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Vol. 5 No. 5

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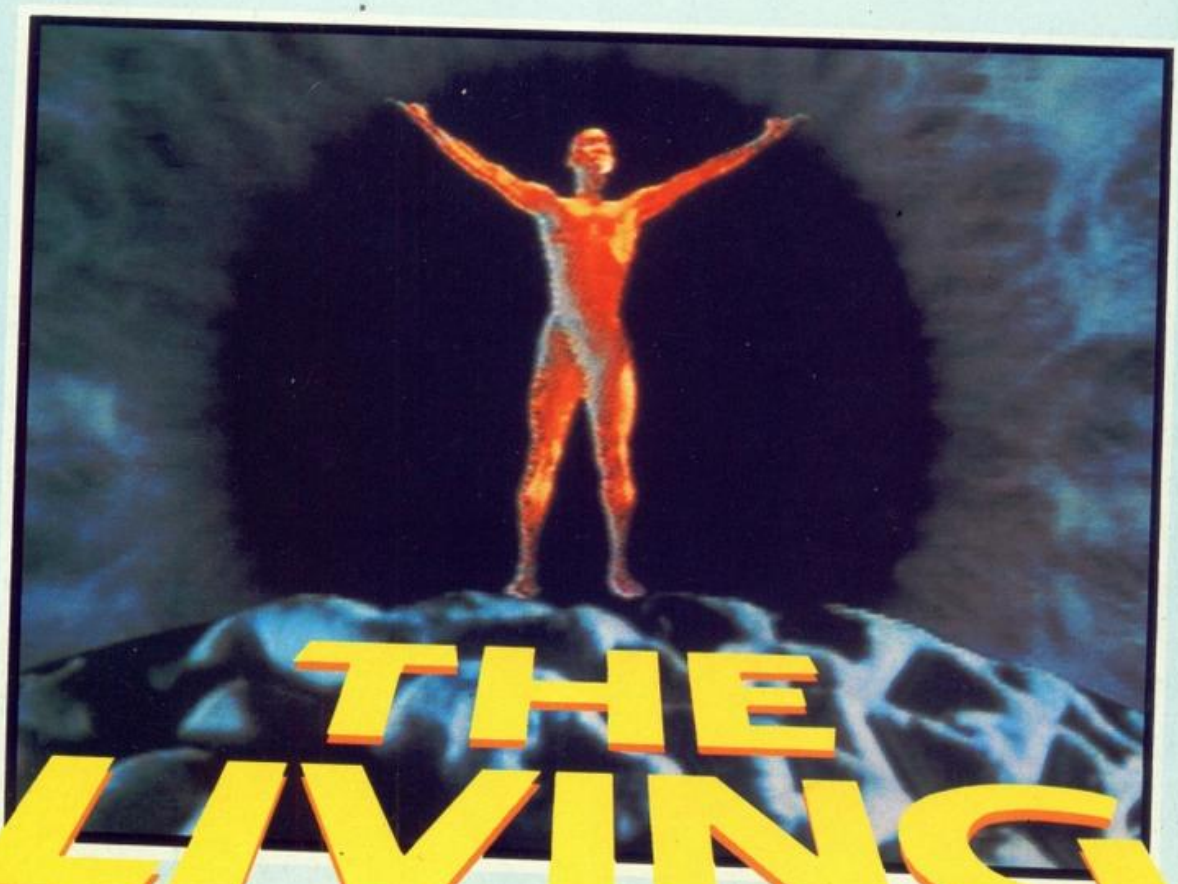

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YOUR COMPUTER

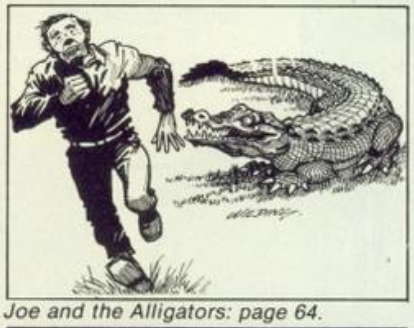
Contents

MAY 1985

Software Shortlist: page 39.

Win an Enterprise: page 51.

Landscapes: page 60.


Joe and the Alligators: page 64.

Cover: Crime and education features: pages 48 and 52.

20 NEWS: US Gold's projected airstrikes; tape cracker; hackers arrested.

25 LETTERS: Keep your old calculators; VDU viewing.

29 FIRST BYTES: We help you hack it in the micro jungle.

33 COMPUTER CLUB: A Scottish busman's holiday on the databuses.

35 HARDWARE HITLIST: Put your QL in touch with the big wide world, courtesy of OEL's QCom package; the Quick Disk alternative to floppy disc drives is tested.

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.

48 HOW COMPUTER CRIME REPORT: Trapdoors, Trojan horses, magic codes. Meirion Jones hacks his way through the mythology of computer crimes and capers.

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.

60 LANDSCAPES: Brian Jones opens up new vistas.

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.

146 DATABASE: Paul Bond rounds up forthcoming micro events.

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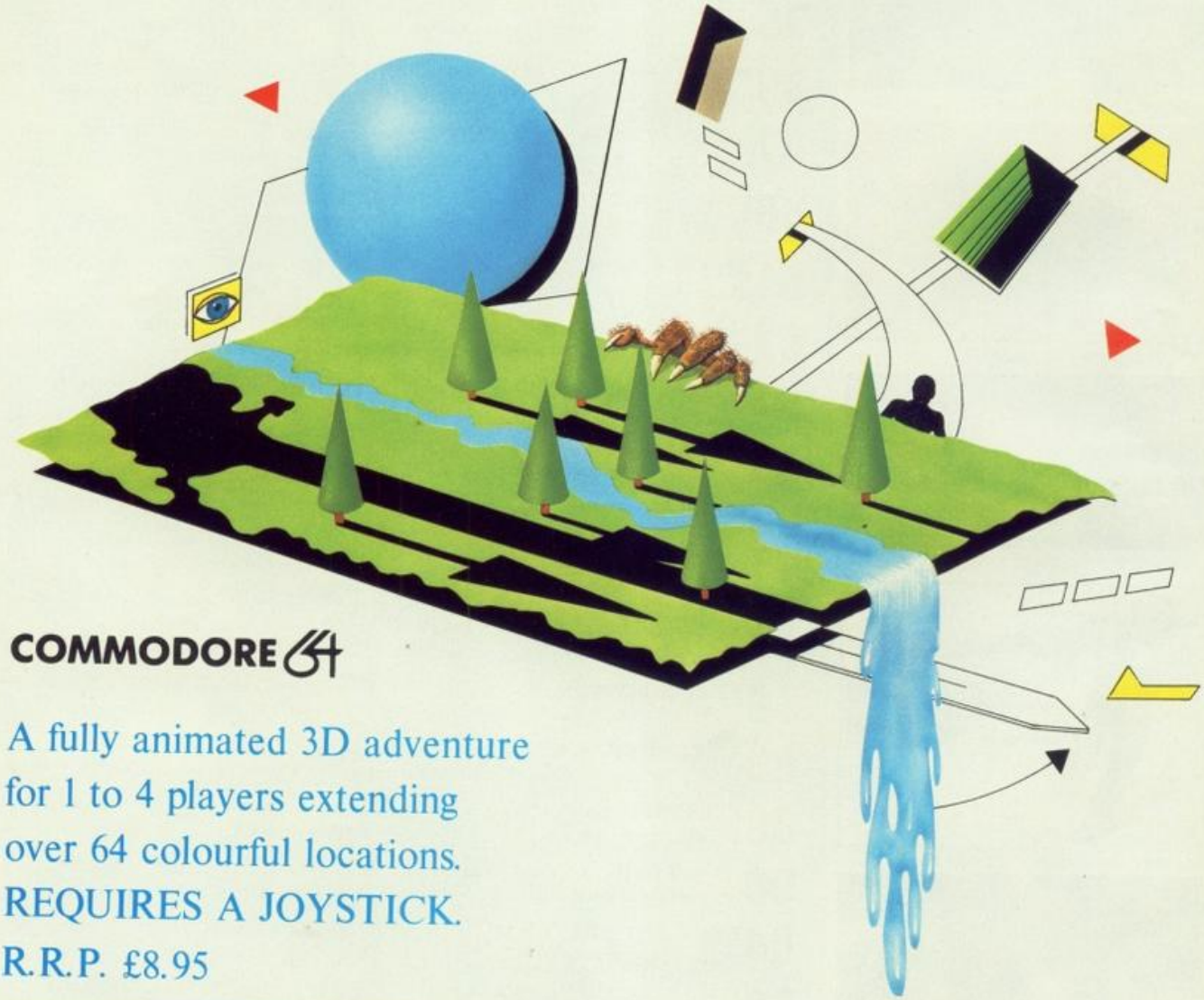

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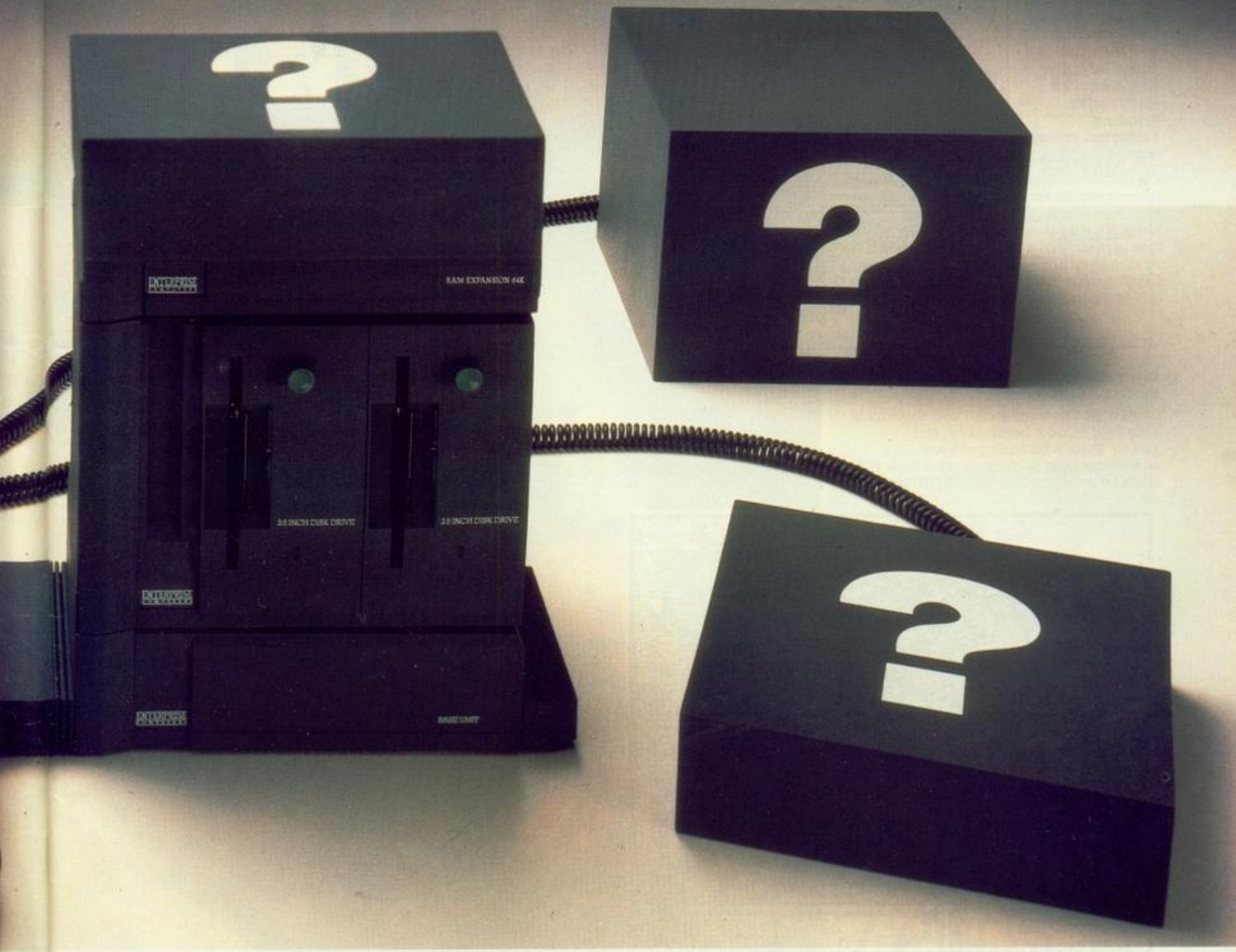

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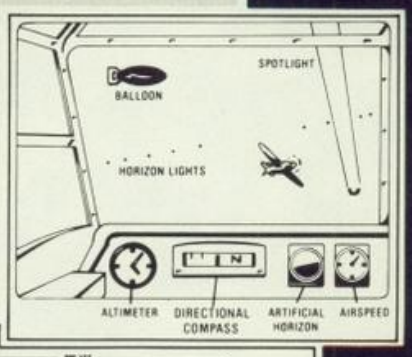
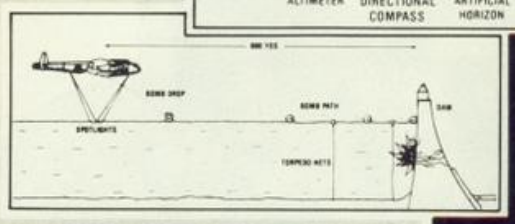
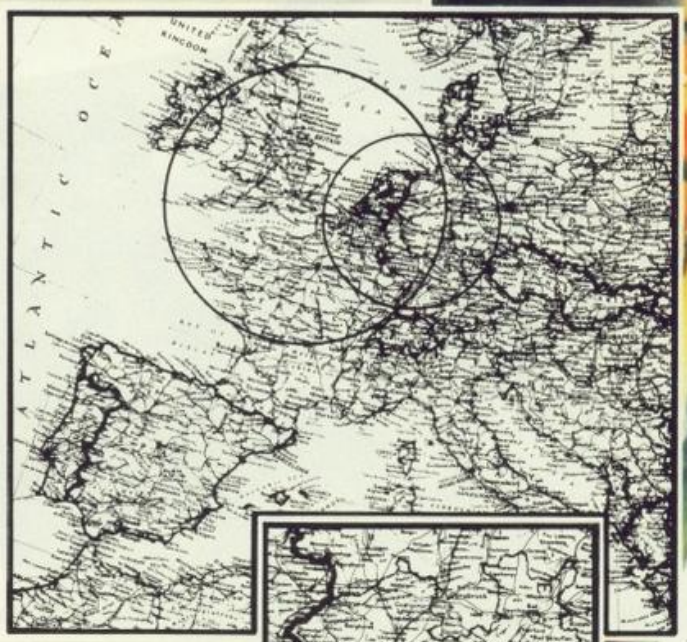




bring the important Mittelland Canal to a virtual standstill.

