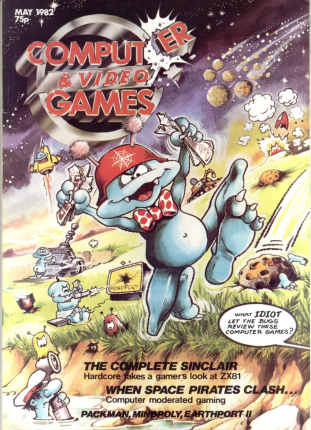


MAY 1982
75p

COMPUTER & VIDEO GAMES



WHAT IDIOT
LET THE BUGS
REVIEW THESE
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THE COMPLETE SINCLAIR

Hardcore takes a gamer's look at ZX81

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Computer moderated gaming

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NEXT
WEEKEND

June will find normally mild-mannered men vehemently pushing forward half-believed theories as indisputable facts. Gesturing wildly with beer-glasses and shouting down conflicting opinions with a bigotry which befits 50,000 years of civilisation.

Yes, you guessed, the World Cup is with us again and love it or adore it — it's difficult to close your eyes to it.

Already the arguments rage with the Huddle Walks on Water School, battling against the He Couldn't Kick His Way Out of a Paper Bag theorists. Northern Ireland is dogged with the Martin O'Neill question and Scotland — which has seen it all twice before in the last eight years — is gearing itself up for the Jordan or Gary debate.

It's certainly a hot topic in Argentina and probably causing quite a furore in El Salvador. But if the facts don't finally support your views then *Computer & Video Games* can help you take the matter into your own hands.

If you feel England would have qualified from their group if only Greenwood had followed your advice for the teams against France then you will have the opportunity to prove it next month when we publish our World Cup Manager game.

You can choose to manage any of the 32 sides, pick your team, play your matches and find out how you're laid. Send out your scouts to watch the opposition, brief your team on tactics, discover the danger men in the opposition and make arrangements to mark them.

Warring with Brazil or West Germany is a hard enough task but anyone who can do it with El Salvador will really have proved their management potential. We think it's a winner, see what you think next month.

Everyone will be a winner with our World Cup competition. The *Silico Shop* is putting up the *Amstrad T.V. Games Centre* and football cartridge for the first prize but there are also consolation prizes and everyone who enters will receive a £3 voucher to spend at the *Silico Shop*.

Find out how to enter and test your football judgement in our June issue.

HOW WOULD YOU FARE IN THE WORLD CUP?



NEXT
WEEKEND

If the spirit of Adventure is lurking in your veins, you'll find plenty of ideas in our June issue.

We have four very different adventures featuring next month. From outer space battles in the *Star Wars* mould with *Dog Star Adventure* down to the depths of the earth for a very different kind of challenge in the hunt for *Trollis Gold*.

Or you could *Save the Princess* in another short adventure game for *Atom* owners.

When the BBC leads its name to a product it has to be special and the microcomputer that bears its name falls into that category.

If you own one already, have one on order, or just have a healthy interest in the machine, you'll want to read our special section on this highly rated microcomputer — including three of the first games created for it.

Commodore's *WC-20* is now in the high streets and selling well. The company is supporting it with some high quality games cartridges and a growing range of peripherals. A complete run-down on this popular micro takes place in next month's *Hardware* section.

NEXT
WEEKEND

The response to our first issue's free cover puzzle brought us on the top. This time we think we're ready for you — and we've also got you programmer/puzzlers a slightly more challenging task.

There's another free puzzle, from the people at Pentangle, going on our June front cover and although you won't need a computer to solve it — we hope you'll see one to enter our second competition. Even if you don't win you should emerge a better problem solver for trying.

The *Beat-the-Bug* puzzle will make *Computer & Video Games* stand out even more on your local newspaper's shelves. But why not make sure of your copy by subscribing now.

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THE LOST KING . . .

Dear Sir,

I was a shame playing computers and always read your page on this game with interest.

In the April issue, I was delighted to find an opportunity to test my own machine by acquiring the problem which Max Brazner had illustrated. However the third diagram, which illustrates a problem solved by the 8th Spa Mark V, is missing a black king — so wonder if dated editing by professional B. Joseph Olan Scotland!

Editor's reply: The diagram is not only missing a black king, it is also the wrong way up. A correct version is printed below which will give you a real test of my chess problem solvers — or their machines!



a b c d e f g h

LANGUAGE PROBLEM

Dear Sir,

Would you please answer a question for me? I will shortly be getting a Vic-20 which I ordered from the United States. What I would like to know is if programs produced for British standard Vic-20s will run on U.S. standard Vic-20s. Is the basic the same?

The command I am wondering about most of all is

the colour command. If the basic is not the same the U.S. Vic would have "COLOR" where the British Vic would have "COLOUR". If this command is different will the tape still load so it can be listed and changes made?

I hope I can use British produced tape as there are many excellent game programs in your magazine for the Vic-20.

Michael A. McAllister
RAF Lakenheath
Suffolk

Editor's reply: You should have no problems Michael as all Vic-20s are imported into the U.S. anyway so there's no such thing as a British standard version. The basic is standard so you should be able to use British produced game tapes.

WAITING TO INVADE

Dear Sir,

I am very pleased to say that I have thoroughly enjoyed all the issues of Computer and Video Games since the first one issued in November.

Every month I look forward to reading your magazine in search of a review or an advertisement for Space Invaders for the Vic-20, but I have been bitterly disappointed every time until your latest issue — March — in which on page 63 I saw an advertisement for it.

I am not too sure whether I should buy.

So could you please help me and all other VIC owners in search of VIC Invaders by providing some information.

R. S. Aron
Telford
Liverpool

Editor's reply: The Commodore Knowledge Answer is

one of the best computerised Space Invader games you'll find. Mr. Aron, it is available from their dealers at £17.95 + VAT.

GRAPHIC DISPLAY

Dear Sir,

I am writing in the hope of adding enjoyment to all graphically frustrated ZX81 owners.

In reply to DK's review advertisement — page 62 of your February edition — I received their 4K graphics ROM. It is a very neat Epson based circuit that fits under the ZX-81 keyboard.

To date I have converted your Cosmos and Cosmos Landing programs and, by inserting a loop within the program loops, have obtained some hilarious stiletch type movement of wings, arms and legs.

While on the subject of Cosmos Landing may I give my congratulations to the co-authors on an excellent program. More of the same quality please — via a ZX-81 case perhaps? R. M. Leathers
Roxborough
Hants.

MORE FOR THE VIC

Dear Sir,

I am requesting more Vic-20 programs. The Vic-20 computer is becoming more and more popular and my — I dare say? — taking over the ZX-81 ZX-80, I know many people in and out of school who have this best of tricks — I, unfortunately have not — and often have access to the use of a Vic-20 would like to see more games for it using all its qualities — sound, colour and good graphics.

Having all but one issue I have played Pot Shot which I enjoyed but am disappointed

to only see one game, whereas the ZX-81 has had six games. Apple computer one used in each issue of your mag will do. Do please, please have more games for the Vic-20.

Clive Young
Luton
Bedfordshire

Editor's reply: We will be running more Vic-20 programs Clive, in fact you'll find one in this issue — and we promise not to ignore your favourite machine.

DOUGEM DODGE

Dear Sir,

Modifications to allow your November Atom Atom Dodgem program to run without floating point ROM.

- A) 11120: remove "COLOUR 1"
1120: remove "COLOUR 1"
- B) 21, 41, 61, 81: in each case
"S = S + ROM (7.5)"
to "GOSUB 9-9+E", and add
2020: E-T-S. IFE-9
8 R
2030 IFE-9 E-1.5
2032 = -1.5
- C) During debugging, remove end of line 2030 from 718, . . . (Inclusive)

Tom Boyd
Avalbury St. Mary,
Dorking,
Surrey.

P.S. On 11120 should be CLEAR 2, not 3 — Congratulations on an otherwise high standard of bug-free code!

John Flynn replies: Thank you for your modifications for running Dodgem on a machine without the floating point ROM. It should also be possible for you to run the program in colour by using the routine on page 89 of Atomic Theory and Practice.



MAILBAG



SINCLAIR SELECTION

Dear Sir,
I have a Sinclair ZX-81 without a 128 KB RAM pack, and have bought the last few editions of your generally excellent magazine. My only complaint is the lack of ZX games that you have recently printed.

I think the best idea you can adopt is to print both a ZX and 128 program, pleasing both ZX and 128 Sinclair owners. I am pretty sure that there are many other frustrated ZX owners who would like to see this idea being carried out.

Patrick Mawer
Mansley
Shepton

Editor's reply: We feature two Sinclair ZX games in this issue Patrick and we hope you'll enjoy playing them. And yes, there will be a 128 game coming up in the near future.

SOUND ADVICE

Dear Sir,
I read in your Sounds column of the December issue of Computer & Video Games that "it is always possible to connect the computer to your hi-fi quality inputs and thereby obtain amplified sound".

I have a Tandy TRS-80 Level II ZX microcomputer and only recently, quite by accident, discovered that it had a sound facility.

As the Tandy shop I was advised to buy a small amplifier with a 3" diameter loudspeaker. They said that a direct connection from the tape outlet to my hi-fi would be dangerous, as spikes output from the hi-fi could damage the computer chips, and this was later confirmed when I contacted a friend who is very keen on hi-fi in these fields.

Yet at another shop a salesman, when I was discussing the purchase of a new U.K.F. V.C.U., said that he could incorporate the sound facility in a converted U.K.F. television by making a one-wise connection across

the ZX-play video output on the computer.

I am now quite bemused. I would like to purchase such a converted U.K.F. television, as I would then have the advantage of portability together with a sound facility, but I would also like to use my hi-fi at home, as I would get much better sound. But I fear that either course might lead me to accidentally damaging my computer. Can you advise?

Leslie Todd,
Bosley,
Huddersfield.

David Ansell replies: It is always wise to consider any damage that might be done to a computer by connecting it to anything else. The safest method of avoiding trouble is to separate the computer completely from the following circuit.

This can be done by using opto-isolators. These are small light-proof chips containing a light emitting diode and a light sensitive transistor, illumination is transmitted by light and no physical connection exists between the two circuits. This method is ideal for detaching relays, transistors, printers, etc, but the difficulty is not high enough for good sound reproduction.

Another way is to use some form of buffer circuit such as an Darlington driver chip like the 2N7108 from Philips. Unfortunately there are three drivers on one chip and eight lines cut from the average computer bus by interposing an extra chip between the computer and the outside world, all that would happen would be for the need to replace this and get one of those in the computer itself.

A much easier way to protect the computer is to simply use a series resistor. Any computer line configured as an output should ALWAYS have a series resistor placed immediately in the wire used to the equipment port before any external circuit is connected to it.

Resistors of 1K are usually adequate, but in the case described above, one of 100K is better and will not affect the output overmuch. Place this in series with the signal

wire from the cassette port, or ZX socket, and no harm should come to the computer.

Note, however, that some board card units when connecting T.V. sets directly to the computer often then via the usual UKF aerial socket. Many such sets have a "floating chassis" which is not earthed. To earth it, through the computer digital ground or by taking a line direct to the earth pin of your socket is highly dangerous, however, a competent T.V. engineer should be well aware of this point.

READER'S APPEAL

Dear Sir,
You have a great magazine but I had a small complaint about the programs sent in by some readers.

I own a ZX-81 and certainly lapped in the program for November, listed in your March edition. This I did despite there seeming to be an error in the machine code statement, where in the ZX's is line 37.

Why in these circumstances, among the ZX-81 owners, after all I have managed to key in and successfully run programs for other computers, after changing them to ZX-81 basic.

Congratulations to an otherwise excellent magazine.
P. J. Link,
Cheshampton,
Sussex.

COSMOS FAULT

Dear Sir,
I have enjoyed playing your Cosmos Landing program very much and was able to correct the mistakes pointed out in your March issue without any great difficulty. I am surprised however to discover that Mr Weil has not also spotted what I would consider as a major machine fault. The variable I assigned in lines 130-140 has no effect whatsoever on the descent rate. The fault lies in line 138 and I found replacing this with 137

3-31 very effective in solving the problem. I am not sure that this is the original line intended, but I feel that the fault should be made known to your other readers as it improves an otherwise brilliant game.

J. W. Streeton
Watney Gardens
Baker

DEFENDER ON APPLE

Dear Sir,
I read in the January issue of Computer and Video Games the article on the arcade game Defender, which interested me greatly, as I play the game myself. As I have access to an Apple II computer, I was wondering whether you might know if a version is being brought out in the foreseeable future, or even if a similar game is available. I hope you can help me with my query.
J. S. Haggard,
Ingtonston,
 Essex.

Editor's reply: There is an Apple II version of Defender on sale in the UK. It is an American written game by Sirius Software and you can obtain a copy of it from most Apple software dealers, including B&B Software of Hammersmith. The game is called Glasgow and according to the latest price list it costs £24.95.

AMERICAN DREAM

Dear Sir,
We are considering going to America for our holidays this year. Is it possible that if we buy an Atari 800 computer — which costs a lot less in USA — we can use it in Britain with our T.V. system?

Also is there any problem on Cosmos, if we declare the purchase of such a computer — as one they export? Adrian Morris
Covent

Editor's reply: Sorry Adrian, the American Atari 800 is not compatible with the British T.V. system — so your American dream will not be coming true.



MAILBAG



FROM THE BATTLEZONE

Dear Sir,
To my mind, people are attracted to arcade games subconsciously, for they often get out far more than they put into these computers.

Take Atari's *Battlezone*. It caught my eye in a fish's shop because of the XT monitor with vector scans, and the prodigious amount of mamba the computer gets through in real time. In case you haven't met it, it's a fighting tank simulator in which you drive around a valley dotting mountains and rocks. Everything is portrayed in full perspective, right down to the missiles flying longer to distant targets.

A kind man let me see one. There's a 6502 riding a 12K program, plus four custom bit-slice chips doing 16-bit trigonometry, among the 150 other support devices. She certainly gets out more than you put in. At a guess the software came out of the backdoor from NASA, Boeing and Lockheed.

Though your readers might be interested, Jonathan Page, Chesterton Road, Cambridge.

JUMBLED ADVENTURE

Dear Sir,
I have an Atari 486 computer with a microtax 32K card in it. Please could you help me with a problem I have. When I run *Scary Adams* adventure games, 1, 2, and 3, 90 percent of the time when I run the games they are all right, but sometimes when I press the return key, the screen is covered with jumbled-up letters and then after about two seconds, the screen either goes black or yellow and black with machine code symbols.

The only way out of this is to turn the power off and to start again. I have also tried the games on an Atari 800 and the same thing happens.

I would just like to congratulate you on the marvelous reading that your magazine offers.
Mr / Harman,
Millbrook,
Southampton.

Editor's reply: I'm afraid that you either have a faulty cassette containing the game, or a faulty computer. I suggest you take your computer to your supplier and get him to give it an overhaul to see if anything is wrong.

Unfortunately, the Microtax 32K card is not one which either Atari or Ingarwell supports for use with the Atari.

If you have not already tried returning the games to the supplier in case they are at fault, it would be a good idea to do so.

TUNE IN TO THE BBC

Dear Sir,
I have ordered a Model B BBC microcomputer which is due in March. Please could you inform me whether a BBC Users Club is planned to be formed in the near future?
Jonathan Freeman
Fulham
Covecity

Editor's reply: Here are a couple of addresses you may find useful, Jonathan.

The 22-8081, Scarsden Road and S.B.C. Micro-user Club can be contacted by writing to Tim Hartwell, 44-45 Earls Court Road, London W8. This club produces a magazine called *Interware* which includes programs for the S.B.C. micro.
The Beeping User Group can be found at 55 St

Juliana Road, St Albans, Hertfordshire and D. E. Godwin is the person to contact.

COUNTING ON COMMODORE

Dear Sir,
As most people know, the Commodore's Pet computer uses a cassette recorder for storing programs on tape. This is very inconvenient, if you have a long program to save or load.

This is a drawback we have to put up with, but another problem, which crops up when saving programs on tapes, is how to find programs in the middle of a tape.

This problem can be overcome by using a tape counter, so it is possible to record the number the program is at. Will we be likely to be seeing Pet computers with tape counters, in the near future?
Andrew Soder,
Fackley,
London.

Editor's reply: Your idea for a tape counter is a good one, but Commodore claims it has beaten you to it. I don't know what make of cassette recorder you have but the standard Commodore compatible one is the C28 which already has a counter.

SOUND AND VISION . . .

Dear Sir,
Well, I'm lost for words! All I can say is that you're one fantastic magazine. But also even with your excellent advice I am still

unable to create my dream game, which, when finished I might let you see. To tell the truth I haven't started yet but with your help, who knows?

I am presently using an Apple II. I have searched for manuals high and low in order to find some good sound effects. All I have achieved so far is a loop around a line like PEEK (-65536) - PEEK (-65536) + PEEK (-65536).

Are there any other ways of getting sound from the Apple because this sounds horrible. Not exactly your ideal laser gun sound.

I am also experiencing problems in High Res Graphics. I am presently using a shape from a shape table with the command:

DRAW 1,AT 0, 0

This works fine but I would like to know how to make the shape move by pressing a key on the keyboard and for the shape to continue moving until that key is released. Another problem I have is how to make the aforementioned shape explode or disappear when touched by another shape e.g. a missile.

Is there any way your dedicated readers could help me out? I'm sure many others like me? Please, please write in because I'm really desperate.

I'm sure many readers with Apple's without pointers would like to know how to convert the Daylight by Mark Polczak in the February issue to a keyboard operated version.

Paul Cairney
Dunfer,
Dunfer.



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And the first 15 imaginative names we receive will be given a place in the game. We also need your name, address and telephone number but most importantly we need 15 people who will make the deadlines for orders, not lose heart if their system is invaded by a fleet of Berserkers and be willing to write the occasional piece about the game for inclusion in the magazine. So be quick off the mark with your letter.

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Confessions of a Bug

There are times when we Bugs surprise even ourselves. The February edition offered the Tandy TRS-80 game of Grand Prix which generated innumerable phone calls from readers who claimed various assorted problems in the program — but we never laughed if honest!

The most popular theory expounded was that disc based instructions made it impossible to run with a cassette. But after thorough testing it Bugs came to John Gibbo of Dover: it has been proved to everyone's satisfaction that the game works perfectly well on both disc and cassette.

The problems seem to relate to the data statements and making sure you distinguish between a "B" and an "E" in them. Also check the letters "D" and "O" in the program. A program which includes a line to check the data entry is available from Computer & Video Games for anyone still having problems with this game.

The 2881 Poker game in our April issue caused plenty of phone calls from observant programmers who spotted an IF statement in line 3830 with no THEN attached.

The line is correct as far as it goes but continues:
=34 AND J2 -2 -J3 -1 THEN LET
T4 =J234

This game does in fact work without the missing line until you get three of a kind up — and so slipped through the rigorous testing the editor put it through.

The Moon Lander caused a few problems as a rogue symbol appeared in the printout in line 368. It was a comma — as most of you seemed to guess. The line should read:
368 N = N:128.6.

BRAINWARE ANSWERS

The answer to our April Mind Boggler problem is 1389 bugs divided as follows: first man 585, second man 477, third man 393 and fourth man 330.

The correct solution to last month's Nevada Crossword is printed right and the winners' names will be published in next month's issue.

For more puzzles to test your mind turn to page 81 for this month's Mind Boggler and Nevada Crossword.

R	E	A	D	H	L	T	F	O	R	K	
H	V	N	I	D	R	N					
H	E	X	E	N	Q	U	I	R	I	N	G
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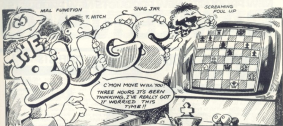
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NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS

GAMES NEWS

SCRAMBLING AROUND THE RED PLANET

CAVERNS OF MARS

On a trip into space you discover a massive hole on Mars.

The giant cavity is the result of a meteor crashing into the planet.

You decide to explore the caverns and control a spaceship on a journey into the depths of the red planet.

The caverns soon narrow as you get underground and you have to steer clear of the jagged sides of the shaft while at the same time landing a number of fuel dumps on your way down. Is the game starting to sound familiar?

If you get through without crashing into the rocky sides you enter the second phase of the game. Swarms of aliens fill the shaft which you must destroy or avoid.

In the third phase the shaft narrows even more and you have to fly your ship around barriers which appear randomly 90 degrees and you are dead.

The game becomes progressively more difficult in the following three phases. The game ends when you successfully land your ship on the pad at the bottom of the shaft.

The Caverns of Mars — based on the Arcade game Sizzamble — is a creation from Atari which runs on their 400 or 800 machines. Retail price is £29.95 and it's available from Atari distributors.

FIGHTING THOSE ALIENS...

SPACE FIGHTER

Aliens are out to get you and your chances of survival are slim as you fly a space cruiser over unrelenting terrain dodging enemy fire coming from all directions.

There are five varieties of alien out to get you and you must avoid being shot down by these nasty characters.

Some move straight towards you, some move down the screen and some diagonally.

Your defence is a laser cannon,

and if the going gets really difficult and you feel your ship is in jeopardy of destruction you can activate one of three smart bombs. These immediately blow up all the alien forces on the screen.

The game is similar in concept to the popular arcade game Defender which has frustrated many players. It's written in machine code to speed up the on-screen action.

There are six skill levels and with 18 phases to get through this tough, competitive game could get you hooked to your Atari monitor.

Space Fighter runs on a SE Atari with 28 graphics facilities. It comes from Leeds based Atom specialists, Program Power and costs £9.95.

