:

**Games:** Go-Pig, Dozer Disorder. **Features:** Part 1 of Codename Droid map, build an anemometer, guide to Viewsheet, adventure hints and tips, memory map explored part 1. **Utilities:** Squashed character sets, sprite print routines. **Programming:** Pascal tutorial, beginners' guide to machine code part 2.

### May 1988 issue:

**Programming:** Machine code tutorial part 3. **Games:** Lion's Lair, Keyboard Gremlins, Lucas' Problem. **Features:** Quest author reveals all, Plus 6 reviewed, part 2 of Codename Droid map, Adventure hints and tips. **Utilities:** French to English translator, guide to Viewsheet,



colour emulator, shadow ram database, machine code map making.

### June 1988 issue:

**Games:** Fibonacci Nim, Bomb Alert. **Features:** Adventure hints and tips, four-page pullout guide to software, memory map part 2, Viewsheet guide. **Utilities:** Procedure and function lister, shadow ram routines, car route database. **Programming:** Machine code tutorial part 4, writing scrolling map routines.

### July 1988 issue:

**Games:** Knockout Whist, Randall Rabbit, Tilley the Train, Tennis. **Utilities:** Shadow ram filing system, machine code score routines, Easy Reader. **Reviews:** Advanced Plus, Spycat. **Features:** Machine code tutorial, adventures, Memory Map part 3.

### August 1988 issue:

**Games:** Fox and Geese, Solitaire. **Utilities:** Mini Prolog, disassembler. **Reviews:** E00 ADFS, Repton Thru Time, Barbarian, Romplus-144. **Features:** Machine code tutorial, adventures, Memory Map part 4.

## electron **user**

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### February 1988:

Rainbow, font designer, sprite editor, Alien Invasion, Navigator, Super Digga, Odd One Out.

### March 1988:

Machine code maths and sprite print routines, letterhead designer, Shove Penny, Hiss, font output utility, Beer kit handbook.

### April 1988:

Go-Pig, Dozer Disorder, squashed character sets, sprite print routines.

### May 1988:

Lion's Lair, Keyboard Gremlins, French to English translator, machine code map display routines.

### June 1988:

Fibonacci Nim, Bomb Alert, Procedure and function lister, car route database, scrolling map routines.

### July 1988:

Knockout Whist, Randall Rabbit, Tilley the Train, Tennis, machine code score routines, Easy Reader.

### August 1988:

Fox and Geese, plus Solitaire board games, Mini Prolog, machine code disassembler.

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# Space Maze THE HUNT

**Maze No. 3**

Mazes one and two – Sphinx Adventure and Project Theslus – were in the July and August 1988 issues of *Electron User*.

Entrance

1

2

4

3

5

6

7

Gallery

Up  
Down

Research area

Up  
Down

Magnolab

Up  
Down

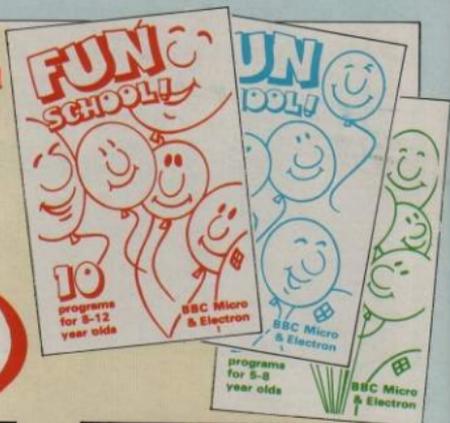
8



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Hilo  
Maths Test  
Mouser  
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Seawall  
Super Spell



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Provide the correct arithmetic sign and aim to score ten out of ten



### BALANCE

Learn maths the fun way. Type in the answer to balance the scales

## Ages 8-12

Anagram  
Codebreaker  
Dog Duck Corn  
Guessing  
Hangman  
Maths Hike  
Nim  
Odd Man Out  
Pelmanism  
Towers of Hanoi



### HANGMAN

Improve your child's spelling with this fun version of the popular game



### ODD MAN OUT

Find the word that does not fit – before your time runs out

**TO ORDER PLEASE USE THE FORM ON PAGE 45**

# MICRO MESSAGES

I have started taking your magazine regularly because of all the useful information and tips it contains. In the June 1988 issue I was most interested to read the letter from Mrs F. Whitehead of Denton, Manchester, saying the December 1986 issue of Micro Messages contained a letter on recovering corrupted files.

Is it possible to reprint this, as I seem to have a lot of trouble with getting tapes to load perfectly, and get fed up with the Rewind error message?

I have been recording the results of the Australian football leagues from the beginning of the season, and this week when I went to the latest results the tape came up with Rewind tape. After all the hard work that has gone into this I feel exasperated.

I have rewound the tape,

## A cure for corruption

turned up the volume, turned it down, but still get the same message. Any help will be most appreciated. — **Doreen Sanson, Hamton Hill, Middlesex.**

● There are several ways of attempting to recover data in corrupted files. Here's one very simple technique to recover a Basic program. Enter:

```
*OPT 2,0
*LOAD " EDD
OLD
!TOP+&FF0D
OLD
```

The OPT command tells

Basic to ignore loading errors and carry on regardless. You should also ignore any messages on screen — don't rewind the tape. The OLD command tries to read the Basic program in memory and find its end which it then stores in TOP.

If it can't find the end it stores the point at which the program is corrupted in TOP.

Storing &FF0D at this point in the program creates a new end of program, chopping off the corrupted section. It sounds like you have saved a data file of

football results, not a Basic program, and without knowing the structure we can't really advise as to how to recover it.