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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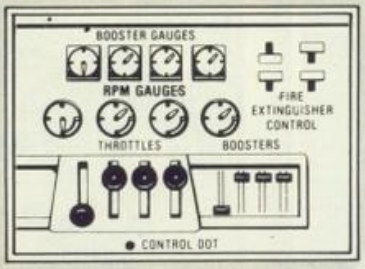

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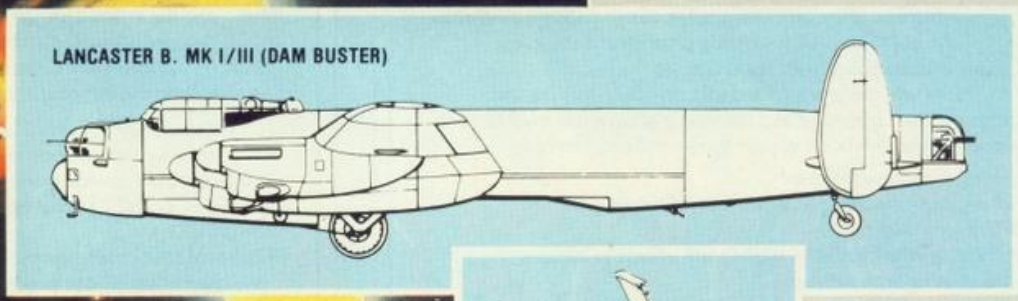

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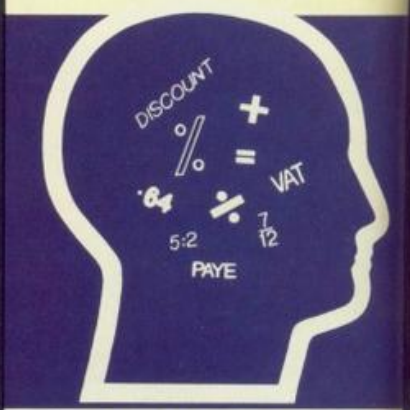

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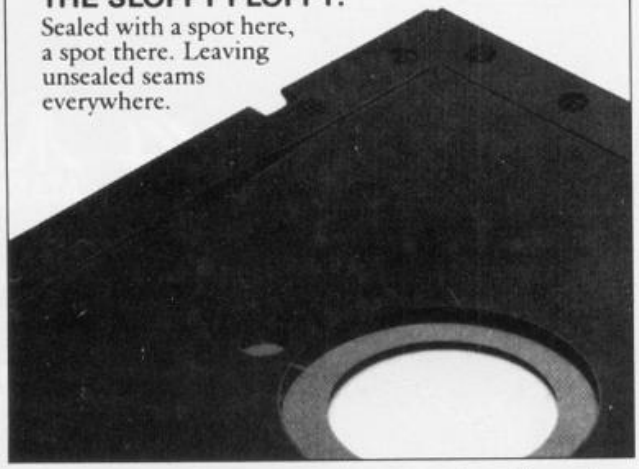

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Quasi wants the soldiers to leave him alone. They fire nasty arrows at him. Quasi doesn't want to, but Quasi will throw big rocks at the nasty soldiers.

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.

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Omnicalc 2	Microsphere	14.95	13.50
Skool Daze	Microsphere	7.95	7.15
Sky Ranger	Microsphere	9.95	8.95
Wheelie	Microsphere	9.95	½ price
Air Traffic Control	Micro-Gen	6.95	6.25
Auto Mania	Micro-Gen	6.95	6.25
Everyone's A Wally	Micro-Gen	6.95	6.25
Pyjamarama	Micro-Gen	6.95	6.25
The Witch's Cauldron	Micro-Gen	6.95	6.25
Alien	Mind Games	6.95	6.95
Collectors Pack	Sinclair	5.95	5.35
Driller Tanks	Sinclair	5.95	5.35
Early Punch	Sinclair	7.95	½ price
English Literature	Sinclair	5.95	½ price
Flight Simulation	Sinclair	7.95	½ price
Forbidden Island	Sinclair	5.95	½ price
Frogger	Sinclair	5.95	½ price
Gilder	Sinclair	5.95	½ price
Hyperdrive	Sinclair	5.95	½ price
Learn to Read 1	Sinclair	5.95	½ price
Learn to Read 2	Sinclair	5.95	4.95
Learn to Read 3	Sinclair	5.95	4.95
Learn to Read 4	Sinclair	5.95	4.95
Learn to Read 5	Sinclair	5.95	4.95
Make a Chip	Sinclair	9.95	½ price
Match Point	Sinclair	5.95	5.35
Moonraker	Sinclair	5.95	½ price
Planet of Death	Sinclair	5.95	½ price
Print Utilities	Sinclair	5.95	½ price
Scrabble	Sinclair	15.95	½ price
Ship of Doom	Sinclair	5.95	½ price
Small Bus Accounts	Sinclair	12.95	½ price
Speech Marks	Sinclair	7.95	7.15
Stop Express	Sinclair	5.95	5.35
Survival	Sinclair	7.95	7.15
The Appointment	Sinclair	7.95	7.15
The Wizard	Sinclair	5.95	½ price
Vu Calc	Sinclair	5.95	½ price
Vu File	Sinclair	5.95	½ price
Vu 3D	Sinclair	5.95	½ price
Zeus Assembler	Sinclair	12.95	½ price
Z Fourth	Sinclair	14.95	½ price
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Black Bull	Micromega	6.95	6.25
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Pogo	Micromega	6.95	6.25
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Bruce Lee	Sinclair	5.95	5.35
Bruce Lee

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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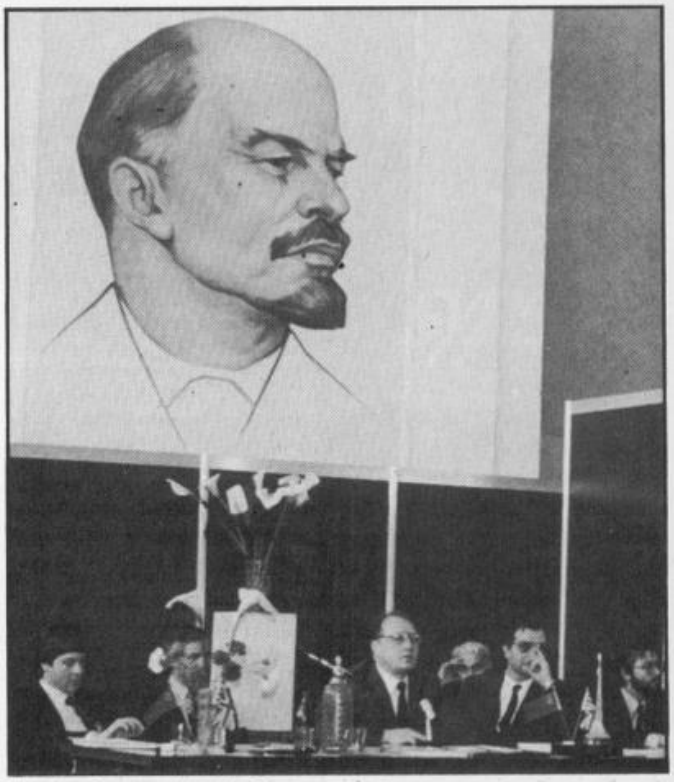

Memotech negotiates in Moscow.

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

1000 FREE MODEMS

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 .....

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British Telecom Modem Competition
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CR4 2XU (Postage stamp required)

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".

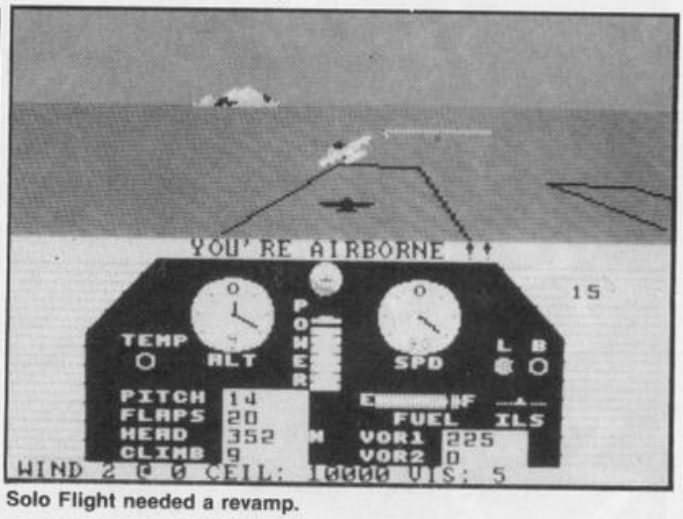
RIGHT STUFF

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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FAST **PACE** WEIGHT LOSS

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

YOUR Letters

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 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.

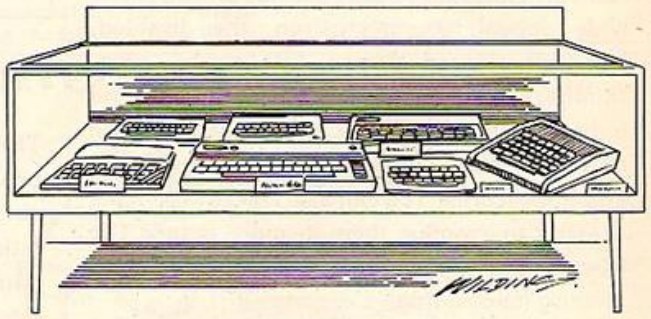
PRESTEL WARNING

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

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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).

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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.

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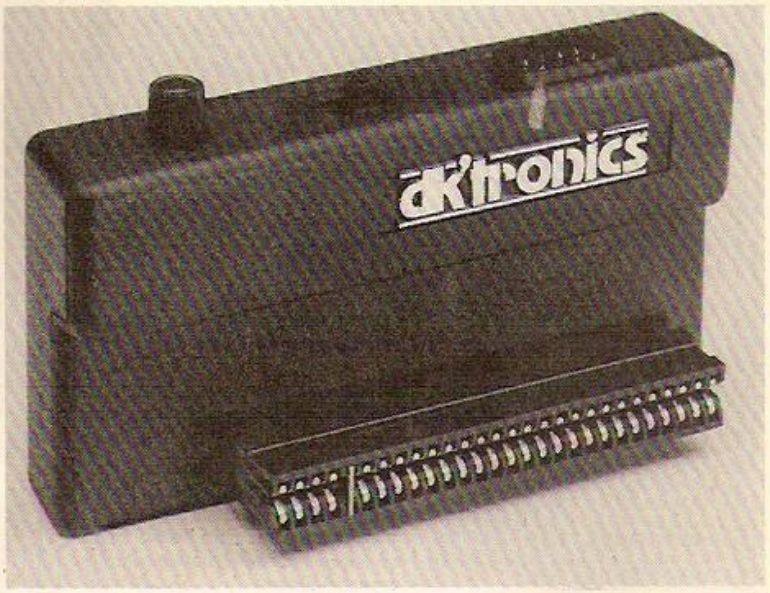

How to Order

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:

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..... *Quickshot II Joysticks* ..... *@ £11.95* .....
add postage and packing £1.50
Total: _____

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

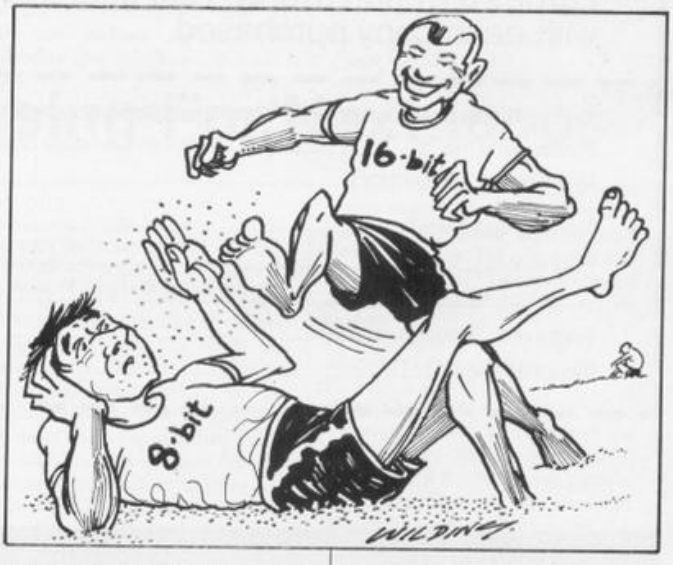
P Wilby, 34 Sheldon Close, Bransholme, Hull wins March's competition to write a program that modifies itself. His routine makes program lines which start with five colons invisible when listed.

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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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.