THE ANCIENT CONFLICTS

TRIUMPH OF ROME

Unbearable back in the second century BC the mighty Roman legions are advancing on the Seleucid Kingdom.

The Seleucid Kingdom was a Greek Empire stretching from north-east Greece to the borders of India — and the prize which the two empires were fighting for was the domination of Greece and the cities on the western coast of Asia Minor.

In this game you relive this ancient battle for power. Improvements have been made to the program logic to make the simulation of warfare more realistic and decisive. A typical game will take about three hours to complete, and a facility for saving a partially finished game is included.

Three maps are provided depicting Greece and the area of Asia Minor on the Aegean Sea. The forces available to each player include infantry, cavalry, elephants, siege artillery warship and transport vessels.

During the game taxes have to be raised, troops recruited and paid. The program also covers naval encounters, land battles and sieges — and takes account of the various capabilities of different troop types in varying circumstances.

Triumph of Rome runs on a TRS-80 in 19K and comes from Multimedia of Barchinon-Sea. It costs £22.95.

THESE MEAN STREETS

CITY ENCOUNTERS

Big cities may lure you to taste their delights with bright lights but within their hidden dangers lurk.

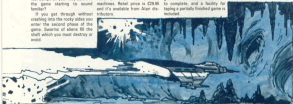
Stepping away from the traditional setting of Adventure games, City Encounters takes place in a concrete jungle. The action takes place in buildings, cafes, garages and down dark alleyways.

The object of the game is to see how you survive in the city. At the beginning of the game each player is allotted various physical attributes including strength, intelligence, and alert-

ness. The computer also gives players with a non-run on their family background, social standing, financial condition.

A special feature of the game is that at any time you can check out where other players are. A description of how the players are getting on is displayed on the screen.

City Encounters is the follow-up to another Adventure, Random Dungeon Generator, produced by Multimedia of Barchinon-Sea. It comes in tape form for the Tandy TRS-80 in 19K. The price is £17.95.



NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS NEW PRODUCTS GAMES NEWS

GNOME FROM GNOME

HOUSE OF GNOMES

In the House of Gnomes, the rooms containing dangers which Gnomemen would be loathe to touch.

You have to wander round the rooms of the house picking up objects as you vary. When you have collected them all without coming to any harm you emerge as the winner, beating the computer.

But hazards abound in the House of Gnomes to prevent you from winning. The gnomes themselves are evil creatures and are willing to tempt and challenge you. A snap decision is needed to accept the challenge and defend yourself, or to try and bribe them.

This game comes from Bug Byte of Liverpool and runs on the UK Sinclair ZX81 II costs £7.

Soon to be released from the same firm are a series of cartridges for the ZX-81 which plug into the machine. They are full K games which means that if you only have 1K memory the cartridges will upgrade the memory space giving you a much better game.

Games on the way are Break-out, Pictol, Invaders and a 3D maze game. The cost of these has not yet been decided but is expected to be £10 or £14.

TORTUOUS TUNNELS

Wandering through twisting tunnels and underground caverns you can find yourself in all sorts of trouble deep within the caverns of poor Atom.

In this game, simply named Adventure, the object is to rescue a beautiful princess from her captors and collect a total of seven treasures on the route.

You will find yourself in a network of caves, a forest, a desert land, and tortuous tunnels during your quest. You wind up in a castle which is filled with evil creatures ready to strike you down given the slightest opportunity.



WE'RE UP FOR THE - WORLD - CUP

SOCCER

With the World Cup looming on the horizon football is creeping into the computer games limelight.

Texas Instruments is keeping up to date with its Five-Side Soccer cartridge for the TRS-80 computer. It sticks closely to the real game with penalties and fouls. Only one player has possession of the ball at any time but the opposition can tackle and take the ball into play for his own team. It's not always successful and a slip of the joystick could mean you end up a goal under.

To shoot or pass the ball you have to press the fire button. You

can speed up the ball by pushing the joystick upwards for a fast ball. There are several variations of the game and it includes the facility to choose the length of the game and play injury time. You have to score as many goals

as possible within the time limit.

Graphics in the game are good but the action of the players seems slow. Full sound is incorporated into the game.

Five-Side Soccer is available through IT distributors including Corrys and Deans and is priced at £24.95.

WARPED ENTERPRISE

SPACE WARP

Captain James T. Kirk, Mr Spock and the rest of the Enterprise crew are going badly when no computer game has gone before — into the heart of the BBC microcomputer.

Space Warp, one of the first games on sale for this sophisticated computer is based on the popular television series, and one of the oldest computer games, Star Trek.

You have to venture into various sections of the galaxy, spread before you a grid. Located within the grid are various space craft, some belonging to unfriendly space warriors and some controlled by allied forces. You can also locate refuelling ships which are vital on your voyage through the stars. And of course the Klingons are there in force, ready to destroy you.

A 76 page booklet accompanies the game tape giving you

detailed instructions of how to play.

Bug Byte's Space Warriors on the Model B machine and you'll need over 12K memory. The game costs £11.50.

The Liverpool firm is making a big push into the BBC market, producing compatible software and has plans to bring out a magazine for BBC micro owners.



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GAMES NEWS

JUST LIKE THE REAL THING . . .

A new space invaders style game for the Sinclair ZX81 has overcome some of the limitations which hampered the game in the past.

Written in machine code the on-screen action is very rapid. The fire button has a reset.

WATCH OUT — THERE'S A ROBOT ABOUT!

VOYAGER

STUCK in space on a strange space cruiser your job as a cosmic commander is to disable the alien ship and destroy the power generators.

First you must locate the generators which are the ship's power source. You get a three-dimensional picture of the interior of the ship and you are armed with weapons to blow up the power supply. Only when you have done this is your mission accomplished.

There are bands of security robots that are programmed to

INVADERS

trackdown, has tried to emulate the original game as much as possible, even to the extent of introducing a random flying saucer which — if hit — scores mystery points.

Filling the screen are seven rows of 12 invading aliens, and you can try out your expertise using any of the three skill levels of the game. The lower skill levels of this version seem very slow, but when it reaches the complicated stage the invading

aliens speed up as their numbers deplete. There are three shields for your firing base to hide behind and a bonus blaster is given after you successfully edge out the sets of invaders — just like the real thing.

Filling the screen are seven rows of 12 invading aliens, and you can try out your expertise using any of the three skill levels of the game. The lower skill levels of this version seem very slow, but when it reaches the complicated stage the invading

robots move across the screen with alarming speed.

Also incorporated into the game is a facility to store the highest score run up by one player, along with that player's name.

Quicksilver also produce a character and sounds board for use with this game. The graphics are very realistic, particularly the aliens. Sounds add an extra dimension to the game and as you can use the board with other games, it is worthwhile investing in one.

You'll need a ZX - 81 with a minimum of 1K RAM to play OS Invaders, which costs £3.50. Excellent value for money!

detect any foreigner on board the ship.

In addition to 3D graphics the game comes with full sound.

Voyager is supplied by Avalon HR UK and it is available for a number of different computers. Currently you can buy it in cassette form for £13.95.

It runs on the TRS-80 Colour Computer and standard TRS-80, PET, Apple — both requiring 32K memory — and Atari 400 and 800 with 32K. (Two versions will be available for the Apple I/8K and Atari 130X).

ALIEN GUNSLINGERS

CRAZY SHOOT-OUT

Unless you are handy with a six-shooter you'll never escape from the deadly room filled with hordes of alien creatures.

There are two exits from the room but you can only escape when you can see the aliens lurking in the rooms.

You move your man around the room picking off the slow-moving creatures. For each one you kill you are rewarded with a number of points. When all the aliens have been you know there are only 10 left to get rid of!

You can angle your shots left or right, up or down. If you need it you can take diagonal aim at the creatures.

The first wave of beasts is the easiest. After wiping them out, you make your man run out of one of the exits — taking care not to bump into any of the deadly reflective walls.

Then you begin the second phase, and things get tougher. The aliens shoot back at you and increase in number. Each stage gets more difficult as the aliens fire back at you with increasing vigour.

Crazy Shoot-Out comes from the newly formed Mappoft subsidiary of Southland based Mappin Electronics. This imaginative addictive game costs £9.95. It runs on the Atari 400 or 800 personal computer and is an American non-Atari imported cartridge.

CURVED BRICKBATS . . .

BREAKOUT

This version of the popular arcade Breakout game features a curved bat.

The idea is the same as the original game. Your task is to keep a ball in play by bouncing it off your bat. Using the joystick to control the movement of the bat.

At the top of the screen are several layers of coloured bricks which you must demolish with the ball. For each brick you knock out you are rewarded with a varying number of points, depending on the layer which the brick comes from.

If you miss the ball and don't catch it on your bat it automatically goes out of play. You get three balls to play with. After you have lost the third one the game ends.

Breakout is the latest addition to Big Byte of Liverpool's range of software for the Vic computer priced £7.95.



TV GAMES CENTRES TV GAMES CENTRES TV GAMES CENTRES VIDEO SCREEN

WHERE THINGS GO BUMP IN THE NIGHT...

Things tend to go bump in the night when you are venturing into a haunted house via your Atari Video Computer System.

Haunted House is the latest game brought out by Atari and it marks a change of tack for the firm. Until now there has only been a limited adventure game for the VCS as Atari concentrated its expertise on arcade games.

An adventure game already exists in the range based on the classic Dungeons and Dragons game. But it all takes place visually rather than in the written form used by computers with more memory space than the VCS.

In this game you control a man who walks through the house which is in complete darkness.

HAUNTED HOUSE

The house is riddled with ghosts and ghoules which you have to avoid or destroy. Which ever is essential for your own safety.

You ask simple questions which the computer answers by moving you graphically on the screen. Objects which you discover also appear and can help you in your travels. Usually you can keep useful things which could help you out of trouble, like

a length of rope or a weapon. You can also acquire some money or other valuables which can be used for buying any hostile characters you come across.

In Adventure games you only have one life to play with, unlike arcade games when you are given more. So you have to be extra careful when moving into various rooms.

A good place to follow is to

draw a map as you investigate the house, and deciding what you found in different rooms. This is a help when you move to a different location because you can look back and ensure you don't go to the same place twice or make the same mistakes more than once.

Haunted House is available through Atari's UK distributors and it costs £29.95.



FANCY A BITE?

Foxman seems to be the hero of the video screens this year with many of the more games on the market.

The latest game centre to be affected is the G7000. Philips has named its version Munchkin because of the small chick with the big mouth who whizzes around the screen devouring anything in his path.

With Munchkin on the screen are three Munchies — which pursue the Munchkin — and 12 Munchies. Each Munchie is worth either one point, or three

MUNCHKIN

points if he is flashing when Munchkin eats him.

Using the handied controls you move Munchkin around the parts of a maze. If your Munchkin swallows a Munchie he earns five points for the first one, for the second you score 10 points, and 20 are up for grabs for a third.

The Munchies are only vulnerable when the Munchies are flashing different colours.

All three Munchies have an in-built secret weapon which allows them to recharge their energy. In the centre of the maze is a rotating chamber which they use as their headquarters.

When one of the Munchies is gobbled up by Munchkin it transforms into a ghost. In ghost form the devoured Munchie heads for its base and a few seconds later he reappears hungry for more action.

The game gets more difficult as it progresses. Once your Munchkin has got rid of the 12 Munchies the maze momentarily clears of its inhabitants. Then another batch of them material-

ise on the screen for your Munchkin to continue eating. With each new wave the Munchies speed up making it harder for you to catch them.

There is a facility to record the current and the highest score.

There are four different standard mazes to play in, plus another four mazes which will disappear when Munchkin is moving. If Munchkin bumps blindly into a wall the maze flashes on the screen for a few seconds for him to get his bearing.

You can also make up your own mazes by deleting or adding lines to the standard mazes.

Munchkin is available from G7000 stockists and costs about £25.

VIDEO SCREEN

often, you relentlessly hammer your video centre to death take a breather to ponder over who brought it to life with video games.

Before you plug a video game into a remote unit it has been through up to six months nurturing by a team of designers and programmers.

Video games emerge in their final form after several stages and Computer and Video Games talked to expert games designer Chris Horneham of Wembley based Centresoft to find out what those steps are.

Often it is the games designers themselves who think of the original idea for a game, but he is always willing to listen to and develop ideas other people come up with.

An idea for a game as innovative as Space Invaders is rarely discovered but ideas are always being tossed around in the design room. Chris Horneham, who worked on the Atari games produced by Team 178, gets his ideas from watching television, existing arcade games which serve as inspiration, and taking a theme and developing it.

He will pick up a subject, often to do with sport, and develop it. For instance the Atari game Jumbo Jet Landing was the result of that method.

The recent invasion of video games based on space invaders is becoming repetitive and sometimes dull. That is why designers are trying to get away from that theme. "I'm working on little animals at the moment," Chris said, "and am trying to think of good games based around them." Judging by the popularity of recent arcade games Frogger and Centipede he is on the right track for a winning formula.

The essence of a good video game lies in two sections. It must be visually attractive, which doesn't mean the screen has to be cluttered with graphics that serve no purpose. It means the graphics should be interesting and the screen colourful. And perhaps more importantly there must be an element of human engineering. "That means there must be something in a game that you don't always see," he explained.

Remember the flying saucer



BEHIND THE SCREENS

which flies across the screen at random intervals during Space Invaders? That's an example of human engineering. Because you never know when it will appear, and because it represents a high-points score, the hidden element makes the game more compulsive.

Then the designer must decide exactly what the game will consist of keeping within the realms of programming feasibility.

Drawing decides may be an odd phrase for you but to Chris it is a crucial job. "Even though I sometimes do them on the team they are a very important stage in making a video game."

He roughly draws a square box representing the screen and fills it with a game idea. Currently working on a sliding game he had drawn on the screen the slopes and different landscape possibilities, the screen positioning in relation to programming, and the

graphics which have to be used.

Once he has arrived at what looks like a viable game the designer takes the proposal to the marketing experts. "The real headache is marketing," moaned Horneham. "The marketing people aren't enough in tune with the market. If they are they will probably react to a game in the same way as the consumer."

The decision to carry a game's idea through to production lies with the marketing chiefs as it is expensive that the designer can show them a close picture of that game.

From there it goes into the hands of the programmer. Now it is up to him to translate the game to the screen. Usually he spends about three months

solidly programming, six months if the game is an exceptionally complex one.

It is often inevitable that a game will change during the programming stage, as the programmer can spot little additions to improve the game as it appears on the screen.

"Games change quite a bit from the original concept, but it depends on a programmer's creativity." A good games programmer should have a creative mind and the ability to see what can improve a game, or what detracts from the game.

According to Chris, finished Atari games are exactly the same as the original design. This is because Atari works on a system of very strict documentation which the programmer uses like a manual.

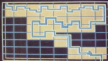
"It's a very strict system with notes that the programmer must stick to at every stage. He must also keep to the time scale laid down in the documentation."

Problems in programming video games centres lie in the lack of memory capacity. "They have a very limited memory so the programmer has a very difficult task to do.

"That's why the programmers have to know the machine inside out to program for it." That is why the only two firms to set up as independent software suppliers for the Atari VCS, Activision and Imagic, are experienced ex-Atari employees.

Once the programmer has got the game running from start to finish the designer photographs each stage of on-screen action and puts the pictures in a "very book" which he uses as ammunition to convince the marketing heads of the game's viability. Usually the games are tested internally on the employees and other their children, who are often good judges.

The cost for a big firm could run to £25,000 but smaller firms can cut spending and bring the figure down by at least half.



CHESS



Everyone knows computers can play chess — but they are also very able problem solvers.

An intriguing type of problem on which little work has been carried out so far is the retrograde analysis problem. These problems, unlike conventional ones — with requirements such as "White to play and mate in three moves" — are concerned only with the past history of positions.

A recent collection of retrograde analysis problems by the American logician Raymond Smullyan was presented as a series of chess detective stories, entitled *The Chess Mysteries of Sherlock Holmes*.

Here is a — relatively simple — example invented by Smullyan.

It is Black's move. The White King has accidentally fallen off the board. The problem is to place it back on the correct square.

At first glance, this problem seems unsolvable, or rather, there seems no reason why the



King cannot be on any one of many possible squares. The key to the solution is to notice that the Black King is in check.

Since White moved last, what move did he make to give check? If the White King were on e3, say, it is impossible to "unmake" any previous White move which takes Black out of check.

This is an example of what is known as an imaginary check. Since the initial position is known to be legal, the only possibility is that White has just

moved his King away from e3 — to e4 for example, but not e2 where it would itself be in check — discovering check by the Bishop on c4.

Unfortunately on e2 the White King is in double check by the Black Rook and Bishop. What was Black's previous move?

There is no possible Rook or Bishop move by Black which produces the required double check configuration, apparently another example of an imaginary check. In fact, however, this one is only "pseudo imaginary"



since the desired effect can be achieved by an en passant Pawn capture. Figure two shows the position shortly before.

Black has just moved his Bishop to give check. The game continues: 1. e2-e4, e4 x c3 en passant; 2. Kb3-e3, giving figure one. Thus, the White King originally stood on c3.

This example illustrates a number of important features of retrograde analysis problems.

Firstly, the phrasing of the question does not immediately suggest that any backward analysis of the position is necessary, but the problem cannot, in fact, be solved otherwise.

Secondly, it is crucially important to think of asking the right questions.

Care must be taken with imaginary checks: a move may have involved a capture — including an en passant capture — given on the eighth rank may represent a promoted Pawn.

It is important to note that retrograde analysis problems

are generally not concerned with strong sequences of play, or even sensible ones, but merely legal ones. Underpromoting, that is turning an eighth rank pawn into something other than a queen, is quite legal (even likely) in these problems.

A researcher at Bristol, Brian Alden, has recently written a program which solves quite a number of retrograde analysis



problems and later I will look at this in some detail.

In the meantime here are two more problems for you to consider. The problem given in figure three is quite simple. To program the solution to this and the previous one you have to write a reverse legal move generator.

The rightmost Pawn in figure four is not a printing error. It is deliberately placed halfway between the g file and the h file.



The problem here is: does the Pawn stand on g5 or h7? It is White to move and as a cryptic hint, you are given that there have been no "underpromotions". Brian Alden's program solves this problem — can you do so well? Solutions next month.

REVERSI

BY JOHN BALL

STAYING SHARP . . .

Making your computer play well can — as a bonus — make you think more clearly too.

Somewhere, you need to give it a sense of judgement as good as your own, to make it play a nerve-wrecking battle against you. Ideally a program should be able to beat you as often as you beat it. But as a human, you improve with practice, whereas the computer cannot, unless you update it with improved logic. You can do this if you have written it yourself.

That is what I have been doing in great depth on a Sharp MZ-80K, to provide me with a reasonable opponent. As a top British player, available programs were no good to me. Ideally I wanted one up to my standard — and repeated updates improved my game too!

This article is intended to help both you and your computer play Reversi — also known as Othello — more skillfully, by three simple rules-of-thumb. They form the backbone of my program, and have been balanced by practice trial-and-error.

Thumb 1: The whole game is about capturing corners, so then you can safely expand from the captured corners without risk of capture yourself. So a general rule is take a corner whenever you can, and avoid playing next to the corners for fear of giving your opponent a chance to take it. Generally, the nearer you play to a corner the more dangerous it is in the long-term. So set values as in diagram one, making the machine select the most negative valid move.

Thumb 2: You want to force your opponent to give you one or more corners as early in the game as possible. So you want to leave him by giving him no option. The best way to reduce your opponent's options is by taking as few pieces as possible

The Reversi column has been taken over by John Ball this month. John is a co-author of the book, *The Key to Othello and a regular U.S. Othello finalist*. He has also written a Reversi program for the Sharp MZ-80K, available from Sharpsoft. We will continue to look at computerizing Reversi every three months.

g	-9	29	5	4	4	5	29	-9
f	29	22	3	2	2	3	22	29
e	5	3	1	1	1	1	3	5
d	4	2	1	○	●	1	2	4
c	4	2	1	●	○	1	2	4
b	5	3	1	1	1	1	3	5
a	29	22	3	2	2	3	22	29
f	-9	29	5	4	4	5	29	-9
	a	b	c	d	e	f	g	h

Fig. 1

h				●	●	C	B	
g				○		A	D	
f			○					
e			○					
d			○				●	
c			○				●	
b			○					
a			○					
	a	b	c	d	e	f	g	h

Fig. 2

h				○	○			
g				○				
f			○					
e			○					
d			○					
c			○					
b			○					
a			○					
	a	b	c	d	e	f	g	h

Fig. 3

— but don't lose them all! With that play, you can easily slaughter any thumbless human or machine. Once you leave the corners secure, you then get revenge.

In diagram two, the squares that capture least pieces for Black — D at b7 — leaves White to give a corner by playing at A or C — if in the best move. So any move that takes lots of pieces early on must be bad. Add points to the value of such squares to dissuade the computer playing there.

Thumb 3: Early on, if you take a side you might feel it a good way of restricting your opponent's options — which is true. But at the end, when corners fall, he who has the sides generally loses. Look at diagram three — Black to play. Black will lose all four corners — but win massively. Try it!

So avoid taking the sides by spotting when side pieces would get captured, and again make such squares less attractive.

Balance thumb: No single thumb should totally over-ride any other. Sometimes it is better to take lots of pieces — if it avoids giving away a corner. Capturing a side isn't all that disastrous — as in diagram two, if it is White to play then P at b6 is far more preferable to A or C in the corner. So only add a few points to the side capture value. It also takes two pieces — but is better than the alternatives of capturing only one.