You must \*LOAD it and use a memory editor to reconstruct the file and data. Then resave it.

Always save programs twice on tape for extra security, and check that they both load with:

```
*LOAD " EDD
```

before switching off the micro. If you get an error message resave the file until it is error free.

False

impressions

## Peripheral enquiries

I AM considering buying some add-ons for my Electron. Could you please answer the following questions?

I would like to buy a printer, just to print out listings and letters. Which is the cheapest printer able to do this? I have seen an advert in your magazine from Delta Computers for a Brother HR5 at £69.95. Would this be fast enough?

The Plus 1 seems the obvious interface to go for as I can also use joysticks. Would I be better off buying separate interfaces as I will never use the cartridge slots?

I have seen an advert from

Slogger for an RS423 interface, Commstar software and modem for £85. Is this all I need to download software from MicroLink? And is a telephone included?

Does using a modem affect phone bills? — **Richard Palmer, Solihull, West Midlands.**

● The Brother HR5 is probably one of the cheapest printers around for the Electron.

It is a thermal transfer printer, and is fairly slow. The quality of print isn't too good on ordinary paper, but is quite acceptable on its own special thermal paper.

The Plus 1 is probably a safer bet than separate interfaces, because although at the moment you may not be planning on using its cartridge ports, you may later change your mind.

The ideal companion for a printer is a word processor like View, and this plugs into a cartridge slot. You'll need View to write your letters.

The Slogger comms pack contains all you need to log on to MicroLink and download software.

A telephone isn't supplied with the package, and using a modem will add to your bill just like any ordinary call.

SO that is what Roland Waddilove looks like (Electron User News July 1988). Not what I expected. I pictured him as a rather more mature middle-aged sage with his mind constantly on higher intellectual esoteric matters rather than on delectable half-clad ladies.

To be fair, however, he does not seem entirely at ease in this compromising situation. Perhaps his mind was on higher things.

On to more mundane matters. I bought the PMS NTQ Font package recently which was advertised as the Electron version. No indication was given as to how it was used on the Electron, or what peripherals were required.

Enquiry at PMS elicited the advice: Put the two roms into your computer and run

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#### 4 From Page 14

the utility disc. Where do I put the roms? I have an AP4 and View in the two cartridge slots of the Plus 1. There is a spare rom socket in the AP4 into which I have put one of the NTQ roms.

Is there an adaptor available which will supply two or more rom sockets for the Electron without having to remove the AP4 and View cartridges? I feel that Pres or Slogger probably have something like this in stock, but I can't fathom out which particular item I need. - V.J. Horgan, Didcot, Oxon.

● There are several solutions to your problem. You could get the Pres battery-backed ram. This would enable you to store View and one of the NTQ roms permanently in the ram. The other rom can be placed in the AP4.

Alternatively, you could upgrade your Plus 1 to a Plus 6, which enables you to plug in the NTQ roms inside your Plus 6.

The third possibility is to throw out your Plus 1 and replace it with a Slogger Rombox, which has both rom and rom cartridge sockets.

## Colourful

## graphics

A COUPLE of months ago I bought a printer for £30 - it's a TRS-80 colour graphic printer from Tandy. I mostly use it for listings, for which it is quite good.

But it is not much good for letters because the paper is so narrow. The problem is that I can't produce graphics on it with my Electron.

Why don't you have a small section for pen friends, can write to each other? - John Young, 44, Hill Crest, Esh Village, Co Durham.

● We haven't used one of these printers so we'll have to ask our readers for help with the graphics output.

If anybody wants a pen pal we'll publish their full address.

**ALL programs printed in this issue are exact reproduction of listings taken from running programs which have been thoroughly tested.**

**However on the very rare occasions that mistakes may occur corrections will be published as a matter of urgency. Should you encounter error messages when you type in a program**

**they will almost certainly be the result of your own typing mistakes.**

**Unfortunately we can no longer answer personal programming queries concerning these mistakes. Of course letters about suggested errors will be investigated without delay, but any replies found necessary will only appear in the mail pages.**

## Sampled

## sound advice

While reading through the December 1986 issue of The Micro User I became very interested in the article on making the computer record and play back sampled sound. This is something I had wanted to do on the Electron for some time, but had thought it impossible.

It says in the article that the sound chip in the BBC Micro is the Texas Instruments 76489. This led me to wonder if a simple swap of a BBC Micro sound chip for the Electron's would enable four channel sound, and thus use the sampled sound outfit.

I was recently given the Pegasus 400 disc system as my main 16th birthday present. Also I was given the T2Peg400 copying rom. When the transferred programs have loaded, the disc filing system is rendered inactive and the tape filing system turned on.

For most games this poses no problem, but for software such as Mini Office and Elite, the saving of data files to cassette somewhat defeats the point of a disc drive, as the only gain is the fast loading speed of the software itself.

I have wondered if there was any way past this, and came up with this method: As a loading program, have a piece of machine code that performs the command \*DISC whenever the

command \*TAPE is called.

My knowledge of machine code is very limited, so I am asking for help writing such a piece of code. - James Hudd, Swindon, Wiltshire.

● There's a lot more to adding four-channel sound than simply plugging in the BBC Micro's sound chip - there isn't a socket available for a start, as the Electron's sound hardware is entirely different to the BBC Micro's.

A cartridge is available from M&S Associates which appears to give full BBC Micro sound compatibility. This looks impressive and will be reviewed shortly.

The main problem of running software from disc is a lack of memory, as all disc systems require some ram as workspace. If this section of memory isn't available, or becomes corrupted in some way, the disc system won't work.