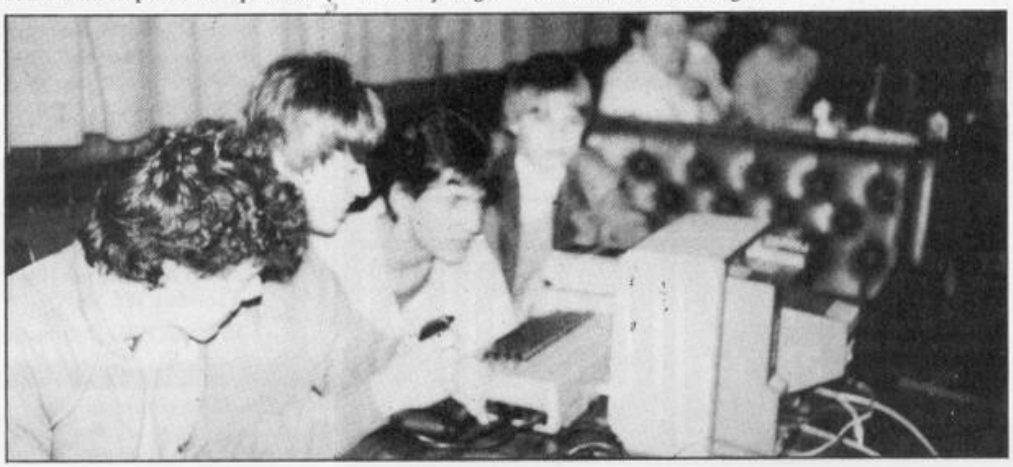
I was surprised to see that there were relatively few computers at the club. Not, I found out, because members didn't have one; but that the organisers preferred people to work together. The theory seemed to work. Spread around the room there were people working on databases, music programs, writing 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.



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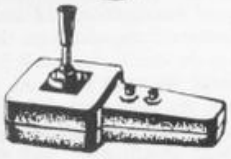

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The XK is available as a kit add-on or fitted to your Spectrum for £5 extra.

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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.

HARDWARE hitlist

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.

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.

Triton Quick Disk.

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.

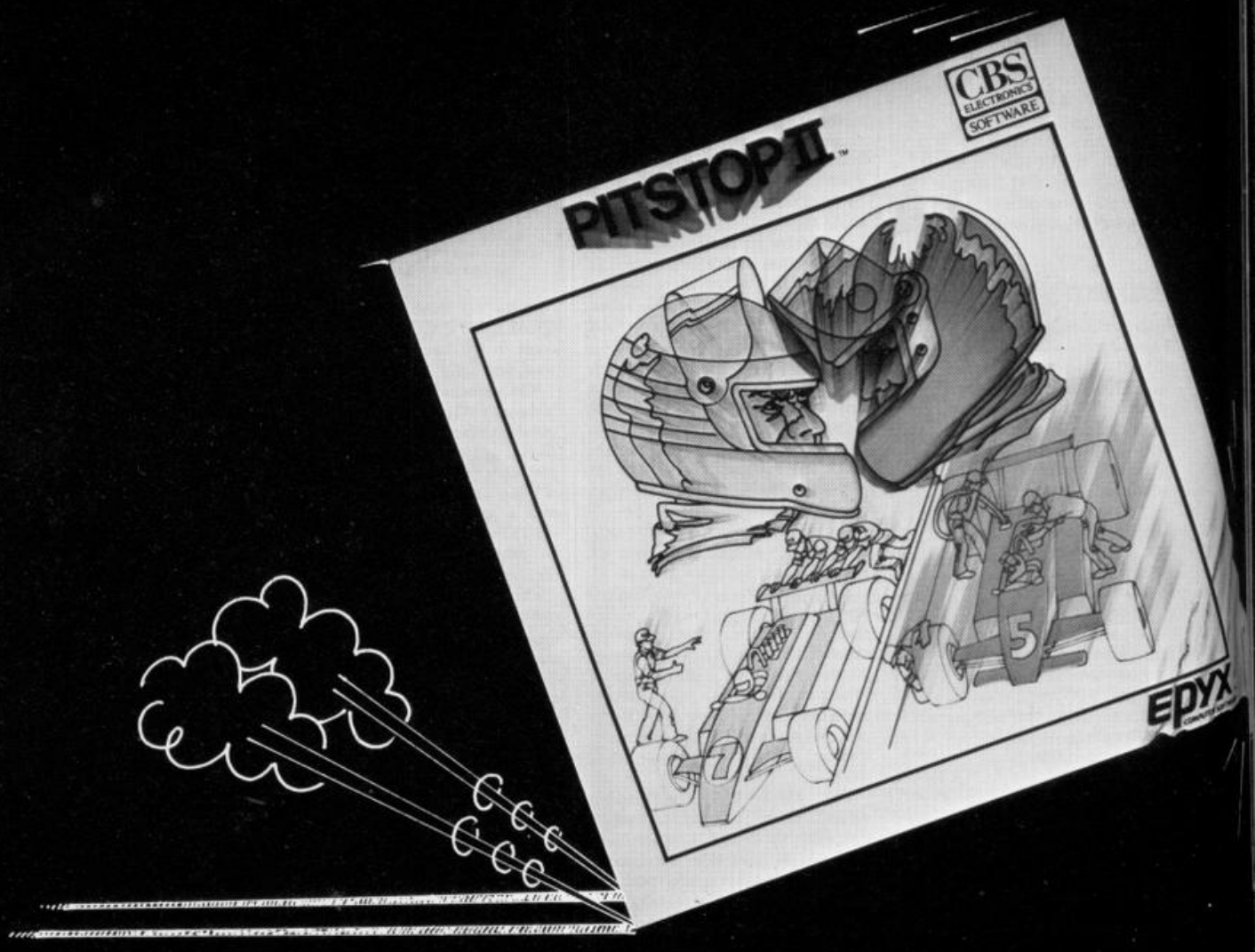
Using Prestel is simple in as far as using Prestel is ever simple. The # and * commands use the Enter and / keys. While on line, frames can be saved, loaded, printed either in text only — i.e., fast — or a full graphics screendump with shading is available which takes a few minutes. The phone book you 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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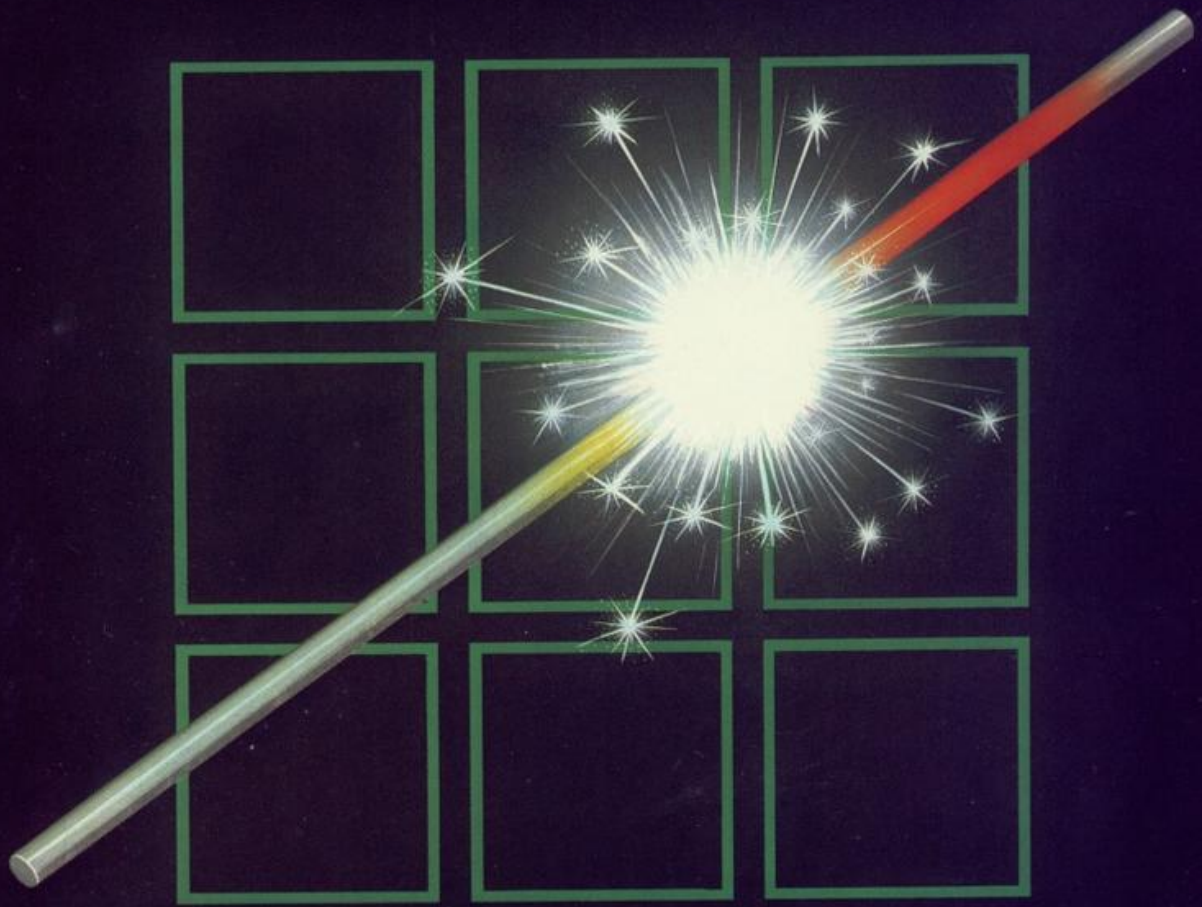

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Star chart

KEY

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

Moon Cresta

ZX Spectrum
£6.95
Shoot'em-up
Incentive

★ ★ ★

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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.

SOFTWARE Shortlist

Formula One

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

★ ★ ★ ★

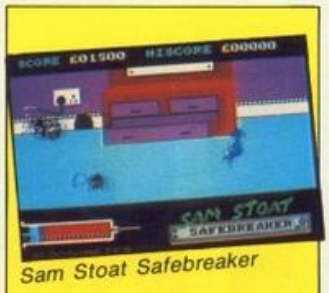
FOOTBALL MANAGER with racing cars. Fabri, De Angelis, De Cesaris, Piquet — you can hire them all provided they haven't already been bought up by your Spectrum. You can load up previous games, enabling you to continue a tournament over a long period of time, you can use a Kempston joystick and from one 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 bedsprings, 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 tne 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)

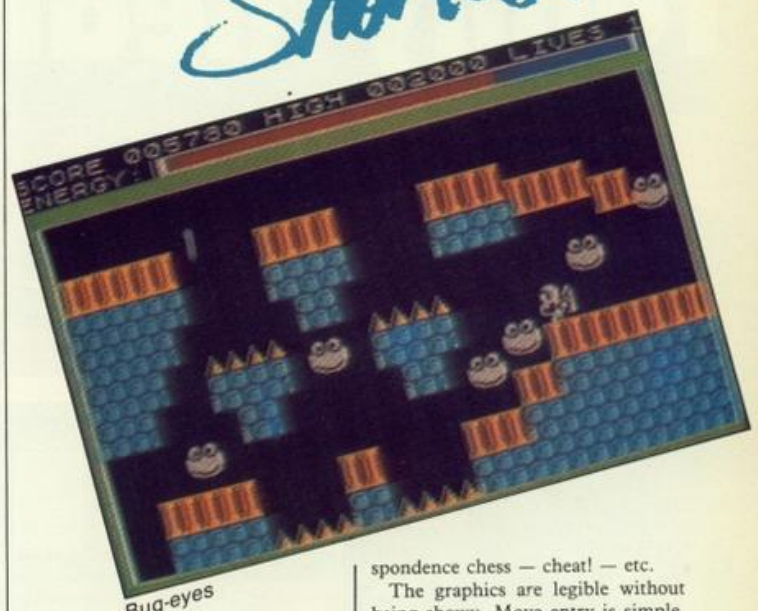
On the second set you build a railway engine while moving around a maze; in the third you attempt to destroy volatile puffins by dropping snowballs on them; on the fourth you assemble a ghetto blaster.

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.

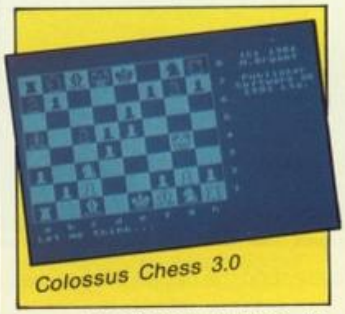
The graphics are legible without being showy. Move entry is simple, by either typing them in (e2-e4) or using the cursor keys. Pressing the space-bar toggles between the game board and a separate screen which lists the moves, shows the time on each player's clock, position and material rating and the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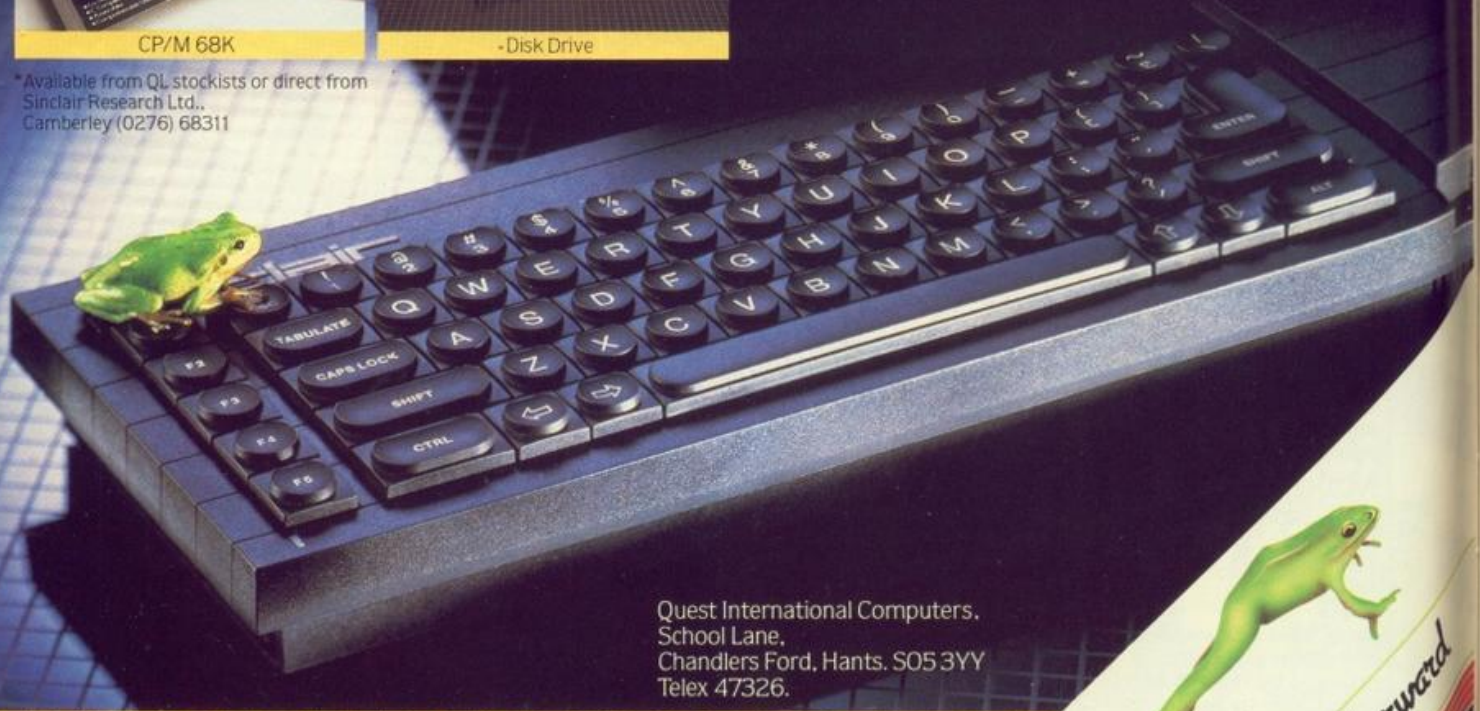

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Star chart

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 airliner 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.

