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Vol. 5 No. 5

CAN A MICRO HELP YOU PASS EXAMS? — We test revision software

PLUS — How hackers cheat the banks



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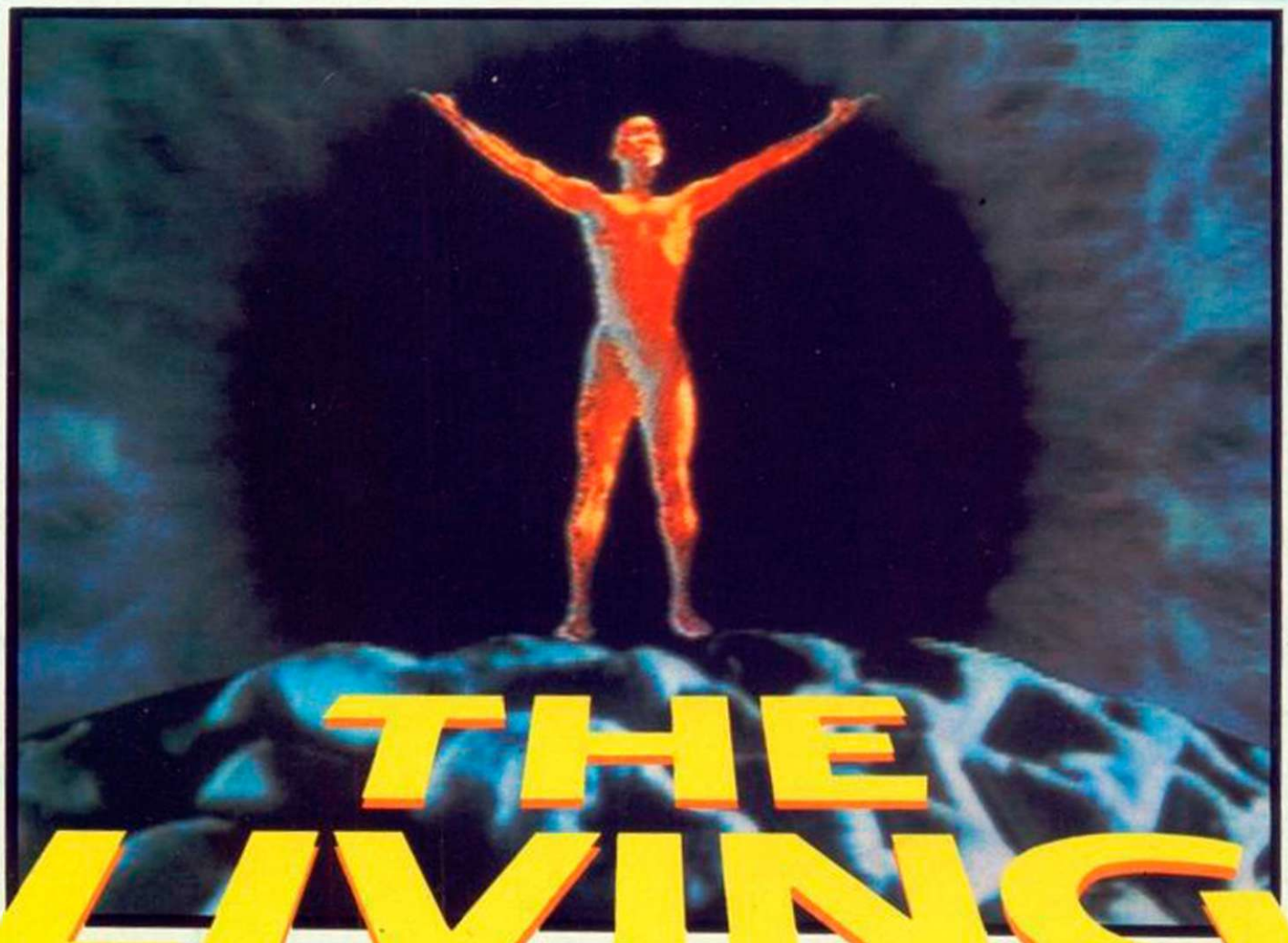
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48K SPECTRUM · COMMODORE 64 · BBC 'B' · ELECTRON

YOUR COMPUTER

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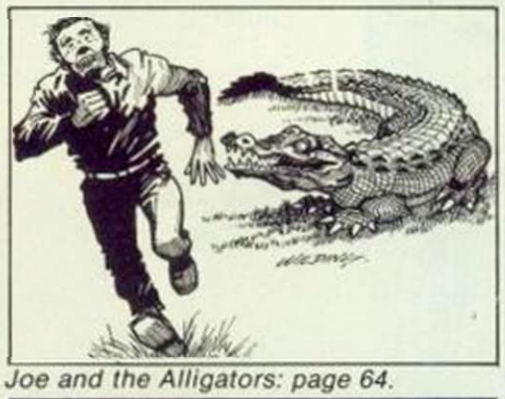
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39 SOFTWARE SHORTLIST: Dogfight with Mirrorsoft's Spitfire 40; Beyond's Shadowfire with stunning icon graphics; Flyer Fox talking flight — all the hits and more.

47 QUEST CORNER: Hugo North and the Heroes of Karn; casing Melboune House's latest criminal program Grand Larceny; and spoof Quest for the Holy Joystick.

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51 COMPETITION: Beat the system, win an Enterprise. What sort of a sneaky add-on would you like to have on your computer?

52 CAN A MICRO HELP YOU PASS EXAMS? Our man at the chalk face, Pete Connor, dons his mortar board and stalks the groves of Academe, cane at the ready.

57 MATHS MASTER: Colin Carruthers puts two and two together.

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64 CBM-64 JOE AND THE ALLIGATORS: Fryin' up a mess o' catfish, goin' down to the store and buy some gingham for Emmy Lou. A peek and poke salad from F Tout.

66 BBC TANKS: Nick Sheard puts something nasty in your briar patch. An armoured division. Time to get the old Sherman out of the garage. Tanks for the memory.

71 VIC-20 TANKS: Serge Simon makes tracks for new territory. The native tanks aren't friendly. The game that took the Rom out of Rommel.

72 ZX SPECTRUM SNAKES ALIVE: A 100 percent machine-code game for any Spectrum. Kahn the snake has to collect nine eggs. 48 locations and joystick option.

78 ZX-81 SURVIVOR: Adrian Spriddell's condensed version of the ZX-81 graphic adventure game Survivor. Contains 10 of the original levels.

83 AMSTRAD JUMPER: An arcade quality game for the Amstrad CPC-64 in which you guide a little man called Jumper to the top of the screen. By Jason Charlesworth.

86 TELSOFT: This month we extend the Telsoft service to Commodore 64 owners. On Telsoft this month are Toolkit, Compiler and Space Junk.

90 ZX SPECTRUM TOOLKIT: User-friendly Dave Spagnol brings you a really useful toolkit which avoids single key entry and default values.

94 BBC COMPILER: Suitable for use on the Electron as well, describes a compiler which enables programs to run five times faster.

99 QL ZOOM: Software-based magnifying glass by Carsten Greave.

102 QL PLOTLINE: Mark Jones draws a better box.

104 CONSUMERS' GUIDE TO DATABASES: John Dawson accesses some useful sources of information on his BBC.

109 COMMODORE CBM-64 REPEAT UNTIL: M C Hart shows you how to nest loops to a theoretical limit of 22 deep.

111 COMMODORE CBM-64 TRAX DISC EDITOR: Keith Suddick shows you how to avoid the trauma of your 1541 disc drive turning work into garbage.

114 CBM-64 SPACE JUNK: Nalin Sharma is lost in space.

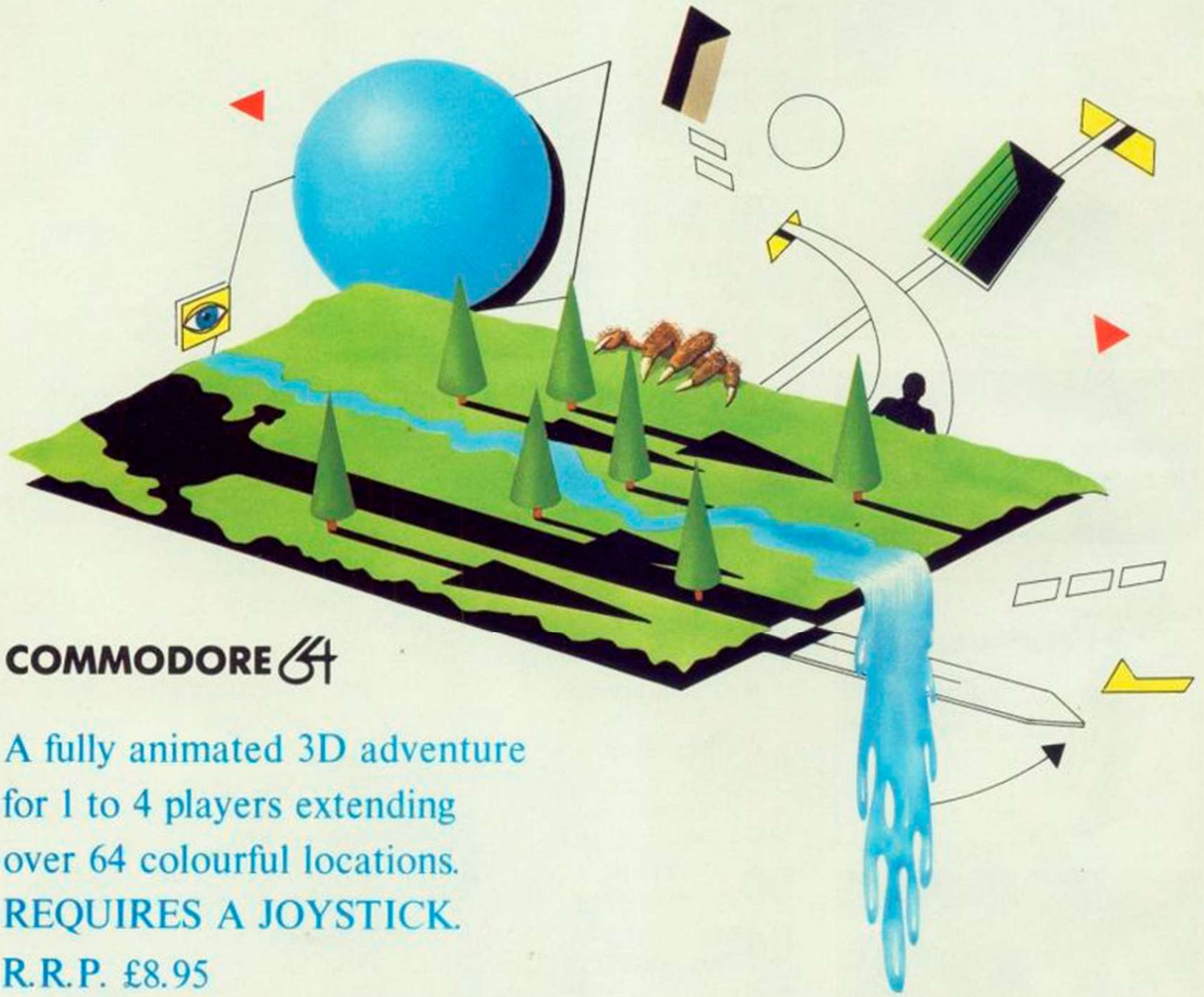
119 RESPONSE FRAME: Tim Hartnell advises confused users.

121 SOFTWARE FILE: Ten pages packed with programs.

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You'll notice that amongst all the usual sockets and terminals, we've gone and incorporated a special 66-way expansion port.

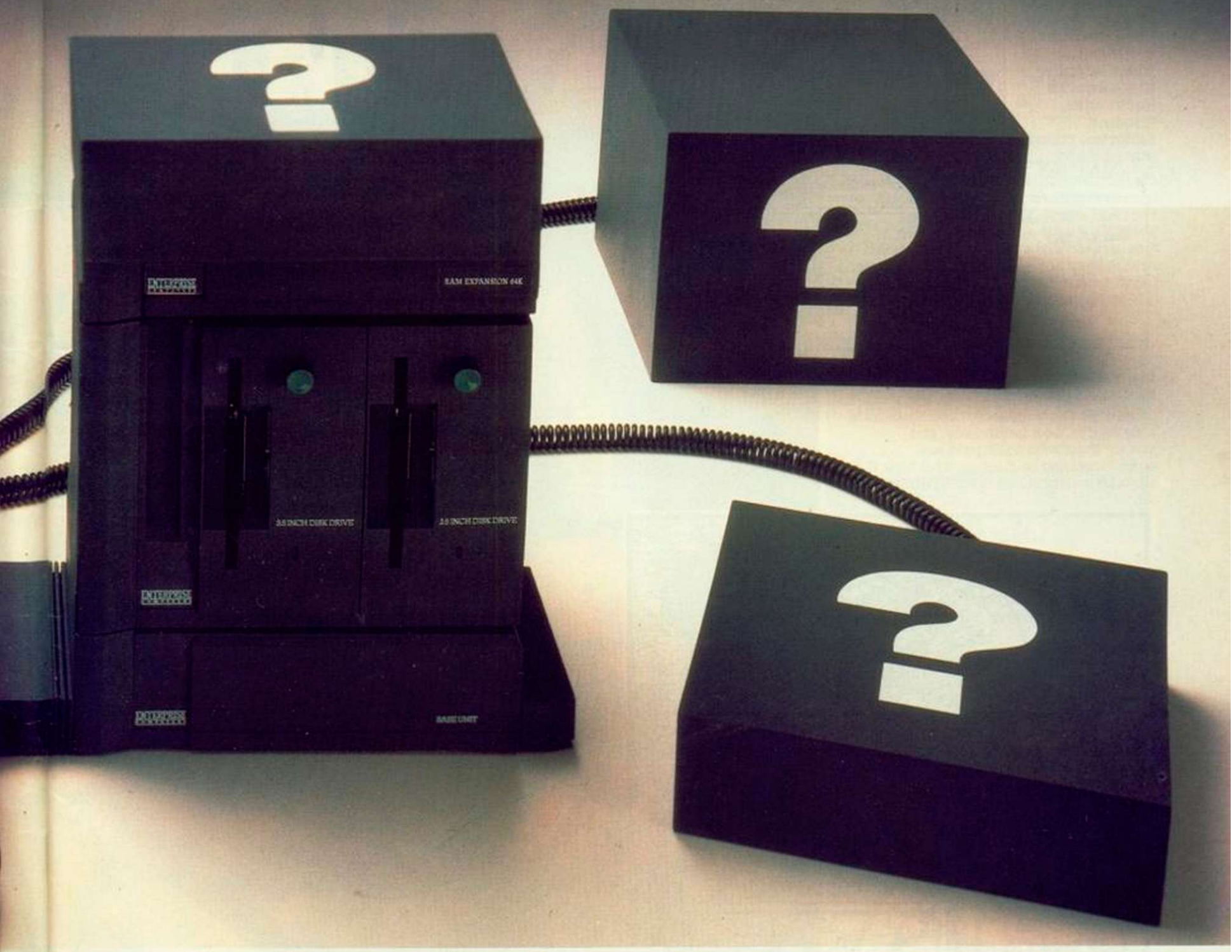
This will accept a whole range of new peripherals that are in the pipeline. Including those that are a mere twinkle in the eyes of our hardware designers.

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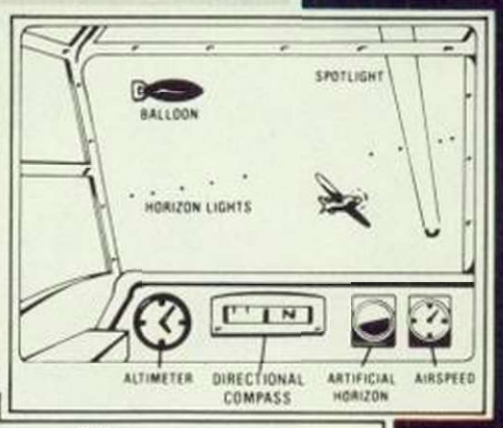
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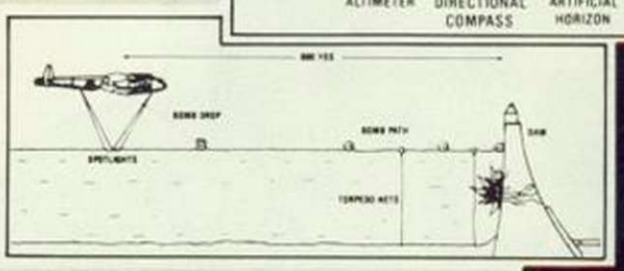
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At 21.15 hours on the evening of May 16th 1943 a flight of specially prepared Lancaster bombers left Scampton Airfield for Germany. After months of planning and preparation Wing Commander Guy Gibson and his 617 Squadron were at last embarking on a mission so daring that it would guarantee them a place in the annals of history.

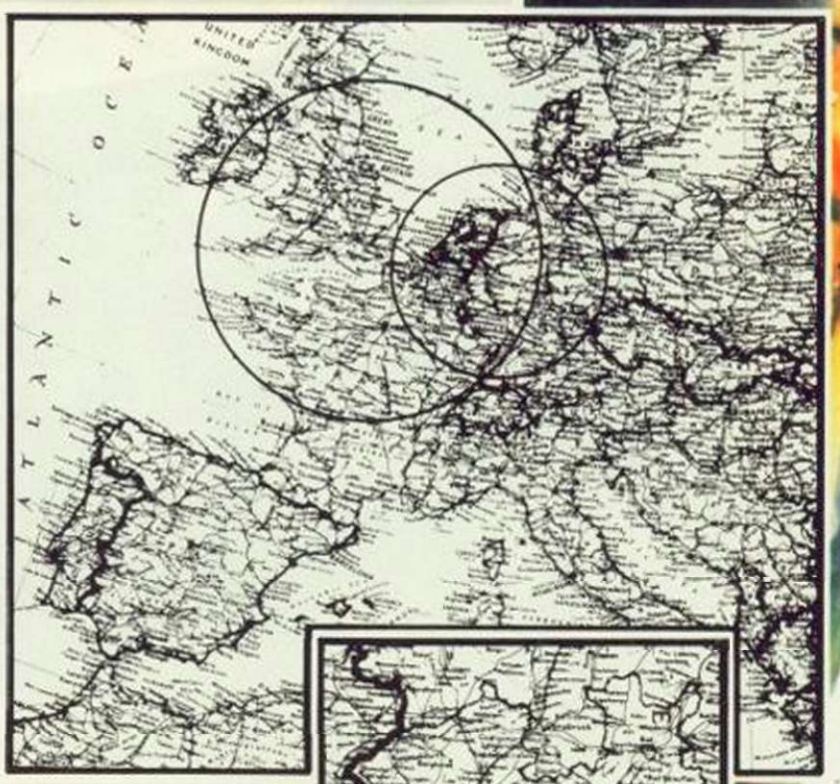
The mission would strike at Germany's industrial heartland. If the giant dams of Moehne, Eder and Sorpe could be breached, millions of tons of water would flood the Ruhr, cutting vital water supplies to steelworks and homes, flooding factories, power stations and farmland, and





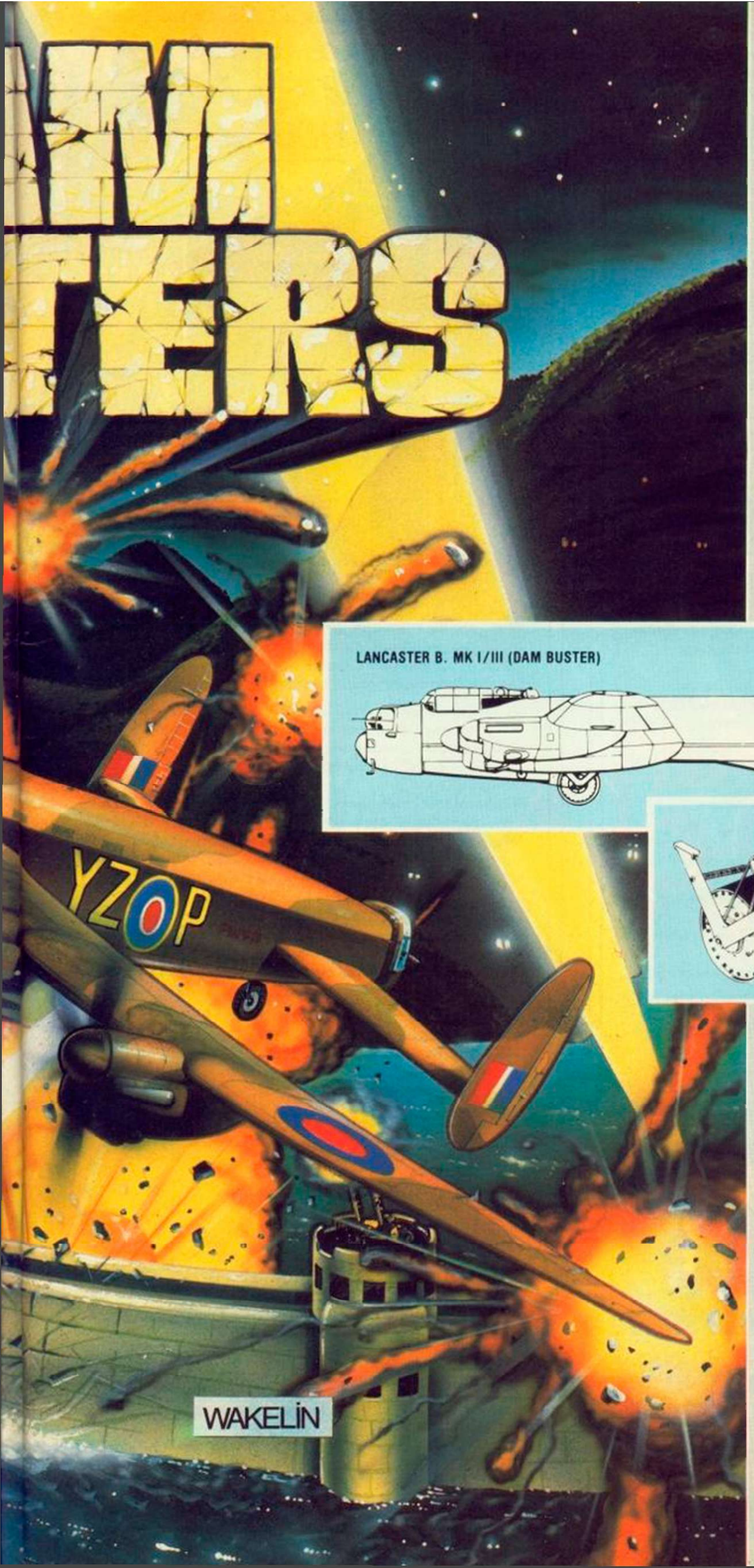
bring the important Mittelland Canal to a virtual standstill.

Of course the successful conclusion of this raid is now legendary, the young men who took part are acknowledged as heroes; and now U.S. Gold in conjunction with Sydney



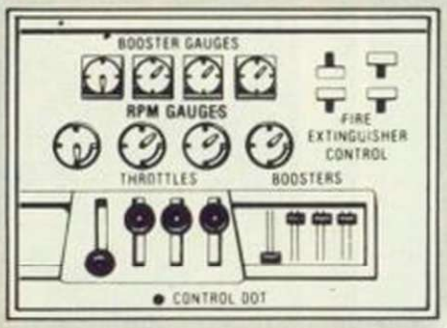
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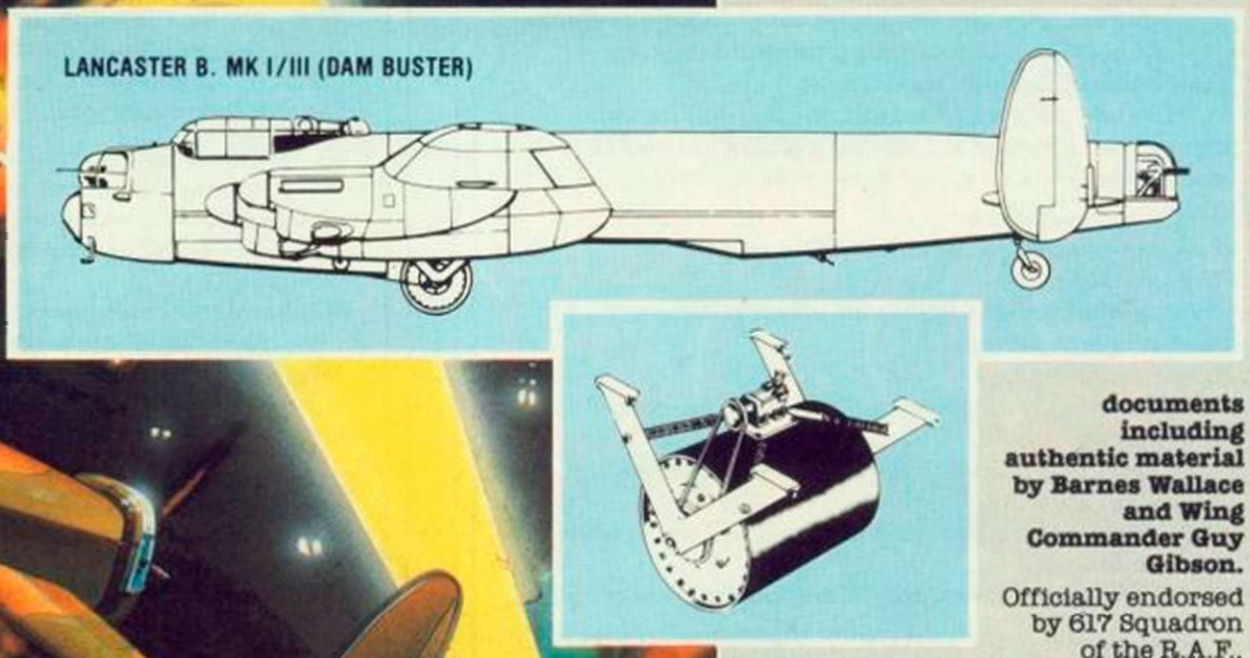


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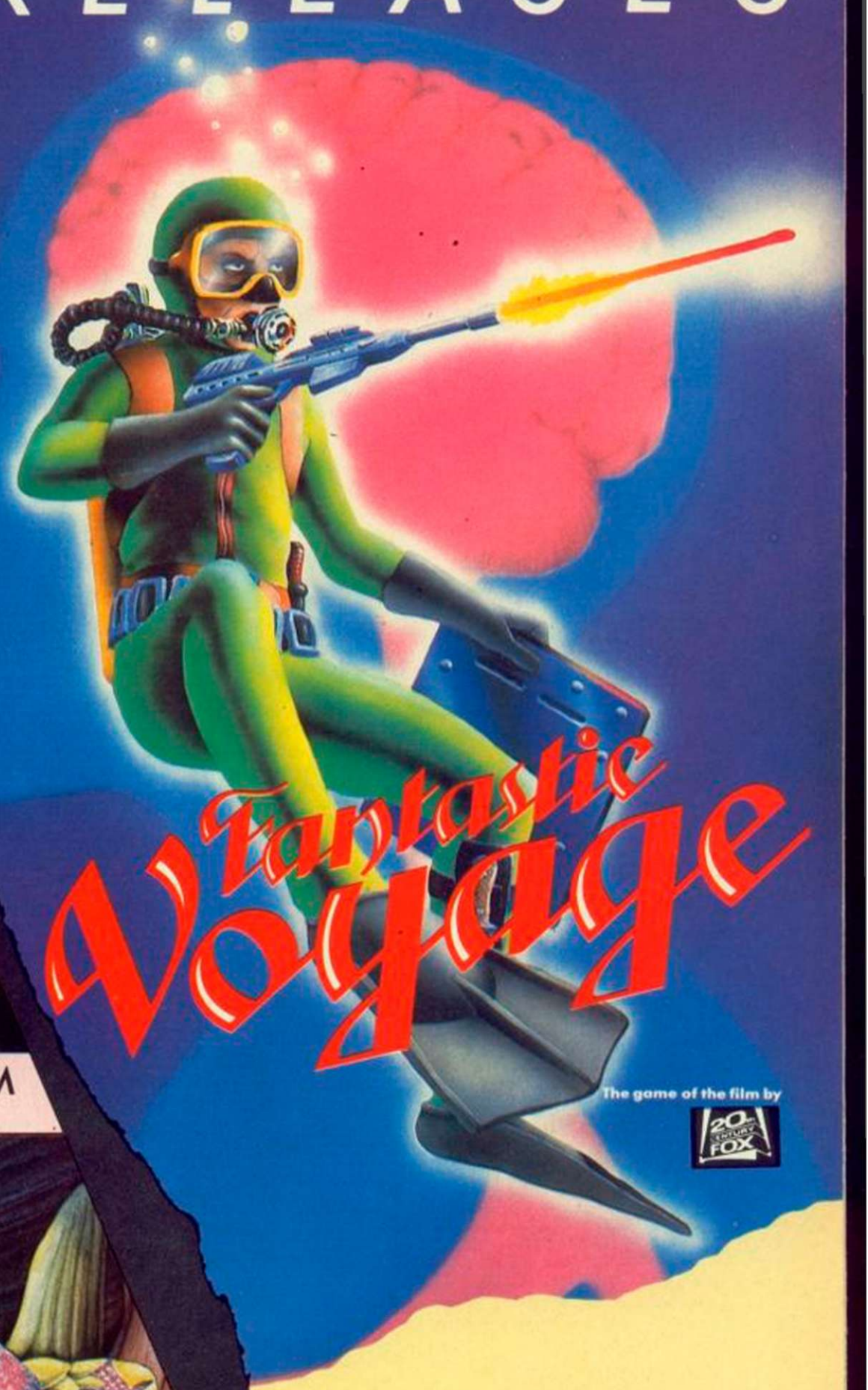
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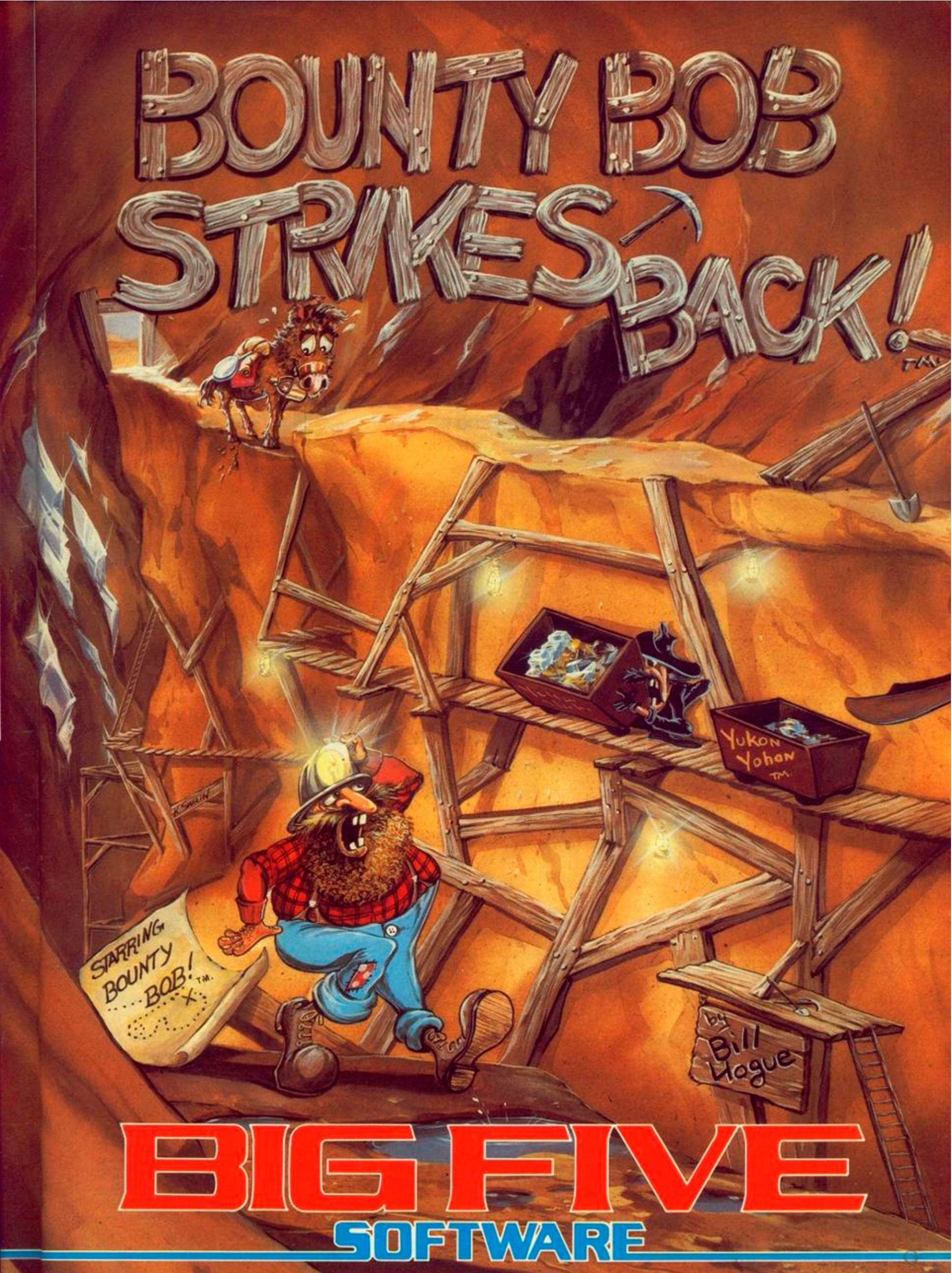
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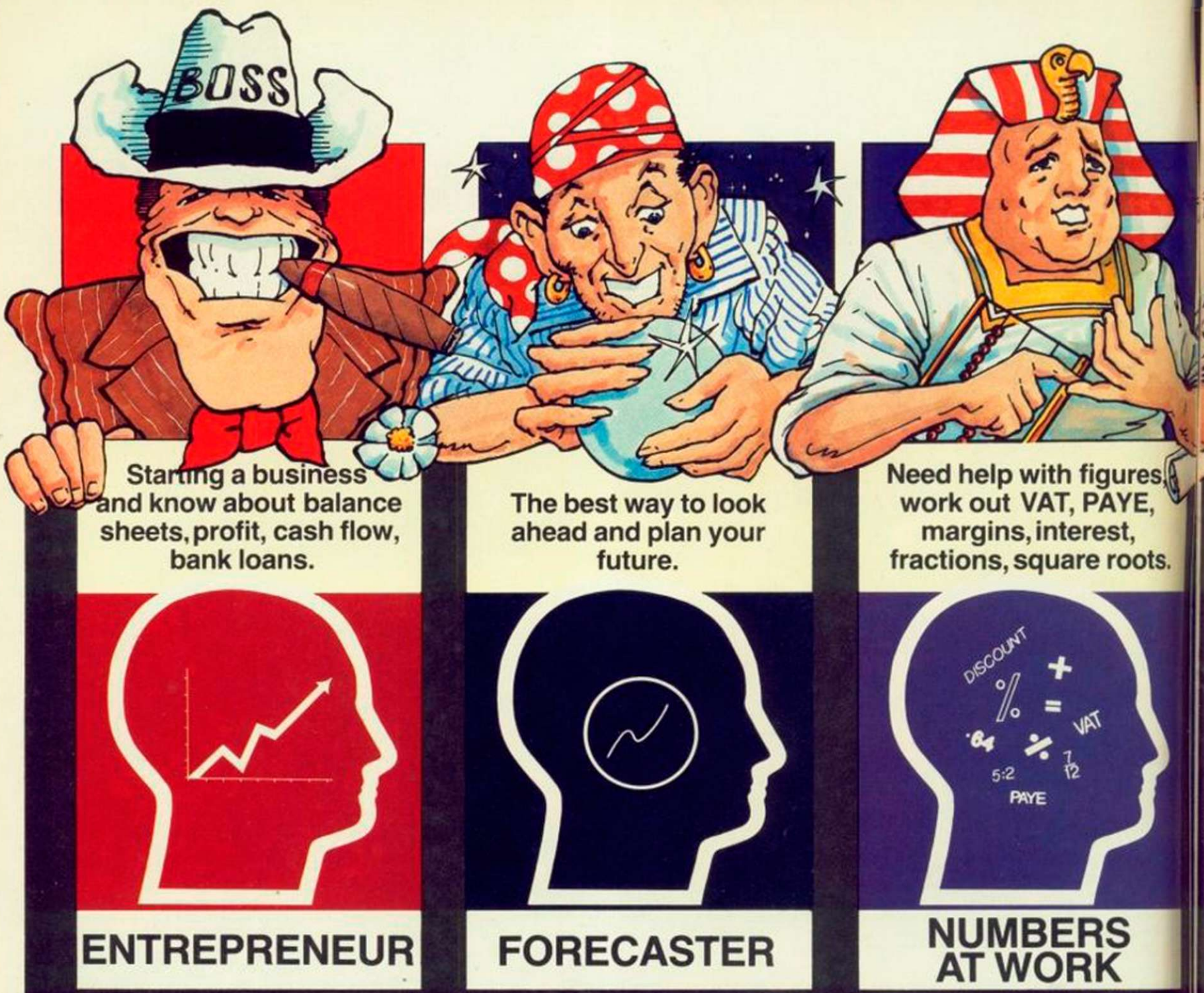
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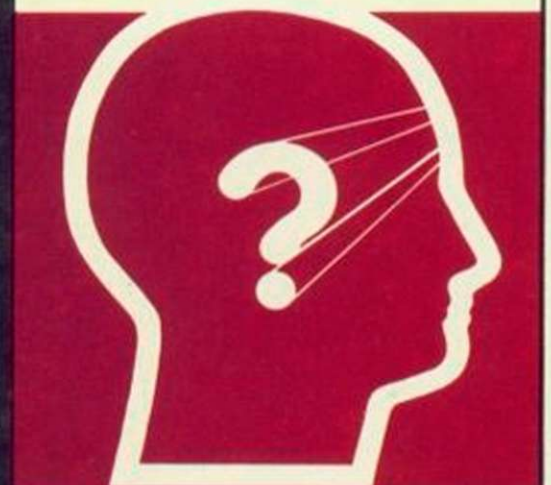
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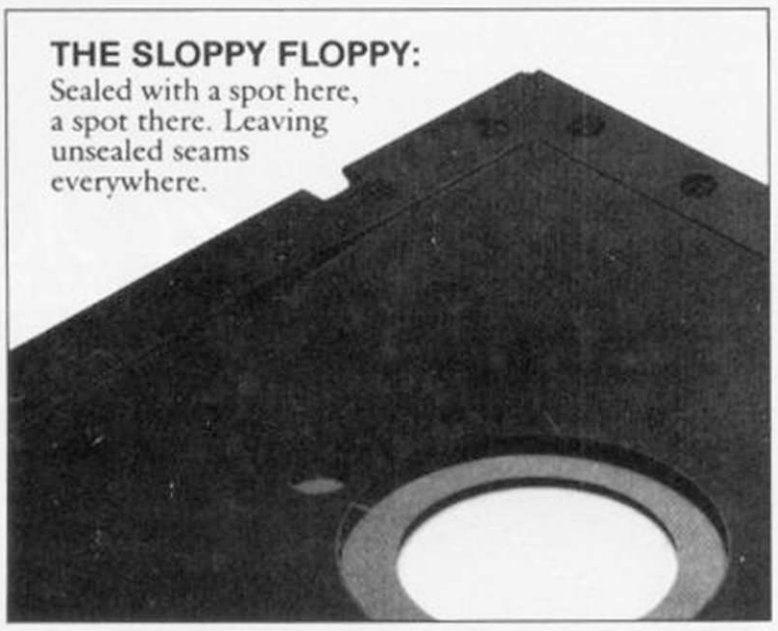
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QUASIMODO

synsoft

Quasimodo likes bells. They make him feel good – they make him happy – they are his friends.

All Quasi wants is to be left alone, but those nasty soldiers think that he stole the royal jewels. Quasi didn't steal them!

Quasi wants the soldiers to leave him alone. They fire nasty arrows at him. Quasi doesn't want to, but Quasi will throw big rocks at the nasty soldiers.

Quasi knows a secret! Quasi knows where the jewels have been hidden in the castle and only Quasi can climb there.

They better leave Quasi alone, 'cause Quasi is getting mad. Quasi better hurry and find the jewels. Not much time. Quasi sees lots of soldiers. Quasi has lots of rocks.

Now the noise has stirred up the bats in the belfry. The bats are mean, they make Quasi fall down. Quasi better jump away from those bats.

Quasi thinks he got up on the wrong side of the bed today.

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Address Manager Standard	OCP	9.95	8.95
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Romeo & Juliet	Penguin	5.95	5.35
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Editor & Assembler	Picturesque	9.50	7.95
Spectrum Monitor	Picturesque	7.50	6.75
Factory Breakout	Pssycastle	5.50	4.95
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Screen Machine	Pssst 'n' Plotter	8.25	7.40
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Adviser	Protek	5.95	5.35
Hunter Killer	Protek	5.95	5.35
Hopper	PSS	5.95	5.35
Les Flics	PSS	6.95	6.25
Mission X	PSS	6.95	6.25
Aquaplane	Quicksilva	6.95	4.95
Bugaboo	Quicksilva	6.95	6.25
Frogger	Quicksilva	6.95	6.25
Frogsplosh	Quicksilva	6.95	6.25
Erik Bristow's Fro Darts	Quicksilva	6.95	6.25
Fred	Quicksilva	6.95	6.25
Games Designer	Quicksilva	14.95	13.50
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3D Tank Duel	Readmore	5.95	5.35
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City of Death	Red Shift	9.95	8.95
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Invasion Island	Richard Shepherd	6.50	5.85
Quatermass	Richard Shepherd	6.50	5.85
Urban Upstart	Richard Shepherd	6.50	5.85
Trans Express (cass)	Richard Shepherd	9.95	8.95
Trans Express (mdr)	Richard Shepherd	14.95	13.50
Titanic	R & R	7.95	7.15
Super Mutt	Silversoft	5.95	5.35
Jasper	Micromega	6.95	6.25
Kentilla	Micromega	6.95	6.25
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SILICON BOBBIES FLEX THEIR KNEES

AS TV SETS BLARE out the British Telecom "It's for you-hoo" ad slogan, hackers quite clearly only get interested when it isn't.

Breaking into unauthorised pages or parts of computers is their idea of having a good time. And although these electronic trespassers might agree that what they do is wrong, they would argue that it's really only good clean fun.

Comparisons with the early, illegal days of CB radio may seem inevitable — doing something you shouldn't — but with little risk of being caught. Yet whereas citizens' band eventually became legal, there is little chance of hacking becoming so. On the contrary, recent events show that the authorities are clamping down. The arrest of two hackers in London may be a taste of what is to come.

Armed with only a home computer, modem and telephone, hackers see their hobby as a test of ingenuity: the authorities see it as a challenge to security.

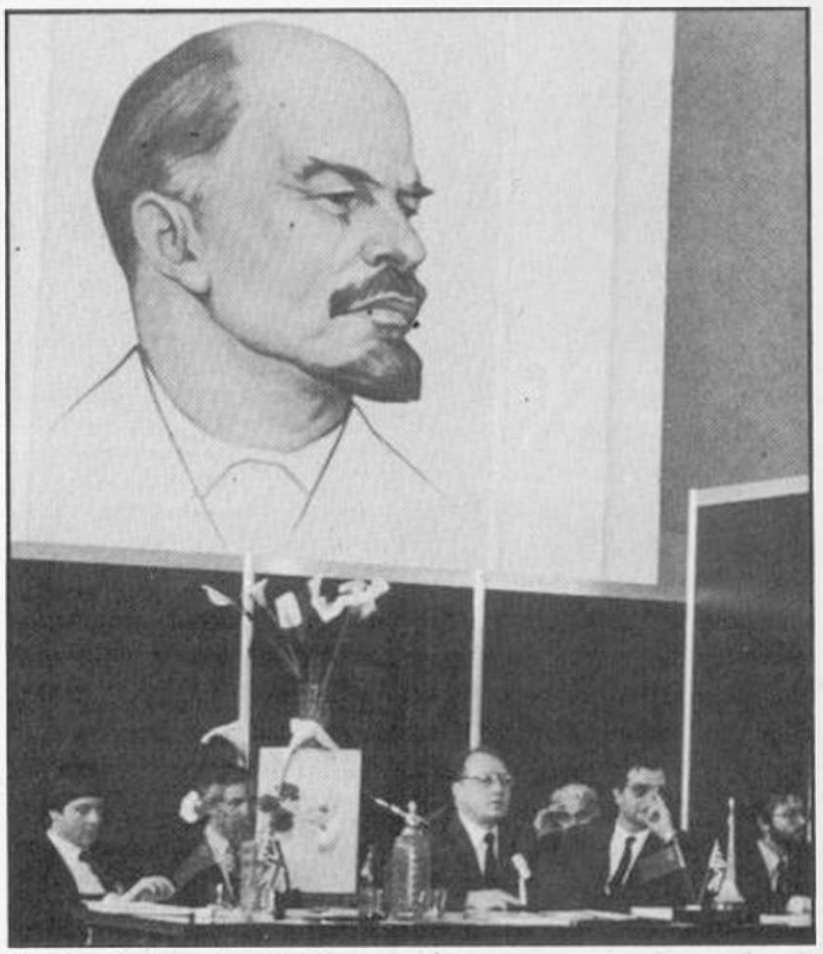
The current flood of hacking stories may be seen as bad publicity for the likes of Prestel but surely they could equally be welcomed for pointing out glaring deficiencies in system security.

After all, because networks like Prestel offer some subscribers a promise of confidentiality and are under obligation to make their system secure, it must be better that if security is to be breached it is done by people for fun rather than by vandals or criminals for financial gain.

Some claim that it is not unknown for a new network to release passwords to the hacking fraternity to test out its ability to react to breaches in safeguards. Hackers aren't interested in making use of information once they have gained access to it. They might occasionally leave a calling card by, for example, changing a letter in an unimportant word just to say they have visited.

Perhaps the recent spate of publicity surrounding hacking could actually help telecomms in general by encouraging home computer owners to buy modems. There are plenty of legitimate applications around such as *Your Computer's* Telsoft service, Prestel and Micronet 800. It seems sad that at a time when interest in modems is increasing, one of Britain's main home computer modem manufacturers, OEL, has gone into receivership. The good news is that you can still pick up one of its modems for around £40.

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Memotech negotiates in Moscow.

KREMLIN 'N CHIPS

RUSSIA needs one million micros in its schools to fulfil the next Five Year Plan and British companies are queueing up to offer their products.

Surprise front runner at the moment is Memotech backed by the Spectrum Group USSR Consortium headed by Dudley Langmead. Memotech has already produced a full Cyrillic keyboard and Rom for its MTX range but since Gorbachev came to power the pace has quickened and last month Langmead, together with Branton and Tupper from Memotech, met Soviet officials in Moscow.

The USSR might import the first 50,000 computers ready-built then switch to components and eventually self-production in a deal worth £100 million a year.

But Acorn and Sinclair are not out of the hunt — with Sinclair claiming that 100,000 Spectrums have already been unofficially exported to Eastern Europe.

Wrist micro

SEIKO'S new computer terminal in a wristwatch is the ultimate gimmick. Just plug it in to your Commodore 64 and it can receive 2K of data which can then be displayed over 80 "pages" of its two-line 24-character LCD display.

If you must use the £120 RC-1000 as a mere wristwatch you can still plug it in to your CBM-64 and use the big TV screen to set up messages which can be timed to appear at any time over the next year on your watch to remind you of birthdays and anniversaries.



Ultimate gimmick

TIME FOR 128K
Commodore sorts chaos



Commodore going to any lengths to dispose of surplus stock.

AMSTRAD, Enterprise and Commodore are launching their new 128K computers into the middle of a price war caused by the low Christmas sales which have left half a million lower specification machines still clogging up the warehouses.

Amstrad's CPC-664 will resemble the 464 except for the extra memory and built-in disc drive to replace the tape. Like the Commodore 128 it will be able to run CP/M programs although the CBM-128 "Shotgun" will also be CBM-64 compatible.

Its lack of compatibility with the C-16 and Plus-4 range probably means that the writing is on the wall for the two most recently introduced Commodores which are already being heavily discounted.

No wonder Commodore U.K. is recruiting an IBM executive as General Manager to try to sort things out.

BODY SYSTEMS AS ENTERTAINMENT

"THE THING about computers is that they lack intentionality. Essentially, they don't *want* to do anything — they're happy to follow orders." After two years' break from theatrical work, it is clear that Dr Miller is bubbling with ideas generated by study at the University of Surrey concerning artificial intelligence, and is almost more keen on discussing this than Bodyworks — the computurised follow-up to his pop-up book *The Human Body.*

Dr Miller first rose to prominence as part of the *60s* revue Beyond the Fringe which spawned such stars as Peter Cooke, Dudley Moore and playwright Alan Bennett. Apart from his work directing opera and stage plays, he more recently conducted a guided tour of the human body in BBC TV's The Body In Question.



Miller's body works

Together with the directors of the production company, Genesis, Jonathan Miller believes that there is a gap between serious business or educational software and games. Bodywork reviewed in this month's Software Shortlist is the first in a series of programs intended to fill this gap.

Genesis' future projects include a pop-up book and probably a computer game designed in co-operation with the Natural History Museum, London. And for Dr Miller? "I'd like to do a program devoted entirely to memory.

As a doctor how does he feel about the use of computers in hospitals? "Quite good in certain respects — diagnostic machines are less forgetful, but they have no intuition. Attempts to use them in psychoanalysis, as happened with Weizenbaum's Eliza program, are a reflection of the impoverishment of our lives."

How to fast load hits on a Spectrum

ALL THAT tedious messing about with assemblers is a thing of the past with the Transformer, a utility from Soft Machine, guaranteed a farm welcome from FAST — or possibly a writ.

This utility contains specific routines for copying 30 of the most recent blockbusters, including the chart-topping Alien 8 and Cyclone. Adding insult to injury, it even copies them to Microdrive, leaving out such space-wasters as loading screens. So legitimate back-ups can be made of your own software!!!

Wafadrive speeds up CBM-64

THIRTY SECONDS to load any program on a Commodore sounds too good to be true, but that's the claim for the new £99.95 Quick Data Drive. That compares well with cassettes which take anything up to a quarter of an hour, and even the 1541 disc drive's take two minutes.

The drive, from Dean Electronics for the CBM-64 or Vic, plugs into the cassette port. Once the system is booted up by pressing Shift/Run, you have the usual Load, Save, and data storage commands. There is also a System file which gives directory, formatting and copying commands. The drive uses the same technology as the Rotronics Wafadrive.

Clive C5 on screen

WHILE gearbox problems halt production of the real C5 tricycle, Scorpio Gamesworld has cashed in with a C5 Clive Spectrum arcade game.

You have to keep picking up batteries if you want to keep going through 50 screens of hazards between the shop and your home.

Link to Giant Mainframes and network to thousands of Micro users via your 'phone with free Modems and Comms software in the British Telecom Modem competition.

British Telecom is offering 1000 free gift packs to plug direct into your home 'phone line.

British TELECOM

MODEM COMPETITION

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500 for Spectrum/Spectrum +
350 for BBC Model B
150 for Commodore 64

And if you haven't got a square-type BT phone socket, British Telecom will arrange to alter your installation at no charge!

HOW TO ENTER

(Monday 22nd April to Sunday 5th May 6pm to midnight)

For the 5 questions 'phone
01-627 3000 or
021-449 9944 or
031-225 8999

To get the Tiebreaker Sentence 'phone
01-627 1199 or
0532 455030 or
0632 324444

Complete the entry form using your skill and judgement, and send it off in the next post.

RULES OF THE BRITISH TELECOM MODEM COMPETITION

1) The dial-in is available from 6pm Monday 22nd April to midnight Sunday 5th May 1985, when the competition closes.
2) Entries must be postmarked the next working day after the questions and tiebreaker were obtained.
3) Entries can only be made on the official entry forms and become the property of British Telecommunications plc.
4) The competition is open only to residents of the United Kingdom over the age of 18 years. Employees of the Network Marketing Unit of British Telecommunications plc and PARKER REDMILE LTD, and their dependants are excluded. Only one winning entry per household.
5) Entries not reaching the competition address before midnight on Thursday 9th May 1985 will not be considered.
6) A list of winners will be provided at the competition address. Please send an SAE if you wish to receive it.
7) The winners will be picked as follows from entries received on time and properly completed –
The entries for each type of prize pack with all correct answers to the 5 questions and with the tiebreaker sentences judged most apt and humorous by the competition organisers will be chosen, subject to the stock of appropriate prize packs.
8) The decision of the competition organisers is final and no correspondence will be entered into. Winners will be notified automatically.
9) British Telecommunications plc offers winners requesting BT 'phone socket conversion on entry forms to waive the charge normally made for such work.
10) Details of how to get on Prestel/Micronet 800/Telecom Gold will be sent to winners. Subscriptions not included in prize.

OFFICIAL ENTRY FORM

A. Your answers:
Q1 .....
Q2 .....
Q3 .....
Q4 .....
Q5 .....

B. Tiebreaker Sentence complete (25 words or less in total):
" .....
.....
..... "

C. If I win, I would like the prize pack for the
■ SPECTRUM/SPECTRUM +
☐ BBC MODEL B (Tick Choice)
☐ COMMODORE 64

D. My home telephone line (* Delete as appropriate)
(a) already has a square-type BT 'phone socket * or
(b) would need converting to square-type BT 'phone socket *
If (b), the person renting the line from British Telecom must fill in this declaration –
If this is a winning entry, I agree to ask British Telecom to convert my line to square-type BT 'phone socket at a convenient date before 1st July 1985. My line is on Residential rental, is not a coinbox and is not shared service.
I understand British Telecom will not charge for doing the work.

Name ..... (Block Capitals)
Telephone number .....
Signature .....
Date 1985

E. I have read the rules of the British Telecom Modem competition and agree to abide by them. I am over 18 years old.

Signature of entrant .....
Date 1985
Name ..... (Block Capitals)
Address .....
.....
..... Postcode .....

POST IMMEDIATELY TO:–
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WINNERS WILL BE NOTIFIED AUTOMATICALLY

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What's my line?

Hacking charges against Mouse

STEVE GOLD, otherwise known as Micronet's Micromouse, and Robert Schifreen, a freelance journalist, were arrested on Wednesday night, 27th March.

The two men were taken to Holborn Police Station, where they were charged the following morning with offences under the Forgery and Counterfeiting Act 1981. A Scotland Yard spokesman said that this was "the first ever police operation in this country into the alleged use of computers to interfere with other computers". He said, "Officers from the Computer Crime Unit of the Metropolitan and City Fraud Squad in an operation in the Edgware area of London and the Crosspool area of Sheffield arrested the two men.

The raids were made in co-operation with the British Telecom officials and South Yorkshire Constabulary, under a warrant issued under section 7 of the Forgery and Counterfeit Act of 1981. They follow a three month operation into the alleged interference with the Prestel system and warnings from police that publications such as *The Hacker's Handbook* might incite people to break the law.

Century, the Handbook's publishers, has denied that either of the men charged is connected with the Handbook and the police admit that the arrests had no connection with the *Hacker's Handbook*, but they are still investigating it.

The charge the two men face is that they "forged an instrument, namely an electronic device, for recording information on the Prestel Gateway and the Kipling, Dickens and Keats Prestel computer, contrary to section 1 of the Counterfeit and Forgery Act 1981".

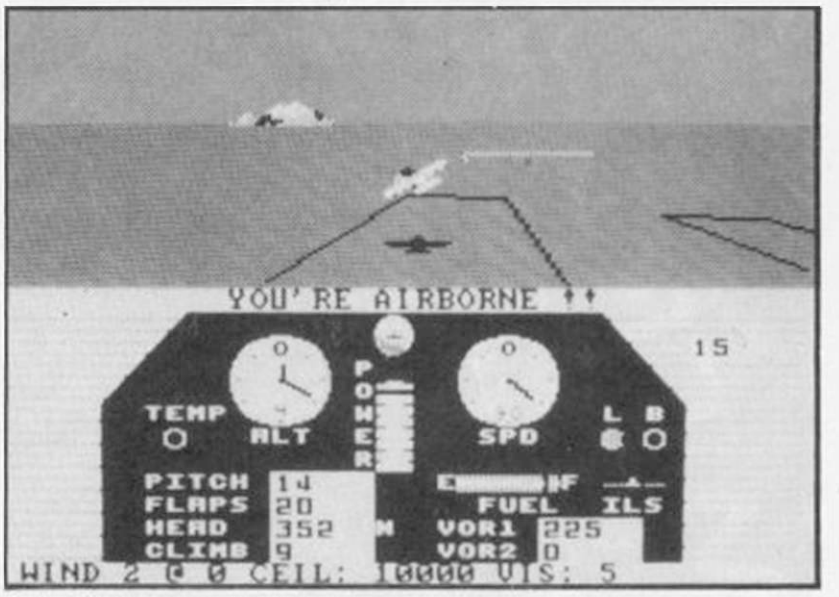
RIGHT STUFF

Pilot's Kennedy Approach

"I'M SELLING these games to men. If you haven't got the right stuff, I don't want to know." rasps Bill Stealey, president of MicroProse Software. Home of such hits as F-15 Strike Eagle, Nato Commander and Solo Flight, MicroProse programs are currently available in this country under the US Gold banner.

The next phase of ex-fighter pilot Bill's assault on the British software market via the US Gold beach-head has three main components: the Command series of Eastern Front style war games; a re-vamped version of Solo Flight and a remarkable air traffic control simulation called Kennedy Approach.

The Command series simulations allow you to play against the computer or against another player. The first two games available in the UK feature multiple scenarios ranging from single missions to in-depth campaigns. Crusade in Europe puts you in command of the Allied or German forces in Europe from D-Day to the Battle of the Bulge, and Decision in the Desert allows you to be either Monty or the Desert Fox in North Africa from 1940 to 1942. Both games have a 10-screen scrolling map, strategic maps, game save and a flashback function.



Solo Flight needed a revamp.

Air traffic controllers are one of the sectors of the American public most prone to heart attacks. You can now expose yourself to this threat in the comfort of your own home with Kennedy Approach — students of American labour relations will be disappointed to know there is no strike option in the £14.95 game. But it features excellent synthesised speech — right down to the blast of static that you always hear in the movies when the pilot replies to the tower.

US Gold plans to market the Command series at £20 — a stiff price? "I'm not interested in the kind of guy who just wants a short thrill," says Bill Stealey." If you want to spend £6 on an arcade game that you're going to play for an hour, I don't want you buying my software."

PSION EYES MARKS CARD

PSION'S ORGANISER is now helping Marks and Spencer fight Chargecard frauds quickly and conveniently.

The Organiser enables assistants to validate a card on the spot without the usual time delay in getting telephone confirmation from the central office. The Eprom datapak is loaded with the latest list of invalid cards and distributed to the stores overnight, making stolen cards virtually worthless within 24 hours of being reported lost.

Other Organiser applications include the Wessex computerised on-site building estimates system, and a prescribed drug calculator, giving a dosage, precautions to be taken and side effects of 280 commonly used drugs. Entering the symptoms produces a list of recommended drugs.



Wessex hard hat

New Gen Jonah and the wail

CLOSE YOUR eyes and you could be playing squash at the highest level — although you might miss the ball. New Generation's talking squash for the Spectrum uses a synthesised version of Jonah Barrington's voice to read out the scores.

Interface clocks on

IF YOU HAVE an Electron with a Plus 1, Cumana's new disc interface plugs straight into the cartridge port. The interface contains a battery-backed real-time clock for date stamping.

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POP★TOPS

TOP 20

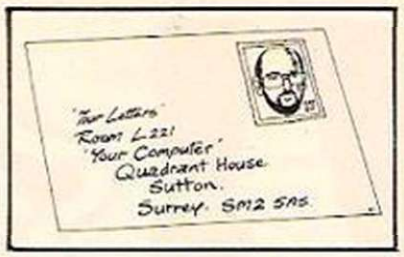
		Game	Company	Machine
	1	Booty	Firebird	Sp
*	2	Everyones a Wally	Microgen	Sp
	3	Starstrike	Real Time	Sp
	4	Match Day	Ocean	Sp
*	5	Alien 8	Ultimate	Sp
	6	Ghostbusters	Activision	Sp
	7	Wild Bunch	Firebird	Sp
*	8	Monkey Magic	Solar	16
*	9	Broad Street	Argus	64
	10	Skool Daze	Micro sphere	Sp
	11	Airwulf	Elite	Sp
	12	Blackbusters	Macsen	Sp
	13	Overdrive	Superior	El
	14	Technician Ted	Hewson	Sp
*	15	3D Time Trek	Anirog	16
	16	Go Go Ghost	Firebird	64
*	17	Byte Bitten	Firebird	Sp
*	18	Dukes of Hazzard	Elite	Sp
*	19	Mini Office	CDS	Sp
*	20	Bumper Bundle	Alligator	El

Sp = Spectrum/Bc = BBC/16 = C16
El = Electron/Vc = Vic-20
Dr = Dragon/64 = CBM 64
Am = Amstrad/Or = Oric/At = Atari
* = New release/— = Same position
Source: WH SMITH

TOP 3 BY MACHINE

		Game	Company	Machine
*	1	Vegas Jackpot	M. Tronic	Vc
—	2	Punchy	Mr Micro	Vc
—	3	Duck Shoot	M. Tronic	Vc
*	1	Mega Hits	Beau Jolly	64
*	2	Chiller	M. Tronic	64
*	3	BMX Racers	M. Tronic	64
	1	Bruce Lee	US Gold	Sp
	2	Raid over Moscow	US Gold	Sp
	3	Wizards Lair	Bubble Bus	Sp
	1	Hunchback	Ocean	Dr
	2	Manic Miner	S. Projects	Dr
	3	Dragon Chess	Oasis	Dr
—	1	Snooker	Visions	Bc
	2	Mini Office	Database Pub.	Bc
—	3	Castle Quest	Micropower	Bc
—	1	Compilation Tape 1	English	At
	2	Colossus Chess	English	At
	3	F15/Strike Eagle	Centresoft	At
—	1	Williamsburg Adv.	Microdeal	16
	2	Roller Kong	Melbourne House	16
—	3	Stellar War/ Blitz	CBM	16
	1	Classis Adventure	Melbourne House	El
—	2	Mini Office	Database	El
	3	Overdrive	Superior	El
—	1	Mutant Monty	Amsoft	Am
	2	Sorcery	Virgin	Am
—	3	Mini Office	Database	Am

Source = Websters Software



CONGRATULATIONS

IT IS ONLY on a very few occasions can I recall seeing in your columns letters from readers who have felt compelled to tell us of retailers who have performed a "service beyond the call of duty". We are so used to reading of late deliveries, damaged goods and exaggerated descriptions that we are flabbergasted when we encounter that almost extinct species, the "caring" supplier.

It is with real pride, therefore, that I bring to the notice of *Your Computer* readers Dr. Andrew Wright of Betasoft whose software application for the 48K Spectrum, Beta Basic, adds 30 extra commands and a further 20 functions in just 11K of code.

I recently bought a Rotronics Wafadrive for my Spectrum and discovered that because of overwritten addresses the drive was not compatible with Beta Basic. I wrote to Betasoft for assistance and, to my utter amazement, almost by return of post I received a reply from Dr. Wright advising me that the necessary modification was in hand and, upon satisfactory trials, I would be sent a copy.

Now, only a few weeks later, I have up and running a Wafa-based version of Beta Basic which, incidentally, has been upgraded to take better advantage of the drive and printer output facilities.

Peter Marles,
Leeds,
West Yorkshire.

NUKE LEAR

DO YOU KNOW Nuke Lear from CCS? It's the best buy on the market! Why?

- It costs only £2.99!
- It is the only game that can be enjoyed by beginners and experts alike! Levels 1 and 2 are for kids, levels 3-7 are hard enough for the best shoot-'em-up champions, levels 8 and 9 will never be finished evey by the best!
- You get a free compiler with it! Just load it by typing

CLEAR 39999: LOAD "W"
CODE 59900,5636

Then type in or load your Basic program. Type Randomise USR 60000 to compile it, Randomise USR 40000 (=start-address) to run the compiled version.

It will run 20-100 times faster than the Basic version.

H. Schneider,
Hamburg,
West Germany.

GOOD HACKERS

I READ WITH interest your first bytes feature in the April 1985 issue of *Your Computer*. May I first make it quite clear that I am in agreement with everything you say about the modern day hackers, people who seem to delight in attempting to sabotage the efforts of serious DP users.

What I do not agree with is your statement about the origin of a hacker — that is someone who spent hours locked away with a home computer. Long before the advent of home computers the hacker had risen to an almost legendary status. The hacker was the person you sent for when you needed some catastrophic software failure — usually on a PDP-11 mini — fixed yesterday.

A good hacker — and by definition there were no bad ones — had, and indeed still has, the ability to fix anything, corrupted file, application program, system software or whatever, and fix it quickly. Naturally, some of these fixes were a little crude but such was the nature of the hacker that most tended to be rather elegant repairs that tended to become accepted as part of the software.

For such a fix the term "a neat hack" was coined.

John Harper,
Roker,
Sunderland.

YOUR Letters

Your Computer now has its own Prestel Mailbox. Our number is 01991800. If you have any program enquiries send us a message. We will try and give you an answer within a few days.

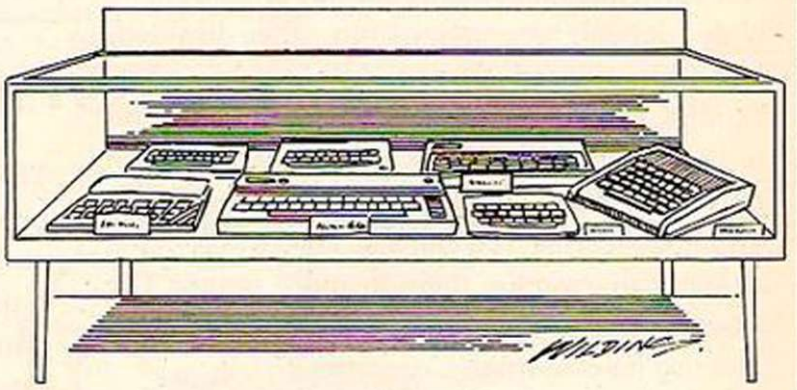
PRESTEL WARNING

I WISH TO issue a warning to future modem owners who are interested in subscribing to Prestel, the British Telecom Viewdata Service. The warning is *watch out, you may be in an area which cannot get Prestel at local call rate.*

(continued on page 27)

"SAVE YOUR OLD COMPUTERS"

COMPUTER MUSEUM



I AM WRITING to ask your readers to think twice before throwing any old pieces of electrical equipment out, especially old calculators and computers.

The urge to collect in the human species is such that today's radios, calculators and especially computers will be tomorrow's collector's items — worth perhaps huge sums of money.

To prove my point, one only has to look at the prices old wirelesses fetch. In the days when such things were common, many people threw them away thinking that their ubiquity proved them worthless. And how wrong they were!

The reason I am making this appeal is so that posterity will be able to look at our present-day devices and marvel at their antiquity.

I am already beginning to build up a collection of old and obsolete microcomputers. They can be obtained for practically nothing, often in pristine condition.

So, think twice before you part with that old computer — it could be worth a fortune one day.

Robert Sedgwick,
Grimsby,
South Humberside.

NEW!

THE GAMES PLAYER

12.95 COMPLETE

Our latest Interface for the Spectrum is the ultimate in games playing accessories. Not only is it a joystick-interface but also a games speed controller. This interface will enable you to become the master of any computer game.

Joystick Interface

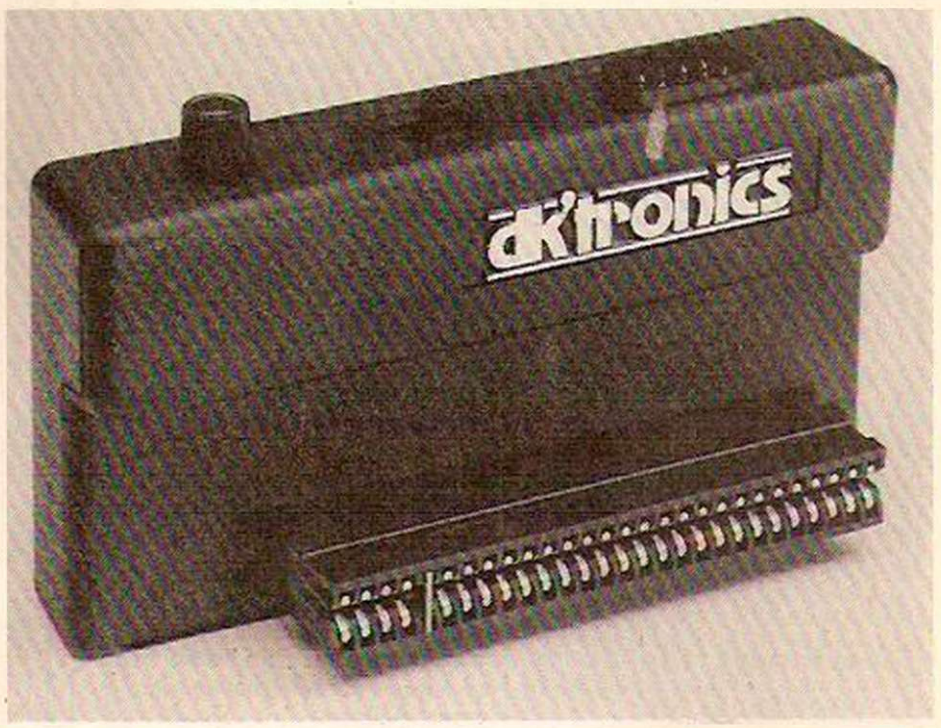
When playing any game at normal speed the interface has all the features you would expect from a DK product. It is compatible with almost all games currently on the market and is fully Microdrive compatible. The port simulates in (31) command and will accept any joystick fitted with a 9 way D plug including the rapid fire types. (e.g. QuickshotII).

Freeze Feature

The secret of the interface is the "Freeze" control, after slotting the interface onto your Spectrum's expansion port you can adjust the speed of any game or program and even "freeze" frames simply by turning the speed control. The games controller has an extremely wide appeal; young children, the disabled, less experienced games enthusiasts, programmers and software developers will find individual benefits, you can slow games down to a complete stop and so improve your skills and high scores. You can also freeze individual screens to examine them in more detail. The freezer adds a new dimension to your games playing (or cheating).

Quickshot II Joystick

The perfect companion for your games controller, the Quickshot II offers the following features: Super positive response. 2 fire buttons. Stabilising suction grips. 4ft lead. Improved control grip. Trigger fire button. Rapid fire option. At only £11.95, it represents superb value for money.



How to Order

The Games Player Interface costs only £12.95 and like all our products is covered by a comprehensive guarantee. You can obtain your interface from any good computer store or by completing the order form below and returning it to:*dk'Tronics Ltd, Shirehill, Saffron Walden, Essex.* or by telephone, quoting your Access or Barclaycard number.
Orders normally despatched within 24 hours.

Please rush me:

..... *Spectrum Games Controllers @ £12.95* .....

..... *Quickshot II Joysticks* ..... *@ £11.95* .....

add postage and packing £1.50

Total: _____

I enclose cash/cheque/Postal Order. Please charge my

Access/Barclaycard No. [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

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IN★TOUCH

How to write for *Your Computer*

We called this magazine *Your Computer* precisely because we welcome your views, tips and hints and even your criticisms of machines and software in general. Here's how you go about getting your name into print. Your article should be typed, double-spaced, on A4 paper. A name and address on each sheet would help. Don't forget to tell us which machine it runs on. With programs please include a cassette or disc and some indication of how long it is. Please put what machine it's for on the envelope. Don't forget full instructions to us how to load and list your program and how to enter it for the readers.

The article must be submitted exclusively to *Your Computer*. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

Telsoft

Telsoft is *Your Computer's* software downloading service. Any program for the Spectrum or the BBC — and soon the Commodore — which has a telephone symbol next to it is available on the service. Both 1200 and 300 baud speeds are catered for. For more details call Colchester (0206) 8068. No more lonely nights typing in endless pages of hex digits.

Message service

You can get messages to us in two ways. Either use the Prestel Telex Link to 892084 BISPRES G or you can use our very own modem, day or night on 01-661 8978. The modem is V21, 300 baud, even parity, 10 bits per character. You simply transmit in upper case "YRC" — our address code, and wait for the acceptance code "+ + + STF GO". Then off you go. Don't forget to tell us who it's for. Sign off with "NNNN" — again in upper case.

(continued from page 25)

It was only after I had subscribed that I found out that the whole country was not at Local Call Rate.

It looks as if I will have to sell my modem soon as our telephone bills are through the roof. If any other Prestel users who do not get the service at local call rate would like to contact me over Mailbox to exchange views on this, my Mailbox number is 082422531. I shall fight on.

Robert Evans,
Ruthin,
Clwyd.

SCREEN ERROR

THANK YOU for publishing my program Screen. However several errors have occured in the text which could lead to difficulty in using the program. The corrections are listed below Page 101, Column 2.

Line 16 "Pressing shift and graphics will alter the letter to an inverse G indicating that keys with graphic characters will have those as face value while the others are normal face value."

Line 28 "1 Indicates"

Line 31 "2 Will"

Line 34 "3 Then"

Line 38 "Editing of the screen may be carried out at any stage up to new-line on 3".

Page 102 Column 2.

Line 11 "PEEK x+1" (No brackets)

In addition the flash character may be altered by Poking 16772 with the code of the character required.

Mark Stenlake,
Whitwick,
Leicestershire.

CREEPY BUGS

IT HAS come to my notice that my program Creepy Castle — March — as it stands will not work on the Oric-1, only the Atmos. This is mainly due to bugs in the Oric-1's Rom but there is also a missing line from listing 1. There should be a line:

```
4525 POKE # 7800, # 4C:POKE
   # 7803, # 4C:POKE # 7806,
   # 4C
```

When the Oric-1 loads in a block of memory, it decides to adjust the Basic program pointers resulting usually in "out of memory" errors. To get around this problem, insert the following lines in listing 1:

```
25 DOKE1024, DEEK (# 9C):
   DOKE1026, DEEK(# 9A)
32 DOKE # 9C, DEEK(1024): DOKE
   # 9A, DEEK(1026): CLEAR
```

I believe that the Val function on the Oric-1 evaluates hex numbers — preceded by a hash — as zero resulting in the machine-code loader not working properly. This problem can be partially solved by making the following changes to listing 2:

```
10 INPUT "START ADDRESS ( - 1
   TO END)";A
20 IF A = - 1 THEN END ELSE
   C = 0
35 INPUT B
40 IF B = - 1 THEN 80
50 POKE A,B,
60 A = A + 1;C = C + B
```

Now −1 is entered to terminate a block instead of "S" and each number entered must be prefixed by a hash character.

YOUR Letters

Also, in the article the command for saving "castle3" should read, A6912 after "Castles" not ,A6192.

Myles Dunlop,
Totnes,
Devon.

OPEN WINDOS

THIS IS a modification to Ian Briscoe's Windos program which may be of interest to those without Microdrives — and maybe some, like me, with — who would like a VDU command to make the Windos system easier to operate. There is a bit of unused space between the program and the UDG area, and this is where this fits. Load Windos, then run the following program:

```
10 RESTORE: DATA 17, 118, 27,
   225, 167, 237, 82, 32 ,250, 213,
   223, 254, 44, 192, 231, 205,251,
   36, 253, 203, 1, 118, 40, 6, 205,
   213, 45, 215, 24, 236, 205, 54,
   32, 24, 231
20 FOR n = 65282 TO 65316
30 READ a: POKE n,a
40 NEXT n
50 SAVE "WINDOS" CODE
   60000,5317
```

Following the normal setting up for Windos — i.e., Rand USR 60000: Rand USR 60003 — insert the command Let VDU = 65282. Now try the following Basic line:

```
LPRINT USR VDU, 31, 22, 10, 10,
"HELLO", 5, 5, 6, 10, 5, 5
```

This is exactly the same as:

```
LPRINT CHR$ 31; CHR$ 22; CHR$
10; CHR$ 10; "HELLO"; CHR$ 5;
CHR$ 5; CHR$ 6; CHR$ 10; CHR$ 5;
CHR$ 5;
```

Dave Spagnol,
London E2.

CORRECTIONS

Statement 542 in April's QL Tutorial program was omitted. It is located at hex 458 and reads trap # 0. The hex code for this instruction is 4E40.

The hex loader for April's Amstrad Disassembler needs modifying before it can work. Change line 200 to read:
200 POKE address + y,a
and insert
165 y = 0
205 y = y + 1

The character which precedes the command for enabling the disassembler should be a bar character — shifted @ — and not an exclamation mark as suggested in the text.

The error messages printed in inverse video in lines 6000 to 6040 of April's Spectrum Singlestep program are not clearly visible.
They read, in order:
Number out of range
Not a decimal number
Not a hex number
Not a suitable flag value
Interrupts disabled

Lines 595 and 610 in the listing for April's CBM Pikchachanja are not clearly printed. They should read:
595 GOSUB 800
610 X = X1:Y = Y1:etc

EYEING UP A VDU PROBLEM



ONE FACTOR seldom mentioned in connection with VDU problems is that of viewing distance. A comfortable reading distance for a typical *Your Computer* article is about 40 cm. At this distance a capital A subtends an angle of 17 minutes at the eye. The equivalent distance for a ZX computer on a 12 inch screen is 90 cm, or about three feet, a far cry from the common practice of standing the monitor on top of the computer.

When the screen is too close flicker is exacerbated since more of the screen falls in the area of periphal vision, and also the eye can only comprehend part of the screen at any time, leading to excessive eye movement. My suggestion to those suffering from eye strain is to move the screen further away if at all possible.

Phillip Bender,
Sunderland.

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Electronics and Wireless World is the only electronics magazine to really tempt the professionals.

It's the only one they take the trouble to pick up for themselves.

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BEGINNERS

first bytes

Starting out in home computing? First Bytes is for you. Just write to *Your Computer* with any hardware or software problems, no matter how small or simple.

I could do that...

If the few examples on page 31 stimulate you into giving some thought to making more imaginative use of loops, maybe you'd like to try your hand at this month's First Bytes competition and a chance to win our £15 prize. To enter, simply write a short routine to achieve anything you like — but make sure it incorporates no more than five loops — at least one of which should be nested.

Your program should also include a dynamnic variable linked to the increasing or decreasing value of one loop, and a counter.

Send your entry to First Bytes, Your Computer, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

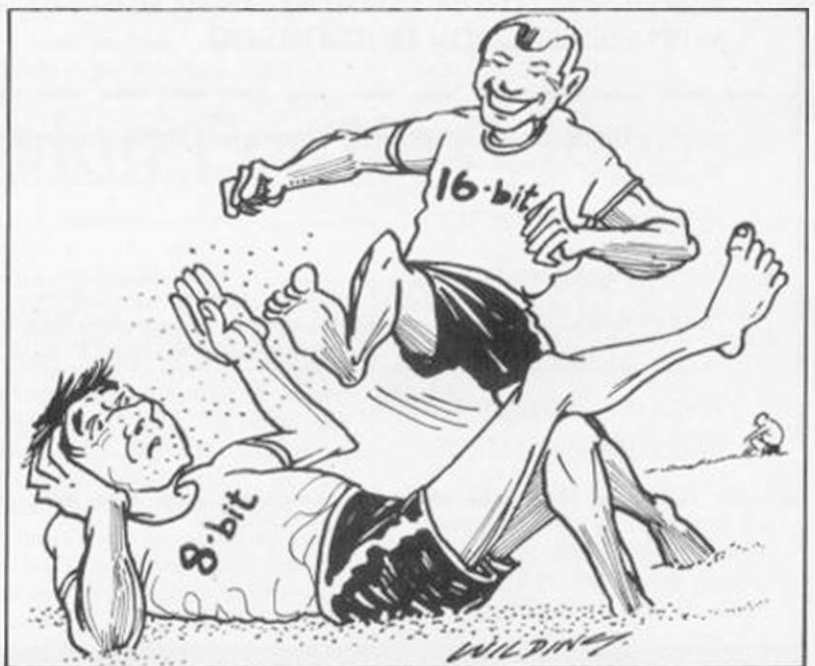
P Wilby, 34 Sheldon Close, Bransholme, Hull wins March's competition to write a program that modifies itself. His routine makes program lines which start with five colons invisible when listed.

By changing the first colon to a zero byte it fools the operating system into thinking it has reached the end of a line. To make the lines visible again change the 0 in line 10050 to 58. The program runs on the Vic-20, and the Commodores 16 and 64.

Anyone interested in the subject of self-modifying code might care to look at *Scientific American's* computer recreations feature. A recent issue introduced the fascinating idea of Core Wars — battles between two or more programs in memory at the same time. The aim of each program is to gain control of all available Ram space by replicating itself and attacking the others.

```
10 ::::PRINT "THIS PROGRAM"
20 ::::PRINT "PROTECTS LINES"
30 ::::PRINT "0 TO 9999"
40 ::::PRINT "FROM"
50 ::::PRINT "PRYING EYES"
10000 A=PEEK(43)+PEEK(44)*256
10010 ADDRESS=PEEK(A)+PEEK(A+1)*
256
10020 LINE=PEEK(A+2)+PEEK(A+3)*2
56
10030 IF ADDRESS=0 THEN END
10040 IF LINE=10000 THEN END
10050 POKE A+4,0
10060 A=ADDRESS
10070 GOTO 10010
```

A bluffers' guide to micros



ADMIT IT. You're not really a computer expert. Okay, you know all about what's at the heart of every computer — a microprocessor, of course. You've probably figured out the oblique reply to the question "But what is a home computer for?" (The correct oblique reply is "What is a piece of *paper* for?").

Maybe you even know enough not to get into a situation you can't handle — like trying to sing the praises of a CBM-64 to someone who owns an IBM PC. But at the end of the day there are still those bits of the conversation when names are dropped or antique machines referred to that make you feel like the man who hasn't been reading the FT. No comment.

Well, *Your Computer* is here to help you. Over the next few months we hope to develop, not just your knowledge, but more importantly, your techniques for defence. As with ju-jitsu, skilled micro-bluffing is all about turning aside remarks that threaten to expose your abysmal ignorance.

First, know your enemy. As with all social groups, there is a recognised pecking order among micro owners. A TI-99/4 owner, for example, is treated very often by the rest of the pack as a complete pariah. Why should this be? After all, as the distressed Texas owner often cries out whenever the pack starts circling him: "It is a 16-bit machine!".

Surely a 16-bit micro owner should be able to kick sand in the faces of mere eight-bit micro owners. But as we watch, we discover that for the Texas owner, at least, this is anything but the case.

The encounter is as horrifying in its way to the detached observer as watching a python swallow a lizard whole in a David Attenborough documentary. Nevertheless, it is instructive, since we are already deep in microbluff territory. What is the true meaning of the piteous cry of 16-bit, coming as it does in stark contrast to the rhythmic tribal grunting of "Eight-bit, eight-bit"?

We all know what a bit is, of course. Defined elsewhere as "a boringly dichotomic entity which precludes rational discussion," the bit is more precisely a binary digit. Microbluffs and microbluffers alike all learned at mother's knee that each of the elements comprising the memory of any computer is a binary system — one state denotes 0, the other state denotes 1. But this cannot help our hapless Texas owner. He is the victim of two things: architecture, and history.

First, architecture. The term eight-bit normally refers to the width of the data bus as opposed to the address bus. The job of the address bus is to access addresses in Rom or Ram. The instruction that the address refers to is sent back to the CPU via the data bus. The address bus is one way. The data bus is two-way — for example the instruction the address bus got hold of might require the transferrence of further data from Rom or Ram, or even to the input/output ports (I/O in microjargon).

Most home computers like the Spectrum, BBC, Commodore 64 etc are referred to as eight-bit micros. This refers to the width of the two-way data bus. And the width of the data bus determines how much information is processed in the CPU in a standard amount of time.

Obviously a true 16-bit micro ought to be able to shove twice as much through the CPU in the same standard amount of time. Just like a six-lane highway can carry twice as much traffic as a three-laner. But — and this is crucial to the TI-99/4 — big motorways can create parking problems in the city centre. For all its 16-bit architecture, only 32K of memory could be accessed by the 9900 chip deep in the heart of ever Texas.

And instead of having just an address bus, data bus and control bus, like the 6502, 6809 or Z-80 chips found in most home micros, it had a separate communications register unit I/O bus as well. So it needed an expensive 64K pin package to keep everything moving around. And instead of carrying on-chip registers like conventional processors, it had blocks of work-space registers in Ram memory.

All it had on the chip was a program counter flag register and the register pointing to the current workspace. So basically it's weird. It had its uses as a dedicated chip in military aircraft and so on, but proved to be too expensive and too strange to be bought by people in large volumes — which chips have to be if they are to be worth making. So much for architecture. Now for

(continued on page 31)

The British Computer Society VARIPLANNER

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(continued from page 29)
history.

When the Texas came out over here, you could only but it with an NTSC colour monitor, so it could set you back £1,000. (Did you know, by the way, that NTSC stands for Not The Same Colour twice?) It spent a long time at £600 in the UK, went through a peculiar phase of being sold for £200, but you could get another £50 back if you sent off a voucher, and ended its days being sold for around £80. Finally, it was withdrawn from the market.

This is a vital piece of home computer mythology, symbolising the legendary price-cuts that reward the patient. It is also a severe lesson in bad marketing. As Commodore chronicler Mike Tomczyk says of TI in his gross book *The Home Computer Wars*, "I figured that if a giant semi-conductor company that made its own chips charged that much money, they either didn't know how to control their manufacturing costs or were gouging profits at the consumer's expense."

So, to summarise, what the pack is conveying to its victim is basically this: "You are a sucker. You bought something that turned out to be slightly less successful step in evolution that Neanderthal man. Worse, you (a) paid a hell of a lot of money for it, (b) bought it for next to nothing off a scrapheap, (c) were given it for Christmas by a loveable but eccentric uncle who thinks that Prestel is a Jewish delicacy".

The pack is demonstrating its irrational but natural fear of the alien. Nearly all of them are 6502 or Z-80 based. There may be a few Dragon owners who are glad it is not their turn to be picked on. There is little the victim can do to defend himself. "To the initiated, the 9900 chip is powerful and flexible," he may call out — this is a strange mantra he has gleaned from an old copy of *Practical Computing*.

He can point out that the mutant communications register unit I/O bus can address up to 4,096 individual bit I/O lines. But he is clutching at straws — the unique TI speech synthesiser add-on has addressed him more often than he has used the computer to address anything else.

He must divert the attention of the pack. As the baying raises to its peak, he plays his trump card. He yells, "Well, I know for a fact that George over there has got a COMX-35 at home!" and runs like hell.

Paul Bond

BEGINNERS first bytes

Elegant programming: using For/Next loops

ELEGANT PROGRAMMING doesn't necessarily mean sitting at your micro wearing a pink carnation and spats — especially if you're female. It's more a question of rethinking those bad old hacking habits you've picked up, so that your self-written Basic routines don't look to others as though you found them at the bottom of a cardboard box.

Take as an example the ubiquitous For/Next loop. It's one of the most powerful Basic commands there is — and probably also the most abused. Check through your own uses of it and you'll doubtless find that you have in all innocence introduced a couple of classic chip-charring catastrophes.

For/Next loops are versatile; use one as a counter set to the number of times you want a particular operation to be executed, to mimic a clock, or to stuff your arrays full of data. They'll always work much better, though, if you observe a couple of golden rules.

First, don't skimp on labelling, especially if you're nesting — that is, introducing one loop or more inside another loop. This is sloppy:

```
10 FOR L = 1 to 10
20 PRINT L
30 FOR D = 1 TO 350
40 NEXT:NEXT
```

Now the proper order of execution might be clear in this simple example — but such routines aren't always so easy to decipher when you're checking over a listing of a program you wrote months before. So why not make the last line

```
40 NEXT D:NEXT L
```

and remove all risk of confusion?

Next, it's wise always to close down a loop when you're finished with it, like this:

```
10 FOR L = 1 TO 10
20 IF L = 7 THEN PRINT
   "SEVEN":L = 10:GOTO 40
30 NEXT L
40 REM PROGRAM CONTINUES
```

There is an exception. You may sometimes want to use the "exhausted' value of L in a subsequent statement. If so, remember that it will usually total one more than the specified value. For example, if you Run the first demo again and then enter Print L in direct mode, you'll find the number printed in response is 11.

Of course, you can also weave in the changing loop value as a dynamic variable in a routine:

```
10 FOR L = 1 TO 10
20 PRINT "*";
30 FOR D = 1 TO (500*L)
40 NEXT D:NEXT L
```

A loop can also be used to create a simple timer. Most micros have a real-time clock held in a reserved string — such as TI$ — but you may want to keep this by for another part of your program. So use a loop instead:

```
10 FOR CD = 10 TO 1 STEP -1
20 PRINT "COUNTDOWN" CD
30 FOR D = 1 TO 350
40 NEXT D:NEXT CD
```

You're probably familiar with the technique for filling one array or more using a For/Next loop equal to the total number of elements involved. However, don't forget that you can nearly always bypass an array provided there are 10 elements or less. Try this:

```
10 FOR L = 1 TO 5
20 READ D$
30 PRINT D$
40 IF D$ = "ORANGES" THEN 60
50 NEXT L
60 PRINT "YOU'RE OUT OF
FRUIT!"
70 END
80 DATA GRAPES, BANANAS,
   LEMONS, PINEAPPLES,
   ORANGES
```

Finally, don't overlook the power that a For/Next loop can bring to all kinds of string-sorting chores. For example, some Basics — such as Commodore's — don't have an equivalent to the INSTR function available on the BBC which searches a string for a specified group of characters and returns its location. But this very useful facility can be emulated:

```
10 A$ = "YOUR COMPUTER"
20 B$ = "PUT"
30 FOR L = 1 TO LEN(A$S)
40 IF MID$(A$,L,LEN(B$)) =
   B$ THEN GOTO 70
50 IF L>LEN(A$) THE PRINT
   "NO MATCH FOUND":GOTO 90
60 NEXT L
70 PRINT "POSITIVE MATCH
FOUND"
80 PRINT "BEGINNING AT
   CHARACTER" L
90 END
```

After trying this version change B$ to "OUR" and Run the program again; next, make B$ = "NIL".

John Ransley

The flexible floppy disc system

ALTHOUGH CASSETTE tape is a perfectly adequate medium for those people who just want to dabble with computers, most serious users find it too hampering for real computing. It is awkward for handling program files and downright obstructive for manipulating data files of more than a handful of records. The remedy most sufferers of data headaches turn to is the floppy disc.

Discs — Americans call them disks or diskettes — are flat, round platters of magnetic material encased in a plastic shell. They come in a variety of sizes; eight inch, five and a quarter inch, three and a half inch, and three inch. There are also a number of different formats, densities and single or double sidedness.

In order to use discs with a micro you need three elements; a disc drive, an interface and some controlling software. Normally, a disc drive will be sold with all three components included in the asking price, however that is not always the case. Most manufacturers market a disc package designed to work with their computer.

The notable exception to this rule is Sinclair Research, who has decided to plough a lonely furrow with the Microdrive. Yet Sinclair owners who desire the flexibility and convenience of floppy discs can turn to the third party disc manufacturers who also market units for other ranges of micros.

When buying a disc unit, it is worth taking a look at the "official" unit for your system first. This is usually the same as the most popular drive and is important because any disc-based software produced for your system is likely to be available in this format. Before purchasing, check that the drive you intend to buy is supported by the software houses.

You will almost certainly want to transfer your library of software to your disc drive. This should be a trivial task as far as converting your own Basic programs is concerned but may be much more difficult for commercial software.

Depending on a number of factors, you should expect to part with around £200 for a single disc drive. A twin drive unit will often cost less than the sum of two singles as the power supply, controller and interface will be shared.

Remember that eight inch discs are a dying breed. Five and a quarter inch discs are still popular, though the drives can be more expensive to buy. Microfloppies — that is the Japanese three and three and a quarter inch discs — are becoming more and more popular all the time; however the discs are expensive to buy costing around £5 each.

Apart from the hardware, you will also be faced with a choice of operating systems. If there is a system specific to your micro, such as Commodore Dos or AMSDOS, you will have little choice. CP/M is a standardised operating system which will open your machine up to a wide range of software.

Bill Bennett

IT'S 1985 — THE YEAR OF COMMUNICATIONS



Why buy programmes for your Spectrum when a world of free 'telesoftware' is open to you. Discover Prestel, Micronet 800, Viewfax, bulletin boards and open a whole new world. Even user to user.

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If you have anything of interest to tell us about your computer club why not contact us on 01-661 3144.

Local news

Memotech

Memotech owners now have a magazine devoted just to them. It has articles on the machine, programs to type in and offers on commercial software. Contact the Memotech Owners Club, 23 Denmead Road, Harefield, Southampton..

Christian

A club has been formed "to promote the use of microcomputers in Church related activities". Christian computer users should contact the Secretary, P.A. Clark at the Christian Micro Users Association, 6 Wakely Street, Sheffield, S6 3RG.

Atari

Atari owners in the Watford area might like to join this likely bunch of WAG's (Watford Atari Group). Yet another offshot of the ever prolific Infomania group, they plan to cover a wide range of Atari related activities. WAG promise a software library and newsletter as well as regular meetings at Infomania HQ. Membership is £15 per year. Interested Atarists should contact Chris Bone (Garston 672235), or write to him for more details at 10 Garston Drive, Garston, Watford Herts WD2 6LB.

Elbug

The publishers of BEEBUG for the BBC have produced a cut-down offshoot for a cut down computer, the Electron. For £9.90 you get 10 issues of ELBUG, and the club provides other facilities such as local user groups, a discount scheme with a number of retailers and a software library. It's available from ELBUG, PO Box 109, High Wycombe, Bucks HP11 2TD.

COMPUTER *club*

Patrick McDermott takes the high road to Glasgow and discovers omnibuses as well as databuses at the S.P.T.E. club.

THERE ARE five, perhaps six, computer clubs around Glasgow. There might be over 100. The difficulty in knowing arises from the fact that they do not make themselves known, particularly to each other. By far the largest and best known is the S.P.T.E. Club organised by John Reid.

When I visited the club for one of the Sunday evening sessions, John was putting on a performance like one of the stall-holders at the famous Glasgow "Barras" market. With a CBM-64, disc drive and monitor, he enthusiastically demonstrated the wonders of computer programming to a gathering of 30 or 40. Not that it seemed necessary to sell them the idea, most listened attentively and stopped him in full flow if he had gone on too quickly.

Elsewhere in the large room, four or five small groups were working on their own, maybe they were playing games; but if they were, then they were silent ones, for games playing is not encouraged until the final hour of each meeting.

The tutorial that was taking place was the easy part of what is a very impressive programming course that forms the main part of the club's activity. This was the second of 12 fortnightly meetings that begin by assuming that the participants have no previous knowledge and end 24 weeks, three test papers and a programming project later.

On completion each member will have a full working knowledge of Basic and a complete set of detailed course notes and exercises for future reference. The course is not as stern as it may sound; the test papers indicate to John and his assistants where extra emphasis is required or if any private tuition is necessary. Just now courses in Sinclair and Commodore Basics are run with an Amstrad course a possibility for the future.

If the whole business seems more like hard work than fun, then that is far from the truth. The membership of 192 is made up mostly from Strathclyde Passenger Transport Executive — S.P.T.E. bus crews and their families, although anyone can join, children with their parents approval only. The meetings take place in the staff function suite at one of the depots, a venue that comfortably provides all the necessary facilities and allows the nightly fee to be kept to 20p for adults and 10p for children.

As with most public computer clubs, there is a span of age groups and while I saw no-one under ten or over fifty, there was a variety of all inbetween working together. Unlike a lot of clubs there was a reasonable representation of female members.

I was surprised to see that there were relatively few computers at the club. Not, I found out, because members didn't have one; but that the organisers preferred people to work together. The theory seemed to work. Spread around the room there were people working on databases, music programs, writing adventure games, helping each other come to terms with machine code as well as Basic. A variety of machines were in use; Commodore 64s, 16s, Vic-20s, BBCs, Amstrads and Spectrums. There were also a variety of monitors, VVS, disc drives and cassettes that seemed freely available.

When younger members found that their joysticks were going down faster than Mary Decker when they played Daley Thomson's Decathlon, John Reid designed and built a more durable customed joystick from the broken one and some extra parts. For more serious breakdowns of computers or peripheries, members can have repairs made via the club which has an arrangement with a local workshop.

Arrangements with other businesses provide discount discettes, discounted software and Activision, and has enabled the club to form its own library. A local book distributor allows the club to review books and then to purchase their choices at a discount. Businesses benefit from greater trade and the club by being able to offer more facilities to its members. Other businesses seeking similar benefits would be made most welcome.

Travelling has never presented any problem to the S.P.T.E. computer club. Free busses are one of the perks of the job and there is no shortage of drivers, a facility that the club intend to make the most of. A full list of outings to computer shows, commercial installations, and some of the computer manufacturers that abound in the area is planned. It is a facility that the club is willing to share with any other local club who dares make themselves known. Other clubs could benefit from both the visits and opportunity to witness an active, well organised and resourceful club at close hand.

The S.P.T.E. Club will welcome any inquiries from business or prospective members and details can be had from the organiser: John Reid, 3 Meadow Road, Partick, Glasgow.



COMCON

Programmable Joystick Interface for the Spectrum

£19.95





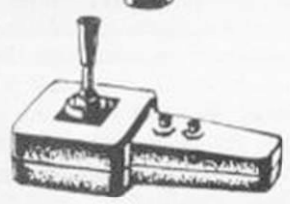
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Interface

HARDWARE hotlist

ADD-ON EXTRA

XK Spectrum

Spectrum 48K
Television Services
£20.95

The XK is available as a kit add-on or fitted to your Spectrum for £5 extra.

What it does is hack the Spectrum's memory up into two 32K pages. It also allows you to add up to 128 external pages, each up to 32K, onto your machine.

Each page of Ram can have a program running in it, and have a separate screen window dedicated to messages generated by that program.

One major problem is that most of the more complex games such as Alien 8 and Lords of Midnight won't run on an XK Spectrum, and being a soldered-in modification, you can't quickly change back.

Maxam

Amstrad CPC-464
Arnor Ltd.
£59.90

Arnor have come to the serious CPC-464 owner's aid with a comprehensive piece of hardware containing an assembler/disassembler/editor.

The small board plugs into the Amstrad so that most of the circuit board disappears inside the computer under the existing PCB. It provides an expansion bus extension and a slot for further Rom boards. You also get a 50-page manual which explains the use of the Rom-based assembler and the commands available.

Calling the assembler is done from Basic using extended commands.

Arithmetic operators and labels are supported and parameters can be passed from Basic to the code and back.

The RST command is mentioned only rather briefly in the provisional manual provided. As this controls breakpoints. This could have done with more explanation and examples. Aside from this rather minor quibble, this looks like a product no serious Amstrad user can afford to be without.

Quick Disk

- *Various*
- *Disc drive*
- *Triton*
- *£129*

THE QUICK Disk is designed as a cheap alternative to floppy disc drives, with only a slight reduction in performance.

There are three versions, Spectrum, Commodore 64 and MSX available, each priced at £129 with 100K 3in discs available at £1.99. The hardware consists of the disc drive and an interface box which plugs into the rear expansion socket of the computer. The performance of the drives is only marginally slower than normal disc drives.

A file takes a minimum of one sector and there are 20 by 2558 byte sectors per side, providing a maximum of 20 files/programs per side. Data files may be transferred between the three types of computers using the discs.