If the software uses the memory allocated to the disc system, issuing a \*DISC command will either produce an error message or the DFS will reclaim its workspace and wipe out that section of the program.

## Pinball mods

JUST recently I entered the program Pinball which was given on page 123 of the February 1988 issue of The Micro User. It was a great source of pleasure to my grandsons.

One of them has an Electron and takes Electron User on a regular basis. He wonders if this program will be given in this magazine

sometime in the future, as having tried it on his machine I discovered it worked except for the non-existent Tab key.

This was partially corrected using his Ctrl key on line 810, but it still did not allow the left flipper to operate. Could you therefore please advise what alteration should be made to enable the program to function correctly on his machine. - W. Trapmore, Barking, Essex.

● You need to alter just two lines to enable it to be run on an Electron. Load the program and enter:

```
810 UNTIL(ADVAL(B)AND3)=1
OR INKEY=-2:TIME=0
2890 DEFPROCKEY1:COPT II:L
DA#81:LDX#254:LDY#254:JSR
&FFF4:J:ENDPROC
```

The game is a little sluggish on a standard Electron, so to speed it up slightly alter lines 820 and 1200 to:

```
820 REPEAT:PROCB:YI=YI-4:
PROCB
1200 DEFPROC2:TIME=0:ENDPR
OC
```

## Pen pal

## wanted

I AM an Electron user from West Germany, the last member of a former Electron user group of six university students. I'd like to contact Electron users in the UK to swap experiences.

I have done a lot of programming over the past three years but during the last few months I have not had much time.

I own an Electron with a Plus 1, SEDFS, a Cumana double-sided 40/80 track switchable disc drive, a Shugart 40 track disc drive, ACP's battery-backed Ram, Acomsoft's ISO Pascal and View, Jafa's 6502 second processor, Slogger's Master Ram Board, two user ports, a Centronics RS232C converter and last but not least a self-designed add-on for my Plus 1 with two more rom sockets and two cartridge slots. - Detlef Fuhrer, Wilhelm Kaiser Str.41, 4000 Dusseldorf 13, West Germany.

OK for

colour?

I SUBSCRIBE to your magazine and I have done so for a year now. It is well worth £1.25. I would like to test your knowledge about a couple of things. I am interested in buying a printer.

As I am not particularly rich I decided that if I got one it would probably be the Panasonic KX-P1081. But then I noticed an advert for the Okimate colour printer which was offered for £139.

In the advert it says it is a "ribbon transfer printer which offers fully versatile colour or black and white printing." Is it likely to be any good?

After the bit about colour or black and white printing it says "A 24 element print head produces more than 100 shades with exceptional clarity". I don't know what to make of it.

I would be grateful for your advice as I don't know what to do. Should I buy the KX-P1081 or this colour one? And one last thing, will I need a Rombox Plus or a Plus 1? — Jason Smith, Oadby, Leicester.

● All the colour pictures of game screens in *Electron User*, apart from the software pages, are dumped using the Okimate colour printer you mention, so you can see the quality.

However, the software required to drive it is on rom, and runs entirely in Mode 7. It does work — slowly — on an Electron, but unfortunately, without Mode 7 you can't select any of the options from the setup menu.

The black and white dumps were mostly taken from a Panasonic KX-P1081, so again, look at the dumps in this issue to judge the quality. Although the Panasonic is only black and white, it is probably the best printer of the two.

You can't plug a printer directly into an Electron as it hasn't got a Centronics printer port. Both the Plus 1 and Rombox Plus supply the necessary hardware and software.

COULD anyone please tell me how I can set up a time loop without it affecting the rest of the program? My problem is that I have written a program where you answer as many arithmetic questions as possible within 60 seconds.

I have used a procedure to make up this time loop, but I can't seem to merge the time and questions together. When I call up the procedure PROCtime the countdown begins, but the questions come after the time is up.

I would like the time to start its countdown and not interfere with the rest of the program, and to display both the time and the questions. — G. Singh, Dunkirk, Nottingham.

● This is quite a difficult, but not impossible problem to overcome. The secret is to avoid INPUT to read the answer, and use INKEYS instead.

This ensures that program

## Timely problem

execution never halts and we can regularly update the time. The short listing below is a simple maths test in which you have 60 seconds to answer 10 questions. Each question is marked right or wrong and you'll be

told if you run out of time.

As it stands, it is quite primitive, but it does show how the technique works. There isn't any error checking so make sure you enter sensible answers.

```

10 MODE 6
20 PRINT TAB(0,1)"Answer
10 questions in 60 seconds..
"
30 TIME=0
40 Q=0
50 REPEAT
60 Q=Q+1
70 AX=RND(12)
80 QX=RND(12)
90 PRINT TAB(0,5+QX);QX;
);AX;" ";BT;" ";
100 AS=""
110 REPEAT
120 PROCtime
130 KS=INKEY$B
140 PRINT KS;
150 AS=AS+KS
160 UNTIL TX<1 OR KS=CHR$
3
170 IF AS>" CX=EVAL AS EL
SE C1=0
180 PRINT TAB(18,5+QX);
190 IF CX=AX+BX PRINT"Corr
ect" ELSE PRINT"Wrong"
200 UNTIL QX=10 OR TX<1
210 IF TX<1 PRINT:PRINT"Ou
t of time!" ELSE PRINT:PRINT
"Well done!"
220 END
230
240 DEF PROCtime
250 TX=60-TIME DIV 100
260 XX=POS:YX=VPOS
270 PRINT TAB(0,3)Time =
";TX";AS+KB
280 ENDPROC

```

## Software

### v hardware

I have a complaint about the way your magazine is set up. I am sure that many people enjoy the technical articles, programs and so on, but I for one, prefer the software reviews.