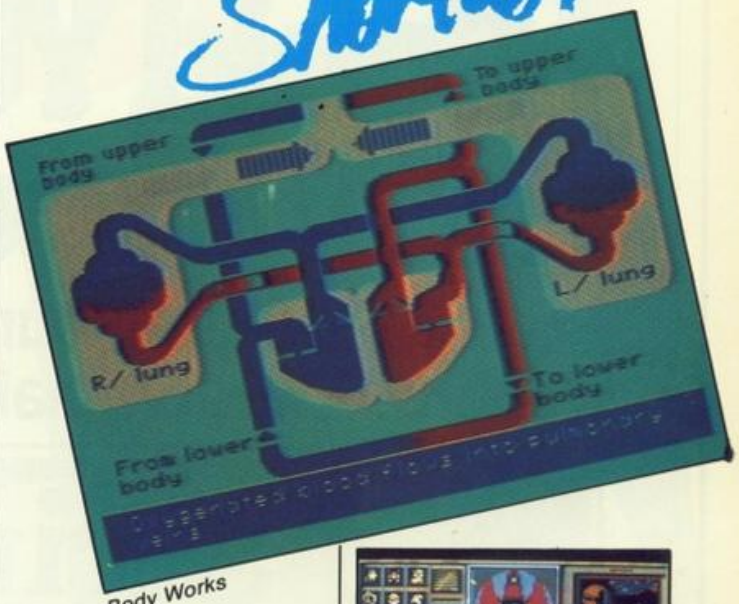
To move, you get the arrow pointing to move. Press the fire button once and the scroll changes to show the move you have selected and how many more uses of it you have left. "Project they soul" hints the scroll. In the style of Gargoyle's Tir Na Nog, you have to move around on pathways.

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

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

Shadowfire

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

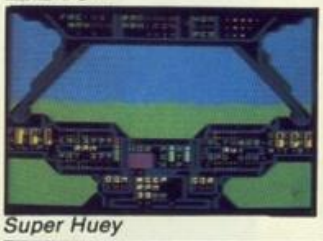
★ ★ ★ ★

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

Shadowfire



Super Huey

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

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

Could YOU get a Newspaper Scoop?

▸ Addictive launch STRINGER ◂
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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.

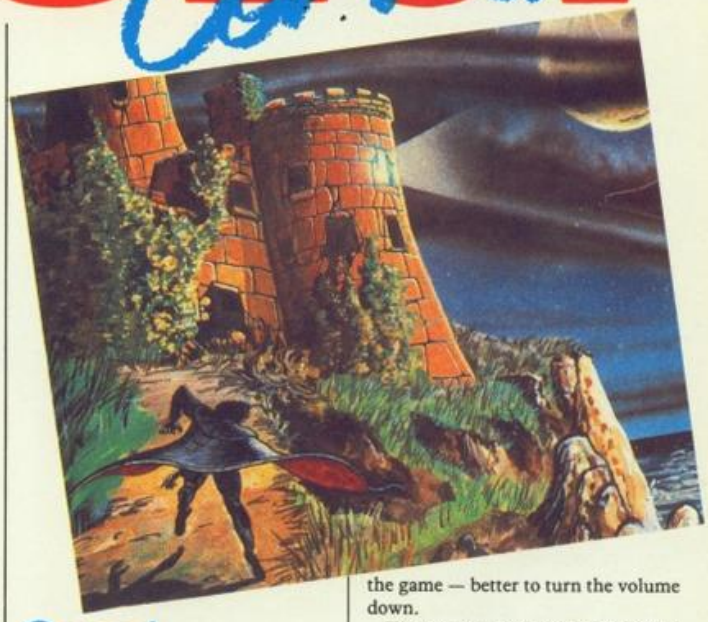
Amstrad and MSX owners can now try Melbourne House's famous Hobbit adventure — £14.95 — for themselves. In addition, a reworked version of The Hobbit, on disc only and for Commdore 64, Apple and IBM PC owners, is available in the UK. The new version includes extra problems, additional text, larger vocabulary,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

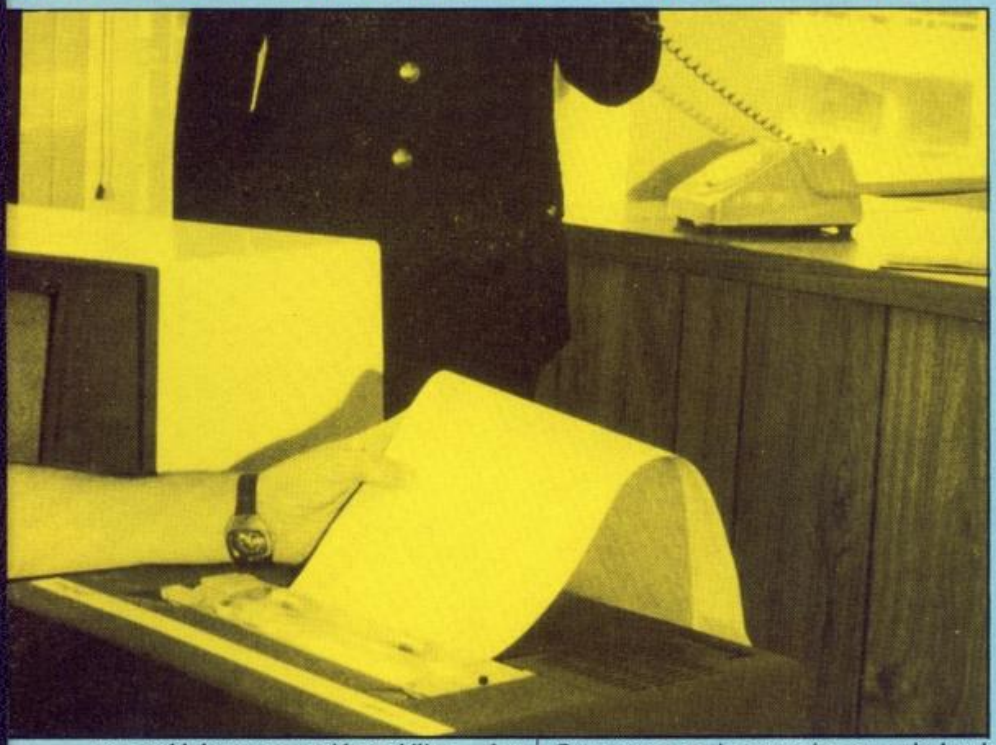
Early computer crimes were unsophisticated but effective. One simple trick, first used in New York was to remove the blank deposit slips on the counters of banks and replace them with apparently blank slips encoded with the fraudster's account number.

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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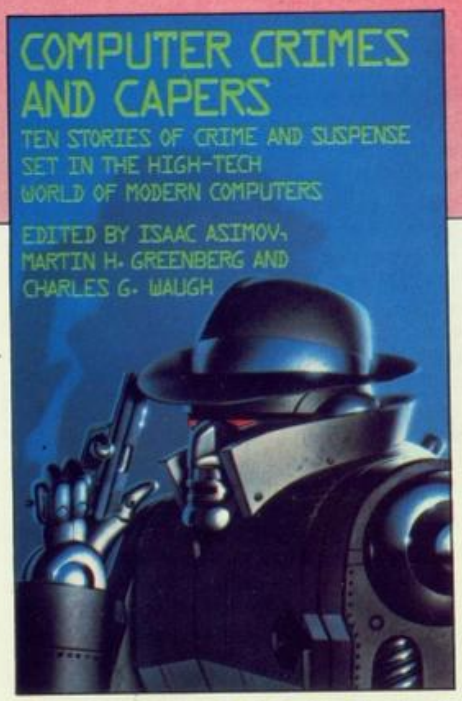
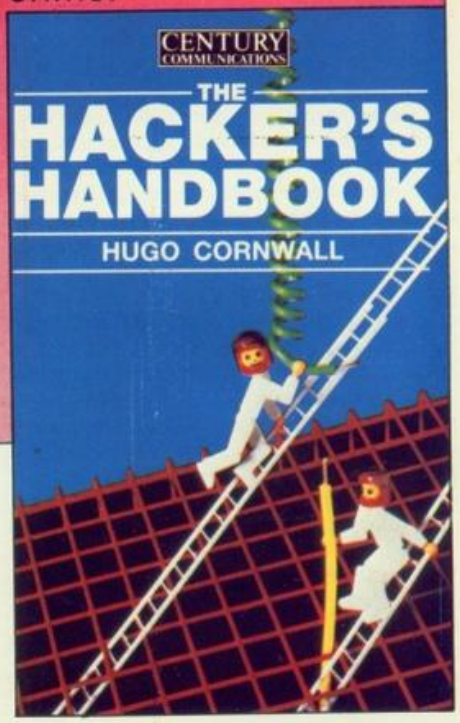


Runners-up can brush up their cheating with Viking Press's Isaac Asimov collection of silicon science fiction called Computer Crimes and Capers plus...



...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.
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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.

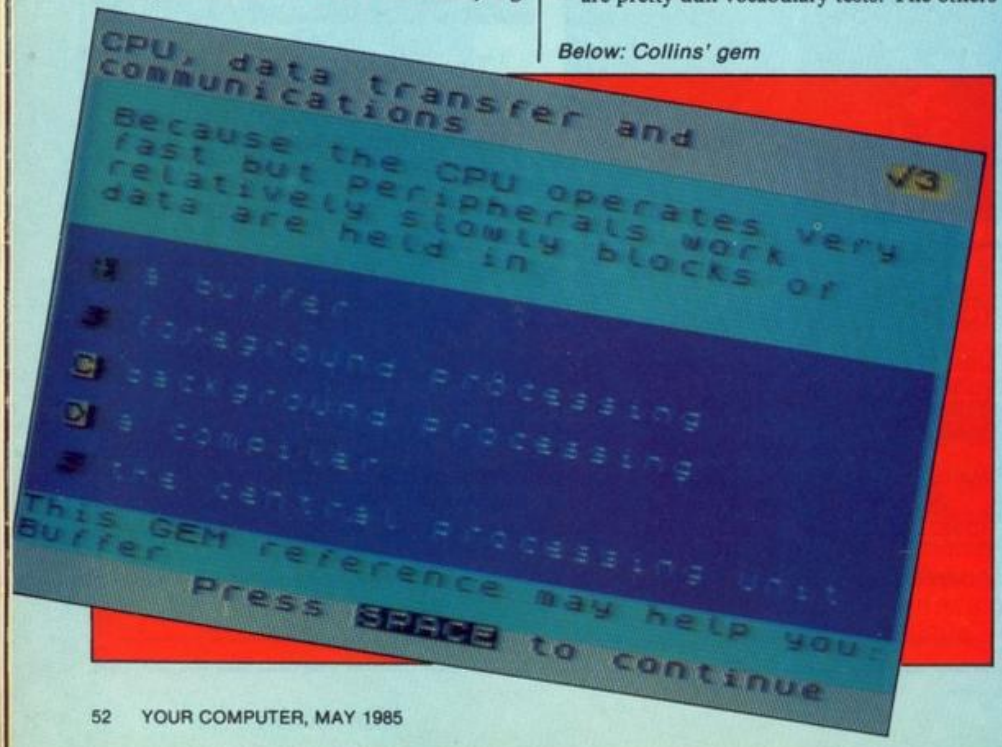
English Literature lends itself readily to this kind of stylish treatment. Other subjects are more traditionally presented and are much heavier going. French, for instance. You're obviously not going to get much guidance on your accent from a computer. And, sadly you won't get an awful lot of guidance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