It is surprising how careful balance of thumb values can encourage good effective play. My Thumb 1 corner values are deliberately big. The squares next to a corner are ugly, while the corner is a luscious — B! The diagonal value is 22 — quite a bit preferable to the 29s — in my experience if you have to give a corner away, do it diagonally. Nine times out of 10 it is best.

Of course, there are times when the thumbs are not valid — at the end you want to capture as many pieces as possible.

```

10  RELATIVISTIC STARSHIP SIMULATOR
20  COPYRIGHT (C) DAVID LANGFORD 1982
30
100  SET UP VARIABLES
110  CLS
120  DT=9 DELT=999999  TENDSTEP= 1 WEEK (SECS)
130  T0=0 T=0  BARTIME L SHOPTIME <SECS>
140  V0=0  VELOCITY (METRES/SEC)
150  A=0  ACC=99999  ACCELERATION I GRAVITY (G-SEC/SEC)
160  R0=0  R=0  MAXIMUM THRUST 100
170  D0=0  DISTANCE FROM EARTH
180  SY=31557600  SECS-YEAR CONVERSION
190  RL=9.4609E15  METRES/LIGHTYEAR
200  CR=2.997925E8  CC=C0000  VELOCITY OF LIGHT
210  TRU=1  TR0=0  RELATIVISTIC CORRECTION FACTORS
220  V00=DELT*DOCK=DELT*DELTR10  MINIMUM V & D FOR RETURN
1000  SET UP DISPLAY
1010  P0="aa,ccccccccc "  C0="aa,cccccccccccccccc"
1020  S0=STRING$(P0(10))
1030  PRINT#0  STARSHIP "FWLQD00" INSTRUMENT READOUTS "100
1040  PRINT#0  C0,"VELOCITY";TAB(30);METRES/SEC";TAB(50);TIMESTEP"
1050  PRINT "V=C (TO 15 PLACES)";TAB(45);PRINT#0  C0,"DELTA/V"
1060  PRINT "ACCELERATION";TAB(25);"G";TAB(35);"GRAVITIES"
1070  PRINT "EARTH TIME";TAB(35);"YEARS";TAB(50);"TIME LPT"
1080  PRINT "SHIP TIME";TAB(35);"YEARS";TAB(65);"YR"
1090  PRINT
1100  PRINT "DISTANCE FROM EARTH";TAB(35);"LIGHTYEARS";TAB(65);"LY"
1110  PRINT "APPARENT DISTANCE";TAB(35);"LIGHTYEARS";TAB(65);"LY"
1120  PRINT
1130  PRINT "TRU" FACTOR
1140  PRINT "SHIP MASS INCREASE";TAB(45);"LYR SEEN FROM EARTH"
1150  PRINT
1160  PRINT "TO INCREASE/DECREASE/HAUT ACCELERATION, PRESS +/-0 KEYS"
2000  DISPLAY MODEIFY FIGURES
2010  PRINT#0  C0,USING#0;V0;  PRINT#0  C0,USING#0;R0
2020  PRINT#0  C0,USING#0;DT;  PRINT#0  C0,USING#0;T0-T;SY
2030  PRINT#0  C0,USING#0;V/VE;  PRINT#0  C0,USING#0;T0-T;SY
2040  PRINT#0  C0,USING#0;D0;RL;  PRINT#0  C0,USING#0;D0;1000;
2050  PRINT#0  C0,USING#0;D;RL;  PRINT#0  C0,USING#0;D;1000;
2060  PRINT#0  C0,TRU  " "
2070  PRINT#0  C0,TR0  " "
3000  " TEST FOR SUCCESSFUL "RETURN" APPROXIMATELY TO EARTH
3010  IF T0<10*DELT THEN 4000
3020  IF V0<D0/DOCK THEN 4000  SHIP "CLOSE" TO EARTH
3030  IF V0<L0 THEN 3020  ZERO VELOCITY ACHIEVED IN LAST DT
3040  IF D0<V0/DOCK THEN 4000  "LOW" VELOCITY
3050  PRINT#0  C0,"CONGRATULATIONS! YOU CAME CLOSE TO EARTH AGAIN, WITH LOW "
3060  PRINT "ENOUGH VELOCITY TO DOCK SAFELY. (PRESS ANY KEY TO RESTART)".
3070  DEFINE#0  C0,"THE00T00EL00110
4000  ACCELERATE/DECELERATE INPUT
4010  R0=TRU*V
4020  IF R0=" " THEN 3020
4030  DT=DELT  START TIME COUNT AT FIRST THRUST
4040  IF R0=" " THEN R0=TRU*TRU*DT*V+V  C0T00010
4050  IF R0=" " THEN R0=-R0*TRU*TRU*DT*V-1  C0T00010
4060  IF R0=" " THEN R0=0
5000  CALCULATE NEW VALUES
5010  PRINT#0  C0,A
5020  D0=R0*DOCK  VELOCITY INCREMENT
5030  V0=V0+R0/VE*100*(100+V0*V0/CC0)  EINHSTEIN VELOCITY ADDITION
5040  T0=T0+DT  TRU=TRU*(100-V0*V0/CC0)  TRU DURATION
5050  T0=T0+DT
5060  T=T+T*TRU*TRU*DOCK*2
5070  D0=D0+V0+V0*DOCK*2
5080  TRU=TRU
5090  R0=R0+TRU
5100  IF D0<V0/DOCK THEN 3020  IF D0<V0/DOCK THEN 3020
5110  V0=V0
5120  D0=D0+TRU
5130  R0=V0+CR
5140  C0T00010

```


EINSTEIN-A-GO-GO

If you want a realistic space game, why not write Einstein's theory of relativity into your program?

In science fiction there are as many ways of commuting to the stars as there are authors. The first method is to let your spaceship travel as fast as you like — as in E.E. Smith's comically ridiculous space operas.

Unfortunately it seems that faster-than-light travel is forbidden by cosmic law, even more so than cheap Telsa fans. The second method is to take a short cut through something called hyperspace — as in almost any Isaac Asimov book. This is simply STL travel in a clever plastic disguise, and it falls victim to the same problems. The third method is to get your teeth and accept that old tyrant Einstein's speed limit.

The velocity of light is the highest speed possible in our universe — about 300,000 kilometers per second. To traverse the galaxy at this speed would seemingly take 10,000 years or so, causing space-time great technical problems at journey's end — such as being dead.

But relativity has its advantages. On a relativistic ship — one that travels close to the speed of light — mass, length and time are straightly distorted. We can't accelerate all the way to c because at that

point the ship's mass reaches infinity. It becomes infinitely hard to push.

Also, as c approaches, the ship's clocks run slower than those at home. This feature is handled in "relativistic" ZF novels like Robert Heinlein's *Time for the Stars*, where the hero has his personal clock slowed by relativistic travel and returns to find his staff barely older than his grand-grandchildren.

Two Zero by Paul Anderson is another famous example. Toss aboard Anderson's starship eventually flees so slowly that the ship outlives the universe itself. The tau of the ship is the correction factor for mass, length and time: $\tau = 1/\sqrt{1-v^2/c^2}$.

At low speeds τ is almost equal to 1, which is why your watch doesn't get noticeably slower each time you drive down the highway. As v approaches c , though, τ shrinks to zero, τ shrinks towards zero but can never get there.

Our relativistic starship's mass is its stationary mass divided by τ — it seems to get heavier from the Earth viewpoint. Its length is multiplied by τ — it seems to shrink. And its clocks run τ times slower than Earth's.

We need one more equation before writing relativity

into a starship program — Einstein's equation for adding velocities.

Normally, if you're traveling at velocity v and accelerating at velocity a for time t — call a u — to your speed, you expect the resulting speed to be $v + u$. This works fine at low speeds, much less than c — but the correct answer is $v + u/\tau$.

Here's a crude TMS-80 program using these equations and some very lumpy approximations — see lines 0000-70 — to track an imaginary starship. You can give the good ship Fangleford various accelerations towards or away from Earth, from a normal one gravity (0.0) to a crushing 100.

The display shows your velocity in km/sec and as a fraction of c , acceleration, Earth and ship time (and the difference between them), and how apparent (shrunk by τ) distances from Earth and you itself.

The ship's mass increase factor τ shows too. When your velocity is almost c and the mass is hundreds or thousands of times greater, all the energy of this mass ($E = mc^2$) would have had to be supplied by burning fuel. And the Hiroshima explosion's energy represented less than one gram of mass!

This is mainly a demonstra-

tion of "relativistic computing" from which you can steal bits for you own space programs. But there are challenges to try.

How quickly can you make the round trip to Proxima Centauri — 4.1 light years away — and back? Can you see the time-saving to lose a year, say, arriving home in minimum time with that TMS-80 without showing approximately one year?

Can you return to Earth without either overshooting (hopelessly at reaching retirement age)?

The "larger" distance and velocity for return are set to be less than 200 and can easily be increased.

As well as blowing people's minds, relativistic calculations can boggy home computers. Even using double precision for v and c , the program gets go-go if you accelerate indefinitely — when the machine can no longer make many closer to c , acceleration effectively halts. "Captain," says Spock, "some unknown force has disabled the warp drive."

Features in program: The left-hand digits in line 1010 shrink of counts by up-adding — i. Reducing DELT in line 120 makes the program slower.

BY DAVID LANGFORD

ARCADE

DRAW YOUR OWN CONCLUSIONS

TIPS ON QIX

The arcade industry is already convinced that Qix is going to be a big draw.

Most arcade players are still making their minds up about the game which has no theme but the industry feels Qix is pointing the way to the video games future.

Technically the game is still an enigma as players develop their own styles and even set their own game targets — like drawing pictures or putting their own initials on the screen.

We have decided to give tips to gain a really big score on one screen.

Score capture is the name of the game as your drawing head captures all the relative safety of



the existing lines and into the realm of the Qix, a large space which must be avoided. Additional problems are the Spex which travel along the border of the screen and up the lines you have drawn and the Fox which chases you along an unfinished line if you hesitate in space.

Double score is awarded for drawing in "slow mode" which fills the boxed area with a red rather than blue colour. Obvious Qix players will already have noticed that you can score 1,000 bonuses for every percent of the screen filled in, over the 75%, you need to earn a new screen.

The third way to score highly is to split the Qix into two. This is done on the third screen when two Qix whirl around.

The way to achieve all these ideas is to start the game by drawing thin blue boxes all the bottom of the screen. Two of these set a few inches apart can be added to by a third thin blue box which runs from the top of one vertical and falls just short of

the other. This is your first trap and you hope that the Qix will be tempted inside it, leaving you with the simple task of switching to slow mode and running across the gap to fill the rest of the screen in red. Make sure you do go right across as the Qix can escape through any gap.

Usually the Qix will remain out of reach and as the Spex continue their hectic dash around your lines you will be forced to keep on the move.

Keep adding to a network of thin blue boxes and give yourself more traps to tempt the Qix into. Long vertical chambers provide optimum — but high-scoring chance of success.

Always keep an eye on the timer — which will release faster Spex to chase you — and the percentage of screen filled — you don't want to go over 75% until you are ready.

You won't get a long time on Qix but you will get a challenge ... 99% has been done!

ARCADE FUN

Humour is a very personal thing and in every batch of cartoons sent to a magazine there are a few which will appeal to someone.

Ian Bennett sent in an arcade series of cartoons which appeared to us and we will be presenting our favourites on these pages over the next few issues.



RECORD BREAKERS

How do you rate in the arcade world. On the right we tell how four students set a new Asteroids world record, but how close are you to your favourite machine to being a world beater?

Here are some of the highest scores we have come across on some of the most popular machines around. If you can better them, or have a top score on some other machine (what about Donkey Kong?) we would like to hear from you.

- Sonsbeide**
626,130
- Michael Holdron**
Garf
228,570
- John Lee**
Blaxx
552,910
- Richard Rudnik**
Battlezone
157,800
- Joseph Andrews**
Blazon Chess
126,950
- Andrew Davies**
Packman
381,280
- Stephen Mainwaring**
Galaxians
431,820
- Claremont Mathers**
Missile Command
2,480,000
- Kyle White**

KENT QUARTET TOP 100 MILLION

Four students from Kent University have blasted their way into the arcade game record books by topping the 100 million mark on Asteroids.

David Brian, David Hill, Tony Thomas and Alan Tilling took on their university's Asteroids machine in shifts to achieve the score.

It took them eight days after starting at 4pm on a Friday and playing through to 7am on Sunday, over a week later.

The record attempt took place during the university's Festival and made around £250 for some 5000 donors.



ACTION



ALPINE SKI

IT'S NOT ALL DOWNHILL ON THE SLOPES

It starts as only as far away as your local arcade with the new game of Alpine Ski.

The game offers three winter Olympic disciplines: downhill slalom and ski-jump.

The first phase is the downhill with obstacles to be dodged. These include, trees, other skiers and even a snowplough. To help you avoid these hazards, there is a good left-right control and an accelerator or push button which stimulates the skier pushing off.

It needs careful timing to judge a reverse around a tree. Other features of the course include, lead up takes which score a bonus but should you score fast, and increase your speed.

DRIBBLING

THAT OLD WORLD CUP FEVER

The accolades are going to crash in on the World Cup fever this summer with a new table-top soccer game.

The three for soccer will be rated by Dröbbling — an electronic version of the old Bar Football game.

The new football game has several advantages over its predecessor. For example, it allows the players to choose their team colours from six different strips.

This game originated in football-crazed Italy and on a perfect green pitch, which would mean said I.F.F.A. fans also requires, two teams of seven-a-side battle it out over 90 minutes — compressed into two minutes for excitement sake.

Two levers, on each side of the table, take the place of the four handles which used to act as controls on the manual version.

The left-hand-side lever controls three forwards and the right-hand-side three defenders and a goalkeeper.

The players can be moved back-and-forth across the pitch but they can also dribble the ball

forward. A fire button enables the player in possession to shoot or pass and if he kungo into the ball too long (over three seconds) this will happen automatically.

The defending player can move his men into blocking positions and hope to deflect the ball away or send his keeper diving across the goalmouth to push a shot away.

Tripping is avoided but it is possible to win a corner. These are trumped across the goal-mouth by the machine itself with both defenders and attackers hoping to make decisive contact.

The referee's whistle keeps the game flowing and the time left and present score is displayed on both sides of the machine.

The second phase features the slalom with gates made up of flags for the player to pass between. Each fir flag knocks 100 points off your score, while 50 to 200 points are matched up for each one successfully negotiated.

Finally the skier is faced with a ski-jump. Judge your take-off carefully as plenty of points will be scored for a long jump.

And a good score here could make sure of a bonus time. The skier must wait until he has enough speed before taking off.

The basic game lasts 1½ to 2½ minutes, depending on the operator, but bonus time is awarded for a high score of either 5, 10 or 15,000 points and for each 10-15,000 points after that.

But as the course gets more difficult, time bonuses are more difficult to win.

Fast reactions are needed to dodge obstacles and steer the skier with the next slalom gate and the game rewards the player who can think and look beyond the immediate target to prepare himself for the following one.

Scenic Games, which is distributing the game over here, is planning to organize leagues and other championships through the pubs and arcade sites.

Jan Jamieson of Scenic claims that Dröbbling championships have already proved successful in Italy with World Cup tickets being put up for prizes. And one final plus: the crowd in the Dröbbling stadium never ceases any trouble!



Pinballs are already talked, now they have taken the plunge into the film world.

The latest offering on the pinball scene, features slide shows which are seen by the player if he hits targets in the correct sequence.

The film machines come in two varieties. The Lady Girl series features, nine different slide shows of girls stripping off. The film is projected onto a 7" square screen in the centre of the playfield. There are 30-different slides and according to Keith Frankham of distributors Mega, only accomplished players will see all 30.

"The girl flashes up in a page 7 pose," said Frankham.

The Magic Picture Pin series is a different playfield and features films of more general themes, like, space pictures, boats and animals. There are seven in this series.

"These games have only just been released in this country," said Frankham, "So it is too early to say how they are going but they have proved very successful in Germany and are played for a much longer period than other pinball machines."





1000
GRAND STREET



Ever fantasized being a property operator and making millions? Well, with the help of your Sharp you can get a taste of real life wheel-dealing in this adaptation of the famous board game Monopoly.

From two-to-five people can play the game and \$5,000 is divided equally among the players. The winner is the one who survives bankruptcy for longest or accumulates a net egg of \$5,000 in his bank account.

Moves are determined by a random selection of numbers from 1-to-6 which are printed up on the screen and the player must try to stop the small arrow which hops above these over the number of his choice. This is an interesting idea which allows some skill into the final result as there is usually at least one number you can avoid if you are sufficiently dexterous.

mino

The aim is to buy property for twice its rental value and then increase the rent by pouring in more money on subsequent landings.

Just like the board game rents have to be paid to opposing players if you land on their property.

A current bank balance is displayed at the top of the screen at the start of each player's turn — so you know just how much cash you have left to splash out on desirable residences.

If you get into financial difficulties you may sell property for one and a half times its original value by pressing the 20 key. But if you have no property to sell you face bankruptcy.

The author says the idea for the game came about as he found other computer games became boring once the player had mastered them. He claims MinoPlay is a game which requires a reasonable blend of skill and luck and presents different challenges each time it is played. He adds that once the game gets down to a battle of wits between two players it can take some time to reach a conclusion.

Here are the uses of the main variables/arrays in the program.

- ANM) Name of player
- AW) Player's bank balance
- SB) Player's "Symbol"
- NO) Number of players at start
- NU) Number of players left as the game progresses
- Y) Delivers which player (e.g. his turn to go)
- POY) Position of a player "T"
- PY) Number of moves that player has made (0 to 24)
- R) Rent or Debt to be collected etc.

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BOW STREET
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 GO TO THE
 BOARD FOR
 THE
 NAME OF THE
 PLACE

TRAYFALL
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 CHEST

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 £120



COMMUNITY
 CHEST



MINGS CROSS
 STATION



£200

ANGEL
 ISLANDTON
 £100



CHANCE
 ?