In your July 1988 issue you had three pages of software reviews compared to 20 pages of hardware and technical articles. I'm not saying that you should leave these out, but a slightly more balanced magazine would be appreciated.

Superior Software, Tyne-soft and ASL have shown that games of extremely high quality can be written on the Electron, and many conversions from other popular computers have been successfully done — Barbarian for instance.

Are you planning to continue with *Arcade Corner*? I found it very enjoyable, but it has recently been missing. Please *Electron User*, hear

this plea and give game addicts some satisfaction. — Ben Rees, Purbrook, Hampshire.

● Arcade corner is back with more hints, tips and cheat modes for popular games.

What do other readers think of *Electron User's* balance of software, hardware, technical articles, adventures, education and so on? Write in to *Micro Messages* and let us know.

## Faulty

### hyperdrive

I HAVE been playing *Elite* and have obtained a rating of *Competent*. Having got this far, I decided to buy a galactic hyperdrive to take me to another galaxy.

However, when I pressed the appropriate keys nothing happened. Are there no other galaxies in the *Electron* version? — Darren Bates, Wick St. Lawrence, Weston-S-Mare.

● The galactic hyperdrive didn't work in the early version of *Elite*, but it was fixed in a later one. It seems that you have an old copy of the game. However, this isn't a disadvantage and you can still complete the game.

## Catch 22

I HAVE a problem with my *Electron*, can you help? When trying to type the CHAIN "" command I get CHAIN 22. Sometimes it works OK and loads, but then when I change games and try it again I get CHAIN 22, or I get lines of numbers instead of CHAIN.

Can you tell me what this is caused by and how I can rectify the problem? — A. Davies, Irlam, Manchester.

● It sounds like a keyboard fault, and may simply be a loose keyboard connector. You could try opening your *Electron* and pushing down the short keyboard connecting cable. You may find this cures the problem.