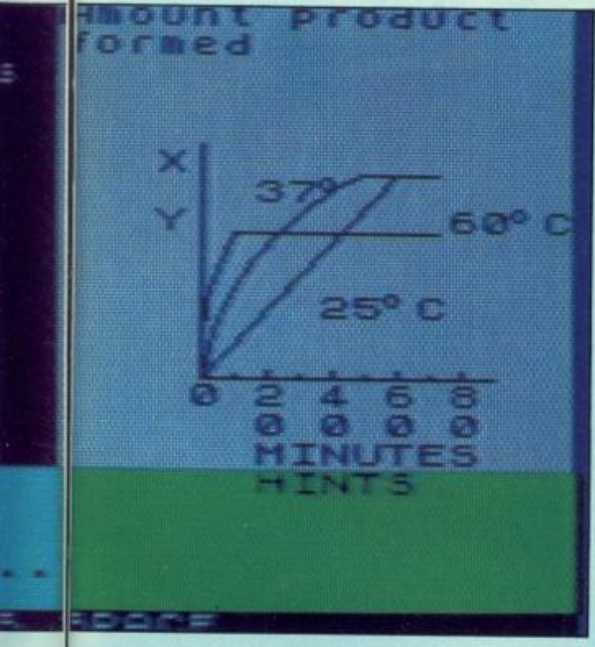


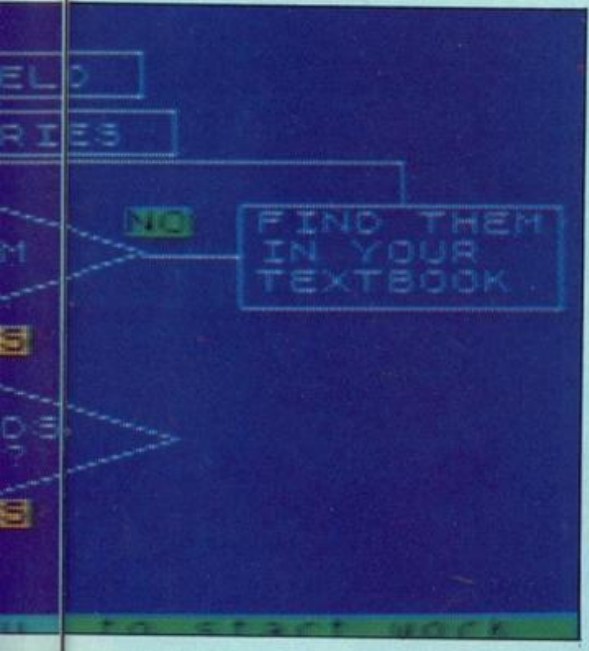
Below: Collins' gem

Above: Pan biology

Above: Longman's biology

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.

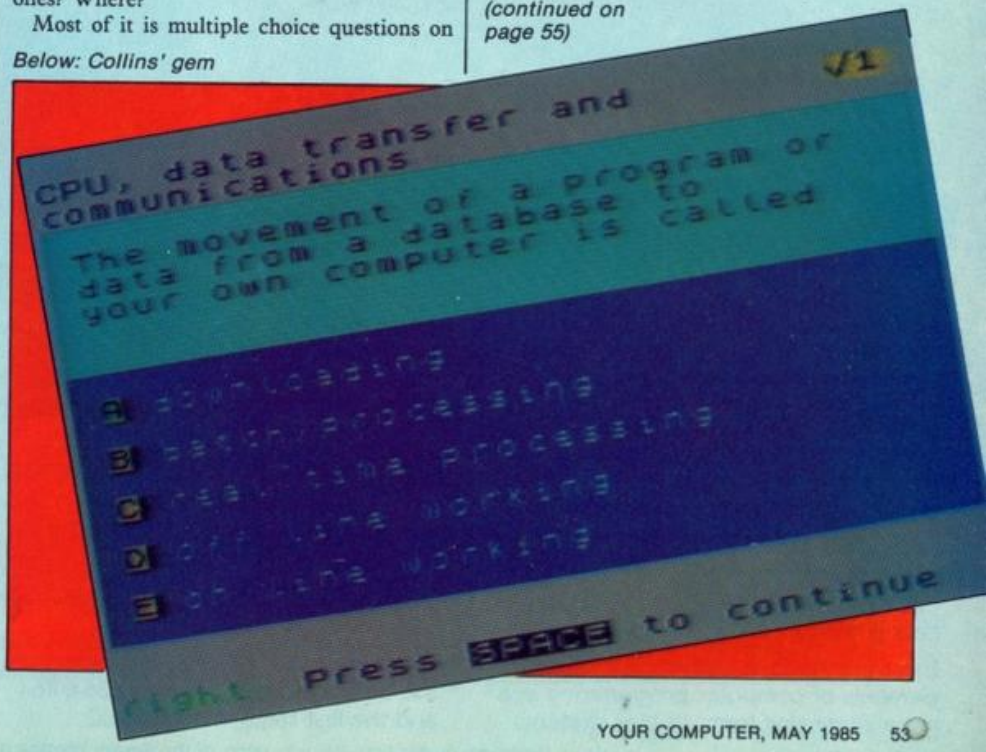
Collins's Computer Studies has the same format as their Biology; three programs in which you must label diagrams and two with multiple choice questions. The program covers much the same ground as Longman's, but is less well organised and therefore not quite so useful. It also contains a truly awful "game",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

(continued on page 55)

Below: Collins' gem



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Video Classroom comes from the originators of the Gemini Integrated Business Systems

(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."

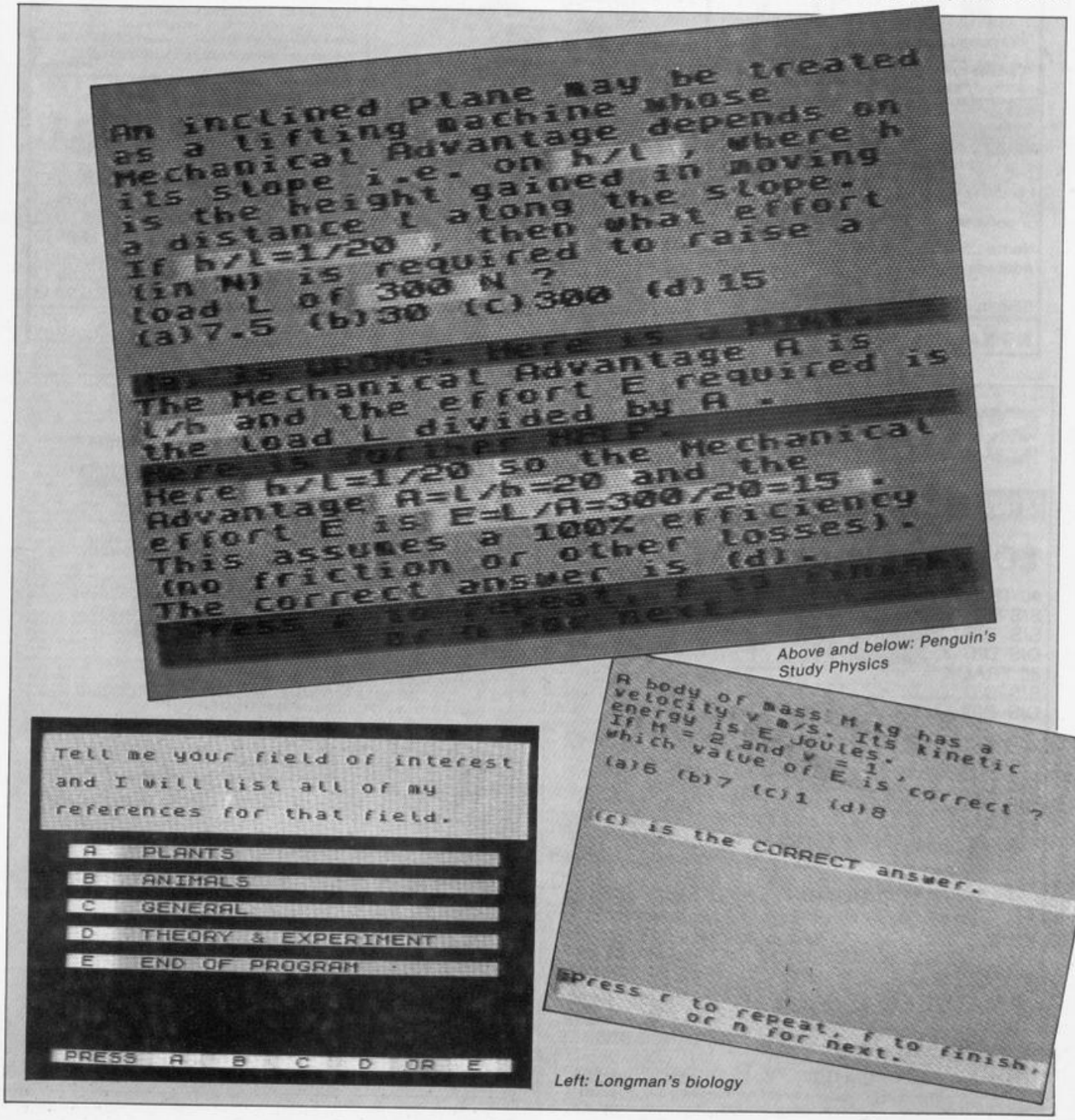
There are two tapes with four programs: Mechanics and Units; Heat and Sound; Electricity and Magnetism; Light, Atomic and Nuclear Physics. Each is presented in a multiple-choice format with a help facility. So, if you're stuck on a question, you can first get a hint, then a detailed explanation with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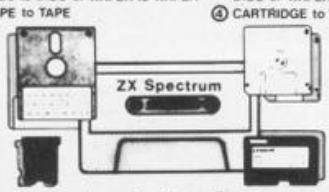

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MATHS MASTER

Colin Carruthers and a Spectrum teach you a thing or two about quadratic equations.

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)

$$x_1 + 3x_2 - 4x_3 = -11$$
$$2x_1 - x_2 + 3x_3 = 10$$
$$4x_1 + x_2 - 2x_3 = 3$$

(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$-1): GO TO 510
580 BEEP .5,-10: GO TO 510
1000 REM menu
1010 BORDER 0: INK 7: PAPER 0
1020 CLS : POKE 23609,30
1030 PRINT AT 3,3;"1  System of Equations";AT 5,3;"2
Quadratic Equation";AT 7,3;"3  Equation of 3rd Degree"
;AT 9,3;"4  Matrix Operations";AT 11,3;"5  Simpson's M
ethod"
1035 PRINT AT 13,3;"0  Quit"
1040 PRINT AT 21,3;"Enter Number -->"
1050 LET x=21: LET y=20: LET integer=1: LET length=1
1060 GO SUB 500: IF a$>"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(11)
*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
2055 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=1 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
2000 PRINT AT 2*i+3,0;"
"
2010 FOR k=1 TO upper: IF ABS a(i,k)<0.001 THEN LET a(
i,k)=0
2020 LET n$=STR$ a(i,k)+"      ": LET n$=n$( TO 5): IF
n$(1)<>"-" THEN LET n$=" "+n$( TO 4)
2030 PRINT AT 2*i+3,6*(k-1);n$: NEXT k: RETURN
2900 LET new=0
2905 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
3030 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 root: ";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(1,1)  a(1,2) ... a(1,n)";AT
 9,3;"a(2,1)  a(2,2) ... a(2,n)";AT 10,3;"  .     .
.";AT 11,3;"a(n,1)  a(n,2) ... a(n,n)"
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)=a(i,j+n)/a(i,i): 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=12: LET length=6: 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 a=a+y: 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 .02,74.4: 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:

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

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

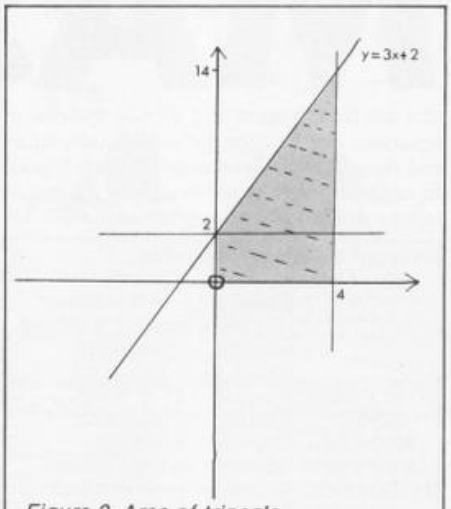

Figure 2. Area of triangle + rectangle.
= ½ x 4 x 10 + 2 x 4
= 20 + 12
= 32

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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AMSTRAD AND SPE
LANDSCA