EUSTON ROAD
 £750



JUST
 VISITING

opoly



FOR THE PURPOSES OF THIS GAME THE BOARD IS TO BE CONSIDERED AS A SQUARE 100 SQUARES LONG AND 100 SQUARES WIDE. THE SQUARES ARE TO BE NUMBERED AS FOLLOWS: 1 TO 50 ALONG THE TOP EDGE, 51 TO 100 ALONG THE BOTTOM EDGE, 101 TO 150 ALONG THE LEFT EDGE, AND 151 TO 200 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1 TO 10 ALONG THE TOP EDGE, 11 TO 20 ALONG THE BOTTOM EDGE, 21 TO 30 ALONG THE LEFT EDGE, AND 31 TO 40 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 41 TO 50 ALONG THE TOP EDGE, 51 TO 60 ALONG THE BOTTOM EDGE, 61 TO 70 ALONG THE LEFT EDGE, AND 71 TO 80 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 81 TO 90 ALONG THE TOP EDGE, 91 TO 100 ALONG THE BOTTOM EDGE, 101 TO 110 ALONG THE LEFT EDGE, AND 111 TO 120 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 121 TO 130 ALONG THE TOP EDGE, 131 TO 140 ALONG THE BOTTOM EDGE, 141 TO 150 ALONG THE LEFT EDGE, AND 151 TO 160 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 161 TO 170 ALONG THE TOP EDGE, 171 TO 180 ALONG THE BOTTOM EDGE, 181 TO 190 ALONG THE LEFT EDGE, AND 191 TO 200 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 201 TO 210 ALONG THE TOP EDGE, 211 TO 220 ALONG THE BOTTOM EDGE, 221 TO 230 ALONG THE LEFT EDGE, AND 231 TO 240 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 241 TO 250 ALONG THE TOP EDGE, 251 TO 260 ALONG THE BOTTOM EDGE, 261 TO 270 ALONG THE LEFT EDGE, AND 271 TO 280 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 281 TO 290 ALONG THE TOP EDGE, 291 TO 300 ALONG THE BOTTOM EDGE, 301 TO 310 ALONG THE LEFT EDGE, AND 311 TO 320 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 321 TO 330 ALONG THE TOP EDGE, 331 TO 340 ALONG THE BOTTOM EDGE, 341 TO 350 ALONG THE LEFT EDGE, AND 351 TO 360 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 361 TO 370 ALONG THE TOP EDGE, 371 TO 380 ALONG THE BOTTOM EDGE, 381 TO 390 ALONG THE LEFT EDGE, AND 391 TO 400 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 401 TO 410 ALONG THE TOP EDGE, 411 TO 420 ALONG THE BOTTOM EDGE, 421 TO 430 ALONG THE LEFT EDGE, AND 431 TO 440 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 441 TO 450 ALONG THE TOP EDGE, 451 TO 460 ALONG THE BOTTOM EDGE, 461 TO 470 ALONG THE LEFT EDGE, AND 471 TO 480 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 481 TO 490 ALONG THE TOP EDGE, 491 TO 500 ALONG THE BOTTOM EDGE, 501 TO 510 ALONG THE LEFT EDGE, AND 511 TO 520 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 521 TO 530 ALONG THE TOP EDGE, 531 TO 540 ALONG THE BOTTOM EDGE, 541 TO 550 ALONG THE LEFT EDGE, AND 551 TO 560 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 561 TO 570 ALONG THE TOP EDGE, 571 TO 580 ALONG THE BOTTOM EDGE, 581 TO 590 ALONG THE LEFT EDGE, AND 591 TO 600 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 601 TO 610 ALONG THE TOP EDGE, 611 TO 620 ALONG THE BOTTOM EDGE, 621 TO 630 ALONG THE LEFT EDGE, AND 631 TO 640 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 641 TO 650 ALONG THE TOP EDGE, 651 TO 660 ALONG THE BOTTOM EDGE, 661 TO 670 ALONG THE LEFT EDGE, AND 671 TO 680 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 681 TO 690 ALONG THE TOP EDGE, 691 TO 700 ALONG THE BOTTOM EDGE, 701 TO 710 ALONG THE LEFT EDGE, AND 711 TO 720 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 721 TO 730 ALONG THE TOP EDGE, 731 TO 740 ALONG THE BOTTOM EDGE, 741 TO 750 ALONG THE LEFT EDGE, AND 751 TO 760 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 761 TO 770 ALONG THE TOP EDGE, 771 TO 780 ALONG THE BOTTOM EDGE, 781 TO 790 ALONG THE LEFT EDGE, AND 791 TO 800 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 801 TO 810 ALONG THE TOP EDGE, 811 TO 820 ALONG THE BOTTOM EDGE, 821 TO 830 ALONG THE LEFT EDGE, AND 831 TO 840 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 841 TO 850 ALONG THE TOP EDGE, 851 TO 860 ALONG THE BOTTOM EDGE, 861 TO 870 ALONG THE LEFT EDGE, AND 871 TO 880 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 881 TO 890 ALONG THE TOP EDGE, 891 TO 900 ALONG THE BOTTOM EDGE, 901 TO 910 ALONG THE LEFT EDGE, AND 911 TO 920 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 921 TO 930 ALONG THE TOP EDGE, 931 TO 940 ALONG THE BOTTOM EDGE, 941 TO 950 ALONG THE LEFT EDGE, AND 951 TO 960 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 961 TO 970 ALONG THE TOP EDGE, 971 TO 980 ALONG THE BOTTOM EDGE, 981 TO 990 ALONG THE LEFT EDGE, AND 991 TO 1000 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1001 TO 1010 ALONG THE TOP EDGE, 1011 TO 1020 ALONG THE BOTTOM EDGE, 1021 TO 1030 ALONG THE LEFT EDGE, AND 1031 TO 1040 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1041 TO 1050 ALONG THE TOP EDGE, 1051 TO 1060 ALONG THE BOTTOM EDGE, 1061 TO 1070 ALONG THE LEFT EDGE, AND 1071 TO 1080 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1081 TO 1090 ALONG THE TOP EDGE, 1091 TO 1100 ALONG THE BOTTOM EDGE, 1101 TO 1110 ALONG THE LEFT EDGE, AND 1111 TO 1120 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1121 TO 1130 ALONG THE TOP EDGE, 1131 TO 1140 ALONG THE BOTTOM EDGE, 1141 TO 1150 ALONG THE LEFT EDGE, AND 1151 TO 1160 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1161 TO 1170 ALONG THE TOP EDGE, 1171 TO 1180 ALONG THE BOTTOM EDGE, 1181 TO 1190 ALONG THE LEFT EDGE, AND 1191 TO 1200 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1201 TO 1210 ALONG THE TOP EDGE, 1211 TO 1220 ALONG THE BOTTOM EDGE, 1221 TO 1230 ALONG THE LEFT EDGE, AND 1231 TO 1240 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1241 TO 1250 ALONG THE TOP EDGE, 1251 TO 1260 ALONG THE BOTTOM EDGE, 1261 TO 1270 ALONG THE LEFT EDGE, AND 1271 TO 1280 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1281 TO 1290 ALONG THE TOP EDGE, 1291 TO 1300 ALONG THE BOTTOM EDGE, 1301 TO 1310 ALONG THE LEFT EDGE, AND 1311 TO 1320 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1321 TO 1330 ALONG THE TOP EDGE, 1331 TO 1340 ALONG THE BOTTOM EDGE, 1341 TO 1350 ALONG THE LEFT EDGE, AND 1351 TO 1360 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1361 TO 1370 ALONG THE TOP EDGE, 1371 TO 1380 ALONG THE BOTTOM EDGE, 1381 TO 1390 ALONG THE LEFT EDGE, AND 1391 TO 1400 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1401 TO 1410 ALONG THE TOP EDGE, 1411 TO 1420 ALONG THE BOTTOM EDGE, 1421 TO 1430 ALONG THE LEFT EDGE, AND 1431 TO 1440 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1441 TO 1450 ALONG THE TOP EDGE, 1451 TO 1460 ALONG THE BOTTOM EDGE, 1461 TO 1470 ALONG THE LEFT EDGE, AND 1471 TO 1480 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1481 TO 1490 ALONG THE TOP EDGE, 1491 TO 1500 ALONG THE BOTTOM EDGE, 1501 TO 1510 ALONG THE LEFT EDGE, AND 1511 TO 1520 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1521 TO 1530 ALONG THE TOP EDGE, 1531 TO 1540 ALONG THE BOTTOM EDGE, 1541 TO 1550 ALONG THE LEFT EDGE, AND 1551 TO 1560 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1561 TO 1570 ALONG THE TOP EDGE, 1571 TO 1580 ALONG THE BOTTOM EDGE, 1581 TO 1590 ALONG THE LEFT EDGE, AND 1591 TO 1600 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1601 TO 1610 ALONG THE TOP EDGE, 1611 TO 1620 ALONG THE BOTTOM EDGE, 1621 TO 1630 ALONG THE LEFT EDGE, AND 1631 TO 1640 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1641 TO 1650 ALONG THE TOP EDGE, 1651 TO 1660 ALONG THE BOTTOM EDGE, 1661 TO 1670 ALONG THE LEFT EDGE, AND 1671 TO 1680 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1681 TO 1690 ALONG THE TOP EDGE, 1691 TO 1700 ALONG THE BOTTOM EDGE, 1701 TO 1710 ALONG THE LEFT EDGE, AND 1711 TO 1720 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1721 TO 1730 ALONG THE TOP EDGE, 1731 TO 1740 ALONG THE BOTTOM EDGE, 1741 TO 1750 ALONG THE LEFT EDGE, AND 1751 TO 1760 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1761 TO 1770 ALONG THE TOP EDGE, 1771 TO 1780 ALONG THE BOTTOM EDGE, 1781 TO 1790 ALONG THE LEFT EDGE, AND 1791 TO 1800 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1801 TO 1810 ALONG THE TOP EDGE, 1811 TO 1820 ALONG THE BOTTOM EDGE, 1821 TO 1830 ALONG THE LEFT EDGE, AND 1831 TO 1840 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1841 TO 1850 ALONG THE TOP EDGE, 1851 TO 1860 ALONG THE BOTTOM EDGE, 1861 TO 1870 ALONG THE LEFT EDGE, AND 1871 TO 1880 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1881 TO 1890 ALONG THE TOP EDGE, 1891 TO 1900 ALONG THE BOTTOM EDGE, 1901 TO 1910 ALONG THE LEFT EDGE, AND 1911 TO 1920 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1921 TO 1930 ALONG THE TOP EDGE, 1931 TO 1940 ALONG THE BOTTOM EDGE, 1941 TO 1950 ALONG THE LEFT EDGE, AND 1951 TO 1960 ALONG THE RIGHT EDGE. THE SQUARES ARE TO BE GROUPED AS FOLLOWS: 1961 TO 1970 ALONG THE TOP EDGE, 1971 TO 1980 ALONG THE BOTTOM EDGE, 1981 TO 1990 ALONG THE LEFT EDGE, AND 1991 TO 2000 ALONG THE RIGHT EDGE.

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ZX 80/81 HARDWARE/SOFTWARE

ZX KEYBOARD

Now with repeat key and facilities to add numeric pad. The keyboard has all the 80/81 functions on the keys, and will greatly increase your programming speed. It is fitted with push type keys as in larger computers.

The keyboard has been specially designed for the Sinclair computer and is supplied ready-built. It also has facilities for 3 extra buttons which could be used for on/off switch, reset, etc. £27.95. Numeric add on £70.



4K GRAPHICS ROM

The 4K Graphic module is our latest ZX81 accessory. This module, unlike most other accessories fits neatly inside your computer under the keyboard. The module comes ready built, fully tested and complete with a 4K graphic ROM. This will give you 448 extra pre-programmed graphics, your normal graphic set contains 64. This means that you now have 512 graphics and with there inverse 1024. This now turns the 81 into a very powerful computer, with a graphic set rarely found on larger more expensive machines. In the ROM are lower case letters, bombs, bullets, rockets, tanks, a complete set of invaders graphics and that only accounts for about 50 of them, there are still about 400 left (that may give you an idea as to the scope of the new ROM). However, the module does not finish there; it also has a spare holder on the board which will accept a further 4K of ROM/RAM. This holder is fitted with a 1K/2K RAM and can be used for user definable graphics so you can create your own custom character sets. £29.95.

MEMORY 80/81

16K RAM

Massive add-on memory for 80/81. £32.95.

16K KIT-A-KIT VERSION

of a 16K Ram. Full instructions included. All memory expansions plug into the user port at the rear of the computer. 16K RAM £42.95 16K KIT £32.95

2K & 4K RAM

Static Ram memory expansion for the 80/81. They both work with onboard Ram i.e. 4K plus onboard = 5K. This is the cheapest small memory expansion available anywhere. 2K RAM £14.95. 4K RAM £19.95.

80 PORT

Interface your computer with the real world, our IO port has holders to add up to 6K of RAM. £12.95.

16K 81 SOFTWARE

As seen at the ZX Microfair.

DEFLEX This totally new and very addictive game, which was highly acclaimed at the Microfair, uses fast moving graphics to provide a challenge requiring not only quick reaction, but also clever thinking. One and two player versions on same cassette. £3.95

3DD LABYRINTH You have all seen 3D Labyrinth games, but this goes one stage beyond; you must manoeuvre within a cubic maze and contend with corridors which may go left/right/up/down. Full size 3D graphical representation. £3.95.

CENTPEDE This is the first implementation of the popular arcade game on any micro anywhere. Never mind your invaders, etc., this is positively stunning, the speed at which this runs makes ZX invaders look like a game of simple snap. £3.95. Graphic ROM Software Centipede. The graphic ROM version of our popular Centipede game. The only real version of Space Invaders on the ZX81.

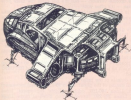
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101=CARR100)+PRM001,STR004(2),F1)+CARR100+STR000,2
1+CARR100+STR000(1),F1)+CARR100);
40 PRM004F,STR000(2),F1)+CARR100+STR000(1),2)+CARR100+R
1000(1),F1)+CARR100)+PRM002,STR004(2),F1)+CARR100+R
000(1),2)+CARR100+STR000(2),F1)+CARR100)+CARR100+R
10);
40 PRM002,STR000(2),F1)+CARR100+STR000(1),2)+CARR100+
CARR100+CARR100+STR000(1),F1)+CARR100); PRM002,STR000
(2),F1)+CARR100+STR000(1),2)+CARR100+STR000(1),F1)+CARR1
0)+CARR100+CARR100);
50 PRM003,STR000(2),F1)+CARR100+CARR100+STR000(1),2)+
STR000(1),F1)+CARR100)+PRM001,STR004(1),F1)+CARR100+R
0(1)+STR000(1),2)+CARR100+CARR100);
60 PRM001,STR000(1),F1)+CARR100)+PRM001,STR004(1),F1)+R
00(1);
70 R00(1)
80 R00000000" GET REPORTS
90 R00000000" GET REPORTS
100 R00(1)
110 R00000000
120 R00000000
130 R00000000
140 R000000
150 PRM000,"YOU HAVE RUN OUT OF STEPS,";PRM001,"YOU ARE
000";PRM002+STR000+R00(1)+R000
160 PRM000,"V. SPEED =";R00(10000)";";PRM000,"M. SPEED
=";R00(10000)";";PRM000,"STEER =";R00(100000000)";"M
000(100)";

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170 RETURN
200 RPRM00000+STR000(1)+R00(10000)+R00000(1)+R00000(1)
2100 RPRM00000+STR000(1)+R00(10000)+R00000(1)+R00000(1)
2200 RPRM00000+R00000(1)
2300 RPRM00000+R00000(1)
2400 RPRM00000+R00000(1)
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6300 RPRM00000+R00000(1)
6400 RPRM00000+R00000(1)
6500 RPRM00000+R00000(1)
6600 RPRM00000+R00000(1)
6700 RPRM00000+R00000(1)
6800 RPRM00000+R00000(1)
6900 RPRM00000+R00000(1)
7000 RPRM00000+R00000(1)
7100 RPRM00000+R00000(1)
7200 RPRM00000+R00000(1)
7300 RPRM00000+R00000(1)
7400 RPRM00000+R00000(1)
7500 RPRM00000+R00000(1)
7600 RPRM00000+R00000(1)
7700 RPRM00000+R00000(1)
7800 RPRM00000+R00000(1)
7900 RPRM00000+R00000(1)
8000 RPRM00000+R00000(1)
8100 RPRM00000+R00000(1)
8200 RPRM00000+R00000(1)
8300 RPRM00000+R00000(1)
8400 RPRM00000+R00000(1)
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9400 RPRM00000+R00000(1)
9500 RPRM00000+R00000(1)
9600 RPRM00000+R00000(1)
9700 RPRM00000+R00000(1)
9800 RPRM00000+R00000(1)
9900 RPRM00000+R00000(1)
10000 RPRM00000+R00000(1)

```

```

5000 PRM0000,"SUCCESS";PRM00000+R00000(1)+R00000(1)
5100 PRM0000,"V. SPEED =";PRM00000,"M. SPEED =";
5200 PRM0000,"STEER =";PRM00000,"R00(10000)";
5300 PRM0000,"R00(10000)";
5400 PRM0000,"R00(10000)";
5500 PRM0000,"R00(10000)";
5600 PRM0000,"R00(10000)";
5700 PRM0000,"R00(10000)";
5800 PRM0000,"R00(10000)";
5900 PRM0000,"R00(10000)";
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6100 PRM0000,"R00(10000)";
6200 PRM0000,"R00(10000)";
6300 PRM0000,"R00(10000)";
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6600 PRM0000,"R00(10000)";
6700 PRM0000,"R00(10000)";
6800 PRM0000,"R00(10000)";
6900 PRM0000,"R00(10000)";
7000 PRM0000,"R00(10000)";
7100 PRM0000,"R00(10000)";
7200 PRM0000,"R00(10000)";
7300 PRM0000,"R00(10000)";
7400 PRM0000,"R00(10000)";
7500 PRM0000,"R00(10000)";
7600 PRM0000,"R00(10000)";
7700 PRM0000,"R00(10000)";
7800 PRM0000,"R00(10000)";
7900 PRM0000,"R00(10000)";
8000 PRM0000,"R00(10000)";
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9500 PRM0000,"R00(10000)";
9600 PRM0000,"R00(10000)";
9700 PRM0000,"R00(10000)";
9800 PRM0000,"R00(10000)";
9900 PRM0000,"R00(10000)";
10000 PRM0000,"R00(10000)";

```



PUCK MAN

MUNCH your way around a maze in this adaptation of the popular arcade game. The deadly ghost which haunts this maze is just as hungry as in the arcade version — but it's not after the tasty dots which fill the maze — it's after you!

But the ghost is not invulnerable. From time to time it becomes luminous. Then you have 10 seconds to catch it — but you have to be quick as during this time the ghost also puts on an extra turn of speed.

If you catch the ghost it returns to the centre of the maze and the game continues. If the ghost is not captured in time then you lose.

Your character is controlled by the keyboard but the ghost moves randomly, changing direction when it reaches a junction in the maze.

Once the maze is emptied of dots — and you have managed to avoid the ghost — it is refilled and the game gets harder.

Every number possible has been changed to a variable to speed up the program as much as possible. Many of the GOTO's and RETURN's are also for speed.

Here are some details of the program:

Lines 50-70 control timing of the ghost. Lines 90-130 control movement of the Puckman. Lines 140-190 control ghosts' movement. Lines 210-260 scoring. Lines 280-290 tunnel joining sides of maze. Lines 310-330 random movement of ghost. Lines 360-410 variables. Lines 420-500 maze. Lines 780-1245 instructions.

BY SIMON MABLEY

RUNS ON A 40 COLUMN PET

IN 8K

```
1  REM*** PUCKMAN ***
2  REM
3  REM*** BY S.P.MABLEY ***
4  REM
5  REM*** INSTRUCTIONS BY P.SALFON ***
6  REM
7  REM*** COPYRIGHT 1/2/82 ***
8  REM
9  PRINT"*****COULD YOU LINE INSTRUCTIONS?Y/N?"
10 GET#A:IF#A="Y" THENG20
110 IF#A="Y" THENG20
120 GOTO300
130 IF#A#="Y":(T1)=0:IF#A="N":(T1)="*****" :G2=1
140 IF#A#="Y":(T1)=0:IF#A="N"
150 IF#A#="Y":(T1)=0:IF#A="N" :G2=0:G2=1:GOTO420
160 #P=0:G2=1
170 IF#A#="Y":(T1)=0:IF#A="N" :G2=0:G2=1:GOTO420
180 #P=0:G2=1
190 IF#A#="Y":(T1)=0:IF#A="N" :G2=0:G2=1:GOTO420
```


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```

670 PRINT "WELCOME"
680 PRINT "SCORING BY THE PHANTOM OF THE RACE!"
690 PRINT "YOU SCORED "JH" POINTS"
700 GOTO 730
710 PRINT "DON'T GET THE WAX OUT ON YOU I'M AFRAID BUT YOU "
720 PRINT "WANT TO SCORE "JH" POINTS"
730 INPUT "PRESS (SPACE) TO TRY AGAIN"
740 PRINT "THE TOP SCORE IS "TS"
750 PRINT "PRESS (SPACE) TO TRY AGAIN"
760 GETLINE:IF ALL <> THEN 750
770 GOTO 680
780 PRINT "INSTRUCTIONS"
790 PRINT "THIS IS THE GAME OF "RACE"
800 PRINT "ON THE HORSE WAX SEEN IN RACE DRIVING ESTABLISHMENTS"
810 PRINT "THE IDEA IS TO "RACE" AS MANY DOTS, BLOOD AND DEPENDS ON PHANTOM WHO HEATS THE PACE"
820 PRINT "HOWEVER YOU MUST BEWARE THE "PHANTOM" WHO HEATS THE PACE"
830 PRINT "SCORING"
840 PRINT "
850 PRINT "THE DOTS SCORE IS POINTS"
860 PRINT "BLOODS "BD"
870 PRINT "DEPENDS "DD"
880 PRINT "PRESS (SPACE) TO CONTINUE"
890 GETLINE:IF ALL <> THEN 880
900 PRINT "
910 PRINT "HOWEVER"
920 PRINT "
930 PRINT "EVERY 30 SECONDS"
940 PRINT "THE "PHANTOM" HAS AN AVERAGE SPEED OF "AV"
950 PRINT "IT DOES THIS YOU MUST CHASE AFTER HIM AND LIVE ON HIM"
960 PRINT "IF YOU CAN DO THIS YOU HAVE PROVED AN AVERAGE TO "RACE" SCORE FOR "
970 PRINT "DOTS ETC."
980 PRINT "HOWEVER HE IS ONLY LUCKY FOR A SPACE OF 30 SECONDS SO BE SURE!"
990 PRINT "PRESS (SPACE) FOR HELP"
1000 GETLINE:IF ALL <> THEN 1000
1010 PRINT "
1020 PRINT "
1030 PRINT "
1040 PRINT "YOU ARE REPRESENTED BY REVERSE SPACE "R"
1050 PRINT "THE "PHANTOM" IS SHOWN AS "PH"
1060 PRINT "THE DOTS FOR REVERSE ARE "
1070 PRINT "L"
1080 PRINT "O"
1090 PRINT "C"
1100 PRINT "LEFT"
1110 PRINT "PRESS (SPACE) TO CONTINUE"
1120 GETLINE:IF ALL <> THEN 1100
1130 PRINT "
1140 PRINT "
1150 PRINT "
1160 PRINT "YOU ARE READY TO PLAY RACE?"
1170 PRINT "YOUR SCORE WILL BE GIVEN TO YOU AT THE END OF THE GAME"
1180 PRINT "GOOD SCORE, CHASE PHANTOM IS "PH"
1190 PRINT "FINALLY IF YOU CLEAR THE RACE IT WILL BE "R" BUT YOU HAVE"
1200 PRINT "LESS TIME TO RACE"
1210 PRINT "WATCH OUT FOR THE PHANTOM!"
1220 PRINT "PRESS (SPACE) TO BEGIN"
1230 GETLINE:IF ALL <> THEN 1200
1240 GOTO 680

```

THE VIC NEEDS VIC REVEALED

**THE DEFINITIVE REFERENCE
BOOK ON THE VIC SYSTEM
FROM NICK HAMPSHIRE**

Now available. Price £10.00 from Commodore dealers and bookshops. Nick Hampshire Publications, P.O. Box 13, Lysander Road, Yeovil, Somerset.



DOUBLE Cannon is a shoot-em-up (or dross) game for one or two players. A sharp eye is needed to judge when the randomly moving target crosses the path of your laser cannon.

But you can't waste time waiting for the perfect shot, as the game is also timed. Yet, it is important that you not waste any shots, either, since your cannon has just enough energy for 20 shots.

To fire, the player on the left need only press the X key, while the player on the right should press the M key. A green box will indicate the time remaining in the game and a blue box for each cannon will show the number of shots you have used. Hits are recorded by red blocks above each cannon's blue box. For two players, the winner is the shooter with the most hits. When there is just one player, the objective is to get as many hits as possible.

Included with the line listing are definitions of the major variables. Also, a line-by-line description of the main game loop is presented.