The drive repositions itself at its start position after every operation; this adds a further three to four seconds before the next disc access can be made, but does leave the head out of harms way and the data safe.

The quick disks overall are slightly quicker than the Spectrum Microdrives and appear to be reliable. Command format is simpler than Microdrive, but only just. As the quick disk built in software does not take up any additional space in memory, most software can be converted to run on the quick disk very easily using the conversion program provided in the manual.

There are a few problems with the Spectrum version — the only printer that can plug in directly is the obsolete ZX Printer, the Alphacom 32 does not work from the rear of interface. Interface 1 cannot be connected which loses the RS-232 port and modem facilities although a standard Centronics adaptor does work.

The MSX and Commodore versions do not have to sell against competitively priced products and appear to be good value for money, the Spectrum version needs tidying up to produce a viable alternative to Microdrives and stringy floppies.



Triton Quick Disk.

QCOM

- *QL*
- *Communications*
- *OEL*
- *£200*

BLOODIED BUT unbowed by the demise of Prism and Oric, OEL once again sally forth into the world of microcommunications. Once again they have teamed up with Scicon to produce a formidable product for a Sinclair machine. The hardware consists of three units: QCON, QCALL and QMOD. All three units come in QL livery and styling and stack one upon the other.

The unfortunately named QCON is the guts of the system. It plugs into serial Interface 2. It uses the TI 7000 single chip micro and controls protocols, baud rates, receiving and sending data. This can be plugged into a standard modem with an RS-232 interface, or another QCON on another QL to provide short-distance communications.

This, bought separately, would cost you £75.95 and comes with all the Scicon software. QMOD is an autodial, autoanswer unit which, at £79.95, might seem an expensive luxury to the hobbiest, but will make a big impact with the business user.

QCALL is a standard OEL V21 modem at a standard OEL price of £49.95. The hardware is only half the story. What makes this product worth a second look is the software. You get some idea when they tell you they only have room for one Prestel frame at a time in memory, the rest is filled up by the software!

The computer can be used as either a Viewdata terminal or as a VT100 terminal emulator, even down to simulating the numeric keypad. These models can either be accessed via a series of menus or the confident can just use command words.

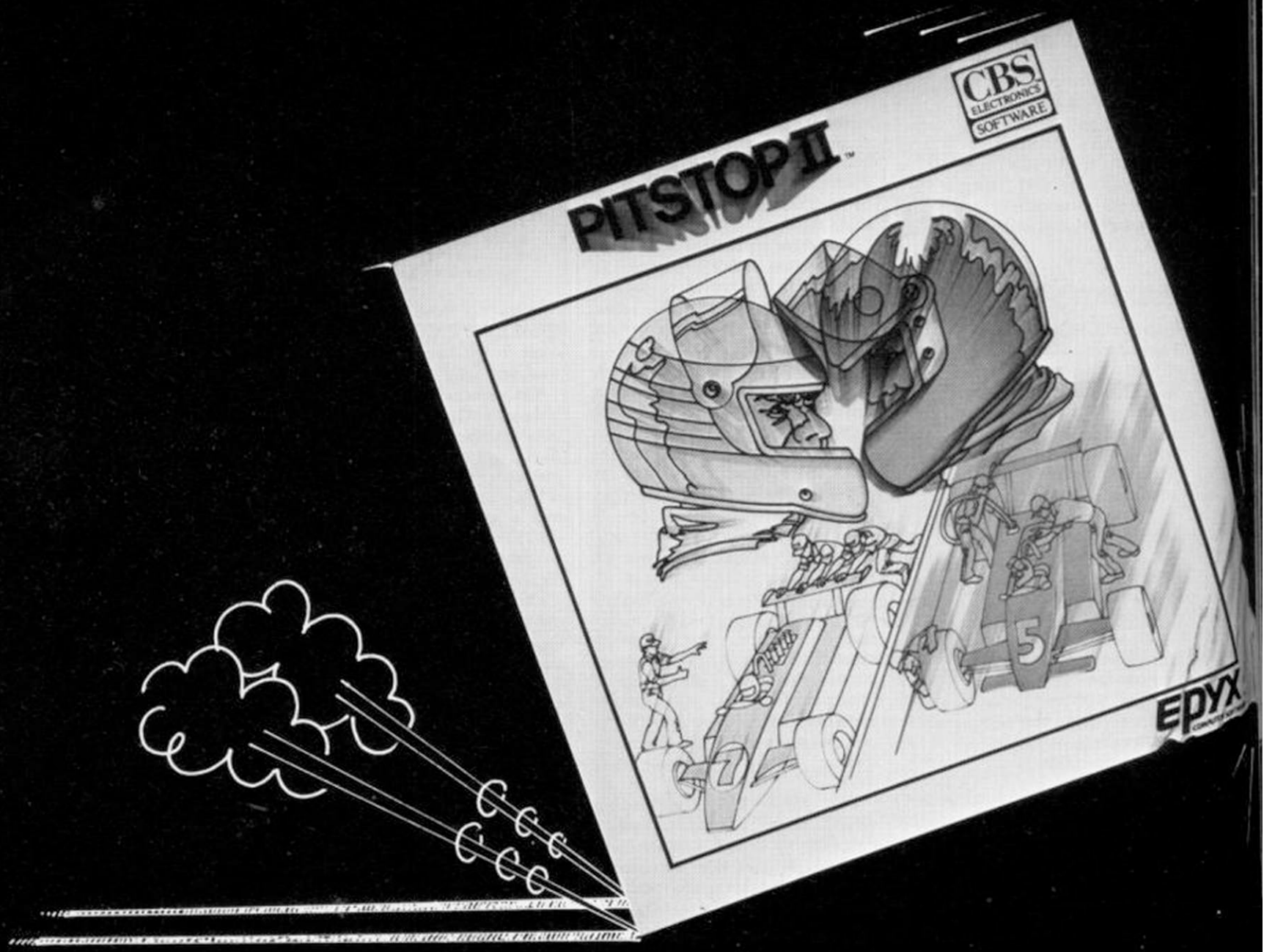
Using Prestel is simple in as far as using Prestel is ever simple. The # and * commands use the Enter and / keys. While on line, frames can be saved, loaded, printed either in text only — i.e., fast — or a full graphics screendump with shading is available which takes a few minutes. The phone book you load on booting the software can contain up to 50 named pages. Each entry on a page is given its own number and prompt string, so once you're through, logging-on is automatic.

The filing commands, again available when on line are very comprehensive, indeed they represent a major improvement on QDOS, with the sort of facilities you would associate with a proper DFS. Data on Microdrive can be encrypted and, if necessary, this encrypted version can be transmitted, with the encryption code sent by some other means.

A command sequence can also be saved on Microdrive. This allows the user to, for instance, write a message for a Telecom Gold mailbox, run his mailbox program and then walk away and let the computer get on with it, even using delayed send to send it while he's asleep!

User-to-User comms works very smoothly. Although 1200 half duplex, time sharing between both ends means it appears full duplex. Both message and file transfer is possible, with checksums sent and echoed in the latter case. Of course, this unique protocol means a QCOM user won't be able to talk to anyone else, even should they wish to converse with such mere mortals in the Spectrum and BBC world.

For the business user, the simple menus and the ruggedness of the software won't leave him with a crashed program and a big phone bill. The hobbiest will revel in the numerous clever facilities, and it might even find a market as a cheap alternative to buying a VT100 terminal for mainframe users.


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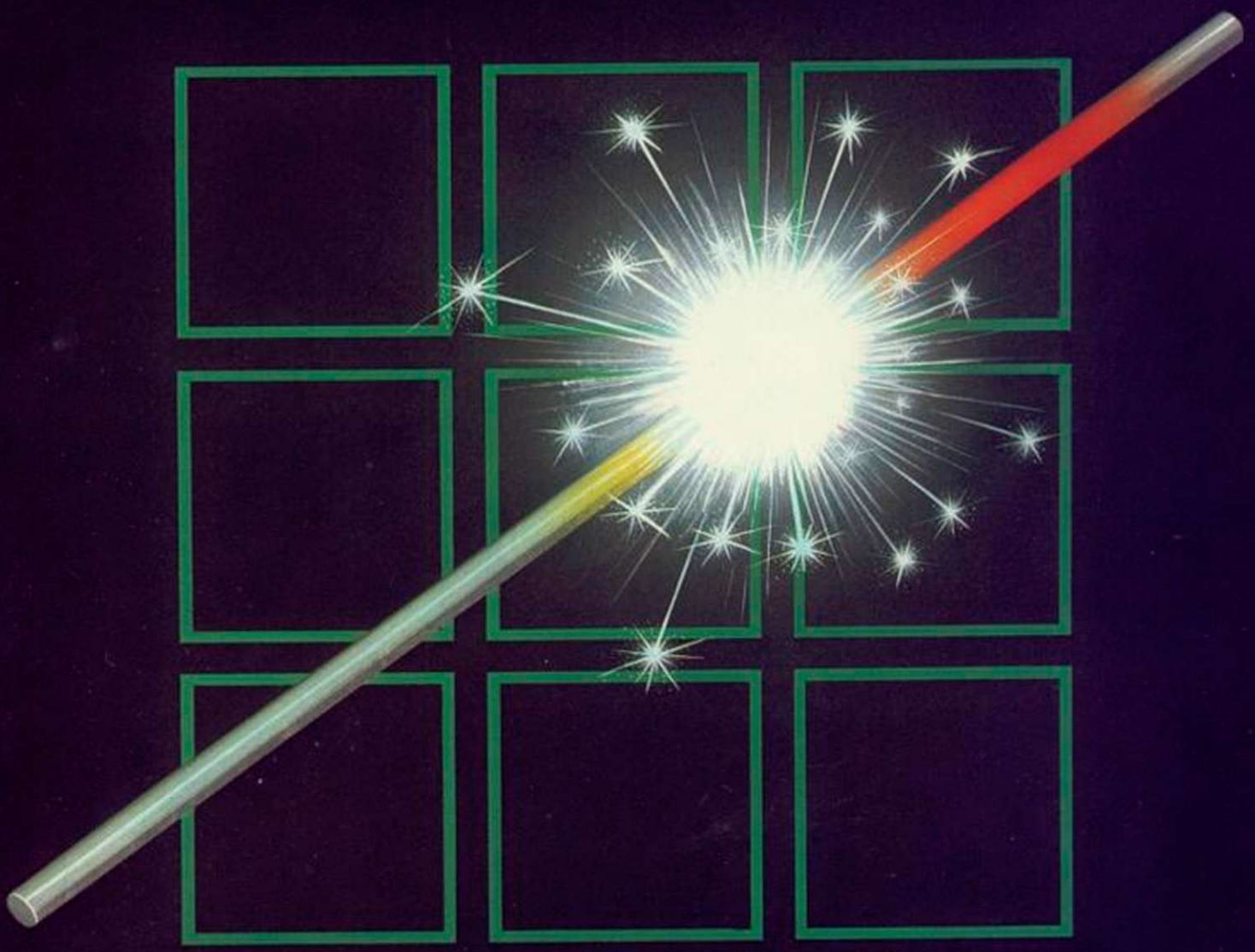
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SOFTWARE Shortlist

Star chart

KEY
★ ★ ★ ★ ★ Best of its type
★ ★ ★ ★ Very good
★ ★ ★ Good
★ ★ Average
★ Below par

Moon Cresta

ZX Spectrum
£6.95
Shoot'em-up
Incentive

★ ★ ★

The Nichibitsu arcade classic, with an opportunity to win your own dedicated Moon Cresta machine. You blast away and score bonus points by docking successfully with the mother ship.

Stay Kool

ZX Spectrum
£6.95
Arcade adventure
Bug-Byte

★ ★

Everyone raved about Manic Miner but what Bug-Byte seem to have forgotten is you must put some oomph into the graphics if you want to get away with this sort of thing. Silly jokes about police boxes and doctors are not enough.

Caveman Capers

BBC Micro
£7.95
Moon buggy derivative
Icon

★ ★

Nice to see some games for the BBC Micro after all this time. Your caveman rides on the back of a perambulating platypus. You must jump holes in the ground but avoid doing this when a low-flying bird is around.

Pole Position

CBM 64
£9.95
Road Race
US Gold

★ ★ ★ ★

The archetypal road-race game for your 64. It's all here, practice round, qualifying round, racing against other vehicles. Only carp is the under-use of CBM-64 sound facilities.

Formula One

- *ZX Spectrum*
- *Management game*
- *CRL*
- *£7.95*

★ ★ ★ ★

FOOTBALL MANAGER with racing cars. Fabri, De Angelis, De Cesaris, Piquet — you can hire them all provided they haven't already been bought up by your Spectrum. You can load up previous games, enabling you to continue a tournament over a long period of time, you can use a Kempston joystick and from one to six people can play at a time. There are five levels of play depending on whether you are a novice, junior, average, good or expert manager.

The six teams the players can manage include Brabham, Ferrari, Lotus, Williams, McLaren and Renault. You can also choose to be a driver — the ability to add new games in is a good one: stops the game getting out of date. After this you can select a sponsor, Saudia or Denim or whatever.

Now down to the nitty gritty — choosing your driver and then outfitting the car. Allotted a sum — depending on your sponsors — usually around £630,000, you can improve the driver, chassis, engine and pit crew. The more money you spend on your pit crew the faster they move in the pits. This is crucial, because although the race itself is randomly generated by the micro in the style of Addictive Games' Football Manager, you control tyre changes and adjustments by steering your man around the screen.

The graphics are functional rather than brilliant — but the heads of the crowd turn to watch the cars and the Goodyear airship moves majestically across the screen. After the race you are shown who won and how they're doing in the championship stakes. Other interactive elements of the game include deciding what sort of tyres to use, dependent on weather conditions, and when to go into the pits. Simple, enjoyable, no doubt socially divisive with six people fighting to get at the controls of one Spectrum.

Paul Bond



Sam Stoat Safebreaker



Formula One

Sam Stoat Safebreaker

- *Spectrum 48K*
- *Arcade adventure*
- *Gremlin Graphics*
- *£6.95*

★ ★ ★

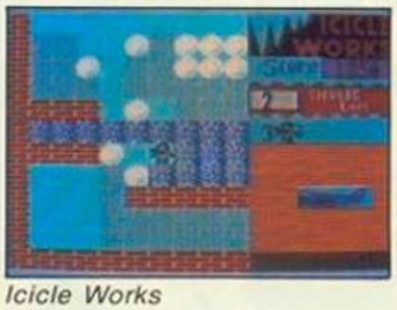
THE LATEST character to emerge from the warren of the Gremlin Gang, Sam Stoat would appear to be as guilty as Monty was innocent. Intent on stealing a very valuable diamond he braves bouncing bed-springs, runaway pool balls, nasty green bottles, pogo gnomes and deadly gnomemobiles in his quest.

Rather like Statesoft's Icicle Works, you get four main scenarios to choose from. Sam prowls about in the dark below four houses ranging from easy to hard. Press the fire button and pop goes the stoat — you're in the house of your choice.

The basic scheme of the game is to locate the explosive bomb and match — then you can blow the safe. Having grabbed the diamond and whatever other jewellery may be lying around in the house, you can then move on. Each house contains 20 screens including the vital bottle of stoat elixir that boosts Sam's blood level — shown graphically in the form of a syringe at the bottom left hand side of the screen. At the top is shown high-score and how much money you personally have gained ill-gottenly.

The maximum score attainable is, we are assured, £64,384. This is not a game that I personally would go wild over. When all's said and done, it has to be remembered that the four houses with 20 screens are just the same house with different levels of difficulty. Some nice graphical possibilities are hinted at, but Gremlin have a little way to go yet if they want to mutate into something bigger and meaner. Keep trying though, lads.

Paul Bond


Icicle Works

Icicle Works

- *Spectrum 48K*
- *Boulderdash clone*
- *Statesoft*
- *£6.95*

★ ★ ★

DID THE ELECTRO-WIMP band name themselves after the game or vice versa? We may never know. Nevertheless, Icicle Works is a taxing and exciting game which bears many hereditary traits of Statesoft's earlier big hit, Boulderdash, for the Commodore 64.

The similarity lies in the snowballs. You dash around the screen, clearing paths and collecting parts of objects. If a bunch of snowballs falls on your head, you lose a life.

There are four main screens apart from the entry screen. This last is quite simple. You just saunter down from the top of the screen, grab a two-part key and decide which set of stairs you are going to go down.

In the first set you assemble a jet fighter and release a stream of water.

(continued on page 41)

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Star chart

Mama Llama

CBM 64
£7.50
Arcade adventure
Llamasoft

★ ★

Ingenious 10 by 10 rotating grid enables you to select from five scenarios in which you protect Mama Llama and her two babes voyaging through the cosmos. You can place retrogenesis and antigenesis devices into areas of the game to block attacks for you. This is an irritating game to play — games for purists are all very well but we at YC feel Jeff's getting too involved in his own head.

Frankie 2000

BBC Micro
£7.95
Fantastic voyage
Icon

★ ★ ★

Right-hand side shows X-ray view of human body, indicating where your minisub is in the bloodstream. Left-hand side is the arcade action as you journey through the trachea, etc., shooting germs. In the left lung you encounter cigarette ends!

Berks

Commodore C-16 and Plus 4
£6.95
Robotronesque
CRL

★ ★ ★

More genocide. Tool around shooting at pathetic robot Berks edging their way round a total of 32 randomly generated maze screens. Paralyse the flashing diamonds that threaten to crush you. And serve you right.

Major Blink

Commodore 16 & Plus 4
£6.95
Painter
CRL

★ ★

Major Blink is the creator of the Berks. He is harassed by "bears" and drones who try to stop him painting the blocks on the screen. A competent implementation of this old favourite.

(continued from page 39)

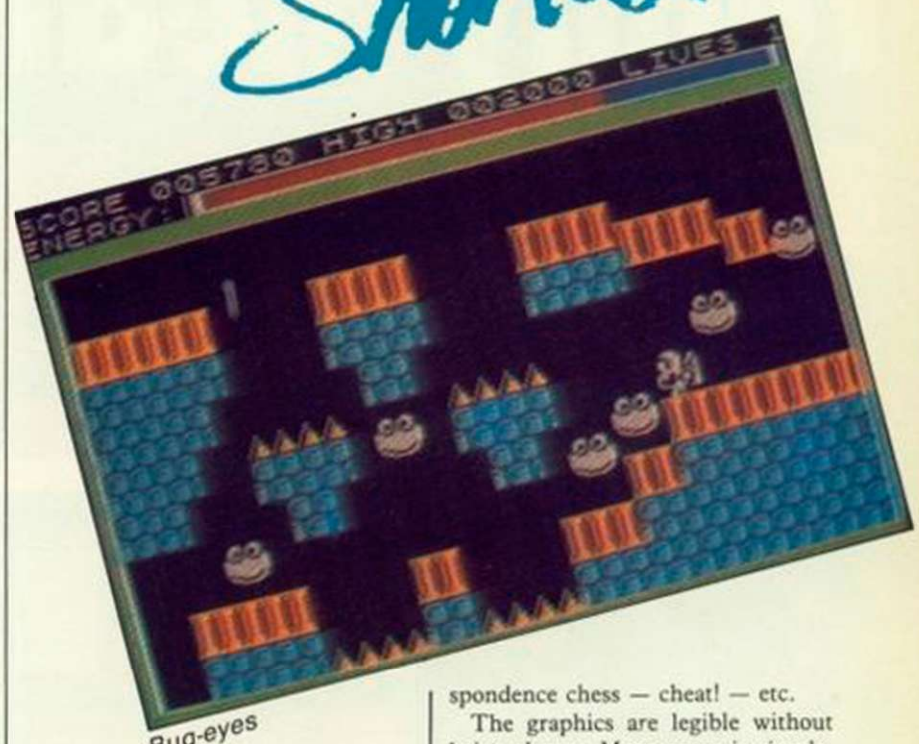
On the second set you build a railway engine while moving around a maze; in the third you attempt to destroy volatile puffins by dropping snowballs on them; on the fourth you assemble a ghetto blaster.

The modus operandi on the last screen is the most ingenious of all. The screen displays a central line of mystery boxes. You knock snowballs down on to them. When you clear a path underneath segments of the ghetto blaster fall from the boxes. You then sweep back and collect the parts. As with the engine and the jet what you are building is gradually displayed on the right-hand side of the screen. Once you have built the radio you start collecting bonus points — but only if you collect the individual letters B-O-N-U-S in the correct order.

Each of the four main screens has exit doors which you use to pass through into ever more mind-boggling levels. You have to get through each part of the game in a certain time — too little time! — this one should appeal to the Chinese puzzle mentality.

Paul Bond

SOFTWARE Shortlist



Bug-eyes

Bug-eyes

- *Icon*
- *Arcade adventure*
- *Spectrum 48K*
- *£6.95*

★ ★ ★

XXABANEANS RULE OK. Well, of course it's not OK since they intend to wipe out all intelligent life and have the universe to themselves. The dummies have invaded earth in a giant starship disguised as a meteorite. Your job is to penetrate down through the 10 levels of the ship and destroy its power generator.

Well-implemented graphics and a sense of humour make this game worthy of comparison with games in the style of Manic Miner. The big-nosed gliding ogre, the terrible twisting thingies, the wigglers and Big Jake all combine to despatch you with a desparing little squeak — all the more pathetic because of the Spectrum's not-wonderful sound capacity.

On the first screen you encounter the stamping stompers, a fiendish arrangement of ascending and descending plungers which make it a little like trying to walk through an internal combustion engine. Your little spaceman can only walk forwards or back, no jetpacking. Timing is of the essence. On most screens it is worth finding a place to ponder on how to scramble through the next set of obstacles.

When you fall through into the second screen you face the blinking bouncers. You also have a problem with disappearing bridges. The combinations of problems seem to grow increasingly more complex as you approach the base of each screen. You might miss the bouncers just to find yourself plummetting onto needle sharp rocks from a non-existent bridge.

Lazer phazer blazers, the third screen, is really two screens in one. There are three layers of ray guns then you have to work through a cavern of spiders casually reeling and unreeling from the roof on their grisly gossamer threads.

Icon may not be a prominent name now, but with quality like this they soon will be.

Paul Bond

Colossus Chess 3.0

- *Atari*
- *Chess game*
- *English Software*
- *£9.95*

★ ★ ★

IS THIS THE greatest chess program on a micro? According to the handbook, Martin Bryant's Atari conversion of his Commodore 2.0 original thrashed 21 other programs mostly by 16-0. That includes Odesta's Chess 7.0 — Apple/Atari — based on a former World Champion program. White Knight II — BBC — it beat 13-3, Sargon III 10-6, and the excellent Parker Bros Chess — Atari, IBM PC — written by David Levy's Intelligent Software (Cyrus IS) — by 12-4. The list does not, however, include Psion's 3-D Chess on the Sinclair QL.

I tested it against the Parker cartridge and it confirmed its form. When it plays in Tournament mode — one of the six available — it claims an ELO rating of 1800 and gives moderate club players like me a challenging game. There are easier modes for beginners, plus Infinite and Problem modes for correspondence chess — cheat! — etc.

The graphics are legible without being showy. Move entry is simple, by either typing them in (e2-e4) or using the cursor keys. Pressing the space-bar toggles between the game board and a separate screen which lists the moves, shows the time on each player's clock, position and material rating and the program's latest thoughts.

Colossus also offers most of the other features you might want, including back-step, save and load game, and replay. You can even adjust the weight according to which positions are assessed, as like most programs Colossus will swap a small amount of material for a large positional inferiority.

The only major flaw is the handbook, which is almost illegible — black dot-matrix type on red paper — and has a cover of almost unsurpassed embarrassingness.

Atari chess enthusiasts have a number of options — Sargon, Chess 7.0, David Kittinger's 3-D Mychess, Parker Bros Chess — but except for the awful Atari Chess cartridge, they are all at American prices, i.e., very expensive. The fact that this is British, probably better and third to a fifth of the price makes it a best buy on either tape or disc. Highly recommended.

Jack Schofield



Colossus Chess 3.0

(continued on page 43)

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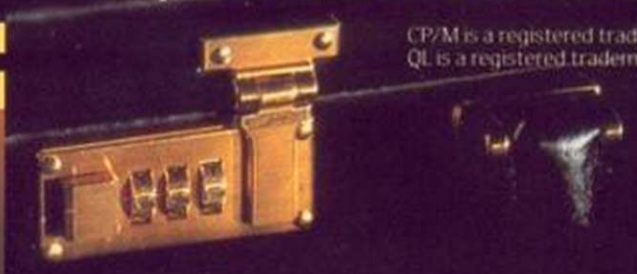
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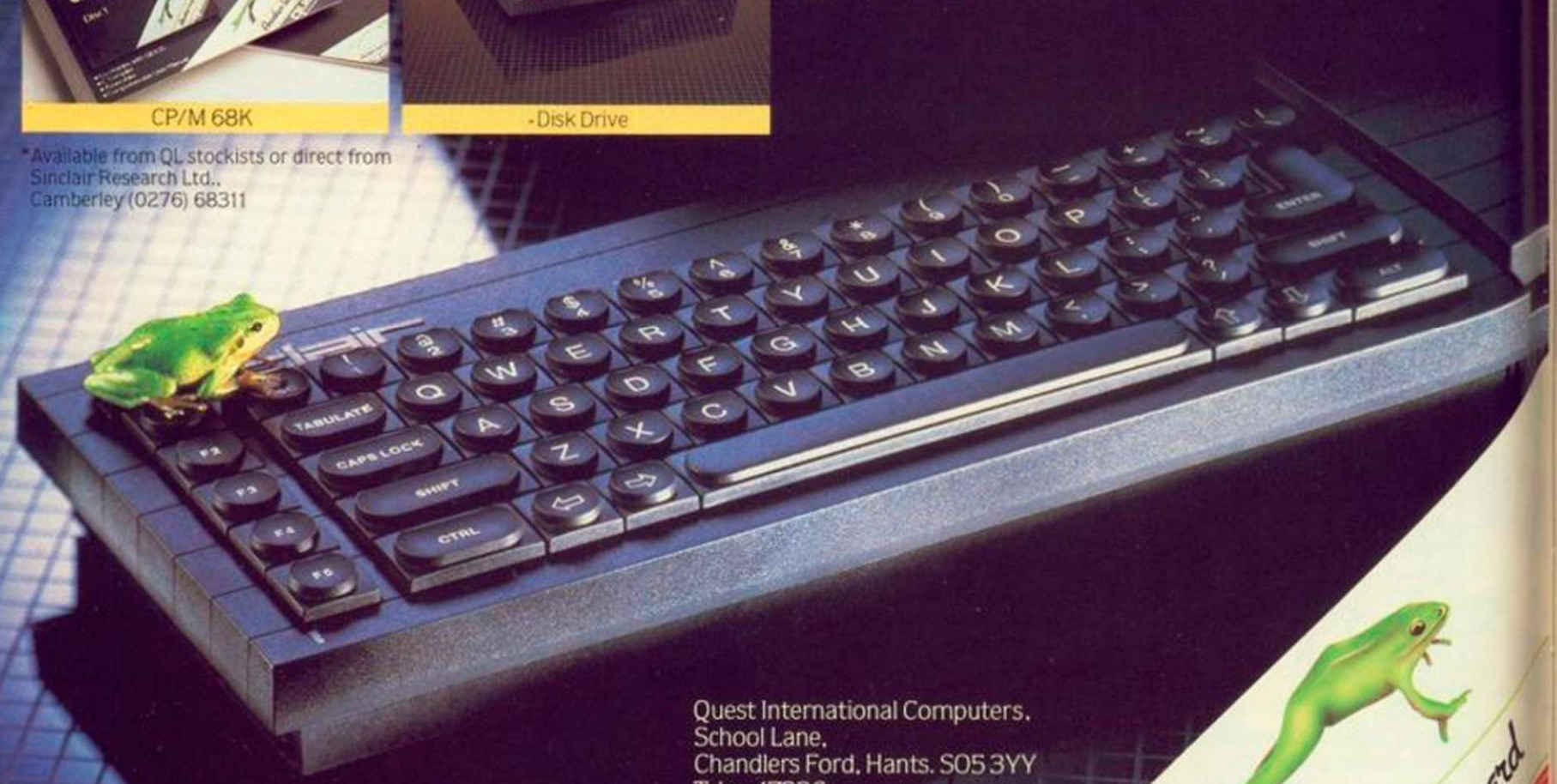
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Star chart

Android 1

CPC 464
Vortex
Shoot-em-up
£7.95
★ ★

Vortex made a name for themselves with TLL and Cyclone. They might have done better to bring out conversions of those games rather than this rather tedious game. Primitive graphics combined with naff sound effects and unoriginal material make this possibly their worst release to date. You have to get to the reactor core before it blows up. To do this, you shoot your way through walls, go through mazes, sideways scrolling and plan views. Naturally there are mutants to blast out of the way.

Don Juan

Oric/Atmos
No Man's Land
Adventure
£8.50
★ ★

Perhaps it was inevitable that sooner or later this French software house would turn to the national obsession — l'amour. Given a choice of a number of young ladies to attempt to seduce, of varying coyness, you must seek to entice them into your little love nest by entering the right keyword at the right time. Some nice humourous touches; might provide some entertainment when inebriated.

Rocketball

C64
IJK
Sport Simulation
£6.95
★ ★ ★

"This was never meant to be a game" in case you hadn't guessed this is Rollerball, hailed at the time as a grotesquely violent film IJK have removed all the blood and gore, and discover underneath a pretty trivial sort of game. Not bad as sport simulation goes, but I don't think International Football will be knocked off its perch by this one.

(continued from page 41)

Banjax

■ *BBC*
■ *Robico Software*
■ *Arcade Adventure*
■ *£9.95*
★ ★ ★

BANJAX IS one of those games that is enjoyable to play even though you do not get very far with it. Despite having been given some tips by Robico this reviewer was only able to explore less than a quarter of the game's 240 locations, but liked what he saw: pleasant landscapes, smooth animation, and just enough threats from spiders, blobs and suchlike to keep you on your toes.

It also boasts some of the best graphics in a BBC game since Frak. Like Frak is uses Mode 1 but varies the pallette to give a different four colours in each screen.

Although challenging enough for those who seek challenge, the game has a pleasingly relaxed quality. As the character you control — a bear wearing a baseball cap — is unarmed you must avoid hostile creatures in your path. But if you do not feel up to dodging them you can leave the room. And when you return they are usually gone.

Some rooms, however, are blocked by gargoyles and guards. To gain access more energetic adventures will need to collect an assortment of objects. They will also have to map the territory thoroughly if they are to achieve the goal of the game and reach the Inner Sanctum of the Golden Temple.

Simon Beesley



Tempest

Tempest

■ *BBC*
■ *Superior Software*
■ *Arcade Classic*
■ *£9.95*
★ ★ ★

IN HIS excellent survey of the arcades, *Invasion of the Space Invaders* Martin Amis calls Tempest the most abstract of all arcade games. The player is in charge of a claw which patrols the rim of a grid, a cobweb-like shape with lanes converging on a hub.

Out of the hub come a variety of what can only be described as animated geometrical figures — spikes, diamonds, stars, and so on. The player's task is to contain them — with the aid of a blaster or, as a last resort, a super zapper.

This version, translated to the BBC with Atari's approval, is the first to appear on a home computer. In its arcade form the use of sharp vector graphics creates a spectacular display as the various shapes cart-wheel outwards and then flip along the rim. But much of the game's impact is lost with pixel graphics: lines look too jagged at this resolution.

Nonetheless Tempest is a sufficiently original game to be worth playing however it is implemented. As far as possible Superior Software have recreated its features faithfully, with nine different grids, 255 levels, and, although rather fuzzy, fast-moving graphics.

Simon Beesley

SOFTWARE Shortlist



Banjax

Flyer Fox

■ *Commodore 64*
■ *Flight emulator*
■ *Tymac*
■ *£9.95*
★ ★ ★

A NICE SIMPLE stick and string air combat emulator, spoilt somewhat by the premise that Mig fighters feel the need to shoot down civilian airliners in international airspace. They only do it in Soviet airspace. You are piloting a fighter in escort of a passenger jet. The screen display gives you radar on the left, compass on the right, artificial horizon in the centre plus showing altitude, fuel and score. Messages are also flashed up on the altitude reading to inform you when you are at the same altitude as the jetliner and also to warn you of imminent contact with hostile aircraft.


Flyer Fox

The view from the cockpit shows a flat plain criss-crossed by straight lines to form a geometrical grid. This stretches away convincingly to mountains in the distance. When the game starts you are automatically elevated to the same height as the air-liner you are defending.

You can't get any higher than the airliner. It always flies at your service ceiling.

Just before the attack the computer speaks — no add-ons required — and says "Mayday". It says other things at other times, all of them unintelligible.

All in all, good graphics, gripping combat action, garbled speech synthesis, all combine to make a tense and enthralling game.

Paul Bond


Dragon Torc

Dragon Torc

■ *Spectrum 48K*
■ *Arcade adventure*
■ *Hewson Consultants*
■ *£7.95*
★ ★ ★

MAROC IS back. So what? Well, this is the entity who vanquished the Lord of Chaos and banished him from his earthly realm — a neat thing to mention in job applications. Afficionados of Hewson's Avalon will remember him; more importantly, they will have experienced the lateral thinking necessary to get things done in this program. Hardly anyone does anything for themselves; Maroc kicks off by projecting his soul — not one of the more manoeuvrable souls I may

(continued on page 45)

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Star chart

A Day in the Life

Micromega
Spectrum
£6.95

★

One of those twee games featuring you-know-who (snigger, snigger) a bloke with bald head and glasses who is (tee-hee) quite important in the (ha-ha) U.K. computer industry.

Oh no, oh no it's no good I can't hold back, it's Sir Clive and the game has really primitive graphics.

Dukes of Hazzard

Elite
Spectrum
£6.95

★ ★ ★

Them good ol' boys can now just roll along your Spectrum. The screen display is excellent and the game is rather more playable than some of Elite's previous offerings.

Up to now the company's main achievement has been the holographic label on the outside of the cassette.

The Duke boys have to make it to the start line of the road race but helicopters, Hell's Angels, and of course, Boss Hog, all conspire against them.

They drive along the motorway changing lanes and chucking bombs at on-coming vehicles. More fun than a traffic jam.

Pacmania

C-16
Pacmanesque
Mr Chips Software
£5.99

★ ★ ★

The old arcade classic revisited on the Commodore 16. Afficianados of Acorn Snapper or other more traditional implementations of the Atari original will probably find themselves shocked and stunned by this version.

The ghosts are completely anarchic, they hold to no known norm of civilised behaviour, recovering almost instantaneously.

(continued from page 43)

say — but quite a lot of Maroc's soul's work is done for him by a servant creature.

To move, you get the arrow pointing to move. Press the fire button once and the scroll changes to show the move you have selected and how many more uses of it you have left. "Project they soul" hints the scroll. In the style of Gargoyle's Tir Na Nog, you have to move around on pathways.

To access the servant, you scroll as before and press the fire button twice. A small will-o'-the-wisp appears which you control with the joystick instead of Maroc.

The graphics are rough — scrolling, sacrificing smoothness for colour, so sometimes irritating to the eyes. But I am sure that the actual mechanics of the game will prove an irresistible addictive factor to adventure fanatics.

Paul Bond

SOFTWARE Shortlist

Body Works

- *Spectrum*
- *Genesis Productions*
- *Educational*
- *£14.95*

★ ★ ★ ★

IS THERE a doctor in the software house? Yes, there is, and it's Dr Jonathan Miller, star of stage, screen and operating theatre. If you don't remember Beyond the Fringe you may remember the mammoth documentary called The Body in Question.

The program in question is based on the pop-up book *The Human Body*, also published by Genesis Productions, a new company specialising in books and computer software. Consultant physician David Jefferys also worked on the project and one suspects a lot of the real slog was done by Five Ways Software's Andrew Rutherford (graphics), and Roger Moffat (code).

The program takes you on a trip round your body, dealing with cells, digestion, respiration, circulation, nerves, and muscles culminating in a marathon run simulation.

Interaction is the name of the game. Apart from pushing the space bar to animate each function, you can key in your own data. So you can choose between fats, proteins and carbohydrates in the digestion program.

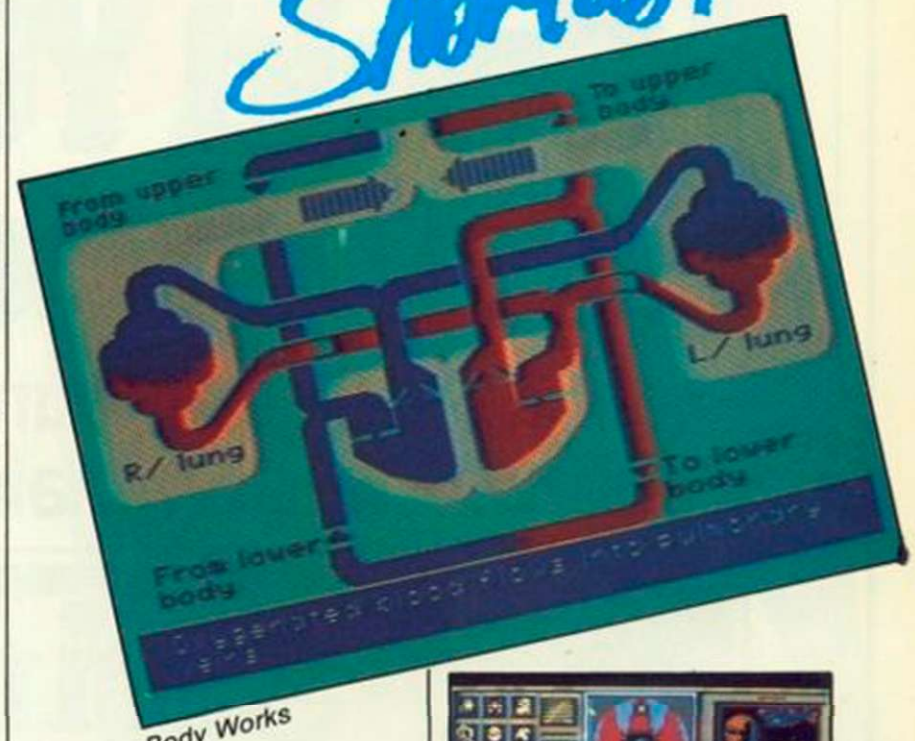
It's not a biology revision program — it doesn't claim to be.

What it is, is an informative and interesting way of putting ideas together for yourself.

The final program in the suite, Marathon, is like a flight simular for the human body. Running eight times faster than real time, the simulation allows you to enter a course from 5-26 miles.

The body monitors displayed on the screen in the form of black graphs include heart rate and output, stroke volume, temperature and lactate.

Paul Bond



Body Works

Shadowfire

- *CBM/Spectrum*
- *Beyond*
- *Adventure*
- *£9.95*

★ ★ ★ ★

IN THIS ADVENTURE your quest is to transport your crack and deadly — why can't they be bungling and harmless for a change — team onto the enemy spaceship. Once there, you have to fight your way through the corridors to rescue Ambassador Kryxix.

All this in 100 minutes of real time before the Ambassador cracks under interogation and tells the bad guys Prince Phillip's Prestel mailbox number. There are six members of your party, each of which have particular strengths and weaknesses. There are various characters around to fight off, doors to open and things like the self destruction mechanism of the ship left lying around.

Lee Paddon

Super Huey

- *Spectrum*
- *Cosmi/U.S. Gold*
- *Simulator*
- *£11.95*

★ ★ ★ ★

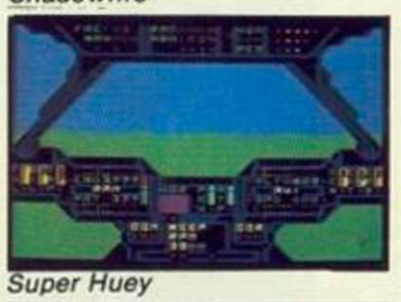
THE GAME goes out of its way to take you gradually through each learning stage till you gain mastery of your "flying gearbox". There's plenty of clear instruction in the manual, including a step-by-step guide on how to get into the air, no mean feat! Once up there your friendly computer will provide you with handy hints on how to stay there.

Once you think you've got the controls sussed, you're ready to proceed onward.

Lee Paddon



Shadowfire



Super Huey



Spitfire 40

Spitfire 40

- *Commodore 64*
- *Mirrorsoft*
- *Simulator*
- *£9.95*

★ ★ ★ ★ ★

THERE ARE three display's — the traditional out-of-cockpit, the obligatory map, and a superb reproduction of the Spitfire instrument panel which takes Commodore graphics to new heights. Not combining the instruments with the forward view has two advantages, better instruments and a better view from the cockpit.

Three game modes are included: practice, combat practice and combat.

Lee Paddon

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STRINGER is an arcade adventure game in which you are a press photographer for the "Daily Blurb" set the task of snatching a shot of a Film Star, Polly Platinum in an hotel. To hinder your attempts your camera, flashbulb, press pass and the key to the lady's room have been hidden in the hotel and these items have to be recovered before the all important shot can be taken. To add to your troubles the hotel staff are bent on catching you before you reach your goal and your Editor has set you a strict deadline for the completion of the task.

The game has 5 skill levels and 10 screens of increasing difficulty. It is tantalisingly playable, graphically excellent and, of course – Addictive! Available . . . . Commodore 64 £6.95

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Software Star
"It carries the Kevin Toms hallmarks of attention to detail and carefully tuned difficulty" *Popular Computing Weekly, February 1985.*
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NEWS oaeo rsu ttt h h

The crystal ball

There's some exciting news from those adventure writing geniuses at Level 9. Later this year, they plan to release the first in a series of mega-adventures which they say will be as large, complex and detailed as those published by Infocom. And don't worry if you haven't got a disc drive — they'll also be available on cassette. Cost is likely to be around £15.00.

Enterprise owners have not been overlooked — Level 9 adventures can now be obtained for this machine.

Other imminent new releases from Level 9 include Red Moon — £6.95 — and The Worm In Paradise — £9.95.

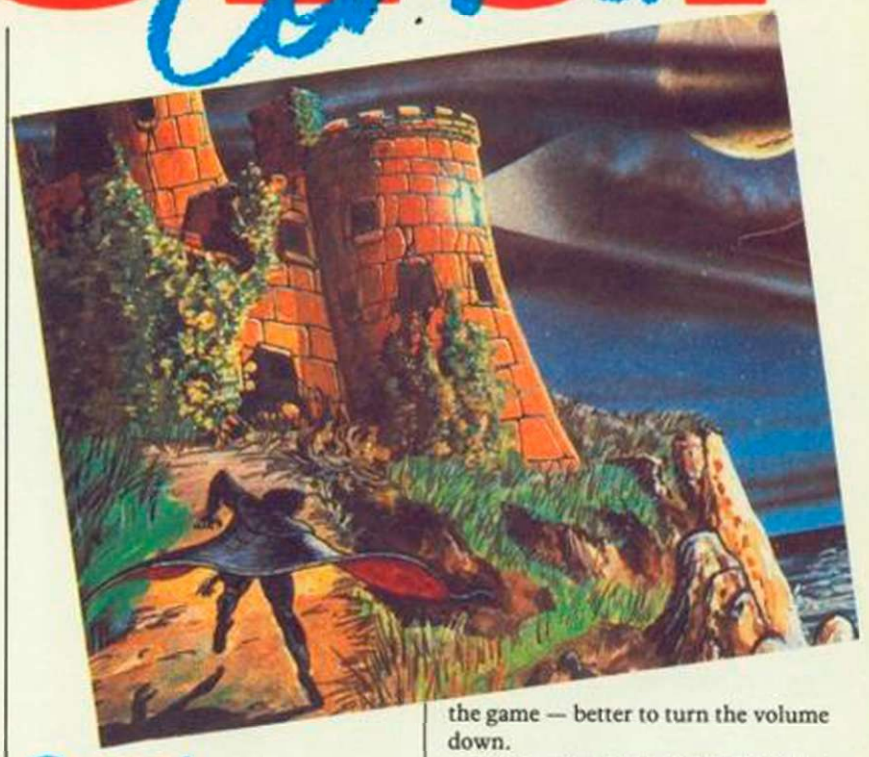
Amstrad and MSX owners can now try Melbourne House's famous Hobbit adventure — £14.95 — for themselves. In addition, a reworked version of The Hobbit, on disc only and for Commdore 64, Apple and IBM PC owners, is available in the UK. The new version includes extra problems, additional text, larger vocabulary, enhanced graphics and, for the Commodore 64, complex music throughout the game.

A helping hand

Here's a trio of tips for Spider-Man devotes:
Sandman proving a gritty problem?
ROGN EHT G NILI ECOG
Not getting far up the elevator shaft?
PU OG NEHT UP HS UP
Madam Web a mystery to you?
OTRE HKSA UOYF IUOY ROFS GNIH TNAC SLLI WEHS
Yours in adversity and adventure,
HUGO NORTH.

QUEST Corner

Our man with the brass lamp and the key to a thousand mysteries sheds light on new adventure programs. Lost? Never fear, Hugo North is here.



Heroes of Karn

- *Spectrum 48K*
- *£6.50*
- *Interceptor Micros*

HEROES OF KARN is a text and graphics adventure that first appeared for the Commodore 64. It proved to be very popular and has now been translated for the Spectrum.

Although the plot and puzzles are identical to the 64 version, the Spectrum program wins hands down in the graphics department, has a small edge in the text input contest but, naturally enough, loses by a mile in the music stakes.

Unlike the 64 version, not every location is depicted graphically but those that are included are magnificent. Credit for the superb computer artwork goes to Terry Greer, as credited by the cassette inlay. The pictures appear instantaneously and are beautifully drawn using colourful high-resolution graphics.

The Spectrum's lack of sound capability means that the impressive music of the 64 version has had to be foresworn. However, the input parser has been tidied up making the acceptance of more complex commands much easier to use.

The plot involves you searching a fantasy land for not one but four lost heroes. The adventure has a host of puzzles, most of which involve hitting on what object to use with what item. The heroes themselves have different capabilities and in certain situations can do things that you could not do by yourself. It is therefore essential that you locate at least one of the lost heroes quite quickly. Finding the first lost hero, Beren, turns out to be quite easy, fortunately.

A thoroughly enjoyable adventure with some of the best graphics on the market.

Grand Larceny

- *Commodore 64*
- *£7.95*
- *Melbourne House*

THIS IS THE second of what Melbourne House call their "joystick adventures". If you've played Zim Sala Bim, their first one of the series, then you'll know precisely what they mean. The adventure is a combination of traditional text and scrolling graphics.

The plot involves your recovering some secret plans which are about to be smuggled out of the country. If the enemy agents believe you are on to them, they will stop at nothing to escape.

You start the adventure outside a large hotel, your first problem being to get inside. The rest of the action takes place inside the hotel which you can explore by riding in the lift or nipping up the fire escape.

The cassette inlay describes the game as having "smooth, arcade style graphics" and "every location brilliantly displayed in 3-D". What you actually get is a minimally animated figure walking in front of some quite uninspiring and very two-dimensional backdrops.

The figure ambles to the left or right in response to the movement of your joystick — or by pressing the "less than" and "greater than" signs on your keyboard. The background scrolls in the appropriate direction.

The graphics mostly consist of hotel rooms and are simplistic stylised representations. Some fairly nondescript music plays throughout the game — better to turn the volume down.

The bottom part of the display is reserved for text input and output. When your character is stationary, you can type in the usual sort of two word command e.g., get knife. The program only recognises the first two letters of each word so abbreviated commands are acceptable. Response to your input is instantaneous but terse.

There seems to be a non-fatal bug in the program. When you move to the extreme left of a floor above ground level and type Look, the description given is not of that location but relates to a location on the floor above.

I found Grand Larceny to be quite tedious, lacking in interesting puzzles and totally devoid of atmosphere. However, if you enjoyed Zim Sala Bim, chances are you might like this one.

Quest for the Holy Joystick

- *Spectrum 48K*
- *£4.95*
- *Delta 4 Software*

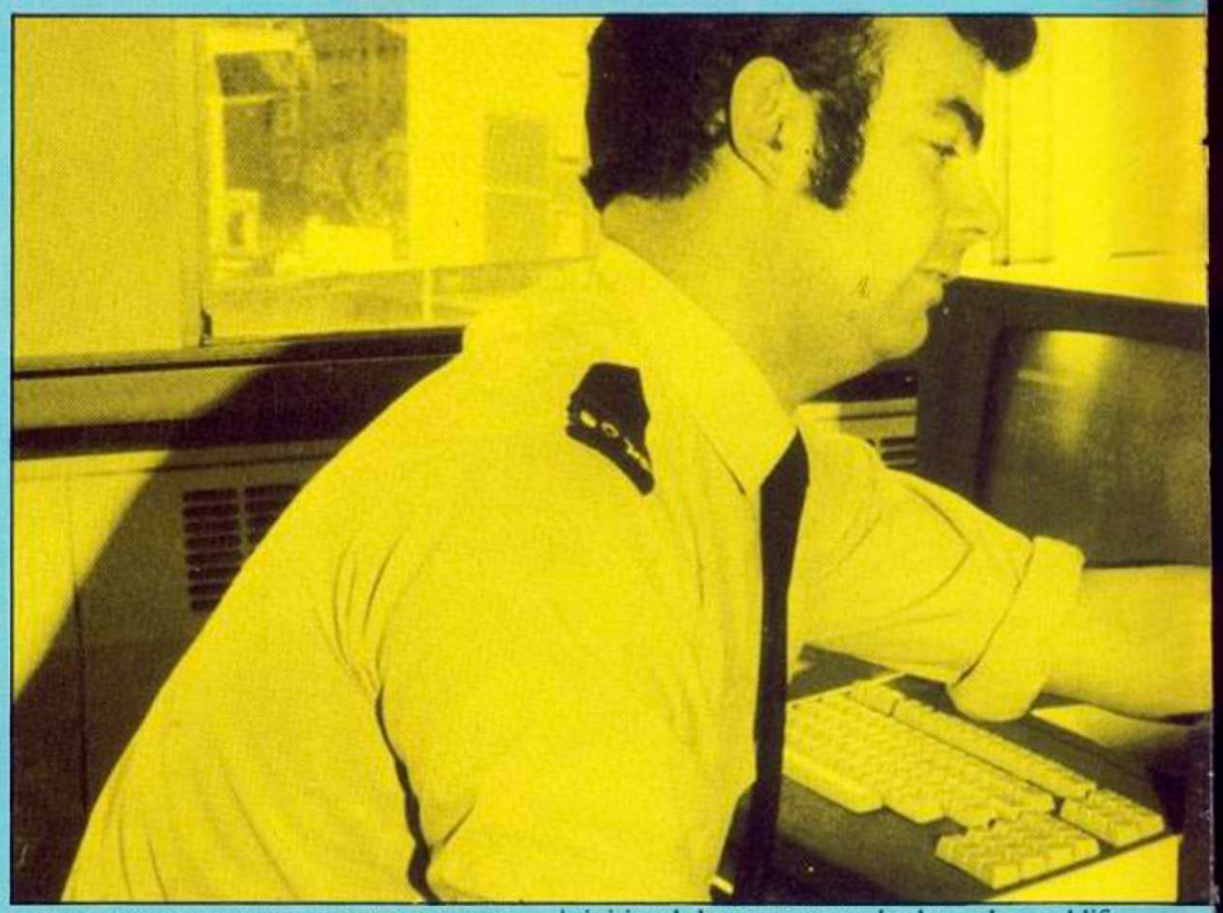
THIS QUILLED text adventure is a zany spoof set around the ZX Microfair. You'll encounter many well known characters and companies who bear more than just a passing resemblance to famous names from the world of computer games and adventures.

The is also a sequel — Return of The Joystick — which has graphics and includes some extremely funny pastiche title screens.

The games are available by mail order (04893 5800) and are sure to provide you with many a belly laugh.

COMPUTER C

Meirion Jones investigates a potentially explosive new crime wave instigated by that master of the keyboards — the hacker.



"You never know who's on the end of a hacked line. Watch out, there's a computer cop about."

COMPUTER CRIMINALS will steal at least £1 billion in Britain this year — that's a Great Train Robbery every day in 1985. But unlike the train robbers, most of the electronic thieves will get away with it and even if they are caught, financial institutions are unwilling to prosecute because public confidence in them might collapse if people knew how easy it had been to breach their security.

In America the problem is worse still. Computer fraudsters range from high-ranking company officials who have invented whole communities on magnetic tape to make business look as if it's booming — as in the multi-million dollar Equity Life insurance scandal — to individuals who have re-suscitated thousands of dead clients in order to pay the pensions into their own accounts.

Interfering with delivery and accounts programs has also produced spectacular results, in one case the disappearance of 200 rerouted freight wagons, in another the collection of a million dollar's worth of components without payment.

And in the unlikely event of the fraudster ending up in jail, white collar criminals don't need to dirty their shirts digging tunnels to escape, they can always follow the example of the Ohio prisoner, who having access as a trustee to a terminal in the library simply used it to bring forward his release date on the computer.

These are just some of the cases that have been discovered and as Brandt Allen, an American researcher who helped to publicise the problem of computer crime in the early 1970s writes, "the first time I assembled a set of computer fraud cases, I was struck by the incompetence of most of the embezzlers who had been discovered. Since the computer provided such a high degree of fraud potential, I wrote at the time, "I can't help wondering what the really clever people are doing" with the computer. I think the biggest computer frauds are still to be revealed."

All this pales into insignificance with the fears of Mr X, a British computer consultant who does not wish to be named. So far, most computer crime has been the work of professional criminals or employees who have taken advantage of their privileged use of a computer.

The amateur hackers — equipped with nothing more than a home computer, modem and a quick brain have been more of a nuisance than a threat to the big companies. Despite the fantasies of films like War Games where global thermonuclear war is almost initiated by a teenage hacker, the real-life exploits have been more usually of the order of the diversions of Pepsi-Cola shipments across Canada, which the pupils of Dalton School, Manhattan, reportedly perpetrated, or again in New York crashing a TV network.

But Mr X believes that all this will change in the next couple of years as modems become as common as data recorders and 16 and 32 bit chips give home micros the capabilities of the minicomputers that run companies today. Six years ago a powerful VAX 750 mini cost £80,000 for a machine with 500K Ram and a 15 Megabyte hard disc drive. Atari plans to offer similar kit for less than £2,000 this year and companies like Commodore and Sinclair will not be far behind.

Armed with that power, the hackers may take some stopping. Mr X believes that if something like the mining dispute was to happen again organised team of hackers could cause power cuts, "you don't need pickets,

HOW IT ALL BEGAN

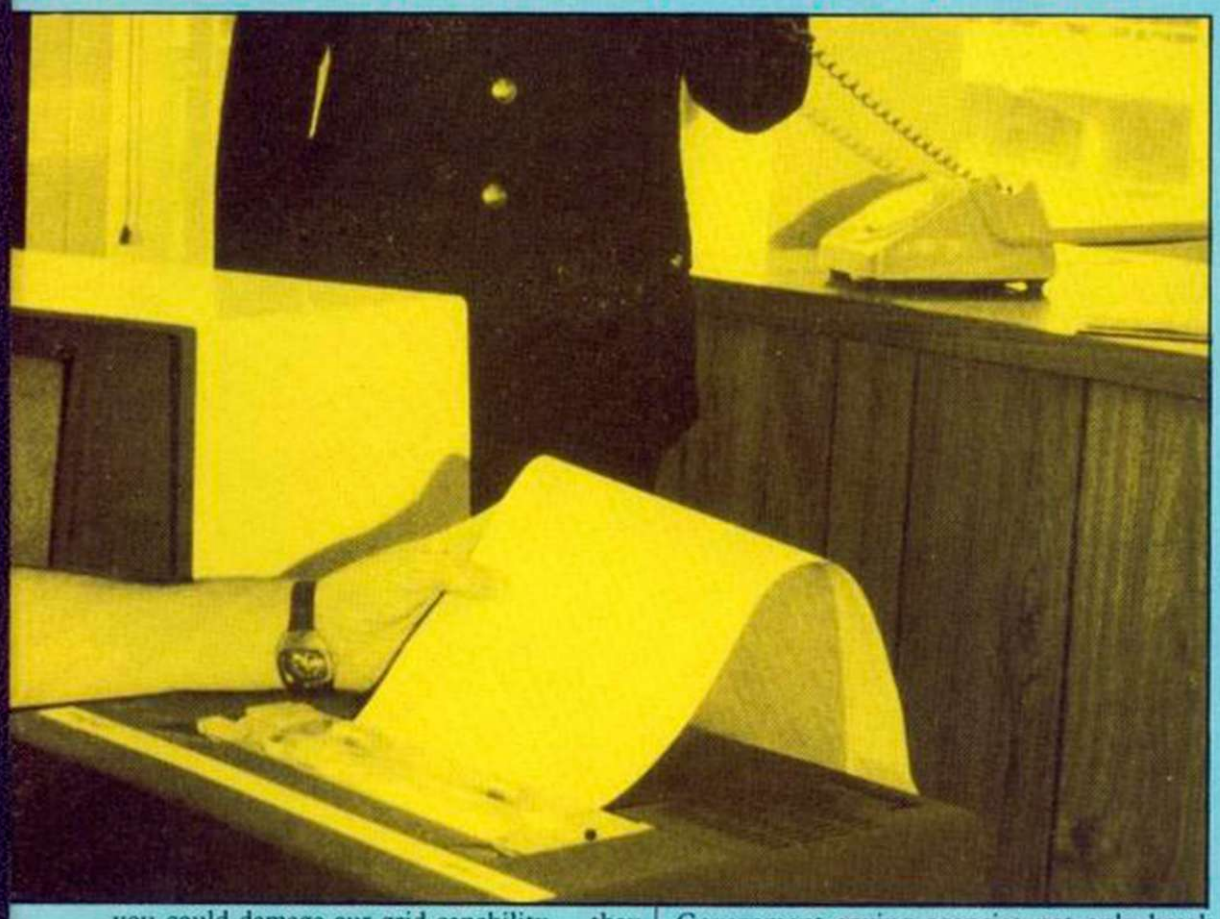
Early computer crimes were unsophisticated but effective. One simple trick, first used in New York was to remove the blank deposit slips on the counters of banks and replace them with apparently blank slips encoded with the fraudster's account number.

When customers filled in the slips as they deposited money the fraudster's account was credited — and with a carefully timed withdrawal from the account the fraudster could be away before anyone noticed that their accounts were awry. Programmers with criminal tendencies who found themselves writing financial software opted for more subtle tricks — the so-called Trojan Horse, a fragment of code buried in a program which looked secure from the outside but which could trigger an unscripted diversion of funds.

These became known as Time Bombs if they were triggered by the central processor clock and Logic Bombs if they were set off by a particular event which might be triggered to suit the programmer. Rather than these one-off raids some villains incorporated subtle routines which stole almost imperceptibly small amounts of money at a time — rounding up cheques by a penny or a cent for instance and sending the difference to their accounts — but on a large number of transactions.

This Salami technique can be very effective in large organisations — one service transfers £27,000,000,000 a day across the Atlantic. You would only need to divert one part in a million to make yourself a millionaire in a matter of weeks.

RIME REPORT



you could damage our grid capability — they could have brought the country down". He also suggests that groups that are opposed to deploying nuclear weapons, like the Greenham women, might be able to disrupt Ministry of Defence Systems — although Sabine Kurjo, who organises anti-war computer users in a Peace Network, has never heard of any such attempts, "none of us would dream of hacking into military computers".

Government cuts which affect scientists' jobs could also be dangerous says Mr X. "Ministry of Defence people are working on systems which can break any computer on earth. The government is paying them to do it — put a few of them out of work . . ."

Government spying agencies not only break their way into private computers, they sometimes deliberately make the job easier by reducing the security of commercial codes.

In America the National Security Agency which runs most of the spy satellites and surveillance interfered with the choice of the National Bureau of Standards Data Encryption Standard to make sure it was set at a level, 56-bit key with 64-bit cryptogram, that the NSA could break. Mr X thinks that the threat posed to major companies by hackers is not just the loss of few percent of turnover as with shoplifting but the complete destruction of their whole organisations. "It's not the petty pilfering, or even the major pilfering that worries them now. If you want to bring down a major company, even IBM, all you have to do is modify profit margins."

Mr X sees a total and unavoidable collapse of companies as the hackers are let loose.

Faced with such apocalyptic predictions it is no wonder that Scotland Yard's computer crime chief Detective Inspector John Austen is calling for a ban on books like the recently published *Hacker's Handbook* which tells you how to set about breaking and entering other people's mainframes down your phone line.

But the book's author, who goes by the name Hugo Cornwall on the title page, believes that hacking is harmless so long as the participants follow a sort of countryside code: "Don't manipulate files unless you are sure a back-up exists; don't crash operating systems; don't lock legitimate users out from access; watch who you give information to; if you really discover something confidential, keep it to yourself." Cornwall also believes that "most hackers are not interested in perpetrating massive frauds. Modifying their personal banking, taxation and employee records, or inducing one world super power into inadvertently commencing Armageddon in the mistaken belief that another super power is about to attack it."

Cornwall prefers to think of hackers as the pranksters who raided Prince Philip's Prestel mailbox and bedevilled every public demonstration of Telecom Gold. Despite assurance from Telecom that the system was secure, Radio @'s Chip Shop presenter Barry Norman found his Gold mailbox raided on a number of occasions and the first demonstration of Telecom Gold on live TV was also disrupted by the appearance of a hacker's message. ■

WATCH OUT-HACKERS

Police fear that the current publicity will give away the "secrets" of hacking and so open up the possibility of computer crime. But once a hacker has the necessary equipment — micro, phone line and modems capable of transmitting and receiving at any baud rate in any protocol and data format which the target computer might use — much of the necessary information such as passwords for breaking into systems is easily available.

Bulletin boards — the electronic noticeboards accessible with a modem, or their more prosaic counterparts, the tatty pieces of paper passed around at computer clubs, often carry a few interesting numbers for enthusiasts to try. For a professional criminal many passwords are easy to find. At exhibitions an access number may be taped to the side of a machine in full view of the public, or typed in while people are watching. A single repeated symbol from the keyboard may trigger a test number and many people use their initials or birthdays as passwords.

Increasing the number of passwords needed to access a system can also cause problems. Clive Blatchford — in charge of ICL's computer security — told a computer crime conference last month that almost no-one who has to remember more than two Personal Identification Numbers trusts their own memories enough not to carry them around in a diary or on a slip of paper. Blatchford told his audience — mainly people in charge of computer security that if he picked their pockets he would expect to find out the PIN numbers for at least one in three of them.

If the hacker has most of the digits of a number, an autodialler can run through the remaining possibilities — although most systems now cut off a modem after two or three false attempts. The professional criminal might buy specialist equipment which can analyse a stream of data and tell you what protocols and formats are being used. Even closed computer networks can be cracked if you can get close enough. £200 would buy a would-be villain a device which could measure the variations in electromagnetic pulse put out by a computer. According to Blatchford an unscreened terminal puts out 150 microvolts 30 feet away — while the device can pick up fluctuations as low as one microvolt. By listening in to the beginning of each transmission the bug could capture the passwords and identification codes. No wonder that some companies now spend up to £500,000 to screen a room which is going to take a £50,000 computer.

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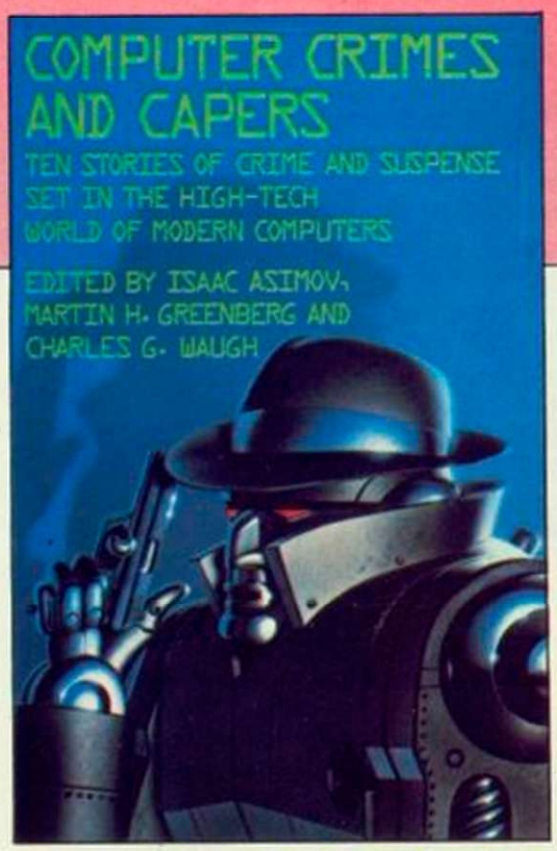
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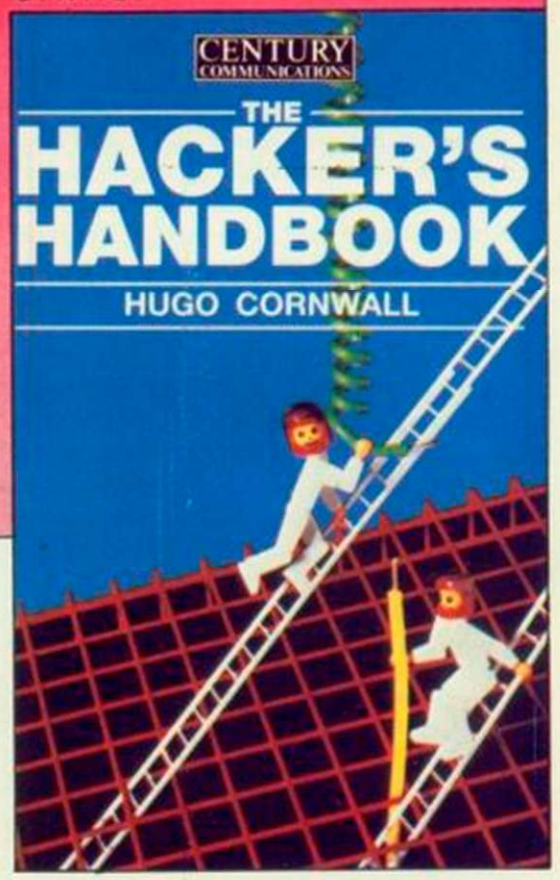


Win £600 of prizes from Enterprise for the best idea how to cheat in an exam or pull off a scam using a computer. Five runners will each get two great books on hacking and computer crime.

Enterprise computers is putting up its first 128K Ram computer together with a printer and software to make a fabulous first prize.

Runners-up can brush up their cheating with Viking Press's Isaac Asimov collection of silicon science fiction called Computer Crimes and Capers plus...





...The Hacker's Handbook by Hugo Cornwall released by Century which might help you break into the computers that store examination records.

RULES

- The winner of the competition will be the person who, in the view of the editor, comes up with the most amusing or clever idea for a computer cheat or scam.
- The name of the winner will be printed in the August issue of *Your Computer*.
- All entries must arrive at the *Your Computer* offices by the last working day in May 1985.
- Each person may enter the competition only once.
- Entries to the competition cannot be acknowledged.
- No employees of Business Press International or their relatives may enter the competition.
- The decision of the editor is final.
- No correspondence on the result of the competition will be entered into.
- Business Press International assumes no responsibility or liability for any complaints arising from this competition.

YOUR COMPUTER COMPETITION

Don't forget to enclose this coupon, or a photocopy of it, when you send your idea, which can be written or drawn or both, for cheating in an exam or pulling off a scam with a computer, to *Your Computer*, Room L221, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

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REVISION SOF

Pete Connor studies revision programs.

EVERY YEAR the nation is swept by an epidemic of exam fever. It begins around Easter and reaches its climax in May and June. Most of the victims suffer no lasting damage, although some do have a relapse known as "retakes". Usually, the trouble passes as quickly and strangely as it has started.

There is no known cure for the complaint; time is the great healer. The only thing the victim can do to alleviate the condition is to take large preventive doses of revision, beginning in mid-winter. In the right doses, revision lessens mental tension and ensures that there will be no need for the misery of retakes.

Many potential sufferers from exam fever will be owners of home computers. Many of the large publishing companies are now producing revision software for a wide range of subjects and machines. Can they help?

In some cases, almost certainly. Penguin Study Software has come up with a series of programs on Shakespeare's plays which shows just how much good educational software can achieve.

The programs run on a database containing three sections: people, themes and acts. So the student can search through each act, or the whole play, searching for references to particular characters or themes. But much more interesting, and useful, is the ability to combine a particular character with a theme in the search.

In Julius Caesar, for instance, the program lists 17 themes ranging from Alchemy to Weeping. Let's say you choose Ambition, combining it with the character of Caeser, and search through the whole play. The screen will display line references — to the Penguin edition, of course — and a comment, e.g. "Look at Act 1 Scene 1 Line 72. Flavius expresses fear, later developed by Cassius, that Caeser's ambition might plunge Rome into dictatorship." Sometimes another reference will be given, or a question for the user or a suggestion that another theme will be worth exploring.

Thus the program constantly makes the user think for himself as well as providing information. It's the kind of service a good teacher would like to give, but never has the time — or perhaps the database — for.

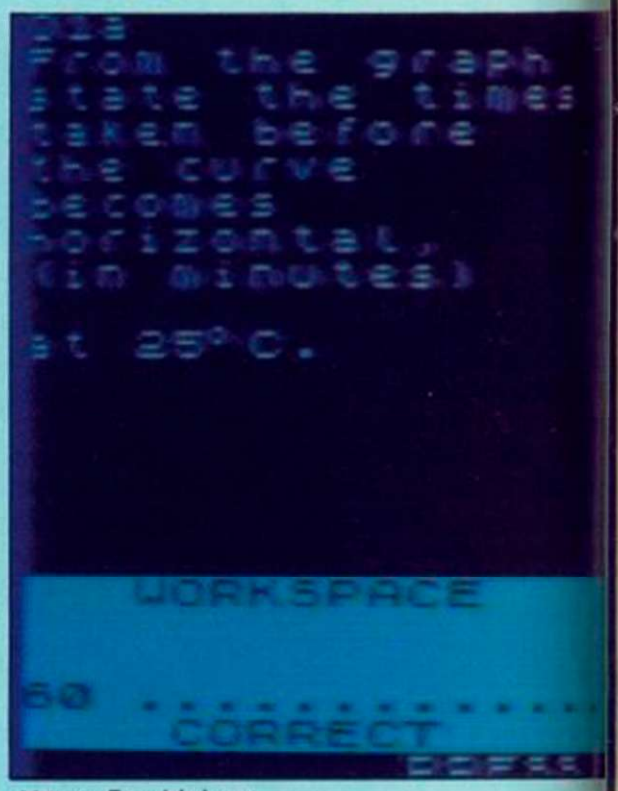
English Literature lends itself readily to this kind of stylish treatment. Other subjects are more traditionally presented and are much heavier going. French, for instance. You're obviously not going to get much guidance on your accent from a computer. And, sadly you won't get an awful lot of guidance on anything else of great value.

In the Hill MacGibbon/Pan Study Aids Software series you get two tapes and the Pan Study Aid book in a hefty £14.95 package. The program starts off with Diagnostic Test in which you have to choose the answers from an accompanying booklet. On completion you get a report showing how you've done.

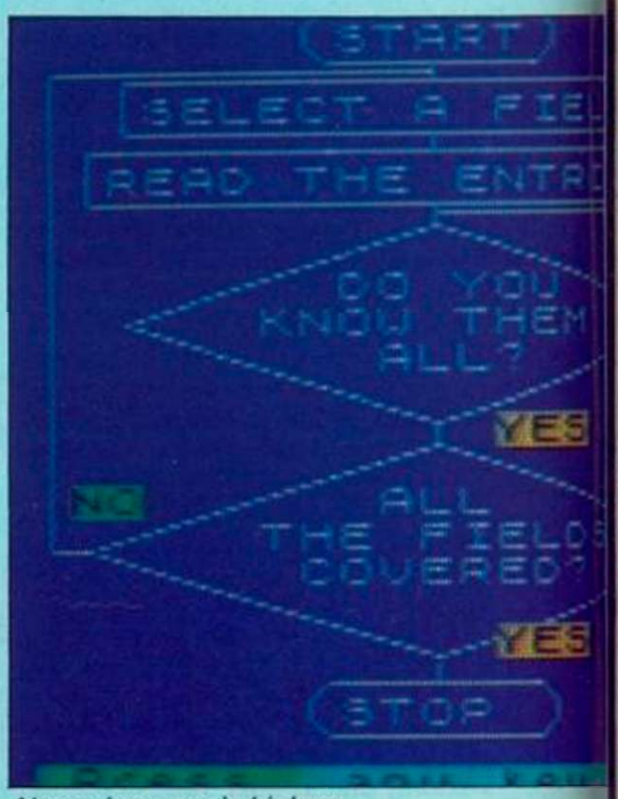
The rest of the program is taken up with sections on grammer and areas of vocabulary. It's pretty simply presented, and will certainly ram home all those rules about the agreement of past participles etc., but it doesn't really seem to provide anything to merit the time taken to load it up.

With the Longman French program on the Spectrum you get only one tape. It contains five programs. Two of these — Lexis 1 and 2 — are pretty dull vocabulary tests. The others test knowledge of verbs and of the geography of France.

The most interesting seemed to be a Comprehension program. Here you get a choice of six passages which you are then asked questions on. But, in fact, this was little more than a memory test like those games where you must remember the objects on a tray. Instead of asking questions and expecting grammatical answers, the student is merely required to reproduce exactly each sentence in the passage. All this is accompanied by atrocious "drawings" designed to jog the memory.

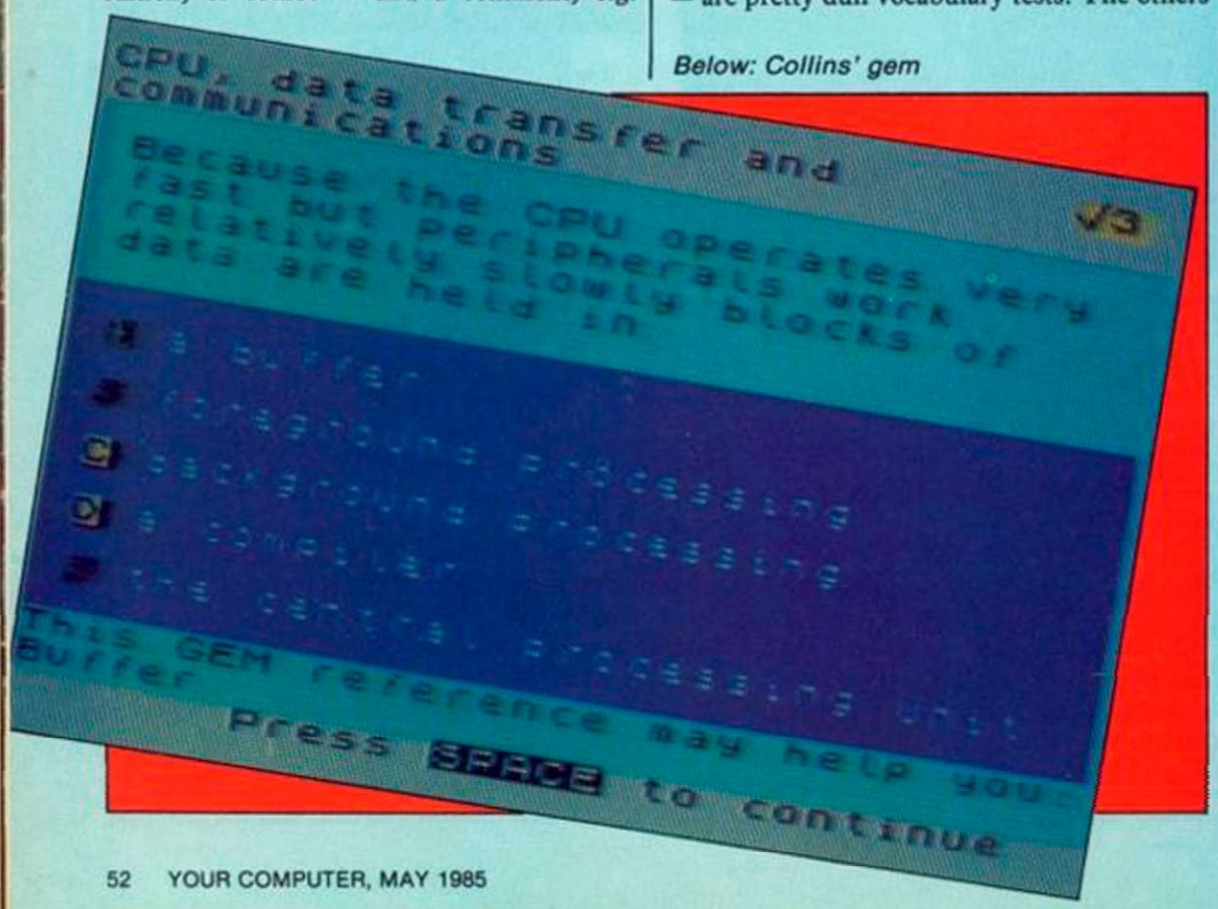


Above: Pan biology

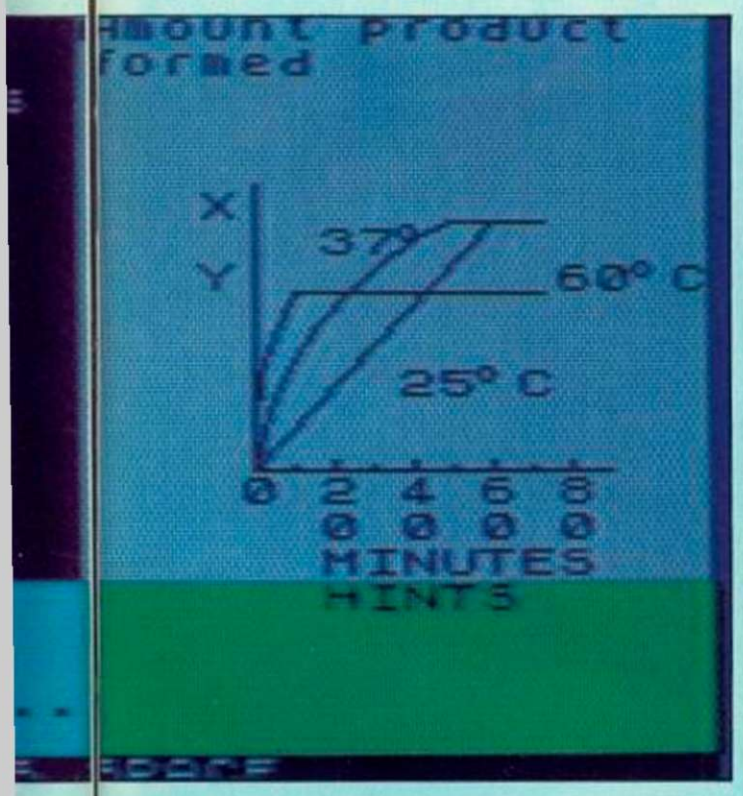


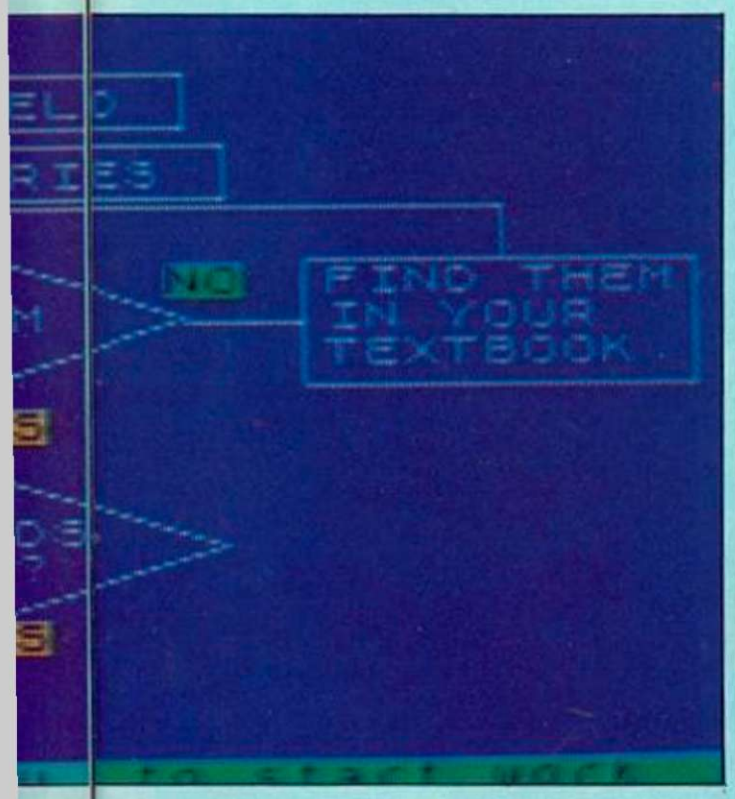
Above: Longman's biology

Below: Collins' gem



TWARE REVIEW





The trouble with language programs is that computers just don't understand what they're talking about and so can only give a very limited number of mechanical and not very useful tests. French is one subject where you're better off with a book, your notes and a teacher.

Biology at least allows you to use diagrams and Longman, Hill MacGibbon, Collins and Scisoft programs all rely heavily on them. Word games are the other favoured means of learning. The Longman package has five programs on the one tape. Of these, Skeleton is the most fun. It's a word game based on hangman in which each correct answer adds another bone with its name.

It's not a terribly original idea, and it hasn't really got much to do with the scientific method, as the blurb claims. But it is quite enjoyable, reinforces the knowledge and covers seven topics. The other programs cover heredity, food and kingdoms.

The Pan/Hill MacGibbon offering is similar to the French package, beginning with "diagnostic tests" and then going on to learning modules covering most of the topics on an 'O' Level syllabus. Since it has two tapes it covers rather more ground than the Longman program. The diagrams are all very clear and the program will be useful to the student — but not that much more useful than his or her own notes. If he or she has got any.

Collins Revision Software is another tape/book package: one tape and the Collins Basic Facts on Biology. The first of the four programs, Tester, asks you to give the answer to definitions from a mixture of topics. Get it wrong once and you're given the first letter, twice and you're referred to the Basic Facts, a third time and you're given the answer.

The other three programs are all diagram-based. The first one, for example, offers the structure of the flower, structure of the eye, kidney tubule, section through a leaf and the human digestive system. The exercises consist of labelling the parts, with plenty of help available if you need it. Again, most of the syllabus is covered and the program will be useful to the student. A pity, though, that the diagrams weren't just a little clearer or quicker on the draw.

Scisoft's Biology is the weakest package under review, even though it does proclaim on the cover "Approved by teachers". Which ones? Where?

Most of it is multiple choice questions on various topics. But each section contains only 20-32 questions, which doesn't really seem enough. There is also a diagram program. The package doesn't really have enough to offer the student in terms of variety or fun. Both Longman and Collins offer Computer Studies revision software, the Collins once more coming in a pack with a Gem Basic Facts.

Longman's tape contains four programs covering most of the syllabus. Topics include Basic routines, file-handling, logic and low-level language. This latter is dealt with in the program Visicode, which gives you 15 commands in a low level language and allows you to write your own programs. This is a particularly useful sction; explanation is clear, graphics are good and it's easy to get any help you might need.

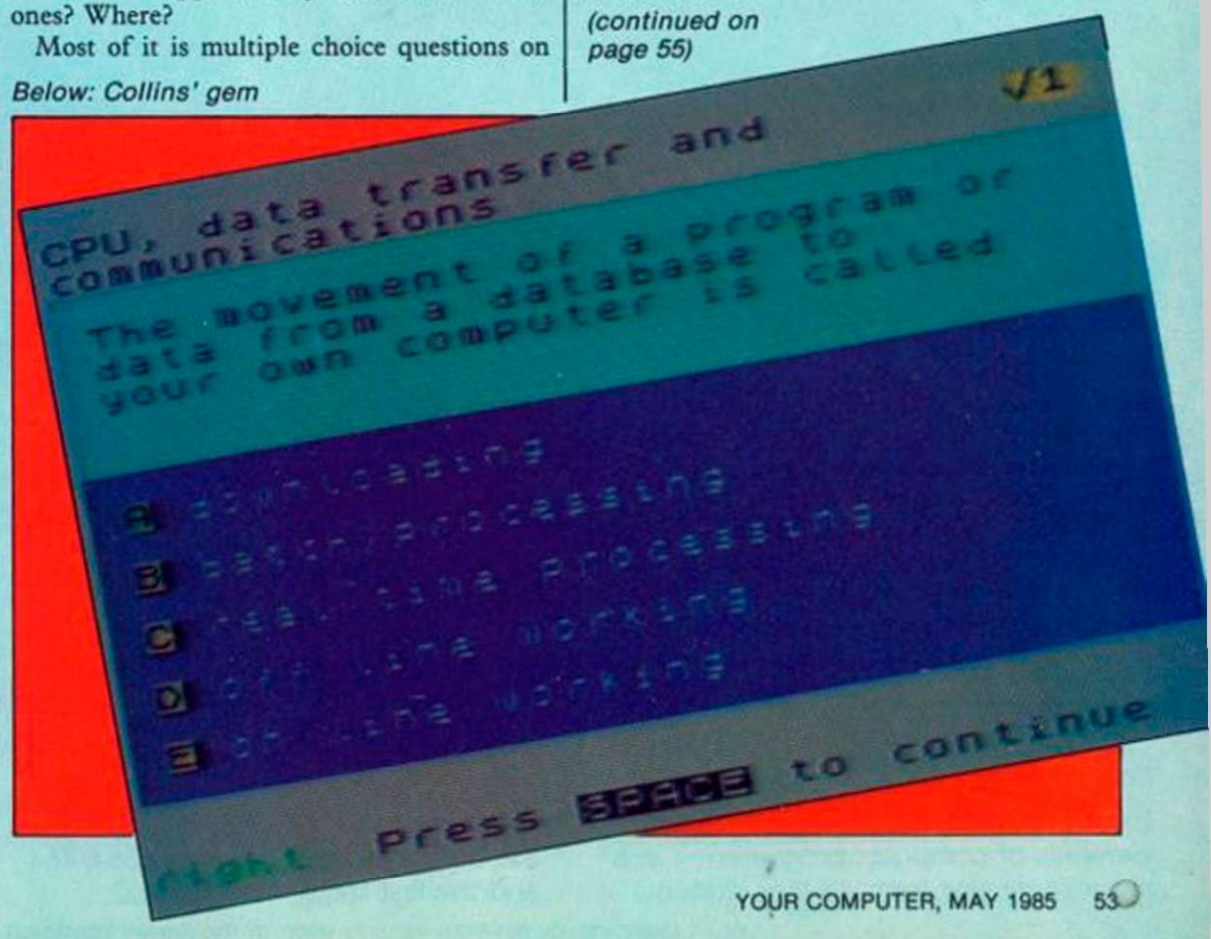
Collins's Computer Studies has the same format as their Biology; three programs in which you must label diagrams and two with multiple choice questions. The program covers much the same ground as Longman's, but is less well organised and therefore not quite so useful. It also contains a truly awful "game", based around darts. It's supposed to be fun, but it isn't.

Longman's do a Physics program as well, and it's pretty good. The four main programs are Formulae, Circuits, Light and Machine. Circuits contains two sections on Ohm's Law, the first of which is a graphich demonstration of the way that diodes and transistors work. It's very clear in its explanations, although the diagrams are constructed rather slowly. The rest of the package is of a similarly high standard.

But it's put in its place by the Physics program in the Penguin Study Software

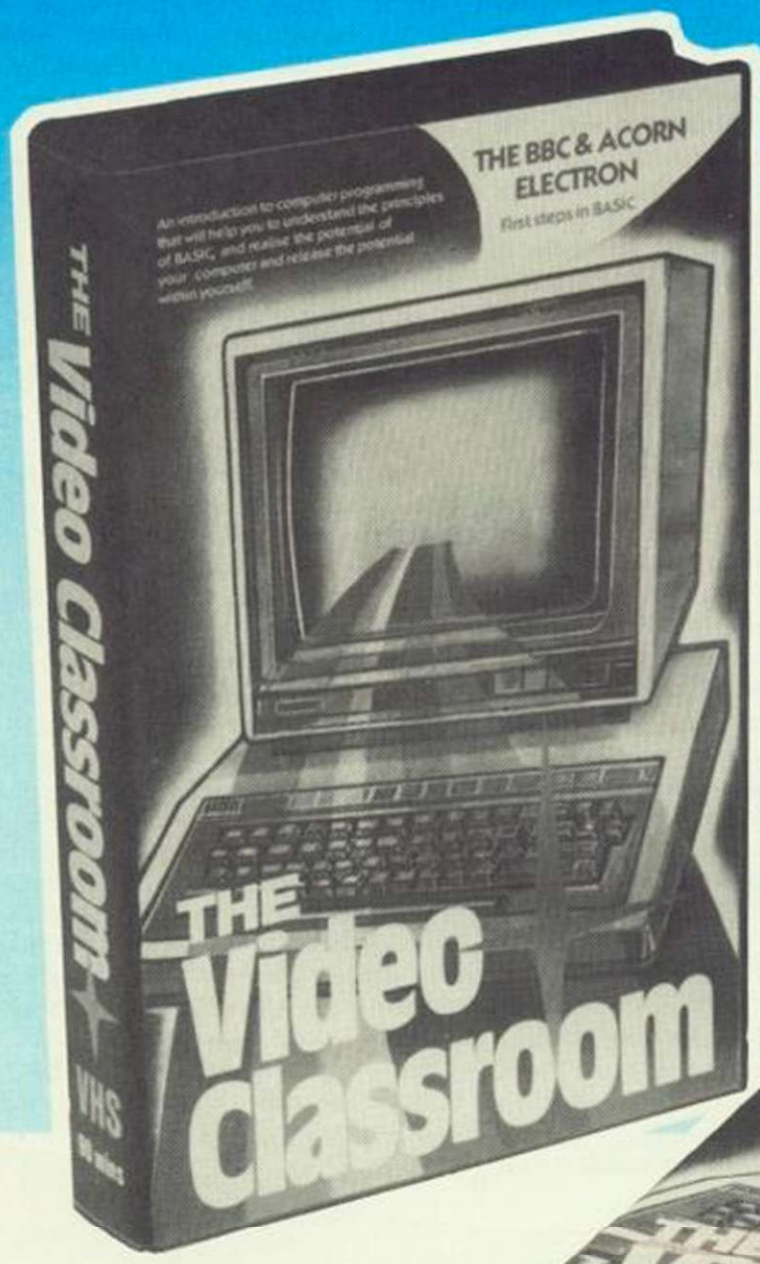
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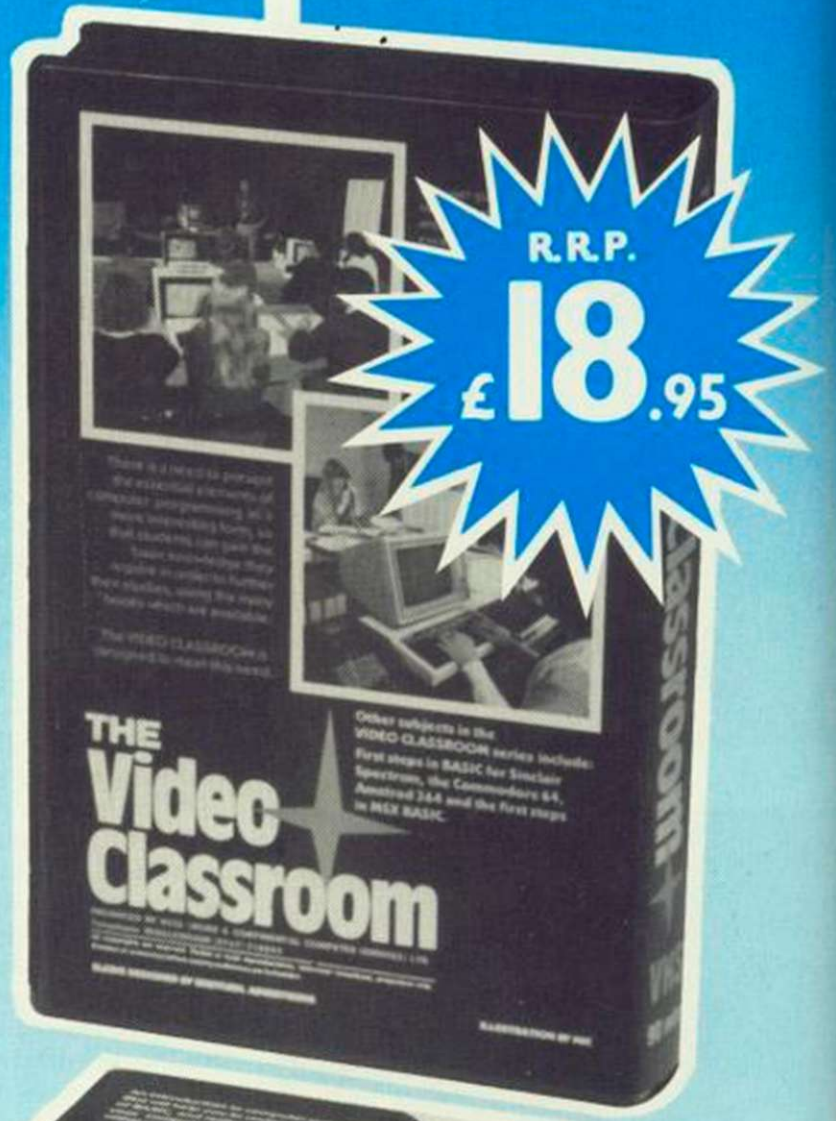
Below: Collins' gem



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(continued from page 53)

series. This really is a very superior product, almost meriting the blurb's claim that it's "the next best thing to having your own private teacher."

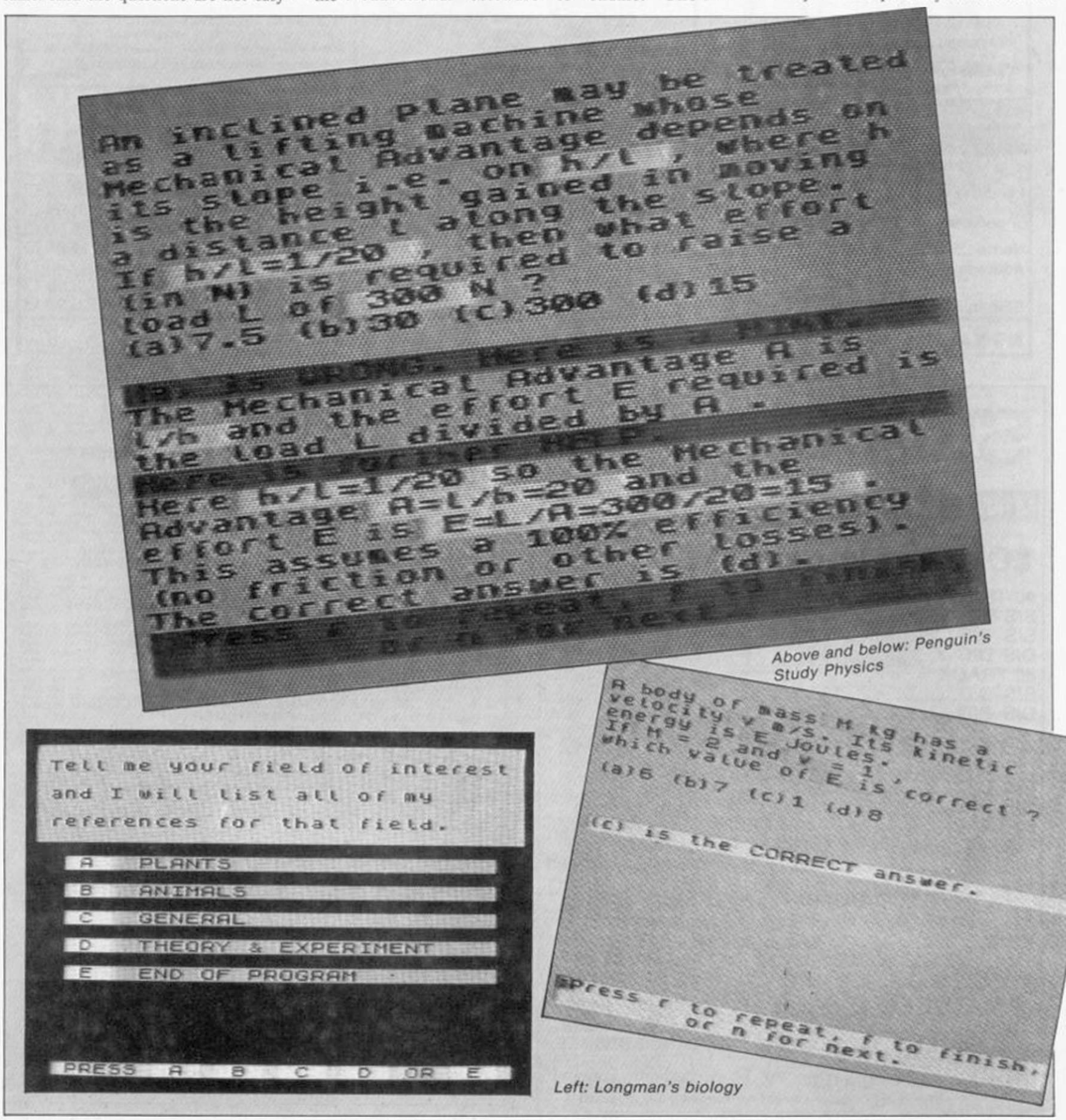
There are two tapes with four programs: Mechanics and Units; Heat and Sound; Electricity and Magnetism; Light, Atomic and Nuclear Physics. Each is presented in a multiple-choice format with a help facility. So, if you're stuck on a question, you can first get a hint, then a detailed explanation with the answer.

The program has a very sophisticated randomising facility. If you want another question on a topic just covered you'll get something similar, but definitely not the same. And the questions are not easy — the program will be useless unless you really have done the work. Which is as it should be in a revision program. Not only is this program more academically useful than others considered here, it is also much classier. It just looks better, with more colour and clearer and faster diagrams.

Perhaps this is because the Penguin software has more machine code routines — it's certainly more attractive and much quicker than any of the others. Indeed, too little thought has been given to visual impact in nearly all the programs mentioned here. If someone has a computer the chances are that he or she will have seen countless games of one kind or another, games whose graphics, speed and general presentation put most educational software to shame. The experienced games player is not going to stand for the sort of pathetic "game" presented on Collins's Computer Studies program.

Educationally, none of the programs is without merit. But too many of them do not give the student enough to do and are just not hard enough. And too many of them do not provide anything substantially different from what you would get from a decent set of notes — and if you haven't got those it's unlikely you're going to pass your exams, computer revision or not.

Top of the class, then, comes Penguin for both presentation and content. The other publishers need to pull their fingers out, pull their socks up and get their noses to the grindstone if they want to pass any future exams.



Above and below: Penguin's Study Physics

Left: Longman's biology

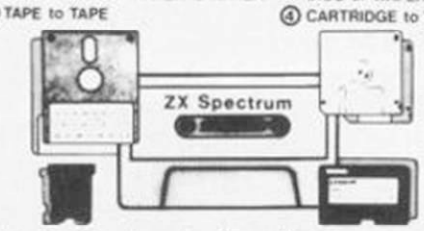
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ARE YOU BORED solving systems of equations with five unknowns? Want a hand to invert a couple of matrices? Shouldn't you check that difficult integration problem you've just spent four hours doing?

Well, the computer's ability to plough through tedious calculations at high speed is used in this program to provide a useful maths package.

The program will run on both the 16K and 48K Spectrums, but since it is written entirely in Basic it should be quite a simple task to implement the package on other micros.