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

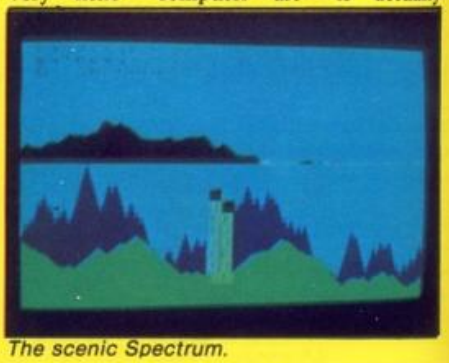
Program 1.

```
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

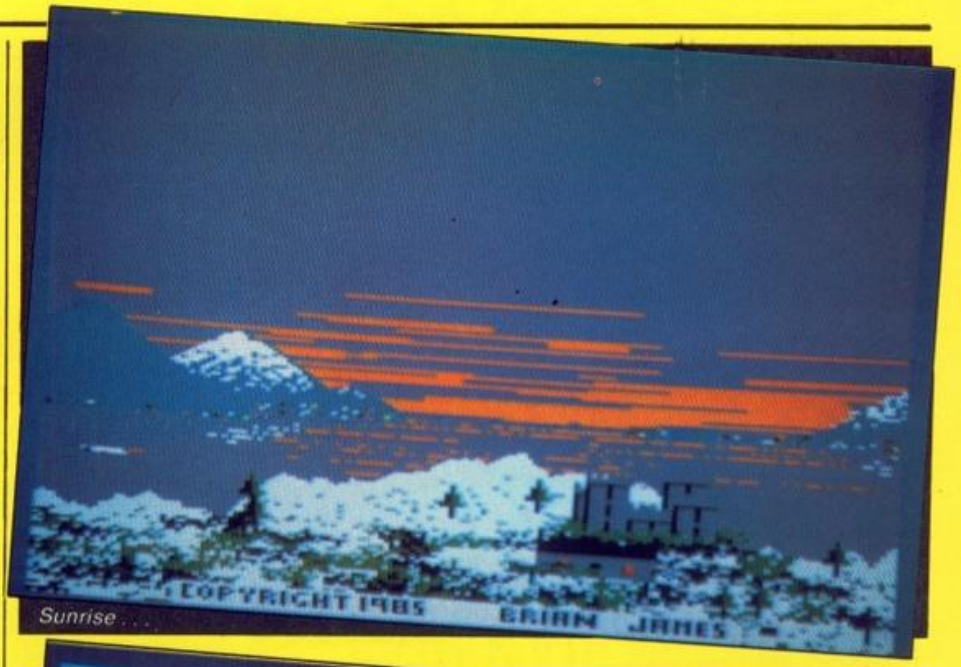
The Amstrad Firmware manual gives the addresses of inbuilt machine-code routines for plotting. These are easy to use and nicely crashproofed — but are therefore not as fast as would be desired. The Landscape Creator utilises its own extremely fast, compact plotting routines. Also the basic arithmetic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

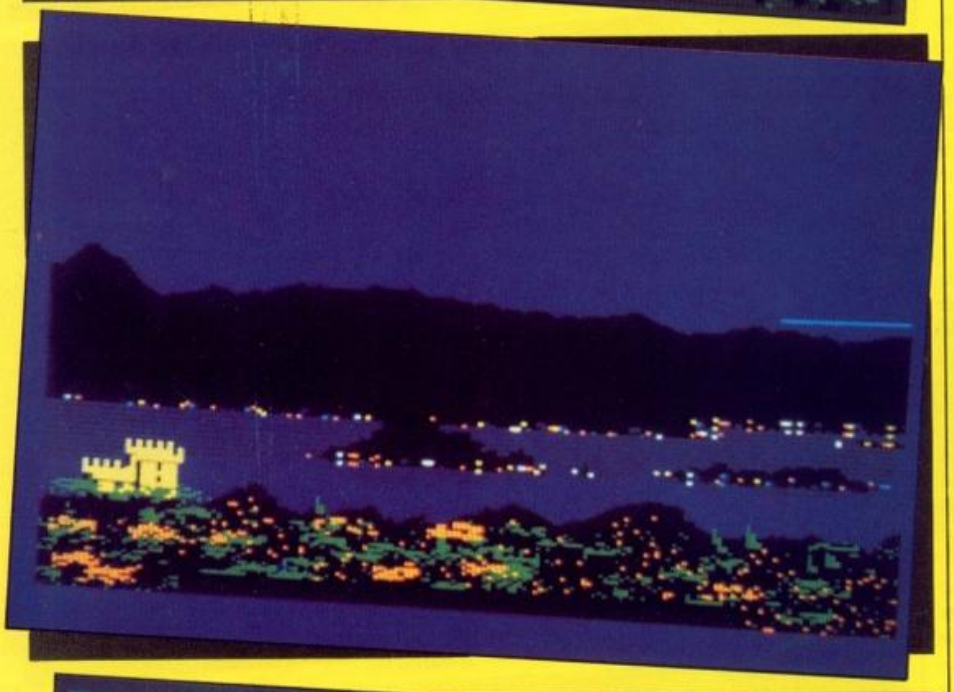
(continued on next page)

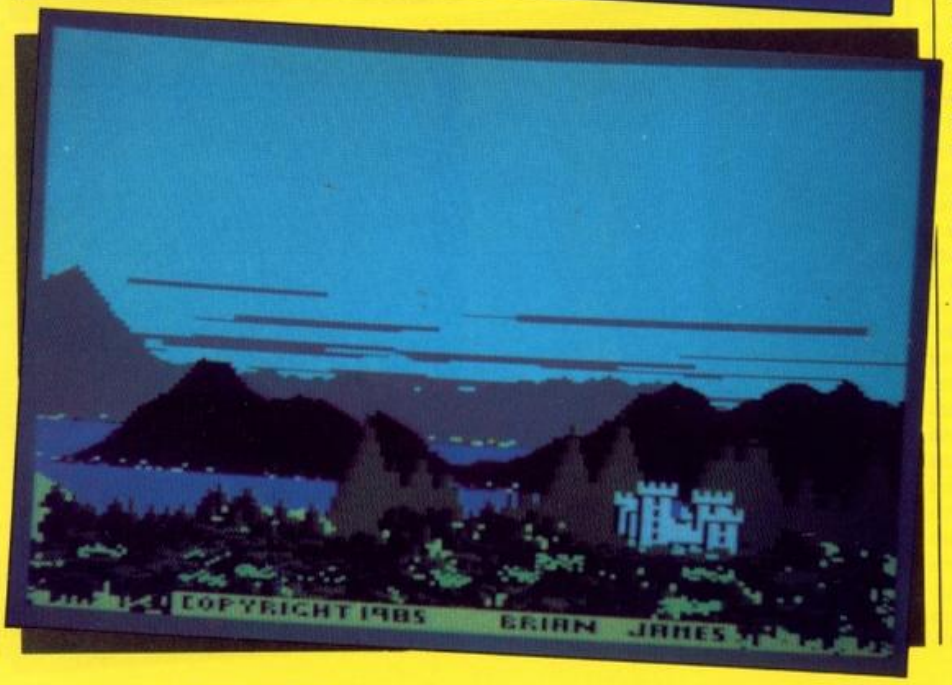


Sunrise . . .

. . . 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.

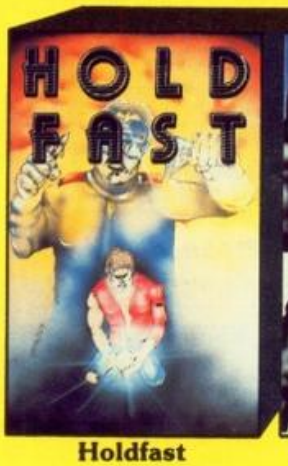
The number of sine waves used in nn. You can try putting in a larger number, say nn=20 or nn=50. The curve becomes more and more complex — but very much slower. This method is very good for smooth curves, but becomes too cumbersome and slow for very rough crinkly lines.

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.

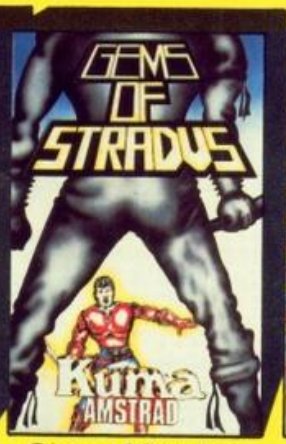
I can supply the Landscape Creator doubly recorded on cassette, for the Amstrad or the Spectrum 48K. Send £5 for the Amstrad version, or £3 for the Spectrum version, to — Brian James, 21 Lamond Place, Aberdeen AB2 3UT. ■

the only choice

Kuma AMSTRAD CPC464 software

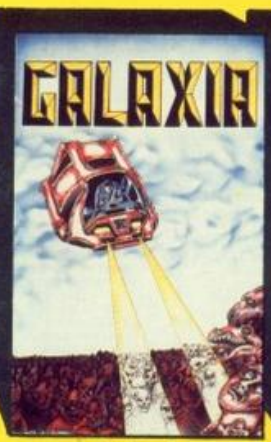


Holdfast



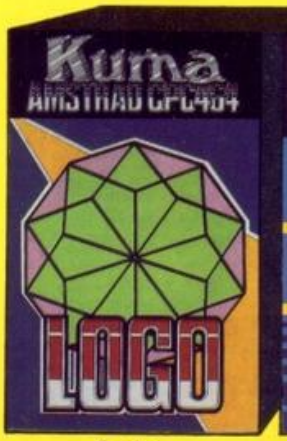
Gems of Stradus

Star Avengers

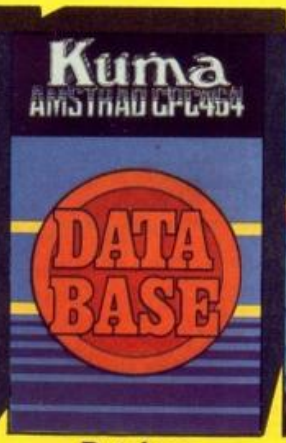


Galaxia

Music Composer

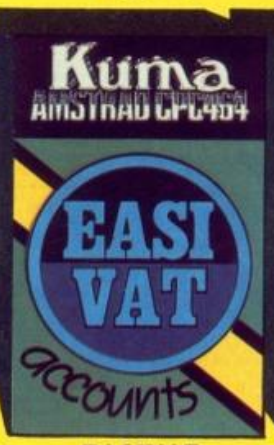


Logo

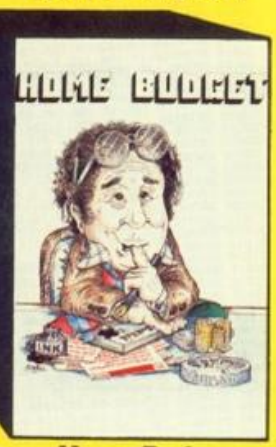


Database

ZEN Assembler



EASIVAT



Home Budget

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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"Ø":FORT=ØTO2:FORX=ØTO255: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 DATA172,0,147,192,16,240,57,206,1,147,173,1,147,201,0,208,44,230,0,147,169
80 DATA0,141,4,212,169,31,141,5,212,169,0,141,6,212,169,17,141,4,212,165,0,147
90 DATA165,0,148,141,1,212,165,0,149,141,0,212,165,0,150,141,1,147,76,49,234
100 DATA169,0,141,0,147,141,4,212,24,144,242,-1
110 POKE37632,0:POKE37633,0:FORT=ØTO62:READMF,LF,D
130 POKE37888+T,MF:POKE38144+T,LF:POKE38400+T,D:NEXTT
135 POKE38144+T,22:POKE38155+T,227:POKE38400+T,100:POKE37380,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 DATA28,214,30,25,177,30,22,227,20,17,37,30,19,63,30,21,154,30,22,227,30
150 DATA21,154,30,22,227,20,17,37,30,19,63,30,21,154,30,22,227,30
155 DATA25,177,30,32,94,30,20,214,20,22,227,100,0,0,20,25,177,30
160 DATA25,177,30,22,227,30,25,177,30,22,227,30,22,227,30,21,154,30
165 DATA22,227,30,25,177,20,20,214,30,25,177,30,22,227,30,20,214,20
170 DATA25,177,30,22,227,30,23,177,30,20,214,30,32,94,30,34,75,30
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 DATA22,227,30,25,177,30,20,214,30,22,227,30,22,227,200
29999 FORI=ØTO1215:READA:POKE2048+I,A:NEXT
30000 FORI=ØTO63:READA:POKE(244864)+I,A:NEXT
30001 DATA48,0,0,23,48,0,213,204,0,197,0,0,49,67,0,0,00,0,0,28,0
30004 DATA8,166,160,2,254,186,11,218,126,43,214,126,43,214,126,11,218,126,2
30007 DATA254,186,0,166,168,0,20,0,0,00,0,49,64,0,197,3,12,21,48,240,212,0,0,0
30011 DATA0,63,0,0,196,192,0,55,0,0,0,4,0,0,4,0,0,4,0,0,4,0
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
30030 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 DATA128,190,171,224,169,167,232,189,167,232,190,171,224,174,191,128,42
30063 DATA154,0,0,20,0,0,5,12,0,1,64,0,12,83,0,3,84,0,0,20,0
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
30090 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 DATA12,0,0,0,00,192,0,87
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
31018 DATA64,0,197,0,0,20,192
31019 DATA0,87,0,0,00,48,0,0
50001 DATA0,0,0,0,0,0,20,0,0,12,0,24,12,0,140,6,0,112,7,1,224
50003 DATA3,191,192,3,255,200,31,255,236,63,255,255,127,255,255,255,255,236,195
50007 DATA255,200,3,191,192,1,195,128,0
50008 DATA195,0,0,12,0,0,0,60,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,2,0,0,3,0,64,3,0
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
51009 DATA129,128,3,1,129,2,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
```