Perhaps of interest to programmers is the movement of the target. The target location for the **PLCT** command is X, Y. This is adjusted each move by the variable X1 and Y1 (line numbers 302, 307). For example, if X=20, Y=10, X1=1 and Y1=1, then after line number 307 has been executed, X=21 and Y=11 — so the target is moving down and to the right.

When the target reaches the right edge of the screen, X1 will be changed to -X1 (X1=-1), since in line 302 the test for X greater than 57 is true. Now the value will decrease by one as Y increases — so the target will move down and to the left.

DOUBLE CANNON

BY DAVID BOLKHE

```

3 REM DAVID BOLKHE    COONIN,LA
4 REM DOUBLE CANNON
10 GRAPHICS 5:SETCOLOR 4,4,7
20 SETCOLOR 1,4,7:SETCOLOR 4,15,8
100 COLOR 2:PLCT 8,2:SHOTS 0,20
101 PLCT 7,2:SHOTS 1,20
104 PLCT 31,2:SHOTS 71,20
104 PLCT 79,2:SHOTS 77,20
110 X1=0:Y1=1
112 B=INT(RND*11425)+25
114 B=INT(RND*11425)+2
117 PRINT
120 PRINT " LEFT press X , and M
M"
122 PRINT "Each side has 20 shots, the
win is WIN"
124 PRINT "HITS are displayed in RED.
"
126 PRINT "Time left is indicated in B
MIN. "
130 PLCT 7,2:SHOTS 11,20
132 PLCT 8,2:SHOTS 21,20
134 PLCT 9,20:PLCT 31,20
140 PLCT 14,2:SHOTS 47,20
142 PLCT 40,2:SHOTS 47,20
144 PLCT 14,20:PLCT 40,20
126 GRAPHICS 4,2,4:SHOTS 40,20
170 COLOR 2:PLCT 31,2:SHOTS 47,20
174 PLCT 31,2:SHOTS 47,20

```



```

174 PLCT 31,2:SHOTS 47,20
200 COLOR 2:SHOTS 100
202 P=POK(704)+PKE 144,8
220 IF P<25 THEN 250
221 SETCOLOR 4,7,8:IF L&H THEN 200
222 COLOR 2:PLCT 1,2:SHOTS 40,0
223 SHOTS 020
224 PLCT 15,20:15+L&H
225 H=H+1-IF P< 8000 AND H=H THEN 2
226 3:PLCT 14,25:4:SHOTS 2:SHOTS 840
240 COLOR 4:PLCT 1,2:SHOTS 40,0:SHOTS
200
250 IF P<25 THEN 200
260 SETCOLOR 4,7,8:IF H=H THEN 200
270 COLOR 2:PLCT 78,79:SHOTS 71,0
280 SHOTS 020
284 PLCT 85,20:85+H-1
285 H=H+1-IF P< 8000 AND H=H THEN 2
286 COLOR 4:PLCT 78,79:SHOTS 71,0
290 IF L<254 AND H=H THEN 800
294 IF L=45 THEN 800
300 COLOR 4:SHOTS 100
301 SETCOLOR 4,15,8
302 IF L<253 OR L<255 THEN 22+11:70
H 3+1 TO 25:SHOTS 8,2+9,10,3:SHOTS 1
305 IF P<25 OR P<254 THEN 70+11:70
H 3+2:SHOTS 3+1 TO 15:SHOTS 8,2+9,10,3:SHOTS
27 0
307 H=H+1:H=H+1
309 COLOR 2:PLCT 7,20
320 IF T=0 THEN 800
330 SHOTS 0,8,8,0
340 H=0 200
344 SHOTS 799
800 PRINT "PRESS RETURN for a
new game T. "
810 P=POK(704)+PKE 142 THEN 800
815 SHOTS 4,40:11425,10,7
820 H=0 800
830 FOR I=0 TO 10:SHOTS 0,1,10,11
832 H=1:SHOTS 0,8,8,0:RETURN
840 SETCOLOR 4,8,8:FOR J=0 TO 799
844 SHOTS 4,2,2,0:NEXT J
848 COLOR 4:SHOTS 100
850 I=INT(RND*11425)+25
872 B=INT(RND*11425)+2
876 RETURN
900 PLCT 64,7:PLCT 242,8:1:PLCT 1,7:0
904 PLCT 241,64:PLCT 8+1,64:RETURN

```

RUNS ON AN

ATARI IN 8K

RUNS ON AN APPLE IN 16K

YOU have been chosen as the best pilot for the job, only the job looks very hard indeed. You have to fly ahead of your mother ship and blast a path through a severe meteor storm.

This is also a paying proposition. You are given points for monetary systems it is possible for just staying alive by dodging the meteors. If you don't want to make your first million within your own lifetime, then just dodge.

But for each meter you destroy you get 100 points. When the situation gets very desperate, you can go into hyperspace. I must warn you to use this as few times as possible because you could come out of hyperspace right on top of a meteor, or be hopelessly lost in space. Within a short time, however, you will be navigating through the meteors with the best of them.

Now for the variable list:

AS - Used for temporary storage of

INSTRUCTIONS and used all over.

BE - this is what your ship looks like.

Q - This is the PRINT or location of

your shot. If it is seen, then you aren't

shooting.

HF - High score

HPS - The score of the high scorer.

I - Used for FOR-NEXT timer loops.

L - The location of your ship in video

memory.

P - temporary storage for PEEK

(14400).

PO - Your score.

E - PRINT or location of the ship.

S1, S2, S3 - PRINT at location of

debris.

S8 - This is what your ship looks like.

S18, S28, S38 - What the debris looks

like.

T - Used for FOR-NEXT timer loops.

YS - Used to ask, "DO YOU WANT TO

TRY ANOTHER MESSING?"

Now to explain myself a little.

First, the whole secret to this game is the screen's scrolling ability. When the screen is made to scroll, everything on it seems to go flying past. That is the way I made such a fast game with such a small amount of typing.

Then, however, is the most useful technique I have found. You may have seen a table that has the keyboard memory on it.

Actually, there is no real memory between locations 14308 and 15558.

It is a bank of switches that were mapped into a place in memory.

The author, Mr. Harper, says he encourages people to edit the copyrights out of his programs. If you think you can make Meteor Storm a better game to play/test free.

BY ROY HARPER



METEOR STORM



THE METEOR STORM IS A RARE AND DANGEROUS PHENOMENON THAT OCCURS WHEN A SWARM OF METEORIDS ENTERS THE EARTH'S ATMOSPHERE. THESE METEORIDS, WHICH ARE SMALL ROCKS OR METALS, BURN UP IN THE SKY, CREATING BRIGHT STREAKS OF LIGHT. IN SOME CASES, THE METEORIDS CAN BE LARGE ENOUGH TO SURVIVE AND HIT THE GROUND, CREATING METEOR CRATERS.

THE METEOR STORM IS CAUSED BY A SWARM OF METEORIDS THAT ORBIT THE SUN IN A SIMILAR PATH. AS THE EARTH ORBITS THE SUN, IT CAN INTERSECT THE PATH OF THE METEORID SWARM, CAUSING THE METEORIDS TO ENTER THE EARTH'S ATMOSPHERE. THE METEORIDS CAN BE OF VARIOUS SIZES, FROM SMALL DUST PARTICLES TO LARGE ROCKS SEVERAL METERS IN DIAMETER.

THE METEOR STORM IS A DANGEROUS PHENOMENON BECAUSE IT CAN CAUSE DAMAGE TO PROPERTY AND HUMAN LIFE. METEOR CRATERS CAN BE FORMED BY METEORIDS THAT HIT THE GROUND, AND THESE CRATERS CAN BE SEVERAL KILOMETERS IN DIAMETER. METEORIDS CAN ALSO CAUSE FIRES AND EXPLOSIONS WHEN THEY ENTER THE ATMOSPHERE.

THE METEOR STORM IS A RARE PHENOMENON THAT OCCURS ONLY A FEW TIMES A YEAR. THE NEXT METEOR STORM IS EXPECTED TO OCCUR IN THE YEAR 2020. IT IS IMPORTANT TO BE PREPARED FOR A METEOR STORM BY HAVING A PLAN IN PLACE TO PROTECT YOURSELF AND YOUR PROPERTY.



ANTI GRAV FLIER

DROOPING across the surface of the alien planet you prepare your ship for battle. Your laser cannon is aimed as you look out for strategic targets. A city looms in front of you — and the attack is on!

In this arcade style game you are piloting an anti-grav air car. It is equipped with a laser and has two speeds — attack and super-fast Zype drive. The idea is to cause as much havoc and destruction in the city as you can.

But you must beware of the deadly super-force-field gravity traps. You have warning indicators which light up when you approach one of these danger zones. The game requires quick reactions and mental awareness.

If you want the fuel to last longer just modify the variable 'T' in lines 1000 and 1060 — the greater the value the longer the fuel lasts.

As soon as the warning indicators light up alerting you to a danger zone the force-held trap will be placed directly in front of your line at the bottom of the screen. Only the centre of your craft is affected by the hazards.

Although the game is written in easily understandable Basic Mr Firmin says it is quite fast in execution.

BY PAUL FIRMIN

```

10 REM ***** 1985 *****
20 REM 4 Lines, by Paul Firmin (Future Software)
30 REM Produced For Computer & Video Games Rev.
40 REM 16-17 Jan. 1985
50 CLEAR 200
60 DIM T(99),Tart(99),GRAV FLIER(9)
70 FOR I=1 TO LEN(T)
80 NEXT I
90 FOR I=1 TO LEN(Tart)
100 NEXT I
110 FOR I=1 TO LEN(Tart)
120 NEXT I
130 REM - Initialization
140 REM *****
150 REM *****
160 REM *****
170 REM *****
180 REM *****
190 REM *****
200 REM *****
210 REM *****
220 REM *****
230 REM *****
240 REM *****
250 REM *****
260 REM *****
270 REM *****
280 REM *****
290 REM *****
300 REM *****
310 REM *****
320 REM *****
330 REM *****
340 REM *****
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870 REM *****
880 REM *****
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940 REM *****
950 REM *****
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970 REM *****
980 REM *****
990 REM *****

```




```

200 GOSUB 1400
270 IF <=5 THEN GOTO 300
280 NEW = Make Game
290 SCREEN 1,10
300 REM(200);
310 FOR I=1 TO 10: THEN GOSUB 1000
320 IF PEEK (2074 AND 7400 AND 1)
330 IF PEEK (2075 AND 7400 AND 2)
340 IF PEEK (2076 AND 7400 AND 3)
350 IF PEEK (2077 AND 7400 AND 4)
360 IF PEEK (2078 AND 7400 AND 5)
370 IF PEEK (2079 AND 7400 AND 6)
380 IF <10 THEN GOTO 400
390 IF <14 THEN GOTO 400
400 IF <18 THEN GOTO 400
410 IF <22 THEN GOTO 400
420 POKE 4,32:POKE 10,32:POKE 14,32
430 PRINT "IF OK!" THEN GOTO 400
440 IF GOTO THEN PRINT
450 PRINT "OK!"
460 IF PEEK (10 AND 200) THEN GOTO 400
470 IF PEEK (10 AND 200) THEN GOTO 400
480 IF PEEK (10 AND 200) THEN GOTO 400
490 POKE P,170:POKE P+1,100:POKE P+1,47
500 IF PEEK (2000 AND 1) THEN GOSUB 600
510 GOTO 1000
520 NEW = Make Planet Surface
530 IF PEEK (10,0) THEN POKE 2000+PEEK(10),200
540 IF PEEK (10,1) THEN GOTO 600
550 GOTO 1000
560 FOR I=1 TO 80: GOTO 600
570 NEW = 100,14,7,30
580 POKE 2000+PEEK(10),30
590 NEW = Detect & Set Up Grav Force-Field
600 IF AND THEN GOTO 610
610 GOTO 600
620 PRINT "THEN AND POKE 2010,104:POKE 2000,104"
630 GOTO 600
640 IF PEEK (10,0) THEN GOTO 600
650 NEW = POKE 2000+1,100
660 POKE 2000,100:POKE 2000,100
670 GOTO 600
680 NEW = Force Laser Gun
690 FOR I=1 TO 4
700 LPH=1000:IF L1000: THEN GOTO 710
710 PRINT "CL=IF PEEK(20) THEN GOTO 700"
720 POKE L,1000
730 NEXT I
740 ST=1
750 FOR J=1 TO 27
760 LPH=1000
770 POKE L,100
780 NEXT J
790 RETURN
800 NEW = Laser Hit
810 IF PEEK (0) PEEK (4) THEN GOTO 820
820 IF PEEK (0) THEN GOTO 830
830 GOTO 740
840 POKE L,100
850 RESTORE 900:PRINT "OK!"
860 FOR I=1 TO 84:POKE 10,HEAT
870 I=10-10
880 PRINT "OK!" FOR I=1 TO 10:PRINT
890 POKE L,100:PRINT "OK!" FOR I=1 TO 10:PRINT
900 PRINT "OK!" FOR I=1 TO 10:PRINT

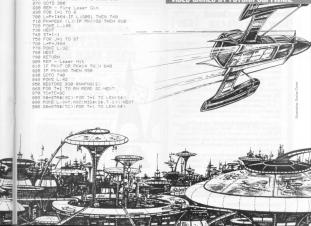
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1138 IF C4004 THEN C4002 GOTO 1140
1139 ABOUT 0400 GOTO 1220
1139 REM - Eng Game
1139 GOSUB 1400
1139 SCREEN 0: S:PRINT""- ATROC OVER --"
1140 IF W:G THEN GOTO 1139
1140 SCREEN 0:0
1140 PRINT"R Crushed Into Buildings 1 R"
1140 IF W:G THEN GOTO 1139
1140 SCREEN 0:0
1140 PRINT"Passed to Grants Force Field 1"
1140 GOSUB 1400:PRINT"0400:0400:0400:0400"
1140 SCREEN 0:400:0
1140 PRINT"you scored 100 points."
1140 IF W:G THEN GOTO 1139
1140 GOTO 1139
1140 SCREEN 0:0:PRINT"you is the highest 1"
1140 PRINT"recorded score so far 1000000"
1140 SCREEN 0:0:PRINT"The highest recorded 1"
1140 PRINT"score is 1000000"
1140 SCREEN 0:13:PRINT"Weather Game (Y or N) 1"
1140 GOSUB 1400:IF W:G THEN GOTO 1400
1140 IF W:G THEN GOTO 1139
1140 IF W:G THEN GOTO 1139
1140 GOTO 1400
1140 CLS:PRINT"Hope you enjoyed the Game!"
1140 END
1140 REM - Clear US Line Screen
1170 FOR I=1 TO 25:SCREEN I:1
1170 PRINT"0400:0400:0400:0400"
1170 RETURN
1170 REM - Passes For Map Press
1170 SCREEN 0:1:1
1170 PRINT"R Hit are you to continue R"
1170 FOR I=1 TO 500
1170 GOSUB 1400:IF W:G THEN RETURN
1170 NEXT
1170 SCREEN 0:1:14:PRINT"0400:0400:0400:0400"
1170 FOR I=1 TO 200
1170 GOSUB 1400:IF W:G THEN RETURN
1170 NEXT
1170 GOTO 1200
1170 REM - Instructions
1170 GOSUB 1400:SCREEN I:1
1170 PRINT" As you go speeding across the surfs
as of an"
1170 PRINT"alien planet is our laser equipped
with a gun."
1170 PRINT"Use the key to go ahead as much
as you can"
1170 PRINT"Instructions on the title below you as
you can."
1170 PRINT"Use steer your craft as to be used
the four"
1170 FOR I=1 TO 200:GOTO 1170
1170 PRINT"cursor arrow keys (Up, Down, Left, and Fire)
your laser"
1170 FOR I=200:0:0:PRINT"0400:0400:0400:0400"
1170 PRINT"Use to freeze the 'SPACE-0400' "
1170 PRINT"Your craft also has too selectable
weapons."
1170 PRINT"Press '1' for normal attack speed as
of 10"
1170 PRINT"super fast 200000000000"
1170 PRINT"Use for the strategic targets '2' as
of '100'



1170 FOR I=200:0:0:PRINT"0400:0400:0400:0400"
1170 PRINT"score points 1000000"
1170 GOSUB 1400:0400:0400:0400
1170 SCREEN 0:1
1170 PRINT" You have a limited fuel supply, but
you can"
1170 PRINT"gain extra by always for the special
fuel"
1170 PRINT"select targets ' '. Your ship can do
10 a day"
1170 FOR I=200:100
1170 PRINT"max of 50 units as shown on the fuel
gauge"
1170 FOR I=200:100
1170 PRINT"your attack will end if you either
run out of"
1170 PRINT"fuel, or fail to avoid one of the on-
coming"
1170 PRINT"city buildings ' '. 1000000
1170 PRINT"Also beware of the invisible super
grants"
1170 PRINT"force fields, your instructions ' ' of
1170 RETURN
1170 FOR I=200:100
1170 PRINT"up ' ' when you are approaching city,
1170 FOR I=200:100
1170 SCREEN 0:13:PRINT"Happy Anniversary 10 11 22"
1170 GOSUB 1400
1170 GOSUB 1400
1170 REM - Start Mission 1, Set up
1170 FOR I=1 TO 0400:0400:0400:0400
1170 FOR I=1 TO 0400:0400:0400:104
1170 PRINT"Points Fuel 10000000000"
1170 FOR I TO 104:GOTO 1170
1170 FOR I=1 TO 104:GOTO 1170
1170 FOR I=1 TO 104:GOTO 1170:PRINT"0400:0400:0400:0400"
1170 GOTO 0400:0400:0400:104
1170 REM -1:100:0400:0400:1
1170 SCREEN 15:0:PRINT"ATROC Selected"
1170 SCREEN 17:0:PRINT"11 Surfers 00 1"
1170 FOR I=1 TO 1000:PRINT"0400:0400:0400:0400"
1170 FOR I=1 TO 1:PRINT"0400:0400:0400:0400"
1170 GOTO 0400:0400:0400:104
1170 GOTO 0400
1170 REM - Copyright (C) 1980 Futura Software
00



GRAND PRIX

Take to the road track in this game of driving skill. The program simulates a track with randomly placed obstacles. Unfortunately due to the limited memory nothing happens if the player crashes into one of these, so a mental note should be taken of the number of obstacles hit and an extra five points added at the end for each collision.

When you have successfully completed the course the game ends and the time you took to cover the distance is shown.

The car accelerates when key six is pressed and is steered by using keys five and eight.

BY JEREMY YOUNGMAN

```

REM WRITTEN BY J.S. YOUNGMAN
1000 LET R=0
1010 LET T=0
1020 LET S=0
1030 LET V=0
1040 PRINT "PRESS [RAND] TO START"
1050 PRINT "PRESS [ESC] TO STOP"
1060 PRINT BY "S.S.S."
1070 LET B=0+(INKEYS="S")-JEREMY
1080 IF B=0 THEN INKEYS="S"
1090 LET I=0
1100 LET G=0
1110 LET Q=0
1120 LET Y=0
1130 INT I/7:PRINT T THEN GOTO 1000
1140 GOTO 1000
1150 GOTO 1000
1160 GOTO 1000
1170 GOTO 1000
1180 GOTO 1000
1190 GOTO 1000
1200 GOTO 1000
1210 GOTO 1000
1220 GOTO 1000
1230 GOTO 1000
1240 GOTO 1000
1250 GOTO 1000
1260 GOTO 1000
1270 GOTO 1000
1280 GOTO 1000
1290 GOTO 1000
1300 GOTO 1000
1310 GOTO 1000
1320 GOTO 1000
1330 GOTO 1000
1340 GOTO 1000
1350 GOTO 1000
1360 GOTO 1000
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1380 GOTO 1000
1390 GOTO 1000
1400 GOTO 1000
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1890 GOTO 1000
1900 GOTO 1000
1910 GOTO 1000
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1930 GOTO 1000
1940 GOTO 1000
1950 GOTO 1000
1960 GOTO 1000
1970 GOTO 1000
1980 GOTO 1000
1990 GOTO 1000
2000 GOTO 1000

```

AVOID THE PROJECTILE

In this game the player has to avoid a self-guiding projectile while attempting to reach home base.

The object of the game is to move from the top corner of the screen to the bottom — without getting hit by the projectile. To make the game more difficult simply use a 15 by 15 array. To move your man up and down use the V and B keys, to move left and right use D and M.

Another way to alter the difficulty of the game is to change the 4 lines 70-100.

BY J. SOUTHWARD