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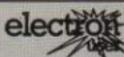
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## ◀ From Page 35

```
AB(7,21)TO PLAY:REPEATUNT1
LG6T=32:GOSUB280:GOTO150
270 DATA4,31,6,28,48,48,48
,31,16,28,49,53,48,48,31,6,3
8,51,31,16,30,48,48,48,48
280 FORI=1T08:CALLCLs:FORO
=0T020:NEXT:RETURN
290 DEFPROCcap
300 VDUS,24,384;258;956;82
8;18,8,138,12
310 xI=412:yI=888:FORIX=84
8A4 TO 8457C STEP40:FORIX=0
TO 31:PIXL=XI?IX
320 GCI=0
330 IF PIXI=1 OR PIXI=6 OR
PIXI=7 GCI=2
340 IF PIXI=4 GCI=3
350 IF PIXI=2 GCI=1
360 YI=YI-16:IFYI<296 YI=YI
92:XI=XI+16
370 GC0L,GCI:MOVEXI,YI:VD
U255:NEXT
380 NEXT
390 *FX21
400 WS=GETS:GOSUB280:ENDPR
OC
410 DEFPROCdraw
420 VDUS:GC0L,3:MOVE284,8
96:DRAW284,832:DRAW1056,832:
DRAW1056,896:DRAW284,896:DRA
W670,996:DRAW1056,896
430 MOVE480,988:DRAW948,98
8:DRAW678,988:DRAW480,988
440 XI=380:GOSUB490:XI=960
:GOSUB490
450 MOVE8,164:DRAW1279,164
:MOVE18,148:DRAW1279,148:MOVE
8,8:DRAW1279,8:MOVE8,16:DRAW
1279,16:MOVE380,254:DRAW968,
254
460 MOVE384,876:PRINT"THE
CRYPT"
470 xI=432:yI=288:FORI=1T06:
GC0L,I:MOVEXI,YI:PRINT"CRYPTO
M":X=X+4:Y=Y+4:NEXT:GC0L,3:
MOVEXI,YI:PRINT"CRYPTOM":VDUI4
COLOURS:PRINTTAB(8,28)"Bones
= Timer="TAB(8,30)"Lives="
Score="
480 ENDPROC
490 XI=XI+XX+88:YI=YI+224:FO
RI=1T04:MOVEXI,YI:DRAWXI,YI:YI
-16:XI=XI-16:XC=XI+16:NEXT
500 X=XI:FORI=1T06:MOVEXI,8
32:DRAWXI,224:XC=XI+16:NEXT:RET
URN
510 DEFPROCass
520 SX=870:SY=872:POINT=88
8:YI=874:GO=876:COU=877:TEMP
=878:MP=874:BODY=87C:DA=87D:
PI=87F:NB=890A:SCORE=8915:
BOI=890A:LI=8911
530 FORPASS=0T02STEP2:PX=8
4A0
540 C OPTPASS
550 GAME LDA#881:LDX#69A:
LDY#6FF:JSR#FF4:TYA:BEQ#G:R
TS:G JSRTEXT:JSR#CHECK:LDA
BODY:BNEG:JSRKEYS:LDA#NB:CMF#
48:BNEG2:LDA#B1:CMF#48:BNEG
2:LDA#B2:CMF#48:BNEG2:JMPTe
Xts.G2 LDAG:BEQ#GAME:JSR#SOU
2:JSRPRINT:MP#GAME
560 G JSRDELTA:LDA#LIV:CM
#48:BEQ#G:DECBODY:LDY#81:LD
```

```
A#0:STA(MP),Y:JSRSCREEN:MP#G
AME:GVP#MTEXT
570 DELAY LDA#255:LDY#255
:LDY DEK:BNEDY:DEFY:BNEDY:RTS
580 .SOU2 LD#SOU2 MO256:L
DY#SO2 DIV256:LDA#Y:JMP#FFF1
590 .TEXT JSR#BONUS:JSR#BO
D:LDY#0:TL LDA#890:Y:JSR#FF
E3:INY:CPY#256:BNEL:RTS
600 .BONUS LDA#B2+3:CMF#48
:BEQ#BON2:DECB#3:RTS:BNON2
LDABOX+2:CMF#48:BEQBON3:DECB
OX+2:LDA#57:STABOX+3:RTS:BO
N3 LDA#B1+1:CMF#48:BEQBON4:DE
CB#OX+1:LDA#57:STABOX+3:STAB
OX+2:RTS:BNON4 LDA#48:STABOX
610 LDA#57:STABOX+1:STABOX
+2:STABOX+3:RTS
620 .BODD LDY#0:BDL LDA#
OX,Y:CMF#48:BEQB2:RTS:BDL
2 INY:CPY#4:BNEL:JMP#CORPSE
630 .KEYS LDA#881:LDX#15:L
DY#0:JSR#FF4
640 LDA#88T:LDX#8DC:LDA#8F
F:JSR#FF4:TYA:BEQ#S:JMP#CORP
SE
650 .KS LDA#881:LDX#6CC:LD
Y#8FF:JSR#FF4:TYA:BEQ#K:LDA
#48:STALIV:INC#BODY:RTS
660 .KR LDA#881:LDX#88B:LD
Y#8FF:JSR#FF4:TYA:BEQ#K:JMP
R1
670 .KL LDA#881:LDX#89E:LD
Y#8FF:JSR#FF4:TYA:BEQ#K:JMP
LE
680 .KU LDA#881:LDX#887:LD
Y#8FF:JSR#FF4:TYA:BEQ#K:JMP
UP
690 .KD LDA#881:LDX#897:LD
Y#8FF:JSR#FF4:TYA:BEQ#K:JMP
PDOW
700 .NOP RTS
710 .DOW LDY#82:LDA#1:STAP
LUS:STAPLUS+2:LDA#0:STAPLUS+
1:STAPLUS+3
720 .MOVEI LDA(MP),Y:CMF#
1:BEQ#NUP:CMF#6:BEQ#NUP:CMF#7:
BNEUP2:;NUP:RTS:;UP2 CMF#2:B
E#NUP:JSR#G:MOV LDA#18:STAC
(MP),Y:LDY#81:LDA#0:STAMP(Y,
Y):CLC:LAMP:ADCPUS:STAMP:LDA
MP+1:ADCPUS+1:STAMP+1:CLC:L
DASY:ADCPUS+2:STASY:CLC:LDA
SX:ADCPUS+3
730 STASX:JMP#PRINT
740 .UP LDY#80:LDA#8FF:STA
PLUS:STAPLUS+1:STAPLUS+2:LDA
#0:STAPLUS+3:JMP#MOVEIT
750 .RI LDY#121:LDA#48:STA
PLUS:LDA#0:STAPLUS+1:STAPLUS
+2:LDA#1:STAPLUS+3:LDA(MP),Y
:CMF#2:BNENOVEIT:LDY#161
760 .BN LDA(MP),Y:BNENOR:L
DA#2:STA(MP),Y:LDY#121:JMP#NO
V:;NOR RTS
770 .LE LDY#41:LDA#888:STA
PLUS:LDA#8FF:STAPLUS+1:STAPL
US+3:LDA#0:STAPLUS+2:LDA(MP
),Y:CMF#2:BEQ#BOV:JMP#MOVEIT
780 .BBU LDY#1:LDA(MP),Y:B
NENOR:LDA#2:STA(MP),Y:LDY#41
:JMP#MOV
790 .G CMF#4:BNENOB:LDA#B
+2:CMF#48:BEQB2:DECB#2:JMP
SCD:;NOR RTS:;GB2 LDA#B1:CM
```

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# Learning by your mistakes

**Now you can teach your micro to play noughts and crosses with the help of CHRIS NIXON's intelligent program**

THE mini-Prolog interpreter I presented last month went some way to introducing some of the ideas behind current artificial intelligence (AI) theory.

This month I'm throwing down a programming challenge together with my own humble solution to it. The challenge is to write a self-learning noughts and crosses program. The programming restrictions which must be applied to any submission are as these:

- There must be no built-in strategy. The program must learn how to play a good game by examining its own mistakes.

- If possible, there should be no built-in rules of play, either. This is the most daunting part of the challenge – as you will see, even my program avoids this problem by knowing how to play the game.

You must observe the first condition, even if the second is beyond your programming capabilities. Don't feel too bad if it is, because I certainly couldn't squeeze the necessary routines into a program that would fit these pages.

First though, let's consider some of the problems involved – and they are many. We'll work in reverse, tackling my second, more difficult condition before turning our attention to the easier problem of producing a program which can learn strategy.

To start out with no idea even of the rules, any games program is faced with a lot of work.

The problem isn't insurmountable, though – there are, as in all aspects of AI theory, certain algorithms which can be applied to arrive at a solution.

When using Basic to write programs of this nature, it's more difficult to define such algorithms from scratch. So it's best to write them down in a kind of pseudo-code – a

cross between Basic and English – before finally coding them into working program lines.