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 DATA162,0,189,0,208,24,105,1,157,0,208,201,240,157,0,208,96
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 DATA162,8,189,1,208,24,105,4,157,1,208,201,240,157,1,208,96
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 DATA32,114,192,32,131,192,32,148,192,32,165,192,32,182,192,32,199
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$="
15 B$="
20 C$="
25 D$="
30 E$="
35 F$="
40 G$="
50 H$="
100 V=53248:G=205:POKEV+21,255:POKEV+28,3:POKEV+37,10:POKEV+38,14:LI=5:SC=0
120 POKEV+39,1:R=0:DEFFNR(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:GG=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<1945ORWL>2022THEN22000
1099 RETURN
10000 POKE53280,2:POKE53281,3:GOSUB13250R=0:LE=1
10005 PRINT"
10006 PRINT"
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"
10199 GOTO10010
11000 PRINT"
11005 PRINT"
11006 PRINT"
11007 PRINT"
11008 PRINT"
11009 PRINT"
11010 PRINT"
11011 PRINT"
11012 PRINT"
11013 PRINT"
11014 PRINT"
11015 PRINT"
11016 PRINT"
11017 PRINT"
11018 PRINT"
11019 PRINT"
11020 PRINT"
11021 PRINT"
11022 PRINT"
11023 PRINT"
11024 PRINT"
11025 PRINT"
11026 PRINT"
11027 PRINT"
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"
11106 PRINT"
11107 PRINTTAB(24);F$:PRINT"
11108 PRINT"
11128 GOSUB600:POKEV+1,170:POKEV,235:POKEV+30,0:POKEV+31,0:POKEV+3,155
11139 LE=3:GOSUB24000:GOSUB12550
11140 GOSUB1000
11160 IFPEEK(V+1)<43THENSC=SC+(LE*500)+INT(TL)-INT(WL/5):GOTO10000
11199 GOTO11140
11200 POKE53280,4:POKE53281,3:PRINT"
11210 FORT=0TO20:PRINT"
11220 PRINT"
11225 PRINT"
11230 PRINT"
11235 PRINT"
11240 PRINT"
11245 PRINT"
11250 PRINT"
11255 POKEV+21,255:PRINT"
11268 GOSUB600:SYS36864:POKEV,241:POKEV+1,195:POKEV+3,200:POKEV+30,0:POKEV+31,0
11269 POKE2041,222:LE=4:GOSUB24000:GOSUB12550:POKEV+28,3:POKE2040,205
11280 GOSUB1000
11290 IFPEEK(V+1)<43THENSC=SC+(LE*500)+INT(TL)-INT(WL/5):GOTO10000
11299 GOTO11200
12550 PRINT"
12555 PRINT"
13250 POKE2040,205:FORI=5TO15STEP2:POKEV+I,0:NEXT:POKEV+30,0:POKEV+31,0:RETURN
22000 SYS36864+256
22005 D=217:POKES1,16:POKES2,15:FORJ=5TO25:A=A+1:IFR>8THEND=D+1:POKE2040,D:A=0
22010 FORJJ=5TOJJSTEP.5:POKES3,JJ:POKES1,33:NEXTJJ,J:POKEV+27,1:POKES1,0
22015 POKES1,128:POKES2,119
22020 X=PEEK(V):Y=PEEK(V+1):POKEV,X:FORT=YTO250STEP5:FORTT=220TO221:POKE2040,TT
22030 POKES1,128:POKEV+1,T:POKES3,250:POKES1,129:FORA=0TO20
22035 NEXTA,TT,T:POKEV+27,0:LI=LI-1:SYS36864:IFLI<1THENGOSUB23100:GOTO60000
22040 ONLEGOTO10000,11000,11100,11200,30000
23000 IFWL<1985THENRETURN
23005 POKEWL,72:POKEWL+CO,4:GG=GG+1:IFGG>216THENGG=215
23010 WL=WL-1:POKE2040,GG:RETURN
23100 K$="
23140 POKE53281,11:POKES1,16:POKES1+7,32:POKES1+14,32:POKES2,31:POKES2+7,15
23145 POKES2+14,31:SYS36864+256
23150 FORTT=100TO0STEP-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"
24005 PRINT"
24010 PRINT"
24020 RETURN
30000 POKE53272,31:CH=14336:U=15496:POKE53280,0:D=1024:W=1208:POKE198,0:FF=255
30005 POKE56331,1
30010 V=53248:FORI=0TO7:POKECH+I+W,FF:NEXT:POKE53281,3
30014 PRINT"
30015 PRINT"
30020 POKE2040,244:X=20:V=171:POKEV+21,1:POKEV,X:POKEV+1,Y:POKEV+31,0
30050 PRINTTAB(37)"
30055 PRINTTAB(37)"
30060 PRINTTAB(34)"
30065 PRINTTAB(30)"
30070 PRINTTAB(22)"
30075 PRINTTAB(10)"
30080 PRINTTAB(10)"
30085 PRINTTAB(10)"
30090 PRINT"
30095 PRINT"
30100 PRINT"
30105 PRINT"
30110 PRINT"
30115 PRINT"
30120 PRINT"
30122 PRINT"
30124 PRINT"
30126 PRINT"
30127 PRINT"
30129 PRINT"
30130 PRINT"
30132 PRINT"
30134 PRINT"
30136 PRINT"
30139 PRINT"
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:GG=250:POKEV+27,0:DD=1:PRINT"
60027 PRINT"
60030 X1=75:X2=125:X3=165:X4=205:X5=245:Y1=255
60032 POKEV,X1:POKEV+2,X2:POKEV+4,X3:POKEV+6,X4:POKEV+8,X5
60035 FORI=1TO9STEP2:POKEV+I,Y1:NEXT:FORI=2040TO2044:GG=GG+1:POKEI,GG:NEXT
60040 FORY1=255TO235STEP-1:POKEV+1,Y1:POKEV+3,Y1:POKEV+5,Y1:POKEV+7,Y1:POKEV+9,Y1
60042 NEXTY1:C=800:R=800:B=800
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
60994 POKES1+7,17:POKES1,33:POKES1+14,17:IFC=000THENRESTORE:GOTO60090
60995 FORT=0TO150:NEXT:IFX$=""THEN60084
60996 IFX$=" "THEN60998
60997 GOTO60084
60998 SYS36864:GOSUB63000:CLR:V=53248:POKEV+23,0:POKEV+29,0:RESTORE
60999 FORI=2042TO2047:POKEI,215:NEXT:GOTO1
61085 DATA5,5,5,10,10,10,5,5,5,5,10,10,10,5,5,5,5,5,10,10,10,5,5,5,5,10,10,10,10
61010 DATA5,10,20,20,10,5,5,5,5,5,10,20,5,5,5,10,5,5,5,5,5,5,10,10,10,20,20,20,20
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 DATA20,30,20,30,40,30,40,50,40,60,60,60,50,40,30,40,30,30,20,30,20,10,20,10,5
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"
63010 A1$="
63015 A2$="
63020 A3$="
63025 A4$="
63050 PRINT"
63050 PRINTTAB(31)"
63060 PRINTTAB(29)"
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(48);A2$TAB(47);A3$TAB(48);A2$TAB(88);A2$
63080 FORT=0TO4:PRINTA1$:NEXT:PRINT"
63082 PRINTTAB(7)"
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+2,248:POKEV+3,121:POKEV+40,10:X=240
63090 FORT=0TO38:FORZ=24STO250:POKE2041,Z:X=X-1:POKEV+2,X:FORR=0TO20:NEXTR,Z,T
63095 FORV=121TO166:POKEV+3,V:NEXT
63097 FORX1=36TO2STEP-.2:POKEV,X1:POKEV+2,X1: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

ATTACK

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)

Listing 2 continued.

```
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%<-800 THEN A%=A%+1000:MOVE A%+4,B%+4:A%=A%-
1000:ENDPROC
  940 IF A%>800 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 GX%=20:HX%=16
 170 TURX%=0:CHAS%=0:ROT%=1
 180 DIRX%=0:TRACK%=2:GUN%=4
 190 PROCgame
 200 IF ?&5030=0 AND ?&5030=0 AND ?&5040=0 AND ?&5040
=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 0,12,1,15,2,14,3,13
 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 0,134,162,99,166,144,12,86,208,0,102,238,96
,0
 520 MEM%=&4200
 530 FOR X%=1 TO 14:READ P%:A%=!28
 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 23,226,0,0,0,0,24,24,0,0,0
 590 DATA 1,1,0,0,0,10,2,2,25,1,1,4,4,10,2,2,5,1,1,0,0,
10,2,35,6,1,1,0,0,10,2,35,27
 600 FOR I%=&5030 TO &504F:READ X%:?I%=X%:NEXT
 610 REPEAT:?(&5030+(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
1,6,33,6,21,12,33,6,13,12,13,6,13,6,21,12,29,6,33
,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 748
 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:?&80=LIVES%:CALL lives
 740 CX=8*X%:HX=HX
 750 CHAS%=CHAS%-(INKEY(-67))+(INKEY(-98))
 760 TURX=TURX-(INKEY(-67))+(INKEY(-98))
 770 TURX=TURX-(INKEY(-105))+(INKEY(-104))
 780 IF TURX<0 TURX=7
 790 IF TURX>7 TURX=0
 800 IF CHAS%<0 CHAS%=7
 810 IF CHAS%>7 CHAS%=0
 820 A%=?(CHAS%+&5000):B%=?(TURX+&5010)
 830 FIL%%=CX:FIL%Y%=DX
 840 IF INKEY(-99) AND CHAS%=0 THEN DX=DX-1
 850 IF INKEY(-99) AND CHAS%=2 THEN CX=CX+1
 860 IF INKEY(-99) AND CHAS%=4 THEN DX=DX+1
 870 IF INKEY(-99) AND CHAS%=6 THEN CX=CX-1
 880 VARX%=CX:VARY%=DX
 890 CX=FIL%:DX=FIL%Y%
 900 PROCclear
 910 CX=VARX%:DX=VARY%
 920 PROCcheck
 930 IF ?&78>0 CX=8%:DX=HX ELSE 8%=CX:HX=DX
 940 PROCdraw
 950 IF INKEY(-1) AND TURX MOD 2=0 THEN GOTO 960:ELSE
ENDPROC
 960 FX=&5070:IF ?FX=0 GOTO 980
 970 FX=&5074:IF ?FX=0 GOTO 980 ELSE ENDPROC
 980 ?FX=1:?(FX+1)=TURX:?(FX+2)=8%+1:?(FX+3)=HX+1:X=
FX:PROCmoveshell:CX=?(FX+2):DX=(FX+3):PROCshellcheck:S
OUND 0,-15,4,2
 990 IF ?&78=0 ?FX=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 20: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%=2 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%=2 TO 2:PRINTTAB(26,A%);CHR#(224);CHR#(224
);CHR#(224):NEXT
1110 PRINTTAB(29,3);CHR#(225);CHR#(225);CHR#(225);PRI
NTTAB(8,38);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%=8: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%=8: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 CX=ENX%:DX=ENY%
1250 PROCclear
1260 IF ?(I%+4)<>10 GOTO 1310
1270 IF ?(I%+2)=0 THEN DX=DX-1
1280 IF ?(I%+2)=2 THEN CX=CX+1
1290 IF ?(I%+2)=4 THEN DX=DX+1
1300 IF ?(I%+2)=6 THEN CX=CX-1
1310 PROCcheck:IF ?&78=0 ?(I%+6)=CX:?(I%+7)=DX ELSE C
X=ENX%:DX=ENY%:?(I%+6)=CX:?(I%+7)=DX
1320 A%=?(&5000+?(I%+2)):B%=?(&5020+?(I%+3))
1330 PROCdraw
1340 ?&78=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
X=I%:IX=A%:PROCmoveshell:PROCmoveshell:I%=FX:C%=?(A%+2
):D%=?(A%+3):PROCshellcheck:SOUND 0,-15,6,2
1370 IF ?&78=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 #&18
1930 .loop
1940 DEY:LDA(&70),Y:ORA(&72),Y:STA(&72),Y:CPY#0: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 #&18
:STA &74:LDA &75:ADC #0:STA &75:LDA &76:CLC:ADC #&18:
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 #&18
:STA &74:LDA &75:ADC #0:STA &75:LDA &76:CLC:ADC #&18:
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 n
ove:RTS
2010
2020 .blank
2030 LDX #&3
2040 .count
2050 LDY #&18
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 #&18
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 &79:RTS
2270
2280 .tankcheck
2290 LDA #0:STA &79: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 #&C8: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 &79:INX:STX &79: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 #64:BPL up:CMP #&8
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

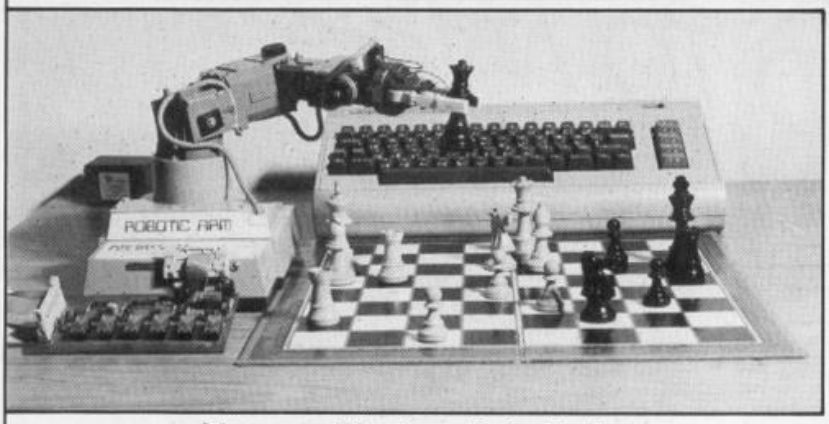
2450
2460 .lives
2470 LDA &74:STA &7C:LDA &75:STA &7D:LDA &76:STA &7E:
LDA &77:STA &7F
2480 LDA #&E0:STA &72:LDA #&58:STA &73:JSR blank:LDA
#&E0:STA &72:LDA #&50:STA &73:JSR control:LDA &7C:STA
&74:LDA &7D:STA &75:LDA &7E:STA &76:LDA &7F:STA &77
2490 LDA &00:CMP #2:BEQ nolives:LDA #0:STA &72:LDA #&
59:STA &73:JSR blank:LDA #0:STA &72:LDA #&59:STA &73:J
SR control:RTS
2500 .nolives: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 MX=CIRCLE%*(PI/6):A%=X%+120*COS(RAD(MX)):B%=Y%+1
50*SIN(RAD(MX)):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

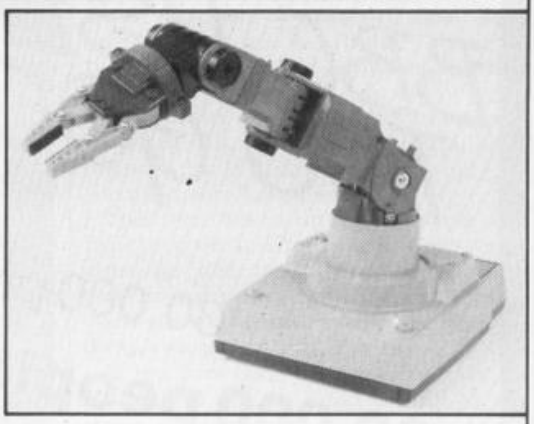
2640
2650 DEFPROCenemyshell
2660 FOR I%=&5060 TO &506B STEP 4
2670 IF ?I%=0 NEXT:ENDPROC
2680 PRINTTAB(?(I%+2),?(I%+3));" "
2690 PROCmoveshell
2700 IF GX%<?(I%+2) AND GX%+2>?(I%+2) AND HX<=?(I%+3)
AND HX+2>=?(I%+3) CX=GX:D%=HX:PROCexplosion:GOTO 110
2710 CX=?(I%+2):D%=?(I%+3):PROCshellcheck:IF ?&78=1 ?
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 ?&78=I% MOD 256:?&79=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?&78>4 AND ?LOCX<>1 SOUND 1,-15,7
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?&78>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 2! STEP -1:D%=16:A%=3:B%=19:PROCdra
w:TIME=0:REPEAT:CALL buffer:IF?&78>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 AX,CX,DX:B%=?(&5010+A%):A%=?(
&5000+A%):PROCdraw:TIME=0:REPEAT:CALL buffer:IF?&78>4
AND ?LOCX<>1 SOUND 1,-15,?LOCX,?(LOCX+1):SOUND 1,0,0,2
: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 GX<=?(I%+2) AND GX+3>?(I%+2) AND HX<=?(I%+3)
AND HX+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 CX=?(I%+2):D%=?(I%+3):PROCshellcheck:IF ?&78=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
```

Make more things happen with Memoco.