```

1 REM D VS. PRODUCTION
2 PRINT "AVOID THE PROJECTILE"
3 PRINT "IT WILL MOVE TOWARDS YOU"
4 PRINT "U MOVES YOU DOWN"
5 PRINT "B MOVES YOU UPDOWN"
6 PRINT "D,M ARE THE SAME ON"
7 PRINT "PRESS NEW LINE"
8 PRINT "BY 15,15: "HOME""
9 PRINT "BY 15,15: "HOME""
10 PRINT "BY 15,15: "HOME""
11 PRINT "BY 15,15: "HOME""
12 PRINT "BY 15,15: "HOME""
13 PRINT "BY 15,15: "HOME""
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96 PRINT "BY 15,15: "HOME""
97 PRINT "BY 15,15: "HOME""
98 PRINT "BY 15,15: "HOME""
99 PRINT "BY 15,15: "HOME""
100 PRINT "BY 15,15: "HOME""

```

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KBUS is a 2K extension to TANBUG that contains a memory assembler and disassembler and cassette firmware running at 380 Baud 0x0A standard or high speed 2400 Baud. Tanbug is standard with 6 character font/lines. Tangent have taken out a full O/E.M license for Microsoft BASIC the microcomputer industry standard. This is a full feature implementation with interrupt and machine code handling, and a superb program editor.



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Parallel I/O

When fully expanded Tanbug includes two V.I.A.s (Versatile Interface Adapters) which implement the cassette interface and the parallel I/O ports. Software in TANBUG V2.2 enables you to plug in and use a Centronics type printer. The two V.I.A.s also contain counter timers that can be used for a variety of applications enhanced by the use of the integral hardware facilities.

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MINDTAUR

Do you enjoy solving mazes? Well, this program will provide a different one each time it is run. Just watch the computer draw out a maze while you try to work out the right path.

When the computer is finished drawing out that maze into action — and do it quickly as you have to race through the maze against the clock.

The program is built on algorithms, which will produce a maze which has one, and only one, path from a cell — the little "rooms" which make up the maze — to another cell.

The algorithm is as follows:

1. Fill the maze with little cells, no one connected to any other. (Lines 40-60 in the program)
2. Choose one of them and call it the "mother cell" (line 65). It will be the "present position"
3. Record cells which aren't connected to any other cell and border on the present position (lines 100-140)
4. If there are no such cells, return to the previous position. If you can't do that, because you're in the mother cell, in the maze ready, (lines 150-160)
5. Choose randomly one of the recorded cells. (line 180)
6. Connect that cell to the present position, and record it that cell from where you connected it. (lines 190-220)
7. Move into that cell. (lines 100-100)
8. Go to step 3. (line 270)

Lines 1-3 show the control keys and must be omitted to make the program fit in 2K.

Lines 12-30 initialize the screen. (F0x0 36875 selects the colour of the screen).

Lines 1000-1010 make the entrance and the exit of the maze and set the time.

Lines 1040-1050 are the main part of the program.

Lines 1110-1130 play a little tune when you have reached the exit.



BY MATS DEHRMAN

RUNS ON A VIC-20 IN 3-5K

```
1 000:0000 0000 0000 0000 0000 0000 0000 0000
2 0000:0000 0000 0000 0000 0000
3 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
4 0000 00000000
5 0000 00000000
6 0000 00000000 00000000 0000 0000 0000 0000 0000 0000 0000
7 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
8 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
9 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
10 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
11 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
12 PRINT:0000 0000 0000
13 0000:0000 0000 0000 0000
14 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
15 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
16 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
17 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
18 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
19 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
20 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
21 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
22 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
23 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
24 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
25 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
26 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
27 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
28 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
29 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
30 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
31 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
32 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
33 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
34 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
35 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
36 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
37 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
38 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
39 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
40 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
41 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
42 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
43 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
44 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
45 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
46 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
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62 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
63 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
64 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
65 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
66 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
67 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
68 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
69 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
70 0000:0000 0000 0000 0000 0000 0000 0000 0000 0000 0000
```




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Adventure

FROM TOP TO BOTTOM

Those of you who have ventured into the dark forest of Adventure programming and typed "LOOK AROUND" probably can't see the wood for the trees by now! So let's have a look at the structure of a complete program.

From top to bottom of the program, the following sequence shows how various blocks of code fit together.

1. This block of code lays out the ground for the program to operate on:
CLEAR string space. (Allows manipulation of character strings)
DEFINE variable types. (string, integer etc.)
DIMENSION arrays.
2. This block loads the framework of the plot READ in DATA or directly assigns variables — or both.
3. Start of program loop. Communicate with the player:
Check for special conditions.
Clear screen.
PRINT display variables.
Reset screen variables to null.
Await INPUT.
4. Interpret the player's communication with the computer: Decode verb and noun.
— IF either are invalid singly or in combination set reply and return to block three.
ELSE GOTO block five.
5. Execute the plot:
This block comprises a number of routines, one to cover each valid verb. Each routine alters game variables and sets reply variables, then returns to block three or goes to block six, for a standard reply.
6. Set standard replies. For example "IMPOSSIBLE" "OK".
7. DATA statements to be read by block two.

Let's have a look at block one in some detail. Don't worry if your computer doesn't have all of these Basic statements — but use them if it does!

Some machines require string space to be set aside, by the use of CLEAR statements.

This reserves the specified amount of memory for strings and string handling. If you have this routine I suggest you start by clearing about 1500 bytes and adjust by trial and error if you start running out.

If your game is approaching the capacity of the machine, you may have to strike quite a fine balance between string space and run-time memory.

Some machines allow scopes of variables to be defined at the beginning of the program by a DEFINT statement. DEFINT A for example would thereafter

create any variable whose name begins with an A to be a string variable. This saves the memory requirement for the \$ sign. Similarly, DEFINT will define a variable scope as an integer.

Dimensioning arrays has already been covered — but a word of advice! Make sure the plot of your game is thoroughly detailed before setting hands on the keyboard — or you will not only have to keep increasing your array dimensions, you will have to lengthen the loops that scan them — and you are BOUND to miss one! I know — I always do!

Now we can see the shape of the whole program. In the next issue I will start to examine more detailed parts of its logic.

GOING UNDERGROUND

I have been playing Abersalt Adventure supplied by Abersalt of Byfed, which runs on a Sinclair ZX81 with 16K RAM pack.

"Welcome to Adventure" greets a flicker-free screen on typing "RUN", and before long we are on the edge of a forest outside a large brick building.

Further exploration leads us to a canyon, and eventually to a locked grating.

"Oh dear — you didn't bring the keys, did you? Never mind — I did, so down the grating we go only to find ourselves in an underground world of caverns, low twisting passages, and a vast chamber with an inaccessible treasure.

We have collected no more a small bird, a wicker cage, and a black red flag about — we've done this before haven't we?



Yes, for all intents and purposes we could be inside a Pyramid of the Tandy variety, for black red and wicker, for small bird and bird-station, and for wicker cage and red station too.

Those of us who are well travelled now know how to cross the Sahara, find torch batteries etc.

What I didn't mention when I reviewed the Tandy game is that Pyramid is itself an abridged and modified version of the original Adventure.

So for anyone read woad. Could be useful for there are things you would expect to do with a woad but not necessarily with a sceptre or wad.

Although not an original plot, it has certainly survived well! What's it like on a Sinclair? I found it — typing apart — better than on a Tandy as the screen is cleared rather than scrubbed, making it, for me anyway, less confusing.

One small criticism is that the inventory is retained within the game in terms. Consequently you can grab things, quit, and then about! Nevertheless, it is pleasing to see full size Adventures — in micro terms — being made available to thousands of Sinclair owners.

My thanks to Mrs. Pam Bryan of Southlands School, New Romney, for the loan of her computer for this review.

By KEITH CAMPBELL

PRACTICAL PROGRAMMING

GRAPHIC GRAPHS...

Many home computers have a sophisticated set of graphics commands, and various dialects of BASIC provide features for the format of output, including cursor control characters and such commands as PRINT USING, PRINT AT, etc. However, it is possible to do a great deal with only the standard formatting features of cursor and semicolon following the PRINT statement and the TAB function.

Using the TAB function it is possible to draw low resolution graphs; for example:

```
100 FOR X = -1 TO 1 STEP 1/10
110 LET Y = X*X
120 PRINT TAB (Y*40); "+"
130 NEXT X
```

will give a graph of the function $Y = X^2$ from $X = -1$ to $X = 1$ while

```
100 FOR X = 0 TO 3 STEP 1/10
110 LET Y = X^3
120 PRINT TAB (Y*30); "+"
130 NEXT X
```

will give a graph of the function $Y = X^3$ from $X = 0$ to $X = 3$.

The reason for using $Y*40$ and $Y*30$ is to provide a suitable scale for the graphs. The argument of the TAB function is required to be not greater than the number of columns on the screen; since $X^2 = 1$ when X is between -1 and 1 , and $X^3 = 3$ when X is between 0 and 3 , these values allow us to use the full width of a 40 column screen.

It is also possible to draw a graph of a function which takes negative values; for example, $Y = \sin X$:

```
100 LET L = 3*3.14159
110 FOR X = 0 TO L STEP 1/30
120 LET Y = SIN(X)
130 PRINT TAB (20 + 20*Y); "+"
140 NEXT X
```

Negative values will appear on the left of the screen and positive values on the right.

The most straightforward use of the comma and semicolon in

PRINT statements is to produce columns of numbers, but there are problems when different numbers of digits are involved. For example:

```
100 FOR I = 1 TO 10
110 PRINT 2*(I+1)*I+1
120 NEXT I
```

will give the result shown in table one, while replacing the semicolons with commas gives the slightly better, but still unsatisfactory table two.

We can use the TAB function to print the columns with the numbers right-justified; we need TAB(N-1) for one-digit numbers, TAB(N-1) for two-digit numbers, TAB(N-2) for three-digit numbers, etc. i.e., we need TAB(N+1 - number of digits), which leaves only the problem of finding the number of digits in each number to be printed. There is no simple way to do this, but the method I prefer is the following:

```
10 LET X = number to be printed
20 LET Z$ = STR$(X)
30 LET D = LEN(Z$)
40 PRINT TAB(N+1-D); X
```

i.e. convert the number to a string and then find the length of the string. The various operations can be combined into a single statement: PRINT TAB(N+1-LEN(STR\$(X))); X

STRINGS AND THINGS...

One point that you need to watch when using STR\$ is the format of the resulting string. Some BASICs give a leading space in a positive number while others give only the digits.

This method can be extended to deal with decimals by replacing line 20 by LET Z\$ = STR\$(INT(X)), or in the compacted expression: PRINT TAB(N+1-LEN(STR\$(INT(X))); X. This allows you to print columns with the decimal point aligned vertically.

Another method for finding the number of digits is to use the expression $D = 1 + \text{INT}(\text{LOG}(\text{ABS}(X)))$. There are several

reasons why this is less satisfactory than using STR\$ and LEN, including its lack of robustness and the practical reason that, due to rounding errors within the BASIC, it may give the wrong answer on numbers close to a power of 10.

COMPLICATED CALCULATIONS

A more complicated problem involving columns of numbers arises when we have amounts of money in pounds and pence which have to be printed with exactly two digits after the decimal point: e.g., £1.39 rather than £1.5 or £2.00 rather than £2.

If the amounts are calculated by a method which does not necessarily produce an exact number of pence the answers must first be rounded. The standard method for rounding to two decimal places is:

```
X = INT(100*X) + 50/100
(rounding to the nearest penny)
or X = INT(100*X)/100
(rounding to the lower penny)
```

When we have the answer correct to two decimal places we cannot simply print it using one of the methods above, as trailing zeroes after the decimal point will not be printed by BASIC, and the decimal point will not be printed if the answer is an integer. To get around this we have to do a great deal of manipulation, separating pounds and pence, converting to strings, removing leading spaces put in by STR\$, making sure that there is always two digits in the pence, and finally putting everything back together.

```
100 LET X = amount in pounds,
to 2 decimal places
110 REM SEPARATE X INTO L
POUNDS AND PENCE
120 LET L = INT(X)
130 LET P = 100*(X-L)
140 REM CONVERT FROM
NUMERIC TO STRING
VARIABLES
150 LET L$ = STR$(L)
160 LET P$ = STR$(P)
170 REM DELETE LEADING
```

PRACTICAL PROGRAMMING

```
SPACES IF NECESSARY
180 IF LEFT$(LS,1) = " "
    THEN LET LS =
    RIGHT$(LEN(LS)-1)
190 IF LEFT$(PS,1) = " "
    THEN LET PS =
    RIGHT$(LEN(PS)-1)
200 REM ADD LEADING ZERO
    IF LESS THAN 10 PENCE
210 IF P=10 THEN PS = "0" +
    PS
220 REM NOW BUILD UP
    FINAL STRING
230 LET AS = " " + LS + " "
    + PS
240 REM PRINT ANSWER
    RIGHT-JUSTIFIED TO
    COLUMN N
250 PRINT
    TAB(N-1)-LEN(AS); AS
```

If you want to see the above routine in a program it can be cut down considerably by combining some of the statements, and either eliminating lines 190 and 200 or cutting them down to the part after "THEN", depending on what is required in your machine. The form given here is intended to explain the method rather than to be used as it stands.

ROUNDING ERRORS

I mentioned rounding and rounding errors above, in passing, but this is a subject that deserves a closer examination. Many of the numbers we deal with are approximate, particularly numbers obtained by measurement, and we often have to round answers to a specified number of decimal places or a specified number of significant figures.

There is a simple method for rounding to any specified number of decimal places, as described above for the case of two decimal places, and the same method can also be used to round to any required degree of accuracy.

However, when using the INT function we must always watch out for differences between the decimal number that the computer prints on the screen and the

1	1	1
2	4	8
3	9	27
4	16	64
5	25	125
6	36	216
7	49	343
8	64	512
9	81	729
10	100	1000

1	1	1
2	4	8
3	9	27
4	16	64
5	25	125
6	36	216
7	49	343
8	64	512
9	81	729
10	100	1000



binary number which is held internally and used in calculations. Just as some fractions do not have a decimal representation in a finite number of digits, we also find that some fractions cannot be represented in binary with a finite number of digits. Thus $1/3$ as a decimal is $.333 \dots$ repeated to infinity, and as a binary fraction is $.010101 \dots$

The problem with INT arises when we have a fraction that has a finite decimal representation but an infinite binary representation.

For example, $1/3$ can be exactly represented in decimal as 0.1 , but in binary is $.00110011 \dots$ If we ask the computer to PRINT $3*(1/3)$ the answer

will come out as 1, as we expect, but interestingly the answer may be binary fraction $.1111 \dots$ to 34 or 35 places. The result of PRINT INT(3*(1/3)) would be 0 since the binary fraction is less than 1.

FINDING THE ANSWER . . .

In order to be sure that we got the right answer we must add a small fraction to the computer's answer, for example, when rounding an amount of money to the lower penny, if we use:

```
LET X = INT(100*X)/100
```

due to binary decimal conversion, $100*X$ may be 2^{32} or 2^{31} less than an integer and INT(100*X) would be one less than the correct amount.

If we do the rounding by:

```
LET X = INT(100 X + .0001)/100
```

we correct for the small error

introduced by binary/decimal conversion, although adding .0001 may sometimes introduce an error in the opposite direction.

A similar problem arises when making tests for equality. As in the example above, we may find that a number printed out as an integer is actually held internally as a fraction differing by a small amount from an integer.

The test IF X = 1 THEN ... may give the wrong result although PRINT X would give the answer 1. This can be allowed for by testing for the two numbers being close together rather than for them being equal, so we should write instead IF ABS(X-1) < 1E-6 THEN ...

Graphics



ADVENTURE IN VIEW

Creators of Adventure games have yet to tap the full potential of graphics.

They can be used to model terrain which could be a big advantage in such games. The terrain can provide opportunities for ambush and give a clear advantage to characters occupying the heights. In general, graphics can provide many tactical possibilities.

An important use of graphics has always been to present information in such a way that it can be easily understood.

In this article we are going to start with a table of numerical data, and examine various ways of presenting this information graphically.

Tabulated data of this kind arises in many problems and applications, and the graphical techniques that are illustrated here are widely applicable. For this reason, although a specific problem and some of the possible ways of presenting its solution are described, the ideas that are put forward should be of general interest and use.

The following table gives the heights measured at each cross-point of a rectangular grid covering a particular site.

	COLUMNS							
ROW	1	2	3	4	5	6	7	8
1	1.8	1.4	1.9	2.6	0.6	0.4	0.2	0.2
2	2.1	1.8	1.3	1.8	2.1	1.9	1.6	0.8
3	2.8	1.9	2.8	3.4	4.3	3.9	3.5	2.3
4	3.3	3.5	4.2	5.8	6.2	7.2	6.7	5.4
5	3.9	4.3	4.6	6.1	5.8	7.7	6.7	4.4
6	2.1	2.3	3.9	3.7	3.8	3.5	4.7	4.4
7	0.5	0.1	1.6	0.1	0.0	1.8	2.5	0.4
8	0.1	0.2	0.4	0.6	0.2	0.2	3.7	0.6

The data could have come from an official survey or from measurements made in my garden. They could be used to model the terrain that was surveyed, but the data could equally well be used to provide the field of operations for an Adventure game.

The information in the table

can be presented in the way shown in figure one by drawing a curve using the data in each row of the table. Each curve gives a different cross-section of the surveyed region. This presentation is rather cluttered and does not really help one to visualize the appearance of the site.

Figure two shows the information presented as a contour map. This is a rather better presentation. It could be enhanced by using colours to shade the regions between contours as is done in the maps in an atlas.

However, it still does not give a visual impression of the appearance of the region. Its effectiveness depends almost entirely on whether the observer is familiar with the idea of a contour map.

A three-dimensional perspective view of the surface is given in figure three, and at last we have a visual presentation that makes it easy to interpret the data.

The appearance of the "wireframe" model is improved considerably because the hidden lines are removed from the drawing.

Incidentally, you might like to determine the position of the vantage point from which the terrain is viewed in this figure.

The three-dimensional contour

map of the region shown in figure four also provides a good visual impression of the surface of the region.

An ideal presentation of the data might consist of a combination of methods. Using both a three-dimensional perspective and a contour map, the details



FIGURE 1



FIGURE 2



FIGURE 3



FIGURE 4

that are not apparent because of hidden line removal in the 3D presentation can be deduced from the contour map. Alternatively, a series of three-dimensional perspectives from different viewpoints may prove to be most useful.

By Gary Marshall

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The name of Ragnar the pirate and his star-troopers must now be traced in this sector of the galaxy. Nine enemy worlds have I plundered in the last campaign but of these but the next time.

The invasion of Saurin's empire is going strongly. She puts up so little resistance that I will pull out half of the attacking force to plan an assault elsewhere.

My tame merchant Epton is transferring materials as fast as his fleet can and I know he needs the business so he is no threat for the moment.

Does the Senator and his many robots have proved latent allies throughout the game ... which makes them a perfect target? And as Does must be thinking the same, I'll attack him now. And I wonder who embroiled those two explorer ships I sent out ...?

The late night catler identifies himself "This is Sphere Pirate Thing. Unless you start delivering raw materials to me on from the next turn I'm going to plunder your home world."

He hangs up abruptly, leaving you to wonder: Can Thing really be serious? How does he expect me to react? Was it even Thing or all?

Hard to imagine a computer being involved in this kind of duplicity but this is an example of the kind of play you have to guard against in the still relatively undiscovered field of computer moderated gaming.

The best established of these games is Starweb, run in the U.K. by Chris Harvey, who has a host of horror stories similar to the above; of marauding homeriders claiming to be merchants to dupe the unwary; of players tricked into forfeiting their next turn; and attackers who, in mid-onslaught, realize they have been fed the wrong map information.

Anything goes and you have to be prepared to face opponents who will stop just this side of the low-of-the-land to achieve their ends. Threats, broken alliances, libel, lies and downright sneakiness, form the fabric of these games, some of which consider 18 months a good life span — others go on indefinitely.

A computer program is used to map out a world, galaxy or even universe and the rules and aims



Play-by-mail computer games are already big business in the U.S. and look ripe to take off over here. Terry Pratt reports

of its races and inhabitants. The game is then populated by players, who take charge of tribes, nations or whole solar systems and then plan their campaigns for conquest.

Starweb, via the U.S. firm, Flying Buffalo, is a good example.

Players choose a racial type for themselves. There are six: Fighters, Berserkers, Empire Builders, Merchants, Artist Collectors, and Apostles. Each type has his own special powers, aims and victory conditions. As he fulfills these conditions, he is awarded points.

Enough players to achieve a good game — (between 18 and 18) — strive for a points total chosen by averaging out each player's suggested winning total.

Apostles try to convert worlds. Empire Builders attempt to own worlds, Berserkers aim to destroy life. Pirates seek to plunder planets, while the popular Merchants ship much-needed raw materials and Artist Collectors hope to gather rarities.

It's a combination of characters which ensures plenty of rivalry and conflict but also demands interaction, reliance on other players and usually results in some uneasy alliances.

The player is played on his home world, given ships and forces as befits his role and embarks on his quest by sending off a letter detailing his orders.

In the case of Starweb these

are sent to an old mainframe computer — a PDP10 — in America to be processed and then returned with a printout of how the universe is developing before each player's eyes. What his exploration ships have discovered and whether any contacts have been made. Turn-around is four weeks.

Other races — players — are usually contacted around turn three and then the "diplomacy" side of the game begins, with a player sending off a card to whoever embroiled his small fleet on the outer edges of his realm. This card will usually include a phone number and suggest a meeting of minds.

Swapping any information with fellow players helps to increase your understanding of the universe.

The game scores over more orthodox wargames, firstly because fellow enthusiasts are found for you and secondly, because there is a greater sense of realism. You can't see your opponent secretly massing his forces on your border and you don't know what is lurking beyond what you have explored.

You only have a player's word about his strength, race characteristics and intentions — so just how far do you trust a space pirate? According to enthusiast Tim Bailey, honesty is the best policy because those who lie are usually caught out and never trusted again.

Diplomacy is the most important part of the game. Being able to persuade others that it is in their interests to do what you want them to is the mark of a good player.

Occasionally you come across a player who will not talk and these, according to top player Bob Brown are the first to go: "They are an unknown quantity and their moves force you to attack them."

It is difficult to estimate how many Starweb players there are in the U.K. as many play several games at once but it is in the region of 350+.

The U.K. end is run from P.O. Box 103, Bath Street, Walsall, West Midlands.

Starweb costs £1.50 per turn. Other Flying Buffalo games which have a following are: Nuclear Destruction, 50p; Battle Plan £1.00; and Space Battle, from 75p.

The only all-British game is Mike Singleton's Starlord which he wrote on his BBC Pet and began running in April 1981. It now has 300 players and allows up to 10 to compete in each game.

This game is designed to run indefinitely. Players aim to become Starlord Emperor and take their seat in the Throne Star at the centre of the Galaxy. The award for this is free turns while Emperor, a complete printed map of the Empire which stretches across a whole galaxy and control of any surviving Empire garrisons.

Players start with a command ship, a base star and a fleet of 90 starships. The command ship has no fighting power but is a communications centre and the player's control is limited to seven orbits around this ship.

All the stars have a name and there are 14 types in this galaxy, including: signal stars, for galactic news; power stars, for fuel; gate and exit stars, for space jumps; city stars; battle stars and fort stars.

Battles are resolved by the computer, comparing each commander's battle orders, retreat threshold and ratio of forces on either side.

Starlord boasts a two weekly tournament and costs £1.25 per turn. But the real measure of its success, is that America, the real

WHO'D TAKE THE WORD OF A SPACE PIRATE?



home of this form of gaming, is been to import Starlord under licence. Mike Singleton claims proudly: "We are negotiating with three American firms. It's a bit like selling coals to Newcastle." Mike is at 1 Bake Key Close, Merton, Wincal, Merseyside.

Tribes of Creese is a computer assisted game with second storage and word processing performed by computer. This is set on the fantasy world of Creese and features the warring tribes of that nation.

Players take the part of a chief of one of the wandering tribes and their aim is to lead their people to dominance over the neighbouring tribes. Each tribe has its own way of measuring prosperity and so obtain points.

The game runs indefinitely and can be entered at any time and the fantasy world has a complete range of geography, ranging from desert to polar ice, with mountains, rivers and forests. Cities also form part of the world of Creese and act as centres of trade and homes for the land's powerful lords and shamans.

Among the creatures you are likely to run into are: caribou, cattle goats, warhorns and huge bipedal lizards.

The game is run in the U.K. by Mark Handell and costs £8.50 for the first four turns. The price includes a rule book — players have to pay £1.50 per turn after that. Mark Handell has two new games planned: Gladiator is one he wrote himself and Starmaster is a popular U.S. game. Both will be started this year. Write to him at Lethbridge, Stockdale, Healds, Bucks.

Perhaps the best recommendation for computer mediated gaming is the players themselves. The four I telephoned came from very different parts of the country but — with one exception — they all either knew or had heard of one another by reputation. A very good way of contacting fellow games enthusiasts.

• If the idea of computer mediated games appeals to you, Starweb's U.K. agent is offering the chance to play it for free through the magazine. Turn to page 15 for further details.

DOWN TO BASIC

SINCLAIR BASIC

The computer language BASIC fails to live up to its simple label in one major way. There is a variety of different versions of the language with each microcomputer manufacturer adding their own extras.

Unfortunately, this makes life difficult for the programmer transferring from one machine to another. To try and help you over this hurdle I have now on, I will include a table summarizing the main features of the version of BASIC available on one of the popular microcomputers. I start with the Sinclair ZX-81.

As I will continue to cover the general features of BASIC in parallel with the production of these tables, it is inevitable that they will include statements that I have not yet covered. You should use the tables for general reference.

NOT SO SIMPLE

As the programs that you write become more complex and longer, you will face two main problems.

You will find yourself having to repeat groups of instructions at several points in your program. These groups of instructions may be identical or very similar.

Another problem is that the increase in the length of your programs makes it more difficult for you to keep track of what is going on in your program.

The unfortunate consequences of this are that you will tend to make more mistakes in developing and typing in the program, and that the errors will be more difficult to track down.

The use of **SUBROUTINES** can help alleviate both these problems.

BASIC contains the facility whereby a sequence of instructions which is to be executed at several points in a program need

Variables: Names of numeric variables may be of any length and consist of any combination of letters and digits provided they start with a letter. The name of a control variable in a FOR-NEXT loop must be a single letter. The name of a string variable must be a single letter followed by \$.

Arrays: The name of an array must be a single letter followed by \$ if it is a string array. Arrays may be of any size and any number of dimensions. For a string array the length of the strings must be specified in a DIM statement e.g. DIM N\$(10, 5) sets up a list of 10 strings each of length 5.

Substrings can be used e.g. (with above defined list) N\$(2,1) refers to the 1st character in the 2nd string of list N\$(N\$(4, 3 TO 5) refers to characters 3-5 of the 4th string.

Statements: No END statement. The form of the IF statement is <line no. > IF <condition> THEN <statement>. CLEAR, deletes all variables. CLS, clears the display. FAST, increases speed of calculation, but affects the display. PAUSE, can inter-

duce a pause in computing until a key is pressed or for a fixed time (if specified). POKE, writes specified value at specified memory address. SCROLL, scrolls the display up one line. SLOW, puts the computer in display mode.

Functions: ACS, arcosine. ASN, arcsine. CHR\$, converts code number to character. CODE, converts character (first in specified string) to code no number. INKEY\$, reads character pressed on keyboard. LN, natural logarithm. PEEK, value of byte in specified memory address (address in range 0 to 65535). PI, value of π . STR\$, converts number to character string of digits. TAN, tangent. USR, calls machine code subroutine with specified start address. VAL, treats specified string as an arithmetic expression. PLOT ABS, STN, COS, EXP, INT, LEN, RND, SGN, SIN, DIR, Graphics: Screen has 25 rows and 25 columns. PLOT X,Y "black-in" screen position row X, column Y. UNPLOT X,Y "black" screen position row X, column Y. Graphics characters:



only be written once. These instructions form a subroutine. Each time the subroutine is to be executed it may be entered by means of a **GOSUB** statement.

The general form of a **GOSUB** statement is