Assuming that your program knows nothing at all about the rules, it has to have at least a framework within which it can learn without things getting totally out of hand.

For instance, if the game in question is chess, you must at least build into the

computer the ability to move pieces inside an eight by eight board. You must also tell the program that each player takes it in turn to move.

And it must be aware of the pieces under its control, even if it doesn't know what to do with them. Otherwise, how could the program even begin to learn the game?

We will call these built-in

requirements laws, as opposed to rules. So once you have created an environment in which the basic laws have been installed, you can begin writing and testing various learning algorithms.

These should consist at first mainly of the ability to store the moves made by its human opponent. The program's own moves would at first be completely meaningless, and probably totally illegal, but you are not allowed to tell it so.

If you did, it would be defeating the object of the exercise, for you might as well have programmed in the legal moves right at the start.

So the program must sit and wait, moving pieces at random while slowly assimilating your replies. After a certain number of moves have been played by both sides, the computer can begin analysing.

This is the meat and bones part of any true self-teaching program. The analyser should go through each of the recorded moves, looking for obvious patterns of play.

Various functions could be applied to this task, but most obvious would be a simple check to see which pieces are always moved in some directions but never in



"Whatever are you going to teach it to do next?"

Turn to Page 51 ▶

If you want to start doing more with your micro than just playing games, this package is your ideal introduction to the four most popular applications for professional computers. All the programs have been designed for simplicity, so even a child can use them. Yet they include advanced features not yet available on programs costing many times as much!

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## HEURISTIC NUGHTS &amp; CROSSES

By Chris Nixon - (c) Electron User

YOU SCORE	STACK: 6	MY SCORE
5		1
	1 X O	
	4 O X	
	O 8 9	

YOU WIN. PRESS ANY KEY TO PLAY

Oxo will always play its next remembered move

## ◀ From Page 49

others. A sort of internal Venn diagram of moves could be built up, where certain pieces are assigned to some sets of moves, but not others.

This Venn diagram would become more accurate as the game progresses, until the computer is able to determine all legal moves. At some point, the computer must begin obeying its own assumptions, but exactly when is a matter of opinion.

The winning move can be determined by providing the human player with a certain key, which when pressed causes the program to sit up and realise that the game has been won. It would then note the most recent move, and store this in readiness for comparison with subsequent winning moves.

All this is just theory, with no examples for you to experiment with. But you should be able to see how a self-learning program works.

You can appreciate the work required to produce such a program, and also why I did not attempt this part myself - I leave it to our capable readers to show me how it can be done.

Assuming our program now knows at least which pieces can move where, and what the winning move is, we can move on to tackling problem number one - how

to learn strategy.

This is the stage at which my own solution to the problem, christened Oxo, is at when you type in the program below. It's fully capable of playing a legal game of noughts and crosses, and it knows when it has won or lost.

But Oxo has no initial idea of how to play the game, other than by moving pieces at random. However, it begins to learn right from the very first game, rather than using the technique I mentioned earlier of storing moves for later analysis.

The program uses a very simple, but effective, method of learning how to play noughts and crosses. In fact, it doesn't even learn, in the strict AI interpretation of the word.

As a matter of interest, Oxo is heuristical, which basically means self-learning. Arthur C. Clarke's HAL, for those of you who are not science-fiction freaks, stands for Heuristically ALgorithmic.

The board positions are numbered one to nine, so that you only have to tap the corresponding key to make your move. What Oxo does is to store the moves in each winning game as a sequence of 10 bytes, where the first byte indicates who won the game, and the following nine are numbers between one and nine for the moves.

Therefore each game is

recorded fairly economically - but before you write in to tell me, yes I could have stored two moves in one byte, but frankly couldn't be bothered!

When more than one game has been played, to keep things simple the human player always moves first. Oxo checks each stage in all subsequent games to see if it can match them with a previous winning game.

If it finds a matching set of moves which led to the human winning a previous game, Oxo simply reads the next move from the stored game, and plays this as its next move - effectively blocking you.

This is the first way in which the program learns strategy. It looks for past games which match the one in progress, preventing you from duplicating the win.

Of course, there are thousands of ways to play noughts and crosses, and in theory it could take months to learn them all. But to stop things from getting out of hand there is an upper limit of 400 on the number of games which Oxo can remember.

Anyway, you will find that individual players tend to use sets of favourite moves, and the computer seems to catch on amazingly quickly. After as few as 20 or 30

games Oxo will be blocking you with what seems to be greater and greater intelligence.

It's quite fascinating to watch. The process - although entirely blind and artificial - is very effective. Which brings us to the second way in which Oxo learns.

It's not enough for it to play defensively all the time, so it also remembers those games which it inadvertently wins. These won't be many at first, but each one helps.

During the course of a game each move is also checked against games previously won - and if the moves match, Oxo will always play its next remembered move.

Of course, if this is blocked in turn by you, and as a result you win the game, you won't win that way again - Oxo will see to that.

Artificial intelligence is a fascinating field, often controversial, but never boring. I hope that these two articles on the subject have stimulated a lot of thought, and hopefully some very interesting programs will be forthcoming from our readers.

So get out of your armchair, and hit your Electron with quick-thinking programs.