As far as possible, each part of the program has been made self-contained enabling the individual to just type in the routines he or she requires. However, the Matrix Operations section demands that the System of Equations routines be present — this is due to the fact that matrix inversion and solving systems of equations can be done by similar techniques and therefore have common program blocks. In any case, the program must have the menu, input a number and hit any key routines — see figure 1.

Figure 1 Program breakdown.

500- 580 :	Input a number routine. Extensive use is made of this routine, so it is placed near the beginning to speed execution.
1000-1180 :	Menu.
2000-2970 :	System of Equations.
3000-3500 :	Quadratic Equation.
4000-4500 :	Equation of third degree.
6000-6650 :	Matrix Determinant and Inverse.
7000-7500 :	Simpson's Rule.
9000-9030 :	Hit any Key to Return.

There now follows a brief description of each part of the program and examples of the kind of mathematical problem they solve. These examples can be used to check that the routines have been typed in correctly.

System of Equations: Solved using Gaussian Elimination, each problem can have a maximum of five equations and five unknowns. The coefficients are held within a two-dimensional array — called "a". The user is prompted for each coefficient of x in turn, with the whole array of values shown on the screen at all times to enable checking.

Ex (n = 3)

$$\begin{aligned} x_1 + 3x_2 - 4x_3 &= -11 \\ 2x_1 - x_2 + 3x_3 &= 10 \\ 4x_1 + x_2 - 2x_3 &= 3 \end{aligned}$$

(continued on next page)

```
 100 GO TO 1000
 500 LET a$="": LET dps=0
 505 IF integer THEN LET dps=1
 510 PRINT AT x,y;a$; INK 4;"  "
 515 IF INKEY$<>"" THEN GO TO 515
 520 LET z$=INKEY$: IF z$="" THEN GO TO 520
 525 BEEP .02,34.4: IF LEN a$>=length THEN GO TO 560
 530 IF z$="." AND NOT dps THEN LET a$=a$+z$: LET dps=
1: GO TO 510
 540 IF z$="-" AND a$="" THEN LET a$=z$: GO TO 510
 550 IF z$>="0" AND z$<="9" THEN LET a$=a$+z$: GO TO 5
10
 560 IF CODE z$=13 AND a$<>"" AND a$<>"-" THEN PRINT A
T x,y;a$;" ": RETURN
 565 IF CODE z$=12 AND LEN a$>=1 THEN IF a$(LEN a$)="
." THEN LET dps=0
 570 IF CODE z$=12 AND LEN a$>=1 THEN LET a$=a$( TO LE
N a$-1): GO TO 510
 580 BEEP .5,-10: GO TO 510
1000 REM menu
1010 BORDER 0: INK 7: PAPER 0
1020 CLS : POKE 23609,30
1030 PRINT AT 3,3;"1  System of Equations";AT 5,3;"2
Quadratic Equation";AT 7,3;"3  Equation of 3rd Degree"
;AT 9,3;"4  Matrix Operations";AT 11,3;"5  Simpson's M
ethod"
1035 PRINT AT 13,3;"0  Quit"
1040 PRINT AT 21,3;"Enter Number ->"
1050 LET x=21: LET y=28: LET integer=1: LET length=1
1060 GO SUB 500: IF a$>"5" THEN BEEP .5,-10: GO TO 106
0
1065 IF a$="0" THEN STOP
1070 IF a$="1" THEN GO SUB 2000
1075 IF a$="2" THEN GO SUB 3000
1080 IF a$="3" THEN GO SUB 4000
1085 IF a$="4" THEN GO SUB 6000
1090 IF a$="5" THEN GO SUB 7000
1100 RUN
2000 REM simultaneous
2005 LET t$="System of Equations"
2010 LET matrix=0: CLS : PRINT AT 1,3;t$;AT 5,3;"a(1)
*x1 + a(12)*x2 ... = b1";AT 6,3;"a(21)*x1 + a(22)*x2 ..
 = b2"
2019 PRINT AT 7,3;"  .     .     .     .     ."
2020 PRINT AT 8,3;"  .     .     .     .     .";AT 9,3;"a
(n1)*x1 + a(n2)*x2 ... = bn"
2030 PRINT AT 15,3;"Enter Order n (2-5) -> "
2040 LET x=15: LET y=26: LET integer=1: LET length=1:
GO SUB 500
2045 IF a$<"2" OR a$>"5" THEN BEEP .5,-10: GO TO 2040
2050 LET n=VAL a$
2052 LET max=n+1: IF matrix THEN LET max=2*n
2053 DIM a(n,max)
2055 CLS : PRINT AT 0,3;t$
2057 LET y=12: LET integer=0: LET length=5
2058 IF NOT matrix THEN FOR j=1 TO n: PRINT AT 3,6*(j-
1);"x";j; NEXT j
2060 FOR i=1 TO n: FOR j=1 TO n
2062 PRINT AT 2*i+3,6*(j-1);"a(";i;",";j;")"
2064 NEXT j: IF NOT matrix THEN PRINT AT 2*i+3,6*(j-1)
;"b";i
2066 NEXT i
2068 FOR i=1 TO n
2072 LET upper=n+1: IF matrix THEN LET upper=n
2080 FOR j=1 TO upper
2090 IF j<=n THEN PRINT AT 15+j,3;"a(";i;",";j;") = ": GO
TO 2100
2095 PRINT AT 15+j,3;"  b";i;" = "
2100 LET x=15+j: GO SUB 500
2105 LET a(i,j)=VAL a$
2107 NEXT j
2109 FOR c=15 TO 21: PRINT AT c,0;"
                ": NEXT c
2110 GO SUB 2000: NEXT i
2120 IF matrix THEN GO SUB 6500
2130 IF matrix THEN IF det=0 THEN GO TO 9000
2200 FOR i=1 TO n
2210 LET piv=a(i,i)
2215 IF piv=0 THEN GO TO 2900
2220 FOR j=1 TO max
2230 LET a(i,j)=a(i,j)/piv
2240 NEXT j
2250 FOR k=i+1 TO n
2255 LET piv=a(k,i)
2260 FOR j=i TO max
2270 LET a(k,j)=a(k,j)-piv*a(i,j)
2280 NEXT j
2290 NEXT k
2300 NEXT i
2310 FOR i=n-1 TO 1 STEP -1
2320 FOR j=i+1 TO n
2330 LET piv=a(i,j)
2340 FOR k=i+1 TO max
2350 LET a(i,k)=a(i,k)-piv*a(j,k)
2360 NEXT k
2370 NEXT j
2380 NEXT i
2390 IF NOT matrix THEN FOR i=1 TO n: PRINT AT 15+i,3;
"x";i;" = ";a(i,n+1): NEXT i: GO TO 9000
2400 FOR i=1 TO n: FOR j=1 TO n
2410 LET a(i,j)=a(i,j+n)
2420 NEXT j: GO SUB 2000: NEXT i
2425 PRINT : PRINT "Inverse"
2430 GO TO 9000
2900 PRINT AT 2*i+3,0;"
"
2910 FOR k=1 TO upper: IF ABS a(i,k)<0.001 THEN LET a(
i,k)=0
2920 LET n$=STR$ a(i,k)+"      ": LET n$=n$( TO 5): IF
n$(1)<>"-" THEN LET n$=" "+n$( TO 4)
2930 PRINT AT 2*i+3,6*(k-1);n$: NEXT k: RETURN
2980 LET new=0
2985 IF matrix THEN GO TO 2940
2910 FOR p=i+1 TO n
2920 IF a(p,i)<>0 THEN LET new=p
2930 NEXT p
2940 IF new=0 THEN PRINT AT 16,3;"No Solution": GO TO
9000
2960 FOR m=1 TO n+1: LET temp=a(i,m): LET a(i,m)=a(new
,m): LET a(new,m)=temp: NEXT m
2965 LET piv=a(i,i)
2970 GO TO 2220
3000 REM quadratic
3010 CLS : PRINT AT 1,3;"Quadratic Equation";AT 5,3;"A
xx + Bx + C = 0"
3020 LET x=9: LET y=7: LET integer=0: LET length=6: PR
INT AT 9,3;"A = ": GO SUB 500: LET a=VAL a$
3024 IF a=0 THEN BEEP .5,-10: GO TO 3020
3025 LET x=11: PRINT AT 11,3;"B = ": GO SUB 500: LET b
=VAL a$
3030 LET x=13: PRINT AT 13,3;"C = ": GO SUB 500: LET c
=VAL a$
3040 LET b=-b/2/a: LET d=b*b-c/a
3050 IF d=0 THEN GO TO 3100
3055 IF d>0 THEN GO TO 3200
3060 LET y=SQR (-d)      *
3070 PRINT AT 17,3;"Real part: ";b;AT 19,3;"Imaginary:
 +/- ";y: GO TO 3500
3100 PRINT AT 17,3;"Equal roots: ";b
3110 GO TO 3500
3200 PRINT AT 17,3;"Real: ";b+SQR d;AT 18,3;"Real: ";b
-SQR d
3500 GO TO 9000
4000 REM 3rd degree
4010 CLS : PRINT AT 1,3;"Equation of 3rd Degree";AT 5,
3;"Axxx + Bxx + Cx + D = 0"
4020 LET x=9: LET y=7: LET integer=0: LET length=6: PR
INT AT 9,3;"A = ": GO SUB 500: LET a=VAL a$: IF a=0 TH
EN BEEP .5,-10: GO TO 4020
4030 LET x=10: PRINT AT x,3;"B = ": GO SUB 500: LET b=
VAL a$
4040 LET x=11: PRINT AT x,3;"C = ": GO SUB 500: LET c=
VAL a$
4050 LET x=12: PRINT AT x,3;"D = ": GO SUB 500: LET d=
VAL a$
4060 LET b=b/a/3: LET c=c/a: LET d=d/a
4070 LET a=c/3-b*b
4080 LET e=d-b*c+2*b*b*b
4090 LET h=4*a*a*a+e*e
4100 IF ABS h<10^-8 THEN GO TO 4300
4105 IF h>0 THEN GO TO 4200
4110 LET f=2*SQR (-a)
4120 LET g=ACS (e/(2*a*SQR (-a)))/3
4125 LET a=ASN 1: LET e=ASN .5
4130 LET c=f*SIN (a-g): LET d=-f*SIN (e+g)
4140 LET i=-f*SIN (e-g)
4150 LET c=c-b: LET d=d-b: LET i=i-b
4160 PRINT AT 16,3;"Real: ";c;AT 17,3;"Real: ";d;AT 18
,3;"Real: ";i
4170 GO TO 9000
4200 LET h=SQR h: LET f=.5*(h-e): LET g=-.5*(h+e): LET
 h=1/3
4210 LET f=ABS f^h*SGN f
4220 LET g=ABS g^h*SGN g: LET h=0.5*SQR 3
4230 PRINT AT 15,3;"Real root: ";f+g-b
4240 PRINT AT 17,3;"Real part: ";-.5*(f+g)-b
4250 PRINT AT 18,3;"Imaginary: +/- ";h*ABS (f-g): GO T
O 9000
4300 IF ABS a<10^-8 THEN PRINT AT 16,3;"Triple: ";-b:
GO TO 9000
4310 LET f=-ABS (.5*e)^(1/3)*SGN e
4320 PRINT AT 16,3;"Real:       ";2*f-b
4330 PRINT AT 17,3;"Equal roots: ";-f-b
4500 GO TO 9000
6000 REM Matrix
6010 CLS : LET matrix=1: LET t$="Matrix Operations"
6020 PRINT AT 1,3;t$;AT 8,3;"a(11)  a(12) .. a(1n)";AT
 9,3;"a(21)  a(22) .. a(2n)";AT 10,3;"  .     .
  .";AT 11,3;"a(n1)  a(n2) .. a(nn)"
6025 PRINT AT 4,3;"Inverse and Determinant";AT 5,3;"of
 nxn Matrix"
6030 GO TO 2030
6500 REM det
6505 FOR i=1 TO n: FOR j=1 TO n
6510 LET a(i,j+n)=a(i,j)
6512 NEXT j: NEXT i
6514 LET det=1
6516 FOR m=n TO 2 STEP -1
6518 LET p=a(m,m+n)
6520 IF p=0 THEN GO TO 6620
6530 FOR i=1 TO m-1
6540 LET q=a(i,m+n)/p
6550 FOR j=1 TO m
6560 LET a(i,j+n)=a(i,j+n)-q*a(m,j+n)
6570 NEXT j
6580 NEXT i
6590 NEXT m
6595 FOR i=1 TO n: LET det=det*a(i,i+n): FOR j=1 TO n:
 LET a(i,j+n)=0: NEXT j: LET a(i,i+n)=1: NEXT i
6597 PRINT AT 17,3;"Determinant = ";det
6598 IF det=0 THEN PRINT AT 18,3;"-> No Inverse"
6599 RETURN
6600 LET new=0: FOR f=1 TO m-1
6610 IF a(f,m+n)<>0 THEN LET new=f
6620 NEXT f
6630 IF new=0 THEN LET det=0: GO TO 6595
6640 FOR f=1 TO n: LET a(m,f+n)=a(m,f+n)+a(new,f+n): N
EXT f
6645 LET p=a(new,m+n)
6650 GO TO 6530
7000 REM Simpson's
7010 CLS : PRINT AT 1,3;"Simpson's Method -";AT 3,3;"A
pproximate integral"
7020 PRINT AT 10,3;"Enter a funtion in x ";AT 12,3;"e.
g.    y = 3*x+2"
7030 INPUT "    y = "; LINE f$
7040 PRINT AT 10,3;"                    ";AT 12,3;"
                ";AT 8,9;"y = ";f$
7050 PRINT AT 10,3;"lower x = "; LET integer=0: LET x=
10: LET y=13: LET length=8: GO SUB 500: LET d=VAL a$
7060 PRINT AT 12,3;"upper x = "; LET x=12: GO SUB 500:
 LET e=VAL a$
7065 IF e<=d THEN BEEP .5,-10: GO TO 7060
7070 PRINT AT 14,3;"samples = "; LET x=14: GO SUB 500:
 LET p=VAL a$
7080 IF p<=0 THEN BEEP .5,-10: GO TO 7070
7090 LET h=(e-d)/2/p
7100 LET a=0: LET x=d: LET y=VAL f$
7110 LET x=x+h: LET y=VAL f$
7120 LET a=4*y+a: LET x=x+h: LET y=VAL f$
7130 LET a=y+a: LET p=p-1
7140 IF p>0 THEN GO TO 7110
7150 LET c=a*h/3
7160 PRINT AT 17,2;"Integral = ";c
7500 GO TO 9000
9000 LET a$="": IF INKEY$<>"" THEN GO TO 9000
9010 PRINT AT 21,3; INK 4; INVERSE 1;"HIT ANY KEY TO R
ETURN"
9020 IF INKEY$="" THEN GO TO 9020
9030 BEEP .02,34.4: RETURN
```

(continued from previous page)

This has the solution $x_1 = 2$, $x_2 = -3$ and $x_3 = 1$.

Quadratic equation: The roots are found using the classic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

This routine allows for both real and imaginary roots.

Ex 1 $x^2 - 3x + 2 = 0$ gives x = or 2
Ex 2 x^2 6x + 10 = 0 gives x = 3+/−i
Ex 3 $x^2 - 6x + 9 = 0$ gives x = 3
(double root?

Roots of a polynominal

Equation of third degree: This routine gives the roots of a polynominal with a term in x^3. Again, imaginary roots are catered for, giving four types of possible solution.

Ex1 $x^3 - 6x^2 + 11x - 6 = 0$
gives x = 1,2,3
Ex2 $x^3 - 3x^2 - 3x - 1 = 0$
gives x = 1,1,1
Ex3 $-x^3 - 9x^2 + 81x + 729 = 0$
gives x = 9,−9,−9
Ex4 $x^3 - 5x^2 + 7x + 13 = 0$
gives x = −1, 3+/−2i

Matrix Operations: The determinant of the given square matrix is calculated and displayed. Assuming that this is non-zero, the inverse is computed using Gaussian Elimination. A matrix with zero determinant has no inverse. The main "invert" routine is the same as that for the System of Equations.

Ex
(n = 3)

3 1 2
2 1 0
2 1 1

has determinant 1
and inverse

1 1 −2
−2 −1 4
0 −1 1

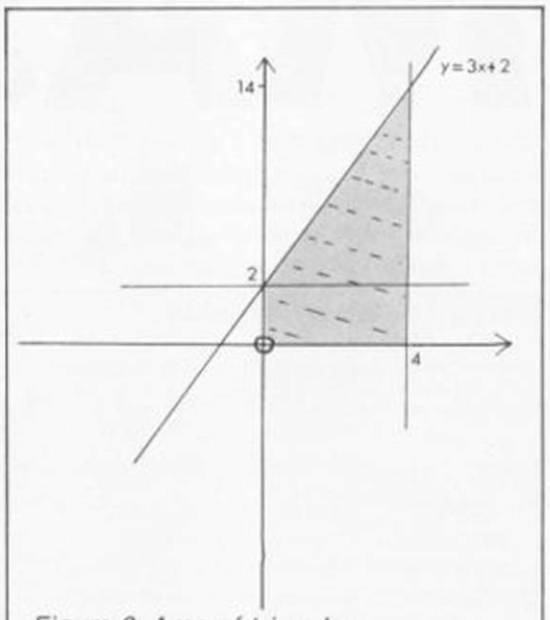


Figure 2. Area of triangle + rectangle.
= ½ x 4 x 10 + 2 x 4
= 20 + 12
= 32

Note that only real matrix elements are allowed.

Simpson's Rule: The function entered must be a valid expression in 'x', for example 'y = 3x+2' must be entered as:

y = 3*x+2

Also, functions such as Sin, Tan or Ln must be entered as single-stroke key words. Any invalid expression typed in response to the prompt will result in an error at line 7100, statement 3. If this should happen, simply type:

GO TO 7000

and re-type the expression correctly.

Ex
y = 3*x+2
lower x = 0
upper x = 4
samples = 10

Value of the integral

As can be seen by looking at figure 2, the value of the integral — or shaded part of the graph — should be 32.

Type in the program as it is listed and check the operation of each segment using the given examples. They have been chosen to test all parts of the program and should make any typing errors apparent. When all is well, save the package by typing:

CLEAR: SAVE "Maths" LINE 100

This prevents any variables being dumped along with the program. ■



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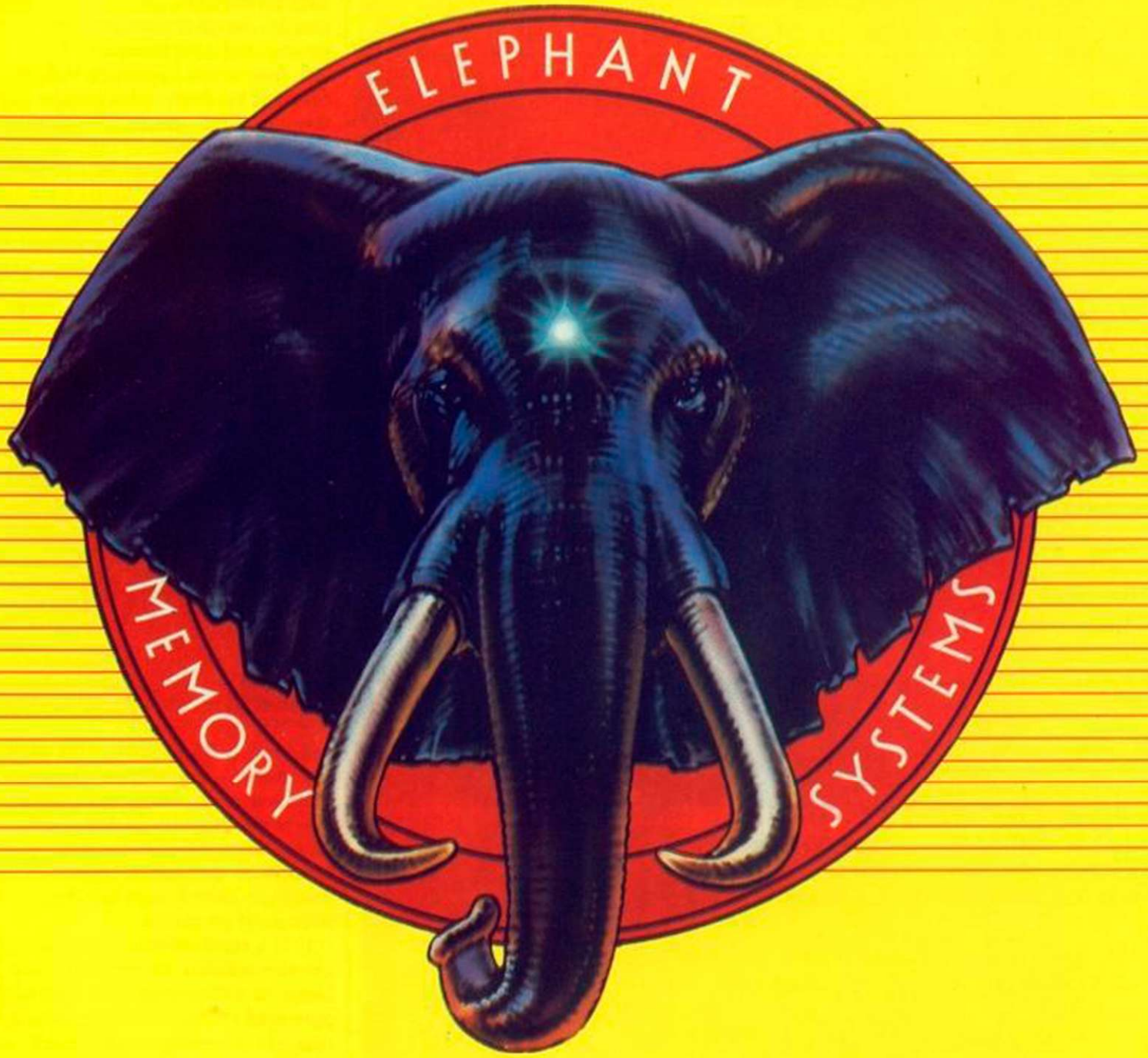
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AMSTRAD AND SPE

LANDSCA

Fill in the background to that text-only adventure. Artist Brian James puts pixel to phosphor.

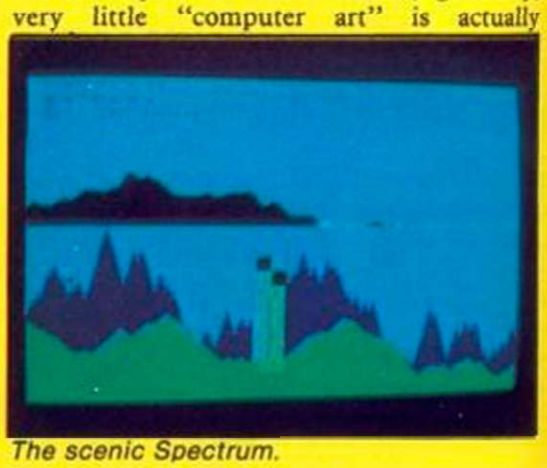
Program 1.

```
10 '       Fourier Synthesis
20 '
30 '          AMSTRAD BASIC
40 '
50 '      Brian James ,  March 1985
60 '
70 c$=CHR$(13)
90 KEY 135,"mode 1:ink 0,1:ink 1,24"+c$+" list "
100 KEY 137," edit ": KEY 128," goto "
120 SPEED KEY 12,2
130 SPEED WRITE 1
170 '
180 DIM a(250),b(250),c(250)
185 '
190 MODE 0          ' for 16 colours
200 nn=6            ' number of terms
210 am=30           ' maximum amplitude
220 INK 0,11        ' blue sky
230 '
240 FOR i= 1 TO 15
250 INK i,RND*26    ' set colours
260 NEXT
270 '
280 FOR n= 1 TO nn  ' Each wavelength
290 a(n)=RND*80/n   ' amplitudes
300 b(n)=RND*2*PI   ' phases
310 c(n)= RND*15     ' colours
320 NEXT
325 PRINT: PRINT" Fourier Synthesis"
330 '
340 FOR x=0 TO 639 STEP 4
350 PLOT x,0,0      ' at bottom
360 y=10
370 k=2*PI*x/640
380 '
390 FOR n= 1 TO nn  'incr. frequencies
400 y=y+a(n)*(1+SIN(n*k+b(n))) 'add waves
410 DRAW x,y,c(n)   ' draw upwards
420 NEXT n
430 '
440 NEXT x          '  go right
450 '
460 FOR i= 1 TO 3000:NEXT  'pause
470 RUN
500 '
6000 WHILE 1:SAVE "":WEND
```

THE LANDSCAPE Creator is a program which creates detailed coloured landscape views, quickly and spontaneously. I developed this idea first on the Spectrum 48K, and now the program has been redesigned to fully exploit the beautiful graphics capability of the Amstrad CPC-464.

It is a simulation of "creativity": the computer makes all decisions relating to a wide range of parameters concerning the hills, trees, flowers, lakes, islands, and buildings. The number of variable parameters is such that the resulting scene gives endless, unexpected surprises with a wide range of possible colour schemes.

I developed this idea because, generally, very little "computer art" is actually



The scenic Spectrum.

generated by the computer. In nearly all cases the computer merely displays the picture, which is arranged by the programmer. We now have graphics packages which make it much easier for the operator to control the results on the screen. However, the result could just as well — or even better — be done with paint on canvas.

It is a much more interesting challenge to get the machine to create its own pictures, based on a "knowledge" of the subject to be portrayed. This involves intricate mathematical modelling, and really begins to unleash the power and the intelligence of the microchip and do things in a way only the computer can.

We have all seen some impressive colour graphics in computer games. In most cases these graphics make extensive use of user defined characters, which are rectangular elements — usually 8 by 8 pixels — used as building bricks. In contrast to this, the use of mathematical functions and probability theory allows us enormously improved flexibility, enabling the spontaneous creation of different scenes, giving endless surprises, even to the programmer!

It is easy enough to write a program to rearrange a number of graphic shapes — say to

ECTRUM APES

select a building from a choice of five, choose a mountain from a choice of five, etc. etc. and put them together. But to simulate the idea of "creativity", we need to use a whole hierarchy of routines, building up the picture from the smallest elements, with freedom of choice at every stage in the process. User-defined characters are of limited use in this kind of exercise.

My objective in the Landscape Creator was to have the minimum of fixed quantities: to allow the greatest freedom for variations, without departing from some basic properties of landscapes. This same idea I used in Country Cottages, a fun game for two players where you buy cottages and try your skill in managing the awful tenants.

The cottages, the landscapes and the tenants are different every time you play the game. However, the Landscape Creator was designed from scratch, to produce greater variations, better colour schemes, better appearance of water and vegetation.

The number of calculations involved is quite horrendous. Just doing a single pixel involves over 50 machine-code instructions. Though Amstrad Basic is very comprehensive and quite fast, the Landscape Creator has so many calculations to do that machine code was essential.

Routines for plotting

The Amstrad Firmware manual gives the addresses of inbuilt machine-code routines for plotting. These are easy to use and nicely crashproofed — but are therefore not as fast as would be desired. The Landscape Creator utilises its own extremely fast, compact plotting routines. Also the basic arithmetic routines were designed for the job.

In the Landscape Creator, the object was to have the maximum variety of pictures. Whether it is creating a rugged skyline, an island, a patch of buttercups, or a castle, a flexible routine is used which combines probability functions with appropriate mathematics.

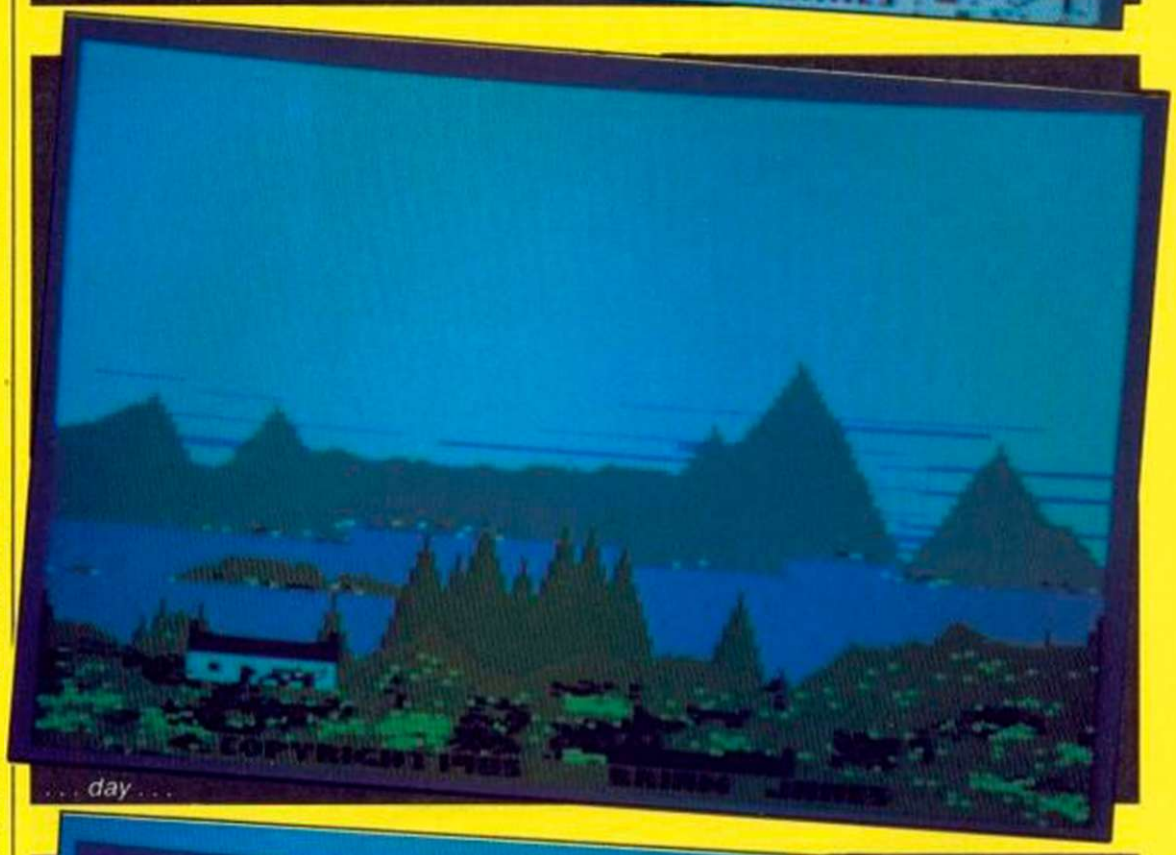
The program needs some "knowledge" about the structure of landscapes, so that the different features will have reasonable shapes and fit sensibly together. Trees and buildings must not hang in mid-air; hills must not have enormous holes through them; land must not be drawn when it is below water! Foreground objects may hide more distant objects — not the reverse — and so on. Distant hills could have a grey or bluish colour; whereas the foreground can have much brighter colours.

Lakes and sea can use a mixture of colours

(continued on next page)



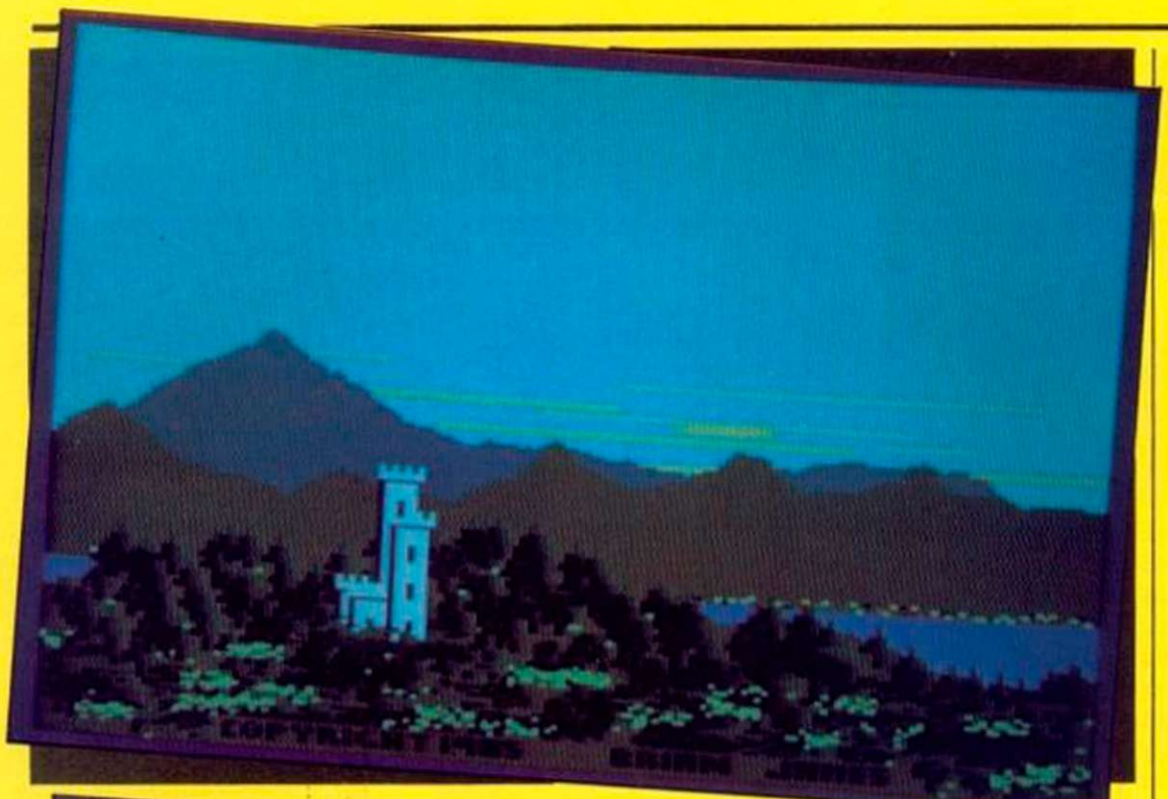
Sunrise . . .

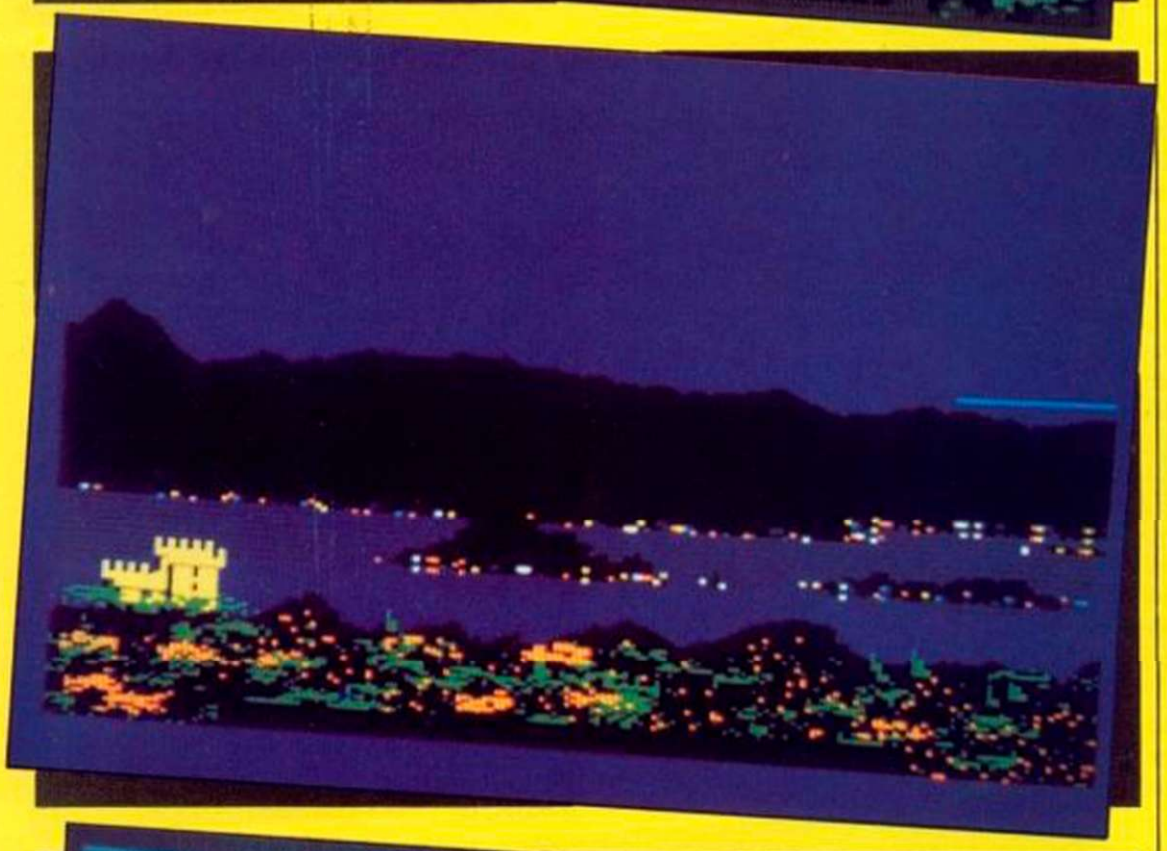


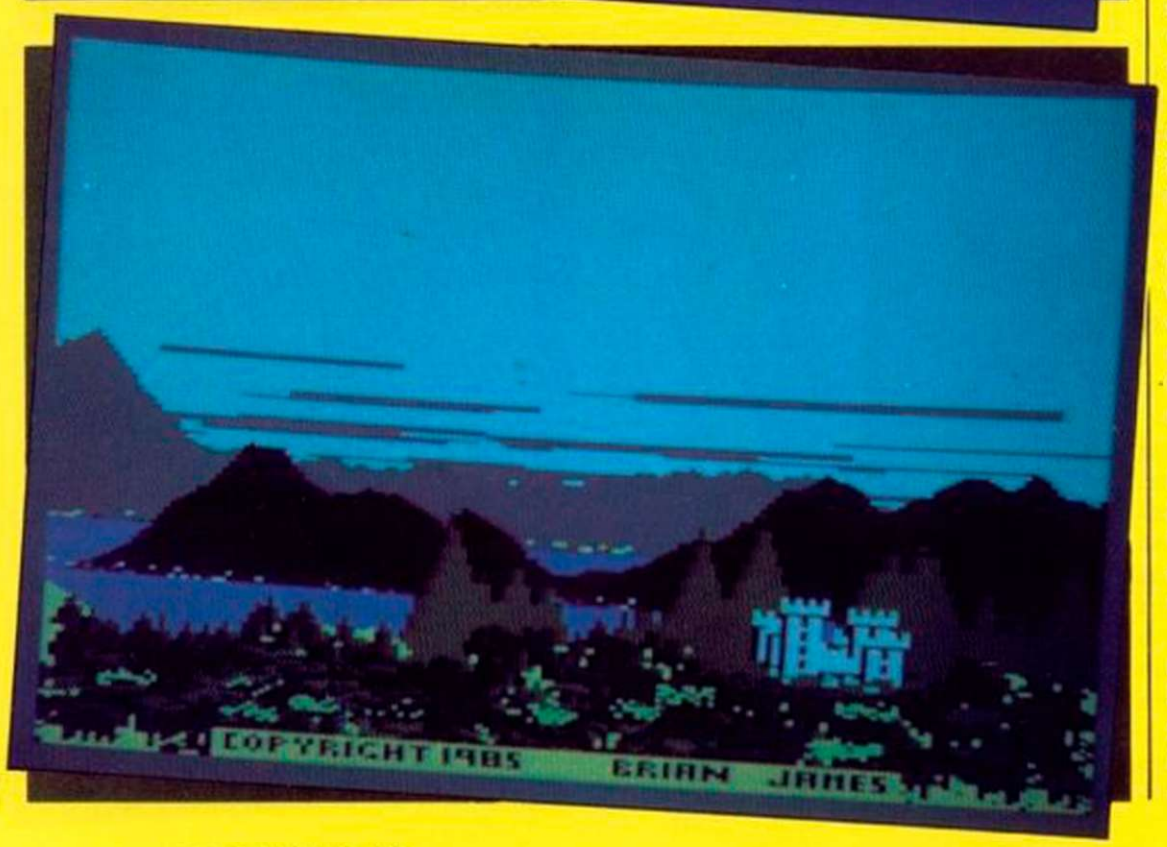
. . . day . . .



. . . sunset







(continued from previous page)

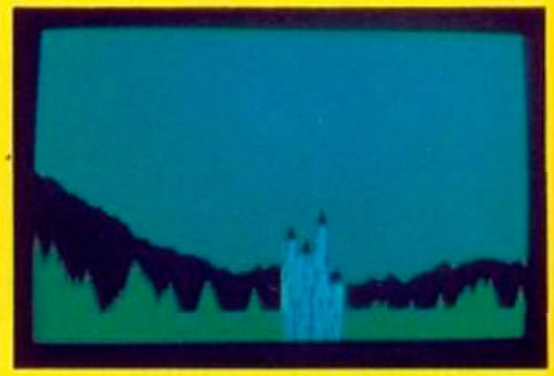
reflecting the hills and sky beyond. The precise formulation of the fundamental properties of a landscape is a subjective process — and this is where the art comes in — and the inspiration for this task came from the Highlands of Scotland and also Cumbria.

The Amstrad version of the program displays several advances compared to the Spectrum version. A tremendous advantage of Amstrad graphics is that any pixel can be any colour. You can have 16 colours in Mode 0, with a resolution of 160 pixels horizontally by 200 vertically. For better resolution, Mode 1 gives you 320 horizontally, but only four colours. I chose Mode 0 with its much greater range of colours. If you want better resolution horizontally than vertically, then you could turn the monitor on its side, and swap your x and y axes.

Pixels can be any colour

Whatever mode you select, any pixel can be any of the available colours. This gives enormous freedom compared to most home computers. Foreground features can be drawn with no effect at all on the background colours. The colours actually used on the screen can be chosen from a selection of 27.

Machine code is notoriously difficult to experiment with and so I am providing a simple program in Amstrad Basic for you to try out. It uses the RND function to generate



a recipe for a mixture of sine waves with different wavelengths and phrases. The sum of all the different waves is a complex curve which can have enormous variability. It is a well-known method called Fourier Synthesis.

Each waveform here is drawn with a different colour and — Hey Presto! — the Fourier Series we learned in stuffy lecture theatres comes to life in brilliant colours.

The number of sine waves used in nn. You can try putting in a larger number, say nn = 20 or nn = 50. The curve becomes more and more complex — but very much slower. This method is very good for smooth curves, but becomes too cumbersome and slow for very rough crinkly lines.

Next month we will explore more possibilities with the RND function, and also peer into the fascinating world of "fractals", functions which are particularly suitable for describing the very rough mountain skylines we like to gaze upon.

I can supply the Landscape Creator doubly recorded on cassette, for the Amstrad or the Spectrum 48K. Send £5 for the Amstrad version, or £3 for the Spectrum version, to — Brian James, 21 Lamond Place, Aberdeen AB2 3UT. ■

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JOE AND THE ALLIGATORS

F G Tout and his CBM-64 are on the run.



YOU ARE Joe, out for a quiet boat ride at your favourite beauty spot when you suddenly realise that someone with a warped sense of humour has sent loose a shoal of dangerous and ferocious aligators, intent on making you their snack of the day.

Guide Joe through four waves trying to steer clear of floating logs, other boats, rafts, floating weed and most of all *watch those 'gators.*

When you reach the narrow exit you have to guide Joe through the locks without hitting the walls or overhanging rocks.

There is also a hole in the boat and you must use the fire/button to bale out or the boat will sink.

Time limit and water level are shown at the bottom of the screen:

Time — WHITE
Water level — BLUE

On the locks screen you can control Joe by:

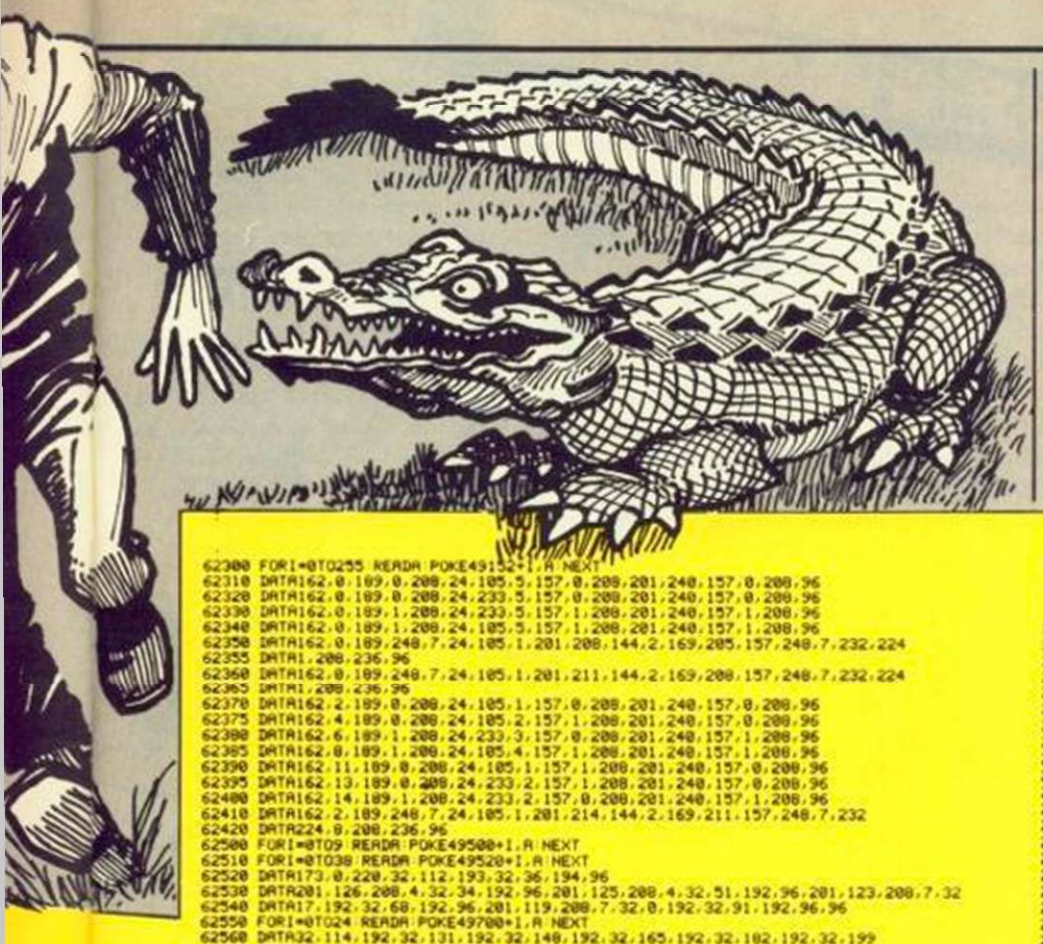
Left — reduce speed of boat
Right — increase speed of boat
Up — increase level of water

Variables.

V — 53248 sprites
Q — sp locations
CO — colour of water level and time limit
TL — time limit
WL — water level
L — joystick port
S1, S2, S3 — sound
SYS 36864 = sound on
SYS 37120 = sound off
LI — lives
LE — lake number
SC — score

Listing 1.

```
10 PRINT"J":FORT=0TO2:FORX=0TO255:READA:IFA=-1THEN40
20 POKE36864+T*256+X,A:NEXTX
40 NEXTT
50 DATA169,146,141,21,3,169,0,141,20,3,96,-1
60 DATA169,234,141,21,3,169,49,141,20,3,96,-1
70 DATA172,0,147,192,16,240,57,206,1,147,173,1,147,201,0,208,44,238,0,147,169
80 DATA0,141,4,212,169,31,141,5,212,169,0,141,6,212,169,17,141,4,212,165,0,147
90 DATA185,0,140,141,1,212,165,0,149,141,0,212,165,0,150,141,1,147,76,49,234
100 DATA169,0,141,0,147,141,4,212,24,144,242,-1
110 POKE37632,0:POKE37633,0:FORT=0TO82:READHF,LF,D
130 POKE37888+T,HF:POKE38144+T,LF:POKE38400+T,D:NEXTT
135 POKE38144+T,22:POKE38155+T,227:POKE38400+T,100:POKE37388,T+1
140 DATA25,177,30,25,177,30,32,94,30,20,214,30,25,177,30,22,227,30,22,227,30
145 DATA20,214,30,25,177,30,22,227,20,17,37,30,19,63,30,21,154,30,22,227,30
150 DATA21,154,30,22,227,30,25,177,40,20,214,20,22,227,100,0,0,20,25,177,30
155 DATA25,177,30,32,94,30,20,214,30,25,177,30,22,227,30,22,227,30,20,214,20
160 DATA25,177,30,22,227,30,17,37,30,19,63,30,21,154,30,22,227,30,21,154,30
165 DATA22,227,30,25,177,20,20,214,20,22,227,100,30,125,20,20,126,20,34,75,30
170 DATA25,177,30,22,227,30,25,177,30,20,214,30,32,94,30,34,75,30,43,52,30
175 DATA43,52,30,43,52,20,30,126,20,25,177,30,20,214,30,22,227,30,25,177,30
180 DATA20,214,30,25,177,30,22,227,30,21,154,30,19,63,30,17,37,20,25,177,30
185 DATA25,177,30,32,94,30,20,214,40,25,177,30,22,227,30,22,227,40,20,214,30
190 DATA25,177,30,22,227,30,17,32,30,19,63,20,21,154,30,22,227,20,21,154,30
200 DATA22,227,30,25,177,30,20,214,30,22,227,30,22,227,30,22,227,200
29999 FORI=0TO1215:READA:POKE285664+I,A:NEXT
30000 FORI=0TO63:READA:POKE(244864)+I,A:NEXT
30001 DATA48,0,0,23,48,0,213,204,0,197,0,0,49,67,0,0,00,0,0,20,0
30004 DATA0,166,160,2,254,186,11,210,126,43,214,126,43,214,126,11,210,126,2
30007 DATA254,186,0,166,168,0,20,0,0,00,0,49,64,0,197,3,12,21,40,240,212,0,0,0
30011 DATA0,63,0,0,196,192,0,55,0,0,4,0,0,4,0,0,4,0,0,4,0
30014 DATA0,166,168,2,254,186,11
30015 DATA186,126,43,90,126,43,90
30016 DATA126,11,186,126,2,254,186
30017 DATA0,166,168,0,4,0,0,4,0,0,4,0,0,55,0,0,196,192,0,63,0,0
30021 DATA0,0,192,0,3,5,0,0,21,0,0,20,0,0,83,0,1,76,0,5,0
30024 DATA0,166,168,3,254,186,13
30025 DATA170,126,45,186,126,45,186
30026 DATA126,13,170,126,3,254,186
30027 DATA0,166,168,0,5,12,0,1,112,0,0,83,0,3,20,0,0,213,0,0,5,0
30050 DATA0,0,192,0,3,20,0,0,84,0,0,83,0,1,76,0,5,0,0,20,0,42,154,0,174,191
30060 DATA128,190,171,224,189,167,232,189,167,232,190,171,224,174,191,128,42
30065 DATA154,0,0,20,0,0,5,12,0,1,64,0,12,83,0,3,04,0,0,20,0
30070 DATA0,0,0,0,252,0,3,19,0,0,220,0,0,16,0,0,16,0,0,16,0,42,154,0,174,191
30080 DATA192,190,170,224,189,169,232,189,169,232,190,170,224,174,191,192
30090 DATA42,154,0,0,16,0,0,16,0,0,16,0,0,220,0,3,19,0,0,252,0,0
31011 DATA12,0,0,00,192,0,07
31012 DATA0,0,20,0,0,197,0
31013 DATA0,49,64,0,0,00,0
31014 DATA42,154,0,174,191,192,190
31015 DATA170,112,189,169,120,189,169
31016 DATA120,190,170,112,174,191,192
31017 DATA42,154,0,0,00,0,49
31010 DATA64,0,197,0,0,20,192
31019 DATA0,07,0,0,00,48,0,0
50001 DATA0,0,0,0,0,0,20,0,0,12,0,24,12,0,140,6,0,112,7,1,224
50003 DATA3,191,192,3,255,200,31,255,236,63,255,255,127,255,255,255,255,255,236,195
50007 DATA255,200,3,191,192,1,195,128,0
50008 DATA195,0,0,102,0,0,60,0,0,0,0,0,0,0,0,0,0,0,0,0,0,2,0,0,3,0,64,3,0
51003 DATA192,3,128,192,3,129,192,3,191,192,3,255,200,31,255,236,255,255,255
51006 DATA255,255,255,63,255,236,3,255,200,3,191,192,3,131,128,3
51008 DATA129,128,3,1,128,2,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,124,0,0,130
52003 DATA0,1,131,128,3,129,192,131,191,192,227,255,200,255,255,236,127,255
52006 DATA255,63,255,255,31,255,236,3,255,200
52007 DATA7,191,192,15,3,128,20,1,192,48,0,96,64,0,48,0,0,24,0,0,0,0
53001 DATA0,0,0,0,0,0,0
53002 DATA0,0,192,0,0,48,0
53003 DATA0,12,0,0,197,64,0
53004 DATA21,149,64,90,233,84,106
53005 DATA86,149,190,183,218,190,183
53006 DATA218,186,86,149,90,233,84
53007 DATA21,149,64,197,84,0,12
53008 DATA0,48,0,0,192,0
53009 DATA0,0,0,0,0,0,0
54001 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
54003 DATA0,20,0,0,21,00,0
54004 DATA21,86,168,2,175,250,10
54005 DATA189,190,42,189,126,42,169
54006 DATA126,10,189,190,2,175,250
54007 DATA21,86,168,21,80,0,20
54008 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
54011 DATA0,51,48,0,12,240,0
54012 DATA243,12,0,12,240,0,51
54013 DATA0,20,12,192,21,83,192
54014 DATA21,87,248,2,173,254,10
54015 DATA189,126,42,189,122,42,169
54016 DATA250,10,191,234,2,175,170
54017 DATA21,86,168,21,80,0,20
54018 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
54020 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,2,0,40,11,0,10,47
54022 DATA64,62,175,80,14,175,80,14,47,64,14,11,192,50
54024 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
54026 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
54028 DATA64,2,175,80,2,175,80,2,15,64,14,3,192,10,0,0,40,0,0,0,0
54030 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
54032 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
54034 DATA64,10,15,80,0,15,80,0,15,64,0,3,192,0
54036 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
54101 DATA0,0,0,0,136,192,0,204,0,3,204,48,0,204,0,0,252,12,12,168,0
54104 DATA0,252,3,48,252,16,3,255,200,195,87,195,3,87,0,15,16,48,204,16,0
54107 DATA13,0,0,1,0,192,48
54108 DATA0,0,0,0,0,0,195,0,0,0,0,0,48,0,0,0,0,0,0,0,136,0,0
54112 DATA204,192,0,204,0,3,204
54113 DATA48,0,252,0,12,168,12
54114 DATA0,252,0,200,252,3,31
54115 DATA252,0,15,87,0,195,87
54116 DATA0,0,19,195,0,16,192
54117 DATA48,1,192,0,1,0,0,0,12,12,0,0,0,0,192,0,204,0,0,48,0,0
54201 DATA0,0,0,0,0,0,0
54202 DATA0,0,0,0,0,4,0
54203 DATA16,38,170,154,166,170,152
54204 DATA4,0,16,166,170,152,38
54205 DATA170,154,4,0,16,166,235
54206 DATA154,39,215,216,7,215,200
54207 DATA38,235,152,166,170,154,4
54208 DATA0,16,38,170,152,6,170
54209 DATA144,4,0,16,0,0,0,0
54301 DATA0,0,129,1,0,134,2
54302 DATA3,0,14,132,0,51,20
54303 DATA4,4,0,4,35,12,9
54304 DATA01,194,50,146,06,66,12
54305 DATA189,140,0,246,16,3,124
54306 DATA17,156,147,96,00,164,132
54307 DATA35,104,132,4,80,72,4
54308 DATA144,232,24,145,48,33,9
54309 DATA0,32,4,128,0,4,0,0
54401 DATA0,0,0,0,0,0,0
54402 DATA0,0,0,0,0,0,0
54403 DATA0,0,0,0,1,128,0
54404 DATA1,128,0,3,224,0,3
54405 DATA240,0,3,216,0,255,255
54406 DATA255,192,252,14,127,255,248
54407 DATA127,255,240,0,0,0,0
54408 DATA0,0,0,0,0,0,0
54409 DATA0,0,0,0,0,0,0
55000 FORI=0TO255+128:READA:POKE245064+I,A:NEXT
55010 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,64,0,1,213,170,151,191
55020 DATA85,126,42,255,235,63,170,189,5,255,244,3,93,200
55030 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
55040 DATA0,252,0,0,124,0,2,172,0,0,172,0,0,16,0,0,252,0,0,116,0,0,236,0,0,100
55050 DATA0,2,172,0,2,164,0,0,252,0,0,252,0,0,252,0,0,204,0,0,204,0,0,204,0,0
55060 DATA136,0,0,60,0,0,136,0,2,100,0,0
55070 DATA0,252,0,0,124,0,2,172,0,0,172,0,0,16,0,0,252,0,0,116,0,2,236,0,2,164,0
,0
55080 DATA174,0,0,102,0,0,252,0,15,252,0,15,252,0,4,12,0,8,12,0,4,15,0,40,6,0,0,
2
55090 DATA0,0,1,0,0,10,0,0
55100 DATA0,252,0,0,124,0,2,172,0,0,172,0,0,16,0,2,252,0,2,116,0,0,174,0,0,166,0
,0
55110 DATA252,0,0,100,0,0,252,0,0,252,0,3,252,0,11,204,0,43,15,0,40,15,128,160,3
55120 DATA160,0,0,160,0,0,32,0,0,160,0
55130 DATA0,252,0,0,124,0,2,172,0,0,172,0,0,16,0,0,252,0,0,116,0,0,172,0,0,164,0
,0
55140 DATA100,0,2,164,0,2,252,0,0,252,0,0,252,0,0,204,0,3,207,0,3,207,128,10,3
55150 DATA160,0,0,160,40,0,32,160,0,160,0
55160 DATA0,252,0,0,124,0,2,172,0,0,172,0,0,16,0,0,252,0,0,116,0,0,172,0,0,164
55170 DATA0,0,188,0,2,164,0,2,252,0,0,252,0,0,252,0,0,204,0,3,206,128,3,206,128
55180 DATA2,0,128,10,0,120,0,0,0,40,0,0,0
61000 POKE53280,6
62000 FORI=0TO40:READA:POKE49900+I,A:NEXT
62010 DATA234,169,40,133,250,169,4,133,251,162,128,160,0,130,145,250,200,192
62020 DATA40,208,249,232,165,250,24,105,40,133,250,165,251,105,0,133,251
62030 DATA224,152,208,228,96,0
62050 POKE53280,0:POKE53281,11:T=0:POKE56334,PEEK(56334)AND254:POKE1,PEEK(1)AND2
51
62055 FORG=0TO64#8:POKE14336+G,PEEK(53248+G):NEXT:POKE1,PEEK(1)OR4:POKE56334,PEE
K(56334)OR1
62060 READDAT:T=T+1:IFA%<>-1THENPOKE14336+G+T,A%:GOTO62060
62065 FORI=0TO60#8STEP8:A=14336+I+I:B=PEEK(A):POKEA,BANDB:NEXT
62070 DATA0,0,0,0,0,0,63,63,120,199,255,124,35,63
62075 DATA192,255,15,240,255,3,255,224,0,195,255,15,243,63,231,0
62080 DATA30,60,255,31,231,255,239,0,136,221,255,255,255,255,255,255
62085 DATA255,255,255,255,255,255,123,34,86,165,153,237,253,117,86,89
62090 DATA255,255,255,255,255,255,255,255
62095 DATA127,255,63,127,31,63,127,255,254,252,248,252,254,255,254,252
62100 DATA27,27,219,216,216,219,195,195,219,219,195,195,27,27,216,216
62105 DATA36,42,28,0,0,28,42,36
62110 DATA63,127,63,255,127,63,93,0,254,255,253,254,253,255,176,136
62115 DATA0,44,190,255,253,254,255,254,34,51,119,63,255,31,63,127
62120 DATA0,12,190,225,127,190,12,0
62125 DATA1,11,7,47,31,191,127,255,255,127,63,95,15,23,3,5
62130 DATA28,62,255,255,255,255,255,255
62135 DATA251,251,0,223,223,0,247,247,242,249,248,49,3,199,231,227
62140 DATA183,183,183,219,221,221,237,237,255,15,240,255,31,231,240,255
62150 DATA-1
62155 FORI=0TO319:READA:POKE251#64+I,A:NEXT
62160 DATA131,255,128,103,255,224,63,224,240,31,192,126,63,128,126,126,192,127
62165 DATA126,32,61,255,0,23,255,0,15,255,0,3,255,0,0,255,14,0,255,7,240,255,19
62170 DATA252,255,97,252,255,192,28,127,128,28,63,192,28,63,255,252,111,255
62175 DATA240,131,255,240,0
62180 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,32,0,48,16,124,96,25,255,192,15
62185 DATA255,128,7,255,192,15,255,192,15,143,192,30,219,192,28,115,192,28,3
62190 DATA198,28,225,204,15,195,240,15,255,240,7,195,240,0,224,224,0
62195 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,32,0,0,112,0,0,168,0,0,240,0,0,240,0,0
62200 DATA112,0,3,254,0,3,254,0,0,112,0,0,240,0,0,252,0,0,252,64,0,249,192,0,127
62205 DATA128,0,255,0,3,150,0,0
62210 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,4,0,0,1,30,16,0,255,160,0,255,192
62215 DATA1,255,224,3,220,240,3,191,112,3,146,112,3,128,112
62220 DATA3,128,48,1,190,48,0,235,160,0,127,192,0,59,128,0,141,0,0
62225 DATA0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
62230 DATA7,0,0,111,240,0,63,232,0,30,80,0,31,56,0
62235 DATA29,128,0,62,128,0,62,0,0,62,0,0,127,0,0,156,128,0,28,0,0,0,0,0,0,0,0
```



Gator: Listing 1.

10	- 200	Music interupt & data
29999-61000		Sprite data
62000-62030		Download W.D.Gs
62155-62235		Sprites for Title
62300-62570		Move sprites.

Gator: Listing 2.

0	- 50	Set variables
100	- 135	Set sprites pos.
600	- 999	Set time and water level
1000	- 1099	Main routine
10000-10199		Screen 1
11000-11099		Screen 2
11100-11199		Screen 3
11200-11288		Screen 4
22000-22040		Lives left
23000-23155		Game over
30000-30199		Locks screen
60000-60998		Title page
60999-61199		Music for title page

```
62300 FORI=0TO255:READA:POKE49152+I,A:NEXT
62310 DATA162,0,189,0,208,24,105,5,157,0,208,201,240,157,0,208,96
62320 DATA162,0,189,0,208,24,233,5,157,0,208,201,240,157,0,208,96
62330 DATA162,0,189,1,208,24,233,5,157,1,208,201,240,157,1,208,96
62340 DATA162,0,189,1,208,24,105,5,157,1,208,201,240,157,1,208,96
62350 DATA162,0,189,248,7,24,105,1,201,208,144,2,169,205,157,248,7,232,224
62355 DATA1,208,236,96
62360 DATA162,0,189,248,7,24,105,1,201,211,144,2,169,208,157,248,7,232,224
62365 DATA1,208,236,96
62370 DATA162,2,189,0,208,24,105,1,157,0,208,201,240,157,0,208,96
62375 DATA162,4,189,0,208,24,105,2,157,1,208,201,240,157,0,208,96
62380 DATA162,6,189,1,208,24,233,3,157,0,208,201,240,157,1,208,96
62385 DATA162,0,189,1,208,24,105,4,157,1,208,201,240,157,1,208,96
62390 DATA162,11,189,0,208,24,105,1,157,1,208,201,240,157,0,208,96
62395 DATA162,13,189,0,208,24,233,2,157,1,208,201,240,157,0,208,96
62400 DATA162,14,189,1,208,24,233,2,157,0,208,201,240,157,1,208,96
62410 DATA162,2,189,248,7,24,105,1,201,214,144,2,169,211,157,248,7,232
62420 DATA224,8,208,236,96
62500 FORI=0TO9:READA:POKE49500+I,A:NEXT
62510 FORI=0TO38:READA:POKE49520+I,A:NEXT
62520 DATA173,0,220,32,112,193,32,36,194,96
62530 DATA201,126,208,4,32,34,192,96,201,125,208,4,32,51,192,96,201,123,208,7,32
62540 DATA17,192,32,68,192,96,201,119,208,7,32,0,192,32,91,192,96,96
62550 FORI=0TO24:READA:POKE49700+I,A:NEXT
62560 DATA32,114,192,32,131,192,32,140,192,32,165,192,32,182,192,32,199
62570 DATA192,32,216,192,32,233,192,96
63000 POKE198,2:POKE631,13:LOAD
```

Listing 2.

```
0 S1=54276:S2=54277:S3=54273:FORI=S1-4TOS1+20:POKEI,0:NEXT:POKES1+20,15:GOTO6000
0
1 S1=54276:S2=54277:S3=54273:FORI=S1-4TOS1+20:POKEI,0:NEXT:POKES1+20,15
10 A$="[graphics]":POKE53272,31
15 B$="[graphics]"
20 C$="[graphics]"
25 D$="[graphics]"
30 E$="[graphics]"
35 F$="[graphics]"
40 G$="[graphics]"
50 H$="[graphics]"
100 V=53248:Q=205:POKEV+21,255:POKEV+28,3:POKEV+37,10:POKEV+38,14:LI=5:SC=0
120 POKEV+39,1:R=0:DEFFNA(A)=(PEEK(V+30)AND1):DEFFNB(B)=(PEEK(V+31)AND1)
130 FORI=40TO46:POKEV+I,12:NEXT:POKEV+3,100:POKEV+8,100:POKEV+9,200:POKEV+10,150
135 POKEV+11,135:POKEV+27,254:POKEV+29,2:POKEV+40,1:CO=54272
500 A0=49500:POKEV+30,0:POKEV+31,0:GOTO10000
600 FORI=1944TO1983:POKEI,72:POKEI+CO,1:NEXT:FORI=1984TO2023:POKEI,72
610 POKEI+CO,4:NEXT:TL=1983:WL=1984:L=56320:QQ=215:IFLI<1THEN23100
999 RETURN
1000 SYSA0:IFFNA(A)=1ORFNB(B)=1THENPOKES1,0:GOTO22000
1010 POKETL,32:POKEWL,72:POKEWL+CO,6:TL=TL-.1:WL=WL+.3:IFPEEK(L)=111THENGOSUB230
00
1012 IFTL<19450RWL>2022THEN22000
1099 RETURN
10000 POKE53280,2:POKE53281,3:GOSUB13250R=0:LE=1
10005 PRINT"[clr]":PRINTD$;D$;A$;C$;"[graphics]";B$;A$;D$;D$:PRINT"[home]";:PRINTF$
10006 PRINT"[graphics]":PRINTG$:PRINT"[graphics]":PRINTTAB(31);G$:GOSUB12550:POKEV+21,255
10008 GOSUB600:POKEV+1,170:POKEV,235:POKEV+30,0:POKEV+31,0:R=0:POKE2041,214
10009 GOSUB24000
10010 GOSUB1000:R=R+1:IFR>39THENR=0
10050 IFPEEK(V+1)<45THENSC=SC+(LE*500)+INT(TL)-INT(WL/5):GOTO30000
10110 PRINT"[graphics]":TAB(R);E$;"[graphics]";TAB(R);E$;"[graphics]";TAB(R);E$
10199 GOTO10010
11000 PRINT"[graphics]":POKE53280,2:POKE53281,3:GOSUB13250
11005 PRINT"[graphics]"
11006 PRINT"[graphics]"
11007 PRINT"[graphics]"
11008 PRINT"[graphics]"
11009 PRINT"[graphics]"
11010 PRINT"[graphics]"
11011 PRINT"[graphics]"
11012 PRINT"[graphics]"
11013 PRINT"[graphics]"
11014 PRINT"[graphics]"
11015 PRINT"[graphics]"
11016 PRINT"[graphics]"
11017 PRINT"[graphics]"
11018 PRINT"[graphics]"
11019 PRINT"[graphics]"
11020 PRINT"[graphics]"
11021 PRINT"[graphics]"
11022 PRINT"[graphics]"
11023 PRINT"[graphics]"
11024 PRINT"[graphics]"
11025 PRINT"[graphics]"
11026 PRINT"[graphics]"
11027 PRINT"[graphics]"
11038 GOSUB600:SYS36864:POKEV,40:POKEV+1,210:POKEV+3,126:POKEV+30,0:POKEV+31,0
11039 POKE2041,222:LE=2:GOSUB24000:GOSUB12550:POKEV+28,3:POKEV+21,255
11040 GOSUB1000
11060 IFPEEK(V+1)<43THENSC=SC+(LE*500)+INT(TL)-INT(WL/5):GOTO30000
11099 GOTO11040
11100 POKE53280,2:POKE53281,3:GOSUB13250:LE=3:V=53248:POKEV+28,1:POKEV+21,255
11105 PRINT"[clr]":PRINTD$;D$;A$;C$;"[graphics]";B$;A$;D$;D$:POKE2041,223
11106 PRINT"[graphics]":PRINTF$:PRINT"[graphics]":POKEV+40,5
11107 PRINTTAB(24);F$:PRINT"[graphics]":PRINTG$:PRINT"[graphics]":PRINTTAB(31);G$:GOSUB12550
11108 PRINT"[graphics]";:PRINTTAB(4)H$;"[graphics]";H$;"[graphics]";H$;"[graphics]";H$
11128 GOSUB600:POKEV+1,170:POKEV,235:POKEV+30,0:POKEV+31,0:POKEV+3,155
11139 LE=3:GOSUB24000:GOSUB12550
11140 GOSUB1000
11160 IFPEEK(V+1)<43THENSC=SC+(LE*500)+INT(TL)-INT(WL/5):GOTO10000
11199 GOTO11140
11200 POKE53280,4:POKE53281,3:PRINT"[graphics]":PRINTC$;
11210 FORT=0TO20:PRINT"[graphics]";:NEXT:PRINTB$
11220 PRINT"[graphics]":PRINTTAB(4);H$;TAB(13);H$;TAB(22);H$;TAB(31);H$
11225 PRINT"[graphics]":PRINTTAB(31);G$
11230 PRINT"[graphics]":PRINTTAB(4);H$;"[graphics]";TAB(13);H$;TAB(22);H$;TAB(31);H$
11235 PRINT"[graphics]":PRINTTAB(13);H$
11240 PRINT"[graphics]":PRINTTAB(11);"[graphics]";TAB(20);"[graphics]";TAB(29);"[graphics]"
11245 PRINT"[graphics]":PRINTTAB(20);"[graphics]"
11250 PRINT"[graphics]":PRINTTAB(7)"[graphics]"
11255 POKEV+21,255:PRINT"[graphics]"
11268 GOSUB600:SYS36864:POKEV,241:POKEV+1,195:POKEV+3,200:POKEV+30,0:POKEV+31,0
11269 POKE2041,222:LE=4:GOSUB24000:GOSUB12550:POKEV+28,3:POKE2040,205
11280 GOSUB1000
11290 IFPEEK(V+1)<43THENSC=SC+(LE*500)+INT(TL)-INT(WL/5):GOTO10000
11299 GOTO11200
12550 PRINT"[graphics]";:PRINTTAB(34)SC;:PRINTTAB(74);LI
12555 PRINT"[graphics]":PRINTTAB(34);LE:RETURN
13250 POKE2040,205:FORI=5TO15STEP2:POKEV+I,0:NEXT:POKEV+30,0:POKEV+31,0:RETURN
22000 SYS36864+256
22005 D=217:POKES1,16:POKES2,15:FORJ=5TO25:A=A+1:IFA>8THEND=D+1:POKE2040,D:A=0
22010 FORJJ=5TOJSTEP.5:POKES3,JJ:POKES1,33:NEXTJJ,J:POKEV+27,1:POKES1,0
22015 POKES1,128:POKES2,119
22020 X=PEEK(V):Y=PEEK(V+1):POKEV,X:FORT=YT0250STEP5:FORTT=220TO221:POKE2040,TT
22030 POKES1,128:POKEV+1,T:POKES3,250:POKES1,129:FORA=0TO20
22035 NEXTA,TT,T:POKEV+27,0:LI=LI-1:SYS36864:IFLI<1THENGOSUB23100:GOTO60000
22040 ONLEGOTO10000,11000,11100,11200,30000
23000 IFWL<1985THENRETURN
23005 POKEWL,72:POKEWL+CO,4:QQ=QQ+1:IFQQ>216THENQQ=215
23010 WL=WL-1:POKE2040,QQ:RETURN
23100 K$="[graphics]                    GAME  OVER":POKEV+21,0:POKE53280,11
23140 POKE53281,11:POKES1,16:POKES1+7,32:POKES1+14,32:POKES2,31:POKES2+7,15
23145 POKES2+14,31:SYS36864+256
23150 FORTT=100TO55STEP-4:POKES3,TT:POKES3+7,TT+10:POKES3+14,TT+20:POKES1,17
23151 POKES1+7,33:POKES1+14,33:PRINTK$:POKE646,INT(RND(1)*15):NEXT
23155 PRINTK$:PRINT"                    SCORE ";SC:FORT=0TO2500:NEXT:RETURN
24000 PRINT"[graphics]";:PRINTTAB(32)"SC";
24005 PRINT"[graphics]";:PRINTTAB(32)"LI";
24010 PRINT"[graphics]";:PRINTTAB(32)"LA"
24020 RETURN
30000 POKE53272,31:CH=14336:U=15496:POKE53280,0:O=1024:W=1200:POKE198,0:FF=255
30005 POKE56331,1
30010 V=53248:FORI=0TO7:POKECH+I+W,FF:NEXT:POKE53281,3
30014 PRINT"[clr]":POKE53281,0:SYS49900:FORI=1024TO1208:POKEI+CH,0:NEXT
30020 POKE2040,244:X=20:Y=171:POKEV,X:POKEV+1,Y:POKEV+31,0
30050 PRINTTAB(37)"[graphics]":PRINTTAB(37)"[graphics]":PRINTTAB(37)"[graphics]"
30055 PRINTTAB(37)"[graphics]":PRINTTAB(34)"[graphics]":PRINTTAB(34)"[graphics]"
30060 PRINTTAB(34)"[graphics]":PRINTTAB(30)"[graphics]"
30065 PRINTTAB(30)"[graphics]":PRINTTAB(22)"[graphics]"
30070 PRINTTAB(22)"[graphics]"
30075 PRINTTAB(10)"[graphics]"
30080 PRINTTAB(10)"[graphics]"
30085 PRINTTAB(10)"[graphics]"
30090 PRINT"[graphics]"
30095 PRINT"[graphics]"
30100 PRINT"[graphics]"
30105 PRINT"[graphics]"
30110 PRINT"[graphics]"
30115 PRINT"[graphics]"
30120 PRINT"[graphics]"
30122 PRINT"[graphics]"
30124 PRINT"[graphics]"
30126 PRINT"[graphics]"
30127 PRINT"[graphics]"
30129 PRINT"[graphics]"
30130 PRINT"[graphics]"
30132 PRINT"[graphics]"
30134 PRINT"[graphics]"
30136 PRINT"[graphics]"
30139 PRINT"[graphics]":IFDD=1THENDD=0:RETURN
30139 POKEV+31,0:Z=0:R=56320
30140 POKEV,X+256*(X>255):POKEV+16,(PEEK(V+16)AND253)OR-(X>255):POKEV+1,Y
30150 POKEU,FF:U=U-.3:Y=Y-.3:POKEV+1,Y:POKEV+31,0:POKEV+30,0:PP=PEEK(R):X=X+2
30155 SC=SC+1:IFPP=123THENX=X-1:Y=Y-.4:U=U-.4
30157 IFPP=119THENX=X+2:Y=Y-.2:U=U-.2
30165 IFPP=126THENY=Y-.7:U=U-.7
30170 IFFNB(B)=1THENPOKEV+16,0:LI=LI-1:ONLEGOTO10000,11000,11100,11200,10000
30175 IFX>338THENPOKEV+16,0:LI=LI+1:ONLEGOTO11000,11100,11200,10000
30199 GOTO30140
60000 POKE53280,11:POKE53281,0:POKE53272,31:SYS37120:POKE53248+21,0:RESTORE
60001 FORI=54272TO54296:POKEI,0:NEXT:POKE54296,15
60005 POKE53265,PEEK(53265)OR16
60010 V=53248:POKEV+21,31:POKEV+23,255:POKEV+29,255:FORI=39TO46:POKEV+I,13:NEXT
60015 POKEV+28,0:QQ=250:POKEV+27,0:DD=1:PRINT"[clr]":GOSUB30050
60027 PRINT"[graphics]":X1=75:X2=125:X3=165:X4=205:X5=245:Y1=235
60030 X1=75:X2=125:X3=165:X4=205:X5=245:Y1=235
60032 POKEV,X1:POKEV+2,X2:POKEV+4,X3:POKEV+6,X4:POKEV+8,X5
60035 FORI=1TO9STEP2:POKEV+I,Y1:NEXT:FORI=2040TO2044:QQ=QQ+1:POKEI,QQ:NEXT
60040 FORY1=255TO55STEP-1:POKEV+1,Y1:POKEV+3,Y1:POKEV+5,Y1:POKEV+7,Y1:POKEV+9,Y1
60042 NEXTY1:C=000:A=000:B=000
60045 FORI=39TO46:POKEV+I,13:NEXT
60084 GETX$
60085 POKES1+7,16:POKES1,32:POKES1+14,16:POKES2+14,31
60090 POKES2+7,31:POKES2,15:READA,B,C:POKES3+7,A:POKES3+14,B:POKES3,C
60094 POKES1+7,17:POKES1,33:POKES1+14,17:IFC=000THENRESTORE:GOTO60090
60095 FORT=0TO150:NEXT:IFX$=""THEN60084
60096 IFX$=" "THEN60998
60097 GOTO60084
60098 SYS36864:GOSUB63000:CLR:V=53248:POKEV+23,0:POKEV+29,0:RESTORE
60099 FORI=2042TO2047:POKEI,215:NEXT:GOTO1
61085 DATA5,5,5,10,10,10,5,5,5,5,10,10,10,5,5,5,5,10,10,10
61010 DATA5,10,20,20,10,5,5,5,5,10,20,5,5,10,5,5,5,5,5,5,10,10,10,20,20,20
61015 DATA10,10,30,10,20,30,10,50,50,10,60,70,10,40,60,10,30,70,10,20,60,10,10,5
61020 DATA20,30,20,30,40,30,40,50,40,60,60,60,50,40,30,40,30,20,30,20,10,20,10,5
61025 DATA20,30,40,20,30,40,20,30,40,40,50,60,40,50,60,40,50,60,30,20,10,20,10,5
61030 DATA20,30,20,30,40,30,40,50,40,60,60,60,50,40,30,40,30,20,30,20,10,20,10,5
61035 DATA10,5
61199 DATA000,000,000
63000 POKE53280,3:POKE53281,3:PRINT"[clr]":POKE53272,31
63010 A1$="[graphics]"
63015 A2$="[graphics]"
63020 A3$="[graphics]"
63025 A4$="[graphics]":A5$="[graphics]":A6$="[graphics]"
63050 PRINT"[home]":PRINTTAB(33)"[graphics]":PRINTTAB(32)"[graphics]"
63055 PRINTTAB(31)"[graphics]":PRINTTAB(30)"[graphics]"
63060 PRINTTAB(29)"[graphics]"
63065 PRINTTAB(29);A4$TAB(29);A5$TAB(69);A5$TAB(69)A4$
63070 PRINTTAB(29);A4$TAB(29);A5$TAB(69);A5$TAB(69)A4$
63075 PRINTTAB(7);A3$TAB(8);A2$TAB(40);A2$TAB(47);A3$TAB(48);A2$TAB(88);A2$
63080 FORT=0TO4:PRINTA1$:NEXT:PRINT"[graphics]":PRINTTAB(67);A6$
63082 PRINTTAB(7)"[graphics]"
63084 POKE2040,245:V=53248:POKEV+21,3:POKEV,36:POKEV+1,166:POKEV+28,3
63086 POKEV+37,7:POKEV+38,0:POKEV+39,1:POKEV+23,3:POKEV+29,3:POKEV+27,2
63088 POKE2041,237:POKEV+2,240:POKEV+3,121:POKEV+40,10:X=240
63090 FORT=0TO38:FORZ=24ST0250:POKE2041,Z:X=X-1:POKEV+2,X:FORA=0TO20:NEXTA,Z,T
63095 FORY=121TO166:POKEV+3,Y:NEXT
63097 FORXI=36TO2STEP-.2:POKEV,XI:POKEV+2,XI:NEXT:POKEV+23,0:POKEV+29,0:RETURN
```

Listing 1.

```
10 *LOAD "TANKS-DATA" 4000
20 CHAIN "TANKS-3"
```

Listing 2.

```
   10 REM TANKS-2 BY N.SHEARD
   20 MODE 4
   30 VDU 29,652;524;
   40 MOVE 0,0:LOC%=&4000
   50 FOR Z%=0 TO 2
   60 CLS
   70 PROCdatachasvert
   80 X%=340
   90 RESTORE X%
  100 PROCdrawvert
  110 NEXT Z%
  120 PROCdatachasdiag
  130 X%=390
  140 PROCdrawdiag
  150 CLS
  160 PROCdataturretvert
  170 X%=440
  180 PROCdrawvert
  190 PROCdataturretdiag
  200 X%=480
  210 PROCdrawdiag
  220 CLS
  230 PROCdataenturvert
  240 X%=520
  250 PROCdrawvert
  260 PROCdataenturdiag
  270 X%=560
  280 PROCdrawdiag
  290 FOR CIRC%=0 TO 360 STEP 30:X%=CIRC%*PI/90:A%=44*
COS X%:B%=44*SIN X%:MOVE 0,0:DRAW A%,B%:NEXT
  300 PROCstore
  310 *SAVE "TANKS-DATA" 4000 4948
  320 END
  330 DEFPROCdatachasvert
  340 DATA -1004,8,-4,-7,-5,-8,-6,-8,-7,-7,-7,8,-6,9,-
5,9,-3,7,5,7,5,8,5,-7,6,-8,7,-8,8,-7,8,8,7,9,6,9,5,8,5
,5,-4,5,-4,-4,5,-4,5,-5,-4,-5,-4,-6,5,-6,5,Z%-7,8,Z%-7
,8,Z%-4,5,Z%-4,5,Z%-1,8,Z%-1,8,Z%+2,5,Z%+2,5,Z%+5,8,Z%
+5
  350 DATA -1007,Z%-7,-4,Z%-7,-4,Z%-4,-7,Z%-4,-7,Z%-1,
-4,Z%-1,-4,Z%+2,-7,Z%+2,-7,Z%+5,-4,Z%+5,1500,1500
  360 ENDPROC
  370
  380 DEFPROCdatachasdiag
  390 DATA 1003,9,3,10,2,10,2,11,1,11,-10,0,-10,-1,-9,
-2,-8,-2,3,9,2,8,8,2,10,2,11,1,11,0,1,-10,0,-10,-1,-9,
-1,-8,9,2,7,0,1,6,0,6,-6,0,-6,-1,0,-7,-1,-7,-7,-1,-1,-
7,-2,-7,-7,-2,-7,-1,-9,1,-7,3,-5,1,-3,3,-5,5,-3,7,-1,5
,1,7,-1,9,1008,1,10,-1
  400 DATA 8,-3,6,-1,4,-3,6,-5,4,-7,2,-5,0,-7,2,-9,150
0,1500
  410 ENDPROC
  420
  430 DEFPROCdataturretvert
  440 DATA -1001,-4,2,-4,2,-3,-1,-3,-2,-2,3,-2,3,-1,-2
,-1,-3,0,4,0,4,1,-3,1,-3,2,4,2,3,3,-2,3,-1,4,2,4,1,4,1
,11,0,11,0,4,1500,1500
  450 ENDPROC
  460

  470 DEFPROCdataturretdiag
  480 DATA -1002,-4,-4,-2,-4,-1,-1,-4,-1,-3,-3,-1,-3,0
,0,-3,1,-3,-3,1,-3,2,2,-3,2,-2,-2,2,-2,3,3,-2,3,-1,-1,
3,0,3,3,0,3,1,1,3,2,3,3,2,9,8,8,9,3,3,3,4,7,8,1500,150
0
  490 ENDPROC
  500
  510 DEFPROCdataenturvert
  520 DATA -1001,-4,2,-4,2,-3,-1,-3,-1,-1,-2,-1,-2,-2,
-2,-1,-3,0,-3,2,-1,2,-2,3,-1,3,-1,4,0,4,0,11,1,11,1,4,
2,4,2,2,3,3,3,2,4,2,4,0,2,-2,2,-1,3,-2,1500,1500
  530 ENDPROC
  540
  550 DEFPROCdataenturdiag
  560 DATA -1002,-4,-4,-2,-4,-1,-1,-4,-1,-3,0,-2,0,-3,
2,-3,2,-2,3,-2,3,0,2,0,3,1,3,2,9,8,8,9,3,3,3,4,7,8,2,3
,0.3,0,2,-1,3,-2,3,-2,2,-3,2,-3,0,-2,0,-3,-1,1500,1500
  570 ENDPROC
  580
  590 DEFPROCdrawvert
  600 REPEAT:READ A%,B%:IF A%=1500 THEN GOTO 620
  610 PROCdraw
  620 UNTIL A%=1500:PROCstore:RESTORE X%:CLS:MOVE 0,0
  630 REPEAT:READ A%,B%:IF A%=1500 THEN GOTO 670
  640 IF A%>1000 THEN A%=A%-1000:C%=A%:A%=B%:B%=C%:A%=
A%+1000:PROCdraw:UNTIL FALSE
  650 IF A%<-1000 THEN A%=A%+1000:C%=A%:A%=B%:B%=C%:A%
=A%-1000:PROCdraw:UNTIL FALSE
  660 C%=A%:A%=B%:B%=C%:PROCdraw
  670 UNTIL A%=1500:PROCstore:RESTORE X%:CLS:MOVE 0,0
  680 REPEAT:READ A%,B%:IF A%=1500 THEN GOTO 700
  690 A%=A%*-1:B%=B%*-1:PROCdraw
  700 UNTIL A%=1500:PROCstore:RESTORE X%:CLS:MOVE 0,0
  710 REPEAT:READ A%,B%:IF A%=1500 THEN GOTO 750
  720 IF A%>1000 THEN A%=A%-1000:C%=A%:A%=B%:B%=C%:A%=
```



BBC

TANK A



TANKS IS an arcade-style game for the BBC Micro with operating system OS 1.2. The program features machine-code, flicker-free, high-resolution graphics, with independent rotation of the tanks' turrets and chassis, music, animated lives and a high-resolution title page.

To get the program Saved on tape, first type in listing 1 and Save it as Tanks-1, then type in listing 2 and Save it as Tanks-2 on a different tape. Run Tanks-2 and a series of rotations of tank's chassis, turrets and trees will appear on the screen followed by the message "Record then return".

Start your tape recording straight after Tanks-1 and press Return. Finally, type in listing 3 and Save it as Tanks-3 after Tanks Data. To load the game

```
CHAIN "TANKS-1"
```

which will draw the title page and automatically load the other sections.

When the whole program has loaded, the instructions will be displayed. The object of the game is to destroy all enemy tanks — those with crosses on their turrets — by cleverly chasing and ambushing them. You score 100 points for each tank destroyed and 1,000 points for each screen completed.

After losing a life or on starting a new game your tank automatically drives from the barracks, at the top right of the screen, to the centre of the screen ready for action, during which the music plays. At the end of the game the last score and the highest score are displayed.

In writing the game the first problem was that, to obtain the necessary independence of rotation of a tank's chassis and turret, a total of 128 3-by-3 character matrices had to be defined, or 1,152 characters, or 9,216 numbers would have had to be typed in. This is obviously a massive waste of memory and would be very prone to error.

The alternative was to separate the turret and chassis into different characters and overlay one of the eight different rotations of each on to the other. This can be done using the Basic function Or, which affects the bits of two numbers when written in binary such that:

```
01010100 OR 00110101 = 01110101
```

It can be seen from this that if there is a 1 in any or both of the corresponding positions of the numbers then a 1 will appear in the corresponding position in the answer. Only where there is an 0 in both of the corresponding positions of the numbers does an 0 appear in a corresponding position in the answer. Thus:

```
8 OR 53 = 117
```

Unfortunately, using Or is too slow to produce flicker-free graphics and so I wrote a machine-code subroutine which appears at line 1940 in listing 3. ORA is the equivalent function to Or in assembly language and takes the form:

```
LDA (first number):
ORA (second number):
STA (on screen)
```

As you can see I have directly accessed the screen for ease and speed and so second processors must be disconnected before running the program.

With the program altered to accept this only 24 3-by-3 character matrices are required, that is 1,728 numbers to be typed in, which is still too prone to error. The solution was simple, use the BBC's processing power to rotate the shapes — from just two of the most important rotations of each shape entered from the keyboard — to create the remaining rotations and store them in the memory before the game begins. Listing 2 does this by reflecting the shapes in varying lines.

With this entered and working correctly only six of the 128 3-by-3 character matrices that will appear on the screen have to be defined.

If you wish to have a copy of the game, but do not have the time to type it in, it is available from N Sheard, 2 Ashbrook Drive, Prestbury, Cheshire SK10 4BY, on cassette for £4 including P&P.