```
<statement no. > GOSUB  
<statement >
```

for example:

```
20 GOSUB 400
```

As you can see, the form of the **GOSUB** statement is very similar

to that of the **GOTO** statement. The operation of the **GOSUB** statement is in fact similar to that of the **GOTO** statement in that control will be transferred to the statement specified. In the above example, control will be transferred to statement 400.

However, with the **GOSUB** statement, a note is made of the current statement number before the specified jump takes place. It is then possible to return after the subroutine has been executed. With the **GOTO** statement, there is no record of where you jumped from.

In BASIC, a subroutine is actually no different from any other group of statements in a program except that there will be a **RETURN** statement at the end of the group. It is when this **RETURN** statement is encountered that the computer transfers to where the previous jump occurred.

The **RETURN** statement takes the form

```
<statement no. > RETURN  
for example
```

BY MOIRA NORRIE

DOWN TO BASIC

450 RETURN

After the return is made, the statement after the GOSUB statement will be executed.

Usually, subroutines are included at the end of a BASIC program. A program containing one subroutine could therefore take the general form:

```
10 _____
20 _____
30 _____
40 GOSUB 400
50 _____
60 _____
70 GOSUB 400
80 _____
90 _____
100 STOP
110 REM
400 REM *****
410 REM SUBROUTINE
420 REM
430 _____
440 _____
450 RETURN
460 REM *****
470 END
```

THE NEED FOR COMMENTS...

Two main points arise from the above example.

As stated previously, the only factors that distinguish a subroutine from any other section of code is that it has a RETURN statement at the end, and it has corresponding GOSUB statements. There is nothing in the mechanism for setting them up that clearly indicates the beginning of a subroutine and the task it performs. I have emphasized

the need for comments in your program before. It is vital when using subroutines that, at the very least, you include a comment at the beginning of the subroutine.

In line 100 of the program there is a STOP statement. This causes the execution of the program to be stopped when it is reached. It is possible to have a number of STOP statements at various points in a program providing alternative stopping points.

SUBROUTINES AND LOGIC



The reason for the inclusion of a STOP statement in line 100 of the above example, is to prevent the computer automatically proceeding sequentially from statement 90 to statement 400

and through the subroutine. As a general rule, there should always be either a STOP statement or a GOTO statement immediately before a subroutine.

Subroutines are also used to split a program into logical sections — where each section can be developed and tested on a single unit. Ideally each logical section should be no longer than a page in length so that they remain easy to read and understand.

This may be achieved by further dividing large subroutines into logical sections some of which will themselves be subroutines. In this way, you can have nesting of subroutines.

NEXT MONTH

In a program, it is often necessary to process a list of related data items e.g. a list of individual golf scores. Next month, I will show you how to set up such a list and then process it. The microcomputer system to be covered is the Commodore PET.

NEXT MONTH



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Kit Korner

SCREWDRIVERS AND SPANNERS

It would be nice, I keep telling myself, if I could carry on me every single piece of electronic equipment I was ever going to need. I tried once but my pockets split. Now all I carry around is a small neon screwdriver and a penknife, with which I can get most pieces of domestic equipment installed or temporarily repaired.

Of course, for construction, as well as for the majority of repair jobs you will need quite a few more pieces of equipment — and these I will cover here.

Before I start these are a number of important points to remember. The first, which is a rule of thumb I always employ, is to buy the best you can afford. Secondly, and almost as important, don't waste money buying something you will not use or which you could do without.

The last point is to find out which model is right for you by reading through the catalogues and trying out the equipment in the shops. This especially applies to soldering iron.

Now, down to the tools. I will start, as I have just mentioned them, with soldering irons. There are two main types — uncontrolled wires heated and temperature controlled, either mains or low voltage AC or DC.

Whichever one you get you will be able to undertake the same work. Buy an iron with interchangeable bits, and get a spare one to go with it. You should have one small — one to 2mm — and one medium — 2 to 4mm.

The names to look out for are: Adco, Atax, Erno, Oxy, and Weller for mains uncontrolled and add Unger to the list for controlled irons. Prices range from £1.50 to £3.00 for mains and from £12 to £40 for controlled. An iron should last a lifetime, only the bits need be changed.

You can't really go wrong with solder, but having said that do not buy acid flux type. Use 60/40, tin/lead in 20wag, which is generally available. To unsolder use desoldering braid. It is easier



and cheaper than a solder sucker. I have found Multicore Solder Wick to be the best although there are other makers such as Spig and WIE-IT. The worst, without a doubt, is the one made by RE Components.

Next on the list are pliers and cutters. These can be bought separately or as a set. Either way will do. Find the ones which suit you best by trying them out.

The pliers should be pointed nose with either plain or serrated jaws. The cutters ought to be lightweight, either side or diagonal cutting for the best results. Manufacturers include Artason, Ferro, GE, EPE Corporation, Kiva, Lindstrom Proco, Wilkinson and Hoxlita. The prices range from £2 to £3 for pliers and from £4 to £15 for cutters.

For cutting heavier gauge wire and pins I suggest a purpose built cutter and stripper as the light cutters can easily be damaged on the harder materials. Prices range from £1.50 to £5.00 and most are usually good value, and most of the makers of pliers and cutters produce these.

It is most important to buy the best when it comes to screwdrivers. Sets are too expensive and usually contain too many sizes. Changeable blades are a waste of time in my opinion, if you are using different heads and screw sizes. For slotted screws you will only need four sizes at the 3, 4, 5, 6.5mm marks. All should have 8-12mm long blades.

When it comes to the cross-heads it is important to match the head with the driver. These are two main types — Phillips and Pozidriv. Pozidriv now have Supadriv, but the difference is only cosmetic. If you use screws in your work please make sure that they are Pozidriv, as they are much more reliable than Phillips. Two sizes will do for each type and it is best to make the smaller ones nice and small to fit the recessed screws. There are too many names to mention so skip around. Individual prices below £1 are good value.

Allen keys, which are really hexagonal keys, are also very handy and come in very reasonably priced sets. It is worthwhile getting both Imperial and Metric.

Small spanners are very useful for tightening up nuts on the use of pliers is not to be encouraged. Again, there is no standard and in fact this time there is a choice of three Imperial, American and Metric.

The common Imperial sizes are 4 and 8BA, 2 and 8BA only occasionally being used. The American sizes are 1/4"AF, 1/2"AF and 3/4"AF. All are commonly used. The Metric nuts come in M2.5, M3, M4, and M5. Again the middle two are most common. The safest method of purchase is to get an adjustable spanner.

There are several types of spanner, the most common being the open ended. Nut drivers are handy but pricey, as are ring spanners. However, do not make do with the wrong sizes. As with crosshead screws you will only damage both tool and component. Some spanner makers are: Bedford, Babco, Eclipse, Elora, Footprint, and King Dick. Prices extend over a great range, from 50p to £3 for nut drivers and sliding spanners. Value for money comes at about midrange.

If you are going to expand your construction projects you will undoubtedly need a comprehensive set of tools.

Make the most of your Sinclair ZX Computer... Sinclair ZX software on cassette. £3.⁹⁵ per cassette.

The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users.

Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully revised for content and quality, and then grouped with other programs to form a single-subject course.

Each cassette costs £3.95 (including VAT and p&p) and comes complete with full instructions.

Although primarily designed for the Sinclair ZX80, many of the cassettes are suitable for running on a Sinclair ZX81 - if fitted with a replacement 8K BASIC ROM.

Some of the more elaborate programs can be run only on a Sinclair ZX Personal Computer as represented by a 16K-192K add-on RAM pack.

This RAM pack and the replacement ROM are described below. And the description of each cassette makes it clear what hardware is required.

8K BASIC ROM

The 8K BASIC ROM used in the ZX81 is available in ZX80 version as a drop-in replacement chip. With the exception of animated graphics, all the advanced features of the ZX81 are now available on a ZX80 - including the ability to run most of the Sinclair ZX software.

The ROM chip comes with a new keyboard template, which can be overlaid on the existing keyboard in minutes, and a new operating manual.

16K-BYTE RAM pack

The 16K-byte RAM pack provides 16-times more RAM than its complete module. Compatible with the ZX81 and ZX80, it can be used in conjunction with a telephone.

The RAM pack simply plugs into the existing expansion port on the rear of a Sinclair ZX Personal Computer.



Cassette 1-Games

For ZX81 (and ZX80 with 16K BASIC ROM)

AGONY - your space craft's mission is to pickup every valuable cargo that's scattered around a star.

SNIPER - you're outnumbered by 40 of the enemy. How quickly can you spot and shoot them when they appear?

MY HERO - your starship is crashing through space when a new planet is discovered. How long can you dodge the deadly danger?

LEVEE - J.H. Conway's 'Game of Life' has achieved tremendous popularity as the computing world. Study the life, death and evolution patterns of cells.

NUM PRICK - your neural detector is on a submarine from the depths across an ocean, but must find a way to penetrate. **LOCAL** - what's your locality? It's a tricky course but you control the strength of your stars.

Cassette 2-Junior

Educators 7-11-year-olds

For ZX81 (and 16K RAM pack ZX80A) - simple addition - with the added attraction of a car crash if you get it wrong.

MULTIPLY - long multiplication with five levels of difficulty. If the answer's wrong - the car crash is explained.

TRAIN - multiplication using addition to compute. The winner's train reaches the station first.

FRACTIONS - fractions explained at three levels of difficulty. A ten-question test completes the program.

ADDS TO - addition and subtraction with three levels of difficulty. Again, wrong answers are followed by an explanation.

DISPERSE - with five levels of difficulty. Minerals are explained graphically, and a mining mine is disclosed.

SPELLING - up to 500 words over five levels of difficulty. You can even change the words yourself.

Cassette 3-Business and Household

For ZX81 (and ZX80 with 16K BASIC ROM) and 16K RAM pack

TELEPHONE - set up your own computerised telephone directory and address book. Changes, additions and deletions of up to 50 cards are easy.

NOTE PAID - a powerful, easy-to-use system for clearing and

receiving everyday information. Use it as a diary, a calendar, a reminder system, an alarm clock. **BANK ACCOUNT** - a sophisticated financial recording system with comprehensive documentation. Use it at home to keep track of where the money goes, and at work for expenses, dimensional budgets, etc.

Cassette 4-Games

For ZX81 (and ZX80 with 16K BASIC ROM) and 16K RAM pack

LINEAR LASHING - bring the laser-like flames from orbit to a safe landing. You control attitude and orbital direction - but watch the fuel gauge! It's a remarkable vector flight game - digitally and graphically. **FRONTVIEW** - a side version of 'Blackjack'.

CLIMB - you're on a outside space station. You have only 12 minutes but the aliens have unlimited strength. Can you take it all three with you?

SUBTERR - on patrol, you frequently detect a pair of 80-tonner tanks. Can you ditch a charge then follow their progress?

EXPERIMENTER - the computer checks all 4-digit numbers which you have to guess in up to 10 tries. The logical approach is best!

MATHS - insurance to a salesman call, you're staggered down the stairs as for 143 calls. Identifiers of 4000 space characters find the optimal letters in a 100-character system falls in 100 time!

Cassette 5-Junior

Educators 9-11-year-olds

For ZX81 (and ZX80 with 16K BASIC ROM)

MATHS - tests arithmetic with three levels of difficulty, and gives your score out of 10.

BALANCE - tests understanding of levers/balances theory with a series of graphic examples.

100 DOTS - '100 or 100' answers from the computer to a series of probability calculations.

AVG - what's the average length of your class? The average shoe size of your family? The average pocket money of your friends? The computer plots a bar chart, and calculates MEAN from MEDIAN.

RANGE - convert from decimal (base 10) to other bases of your choice in the range 2 to 9.

TEMP - minutes, temperatures - and other conversions.

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	5	Cassette 5 - Junior Education		£19.75
	11	16K BASIC ROM for ZX81 and ZX80		£43.95
	12	16K RAM pack for ZX81 and ZX80		£43.95
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1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

In March 1981, the Sinclair lead increased dramatically. For just £69.95 the Sinclair ZX81 offers even more advanced facilities at an even lower price. Initially, even we were surprised by the demand – over 60,000 in the first 3 months!

Today, the Sinclair ZX81 is the heart of a computer system. You can add 16-times more memory with the ZX RAM pack. The ZX Printer offers an unbeatable combination of performance and price. And the ZX Software library is growing every day.

Lower price, higher capability

With the ZX81, it's still very simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, and to drive the new ZX Printer.



New BASIC manual

Each ZX81 comes with 8000 characters, double-width memory – complete BASIC programming from the professional computer programmer.

Kit: £49.⁹⁵

Higher specification, lower price – how's it done?

Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

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- Z80A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
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Brainwave

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WORD ROUTINES

QUESTION 1

Find the first prime number greater than 500 which is the sum of two other prime numbers.

QUESTION 2

Find a prime number such that the sum of the prime number itself and its next two consecutive numbers is also a prime number greater than 500.

QUESTION 3

Find three prime numbers all different which add up to 3001 such that their product is maximised.

• The winners of our March Brainwave problems are Stan Cartwright of Moxley Place, Gorbals in Cardiff who was first out of the hat with a correct crossword entry, and Andrew Chomley of Downland Close, Sotley, Scarborough, who was first out of the hat in the Mind Routines puzzle. Bottles of champagne are on their way to both.

More bottles can be won for the first two correct entries out of the hat for this month's problems.

Send them to Computer & Video Games, Durrant House, 9 Herbol Hill, London EC1R 5HS. The closing date is 13 May.

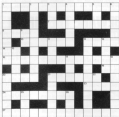
NEVERA CROSSWORD

ACROSS

- In which to write — bridge program (8, 8).
- Creature created from an article on party eleven (6).
- A beginner in the race ends the pitbull game (4).
- Souped up pretender (5).
- Type of operation requiring lots of pouting (4).
- A abbreviated divinity in the middle of the grid (2).
- Space game where tracks are a lot mislaid (8, 8).
- Greek cat noise (2).
- Keep the program from the U.S.A. very carefully (4).
- Time measurement of computer direction. Denoted by 19 across (6).
- Get rid of southern basic retrieve command (4).
- Autoid background of endless unit poem (8).
- Program explanation paper at a charge (10).

DOWN

- Truth alternatives as are 3 and 4 of 12 (7).
- Paper's speed string storage (9).
- Record function (3).



- White collar union in nominal (6).
- Valid centre lighter (3).
- PCO machine man (3).
- Initially the line printer disc (2).
- Silicon Valley country (13).
- Software company 685 frequently (7).
- Judge side emulation piece (4).
- One on an island (4).
- Click on to the first part of this popular game (3).
- Tryed program execution leathers (7).
- Pathen the micro's audio output (5).
- Buffy code (5).
- Absence not without end (2).
- Company in new computer beginnings (3).
- Take a hint? (4).

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REVIEWS**

**THE APPLE
COMES UP
TRUMPS**

GERMAN WHIST

Keeping the kids amused with a computer is easy, but you end up with rather anti-social kids.

This program is the answer. German Whist is a fun card game, ideal for teaching children the rudiments of trick-taking, trumps, and all of the other things they will need for playing Bridge when they enter High Society.

Getting your Apple to do the teaching is probably more fun for the children and more relaxing for you. This particular program is so easy to use and understand that

it could also be a useful introduction to using the computer.

The screen displays your hand of 13 cards, in good graphics, plus an indicator showing trumps, and the top card of the remaining pack.

The Apple's hand is not visible. To play a card from your hand you simply turn the game paddles until a large flashing rectangle is over the desired card, then press the button.

The standard of play is quite good and the game is fast enough to be interesting. The program keeps a running total of games won and lost.

All told, an amusing little program without the stress-building tension of the usual computer games.

German Whist runs on a 48K Apple under OS/2.2 or 3.1, costs £9.95 and is available from principal Apple software dealers.

BEWARE THE BIRDS!

FALCONS

A squadron of deadly falcons fly in battle formation above your defence base on a lonely planet.

It's up to you to shoot down the birds of prey before they swoop down and grab you with their razor-sharp claws. If you manage to neutralise the birds the game moves onto the second phase.

This time the falcons appear on the screen in a diagonal formation, will suddenly swooping down at you. More of them move out of their formation to take up alternative attacking positions.

The ordinary falcons will earn you 100 points, but are worth 200 if you blast them as they swoop at you.

Beware of the falcons which reach your base level. They walk along the bottom of the screen.

Into the third phase your life gets really dangerous. The falcons have laid eggs, and these lay blue dots inside the screen making their way towards you, all the time getting bigger and bigger.

It's vital to shoot them down while they are in their early stage of development.

because if you don't they grow into huge green creatures capable of the most horrific destruction. They are worth 200 points.

When I played it, I was unable to come out of this stage of the game alive.

But if you do manage it the fourth stage brings a rather ship on to the screen which can be worth up to 8000 points.

This is the most hazardous phase of all as the ship opens up a hatch and drops scores of baby falcons on top of you.

One advantage the player has is a protective shield. This only lasts for four seconds and will not operate again for another five seconds.

To fire your laser beam press the 0 key on the keyboard, the 1 key to activate the protective shield. A joystick or the arrow keys are used to move your base ship.

This is one of the latest offerings from Richmond-based S&S Software who specialise in Apple games imported from the States. Falcons costs £19 and is for an Apple II with 48K memory.



ILLUSTRATION BY TERRY ROBERTS

UNDERGROUND HAUNT FOR MONSTERS

CATACOMBS

Prodding around the Catacombs in search of gold you suddenly come across an evil looking monster — will you get the gold before the monster gets you?

The aim of Catacombs is to find as much gold as possible before you run out of food or are caught by one of a variety of creatures. It runs on a ZX81 or ZX8.

Keys 1 to 8 move you in the direction indicated on the keys — 1 to 4 move you diagonally. Keys 9 to 8 with shift enable you to tunnel, but beware, this sets up a lot of your food. As you move a series of rooms and passages will unfold, these may contain food, gold, monsters or nothing at all.

There is always an exit to be found on each level if things get tough. The exit takes you to a different level, which provides a breathing space while the ZX sets this up.

MISSILES MISS TARGET

Man the Bombers! Take cover! It's the four minute warning! Which is about the length of time you need to get used to working the controls in this game of Missile Attack.

This game is a very fast machine-code program of the well-known arcade game Missile Command.