## Heuristical Noughts and Crosses

```

10 REM OXO - Heuristical
20 REM Noughts & Crosses
30 REM By Chris Nixon
40 REM (c) Electron User
50 REM
60 IF PAGE=0000 THEN 110
70 *FX18,0
80 *K 0 *t:IMFOR1=0TO(C)
P-PAGE)STEP4:1:1:000=1:PAGE
:NEXT:MPAGE=0000:MOLD:MRUNIM
90 *FX18,0,128
100 END
110 *FX16
120 MODE:VDU23;820;0;0;0
::PROCPSETUP:REPEAT:PROCPPLAY:
UNTIL FALSE
130 DEFPROCSETUP:COLOUR0:C
OLOUR129:PRINTTAB(6,1)Heuri
stic Noughts & Crosses:COLO
UR1:COLOUR128:PRINTTAB(3,3)
By Chris Nixon - (c) Electro
n User:VDU28,0,24,39,4
140 LimitX=400:DIM gX(Limit
X,9),bX(9),rX(9):maxX=0:sta
rtX=0:1X=0:s2X=0:ENDPROC
150 DEFPROCplay:CLS:PROCB
ard:winX=FALSE:loseX=FALSE:d
rawX=FALSE:ptX=0:goX=1:turn
X:startX:FORLX=1TO9:bX(LX)=0
:NEXT:REPEAT
160 IF turnX=0 PROCPlose:
ELSE PROCPcomputer
170 PROCPcheckwin:turnX=tur
nX EOR 1:goX=goX+1:UNTILwinX
OR loseX OR drawX
180 IF winX PROCPwin:PROCP
pe:ENDPROC
190 IF loseX PROCPlose:PROCP
wipe:ENDPROC
200 IF drawX PROCPdraw:PROCP
wipe:ENDPROC
210 DEFPROCboard:1X=1:FORY
X=1TO3:FORX=1TO3:VDU51,X,X+
12,1Y,X+3:bX(LX)=0:PRINT ST

```

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# ACTION

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```

RL(L):LI=LI+1;NEXT:NEXT
220 COLOUR:COLOUR129:PRINT
TTAB(3,1)YOUR SCORE:PRINT
AB(29,1)MY SCORE:COLOUR1:CO
LOUR128:PRINTTAB(7,3)STR$a2X:
X:PRINTTAB(32,3)STR$a2X:PRINT
TTAB(16,1)STACK:;maxX:END
PROC
250 DEFPROCPlayer:COLOUR0:
COLOUR129:PRINTTAB(15,20)Y
our Move ";:COLOUR1:COLOUR12
8
240 REPEAT:REPEAT:GX=GET+4
8:UNTIL GX=0 AND GX<10:UNTIL
BL(GX)=0:;X(GO)GX
250 PROCmark("O"):ENDPROC
260 DEFPROCcheckWin
270 IF bX(1)=1 AND bX(2)=1
AND bX(3)=1 winX=TRUE:ENDP
ROC
280 IF bX(4)=1 AND bX(5)=1
AND bX(6)=1 winX=TRUE:ENDP
ROC
290 IF bX(7)=1 AND bX(8)=1
AND bX(9)=1 winX=TRUE:ENDP
ROC
300 IF bX(1)=1 AND bX(4)=1
AND bX(7)=1 winX=TRUE:ENDP
ROC
310 IF bX(2)=1 AND bX(5)=1
AND bX(8)=1 winX=TRUE:ENDP
ROC
320 IF bX(3)=1 AND bX(6)=1
AND bX(9)=1 winX=TRUE:ENDP
ROC
330 IF bX(1)=1 AND bX(5)=1
AND bX(9)=1 winX=TRUE:ENDP
ROC
340 IF bX(3)=1 AND bX(5)=1
AND bX(7)=1 winX=TRUE:ENDP
ROC
350 IF bX(1)=2 AND bX(2)=2
AND bX(3)=2 loseX=TRUE:END
PROC
360 IF bX(4)=2 AND bX(5)=2
AND bX(6)=2 loseX=TRUE:ENDP
ROC
370 IF bX(7)=2 AND bX(8)=2
AND bX(9)=2 loseX=TRUE:END
PROC
380 IF bX(1)=2 AND bX(4)=2
AND bX(7)=2 loseX=TRUE:ENDP
ROC
390 IF bX(2)=2 AND bX(5)=2
AND bX(8)=2 loseX=TRUE:ENDP
ROC
400 IF bX(3)=2 AND bX(6)=2
AND bX(9)=2 loseX=TRUE:ENDP
ROC
410 IF bX(1)=2 AND bX(3)=2
AND bX(9)=2 loseX=TRUE:ENDP
ROC

```