(continued on next page)

ATTACK



Listing 2 continued.

```
A%=A%+1:B%=B%+1:A%=A%+1000:PROCdraw:UNTIL FALSE
  730 IF A%<-1000 THEN A%=A%+1000:C%=A%:A%=B%:B%=C%:A%
=A%+1:B%=B%+1:A%=A%-1000:PROCdraw:UNTIL FALSE
  740 C%=A%:A%=B%:B%=C%:A%=A%+1:B%=B%+1:PROCdraw
  750 UNTIL A%=1500:PROCstore:CLS:ENDPROC
  760
  770 DEFPROCdrawdiag
  780 CLS:MOVE 0,0
  790 REPEAT:READ A%,B%:IF A%=1500 THEN GOTO 810
  800 PROCdraw
  810 UNTIL A%=1500:PROCstore:RESTORE X%:CLS:MOVE 0,0
  820 REPEAT:READ A%,B%:IF A%=1500 THEN GOTO 840
  830 A%=A%+1:PROCdraw
  840 UNTIL A%=1500:PROCstore:RESTORE X%:CLS:MOVE 0,0
  850 REPEAT:READ A%,B%:IF A%=1500 THEN GOTO 870
  860 A%=A%+1:B%=B%+1:PROCdraw
  870 UNTIL A%=1500:PROCstore:RESTORE X%:CLS:MOVE 0,0
  880 REPEAT:READ A%,B%:IF A%=1500 THEN GOTO 900
  890 B%=B%+1:PROCdraw
  900 UNTIL A%=1500:PROCstore:CLS:ENDPROC
  910
  920 DEFPROCdraw
  930 IF A%<-000 THEN A%=A%+1000:MOVE A%+4,B%+4:A%=A%-
1000:ENDPROC
  940 IF A%>000 THEN A%=A%-1000:MOVE A%+4,B%+4:A%=A%+1
000:ENDPROC
  950 DRAW A%+4,B%+4:ENDPROC
  960
  970 DEFPROCstore
  980 FOR P%=&6A10 TO &6A2F:?LOC%=?P%:LOC%=LOC%+1:NEXT
  990 FOR P%=&6B50 TO &6B6F:?LOC%=?P%:LOC%=LOC%+1:NEXT
 1000 FOR P%=&6C90 TO &6CAF:?LOC%=?P%:LOC%=LOC%+1:NEXT
 1010 ENDPROC
```

(continued from previous page)

Listing 3.

```
  10 REM TANKS-3 BY N.SHEARD
  20 ON ERROR GOTO 50
  30 HI%=0
  40 SCORE%=0
  50 MODE 7:VDU 23;8202;0;0;0;
  60 PROCinstructions
  70 MODE 4:VDU 23;8202;0;0;0;
  80 VDU 19,1,0,0,0,0:VDU 19,0,3,0,0,0
  90 LIVES%=4
 100 PROCmachinecode
 110 RESTORE:PROCdata
 120 PROCnewlife
 130 GOTO 160
 140 RESTORE:PROCdata
 150 PROCscreen
 160 G%=20:H%=16
 170 TUR%=0:CHAS%=0:ROT%=1
 180 DIR%=0:TRACK%=2:GUN%=4
 190 PROCgame
 200 IF ?&5030=0 AND ?&5038=0 AND ?&5040=0 AND ?&5048
=0 SCORE%=SCORE%+1000:RESTORE:PROCdata:CLS:GOTO140
 210 GOTO 190

 220
 230 DEFPROCdraw
 240 A%=(A%+72)+&4000:B%=(B%+72)+&4000
 250 E%=(D%+320)+(C%+8)+&5000:?&72=E% MOD 256
 260 ?&74=A% MOD 256:?&75=A% DIV 256
 270 ?&76=B% MOD 256:?&77=B% DIV 256
 280 ?&72=E% MOD 256:?&73=E% DIV 256
 290 CALL control
 300 ENDPROC

 310
 320 DEFPROCcheck
 330 E%=(D%+320)+(C%+8)+&5000
 340 ?&72=E% MOD 256:?&73=E% DIV 256
 350 CALL check
 360 ENDPROC

 370
 380 DEFPROCclear
 390 E%=(D%+320)+(C%+8)+&5000
 400 ?&72=E% MOD 256:?&73=E% DIV 256
 410 CALL blank
 420 ENDPROC

 430
 440 DEFPROCdata
 450 DATA 8,12,1,15,2,14,3,13
 460 FOR I%=&5000 TO &5007:READ X%:?I%=X%:NEXT
 470 DATA 16,20,17,23,18,22,19,21
 480 FOR I%=&5010 TO &5017:READ X%:?I%=X%:NEXT
 490 DATA 24,28,25,31,26,30,27,29
 500 FOR I%=&5020 TO &5027:READ X%:?I%=X%:NEXT
 510 DATA 8,134,162,99,166,144,12,86,208,8,102,238,96
,0
 520 MEM%=&4200
 530 FOR X%=1 TO 14:READ P%:A%=128
 540 REPEAT:IF (A% AND P%) THEN ?MEM%=1 ELSE ?MEM%=0
 550 A%=A% DIV 2:MEM%=MEM%+1:UNTIL A%=0:NEXT X%
 560 VDU 23,224,85,170,85,170,85,170,85,170
 570 VDU 23,225,0,0,255,0,0,255,0,0

 580 VDU 23,226,0,0,0,24,24,0,0,0
 590 DATA 1,1,0,0,10,2,2,25,1,1,4,4,10,2,2,5,1,1,0,0,
10,2,25,6,1,1,0,0,10,2,25,27
 600 FOR I%=&5030 TO &504F:READ X%:?I%=X%:NEXT
 610 REPEAT:?(&5038+(INT(RND(4))-1)*8)=0:UNTIL RND(1)
>.2
 620 FOR I%=&5060 TO &507F:?I%=0:NEXT
 630 DATA 13,6,13,6,13,6,21,12,29,6,33,6,49,12,49,6,4
1,6,33,6,21,12,33,6,13,12,13,6,13,6,13,6,21,12,29,6,33
,6,49,12,49,6,41,6,33,6,21,12,33,6,13,24,1,1
 640 LOCX=&5700:REPEAT:READ A%,B%:?LOCX=A%:?(LOCX+1)=
B%:LOCX=LOCX+2:UNTIL A%=1
 650 ENDPROC

 660
 670 DEFPROCtank
 680 TRACK%=TRACK%+4:IF TRACK%=14 TRACK%=2
 690 IF ROT%=1 GUN%=GUN%-1 ELSE GUN%=GUN%+1
 700 IF GUN%>5 ROT%=1
 710 IF GUN%<3 ROT%=0
 720 IF LIVES%=1 GOTO 740
 730 A%=(?(&5010+GUN%)*72)+&4000:?&74=A% MOD 256:?&75
=A% DIV 256:B%=(TRACK%*72)+&4000:?&76=B% MOD 256:?&77=
B% DIV 256:?&00=LIVES%:CALL livee
 740 C%=G%:D%=H%
 750 CHAS%=CHAS%-(INKEY(-67))+(INKEY(-98))
 760 TUR%=TUR%-(INKEY(-67))+(INKEY(-98))
 770 TUR%=TUR%-(INKEY(-105))+(INKEY(-104))
 780 IF TUR%<0 TUR%=7
 790 IF TUR%>7 TUR%=0
 800 IF CHAS%<0 CHAS%=7
 810 IF CHAS%>7 CHAS%=0
 820 A%=?(CHAS%+&5000):B%=?(TUR%+&5010)
 830 FILX%=C%:FILY%=D%
 840 IF INKEY(-99) AND CHAS%=0 THEN D%=D%-1
 850 IF INKEY(-99) AND CHAS%=2 THEN C%=C%+1
 860 IF INKEY(-99) AND CHAS%=4 THEN D%=D%+1
 870 IF INKEY(-99) AND CHAS%=6 THEN C%=C%-1
 880 VARX%=C%:VARY%=D%
 890 C%=FILX%:D%=FILY%
 900 PROCclear
 910 C%=VARX%:D%=VARY%
 920 PROCcheck
 930 IF ?&70>0 C%=G%:D%=H% ELSE G%=C%:H%=D%
 940 PROCdraw
 950 IF INKEY(-1) AND TUR% MOD 2=0 THEN GOTO 960:ELSE
 ENDPROC
 960 F%=&5070:IF ?F%=0 GOTO 900
 970 F%=&5074:IF ?F%=0 GOTO 900 ELSE ENDPROC
 980 ?F%=1:?(F%+1)=TUR%:?(F%+2)=G%:?(F%+3)=H%+1:?I%=
F%:PROCmoveshell:C%=?(F%+2):D%=(F%+3):PROCshellcheck:S
OUND 0,-15,4,2
 990 IF ?&70=0 ?F%=0
1000 ENDPROC

1010
1020 DEFPROCscreen
1030 MEM%=&4200
1040 FOR Y%=4 TO 28 STEP 3:FOR X%=2 TO 35 STEP 3:IF ?
MEM%=1 A%=32:B%=33:C%=X%:D%=Y%:PROCdraw
1050 MEM%=MEM%+1:NEXT X%:NEXT Y%
1060 FOR Y%=0 TO 28:PRINTTAB(Y%,0);CHR#(224):NEXT

1070 FOR A%=0 TO 29:PRINTTAB(0,A%);CHR#(224);CHR#(224
);PRINTTAB(38,A%);CHR#(224);CHR#(224):NEXT
1080 FOR A%=0 TO 38:PRINTTAB(A%,3)CHR#(224):NEXT
1090 FOR A%=&7E80 TO &7FFF STEP 2:?A%=85:?(A%+1)=170:
NEXT
1100 FOR A%=0 TO 2:PRINTTAB(26,A%);CHR#(224);CHR#(224
);CHR#(224):NEXT
1110 PRINTTAB(29,3);CHR#(225);CHR#(225);CHR#(225);PRI
NTTAB(0,38);CHR#(224);CHR#(224)
1120 PRINTTAB(5,2);"SCORE=";SCORE%;PRINTTAB(5,1);"HI-
SCORE=";HI%
1130 IF LIVES%=4 GOTO1150
1140 C%=29:FOR VAR%=0 TO LIVES%-1:A%=2:B%=18:C%=29+VA
R%*3:D%=0:PROCclear:NEXT
1150 IF LIVES%=1 ENDPROC
1160 C%=29:FOR VAR%=0 TO LIVES%-2:A%=2:B%=18:C%=29+VA
R%*3:D%=0:PROCdraw:NEXT
1170 ENDPROC

1180
1190 DEFPROCenemytanks
1200 FOR I%=&5030 TO &504F STEP 8
1210 ENX%=?(I%+6):ENY%=?(I%+7)

1220 IF ?I%=0 NEXT I%:ENDPROC
1230 PROCsearch
1240 C%=ENX%:D%=ENY%
1250 PROCclear
1260 IF ?(I%+4)<>10 GOTO 1310
1270 IF ?(I%+2)=0 THEN D%=D%-1
1280 IF ?(I%+2)=2 THEN C%=C%+1
1290 IF ?(I%+2)=4 THEN D%=D%+1
1300 IF ?(I%+2)=6 THEN C%=C%-1
1310 PROCcheck:IF ?&70=0 ?(I%+6)=C%:?(I%+7)=D% ELSE C
%=ENX%:D%=ENY%:?(I%+6)=C%:?(I%+7)=D%
1320 A%=?(&5000+?(I%+2)):B%=?(&5020+?(I%+3))
1330 PROCdraw
1340 ?&70=0
1350 A%=(((INT(RND(3))-1)*4)+&5060
1360 IF ?(I%+3) MOD 2=0 AND ?A%=0 AND RND(1)>.2 ?A%=1
:?(A%+1)=?(I%+3):?(A%+2)=?(I%+6)+1:?(A%+3)=?(I%+7)+1:F
%=I%:I%=A%:PROCmoveshell:PROCmoveshell:I%=F%:C%=?(A%+2
):D%=?(A%+3):PROCshellcheck:SOUND 0,-15,6,2
1370 IF ?&70=1 ?A%=0
1380 NEXT I%:ENDPROC

1390
1400 DEFPROCsearch
1410 ?(I%+3)=?(I%+2)+GUN%-4
1420 IF ?(I%+4)=10 AND (ENX%-2) MOD 3=0 AND (ENY%-1)
MOD 3=0 THEN PROCdirection
1430 IF ?(I%+4)>10 ?(I%+2)=?(I%+2)+1:?(I%+3)=?(I%+3)-
1:?(I%+4)=?(I%+4)-1
1440 IF ?(I%+4)<10 ?(I%+2)=?(I%+2)-1:?(I%+3)=?(I%+3)-
1:?(I%+4)=?(I%+4)-1
1450 IF ?(I%+4)=0 OR ?(I%+4)=100 ?(I%+4)=10
1460 IF ?(I%+3)>250 ?(I%+3)=7
1470 IF ?(I%+3)>7 ?(I%+3)=?(I%+3)-8
1480 IF ?(I%+2)>250 ?(I%+2)=7
1490 IF ?(I%+2)>7 ?(I%+2)=0
1500 ENDPROC
1510
1520 DEFPROCdirection

1530 C%=ENX%:D%=ENY%:E%=(D%+320)+(C%+8)+&5000:?&7C=E%
MOD 256:?&7D=E% DIV 256
1540 CALL tankcheck:VAR%=?&78
1550 IF VAR%=0:ENDPROC
1560 IF VAR%>1 GOTO 1590
1570 IF VAR%=1:DIR%=-1:REPEAT:DIR%=DIR%+1:IF DIR%=4 T
HEN ENDPROC
1580UNTIL ?(DIR%+&5050)=1:PROCnewdirect:ENDPROC
1590 A%=?(I%+2)+4:IF A%>7 A%=A%-8
1600 ?(&5050+(A%/2))=0
1610 A%=INT(RND(4))+&504F:IF ?(A%)=1 DIR%=(A%-&5050):
PROCnewdirect:ENDPROC ELSE GOTO1610

1620
1630 DEFPROCnewdirect
1640 A%=?(I%+2)/2
1650 IF A%-DIR%=2 OR DIR%-A%=2 ?(I%+4)=4:ENDPROC
1660 IF A%=3 AND DIR%=0 ?(I%+4)=102:ENDPROC
1670 IF A%=0 AND DIR%=3 ?(I%+4)=2:ENDPROC
1680 IF A%-DIR%>0 ?(I%+4)=2:ENDPROC
1690 IF A%-DIR%<0 ?(I%+4)=102:ENDPROC
1700 ENDPROC
1710
1720 DEFPROCgame
1730 TIME=0
1740 PROCshell
1750 PROCenemyshell
1760 PROCtank
1770 PROCenemyshell
1780 PROCshell
1790 PROCenemytanks
1800 REPEAT UNTIL TIME>35
1810 PRINTTAB(5,2);"SCORE=";SCORE%
1820 IF SCORE%>HI% HI%=SCORE%
1830 PRINTTAB(5,1);"HI-SCORE=";HI%
1840 ENDPROC

1850
1860 DEFPROCmachinecode
1870 FOR pass=0 TO 2 STEP 2
1880 P%=&5100
1890 [
1900 OPT pass
1910 .move
1920 LDY #&10
1930 .loop
1940 DEY:LDA(&70),Y:ORA(&72),Y:STA(&72),Y:CPY#00:BNE l
oop:RTS

1950
1960 .control
1970 LDA &74:STA &70:LDA &75:STA &71:JSR move:LDA &76
:STA &70:LDA &77:STA &71:JSR move:LDA &74:CLC:ADC #&10
:STA &74:LDA &75:ADC #&0:STA &75:LDA &76:CLC:ADC #&10:
STA &76:LDA &77:ADC #&0:STA &77:LDA &72:CLC:ADC #&40:S
TA &72
1980 LDA &73:ADC #&1:STA &73
1990 LDA &74:STA &70:LDA &75:STA &71:JSR move:LDA &76
:STA &70:LDA &77:STA &71:JSR move:LDA &74:CLC:ADC #&10
:STA &74:LDA &75:ADC #&0:STA &75:LDA &76:CLC:ADC #&10:
STA &76:LDA &77:ADC #&0:STA &77:LDA &72:CLC:ADC #&40:S
TA &72
2000 LDA &73:ADC #&1:STA &73:LDA &74:STA &70:LDA &75:
STA &71:JSR move:LDA &76:STA &70:LDA &77:STA &71:JSR m
ove:RTS
2010
2020 .blank
2030 LDX #&3
2040 .count
2050 LDY #&10
2060 .b_loop
2070 DEY:LDA #&0:STA (&72),Y:CPY #&0:BNE b_loop:DEX:C
PX #&0:BEQ exit:LDA &72:CLC:ADC #&40:STA &72:LDA &73:A
DC #&1:STA &73:JMP count
2080 .exit:RTS
2090
2100 .check
2110 LDX #&3
2120 .c_count
2130 LDY #&10
2140 .c_loop
2150 DEY:LDA (&72),Y:BNE found:CPY #&0:BNE c_loop:DEX
:CPX #&0:BEQ c_exit:LDA &72:CLC:ADC #&40:STA &72:LDA &
73:ADC #&1:STA &73:JMP c_count
2160 .c_exit:LDA #&0:STA &78:RTS
2170 .found:LDA #&1:STA &78:RTS

2180
2190 .shellcheck
2200 LDY #&8
2210 .s_loop
2220 DEY:LDA (&72),Y:BNE s_found:CPY #&0:BNE s_loop:L
DA #&0:STA &78:RTS
2230 .s_found:LDA #&1:STA &78:RTS
2240
2250 .buffer
2260 LDX #250:LDA #&00:JSR &FFF4:STX &7B:RTS
2270
2280 .tankcheck
2290 LDA #0:STA &78:LDA &7C:SEC:SBC #&C8:STA &72:LDA
&7D:SBC #&3:STA &73:JSR check:JSR block:LDA &7E:STA &5
050
2300 LDA &7C:SEC:SBC #&10:STA &72:LDA &7D:SBC #&0:STA
&73:JSR check:JSR block:LDA &7E:STA &5053
2310 LDA &7C:CLC:ADC #&C0:STA &72:LDA &7D:ADC #&3:STA
&73:JSR check:JSR block:LDA &7E:STA &5052
2320 LDA &7C:CLC:ADC #&10:STA &72:LDA &7D:ADC #&0:STA
&73:JSR check:JSR block:LDA &7E:STA &5051:RTS

2330
2340 .block
2350 LDA &78:BEQ nought:LDA #&0:STA &7E:RTS
2360 .nought:LDA #&1:STA &7E:LDX &7B:INX:STX &7B:RTS

2370
2380 .moveshell
2390 LDY #1:LDA(&70),Y:CMP #5:BMI  right:LDY #2:LDA (
&70),Y:STA &73:DEC &73:LDA &73:STA (&70),Y
2400 .right:LDY #1:LDA(&70),Y:CMP #&4:BPL up:CMP #0:B
EQ up:LDY #2:LDA(&70),Y:STA &73:INC &73:LDA &73:STA(&7
0),Y
2410 .up:LDY #1:LDA(&70),Y:CMP #2:BMI moveup:CMP #7:B
PL moveup:JMP down
2420 .moveup:LDY #3:LDA(&70),Y:STA &73:DEC &73:LDA &7
3:STA(&70),Y
2430 .down:LDY #1:LDA(&70),Y:CMP #3:BMI end:CMP #&6:BP
L end:LDY #3:LDA(&70),Y:STA &73:INC &73:LDA &73:STA(&7
0),Y
2440 .end:RTS

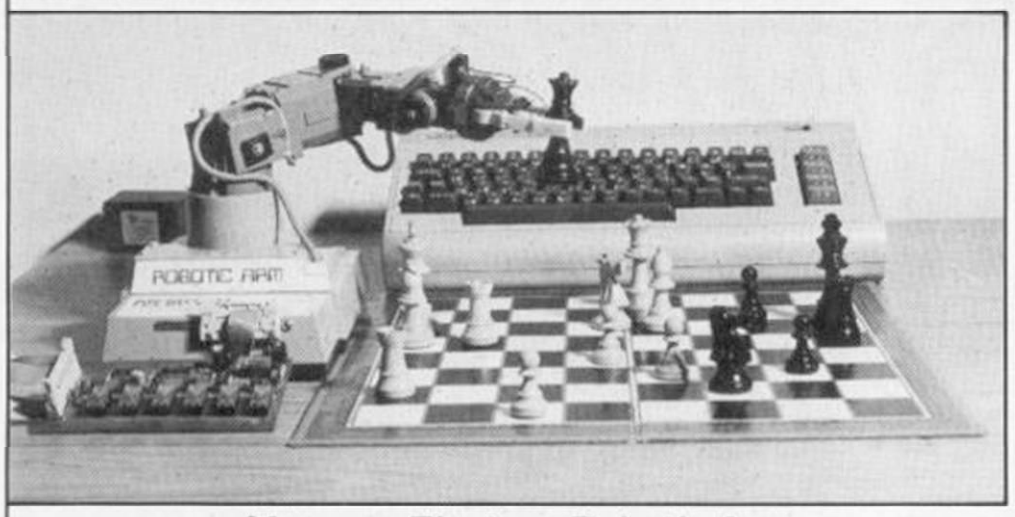
2450
2460 .livee
2470 LDA &74:STA &7C:LDA &75:STA &7D:LDA &76:STA &7E:
LDA &77:STA &7F
2480 LDA #&E8:STA &72:LDA #&50:STA &73:JSR blank:LDA
#&E8:STA &72:LDA #&50:STA &73:JSR control:LDA &7C:STA
&74:LDA &7D:STA &75:LDA &7E:STA &76:LDA &7F:STA &77
2490 LDA &00:CMP #2:BEQ nolivee:LDA #0:STA &72:LDA #&
59:STA &73:JSR blank:LDA #0:STA &72:LDA #&59:STA &73:J
SR control:RTS
2500 .nolivee:RTS
2510 ]
2520 NEXT
2530 ENDPROC
2540
2550 DEFPROCexplosion
2560 X%=C%*32+48:Y%=1023-(D%*32+48)
2570 SOUND 0,-15,6,10:SOUND 0,-15,5,15:SOUND 0,-8,6,5
2580 FOR LOOP%=1 TO 2
2590 FOR CIRCLE%=0 TO 500 STEP 60
2600 N%=CIRCLE%*(PI/6):A%=X%+120*COS(RAD(N%)):B%=Y%+1
50*SIN(RAD(N%)):MOVE X%,Y%:PLOT 6,A%,B%:MOVE X%,Y%:A%=
X%-(A%-X%):B%=Y%-(B%-Y%):PLOT 6,A%,B%:NEXT
2610 NEXT LOOP%
2620 PROCclear
2630 ENDPROC

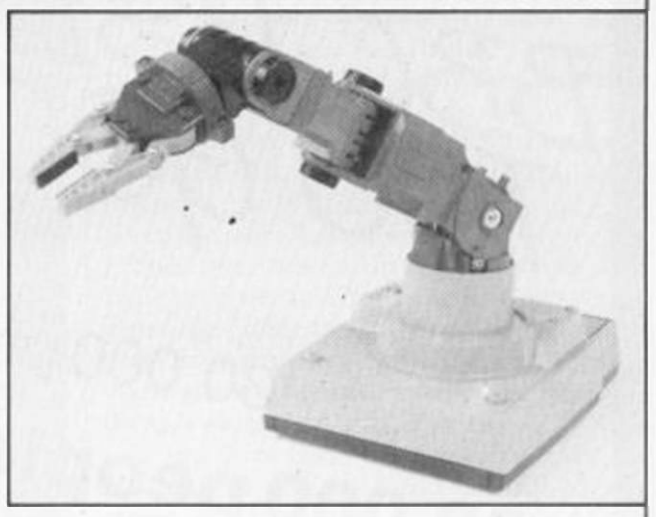
2640
2650 DEFPROCenemyshell
2660 FOR I%=&5060 TO &506B STEP 4
2670 IF ?I%=0 NEXT:ENDPROC
2680 PRINTTAB(?(I%+2),?(I%+3));" "
2690 PROCmoveshell
2700 IF G%<=?(I%+2) AND G%+2>=?(I%+2) AND H%<=?(I%+3)
AND H%+2>=?(I%+3) C%=G%:D%=H%:PROCexplosion:GOTO 110
2710 C%=?(I%+2):D%=?(I%+3):PROCshellcheck:IF ?&70=1 ?
I%=0:NEXT:ENDPROC
2720 PRINTTAB(?(I%+2),?(I%+3));CHR#(226):NEXT:ENDPROC
2730
2740 DEFPROCshellcheck
2750 E%=(D%+320)+(C%+8)+&5000:?&72=E% MOD 256:?&73=E%
DIV 256:CALL shellcheck:ENDPROC
2760
2770 DEFPROCmoveshell
2780 ?&70=I% MOD 256:?&71=I% DIV 256:CALLmoveshell
2790 ENDPROC

2800
2810 DEFPROCnewlife
2820 RESTORE 2840
2830 IF LIVES%=1 THEN PRINTTAB(15,16);"GAME OVER":TIM
E=0:REPEAT UNTIL TIME>300:GOTO50 ELSE CLS:PROCscreen:L
IVES%=LIVES%-1
2840 DATA 5,29,13,6,29,13,6,28,13,6,27,13,6,26,13,5,2
6,13,4,26,14,4,26,15,4,26,16,5,26,16,6,26,16,7,28,16,8
,28,16
2850 LOCX=&5700
2860 FOR D%=0 TO 12:C%=29:A%=2:B%=18:PROCdraw:TIME=0:
REPEAT:CALL buffer:IF?&7B>4 AND ?LOCX<>1 SOUND 1,-15,?
LOCX,?(LOCX+1):SOUND 1,0,0,2:LOCX=LOCX+2:UNTIL TIME>37
:PROCclear:NEXT ELSE UNTIL TIME>37:PROCclear:NEXT
2870 FOR I%=1 TO 11:READ A%,C%,D%:B%=?(&5010+A%):A%=?
(&5000+A%):PROCdraw:TIME=0:REPEAT:CALL buffer:IF?&7B>4
 AND ?LOCX<>1 SOUND 1,-15,?LOCX,?(LOCX+1):SOUND 1,0,0,
2:LOCX=LOCX+2:UNTIL TIME>37:PROCclear:NEXT ELSE UNTIL
TIME>37:PROCclear:NEXT
2880 FOR C%=26 TO 21 STEP -1:D%=16:A%=3:B%=19:PROCdra
w:TIME=0:REPEAT:CALL buffer:IF?&7B>4 AND ?LOCX<>1 SOUN
D 1,-15,?LOCX,?(LOCX+1):SOUND 1,0,0,2:LOCX=LOCX+2:UNTI
L TIME>40:PROCclear:NEXT ELSE UNTIL TIME>40:PROCclear:
NEXT
2890 FOR I%=1 TO 2:READ A%,C%,D%:B%=?(&5010+A%):A%=?(
&5000+A%):PROCdraw:TIME=0:REPEAT:CALL buffer:IF?&7B>4
AND ?LOCX<>1 SOUND 1,-15,?LOCX,?(LOCX+1):SOUND 1,8,8,2
:LOCX=LOCX+2:UNTIL TIME>40:PROCclear:NEXT ELSE UNTIL T
IME>40:PROCclear:NEXT
2900 PROCclear:A%=0:B%=16:PROCdraw:PROCscreen:ENDPROC
2910
2920 DEFPROCshell
2930 FOR I%=&5070 TO &5075 STEP 4:IF ?I%=0 NEXT:ENDPR
OC
2940 IF G%<=?(I%+2) AND G%+3>?(I%+2) AND H%<=?(I%+3)
AND H%+3>?(I%+3):GOTO 2950 ELSE PRINTTAB(?(I%+2),?(I%+
3));" "
2950 PROCmoveshell
2960 FOR L%=&5030 TO &504F STEP 8:IF ?(L%+6)<=?(I%+2)
 AND ?(L%+6)+2>=?(I%+2) AND ?(L%+7)<=?(I%+3) AND ?(L%+
7)+2>=?(I%+3) AND ?L%=1 C%=?(L%+6):D%=?(L%+7):PROCexpl
osion:SCORE%=SCORE%+100:?L%=0:?I%=0:NEXT L%:NEXT I% EL
SE NEXT L%
2970 C%=?(I%+2):D%=?(I%+3):PROCshellcheck:IF ?&70=1 ?
I%=0:NEXT:ENDPROC
2980 IF ?I%=1 PRINTTAB(?(I%+2),?(I%+3));CHR#(226):NEX
T:ENDPROC
2990 NEXT:ENDPROC

3000
3010 DEFPROCinstructions
3020 PRINTTAB(9,2);CHR#(131);CHR#(141);"TANKS by N.Sh
eard":PRINTTAB(9,3);CHR#(131);CHR#(141);"TANKS by N.Sh
eard"
3030 PRINTTAB(9,4);CHR#(136);CHR#(146);"==============
===="
3040 PRINTTAB(5,7);CHR#(130);"SCORE=";SCORE%:PRINTTAB
(23,7);"HI-SCORE=";HI%
3050 PRINTTAB(11,10);CHR#(131);CHR#(141);"INSTRUCTION
S":PRINTTAB(11,11);CHR#(131);CHR#(141);"INSTRUCTIONS":
PRINTTAB(11,12);CHR#(136);CHR#(146);"============"
3060 PRINTTAB(9,14);CHR#(134);"Guide your tank using:
-"
3070 PRINTTAB(8,16);CHR#(134);"'Z'-ROTATE CHASSIS LEF
T.":PRINTTAB(8,17);CHR#(134);"'X'-ROTATE CHASSIS RIGHT
.":PRINTTAB(8,18);CHR#(134);"','-ROTATE TURRET LEFT.":
PRINTTAB(8,19);CHR#(134);"'/'-ROTATE TURRET RIGHT."
3080 PRINTTAB(8,20);CHR#(134);"'(space bar)'-ACCELERA
TE.":PRINTTAB(8,21);CHR#(134);"'(shift)'-FIRE."
3090 PRINTTAB(6,23);CHR#(136);CHR#(131);CHR#(157);CHR
#(132);"PRESS ANY KEY TO START  ";CHR#(156)
3100 *FX15,1
3110 TIME=0:REPEAT UNTIL TIME>100:G=GET:SCORE%=0:ENDP
ROC
3120 END
```

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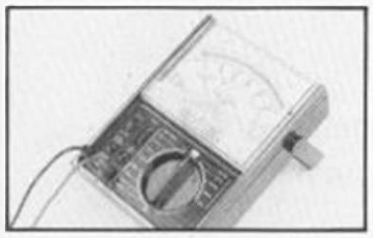




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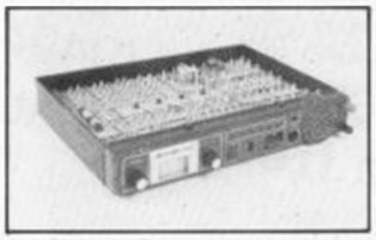
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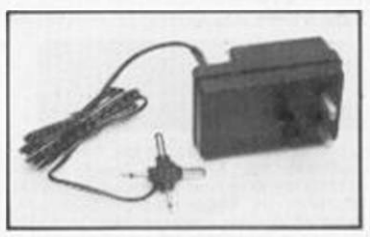


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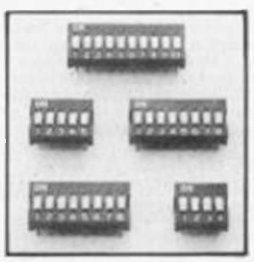
(Grey)

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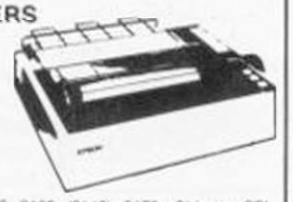
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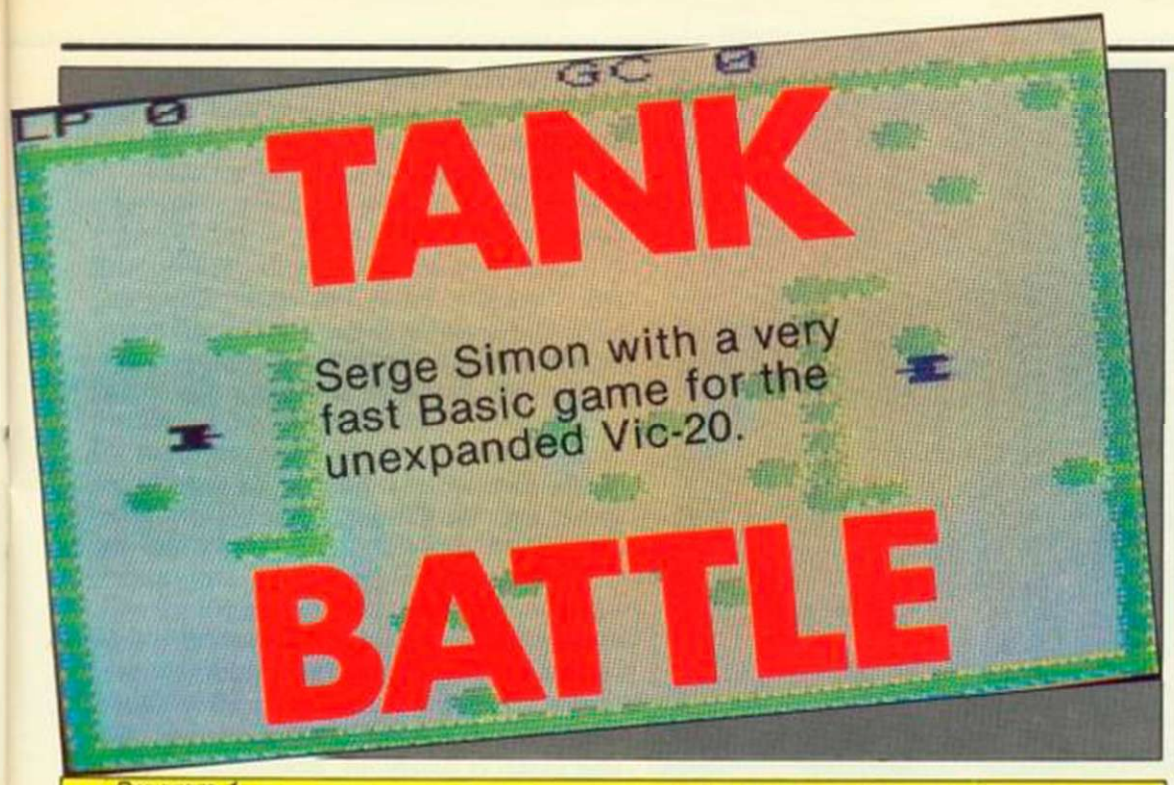
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Interface



AS REGULAR readers of *Your Computer* can see, machine code is used more and more for writing games. Such programs are much faster and more sophisticated than Basic programs, but are they better? Typing in those programs, mostly consisting of endless data lines is not a pleasant task, and for beginning computer enthusiasts it may be very discouraging. Also it seems as if people have forgotten that in Basic too, one can write good and reasonable fast games.

Therefore I have written this 100 per cent Basic program. It is Tank Battle, a two-player game for the unexpanded Vic-20. The program starts with displaying a title page, where you will be asked to enter the names of the two players.

If you have done this, and you have hit Return, you can see a sort of map on the screen, and two tanks.

The two players can move around the tanks and they can fire in the direction they move. The aim is — naturally — to destroy the other's tank and to score points. The keys to be used are:

For player one (black tank)
forward, Ctrl; turn, Shift; and fire, CBM
For player two (blue tank)
forward, £5; turn, £7; and fire, £3

The game itself is divided into two parts because of the limited memory of the standard Vic-20. First type in the program with the data statements for the user defined graphics. Then save it and type in the second part. Save this immediately after the first one. If you later load in the first program, the main program will be loaded automatically.

One last note: player one, who sits at the left side, may accidentally hit the Run-Stop key and thus break into the program. To prevent this add line:

2 POKE 45, 240: POKE 46, 26: POKE 788, 194

Program 1.

```
0 POKE52,28:POKE56,28:POKE36879
152
1 REM ***************          * TA
NK BATTLE *        * SERGE SIMON
*        ***************
5 PRINT"■■■■■■■■■■TANK BATTLE■■■■■
■"
6 PRINT"■■■■■-MADE BY SERGE SIM
ON-"
10 PRINT"■■■■■JDG'S...PLEASE WAI
T..."
20 C=0:FORI=7168TO7679
30 READA:IFA=-1THEN51
40 POKEI,A:C=C+A
50 NEXTI
51 IFC<>12528THENPRINT"ERROR IN
DATA"
55 FORT=7168+256TO7168+256+8:POK
ET,0:NEXT
60 POKE198,0:POKE198,1:POKE631,1
31:NEW
90 DATA0,0,0,0,0,0,0,0
99 REMTANKS***********
100 DATA16,16,214,254,254,254,19
8,198
110 DATA25,50,124,253,191,30,12,
24
120 DATA0,252,252,56,63,56,252,2
52
130 DATA24,12,30,191,253,124,50,
25
140 DATA198,198,254,254,254,214,
16,16
150 DATA24,48,120,253,191,62,76,
152
160 DATA63,63,28,252,28,63,63,0
170 DATA152,76,62,191,253,120,48
,24
171 REMEND OF TANKS***
180 DATA0,54,126,62,60,126,124,2
0
190 DATA0,109,255,255,255,255,74
,0
191 DATA60,126,255,255,255,255,1
26,60
192 DATA0,0,0,24,24,0,0,0
193 DATA129,90,36,90,90,36,90,12
9
194 DATA124,60,126,120,60,124,12
6,60
300 DATA-1
```

```
0 PRINT"■":V=36878:POKEV+1,152
1 FORT=1TO8:READR(T):NEXT:DATA-2
2,-21,1,23,22,21,-1,-23
5 PRINTCHR$(8)CHR$(142)
10 REM   TANKGEVECHT*    *DOOR SE
RGE SIMON *    *VLAANDEREN,BELGIE
*
40 PRINT"■R■■■■■■TANK BATTLE■■■■
■■"
41 PRINT"■■■■■BY SERGE SIMON"
45 PRINT"■■■■PLAYER 1:CBM/SHFT/C
TRLPLAYER 2:FUNCTION KEYS"
46 PRINT"■■■■GIVE NAME OF"
50 INPUT"PLAYER 1";B$:IFLEN(B$)
>6THENB$=LEFT$(B$,6)
60 INPUT"■PLAYER 2";A$:IFLEN(A$)
>6THENA$=LEFT$(A$,6)
65 PRINT"■"
69 REM SETUP SCREEN***
70 POKE36869,255
71 FORT=44TO484:POKE38400+T,0:NE
XT
75 PRINT"■■■KJJJKJJJJJKJJJJJJJJKJ
JK";
76 FORT=1TO20:PRINT"N"SPC(20)"N"
;:NEXT
77 PRINT"KJJJJKJJJKJKJJJJJKJJK";
:PRINTCHR$(157)CHR$(148)"J";
80 FORT=0TO20:P=RND(1)*484+22:PO
KE38400+P,5:POKE7680+P,11:NEXT
85 PRINT"■■■■■■■■■"SPC(4)"JK■■■K
■■■■■■■■■■
```

Loader.

```
  1 POKE 23693,7: BORDER 0: CLE
AR 23999: LOAD ""CODE : LOAD ""C
ODE : PRINT "HIT ANY KEY..";USR
30059
```

The hex loader.

```
  10 DEF FN h(h$)=16*(CODE h$(1)
-48-(7 AND h$(1)>"9"))+CODE h$(2
)-48-(7 AND h$(2)>"9")
  20 INPUT "Start ";s
  30 INPUT "Finish ";f
  40 FOR n=s TO f STEP 8
  50 LET tot=0: PRINT n;": ";
  60 INPUT h$: PRINT h$;
  70 LET x=0
  80 FOR b=1 TO LEN h$ STEP 2
  90 LET z=FN h(h$): LET tot=tot
+z
 100 POKE n+x,z
 110 LET h$=h$(3 TO ): LET x=x+1
 120 NEXT b
 130 PRINT " = ";: INPUT t: PRIN
T t
 140 IF tot<>t THEN PRINT "input
error - try again": GO TO 50
 150 NEXT n
 160 REM enter STOP to stop
```

Listing 1.

```
23296: 2A1501240401250 = 151
23304: 03251111C1D0C1E00 = 156
23312: 0905060C061F0D1E = 113
23320: 19140E1914112560C = 171
23328: 1826041E271211127 = 209
23336: 121D050990F1E1506 = 133
23344: 2F111E2D080F2B08 = 213
23352: 1828151E23041E23 = 219
23360: 141E2900D0102090A = 126
23368: 2109111150F180E0D = 146
23376: 09080A0F170B100D = 105
23384: 0C0D07050A140D0F = 95
23392: 0000000000000000 = 0
23400: 0000000000000000 = 0
23408: 0000000000000000 = 0
23416: 000000E95B2A7B5B = 580
23424: 2377227B5BC92A7B = 768
23432: 5B7EA7C82B227B5B = 875
23440: 6F5F0E023E10D3FE = 765
23448: 2D2003EE106B10F6 = 703
23456: 0D20F3AFD3FEC90F = 1144
23464: 0B0200B45B000328 = 330
23472: 051B051B051B0F05 = 118
23480: 9003000000000000 = 152
23488: 0000000000000000 = 0
23496: 0000000000000000 = 0
23504: 261E2219040403I1 = 155
23512: 04840704000E4E8 = 607
23520: D3241C140C04130B = 341
23528: 03ED5FAE0707ED4F = 839
23536: E61FC90107000000 = 470
23544: 0000000000000000 = 0
```

SNAKES ALIVE is a 100 per cent machine-code game for any Spectrum which just fills all the memory available to the 16K machine. It features:

- 48 locations, which you are free to move between and around, and each of which is named.
- Choice of control by Kempston-type joystick, cursor type, Interface II or redefinable keyboard.
- Title screen with music, scrolling instructions and display of
- High-score table.
- Annoying addictiveness that makes you unable to stop playing!

The object of the game is to guide Kahn the snake around a house and its grounds to find and collect nine eggs which he has lost. It is totally non-violent — your poor snake is absolutely defenceless — which doesn't matter as there is nothing else about. The worst thing that can happen to Kahn is either bumping into an object, which results, in a nasty headache, or tying himself in knots. Despite Kahn being the only character that moves, the game is still frustratingly difficult.

On a blank cassette, save the loader program. This will load in the final code:

SAVE "SNAKES II"LINE 1

Type in the hex loader carefully. Save this on the other cassette, in case you don't type in all the hex in one go, or need to check it later.

Now Run the hexloader, type in the code from listing 1, and save the resultant code on the cassette with the loader, using:

SAVE "PRBF" CODE 23296,256

Run the hex loader again, and this time enter data from listing 2. Once finished, type:

SAVE "CODE II"CODE 28384,4384

This code should not be saved on the final cassette.

Repeat this exactly, except type in code from listing 3. It may be saved temporarily with the same save instruction as before. When you have typed in this code, type:

CLEAR 23833: NEW and then
CLEAR 23999: LOAD""CODE 2400

Load in the code from listing 2. Save the whole code on the finished cassette of the game, after the PRBF file, with:

SAVE "TOTAL"CODE 24000,8768

Summon up enough courage to try out the game — type Load"" and cross your fingers. If the game does not work perfectly first time, the most likely mistake that could have been made is that of entering one or more lines of hex data twice, or missing out others. The checksum is likely to stop other possible errors, but may not have. The only solution, short of starting again from scratch, is to list the program from the hexloader, by loading in relevant sections of code. As a guideline — if the program when tested crashes straight away, the error is likely to be within the code typed in from listing 2.

SNA

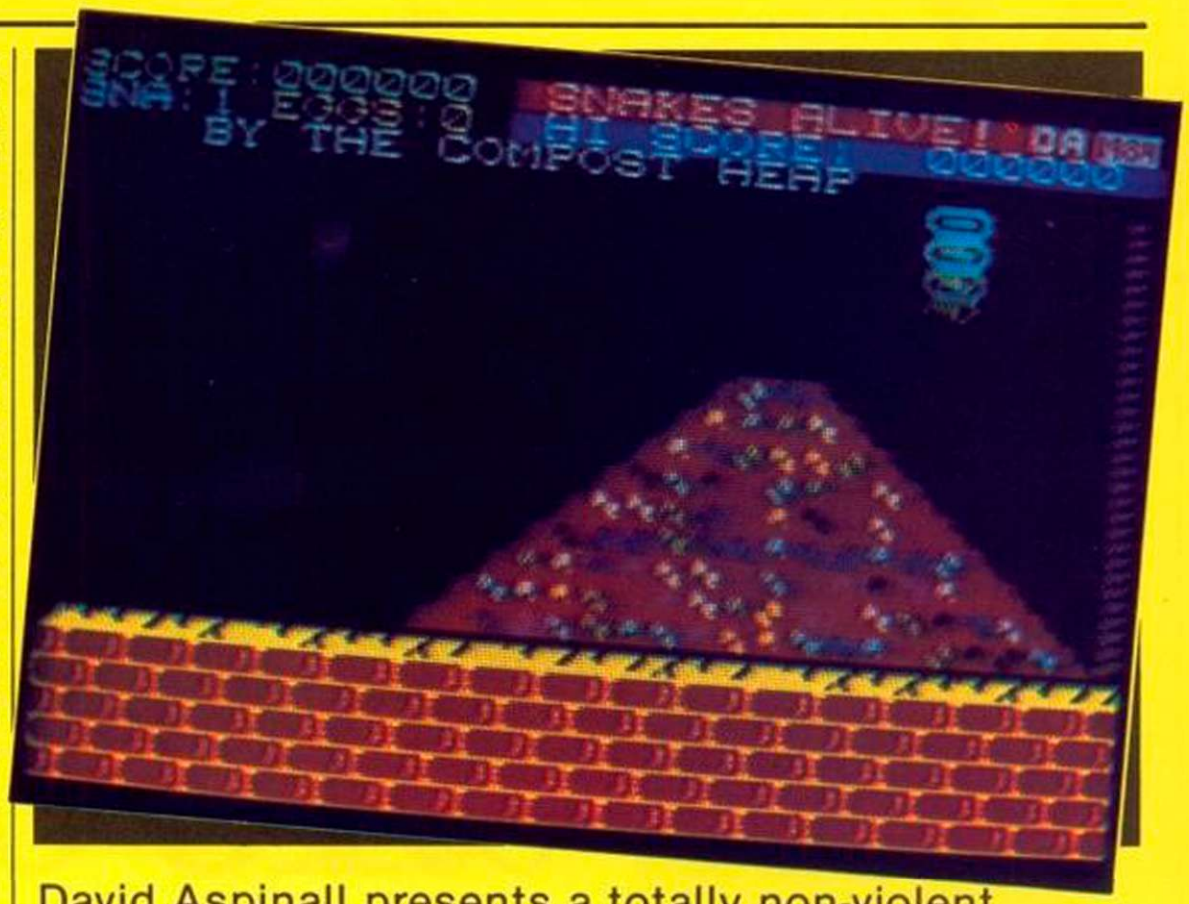
Listing 2.

```
28384: 05CD078F0E051E05 = 996
28392: 5211414CDD06A474A = 693
28400: 060A14CDD06A464A = 694
28408: 10F914CDD06A7C4A = 993
28416: 1C0C20E41C0E0406 = 393
28424: 04E1CDD06A410679 = 796
28432: C4C1F7CDD06A4206 = 884
28440: 1C10EEC9CD467408 = 884
28448: 1F1CCC1F74090328 = 484
28456: 6F2108185A1E09CC = 802
28464: 6A6F3E0632A75BCD = 793
28472: 32740A173ACD866E = 706
28480: 1716CD4674170017 = 484
28488: 060921205936007D = 348
28496: C6205F2001241DF5 = 671
28504: 09C0BB71A10A0C54 = 845
28512: 1E0C7DC6046F0605 = 491
28520: 7C8367EEBCDD06A = 1149
28528: 40021CCDD06A4D02 = 705
28536: 1CCDD06A4B021D15 = 671
28544: 10EEEB7DC8066F02 = 1043
28552: 7B06000416D020FB = 630
28560: 7E0632A75B3E7ECD = 769
28568: D8703CCDB703E7F = 1117
28576: CDB7010F00E022C = 852
28584: 64433E81CDB87010 = 660
28592: F92C020F30E053E = 683
28600: 4432A75B7AD60781 = 848
28608: 673E49CDB704333E = 903
28616: 4CCCDB7010F92CCD = 977
28624: A0EA2E6932A7587A = 663
28632: 0B0B573F0E022C = 671
28640: CDDB7010FB2CFE7D = 1226
28648: 3E4D28F1C9115970 = 839
28656: 2E0F0606260422A9 = 378
28664: 58C5CD3366C12C10 = 899
28672: F33E0732A75B060F = 631
28680: 8E0426173E42CDDB = 683
28688: 703E41CDDB702C10 = 835
28696: F1060326165222A9 = 710
28704: 5BCD3366C12C3E16 = 786
28712: 5D67107F12E0E060 = 562
28720: C9261326A9B5CD03 = 604
28728: 66C12C10F3CDB871 = 1103
28736: 3C274D3D3221614 = 541
28744: 5B0616360002C10FB = 461
28752: C9000F434E4E4E4E = 598
28760: C4415F0E5F0ECF00 = 686
28768: 2F4100261E0E2E0E = 278
28776: 00AFCF5B5D505D50 = 717
28784: DC00022E41414242 = 530
28792: AF0E410E0ECD0004 = 450
28800: 0B3D3B5B3D3D1130 = 538
28808: 21B9000322223234 = 377
28816: 2A2323A50006E0E = 305
28824: 787E7D7FF90E7E54 = 971
28832: 54545454FF0E1754 = 712
28840: 54545454497E1754 = 608
28848: 54545454497E7A54 = 707
28856: 54545454F80E1754 = 756
28864: 54545454C1475454 = 768
28872: 5454547CC1434E4E = 792
28880: 4E4EC4F5D5C522A9 = 1210
28888: 5BCD1D67C1D1F1C9 = 1272
28896: 3E443A75B0E041E = 486
28904: 067917E602C60357 = 670
28912: 0606CDD76A0F9114 = 718
28920: 1410F77AE607571C = 757
28928: 0606CDD76A109214 = 720
28936: 1410F71C1C1C0D20 = 412
28944: D65AAF5BFE13C011 = 1022
28952: 1700CDD06A1304C9 = 766
28960: C93E0632A75BCD32 = 832
28968: 741B03062104000E = 195
28976: 503E0ECDDB703E5A = 844
28984: 6D5B7010F42111200 = 847
28992: 1118186067ACDDB = 629
29000: 7078CDDB707ACDDB = 1317
29008: 7078EE6047E68026 = 1065
29016: 1D20EA110E5A2600 = 454
29024: 10E3C9CD32740D03 = 831
29032: 0ACD46744B000521 = 520
29040: A059AF772EC07721 = 933
29048: 121CCD8871210311 = 564
29056: 0606E0632A75B11 = 405
29064: AE7122A95BC5CD33 = 1034
29072: 67CA728093E5AD5 = 807
29080: CD1D67D118F3C13E = 1068
29088: 15806710E5C91D18 = 754
29096: 1898D7D7D70ED90E = 1072
29104: 0E0EDACD46745E00 = 731
29112: 0BCD4874E1F0BCD = 743
29120: 3274EF170CCD3274 = 667
29128: 5E0314CD866E031A = 795
29136: 3AAF5BFE27C01110 = 845
29144: 12CCDD06A6D070E04 = 671
29152: 1C060DCDD06A4D16 = 665
29160: 1510F816120D20F0 = 610
29168: 2121721E100E0716 = 269
29176: 1E7EE67FCDBE6A07 = 1021
29184: 157E23E680283F21C = 850
29192: 0D20EC21BC5A3E38 = 710
29200: 778C772EDC772C77 = 830
29208: C9F3F3F3F3717D6F = 1505
29216: EE750E0EF4770E0E = 774
29224: F63E2832A75B2103 = 692
29232: 0022A95BCD7772EE = 776
29240: 1322A95BCD7772CD = 956
29248: 32744E0D0721A159 = 547
29256: 060836002C36002C = 210
29264: 2C2C10F63AAF5BFE = 928
29272: 2CC0CD4674420006 = 699
29280: 212059AF772E4077 = 677
29288: 2EE0772467F77C90E = 870
29296: 05060479FE043FCE = 863
29304: 002FE603F511A472 = 820
29312: C5CD3066C1F13CFE = 1300
29320: 033FCE00E60311A4 = 686
29328: 72C5CD3066C110DB = 1094
29336: 0D20D6C9434E4EC4 = 879
29344: 410E0EC26B5D5DDC = 784
29352: CD4674421F32CD32 = 793
29360: 744E0306CD866E03 = 655
29368: 1806041E07160JCD = 301
29376: B76C1D161CCDAB6C = 854
29384: 1C1C1C10F0C91128 = 601
29392: 73210B0822A95B3E = 523
29400: 41324A75BCD33660E = 745
29408: 020603113973AC26 = 262
29416: 071A13CDDB701A13 = 633
29424: CDDB70C53E4832A7 = 1084
29432: 5B060C3E0ECDDB70 = 721
29440: 10FB3E4132A75B1A = 728
29448: 13CDDB70C110D70D = 992
29456: 20CF2C26082A95B = 623
29464: 2607CD3366CD2B74 = 767
29472: C3CA6D3A3C3D3E3D = 808
29480: 3D3E3F3D3E3C3D3E = 492
29488: B83C513E7A517B0E = 730
29496: 3A3B7A00480E0E0E = 353
29504: 0E0E00417B7A7B7A = 563
29512: 00480E0E0E0E0041FB = 430
29520: CD2B74110913 0E09 = 432
29528: ED53A95BCDD06A78 = 1219
29536: D2143E0A910 7EB = 852
29544: 7EE638F602 75B = 968
29552: 7EE60C630C0B670 = 1141
29560: 10EEEBCDD06A7902 = 1131
29568: 1C3E0A9157 3E1392 = 559
29576: 570D20D0C37B7421 = 807
29584: 5A7401080 3AAF5B = 539
29592: D60609D60630FB5E = 842
29600: CBBB2356237E23E5 = 936
29608: 664FE64732A75B32 = 840
29616: DB7332EA737932D5 = 1117
29624: 7302E4734ACDD76A = 1108
29632: 3A3C3D3E3FBB511C = 600
29640: CDD76A3800163332 = 705
29648: 3031000489511CCD = 600
29656: D76A3600163102 30 = 544
29664: 310004B70C811CCD = 562
29672: D76A2E2C2DAF1C51 = 740
29680: 1406032E2A7C0870 = 374
29688: D5D9D1CD5285D97C = 1368
29696: 0B7D3CD5D9D114CD = 1057
29704: 5265D91C2D2D10E5 = 763
29712: 157C32A75BCDD76A = 979
29720: 222324A5E123CB7E = 859
29728: CAA773CD4674401F = 970
29736: 42C9E17E235E2308 = 790
29744: 7E23E516000620CD = 655
29752: 5A741410FAC9E17E = 1044
29760: 235623087E23E51E = 584
29768: 030615CD5A741C10 = 485
29776: FAC9F508CDC66A08 = 1221
29784: F1C987041C060813 = 542
29792: 4C028C045A060B0C = 338
29800: 74028A0A4C020A12 = 372
29808: 1406FF1112003E06 = 364
29816: 32A75BCDD76A1D21 = 896
29824: 2120211C1B211C21 = 247
29832: 211C201B2120120 = 250
29840: 1C21201B211C211C = 842
29848: 21211C2120A00E05 = 338
29856: 79E601F61E0620CD = 871
29864: BE6A32EE011410F7 = 868
29872: 16001C0D20EAC9CD = 735
29880: 4674421F28C33172 = 681
29888: CD46744 11F06213F = 589
29896: 59AF772E5F772EFF = 944
29904: 77242E1F77211B75 = 528
29912: 1806CD176C212775 = 555
29920: 06063E0532A75B5E = 481
29928: 235623E5C5ED53A9 = 1071
29936: 5B3E78CD1D673E79 = 793
29944: CD1D672C25253E7A = 639
29952: CDDB703E78CDDB70 = 1257
29960: C1E110DBCD327440 = 1058
29968: 1706C910030E080E = 285
29976: 0D0C120816071A07 = 113
29984: 03090808D0C130E = 89
29992: 18101C3ADB5B2174 = 585
30000: 6AFE023003214D6A = 629
30008: 22716430BC6DC5F = 827
30016: 165B1A6F62226B6A = 621
30024: CD64642100702268 = 704
30032: 65110C06CDD76A00 = 662
30040: 47472041204D2045 = 449
30048: 2020204F20562045 = 394
30056: 20D231BF5DAFDBFE = 1223
30064: 2FE61F28F8CDA175 = 1079
30072: CD027AAF3248SCD3 = 929
30080: FECD8179CDC05FF3 = 1444
30088: 1803CD81793E0FCD = 764
30096: 3178214776370C3D = 654
30104: 79AFDBFE2FE61F20 = 1109
30112: F826500E08AF0620 = 601
30120: 2EE0772C10FC240D = 750
30128: 20F4C93030303035 = 722
30136: 3030303030343030 = 388
30144: 3030303030303030 = 387
30152: 3032303030303031 = 387
30160: 302D202D20505245 = 433
30168: 5353204B45595320 = 546
30176: 3120544F20420054 = 444
30184: 4F204348414E4745 = 533
30192: 20435552454E54 = 379
30200: 204F50544946AE2C = 549
30208: 20522054AF205245 = 492
30216: 444546494E452054 = 543
30224: 4845204B45595320 = 521
30232: 4F5220454E544552 = 575
30240: 20544F20524554 = 547
30248: 524E20544F2054 = 543
30256: 4520544954454E = 589
30264: 5343524454EA02D = 653
30272: 534E414B4552041 = 550
30280: 4C4956452045746F = 586
30288: 20205F2031393834 = 418
30296: 20575249544544E = 589
30304: 2045726202D202D0 = 329
30312: 2D202D2020434152 = 400
30320: 4146554C4C59204D = 574
30328: 414E4F4555565245 = 613
30336: 20484148452054 = 510
30344: 4520534E414B4520 = 503
30352: 4A4F4F5554205448 = 567
30360: 4520484F55534520 = 521
30368: 414E44204954520 = 515
30376: 47524F554E44520C = 590
30384: 20544F20434F4C4C = 525
30392: 4543542045494E45 = 550
```

If it is during the game that an error becomes apparent, then look at the hex from listing 3. If, however, it is some mistake with the sound effects, or egg positioning, then check the code from listing 1.

Once the game has loaded, and works successfully, after pressing a key you will be shown the title screen to the game and some quite lengthy, but good, music will play. If this ends or is interrupted by a key press, the scrolling instructions will move slowly along the bottom line. Pressing S or O now will start or take you to the control options screen, respectively. On the control option screen, scrolling instructions again tell you which keys to press: 1 is keyboard, 2 — cursor joystick, 3 — Interface II joystick and 4 — Kempston-type joystick. The current choice is highlighted in white — the others in cyan.

I can supply tapes of the game, with both a turbo load — yes, in 16K! — and a normal load version of the game on, for only £2.75 inc. from: Snakes Alive, 16 Viking Way, Pilgrims Hatch, Brentwood, Essex, CM15 9HX. If you would also like a copy of my other game, Aliquid Simplex, published in *Your Computer* in November of last year, which includes sprites, two-channel music, etc., then I will put this on the same tape for you for another £1. Europe please add £1, overseas an extra £2.



David Aspinall presents a totally non-violent but, nevertheless exciting, game for the Spectrum featuring Kahn the snake.

AKES ALIVE

```
30416: 2045474753205748 = 517
30424: 494348204B414B4E = 534
30432: 2048415320C4CF53 = 522
30440: 542E205748454E20 = 500
30448: 414C4C2045474753 = 543
30456: 2048415645204245 = 491
30464: 454E20464F554E44 = 559
30472: 2C20524554455245 = 556
30480: 20544F2054484520 = 484
30488: 53544152544494E47 = 620
30496: 204C4F4341544494F = 555
30504: 4E2E2E2E2E2041564F = 478
30512: 4944205459494E47 = 568
30520: 204841484E20494E = 505
30528: 20484E4F54532044F = 542
30536: 5220464154414C20 = 506
30544: 434F4C4C4953494F = 606
30552: 4E532057495448520 = 541
30560: 414E595448494E47 = 610
30568: 20454C5345212020 = 439
30576: 202D202D202D2D2D = 343
30584: 524553532044F2046 = 530
30592: 4F522047414D4520 = 507
30600: 4F5054494F4E532C = 600
30608: 204F5220532044F = 503
30616: 2053544152542020 = 494
30624: 202020383C3D4020 = 372
30632: 20202020A0000647 = 365
30640: 20412042045220 = 371
30648: 204F205020542049 = 444
30656: 204F204E20D32D2D = 554
30664: 2D2D2D2D2D202020 = 321
30672: 2D2D2D2D2D2D2D2D = 360
30680: 2D2D2D20AD4B4559 = 573
30688: 424F4152442C2041 = 501
30696: 532042454C4FD743 = 687
30704: 5552534F52204A4F = 596
30712: 5953544943CB494E = 750
30720: 5445524641434520 = 538
30728: 49C948454D505354 = 742
30736: 4F4E204A4F595354 = 598
30744: 494JCB26500E0806 = 489
30752: 202EFFAFCB162D10 = 794
30760: FB2400202F2FB76F3 = 1186
30768: C921E15A11E25A01 = 883
30776: 1C0077ED50C9CDA1 = 1127
30784: 75CDAD653E1F7CD31 = 943
30792: 7811AD7721000422 = 500
30800: A958CD33662C2604 = 704
30808: 22A958CD33660604 = 662
30816: 3AD858B83E052002 = 653
30824: 3E0732A75BF64008 = 695
30832: 26052C2C22A958EB = 660
30840: C5E816013E3590CD = 913
30848: 5265D1CD3366C110 = 959
30856: D7110E00CDD76A00 = 772
30864: 044B4559424F4152 = 529
30872: 4420434F4E54524F = 569
30880: 4C53204E4F572044 = 535
30888: 4546494E45442041 = 524
30896: 530003A021110322 = 333
30904: A95B21D058060411 = 619
30912: E85DC5E5CD3366E1 = 1334
30920: D55E23E5A7CD9778 = 1217
30928: CD1D677CEE10E610 = 961
30936: F60367E610200D2C = 676
30944: 2C22A958E1D1C110 = 981
30952: D921D975A7C30D79 = 1080
30960: 4F3E359132DB7E50 = 904
30968: A175C34978CD9E6A = 1135
30976: 3E00C01CC81D5721 = 631
30984: 0502197EC922DC5B = 704
30992: 1732815CEBAF08CD = 917
31000: 1B78D5CDFD78D14F = 1226
31008: 3A815C1F79300CFE = 745
31016: 53CA3375FE4FCA3E = 1050
31024: 781813FE52CA2C78 = 668
31032: FE0DCA9275FE3138 = 1091
31040: 05FE35DAF0781AE6 = 1146
31048: 7F6F260029292901 = 400
31056: 007D09084F080608 = 243
31064: D5EB21FF50C5793C = 1194
31072: 471A0710FDE60186 = 786
31080: 772413C110EFD108 = 839
31088: 3CE60720A1081A13 = 543
31096: CB7F2898ADC5B10 = 902
31104: 93CDAD6521007D22 = 818
31112: 68653E0632A75B11 = 601
31120: C17BAF32FB792100 = 946
31128: 0022A95BCDF4793E = 926
31136: 0232FB793E0532A7 = 708
31144: 5B11347C21060222 = 359
31152: A95BCDF4791E0D0E = 887
31160: 0521C05DE5218B75 = 889
31168: 3E4732A75B060816 = 477
31176: 0AE3CDE57910FB14 = 1079
31184: 14E30606CDE57910 = 830
31192: FB1C1C3E4432A75B = 745
31200: 0D20E2F1C97EEBD5 = 1267
31208: C522A95BCD1D67EB = 1063
31216: C1E123C9CD33661A = 1038
31224: 3CC826052C22A95B = 641
31232: 18F211BB750E05D5 = 819
31240: 060621DB651ABE23 = 616
31248: 13200710F3F10D20 = 608
31256: EEC9D13807210600 = 750
31264: 19EB18F2D50600C5 = 942
31272: 0D281E0C21D27511 = 472
31280: D87579787878184F = 1061
31288: ED88C1C521DF5D11 = 1177
31296: E75D79787878FED = 1168
31304: B8C1D121D8653E06 = 1007
31312: 910E06EDB021BB75 = 915
31320: 1116660E08EDB021 = 607
31328: B85D0E08093D20FC = 653
31336: E5CDAD6511070CCD = 937
31344: D76A000620205745 = 547
31352: 4C4C20444F4E4521 = 511
31360: 2120594F55204841 = 487
31368: 5645204143484945 = 533
31376: 5645442020204F4E = 478
31384: 45204F4620544E5E = 507
31392: 204649564520484 = 507
31400: 4748455554202020 = 475
31408: 2020202020205343 = 342
31416: 4F5245532054F44 = 576
31424: 415924E2E2E2E2E2E = 430
31432: 2020202020202020 = 256
31440: 2020202000004504C = 288
31448: 4541534520545950 = 571
31456: 4520594F55522044E = 546
31464: 414D453A0047A0E1 = 725
31472: 0608E5C5CDA17537 = 978
31480: CD1B7B3C28F63DFE = 1016
31488: 0D280EF5CD1D67F1 = 890
31496: C1E177231DE4C3A1 = 1172
31504: 75C1E13620231DF8 = 923
31512: C3A17508CDA17520 = 996
31520: FBCD9E6A20F61C28 = 1066
31528: F81D186C21D05806 = 747
31536: 04C5E5C5CDA175CD = 1315
31544: AD65110802CDD75A = 827
31552: 0045505245535320 = 498
31560: 524551554954204E = 609
31568: 204B455920464F52 = 528
31576: 3AADC1210E0A22A9 = 684
31584: 5B11E85D3E0490CD = 848
31592: 3066A7CD187BE1C1 = 1090
31600: 73545D48083E0590 = 583
31608: 471A0528082B8E20 = 415
31616: F9EB4118ACD5C508 = 1163
31624: CD1D67C141E12310 = 871
31632: A0CDA175C33E7808 = 1028
31640: 21050216001197E21 = 246
31648: 557B0604BE280423 = 583
31656: 10FAC90104000908 = 489
31664: 30010977EC9E30D0E = 639
31672: 20141516171FF0DFF = 641
31680: 20272223202722228 = 285
31688: 20272222202622026 = 285
31696: 20272223202722A3 = 408
31704: 222B202022222220 = 282
31712: 223E2222222A2220 = 304
31720: 222B202022AB5D22 = 473
31728: 2820222222222222 = 272
31736: 2222022225B202222 = 325
31744: 23205D22A8202F22 = 475
31752: 2022202222022922 = 273
31760: 2022292222022B20 = 282
31768: 20202FA225225E20 = 470
31776: 24202420242024220 = 272
31784: 2420242052222320 = 330
31792: 2522DEFF27222820 = 693
31800: 2620202026202620 = 274
31808: 2620272222320A622 = 410
31816: 3E2222022202222 = 292
31824: 20222022222222B20 = 273
31832: 20A2222222220220 = 394
31840: 20202222222202220 = 262
31848: 22222320A2222922 = 406
31856: 2022202022022022 = 262
31864: 2A2220225B2020A4 = 461
31872: 2420242052222320 = 330
31880: 24205D225E205D22 = 448
31888: 2320DCFF000042D9 = 825
31896: 49CE41D44FCE5448 = 997
31904: C5004741524445E = 630
31912: 20534845C4014341 = 585
31920: 4242414745205041 = 514
31928: 5443C80047524150 = 649
31936: 452056494E45D303 = 621
31944: 4C4157CE00484544 = 643
31952: 47C50046454E43C5 = 749
31960: 02444F4F52535445 = 546
31968: D0014841C4C5741 = 650
31976: D90353544149520D3 = 818
31984: 0153544152452052 = 494
31992: 4F4FCD01D41494E = 657
32000: 20424544524F4FCD = 600
32008: 014C4956494E4720 = 490
32016: 524F4FCD03504154 = 677
32024: 485741D901424143 = 640
32032: 4B2042454452 4F4F = 550
32040: CD034C414E44494E = 646
32048: C701424154485 24F = 648
32056: 4FCD0047415241 47 = 638
32064: C501535452454 5D4 = 797
32072: 0246524F4E524044 = 495
32080: 4F4FD200504F4E44 = 673
32088: 202020202A00043 = 387
32096: 4F4D504F53542048 = 586
32104: 4541D00048454447 = 622
32112: 45524FD700465255 = 682
32120: 49542054524545D3 = 704
32128: 0057414CCC025354 = 601
32136: 524545542043 4F52 = 564
32144: 4E45D2034715244 = 646
32152: 454E2050415 4C800 = 608
32160: 669988868199660 0 = 909
32168: F9898DE89889F900 = 1285
32176: 669988661199660 0 = 765
32184: 4EA9894E28A84800 = 742
32192: 2ACDFFC2178619AC = 1098
32200: 1AA21C991E901F58 = 710
32208: 2180237925722868 = 615
32216: 2A652C5F2F593254 = 552
32224: 354F384B3B463F42 = 521
32232: 423E463A4B374F34 = 517
32240: 5430592E5E2B7D42 = 595
32248: 3F88A730034FFF00 = 959
32256: 0000000000000000 = 0
32264: 1818181818001800 = 144
32272: FF00FF00FF00FF00 = 1020
32280: F800FE00FE00F800 = 1004
32288: FF00FF007E003C00 = 696
32296: 1F007F007F001F00 = 316
32304: 3C007E00FF00FF00 = 596
32312: 0700JF007F00FF00 = 452
32320: E000FC00FE00FF00 = 988
32328: FF00C3008100810 0 = 708
32336: 0000510C300C300 = 519
32344: FC00F0005000F000 = 860
32352: 0000000018306000 = 168
32360: 0000007E00000000 = 126
32368: 0000000000303000 = 96
32376: 3F000F0007001F00 = 116
32384: 7C868A92A2C27C00 = 1022
32392: 0818000000881C00 = 92
32400: 7CC2023C4080FE00 = 826
32408: 7CC2021C02C27C00 = 668
32416: 0818284BFE080800 = 414
32424: FC8080FC02C27C00 = 1080
32432: 3C4080FC82827C00 = 888
32440: FE02043E08101000 = 362
```

(continued on page 76)

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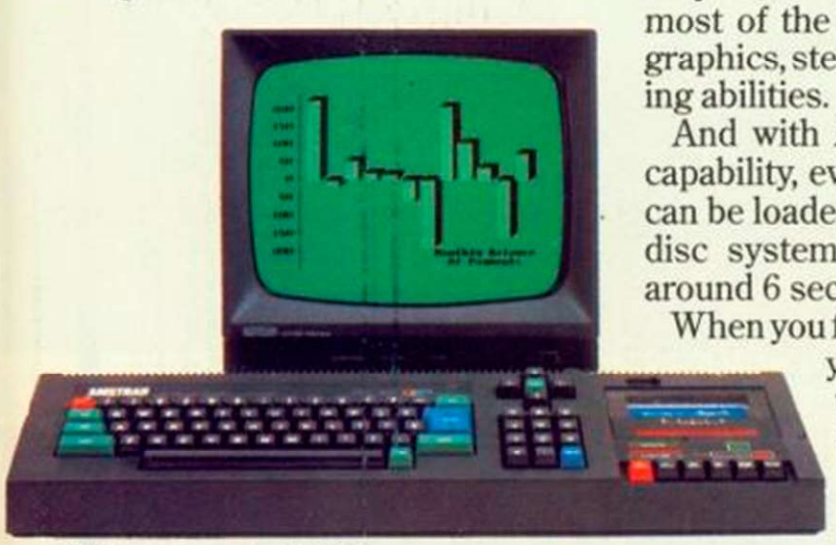
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YC9

(continued from page 73)

```
32448: 7C82827C82827C00 = 892
32456: 7C82827E02020200 = 516
32464: 0010100000101000 = 64
32472: F8FDCDCDCDFDF900 = 1616
32480: F0F898F8F8989800 = 1440
32488: FFB3AAABB2BABBFF = 1581
32496: FF00C3006100E700 = 810
32504: 7C8282041800100B = 488
32512: FF3D535D1DD3DFFF = 1320
32520: 7C828AFE8282C600 = 1096
32528: FC42427C4242FC00 = 892
32536: 7C8680808086 7C00 = 900
32544: F8444242424 4F800 = 830
32552: FE4040784040FE00 = 864
32560: FE4040784040E000 = 854
32568: 3C46808E82443800 = 654
32576: C682828FE8282C600 = 1170
32584: 7C1010101010 7C00 = 326
32592: 0E040404C4847800 = 474
32600: E2444870484 4E600 = 848
32608: 8080808080 82FE00 = 1024
32616: 82C6AA928282C600 = 1102
32624: 86C2A2928A86C200 = 1102
32632: 3844828282443800 = 636
32640: FC42427C4040E000 = 860
32648: 3844828284443A00 = 648
32656: FC42427C4844E200 = 874
32664: 7C86807C02C27C00 = 830
32672: FE92101010103800 = 520
32680: C6828282828 27C00 = 972
32688: C6828282442810 00 = 712
32696: C6828292925428 00 = 874
32704: C6442810284 4C600 = 628
32712: C6442810101038 00 = 410
32720: FE8408102042FE00 = 762
32728: FC00F000E000F800 = 964
32736: 00183C7E7E3C1800 = 420
32744: FF007F003F000700 = 452
32752: FF00FE00FC00E000 = 985
32760: 3C66D8B1B1D8663C = 1116
```

Listing 3.

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Hex dump.

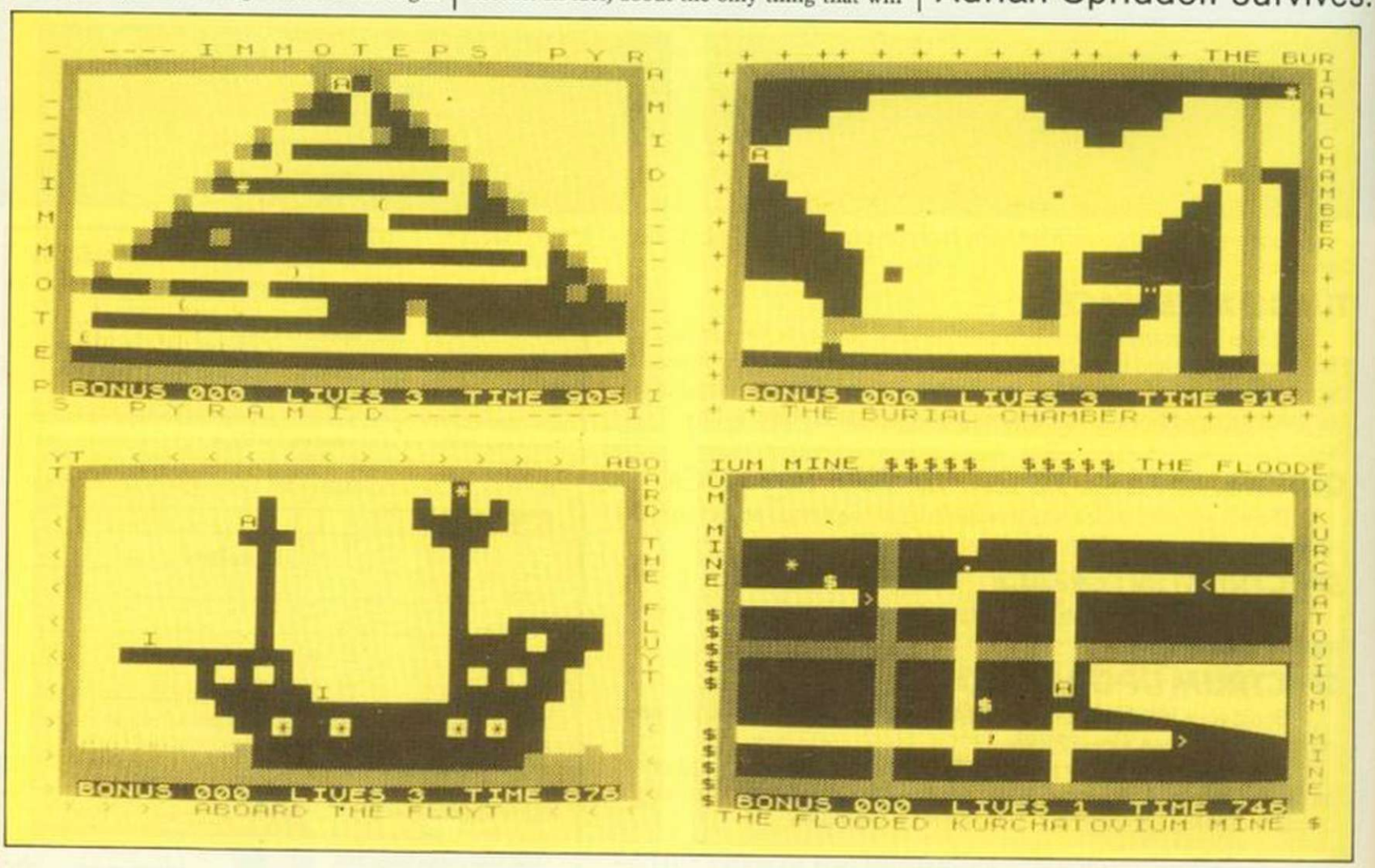
SURV

Ádrian Spriddell survives.

THIS IS A ZX-81 graphic adventure game called Survivor containing 10 levels each with its own different screen display and running in under 5K of machine code including all data. And before you reach for a calculator, I know that it takes 7K to store 10 screens. The discrepancy is due to the effects of Bistromatics, the original program having been written on the back of an old restaurant menu.

You are a lonely little blue person with short spindly arms having next to no strength so you cannot hang from anything. You are, however, possessed of a pretty good pair of legs — good that is for running and jumping. Unfortunately, the standard ZX-81 graphics set is somewhat limited and most little blue people end up looking suspiciously like a capital A, and on most televisions, worse still a black and white capital A.

You have absolutely no defences or protection. Almost anything in your environment is hostile. In fact, about the only thing that will





(listing continued on next page).

VIVOR

not harm you is stepping on the cracks in the pavement.

Apart from flying bricks, arrows, boulders and anti-matter bombs being hurled at you, mummies, ghosts and horrid guards with sharp spears — OK then, dollar signs — are running around and will kill you if they get half a chance.

Not even the ground is safe entirely. Black blocks are OK and may be walked on or through with impunity but anything else black should not be trusted. There are grey seams of old Windscale waste around. These are impenetrable and although not immediately fatal, should you step on one, you will lose 50 health credits and have to start again. Bridges and elevators are there to help you — usually. Keys are: P — left; O — right; Shift — jump.

The object of your endeavours is to reach the inverse star which is the key to the exit. Once this has been achieved you will be awarded 100 points and the exit itself will appear as another inverse star. This is your way through to the next level. Any time points then remaining will be added to your bonus. If you fail to collect a key or reach an exit before the time count reaches zero you will lose a life but will be able to carry on — assuming that was not your last life — where you left off by pressing any key.

Keys Y, H or B will suspend the game while you grab asprin and a coffee. Pressing any other key will restart play.

Type in any 160 characters as line 1. Edit line 1 and change it to line 2. Edit this and change to line 3, etc. until you have lines 1 to 35. Type

```
POKE 22317,180
```

and line 35 should end in an inverse letter O. If it does not, a mistake has been made. Now enter as direct commands:

```
POKE 16510,0
POKE 16511,179
POKE 16512,22
```

This joins lines 1 to 35 together.

Enter a new line 1:

```
1 REM *** DO NOT DELETE ***
```

Make sure that you do not delete it.

Type in the Basic loader/checker from listing 1. Run, enter 16514 as the start address and enter the code from the hex dump one row at a time. Do not attempt to enter the equals sign or the following number. This is a checksum which should tally with what the computer is holding. It will be displayed on pressing N/L after entering every eight bytes. If the two totals are not the same, you have made an error in that line. Enter S to reRun the loader entering the start address of that line in answer to the prompt.

To test the game enter the lines of Basic from listing 2 and Run. If it crashes, reLoad from tape and Run 400 to check the code. When all is well, delete lines 20 onwards and add line 2:

```
2 SAVE "YC SURVIVOR"
```

The game contains a number of variables initialy set to nominal values but which may be Poked to effect changes as shown in table 1.

Listing 1.

```
 20 CLS
 30 PRINT AT 21,0;"INPUT START
ADDRESS"
 40 INPUT A
 50 CLS
 60 PRINT A;"->";
 70 INPUT A$
 80 IF A$="S" THEN RUN 30
 90 IF A$="SAVE" THEN GOTO 260
100 IF LEN A$<>16 THEN GOTO 220
110 PRINT A$;"=";
120 LET TT=0
130 FOR F=1 TO 15 STEP 2
140 LET B$=A$(F TO F+1)
150 LET P=16*CODE B$+CODE B$(2)
-176
160 POKE A,P
170 LET TT=TT+P
180 LET A=A+1
190 NEXT F
200 PRINT TT
210 GOTO 60
220 PRINT
230 PRINT "INCORRECT LENGTH PLE
ASE RE-ENTER"
240 PAUSE 4E4
250 GOTO 60
260 PRINT AT 21,0;"          PRESS
ANY KEY TO SAVE"
270 PAUSE 4E4
280 SAVE "YC SURVIVOR"
290 RUN 20
400 CLS
410 PRINT AT 21,0;"INPUT START
ADDRESS"
420 INPUT A
430 CLS
440 LPRINT A;"->";
450 LET TT=0
460 FOR F=1 TO 8
470 LET P=PEEK A
480 LET B=INT (P/16)
490 LET C=P-B*16
500 LPRINT CHR$ (B+28);CHR$ (C+
28);
510 LET A=A+1
520 LET TT=TT+P
530 NEXT F
540 LPRINT " = ";TT
550 GOTO 440
```

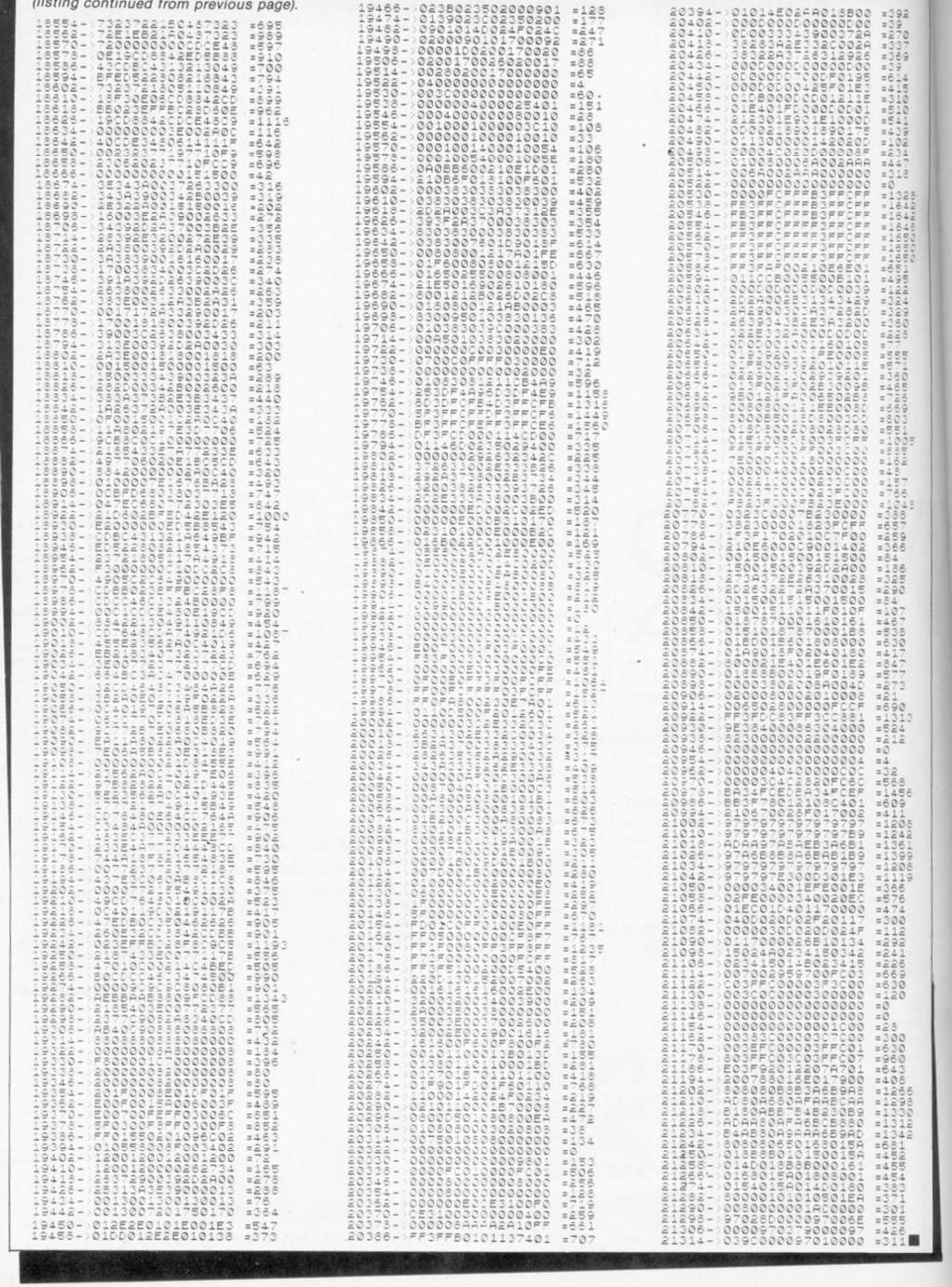
Table 1.

Address	Nominal value	Parameters	Function/notes
16674	204	see note	Wait key. Change to 202 for Break key
18863	61	see note	Change to 0 for infinite lives
17021	3	2 to 5	Speed. Increase to slow play
17287	0	0 to 9	Level.
19050	50	0 to 250	Grey block penalty points

Listing 2.

```
  3 CLS
  4 POKE 17287,0
  5 RAND USR 17735
  6 PRINT AT 10,8;"
  "
  7 PRINT AT 11,8;" ANOTHER GAM
E?"
  8 PRINT AT 12,8;"
  "
  9 INPUT A$
 10 IF A$="Y" THEN GOTO 3
 11 STOP
```

(listing continued from previous page).



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```
10 MEMORY HIMEM-10
20 start=HIMEM+1
30 |ASSEMBLE,start
40 'get start
50 'limit &FFFF
60 'ORG start
70 'CP 10:SCF:RET Z
80 'RST 1,&87F2
90 'ORG &BD2B
100'JP start
110'END
```

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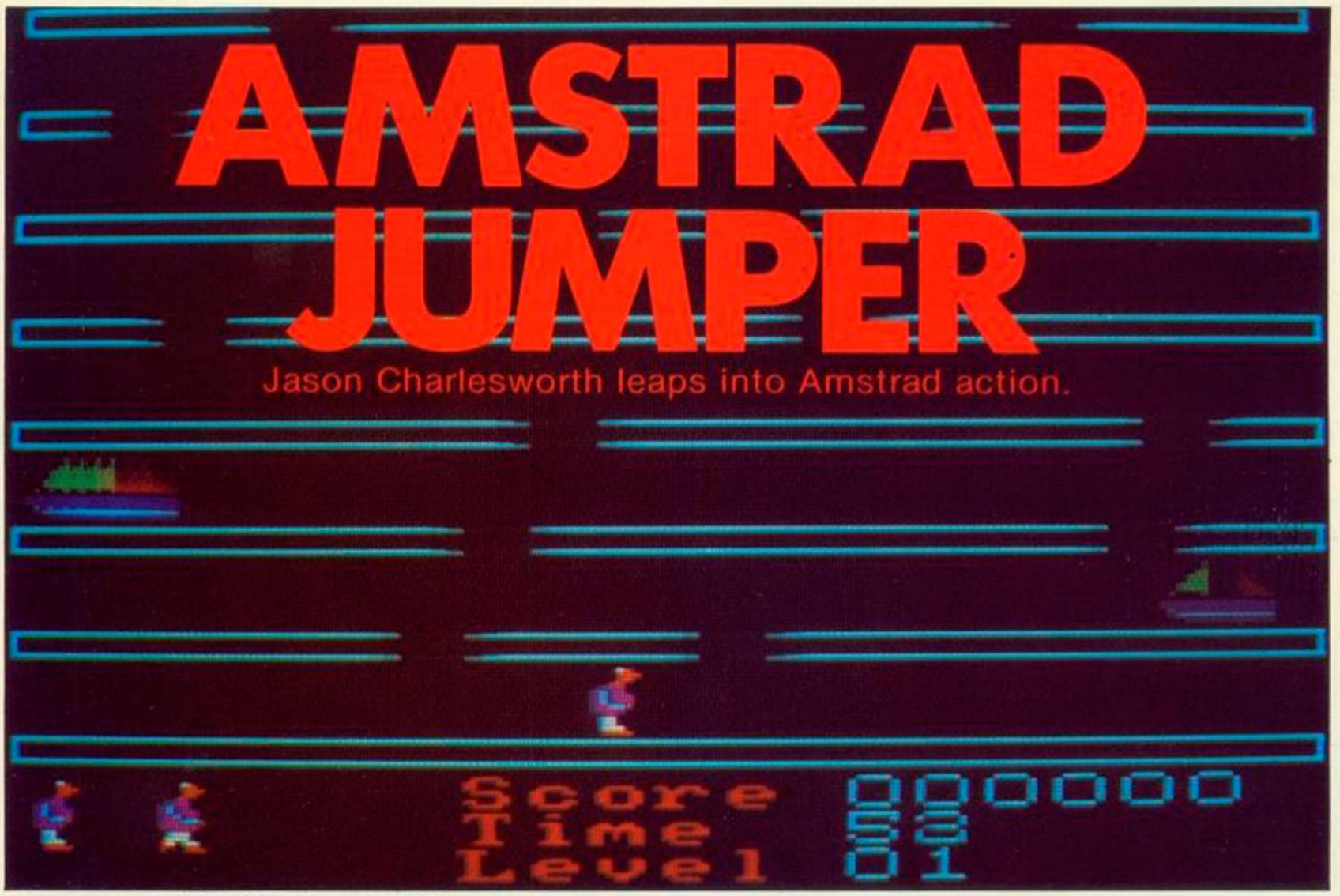
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AMSTRAD JUMPER

Jason Charlesworth leaps into Amstrad action.



JUMPER IS an arcade-quality game for the Amstrad CPC-464 computer in which you must guide a little man called Jumper to the top of the screen.

To get to the top of the screen, Jumper must jump through the moving holes in the platforms but if he falls through a hole he will be stunned and so will be unable to move for a while. However, all the time the nasties are advancing and Jumper, being a nice sort of chap, does not want to kill them so he must run away from them. To help him do this, the screen is wrap round i.e. if he runs off the left-hand side of the screen he will appear on the right-hand side and vice versa.

The scoring in the game is based on how many times you jump up. The more times you jump up, the more points you get and the amount of points you get per jump increases every other round. If your score is high enough at the end of the game, the program will ask for your name.

The game has 15 screens featuring different combinations of the nasties — yachts, teapots, telephones and tanks — and on each screen continuous music plays — translated by Robert Rhodes.

The game also features a joystick option and a hard or easy game option. To set up the game type in listing 1 and save it with

SAVE "JUMPER"

Next type in listing 2 and run it. If it finds an error in the code, correct it then rerun the program and when it gives the "Finished, no errors" message, save the code with

SAVE "CODE",b,35900,3700

The game may now be played by rewinding the cassette and typing Run"".

Listing 2 is on the next page.

Listing 1.

```
100 e=0:j=1:DEF FN x(n)=10*INT(PEEK(n)/16)+PEEK(n)-16*
INT(PEEK(n)/16)
110 INK 1,24:INK 14,26,0:INK 15,0,26:INK 5,0:INK 8,15:
INK 9,3:INK 13,4:INK 10,3
120 GOSUB 130:GOTO 360
130 REM SETUP
140 MEMORY 32767:BORDER 0:INK 0,0:MODE 0:PRINT"Please
wait":LOAD "!":e=0:j=1
150 ENV 1,5,2,1,5,1,1,1,0,8,5,-1,1,5,-2,3
160 DIM a$(5),a(5):FOR a=1 TO 5:READ a$(a),a(a):NEXT a
170 DATA Super Ted,50,Shaggy the Yak,40,Black Adder,30
,Doomdark,20,Mangled Cassette,10
180 RETURN
190 REM demo
200 BORDER 1:INK 0,1:MODE 0:CALL 35900
210 FOR a=0 TO 999:z$=INKEY$:NEXT a:BORDER 0:INK 1,0:R
ETURN
220 REM game
230 BORDER 1:INK 0,1:CALL 35946
240 FOR a=0 TO 1999:z$=INKEY$:NEXT a:BORDER 0:INK 0,0
250 sc=10000*FN x(37856)+100*FN x(37855)+FN x(37854)
260 FOR a=1 TO 5:IF sc<a(a) THEN NEXT a:GOTO 290
270 IF a<>5 THEN FOR b=5 TO a+1 STEP -1:a$(b)=a$(b-1):
a(b)=a(b-1):NEXT b
280 CLS:PEN 1:INK 1,24:INPUT "Name ",a$(a):a(a)=sc
290 RETURN
300 REM High score table
310 BORDER 0:INK 0,0:MODE 0
320 PEN 2:PRINT"  High Score Table":FOR a=1 TO 5:PEN a
+5
330 LOCATE 1,2*a+3:PRINT a$(a):LOCATE 16,2*a+3:PRINT a
(a):NEXT a
340 LOCATE 3,24:PEN 2:PRINT"Press a key"
350 IF INKEY$="" THEN 350 ELSE RETURN
360 REM instructions
370 BORDER 0:INK 0,0:MODE 0:PRINT"   Instructions"
380 RESTORE 360:FOR a=5 TO 11:READ z$:LOCATE 1,2*a-3:P
EN a+1:PRINT z$:NEXT a
390 LOCATE 1,24:PEN 1:PRINT"   Press a key"
400 IF INKEY$="" THEN 400
410 DATA Z     Left,\     Right,SHIFT Jump,0     Abort
,H     Halt,S     Start,SPACE Music on/off
420 DATA 1     Game,2     Demo,3     Easy game,4     Hard
game,5     Joystick,6     Keys
430 MODE 0:PRINT"       OPTIONS"
440 FOR a=2 TO 7:READ z$:LOCATE 4,2*a+2:PEN a+4:PRINT
z$:NEXT a
450 IF j=1 THEN LOCATE 4,14:PEN 14:PRINT"5":PEN 1:PRIN
T:PRINT"   6" ELSE LOCATE 4,14:PRINT"5":PRINT:PEN 14:P
RINT"   6":PEN 1
460 IF e=1 THEN LOCATE 4,10:PEN 14:PRINT"3":PEN 1:PRIN
T:PRINT"   4" ELSE LOCATE 4,10:PRINT"3":PRINT:PEN 14:P
RINT"   4":PEN 1
470 z$=INKEY$:IF z$="5" THEN j=1 ELSE IF z$="6" THEN j
=0
480 IF z$="3" THEN e=1 ELSE IF z$="4" THEN e=0
490 IF z$<>"1" AND z$<>"2" THEN 450
500 PEN 1:IF z$="2" THEN GOSUB 190:GOSUB 300:PEN 1:INK
 1,24:GOTO 360
510 IF Z$<>"1" THEN 490
520 POKE 37853,e:IF j=1 THEN POKE 37562,74:POKE 37570,
75:POKE 36659,72 ELSE POKE 37562,71:POKE 37570,22:POKE
 36659,21
530 GOSUB 220:PEN 1:GOSUB 300:PEN 1
540 GOTO 360
```

Listing 2.

```
10 MEMORY 32767:MODE 2:PRINT"Taking in progress,please
 wait"
20 DIM t(46):FOR a=0 TO 46:READ t(a):NEXT a
30 a=35900:FOR a=0 TO 46:READ a$:IF LEN(a$)<>160 THEN
 70
40 t=0:FOR b=0 TO 79:s=VAL ("&"+MID$(a$,b*2+1,2)):t=t+
 s:POKE a,s
50 a=a+1:NEXT b:IF t<>t(a) THEN 70
60 NEXT a:PRINT"Finished,no errors":END
70 PRINT"Error in line 60 or line "a+10+40:END
80 DATA 10000,9982,6333,5836,8348,6667,8470,8333,8831,
10395,8690,8912,6886,10163,9924,9238,9424,8415,9040,95
81,8835,10313,8385,9303,
6397,1519,3422,3899,3471,3684,3664,3975,4571,2877,1895
,9518,6621,3832,4090,3693,8,7432,2353,6859,5707,6313,1
617
90 DATA CD7C0E3E01F532E795CDA290CD2191CD7C90B600C59CD19
80CDB690CD8F0FCD8D00ECD308EC110EDF13CFE1020D8C9CD7C0E3E
6032E1939732199432159421
239622E593CDA290CD2191CD7C90CD2C0FCD
100 DATA 0F8ECD1980CD2092CDB690CD8F0FCD0000ECD308ECDF20
D3A1994FE01CA72803A1594FE002806C3AE7933CE60F32E7933AE79
33D87807BF1600219A0L19E
597CD0EBC2103002276932 1F40CB66B67E23CD
110 DATA F49210F9E106007E23CDF49210F90A04CD1980 10FBC36
D0C4C4556454C204F4E4520202020205457 4F20202020205440524
5452020204A4F55522020202
0464956452020202053495020202020205345
120 DATA 5A454E2020204549474854202045494E4E4520202085
4454E2020202020454C4556454E2020545456C5645202054484954
25445454E464F55525445454
E4649465445454E203AF5933D32F593FE00C8
130 DATA 0632CD1980 10FB97CD0E0C3AF59321BE80FE02200321D
00D01804ED4376930B107E23CDF49210F901050 6ED4376930B0A7
E23CDF49210F90604CD1980 1
0FDC360D0C4341524546554C204F4E4C592054
140 DATA 574F4C4956455320 4C4546544154554C204F4E4
C59204F4E454C4946452020 4C4546543E2FCD1E9020143A370EFE0
0C03E0132370E3A1C94EE013
21C94C99732370E3E20CD1E9020021C93E2C
150 DATA CD1E9 0C0D8A0C2100001100 0CD1980 3E3CCD1E9020E
DCD99BCC9003A1C94FE00C03E02CDA00CE607FE04D02A1A947E239
6238620072184992210494C92
7221A9420202078E327A0E235E235AED537 60E
160 DATA 21738CDAABCC9020000EF00000F5A0013F00211D941
1A0 DATA 21738CDAABCC9020000EF00000F5A0013F00211D941
1DE93ED00C9CD00D07CFE01C07DFE2CD0D62C260 0CD1980 3A1C94F
E012006211D60ECDAABC3AE19
7D6012732E193FE002006 3E013219949701 0D
170 DATA 17ED4376 93F5E6F01F1F1FCA3 0CDF492F1E60FCA30C
DF492C9B1 0000C0100003200ED4BE5933A1694FE002 0053D3216 9
4C93E3980AF79075F160062C
D109C7EFE00C0232323237EFE00C0 2E0CED49
180 DATA E593F521C594CD0893ED4BE5934804ED43E593F13D20E
BCD0A923E3232 1994C93A1094FE00C3E40CD1E90C0ED40E5933EC
4906779075F260054CD1DBC7
EFE00C0232323237EFE00C0ED40E59370FE06
190 DATA 2006 3E01321594C93E10F5217594CD0893ED4BE593050
5ED43E593F13D3D20EACDBA923E04321694 3AE7933CE6AFE1FCD709
3C93A1794FE002005 9732179
4C93E0321794 3E0721FA6930600F5C54E235E
200 DATA 79034FFE0120021E01FE4720021EFF732B7123235E5CDC
DF40FC1613A0693FE0120 1C4E235E79034FFE0120021E01FE47200
21EFF732B7123235E5CDF40FE
1C170C61047F13D20B4C970E6FB6F26002950
210 DATA 5429291916CB5919505434 0CB4862336 010FB23360C0
6046B7AC600675736F30E0623360 0020FA2336F510ED6B7AC600
7360C060623360010FB23360
CC9E5D53A1494 3CE61F3214945F160021519 0
220 DATA 197ED1E1C9F8EC6 0741DBC47A5289A7B49 3B9707D0030
FC2307A6C621E6F4B9ACF11F44F9EEB6DAE1D0E39040C001173921F
6930607CD3B905FE67E1FC60
5772379E6023D772323EEFE772B79E63FC405
230 DATA 77232318E0C921AE9011E0930100 0ED80C9446 0723374
6A73C973AE79321 0C9611E0935B47C4E6960210C9711EA93C04FC4E
6902 0C9711EC93C857C4E69
0210C9011EE93C85FC4E698C9F5EB4E23460D
240 DATA 2B15E210C900CCDCA92E10E4A70CA1047FEA03002060
7702B71EBCDCA922AE5937C3C90200D7DC4 0491FE0C30055E01321
994F1C997CD0EBC3EC7F5CDC
791F1D610FE0720F53E87CD900B210716 2276
250 DATA 93219 ,9106 67ECDF492231 F9210710227693 21C1910 67E23CDF
3219901060 7ECDF492231BF9210710227693 21C1910 67E23CDF
4921BF93AE7930AFF84D60A3
0FBC60A4F70C630CDF49279C630CDF49235F5
260 DATA 9321789411540001000F5C5D5E5C09893E1D119C179C
4004FF13D20ED210000110000CD1B0DC95363 6F72652054696D652
0203630 4C657 6656C2026006
F29E53E02CDDEBB110000CDEABB117C02E1E5
270 DATA CDFA80E1110A00A7ED52E5117C02CDFA80E1110000E5C
DFA8BE1110A001 9E5110000CDFA8BE13E0DCDDE9B06B4C5202BE51
10400CDEABB117002E1E5CDF
6B9E1C110EAC93A1894FE002007 3D321894C3
280 DATA 0A92CD07927BFE00CA0A92ED43E5933AE493B0203790
34FFEFF200C210C900E0004CDCA92050E4AFE4B200C8E4B21BC900
4CDCA92050E007B32E493ED4
3E5933AE3935F3AE2930332E293FE002004FE
290 DATA 0920843EFEA05F7B32E393C3BA922170945AE493FE012
003217E9534AE293EAFC1F1F110000FE012005115A00FE02200311B
40019ED4BE593C3B931E003
E4ACD1EB0B20B11D3E4BCD1E9B20011CC9F5C5
300 DATA D5E5E5790716 0625F3EC790AFCD1D8CD1B610C5E5010
000EBED09EBE1CD26BCC11B0E1D1C1F1C9E5D5C5F5FE3B305CFE3
A3050D63017171F552A7A937
D8787B5F1600E1E19487B787C6A76F260 0CD
310 DATA 10BCF1C6BC16995F60714D50E831E00A717CB1317CB1
35797CB4820023E00CB422002C60477237A8D20E311FD0719D1131
0D7217693 34F1C1D1E1C92A7
6933E1FCD5A8B2C7DC05AB0247CCD5AB3F1CD
320 DATA 5A0B217693 34C1D1E1C9E5 17E505C5F5210D162276932
10D93E50627773D0E233E01862777 3D0623 3E01862777E12325B60
57E4FE6F01F1F1F1FC63DCDF
49279E60FC630CDF4922B10E8F1C1D1E1C9E5
330 DATA 79071600625F3EC790AFCD1D8CD1B612C5E5010500EBE
D00EBE1CD2A8CC110F8C9810000004000010122960F104F3B97100
70E579000000005410120D
1FFF1A0117FF8501 C010CFF37FF2A011A01
340 DATA 38FF12011FFF0000090000000 1A07A010000060000
1012259601 0000000000000000
0000000000000000
```

```
350 DATA 0000000000000000000000000000000000000000000000
0000000A00F0A0000540 60 0000054FC0 0000500FC0 0000A04F0
00000C A0000045CA0000D5
45CFC000054CFC0000054CA1 0000541 0000
360 DATA 0003FC0000000 1A0300000 0300000000 7020D0000C0
0500000000000000000000 0000000000 0F0000050FC0
0000A04F0A00000
0 0 0200000545C0000054CA1 0000541 0000
370 DATA 0054FC0C0000054FCFC0000054CA0000D3020000013
020000001200000001000200000000000000000000000 0A0
50FC0 0000A04F0A00000FCA0000045CA0000
000050F6F0000050FCFA000
500 DATA 0054AC0000054FCFC0000054FCFC0000000
CA0000003020000002000000120 0000001000102000000000
0000000000000F0A00004
52FF0F0000CFBF0F0000450F0F000000CFD400
```

```
590 DATA 0000FCA0000000FC5C000054FC5C000054FC5C000450
CFC000054FCFC000000 CA0000001020000001020000003020
0000103020000000000000
0000000000FA0000452F0F0000CFBF0F00
400 DATA 0045CF0F0000CFBA0000 0FCA0000000FC5C000054F
C5C000054ACFC0000 0E5CFC000054FCFC0000 0FCA0000003020
0000103100010202100000
0000000000000000000000000000F0A00
410 DATA 00452F0F0000CFBF0F000045CF0F0000 0CF0A000000F
CA0000000FC5C000054CFC0000E5CFC000054FCFC000054FCFC0
0000FCA0000003020000001
020200001000210000030001000000000000
420 DATA 0000041000000000000011414400000000011414400
0000000334144000000001133414400000000113341440000000
3334144CC0000003334144C
C0000110011414 4CCCC0000000410000000
430 DATA 3C3C3C3C3C3C3C3C003C3C3C3C3C3C00043C3C3C3C3C
C00140C0C0C0C0C0C0001 43C3C3C3C3C0000000000000000000
0000000000C0000000000C
0000000003C0000000000000C3C0000C00
440 DATA 0200C3C3C3000C00E141E1C3D2B6040 0E14102F0E1020
40C30AC3C3C3C3840041C3C3C3C3800041C3C3C1C3C3020000C
3C2C3C3C3000000C0C0C3C3C
3000000401C3C3020000000C3C3C3000000
450 DATA 000041C3020000000000000000000000CCCCCCCCCC0
00044CCCCCCCCC0000CCCCCCCCCCCCCCCCCCCC00CCCC0C000CCCCC00440
00C000C4400000014 3C3C3C2
0000000 3C3CFC3C3C000014 3C7C3FBC3C2000
460 DATA 143CFD03FE3C20003C3FD03FE3C3C003C3C7C3FBC3C3
C003C3C3CFC3C3C3C001C3C3C3C3C3C2C0000E0C0C0C0C0D002D0
F0F0F0F0F1E003C3C3C3C3C3
C3C0000000044400000000000044000000
470 DATA 0000113333000000C3C39333B1220000C3C3933372220
0000000403333000000011C0000000000011333333220000003
3333333300001133333333
32200223FFF3FFF3F110055F052F0A1F0AA00
480 DATA FAA103F00352F5007AA103F00352B50015F052F0A1F02
A0000FF3FFF3FFF0000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000
490 DATA 0000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000
500 DATA 7004848484047000103010101010700484847000F4F
C007004830048047000182040000FC0000FC040F004847000700
408F004847000FC0484801 02
0200070048047004847000704847C04847000
510 DATA 0000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000012D5001 2DE0012EF002
41C0112FD00243F0112AAB11
2700112DE012430012FA81247E0212530312
520 DATA F4021 2E0124300212FA81247E0212530312
012AAB1129201127D0124EF001127D0124EF001127D0148EF0012EF8
012D5002 2C900128E0012EF8
012D5002 4E0012FD0024D5006CEF0012AA01
530 DATA 1292011270124EF001270124EF001270017EEF00121
C01122F011252B1121C0112EF0024E001 2D5001 2EF00121C016CD
5001 2AA01129201127D0124E
F0012700124EF001270016CEF0012EF00 12D5
540 DATA 0012C9001 2E0012EF001 2D5002 4E0012FD0024D5006
CEF0012EF001 2D5001 2E0012EF001 2D5002 49E0012EF0012D5001
2EF0012E0012EF0012D5002
49E0012EF001 2D5001 2EF0012E0012EF0012
550 DATA D5002 49E0012FD0024D5006AEF005AEF0000000000000
0000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000
```


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25-way	.40	.65
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CBM-64

The Telsoft service now extends to include the CBM-64.

THIS MONTH we are pleased to be able to announce the extension of the Telsoft service to Commodore 64 owners. It will be available initially to users who have the OEL Comms pack coupled with the Telemod 2 or similar modem.

Both the downloading program — which is listed with this article — and the full user-to-user communications program for the C-64 have slightly different menus to those produced for the BBC and Spectrum computers — see page 88.

The main difference is the addition of a machine-code Save routine which was considered essential since this is absent from the Commodore operating system. The full C-64 menu is: (1) Receive; (2) Transmit; (3) Chat; (4) Set Baud Rate; (5) Return to Basic; (6) Save Bytes — ie machine code sections. Brief details of the functions of these menu options are as follows:

Chat mode: This mode allows a real time conversation between the users with automatic changeover from one end to the other. Each time characters are entered from a different end a carriage return is generated automatically which ensures that the text sent by the two ends is not mixed up on the same line.

Transmit and Receive modes: These modes are used to transfer data between computers and if both users start off in the Chat mode the procedure is semi automatic, as follows:

The user who is going to send the program presses his Stop key which reverts the computers at both ends to the menu. Menu option 2 is called to go to Transmit mode and the user will then be asked to enter details of the data that is to be transmitted to the distant end.

Both the transmitting and receiving ends get a visual display of the progress of the data or program transfer. The data is sent in 256 character blocks, each block being numbered in hex and finishing with an OK if the receiving end calculates that it has received the block without any errors.

If the block contains errors, the OK is

Figure 1.