The object is to protect your cities and missile bases from the onslaught of countless enemy missiles. This is attempted by firing your own missiles to intercept the enemy rockets prior to them making a successful strike. Each of your bases to start with has a total of nine missiles.

The graphics, while fast, leave quite a lot to be desired. The movement of the tracks of missiles across the screen is accomplished in a weird eye-wrenching jagged fashion which detracts greatly from concentration. Also, the use of the numeric keypad to control the movements of the Bomber — by using the figures 7, 8, 9, 4, 5, 1, and 3 — is tedious and time-consuming.

Much time — and many games — can be lost just by glancing down to try to discover which key you have been operating which successfully lost you your last city and two of your bases.

Missiles are launched by using the keys C, R and G and once again, valuable time can be lost by glancing down to verify which one is being pushed.



When meeting a monster you can run away, but it will follow.

An excellent addictive game which will keep you amused for hours. For £4.95 it is certainly worth adding to your collection, but be prepared for a struggle when loading — certainly the most troublesome that I have encountered. Catacombs comes from J. R. Grey Software.

MISSILE ATTACK

Maybe the answer is the introduction of a single joystick control — because it certainly doesn't work well using the keys referred to above.

The game itself is similar in all respects to the arcade Missile Command, and apart from the "nibbles" and the lack of full control, it plays quite well and fast.

The page of instructions is not held on the screen for long enough for the average reader to assimilate full details of the opening screen. This blips up for a grand total of four seconds, and as a consequence of this, it does take a while to work out which keys are supposed to operate which function of the game.

There are no written instructions provided. Like the quality of the booklet that came with the game is very poor.

For the sum of £19.95 it is not good value and I'm rather surprised that the price exceeds the £1.50 I expected. On second thoughts I think I'd prefer to continue visiting my local arcade!

On the whole it's a game which would only maintain a slight interest, you might even play it twice then shove it away and forget about it until you can persuade the cumbersome controls. It runs on a Pet, from Softpoint, in New Malden.

Quality Software

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SOFTWARE GLOSSARY

A beginner's guide to plain jargon

ADVENTURE A type of game in which the player has to take a character role and retrieve a number of treasures or objects by a trial and error process giving instructions to the computer. The "hero" (or player) encounters a variety of hazards often taking the form of dangerous monsters, wizards and animals. Some adventure games are so complex that they take weeks, or months, to solve.

ALGORITHM A process or set of rules to carry out a task or solve a mathematical problem.

ARRAY A series of items (data or information) arranged to form a meaningful pattern.

BYTE A term to measure a number of bits (Binary digits), usually eight bits to a byte.

CHARACTER STRING A sequence of characters in a row.

COMMAND In writing programs this word refers to an instruction word which specifies an operation which the computer must perform.

CONVERSATIONAL SCROLLING Data displayed on the screen involving step-by-step communication between the user and the computer.

DEDICATED CHIP A chip (microprocessor) which has been specially programmed to perform a single or special group of applications, e.g. computer games. ROMs are usually the means by which dedicated chips are developed.

DISK A magnetic storage device.

DISK DRIVE A unit which is connected to the computer, used for loading the information stored on disks into the computer.

EUROCARD A type of printed circuit board suited to circuits with a large number of chips.

FLOATING POINT This is a notation used for the calculation of numbers in which the arithmetic point, binary or decimal, is movable but not necessarily the same for each number.

FUNCTION A special purpose or characteristic action.

HIGH RESOLUTION GRAPHICS A method of using Basic commands to move a drawing head to any position on the screen drawing a line between two specified points.

INTEGER A number which does not contain a decimal point, i.e. a whole number.

INTERACTIVE A word used to describe a system which is capable of real-time man-machine communications.

JUMP An instruction which causes the next instruction executed to be the one specified by the jump instruction. A jump can be conditional, where it will branch only if a specified condition occurs. Otherwise, execution will continue to the next instruction following the jump instruction.

L.C.D. (Liquid Crystal Display) A display containing liquid crystals which light up when electricity touches them. Used in calculators and watches.
L.E.D. (Light Emitting Diode) Provides a simple display and consists of an electron tube which lights up when electricity is passed through it.

LOOP A Basic function referring to the repeated execution of a series of instructions for a fixed number of times.

MACHINE CODE The term used to refer to symbols or numbers assigned to parts of a machine.

MAINFRAME COMPUTER The jargon word used to describe a very large computer.

MONOCHROME COMPUTER DISPLAY A display screen used in a computer which shows a picture in one tone or black and white only.

NESTED SUBROUTINE A subroutine which is called within another subroutine.

NUMBER CRUNCHING The operation in computing which carries out the arithmetic and logical processes which information has to go through.

OUTPUT Data which is emitted from a computer system.

PEEK A statement used in Basic which allows you to read the contents of a specified memory address.

POKE An instruction used in most versions of Basic allowing you to store integers in a specific place in memory.

RANDOMISE A Basic command referring to the procedure for making numbers, data, or events occur at random.

REAL TIME This is on-the-spot computing when the operation is performed during the time an event is taking place in time to influence the result.

ROUTINE A set of coded computer instructions used for a particular function in a program.

VARIABLE A symbol whose numeric value can be changed at all times. It is used when writing programs.

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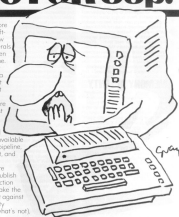
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HARD

ONE TOUCH WORDS

The Sinclair is based around a 280 micro-processor, and for your money you will initially receive a startlingly small, light box with a "Qwerty" keyboard on it, a power pack, leads for a television and cassette recorder and one of the best written Basic manuals for beginners to get to grips with.

The Sinclair Basic is very close to the Microsoft variety but does without such well-used command words as **LOAD** and **SAVE**. It also has the time-saving notion of one-touch key words which come up on the screen when you need them.

An example is to touch the "P" on the keyboard after a program line number, then **PRINT** will appear on the screen, already stored for you.

Beginners will find this confusing initially but with usage it becomes automatic.

MEMORY APLENTY

Memory capacity for the Z801 is expanding and prices are coming down. Microsoft now offers a 64K RAM pack for £79. Details can be obtained from the company at 103 Watton Street, Dept. 032 9H. A variety of 16K RAM packs are available. Z80 Software produces one at £26. D.C. Tronic sells a ready built pack for £32.95, and a kit for £22.95. It also produces a 32 pack at £79.95 and a 4K pack for £22.95.

Other firms which offer memory expansion packs include Big Byte of 28, The Spin Research, items: 190 for £42.95. And Audio Computers of 81, Bournemouth Park Road, Southend-on-Sea. Essex does a 16K for £28, 32K for £45, 64K for £70 and 128K for £125. Sinclair Research's 16K RAM pack costs £29.95.

The Z801's membrane keyboard has proved a problem for some users. There are now several typewriter-style keyboards available. Fuller Micro Systems produce a keyboard which comes ready-built and costs £28.95. The Z801 fits neatly inside the case, as does the power supply and memory boards with no leads hanging about outside. Details from Fuller Micro Systems, The 29 Centre, Seward Street, Liverpool.

DT Tronic also produces a keyboard at £27.95. Reddish Electronics produce a keyboard in kit form for £25.50. A keyboard connector is optional and costs a further £1.95. D. B. Computer Keyboards produce a keyboard, at £26.95.

Voice recognition and music are possible on the Z801. William Stuart Systems produces a speech recognition system for the Z801 called Big Ear. It allows speech input through a microphone provided with the system, and costs £48. It also produces a music synthesizer which can be used to put out sound effects and music. Through its input and output lines the Z801 can monitor a home security system and central a robot arm. Details can be obtained

in the spring of 1980, home computing was lifted out of the waters of the speculative hobbyist market and offered to a receptive public.

The Sinclair Z801 was the reason and it was separated the following year by the Z801 model later to lure these machines. They were instrumental in putting computers at the fingertips of the public at a price they could afford—and allowing each house-hold items as a TV set and a cassette recorder.

Among the 87's limitations were a difficult to operate touch-sensitive keyboard, crude graphics and no printer facilities. . . it still sold 50,000 in the first three months and Sinclair eventually had more sales in 1980 than the US, and 750,000 worldwide.

The pricing and memory deficiencies were made up towards the latter end of last year and many other firms realised the potential for producing Sinclair peripherals and software. These names and addresses are laid out below — if an address is missing it will be included elsewhere.

The Z801 is kit form costs £49.95 and £69.95 assembled. It is built by Sinclair Research of 6 Kings Parade, Cambridge CB2 1DA.

from William Stuart Systems Ltd, Dewar Road, Billingsley Road, Hemmings, Brentwood, Essex, CM8 3 3SU.

The Manchester-on-second printer developed by Sinclair for the Z801 allows the user to have hard copy of program listings or of program output. It costs £49.95.

It is useful to have a holder for the Z801 and its peripherals, to contain all those loose wires. Various units are available including the Z801 Workstation, a specially-designed tray from Peter Furlong Products, 129 Colford Hill, London, SE4 4PS.

If you prefer a wireless collaboration, try DJ Systems Systems' 075 console. The address is 14 Brookfield Garden, Hyde, Isle of Wight.

ARE YOU GAME?

There is no shortage of software for the Z801 from independent suppliers.

Many firms have set up producing both business and games for the machine (but the standard of some of these is very poor).

Sinclair Research itself sells four tapes of programs which users have submitted to the firm. Included in the range is a tape containing six games, Drift, Sniper, Mirages, Life, Wall Pack and Golf. There is a journal education tape, and a business and household management tape. You can buy the tapes mail order from Cambridge based Sinclair for £3.95 each.

Many of the firms are small, one-man outfits which operate on a mail order basis. Prices for software range from £2 to £28 and the more you pay the better the quality tends to be.

The main firms involved in software production are: Big Byte, 98-100 The Albany, Old Hall Street, Liverpool L3 9EP. This firm has about a dozen games on its books including versions of most of the popular arcade games like asteroids, space invaders as well as an adventure game. It also supplies a multi-purpose filing program, a machine code program, and a disassembler/debugging program.

Artic Computing, 286 James Beckitt Avenue, Hill HUR 6UR has a trio of adventure games for the Z801 with 16K.

Premier Publications, 12 Kingscote Road, Ashbourne, Chrylton, is a games store offering a wide range of generally good quality. The prices start at just under £4.

Goldfish, 35 Upper Brentnall Road, Maybush, Southampton currently has three well presented games on the market. They are all versions of popular arcade games, space invaders, defender and asteroids and all cost £5.50.

Silverleaf, 80 Empress Avenue, third floor produces games for the Z801 with a starting price of £3.95.

Maverics, 28 Spain Close, Kewville, Solihull, West Midlands. This firm has nine games on sale which start at £3.95 going up to £9.95. Games included are space invaders, breakout and a music pack.

DT Tronic, 31 Sussex Road, Gillingham, Great Yarmouth, Norfolk, offers centimes, a version of the recent arcade game, and a 36 labyrinth game. Prices start at £3.95.

Micro-Gem, 34 Agar Crescent, Brockwell, Brixton, is a small firm supplying a couple of games for the Z801, including a chess program, for £5.50.

Historous games come from Automeis, 66A Gibraltar Road, Portsmouth, Hampshire. Advertised as suitable for adults only, the series of three starts at £2.

J. S. Coyle Software, 16 Park Street, Bath, Avon BA1 1TE produce a range of games with a lot of variety. Lowest price is £3.95.

Poison Computers, 20 Dilton Court, Meads Way, London NW9 9HT, sells 10-11 fantasy games based on the adventure concept. Again the price is low at £3.95.

Other suppliers are: Axis, 21 Broadfield Avenue, Loughtonbury, Essex; J O'Connor, 5 Terrace Close, Ballin-Le-Gaids, Lincaster; Bridge Software, 38 Farnborough, Marble Bridge, Stockport, Cheshire, SK9 9BB; Galtree, PO Box 52, Bughy, Warrington, CV11 4DR; Michael Green, 28 Bromley Road, Willesden, London, NW10 9SL; Second Foundation, 22 Bromley, Blyth, Tamworth, Staffordshire, B77 7JL; Control Technology, 30 Gloucester Road, Gee Cross, Hyde, Cheshire, SK14 5JG; Tomabate, 27 Southwold, Basilton, Essex.

CORE

J&J Software, 10 Myrtle Avenue, Worthing, Sussex; Video Software, Stone Lane, Greer, Sharncliffe, West Midlands and Richard Shipstead Software, 22, Green Lays, Maidenhead, Berks.

A USER'S STORY

What's the user's view of the ZX81? Well! To set up the computer it is much like any other, fairly easy if you read the manual. It is when you come to type in a program that the trouble starts. The membrane keyboard is difficult to get along with, especially if you are used to a regular keyboard. Most people I have talked to heartily dislike it. As well, I found the keypad system slow and awkward to use at first.

If you are new to computing don't bother to use the manual that comes with the unit. I found it easier to grasp the basic principles using a book like the **ZX81 Basic Book**.

A lot has been said about loading problems, but I have not encountered very many. For the record, I use a Ferguson 3115 portable cassette player.

All sorts of hard and software is becoming available for the ZX81 and it must be said that some of it is of dubious quality. Buy software carefully, read the reviews published in this and other magazines.

This year will see a multitude of peripherals for the ZX81. Sinclair's own printer has just become available and various bits and pieces are coming on the market monthly. Joysticks, memory packs, sound boards and disk units.

I would recommend that you join a group of local users if there is a club in your area. The interchange of ideas is invaluable. Another source of advice, programs and reviews is the National ZX81 Users Club. For details send an S.A.E. to 44-48 Earle Court Road, London W8 5LJ.

The ZX81 represents good value for money. Sinclair's product support does have a lot to be desired especially if you need water. Older lead times are quite long.

WEALTH OF BOOKS

A wealth of books are now on sale to help you glean every piece of information about your Sinclair machine.

Many of them cover the same subjects, like programming your ZX81, machine language and the use of subroutines, but treat the topics in varying ways. We have included a selection with comments.

The Explorer's Guide to the ZX81 by Miss Louf of software house, Timedata. It covers programming aids, lists some games, applications, machine language and goes over the hardware side and expansion. It costs £3.95 from Timedata, 63 Southfields, London, W. It claims to carry on where the Sinclair manual leaves off. And for £2.75, Timedata sells the **ZX81 Magic Book**.

Getting acquainted with your ZX81 by Tim Harwell. It contains 80 programs for the unexpanded ZX81 and is available in three editions: Numbers two and three cost £3.95 and £4.95 respectively from the ZX81 user club's magazine interface by mail order. The address is 44-48 Earle Court Road, London W8 5LJ.

And 48 Explosive Games for the ZX81 by Martin Cooks £3.25 and contains listings to program into your Sinclair.

Scotching Your ZX81 to its limits by Trevor Sharpley and Harwell is available from Computer Publications, Unit 3, 20 Woodthorpe Road, Ashford, Middle. It costs £3.95.

Mastering Machine Code On Your ZX81 by Tony Baker and it costs £5.95. So is the **Gateway Guide to the ZX81 and ZX80** by Mark Dunford for £5.95. **34 Amazing Games for the 16 ZX81** by Alister Country is priced at £3.95. All are obtainable from Interface.

The ZX81 Basic Book by Robin Norman is from Norman Microcomputers Books and the price is £4.95. He has also written a similar book for the other machine called **Learning Basic With Your Sinclair ZX80**, costing £4.95.

Peak, Pogo, Bop and BAM is about Basic programming and includes information on graphics, writing up the hardware, logic, looping and branching, character manipulation, subroutines and debugging. It is by Ian Stewart and Robin Jones and costs £4.95 from Stars Publishing at 4 Church Lane, Newnash, Cheshire CV9 5RD.

Swing Deeper into Your ZX81 by Mark Harman gives programming tips and 37 programs to try out your newly acquired skills. Sigma Technical Press is the publisher at 4 Milton Road, Wilmston, Cheshire. The price £4.95.

The ZX81 Pocket Book deals with machine code, decimal justification, and playing adventure games as well as giving hints and tips to get the most out of your computer. Pippa Associates of 29 East Street, Epsom, Surrey publishes this book by Trevor Toms and sells it for £3.95.

Books from Roma Computers of 11 York Road, Manchester, Berkshire are: Understanding Your ZX81 ROM by Dr Ian Tegan, costing £3.95.

The ZX81 Companion for £3.95. **The Sinclair ZX81 Programming for Real Applications** by Rendle Hurley for £5.95. **Hints and Tips for the ZX81** by Andrew Henson priced at £4.25. **Machine Language Made Simple** for £3.95 and **For Dopey 30 Programs for the ZX81** for £3.95 but also **50 Hip Boring Games for the ZX81/80** for £4.95.

Finally **Making the Most of Your ZX81** by Tim Harwell is obtainable through Interface and the following shops: Timedata, 27 Southfields, London, W. New; Pippa Associates, Charing Cross Road, London WC2; Syntex Software, 46 Colindale Gardens, Hild, Essex; The Software House,

140 Oxford Street, London, W1; Miss G of Information, 7 Francis Avenue, St Albans, Hertfordshire; Similar Research, 6 Kings Parade, Cambridge; Cambridgehire OSI 15A.

GRAPHICS JAM

The ZX81's graphics capability is very limited in fact there are 20 graphics characters, and an inverse space, to play with. Although it has taken five graphics the ZX81 is not viable for programming complex graphics displays in Basic. It is possible, but it takes up an awful lot of memory and makes animated graphics displays more sluggish and jerky. Machine code is the other possibility, but not a good alternative for Basic for the beginner.

There are several add-ons for the ZX81 that allow use of programmable and hi-resolution graphics. Quikwrite produces a programmable character generator of £26.95. It allows the user to program lower case letters, scientific notation, and speed reader-type menus to name just a few.

The character generator comes with a demonstration cassette of fast machine code routines. Quikwrite also produces a hi-resolution graphics board, at £25. This enables the user to produce very detailed screen displays, such as maps and almost perfect line waves, with a high degree of accuracy. Details of both these products can be obtained from Quikwrite, 95 Upper Grosvenor Road, Weymouth, Dorset, Dorset.

SK Tronic produces a graphic ROM board at £29.95. This can be attached to the ZX81 by three solder connections. It allows the use of lowercase characters and also a variety of games, orientated graphics characters.

Anyone who has tried playing a dexterity game on the ZX81 keyboard, will realize the value of joysticks. These are available from Micro Gen, Dept. W5, 24 Ager Crescent, Beckenham, Berks, at £3.95 each.

Light pens are useful when using menu driven programs. They make the selection of items on the screen easier, without having to use the keyboard to input replies. RD Laboratories produces the "Boodler" at £22.50. Details from RD Laboratories, Dept. 71, 5 Kennedy Road, Dove End, West, Essex, SS12 0JZ.

For users who have difficulty with loading, the Alpacas Controller should provide a remedy. At £17 the controller switches from SIVS to LMSB by turning just one switch. Details from Alpacas Electronics, 78 St Helena Avenue, Swansea, West Glam. Finally a colour programmable character generator will soon be available from Fountain Computers of Darbill Road, Rockley, Ashford, Herts. As we wait to press it was still under development and a price had yet to be fixed. But for around £90 it will let you program any character or jewel in colour.

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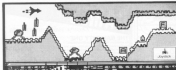
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