```

420 IF bX(3)=2 AND bX(5)=2
AND bX(7)=2 loseX=TRUE:ENDP
ROC
430 FX=0:FORLX=1TO9:IFbX(L
X)=0 FX=1
440 NEXT:IF FX=0 drawX=TRU
E
450 ENDPROC
460 DEFPROCComputer:COLOUR
0:COLOUR129:PRINTTAB(15,20)
My Move ";:COLOUR1:COLOUR
128:IF maxX=0 PROCrandom:END
PROC
470 GX=FNsearch:IF GX=0 PR
O:random:ENDPROC
480 PROCmark("X"):ENDPROC
490 DEFPROCrandom:REPEAT:G
X=RN(9):UNTILbX(GX)=0:PROCM
ark("X"):ENDPROC
500 DEFPROCmark(MS):IF MS=
"O" bX(GX)=1 ELSE bX(GX)=2
510 bX(GX)=GX:XT=(GX-1)/(M
O3)+4+16:;INT((GX-1)/33)
+3+6:VDU3X,XT,FX:COLOUR0:COL
OUR129:PRINTMS,FX:COLOUR1:COL
OUR128:ENDPROC
520 DEFPROCwin:COLOUR0:COL
OUR129:PRINTTAB(5,20) You w
in. Press any key to play ";
:COLOUR1:COLOUR128:;X=1X+1
:;X=0:PROCscore:ENDPROC
530 DEFPROClose:COLOUR0:CO
LOUR129:PRINTTAB(6,20) I wi
n. Press any key to play ";
:COLOUR1:COLOUR128:;X=2X+1:
;X=1:PROCscore:ENDPROC
540 DEFPROCdraw:COLOUR0:CO
LOUR129:PRINTTAB(6,20) Draw
. Press any key to play ";:C
OLOUR1:COLOUR128:ENDPROC
550 DEFPROCpipe:GX=GET:PRIN
TTAB(5,20)STRINGS(32," ");E
NDPROC
560 DEFPROCscore:GX(maxX,0
)=startI:FORLX=1TO9:GX(maxX,
LX)=X(LX):NEXT:maxI=maxX+1:
ENDPROC
570 DEFNFsearch:IFgo1=1 TH
EN 640
580 ptrI=0:REPEAT:stI=GX(p
trI,0)
590 LI=1:REPEAT:IF gI(ptr
I,LX) < rI(LX) THEN UNTIL gI(ptr
rI,LX) < rI(LX):GOT0620
600 LI=LI+1:UNTIL LI=GX:U
NTIL LI=goX
610 =gI(ptrI,LX+1)
620 ptrI=ptrI+1:UNTIL ptrI
=maxX
630 REPEAT:GX=RN(9):UNTIL
bX(GX)=0:GX
640 REPEAT:ptrI=RN(maxI)-
1:UNTIL LI(gI(ptrI,0)=0)=GX(ptr
I,1)

```

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# Electron Memory Map

# Part 5

In the final part of this series we take a look at the memory map from &D00 right through to &FFFF as the bulk of it is free ram and the roms.

Page &D00 is split into four main areas. The first &5F bytes are devoted to non-maskable interrupts, generated by hardware devices such as the Plus 3 disc system and internal interrupts from the ULA.

The remainder of Page &D00 is con-

cerned with paged roms, including the extended rom vector set and a table containing each of the 16 possible roms' private workspace allocation.

Then comes the Electron's free ram, extending up to the start of screen memory.

The paged roms start at &8000 and the os starts at &C000. There's a small IO (input/output) region at pages &FC to &FE.

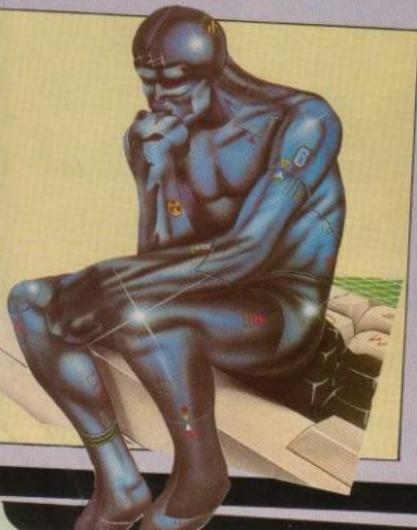
TABLE I: The remaining ram and rom

Address	Use
&D00-&D5F	Non-maskable interrupts (NMI) workspace.
&D5F-&D9E &D9F-&DEF &DF0-&DFE	Reserved. Paged rom extended vectors. High bytes of paged roms' private workspace.
&E00	Operating system high water mark (OSHW). Paged roms may raise this to claim workspace.
&E00-&8000 &3000-&7FFF &4000-&7FFF &5800-&7FFF &6000-&7FFF &8000-&BFFF &C000-&FFFF	User ram and screen memory. Modes 0, 1 and 2 screen area. Mode 3 screen area. Modes 4 and 5 screen area. Mode 6 screen area. Paged roms. The operating system rom.

TABLE II: Memory mapped IO

Address	Use
&FC00-&FCFF &FD00-&FDFF	Memory mapped IO hardware. Available for accessing an extra 64k of ram.
&FE00	Interrupt status and control register. Bit 0 - Master interrupt request. Bit 1 - Power on reset flag. Bit 2 - Display end interrupt flag. Bit 3 - 50Hz real time clock (RTC). Bit 4 - Transmit data empty flag. Bit 5 - Receive data full flag. Bit 6 - High tone detect flag. Bit 7 - Not used.
&FE02/&FE03	Screen start address: &FE03 bits 5-0 + &FE02 bits 7-5.
&FE04 &FE05	Cassette data shift register. Clear interrupt and rom paging register. Bits 0-2 - rom paging bits. Bit 3 - rom page enable. Bit 4 - clear display interrupt. Bit 5 - clear RTC interrupt. Bit 6 - clear high tone interrupt. Bit 7 - NMI clear.
&FE06	Read/write cassette data, generate sounds.
&FE07	Control register. Bit 0 - not used. Bits 1-2 - mode of operation: 00=cassette input 01=generate sound 10=cassette output Bits 3-5 - screen mode. Bit 6 - cassette motor switch. Bit 7 - Caps Lk LED switch.
&FE08-&FE0F	Colour palette registers.

The Electron memory map - which started in the April 1988 issue of *Electron User* - is an essential guide for any programmer. It enables you to make use of those hidden and undocumented memory locations, and improve the efficiency of your programs.



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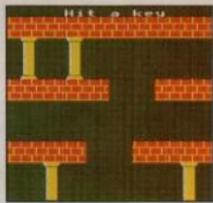
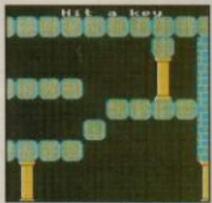
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# REPTON

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