```
5 REM   HEX LOADER FOR CBM 64   FIG.1
6 REM
10 FOR I=680 TO 727:READA:POKEI,A:T=T+A
20 NEXT:IF T=6716 THEN GOTO 100
30 PRINT"ERROR IN DATA ";T-6716:END
40 DATA 169,1,133,186,169,1,133,184
50 DATA 133,185,169,8,133,183,169,208
60 DATA 133,187,169,2,133,188,169,56
70 DATA 133,251,169,199,133,252,169,251
80 DATA 162,231,160,206,32,216,255,96
90 DATA 68,79,87,78,76,79,65,68
100 SA=51000:LA=52855
110 INPUT"START ADDRESS";A
120 IF (A<SA) OR (A>LA) THEN GOTO 140
130 IF A/8=INT(A/8) THEN GOTO 150
140 PRINT:PRINT"ADDRESS ERROR":GOTO 110
150 T=(A-32768)AND255:PRINTA;:INPUTD$
160 IF D$="END" THEN GOTO 900
170 IF LEN(D$)=20 THEN GOTO 190
180 PRINT"WRONG LENGTH":GOTO 150
190 FOR B=0 TO 7:B$=MID$(D$,2*B+1,2)
200 GOSUB 300:IF E=1 THEN GOTO 280
210 POKE A+B,D:T=T+D:NEXT
220 B$=MID$(D$,18,3):GOSUB 300
230 IF E=1 THEN GOTO 280
240 IF T=D THEN GOTO 260
250 PRINT"CHECKSUM ERROR":GOTO 150
260 A = A+B:IF A<LA THEN GOTO 150
270 GOTO 800
280 PRINT TAB(8+2*B+D)C$"??"
290 B=8:NEXT:GOTO 150
300 E=0:D=0:FOR N=1 TO LEN(B$)
310 C$=MID$(B$,N,1):GOSUB 400
320 IF E=1 THEN D=N:N=4:NEXT:RETURN
330 D=D*16+X:NEXT:RETURN
400 X=ASC(C$)-48:IF X<0 THEN E=1:RETURN
410 IF X<10 THEN RETURN
420 X=X-7:IF X<10 THEN E=1:RETURN
430 IF X>15 THEN E=1
440 RETURN
500 H$="0123456789ABCDEF"
510 FOR A=SA TO LA STEP 8
520 PRINT A;"? ";:T=(A-32768)AND255
530 FOR B=0 TO 7:X=PEEK(A+B):GOSUB 600
540 T=T+X:NEXT:PRINT"=";
560 Y=INT(T/256):PRINT MID$(H$,Y+1,1);
570 X=255 AND T:GOSUB 600:PRINT
580 NEXT:GOTO 900
600 PRINT MID$(H$,INT(X/16)+1,1);
610 PRINT MID$(H$,1+(XAND15),1);:RETURN
800 SYS 680:C$=CHR$(34)
810 PRINT:PRINT" TO RELOAD CODE :"
815 PRINT:PRINT"  LOAD"C$"DOWNLOAD";
820 PRINTC$",1,1  (RETURN)"
825 PRINT:PRINT"  THEN TYPE   NEW";
830 PRINT"  (RETURN)"
835 PRINT:PRINT"TO RUN THE PROGRAM";
840 PRINT"  SYS 51000  (RETURN)"
900 PRINT:PRINT:PRINT"1  ENTER DATA"
910 PRINT:PRINT"2  PRINT DATA"
920 PRINT:PRINT"3  SAVE DATA"
930 INPUT Z:ON Z GOTO 100,500,800
```

Figure 2.

```
51000 ? A9068D21D08D20D0=3E2
51008 ? A90F8D8602A90E20=2E4
51016 ? D2FFA9008D15D0A9=4DD
51024 ? FF8D8A02BA8E92CE=510
51032 ? 20CAC920C7CB20F8=4D5
51040 ? CAAD80CEC931F023=532
51048 ? C935F014C936D006=43F
51056 ? 208EC74C5BC7A914=410
51064 ? 20D2FF202FCBD0DB=52E
51072 ? 203FC8A92020D2FF=461
51080 ? 4C93C94C4AC82063=411
51088 ? CC2022CDA95B85FD=4F1
51096 ? A9CE85FE2028CDA0=547
51104 ? 002095CC202FCBC9=404
51112 ? 44F00BC954D0ED20=4E1
51120 ? D2FFA901D007A944=4EF
51128 ? 20D2FFA90885BA20=4B9
51136 ? 25CDA90820ABCCA9=4A3
51144 ? BD85FDA9CD85FEA0=6A0
51152 ? 002095CC2025CD20=383
51160 ? 95CC9848A0048C83=4CC
51168 ? CE20D8C968A82025=4C4
51176 ? CD2095CC9848A906=4C5
51184 ? 8D83CE20D8C9ADA7=5E3
51192 ? CE85FBADA8CE85FC=6EA
51200 ? 68A82060CBA90185=38A
51208 ? B885B998A293A0CE=539
51216 ? 20BDFFAEA9CEACAA=567
51224 ? CEE8D001C8202SCD=479
51232 ? A9FB20D8FF20F1CB=597
51240 ? 6020D9CCC90DD00B=3FE
51248 ? A90085C7A92020D2=3E0
51256 ? FFA90D20D2FF60A9=4E7
51264 ? 0D2029C8A90D20D2=306
51272 ? FF602063CCA000A9=43F
51280 ? FF9993CEC8D0FA20=5FB
51288 ? D2CB90FB20D2CBB0=5ED
51296 ? FB8D72CEA0008C7C=4D0
51304 ? CE8C7DCE202ECCAD=4D4
51312 ? 72CE29F0C980D0E4=5C6
51320 ? 20D2CBB0DA9973CE=599
51328 ? C8202ECCC009D0F0=4EB
51336 ? A000AD76CE2980D0=492
51344 ? 0FA52B85FB18A52C=3D8
51352 ? 6D75CE85FC4CAAC8=587
51360 ? AD78CE85FBAD79CE=607
51368 ? 85FC20D2CBB0A820=55E
51376 ? D9CC20D2FFC820D9=607
51384 ? CC202ECCC010D0EA=528
51392 ? A92020D2FFAD75CE=56A
51400 ? 202ECD20D2CBB087=4D7
51408 ? CD7CCEF00BA95820=503
51416 ? D2FF2030C84C57C8=52C
51424 ? 20D2CBB0F8CD7DCE=65D
51432 ? D0EBAD75CEA8B993=687
51440 ? CED00E2030C8A991=4EE
51448 ? 20D2FF4C7EC94C57=51F
51456 ? C8A0008C7CCE8C7D=447
51464 ? CE20D2CBB0F091FB=5BF
51472 ? 202ECCC8CC77CED0=4D3
51480 ? F020D2CBB0E0CD7C=59E
51488 ? CEF008A95820D2FF=4D8
51496 ? 4C57C820D2CBB0CE=4CE
51504 ? CD7DCEF0034C23C9=473
51512 ? 20ACCB2030C8AD75=409
51520 ? CEA8A9009993CEAD=506
51528 ? 84CEC902D02520BC=436
51536 ? CBA9C820F3CBA955=568
51544 ? 2016CDA95020F3CB=432
51552 ? 20C7CBAC73CEC888=54F
51560 ? B993CED02398D0F7=5D4
51568 ? 4C5BC7A9552016CD=3DF
51576 ? 20F1CB4C63C9AC77=4EF
51584 ? CE20D2CB88D0FA20=57D
51592 ? D2CB20D2CB4C47C9=53E
51600 ? 4C5CC8A52B85FBA5=4F5
```

TELSOFT

omitted and the block is retransmitted by the sending end until it is received without error.

When data transfer is successfully completed Program loaded OK is printed at both ends and they then revert back to Chat mode.

Set baud rate: This gives the user the option to change baud rates to try out different methods of working; e.g., the Telemod 3 has the facilities for full duplex working at 1200/75 and 75/1200. However, the program was specifically written for 1200/1200 bit/s half duplex working — selection 4 from the baud rate menu.

Save bytes: As mentioned earlier this facility is built in to enable users to save any number of machine code sections to tape or disc after downloading. The start and finish memory addresses of the machine code can be entered using either decimal or hex numbering. Naturally, any Basic program located in its usual position in memory — i.e., 2048 upwards — should be saved using the machine's built-in Save to tape or disc facility.

Only the Download section of the machine code is given in this listing, not the Transmit and Chat routines.

When you have been returned to the menu, exit to Basic and list the first few lines of the program where we will give the instructions needed to Save the program to tape or disc.

The download program is approximately 1800 bytes in length and consists of a Basic hex loader program and a list of machine code. Type in the hex loader program listed in figure 1 and then Save to tape or disc before you Run it. When the hex loader program is run the computer will give the prompt "Start address (hex)?" and you should enter 51000 and press Return.

The computer will print the start address of the line and a question mark — e.g., 51000? — you then have to enter all the characters after the question mark from the relevant line in figure 2 and press Return at the end of the line. If all is well you will be prompted with the next address and so on. Each line comes with its own checksum so that you can correct any errors as you go.

If you want to enter the machine code in several sessions you can save part of the code — but to tape only — by entering End instead of the next line of data when you are prompted with a line number and question mark. When you want to continue typing in the machine code program it is reloaded with the Command.

When you have entered all the machine-code lines the hex loader program will automatically save this machine-code section with the title Download, so make sure that you have your tape recorder or disc ready to record, before starting to type in the machine-code section.

If you want to enter the machine code in several sessions you can save part of the code (but to tape only) by entering End instead of the next line of data when you are prompted with a line number and question mark. When you want to continue typing in the machine code program it is reloaded with the command.

```
LOAD "DOWNLOAD",1,1
```

then enter New and Load and Run the hex loader program.

When you have completed and saved the Download program it is reloaded with the command

```
LOAD "DOWNLOAD",1,1
```

or 8,1 for disc — followed by the New command. To Run the program, enter

```
SYS 51000 (Return)
```

Modem transmit speeds

Provided the machine code is correct you will be asked to select the modem transmit and receive speeds. For the OEL Telemod 2 modem simply select Option 4.

To receive software from Telsoft, the *Your Computer* downloading service, first dial up Colchester (0206) 8068 and check when software for your machine is being downloaded. This audio recorded information service will also advise you which telephone numbers to ring for the 300 and 1200 bit/s downloading services.

When a program you want to download is available, make sure your modem is correctly set up and dial up the telephone number appropriate to your modem's speed. When you hear the modem tones switch the modem to line and replace the receiver.

Select Option 1 from the menu — Receive. As each block of data is recieved the block number and the program title will be displayed, followed by "OK" if there were no errors. Note that the "OK" will be missing from any blocks in which errors are detected and that the downloading program will wait for these blocks to come round again in order to make a second attempt to load.

When all blocks have been loaded, the Program loaded OK message will appear and you will be returned to the menu or Chat mode after which select Option 5 to leave the Telsoft Menu and list the first few lines of the Basic program you have received to get the necessary Saving instructions. ■

```
51608 ? 2C85FCA000B1FB99=52A
51616 ? 2200C8B1FB8523F0=4CE
51624 ? 0BA52285FBA52385=447
51632 ? FC4C9BC918A5FB69=57D
51640 ? 02852D852F8531A5=37B
51648 ? FC6900852E853085=412
51656 ? 32602063CCA9028D=3E1
51664 ? 84CEA90B8D02DE60=4A3
51672 ? 8E81CE8C82CEA200=533
51680 ? A9098DCDCE202FCB=4D4
51688 ? C914F016C90DF051=4E2
51696 ? C924D01920D2FF8D=544
51704 ? C3CEE84CE5C9E000=64B
51712 ? D0E3E000F0DF20D2=554
51720 ? FFCA4CE5C9C93090=554
51728 ? D4C93A901548ADC3=444
51736 ? CEC924F004684CE5=460
51744 ? C968C94190BFC947=4BA
51752 ? B0BB20D2FF38E930=4D5
51760 ? C90A9002E907E005=36A
51768 ? F0AB9DC3CEE84CE5=61A
51776 ? C9E000F0A0E001D0=52A
51784 ? 07ADC3CEC924F095=4FF
51792 ? A92020D2FFA9FF9D=54F
51800 ? C3CEA2008ECFCE8E=544
51808 ? D0CE8ED1CE8ED2CE=659
51816 ? ADC3CEC924D006A9=512
51824 ? 0F8DCDCEE8BDC3CE=5DD
51832 ? C9FFF01D20CBCAB0=5B2
51840 ? 3418BDC3CE5DCFCE=524
51848 ? 8DCFCEA9006DD0CE=566
51856 ? 8DD0CEB020E84C75=534
51864 ? CAADCFCEAC83CE99=642
51872 ? A3CEC8ADD0CE99A3=660
51880 ? CEC8188C83CEAC82=561
51888 ? CEAE81CE602025CD=4ED
51896 ? A200BD41CEC921F0=500
51904 ? 0720D2FFE84CBACA=570
51912 ? 4CDEC9ADCDCE8DCE=65E
51920 ? CEADCFCE8DD1CEAD=6C1
51928 ? D0CE8DD2CE18ADD1=639
51936 ? CE6DCFCE8DCFCEAD=68F
51944 ? D2CE6DD0CE8DD0CE=6BE
51952 ? B005CECECED0E660=625
51960 ? 2063CCA90F8D8602=414
51968 ? A95185FDA9CD85FE=575
51976 ? A000209DCC2025CD=343
51984 ? 209DCC209DCC209D=3DF
51992 ? CC2022CD20A9CC20=3A8
52000 ? 95CC2022CD2095CC=411
52008 ? 202FCB20D2FF608E=421
52016 ? 81CE8C82CE2069CC=4B0
52024 ? 20ECCC20CACCC900=48F
52032 ? D00D20FDCCC931F0=4F0
52040 ? 062001CC4C35CB8D=314
52048 ? 80CEAE81CEAC82CE=597
52056 ? 60AE92CE9A4C5BC7=4CE
52064 ? 2022CDA92285FDA9=465
52072 ? CE85FEA0002095CC=4DA
52080 ? 2025CDA00FA92099=393
52088 ? 93CE88D0FA8D93CE=619
52096 ? 202FCBC914D010C0=417
52104 ? 00F0F520D2FF88A9=58F
52112 ? 209993CE4C80CBC9=50A
52120 ? 0DF00B20D2FF9993=4BD
52128 ? CEC8C010D0DAA920=579
52136 ? 20D2FF60A92020D2=4B4
52144 ? FFA94F20D2FFA94B=58C
52152 ? 20D2FF60A9138D00=452
52160 ? DEA9128D00DE60A9=4CD
52168 ? 538D00DEA9528D00=40E
52176 ? DE60A996188D87CE=547
52184 ? 8C82CEAC82CE2004=4D4
52192 ? CC20ECCCCE87CED0=677
52200 ? 02386020FDCCB0EE=509
52208 ? 60A9FA8C82CEA820=597
52216 ? 04CC88D0FAAC82CE=616
52224 ? 602004CC8AA2A8CA=3EE
52232 ? D0FDAA2069CC6020=454
52240 ? 25CDA90220ABCC20=364
52248 ? 95CCAD8ECE20D2FF=573
52256 ? A92020D2FFA90320=3A6
52264 ? ABCC20D8C9604D7D=48A
52272 ? CE8D7DCEA208AD7D=4AA
52280 ? CE2A9010AD7DCE49=411
52288 ? 088D7DCEAD7CCE49=460
52296 ? 108D7CCE2E7CCE2E=3D5
52304 ? 7DCECAD0E160A000=516
52312 ? A9009900D4C8C018=40E
52320 ? D0F660A99320D2FF=5B3
52328 ? 6048A5A2290FD01F=37E
52336 ? A5D448A5A22910F0=4A1
52344 ? 05A9A44C80CCA920=42B
52352 ? 20D2FFA90085D4A9=51C
52360 ? 9D20D2FF6885D468=53F
52368 ? 6020D2FFC8B1FDC9=620
52376 ? 21D0F6C8602025CD=4B9
52384 ? A90C20ABCC2095CC=46D
52392 ? 60A9058E81CEAAA9=4E6
52400 ? 2020D2FFCAD0FAAE=603
52408 ? 81CE60C914F008C9=505
52416 ? 7FF00160A91460A9=456
52424 ? 7F6020E4FFC9C190=5C4
52432 ? 07C9DBB00338E960=4AF
52440 ? 60C941900EC95B90=494
52448 ? 08C9619006C97BB0=49C
52456 ? 0249206048A4808=2D5
52464 ? 20E1FFD0034C59CB=533
52472 ? 2868AA6860AD00DE=485
52480 ? 49016A9003A90060=250
52488 ? AD01DE6048AD00DE=307
52496 ? 49026A6A6860200C=223
52504 ? CDB0FB0D01DE20EC=508
52512 ? CC602025CD2028CD=373
52520 ? A90D20D2FF604829=3A0
52528 ? F06A6A6A6A0930C9=3CA
52536 ? 3A300318690720D2=21F
52544 ? FF68290F0930C93A=31B
52552 ? 300318690720D2FF=2F4
52560 ? 60444F574E4C4F41=2C4
52568 ? 44204D454E552131=243
52576 ? 2020205245434549=228
52584 ? 5645213520202045=1FE
52592 ? 58495420544F2042=28A
52600 ? 4153494321362020=22F
52608 ? 2053415645204259=28A
52616 ? 5445532128205553=285
52624 ? 4520122053544F50=26D
52632 ? 20922054F205245=2C4
52640 ? 5455524E20544F20=2CC
52648 ? 4D454E5520292145=28C
52656 ? 4E544552204E554D=2F9
52664 ? 4245522021494620=281
52672 ? 4144445245535320=2E6
52680 ? 495320494E204845=2C8
52688 ? 582C119D9D9D9D9D=476
52696 ? 9D9D9D9D9D9D9D9D=5C0
52704 ? 9D9D9D9D50524546=481
52712 ? 4958205749544820=305
52720 ? 2421535441525420=2E3
52728 ? 4144445245535320=31E
52736 ? 464F522041524541=220
52744 ? 202146494E414C20=1D3
52752 ? 4144445245535320=236
52760 ? 464F522041524541=238
52768 ? 202150524F475241=22C
52776 ? 4D20544954C4520=237
52784 ? 284D41582031362O=1E5
52792 ? 4348415227532920=219
52800 ? 21124E4F5420564I=21B
52808 ? 4C4944922C205452=2A5
52816 ? 592041474149 4E20=249
52824 ? 3A2021444953 4320=216
52832 ? 4F522054415045 20=26B
52840 ? 2820442F54202920=1E0
52848 ? 3F2100000000000=0D0
```

TELSOFT



A reminder of how to use the Telsoft service.

THE PROGRAMS given here will enable Spectrum and BBC owners to download via *Your Computer's* Telsoft service. First type the hexloader for your machine — figure 1 — and then enter the machine code — figure 2. On the BBC you call the service by entering

CALL &6A00

while Spectrum owners must type

RANDOMIZE USR 60000

So far OE Ltd's Telemod 2 and VTX 5000 modems have been tested with the service, but it also works with a number of other makes.

To find out what is available on Telsoft and how to receive software dial up Colchester (0206) 8068. This audio recorded information line will also advise you which telephone numbers to ring for the 300 and 1200 bit/s services.

When a program you want to download is available, make sure your modem is set up and dial the number appropriate to your modem's speed. As soon as you hear the modem tones switch the modem to line and replace the receiver. Select Option 1 from the menu — Receive. After a block of data is received, you will see "OK" printed if there were no errors, otherwise the program will wait for the blocks to come round again.

When the "Program loaded OK" message appears return to the Telsoft menu and select Option 5. You can now save and run the program.

Figure 1. BBC.

```
10 REM BBC HEX CODE LOADER
15 HIMEM=&69FF
20 CLS:PRINT
30 INPUT " START ADDRESS (Hex)";A$
40 A=EVAL("&"+A$)
50 IF A>&6F87 THEN 200
60 IF A<&2A00 OR A>&6FE7 THEN 20
70 PRINT "A" ";
80 INPUT ";" B$,C$
90 IF LEN(B$) <>16 THEN 50
100 T=0
110 FOR N=0 TO 7
120 X$= MID$(B$,2*N+1,1): GOSUB 300
130 IF E=1 THEN 260
140 X$= MID$(B$,2*N+2,1): GOSUB 300
150 IF E=1 THEN 260
160 B= EVAL("&"+MID$(B$,2*N+1,2))
170 ?A=B:A=A+1:T=T+B
180 NEXT
190 FOR M = 1 TO LEN (C$)
200 X$=MID$(C$,M,1):GOSUB 300
210 IF E =1 THEN A=A-1: GOTO 260
220 NEXT
230 IF T= EVAL("&"+C$) THEN 50
240 PRINT "CHECKSUM ERROR !"
250 A=A-8:GOTO 50
260 PRINT "TYPING ERROR !"
270 A=8*(A DIV 8):GOTO 50
280 *SAVE "DOWNLOAD" 6A00 6F87
290 END
300 E=0:IF ASC(X$)<48 THEN E=1:RETURN
310 IF ASC(X$)<58 THEN RETURN
320 IF ASC(X$)<65 THEN E=1:RETURN
330 IF ASC(X$)>71 THEN E=1
340 RETURN
```

Figure 2. BBC.

```
6A00 :A9CBA0FEA20120F4,4C6
6A08 :FF20616C20486DC9,38A
6A10 :31F08BC934F0E9C9,4CB
6A18 :35F0864C0C6A4C47,200
6A20 :6AA98C20E3FFA9E0,4B2
6A28 :A000A2FF20F4FFA9,4FD
6A30 :03A20020F4FFA902,363
6A38 :A20220F4FFA9C0A0,4C0
6A40 :FEA20020F4FF60A9,4BC
6A48 :0C20E3FF20F76BA9,439
6A50 :15A20120F4FFA000,3EB
6A58 :A9FF8099856FD0FA,507
6A60 :A915A20120F4FF20,394
6A68 :0C6C90FB200C6CB0,34B
6A70 :FBA000847784784,416
6A78 :79847A847B857820,38B
6A80 :D56DA5729F0C980,4B9
6A88 :D0E2200C6CB0D099,46B
6A90 :7100C820D56DC009,364
6A98 :D0F8A000A5742980,422
6AA0 :D00BA51C857618A5,354
6AA8 :1D6573857720C6C,289
6AB0 :B0B520E3FFC820D5,524
6AB8 :6DC810D0F8A57320,435
6AC0 :B26D200C6CB0A0C5,3CC
6AC8 :7AF00BA95820E3FF,478
6AD0 :20E7FF4C676A200C,34F
6AD8 :6CD00CC57BF00BA9,40C
6AE0 :5820E3FF20E7FF4C,4AC
6AE8 :676AA573A0B9856F,43E
6AF0 :D00E20E7FFA9BB20,3B8
6AF8 :E3FF4CB36B4C676A,469
6B00 :A000847A847B200C,2C9
6B08 :6CB0F2917620D56D,477
6B10 :C8C475D0F1200C6C,45A
6B18 :B0E3C57AF00BA958,4CE
6B20 :20E3FF20E7FF4C67,4BB
6B28 :6A200C6CB0CFC57B,3C1
6B30 :F000A95020E3FF4C,447
6B38 :676A20C76B20E7FF,429
6B40 :A573A0A9009856F,3F6
6B48 :A50AC902D0502BD7,419
6B50 :6BA9C820556CA955,3BB
6B58 :20306EA95020556C,298
6B60 :A915A20120F4FF20,394
6B68 :F76BA471C800B985,505
6B70 :6FD05198D0F7A90C,4A4
6B78 :20E3FF20A56DA95A,437
6B80 :8582A96F8503A907,3D7
6B88 :20006E20F86D20A0,2DB
6B90 :6DA9052006EA900B,2DA
6B98 :20E3FF20F86DA9D2,502
6BA0 :20E0FF4C0C6AA955,3BF
6BA8 :20306EA99620556C,2DE
6BB0 :4C6A6BA475200C6C,2D2
6BB8 :88D0FA200C6C200C,316
6BC0 :6C4C486B4C6C6AA9,336
6BC8 :2020E3FFA96F20E3,43D
6BD0 :FFA96B20E3FF60A9,51E
6BD8 :9CA000A6BAE002D0,41E
6BE0 :00A21320F4FFA212,387
6BE8 :20F4FF60A29720F4,4C0
6BF0 :FFA29620F4FF60A9,553
6BF8 :9CA000A6BAE002D0,41E
6C00 :EBA25320F4FFA252,4E7
6C08 :20F4FF6010A99685,44F
6C10 :0F847EA991A20020,38D
6C18 :F4FFB009C007D005,448
6C20 :60684C0C6AA47E20,2D4
6C28 :496CC60FD0023860,374
6C30 :A58AC902D0062079,369
6C38 :6EB0EC60A991A201,447
6C40 :20F4FF98A47EB0DF,55C
6C48 :60BAA2D2CAEBCAD0,5AA
6C50 :FBAA60A900847EA8,458
6C58 :20496CB0D0FAA47E,449
6C60 :60A9E0A000A2FF20,452
6C68 :F4FFA900850AA90C,460
6C70 :20E3FF20A86DA904,3E4
6C78 :20006EA9B9B502A9,2F0
6C80 :6F0503A00020F86D,39C
6C88 :20156DC941F00BC9,378
6C90 :42F011C943F0174C,3A2
6C98 :616CA900A20120F4,335
6CA0 :FF4CB76CA900A203,3C4
6CA8 :20F4FF4CB76CA900,433
6CB0 :A20420F4FFE60AA5,4CE
6CB8 :7C20E3FFA47E20AB,46B
6CC0 :6DA900B20006E20F0,2C4
6CC8 :6DA0172015 6DC941,2D0
6CD0 :F00BC942F011C943,413
6CD8 :F0174C616CA907A2,372
6CE0 :0120F4FF4C096DA9,37F
6CE8 :07A20320F4FF4C09,314
6CF0 :6DA907A20420F4FF,3D6
6CF8 :E60AA50AC902D009,443
6D00 :A9E0A000A20120F4,3E8
6D08 :FFA57C20E3FF2053,495
6D10 :6C20536C6020AB6D,2E3
6D18 :A9052006E20F86D,2C1
6D20 :20AB6DA90520006E,274
6D28 :20F86D20AB6DA905,36B
6D30 :20006E20F86D20AB,2DE
6D38 :6DB47EA9032006E,2A9
6D40 :A9D220E0FF857C60,4DB
6D48 :A90C20E3FF20AB6D,3EF
6D50 :A9072006EA99AB5,306
6D58 :02A96E0583A00020,361
6D60 :FB6D20AB6D20996D,3C0
6D68 :20996D20996D20AB,317
6D70 :6DA90A20006E20F0,2C6
6D78 :6D20AB6DA9022000,270
6D80 :6E20FB6D20AB6D20,34B
6D88 :E7FFA9D220E0FF40,5AB
6D90 :A90FA20020F4FF60,3D5
6D98 :6DA9002006E20FB,287
6DA0 :6D20AB6D6020AB6D,33A
6DA8 :20AB6D20E7FF20E7,445
6DB0 :FF604829F86A6A6A,3FE
6DB8 :6A0930C93A300310,1F1
6DC0 :6907 20E3FF60290F,312
6DC8 :0930C93A3003 1069,1F0
6DD0 :0720E3FF60457B05,3AE
6DD8 :7BA200A57B2A900C,30B
6DE0 :A57B4900857BA57A,390
6DE8 :4910857A267A267B,299
6DF0 :CAD0EB6020E3FFC0,5AC
6DF8 :B102C90DD0F6CB60,4F7
6E00 :B67DAAA9202 0E3FF,478
6E08 :CAD0FAA67D60C97F,55F
6E10 :D00BA9B620F4FFE0,4FD
6E18 :00F012A97FC92080,3C3
6E20 :0EC90AF00AC90DF0,3A1
6E28 :06C907F002A90060,2D1
6E30 :057CB67D847EA991,440
6E38 :A20120F4FFA903A2,404
6E40 :0720F4FFA996A200,403
6E48 :20F4FF902902F0F4,4BA
6E50 :A47CA997A2 0920F4,41F
6E58 :FFA903A20420F4FF,464
6E60 :A991A20020F4FF00,49F
6E68 :09C007D00560604C,2C1
6E70 :0C6AA57CA67DA47E,3DC
6E78 :60847E867DA996A2,446
6E80 :0820F4FF902901F0,3CD
6E88 :08A996A20920F4FF,408
6E90 :9818900130A67DA4,348
6E98 :7E60444F574E4C4F,281
6EA0 :4144494E47204D45,215
6EA8 :4E550D3120202052,193
6EB0 :4543454956450D34,1F2
6EB8 :2020205345204242,1AE
6EC0 :617564205261746 5,2E6
6EC8 :0D3520202045849,180
6ED0 :5420544F20424153,280
6ED8 :49430D454E544552,217
6EE0 :204E554D42455520,1F6
6EE8 :2020555345204354,1EC
6EF0 :524C2D4720544F20,1F5
6EF8 :5245545554E2054,254
6F00 :4F204D454E552029,1ED
6F08 :0D53455420545241,200
6F10 :4E534D495420 4261,24E
6F18 :7564205261746 50D,292
6F20 :412020203735204 2,16F
6F28 :6175640D42202033,1FC
6F30 :3030204261756 40D,209
6F38 :4320313230300242,188
6F40 :6175640D53455420,253
6F48 :5245434549564520,223
6F50 :426175642052616174,2C3
6F58 :650050524F475241,230
6F60 :4D20204C4F414445,1F2
6F68 :4420206F6D0D5052,280
6F70 :4553532041 4E5920,213
6F78 :4B455920464F5220,218
6F80 :4D454E550D202020,1A2
```

Figure 1. Spectrum.

```
5 REM SPECTRUM 48k      fig 1
10 REM Hex Code Loader
15 CLEAR 59999
20 POKE 23658,8: CLS : PRINT
30 INPUT "Start Address ";a
50 IF a>61135 THEN GO TO 200
60 IF a<60000 THEN GO TO 20
70 PRINT a;
80 INPUT " :";b$
85 IF b$="END" THEN GO TO 200
90 IF LEN b$<>20 THEN GO TO 260
100 LET t=a-256*INT (a/256)
110 FOR n=0 TO 7
120 LET x$=b$(2*n+1 TO 2*n+1)
125 GO SUB 300: LET y=x
130 IF e=1 THEN GO TO 260
140 LET x$=b$(2*n+2 TO 2*n+2)
145 GO SUB 300: LET y=y*16+x
150 IF e=1 THEN GO TO 260
170 POKE a,y: LET a=a+1
180 LET t=t+y: NEXT n: LET y=0
190 FOR a=1 TO 3
200 LET x$=b$(17+a TO 17+a)
205 GO SUB 300: LET y=y*16+x
210 IF e=1 THEN LET a=a-1: GO TO 260
220 NEXT a
230 IF t=y THEN PRINT ":";b$: GO TO 50
240 PRINT "Checksum Error"
250 LET a=a-8: GO TO 50
260 PRINT "Typing Error"
270 LET a=8*INT (a/8): GO TO 50
280 SAVE "download"CODE 60000,1136
290 POKE 23658,0: STOP
300 LET e=0: LET x=CODE x$-48-7*(x$>"9")
310 IF x<0 OR x>15 THEN LET e=1
320 RETURN
```

Figure 2. Spectrum.

```
60000 :CD15EDC307ECCD15,4C7
60008 :EDCD36ECCD66EDCD,631
60016 :50EDCD47EE38FBCD,5AF
60024 :BBEDFE31CA99EAFE,69A
60032 :35CA87EAC366EACD,5D0
60040 :15ED3EFACDB4EDCD,5FD
60048 :15EDC9CD15EDC366,553
60056 :EACD66ED11E5EE06,50C
60064 :803EFF121310FCCD,458
60072 :15EE11CDEE06173E,3D2
60080 :20121310FCCD1FED,3DA
60088 :38F0CD50EDCD1FED,5BB
60096 :38FB3265EF3E0032,3E9
60104 :6CEF326FEF3270EF,544
60112 :3A65EFCDEBEC3A65,5A1
60120 :EFE6F0FE0020DE0E,627
60128 :091165EFCD1FEDDA,581
60136 :AAEA1312CDEBEC0D,552
60144 :20F23A69EFE60020,51A
60152 :0D214B5C3A68EF0E,36C
60160 :0047B9226DEF0E00,1DA
60168 :11CDEECD1FED389A,47F
60176 :12130CCDEBEC79FE,45C
60184 :1020F03A68EFCDB1,447
60192 :ECCD1FEDDAAAEA21,574
60200 :6FEF8E28133E5811,326
60208 :E0EE12133E0012CD,340
60216 :D7ECCDA6ECC3AAEA,6B1
60224 :CD1FEDDAAAEA2170,518
60232 :EFBE20E121E5EE3A,524
60240 :60EF856F3E000C67,3CC
60248 :3E00BE200BCDD7EC,40F
60256 :3E2132005CC3FFEB,482
60264 :3E00326FEF3270EF,3C7
60272 :ED5B6BEF0E00CD1F,40C
60280 :EDDAAAEA3273EFCD,634
60288 :EBEC3A68EFFE0020,506
60296 :053A69EFE6003A73,432
60304 :EF12130C3A6AEFB9,3FC
60312 :20DCCD1FEDDAAAEA,5DB
60320 :216FEFBEC22DEBCD,504
60328 :1FEDDAAAEA2170EF,5A2
60336 :BEC22DEB3E6F32E2,509
60344 :EE3E6B32E3EE3E00,498
60352 :32E4EE3A005CFE21,501
60360 :2003CD15EECDD7EC,553
60368 :CDA6EC21E5EE3A60,5C5
60376 :EF056F3E000C6736,422
60384 :0021E5EEED4B66EF,561
60392 :0C7EFE00C20DEA23,4FC
60400 :0D20F63EFACDB4ED,5B9
60408 :3E01D3FEC366EACD,5EB
60416 :1FED3BFBC3BDEAF3,594
60424 :0603AFD3FF10FB3E,3DB
60432 :40D3FF3EFFD3FF3E,56F
60440 :31D3FF3E0F320F5C,385
60448 :320D5C32405C3E01,250
60456 :D3FE21915CCB9EFB,56B
60464 :CD50EDC366EACD15,52F
60472 :EECD66ED3E01D3FE,556
60480 :2165EE3E00CD0FEC,442
60488 :CD84ECCDA3ECCDA6,654
60496 :EC23CD77ECCD77EC,5BF
60504 :CDA0ECCD84ECCDA6,661
60512 :EC233E00CD0FECCD,4CF
60520 :84EC23CDA3EC3E03,498
60528 :CD0FECCD84ECC9CD,60B
60536 :A3EC3E07CD0FECCD,561
60544 :84EC23C97EFE00C0,520
60552 :CDBBED23C384ECFE,651
60560 :00C8F53E20CDBBED,520
60568 :F13DC3BFECCDA0EC,65D
60576 :CDA3ECCDA6EC3E0D,5A6
60584 :CDBBED3EFF320C5C,574
60592 :C9F513E6F0CB1FCB,60C
60600 :1FCB1FCB1FF630FE,4CF
60608 :3AFAC6ECC6071213,498
60616 :F1E60FF630FE3AFA,606
60624 :D4ECC6071213C921,46C
60632 :CDEEE5CD84ECE106,69C
60640 :173E2077231BFC3E,339
60648 :0077C9E52170EFAE,53B
60656 :77C50E007EA7CB17,449
60664 :30D7EEE0773A6F,3C9
60672 :EFEE10326FEF3721,3D5
60680 :6FEFCB1623CB160D,350
60688 :20E2C1E1C9110501,394
60696 :216A00CDB503C93E,32F
60704 :963277EFCD47EDDA,529
60712 :2EEDF1C366EACDAC,5C0
60720 :ED7BE601F602D3FE,548
60728 :AF2177EF35200237,2FC
60736 :C9CD77ED38E8C9CD,6F0
60744 :47EED8FECBC837C9,5E6
60752 :F5DBFF3A01EFFE00,5C7
60760 :20043E3610023E37,107
60768 :D3FFDB7FF1C9F53A,675
60776 :01EFFE0020043E36,376
60784 :D3FFCD50EDF1C93E,644
60792 :00DBFFE60037C8DB,59.
60800 :FFE60237C8DBFFE6,626
60808 :302004DB7FA7C93A,3E0
60816 :01EFFE0020043E37,397
60824 :1802E36D3FFDB7F,452
60832 :C9CD47ED3A73EFD0,5DE
60840 :F1C366EAF53ED23D,5EE
60848 :20FDF1C9CDACED3D,62A
60856 :20FAC9C5D5E5F5FE,780
60864 :7F2813CDF9EDFE0C,537
60872 :200CFE0D20053E20,20A
60880 :D73E00DD71010 3E20,34F
60888 :D73E00D73A005CFE,4E8
60896 :212003 3E00D73E5F,2E6
60904 :D73E00D7F1E1D1C1,648
60912 :C9FE07201CFECB20,4F3
60920 :19FE0C2014FE0820,300
60928 :10FE0D200CFE20FA,367
60936 :0FEEFE00FA11EE3E,4BA
60944 :00C93E07C9CD600D,32C
60952 :3E02CD01163E1832,1C4
60960 :095CC93E121601CD,302
60968 :1122C93E121600CD,257
60976 :1122C9C5D5E533E2,3EB
60984 :CD0116CD47EE30FB,451
60992 :CD5CEEE1D1C1C93A,5CD
61000 :305CCD6F200C3A00,28F
61008 :5CF5213B5CCBAEF1,4C3
61016 :A7C937C9F5111000,3DE
61024 :CD10EDF1C9444F57,4D6
61032 :4E4C4F4144494E47,2B4
61040 :204D454E55003120,216
61048 :20205245345495 6,276
61056 :4500352020204570,217
61064 :697420746F204261,328
61072 :736963002020573,20F
61080 :652053796D626F6C,393
61088 :2053686966742020,388
61096 :204700746F205265,2C9
61104 :7475726E20746F20,39C
61112 :4D454E552029 0045,278
61120 :4E5445522045546D,389
61128 :4245522000000000,1C1
```

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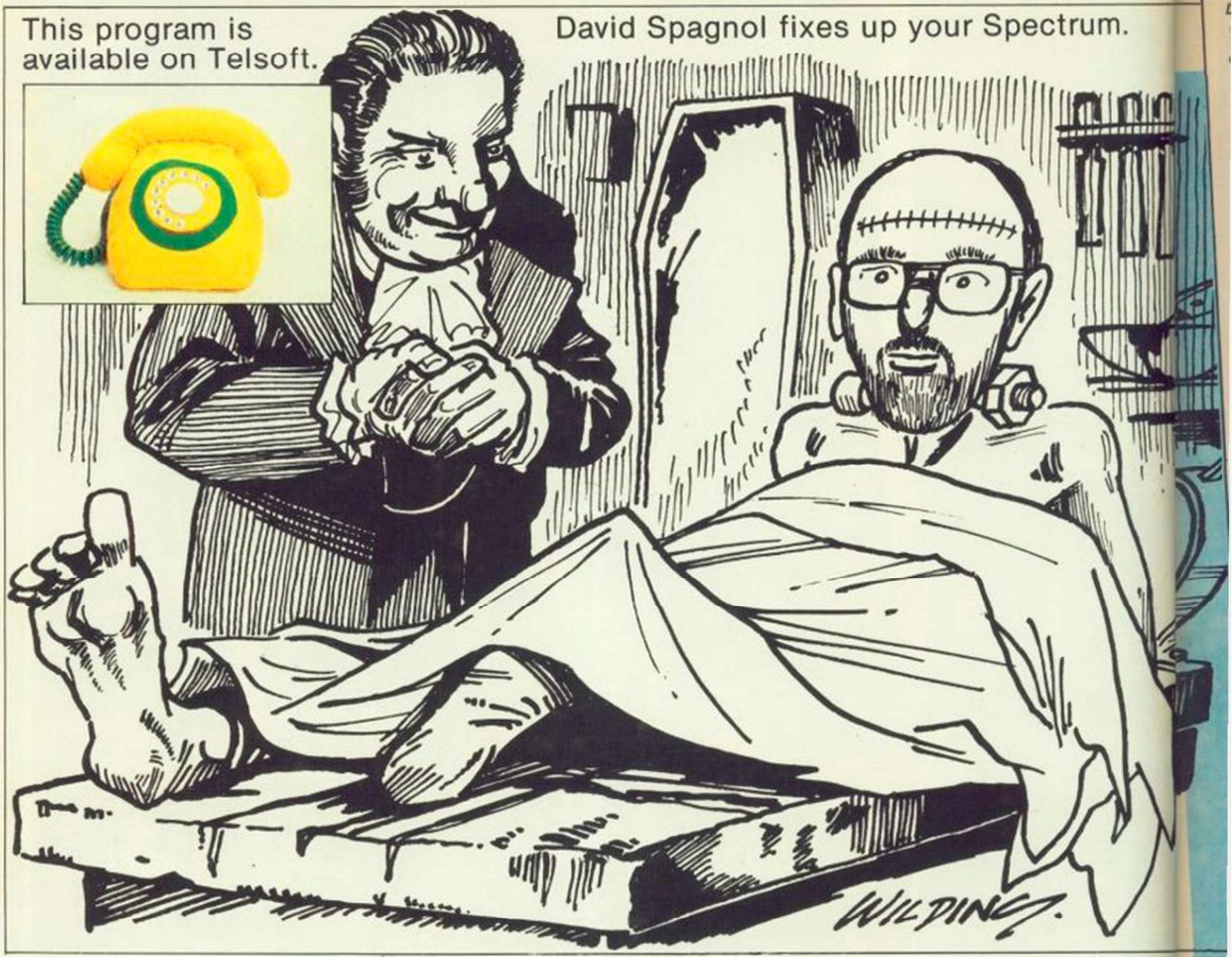
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TOOLKIT

THERE ARE a number of Basic Programmer's Toolkits on the market for the ZX Spectrum. They all seem to have one or two absolutely brilliant functions, which are only used because they are there. Meanwhile, the normal toolkit functions are pretty ordinary and often not at all user-friendly. I have tried to compile a number of Toolkit functions which operate the way I want them to. I also decided to write a user-friendly System to link them all up. A tidy Menu Page is included as is a method of returning to the menu any time Input is requested.

Single-key entry and default values have been avoided. It is too easy to make a mistake and ruin a program. Every parameter is prompted for on screen. Most errors that can occur are trapped. There are a number of error messages.

A feature that will please many people is that if Open # 2, p or t is entered before calling the machine-code, the menu and prompts are still printed to the screen, but any Output — say, in Search and List, or List Variables — is sent to the selected channel.

The Editor: After much searching through Logan & O'Hara's book on the Spectrum Rom disassembly, I worked out how to call the internal Editor from machine-code. All Input is treated like Input Line — i.e. Caps 6 will return to Basic and no syntax check is made. Two added features are that the calling routine has to specify a length limit for any string, and that the empty string causes a return to the Menu. If the length limit is exceeded then the input is rejected and the editor is called again.

The Collect Number Routine: This uses the Editor to allow input up to five bytes. If any non-numeric characters are included, or the number is over 65535, then input is rejected and the Editor called again. Only positive whole numbers are allowed. If the first character is a " # ", then characters A-F or a-f are also allowed, and a hex number is evaluated.

The Parameter subroutine: This is a bit of code that when called, uses the bytes following the call as instructions. Compare the Spectrum Rom's floating-point calculator. It calls the editor for input, prints strings and numbers on screen, as well as ordinary letters and messages from a table. It places input into buffers, and when all the prompts have been answered, tests to see if the values are valid. If all is well, it then asks if the routine should be executed. If you answer Y or y then the work is done. Some individual routines have further tests and error traps inside them.

The Renumber functions: Because of the way these programs correct Goto line numbers, they should not be used with programs that contain machine-code in Rem lines.

R — Renumber block of program: Renumbers a specified block — Start and first unaffected line numbers — with a new base — Destination — and Increment as specified by the user. It makes sure that line numbers will not overlap. It corrects purely integer, simple and up to four-figure numbers after Goto, Gosub, Llist, Run, Restore, and Line — as in Save a$ Line 100 — throughout the entire program. It also removes leading zeros in

Listing 1.

```
100 REM  PUT MACHINE CODE
110 CLEAR 59999
120 LET a=1: LET b=11: LET c=12: LET d=13: LET e=14:
LET f=15
130 LET line=1000
140 LET address=60000+(line-1000)*6.4
150 RESTORE line
160 READ a$,sum
170 LET tot=0
180 LET byte=16*VAL a$(1)+VAL a$(2)
190 LET tot=tot+byte
200 POKE address,byte
210 LET a$=a$(3 TO )
220 LET address=address+1
230 IF a$(3)<>" " THEN GO TO 180
240 POKE 23692,255
250 IF sum<>tot THEN PRINT "Line ";line;" OK.": LET li
ne=line+10: GO TO 150
260 PRINT "Error in Line ";line
270 BEEP .4,-10: BEEP .4,-16
280 STOP
490 ERASE "a";1;"Tool Load"
500 REM  SAVE LOADER
510 SAVE a"a";1;"Tool Load"
520 VERIFY a"a";1;"Tool Load"
530 STOP
600 REM  SAVE CODE
610 SAVE a"a";1;"Toolbytes"CODE 60000,5360
620 VERIFY a"a";1;"Toolbytes"CODE 60000,5360
630 STOP
1000 DATA "21A0EAE5ED73C9EC2146EFE5CD0FED0020202020202
02020535045435452554D20544F4F4C4B495400D4120416C74657
2205072AF477216AD204E204175746F",5953
1010 DATA "6A696E65204F6E20202042204279746573732046F204
4415441204F204C6F6361746520546F6B656E2020432046F78792
04C6A696E6573202020205020432046F6D70",4971
1020 DATA "616374696F722020202042442044656C65746520496
E6573202051204469737061726520656E75",5108
1030 DATA "6D6265722020202020204420524541544520446572465
5202020205320536561726368202064697374204720554447204
465736976E657220205420547261636",4700
1040 DATA "65204F6E20202020202020402046572076520496E66
6F72202020555245544773207446F2044415441202049204965
2D61746966F6E20202056204C697374",4423
1050 DATA "2056617269616C6573544204D65726765204C696E6
5202020572446973706C617941642F512F",4987
1060 DATA "542F57204F6666202020420420420420420420420420
5202020205920556E63AF72727574742020202020204D204F76652
04C6A696E6573202020205A204C696E65",4786
1070 DATA "20536F727420202020202020202020202020202020
845592046F4C4C4F5745442042592045445522C0D206F72206
A7537342045445445522016E797469",4465
1080 DATA "A065206A6F72206D656E75FE7FF30D1981820DCDF7E
ECD8D2C30F5EA0FD6419721 1DED5F16081956235A05C93E23D77CC
D9EEC7CCDA2EC7DCD9EEC7D10841F1F",7714
1090 DATA "1F1FE60FFE0A3002C6D7C3EF151EFF01F0D0CD2A190
118FCCD2A1901 9CFFCD2A190EF6CD2A197D10E14AEA06EA57FFF10
3400093000000100600000000000",5978

1100 DATA "00000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000ADF1EE",652
1110 DATA "FA9AF518F63FFE6FF9B1FA77F125FBA4FCF7FC03FD2
4F374FD9 1FE3CFCEBFD5CF385F9F7FD0BFA6EF93EFF35FF52F419F
5FE7F2004301AD7C94F2A515C232323",1090
1120 DATA "237EFE552005FE507920073E2007797D7C94FE63F47C
53E20D778115FAEFFDC001C6CD6A0C1C871C03E3AD73E2007C9CD6
B003EFECD0116D11B131AA7CA34EEFE",7949
1130 DATA "203843FE10303F202EFE112052FE12206 3FE13203AF
E1420 3DFE15221FE19CA57EE3B67D61A074F0600D5EB21C9EC097
32372EBD110C205CD6CECD110807CB5",7319
1140 DATA "2007CD4AEF04D5E5CD51EDE1D110AA05CDA9EED110A
3D5E5CDADECE1D1109A131AD5A721D7EC200321FAEC",9150
1150 DATA "4E2346235EBCD35C20D110E7D617D5CD61EED110DED5E
5 11EBEFD5AFCD0A0C01020D0CF7EEEA0FFE592005ED79C9ECC9D13
ED1C0D0A0CE1D113D5E53E02CD0116E1",8650
1160 DATA "C928203A0F4F1164002AD1EC37ED52D0CD4AEF812AC
BECED5BCDEC37ED52D0CD4AEF0221BC27ED5BCFECED5230019ED5
BCDECED520CD4AEF033E5CDF7EEE171",8921
1170 DATA "237023EBED00AF12C9810600CDF7EE210000FE2320 1
CFE0DC0444D2929092938DFCD1B2D300AD6300600 4F131A0930E61
0D7131AFE0DC029292929CD1B2DDCEB",5795
1180 DATA "EE30ED0630600 4F0910E7E6DFD641D0FE063FD0C63
AC9C52A515CE5AFCD0116CD6E0DFDC002DECDBF1621715CCBEECBF
EE5010100F736002258 5CCD2C0FCD6E",8033
1190 DATA "80E1CBAECBBEE1CD1516FD362202A635CED5B615C3
7ED52C1ED42308A09444D70B11AC81821CD4AEF00CD6E0DE17E116
8EFCD0A0C210401110A02CDB5030101",6775
1200 DATA "00CD3D1FCD3D1FED7BC9ECC9546173620436F6D706
C65746520452616E676520457226FF24E756626572732052657665
5727365E4496E76616C6964204C696E",7013
```

```
1210 DATA "A5204E754D6265F25A65726F206E6F7420416C6C6F7
7A5E44C6A96E65732077 6F756C64204F7665726C61F04E6F2052
FAD206174204465737469 6E6174696F",6473
1220 DATA "EE5A65726F20426C6F636B4180D02045584543555
53FA859D0D041444452455 5444455354494E",5858
54E414464645444554C4449E4352454D454ED44C494EC54E554D4
1230 DATA "4154494FCE494E4352454D454ED44C494EC54E554D4
245D244454C4554C5D4F56C5434F50D952454E5540424502424C4
F43CB4FC4505024F475241CD4D414348",6215
1240 DATA "494EC5434F44C5554447F354CF444154C1534541524
3CB4C4953D4524550D4C4143C54FAC44E4F5D3545249 4EC7524SC
0555050450264C6F7765F2434153C544",6926
1250 DATA "45C34845D84D455247C53F2020303D6E6FA94352454
154C553594D424FCC42595445D354E52F4F2020AF6E2F6F6666A9494
35245584F52D44D454D4F52D94C4546",6582
1260 DATA "D44C454E4754CB564152494142 4CC546494CC555534
552205241CD494E5445525255554D34E4F524D41CC4449546525
445C444415645205535D41474E4F4C20",5743
1270 DATA "31393885444553494 7CE434B4152414354455D5553C
5434F4D504143D4434F4C5540CE492F4F2020AF6E2F6F6666A9494
E2051554F5445533F2020592F4EA941",5566
1280 DATA "5554CF414243444546473B5245553544152D48DDD206
3A9CD8FED0DED206DF494D414CFE205B72A56365A65E0206E6F7
3207769746820222322E19CD97ED13",6465
1290 DATA "FE9F1406A0181 9FD3652FF10EFCD0FED0DD5206D7F
EC10131A14FEC20813181C14FED89A1 80120 0FED99A1181201F
ED6A2131D141617100C095F22ACBEC",7118

1300 DATA "CD6E1910832AD5EC22D3ECCD0819ED5305EC5623 5E2
3E52ACDECA7ED52E1D84E2346231 1D9EC1ABE2814 7ECD6A1 0200 62
0000000002300780128C910E9C5DD",7306
1310 DATA "E137E52AD7ECED42E1308AE5ED4B D7EC1ABE1323 0B2
007E1DDE5C1810C4780128EEED4BD7EC2AFAECA7ED42C5E5444DD
4051FE1C1E3CDE919E5ED4BFAECC5CD",9866
1320 DATA "5516C1D121FCECED0BC1D52AD5EC0922D5ECA7ED52E
52AD3EC23235E2356E800EB7228732828 3AD1ECA72004CD55 1807C
1E1C303F2ED4BD7EC11D9ECCD8AF2DC",9341
1330 DATA "D3F230F1ED4BFAEC11FCECCD8AF2DCD3F230F1C9545
D1AFE2A200713087801CB1DF4626B237FEE2620F1237EFE2620EB2
337C9D5E5E523A5D5CE322505CDFCD1B",8931
1340 DATA "2D300CFEC42000E122505CE1E1A7C9CD992CDF01010
0CDB4F2E1225D5CE13086EFB230D1A7C9EBA7ED52EB424B01ED003
EEE12132A655C01050A7ED4222655C",7496
1350 DATA "ED0037C9CD8FED0DCA19CD39F3CD44F5CD6DF3CD8BF
3C319F5CD92EDCDCECFFEC180131A14FEC3C400131B14FE85131C1
4FE101706131D14151600C9CD8FED0D",8650
1360 DATA "CC19CD39F3CD6DF3CDF4F41B4E2ACBECCD6E19E52AC
DECCD6E1913ED53D3ECED5BCFEC2A535CDCFF4300D44234E23712
37023CDC4F410EEE1E505ED5B03ECA7",9481
1370 DATA "ED52D1E1D4467223 4E7323712370235E52AD1EC19EBE
1CDC4F410DE3EFFCD01162A535C2323232 3CD6EF4D252F45450D60
004237EFE2E2003ED10ECFE0E20F223",7547
1380 DATA "2323232237EFE3A200AFE802 0EA70FE0530E5D5210
0001AFE0E200FD63D4D44292989294FB6000F1310EC4D442A535C2
323CDCFF43083E110A0237E9B3087 23",5357
1390 DATA "23CDC4F410EA2B2004 7EB938F2284E2B46E1E5EBC5C
DE519C1225B5CC5D1B1AC12A5B5CAF2377237723712370237 7E11
0C62A535C2323CDCFF4D854D2323CD",7247
1400 DATA "C4F4E537ED5220EB732372E118E77ECDCFF4D8FEEA2
00237EFE0D20F8CDA6202A2322323231 0EAFE222D09237FEFE2220FA2318D
DFE0D20E8CDB61020 4FE2D201BFEEC",8321
1410 DATA "2017FEF7201 3FEF0200FFEE52080FEE12007FECA200
3231805237EFE3030AFFE3A3DABC97ECDB6102 0FBFE80232 0F5E5D
5ED5B4B5CA7ED52D1E1C92A535C1100",8096
1420 DATA "0005562 35E23E37907ED52E1D02323CDC4F438ED37C
9AF4FCDDBF4D82A535C23234E2346292B2B7023712323235CDC4F43
8EDCD52F4CD4AEF050EFFCDDBF4D84E",8287
1430 DATA "2346292B2B2B3030303E5C5EBCD4E19C1E5C5CD5516C
1D1E109E5C5ED60BC1E1CDE819B052ACBECCD6E1911 0000462 34E2
3E52ACDECA7ED42E1300A2000132323",7436
1440 DATA "CDC4F410E02AD1ECCDA9303816E52ACFECE5CD6E192
00C5623 5EE1EBA7ED52C1ED42D0CD4AEF062ACBECED5BCFECA7ED5
2D02ACDECED52D0 18E9CDDFED0CDB19",9659
1450 DATA "CD39F3CD07F5CD44F52ACBECCD6E19E5CD5E5CD551AD1E
9D1ED522051E5D52ACFECCD6E19D1ED5219C1F5C505E5CD551AD1E
1C1F1300109E52A515CE3ED53535CED",9670
1460 DATA "002A405CE5D5ED534B5CED53D3ECED5BCFEC2A535CC
D9F3CDBBF3D12A405CA7ED52C1092249 5CE122535CC9CD4AEF07C
D8FED0DC9CDCECFFEC180131A14FEC2",9277
1470 DATA "80131B1C141817002ACBECCD6E19E52ACDEC23CD6E1
9D1ED5228D119C3E519CDDFED0E3D0C7FE780131B1C1417FEAC1
31D1415FEA411081200000ED4DD1EC83",7185
1480 DATA "03C503030303210000ED4DD1EC83",7185
9C1CA03F5CD5516231D1722373233C171237023 3EAED5BD9EC0000
8227370B120F923600C9000000000000",6725
1490 DATA "00000000000000000000000000000000000000000000
3D4FEC8CE92131F1D1415FEC3C7B0131B1C1417161924D5EC3E159
5DA7BEE210000221D1EC2A785C22CBEC",5646

1500 DATA "EB2A05EC292929102822CDEC1822CD0FED0D0D1D3D
4FEC1B0131A14FEC20813181C14FE10C3C7B0131C1C14FE5E6A871131D1
415161924CFEC110C27A7ED5D2D96E",7602
1510 DATA "CD92EDFEDF2B4F52A01101200002ACDEC23ED5BCBE
CAFED52ED5B01EC474F03ED5230FB6B69CD6DF53AD9ECE6DF2AD1E
CFE44208FFE402804CD44EF0111300",8209
1520 DATA "2919100E2AD1EC4D442929092923232323222D3EC2
ACFECCD6E1922585C3EFFCD0116ED5BCBEC2ACDECA7ED520BCD9DF
77AB3C02ACFEC2322CFEC10EAED4B03",7951
1530 DATA "ED5CD051FD12A535CE52ACFEC7CD77DD7D7D73EE4D
72AD1EC3AD9ECE6DFFE442030010008 3E22D71AE52600AF0944ADE
1D5F5CD9EECF1CDA2ECD1287CB51320",8925
1540 DATA "847AB320E53E22D73E2CD71B2318075E2CD71A4F060
0C5CDC4FEC13E0ED7AFD7AFD7797078D7AFD7297C851320847AB32
0003E0DD7C12A595C50303237ED427C",7862
1550 DATA "020B7D02C9FDCB01CE3E02CD0116FDCB014ECCA0803
E02CD0116CD97ED80E8E9FEEAAB1921000039ED5B655CED52CD97E
D14E7FECFAC192A405CED5B535CA7ED",7750
1560 DATA "52CD97ED14E7FEEDAE192A595CED5B485CA7ED52CD9
7ED14E7FEAF192A825CED5B535CA7ED52CD97ED14E7FEF81 9ED57F
E3F2007CD97EDF2191005CD97EDF119",9218
1570 DATA "2A515C2323232237EFE53200 2FE50CCBCFBCD97EDFE7
FF3001 9C378ECCD97EDFE92FE2819A6153E5690D710FA3E0D073E2
0D70A153EA590D710FA3E0D07C9CD0F",8053
1580 DATA "EDD6ED53FE192A485CE5E1CD0819D57EFE002003D11
0C2C87F2043CB6F281AD73E3DD723ED5B455C010500ED09ED53A55
0CDE32D3E0DD710D1CBEFD73E24D73E",8192
1590 DATA "3DD73E22D7234E2346237DB100200 53E22D710E07EF
E2830023E3FD710EBCB772011CBAF281 5EECB07237ECB7F20F9CBB
F10ACCB6F2009E65F10A4EEE0D71806",7149
1600 DATA "EEA0D73E24D73E29D723232346100 33E2CD7235E235
6C5E5EBCDADECE1C110EF3E29D7100FCD0FED0005202 6D6FEC1001
31A14FEC200131B1C14FE10179A100",7326
1610 DATA "1200000 2ACBECCD6E19CD0819D5E556235E23E52ACDE
CA7ED52E13003C1C1C923231D9ECED4BD7EC7EFE002007E1E110D
0E110ECE57CD861020FB1ABE20F213",8402
1620 DATA "2308700120BFE1E1C05518D7E110BACD0FED0D08C9F
EC100131A14FEC200131B1C14FE1B17002ACBECCD6E1920232 03E
CCD081 9ED53D5EC5623 5E23E52ACDEC",8102
1630 DATA "A7ED52E1D023237EFE2138FAFEEA200CED5B03EC2AD
9ECCB4120E05D54237EFE0020FFE21",8139
1640 DATA "38F6FEEAEB20D7EB2AD5EC29CDE519ED5B03EC13131
3A7ED52EB722B7328210B01CD0BFED0F4D2FE9511081200193EFEC
D0163E16D73E05D7AFD7CD97EDF6C7",8676
1650 DATA "FBF9193EFECD0116111DBFBAFCD0ABCCD66FB0600C53
E20073E09905FC63B07216C3F7B0467AED600CB113E20303E0FD
710F5C178CA30D73E0D07100 7CD6EFB",7367
1660 DATA "CD97ED8020302D0FDFE2019 3EFECD0116CDC4F0810
40021D7ECE5CD9AEED113131ACD1B2D30ED603ACA01FAFE0920312
E6CC63F67131AE4DFFE413807FE4930",7878
1670 DATA "D3D4B47AF371F1DF4F131AE4DFFE492009FE4F208
E792FA61002279B677C3AFFA131AE4DFFE5A3032D64138A78787875
F16002A7B5C19EB216C4006007E1224",6876
1680 DATA "1310FAC301FA3E16073EB7D7AFD7CD97ED20FC80193
EFECD0116C921AFFAE5FE5A204CD0216C4006 00FE592029FE5820I
8FE57200777E2F772410FAC9E00CB1A",7328
1690 DATA "1F0D20FA77241 0FAC9E00CB1A",7328
0F7C91102409FE801A87CB1E3E20035F0D20F5D11C2410EDC9210
03EED5B785C01A000ED00C916071046",5632

1700 DATA "554E43544494F4E5300 0D0A3941203955204544554455
2205544470D0D063956209445E5455253450D0A395720C4546542
0524947485400D0639502055502044F",8447
1710 DATA "574E0D0A395920524F544154450D0A395A205245534
5542055447D3CD0FED0DF7CFFEC180131A14FEC200131D1C14FE1
0170024ACBECCD6E19CD0819462342E23",5993
1720 DATA "E52ACDECA7ED42E1D0E54E2346237EFEEA2004EBC11
0E21E00CD0A1020FBFE0D2000E171237023091 8CFFE2220011CFE2
1237E30E4CB4322E02B5C01010C180",7405
1730 DATA "AF5F10EECD0FED0DE1CFC753FEC180131A14FEC2001
31B1C1410170024ACBECCD6E1923235450 4E2346093634AE5234623
4
E23E52ACDECA7ED42E13814E2346E5",6953
1740 DATA "ED5E2356ED0FED722B73E1D12313CDE5910C9E1360
DC9CD0FED0D0DD3C190E0810 0ACD0FED0DCD30D190E00C5CD92E
D0EFEC180131A14FEC200131B1C1410",7947
1750 DATA "17FEBA1180120000 2ACDEC23CD6E19E52ACBECCD6E1
9D1C13AD9ECE6DFFE592001 0C8600232323232 3A7ED52D0197ECD0
61020FBFE0D20EAFE2220014CD0D2C",7144
1760 DATA "30E4CB402004CB4120DECBEECB7920D0CBAE10D4CDB
FED0DFBC7C0FE0613D14151600 2AD1EC224FFF210FFDC341FFF3A5
2FFA720102A025C3E200DC03E17BCC0",8121
1770 DATA "3A005CFE0DC03A305C07D838043D3252FF2A495CED5
B4FFF190110FCCDD4FDFE03C801 9CFFCDD4FDFE02C80EFACDD4FD3
DC80EFFAF3C0930FCED42C42FE5320D",8374
1780 DATA "5C2130 5CCBEEE13A52FFC9CD0FED0DEAE9002144FE1
027CD0FED0D2054524143452044F4EFE2055504545443A20131D141
6003E652AD1EC95325 1FF2121FEC341",6089
1790 DATA "FF3E3FD8FEE607FE0428F6FE0220 103A51FF0F14012
1000054506D0D03D20F32A455C100AA72A305CED5B655CED5211BF5
0ED5353FF01F0D0CD78FE0116FCC07D",7608
1800 DATA "FE019CFFCD78FE01FAFFCD78FE01FFFAF3C0938FCE
D4207B787C6705F1630E52A53FF232253FFB6001A77132410FAE1C
9CD0FED0D2046494E44C0CEC3E4FEC7",8692
1810 DATA "0131B1C1417002ACFECCD6E19C44AEF0323232323C
D97EDC020495 3FE9F148A0181 9C9E5D5B4B49CDA7ED42E138E
1020 DATA "5C13722373234E234E2303E5ED4B485CA7ED42E138E
0C9000000000000CD52F4110000 2A53",6189
0000000000000CD52F411000 2A53",6189
1020 DATA "5C13722373234E234E2303E5ED4B485CA7ED42E138E
0C9000000000000000001FFFFF3C5D5E5F5CD10FFF1E1D1C1FBC92
0C900000000000000000001FFFFF3C5D5E5F5CD10FFF1E1D1C1FBC92
1005C3EE6BE200234E23EE2BE200F3E",7482
1030 DATA "7FD8FECB4F200721305C3ED7A6772A4D0FF7C85CBE9F
33E3FED47ED56FBC9210000F3224DFF3EFEED47ED56FBC900000A0
00A000F5013003E003C42427E424200",7181
9999 RANDOMIZE USR 60000
```

front of converted numbers. That is why it may appear a trifle slow.

M — Move block of program: This asks for the same four inputs as Renumber but instead of ensuring no overlap it checks the number of unused line numbers at the Destination. It renumbers your selected block as requested, then sorts the lines into the correct order. It therefore Moves the code and deals with all the Gotos etc.

C — Copy block of program: This asks for the same four inputs as Renumber. It copies the requested block at another point in the program and renumbers it. No Goto destinations in lines outside the new block are touched, but the new block is renumbered fully within itself. Any Gotos that point to before the original start of the copied block may be renumbered wrongly, but this is not a problem. Move the block you want copying to the front of the program, copy it, move it back, and all will be well.

R, M and C — Make sure there is enough memory: It is possible to get a Basic error report 4 Out of Memory and this can very rarely occur if the new line numbers after Gotos are longer — in terms of digits — than the old ones and there is no room to fit them

```
490
500 REM  SAVE LOADER
510 SAVE "Tool Load"
520 VERIFY "Tool Load"
530 STOP
600 REM  SAVE CODE
610 SAVE "Toolbytes"CODE 60000,5360
620 VERIFY "Toolbytes"CODE 60000,5360
630 STOP
```

For tape saving substitute these lines for lines 490-630 in listing 1.

in. This can only happen if the computer is near choc-a-bloc, but if it does, the program will be corrupted. Using function Y will leave something that can be worked with, unless copying when the system variables will have been corrupted — in which case, cry.

When copying it is more likely that there will be insufficient space for the actual copying of lines, in which case no damage will have been done at all. In Move, it is more likely that memory will be full when the lines are being rearranged. Deleting a line or so and using function Z will put things right. This is all theoretical. It has never yet happened to me in practise.

The "correct corruption" routines: Y — Restore line lengths; Z — Sort lines into correct order; USR 65240 — Renumber 1,1. These have more uses than outlined under the above routines. Occasionally a program won't load very well from tape. Any attempt to edit lines results in a large number of program lines disappearing — or the computer crashing — because the Invisible Length bytes have been corrupted. Use Y and editing is possible. It could, however, spoil programs with machine-code in Rem lines if CHR$ 13 is contained in them.

Z sorts lines into their correct order. If line numbers are very badly corrupted, they may not be listed and will be rejected as program lines. Breaking back into Basic and calling USR 65240 will renumber the entire contents of the Program area from line 1, in steps of 1. No Gotos will be corrected. Because this can mess up a program it is made relatively hard to get at.

W — Disable New: This is the "Boss" routine for Diverted Interrupts. Functions N, Q and T are all routed through here, so that when they are on, the functions of W happen as well.

If you press key A in K mode, instead of getting New you will get Stop. If you hold down Symbol Shift and A in L mode, nothing will appear to happen. But the next key

(continued on next page)

(continued from previous page)

depression will be taken as K mode. Symbol Shift A followed by just A will give Stop. This is useful in functions A and S, avoiding having to do Then keyword backspace Delete forwardspace.

N — Autoline Number: Prompts for Increment. When awaiting a Basic line to be entered, adds the Increment value to the existing current line and inserts that number in the Edit line. It only works if the last key pressed was Enter. It will very rarely append to a line after a syntax error — you'll just have to delete. Note that Q, T, W and X all turn this utility off.

Q — Constant memory: Gives a constant display of memory left. Is turned off by N, T, W and X.

T — Trace — Continuous display of current program line: This function prompts for speed. 100 is close to normal running speed. As the number is reduced, the program runs considerably slower. So if there is something wrong with your program you can get a rough idea why. When this function is in operation, you can skip through part of your program at normal speed by holding down Enter and K together. You can freeze the program by holding Enter and L together. Trace is turned off by N, Q, W and X.

X — Return interrupts to normal: Switches off N, Q, T and W. You can now New if you wish!

A — Search and replace: This prompts for Start and Finish line numbers. It then asks for Old and New strings. String in this sense means a string of characters from the program. They do not have to be the same length. There is also a List option (not advisable when there will be a large number of alterations). If the string to be altered contains floating point numbers, tell the program by preceding and following the number with three "&" signs. For example:

OLD STRING: *"m";&&&1&&&;" NEW STRING:"

would allow you to change Microdrive commands for tape. If "&&&" is part of a non-numeric string, this feature would not work further down the line. It also works in the New String. There is a maximum string length, including &'s, of 32 characters. To use the Bin character, place &&& before the Bin and after the bits. If the number is too large, a return to Basic is made with error 6. Error 4 is also possible but no damage will have been done.

B — Machine code to data: This prompts for start and finish addresses, a destination and number of bytes per line. Lines are formed incrementing by one. It gives the option of hex in the same form as line 1000 onwards in listing 1 or Decimal numbers. Only the hex form gives a checksum. A memory check is made before each line is started to ensure that the program is not corrupted by unfinished lines.

Error Reports.

Error message	May occur in
Task completed	Most routines: it means it's done as told
Range error	B, C, M, N, R, T, U. Increment > 100
Numbers reversed	A B C D J K L M P R . S. Start > Finish
Invalid line number	Line > 9996. Non-existent line in 0.
Zero not allowed	C M N R T U. Speaks for itself.
Lines would overlap	R. Check what you are trying to do.
No room at destination	B C E M. Not enough unused line numbers.
Zero block!	C D. No actual lines from start to finish

A check is also made to ensure that there are enough unused line numbers at the destination. Of course, machine code occupying the same space as the Toolkit will have to be moved before the Toolkit is loaded but that is simple enough.

U — UDGs to data: This is the same as function "B" but is an easier way of working if you want to put any UDGs — perhaps produced by function G — into Data lines. It asks for the number of UDGs required — starting from A — so 4 gives graphic A, B, C and D — and the number of the first Data line. It puts eight bytes on each line.

D — Delete block of program: This is obvious. Enter first line and finish line as prompted. It is very quick indeed.

E — Create a Rem line: This can create a Rem line of 35,000 characters in less than a second. Useful for those without Interface 1 who enter their machine code that way. Prompts for Line Number, Length, and Symbol.

F — Delete Rem lines: Prompts for Start and Finish line numbers. Deletes Rem lines in specified range only, including :Rem further down a line. Does not deal with If a Then Rem but who is that daft?

G — UDG Designer: Prompts for a character to be used as a starting point. This is then amended by entering the co-ordinates of a point on an 8 by 8 grid — number first — followed by i for fill in and o for rub out. Mirror images, inversions and rotations can also be made. Finally, the UDG is entered into a specified letter.

H — Hex/Decimal conversions: Will print any number input in both hex and decimal. As all numbers 0-65535 can be entered in either hex or decimal — see above under Collect Number routine — this is useful. It keeps prompting for more numbers. Return to menu using Empty String.

I — Status report: Gives a report of memory left, whether interrupts are normal or diverted, printout of UDGs provided channel s or p is in use, plus a few other bits. A command can be entered without returning to the menu.

J — Merge block of lines: Will merge together a specified block of lines as one line. Watch out for Goto destinations, Rem lines, and the fact that the Spectrum only allows 127 commands on a line.

K — Lower to upper case and L — upper to lower case: Will convert letters inside a program between two specified lines. Note that there is an option to include or exclude characters inside string quotes.

O — Token locate: This gives the address in both decimal and hex of the first symbol after the Line Number and Length Pointer in a specified line. Gives an error if the line does not exist.

P — Compact program: Does usual prompts for specified program block. Then deletes any unnecessary characters — i.e, spaces and colour controls outside quotes. It ignores lines that start with Rem but does affect messages after Rems if it is not the very first symbol on the line.

S — Search and List: This is the opposite to function A in how it deals with floating-point forms. It searches the lines and prints them in accordance with how they look when listed so you don't have to worry about hidden characters. It prompts for Start and Finish line numbers, and the string of characters to be searched for — maximum length 32.

V — List variables: Does what it says. All simple variables are given with their values, except that CHR$ 0-31 in string variables are printed as "?". For-Next variables are printed in capitals with their values, and Dimensioned variables are printed with their dimensions but no values.

Warning — Line 9999: If at any time there is an attempt to append to the existing program — i.e., creating lines after the last one present — using functions B, C, E, M or U, then although the functions will appear to work, the new lines will be formed in the variables area, and the computer will not work properly until you Clear it. Also Renumber relies on the fact that Line 9999 is present to ensure that if doesn't form invalid line numbers. So always ensure that at least Line 9999 is present in a program before using the Toolkit.

All prompts requiring line numbers actually reject anything above 9996. I append two suggested ideas for lines 9997 to 9999 depending on whether you are a Microdrive owner or not. Note that it is unwise to use Autorun on the Microdrive version as you would be unable to Merge the control lines with your existing program.

Lines 1000 upwards of listing 1 were produced by the toolkit. Type in listing 1. Save it by Run 500. Run the program. If all is well you will end up with Report E. Once okay, save it by Run 490 and save the Code also — Run 600. Rand USR 60000 should give you a nice title page. Use Caps 6 to return to Basic, then do a New then enter listing 2 or 3 as appropriate. Now Run 9997, then continue. ■

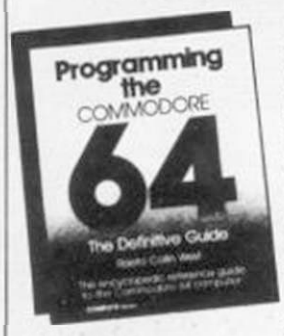
Listing 2.

```
  1
  2 REM Lines  9997-9999  are  referred to as L
ISTing 2 in  the text. LISTing 3 is, of  course,
 the first program  on this tape!
  3
9997 STOP : ERASE "m";1;"Toolkit": ERASE "m";1;"Toolby
tes": SAVE *"m";1;"Toolkit": VERIFY *"m";1;"Toolkit":
SAVE *"m";1;"Toolbytes"CODE 60000,5368: VERIFY *"m";1;
"Toolbytes"CODE : STOP
9998 CLEAR 59999: LOAD *"m";1;"Toolbytes"CODE 60000: S
TOP
9999 RANDOMIZE USR 60000
```

Listing 3.

```
9997 STOP : SAVE "Toolkit" LINE 9998: SAVE "Toolbytes"
CODE 60000,5368: VERIFY "Toolkit": VERIFY "Toolbytes"C
ODE : STOP
9998 CLEAR 59999: LOAD "Toolbytes"CODE 60000: STOP
9999 RANDOMIZE USR 60000
```

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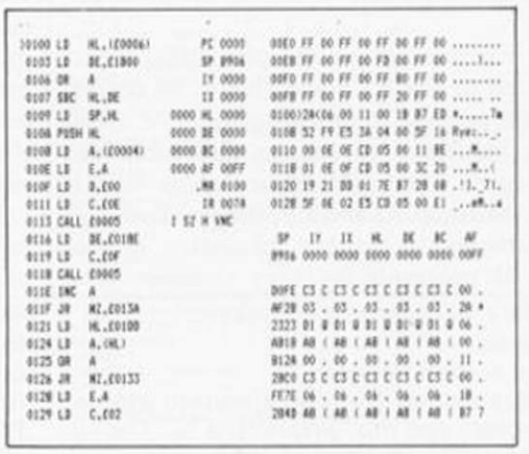


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COMP

THE AIM OF this and the next article is to describe the construction of a compiler system for BBC Basic that is suitable for use on the BBC and Electron computers. The limitations on the amount of memory available on these machines mean that it is not possible for the program to compile all of BBC Basic — instead only a subset is treated but this is more extensive than that handled by some commercially available compilers. This subset is shown in figure 1. I shall refer to it as TC — Tiny Compiled — Basic.

TC Basic consists of two programs; the compiler which is a large Basic program and the run time system — RTS — which is a hybrid machine code — Basic program. This article will describe the compiler while the subsequent one will contain a description of the assembly language program that generates the RTS: this is called the run time system generator — RTSG.

The aim of a compiler, is to convert a program written in a high-level language like BBC Basic into a much simpler one like machine code which will therefore run faster. A program compiled by the TC Basic compiler will run as fast as a Forth program — ie., four to five times faster than the usual interpreted BBC Basic.

The code version of a program is rather more compact than the original Basic program and, typically, at least 10K of code can be generated on a BBC micro — for the Electron 4K would be a reasonable estimate.

The compilers usually implemented on mainframe and minicomputers take the high-level program and convert it into machine code. However, for the BBC computer this approach has the disadvantage that the 6502 CPU chip does not have instructions to do many of the things one would like it to.

For instance, there are no instructions to add two 16 bit numbers or for multiplication. To get round this I have invented a "virtual machine". This is an idealised CPU which has instructions to do all the things required. It is implemented as a 6502 machine-code program. The compiler produces machine-code for this virtual machine; such code is usually called pseudo-code or more briefly, p-code.

The machine-code to interpret the p-code, is contained in the RTS and this is, of course, the main purpose of this program. The use of p-code has some advantages and some disadvantages. The chief advantage is that it makes the compiler and run time system a bit less complex. A further advantage is that compiled programs are very compact. The chief disadvantage is that p-code executes about three times slower than machine code.

An alternative to p-code would be to compile the Basic program into 6502 machine-code statements. Every time some feature not in the 6502 instruction set was required we could jump to a subroutine in a run time support system. Simple functions like addition could be implemented as in line code. The major advantage of this approach is that programs run faster. However, there is the disadvantage that programs are very long; perhaps three to four times the length of an equivalent p-code program.

All the components of a p-code system are used by a true machine-code compiler. It is therefore worth starting with such a system if you want to learn how to make a compiler work.

The TC Basic compiler is shown in the listing. Obviously, if you want a TC Basic system, begin by typing in this listing. It should be Saved before you try Running it. In addition, before you can declare the compiler finished, it is necessary to enter in line 120 the value of the address in memory of the top of the RTS. This number, is provided by the RTSG program to be described in part 2.

The following is a desciption of the major components of the compiler. The main program runs between lines 150 and 300. Line 150 calls Procsetup — line 560. This initialises the values of various variables; in particular, it gives a large number of them the values of the Basic tokens which correspond to the keywords the compiler needs to know about. Procsetup also calls Proctok — lines 380 to 540 — which assembles a small machine-code program which is used to print out keywords from their tokens in the listings of programs. In addition, Procsetup prompts the user to specify the sizes of various things and reserves the appropriate quantities of memory.

Line 160 is a call of Procopen — lines 940 to 1020 — which opens the file containing the program to be compiled. Once the file is open, characters are always read from it by using FNCH — line 1020. Line 170 set things up so that compilation can start and in line 180, the call of Procprog actually initiates the compilation process. After the program has been compiled, execution of the main program continues at line 190. Lines 190 to 210 check if the storage allocations have been exceeded and print error messages if this is the case.

At line 220, a check is made to see if there have been any errors so far. If there have, the program branches to line 290: this is where the compiler ends if there are errors; a message is printed out giving the number of errors.

At this point, the compiler has constructed a p-code version of the Basic program. However, there are no actual addresses in this for either variables or for Goto — or in p-code jump — statements to branch to. To complete the p-code program it must be "fixed up". This is done by Procfix — lines 4050 to 4230 — and its associated routines in lines 3950 to 4280. This procedure allocates memory to variables and finds out the addresses in code to which Gotos, procedures and functions correspond. While the code is being fixed up, it is also relocated so that it will run at the address corresponding to the top of the RTS. Hence the reason why the value of this must

Figure 1. TC Basic Specification

Variables:
2 byte signed integers.
Variable names may contain up to 255 characters and may end with a %. The variables A% to Z%, use the same memory locations as the usual Basic system variables thus allowing programs to pass information, and enabling parameter passing to the Call statement.
Arrays:
Multiple dimension arrays of 2 byte signed integers.
Arithmetic Operators: +, −, *, /, DIV, MOD
Logical Operators: AND, OR, EOR, NOT
Relational Operators: =, <, >, >=, <=, <>
Indirection Operator: ? (right hand side operand only)
Statements:
FOR TO STEP NEXT (no variable allowed after NEXT)
REPEAT UNTIL
PRINT"string" ' variable / expression, TAB(X,Y) ;
IF THEN ELSE
VDU , ;
* string (send string to OSCLI)
GOTO line number
SOUND ENVELOPE
MODE GCOL COLOUR CLS CLG MOVE DRAW PLOT
CALL END
DIM array / vairable
System variables / functions:

INKEY	GET	TRUE	FALSE	
ADVAL	TIME	ABS	SGN	
POS	VPOS	POINT	SQR	RND()

Procedures / functions:

DEFPROC	PROC	ENDPROC
DEFFN	FN	=

procedure and function arguments are not supported but procedures and functions can be used recursively.
In addition, the following are supported: REM, () (brackets), = (asignment), : (for multi-statement lines), integer constants, + and − (unary sign operators), & (for hex constants).



D J Piling with a compiler for the BBC.

PILER

be known.

Finally, if no errors occur in the fix up process the compiler ends at line 260; this calls Procdump — lines 1040 to 1180 — to save the code produced.

Some other features of the compiler are worth describing. The procedures in lines 1230 to 1900 compose the lexical analyser. Every time Proclx — lines 1230 to 1360 — is called, it reads the text token from the program and puts its type in the variable T%. Here "token" does not refer to the usual BBC Basic keyword token. Instead, it means the next significant piece of the program. Therefore, tokens can be variables and strings.

As was stated earlier, in a p-code system one constructs a virtual machine. In TC Basic the virtual machine is stack-based. This means that all operations take place either to or from the stack. For instance, there is an operation Add which takes a variable and adds it to the top element of the stack the result of the addition becoming the new top of stack element.

When the syntax analysis requires that a variable be added to the stack it calls Procadd. This writes the opcode for Add (2) into the code space and follows it with the address of the variable. In fact, until fix up instead of the variables address its number in the symbol table is used.

Other code generating subroutines, are supplied for all the operations the virtual machine is required to perform.

A typical scenario for the use of the compiler would be as follows: First, the program is developed as usual using the TC Basic subset to BBC Basic with the BBC Basic interpreter and Saved. Next, the compiler is Loaded and Run. It then asks for three pieces of information; the number of variables, the number of line numbers and the code space in bytes for the program to be compiled. Typically, answers of 100, 100 and 2000 would suffice for a small program. It is important to note that the number after a Goto counts as a variable as do the names of functions and procedures. Thus you must be careful when calculating how many variables to reserve space for.

Next, the compiler will ask you for the name of the program to be compiled. This will then be read in off the tape. This can in fact lead to a slight problem since, the compiler, is treating a program file as a data file. On a cassette-based system they are written to tape with different inter-block gaps.



This article is available on the Telsoft service.

With some cassette recorders having the wrong gap will lead to filing system errors when the program is being read in. The solution to this problem; if it happens to you, is to define one of the function keys as follows:

```
*KEY0 *OPT,1 IIM INPUT '' ''FILE NAME ''A$:X% = OPENOUTA$: FORI% = PAGE TO TOP-1: BPUT#X%, ?I%: NEXT: CLOSE#X%: *OPT IIM
```

f0 is then used for saving programs to be compiled.

As the program is compiled, it will be listed out on the screen. If any errors are found there will be a break in the listing and an appropriate error message. If enough room has not been reserved for variables code or lines you will be informed of the amount of space needed for the.

Finally, if there are no errors in compilation, a copy of the code equivalent of the Basic program can be saved. This will automatically be given the name C.name-of-compiled-program.

To execute the program, this new code file must be loaded into the RTS. The construction of this will be described in part 2. A C30 containing the listings from both articles, TC Basic systems set up for both tape and disc based computers and example programs and code files is available from D. J. Pilling, 12 Cherrywood Avenue, Anchorsholme, Blackpool. FY5 1SU. in return for a cheque for £2.99.

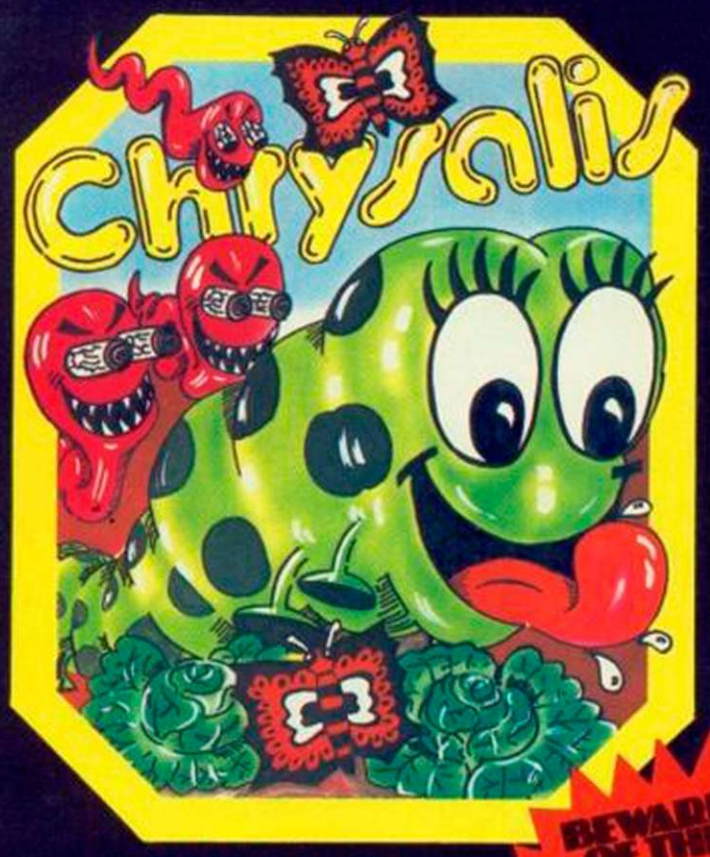
```
  10REM ******************************
  20REM
  30REM TC BASIC COMPILER
  40REM D. J. Pilling
  50REM (c) January 1985
  60REM
  70REM ******************************
  80
  90REM enter value for top of RTS in
100REM line 120.
110
120toprts=7B48
130
140MODE7:PROCT
150PROCSETUP
160PROCOPEN
170TX=FNCH:AX=FNCH:PROCLX
180PROCprog:CLOSE#ZX
190IFNLX>MLX PROCEM(5)
200IFNSX>MSX PROCEM(4)
210IFEX(CX+MCX PROCEM(6)
220IFENX GOTO290
230PROCFIX
240IFENX GOTO290
250
260PROCNE:PROCDUMP
270END
280
290PROCEE
300END
310
320DEFFNL(B1X,B2X,B3X)
330B3X=B3X*256+B2X-&4040
340IFB1X MOD&10=0 B3X=B3X+16384:B1X=B1X+4
350IFB1X=&44 B1X=64 ELSEIFB1X=&54 B1X=0 ELSEIFB1X=&6
4 B1X=192 ELSEIFB1X=&74 B1X=128
360=B1X+B3X
370
380DEFPROCTOK
390IF?&0015=&88%=&7FF1 ELSE8X=&7FED
400OX=&02ED:DIMTK 100
410FOR1%=0TO3STEP2:P%=TK:[OPT1%
420CMPC128:BCCK%:BEQ LX
430TAX:LDAE8%DIV256:STA&71:LDAE8%MOD256:STA&70:LDY#1
20
440.DX TXA:CMP(&70),Y:BEQ CX
450INC &70:BNE DX:INC &71
460LDA&71:CMP #%DIV256:BNE DX
470LDA&70:CMP #%MOD256:BNE DX:BEQ FX
480.CX LDX#0
490.HX DEY:INX:LDA(&70),Y:CMPC127:BCCH%
500INY:INY:DEX:DEX:TXA:CMPC9:BCS FX
510.EX LDA(&70),Y:JSR &FFEE:INY:DEX:BNE EX
520.FX RTS:.KX JSR &FFEE:RTS
530.LX LDAC65:JSR &FFEE:LDAC70:JSR &FFEE:LDAC68:JSR
&FFEE:RTS:]:NEXT
540ENDPROC
550
560DEFPROCSETUP
570PROCTOK
580PRINT"SELECT STORAGE ALLOCATIONS"
590INPUT''"ENTER MAX. NUMBER OF LINES"''"NOT LESS THAN
10 >"MLX
600IFMLX<10GOTO590
610INPUT''"ENTER NUMBER OF VARIABLES"''"BETWEEN 5 AND
256 >"MSX
620IF MSX>256 OR MSX<5 GOTO610
630INPUT''"ENTER SIZE OF CODE SPACE IN BYTES"''"NOT LE
SS THAN 100 >"MCX
640IF MCX<100 GOTO630
650DIM S$(MSX),S% 3+MSX,LX 4+MLX
660S$=STRING$(40," "):S$=""
670NLX=0:NSX=0:SNX=0:ENX=0:ELX=0
680DIM CX MCX:CX=CX+4
690RLX=toprts-CX+4:MCX=MCX-4
700P%=CX:EX=CX+MCX
710for=&E3:to=&B0:step=&B8:next=&ED
720vdu=&EF:print=&F1:tab=&8A:proc=&F2
730def=&DD:endproc=&E1:rnum=&F4
740goto=&E5:end=&E8:inkey=&A6:if=&E7
750else=&8B:line=&8D:then=&BC:dim=&DE
760eq=&3D:geq=&1:leq=&2:gt=&3E:lt=&3C
770neq=&3:lb=&28:rb=&29:tr=&B9:fl=&A3
780plus=&2B:minus=&2D:slash=&2F
790times=&2A:pling=&3F:squote=&27
800dquote=&22:comma=&2C:scol=&3B
810col=&3A:spc=32:eoln=&D:eop=&FF
820geq=&1:leq=&2:neq=&3:id=&4:lbl=&5
830const=&6:string=&7:rep=&F5:unt=&FD
840mod=&83:div=&81:sound=&D4:ar=&8
850and=&88:or=&84:eor=&82:fn=&A4
860time1=&D1:timer=&91:pc=37:ap=38
870mode=&E3:cls=&D8:clg=&DA:gcol=&E6
880colo=&FB:draw=&DF:move=&EC:plot=&F8
890rnd=&83:sgr=&B6:sgn=&B4:abs=&94
900get=&A5:adv=&96:pos=&B1:vpo=&BC
910poi=&B8:call=&D6:not=&AC:env=&E2
920ENDPROC
930
940DEFPROCOPEN
950*OPT1,1
960*OPT2,1
970PRINT''"ENTER NAME OF PROGRAM TO"
980INPUT"COMPILE >"F$
990ZX=OPENUPF$
1000PRINT''"START OF COMPILATION"''
1010*OPT1,0
1020ENDPROC
1030
1040DEFPROCDUMP
1050IFLENF$>0 F$=LEFT$(F$,8)
1060F$="C."+F$
1070PRINT''"READY TO SAVE CODE";F$
1080PRINT"SAVE CODE ? Y/N ";
1090IX=GET:IF IX=ASC"Y" ELSEIF IX=ASC"N"GOTO1170 ELSE
1090
1100PRINT''
1110*OPT1,1
1120XX=OPENOUTF$
1130PRINT#XX,CX,FX,EX,F$
1140FOR IX=CX-4 TO EX:BPUT#XX,?IX:NEXT
1150CLOSE#XX
1160GOTO1070
1170*OPT
1180PRINT'':ENDPROC
1190
1200DEFFNCH:=B9ET#ZX
1210DEFPROCA:CALL TX:AX=FNCH:ENDPROC
1220
1230DEFPROCLX
1240IFELX TX=0:ENDPROC
1250IFTX=eop:ENDPROC
1260IFTX=eoln PROCNL
1270IFAX=spc:REPEAT PROCA:UNTILAX<>spc
1280IFNOTFNAL(AX) GOTO1320
1290PROCID:IFAX=pc B#=B#+"X":PROCA
1300IFAX=lb TX=ar ELSETX=id
1310PROCB:ENDPROC
1320IFAX<>proc ANDAX<>fn GOTO1350
1330TX=AX:PROCA:IFNOTFNAL(AX) TX=0:ENDPROC
1340PROCID:PROCB:ENDPROC
1350IF FNDN(AX) PROCDN0 ELSEIF AX=ap PROCA:PROCHN0 EL
SEIF AX=rem PROCR0 ELSEIF AX=dquote PROCS0 ELSEIF AX=l
ine PROCL0 ELSEPROCT0
1360ENDPROC
1370DEFFNAL(AX):=(AX)>64ANDAX<91)OR(AX)>96ANDAX<123)
1380DEFFNDN(AX):=(AX)>47ANDAX<58)
1390DEFFNHN(AX):=(AX)>47ANDAX<58)OR(AX)>64ANDAX<71)
1400DEFPROCL0
```

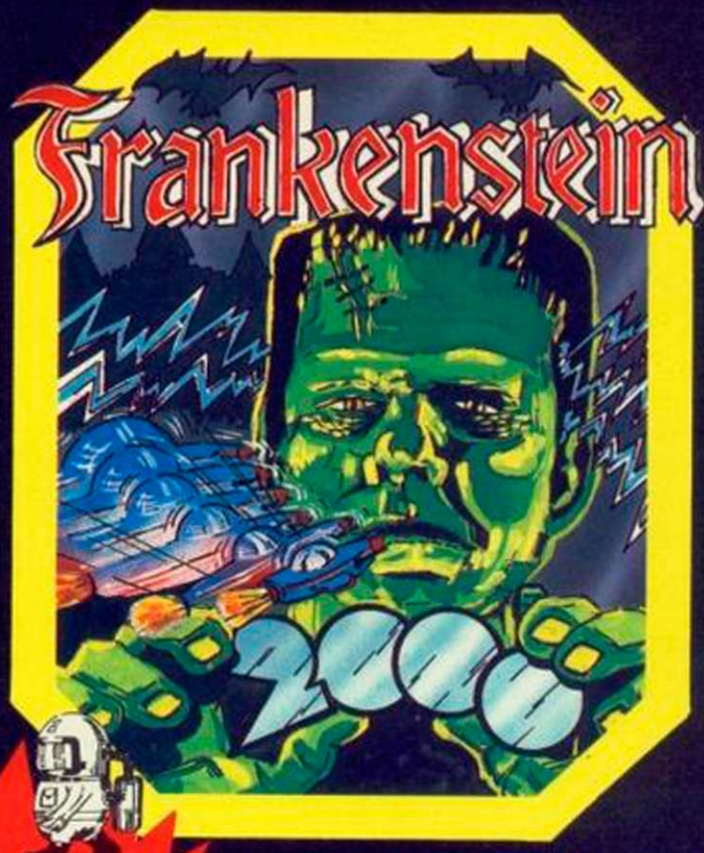
(listing continued on next page)

(listing continued from previous page)

```
1410NX=FNL(FNCH,FNCH,FNCH)
1420T%=lino:A%=FNCH:S$=STR$N%
1430PROCS
1440PRINT;N%;
1450ENDPROC
1460DEFPROCIO
1470S$="":REPEAT:S$=S$+CHR$A%:PROCA:UNTIL NOT(FNDN(A%
)ORFNAL(A%))
1480ENDPROC
1490DEFPROCDNO
1500N%=0:REPEAT N%=N%*10:N%=N%+A%-ASC"0":PROCA:UNTILN
OTFNDN(A%)
1510T%=const
1520ENDPROC
1530DEFPROCHNO
1540N%=0:REPEAT N%=N%*16
1550IFFNDN(A%) N%=N%+A%-ASC"0":PROCA ELSEIFFNHN(A%) N
%=N%+A%-ASC"A"+10:PROCA
1560UNTILNOTFNHN(A%)
1570T%=const
1580ENDPROC
1590DEFPROCRO
1600REPEAT PROCA:UNTILA%=eoln:T%=A%:PROCA
1610ENDPROC
1620DEFPROCSO
1630S$="":PROCA
1640REPEAT:S$=S$+CHR$A%:VDUA%:A%=FNCH:UNTIL A%=dquote
ORA%=eoln:IFA%=eoln PROCEM(1) ELSE PROCA
1650IFA%=dquote GOTO1640
1660T%=string
1670ENDPROC
1680DEFPROCCLIO
1690S$=CHR$A%
1700REPEAT:PROCA:S$=S$+CHR$A%:UNTIL A%=eoln:T%=A%:PRO
CA
1710ENDPROC
1720DEFPROCTO
1730T%=A%:PROCA
1740IFT%=gt ANDA%=eq T%=geq:PROCA
1750IFT%=lt ANDA%=eq T%=leq:PROCA
1760IFT%=lt ANDA%=gt T%=neq:PROCA
1770IFT%=col ANDA%=col REPEATPROCA:UNTIL(A%<>col)AND(
A%<>spc)
1780IFT%=col ANDA%=eoln:T%=A%:PROCA
1790ENDPROC
1800DEFPROCNL
1810IFA%=eop:ENDPROC
1820L1%=A%+256+FNCH:L2%=FNCH
1830IFNL%)=NL% EN%=EN%+1:GOTO1800
1840L%?(NL%+4)=L1%DIV256
1850L%?(NL%+4+1)=L1%MOD256
1860L%?(NL%+4+2)=P%DIV256
1870L%?(NL%+4+3)=P%MOD256
1880NL%=NL%+1
1890PRINT';L1%; TAB(4);:A%=32
1900ENDPROC
1910
1920DEFPROCS
1930IF N8%)=M8% EN%=EN%+1:ENDPROC
1940BN%=-1:REPEAT BN%=BN%+1
1950UNTIL (S$(BN%)=S$ AND S%?(3+BN%)=T%) OR S$(BN%)="
"
1960IFS$(BN%)="" S$(BN%)=S$:N8%=N8%+1:S%?(3+BN%)=T%:S
%?(3+BN%+1)=0:S%?(3+BN%+2)=0
1970ENDPROC
1980
1990DEFPROCprog
2000IFT%=eop PROCEND:ENDPROC
2010PROCstate:IFT%=col ORT%=eoln PROCLX:GOTO2000
2020ENDPROC
2030DEFPROCdef:PROCEND
2040PROCLX:IFT%()proc ANDT%()fn PROCC(proc)
2050S%?(3+BN%+1)=P%DIV256
2060S%?(3+BN%+2)=P%MOD256
2070IFT%=fn PROCLX:GOTO2120
2080PROCLX
2090IFT%=eop ORT%=endproc GOTO2110
2100PROCstate:IFT%=col ORT%=eoln PROCLX:GOTO2090
2110PROCC(endproc):PROCLX:PROCRTS:ENDPROC
2120IFT%=eop ORT%=eq GOTO2140
2130PROCstate:IFT%=col ORT%=eoln PROCLX:GOTO2120
2140PROCC(eq):PROCLX:PROCexp:PROCRTF:ENDPROC
2150
2160DEFPROCstate
2170IFT%=eoln ORT%=col ORT%=else:GOTO2450
2180IFT%=id PROCassign:GOTO2450
2190IFT%=ar PROCarasign:GOTO2450
2200IFT%=pling PROCaasign:GOTO2450
2210IFT%=time$ PROCtasign:GOTO2450
2220IFT%=proc PROCproc:GOTO2450
2230IFT%=rep PROCrep:GOTO2450
2240IFT%=vdu PROCvdu:GOTO2450
2250IFT%=if PROCif:GOTO2450
2260IFT%=for PROCfor:GOTO2450
2270IFT%=goto PROCgoto:GOTO2450
2280IFT%=print PROCprint:GOTO2450
2290IFT%=end PROCend:GOTO2450
2300IFT%=def PROCdef:GOTO2450
2310IFT%=sound PROCsound:GOTO2450
2320IFT%=env PROCenv:GOTO2450
2330IFT%=call PROCcall:GOTO2450
2340IFT%=dim PROCdim:GOTO2450
2350IFT%=time$ PROCLIO:PROCCLI:GOTO2450
2360IFT%=mode PROCmode:GOTO2450
2370IFT%=colo PROCcolo:GOTO2450
2380IFT%=gcol PROCgcol:GOTO2450
2390IFT%=move PROCmove:GOTO2450
2400IFT%=draw PROCdraw:GOTO2450
2410IFT%=plot PROCplot:GOTO2450
2420IFT%=cls PROCLX:PROCVDL(12):GOTO2450
2430IFT%=clg PROCLX:PROCVDL(16):GOTO2450
2440PROCEM(7):PROCELP
2450IFELX PROCELP
2460IF(T%<>eoln ANDT%<>col ANDT%<>else) PROCEM(7):PRO
CELP
2470ENDPROC
2480
2490DEFPROCend:PROCEND:PROCLX:ENDPROC
2500DEFPROCassign:LOCALST%:ST%=BN%
2510PROCLX:PROCC(eq):PROCLX:PROCexp
2520PROCSTA:PROCADR(P%-3,ST%):ENDPROC
2530DEFPROCarasign:LOCALST%:ST%=BN%
2540PROCgma:PROCC(eq):PROCLX:PROCexp
2550PROCSTM:PROCADR(P%-3,ST%):ENDPROC
2560DEFPROCaasign:PROCLX:PROCaexp:PROCC(eq):PROCLX:PR
OCexp:PROCSTI:ENDPROC
2570DEFPROCtasign:PROCLX:PROCC(eq):PROCLX:PROCexp:PRO
CSTT:ENDPROC
2580DEFPROCproc:PROCJSR:PROCADR(P%-3,BN%):PROCLX:ENDP
ROC
2590DEFPROCfn:PROCJSR:PROCADR(P%-3,BN%):PROCLX:ENDPRO
C
2600DEFPROCvdu
2610PROCLX
2620PROCexp:IFT%=col PROCVDD ELSEPROCVDU
2630IFT%=comma GOTO2610 ELSEIFT%=col PROCLX:IFFNEXP
GOTO2620
2640ENDPROC
2650DEFPROCif:LOCAL L1%,L2%
2660PROCLX
2670PROCexp
2680L1%=P%:PROCJMC
2690IFT%=then PROCLX:IFT%=lino PROCJMP:PROCADR(P%-3,B
N%):PROCLX:GOTO2710
2700PROCstate
2710IFT%=col:PROCLX:GOTO2700
2720IFT%()else PROCADR(L1%,P%):ENDPROC
2730L2%=P%:PROCJMP:PROCADR(L1%,P%)
2740PROCLX
2750IFT%=lino PROCJMP:PROCADR(P%-3,BN%):PROCLX:GOTO27
70
2760PROCstate
2770IFT%=col:PROCLX:GOTO2760
2780PROCADR(L2%,P%)
2790ENDPROC
2800DEFPROCfor:LOCAL ST%:PROCLX
2810PROCC(id):ST%=BN%:PROCLX
2820PROCC(eq):PROCLX:PROCexp
2830PROCSTA:PROCADR(P%-3,ST%)
2840PROCC(to):PROCLX:PROCexp
2850IFT%=step PROCLX:PROCexp ELSEPROCLDL(1)
2860PROCLX:PROCFXR:PROCADR(P%-3,ST%)
2870IFT%=eop ORT%=next GOTO2890
2880PROCstate:IFT%=col ORT%=eoln PROCLX:GOTO2870
2890PROCC(next):PROCLX:PROCNXT:ENDPROC
2900DEFPROCgoto:PROCLX:PROCC(lino):PROCJMP:PROCADR(P%
-3,BN%):PROCLX:ENDPROC
2910DEFPROCprint:LOCALT1%
2920T1%=T%:PROCLX
2930IFT%=squote PROCVDL(13):PROCVDL(10):GOTO2920
2940IFT%=col GOTO2920
2950IFT%=string PROCSTR:GOTO2920
2960IFT%=comma PROCVDL(32):GOTO2920
2970IFT%=tab T1%=T%:PROCVDL(31):PROCLX:PROCexp:PROCC(
comma):PROCLX:PROCVDU:PROCexp:PROCC(rb):PROCLX:PROCVDU
:GOTO2930
2980IFFNEXP T1%=id:PROCexp:PROCPRI:GOTO2930
2990IFT1%()col PROCVDL(13):PROCVDL(10)
3000ENDPROC
3010DEFFNEXP:=T%=plus ORT%=minus ORT%=id ORT%=lb ORT%
=pling ORT%=const ORT%=inkey ORT%=timer ORT%=tr ORT%=f
1 ORT%=sqr ORT%=rnd ORT%=sgn ORT%=abs ORT%=get ORT%=ad
v ORT%=pos ORT%=vpo ORT%=poi ORT%=not ORT%=fn ORT%=ar
3020DEFPROCSTR
3030IFLEN$$=1 PROCVDL(ASC$$) ELSE PROCVDS
3040ENDPROC
3050DEFPROCexp:PROCiterm
3060IFT%=or PROCLX:PROCiterm:PROCORA:GOTO3060 ELSEIFT
%=eor PROCLX:PROCiterm:PROCEOR:GOTO3060
3070ENDPROC
3080DEFPROCiterm
3090PROCifact
3100IFT%=and PROCLX:PROCifact:PROCAND:GOTO3100
3110ENDPROC
3120DEFPROCifact:LOCAL T1%:PROCsexp
3130IFT%()gt ANDT%()lt ANDT%()geq ANDT%()leq ANDT%()e
q ANDT%()neq GOTO3160
3140T1%=T%:PROCLX:PROCsexp
3150IFT1%=gt PROCSTT ELSEIFT1%=lt PROCLTT ELSEIFT1%=g
eq PROCSEQ ELSEIFT1%=leq PROCLEQ ELSEIFT1%=eq PROCEQU
ELSEIFT1%=neq PROCNEQ
3160ENDPROC
3170DEFPROCsexp
3180IFT%=plus PROCLX:PROCterm ELSEIFT%=minus PROCLX:P
ROCterm:PROCNEG ELSE PROCterm
3190IFT%=plus PROCLX:PROCterm:PROCADD:GOTO3190 ELSEIF
T%=minus PROCLX:PROCterm:PROCSUB:GOTO3190
3200ENDPROC
3210DEFPROCfactor:LOCAL ST%:ST%=BN%
3220IFT%=id PROCLX:PROCLDA:PROCADR(P%-3,ST%):ENDPROC
3230IFT%=ar PROCgea:PROCLDM:PROCADR(P%-3,ST%):ENDPROC
3240IFT%=const PROCLX:PROCLDL(N%):ENDPROC
3250IFT%=pling PROCLX:PROCiterm:PROCLDI:ENDPROC
3260IFT%=timer PROCLX:PROCLDT:ENDPROC
3270IFT%=fn PROCfn:ENDPROC
3280IFT%=lb PROCLX:PROCexp:PROCLX:ENDPROC
3290IFT%=inkey PROCLX:PROCiterm:PROCINK:ENDPROC
3300IFT%=sqr PROCLX:PROCiterm:PROCSQR:ENDPROC
3310IFT%=sgn PROCLX:PROCiterm:PROCSGN:ENDPROC
3320IFT%=abs PROCLX:PROCiterm:PROCABS:ENDPROC
3330IFT%=adv PROCLX:PROCiterm:PROCADV:ENDPROC
3340IFT%=poi PROCLX:PROCexp:PROCC(comma):PROCLX:PROCe
xp:PROCC(rb):PROCLX:PROCPOI:ENDPROC
3350IFT%=rnd PROCLX:PROCC(lb):PROCLX:PROCexp:PROCC(rb
):PROCLX:PROCRND:ENDPROC
3360IFT%=tr PROCLX:PROCLDL(&FFFF):ENDPROC
3370IFT%=get PROCLX:PROCBET:ENDPROC
3380IFT%=pos PROCLX:PROCPOS:ENDPROC
3390IFT%=vpo PROCLX:PROCVPO:ENDPROC
3400IFT%=fl PROCLX:PROCLDL(8):ENDPROC
3410IFT%=not PROCLX:PROCiterm:PROCNOT:ENDPROC
3420PROCC(1)
3430ENDPROC
3440DEFPROCiterm
3450PROCifactor
3460IFT%=times PROCLX:PROCifactor:PROCMUL:GOTO3460 ELS
EIFT%=slash PROCLX:PROCifactor:PROCDIV:GOTO3460
3470IFT%=div PROCLX:PROCifactor:PROCDIV:GOTO3460 ELSEI
FT%=mod PROCLX:PROCifactor:PROCMOD:GOTO3460
3480ENDPROC
3490DEFPROCiere
3500IFT%=plus PROCLX:PROCifactor ELSEIFT%=minus PROCLX
:PROCifactor:PROCNEG ELSE PROCifactor
3510ENDPROC
3520DEFPROCsound
3530PROCLX:PROCexp:PROCC(comma)
3540PROCLX:PROCexp:PROCC(comma)
3550PROCLX:PROCexp:PROCC(comma)
3560PROCLX:PROCexp:PROCBND:ENDPROC
3570DEFPROCenv
3580LOCALI%:FOR I%=1TO13
3590PROCLX:PROCexp:PROCC(comma):NEXT
3600PROCLX:PROCexp:PROCENV:ENDPROC
3610DEFPROCcall:PROCLX:PROCexp:PROCCAL:ENDPROC
3620DEFPROCdim:LOCAL ST%
3630PROCLX:IFT%()ar GOTO3660
3640ST%=BN%:IF S%?(BN%+3+1)<>0 PROCEM(8):PROCELP:ENDP
ROC
3650PROCgma:PROCLDL(S%?(ST%+3+2)):PROCDMA:PROCADR(P%-
3,ST%):S%?(ST%+3+1)=1:GOTO3680
3660IFT%()id ENDPROC
3670ST%=BN%:PROCLX:PROCexp:PROCDMM:PROCADR(P%-3,ST%)
3680IFT%=comma:GOTO3630
3690ENDPROC
3700DEFPROCgma:LOCAL I%
3710PROCLX:PROCLX:I%=S%?(ST%+3+2):IFI%=0:I%=1:GOTO374
0
3720REPEAT I%=I%-1:PROCexp:IFI%()0 PROCC(comma):PROCL
X
3730UNTILI%=0:PROCC(rb):PROCLX:ENDPROC
3740PROCexp:IFT%=comma:I%=I%+1:PROCLX:GOTO3740 ELSEPR
OCC(rb):PROCLX:S%?(ST%+3+2)=I%:ENDPROC
3750DEFPROCmode:PROCLX:PROCexp:PROCVDL(22):PROCVDU:EN
DPROC
3760DEFPROCcolo:PROCLX:PROCexp:PROCVDL(17):PROCVDU:EN
DPROC
3770DEFPROCgcol:PROCLX:PROCVDL(18):PROCexp:PROCVDU:PR
OCC(comma):PROCLX:PROCexp:PROCVDU:ENDPROC
3780DEFPROCplot:PROCLX:PROCVDL(25):PROCexp:PROCVDU:PR
OCC(comma):PROCLX:PROCexp:PROCVDD:PROCC(comma):PROCLX:
PROCexp:PROCVDD:ENDPROC
3790DEFPROCmove:PROCLX:PROCVDL(25):PROCVDL(4):PROCexp
:PROCVDD:PROCC(comma):PROCLX:PROCexp:PROCVDD:ENDPROC
3800DEFPROCdraw:PROCLX:PROCVDL(25):PROCVDL(5):PROCexp
:PROCVDD:PROCC(comma):PROCLX:PROCexp:PROCVDD:ENDPROC
3810DEFPROCrep:LOCALL1%:PROCLX:L1%=P%
3820IFT%=eop ORT%=unt GOTO3840
3830PROCstate:IFT%=col ORT%=eoln PROCLX:GOTO3820
3840PROCC(unt):PROCLX:PROCexp
3850PROCJMC:PROCADR(P%-3,L1%):ENDPROC
3860DEFPROCLFIX(BX%)
3870L1%=VAL$$(BN%)
3880I%=0:REPEAT
3890IFL1%=L%?(4+I%)*256+L%?(4+I%+1):B%?(BX%+1)=L%?(4+
I%+2):B%?(BX%+2)=L%?(4+I%+3):I%=NL%
3900I%=I%+1
3910UNTIL I%>=NL%
3920IFI%=NL% PROCEM(2)
3930ENDPROC
3940
3950DEFPROCIFIX(BX%)
3960IFLEN$$(BN%)=2:IFRIGHT$$(S$(BN%),1)="%":I%=ASCLEFT
$$(S$(BN%),1):IF(I%)64ANDI%(91):I%=(I%-65)*4+&404:B%?(B
X%+1)=I% DIV256:B%?(BX%+2)=I% MOD256:ENDPROC
3970B%?(BX%+1)=P% DIV256:B%?(BX%+2)=P% MOD256:P%=P%
:ENDPROC
3980DEFPROCAFIX(BX%)
3990IFB%?(BX%+1)=0 PROCEM(9)
4000B%?(BX%+1)=P% DIV256:B%?(BX%+2)=P% MOD256:P%=P%
:ENDPROC
4010DEFPROCPFIX(BX%):IFB%?(BX%+1)=0 PROCEM(3)
4020ENDPROC
4030DEFPROCFFIX(BX%):IFB%?(BX%+1)=0 PROCEM(3)
4040ENDPROC
4050DEFPROCFIX
4060PRINT''"FIX UP STAGE"
4070EX=P%:BN%=0:REPEAT
4080IFB%?(3+BN%)=lino:PROCLFIX(3+BN%)
4090IFB%?(3+BN%)=id PROCIFIX(3+BN%) ELSEIFB%?(3+BN%+
ar PROCAFIX(3+BN%)
4100IFB%?(3+BN%)=proc:PROCPFIX(3+BN%)
4110IFB%?(3+BN%)=fn:PROCFFIX(3+BN%)
4120BN%=BN%+1:UNTILB#(BN%)=""
4130FX=P%:C%!-4=(P%+RL%)+&10000-EX+RL%
4140P%=C%:REPEAT:I%=?P%:IFI%=48P%=P%+1
4150IF(I%(64ORI%)100) P%=P%+1:GOTO4210 ELSEP%=P%+3
4160IFI%=74GOTO4210
4170IFI%=98 ORI%=92:P%=P%+(P%?-2)-1:GOTO4210
4180IFP%?-1<>0 GOTO4200
4190BN%=P%?-2:P%?-1=B%?(N%+3+1):P%?-2=B%?(N%+3+2)
4200PROCRL
4210UNTIL P%>=EX
4220PRINT''"FIX UP NOW COMPLETE"
4230ENDPROC
4240DEFPROCRL
4250BN%=256*P%?-1+P%?-2
4260IFN%(&E00 ENDPROC ELSEN%=N%+RL%
4270P%?-1=N%DIV256:P%?-2=N%MOD256
4280ENDPROC
4290
4300DEFPROCADD:PROCPP(1,2):ENDPROC
4310DEFPROCSUB:PROCPP(1,4):ENDPROC
4320DEFPROCMUL:PROCPP(1,6):ENDPROC
4330DEFPROCDIV:PROCPP(1,8):ENDPROC
4340DEFPROCSTT:PROCPP(1,10):ENDPROC
4350DEFPROCLTT:PROCPP(1,12):ENDPROC
4360DEFPROCSEQ:PROCPP(1,14):ENDPROC
4370DEFPROCLEQ:PROCPP(1,16):ENDPROC
4380DEFPROCEQU:PROCPP(1,18):ENDPROC
4390DEFPROCNEQ:PROCPP(1,20):ENDPROC
4400DEFPROCNEG:PROCPP(1,22):ENDPROC
4410DEFPROCVDU:PROCPP(1,24):ENDPROC
4420DEFPROCINK:PROCPP(1,26):ENDPROC
4430DEFPROCRTS:PROCPP(1,28):ENDPROC
4440DEFPROCLDI:PROCPP(1,30):ENDPROC
4450DEFPROCSTI:PROCPP(1,32):ENDPROC
4460DEFPROCEND:PROCPP(1,34):ENDPROC
4470DEFPROCPRI:PROCPP(1,36):ENDPROC
4480DEFPROCMOD:PROCPP(1,44):ENDPROC
4490DEFPROCVDD:PROCPP(1,46):ENDPROC
4500DEFPROCPP(BX,CX)
4510IFFNC(BX) ?P%=C%:P%=P%+BX
4520ENDPROC
4530DEFPROCVDL(L%):IFFNC(3):?P%=48:P%?1=L%:P%=P%+2
4540ENDPROC
4550DEFPROCBND:PROCPP(1,58):ENDPROC
4560DEFPROCLDT:PROCPP(1,52):ENDPROC
4570DEFPROCSTT:PROCPP(1,54):ENDPROC
4580DEFPROCAND:PROCPP(1,56):ENDPROC
4590DEFPROCORA:PROCPP(1,58):ENDPROC
4600DEFPROCEOR:PROCPP(1,60):ENDPROC
4610DEFPROCRND:PROCPP(1,62):ENDPROC
4620DEFPROCJMP:PROCPP(3,64):ENDPROC
4630DEFPROCJSR:PROCPP(3,66):ENDPROC
4640DEFPROCJMC:PROCPP(3,68):ENDPROC
4650DEFPROCLDA:PROCPP(3,70):ENDPROC
4660DEFPROCSTA:PROCPP(3,72):ENDPROC
4670DEFPROCFXR:PROCPP(3,76):ENDPROC
4680DEFPROCLDM:PROCPP(3,80):ENDPROC
4690DEFPROCSTM:PROCPP(3,82):ENDPROC
4700DEFPROCDMM:PROCPP(3,84):ENDPROC
4710DEFPROCDMA:PROCPP(3,86):ENDPROC
4720DEFPROCLDL(L%)
4730IFFNC(3) ?P%=74:P%?1=L%MOD256:P%?2=L%DIV256:P%=P%
+3
4740ENDPROC
4750DEFPROCVDS
4760IFFNC(2+LEN$$) ?P%=98:P%?1=LEN$$:$(P%+2)=S$:P%=P%
+2+LEN$$
4770ENDPROC
4780DEFPROCCLI
4790IFFNC(2+LEN$$) ?P%=92:P%?1=LEN$$:$(P%+2)=S$:P%=P%
+2+LEN$$
4800ENDPROC
4810DEFPROCSQR:PROCPP(1,102):ENDPROC
4820DEFPROCSGN:PROCPP(1,104):ENDPROC
4830DEFPROCABS:PROCPP(1,106):ENDPROC
4840DEFPROCGET:PROCPP(1,108):ENDPROC
4850DEFPROCADV:PROCPP(1,110):ENDPROC
4860DEFPROCPOS:PROCPP(1,112):ENDPROC
4870DEFPROCVPO:PROCPP(1,114):ENDPROC
4880DEFPROCPOI:PROCPP(1,116):ENDPROC
4890DEFPROCCAL:PROCPP(1,118):ENDPROC
4900DEFPROCNOT:PROCPP(1,120):ENDPROC
4910DEFPROCENV:PROCPP(1,122):ENDPROC
4920DEFPROCRTF:PROCPP(1,126):ENDPROC
4930DEFPROCNXT:PROCPP(1,132):ENDPROC
4940DEFPROCADR(P%,A%)
4950IFP%<EX OR P%+2>EX ENDPROC
4960P%?2=A%DIV256
4970P%?1=A%MOD256
4980ENDPROC
4990
5000DEFFNC(B%)
5010IFP%+B%>=EX EN%=EN%+1:EX=EX-B%:=FALSE ELSE:=TRUE
5020DEFPROCERT:PRINT"<RETURN> TO CONTINUE ";:REPEAT U
NTIL INKEY-74:PRINT:ENDPROC
5030DEFPROCEM(I%)
5040EN%=EN%+1
5050IFI%=1 PRINT''"aiasing """
5060IFI%=2 PRINT''"no such line number "+S$(BN%)
5070IFI%=3 PRINT''"no such fn/proc "+S$(BN%)
5080IFI%=4 PRINT''"too many variables"
5090IFI%=5 PRINT''"program needs ";NL%;" lines"
5100IFI%=6 PRINT''"program needs ";2*MC%+C%-EX;" bytes
"
5110IFI%=7 PRINT''"syntax error !"
5120IFI%=8 PRINT''"array already dim'd"
5130IFI%=9 PRINT''"array "+S$(BN%)+" not dim'd"
5140PROCERT:ENDPROC
5150DEFPROCC(DX)
5160IF ELX ENDPROC
5170IF T%=DX ENDPROC
5180PRINT''"aiasing ";
5190ELX=T%:T%=A%:A%=DX
5200IFA%>32 ANDA%()lino THEN CALL TK ELSEIFA%=id PRIN
T"id / variable";ELSEIFA%=ar PRINT"array dim";ELSEIFA
%=1 PRINT"expression";ELSEIFA%=lino PRINT"line number
";
5210A%=T%:EN%=EN%+1:PRINT;T%=8:PROCERT:ENDPROC
5220DEFPROCELP
5230IFELX=eop OR ELX=eop T%=ELX:ELX=FALSE:ENDPROC
5240ELX=FALSE:REPEAT PROCLX:UNTIL T%=eoln ORT%=eop
5250ENDPROC
5260DEFPROCEE
5270PRINT''"";EN%;" ERRORS - COMPILATION STOPPED"
5280ENDPROC
5290DEFPROCNE
5300PRINT''"COMPILATION COMPLETE"
5310ENDPROC
5320DEFPROCT
5330FORIX=0TO23
5340VDU129+(IX/2)MOD5,157,141,135
5350PRINT"<<< T.C. BASIC COMPILER >>>"
5360NEXT:IX=INKEY150:CLS
5370ENDPROC
```

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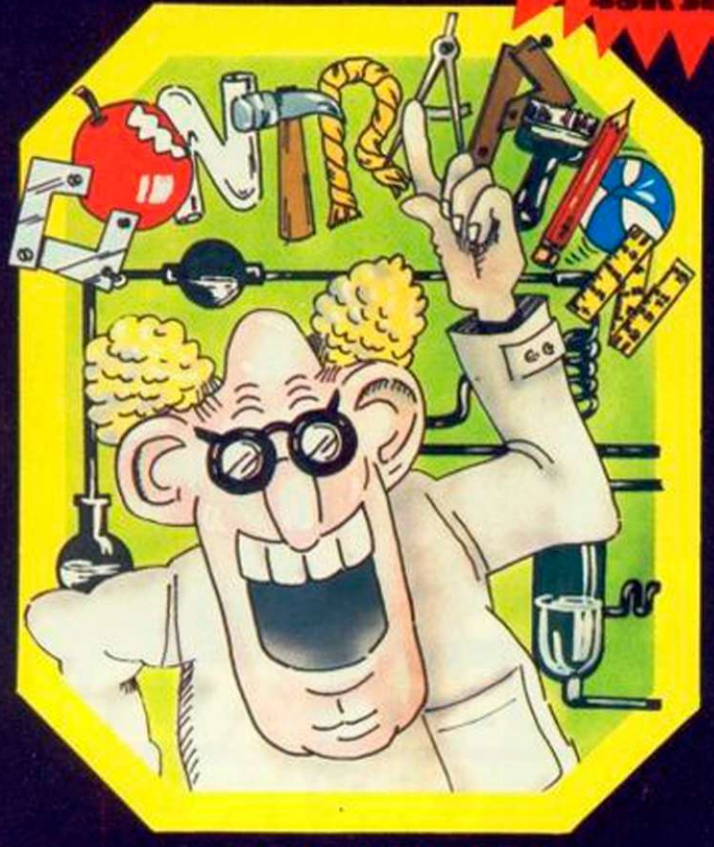


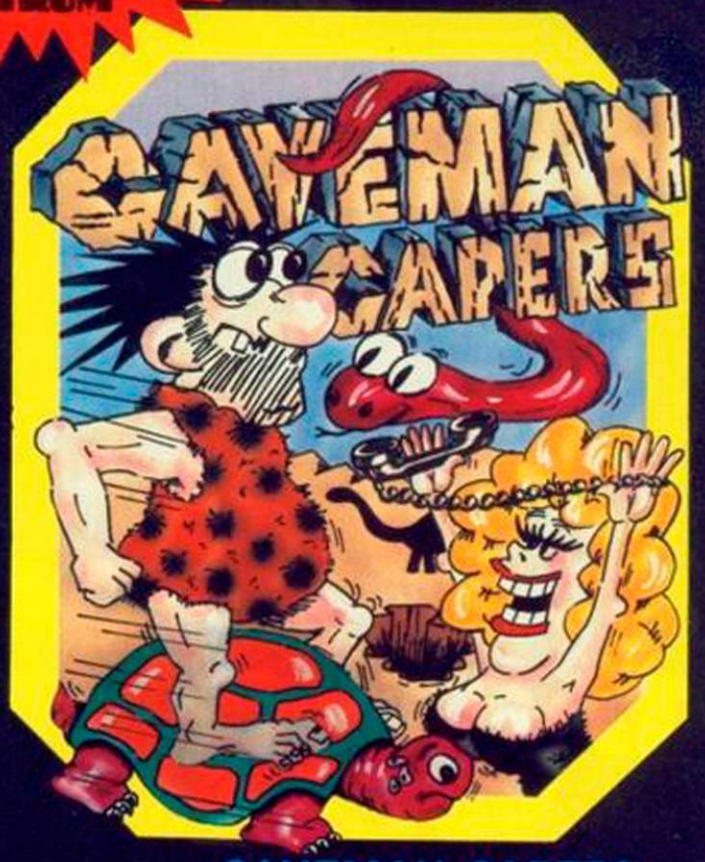


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Hex loader.

```
100 MODE 4
110 BORDER 5,0,6:CLS
120 PRINT"Type in starting address (followed
    by an 'h' if in hex)"
130 INPUT a$
140 IF a$(LEN(a$) TO LEN(a$))="h" THEN
150  a$=a$(1 TO LEN(a$)-1)
160  hex_dec a$
170 ELSE
180  t=a$
190 END IF
200 add=t
210 REPeat loader
220  CLS
230  FOR col=0 TO 18
240   AT col,0
250   dec_hex add,5
260   PRINT d$;"      ";
270   FOR q=0 TO 1
280    dec_hex PEEK(add+q),2
290     PRINT d$;
300   END FOR q
310   AT col,18
320   INPUT"?";b$
330   IF b$="" THEN GO TO 390
340   hex_dec b$
350   POKE_W add,t
360   AT col,18
370   dec_hex t,4
380   UNDER 1:PRINT d$;:UNDER 0:PRINT"    ";
390   add=add+2
400  END FOR col
410 END REPeat loader
420 DEFine PROCedure hex_dec(h$)
430  LOCal l,a$,v
440  v=0:t=0
450  FOR l=0 TO LEN(h$)-1
460   a$=h$(LEN(h$)-l TO LEN(h$)-l)
470   IF CODE(a$)>57 THEN
480    v=CODE(a$)-87
490   ELSE
500    v=a$
510   END IF
520   t=t+v*16^l
530  END FOR l
540 END DEFine
550 DEFine PROCedure dec_hex(v,l)
560  LOCal c,a$,b
570  b=v:d$=""
580  a$=b:a$=a$(1 TO 1)
590  b=ABS(b)
600  REPeat work
610   c=(b/16-INT(b/16))*16
620   IF c<=9 THEN
630    d$=CHR$(c+48)&d$
640   ELSE
650    d$=CHR$(c+55)&d$
660   END IF
670   b=INT(b/16)
680   IF b=0 THEN EXIT work
690  END REPeat work
700  d$=FILL$("0",l-LEN(d$))&d$
710  IF a$="-"THEN d$=a$&d$
720 END DEFine
```

ZOOM

Carsten Greve makes the QL screen bigger.

ZOOM IS a graphics utility for the QL which enlarges part of the screen in Mode 4 or Mode 8. It allows you to double one of the four screen quadrants simply by pressing a key. Once you have zoomed you can zoom again, and again . . . until the screen either fills up or becomes empty.

If you have an assembler you can enter the assembler code directly. You must remember that it has to produce an executive code — that is a position independent code.

If you have not got an assembler you can use the Basic hex-loader listed elsewhere or use your own program to enter the assembled code — this is much faster than using an assembler but errors arise more often.

If you use the Basic hex-loader type the program in and save it for later use. Make room in memory for the machine code by typing

OP = RESPR (512)

See what starting address you have got for the code by typing

PRINT OP

Run the hex-loader and type in the address. Remember that you must type in the code as words, so if the listing says:

0000' 223C 0000 2000 23
MOVE.L #HEAP__ROOM,D1

(continued on page 101)

Explaining Zoom.

8 – 15	QDOS Trap routines.
18-24	Take 8192 bytes from the common heaproom. If not succeeded kill Zoom and return to Superbasic.
26-37	Open a console and set the cursor. If not succeeded kill Zoom and return to Superbasic.
38-44	Find out display mode and store it for later use.
46-62	Get a number from keyboard and jump to an Area.
64-101	Fill Heap__Room with the right area of screen.
103-140	Take Heap__Room and enlarge to the whole screen.
142-146	Kill Zoom and return to Superbasic.
148-182	Data definition for console and Bit__Data.

Assembly listing.

```
LOC       OBJECT          STMT    SOURCE STATEMENT

                            1 * ZOOM
                            2 * A procedure to enlarge part of the screen
                            3 * By Carsten Greve
                            4 * Started on the 14th of December 1984
                            5 * Finished on the 22nd of December 1984
                            6 * For the SINCLAIR QL version JM
                            7
    =2000                   8 HEAP_ROOM EQU     8192
    =0018                   9 MT_ALCHP  EQU     24
    =0001                  10 IO_OPEN   EQU     1
    =000E                  11 SD_CURE   EQU     14
    =0001                  12 IO_FBYTE  EQU     1
    =00CA                  13 UT_ERR0   EQU     202
    =0005                  14 MT_FRJOB  EQU     5
    =0010                  15 MT_DMODE  EQU     16
                           16
0000'                      17 START
0000'  223C 0000 2000      18          MOVE.L   #HEAP_ROOM,D1
0006'  74FF                19          MOVEQ    #-1,D2
0008'  7018                20          MOVEQ    #MT_ALCHP,D0
000A'  4E41                21          TRAP     #1
000C'  4A80                22          TST.L    D0
000E'  6600 0158           23          BNE      JOB_END
0012'  2A48                24          MOVE.L   A0,A5
0014'  72FF                25
0016'  7602                26          MOVEQ    #-1,D1
0018'  41FA 015A           27          MOVEQ    #2,D3
001C'  7001                28          LEA.L    DEVNAME,A0
001E'  4E42                29          MOVEQ    #IO_OPEN,D0
0020'  4A80                30          TRAP     #2
0022'  6600 0144           31          TST.L    D0
0026'  76FF                32          BNE      JOB_END
0028'  700E                33          MOVEQ    #-1,D3
002A'  4E43                34          MOVEQ    #SD_CURE,D0
002C'  4A80                35          TRAP     #3
002E'  6600 0138           36          TST.L    D0
                           37          BNE      JOB_END
0032'  72FF                38
0034'  74FF                39          MOVEQ    #-1,D1
0036'  7010                40          MOVEQ    #-1,D2
0038'  4E41                41          MOVEQ    #MT_DMODE,D0
003A'  E309                42          TRAP     #1
003C'  1801                43          LSL.B    #1,D1
                           44          MOVE.B   D1,D4
003E'  284D                45
0040'  76FF                46 LOOP_0   MOVE.L   A5,A4
0042'  7001                47          MOVEQ    #-1,D3
0044'  4E43                48          MOVEQ    #IO_FBYTE,D0
0046'  4A80                49          TRAP     #3
                           50          TST.L    D0
```

(listing continued on page 101)

```
* Program to dump a screen
* Using <ESC>"*"+5+n1+n2
* By Carsten Greve
* Started on the 29th of D

          MOVEQ     #-1,D1
          MOVEQ     #1,D3
          LEA.L     DEVNAM
          MOVEQ     #1,D0
          TRAP      #2
          TST.L     D0
          BNE.S     END_JO

          MOVE.W    #3,D2
          MOVE.W    #-1,D3
          LEA.L     SETUP,
```

```
* Program to
* Using <ESC>
* By Carsten
* Started on

          MOV
          MOV
          LEA
```

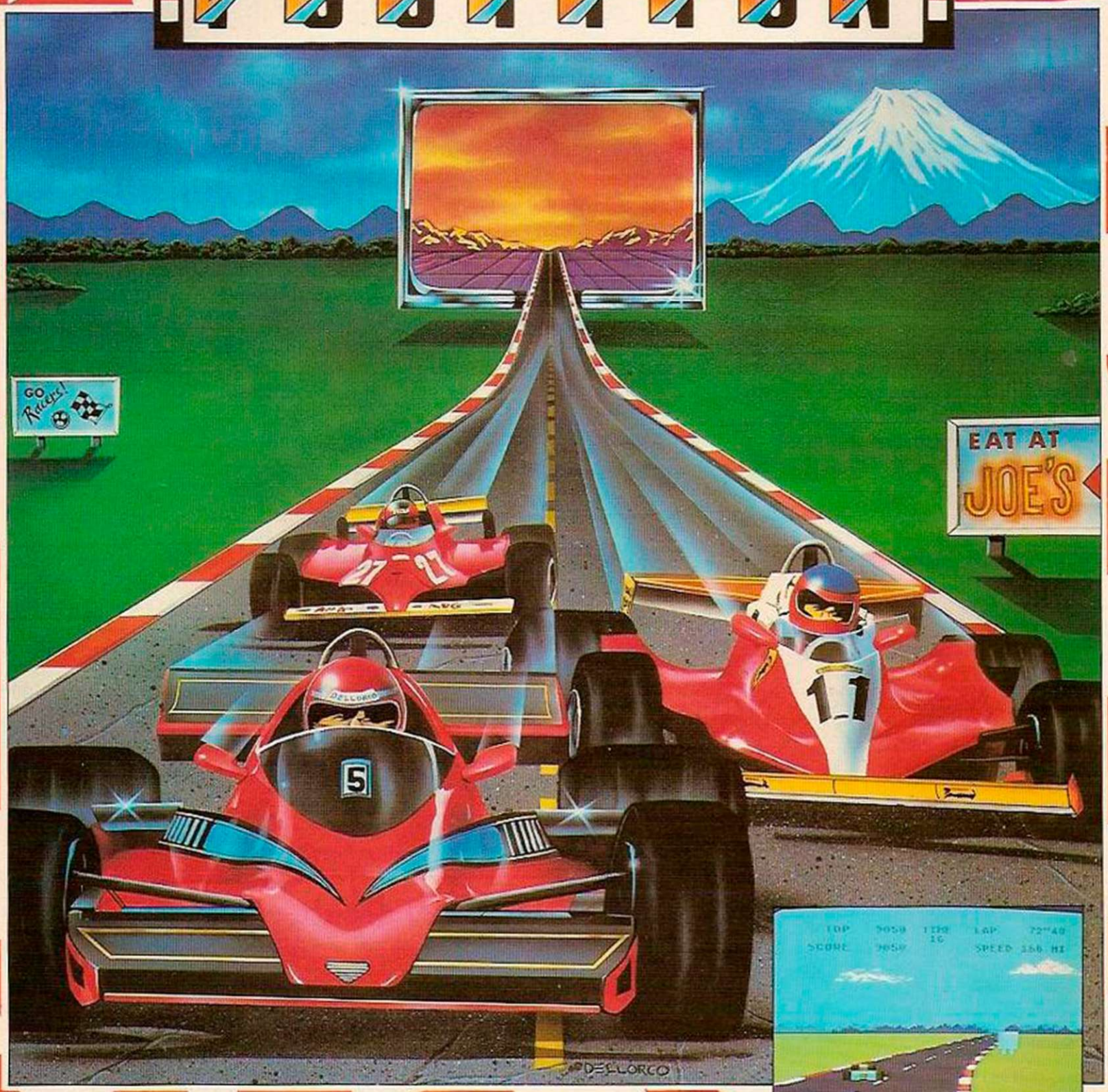
```
mp a sc
"+5+n1+
eve
e 29th
```

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(listing continued from page 99)

```
0048' 6600 011E          51          BNE       JOB_END
004C' B23C 0031          52          CMP.B     #$31,D1
0050' 671C               53          BEQ.S     AREA_1
0052' B23C 0032          54          CMP.B     #$32,D1
0056' 6736               55          BEQ.S     AREA_2
0058' B23C 0033          56          CMP.B     #$33,D1
005C' 6750               57          BEQ.S     AREA_3
005E' B23C 0034          58          CMP.B     #$34,D1
0062' 676A               59          BEQ.S     AREA_4
0064' B23C 000A          60          CMP.B     #$0A,D1
0068' 6700 0104          61          BEQ       END_JOB
006C' 60D0               62          BRA.S     LOOP_0
                         63
006E' 227C 0002 0000     64 AREA_1   MOVE.L    #$20000,A1
0074' 28D9               65 LOOP_1   MOVE.L    (A1)+,(A4)+
0076' 2209               66          MOVE.L    A1,D1
0078' 0801 0006          67          BTST      #6,D1
007C' 67F6               68          BEQ.S     LOOP_1
007E' D3FC 0000 0040     69          ADDA.L    #$40,A1
0084' B3FC 0002 4000     70          CMPA.L    #$24000,A1
008A' 66E8               71          BNE.S     LOOP_1
008C' 605E               72          BRA.S     FILL_SCR
                         73
008E' 227C 0002 0040     74 AREA_2   MOVE.L    #$20040,A1
0094' 28D9               75 LOOP_2   MOVE.L    (A1)+,(A4)+
0096' 2209               76          MOVE.L    A1,D1
0098' 0801 0006          77          BTST      #6,D1
009C' 66F6               78          BNE.S     LOOP_2
009E' D3FC 0000 0040     79          ADDA.L    #$40,A1
00A4' B3FC 0002 4040     80          CMPA.L    #$24040,A1
00AA' 66E8               81          BNE.S     LOOP_2
00AC' 603E               82          BRA.S     FILL_SCR
                         83
00AE' 227C 0002 4000     84 AREA_3   MOVE.L    #$24000,A1
00B4' 28D9               85 LOOP_3   MOVE.L    (A1)+,(A4)+
00B6' 2209               86          MOVE.L    A1,D1
00B8' 0801 0006          87          BTST      #6,D1
00BC' 67F6               88          BEQ.S     LOOP_3
00BE' D3FC 0000 0040     89          ADDA.L    #$40,A1
00C4' B3FC 0002 8000     90          CMPA.L    #$28000,A1
00CA' 66E8               91          BNE.S     LOOP_3
00CC' 601E               92          BRA.S     FILL_SCR
                         93
00CE' 227C 0002 4040     94 AREA_4   MOVE.L    #$24040,A1
00D4' 28D9               95 LOOP_4   MOVE.L    (A1)+,(A4)+
00D6' 2209               96          MOVE.L    A1,D1
00D8' 0801 0006          97          BTST      #6,D1
00DC' 66F6               98          BNE.S     LOOP_4
00DE' D3FC 0000 0040     99          ADDA.L    #$40,A1
00E4' B3FC 0002 8040    100          CMPA.L    #$28040,A1
00EA' 66E8              101          BNE.S     LOOP_4
                        102
00EC' 284D              103 FILL_SCR  MOVE.L    A5,A4
00EE' 227C 0002 0000    104          MOVEA.L   #$20000,A1
00F4' 1214              105 LOOP_FS   MOVE.B    (A4),D1
00F6' E809              106          LSR.B     #4,D1
00F8' C27C 000F         107          AND.W     #$F,D1
00FC' D204              108          ADD.B     D4,D1
00FE' 45FA 007A         109          LEA.L     BIT_DATA,A2
0102' 1432 1000         110          MOVE.B    0(A2,D1.W),D2
0106' 1342 0080         111          MOVE.B    D2,$80(A1)
010A' 12C2              112          MOVE.B    D2,(A1)+
010C' 121C              113          MOVE.B    (A4)+,D1
010E' C27C 000F         114          AND.W     #$F,D1
0112' D204              115          ADD.B     D4,D1
0114' 1432 1000         116          MOVE.B    0(A2,D1.W),D2
0118' 1342 0081         117          MOVE.B    D2,$81(A1)
011C' 1342 0001         118          MOVE.B    D2,1(A1)
0120' 1214              119          MOVE.B    (A4),D1
0122' E809              120          LSR.B     #4,D1
0124' C27C 000F         121          AND.W     #$F,D1
0128' D204              122          ADD.B     D4,D1
012A' 45FA 004E         123          LEA.L     BIT_DATA,A2
012E' 1432 1000         124          MOVE.B    0(A2,D1.W),D2
0132' 1342 0080         125          MOVE.B    D2,$80(A1)
0136' 1282              126          MOVE.B    D2,(A1)
0138' 121C              127          MOVE.B    (A4)+,D1
013A' C27C 000F         128          AND.W     #$F,D1
013E' D204              129          ADD.B     D4,D1
0140' 1432 1000         130          MOVE.B    0(A2,D1.W),D2
0144' 1342 0082         131          MOVE.B    D2,$82(A1)
0148' 1342 0002         132          MOVE.B    D2,2(A1)
014C' 5689              133          ADDQ.L    #3,A1
014E' 3209              134          MOVE.W    A1,D1
0150' 0801 0007         135          BTST      #7,D1
0154' 679E              136          BEQ.S     LOOP_FS
0156' D3FC 0000 0080    137          ADDA.L    #$80,A1
015C' B3FC 0002 8000    138          CMPA.L    #$28000,A1
0162' 6690              139          BNE.S     LOOP_FS
0164' 6000 FED8         140          BRA       LOOP_0
                        141
0168' 3478 00CA         142 JOB_END   MOVE.W    UT_ERR0,A2
016C' 4E92              143          JSR       (A2)
016E' 7005              144 END_JOB   MOVEQ     #MT_FRJOB,D0
0170' 72FF              145          MOVEQ     #-1,D1
0172' 4E41              146          TRAP      #1
                        147
0174' 0004              148 DEVNAME   DC.W      4
0176' 434F 4E5F         149          DC.B      'CON_'
                        150                    These are for MODE 4
017A' 00                151 BIT_DATA  DC.B      %00000000
017B' 03                152          DC.B      %00000011
017C' 0C                153          DC.B      %00001100
017D' 0F                154          DC.B      %00001111
017E' 30                155          DC.B      %00110000
017F' 33                156          DC.B      %00110011
0180' 3C                157          DC.B      %00111100
0181' 3F                158          DC.B      %00111111
0182' C0                159          DC.B      %11000000
0183' C3                160          DC.B      %11000011
0184' CC                161          DC.B      %11001100
0185' CF                162          DC.B      %11001111
0186' F0                163          DC.B      %11110000
0187' F3                164          DC.B      %11110011
0188' FC                165          DC.B      %11111100
                                               These are for MODE 8
0189' FF                166          DC.B      %11111111
018A' 00                167          DC.B      %00000000
018B' 05                168          DC.B      %00000101
018C' 0A                169          DC.B      %00001010
018D' 0F                170          DC.B      %00001111
018E' 50                171          DC.B      %01010000
018F' 55                172          DC.B      %01010101
0190' 5A                173          DC.B      %01011010
0191' 5F                174          DC.B      %01011111
0192' A0                175          DC.B      %10100000
0193' A5                176          DC.B      %10100101
0194' AA                177          DC.B      %10101010
0195' AF                178          DC.B      %10101111
0196' F0                179          DC.B      %11110000
0197' F5                180          DC.B      %11110101
0198' FA                181          DC.B      %11111010
0199' FF                182          DC.B      %11111111
                        183
                        184          END
```

(continued from page 99)

you must type 223C and Enter, 0000 and Enter, 2000 and Enter.

If the listing says:

```
0190' 5A 173 DC.B %01011010
0191' 5F 174 DC.B %01011111
```

you must type 5A5F and Enter.

When you have finished typing in press Ctrl-space. To check the code you must Run the hex-loader again with the same starting address. If the code is correct just type Enter, and if the code is incorrect type the correct code in and continue.

If you have used an assembler, the assembler should have produced an Executable code. If you have used the hex-loader you must type:

```
SEXEC mdv1_ZOOM,OP,412,64
```

Therre are two different ways of running the Zoom-code and I will describe both here.

EXEC_W MDV1_ZOOM = With this command you run the code and you cn make as many Zoom's as you like, and when you have finished you type Enter to return to Superbasic.

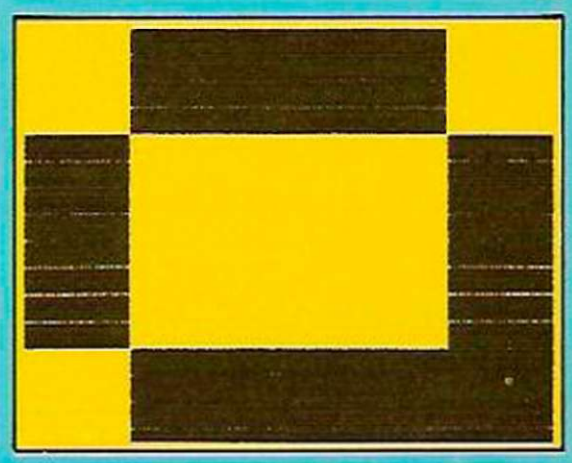
EXECMDV1_ZOOM = With this command you also run the code, but you stay in Superbasic. To make a Zoom you must type Ctrl C to transfer control to the Zoom-procedure. Now you can again make as many Zoom's as you like, but to go back to Superbasic you just have to type Ctrl C. In this way you can use the Zoom-procedure on many screens.

The screen is organised in the following way and you just have to type one of the numbers to obtain a Zooming.

1	2
3	4







PLOTLINE

Mark Jones with a set of programs which show how difficult it is to manipulate screen memory and the ease of using the Call command.

THE FOLLOWING machine-code routines for the QL were written as an exercise in 68008 programming. They demonstrate the difficulties involved in manipulating the screen memory and also show the ease with which data can be passed to machine code from Basic using the Call command.

To set up the code, run the Basic code creator program. Whenever you reset the computer you will need to reserve some memory for the routines by typing

BOX = RESPR (250)

Now load the code with

LBYTES MDV1—CODE,BOX

The variable Box contains the address at which the code is stored. To plot a point Call ST, x co-ordinate, y co-ordinate, colour. To draw a box Call ST+2, x co-ordinate of bottom left corner, y co-ordinate of bottom left corner, width of box, depth, thickness of box.

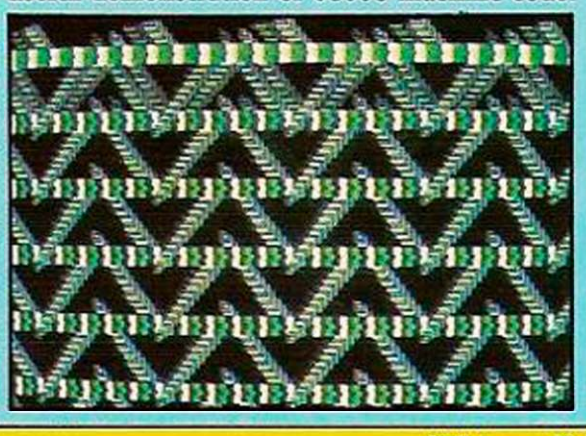
For example, to draw a box at 100,000, width = 10, depth = 10, thickness 3, colour red — in mode 4:

CALL BOX + 2, 100,100,2,10,10,3

For further information see under Call in the QL manual.

The x and y co-ordinates are independent of channels and scale where x = 0, y = 0 is the top left corner of the screen, x = 512 (26 if mode 8), y = 256 is the bottom right corner. Colour codes for the routine are explained in the assembler listing.

Speeds achieved for the plot routine are faster than the QL's own plot routine and this speed advantage is particularly effective in machine code. Using a plot routine is not the fastest way to draw a box but again serves as a useful demonstration of 68008 machine code.



Demo program.

```
  1 REMark **** BASIC DEMONSTRATION PROGRAM ****
3 OPEN #4,scr_512x256a0x0:CLS #4
4 FOR h=0 TO 250 STEP 40
5  g=1:j=1
9 FOR m=1 TO 11
10 FOR f=1 TO 50
11 k=f:IF g:k=50-k
20 CALL box+2,j,k+h,f,10-f/10,10-f/10,1
21 j=j+1
30 NEXT f
40 g=1-g
50 NEXT m
60 FOR f=1 TO 512 STEP 5:CALL box+2,f,h,f,10,10,4
70 NEXT h
80 FOR f=1 TO 32:PAN #4,16
90 GO TO 4
100 box=RESPR(240):LBYTES mdv1_code,box:RUN
999 MODE 4:PRINT "Loading Basic Demonstration"
1000 MERGE mdv1_basic_demo:GO TO 100
```

Code loader.

```
  1 st=RESPR(500)
2 REMark
10 DATA 96,22,85,10,101,236,62,65,255,4,81,4,97,250,82
,207,72,2,100,134,0,41,183,255,0,65,0,3,0,34,104,76,22
7,40,0,3,239,2,2,196,96,14,255,0,283,41,0
15 REMark
20 DATA 78,62,68,85,4,78,4,97,250,83,207,96,18,62,66,2
55,167,2,66,56,2,0,34,104,100,0,254,28,1,2,65,2,73,0,1
5,0,74,0,60,112,6,227,240,135,41,0,126
25 REMark
30 DATA 96,65,183,69,81,117,96,42,62,44,255,4,81,2,97,
250,126,66,102,1,128,0,2,65,228,7,2,3,226,65,102,65,82
,252,28,3,34,0,1,7,227,29,205,41,0,1,112
35 REMark
40 DATA 10,83,12,183,206,66,4,81,3,97,250,83,207,96,6,
78,0,0,0,34,52,0,65,102,76,58,3,2,14,0,74,0,65,198,3,2
20,124,210,254,144,11,81,41,0,1,76,0
45 REMark
50 DATA 97,66,101,6,255,135,82,207,96,38,62,65,255,4,0
1,117,60,255,0,124,12,0,1,0,2,60,0,3,96,255,226,3,29,6
0,2,14,0,174,210,1,227,200,0,0,141,159,78
51 DATA 117
55 REMark
70 RESTORE
80 tot=0
90 FOR g=0 TO 4
100 FOR f=0 TO 46
110 READ d:POKE st+g*f+5,d
115 tot=tot+d
120 NEXT f
130 NEXT g
140 READ d:POKE st+235,d
145 tot=tot+d
146 IF tot<>18702 THEN PRINT "error"
147 PRINT "code stored ok from "st" length 236 bytes
"
150 STOP
```

Assembly listing.

```
MODE    EQU   163892
SCREEN  EQU   131072
*
*
PLIN  BRA.S  PLOT      ENTER HERE FROM BASIC TO PLOT ONLY
BXIN  BRA.S  MULTI     ENTER HERE FROM BASIC TO DRAW BOX (PLIN +2)
*************************************************************************
*  MULTI THICNESS BOX ROUTINE                                           *
*      D6=THICKNESS OF BOX, WIDTH AND DEPTH ARE EXTERNAL MEASUREMENTS   *
*      OTHER ENTRY PARAMETERS AS FOR BOX ROUTINE                        *
*                                                                       *
*************************************************************************
LOOP  BSR.S   BOX
      ADDQ    #1,D1         NEXT BOX LH CORNER IS X=X+1
      SUBQ    #1,D2         Y=Y-1
      SUBQ    #2,D4         WIDTH=WIDTH-2
      BEQ.S   EXIT          EXIT LOOP IF WIDTH=0
      BCS.S   EXIT          EXIT LOOP IF WIDTH<0
      SUBQ    #2,D5         DEPTH=DEPTH-2
      BEQ.S   EXIT          EXIT LOOP IF DEPTH=0
      BCS.S   EXIT          EXIT LOOP IF DEPTH<0
MULTI DBRA    D6,LOOP       DRAW (D6) BOXES. ENTER ROUTINE HERE FROM BOX_ENT
EXIT  RTS
*************************************************************************
*   BOX ROUTINE        D1=X, D2=Y, D3=COL, D4=WIDTH, D5=DEPTH           *
*                                                                       *
*          ALL REGISTERS UNCHANGED EXCEPT   A1=ADDRESS OF LH CORNER, D7=-1 *
*                                                                       *
* MODE 4 COLS  0=BLACK,1=GREEN,2=RED,3=WHITE                            *
* MODE 8 COLS  0=BLACK,2=GREEN,4=BLUE,6=CYAN,8=RED,10=YELLOW,12=MAGENTA *
*              14=WHITE,ADD 1 TO MODE 0 COLOUR FOR FLASH                *
*************************************************************************
BOX   CLR.L   D7
      MOVE.W  D4,D7
      BRA.S   BOXA          TOP OF BOX
BOXAA ADDQ    #1,D1
      BSR.S   PLOT
BOXA  DBRA    D7,BOXAA
*
      MOVE.W  D5,D7
      BRA.S   BOXB
BOXBB SUBQ    #1,D2         RIGHTHAND SIDE
      BSR.S   PLOT
BOXB  DBRA    D7,BOXBB
*
      MOVE.W  D4,D7
      BRA.S   BOXC
BOXCC SUBQ    #1,D1         BOTTOM OF BOX
      BSR.S   PLOT
BOXC  DBRA    D7,BOXCC
*
      MOVE.W  D5,D7
      BRA.S   BOXD
BOXDD ADDQ    #1,D2         LEFTHAND SIDE
      BSR.S   PLOT
BOXD  DBRA    D7,BOXDD      X1 AND X2 ARE NOW BACK TO ORIGINAL VALUES
      RTS
*************************************************************************
* PLOT ROUTINE   D1=X D2=Y D3=COLOUR(0-15)                              *
*                SPEED=110 PLOTS/SEC FROM BASIC - 3000 PLOTS/SEC FROM M/C *
*                   QL POINT ROUTINE=40 PLOTS/SEC                       *
*        ALL REGISTERS UNCHANGED EXCEPT D0-3,A1(LEFT WITH SCREEN ADDRESS) *
*                                                                       *
*************************************************************************
PLOT  MOVEM.W   D1-D6,-(A7)       SAVE REGISTERS
      MOVE.W    D2,D6             COPY Y
      ANDI.W    #255,D2
      CMP.W     D2,D6             Y OUT OF RANGE ?
      BNE       RANGX
      MOVE.W    D1,D4             COPY X
      MOVE.L    #MODE,A1          MODE STORAGE AREA
      CMPI.B    #8,0(A1)          MODE 8 ?
      BEQ.S     MODE8             YES..
*
*       EITHER MODE 8 OR MODE 4 ROUTINE USED HERE
*
MODE4 ANDI.W    #511,D1           0<X<512
      CMP.W     D1,D4             X OUT OF RANGE ?
      BNE       RANGX
      LSR.W     #2,D4             X2=X/4        USED FOR ADDRESS
      ANDI.W    #7,D1             X AND 7     = X3=X AND 7
      MOVE.W    #254,D5           MASK=11111110
      ANDI.B    #3,D3             COLOURS 0-3
      MOVE.B    D3,D6             COPY COLOUR
      ANDI.B    #1,D3             BOTTOM 1 BIT OF COLOUR BYTE 1
      LSR.B     #1,D6             TOP 1 BIT OF COLOUR BYTE 2
      BRA.S     ALLOK
*
*
*
MODE8 ANDI.W    #255,D1           0<X<256
      CMP.W     D1,D4             X OUT OF RANGE ?
      BNE.S     RANGX
      LSR.W     #1,D4             X2=X/2        USED FOR ADDRESS
      ANDI.W    #3,D1             X AND 3     *
      LSL.W     #1,D1             X*2         * X3=2*(X AND 3)+1
      ADDQ      #1,D1             X+1         *
      MOVE.B    #252,D5           MASK=11111100
      AND.B     #15,D3            COLOURS 0-15
      MOVE.B    D3,D6             COPY COLOUR
      ANDI.B    #3,D3             BOTTOM 2 BITS OF COLOUR BYTE1
      LSR.B     #2,D6             TOP 2 BITS OF COLOUR BYTE2
*
*       SCREEN ADDRESS= Y*128 + (IF MODE8 X/4 AND 510,IF MODE4 X/2 AND 510)
*       MODE 4 AND MODE 8 ROUTINES BOTH END UP HERE
*
ALLOK LSL.W     #7,D2             Y2=Y*128
      MOVE.L    #SCREEN,A1        GET START OF SCREEN
      ADDA.W    D2,A1             ADDR=ADDR+Y2
      ANDI.W    #510,D4           LOSE ANY ODD 1
      ADDA.W    D4,A1             ADDR=ADDR+X2
*
*       A1 NOW CONTAINS CORRECT SCREEN ADDRESS
*
      MOVEQ     #7,D0
      SUB.B     D1,D0             7-X3    FIND WHICH BITS TO ALTER
      BRA.S     LPA
LPA1  LSL.B     #1,D5             ROTATE 1ST COLOUR BYTE
      LSL.B     #1,D6             ROTATE 2ND COLOUR BYTE
      ROL.B     #1,D5             ROTATE MASK OVER  E.G 11110011
LPA   DBRA      D0,LPA1
*
*       ACTUAL PLOT IS DONE HERE
*
      AND.B     D5,0(A1)          MASK OF SCREEN  (SET PLOT POS TO 00)
      OR.B      D3,0(A1)          OR 1ST BYTE WITH SCREEN
      AND.B     D5,1(A1)          MASK OF SCREEN
      OR.B      D6,1(A1)          OR 2ND BYTE WITH SCREEN
RANGX MOVEM.W   (A7)+,D1-D6       RETRIEVE REGISTERS
      MOVEQ     #0,D0             ENSURE NO ERROR ON RETURN TO BASIC
      RTS
      END
```

CONNECT PROTECT

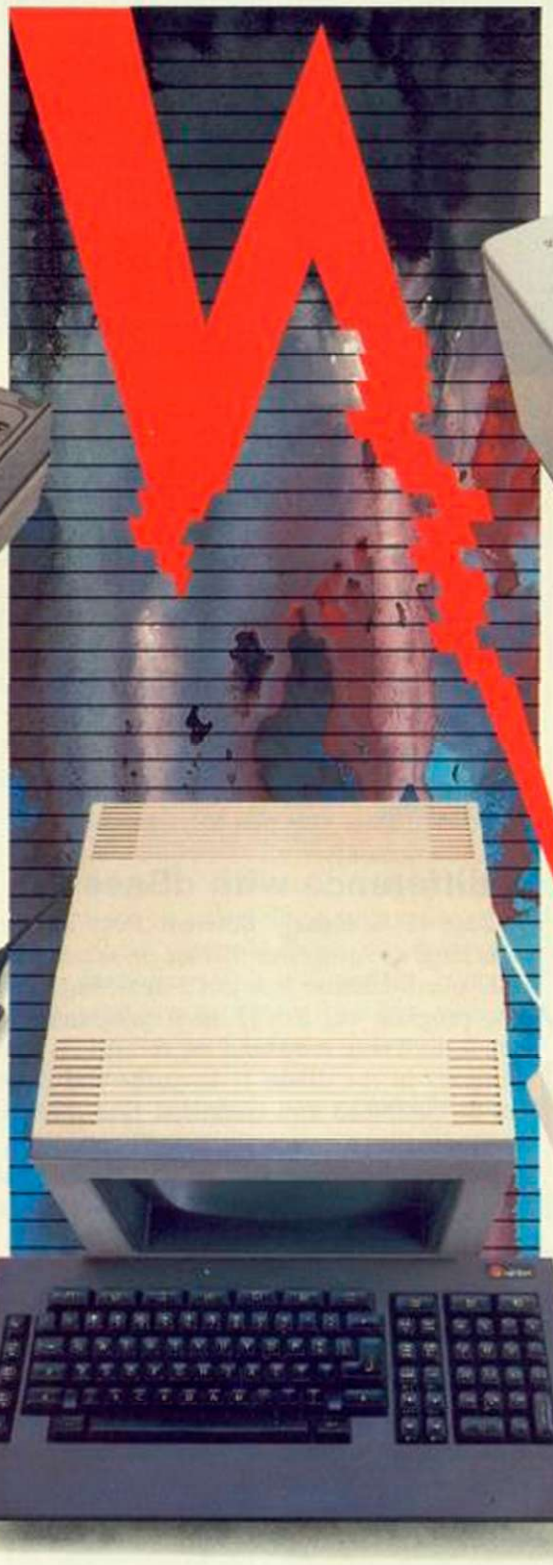
Peripherals make using your computer more interesting and easier. But you may have more items of equipment than power outlets. The best way of tidying up the trailing wires and obtaining a 'clean' power supply is to use STRIPBLOC. It has five CEE 22 outlets, probably more than enough for connecting your add-ons to your power source. It's rugged, made from tough black plastic, and safe, meeting British and European safety requirements.



The Stripbloc is RFI filtered against spikes, 'dirty' mains and 'unclean' power.

Once you've bought it you don't need any extras, it's supplied with five standard right-angled rewireable plugs, a 2m fully-approved cable and moulded 13A plug. Forget about risky connections. Be safe with STRIPBLOC.

Stripbloc includes: ■ 1 five outlet mains unit with RFT filter ■ 2m cable with moulded 13A mains plug ■ 5 rewireable right-angled plugs **Spikebloc includes:** ■ 1 mains protection unit with integral 13A mains socket ■ 2m cable with moulded 13A plug



Have you ever noticed interference when you are using your computer?



It could be caused by any number of things: a light switch, a fridge, a central heating motor starting, or even a thunderstorm. The power lines of your computer can pick up many forms of natural and man-made interference, which can be damaging to computers and peripherals. Rendar's SPIKEBLOC has been developed to give protection against transient over voltages and continuous high frequency interference on the mains supply. The unit is housed in a rugged metal case and gives good electrical screening from high frequency sources. This high level of protection was only possible previously using elaborate and expensive filter units. Now it isn't too expensive for you to protect your equipment.

Send to (no stamp required):
Rendar Limited, FREEPOST,
Durban Road, Bognor Regis PO22 9RL.

Please send me the following items:

Item	Quantity	Price	Total
Stripbloc		£24.99	
Spikebloc		£49.99	
		TOTAL	

Name _____

Address _____

_____

_____ Post Code _____

I enclose cheque/postal order made payable to **Rendar Ltd.,**

for £ _____ or debit my

Access/
Visa Credit Card

Access BARCLAYCARD VISA

No _____

(Prices includes VAT, Postage & Packing)

Rendar Ltd, Durban Road, RENDAR Bognor Regis, PO22 9RL.

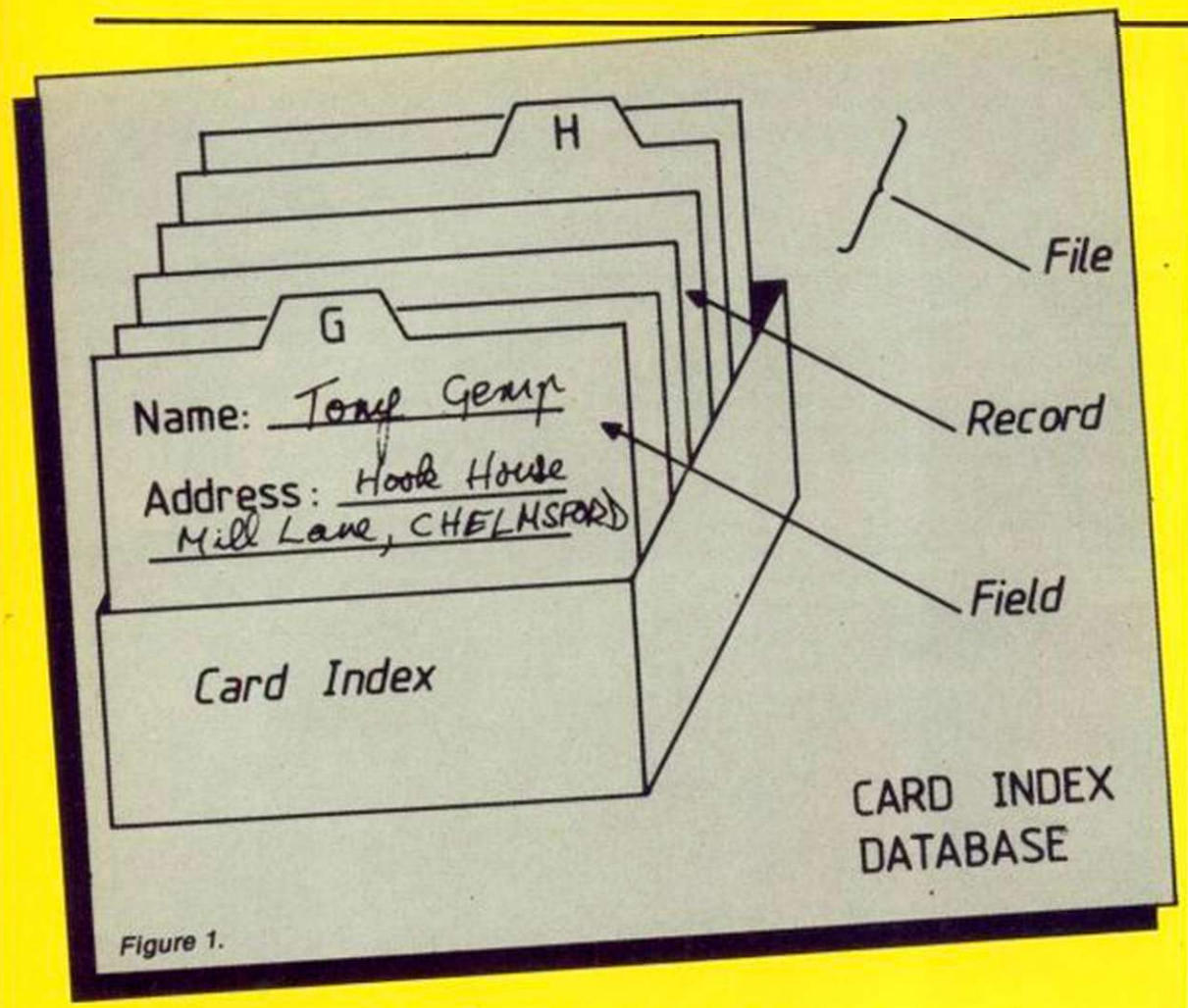


Figure 1.

DATAB

THIS SERIES of articles is about four database programs for the BBC microcomputer. It is impossible to review these sophisticated programs adequately in a single article and I hope that some of the ideas and the solutions to problems will help you if you are thinking of buying a database program for *any* microcomputer, not just the BBC machine.

A microcomputer is a general-purpose machine that can be made to look like any other machine by programming it to simulate the actions of the machine. In other words, a microcomputer can simulate a numerically controlled machine tool, model a central heating system or act as a central heating system controller, edit and format text or work as a complex pocket calculator.

A microcomputer can be used to store, manipulate and retrieve information and a spreadsheet program like Viewsheet or Ultracalc 2, for example, establishes a sort of database except that it is dedicated to displaying information in a particular way. General-purpose programs for database manipulation make fewer assumptions about the type of data that will be held in the system and the ways in which it will be used for calculation and displayed.

The best known, and most widely sold, database for microcomputers is dBase II which is marketed by Ashton Tate, California. dBase II is written in machine code for the Z-80 central processor unit and will not run directly on the BBC microcomputer's 6502 CPU. However, the program has been installed on the Z-80 second processor for the BBC machine and is now available.

A difference with dBase II

dBase II is entirely different from all the other database programs that are on sale for the BBC micro because it is not a dedicated database program but a high level programming language. There are about 84 commands and functions in the dBase II language and these can be combined into command files that are interpreted by the central dBase II core.

A dBase II program can set up a database of information and can then sort, search, calculate results and output the results in a huge variety of different ways.

The four databases that are included are:

Datagem	Gemini Marketing Ltd., Exmouth. 0395 265165.
Scribe Database	Merlin Computer Products, Swansea. 0792 467980.
Stardatabase	GCC (Cambridge) Ltd., Cambridge. 0223 835330.
Database	Acornsoft Ltd., Cambridge. 0223 316039.

All of these programs are dedicated in the sense that the structure of the information in the database is largely preordained. That seems to contradict some of the advertising claims made for Datagem and Stardatabase so let's see what's going on in more detail.

Figure 1 shows the card index architecture that is used by all four programs. A single file of information is held on a floppy disc and this can be accessed by the program to give you the results that you want. In these programs a *file* looks like a box holding a number of cards. You may have a number of boxes holding cards on different subjects; a stamp collection, a name and address list, recipes for your kitchen and so on.

Each file consists of a number of *records* which you can think of as the individual cards in the card-index box. Each card has information written on it. If the information is organised in a regular way then each piece of information is a *field* in the record.

So, there are several fields in each record and a number of records make up a file. Figure 2 shows the record format for a hypothetical wine cellar file. There are eight fields in each record and the information recorded about each wine is of various types. The date the wine was brought into the cellar is structured information in the form DD/MM/YYYY — Day/Month/Year — while the name of the wine is a string of alphanumeric characters of indeterminate length.

Note particularly that the tasting notes field is longer than the width of the paper or the VDU screen; long fields create special problems for printing out information in three of the databases when you try to use them in conjunction with *View* or *Wordwise*.

Figure 3 shows the record format of a real name and address file. This record layout and the fields it contains are more complex than the usual, trivial examples shown in the instruction manuals because "real" life is both complex and messy.

However, in both figure 2 and figure 3 you can see at once that the same information is recorded in the same place on each card. In other words, the program can look in the same place on each record and expect to find a name, or the date you bought a stamp, or how much you paid for a consignment of wine, or simply the town in which someone lives.

Figure 2.

NAME: Corton-Charlemagne

MERCHANT: S H Jones
TELEPHONE: 0295 11798

VINTAGE: 1980

DATE BOUGHT: 25/05/1983

QUANTITY: 8 bottles
CURRENT STOCK: 3

TASTING NOTES: .....

.....

.....

.....

ABASES

In the first in a series of articles, John Dawson looks at databases in general and how they operate.

Figure 3.

```
PEOPLE                          04/03/1985

FILE     LENGTH      625 records
FILE     USED         34 records
RECORD LENGTH       601 characters

*** FIELD NAME LIST ***

ONAME      S
ACTIVE     S
ADD1       S
ADD2       S
ADD3       S
CODE       S
FAMILY     S
FNAME      S
KEY1       S
NOTES      S
ORGN       S
P1         S
P2         S
P3         S
P4         S
PINDEX     S
TITLE      S
UPDATE     N
XMAS       S
XREF       S
XREF1      S

*** INPUT CARD ***

SURNAME.....
Firstname..... Title.....
ORGANISATION.....
TELEPHONE
.....  .....
.....  .....
ADDRESS.....
.....
.....
KEYWORDS.....
.....
.....
A>..... Update..... Christmas.....
Phone index..... Family.....
References.....
NOTES.....
.....
.....
.....
```

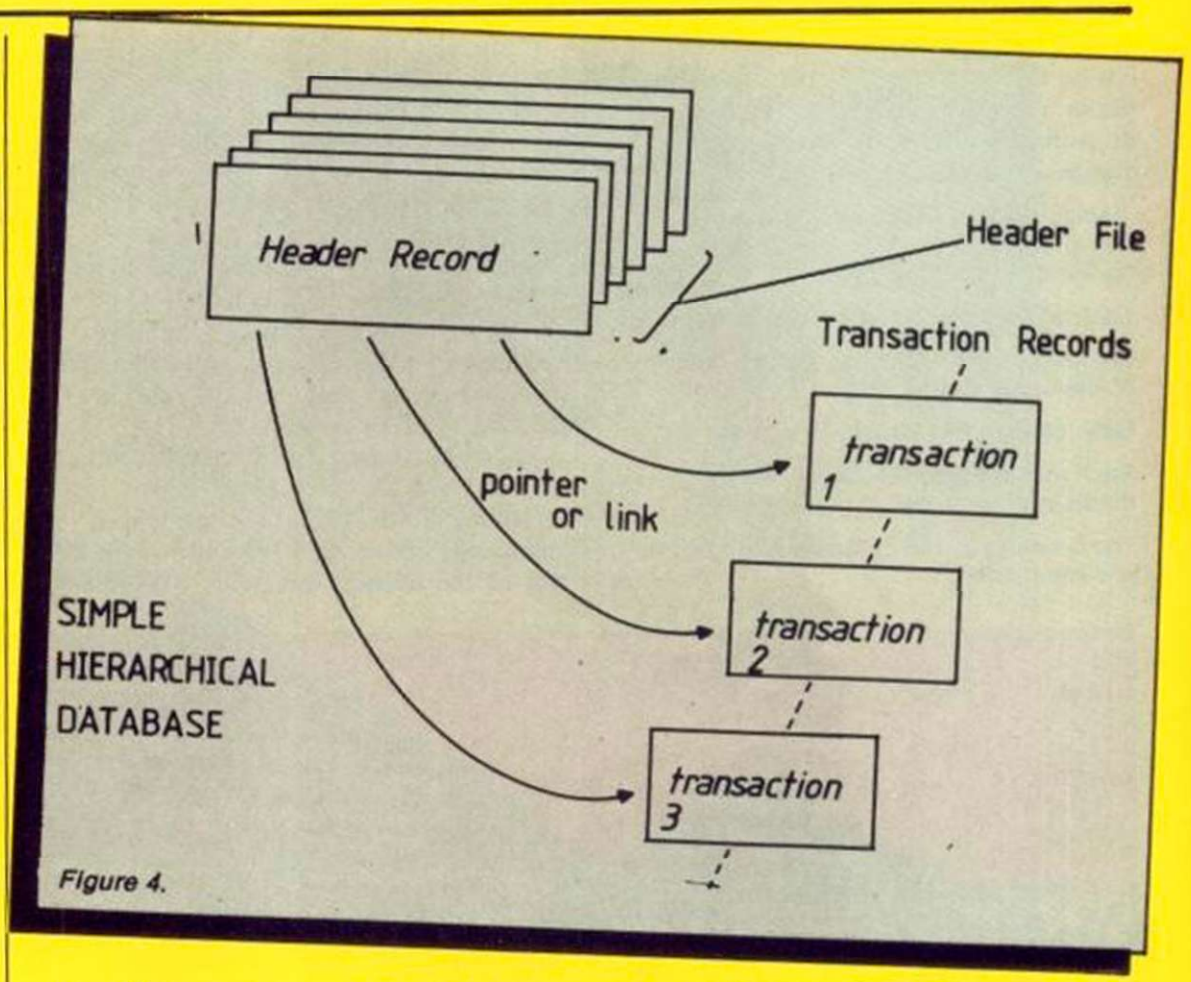


Figure 4.

A card index architecture is simple, straightforward and can be very useful for many purposes. For example, all other factors being equal, you could use any of the four programs for the following purposes:

Software catalogue
Photograph and slide indexing
Christmas card lists
Name and address files
Mailshot personalised mailings
Price lists
Estate agents' housing lists

There are, however, other ways of structuring information that are better suited to many common tasks that you may want to carry out.

Figure 4 illustrates the architecture of a very simple hierarchical database. Suppose that you want to set up an invoicing system for sales of mugs, plates, casserole dishes, parsley pots and other items from your craft pottery. If none of your customers ever buys from you more than once then the card index architecture is quite adequate.

Presumably, though, you would like some of your customers to come back again for more of your goods. When this happens you have to re-enter all the same details about the customer's name, invoice address, delivery address, telephone number each time you make a sale.

Apart from being very time consuming, the chances of errors occurring are large and if you make a mistake in entering the customer's name it becomes more and more difficult to relate one sale in June to another in October and two in the previous March. You can't run any sort of a credit system with the card index approach.

The database in figure 4 is different. When a customer first makes contact with your operation the name, addresses, telephone numbers and other information that you will need for the first, *and subsequent orders,* are typed into the database to form a header record. The goods that you supply, the cost per item, total price, Value Added Tax, discount and so on are entered into a separate transaction record which is linked to the header record by a pointer.

The information in the transaction record is different to that in the header record — the second field, for example, may contain a telephone number in the header record and a description of a piece of furniture in the transaction record; so you need two files, but the files are linked automatically by the database program.

When the customer, impressed by your efficiency, returns for the third time you can search through the header file to find the original entry and immediately enter information into a new transaction record for the next sale. In a well designed system it should be possible to merge information from the header record with the transaction record to print an invoice and label for the envelope. The transaction should point to the header, just as the header must point to all the transactions.

dBase II has an exceptionally advanced feature that permits you to work in two separate active areas at the same time: Primary and Secondary. You can switch between the two areas by typing Select Secondary followed by Use 'newfilename'. Return to the primary database is achieved by typing Select Primary.

Prefix the name of variable

Information can be transferred from one area to another by prefixing the name of a variable with either P. or S. This facility means that records in a second file can be found or manipulated by reference to records in the first file.

dBase II is an example of the third type of database which has been talked about greatly in the last few years. dBase II is a relational database. E.F. Codd published a fundamental paper titled 'A Relational Model of Data for Large Shared Databanks' in Communications ACM in June 1970.

Although the theory of relational databases

(continued on next page)

(continued from previous page)

can be taken into quite high powered mathematics, the ideas underlying it all are simply to do with tables. As Kenneth Robinson says in Database Analysis and Design:

"tables are a very simple and natural way of regarding data . . . The tables conform to a set of rules . . .

Each box in a table contains one value

Within a column the box values are all of the same kind

Each column has a distinct name

Each row is unique — there are no duplicates

The ordering of the columns and rows is not significant"

Figure 5 illustrates part of a simple medical relational database. The information in the database is arranged in tables and each part of the information relates to other parts. The patient's name is put together with the address and a registration number.

By looking down — searching — the name and address file it's possible to find a name by reference to the registration number or the number in relation to a name. Similarly, the drug stock list file contains information about the cost of each drug and the quantity that should be held in stock.

The prescriptions file relates to both the patients and drugs file. A patient called M Hunter (No. 4914) was prescribed one Salbutamol inhaler on 5 November 1983. The cost of the inhaler was £4.75. The relations between data in the tables could be much more complex.

For example, you may want to see the total cost of prescriptions which have been issued for Penicillin in the last year and to whom they were given — children are not charged. The prescriptions table must be searched for Penicillin between 1 January 1984 and 31 December 1984 and the registration numbers looked up. The age of the patient must be extracted from the patient file and the quantity prescribed costed for records matching the age criteria.

Next month I'll describe the four programs in detail, look at passwords, record and file sizes, and discuss how you can set about planning and building a database for your own purposes. ■

RELATIONAL DATABASE

Patients

name	address	no.
HUNTER. J	25 MILL ROAD	4250
HUNTER. M	25 MILL ROAD	4914
JAMES. A	135 WHEELER ST	1772
KYLE. J	2 NEW CROSS ST	6918
MARKS. B	101 RUTLAND RD.	6664
WEBB. E	4 UPPER LANE	3350
WEBB. F	271 WARWICK ST.	2218
DAWSON. R	11 ABBEY CLOSE	7253

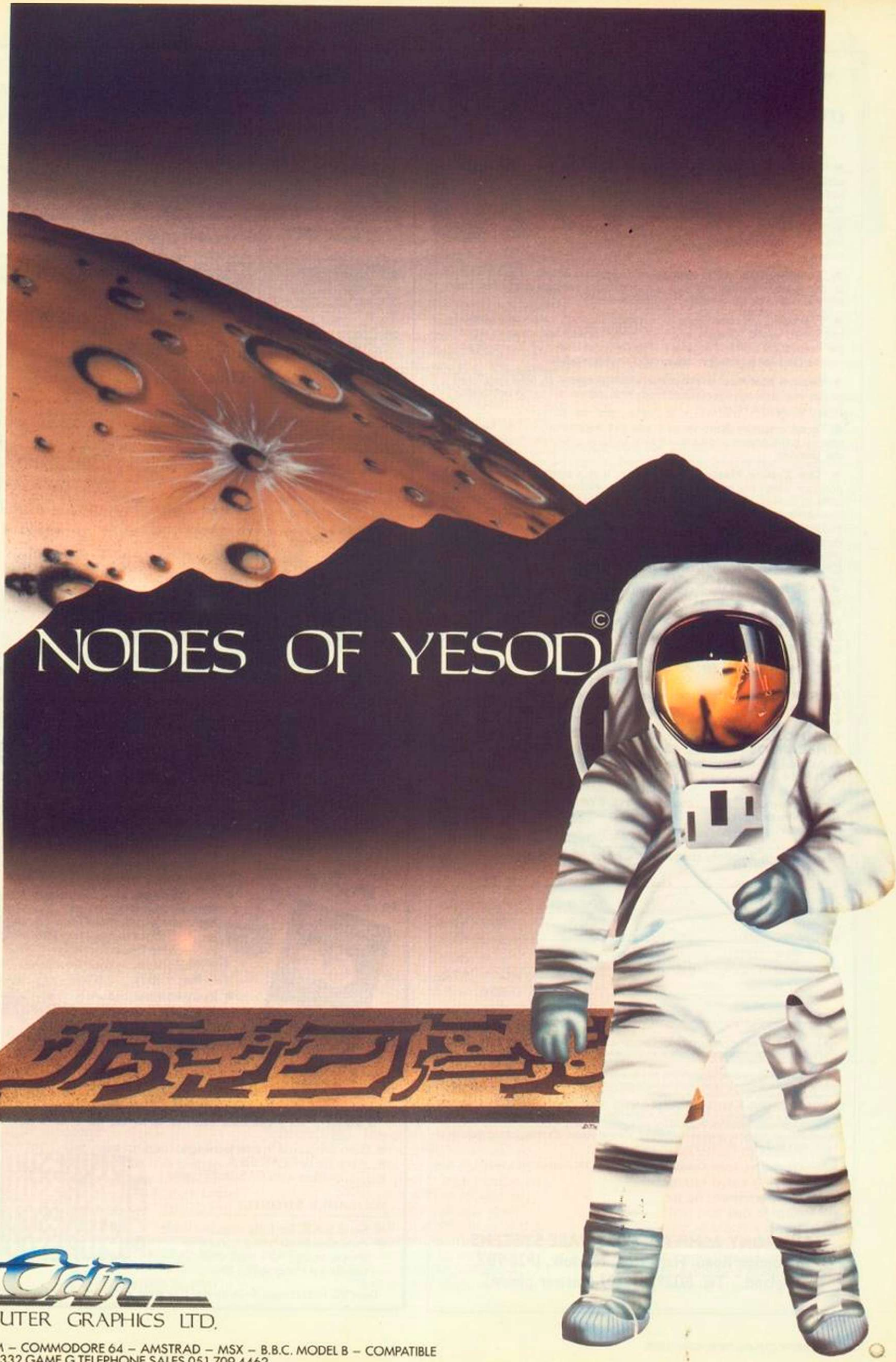
Prescriptions

no.	date	drug	dose
4914	6/11/83	SALBUTAMOL	2 × 3(1)
3149	5/11/83	PENICILLIN	2 × 4(48)
1772	6/11/83	WARFARIN	1 × 4(20)
6918	6/11/83	PENICILLIN	2 × 4(48)
6664	6/11/83	NITRAZEPAM	2 × 1(30)
3149	10/11/83	PHENERGAN	1 ADM(20)

Drug Stocks

drug	stock	cost
SALBUTAMOL	10 INHALERS	4.75
PENICILLIN	1000 TABS	10.70
AMPICILLIN	1000 TABS	25.35
TETRACYCLINE	500 TABS	17.50
NITRAZEPAM	1000 TABS	19.10
OXAZEPAM	1500 TABS	27.80
PHENERGAN	400 TABS	11.15
WARFARIN	1200 TABS	35.60
ASPIRIN	2000 TABS	4.35

Figure 5.



SPECTRUM – COMMODORE 64 – AMSTRAD – MSX – B.B.C. MODEL B – COMPATIBLE
TELEX 628332 GAME G TELEPHONE SALES 051-709 4462
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THE TYPING MASTER

(The Keyboard Skills program that puts you in a class of your own)

● **'The Typing Master'** program exists to teach you to type. The easily met target is 30 words per minute with 95% accuracy after 30 half-hour sessions. The following facilities help you to accomplish this standard.

● **'Sight & Type'** introduces you to the keyboard with the correct finger for each key and takes you to a speed of around 12 words per minute.

● **'Touch-Typing'** takes your speed to around 24 words per minute at the same time ensuring that you learn the peripheral keys to the same standard as those more commonly used.

● **'Practice Exercises'** gives Non-Timed accuracy oriented exercises and Timed speed/accuracy exercises. Your results are given in words per minute and percent accuracy. The target standard of 30 words per minute (and far beyond) is achieved with this module.

● **'Session Monitor'** overlays the whole program to hold your hand all the way through the course from first use of the program to that final, very useful result.

● To back up this Basic version you get documentation on how to approach the course and a record card to fill-in as you progress through the sessions.

● **'The Typing Master'** is not a toy. It is a professionally-written program which has as its sole purpose the teaching of typing/keyboard skills in a way that is friendly and fun. It was written by a typing instructor and it has been marketed world-wide on CP/M, MSDOS, PCDOS and other operating system-based machines over the past three years. It has also been available on Newbrain and BBC Micro (Model A or B) for over a year and is now being released for Amstrad CPC (mono or colour), Commodore 64 and Sinclair QL!

● TAPE formats of the Basic version are available from the following selected list of distributors (media and prices are shown in brackets).

NEWBRAIN (Cassette: £15.00 (no VAT)):
GFG Microsystems, 36 Armitage Way, King's Hedges, Cambridge, CB4 2UE. Tel. (0223) 315120.

BBC MICRO (model A or B) (Cassette, usable with disk: £15.00+VAT)

AMSTRAD CPC (mono or colour) (Cassette: £15.00 + VAT).
E.C.H. Hobday, The Chestnuts, Rodmersham, Sittingbourne, Kent ME9 0PL. Tel. (0795) 24191.

COMMODORE 64 (Cassette: £15.00 + VAT).

SINCLAIR QL (Cartridge: £20.00 + VAT).
P. Ashpitel, 36 Athlone Avenue, Bury, Lancashire, BL9 5EE. Tel. (061-797) 5214.

Please send me_____copies of **THE TYPING MASTER (Basic Version)**

for the _____computer at £_____per copy (+VAT where shown). I enclose cheque/postal order for total amount:

£_____

NAME:_____

ADDRESS:_____

_____

_____

_____

PLEASE SEND THE COMPLETED COUPON AND PAYMENT DIRECT TO THE DISTRIBUTOR FOR *YOUR COMPUTER* AS SHOWN ABOVE.

● DISK formats of the Basic program may be obtained from the following suppliers. They also supply a Business/Schools version which incorporates record keeping and many other facilities. Prices shown below are for the Basic version.
APRICOT, SIRIUS & VICTOR (tailored versions). (Disk: £50.00 + VAT).
Anglia Business Computers, 1 Milton Road, Cambridge, CB4 1UY. Tel. (0223) 315580.
CP/M80, CP/M86, MSDOS, PCDOS. (Disk: £50.00 + VAT).
Microcomputer Products International Limited, Central House, Cambridge Road, Barking, Essex, IG11 8NT. Tel. (01-591) 6511.
or,
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EDIT specified line
ELSE (used with IF ... THEN)
EXIT leave DO-LOOP
FILL enclosed area with specified ink or paper
GET wait for keypress
JOIN two program lines
KEYIN a string
KEYWORDS new keywords on/off
LIST/LLIST line TO line
USED (used with GOTO, GOSUB)
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USING used with PRINT
WHILE used with DO or LOOP
XOS, YOS move PLOT origin
XRG, YRG change PLOT scale

FUNCTIONS

AND (bit-by-bit)
BIN$ decimal to binary
CHAR$ number to 2 characters
COSE fast cosine
DEC hexadecimal to decimal
DPEEK double PEEK
FILLED filled area
HEX$ decimal to hexadecimal
INSTRING string search
MEM free memory
MEMORY$ all of memory as a string
MOD modulus
NUMBER 2 characters to number
OR (bit-by-bit)
RNDM fast RND
SCRN$ recognises user graphics
SINE fast sine
STRING$ repeats strings
TIME$ current time
USING$ formats numbers
XOR (bit-by-bit)

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REPEAT UNTIL

MC Hart gives your CBM-64 an extra command.

```
 1 REM **** REPEAT-UNTIL ****
 2 REM          C-64
 3 :
 4 REM  ***  M. C. HART  ***
 5 :
 6 REM SYNTAX:&R:(EXP)....&U:(EXP)
 7 :
 8 FOR J=828 TO 968:READ X:POKE J,X:NEXT:END
 9 :
 10 DATA 201,58,176,234,76,95,3,162
 11 DATA 2,189,64,3,149,124,202,16
 12 DATA 248,232,134,2,96,76,171,227
 13 DATA 162,2,189,60,3,149,124,202
 14 DATA 16,248,96,201,38,208,238,32
 15 DATA 115,0,201,85,240,37,201,82
 16 DATA 208,227,165,2,10,10,170,165
 17 DATA 123,157,167,2,165,122,157,168
 18 DATA 2,165,58,157,169,2,165,57
 19 DATA 157,170,2,230,2,32,115,0
 20 DATA 76,174,167,32,115,0,32,115
 21 DATA 0,32,158,173,165,97,240,5
 22 DATA 198,2,76,64,169,166,2,202
 23 DATA 138,10,10,170,189,167,2,133
 24 DATA 123,189,168,2,133,122,189,169
 25 DATA 2,133,58,189,170,2,133,57
 26 DATA 104,104,76,228,167
 27 :
 28 :
 100 REM *** DEMO REPEAT-UNTIL ***
 110 :
 120 SYS 835 :REM INITIALISE
 130 :
 140 &R:A=A+1:PRINT"OUTER";A:REM OUTER
 150 :
 160 J=0 :REM NB ZERO BEFORE INNER LOOP
 170 :
 180 :&R:J=J+1:PRINT J,:REM INNER
 190 :&U:J=4:PRINT:REM INNER
 200 :
 210 &U:A=10:REM OUTER
 220 :
 230 PRINT"--END--"
 240 :
 250 SYS 852 :REM RESTORE CHRGOT
READY.
```

THOSE WHO like structured programming or even those who are just interested in 6502/6510 programming for its own sake might be interested in this Repeat-Until.

The routine works by altering Chrgot to look for and process the & symbol followed by R — for Repeat — or U — for Until. Other characters will be passed to the interpreter where they will generate a syntax error.



Unlike For-Next loops in CBM Basic a variable which is used within a loop — such as J in the inner loop in the demo provided — is not initialised back to a starting value and it is the responsibility of the programmer to ensure that such variables are set to the correct value before the loop is entered.

Notice also that the loop will always execute at least once: if a Do-While loop is required which may require the entire loop being skipped if the initial conditions are met then this is best tested for before the Repeat-Until loop is entered. When the routine is in operation, the interpreter will not handle spaces — outside quotes — in excess of one — hence the double colons in lines 180-190.

When Run the code will be read into the cassette buffer — if you totalise the X's in line 8 then they should provide you with a checksum of 15167. The routine is activated by a Sys 835 and restored to normal by a Sys 852. Run 100 runs the little demo routine.

Disassembly.

```
B*
   PC  SR AC XR YR SP
.:0008 30 4F 4F 00 F6
.
033C C9 3A      CMP #$3A
033E B0 EA      BCS $032A
0340 4C 5F 03   JMP $035F
0343 A2 02      LDX #$02
0345 BD 40 03   LDA $0340,X
0348 95 7C      STA $7C,X
034A CA         DEX
034B 10 F8      BPL $0345
034D E8         INX
034E 86 02      STX $02
0350 60         RTS
0351 4C AB E3   JMP $E3AB
0354 A2 02      LDX #$02
0356 BD 3C 03   LDA $033C,X
0359 95 7C      STA $7C,X
035B CA         DEX
035C 10 F8      BPL $0356
035E 60         RTS
035F C9 26      CMP #$26
0361 D0 EE      BNE $0351
0363 20 73 00   JSR $0073
0366 C9 55      CMP #$55
0368 F0 25      BEQ $038F
036A C9 52      CMP #$52
036C D0 E3      BNE $0351
036E A5 02      LDA $02
0370 0A         ASL
0371 0A         ASL
0372 AA         TAX
0373 A5 7B      LDA $7B
0375 9D A7 02   STA $02A7,X
0378 A5 7A      LDA $7A
037A 9D A8 02   STA $02A8,X
037D A5 3A      LDA $3A
037F 9D A9 02   STA $02A9,X
0382 A5 39      LDA $39
0384 9D AA 02   STA $02AA,X
0387 E6 02      INC $02
0389 20 73 00   JSR $0073
038C 4C AE A7   JMP $A7AE
038F 20 73 00   JSR $0073
0392 20 73 00   JSR $0073
0395 20 9E AD   JSR $AD9E
0398 A5 61      LDA $61
039A F0 05      BEQ $03A1
039C C6 02      DEC $02
039E 4C 40 A9   JMP $A940
03A1 A6 02      LDX $02
03A3 CA         DEX
03A4 8A         TXA
03A5 0A         ASL
03A6 0A         ASL
03A7 AA         TAX
03A8 BD A7 02   LDA $02A7,X
03AB 85 7B      STA $7B
03AD BD A8 02   LDA $02A8,X
03B0 85 7A      STA $7A
03B2 BD A9 02   LDA $02A9,X
03B5 85 3A      STA $3A
03B7 BD AA 02   LDA $02AA,X
03BA 85 39      STA $39
03BC 68         PLA
03BD 68         PLA
03BE 4C E4 A7   JMP $A7E4
```

Location	Explanation
033C-035E	This is the initialisation.
035F-0361	See if & character and exit to CHRGOT in Rom if not found.
0363-036C	Get next character from the text and if it is a U then branch forward to $038F — if it is *not* an R then branch back to Goto CHRGOT in Rom — where a syntax error will be generated.
036E-038C	Get the contents of the 'Loop counter' which has been initialised to zero in lines $034D-$034E. Multiply by four to provide an offset and then put into the X register.
038F-039E	The characters & and then U have been identified so bump the text pointers by two (past U and :) and then access a Rom routine to input and evaluate the 'truth' of a condition. If the statement is 'true' then $61 is non-zero so the loop counter is decremented and an exit made to Rom.
03A1-03C0	If "false" i.e. zero then a branch is mae to $03A1. Get the loop counter in A, decrement it and then multiply by four, putting it in an offset to restore the line number and text pointer bytes previously put on the temporary stack. Then pull two bytes off the normal stack and 'throw them away' before accessing a routine in Rom to execute a statement within a line. ■

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*PLEASE TICK WHERE APPROPRIATE

Keith Suddick with a program for the CBM-64 which will allow easy reading, writing and alteration of disc blocks.



TRAX

ANY 64 OWNERS who use a 1541 disc drive may well have gone through the trauma of having it turn six weeks' worth of their latest masterpiece into the kind of garbage that makes random numbers look sensible.

Fear not — as many users may know, this is quite often caused by an error in only one of the many blocks that may be used by the disc drive to store the file. In many cases it is quite easy to fix these errors — if not quite so easy to trace them in the first place.

Consider the way in which the 1541 stores files on a disc, take the most common type — a program file. First of all, the file has to have an entry in the directory. This directory entry contains details of the name, type and length of the file and the track and sector numbers of the block on which the actual file starts.

Each block on the disc is 256 bytes long and the details of the formats are given in the user manual for the disc drive. Briefly, however, in each block the first two bytes, or links, point to the next block in the file and the following 254 bytes are data in the file itself. The last block in a file is marked by links that are invalid track and sector numbers.

When an error occurs on a disc it can corrupt a file in several ways. The error may occur in the data part of the file, changing a character or keyword in a program for example. Another type of error could occur if the links from one block become corrupted and point to an incorrect block as the next in the file.

In both cases the error needs to be found — this may involve careful examination of the file as stored on the disc. Once the error is identified, attempts can be made to correct it, in the case of corrupted links this may involve searching areas of the disc for pieces of the file and then linking them back together. It is not always possible to recover the whole of a file but unless the error is compounded by extensive writing to the disc afte the error occurs, then perhaps only one or two blocks will be lost.

The details of detection and remedy of such errors on a disc is beyond this article and is more related to experience and even reasonable guess-work than a set of rules, but the manuals and reference guides provide all the information on how things are supposed to be stored on the disc and comparison with this should highlight the corruption.

Finding the error will probably mean careful inspection of the data on the disc and then some alterations to correct it. This is where the program Trax becomes useful.

Although the 1541 allows the use of random files, through which it is possible to access any block on the disc in any order, a program is needed to make use of this. While a simple program may suffice to deal with a particular situation, Trax is a more general program which allows easy reading, writing and alteration of disc blocks as well as allowing the use of the 1541's built in DOS commands.

When the program is running it will attempt to identify the disc that you want to work on. It does this by loading in the directory header and block allocation map from track 18, sector 0 and examining it — although the BAM is not used. During execution various things are displayed on the screen in several "windows".

The track and sector numbers of the block currently in the computer's memory are shown along with the track and sector numbers to which the current block is linked or points to. Along the bottom of the screen the disk name, ID and operating system version are shown and below this the error channel form the disc drive is shown.

The largest of the windows on the screen is used to display the actual contents of the block in memory. There is a choice of either hexadecimal or ASCII displays, although editing can only be done hexadecimal mode. Because of the size of a block — 256 bytes — only one half of the block is displayed at any one time, in the bottom right hand corner of the screen is an indicator showing whether the display is the top or bottom half of the block, the bytes are also numbered in groups of eight. Finally, the top lines of the screen are used for communications with the program — prompts will appear here along with any responses that you may type.

In the case of a hard copy version of the display, both the hexadecimal and ASCII data is printed along with the track, sector, name, etc.

The commands provided by Trax are all invoked by single keys to make editing easier, although as a precaution commands that move data to and from the disc are obtained via the control key — Ctrl.

The commands may be summarised:

Ctrl R: Read a specified block from the disc into memory.
Ctrl W: Write the data in memory to the specified block on the disc.
Crtl U: Update the current block on the disc with the data in memory.
Ctrl F: Follow the links from the current block and read the next block if possible.
Ctrl P: Print the current block contents on a printer.
Ctrl Q: Quit the program.

(continued on next page)

(continued from previous page)

*: Switch between ASCII and hexadecimal display modes.

↑: Switch page to display other half of block.

@: Send following DOS command to disc drive.

In addition the cursor keys and the Home key may be used to move around the block display to edit the data.

Note that all numbers are in hex including the track and sector numbers typed as responses to read and write commands although leading zeros may be omitted. The only exception to this is the error channel which shows numbers in decimal in line with the disc manual which gives more details on error conditions. DOS commands are sent to the disc drive exactly as typed, so the normal syntax applies. In addition, entering just return when asked for a track or sector number will substitute the current value and pressing the CLR key — Shift Home — during a response will cancel the command.

The program is relatively straightforward to type in; the Commodore control codes are as usual. The only exception is line 50 where the reverse characters u,w,f,r,p and x inside the quotes are obtained by pressing Ctrl and the given letter key whilst in quotes mode.

Don't forget to save a copy of the program before trying to use it and I strongly recommend testing it out with a blank but formatted disc to ensure the program is correct.

For anyone who doesn't want to type the program in I can supply tape copies for £2.00, write to: Keith Suddick, 6 Ravel Court, Jarrow, Tyne and Wear, NE32 3BW.

Place the required disc in the drive and run the program. Pressing return when asked will result in the program reading in track 18 sector 0 — the directory header, and getting from this data the name, id and operating system version of the disc. The first page of the block will be displayed along with the links and error channel. When the command prompt appears at the top of the screen you can either enter one of the commands listed above or use the cursor keys to move the "cursor" around the block.

If you want to change a byte in a block then simply put the cursor on that byte and type the new value — remember the values are shown in hexadecimal — you will see the byte change and although it will have been altered in memory the change is not sent to the disc until either an Update command is used to rewrite the current block or a Write command ius used to place the data in any block on the disc. Note that should you change either of the first two bytes in a block — the links, then the link display will change accordingly and any Follow commands will use the new values even if the block has not been written to the disc.

The first directory block is linked to track 18 sector 1 which is the start of the file entries and you can follow this link from the directory header by using the Follow command. The first files in the directory will be in this block and if you switch the display to ASCII using * you will be able to see the file names more easily although you must change back to hex to be able to edit the block.

Since only half of the block is displayed at any time you can see the other half by using the ↑ to change the display.

If you find the file you want in the directory then this entry will tell you where the actual file starts and you can then get the first block of the file using the Read command and then follow the rest of the file — note that Follow will not work from the directory entry as this will link to the next directory block.

■

Program breakdown.

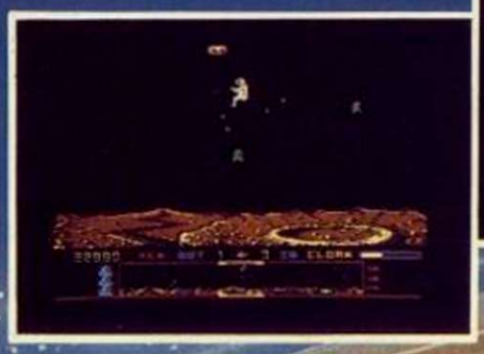
0-90:	Initialisation.
100-180:	Main input loop. Edit block if requested and check for valid commands.
200-260:	Get track and sector numbers for read and write commands.
300-360:	Produce printed copy of current block.
400-499:	Move "cursor" around block display.
500-590:	Execute commands.
600-630:	Display block on screen.
700-760:	Convert to and from hex/decimal.
800-899:	Read specified block from the disc, update current track and sector values and set links to next block.
900-999:	Write current block data to specified block on disc.
1000-1020:	Read and display error channel from disc drive.
2000-2150:	Draw screen "windows".
2200-2300:	Attempted to identify disc — read track 18 ($12) sector 0.
2400-2550:	Error messages for unreadable dics.
3000-3070:	Input a string subroutine.

```
0 rem  trax  : 1541 disk editor
1 rem  k. suddick  mar 1985
10 dim#(255):cl=214
20 r$=chr$(13):d$=chr$(20):z$=chr$(0):hx$="0123456789abcdef"
30 cl$="■"
40 cl$=cl$+"■"+mid$(cl$,2)+"■"
50 ok$="■■■
```

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SPACE JUNK

Nalin Sharma continues his epic for the CBM-64.

HERE IS a reminder of the loading and game instructions for Space Junk.

Insert cassette, press Shift and Run/Stop and start your cassette recorder. Loading time is about two minutes. Put your joystick into Port 2.

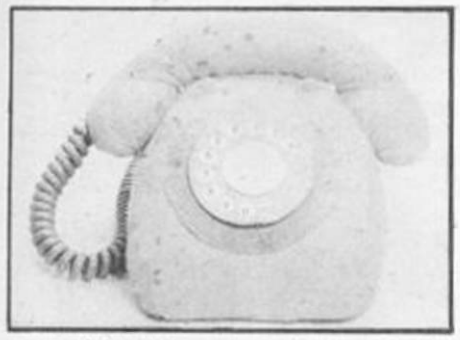
Can you retrieve all 32 satellites by mastering control of your ship, which can move up, down, left and right and can also fire bullets?

However, beware of the four yellow junkies which patrol the skies. Unless you can work out how to destroy them you're in trouble! To help you there's a radar at the top of the screen which will pinpoint the junkies and any miscellaneous junk which appears from time to time and can be retrieved for bonus points.

After every two sheets you'll get an extra life and an attempt at the challenge stage. Here you have 99 units of time to turn the four junkies into stormer — if you succeed you'll get 8000 points! Below your score is shown the number of satellites left to collect, together with the number of lives left.

Pressing F7 will freeze the game and pressing the Space-Bar will restart it. Tape copies of the program are available for £3.25 from Nalin Sharma, 35 Kitchener Road, Walthamstow, London E17 4LJ.

```
note: enter letters as
capitals
3470: c19a53544120484g 2d4
3472: 474848b9aa35000a 279
3500: 35b68a4c44412023 289
3508: 3600jb35bb8a5354 274
3510: 4120484947484bb9 282
3518: aa36002635ca8a4c 2db
3520: 4441202335003525 167
3528: d48a535441205348 301
3530: 49454c44004635e8 281
3538: 8a4a535220534854 285
3540: 52414441520057351 1+5
3548: +48a5349c343+520 385
3550: 4c44582023300050 1c7
3558: 35+68a9c53494420 351
3560: 4c444120534+554e 236
3568: 442c58007d35+88a 2+c
3570: 535441204455505J 244
3578: 49442c5800083549 2c7
3580: 8a4c44412023000 1ce
3588: 9935+a8a53544120 35a
3590: 5748494348322c58 229
3598: 00a135+b8a494e58 34a
35a0: 00ad35+c8a435050 353
35a8: 2023323500ba35+e 297
35b0: 8a424e45209c5349 2b7
35b8: 4400c235108b5254 27c
35c0: 5300d735748b5241 2+1
35c8: 53549a34204c4441 266
35d0: 2053415453910052 2ce
35d8: 357e6b434d502023 261
35e0: 3100+235888b424e 2+b
35e8: 452046494e524153 228
35+0: 340003369288b4a53 227
35+8: 522042554c4c434+ 233
3600: 4c53001436978b4a 255
3608: 535220534849504J 23c
3610: 4+4c53002536908b 270
3618: 4a5352204d495343 23b
3620: 48444c5200356a6 23b
3628: 8b46494e52415334 282
3630: 202c3000d22+8d+2 2+c
3638: 563252454c204259 226
3640: 542032343820234 1a4
3648: 392c3235342c3235 193
3650: 3000ed2+934256J2 356
3658: 57415645204259J4 242
3660: 2033332c33332c33 177
3668: 332c333300353094 1ce
3670: +2545753+455+e44 326
3678: 204259542030200232 1cd
3680: 34302c31362c3232 187
3688: 342c33322c323033 18b
3690: 2c34382c3139322c 18c
3698: 36342c3137362c38 198
36+0: 302c3136302c3936 18e
36+8: 2c3134342c313132 185
36b0: 2c3132303?e3e9e 213
36b8: +248595053++554e 328
36c0: 442042594200202c 1c+
36c8: 31362c33322c3438 190
36d0: 2c36342c38302c39 18+
36d8: 362c3131322c3132 185
36e0: 382c3134342c3136 190
36e8: 302c3137362c3139 190
36+0: 322c3230382c3232 188
36+8: 342c32343000c730 1ed
3700: a8+2524546534+55 36e
3708: 4e44204259542032 1+3
3710: 34302c3232342c32 186
3718: 30382c3139322c31 18d
3720: 37362c3136302c31 18d
3728: 34342c3132382c31 18c
3730: 31322c39362c3830 192
3738: 2c36342c34382c33 18d
3740: 322c31362c3000e1 202
3748: 30b2+291534204J 35d
3750: 595420394362c3134 1cd
3758: 342c36342c313736 194
3760: 00+23018+6802022 2+2
3768: 5350414345322222c 1ec
3770: 380000005c8c4445 1a9
3778: 58000b375+8c4a53 2a2
3780: 5220504c44545341 245
3788: 5453009337648c52 2b3
3790: 545300ae37698c52 2d3
3798: 415354Sa32204c44 264
37a0: 4120534154539120 24d
37a8: 214c4546540006937 23c
37b0: 6e8c434d50202331 24e
37b8: 00c537738c424551 2d3
37c0: 20acaa3300cd3778 325
37c8: 8c52545300ac377d 315
37d0: 8c4c445820534341 26b
37d8: 50455800ee37628c 320
37e0: 4a535220434c4541 224
37e8: 525341545300+d37 2c1
37+0: 878c4c4458205343 2b1
37+8: 4150455500053889 1+4
3800: 03030+0+3+3+++++ 2a0
3808: ++++++++++++++++ 7+8
3810: 80a0e8eafafafafe+e 6e2
3818: 0000000000a0a8aa 272
3820: aaaaeaeafafafafe+c 716
3828: 80a0a0808080000000 2c0
3830: 0000000000010205 008
3838: ea12a548902040b+ 398
3840: 7+00000001++00++ 27e
3848: ++00++0001030G+c 304
3850: +83060c080++00++ 4c6
3858: ++00++c0800000001 33+
3860: 0103070G0+1830+8 160
3868: 0018181818183c3c 0+0
3870: 6666667e66c3++c3 49b
3878: c37ec300++000000 303
3880: 80c0e060+0180c1+ 3b3
3888: 0000000000000003 003
3890: 0+1+3+3d3+1+0+01 118
3898: 000000000000++++ 20a
38a0: b++b+++dd++++++c 76+
38a8: 00000001?+++d++b 359
38b0: ++da+++7++++e000 6b0
38b8: 000000++++++dd++ 4d9
38c0: e++++bb++++e0000 5a5
38c8: 000000e0+3+0+c6e 432
38d0: e+++be+c+0000000 498
38d8: 1038386c7cbe6e7+ 313
38e0: +++7b++eee+ebd+d 759
38e8: ebd3bd3b6d+d++c+ 5ec
38+0: 0000000101032377 09+
38+8: 7b+b+bd9+deckd+e 6ee
3900: 0000000000000000 000
3908: dd+d7ded+fb+3+7e+ 718
3910: 000081c1c367e7ed 440
3918: efe6+6b5db+b+677 6c3
3920: b7cadbef66+7db++ 685
3928: c0c0e4eeeb6++7+6 699
3930: b6+57b6bbdb5aeda+ 5b+
3938: e+a+b7+af9cdb6++ 6ca
3940: 0006330c63cc63cc 2a3
3948: 330+0303030303d3b 096
3950: 0060cc30c633c633 34e
3958: cc70c0c0c0c0b0dc 5c8
3960: 0000000000181830 060
3968: 0000007e00000000 07e
3970: ++++++++++c+c+++ 798
3978: 0040406060703038 218
3980: 1c1e0+0703000000 053
3988: 00000000e0+83e00 296
3990: 0000001818000000 030
3998: 000000c3dbdb++db 452
39a0: dbe7dbff+dbe7db++ 738
39a8: e7++db++++db++7e 717
39b0: 5555++dbe7e75ac3 56+
39b8: e7e7++++7e000000 44a
39c0: 6666++++c3bd9999 57c
39c8: bdc3++++7e000000 3+c
39d0: ++++815e575+5780 46a
39d8: ++++9177+d6++b44 5b1
39e0: ++++03+5dd79ed03 53c
39e8: ++++++87++87++++ 708
39f0: ++c3dbd+d+dbc3++ 6+8
39f8: ++c7bb+7e+++e+++ 754
3a00: ++++++++++++++++ 7+8
3a08: ++++03330333333++ 39c
3a10: ++++07330733074++ 378
3a18: ++++03333+3303++ 3a8
3a20: .++++07333333074++ 3a4
3a28: ++++033+073+03++ 388
3a30: ++++033+073+3+++ 3c4
3a38: ++++033+33333++ 3a6
3a40: ++++333303333++ 3cc
3a48: ++++03c+c+c+03++ 570
3a50: ++++03c+c+c+0+++ 57c
3a58: ++++333307333++ 3d0
3a60: ++++3+3+3+3303++ 3+0
3a68: ++++330333333++ 3cc
3a70: ++++033333333++ 3cc
3a78: ++++033333303++ 39c
3a80: ++++0333033+3+++ 3b4
3a88: ++++033303+3+3++ 51c
3a90: ++++07330733333++ 3a4
3a98: ++++033+03+303++ 438
3aa0: ++++03c+c+c+c+++ 63c
3aa8: ++++333333303++ 3cc
3ab0: ++++333333330+++ 498
3ab8: ++++333333333++ 3cc
3ac0: ++++3333c+3333++ 498
3ac8: ++++33333+303++ 45c
3ad0: ++++03+3c+3+03++ 504
3ad8: 0103060c183+60++ 1cc
3ae0: 0103070c183060c0 17+
3ae8: 80000000103++00++ 282
3af0: ++00++0103060c1+ 233
3af8: 3+60c08000+e00++ 3dc
3b00: ++00++8000010204 365
3b08: c912244890a+40++ 3c5
3b10: 0000000000000000 000
3b18: 00000000000++++ 1+e
3b20: 0000000++++0000 1+e
3b28: 0000++++00000000 1+e
3b30: ++++0000000000000 1+e
3b38: 0000000000000000 000
3b40: 03060c1830e0c080 27d
3b48: ++06+c183060c080 3e9
3b50: 0018185a3cdb7e18 237
3b58: 000000183c187e18 102
3b60: 00c0d8db+b1b1+18 3c0
3b68: 000018781e180000 0c6
3b70: 00000000?ee7e37e 2c6
3b78: 0000000000e391e 075
3b80: 0000000000000606 00c
3b88: 00000003c000000 03c
3b90: 0000000018000000 018
3b98: 1+7++00000c0+03c 3+a
3ba0: ++c0000000000007+ 23e
3ba8: c303010101074++c 2cb
3bb0: ++++c3c3c3c3++++ 708
3bb8: ++++ebebebeb++++ 7a8
3bc0: ++++d7d7d7d7++++ 758
3bc8: ++9999++++9999++ 660
3bd0: ++e7e7++9999++++ 6+c
3bd8: 3+++c3c3c3c3++++ 648
3be0: +c++c3c3c3c3++++ 705
3be8: 0103070+1+3+7+++ 1+6
3bf0: 80c0e0+0+8+c+e++ 701
3bf8: 00000003c3c5555 122
3c00: 0103070+1+3+7+00 0+7
3c08: ++99++99++99++++ 6c6
```



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```
3c10: ++ebeb++ebeb++++ 7a8   3e28: 7e++++7+7+7+77+ 657
3c18: ++c3c3++c3c3++++ 708   3e30: ++++dd+++++32000 5ec
3c20: ++++++++++++++00 6+9   3e38: 000000+++bb+e10c 3a6
3c28: ++++99++99++++00 62a   3e40: 77++++bbb+7+77+7 5dc
3c30: ++00++00++00++00 3+c   3e48: ++7+7b77++++d800 546
3c38: ++55++55++55++55 550   3e50: 000000++++d++926 3+c
3c40: +e+d+b+7e+d+b+7+ 6+9   3e58: 8++++b7b7+7+++ef 5+0
3c48: 7+7e7c7870604000 301   3e60: e+7+e+++d+8e0500 4ce
3c50: 0000000000003+3+ 07e   3e68: 000000++d++d0770 352
3c58: 303030333+3+0000 141   3e70: e+e+777++++7+777 638
3c60: 000+3+3+00000000 08d   3e78: d+d++++7777+3a10 4+4
3c68: 0000003c003cc3++ 23a   3e80: 000000++e+++9339 3a9
3c70: 3c3c3c3c++++3c3c 366   3e88: 7++77773+b+b7+7+ 554
3c78: 3c3c++++3c3c3c3c 366   3e90: e+e++++7+77e0c00 555
3c80: 0000000000000+c+c 1+8  3e98: 00000000c0+0+bce+ 363
3c88: 0c0c0ccc+c+c0000 2e8   3ea0: c0+0+8dcbe+6abd+ 6+2
3c90: 00+0+c+c00000000 2e6   3ea8: 80c0e060+0b8d87c 57c
3c98: 000000300c330+30 0ae   3eb0: 000000000031+3d+7 156
3ca0: 0c300c300c300c30 0+0   3eb8: 030+1+3b7d6+ab+fb 32e
3ca8: 0c300c300c7e7e++ 27+   3ec0: 01030700+1d1b3e 096
3cb0: 0000000000+0+818 200   3ec8: 0000++++++++++++ 5+a
3cb8: 000000300c+0cc30 228   3ed0: 000001070c3++6++ 1b8
3cc0: 0000000000001+1+18 046 3ed8: 030+387+e3++3c0+ 2+6
3cc8: 003cc3++00++003c 339   3ee0: ++391+3+1c070100 1ba
3cd0: 2a3+003c003c003c 11d   3ee8: 000080e030+c66++ 3+1
3cd8: 2a3+003c003c00++ 1e0   3e+0: c0+01c+ec7++3c+3 5b6
3ce0: a8+c003c003c003c 258   3e+8: ++9c+8+c38e000000 527
3ce8: a8+c003c003c00++ 31b   3+00: 0004+3++++04++00 3+8
3cf0: 000000001+3264++ 1b4   3+08: +b05++00++00++00 3+d
3cf8: 00000000++224+++ 264   3+10: +b04+++b++00++43 53a
3d00: 000+3b67++7+88++ 3b6   3+18: ++00++00++00++++ 4+b
3d08: 0000+cb6+e+800++ 4a7   3+20: +b8c++00++00++73 4+7
3d10: 00000000++468c+8 2c9   3+28: ++00++00++00++00 3+c
3d18: 0000000101010000 003   3+30: ++00++00++00++00 3+c
3d20: 0000010307041e3d 075   3+38: ++00++00++0094+57 453
3d28: 7+++00++++++0000 47b   3+40: ++00++04++00++01 401
3d30: 0103070+001e1e1e 074   3+48: ++00++++++00++++ 5+a
3d38: 0000e0d0b060c080 400   3+50: ++00++++++00++e3 5de
3d40: +d+b07eed+be7d+3 5+7   3+58: ++00d+00++006101 33+
3d48: e7a7b770e0c18101 508   3+60: ++01++3a++00++00 437
3d50: ++++1+3a++03+70+ 463   3+68: ++++++00++00++00 4+b
3d58: debd7b+70eece8e0 5c+   3+70: ++00++00++00++00 3+c
3d60: +e+d1833ebdbb870 534   3+78: ++00bc00++00++04 3bd
3d68: e0c0000000000000 220   3+80: 01+b0cdb00+b03++ 3e0
3d70: ++++00++++++0000 4+b   3+88: 1+bc93++00++43++ 4ae
3d78: 0000070+1e3d7b+7 1e3   3+90: 04+b000c00++00b+ 2c9
3d80: eedc38b0a0000000 3d2   3+98: 00++00++00++00++ 3+c
3d88: 0000000080806000 200   3+a0: 0c+b00++00++005+ 374
3d90: 0001+307+00++d+ 2ac    3+a8: 00++00+2c++00++ 428
3d98: +c++00++++dede++ 6b4   3+b0: 00++00++00++00++ 3+c
3da0: ++00++c0c0c0c0++ 5+d   3+b8: 00++00++00++ac9+ 448
3da8: 0000++00++00++++ 3+c   3+c0: 00++43+b00++03be 3+d
3db0: 00++00++++6666++ 4c8   3+c8: 1b++934300++db43 40d
3db8: ++30++e6++e6++++ 5c7   3+d0: 00++00++++++d3++ 5ce
3dc0: 00++00++e16d5de1 49a   3+d8: 00++00++00++++bc 4b8
3dc8: ++00++67++67++++ 5c9   3+e0: 00++00++00++00++ 3+c
3dd0: 0000+00c+e00++++ 400   3+e8: 00db00++00++00++ 3d8
3dd8: 73++00++c3dbdbc3 5ad   3+f0: 00++00++00++43++ 43+
3de0: ++00++++3333++++ 561   3+f8: 00++00++00++00++ 3+c
3de8: 3++++0+7+0+++0++ 703   4000: 208a++4c50400012 237
3df0: 3+000303030302a2a 07+  4008: 40+54b4350582023 2ae
3df8: ++0500000++00000 203   4010: 30002040+a4b424e 265
3e00: ++++03+3c3+303++ 5ac   4018: 452053434c503200 1c9
3e08: ++5000000++00000 24e   4020: 2+40044c4c445920 1c8
3e10: +c++03333333003++ 399  4028: 534341504558003d 201
3e18: +c00c0c0c080a0a8 504   4030: 40094c4a4d5020a2 23e
3e20: 000000++de++0378 357   4038: 434+4c4d0055402c 1ec
4040: 4c54414b45534352 259   42c8: 43bd2470186901 9d 2b3   4550: +be8c8cc0270d0c8 581
4048: 4+4c4c204c444120 1+8   42d0: 2470bd3770690 09d 2+e   4558: 6085168418a90185 2c6
4050: a96c8d1803a9408d 333   42d8: 3770c904d005a900 2+2   4560: 178519a200182616 1ab
4058: 1903a99320d2++a9 3+2   42e0: 9d3770b960701870 3b2   4568: 26171826182619e8 1ba
4060: 0820d2++a9008d20 34+   42e8: 2470850 2b963707d 324   4570: e003d0+1a000b116 40b
4068: d08d21d0a2+49a78 501   42+0: 3770850396848a000 2a+   4578: 5118c8c008d0+750 460
4070: a90d8d1403a9418d 2d1   42+8: b1029d2670a9009d 32c   4580: 207944209044a900 27a
4078: 150358a9d08d16d0 35c   4300: 2570685a8b9667018 34c   4588: 8d370385fb85+da9 472
4080: a900657850e6512 2cb    4308: 7d2470850 2b96970 32a   4590: 0485+ca9d885+ea9 532
4088: 850+8510a9018511 269   4310: 7d3770850 3a000b1 2+d   4598: 078d0070a2668a20 2b6
4090: 850d8d1ad0ad11d0 397   4318: 02c961d007ea2051 35e   45a0: 58468a48a20a20aa 2e6
4098: 297+8d11d0a9518d 39d   4320: 434c6c429d4+70bd 356   45a8: 4668aacae062+00e 462
40a0: 12d0a9++8d19d0a9 4a9   4328: 087029+e9d0870a9 35d   45b0: e88a205846caa00a 3a4
40a8: 008d0edc20da4420 2d5   4330: 019d2370e00e+016 325   45b8: 20b9464c9e45a920 317
40b0: ec45200434c+04a 39a    4338: 8a16f907aa4c6c42 2b6   45c0: 205846ad37030a0a 1b9
40b8: a273a9009500e8e0 41b   4340: a200bd04709d00d4 344   45c8: 0a49++8d0c70ee37 380
40c0: 8bd0+9a99320d2++ 581   4348: e8e019d0+5604c31 483   45d0: 03ad3703c919d00e 2aa
40c8: a93+85+b85+da905 498   4350: eaa9019d23709d26 387   45d8: a9138d4841a9008d 308
40d0: 85+ca9d965+ea011 537   4358: 70a9009d2570a9++ 3+3   45e0: 0b709d0c7060207e 282
40d8: a247a917200546a0 344   4360: 9d24709d3770bd28 35a   45e8: 464c9c4520794420 270
40e0: 29a91085+ca9c085 451   4368: 709d2770bd067029 302   45+0: 9044a9008d3703a9 2ea
40e8: +ea95191+ba90091 4be   4370: +e9d0870a9009a04 35d   45+8: c085+b85+da90785 447
40+0: +da9011865+c85+b 49+   4378: 709d05709d4c7060 33b   4600: +ca9db85+ea9078d 540
40+8: 85+da90065+c85+c 50d   4380: a9058d0e70a9408d 32+   4608: 0070a2638a205846 2bd
4100: 1869d485+ec9++d0 570   4388: 0+70a90a8d1070a9 2e8   4610: 8a48a20a20aa4668 2+6
4108: e0e84c0941a50dc9 3d9   4390: 008d1170a2002051 221   4618: aae8e067+00eca8a 52b
4110: 01d030ad16d029e8 3a5   4398: 43a207205143a20e 250   4620: 205846e8a00a20b9 329
4118: a673e001+002050+ 300   43a0: 205143a9018d2170 27c   4628: 464c0c46a9202058 225
4120: 8d16d0e60da9818d 41d   43a8: 60ce7a52ad7a52c9 43c   4630: 46ad3703a0a0a8d 1d8
4128: 19d0ad11d0297+8d 3ac   43b0: 00d01aa9048d7a52 2+0   4638: 0c70ee3703ad3703 28b
4130: 11d0a9ca8d12d020 3e3   43b8: ae7652e8e004d002 414   4640: c919d00ea9008d0c 302
4138: 7b4820404320++53 228   43c0: a2008e7652bd7e52 385   4648: 708d0b70a9138d48 309
4140: 4c+a41c902d02ba9 3+6   43c8: a0dc205945ce7b52 3d5   4650: 4160206946+c0a46 20c
4148: 1+8d18d0ad16d029 350   43d0: ad7b52c900d01aa9 3d6   4658: a0004891+bad0070 391
4150: +80910050+8d16d0 298   43d8: 018d7b52ae7752e8 3ba   4660: 91+d68c8c028d0+2 568
4158: e60da9818d19d0ad 440   43e0: e004d002a2008e77 35d   4668: 60a5+b38e92885+b 4c9
4160: 11d0297+8d11d0a9 3a0   43e8: 52bd8252a0dd2059 3d9   4670: 85+da5+ce90085+c 58d
4168: e28d12d020a9434c 3a9   43+0: 45ce7c52ad7c52c9 425   4678: 1869d485+e60a5+b 4d8
4170: +a41c903d020ad6+ 413   43+8: 00d01aa9038d7c52 2+1   4680: 18692885+b85+aa5 450
4178: 528d21d0e60da981 3ed   4400: ae7852e8e00ad002 41c   4688: +c690085+c1869d4 43b
4180: 8d19d0ad11d0297+ 3ac   4408: a2008e7852bd8652 38+   4690: 85+e60a9008d0270 382
4188: 8d11d0a9+b8d12d0 481   4410: a0de205945ce7d52 3d9   4698: bde25091+bad0170 499
4190: 204c534c+a41c904 313   4418: ad7d52c900d01aa9 3d8   46a0: 91+dc8e8cc0270d0 54c
4198: d05da901850da900 312   4420: 018d7d52ae7952e8 3be   46a8: e+60a0e688eaeac0 5+1
41a0: 8d21d0a9138d19d0 3a+   4428: e006d002a2008e79 361   46b0: 00d0+9caa000d0+2 535
41a8: ad16d029+88d16d0 427   4430: 52bd9052a0d+2059 3e9   46b8: 6088d0+de60a05+86 49c
41b0: a9818d19d0ad11d0 42e   4438: 4560a200ad5b4449 2dc   46c0: a515c900d00ac000 31d
41b8: 2974d11d0a9518d 39d    4440: 088d5b448d5e44c9 3a4   46c8: d0+5cae000d0ee60 56d
41c0: 12d0203a44a511c9 2++   4448: 00d00+ee5c44ad5c 376   46d0: c903d00ea510c900 328
41c8: 02+013a50e38e510 2e5   4450: 44c918d005a9108d 340   46d8: +005a9008515604c 2e4
41d0: 850e2980c960d014 369   4458: 5c44bd00109d003+ 249   46e0: 5253a9008513 4c40 272
41d8: 206b474cec41a50e 2+e   4460: e8e080d0+560a200 50+   46e8: 53a90085+b85+da9 4a7
41e0: 1865108 50ec90830 221  4468: bd70529d6c52e8e0 4a2   46+0: 0485+ca9d885+ea9 532
41e8: 03201a46a50e2907 168   4470: 04d0+5a91+8d4841 3a7   46+8: 0a8d23d0a90e6d22 2+0
41+0: 850+850e2049534c 22+   4478: 60a200a9009d6c52 306   4700: d0a9096d0170a004 324
41+8: 004268a868aa6840 30c   4480: e8e004d0+8851385 4b1   4708: a200a912209546a0 2+8
4200: a513c901d050a515 35c   4488: 73850e8510850460 284   4710: 94a20e297c4e911 252
4208: c900d04aa5c5c904 41a   4490: a200bd96529d0470 358   4718: 209546a00+a21b20 297
4210: d007a90185154c56 2bd   4498: 9d00d4e6e019d0+2 514   4720: 7e46a9172095 46a0 31+
4218: 42c905d007a90285 317   44a0: a9008d217060a9+a 3ca   4728: 0ea223207e46a917 277
4220: 154c5642c93cd007 2d5   44a8: 85+b85+da90485+c 530   4730: 209546a9078d0170 2a9
4228: a90385154c5642c6 2+0   44b0: a9d885+ea9018d01 43c   4738: a01ba921a2e52095 3c1
4230: 14a514c900d01+a9 32e   44b8: 70a914a22c209346 2+4   4740: 46206946a01ba921 29a
4238: 148514ad+a044980 321   44c0: 207e46207e46a000 268   4748: a2d+2095462069 46 34b
4240: 8d+a048d4a05ad+b 40+   44c8: 209846a9008515a9 2ea   4750: a019a91+a2d92095 3b1
4248: 0449808d+b04ad4b 351   44d0: 148514a901857095 2d4   4758: 46206946a9058d01 251
4250: 0549808d4b05ad21 279   44d8: 1360a900a2009d00 25b   4760: 70a019a927a2eb20 3a6
4258: 70c901+0034c4e43 30a   44e0: d0e8e011d0+88d15 513   4768: 954660204653a901 29e
4260: a9038d0d70a9058d 2ee   44e8: d08d17d08d1cd08d 449   4770: 8504e61260a001a2 324
4268: 0e70a200bc2270c0 32e   44+0: 1cd0a9018d1dd0ae 3b0   4778: 00b9+8069d+80b6b9 40b
4270: 00d0034c344388bd 2db   44+8: c69848a9be201a49 392   4780: +8da9d+8dab92007 521
4278: 08702901c901+028 284   4500: 20524968a8c8c0e0 433   4788: 9d2007b920db9d20 335
4280: de2370bd2370c900 38a   4508: d0e+a2c9a0008a99 4ed   4790: dbb948079d4807b9 388
4288: +0034c3443984 8bc 352  4510: +807c8e8e8e8c909 547   4798: 48db9d48dbb97007 413
4290: 4+70b96e709d0470 367   4518: d0+460a0008d0270 3c3   47a0: 9d7007b970db9d70 425
4298: b9d2709d057068a8 41d   4520: 98488a48a920a03e 359   47a8: dbb998079d9807b9 426
42a0: ba08709019d0870 254    4528: a20020d34868aa68 357   47b0: 98db9d98dbb9c007 503
42a8: bd2770dd2670+006 3b+   4530: a8a93e91+bad0170 439   47b8: 9dc007b9c0db9dc0 515
42b0: +e2770+c3443a900 301   4538: 91+d98488a48bde2 4d+   47c0: dbe8c8e027d0b2a5 5b9
42b8: 9d2770+e2570bd25 3a9   4540: 50a03ea21420d348 31+
42c0: 70dd2670+0034c34 356   4548: 68aa68a8bde25091 4a2
```

(continued on next page)

(continued from previous page)

```
47c8: 12186927a8b90018 233
47d0: 9df80d6b9001e9df+8 487
47d8: dab900139d2007b9 329
47e0: 001f3d20dbb9001a 28a
47e8: 9d4807b900205d46 2aa
47f0: dbb9001b9d7007b9 37c
47f8: 00219d70dbb9001c 2de
4800: 9d9807b900225d98 34c
4808: dbb9001d9dc007b9 3ce
4810: 00239dc0dba90009 389
4818: 0460204353a90205 24a
4820: 04c61260a026a227 2cb
4828: b9f80d69df806b9+8 583
4830: da9af9dab9200f9d 4c6
4838: 2007b920db9d2d0b 373
4840: b94807b9d4807b948 2f5
4848: db9d48dbb9700f9a 468
4850: 7007b970db9d70db 493
4858: b998079d9807b998 3e5
4860: db9d98dbb9c00f9a 508
4868: c007b9c0db9dc0db 553
4870: ca88e000d0b2e412 46a
4878: 4ccd47a504c901d0 5a3
4880: 04207547600c902d0 2db
4888: 0320244860850558 1++
4890: 09840f7a901850689 24e
4898: 08a200362502506 139
48a0: 18250726056e6e003 23e
48a8: d0f1a200a000c185 3b9
48b0: 9107e6e0d6d001b0 399
48b8: c6058a48e0920d0a 329
48c0: 4668aaad0bb107c8 37e
48c8: 9107888c0++d0ee5 52c
48d0: 4cac48850be09884 2da
48d8: 07a901950e6506a2 26d
48e0: 0019250526061826 0ad
48e8: 07260be8e003d0+1 3c1
48f0: b000b1059107984f 2ce
48f8: a689e000+0032bbd 35+
4900: 4668a8c8c005d8ea 4a0
4908: 50850ca900950519 23c
4910: c6506650519660666 1c1
4918: 05605506b6098409 2db
4920: a2006b0586071bb6 238
4928: 0666051866086607 1e4
4930: e8e002d0+160a000 48b
4938: a2009b1059107e8c8 3a0
4940: e00d0d+69848ae09 438
4948: 20bd4e68a8c03+d0 40c
4950: e760ad00b1059107 335
4958: c8c03+d0+760a200 490
4960: a000b105950ae8c8 3a5
4968: c003d0+6b1058888 44+
4970: 883105c8c8c8c8c0 4+e
4978: 3+d0+1a200a03cb5 433
4980: 0a9105c8e6e003d0 403
4988: +660a202a03eb105 38e
4990: 950aca88c03ba0+6 4b2
4998: b105c8c8c8910588 42c
49a0: 888888c0++d0+1a2 5ca
49a8: 00a000b30a9105e8 2dd
49b0: c8e003d0+660a000 471
49b8: 18b1056a9105c8b1 347
49c0: 056a9105c8b1056a 2ed
49c8: 9105a9006a088611 2ca
49d0: 059105a8c8c8c03+ 3+2
49d8: d0aec0a03e18b105 3ba
49e0: 2a910583b105aa91 2b9
49e8: 0588b1052a9105a9 2ac
49+0: 0e2ac8c811059105 266
49+8: 888888c0++d0aee0 5c5
4a00: e003b1058888891 382
4a08: 05c8c8c8c8c03+d0 4+4
4a10: +1c8b1058888888 48+
4a18: 9105c8c8c8c8c8c0 53e
4a20: 43d0e+b1058888888 450
4a28: 9105c8c8c8c8c07+ 4+5
4a30: d0+188a900910588 410
4a38: 9105889105c0a07b 32+
4a40: e105c8c8c8910588 42c
4a48: 888888c03+d0+188 4e0
4a50: b105c8c8c8c89105 45c
4a58: 8888888888c03bd0 473
4a60: e+b105c8c8c89105 493
4a68: 88888888c0++d0+1 5a0
4a70: c8a900910c89105 365
4a78: c8910560a04218c1 369
4a80: 052a910589b1052a 22d
4a88: 910588b1052a9105 294
4a90: a9002a489838e93e 312
4a98: a8686ab1052a9105 2+0
4aa0: 88b1052a9105b8b1 337
4aa8: 052a9105988168945 223
4ab0: a8c081d0c960a000 482
4ab8: 18b1056a9105c8b1 347
4ac0: 056a9105c8b1056a 2ed
4ac8: 9105a9006a489818 2a1
4ad0: 693ea8682ab1056a 301
4ad8: 9105c8b1056a9105 314
4ae0: c8b1056a9105989e 34e
4ae8: e93+a8c03+d0c960 4c8
4af0: a900856+8d20d08d 3a7
4af8: 21d020da44207944 30c
4b00: a99320d2++a9138d 476
4b08: 48412de94620ae44 2e2
4b10: a99b8d07d08d09d0 40e
4b18: a9386d06d06d06d0 3a9
4b20: a9078d2ad08d2bd0 3b+
4b28: a9++8d15d0a954a0 4+7
4b30: d2a219201a492036 266
4b38: 49a93985+b85+da9 4d6
4b40: 0e85+ca9da85+ea9 536
4b48: 038d0170a906a254 2a6
4b50: 201b45a994a0d520 352
4b58: 1a49205249a20a20 1ea
4b60: bd46ee09d0ad09d0 450
4b68: c9bba0+1a9bb8a01 537
4b70: d08d03d0a9++8d00 465
4b78: d0a992a0ca201a49 3+8
4b80: 205249a90e8d27d0 2+6
4b88: a2006a48a9c92009 30+
4b90: 49207c4aa21420bd 2c2
4b98: 4668aae8e018d0ea 4+2
4ba0: a9e68d02d0a9048d 428
4ba8: 28d0a297e09d+0+a 596
4bb0: 8a48a0cc201a4920 2e1
4bb8: 5249ce02d0ce02d0 3db
4bc0: ce00d0a20a20bd46 36d
4bc8: 68aae8ad02d0c94a 48c
4bd0: d0daa200a9cb2009 3e9
4bd8: 49207c4aa8e018d0 3d+
4be0: +3a2008a48a9d520 405
4be8: 0949205e49ce00d0 2b7
4bf0: a20a20bd4668aaad 38e
4bf8: 00d0c94cd0e5a2a4 4e0
4c00: 8a48a0d5201a4920 2ea
4c08: 5249a21e20bd4668 2e6
4c10: aacae09cd0eaa200 54c
4c18: 8a48a9c920094920 2d6
4c20: 3e4aa21420bd4668 2c9
4c28: aae8e015d0eaa908 4+2
4c30: 8d2bd08d2cd0a994 44e
4c38: a0d5a219201a4920 2d3
4c40: 3649207e46207e46 247
4c48: 207e46207e46a907 278
4c50: a25a201b45a9388d 2ea
4c58: 0ad0a9bb8d0bd0a9 44+
4c60: 94a0d8201a492052 301
4c68: 49a20a20bd46ee0a 310
4c70: d0ad0ad0c9b8d0+1 599
4c78: a20a20bd46ce0bd0 378
4c80: ad0bd0c99bd0+18d 53a
4c88: 01d09d03d0a9038d 36a
4c90: 10d0e9208d00d0a9 3a+
4c98: 0a8d02d0a2008e48 2dd
4ca0: a9c920094920094a 24e
4ca8: a21420bd4668aae8 3d3
4cb0: e015d0eaa2008e48 423
4cb8: a9cb20094920be64a 30e
4cc0: a20+20bd4668aae8 3ce
4cc8: e018d0eaa297e09d 568
4cd0: +0+a8a48a8cc201a 462
4cd8: 4920524ad02d038 2ab
4ce0: e902b00748a9018d 321
4ce8: 10d0688d02d0ce00 375
4cf0: d0a20a20bd4668aa 3b1
4cf8: e8ad02d0c9cad0ce 598
4d00: a200a9cb20094920 2a8
4d08: 7c4ae8e018d0+3a2 50b
4d10: 008a48a9d8200949 2c5
4d18: 205e49ad00d038e9 365
4d20: 01b00748a9008d10 246
4d28: d0688d00d0a20a20 3b1
4d30: bd4668aaaad00d0c9 45b
4d38: d0d0d6a2a48a48a0 52e
4d40: d8201a49205249a2 2b8
4d48: 1e20bd4668aacaae0 3+d
4d50: 9cd0eaa20a20bd46 425
4d58: ee01d0ad01d0c9bb 4c1
4d60: d0+1a90a8d2cd0a9 4a6
4d68: 94a0d8a219201a49 34a
4d70: 203649a94985+b85 396
4d78: +da90685+ca9da85 535
4d80: +ea907a26120ba45 331
4d88: a990a0ca201a4920 346
4d90: 5249a21420bd46a9 31d
4d98: c9200949207c4ace 2ef
4da0: 00d0ce00d0ad00d0 3eb
4da8: c9a0d0e6207e4620 423
4db0: 7e46207e46207e46 28c
4db8: a908a268201b45a9 2e4
4dc0: b8a0cb201a492052 318
4dc8: 49a9b8a0ce201a49 39b
4dd0: 205249a9078d28d0 2+0
4dd8: 8d29d0a96a8d03d0 3+9
4de0: 8d05d0a9208d02d0 38a
4de8: a9388d04d0a9048d 37c
4df0: 10d0a2008a48a9cb 3c8
4df8: 200949203e4aa9ce 291
4e00: 200949203e4aa207 1c3
4e08: 20bd4668aae8e015 412
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4e18: +a07a20720bd46ee 3bb
4e20: 03d0ee05d020d150 3d7
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4e30: b68d+907a91a8d02 395
4e38: d0a20720bd46ee02 38c
4e40: d0ee05d020d150ad 481
4e48: 05d0c9e1d0ebe9ba 59a
4e50: 8d+a07a93e8d04d0 3d5
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4e60: a015a200988488a48 309
4e68: a20520bd46ad02d0 349
4e70: 186901900748a902 20c
4e78: 8a10d0688d02d0ad 3e1
4e80: 04d038e901c00748 2+5
4e88: a9008d10d0688d04 30+
4e90: d020d150ad02d0c9 459
4e98: 4ed004a9018505ad 304
4ea0: 04d0c90cd004a901 327
4ea8: 850768ae68a8ad10 36b
4eb0: d0c902d00aad02d0 3+4
4eb8: c93ed0034c094+e6 364
4ec0: 05a505c908d09da9 396
4ec8: 008505a506c901d0 2c+
4ed0: 1ee01ed007a90085 311
4ed8: 064ce74ea90a9d51 328
4ee0: 07a9019d51dbe8a5 407
4ee8: 07c901+0034c644e 2c2
4ef0: c0++d007a9008507 3cb
4ef8: 4c644ea90a997907 2ca
4+00: a9019979db884c64 3c+
4+08: 4ea9b88d+907a938 41d
4+10: 8d02d0a20a20bd46 32e
4+18: ce04d0ee03d020d1 454
4+20: 50ad04d0c91ad0eb 46+
4+28: a9b88d+a07a9208d 445
4+30: 04d0a20720bd4c6ee 38e
4+38: 03d0ee05d020d150 3d7
4+40: ad03d0c9eed0eba9 59b
4+48: 1a8d04d0a9b68d+a 461
4+50: 07a93e8d02d0a9ba 3b0
4+58: 8d+907a20520bd46 357
4+60: ad02d038e901b007 358
4+68: 48a9008d10d0688d 353
4+70: 02d0ee04d020d150 3d5
4+78: ad04d0c9a0d0dca9 53+
4+80: b6a0c+201a492052 31a
4+88: 49a9c+8d+a07a9ba 4b2
4+90: a0cc201a49205249 2aa
4+98: a9cc8d+907a2008a 42e
4+a0: 48a9c+20094920b6 308
4+a8: 4aa9cb200949207c 2cc
4+b0: 4aa2042[illegible]bd4668aa 325
4+b8: e8e018d0e2a9088d 550
4+c0: 02d0a9b88d04d0a9 43d
4+c8: 478d1dd0a9bca0cd 493
4+d0: 201a49205249a9bc 2a3
4+d8: a0ce201a49205249 2ac
4+e0: a2008a48a9cc2009 312
4+e8: 49207c4aa9ce2009 2c+
4++0: 4920b64aa20420bd 2ec
4++8: 4668aae8e00cd0e2 4de
5000: a9a08d0cd0a9ee8d 4d6
5008: 0dd0a9078d2dd0a9 3c0
5010: bc8d+e07a9+98d15 492
5018: d0ad6b52c901+003 3+7
5020: 4ca150a2008a48+e 3a+
5028: 5107a21920bd4668 29e
5030: aabd5107c90dd0ed 452
5038: 8a48a200a90da03e 308
5040: 20d34868aa48a93e 37c
5048: 9d5107bd3952a03e 31b
5050: a219208d4868aabd 37+
5058: 39529d5107e8e016 35e
5060: d0c3a2008a48+e79 47e
5068: 07a21920bd4668aa 2+7
5070: 0d7907c90dd0ed5a 45a
5078: 48a200a90da03e20 29e
5080: d34868aa48a93e9d 3+9
5088: 7907bd4+52a03ea2 35e
5090: 19208d4868aabd4+ 32c
5098: 529d7907e8e016d0 41d
50a0: c3a20a20bd46ce0c 36c
50a8: d0ad0cd0c95ed0+1 541
50b0: a20a20bd46ee0cd0 399
50b8: ad0cd0c9e1d0+1a2 596
50c0: 0a20bd46ce0cd0ad 384
50c8: 0cd0c9add0+14c52 4a4
50d0: 53ad+9074901 8d+9 3d0
50d8: 07ad+a0749018d+a 386
50e0: 07608a8b8e8+9192 3bc
50e8: 9596999a9d9e9+a0 4d8
50+0: 8c8d9020939497 98 41+
50+8: 9b9c20a1a2a3a4a8 489
5100: a9acadb0b1a5a6a7 535
5108: aaabaeafb2b34601 45e
5110: 203d204+4e452050 1c+
5118: 4c41594552204741 225
5120: 4d454603203d2054 1ac
5128: 574+20504c415945 241
5130: 522047414d454a55 22b
5138: 4e4b49455452 4+4+ 26b
5140: 5045525354 4+524d 27c
5148: 4552544845204a55 237
5150: 4b45504c41594552 25d
5158: 2001504c41594552 1ee
5160: 2002504c41592054 1cc
5168: 4845204741 4d4520 1e7
5170: 4c46464+52204c45 22a
5178: 56454c2dd0ccc1d9 44a
5180: c5d210112d171819 22d
5188: 1a1b1c1d1e1+2c21 0+8
5190: 22232425262728 2d 130
5198: d0ccc1d9c5a21213 4+2
51a0: 2d47414d4520204+ 1d6
51a8: 5645524348414c4c 251
51b0: 454e474520E05354 206
51b8: 4147454020010908 13+
51c0: 054e414c494e2053 1ea
51c8: 4841524d41b4b5b6 388
51d0: b7b8b9babbbcbdbe 5d4
51d8: c+2020204e59204+ 23f
5200: 0000000000002e20 0+e
5208: 2020452e412e2020 162
5210: 20202020032e0000 0c1
5218: 0000000000002e20 04e
5220: 2020452e412e2020 162
5228: 20202020204544+53 193
5230: 20032053434+5245 1c+
5238: 53d4c8c9d32dc7c1 548
5240: cdc52dc9d32dc4c3 511
5248: c4c9c3c1d4c5c4d4 642
5250: c+2dd3c+cdc5c+ce 5cd
5258: c52dc92dc+cec3c5 58d
5260: 2dcbcec5d7414e43 436
5268: 4548530000000000 0e0
5270: 00000006cacae0000 15c
5278: 0000040103013334 070
5280: 35362f3031323337 197
5288: 3839353539383733 1b6
5290: 6869e6b6c6d00000 27+
5298: 0008200+00000000 037
52a0: 08410e+100000008 142
52a8: 8007000000000+44 0ab
52b0: 4120233000c352ad 276
52b8: 6153544120534154 251
52c0: 539100d052b26153 36c
52c8: 5441205 3aa333200 217
52d0: dd52bc6153544120 354
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52e8: 4152535052495445 26a
52+0: 5300++52cb614a53 36d
52+8: 52209c415354000c 202
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5308: 531ca75458410017 21a
5310: 5326a7434c430024 216
5318: 5330a74144432023 235
5320: 323136002c533aa7 1+9
5328: 5048410034534+a7 24b
5330: 5441590041534ea7 277
5338: 4c4441202331393O 1ae
5340: 4c70674c09594c1c 239
5348: 594cea584cda584c 3e1
5350: cd58a2++9a20da44 49e
5358: a900851320d75320 2a0
5360: 0+5420a644206b53 24b
5368: 4cbbc53a9b885+b85 4c1
5370: +da90585+ca9d985 533
5378: +ea9078d0170ea9a 434
5380: 46a24ba00ea91a20 2c4
5388: 9546207e46207e46 2a3
5390: a9078d0170a00aa2 2+a
5398: 00a923209546207e 265
53a0: 46207e46a00aa219 28+
53a8: 209846a00aa23220 29c
53b0: 7e46207e46209846 2a6
53b8: ce9a4660a9008512 34e
53c0: 209055a901851185 2ca
53c8: 10a20120bd46a512 28d
53d0: c9++d0+54c+04aa2 5b5
53d8: 008a951be8e008d0 3da
53e0: +9a9018523852 4a2 396
53e8: 00207061a901a220 25d
53+0: 2070c1a900852+a9 2+7
53+8: 0085338525852 6a9 2b6
5400: 3285278528a90585 2be
5408: 29852a206b5560a9 2c1
5410: 9320d2++a90e8d23 3eb
5418: d0a9098d22d0a900 3aa
5420: 85+c85+da90485+c 530
5428: a9d885+ea9078d01 442
5430: 70a299a901a90a20 320
5438: 9546a01da2b5a917 3e+
5440: 209546a9098d0170 2ac
5448: a00ba2a3a91d20f5 3bc
```

To be continued.

software that's hard to beat...

MSX
AMSTRAD
48K SPECTRUM

TASWORD TWO

The Word Processor ✸

"If you have been looking for a word processor, then look no further."
CRASH June 1984

"The number of on-screen prompts, together with the excellent manual, make it ideal – even for an absolute beginner."
PERSONAL COMPUTER WORLD September 1983

"Without doubt, the best utility I have reviewed for the Spectrum."
HOME COMPUTING WEEKLY April 1984

TASWORD TWO ZX 48K Spectrum **£13.90**

TASWORD MSX

The Word Processor

The Tasman Word Processor for MSX microcomputers.
All the features of the Spectrum version.

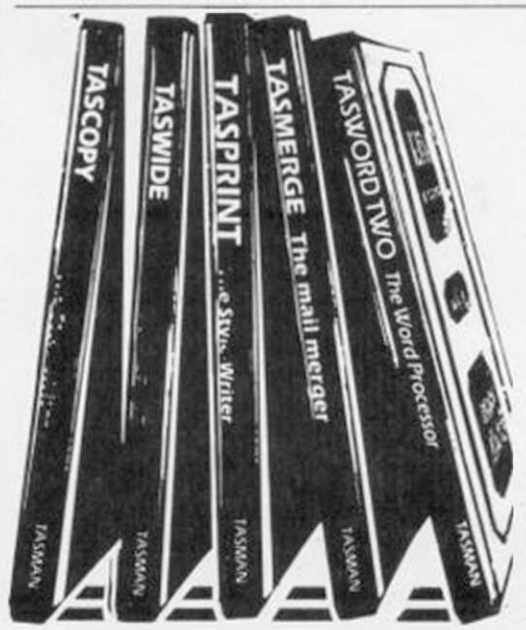
TASWORD MSX MSX Computers **£13.90**

TASCOPY

The Screen Copier

Screen copy software for Spectrum with Interface 1 and Amstrad CPC 464. Print high resolution screen copies (in a choice of sizes), and also large 'shaded' copies with different dot densities for the various screen colours. Tascopy supports all eight pin dot matrix printers with Epson type control codes, e.g. Epson RX-80 and FX-80, Shinwa CP-80, Mannesmann Tally MT-80, Star DMP 510/515, Brother HR5, and also Amstrad DMP 1 with the CPC 464.

TASCOPY ZX Spectrum **£9.90**
TASCOPY 464 Amstrad CP 464 **£9.90**



TASWORD 464

The Word Processor

The Amstrad implementation of Tasword Two plus many extra features.

TASWORD 464 Amstrad CPC 464 **£19.95**

TASMERGE

The Mail Merger

Transfer data from MASTERFILE to TASWORD TWO! Letters and forms typed on TASWORD TWO can be printed with addresses and data taken from MASTERFILE. The mail merge facility allows, for example, multiple copies of a letter to be printed, each containing a different name and address taken from your MASTERFILE data. To use TASMERGE you must have one or more microdrives as well as TASWORD TWO and MASTERFILE by Campbell Systems. (version 9 or later).

TASMERGE ZX 48K Spectrum **£10.90**

TASPRINT

The Style Writer

A must for dot-matrix printer owners! Print your program output and listings in a choice of five impressive print styles. TASPRINT utilises the graphics capabilities of dot-matrix printers to form, with a double pass of the printhead, output in a range of five fonts varying from the futuristic DATARUN to the hand-writing style of PALACE SCRIPT. TASPRINT drives all dot-matrix printers with bit image graphics capabilities and can be used to print TASWORD text files. TASPRINT gives your output originality and style!

TASPRINT ZX 48K Spectrum **£9.90**
TASPRINT Amstrad CPC 464 **£9.90**

TASWIDE

The Screen Stretcher

With this machine code utility you can write your own Basic programs that will, with normal PRINT statements, print onto the screen in the compact lettering used by TASWORD TWO. With TASWIDE you can double the information shown on the screen!

TASWIDE ZX 48K Spectrum **£5.50**

TASMAN PRINTER INTERFACE

Plug into your Spectrum and drive any printer fitted with the Centronics standard parallel interface. Supplied complete with ribbon cable and driving software. The user changeable interface software makes it easy to send control codes to your printer using the method so successfully pioneered with TASWORD TWO. The cassette also contains fast machine code high resolution full width SCREEN COPY SOFTWARE for Epson, Mannesmann Tally, Seikosha, Shinwa, Star, and Tandy Colour Graphic (in colour!) printers. Compatible with microdrives and ZX Interface 1.

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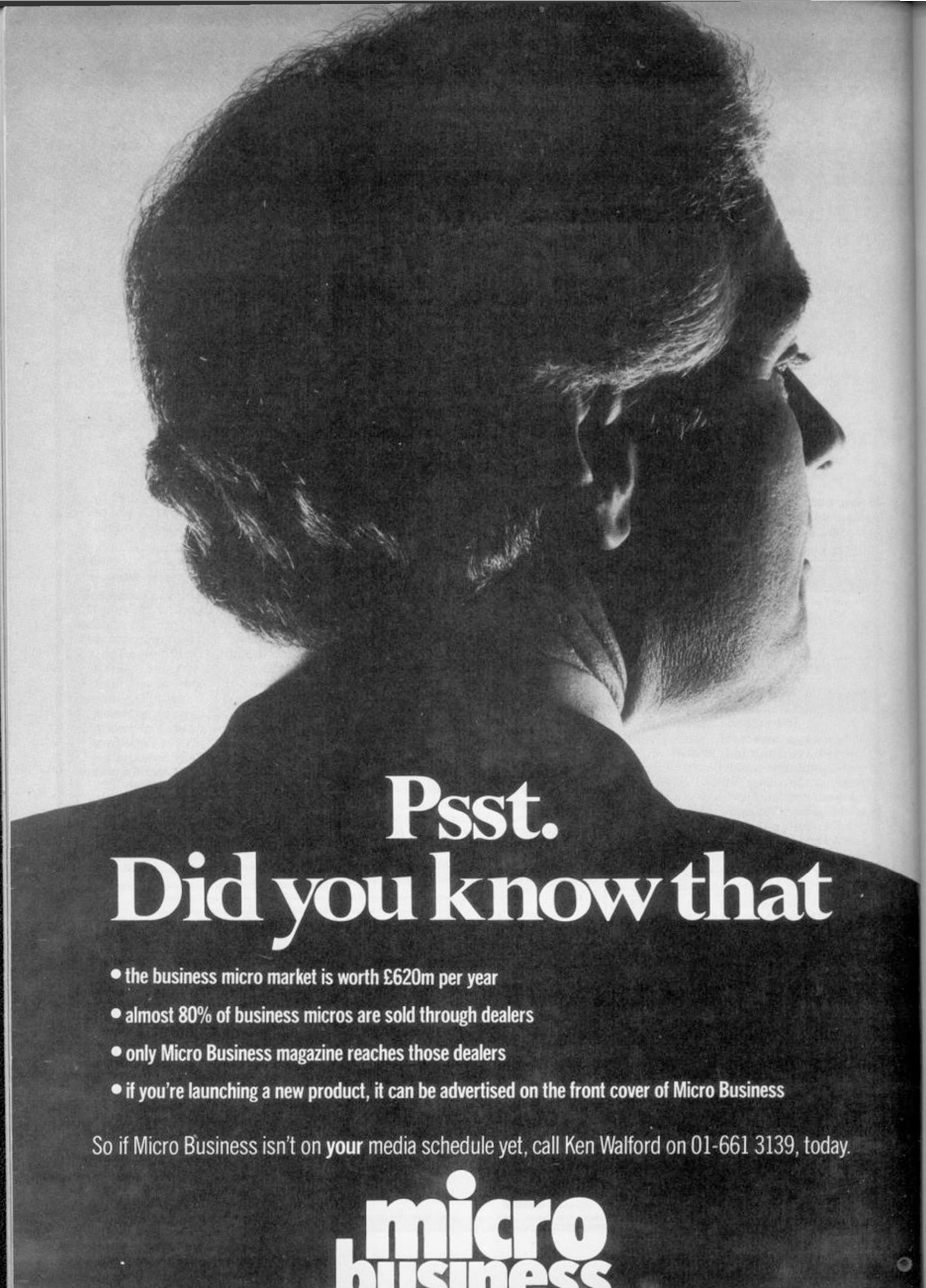
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TOP★ TIPS

MEMORY LOOK

To enable the contents of the memory holding a Basic program to be examined I have written the following utility which uses line numbers from 9000 onwards. This allows it to be added to the end of existing programs using Merge "" instead of Load "".

Once installed the direct command Go To 9000 should be used to execute the routine. The screen is filled with the memory locations, the corresponding contents in decimal and where applicable the ASCII character or keyword.

The "scroll?" prompt appears after each screen fill and allows you to stop by pressing key N.

Alan Pratt

```
9000 REM Examine memory
9010 CLS : LET s=PEEK 23635+PEEK
 23636*256-1: GO TO 9010
9020 LET p=PEEK s
9030 IF p=13 THEN GO TO 9200
9040 IF p=14 THEN GO TO 9300
9050 IF p<10 THEN PRINT s;"
 0";p;" ";
9060 IF p>9 AND p<100 THEN PRINT
 s;" ";p;" ";
9070 IF p>99 THEN PRINT s;" ";p
;" ";
9080 IF p>31 THEN PRINT PAPER 5;
CHR$ p
9090 IF p<32 THEN PRINT
9100 LET s=s+1: GO TO 9020
9200 PRINT s;" ";p;" ";: PAPE
R 4:"end of line"
9210 LET s=s+1: LET p=PEEK s+256
*PEEK (s+1)
9220 PRINT s;" ";: PAPER 6:"Line
 No.";p
9230 LET s=s+2: LET p=PEEK s+PEE
K (s+1)*256
9240 PRINT s;" ";: PAPER 6:"No.
of bytes =";p
9250 LET s=s+1: GO TO 9100
9300 PRINT s;" ";p;" ";: PAPE
R 4:"number held as"
9310 PRINT s+1;
9320 FOR i=s+2 TO s+5
9330 PRINT PEEK i;" ";
9340 NEXT i
9350 PRINT: LET s=s+5: GO TO 91
00
```

HEX-DEC/DEC-HEX

This is a machine-code program which is for the CBM 64 and readily converts either hexadecimal to decimal or decimal to hexadecimal.

To do this you simply type the following:

for dec/hex
SYS 49152,***** (decimal number)
for hex/dec
SYS 49242,$**** (hexadecimal number)

Gary Taylor

```
30000 REM HEX-DEC & DEC-HEX
30010 ADD=49152:C=0
30020 READ A:IF A<0 THEN END
30030 POKE ADD+C,A:C=C+1:GOTO 30
020
30040 DATA 32,253,174,32,138,173
,32,247,183,170,152,72,72,138,72
,72
30050 DATA 169,36,32,210,255,104
,32,38,192,104,32,43,192,104,32,
38
30060 DATA 192,104,32,43,192,96,
24,104,104,104,104,41,15,24,105,
48
30070 DATA 201,58,144,2,105,6,32
,210,255,96,234,234,234,32,115,0
30080 DATA 201,58,41,15,144,2,10
5,8,96,32,61,192,10,10,10,10
30090 DATA 133,35,32,61,192,101,
35,133,35,96,32,115,0,201,36,240

30100 DATA 3,76,8,175,32,73,192,
133,34,32,73,192,165,34,166,35
30110 DATA 32,205,189,76,116,164
,234,234,-1
```

RESPONSE Frame

Do you have a problem related to your micro? Tim Hartnell will do his best to help. Please include only one question per letter and mark it "Response Frame". Alternatively, perhaps you have an idea you'd like to pass on to others. Why not write to us with your top tips?

BBC FILL-IN

■ **I have owned my BBC Model B computer for over eight months and have not experienced any problems with it until now. I discovered the problem when I accidentally used a recently-obtained "fill" routine on a screen full of text. When the routine encounters the text, the computer locks up, and I have to resort to the Break key, or it produces a variety of very strange error messages, depending on which graphic mode it is used in. The "fill" routine uses the Point command and it is the lines which contact this command which produce the error messages. To start the routine, I used the command Procfill (500,500). I would be pleased if you could tell me if the fault is in the programming, if it is a universal fault in all PS 1.2's or if it is just my computer at fault. Here is the offending program:**

```
10 DEFPROCFILL (X%, Y%)
20 CLEAR
30 X=X%:Y=Y%
40 IF POINT (X,Y)=0 THEN PLOT
    69,X%,Y%
50 IF POINT ((X+4),Y)=0 THEN
    PROCFILL ((X+4),Y)
60 IF POINT (X,(Y+4))=0 THEN
    PROCFILL (X,(Y+4))
70 IF POINT ((X-4),Y)=0 THEN
    PROCFILL ((X-4),Y)
80 IF POINT (X,(Y-4))=0 THEN
    PROCFILL (X,(Y-4))
```

Darren Powell,
Thorne,
Doncaster.

THE PROBLEM lies in the program, not in the operating system or your computer. For a start, you should not use Clear within a procedure as this strips the return address for exiting the procedure from the stack, so it can return to almost anywhere in the program.

The BBC Micro generates meaningless random error messages under certain circumstances, so the content of the messages you have generated is irrelevant. Your routine, even without the Clear, is probably the least sophisticated "fill" routine possible. As it is recursive, it is also very, very memory-hungry.

It probably consumes around 60 bytes every time it calls itself. When you try to "fill" on a page of text, more than half the screen is blank, so the number of self-calls will be huge, giving rise to the problems you've experienced. I suggest you delete the Clear, and only use your routine for filling relatively small shapes.

COLOURED MAN

■ **I have an Amstrad computer and am presently writing a program in Mode 1. I want to include a figure of a man, made up of five user-defined graphic shapes. However, I want to mix colours within particular defined graphics and cannot figure out how to do this. Can it be done?**

M Smith,
Stoke-on-Trent.

MODE 1, AS you know, gives four colours but there is no way in Basic which I can discover which will allow more than one colour to be used for a user-defined graphic. Although this would doubtless produce a program which ran more slowly, you could user Line and Draw to construct your figure as these do allow you to do colour changes.

WHICH MODEM?

■ **I am looking for help on the subject of modems for the Electron. I am interested in buying one, but am not sure which are available.**

Richard Rennie,
West Calder,
West Lothian.

I HAVE BEEN unable to locate any modems made specifically for the Electron. If you get an RS-423 interface for your Electron, you will then be able to hook your computer to any modem made for the BBC. In fact, with this interface, you'll probably be able to use any standard 1200 baud modem.

CBM-64 SOUND

■ **In a recent edition of *Your Computer* magazine I saw an advertisement for a "digital sound sampler" for the ZX Spectrum. I own a Commodore 64, and wonder if there are similar products available for it?**

Stewart Sadler,
Tollesbury.

WHILE I have not been able to track down a sound sampler as such, I've discovered that many of the music synthesiser programs available for the 64 give you the capability of generating many non-musical sounds. The *Commodore Music Maker,* which you might have seen, includes a small keyboard which actually sits on the Commodore's keys, and comes with driver software. If you want to generate speech, the cassette program from an American company, *Big-Mouth,* is available. There is also the plug-in speech module from Commodore called *Magic Voice.*

VIC DISC DRIVE

■ **I am a Vic-20 owner, and after a couple of years' computing I now wish to invest in a disc drive. The obvious choice is the Commodore drive, but this is fairly expensive.**

Andrew McFarlane,
Sheffield.

THE EASIEST route to follow is to buy an RS-232 interface for your Vic-20, which will give you the ability to choose from a very wide range of disc drives — and, incidentally, other peripherals as well.

AMSTRAD COLOUR

■ **I am considering buying an Amstrad CPC-464. However, there is one thing I have not been able to find out from the articles which have been printed on it. If I buy a green-screen monitor version, can I plug the computer into a colour television? If I can, will it produce a colour picture, or is the "colour circuitry" only provided with the colour version?**

Anthony Hodgson,
Sunderland.

THERE IS only one type of Amstrad machine, in terms of its ability to produce a colour picture. The only difference is in the monitor provided with the one you buy. You cannot connect the CPC-464 up directly to a colour television. However, Amstrad make a modulator, costing around £30, for this purpose.

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Dodgems

Julian Wood,
Downham Market,
Norfolk.

Spectrum

YOU CONTROL a white car running around a track of five lanes, trying to collect the yellow dots while avoiding the red computer-controlled car. Every so often the red car will drop a steering wheel — worth 50 points when collected. However, if you aren't quick enough, the red car will pick it up again. A dot is worth five points.

To make the game slightly more difficult, you have a limited amount of fuel. Once your fuel has run out, your car stops and it is only a matter of time before the red car crashes into you. When you crash you lose one of your three lives and when you have lost all your lives, a short tune is played, the game ends and you are invited to have another go. There is a high-score facility.

The amount of fuel changes from 500 to 400 to 300 units with each level completed. After three levels you receive a bonus number of points, the fuel returns to 500 units and the game becomes slightly harder. A level is completed when all the dots have been collected. At the beginning of each level, and also when you receive a bonus, the computer plays a short tune.

To enter Dodgems, first type in the Basic program in listing 1. Then enter a line 1 Rem followed by the letter "a" 384 times — or 12 lines' worth. This is used to hold the machine code. Then Run 9990 and carefully enter the decimal values in listing 2. In the left-hand column are the addresses and on the right-hand side, in brackets, are the addresses and on the right-hand side, in brackets, are the checksum values. If you make a mistake, enter −1 and enter that line again.

After entering a line of five numbers, check the checksum value before entering the next line. When you have finished entering the machine code and are sure that everything is correct, delete lines 9990-9995 and save the program using

SAVE "DODGEMS" LINE 15

When the program is run, there is a short pause while the user-defined graphics are set up and then the game starts. I moves your car in a lane, O moves it out a lane. You can move in or out up to two lanes at once, as can the red car.

The program uses four machine code subroutines:

23760—prints a certain number of dots used in setting up the display
23807—the explosion sound-effects routine
23848—moves the white car, and also decreases and prints amount of fuel
24011—moves the red car

The routines use two Rom subroutines:

8141—executes a #2, thus allowing printing in the upper half of the screen #n can also be achieved by: LD A,n: CALL 8143
6683—prints a decimal number in the range 0-9999.

Listing 1.

```
  15 RESTORE 20: FOR a=USR "a" T
O USR "o"-1: READ b: POKE a,b: N
EXT a
  20 DATA 0,0,0,7,15,25,24,24,0,
0,0,255,255,0,0,0,24,24,24,24,24
,24,24,24
  30 DATA 0,0,0,224,240,56,24,24
,24,24,56,240,224,0,0,0,24,24,28
,15,7,0,0,0
  40 DATA 189,255,189,60,24,153,
255,153,231,66,242,255,255,242,6
6,231,0,0,0,24,24,0,0,0
  50 DATA 231,66,79,255,255,79,6
6,231,153,255,153,24,60,189,255,
189,137,82,85,82,168,90,42,201,2
4,24,255,255,24,24,24,24
  55 DATA 126,195,165,153,153,16
5,195,126
  60 DATA .2,-10,50,5,.2,-10,.5,
-5,.2,-10,50,5,.2,-10,.5,-3
  65 DATA .2,-10,50,5,.2,-10,.15
,-1,.15,0,.15,-1,.15,-3,.15,-1,.
15,-3,1,-5
  80 DATA .4,0,50,1,.4,-5,.2,4,5
0,1,.2,4,50,1,.2,4,50,1,.2,4,.1,
2,.3,0,1,-1
  90 DATA .1,-5,.1,-5,.3,4,.3,-5
,.3,4,.7,-5,.7,4,1,-5
 190 LET hi=0
 200 LET le=1: LET li=3: LET h=2
: LET s=0
 205 FOR m=500 TO 300 STEP -100
 210 LET p=0: GO SUB 1000: PRINT
 #1;" SCORE:";s;TAB 16;"HIGH:";h
i
 211 LET f=m: PRINT AT 7,23;"FUE
L";f;AT 12,23;"LIVES:";li
 212 PRINT AT 9,9; INK 7;"H";AT
9,12, BRIGHT 1; INK 2;"H"
 213 LET d=6: LET l=5: LET l1=5
 214 RESTORE 60: LET r=INT (RND*
15): FOR a=1 TO 18: READ b,c: IF
 b=50 THEN PAUSE c: GO TO 216
 215 BEEP b,c+r
 216 NEXT a: LET ts=0: LET x=9:
LET y=x: LET xr=12: LET yr=x: RA
NDOMIZE
 220 LET ch=152: LET x1=x: LET y
1=y: LET xr1=xr: LET yr1=yr: IF
NOT f THEN GO TO 350
 225 LET o=l: LET a$=INKEY$
 230 IF y>9 AND y<12 THEN LET x=
x+2*(x<9 AND a$="i" OR x>11 AND
x<20 AND a$="o")-2*(x>12 AND a$=
"i" OR x>1 AND x<10 AND a$="o"):
 IF x<>x1 THEN LET ch=ch+x-x1: L
ET l=l+(a$="i")-(a$="o")
 240 IF x>9 AND x<12 THEN LET y=
y+2*(y<9 AND a$="i" OR y>11 AND
y<20 AND a$="o")-2*(y>12 AND a$=
"i" OR y>1 AND y<10 AND a$="o"):
 IF y<>y1 THEN LET ch=ch+2*(y-y1
): LET l=l+(a$="i")-(a$="o")
 310 LET a=USR 23848
 320 IF a=6 THEN LET s=s+5: LET
ts=ts+1: BEEP .005,0: IF ts=179
THEN GO TO 510
 330 IF a=5 THEN LET s=s+50: BEE
P .1,20
 340 PRINT #1;AT 1,7;s
 350 IF x=xr AND y=yr THEN GO TO
 1100
 360 LET ch=152: IF RND*h<=1 THE
N GO TO 450
 380 LET a=(l1<l)-(l1>l)
 385 IF l<l1 AND o=l1 OR p THEN
LET p=NOT p: GO TO 450
 390 IF yr>9 AND yr<12 THEN LET
xr=xr+2*(xr<9 AND a=1 OR xr>11 A
ND xr<20 AND a=-1)-2*(xr>12 AND
a=1 OR xr>1 AND xr<10 AND a=-1):
 IF xr<>xr1 THEN LET ch=ch+xr-xr
1: LET l1=l1+a
 400 IF xr>9 AND xr<12 THEN LET
yr=yr+2*(yr<9 AND a=1 OR yr>11 A
ND yr<20 AND a=-1)-2*(yr>12 AND
a=1 OR yr>1 AND yr<10 AND a=-1):
 IF yr<>yr1 THEN LET ch=ch+2*(yr
-yr1): LET l1=l1+a
 450 LET a=USR 24011: IF NOT a A
ND RND>.99 THEN LET d=5
 500 GO TO 220
 510 FOR a=0 TO 100: NEXT a: LET
 le=le+1: NEXT a: LET h=h+h
 520 BORDER 1: PAPER 7: CLS : PR
INT AT 5,9; INK 0; FLASH 1;" LEL
L DONE! ";AT 8,6;" BONUS ";250*l
e/4;" POINTS "
 530 LET s=s+250*le/4: RESTORE 5
0: FOR a=1 TO 21: READ b,c: IF b
=50 THEN PAUSE c: GO TO 550
 540 BEEP b,c+r
 550 NEXT a: PRINT #1; FLASH 1;"
   PRESS ANY KEY TO CONTINUE";
 555 IF INKEY$<>"" THEN GO TO 55
5
 557 IF INKEY$="" THEN GO TO 557
 560 GO TO 205
1000 BORDER 0: PAPER 0: CLS : PR
INT USR 23760: INK 4
1015 PRINT INK 0;AT 10,0;;;;;;;;
INT AT 0,10;"▬";AT 21,10;"▬";AT
 10,0;"▌";AT 10,21;"▐";AT 11,21;
"▐"
1030 FOR a=0 TO 10 STEP 2: PRINT
 AT a,a;"▛";AT a,21-a;"▜": FOR b
=a+1 TO 9: PRINT AT a,21-b;"▬";A
T a,b;"▬";AT b,a;"▌";AT b,21-a;"
▐": NEXT b
1040 PRINT AT 21-a,a;"▙";AT 21-a
,21-a;"▟": FOR b=12 TO 20-a: PRI
NT AT 21-a,b;"▬";AT 21-a,21-b;"▬
";AT b,a;"▌";AT b,21-a;"▐": NEXT
 b: NEXT a
1045 INK 7: PRINT AT 2,23;"LEVEL
:";le
1050 RETURN
1100 PRINT AT y,x; FLASH 1; BRIG
HT 1; INK 2; PAPER 6;"✖": IF USR
 23807 THEN LET li=li-1
1105 DATA .6,0,.6,0,.1,0,.6,0,.5
,3,.1,3,.3,2,.3,0,.3,0,.3,-1,1,0
1110 IF li THEN GO TO 210
1120 BORDER 2: PRINT INK 2;AT y,
x;"✝": RESTORE 1105: FOR a=1 TO
11: READ b,c: BEEP b,c+r: NEXT a
1125 IF s>hi THEN LET hi=s: PRIN
T #1; FLASH 1; INK 7; PAPER 0;AT
 1,21;hi
1130 BORDER 0: PRINT AT 17,23; F
LASH 1;"PRESS ANY";AT 18,23;" KE
Y FOR ";AT 19,23;" ANOTHER ";AT
20,23;"  GAME  "
1135 IF INKEY$<>"" THEN GO TO 11
35
1137 IF INKEY$="" THEN GO TO 113
7
1140 CLS : GO TO 200
9990 LET c=0: FOR a=23760 TO 241
44 STEP 5: LET p=c
9991 PRINT a;"-";: FOR b=0 TO 4
9992 INPUT d: IF d=-1 THEN LET c
=p: PRINT : LET a=a-5+NOT b: GO
TO 9991
9994 IF d<0 OR d>255 THEN BEEP .
5,-10: GO TO 9992
9995 POKE a+b,d: LET c=c+d: PRI
NT TAB 6+b*4;d;: NEXT b: PRINT T
AB 25;"(";c;")": NEXT a
```

Listing 2.

```
23760-205 205  31   14   0   (455)
23765-62   16  215  62   6   (816)
23770-215  6   21   62   152 (1272)
23775-215  16  251  62   16  (1832)
23780-215  175 215  62   22  (2521)
23785-215  121 215  62   10  (3144)
23790-215  62  32   215  62  (3730)
23795-32   215 62   10   215 (4287)
23800-12   62  21   185  32  (4579)
23805-215  201 6    10   33  (5044)
23810-0    0   126  211  254 (5635)
23815-35   124 254  64   32  (6144)
23820-247  16  242  201  229 (7079)
23825-213  68  77   33   0   (7470)
23830-0    17  32   0    25  (7544)
23835-16   253 9    1    0   (7823)
23840-88   9   126  209  225 (8480)
23845-254  4   201  221  42  (9202)
23850-75   92  1    74   0   (9444)
23855-221  9   221  78   25  (9998)
23860-221  70  26   11   221 (10547)
23865-113  25  221  112  26  (11044)
23870-62   16  215  62   7   (11406)
23875-215  62  22   215  62  (11982)
23880-7    215 62   28   215 (12509)
23885-205  27  26   62   6   (12835)
23890-215  221 94   103  221 (13589)
23895-86   110 221  110  69  (14285)
23900-221  102 75   62   9   (14754)
23905-186  56  7    44   205 (15254)
23910-16   93  32   43   45  (15483)
23915-62   11  180  48   7   (15799)
23920-45   205 16   93   32  (16190)
23925-1    44  62   11   187 (16495)
23930-48   10  36   229  107 (16925)
23935-205  16  93   225  32  (17496)
23940-16   37  62   9    187 (17807)
23945-56   10  37   229  107 (18246)
23950-205  16  93   225  32  (18817)
23955-1    36  221  117  69  (19261)
23960-221  116 75   205  16  (19894)
23965-93   79  62   16   215 (20359)
23970-175  215 62   22   215 (21048)
23975-122  215 123  215  62  (21785)
23980-32   215 62   16   215 (22325)
23985-62   7   215  62   22  (22693)
23990-215  124 215  125  215 (23587)
23995-221  126 96   131  149 (24310)
24000-245  122 148  71   241 (25137)
24005-128  128 215  6    0   (25614)
```

(continued on next page)

(continued from previous page)

```
24010-201 205 205 31  221(26477)
24015-42  75  92  1   74 (26761)
24020-0   221 9   221 94 (27306)
24025-118 221 86  126 221(28078)
24030-110 82  221 102 89 (28682)
24035-62  9   188 56  7  (29004)
24040-45  205 16  93  32 (29395)
24045-43  44  82  11  188(29743)
24050-48  7   44  205 16 (30063)
24055-93  32  1   45  62 (30296)
24060-11  187 48  10  37 (30589)
24065-229 107 205 16  93 (31239)
24070-225 32  16  36  62 (31610)
24075-9   187 56  10  36 (31908)
24080-229 107 205 16  93 (32558)
24085-225 32  1   37  221(33074)
24090-117 82  221 116 89 (33699)
24095-205 16  93  79  62 (34154)
24100-16  215 221 126 31 (34763)
24105-245 215 62  22  215(35522)
24110-122 215 123 215 241(36438)
24115-254 5   62  152 32 (36943)
24120-2   62  157 215 62 (37441)
24125-16  215 62  2   215(37951)
24130-221 54  31  0   62 (38319)
24135-6   185 32  3   221(38786)
24140-113 31  195 180 93 (39378)
```

Carnival Shootout

Tony Loton,
Stoke-on-Trent,
Staffordshire.

Amstrad

CARNIVAL SHOOTOUT is an arcade-style game for the Amstrad CPC-464. It is about 6K long and is written partly in Basic and partly in machine code. Typing the data in wrongly could cause the program to crash so it is best to save the program on tape before running

```
10 ENV 1,15,1,1:ENT 1,15,1,1:ENV 2,15,-1,1:RESTORE
20 REM CARNIVAL
30 FOR I=38500 TO 38546:READ A:POKE I,A:NEXT
40 DATA 221 , 126 , 0 , 38 , 0 , 61 , 111 ,205 , 26 ,
188 , 6 , 8 , 125 , 50 , 44 , 151 , 124 , 50 , 45 , 15
1 , 126 , 84 , 93 , 35 , 197 , 1 , 79 , 0 , 237 , 176
, 193 , 43 , 119 , 58 , 45 , 151 , 103 , 58 , 44 , 151
 , 111 , 205 , 38 , 188 ,  16,222,201
50 FOR I=38400 TO 38451:READ A:POKE I,A:NEXT
60 DATA 221,126,0,38,0,61,111,205,26,188,6,8,125,50,44
,151,124,50,45,151,17,79,0,237,90,126,84,93,43,197 , 1
 , 79 , 0 , 237 , 184 , 193 ,    35 , 119 , 58 , 45 ,
151 , 103 , 58 ,   44 , 151 , 111 , 205 , 38 , 188 , 1
6 ,  217 , 201
70 FOR I=39000 TO 39073:READ A:POKE I,A:NEXT
80 DATA 17 , 64 , 156 , 221 , 110 , 0 , 221 ,   35 , 2
21 , 102 , 0 , 237 , 90 , 68 ,    77 , 197 , 221 , 35
, 221 , 110 , 0 ,   221 , 35 , 221 , 102 , 0 , 17 , 0
, 0 , 205 , 29 , 188 , 193 , 221 , 35 , 221
90 DATA 94 , 0 , 221 , 35 , 221 , 86 , 0 , 237 , 90 ,
89 , 80 , 6 , 4 , 14 , 16 , 26 ,  119 , 19 , 35 , 16 ,
 250 , 6 , 4 , 43 , 43 , 43 , 43 , 205 , 38 , 188 , 13
,    62 , 0 , 185 , 194 , 139 , 152 , 201
100 SYMBOL AFTER 97:SYMBOL 97,0,0,48,88,248,184,4,28:S
YMBOL 98,28,28,14,7,61,88,36,8:SYMBOL 99,0,0,0,0,0,0,5
6,96:SYMBOL 100,96,96,112,120,0,0,0,0
110 SYMBOL 101,0,0,12,26,31,29,32,56:SYMBOL 102,56,56,
112,224,188,26,36,16:SYMBOL 103,0,0,0,0,0,0,0,28,6:SYMBO
L 104,6,6,14,30,0,0,0,0
120 SYMBOL 105,0,48,16,48,32,32,65,126:SYMBOL 106,127,
126,127,126,60,0,0,0:SYMBOL 107,0,128,64,64,128,0,0,0:
SYMBOL 108,0,0,0,0,0,0,8,8,24
130 FOR I=40000 TO 40063:READ A:POKE I,A:NEXT
140 DATA 0,48,0,0,0,16,0,0,0,16,0,0,0,16,0,0,0,16,0,0,
0,16,0,0,0,16,0,0,0,16,0,0,0,16,0,0,0,16,0,0,0,16,32,0
,0,16,16,0,0,16,16,0,0,48,16,0,0,48,48,48,16,16,48,48
150 FOR I=40064 TO 40127:READ A:POKE I,A:NEXT
160 DATA 0,0,0,0,0,0,0,0,0,80,0,0,0,80,0,0,0,240,160,0
,0,240,160,0,0,240,160,0,0,240,160,0,0,240,160,0,0,240
,160,0,0,240,160,0,0,240,160,0,0,80,0,0,0,80,0,0,0,240
,160,0,0,240,160,0
170 SC%=0:GOSUB 520
180 MODE 0:PAPER 0:CLS:INK 0,3:BORDER 3:INK 1,0:INK 2,
26:INK 3,20:INK 4,2:INK 5,0:INK 6,1:INK 7,24:INK 15,18
,9
190 SH%=0:FOR i=41000 TO 41063:POKE i,0:NEXT
200 SL=38500:SR=38400:SPRITE=39000
210 PEN 1:PRINT:PRINT:PRINT "a a a a a a a a a a a b b b
 b b b b b b":PRINT CHR$(22)+CHR$(1):PEN 2:LOCATE 1,
3:PRINT"c c c c c c c c c c d d d d d d d d d d":PRINT
 CHR$(22)+CHR$(0)
220 PEN 6:PRINT:PRINT " e e e e e e e e e e f f f f f
f f f f f":PRINT CHR$(22)+CHR$(1):LOCATE 1,7:PEN 2:PRI
NT" g g g g g g g g g g h h h h h h h h h h":PRINT CHR
$(22)+CHR$(0)
230 PEN 7:PRINT "i i i i i i i i i i j j j j j j j j j
 j":PRINT CHR$(22)+CHR$(1):PEN 2:LOCATE 1,11:PRINT"k k
 k k k k k k k l l l l l l l l l l":PRINT CHR$(22)+C
HR$(0)
240 LOCATE 1,25:PEN 3:PRINT" CARNIVAL SHOOTOUT";
250 X%=40:PEN 15:B%=35
260 CALL SL,3:CALL SL,4:CALL SR,7:CALL SR,8:CALL SL,11
:CALL SL,12
270 IF INKEY(71)=0 AND F=0 AND X%>0 THEN GOSUB 330:X%=
X%-2
280 IF INKEY(63)=0 AND F=0 AND X%<72 THEN GOSUB 330:X%
=X%+2
290 IF INKEY(47)=0 AND F=0 THEN F=1:Y%=7:BX%=X%:SOUND
2,0,0,15,2,0,10:B%=B%-1:LOCATE 9,1:PRINT B%:IF B%<0 TH
EN 440
300 CALL SPRITE,X%,23,0
310 IF F>0 THEN GOSUB 350
320 GOTO 260
330 CALL SPRITE,X%,23,1000
340 RETURN
350 Y%=Y%+32:IF Y%>190 THEN F=0:CALL SPRITE,BX%,Y%-32,
1000:RETURN
360 IF Y%>39 THEN CALL SPRITE,BX%,Y%-32,1000 ELSE CALL
 SPRITE,BX%,Y%-16,1000
370 CALL SPRITE,BX%,Y%,64
380 IF TEST(X%*8+14,Y%*2+10)<>0 THEN 400
390 RETURN
400 CALL SPRITE,BX%-2,Y%+16,1000:CALL SPRITE,BX%+2,Y%+
16,1000:SH%=SH%+1:SC%=SC%+RND*10+10
410 SOUND 1,60,0,0,1,1:F=0:CALL SPRITE,X%,Y%,1000
420 IF SH%=30 THEN 480
430 RETURN
440 CLS:PEN 1:PRINT "YOU RAN OUT OF       BULLETS."
450 PRINT:PRINT"YOU SCORED:";SC%
460 PRINT:PRINT" HIT ENTER TO PLAY"
470 IF INKEY(18)<>0 THEN 470 ELSE RUN
480 CLS:PEN 1:PRINT"YOU SHOT ALL THE     TARGETS 'WELL
DONE'"
490 PRINT:PRINT "YOU SCORED:";SC%
500 PRINT:PRINT "PRESS ENTER TO       CARRY ON."
510 IF INKEY(18)<>0 THEN 510 ELSE GOTO 180
520 MODE 1:PAPER 0:CLS:INK 0,3:BORDER 3:INK 1,0:INK 2,
26:INK 3,18:ENV 5,30,0,2,1,-15,1
530 PEN 1:PRINT "a a a a a a a a a a a a a a a a a a a
 a b b b b b b b b b b b b b b b b b b b b":PRINT CHR$
(22)+CHR$(1):PEN 2:LOCATE 1,1:PRINT"c c c c c c c c c
c c c c c c c c c c d d d d d d d d d d d d d d d d d
d d d"
540 PEN 3:PRINT "           CARNIVAL SHOOTOUT"
550 PEN 1:PRINT"e e e e e e e e e e e e e e e e e e e
e f f f f f f f f f f f f f f f f f f f":PEN 2:LOCAT
E 1,4:PRINT"g g g g g g g g g g g g g g g g g g g g h
h h h h h h h h h h h h h h h h h h h h"
560 PRINT CHR$(22)+CHR$(0)
570 PEN 3:PRINT:PRINT"YOU HAVE TO SHOOT AS MANY OF THE
 MOVING TARGETS AS POSSIBLE. THERE ARE 30 TO HITAND YO
U ONLY HAVE 35 BULLETS SO AIM WITHCARE."
575 PRINT:PRINT "THE NUMBER OF BULLETS YOU HAVE LEFT I
S  SHOWN AT THE TOP OF THE SCREEN."
580 PEN 2:PRINT:PRINT "KEYS TO USE:-
                    Z-LEFT  X-RIGHT
          SPACE-SHOOT"
590 PAPER 1:PEN 0:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT"
          HIT ENTER TO START              "
600 SL=38500:SR=38400:RESTORE 640
610 CALL SL,1:CALL SL,2:CALL SR,4:CALL SR,5
620 READ N,D:IF N=-1 THEN RESTORE 640 ELSE SOUND 4,N,D
*6,15,5
630 IF INKEY(18)=0 THEN RESTORE:RETURN ELSE 610
640 DATA 95,4,106,4,119,4,106,4,95,8,106,2,119,2,127,2
,142,4,159,4,142,4,127,8,142,2,159,2,179,2,190,4,159,4
,119,4,127,4,106,4,80,4,95,16
650 DATA 95,4,106,4,119,4,106,4,95,8,106,2,119,2,127,2
,142,4,159,4,142,4,127,8,142,2,159,2,179,2,190,4,159,4
,119,4,127,4,106,4,80,4,119,16,-1,-1
```

Colours

A D Grundy,
Merton,
London.

Spectrum

THE PROGRAM sets out to prove that the Spectrum can show more than the usual eight colours. It does this by picking up the letter to be displayed and subtracting it byte by byte from the sprite graphic.

```
5002 LET k$="1234567": LET i$="6 per ";paper
260066": LET p$="1702332": FOR m 7000 REM show line l$
=1 TO 7
5004 LET high=VAL k$(m TO m): LE 7010 CLS : INK ink: PAPER paper
T ink=VAL i$(m TO m): LET paper= LET l$=" Press Y to show with i
VAL p$(m TO m)                nfill "
5006 LET z=0: GO SUB 9400: GO SU 7020 GO SUB 7200
B 9500: PRINT INK ink; PAPER pap 7030 IF INKEY$="Y" OR INKEY$="y
er;AT high,1;"A";" ink ";ink;" p  THEN GO TO 7100
aper ";paper                    7040 GO SUB 7300: GO TO 7030
5008 NEXT m                     7050 REM **show pink text**
6000 INPUT "If Colour ok press Y
  ";y$: IF y$="y" OR y$="Y" THEN  7100 FOR d=1 TO 30: LET z=8*(-32
LET ink=6: LET paper=1: GO TO 70 +CODE l$(d TO d)): GO SUB 9400:
00                              GO SUB 9500: GO SUB 9600: PRINT
6010 INPUT "ink ";ink: INPUT "pa AT 10,d;"A";AT 11,d;"B": NEXT d
```

```
 GO TO 8800: REM
  show effect of filling in

7200 FOR d=1 TO 30: LET z=8+(-32
+CODE l$(d TO d)): GO SUB 9400:
GO SUB 9500: PRINT AT 10,d;"A";A
T 11,d;"B": NEXT d: RETURN : REM

 show line of print

7300 FOR f=2 TO 30: BEEP .25,((C
ODE l$(f TO f))/4): NEXT f: RETU
RN : REM make a noise

8800 REM ** BIG LETTERS **
8810 BORDER 1: FOR g=0 TO 10: IN
K RND*3: PAPER 7-RND*3
8820 INPUT " LETTER ";h$: LET z=
8*(-32+CODE h$)
8825 GO SUB 9400
8830 GO SUB 9500
8840 GO SUB 9600
8850 FOR e=0 TO 21 STEP 2: PRINT
 AT e,0;"AAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAA";AT 1+e,0;"BBBBBBBBBB
BBBBBBBBBBBBBBBBBBBB"
8860 NEXT e: IF h$=" " THEN GO T
O 5000
8870 NEXT g
8880 GO TO 5000
9000 REM *big*
9400 FOR f=1 TO 7 STEP 2: POKE 6
5368+f,0: POKE 65368+8+f,0: NEXT
 f: RETURN : REM stripe Graphic
9500 FOR f=0 TO 7: POKE (65368+2
*f),255-PEEK (15616+f+z): NEXT f
: RETURN : REM get alpha-numeric
9600 FOR f=0 TO 7: POKE (65369+2
*f),0.5*PEEK (15616+f+z): NEXT f
: RETURN : REM half infill
```

Dominoes

J Ireland,
Canterbury,
Kent.

VIC-20

DOMINOES NEEDS a minimum 8K expansion. There are three variations on the game against the computer. All instructions are included with the game.

There are three versions. Block, Draw and Bergen. Each version has slightly different rules for scoring. In Block, or Draw you lose points for what is in your hand at the end. In Bergen you gain points for matching ends of chains.

```
READY.


10 PRINT"■": POKE36879,25
20 DIMA%(28,1),P%(28,1),C%(28,1),CP%(6)
30 I$="■■■■■■■■■■" CL$="                    ": C1$=CL$+CL$+CL$+CL$+CL$: D1$=D$+CL
$
40 PL=4326: CO=33792: PR=PL+1: IL=-1: IR=1: TP=PL-158
50 CL=0: CP=6: LL=0: RL=0: PA=0: LD=0: RD=0: SD=0: K1=-1: K2=K1
60 IFNGTHEN140
70 PRINT"■■■■■■■■■■■1 BLOCK": PRINT"■■■■■■■2 DRAW": PRINT"■■■■■■■3 BERGEN"
80 PRINT"■■■■■■■■SELECT GAME"
90 GETA$: IFA$<"1"ORA$>"3"THEN90
100 G=VAL(A$): PRINT"■■INSTRUCTIONS? (Y/N)"
110 GETA$: IFA$="Y"THEN2410
120 IFA$<>"N"THEN110
130 PRINT"■"
140 GT=-50*(G=1)-100*(G=2)-15*(G=3): PT=-6*(G=3)-7*(G<3): CT=PT
150 IFNGTHEN170
160 NG=1: C=1: FORA=0TO6: FORB=ATO6: A%(C,0)=A: A%(C,1)=B: C=C+1: NEXTB,A
169 REM ##SHUFFLE TILES##
170 FORJ=28TO2STEP-1
180 I=INT(RND(1)*(J-1))+1: A=A%(I,0): B=A%(I,1)
190 A%(I,0)=A%(J,0): A%(I,1)=A%(J,1): A%(J,0)=A: A%(J,1)=B
200 NEXTJ
210 J=28: FORI=1TOPT: P%(I,0)=A%(J,0): P%(I,1)=A%(J,1): J=J-1
220 C%(I,0)=A%(J,0): C%(I,1)=A%(J,1): J=J-1: NEXTI: BY=J
230 IFG=3THEN390
240 IFG=2THENPRINT"■"TAB(9)"■■RAW": GOTO260
250 PRINT"■"TAB(8)"■■LOCK"
260 IFDOTHEN360
270 PRINT"■■■WE'LL DRAW TO START": FORI=1TO2000: NEXT
280 A=INT(RND(1)*28)+1
290 B=INT(RND(1)*28)+1: IFA=BTHEN290
300 PRINT: PRINT"I DREW A  "A%(A,0)","A%(A,1)
310 PRINT: PRINT"YOU DREW A"A%(B,0)","A%(B,1): PRINT
320 I=A%(A,0)+A%(A,1): J=A%(B,0)+A%(B,1): IFI<>JTHEN340
330 PRINT"WE'LL HAVE TO REDRAW": FORI=1TO3000: NEXT: PRINT"■■■": GOTO280
340 IFI>JTHENPRINT"I'LL START": WT=2: GOSUB600: GOSUB650: GOTO1530
350 PRINT"YOU START": WT=1: GOSUB600: GOSUB650: GOSUB770: GOTO670
360 PRINT"■■■■■■■■■■";
370 IFDO=1THENPRINT"YOU START.": WT=1: GOSUB600: GOSUB650: GOSUB770: GOTO670
380 PRINT"I START.": WT=2: GOSUB600: GOSUB650: GOTO1530
390 PRINT"■"TAB(8)"■■BERGEN"
400 PRINT"■■■LOWEST DOUBLE STARTS": PRINT: FORI=1TO2000: NEXT
410 C=7: FORI=1TOPT: A=P%(I,0): B=P%(I,1)
420 IFA=BANDA<CTHENC=A: PI=I
 30 NEXTI
 40 D=7: FORI=1TOCT: A=C%(I,0): B=C%(I,1)
 50 IFA=BANDA<DTHEND=A: CI=I
 60 NEXTI
470 IFC=7ANDD=7THENPRINT"NO DOUBLE IN PLAY.....WE'LL START AGAIN"
480 IFC=7ANDD=7THENFORI=1TO2000: NEXT: GOTO150
490 IFC>DTHEN550
500 IFD=7THENPRINT"I HAVE NO DOUBLE": GOTO520
510 PRINT"I HAVE THE"C%(C1,0)","C%(C1,1)
520 PRINT"■YOU HAVE THE LOWEST   DOUBLE - THE"P%(P1,0)","P%(P1,1)
530 PRINT"■YOU START.": WT=1: F=P1: A=P%(F,0): B=A: FORI=1TO3000: NEXT
540 GOSUB600: GOSUB650: GOSUB850: RD=1: GOTO670
550 IFC=7THENPRINT"YOU HAVE NO DOUBLE": GOTO570
560 PRINT"YOU HAVE THE"P%(P1,0)","P%(P1,1)
570 PRINT"■I HAVE THE LOWEST    DOUBLE - THE"C%(C1,0)","C%(C1,1)
580 PRINT"■I'LL START.": WT=2: F=C1: A=C%(F,0): B=A: FORI=1TO3000: NEXT
590 GOSUB600: GOSUB650: DL=A: GOSUB1390: LD=1: GOTO2000
599 REM ##SET UP PLAYING AREA##
600 FORI=1TO3000: NEXT: PRINT"■": X=PL-10: POKEX,96: POKEX+21,96
610 FORY=X+22TOX+9*22STEP22: POKEY,96: POKEY+10,96: POKEY+21,96: NEXTY
620 PRINT"■"C1$;C1$"■■■ SCORE ■■■   TILES   ";
630 PRINT"■YOU■■■■■■■■YOU■■■■■■■■■■■
```

(continued from previous page)

```
1980 PA=PA+1:IFPA=2THEN2080
1990 WT=1:GOTO670
2000 CT=CT-1:FORJ=FTOCT:C%(J,0)=C%(J+1,0):C%(J,1)=C%(J+1,1):NEXTJ
2010 IFSD>0ANDG=3ANDDL=DRTHENCS=CS+2:GOSUB2050:IFLDORRDTHENCS=CS+1
2020 GOSUB1170:SD=SD+1:WT=1:IFCT=0THEN2080
2030 GOTO670
2040 PRINTD1$D$"I'LL PLAY THE"A"."B:FORI=1TO3000:NEXT:RETURN
2050 PRINTD1$D$:IFLDORRDTHENPRINT"TRIPLE HEADER.":GOTO2070
2060 PRINT"DOUBLE HEADER."
2070 FORI=1TO2000:NEXT:RETURN
2079 REM **END OF HAND**
2080 FORI=1TO1000:NEXT:PRINT"■"
2090 GOSUB620:GOSUB1200:PRINT"■"
2100 IFG=3THEN2170
2110 GOSUB2370:PRINTD$"YOU HAVE"A"SPOTS":PRINT"I HAVE"B"SPOTS■"
2120 IFA<BTHENPRINT"YOU WIN THE HAND":DG=1:GOTO2150
2130 IFA>BTHENPRINT"I WIN THE HAND":DG=2:GOTO2160
2140 PRINT"A DRAWN HAND.":DG=0:GOTO2200
2150 PS=PS+B-A:GOTO2200
2160 CS=CS+A-B:GOTO2200
2170 PRINTD$:IFPT=0THENPRINT"YOU GET ONE POINT FOR GOING OUT":PS=PS+1:DG=1:GOTO
2200
2180 IFCT=0THENPRINT"I GET ONE POINT FOR  GOING OUT":DG=2:CS=CS+1:GOTO2200
2190 PRINT"END OF HAND.":DG=0
2200 GOSUB1170:IFPS>=CSORCS>=CTTHEN2240
2210 IFDG=1THEN2230
2220 IFDG=0THENA$="I":GOTO2320
2230 GOTO2310
2240 IFPS<CTTHEN2280
2250 IFDG=2THEN2300
2260 IFDG=0THENA$="YOU":GOTO2320
2270 GOTO2310
2280 FORI=1TO5000:NEXT:GOTO40
2290 A$="BUT I":GOTO2320
2300 A$="BUT YOU":GOTO2320
2310 A$="AND"
2320 IFPS=CSTHENPRINTD$"■■■■■■■N DRAWN GAME.":GOTO2340
2330 PRINTD$"■■■■■■■"A$" WIN THE GAME."
2340 PRINT:PRINT"■PRESS RETURN."
2350 GETA$:IFA$<>CHR$(13)THEN2350
2360 RUN
2369 REM **CALCULATE NO. OF SPOTS IN EACH PLAYER'S HAND**
2370 A=0:B=0:IFPT=0THEN2390
2380 FORI=1TOPT:A=A+P%(I,0)+P%(I,1):NEXTI
2390 IFCT=0THENRETURN
2400 FORI=1TOCT:B=B+C%(I,0)+C%(I,1):NEXTI:RETURN
2410 PRINT"■ THE GAME OF DOMINOES IS PLAYED WITH A DECK OF 28 DOUBLE-ENDED"
2420 PRINT"TILES WITH PIPS OR     SPOTS AT EACH END FROM0 TO 6. PLAYERS ARE"
2430 PRINT"DEALT 6 OR 7 TILES     EACH, DEPENDING ON     WHICH GAME IS BEING"
2440 PRINT"PLAYED. THE REMAINDER GOING INTO A POOL      CALLED THE YARD."
2450 PRINT" TILES ARE PLAYED TO  EITHER END OF A CHAIN UNTIL ONE PLAYER HAS"
2460 PRINT"USED ALL HIS TILES OR NEITHER PLAYER CAN GO."
2470 GOSUB2710
2480 ONGOTO2490,2530,2600
2490 PRINT" IN BLOCK GAME PLAYERSARE DEALT 7 TILES EACHAND THE GAME IS PLAYED"
2500 PRINT"TO 50 POINTS." PRINT" THE PLAYER WITH THE  HIGHEST DOUBLE STARTS"
2510 PRINT"AND PLAYS THAT TILE.  THERE IS NO DRAW FROM THE YARD."
2520 GOTO2670
2530 PRINT" IN DRAW GAME PLAYERS ARE DEALT 7 TILES EACHAND THE GAME IS PLAYED"
2540 PRINT"TO 100 POINTS." PRINT" PLAYERS DRAW TILES    FROM THE DECK TO"
2550 PRINT"DECIDE WHO STARTS.     THE PLAYER WITH THE    HIGHEST NUMBER OF"
2560 PRINT"SPOTS STARTING AND     PLAYING ANY TILE."
2570 PRINT" IF UNABLE TO PLAY,THEPLAYER MUST DRAW FROM THE YARD UNTIL ABLE."
2580 PRINT"THE LAST 2 TILES IN    THE YARD CAN'T BE      DRAWN."
2590 GOTO2670
2600 PRINT" IN BERGEN PLAYERS AREDEALT 6 TILES EACH.    AND THE GAME IS PLAYED"
2610 PRINT"TO 15 POINTS." PRINT" THE PLAYER WITH THE  LOWEST DOUBLE STARTS"
2620 PRINT"AND PLAYS THAT TILE.  IF UNABLE TO PLAY THE PLAYER MUST DRAW FROM"
2630 PRINT"THE YARD. IF STILL    UNABLE TO PLAY THEN    PLAY PASSES TO HIS    OPP
ONENT."
2640 PRINT" POINTS ARE SCORED BY MATCHING ENDS OF THE  CHAIN. AN EXTRA POINT"
2650 PRINT"BEING SCORED IF ONE    END IS A DOUBLE."
2660 GOSUB2710:GOTO130
2670 GOSUB2710:PRINT" POINTS ARE SCORED AT END OF HAND BY THE    PLAYER WITH THE
 FEWEST":
2680 PRINT"TOTAL SPOTS ON HIS     REMAINING TILES.      SUBTRACTING HIS SPOTS"
2690 PRINT"FROM HIS OPPONENTS.    THE REMAINDER BEING"
2700 PRINT"THE SCORE FOR THAT     HAND." GOSUB2710:GOTO130
2710 PRINT"■■ANY KEY TO CONTINUE"
2720 GETA$:IFA$=""THEN2720
2730 PRINT"■":RETURN

READY.
```

Sound experimenter

Edward Upsdell,
Thonex,
Switzerland.

THIS PROGRAM is for an Atari with at least 32K of memory. It aims to help in understanding sound on the Atari and experiment with the sound.

Type in the program and run it. You should see something like figure 1.

To use sound register 0 type 0, hit Return, type REG, and hit Return. The rest is basically the same. Type in the number, hit Return, command, Return. This is used for the REG, FRE, DIS, VOL commands. Next is the FRC command. It does not have to be preceded by a number. Its function is to produce a click from the TV. A value of one in this place means on and a zero signal that it is off. The first eight lines, B7 to B0, are the bits in the AUDCTL register. To change bit seven to one, type B7, Return. To return it back to zero again, type B7, Return. These changes are technical and give no indication on what the sound will be like. It is best to experiment. Enough to say that using B0 through B4 turns on both sound channels associated with B7.

To hear the sound type in the register number, press Return, type in CH and hit Return again. It is possible is listen to all four channels at once. To turn off the sound type in Off and hit Return. The sound must be off to change one of the parameters. When you want to look at the sound statements to write them down for future reference, type in SDIS and hit Return. This will show the numbers for all four channels. When you use this sound in one of your own programs just type in the same numbers.

If any of the eight bits have a one beside them then in order to view the sound you must type in PDIS. This prints out the Poke statements for that sound. The SDIS command will not give you the full information. Again, when you went to use this sound, just copy the Poke statement into your program.

Figure 1.

```
AUDCTL (REG)ISTER 4
                    9 BIT POLY:(B7):0
          clock Ch.0 w/1.79 MHz:(B6):0
          clock Ch.2 w/1.79 MHz:(B5):0
              clock Ch.1 w/Ch.0:(B4):0
              clock Ch.3 w/Ch.2:(B3):0
         clock Ch.0 w/Ch.2HiP:(B2):0
         clock Ch.1 w/Ch.3HiP:(B1):0
                     15 kHz:(B0):0
  SOUND (REG)ISTER:
    (DIS)TORTION:
     (FRE)QUENCY:
       (VOL)UME:
X:
D: ?
USABLE COMMANDS:
REG DIS FRE FRC VOL OFF CH SDIS
PDIS
```

```
10 REM ********************
20 REM *SOUND EXPERIMENTER*
25 REM *         BY       *
30 REM *  EDWARD UPSDELL   *
40 REM *                   *
50 REM * COPYRIGHT(C)1984 *
60 REM ********************
80 DIM S(5,8),IN$(50),SP$(35)
85 SP$="
":REM 35 SPACES
90 FOR I=0 TO 8:FOR J=0 TO 5:S(J,I)=0:NEXT J
:NEXT I
100 REG=5000:DIS=5100:FRE=5200:FRC=5300:OFF=
5400
102 CLD=5900:CLX=6000:VOL=6100:POKAUD=6200:C
H=6300:START=6400:REGDIS=6500:BUZZ=6600
104 PDIS=6700:SDIS=6800:EDIS=6900
1002 GRAPHICS 0:POKE 752,1
1008 POSITION 2,0:? "AUDCTL (REG)ISTER 4"
1010 POSITION 2,1:? "           9 BIT POLY:(
B7):"
1020 POSITION 2,2:? "clock Ch.0 w/1.79 MHz:(
B6):"
1030 POSITION 2,3:? "clock Ch.2 w/1.79 MHz:(
B5):"
1040 POSITION 2,4:? "    clock Ch.1 w/Ch.0:(
B4):"
1050 POSITION 2,5:? "    clock Ch.3 w/Ch.2:(
B3):"
1060 POSITION 2,6:? "clock Ch.0 w/Ch.2 HiP:(
B2):"
1070 POSITION 2,7:? "clock Ch.1 w/Ch.3 HiP:(
B1):"
1080 POSITION 2,8:? "               15 kHz:(
B0):"
1090 POSITION 2,9:? "  SOUND (REG)ISTER:"
1100 POSITION 2,10:? "      (DIS)TORTION:"
1110 POSITION 2,11:? "       (FRE)QUENCY:"
1120 POSITION 2,12:? "      FORCE OUTPUT:"
1126 POSITION 2,13:? "         (VOL)UME:"
1128 POSITION 2,14:? "X:"
1130 POSITION 2,15:? "D:"
1140 POSITION 2,16:? "USABLE COMMANDS:":POSI
TION 2,17:? "REG DIS FRE FRC VOL OFF CH PDIS
 SDIS"
1500 GOSUB START
2000 REM JUMP TABLE
2008 FOR ZZZ=1 TO 2 STEP 0
2010 POSITION 5,15:POKE 752,0:INPUT IN$:POKE
 752,1
2020 TRAP 2040:A=VAL(IN$):TRAP 40000
2030 POSITION 5,14:? A:GOSUB CLD
2040 IF IN$="REG" THEN GOSUB REG
2042 IF IN$="DIS" THEN GOSUB DIS
2044 IF IN$="FRE" THEN GOSUB FRE
2046 IF IN$="FRC" THEN GOSUB FRC
2048 IF IN$="OFF" THEN GOSUB OFF
2049 IF IN$="CH" THEN GOSUB CH
2058 IF IN$="VOL" THEN GOSUB VOL
2060 IF IN$="B7" THEN S(4,7)= NOT (S(4,7)):P
OSITION 30,1:? S(4,7):GOSUB CLD
2061 IF IN$="B6" THEN S(4,6)= NOT (S(4,6)):P
OSITION 30,2:? S(4,6):GOSUB CLD
2062 IF IN$="B5" THEN S(4,5)= NOT (S(4,5)):P
OSITION 30,3:? S(4,5):GOSUB CLD
2063 IF IN$="B4" THEN S(4,4)= NOT (S(4,4)):P
OSITION 30,4:? S(4,4):GOSUB CLD
2064 IF IN$="B3" THEN S(4,3)= NOT (S(4,3)):P
OSITION 30,5:? S(4,3):GOSUB CLD
2065 IF IN$="B2" THEN S(4,2)= NOT (S(4,2)):P
OSITION 30,6:? S(4,2):GOSUB CLD
2066 IF IN$="B1" THEN S(4,1)= NOT (S(4,1)):P
OSITION 30,7:? S(4,1):GOSUB CLD
2067 IF IN$="B0" THEN S(4,0)= NOT (S(4,0)):P
OSITION 30,8:? S(4,0):GOSUB CLD
2070 IF IN$="PDIS" THEN GOSUB PDIS
2072 IF IN$="SDIS" THEN GOSUB SDIS
2980 IF FAIL=1 THEN GOSUB BUZZ
2989 FAIL=0
2990 NEXT ZZZ
5000 REM REG
5010 IF A<0 OR A>3 THEN FAIL=1:GOTO 5088
5020 IF A>0 OR A<4 THEN POSITION 21,9:? A
5030 C=A
5040 GOSUB REGDIS
5088 GOSUB CLD:GOSUB CLX
5090 RETURN
5100 REM
5110 IF A<0 OR A>14 THEN FAIL=1:GOTO 5180
5112 IF INT(A/2)-A/2<>0 THEN FAIL=1:GOTO 518
0
5120 IF A=0 THEN D1=0
5121 IF A=2 THEN D1=32
5122 IF A=4 THEN D1=64
5123 IF A=6 THEN D1=96
5124 IF A=8 THEN D1=128
5125 IF A=10 THEN D1=160
5126 IF A=12 THEN D1=192
5127 IF A=14 THEN D1=224
5130 POSITION 21,10:? A
5140 S(C,1)=D1:S(C,5)=A
5170 S(C,8)=A
5180 GOSUB CLD:GOSUB CLX
5190 RETURN
5200 REM
5210 IF A<0 OR A>255 THEN FAIL=1
5218 POSITION 21,11:? "       "
5220 POSITION 21,11:? A
```

```
5230 S(C,2)=A
5280 GOSUB CLD:GOSUB CLX
5290 RETURN
5300 REM
5310 IF A=0 THEN S(0,3)= NOT S(0,3)
5320 IF A=1 THEN S(1,3)= NOT S(1,3)
5330 IF A=2 THEN S(2,3)= NOT S(2,3)
5340 IF A=3 THEN S(3,3)= NOT S(3,3)
5350 POSITION 21,12:? S(C,3)
5380 GOSUB CLD
5390 RETURN
5400 POKE 53761,0:POKE 53763,0:POKE 53765,0:
POKE 53767,0
5480 GOSUB CLD
5900 REM
5910 POSITION 5,15:? SP$(1,20)
5990 RETURN
6000 REM
6010 POSITION 5,14:? SP$(1,21):A=0
6090 RETURN
6100 REM
6110 IF A<0 OR A>15 THEN FAIL=1:GOTO 6180
6120 POSITION 21,13:?  "
6122 POSITION 21,13:? A
6130 S(C,4)=A
6180 GOSUB CLD:GOSUB CLX
6190 RETURN
6200 REM
6208 SUM=0
6210 IF S(4,0)=1 THEN SUM=SUM+1
6211 IF S(4,1)=1 THEN SUM=SUM+2
6212 IF S(4,2)=1 THEN SUM=SUM+4
6213 IF S(4,3)=1 THEN SUM=SUM+8
6214 IF S(4,4)=1 THEN SUM=SUM+16
6215 IF S(4,5)=1 THEN SUM=SUM+32
6216 IF S(4,6)=1 THEN SUM=SUM+64
6217 IF S(4,7)=1 THEN SUM=SUM+128
6220 POKE 53768,SUM
6290 RETURN
6300 REM CH
6310 GOSUB POKAUD
6320 IF A=0 THEN POKE 53761,S(0,1)+S(0,4):PO
KE 53760,S(0,2)
6322 IF A=1 THEN POKE 53763,S(1,1)+S(1,4):PO
KE 53762,S(1,2)
6324 IF A=2 THEN POKE 53765,S(2,1)+S(2,4):PO
KE 53764,S(2,2)
6326 IF A=3 THEN POKE 53767,S(3,1)+S(3,4):PO
KE 53766,S(3,2)
6380 GOSUR CLX:GOSUB CLD:GOSUB REGDIS
6390 RETURN
6400 REM START
6410 FOR I=1 TO 8:POSITION 30,I:? "0":NEXT I
6490 RETURN
6500 REM REGDIS
6505 POSITION 21,12:?  "   "
6506 POSITION 21,12:? S(C,3)
6507 POSITION 21,11:?  "      "
6508 POSITION 21,11:? S(C,2)
6520 POSITION 21,10:?  "      "
6521 POSITION 21,10
6522 IF S(C,1)=224 THEN ? "14"
6523 IF S(C,1)=192 THEN ? "12"
6524 IF S(C,1)=160 THEN ? "10"
6525 IF S(C,1)=128 THEN ? "8"
6526 IF S(C,1)=96 THEN ? "6"
6527 IF S(C,1)=64 THEN ? "4"
6528 IF S(C,1)=32 THEN ? "2"
6529 IF S(C,1)=0 THEN ? "0"
6530 POSITION 21,13:?  "      "
6531 POSITION 21,13:? S(C,4)
6590 RETURN
6600 REM BUZZ
6610 ? CHR$(125):REM CLEAR SCREEN
6690 RETURN
6700 REM PDIS
6705 GOSUB EDIS
6710 POSITION 2,22:? "POKE 53768, ";SUM
6720 POSITION 20,18:? "POKE 53761, ";S(0,1)+
S(0,4):POSITION 2,18:? "POKE 53760, ";S(0,2)
6730 POSITION 20,19:? "POKE 53763, ";S(1,1)+
S(1,4):POSITION 2,19:? "POKE 53762, ";S(1,2)
6740 POSITION 20,20:? "POKE 53765, ";S(2,1)+
S(2,4):POSITION 2,20:? "POKE 53764, ";S(2,2)
6750 POSITION 20,21:? "POKE 53767, ";S(3,1)+
S(3,4):POSITION 2,21:? "POKE 53766, ";S(3,2)
6780 GOSUB CLD
6790 RETURN
6800 REM EDIS
6805 GOSUB EDIS
6810 POSITION 2,19:? "SOUND 0, ";S(0,2);", "
;S(0,8);", ";S(0,4)
6820 POSITION 2,20:? "SOUND 1, ";S(1,2);", "
;S(1,8);", ";S(1,4)
6830 POSITION 2,21:? "SOUND 2, ";S(2,2);", "
;S(2,8);", ";S(2,4)
6840 POSITION 2,22:? "SOUND 3, ";S(3,2);", "
;S(3,8);", ";S(3,4)
6880 GOSUB CLD
6890 RETURN
6900 POSITION 2,18:? SP$
6910 POSITION 2,19:? SP$
6920 POSITION 2,20:? SP$
6930 POSITION 2,21:? SP$
6940 POSITION 2,22:? SP$
6950 RETURN
9000 POSITION 2,18:? SP$
9010 POSITION 2,19:? SP$
9020 POSITION 2,20:? SP$
9030 POSITION 2,21:? SP$
9040 POSITION 2,22:? SP$
9050 RETURN
10000 END
```

Speedy commands

Brian Allan,
Scuntfield,
County Down.

Dragon

HERE ARE two routines for the Dragon. One of them lets you enter 52 commands by pressing two keys. The second one lets you change the speed of printing. First, I will show you how to use the single-key entry routine. Enter the listing. Save this then run it.

The routines are now activated. To use the single key entry option press the down arrow. The black cursor will change to a graphic character. To get a command press any letter — experiment for yourselves. 52 commands are available by using Shift. To enter the command

EDIT

press E. Edit should appear on the screen. You can put a line number after it. To enter a command like Point press P then the down arrow then J—Point will appear on the screen.

The print speed is held in locations 1022 and 1023. After the hex loader has finished enter

POKE 1022,20: LIST

You will see the program list slowly. The higher the value in 1022 and 1023 the slower the print speed. To switch off both routines enter

EXEC 32252

```
10 REM ********************
20 REM ** ONE KEY ENTRY **
30 REM ** & PRINT SPEED **
40 REM ** M/C. ROUTINE. **
50 REM ********************
60 REM **BY BRIAN ALLAN.**
70 REM ********************
80 CLEAR 200,32224
90 CLS
100 PRINTTAB(9);"KEYWORD & PRINT"
110 PRINTTAB(9);"****************"
120 PRINT"please wait...LOADING THE HEX."
130 PRINT:PRINT"LOCATIONS."
140 PRINT:PRINT"'EXEC 32225' - ROUTINES ON.":PRINT "'E
XEC 32252' - ROUTINES OFF."
150 PRINT:PRINT "PEEK(1022)*256+PEEK(1023) IS THEPRINT
 DELAY."
160 PRINT:PRINT "FOR KEYWORD - PRESS THE DOWN    ARROW
 THEN A (SHIFT-LETTER) OR  (LETTER).52 COMMANDS AVAILA
BLE."
170 FOR AD=32225 TO 32767 STEP 10
180 CS=0
190 FOR Z=AD TO AD+9
200 READ H$:H=VAL("&H"+H$)
210 CS=CS+H
220 POKE Z,H
230 IF Z=32767 THEN 270
240 NEXT Z
250 READ CS$:SS=VAL("&H"+CS$)
260 IF SS<>CS THEN PRINT:PRINT "THERE IS AN ERROR IN L
INE";PEEK(49)*256+PEEK(50):END
270 NEXT AD
280 PRINT:PRINT:PRINT"ALL LOADED AND BOTH ROUTINES
ACTIVATED."
290 PRINT:PRINT
300 EXEC 32225
310 END
320 REM DATA FOR ROUTINES.
330 DATA 86,7E,B7,1,6A,B7,1,67,8E,7E,451
340 DATA 15,BF,1,6B,8E,7E,5,BF,1,68,379
350 DATA 8E,0,0,BF,3,FE,39,86,39,B7,3FD
360 DATA 1,67,B7,1,6A,39,BF,3,FC,BE,43F
370 DATA 3,FE,30,1,30,1F,26,FC,BE,3,364
380 DATA FC,39,81,A,26,E2,C1,E6,22,DE,56F
390 DATA BF,3,F2,10,BF,3,F4,FD,3,F6,570
400 DATA 86,C9,10,9E,88,A7,A4,7F,1,19,499
410 DATA BD,B5,D,73,1,49,81,41,10,25,333
420 DATA 0,8A,81,7A,10,22,0,84,81,5B,317
430 DATA 25,6,81,60,22,2,20,7A,81,5B,2A6
440 DATA 25,2,80,6,80,40,8E,7E,D2,5F,3AA
450 DATA B7,3,F8,5C,F1,3,F8,27,8,A6,4CF
460 DATA 80,81,0,26,FA,20,F2,BF,3,F9,4EE
470 DATA 10,BE,3,F2,A6,80,81,0,27,7,398
480 DATA A7,A0,7C,3,F7,20,F3,10,BF,3,4A2
490 DATA F2,BE,3,F9,10,9E,88,A6,80,81,589
500 DATA 0,27,36,81,40,22,2,8B,40,A7,2B4
510 DATA A0,10,8C,5,FF,22,2,20,EA,10,37E
520 DATA BF,3,FB,10,8E,4,0,E6,A8,20,40D
530 DATA E7,A0,10,8C,5,E0,25,F5,C6,60,548
540 DATA E7,A0,10,8C,6,0,25,F8,10,BE,414
550 DATA 3,FB,31,A8,E0,20,C4,10,9F,88,4D2
560 DATA BE,3,F2,10,BE,3,F4,FC,3,F6,56D
570 DATA 39,41,55,44,49,4F,0,44,49,4D,285
580 DATA 0,43,4C,45,41,52,0,52,45,41,23F
590 DATA 44,0,45,58,45,43,0,46,4F,52,250
600 DATA 0,47,4F,54,4F,0,50,52,49,4E,272
610 DATA 54,0,49,4E,50,55,54,0,4A,4F,27D
620 DATA 59,53,54,4B,28,0,43,49,52,43,294
630 DATA 4C,45,28,0,4C,49,53,54,0,53,248
640 DATA 4F,55,4E,44,0,54,48,45,4E,0,265
```

(continued on next page)

(continued from previous page)

```
650 DATA 4F,50,45,4E,0,50,4D,4F,44,45,2A7
660 DATA 0,44,52,41,57,0,52,45,54,55,26E
670 DATA 52,4E,0,53,43,52,45,45,4E,0,260
680 DATA 43,4C,4F,41,44,0,43,4C,53,0,245
690 DATA 53,45,54,28,0,53,54,45,50,0,250
700 DATA 4C,45,46,54,24,28,0,52,55,4E,26C
710 DATA 0,50,4F,4B,45,0,4D,4F,54,4F,26E
720 DATA 52,0,52,45,4D,0,43,4F,4C,4F,263
730 DATA 52,0,44,41,54,41,0,45,44,49,23E
740 DATA 54,0,4E,45,58,54,0,47,4F,53,27C
750 DATA 55,42,0,45,4C,53,45,0,49,4E,257
760 DATA 4B,45,59,24,0,50,4F,49,4E,54,297
770 DATA 28,0,50,41,49,4E,54,28,0,4C,218
780 DATA 49,4E,45,0,41,4E,44,0,54,41,244
790 DATA 42,28,0,43,4C,4F,53,45,0,50,230
800 DATA 43,4F,50,59,0,43,48,52,24,28,264
810 DATA 0,52,45,53,54,4F,52,45,0,53,277
820 DATA 54,52,49,4E,47,24,28,0,43,53,266
830 DATA 41,56,45,0,53,4B,49,50,4e,0,259
840 DATA 52,45,53,45,54,28,0,52,49,47,28D
850 DATA 48,54,24,28,0,4D,49,44,24,28,20E
860 DATA 0,52,45,4E,55,4D,0,50,45,45,261
870 DATA 4B,26,0,73
880 END
```

Sideways dump

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Bretton Estate,
Peterborough.

Amstrad

THIS PROGRAM will produce a hard copy of any screen in any mode as long as the graphics origin is set to its default (0,0). The final printout is two tone only and assumes that the background colour is Paper 0.

The program is written in machine code. It is 202 bytes long and is located at &AAB3. Rather than having to use the Call statement to run the program, a new command is implemented via the resident system extention capability of the Amstrad.

To enter the program type in the basic listing and run it. If all is well you will be given the chance to save the code to tape.

To reload the code type:

```
MEMORY &AAB2:LOAD"",&AAB3
```

and press Return. Once loaded

```
CALL &AAB3
```

to log on the new command. If you are using a Paper other than 0 you may inform the routine with

```
POKE &AAF8,n
```

where n= the Paper being used. Please take note that it is Paper and not Ink.

Listing 1.

```
10 MODE 1
20 MEMORY &AAB2
30 SUM=0:RESTORE 170
40 FOR N=&AAB3 TO &AB7C
50 READ X$
60 POKE N,VAL("&"+X$)
70 SUM=SUM+VAL("&"+X$)
80 NEXT
90 IF SUM<>&5FA8 THEN SOUND 1,254,10:PRINT CLS:PRINT"
DATA WRONG PLEASE CHECK":END .
100 CLS:PRINT"DATA LOADED CORRECTLY"
110 PRINT:PRINT"PLEASE INSERT TAPE FOR BYTES"
120 PRINT:PRINT"THEN PRESS ANY KEY"
130 IF INKEY$="" THEN 130
140 CLS:PRINT"SAVING DUMP,B,&AAB3,&CA"
150 SAVE "DUMP",B,&AAB3,&CA
160 END
170 DATA 01,c1,aa,21,bd,aa,cd,d1,bc,c9,00,00,00,00,c6,aa
180 DATA c3,d1,aa,44,55,4d,d0,00,00,00,00,00,00,00,cd,06
190 DATA b9,21,00,00,22,cb,aa,22,cd,aa,01,00,00,c5,3e,00
200 DATA 32,d0,aa,3c,32,cf,aa,06,07,c5,ed,5b,cb,aa,2a,cd
210 DATA aa,cd,df,bd,fe,00,28,0b,3a,cf,aa,47,3a,d0,aa,80
220 DATA 32,d0,aa,3a,cf,aa,a7,cb,17,32,cf,aa,2a,cb,aa,23
230 DATA 22,cb,aa,c1,10,d3,3e,1b,cd,73,ab,3e,4b,cd,73,ab
240 DATA 3e,00,cd,73,ab,3e,01,cd,73,ab,3a,d0,aa,cd,73,ab
250 DATA 2a,cb,aa,11,07,00,a7,ed,52,22,cb,aa,c1,03,78,fe
260 DATA 01,20,26,79,fe,91,20,21,3e,0a,cd,73,ab,2a,cb,aa
270 DATA 11,07,00,19,22,cb,aa,7c,fe,02,c2,dd,aa,7d,fe,84
280 DATA c2,dd,aa,3e,0f,cd,73,ab,c9,ed,43,cd,aa,c3,e0,aa
290 DATA c5,47,cd,2b,bd,78,30,fa,c1,c9
```

Listing 2.

```
AAB3  01 C1 AA 21 BD AA CD D1
AABB  BC C9 00 00 00 00 C5 AA
AAC3  C3 D1 AA 44 55 4D D0 00
AACB  00 00 00 00 00 00 CD 06
AAD3  B9 21 00 00 22 CB AA 22
AADB  CD AA 01 00 00 C5 3E 00
AAE3  32 D0 AA 3C 32 CF AA 06
AAEB  07 C5 ED 5B CB AA 2A CD
AAF3  AA CD DF BD FE 00 28 0B
AAFB  3A CF AA 47 3A D0 AA 80
AB03  32 D0 AA 3A CF AA A7 CB
AB0B  17 32 CF AA 2A CB AA 23
AB13  22 CB AA C1 10 D3 3E 1B
AB1B  CD 73 AB 3E 4B CD 73 AB
AB23  3E 00 CD 73 AB 3E 01 CD
AB2B  73 AB 3A D0 AA CD 73 AB
AB33  2A CB AA 11 07 00 A7 ED
AB3B  52 22 CB AA C1 03 78 FE
AB43  01 20 26 79 FE 91 20 21
AB4B  3E 0A CD 73 AB 2A CB AA
AB53  11 07 00 19 22 CB AA 7C
AB5B  FE 02 C2 DD AA 7D FE 84
AB63  C2 DD AA 3E 0F CD 73 AB
AB6B  C9 ED 43 CD AA C3 E0 AA
AB73  C5 47 CD 2B BD 78 30 FA
AB7B  C1 C9
```

Wild West

Anszar Zerfass,
Lehrberg,
West Germany.

Spectrum

THIS GAME uses the excellent Sprite routine by Robert Newman — *Your Computer* January, 1984, page 106 — to create smooth animated graphics in different colours. The programs will work on the 48K machine only. However, it may be changed for a 16K Spectrum by changing the Clear statement in line 10 to

```
CLEAR 31199
```

and by changing all Peek and Poke addresses except line 10. The new values for Peek, Poke and Rand USR statements can be calculated from the information in Newman's article.

The main program.

```
    3 REM LINE 20 LOADS MACHINE
        CODE SPRITE ROUTINE BY
        R.NEWMAN - YOUR COMPU-
        TER 1/84,PAGE 106


   10 POKE 23658,0: BORDER 0: PAP
ER 0: INK 0: INVERSE 0: OVER 0:
BRIGHT 0: FLASH 0: CLEAR 63999
   15 PRINT AT 5,7; PAPER 6; INK
0;" -- WILD WEST -- ";#0;" DO
N'T STOP THE TAPE YET! ";AT 1
4,0;
   20 FOR F=1 TO 25: BEEP .005,F
: NEXT F: LOAD ""CODE
   25 LET CW=0: LET PW=CW: GO TO
800
   35 LET HI=0: LET CHI=HI: LET H
I1=HI: LET CHI1=CHI
   40 GO SUB 500
   45 RANDOMIZE USR 65148
   50 LET I$=INKEY$: IF PEEK 6520
7=0 THEN IF I$="P" OR I$="(" THE
N POKE 65203,1-(2 AND I$="("): P
OKE 65207,5
   51 IF NOT WAG THEN IF RND>.96
THEN LET WAG=1: POKE 65260,120:
POKE 65261,16: POKE 65267,255: P
OKE 65269,0: POKE 65268,1
   52 IF PEEK 65222=0 THEN POKE 6
5218,2-(4 AND RND<.5): POKE 6522
2,5
   54 IF I$="9" THEN IF NOT SP TH
EN POKE 65230,189: POKE 65231,(P
EEK 65201)-6: POKE 65237,254: PO
KE 65238,1: LET SP=1
   56 IF NOT SC THEN IF RND>.1 TH
EN POKE 65245,83: POKE 65246,(PE
EK 65216)-6: POKE 65252,254: POK
E 65253,1: LET SC=1
   58 IF SP THEN IF PEEK 65230=0
THEN POKE 65238,0: POKE 65239,0
: PRINT AT 21-INT (PEEK 65231/8),
0;" ": LET SP=0
   60 IF SP THEN IF PEEK 65239=12
8 THEN GO SUB 70
   62 IF SC THEN IF PEEK 65245=25
2 THEN POKE 65253,0: POKE 65254,
0: PRINT AT 21-INT (PEEK 65246/8
),31;" ": LET SC=0
   64 IF SC THEN IF PEEK 65254=12
8 THEN GO SUB 75: IF SP THEN IF
PEEK 65239=128 THEN GO SUB 70
   65 IF CHI<>CHI1 OR HI<>HI1 THE
N LET CHI1=CHI: LET HI1=HI: GO T
```

```
 40+(120 AND (CHI=3 OR HI=3))
  66 GO TO 50
  70 LET SP=0: POKE 65238,0: POK
E 65239,0: IF PEEK 65230<62 AND
PEEK 65230>50 THEN GO TO 100
  71 IF PEEK 65230<132 AND PEEK
65230>120 THEN POKE 65268,0: LET
 WAG=0: LET CY=15: LET CX=21-INT
 (PEEK 65261/8): FOR F=5 TO 0 ST
EP -1: PRINT AT CX,CY; INK 2+(F/
2=INT (F/2));"CD";AT CX+1,CY;"EF
": BEEP .005,F: NEXT F: PRINT AT
 CX,CY;"  ";AT CX+1,CY;"  ";AT C
X+2,CY;"  ": RETURN
  72 LET CY=INT (PEEK 65230/8):
LET CX=21-INT (PEEK 65231/8): PR
INT AT CX,CY; INK 2; FLASH 1;"A"
: BEEP .005,0: PRINT AT CX,CY;"
": RETURN
  75 LET SC=0: POKE 65253,0: POK
E 65254,0: IF PEEK 65245>195 AND
 PEEK 65245<212 THEN GO TO 110
  76 IF PEEK 65245<132 AND PEEK
65245>117 THEN POKE 65268,0: LET
 WAG=0: LET CY=15: LET CX=21-INT
 (PEEK 65261/8): FOR F=5 TO 0 ST
EP -1: PRINT AT CX,CY; INK 2+(F/
2=INT (F/2));"CD";AT CX+1,CY;"EF
": BEEP .005,F: NEXT F: PRINT AT
 CX,CY-1;"  ";AT CX+1,CY-1;"
";AT CX+2,CY-1;"  ": RETURN
  77 LET CX=21-INT (PEEK 65246/8
): LET CY=INT (PEEK 65245/8): LE
T CY=CY+(ATTR (CX,CY)<>52): PRIN
T AT CX,CY; INK 3; FLASH 1;"A":
BEEP .005,0: PRINT AT CX,CY-1;"
": RETURN
  100 FOR F=0 TO 255 STEP 5: BEEP
.01,F/10: OUT 254,F: NEXT F: LE
T CHI=CHI+1: GO SUB 150
  105 RETURN
  110 FOR F=255 TO 0 STEP -5: BEE
P .01,F/10: OUT 254,F: NEXT F: L
ET HI=HI+1: GO SUB 150
  115 RETURN
  150 LET S$=" HITS="+STR$ CHI+"
-- WILD WEST -- HITS="+STR$ HI+"
": INPUT "": PRINT #0; PAPER 5
; INK 1;S$: RETURN
  160 IF CHI=3 AND HI=3 THEN LET
 S$=" --- BOTH HAVE BEEN KILLED -
-- ": GO TO 200
  170 IF CHI=3 THEN LET PW=PW+1:
LET S$="  --- YOU HAVE SURVIVED
! ---"
  180 IF HI=3 THEN LET CW=CW+1: L
ET S$="  --- YOU HAVE BEEN KILLE
D ---"
  200 RANDOMIZE USR 65155: PRINT
AT 4,0; BRIGHT 1; PAPER 5; INK 0
;S$
  210 LET S$=" SCORE: SLIM JOEY "
+STR$ CW+" - YOU "+STR$ PW
  220 IF LEN S$<32 THEN LET S$=S$
+" ": GO TO 220*
  230 PRINT AT 20,0; PAPER 7; INK
 1;S$
  240 INPUT "": PRINT #0; INK 0;"
Another game (Press Y or N) ?
": BEEP .5,-12
  250 IF INKEY$="y" THEN CLS : GO
 TO 870
  260 IF INKEY$="n" THEN GO TO 99
99
  270 GO TO 250
  500 RANDOMIZE USR 65155
  505 BORDER 6: PAPER 6: INK 0: C
LS : GO SUB 150
  510 FOR F=65208 TO 65313 STEP 1
5: POKE F,0: NEXT F
  515 RANDOMIZE : RESTORE 520: FO
R F=65200 TO 65274: READ G: POKE
 F,G: NEXT F
  520 DATA 200,INT (RND*140)+25,0
,0,LEV,2,0,0,1,0,0,250,0,11,15
  530 DATA 50,INT (RND*140)+25,0,
0,2,2,0,0,1,0,32,250,0,11,15
  540 DATA 188,0,-3,0,1,0,0,254,0
,0,64,250,0,3,1
  550 DATA 62,0,4,0,1,0,0,254,0,0
,64,250,0,3,1
  560 DATA 0,0,0,1,4,2,0,255,0,0,
96,250,0,12,16
  570 LET SC=0: LET SP=0: LET WAG
=0
  580 RANDOMIZE : FOR F=1 TO 4: F
OR G=1 TO INT (RND*6)+6: PRINT A
T INT (RND*22),INT (RND*4)+(1 AN
D F=1)+(9 AND F=2)+(18 AND F=3)+
(27 AND F=4); INK 4;CHR$ (144+(R
ND*3)): NEXT G: NEXT F
  590 FOR F=0 TO 21: PRINT AT F,6
; INK 2;"  ";AT F,25; INK 1;"  "
: NEXT F
  600 RETURN
  800 BORDER 1: PAPER 5: INK 1: B
RIGHT 1: CLS
  810 PRINT AT 1,7; BRIGHT 0; PAP
ER 7;" -- WILD WEST -- "
  820 PRINT AT 3,0;" Here you are
 again - a lone      cowboy facin
g death under the    hot sun burn
ing down on the      wide desert.
"
  830 PRINT '" No one there to he
lp you -      you're on your own
 against      Slim Joey, whose n
ame is       feared throughout
the west."
  835 PRINT '" He moves faster, h
is bullet is   faster - so good l
uck, boy!"
  840 PRINT '" You will only surv
ive 2 hits.    And you cannot mov
e once Joey    has been hit, his
bullet may     hit you in the mea
ntime."
  850 GO SUB 1000: PRINT #0; PAPE
R 6; INK 0;"                PRESS ANY K
EY!": BEEP 1,-10: PAUSE
 0: CLS
  860 PRINT '" The cacti and cove
red waggons    will gain you no b
onus points.   It is just him or
you."
  870 PRINT '" Move by pressing
keys P or L    (up/down) and pul
l the trigger  by pressing key 0
."
  880 PRINT AT 19,0;" Press key 1
-6 to select game      level (1-5;
6=hard) ": BEEP 1,-12
  890 LET I$=INKEY$: IF I$<"1" OR
 I$>"6" THEN GO TO 890
  900 LET LEV=VAL I$: BRIGHT 0: G
O TO 30
1000 RESTORE 1000: FOR F=USR "A"
 TO USR "F"+7: READ G: POKE F,G:
 NEXT F
1010 DATA 16,144,146,146,242,18,
30,16,16,16,18,146,146,158,240,1
6
1020 DATA 2,17,9,5,37,21,108,44,
0,0,4,72,80,36,168,176
1030 DATA 36,21,138,74,38,27,7,7
,178,164,168,176,80,252,128,192
1040 FOR F=64000 TO 64064: READ
G: POKE F,G: NEXT F
1050 DATA 7,0,15,128,5,0,9,0,5,0
,2,0,199,224,63,160,15,160,15,64
,15,128,7,128,5,0,5,0,11,0,0,0,2
8,0,62,0,20,0,16,0,20,0,8,0,252,
96,191,128,190,0,94,0,62,0,60,0,
20,0,20,0,26,0,0,0,224
1060 FOR F=64096 TO 64127: READ
G: POKE F,G: NEXT F: RETURN
1070 DATA 15,0,16,128,96,96,192,
48,192,48,192,48,192,48,192,48,1
92,48,192,48,64,32,63,192,15,0,1
59,144,255,240,128,16
9999 CLS : PRINT AT 10,8;"© A.ZE
RFASS 1984"
```

The game Wild West allows one player to take part in a deadly gunfight. Full instructions are included in the program. It is you against Slim Joey, who is controlled by the computer. Joey will be able to move faster than you — especially on the higher levels — so he's a really tough opponent. Some extra features are cacti spread all over the scenario — a desert — and a covered wagon which will appear at random and will explode if hit by a bullet.

Type in the program carefully and save it on tape with

SAVE "wild west" LINE 1

Load the 48K Sprite routine and save it immediately behind the main program with

SAVE "spmov48k" CODE 64551,611

Verify the recordings and try to run the program. Check all Peek/Poke/Rand USR statements and the sprite data hold in lines 520-560 and 1050-1070 — graphics — if the game does not work properly.

A lot of work may be saved by editing similar lines and changing the small differences — e.g. 70-72 and 75-77.

Program structure.

1-25	Set-up
50-66	Main loop
70-72	Subroutine: Player's bullet hit
75-77	Subroutine: Joey's bullet hit
100-110	Subroutine: Player/Joey hit
150	Subroutine: Print score table
160-270	End of game
500-600	Subroutine: Set up screen and Poke initial values for sprites
800-900	Instructions and selection of skill level
1000-1070	Subroutines: Set up user-defined graphics (1000-1030) and sprite graphics (1040-1070)

The hex loader.

```
  10 DEF FN h(h$)=16*(CODE h$(1)
-48-(7 AND h$(1)>"9"))+CODE h$(2
)-48-(7 AND h$(2)>"9")
  20 INPUT "Start ";s
  30 INPUT "Finish ";f
  40 FOR n=s TO f STEP 8
  50 LET tot=0: PRINT n;": ";
  60 INPUT h$: PRINT h$;
  70 LET x=0
  80 FOR b=1 TO LEN h$ STEP 2
  90 LET z=FN h(h$): LET tot=tot
+z
 100 POKE n+x,z
 110 LET h$=h$(3 TO ): LET x=x+1
 120 NEXT b
 130 PRINT " = ";: INPUT t: PRIN
T t
 140 IF tot<>t THEN PRINT "input
 error - try again": GO TO 50
 150 NEXT n
 160 REM enter STOP to stop
```

The machine code.

```
64551: 2A94FE22A0FE3A8B = 1089
64559: FE329DFEDD460EC5 = 1217
64567: 3A9DFEFEFF2004DD = 1235
64575: 3613AF3A8AFE329C = 904
64583: FE2AA0FE56235E23 = 960
64591: 22A0FEED4B9CFECD = 1375
64599: AA223299FE329EFE = 1123
64607: 2FE6073003295FE32 = 853
64615: 9FFEDD861232 9CFE = 1246
64623: DD361000CD85FCED = 1187
64631: 4B9CFEAF3299FE32 = 1167
64639: 9AFED D361108CDAA = 1083
64647: 224ECDCEFC3A9CFE = 1243
64655: C5083290FEED4B9C = 1134
64663: FECDAA223A9EFE32 = 1183
64671: 9BFE3A9FFE329AFE = 1338
64679: DD360F004ECDC3FC = 1020
64687: DD3513C11081C94E = 910
64695: 3A99FEFE002805CB = 967
64703: 013D20FB3A9BFEFE = 1066
64711: 002835FE08201 57A = 530
64719: DDCB184520042FA1 = 762
64727: 1806A1C40DFD7AB1 = 952
64735: 4F5371C9CB23CB12 = 935
64743: 3804CB01180FDDCB = 727
64751: 18462807CB11DC0D = 594
64759: FD1802CB213D20E4 = 836
64767: 3A9AFEFE002805CB = 968
64775: 013D20FB71C9DDCB = 1083
64783: 09FEC9DD360900DD = 969
64791: CB027E28103AA3FE = 862
64799: FE00283FDDBE0028 = 808
64807: 1C3038181803A8AFE = 630
64815: DD850D329EFE3AA3 = 1051
64823: FEDD860DFEFF2823 = 1206
64831: DDBE14381EDDCB03 = 944
64839: 7E20083AA4FEFEAF = 1071
64847: 3040C93AA4FEDD96 = 1150
64855: 0E3CFE002834FE80 = 850
64863: 3030C9DDCB09C6DD = 1149
64871: CB0546 20D8AFDDCB = 1125
64879: 027E20053EFFDD96 = 850
64887: 0D32A3FEDDCB054E = 987
64895: 2005AF3291FE18BD = 875
64903: 3A8CFEED44328CFE = 1201
64911: 18B3DDCB09C6DDCB = 1258
64919: 0546202 43EAFDDCB = 804
64927: 037E28053EFFDD86 = 845
64935: 0E32A4FEDDCB054E = 989
64943: 2005AF3291FEC93A = 920
64951: 8DFEED44328DFEC9 = 1346
64959: 3AA4FEFEE0D8C650 = 1400
64967: DDCB037E2802C660 = 889
64975: 32A4FEC921B0FE11 = 1149
64983: 0F000608C5D5E5E5 = 897
64991: DDE1DDCB08462008 = 991
64999: DDCB0CFEE1D1C119 = 1342
65007: 10EAC9DDCB0C7E28 = 1053
65015: 2BCD5DFEDD361801 = 895
65023: CD27FCDDCB097E28 = 1095
65031: 0ADDCB0846200 4DD = 767
65039: 3607003A8EFE3296 = 715
65047: FEDDE5E1D1C1C5D5 = 1741
65055: EDB018C8DD350020 = 955
65063: C3DD7E07FE0028C9 = 1044
65071: FEFF2803DD3507CD = 1038
65079: 5DFE3A8AFEDD8602 = 1154
65087: 32A3FE3A8BFEDD86 = 1273
65095: 0332A4FEDD361800 = 770
65103: CD27FCCD12FD2AA3 = 1177
65111: FE228AFE189E118A = 1017
65119: FE010F00D5DDE1ED = 1166
65127: B0C9F3F5C5D5E5DD = 1725
65135: E5CDD3FDDDE1E1D1 = 1778
65143: C1F1C338003E09ED = 993
65151: 47ED5EC93E3EED56 = 1050
65159: ED47C900 = 509
```

Graphics 7 Paintbox

Christopher Jones,
Herne Bay,
Kent.

THIS PROGRAM allows the user to draw a picture on a Graphics screen. These pictures may be stored on cassette for retrieval at a later time, so that finished pictures may be viewed again and again or unfinished pictures completed. A number of paint programs are now on the Atari market, but my program allows the user to sample the possibilities of this type of program without parting with any cash!

One of the main considerations while writing this program was to keep it as user-friendly as possible. There are on-screen prompts at all times, and all options are performed in a similar way. In addition to the joystick only the number keys are used to carry out instructions. Although the Atari computer has a vast range of colours to display, I have deliberately kept the choice down to a simple minimum.

The colours are also named — rather than using a combination of hue and luminance — which means that children of reading age should be able to use the program. If anyone is not satisfied with my choice of colours they are easily changed: lines 3000-5000 contain the relevant routines.

When you have typed in the program save it on a cassette and then run it. The screen will show a menu of options:

SCREEN — First select the screen colour of your choice.

PALETTE — Next select three colours with which you wish to draw your picture.

COLOUR — This command allows you to choose a working colour from your palette. This colour will then be used when you select draw, circle, etc.

DRAW — A cursor will appear in the centre of the screen in the colour you have chosen. Move the cursor by pushing the joystick in the required direction. If you wish to draw then keep the joystick button depressed and move the joystick in the required direction. To plot a point — useful for stars — simply fire the button once and move on.

DRAWTO — A cursor will appear in the centre of the screen. Move the cursor to one end of the line you wish to draw and hit any key. Then move the cursor to the other end and hit any key. A line will be drawn between the two points.

ERASE — When the cursor appears move it to the area you wish to erase. Hold the joystick button down and move over the points and lines you wish to erase.

CIRCLE — Move the cursor to the point where you wish the circle's centre to be and hit any key. Then move the cursor left or right to establish the radius of the circle and hit any key.

FILL — Move the cursor to the area you wish to fill and hit any key. The area must be enclosed and must be filled with the same colour with which it was drawn. Awkward shapes may need more than one fill.

SAVE — Put a blank tape in the casette unit. When you hear two beeps press play and record, then hit return.

LOAD — Put the tape on which you saved the picture in the cassette unit. When you hear a beep press play, then hit return.

Choose your screen colour carefully. It need not be merely a background, but an integral part of the picture e.g. a grey screen colour could be used for the surface of the moon.

If you wish to erase part of a filled in area select a working colour which will show up against that area and then select erase. When the picture is finished try putting a frame around it by using draw or drawto.

Screen colours and palette colours can be changed at any time, often with interesting results. Experimentation is the best approach in this respect, so don't be shy!

If the program should stop for any reason — such as a misuse of Fill — then type Goto 1000 and you will be able to continue work on that picture.

The circle routine in my program is based on the one in Ian Sinclair's *Boots Guide to the Atari 600XL*. I have adapted it to plot a continuous line as the circumference of the circle, because any gaps would interfere with the smooth running of the fill routine. In my version it is also possible to have semicircles and arcs at the edges of the screen.

The display list interrupt routine which protects the colours in the text window is based on the one in Peter Budgell's article on Graphics 10/7 in *Analog 14*. I have altered it to fit in with the colour requirement of my program.

```
1 REM GRAPHICS 7 PAINTBOX
2 REM CHRISTOPHER P. JONES
3 REM APRIL 1984
9 REM INITIALISE
10 OPEN #1,4,0,"K:"
20 GRAPHICS 7
25 DIM A$(10),C1$(10),C2$(10),C3$(10),R(
3,2)
35 R(1,1)=0:R(1,2)=0:R(2,1)=0:R(2,2)=0:R
(3,1)=9:R(3,2)=14
36 GOSUB 11000
37 POKE 752,1
38 SETCOLOR 4,8,8:POKE 54286,192
40 GOTO 1000
199 REM MAIN LOOP
200 X=80:Y=40
205 X1=X:Y1=Y:COLOR C:PLOT X,Y
250 GOSUB 800
255 IF PEEK(764)<255 THEN 2500
265 IF S=15 AND FLAG=0 THEN 350
270 IF FLAG=0 THEN 350
280 COLOR B
290 PLOT X1,Y1
295 LOCATE X,Y,B
305 GOTO 205
350 IF ERASE=1 THEN COLOR 0:PLOT X1,Y1
360 GOTO 295
399 REM FILL
400 Y2=Y:X2=X:COLOR C
405 Y2=Y2-1:LOCATE X2,Y2,C1
410 IF C1<>C THEN 405
415 Y3=Y
420 Y3=Y3+1:LOCATE X2,Y3,C1
425 IF C1<>C THEN 420
450 K=Y3-Y2
460 FOR L=1 TO K:X2=X
465 LOCATE X2,Y2+L,C1
470 IF C1=C THEN 500
480 PLOT X2,Y2+L
485 X2=X2-1
490 GOTO 465
500 X2=X+1
505 LOCATE X2,Y2+L,C1
510 IF C1=C THEN 530
515 PLOT X2,Y2+L:X2=X2+1
520 GOTO 505
530 NEXT L
535 POKE 764,255
550 GOTO 1000
599 REM CIRCLE
600 IF Q=1 THEN 610
601 Q=1:D=B:COLOR C:PLOT X,Y:X2=X:Y2=Y:P
OKE 764,255:GOTO 295
610 Q=0
620 R=X-X2:COLOR C
640 FOR N=0 TO 360
645 Z=X2+R*SIN(N)
646 IF Z<0 OR Z>159 THEN 660
647 O=Y2+R*COS(N)
648 IF O<0 OR O>79 THEN 660
650 PLOT Z,O
660 NEXT N
665 COLOR D:PLOT X2,Y2
680 GOTO 1000
800 REM JOYSTICK INPUT
810 S=STICK(0)
815 T=STRIG(0):FLAG=SGN(T)
825 IF S=10 OR S=11 OR S=9 THEN X=X-1
830 IF S=6 OR S=7 OR S=5 THEN X=X+1
835 IF S=10 OR S=14 OR S=6 THEN Y=Y-1
840 IF S=13 OR S=5 OR S=9 THEN Y=Y+1
845 IF X<0 THEN X=0
850 IF Y<0 THEN Y=0
855 IF X>159 THEN X=159
860 IF Y>79 THEN Y=79
895 RETURN
899 REM DRAWTO
900 IF Q=1 THEN 910
901 COLOR C:PLOT X,Y
905 Q=1
906 X2=X:Y2=Y
907 POKE 764,255:GOTO 295
910 X3=X:Y3=Y
911 COLOR C
915 PLOT X3,Y3:DRAWTO X2,Y2
920 POKE 764,255:Q=0:GOTO 1000
999 REM MAIN MENU
1000 ? "}"
1001 FOR K=1 TO 3:SETCOLOR K-1,R(K,1),R(
K,2):NEXT K
1005 POKE 764,255
1010 ? "DRAW(1),DRAWTO(2),ERASE(3),CIRCL
E(4), FILL(5),SCREEN(6),COLOUR(7),PALETT
E(8)SAVE(9),LOAD(0)?";
1015 ERASE=0:LOCATE 80,40,B
1018 FILL=0:DRAW=0
1019 DRTO=0:CIRCLE=0
1020 GET #1,A
1025 IF A<48 THEN 1020
1030 IF A>57 THEN 1020
1040 IF A=49 THEN DRAW=1:GOTO 2000
1050 IF A=53 THEN FILL=1:GOTO 2200
1055 IF A=51 THEN ERASE=1:GOTO 2100
1060 IF A=52 THEN CIRCLE=1:GOTO 2150
1065 IF A=50 THEN DRTO=1:GOTO 2050
1070 IF A=54 THEN 3000
1075 IF A=55 THEN 3500
1080 IF A=56 THEN 4000
1085 IF A=57 THEN 10000
1090 IF A=48 THEN 10500
2000 ? "}"
2005 ? "PRESS BUTTON TO PLOT,HOLD BUTTON
 TO    DRAW,HIT ANY KEY TO RETURN"
2010 GOTO 200
2050 ? "}"
2055 ? "HIT ANY KEY TO ESTABLISH POINTS"
2060 GOTO 200
2100 ? "}"
2105 ? "HOLD BUTTON TO ERASE,HIT ANY KEY
 TO   RETURN"
2110 GOTO 200
2150 ? "}"
2155 ? "HIT ANY KEY TO ESTABLISH CENTRE
AND   RADIUS(LEFT-RIGHT)"
2160 GOTO 200
2200 ? "}"
2205 ? "HIT ANY KEY TO FILL AN ENCLOSED
SPACE"
2210 GOTO 200
2500 IF ERASE=1 THEN COLOR B:PLOT X,Y:GO
TO 1000
2505 IF DRAW=1 THEN COLOR B:PLOT X,Y:GOT
```

```
0 1000
2510 IF FILL=1 THEN COLOR 0:PLOT X,Y:GOT
0 400
2515 IF DRTO=1 THEN 900
2520 IF CIRCLE=1 THEN 600
2999 REM SCREEN COLOURS
3000 ? ")"
3005 ? "GREY(0),BLUE(1),ORANGE(2),GREEN(
3),   PINK(4),PURPLE(5)?";
3010 GET #1,SET
3011 IF SET<48 THEN 3010
3012 IF SET>53 THEN 3010
3015 IF SET=49 THEN SET=8
3020 IF SET=51 THEN SET=13
3030 SETCOLOR 4,SET,8
3035 GOTO 1000
3499 REM PLOT COLOUR
3500 ? ")"
3505 ? C1$;"(1),";C2$;"(2),";C3$;"(3)?"
3525 GET #1,A:C=A-48
3530 IF C<1 OR C>3 THEN 3525
3535 GOTO 1000
3999 REM PALETTE COLOURS
4000 ? ")"
4005 ? "WHITE(0),BLACK(1),BLUE(2),GREEN(
3),   YELLOW(4),RED(5),ORANGE(6),BROWN(7
)   PICK 3";
4015 FOR K=1 TO 3
4020 GET #1,A:A=A-48
4025 IF A<0 OR A>7 THEN 4020
4030 IF A=0 THEN A$="WHITE":R(K,1)=9:R(K
,2)=14
4035 IF A=1 THEN A$="BLACK":R(K,1)=0:R(K
,2)=0
4040 IF A=2 THEN A$="BLUE":R(K,1)=7:R(K,
2)=6
4045 IF A=3 THEN A$="GREEN":R(K,1)=13:R(
K,2)=10
4050 IF A=4 THEN A$="YELLOW":R(K,1)=15:R
(K,2)=12
4055 IF A=5 THEN A$="RED":R(K,1)=3:R(K,2
)=4
4060 IF A=6 THEN A$="ORANGE":R(K,1)=2:R(
K,2)=8
4065 IF A=7 THEN A$="BROWN":R(K,1)=2:R(K
,2)=2
4071 ON K GOSUB 4600,4700,4800
4075 NEXT K
4080 GOTO 1000
4600 C1$=A$:RETURN
4700 C2$=A$:RETURN
4800 C3$=A$:RETURN
9999 REM SAVE ROUTINE
10000 ? ")":? "PREPARE CASSETTE FOR SAVE
"
10005 SCREEN=PEEK(88)+256*PEEK(89)
10010 OPEN #2,8,0,"C:"
10015 FOR T=0 TO 3199
10020 PUT #2,PEEK(SCREEN+T)
10025 NEXT T
10030 PUT #2,SET
10035 FOR T=1 TO 3
10040 PUT #2,R(T,1):PUT #2,R(T,2)
10045 NEXT T
10050 CLOSE #2
10055 GOTO 1000
10499 REM LOAD ROUTINE
10500 ? ")":? "PREPARE CASSETTE FOR LOAD
"
10505 SCREEN=PEEK(88)+256*PEEK(89)
10510 OPEN #2,4,0,"C:"
10515 FOR T=0 TO 3199
10520 GET #2,A:POKE SCREEN+T,A
10525 NEXT T
10530 GET #2,SET
10535 FOR T=1 TO 3
10540 GET #2,A:R(T,1)=A:GET #2,A:R(T,2)=
A
10545 NEXT T
10550 CLOSE #2
10551 SETCOLOR 4,SET,6
10555 GOTO 1000
10999 REM PROTECT TEXT WINDOW
11000 DIM DLI$(29)
11010 RESTORE 11050:FOR X=0 TO 28:READ I
:POKE ADR(DLI$)+X,I:NEXT X
11020 POKE PEEK(560)+256*PEEK(561)+84,14
1
11030 POKE 513,INT(ADR(DLI$)/256):POKE 5
12,ADR(DLI$)-PEEK(513)*256
11040 RETURN
11050 DATA 72,169,0,141,10,212,141,27,20
8,169,144,69,79,37
11060 DATA 78,141,24,208,169,10,69,79,37
,78,141,23,208,104,64
```

McConverter

Ed Corteen,
Westbury,
Wiltshire.

Spectrum

THIS PROGRAM is designed to convert machine code into data statements which are then ready for publication. I have used the method used by Ian Briscoe in his Windos program.

To use the program simply type it into your Spectrum altering the program to suite. The addition of the interface 1 and Microdrives alters the base address of Basic so use Let Poke =23761 for non-Microdrive users and LET Poke =23819 if the Microdrives are fitted.

The program as listed is self-explanatory. Run the program and you will be presented with the Menu. If your program is a long one it is probably best if you use option 3 first to ensure you don't run out of memory when using Edit to enter copies of line 1000.

Once the program has been run always use Goto g to run. Now use option 1 to initialise the variables. Use Edit to enter copies of line 1000. Use a line interval of 10.

Next use option 2 to check that you have entered enough copies.

Now we come to the interesting part. If you look in the manual page 166, you will see how the lines of Basic are organised. We know the address and length of each line — 119 bytes. Option 4 will read the machine code, convert it to Hex notation and Poke the code into each line. At the same time it calculates the checksum and this is Poked in at the end of the line. Using Edit to enter copies of line 1000 reserves space at the correct address for your machine code.

This process is quite slow being Basic. It takes about 40 seconds per line. Clever machine-code programmers can convert this.

Once the code has been Poked into each line it can be checked with option 5. To publish your masterpiece simply send off the data lines with the loader program (lines 7200 to 7630) plus any extra Basic lines required. And there you have it — all the hours spent covertting and checking your code have been overcome.

The data lines once "decompiled" can now be anywhere in your completed program. But remember they must be at the beginning of your program while they are being converted. If they aren't you will end up with some very strange looking lines or more likely a crash!

```
1000 DATA "000000000000000000000000
0000000000000000000000000000000000
0000000000000000000000000000000000
0000000000000000",1234
1010 DATA "000000000000000000000000
0000000000000000000000000000000000
0000000000000000000000000000000000
0000000000000000",1234
1020 REM use 100 characters per
line, with 4 characters for chec
ksum
1030 REM use line interval of 10
 for data statements
6000 REM AUTOLINE
6010 REM ED CORTEEN
6020 REM January 1985
6990 REM after running program
use GO TO g to run
7000 LET g=7000: CLS : PRINT "En
ter......"
7010 PRINT "1:To initialise"
7020 PRINT "2:To check number of
 DATA lines"
7030 PRINT "3:To load m/c code"
7040 PRINT "4:To Decompile progr
am"
7045 PRINT "5:To compile program
"
7050 IF INKEY$="" THEN  GO TO 70
50
7060 IF INKEY$="1" THEN  GO TO 8
000
7070 IF INKEY$="2" THEN  GO TO 8
055
7080 IF INKEY$="3" THEN  GO TO 8
500
7090 IF INKEY$="4" THEN  GO TO 8
100
7100 IF INKEY$="5" THEN  GO TO 7
200
7110 GO TO 7050
7195 REM **hex loader**
7197 REM change address as neede
d
7200 CLEAR 58999
7210 LET address=59000
7220 LET line=1000: RESTORE line
7230 FOR a=1 TO line:
  REM **number of DATA lines**
7240 GO SUB 7500
7245 PRINT line;" OK.";
7250 LET line=line+10
7260 NEXT a
7270 CLS : PRINT "Code in memory
."
7280 INPUT "name of code? ";z$:
INPUT "length of code? ";length
7290 SAVE *"m";1;z$CODE address,
length
7300 PRINT "Verifying..": VERIFY
 *"m";1;z$CODE
7310 PRINT "Finished saving ";z$
7320 GO TO 7000
7500 READ a$,checksum
7510 LET total=0
7520 FOR i=1 TO LEN a$ STEP 2
7530 LET high=CODE a$(i)-48
7540 LET low=CODE a$(i+1)-48
7550 LET high=high-39*(high>9)
7560 LET low=low-39*(low>9)
7570 LET byte=(16*high)+low
7580 LET total=total+byte
7590 POKE address,byte
7600 LET address=address+1
7610 NEXT i
7620 IF total<>checksum THEN  PR
INT "Error in line ";line;"."''"c
heck and re-run": STOP
7630 RETURN
7990 REM **initialise**
8000 CLS : PRINT "enter lenth of
 m/c CODE ": PRINT "this must be
 rounded UP to the  nearest 50":
 INPUT l
8005 LET x=INT (l/50): REM numbe
r of lines required
8010 PRINT "use EDIT to create "
;x;" copies      of line 1000"
```

(continued on next page)

(continued from previous page)

```
8015 PRINT#0;"press any key to
LIST program": PAUSE 0
8020 CLS : LIST 1000
8040 REM **check number of data
lines**
8050 REM *detects the quote mark
after each data statement**
8053 REM if no microdrive fitted
 LET poke=23761
8055 LET poke=23819: LET line=0
8065 FOR p=poke TO poke+(x+1)*11
9 STEP 119: IF PEEK (p-1)<>34 TH
EN  GO TO 8080
8070 LET line=line+1: NEXT p
8080 PRINT AT 8,0;"you have ente
red ";line ;" copies of line 100
0"
8090 GO TO 7050
8095 REM **decompiling routine**
8100 LET poke=23819: INPUT "star
t of code? ";peek
8110 LET linenumber=990
8115 FOR p=poke TO poke+((x-1)*1
19) STEP 119
8120 LET linenumber=linenumber+1
0: PRINT AT 10,0;"decompiling li
ne ";linenumber
8130 GO SUB 9000
8140 NEXT p
8150 PRINT AT 12,0;"FINISHED!"
8155 PRINT#0;"Hit any key to co
ntinue": PAUSE 0
8160 GO TO 7000
8490 REM **loading routine**
8500 IF poke=23819 THEN  GO TO 8
550
8510 PRINT#0;"prepare cassette
and hit any key": PAUSE 0
8520 LOAD ""CODE
8530 GO TO 7000
8550 CAT 1: INPUT "name of CODE
?";z$
8560 LOAD *"m";1;z$CODE
8570 GO TO 7000
9000 DIM a$(2): LET checksum=0
9010 LET a=p
9030 FOR a=a TO a+99 STEP 2
9040 LET a$=FN h$(PEEK peek)
9050 LET checksum=checksum+PEEK
peek
9060 LET peek=peek+1
9070 POKE a,CODE a$(1)
9080 POKE a+1,CODE a$(2)
9090 NEXT a
9100 DIM c$(4): LET c$=STR$ chec
ksum
9110 FOR f=2 TO 5: POKE a+f,CODE
 c$(f-1): NEXT f
9120 RETURN
9960 REM ***dec-hex converter***
9970 DEF FN k$(x,y)="0123456789a
bcdef"(INT (x/16^y)-16*INT (x/16
^(y+1))+1)
9980 DEF FN h$(x)=FN k$(x,1)+FN
k$(x,0)
9998 ERASE "m";1;"autoline"
9999 SAVE *"m";1;"autoline": VER
IFY *"M";1;"autoline"
```

Hires and Gnasher

Karl Williams,
Swansea,
West Glamorgan.

Oric

HIRES COPY provides a direct screen to printer dumping utility which handles text and graphics on all Oric computers except the 16K machine for which the addresses in lines 10020, 10050, 10060 and 11010 must be altered.

Oric Gnasher is a Pac-man style program following the usual rules and is designed for use on the Atmos although it should run on the Oric-I 48K.

Cursor keys are used to guide your man around the maze. However, points are lost if you retrace your steps which is also dangerous as the ghost follows in your footsteps and gets closer towards the end of the game, the maze has been designed with this in mind.

Moving over the fruit enables you to kill the ghost before the screen returns to normal. The object is to eat all the dots and move onto the pyramid. More screens could be added by using more data after lines 2120 to 2180 with appropriate adjustments in the rest of the program.

Hire copy.

```
10015 LPRINT CHR$(18):LPRINT"I"
10020 A=£A000
10030 REPEAT
10040 A=A+1
10050 UNTIL PEEK(A)>64 OR A=£BF3F
10060 IF A=£BF3F THEN LPRINT'M0,-400":PING:END
10070 X=PEEK(A)-64
10080 IF X/32>=1 THEN X=X-32:S=1:GOSUB 11000
10090 IF X/16>=1 THEN X=X-16:S=2:GOSUB 11000
10100 IF X/8>=1 THEN X=X-8:S=3:GOSUB 11000
10110 IF X/4>=1 THEN X=X-4:S=4:GOSUB 11000
10120 IF X/2>=1 THEN X=X-2:S=5:GOSUB 11000
10130 IF X/1>=1 THEN S=6:GOSUB 11000
10140 GOTO 10030
11000 REM *PRINTER*
11010 B=A-£A000
11020 CY=INT(B/40)
11030 CX=(((B-CY*40)*6)+S)*2
11035 CY=CY*-2
11040 LPRINT"M";CX;",";CY:LPRINT"D";CX+1;",";CY
11050 LPRINT"M";CX;",";CY-1:LPRINT"D";CX+1;",";CY-1
11060 RETURN
```

Gnasher.

```
 0 CLS:PAPER 0:INK 1
 1 DIM M(1000),N(1000):C#="2500":S=3:H$="Karl Williams
":HI=2500
 2 PRINT CHR$(6),CHR$(28),CHR$(17)
 3 GOSUB 5000
 4 CLS
 10 GOSUB 1000
 20 GOSUB 2000
 25 GOSUB 3000
 30 X=21:Y=0:D=1:E=26
 35 EXPLODE
 40 FOR K=LEV TO 1 STEP -1
 42 V=42:W=44:AV=-46:AW=175
 45 IF K/2=INT(K/2) THEN V=41:W=43:AV=174:AW=47
 50 A=DEEK(783)
 52 M(K)=X:N(K)=Y:O=O-1
 53 IF O=0 THEN GOSUB 6000
 54 IF O>0 THEN PAPER7:INK4:V=41:W=43:WAIT 10 ELSE PAP
ER 0
 55 IF A=45310 THEN L=SCRN(X,Y):GOTO 130
 70 IF A=48351 THEN X=X-1:GOTO 110
 80 IF A=48255 THEN X=X+1:GOTO 110
 90 IF A=48319 THEN Y=Y+1:GOTO 110
 100 IF A=48375 THEN Y=Y-1
 110 L=SCRN(X,Y)
 115 IF L=48 THEN X=M(K):Y=N(K):GOTO 145
 120 IF L=45 THEN P=P+10:O=O+1:GOTO 140
 125 IF L=32 THEN P=P-5:GOTO 140
 130 IF L=43 OR L=44 OR L=46 OR L=47 OR L=48 THEN 210
 135 IF S<1 THEN R=555:GOTO 4000
 140 PLOT M(K),N(K),32:PLOT X,Y,V
 145 IF K>LEV-LEV*.07 THEN 155
 150 U=(K*K/15)+1:PLOT D,E,32:PLOT M(U),N(U),W:D=M(U):
E=N(U)
 155 PLOT 21,9,AW:PLOT AX,AY,AV
 157 PLOT 21,9,AW:PLOT AX,AY,AV
 160 SOUND 1,X*2,0:PLAY 1,0,6,1000
 170 PRINT@ 16,0;A:PRINT@ 31,0;S
 180 PRINT@ 18,1;INT(P/(A-(VAL(A$)/2))):PRINT@21,1;INT
(P/10):PRINT@ 33,1;C#
 185 IF S<1 THEN R=555:GOTO 4000
 190 NEXT K
 200 R=777:GOTO 4000
 210 A=58310
 230 IF L=46 OR L=174 THEN PING:P=P+250:PQ=PQ+1:O=25:G
OSUB 3000:GOTO 135
 240 IF L=47 OR L=175 THEN 280
 250 IF (L=43 OR L=44) AND O<0 THEN 270
 260 PLOT X,Y,V:PING:FOR H=500 TO 1 STEP-1:SOUND 1,H,1
5:NEXT H:P=P+500
 265 IR=IR+1:O=1:GOTO 140
 270 PLOT M(K),N(K),32:FOR H=1 TO 300:SOUND 1,H,0:PLAY
1,1,2,5:NEXT H
 275 P=P-500:S=S-1:GOTO 150
 280 IF O<(397-PQ) THEN 290 ELSE 310
 290 PLOT X,Y,V:PLOT M(K),N(K),32:FOR H=80 TO 300 STEP
3:PAPER H/40
 300 SOUND 1,350-H,15:NEXT H:P=P+1000:R=111:GOTO 4000
 310 SHOOT:S=S-1:GOTO 150
 320 SOUND 1,RND(1)*1000+1,15:PAPER 1:WAIT RND(1)*100
0:GOTO 4000
 330 SHOOT:S=S-1:GOTO 150
 1000 REM REDEFINE CHARACTERS
 1010 FOR A=46400 TO 46463
 1020 READ B:POKE A,B
 1030 NEXT A
 1040 RETURN
 1050 DATA 12,12,30,51,51,30,12,12,30,63,45,45,63,33,6
3,30,30,63,45,63,33,63,63
 1060 DATA 30,14,21,31,31,27,17,17,17,14,31,21,31,31,3
1,31,31,0,0,0,12,12,0,0,0
 1070 DATA 6,0,12,30,63,63,30,12,0,0,12,12,30,30,63,0
 2000 REM SET UP SCREEN
 2005 CLS:PAPER 0
 2010 PRINT CHR$(135):PRINT CHR$(135)
 2015 GOSUB 6000
 2020 PLOT 9,0,"LEVEL=":PLOT 24,0,"LIVES="
 2025 PLOT3,1,"POINTS=":PLOT16,1,"TIME=":PLOT25,1,"HIS
CORE="
 2030 FOR C=1 TO 55
 2040 IF C>32 THEN D=40 ELSE D=1
 2050 READ E,F
 2060 FOR G=E+48040 TO F+48040 STEP D:POKE G,40:NEXT G
,C
 2070 FOR H=48162 TO 48999:IF PEEK(H)=32 THEN POKE H,4
3
 2080 NEXT H
 2090 FOR I=48162 TO 49002 STEP 40:POKE I,32:NEXT I
 2100 FOR I=48199 TO 49039 STEP 40:POKE I,32:NEXT I
 2120 DATA 83,118,165,170,172,189,191,196,247,256,258,
260,262,274,327,334
 2130 DATA 409,416,458,459,463,465,491,499,542,544,571
,579,623,625,649,657
 2140 DATA 701,702,704,705,729,738,744,754,769,770,807
,808,812,818,824,829
 2150 DATA 833,834,850,858,885,890,894,900,902,907,911
,916,963,998,378,384
 2160 DATA 123,923,285,485,565,645,367,767,449,609,852
,892,296,376,298,338
 2170 DATA 619,699,780,808,421,661,782,862,384,344,346
,666,388,668,869,989
 2180 DATA 358,718,791,871,312,672,254,714,236,516,596
,876,150,958
 2200 RESTORE:RETURN
 3000 F=AX:G=AY
 3005 B=INT(RND(1)*3)+1:IF B=1 THEN AX=33:AY=21
 3010 IF B=2 THEN AX=24:AY=12
 3020 IF B=3 THEN AX=18:AY=21
 3030 IF AX=F AND AY=G THEN 3005
 3040 IF O<25 THEN PRINT@ 2,0;CHR$(129):PRINT CHR$(129
)
 3050 RETURN
 4000 WAIT 200:CLS:PAPER 0:INK 4
 4005 PING
 4010 IF R=111 THEN B$="CONGRATULATIONS!"
 4020 IF R=777 THEN B$="Sorry you ran out of time!"
 4030 IF R=555 THEN B$="Sorry you ran out of lives!"
 4040 SA=(40-LEN(B$))/2
 4045 PRINT:PRINT CHR$(4)
 4050 PRINT:PRINT CHR$(27);"G";CHR$(27);"N";SPC(SA);B$
 4055 PRINTCHR$(4)
 4060 PRINT:PRINT" LEVEL:";TAB(10);CHR$(135);A#
 4070 PRINT:PRINT" GHOSTS KILLED:";TAB(18);CHR$(135);I
R
 4080 PRINT:PRINT" FRUIT OBTAINED:";TAB(18);CHR$(135);
PQ
 4090 PRINT:PRINT" LIVES LOST:";CHR$(135);TAB(18);3-S
 4100 PRINT:PRINT CHR$(27);"B  You scored ";INT(P/(4-V
AL(A#)));" points!"
 4110 IF P/(4-VAL(A#))<HI THEN 4140
 4120 PRINT:PRINT CHR$(135);CHR$(148);"You have beaten
 the previous HISCORE"
 4125 PRINT CHR$(135);CHR$(148);"of ";C#;" points by "
;HI
 4130 C#=STR$(P):PRINT:INPUT" Your NAME:";H$:HI=P
 4140 PRINT:PRINT"Again? Y or N":REPEAT:GET X#:UNTIL X
#="y" OR X#="n"
 4150 IF X#="y" THEN 4180
 4160 PRINT CHR$(6),CHR$(17),CHR$(28)
 4170 CLS:PAPER 4:INK 7:PING:CALL 583
 4180 PRINT:PRINT"Enter level 1,2 or 3";CHR$(135);
 4185 REPEAT:GET A#:UNTIL VAL(A#)>0 AND VAL(A#)<4:PING
:PRINT A#
 4190 LEV=(4-VAL(A#))*75+400
 4195 S=3:IR=0:PQ=0:T=0:P=0:O=0:D=0:GOTO 10
 5000 CLS:PAPER 0:INK 2
 5010 PRINT CHR$(4)
 5020 PRINT CHR$(27);"G";CHR$(27);"N            ORIC GNA
SHER"
 5025 PRINT CHR$(4)
 5030 PRINT:PRINT:PRINT"Use Cursor keys to guide yours
elf"
 5040 PRINT:PRINT"through the maze but beware of Gollu
m"
 5050 PRINT:PRINT"the Gaelic Ghost! He can only be "
 5060 PRINT:PRINT"destroyed in the short time after yo
u"
 5070 PRINT:PRINT"have eaten the fruit found somewhere
"
 5080 PRINT:PRINT"in the maze."
 5085 PRINT:PRINT"    Your final objective being to ge
t"
 5087 PRINT:PRINT"to the flashing pyramid after eating
"
 5090 PRINT:PRINT"all the dots!":PRINT
 5095 PRINT"AB(8);CHR$(133);"Enter level 1,2 or 3";C
HR$(135);
 5097 REPEAT:A#=KEY$:SOUND1,RND(1)*300,12:WAIT20:UNTIL
 VAL(A#)>0 AND VAL(A#)<4
 5094 PRINT VAL(A#);:LEV=(4-VAL(A#))*75+400
 5095 PRINT:PRINT CHR$(132);CHR$(148);SPC(5);"Press 'R
ETURN' to start"
 5100 REPEAT:SOUND 1,RND(1)*300,12:WAIT 15:UNTIL KEY$=
CHR$(13)
 5110 PING:RETURN
 6000 FOR D=4 TO 24:PRINT@ 1,D;CHR$(INT(RND(1)*5)+129)
 6010 NEXT D
 6020 PRINT@ 2,0;CHR$(135):PRINT CHR$(135)
 6050 RETURN
```

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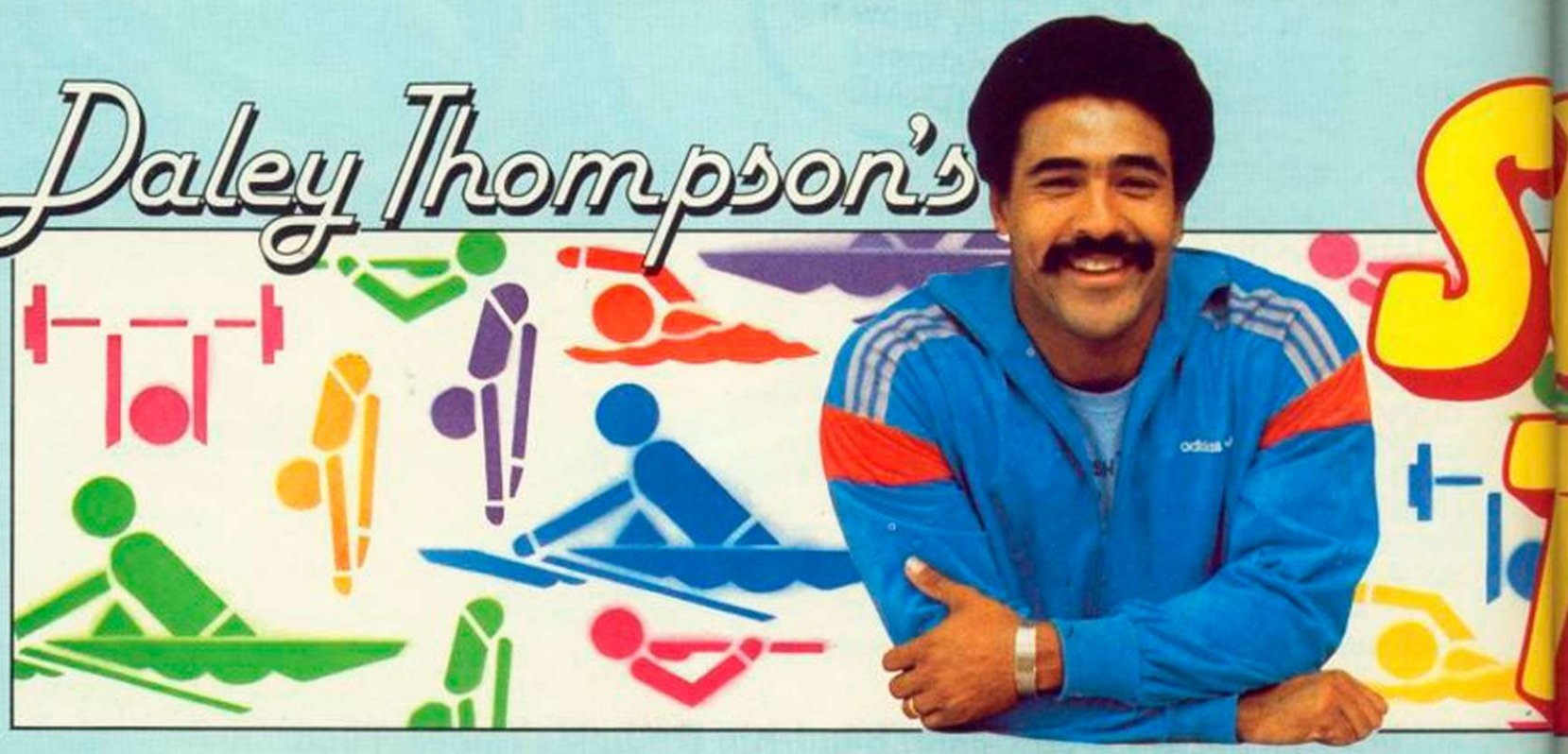
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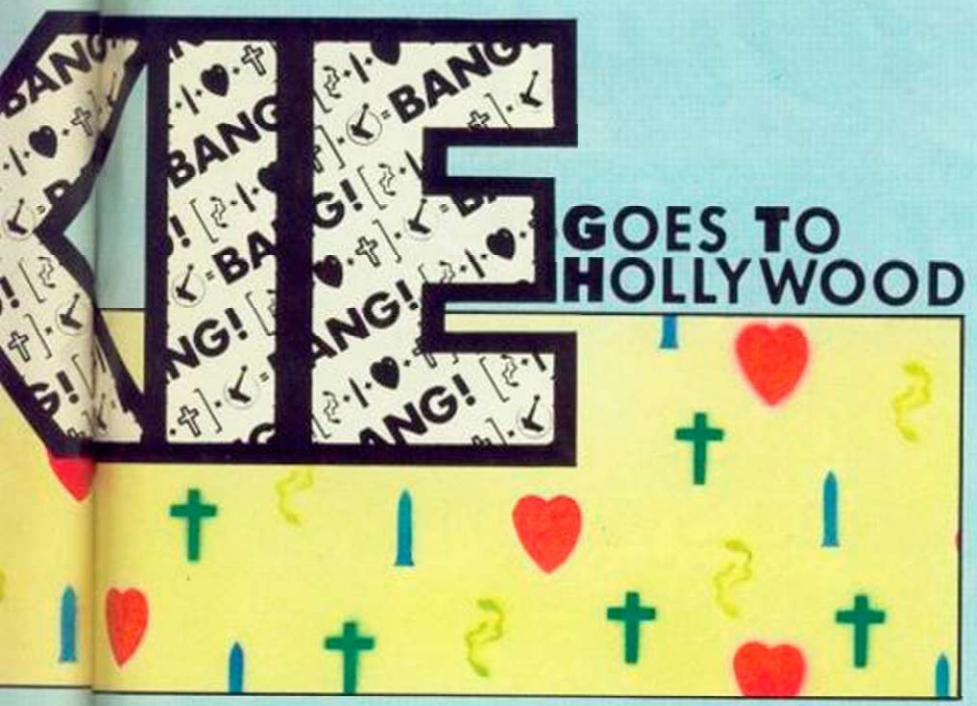
STREET HAWK



Daley Thompson's

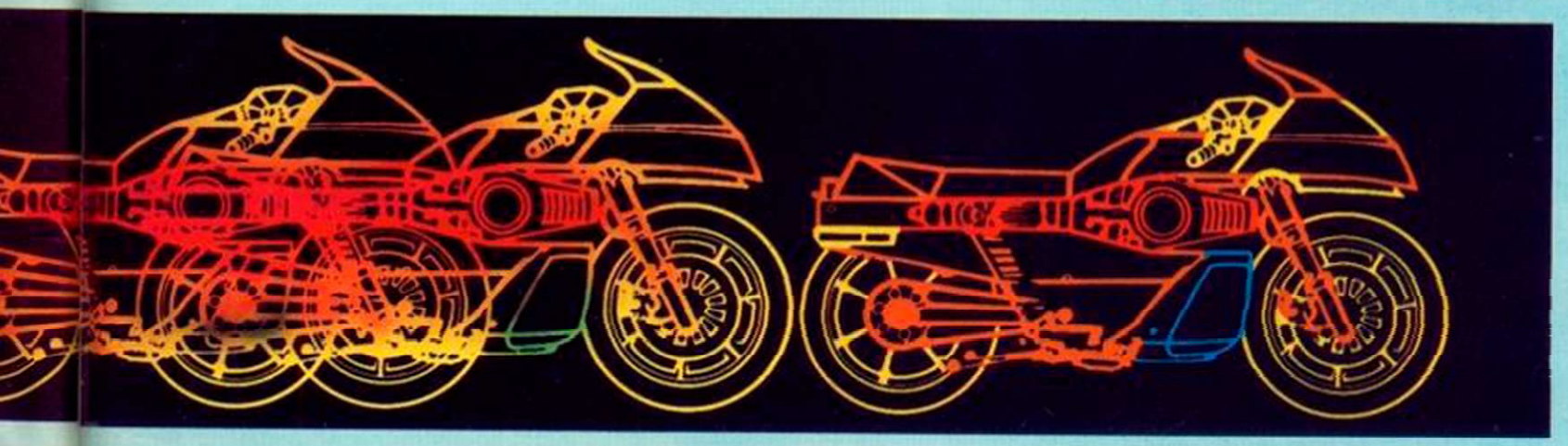


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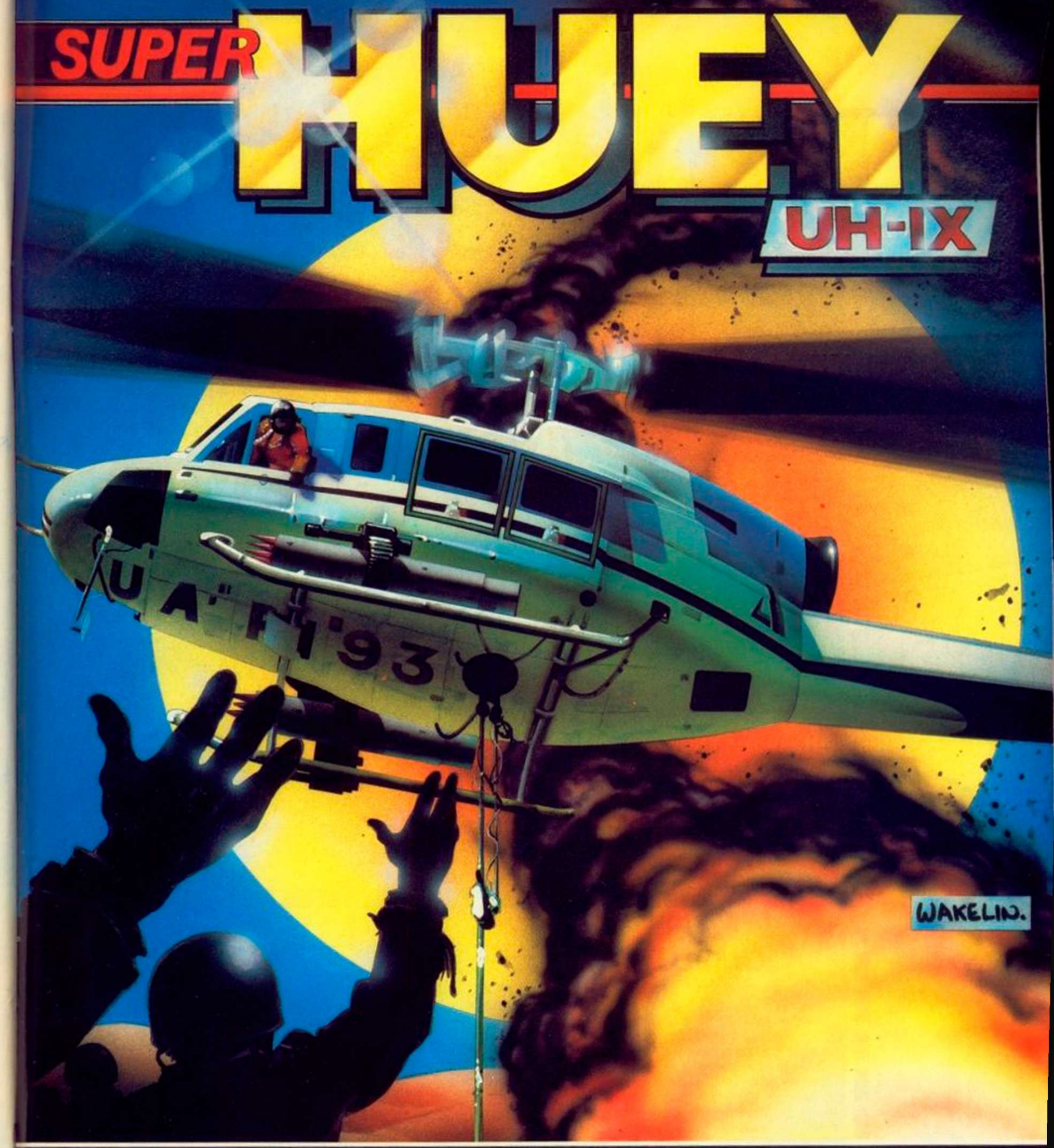
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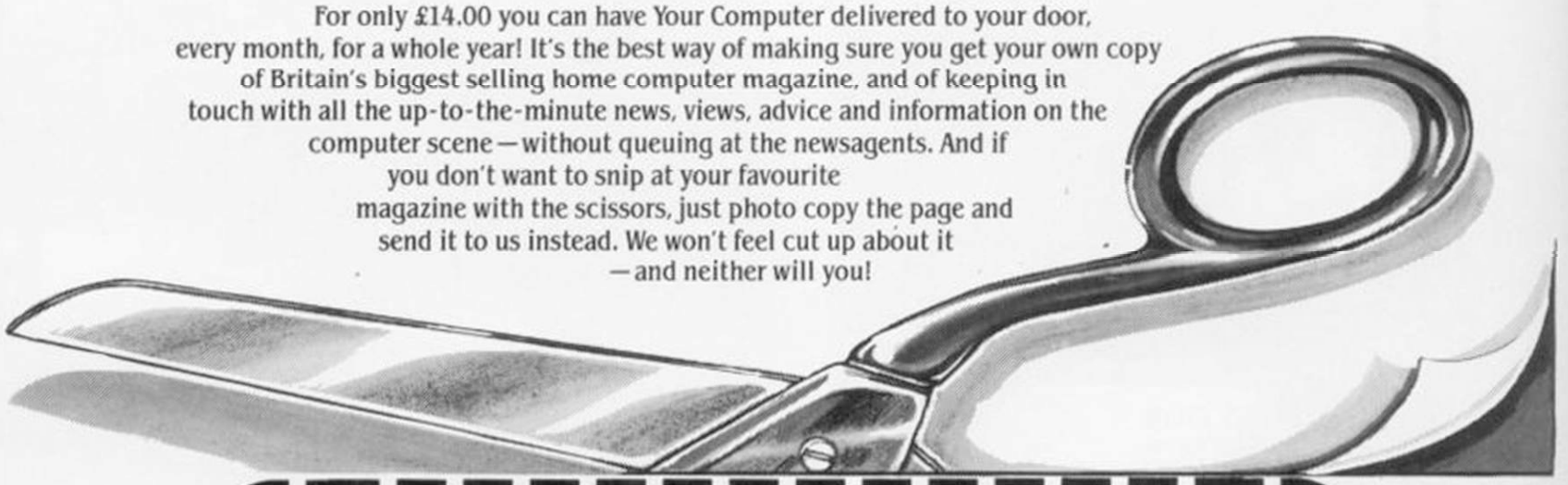
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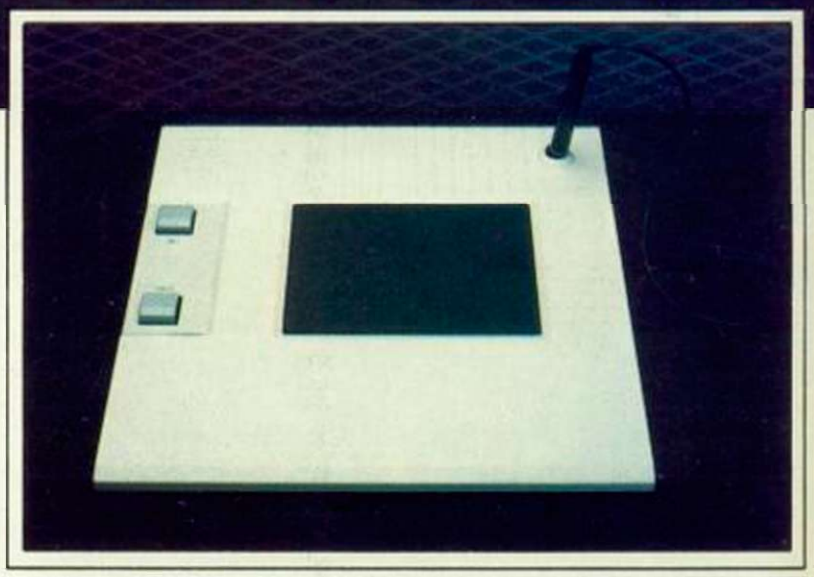
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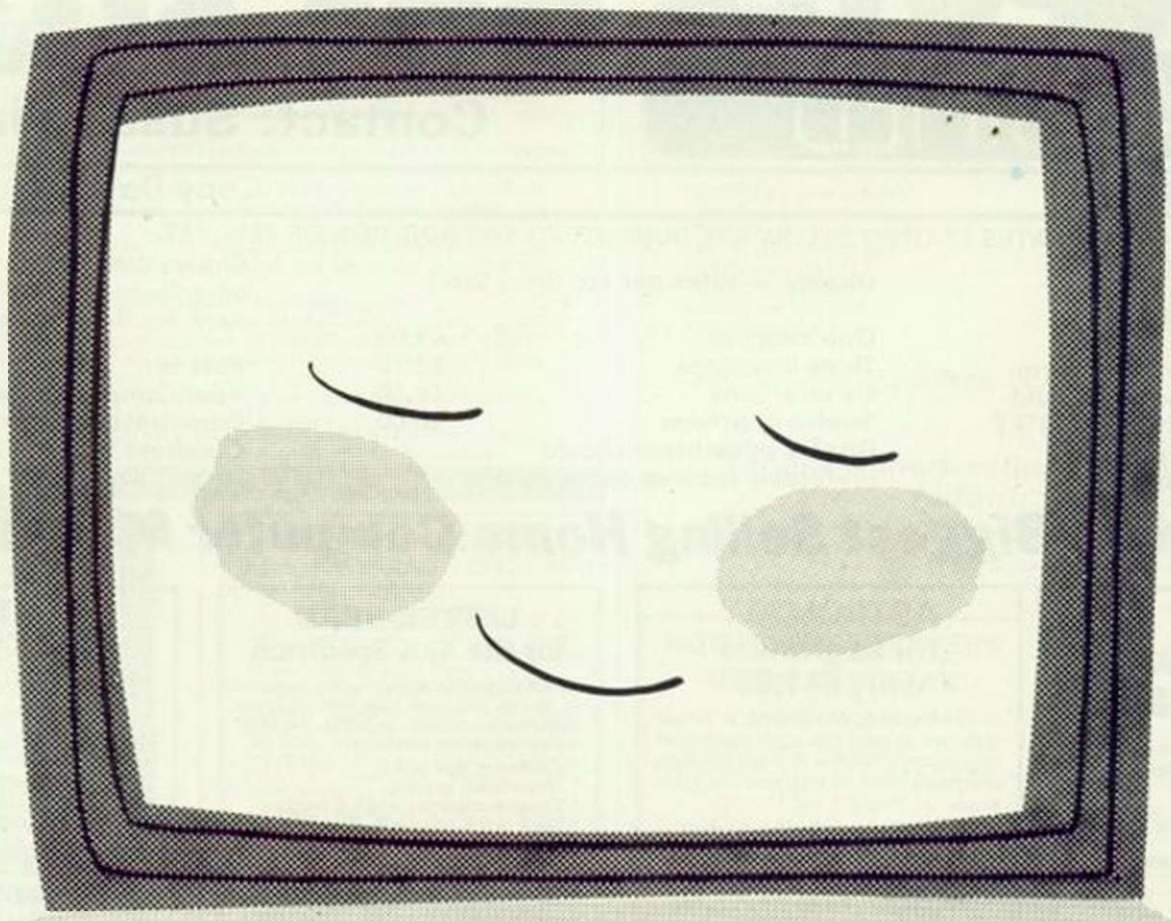
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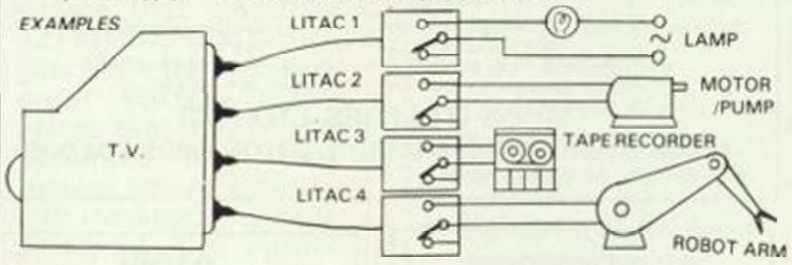
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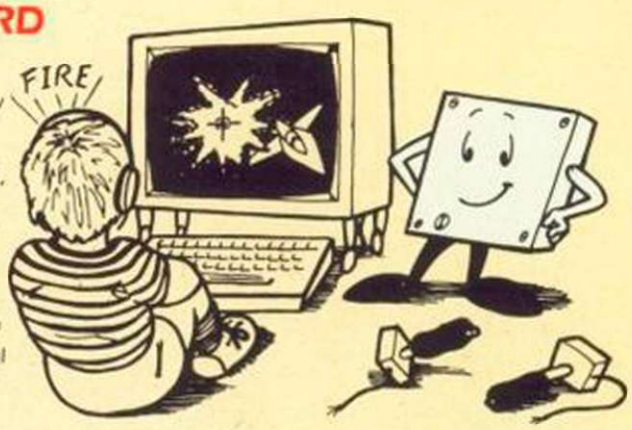




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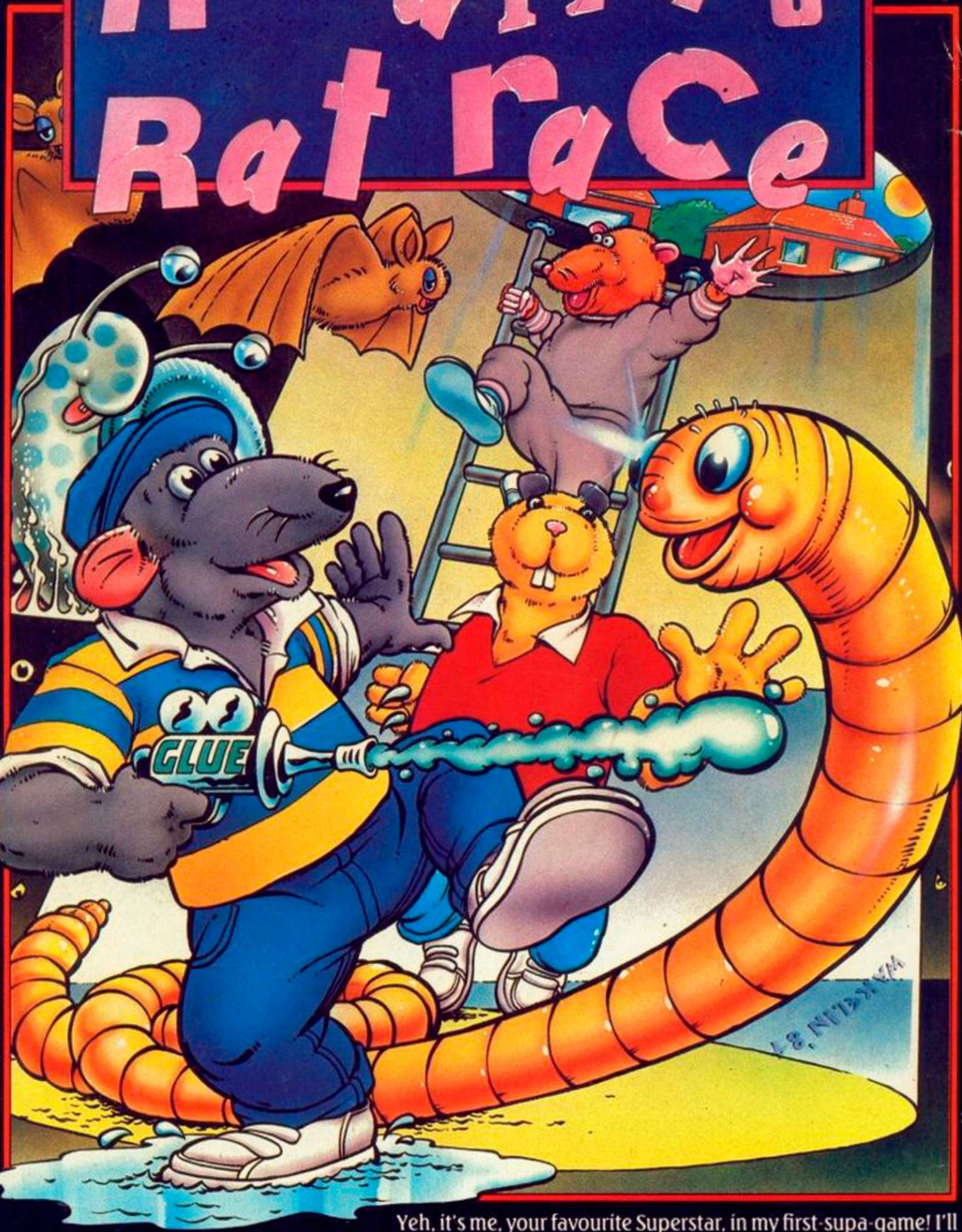
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