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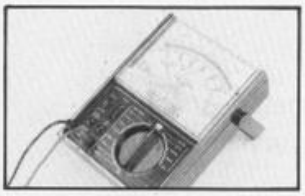

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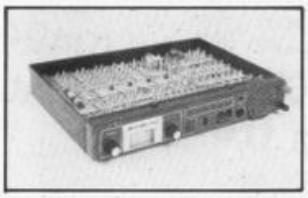

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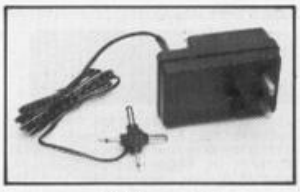

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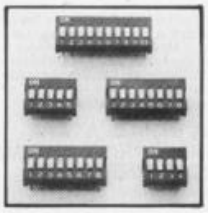

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Interface

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"■■■■UDG'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:POKE196,1: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 DATA0,109,255,255,255,255,76
,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"■■■■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"■■■KJJKJJJJJKJJJJJJJKJ
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■■■
■■■■■■■■■■■■■■■■■■■■■■■■■■■■■
```

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: 2A1501240400125O9 = 151
23304: 0325111C1D0C1E00 = 156
23312: 0905060C061F0D1E = 113
23320: 19140E1914112600 = 171
23328: 1826041E27121127 = 209
23336: 121D050900F1E1506 = 133
23344: 2F111E2D080F2B06 = 213
23352: 1828151E23041E23 = 219
23360: 141E290D0102090A = 126
23368: 2109111150F180E0D = 145
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: 6F5F0E0223E10D3FE = 765
23448: 2D2003EE106B10F6 = 703
23456: 0D20F3AFD3FEC90F = 1144
23464: 0B0200B45B000328 = 330
23472: 051B051B051B0F05 = 118
23480: 9008000000000000 = 152
23488: 0000000000000000 = 0
23496: 0000000000000000 = 0
23504: 261E221904040311 = 155
23512: 04840704000E4E8 = 607
23520: D3241C140C041308 = 341
23528: 03ED5FAE0707ED4F = 839
23536: E51FC90107000000 = 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

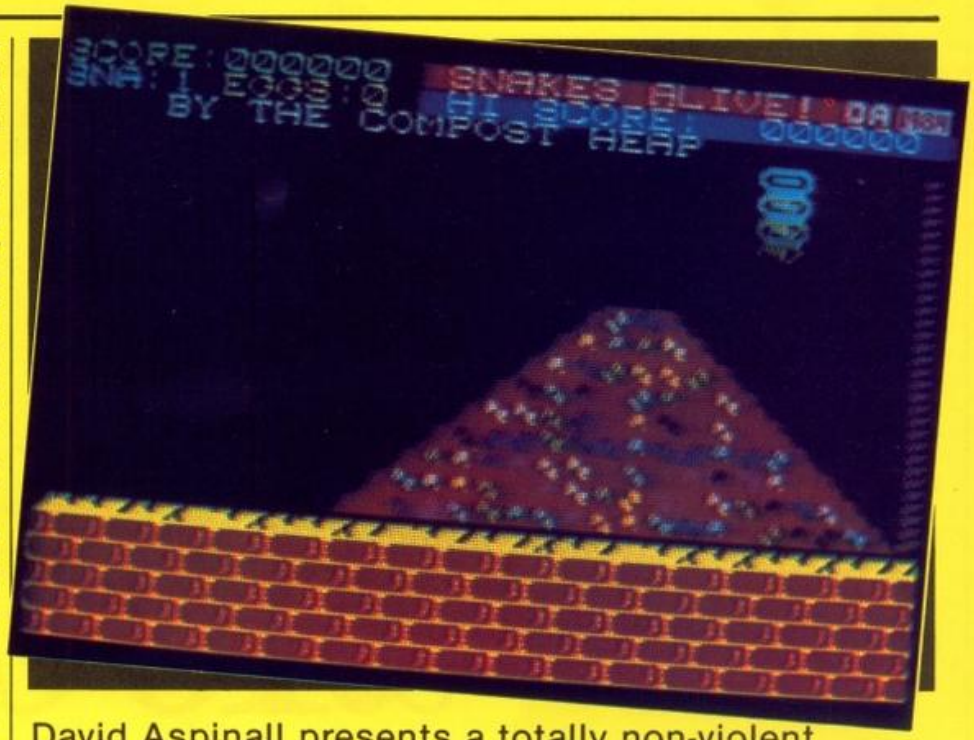
Listing 2.

```
28800: 5454547CC1434E4E = 792
28808: 4E4EC4F5D5C522A9 = 1210
28816: 5BCD1D67C1D1F1C9 = 1272
28824: 3E443BA7580E041E = 486
28832: 067917E602C603B7 = 670
28840: 0606CDD76A0F9114 = 718
28848: 1410F77AE6757IC = 767
28856: 0606CDD76A109214 = 720
28864: 1410F71C1C1CD020 = 412
28872: D63AAF58FE13C011 = 1022
28880: 1700CDD0B1E5D5C5 = 766
28888: 4E4EC4F5D5C522A9 = 1210
28896: 5BCD1D67C1D1F1C9 = 1272
28904: 3E443BA7580E041E = 486
28912: 067917E602C603B7 = 670
28920: 0606CDD76A0F9114 = 718
28928: 1410F77AE6757IC = 767
28936: 0606CDD76A109214 = 720
28944: 1410F71C1C1CD020 = 412
28952: D63AAF58FE13C011 = 1022
28960: 1700CDD0B1E5D5C5 = 766
28968: 741B03062104000E = 195
28976: 741B03062104000E = 195
28984: 503E0ECDDB703E5A = 844
28992: CDDB7010F4211200 = 847
29000: 111B1806067ECDDB = 629
29008: 707BCDDB707ACDDB = 1317
29016: 7078EE8047E60026 = 1065
29024: 1D20EA110E5A2600 = 454
29032: 19E3C9CD27400603 = 831
29040: 0ACD4B7444B000E21 = 520
29048: A059AF772EC07721 = 903
29056: 121CCDD867121031C = 564
29064: 06063E0632A75B11 = 405
29072: AE7122A95BC5CD33 = 1034
29080: 667CA72809E5AD5 = 807
29088: CD1D67D118F3C13E = 1068
29096: 15806710E5C91D1B = 784
29104: 1B9BD7D7D70ED90E = 1072
29112: 0E0EDACD4E745E00 = 721
29120: 0E0445E1F5CDDD6A = 743
29128: 3E745F170CCD3274 = 667
29136: 5E0314CD866E031A = 595
29144: 3AAF5BFE27C01113 = 846
29152: 12CDD06A6D070E04 = 671
29160: 1C06DCDD06A4D16 = 665
29168: 1510F815120D20F0 = 610
29176: 212171211E100ED716 = 269
29184: 1E7EE67F77CDBE6A07 = 1021
29192: 7E7EE67F77E02E9E21C = 850
29200: 0D20EC21E5F3A3E38 = 710
29208: 77EC772EDC772C77 = 830
29216: C9F2F3F3F371706F = 1506
29224: EE750E0EF477E0E0E = 774
29232: F63E2032A75B2103 = 692
29240: 0022A95BCD777722E = 778
29248: 1322A95BCD777ACD = 956
29256: 32744E0D721A159 = 547
29264: 060836002C3600C2C = 210
29272: 0E2C10F63AAF5BFE = 928
29280: 2C10CD4674420006 = 699
29288: 212059AF772E4077 = 677
29296: 2EE0772465F77C90E = 870
29304: 05060479FE043FCE = 663
29312: 002FE603F511A472 = 820
29320: C5CD3066C1F13CFE = 1300
29328: 033FCE00E6031 1A4 = 686
29336: 2C5CD3066C110DB = 1094
29344: 0D2006C9434E4EC4 = 979
29352: 110E0EC2F85D5D5C = 784
29360: CD4674421F32CD32 = 793
29368: 744E0305CD858E03 = 655
29376: 1806041E071603CD = 301
29384: B76C1D151CCDAB6C = 854
29392: 1C1C1C10F0C91128 = 601
29400: 3321084822A9583E = 520
29408: 4132A75BCD13660E = 745
29416: 0206031139732C26 = 282
29424: 071A13CDDB701A13 = 633
29432: CDDB70C53E483AA7 = 1084
29440: 5B060C3E0ECDDB70 = 721
29448: 10FB3E413A75B1A = 728
29456: 13CDDB70C110D70D = 992
29464: 20CF2C26082A95B = 623
29472: 2667CD3366CD2B74 = 767
29480: C3CA6D3A3C3D3E3D = 808
29488: 3C3D3E3D3C3D3E = 492
29496: BB3C513E7A517B0E = 750
29504: 3A3B7A00480E0E0E = 353
29512: 0E0E0041 7B7A7B7A = 583
29520: 00480E0E0E0041FB = 430
29528: CD2B741109130E09 = 432
29536: ED5A95BCDD06A78 = 1219
29544: 7EE603C603CDC670 = 1141
29552: 10EEEBCDD06A7902 = 1131
29560: 1C3E0A91573E1392 = 559
29568: 570D20DDC37B7421 = 807
29576: 5A7401080034AF5B = 539
29584: D6060D60630FB5E = 842
29592: CBBB2356237E23E5 = 936
29600: 664FE6473A75B32 = 840
29608: DB7332EA7334CDD76A = 1117
29616: 7332EA7334CDD76A = 1108
29624: 3A3C3D3E3FBB511C = 600
29632: CDD76A3800163332 = 705
29640: 3031000489511CCD = 600
29648: D76A3600163D230 = 544
29656: 310004B70C511CCD = 562
29664: D76A2E2C2DAF1C51 = 740
29672: 140603E2AA7C087D = 374
29680: D5D9D1CD5265D97C = 1368
29688: 0E7D3CD5D9D114CD = 1057
29696: 7E66D9D1CD2B01E5 = 750
29704: 157C32A75BCDD76A = 979
29712: 223234A5E123CB7E = 859
29720: CAA773CD4674401F = 970
29728: 42C9E17E235E2306 = 790
29736: 7E23E51600062ACD = 655
29744: 5A74141 0FAC9E17E = 1044
29752: 23562307E23E51E = 584
29760: D3061 5CD5A7741C8 = 466
29768: FAC9F5085E3766A08 = 1221
29776: F1C987041C060813 = 642
29784: 4C028C045A06080C = 338
29792: 74028A0A4C020A12 = 372
29800: 1406FF1112003E06 = 364
29808: 32A75BCDD76A1D21 = 896
29816: 212021 1C1B211C21 = 247
29824: 211C201B21202120 = 250
29832: 1C212017B211C211C = 442
29840: 212 11C212020 0E05 = 336
29848: 7E601F611E0620CD = 871
29856: BE6A32EE01141 0F7 = 868
29864: 16001C0D20EA09CD = 735
29872: 4674421F28C33172 = 681
29880: CD4674411F06213F = 589
29888: 5454547CC1434E4E = 792
29896: 4E4EC4F5D5C522A9 = 1210
29904: 59AF772E5F772EFF = 944
29912: 77242E1F772E11D75 = 528
29920: 1806774D77621E75 = 555
29928: 06063E0532A75B5E = 401
29936: 235623E5C5ED53A9 = 1071
29944: 5B3E78CD1D673E79 = 793
29952: CD1D672C2825473E = 639
29960: CDDB703E7BCDDB70 = 1257
29968: C1E110DBCD327440 = 1088
29976: 1706C910030E080E = 265
29984: 0D0C1808160718D7 = 113
29992: 030900000D0C130E = 89
30000: 181013ADB5B2174 = 585
30008: 60FE0220030214DBA = 629
30016: 22716438B8C6DC5F = 827
30024: 185B1A6F62220856A = 621
30032: CD646421007D226B = 704
30040: 65110C06CDD76A00 = 662
30048: 4747204120 4D2045 = 449
30056: 2020204F20562045 = 394
30064: 20D231BF50AFDBFE = 1223
30072: 2FE61F28F8CDA175 = 1079
30080: CD0276A7234E5F23 = 929
30088: FECD81794CD205FF3 = 1444
30096: 1803CD81793E0FCD = 764
30104: 31782147763 7C30D = 654
30112: 79AFDBFE2FE61F20 = 1109
30120: F826500E08AF0620 = 601
30128: 2EE0772C10FC240D = 750
30136: 20F4C93030303035 = 722
30144: 3030303030343030 = 388
30152: 3030303330303030 = 387
30160: 3032303030303031 = 387
30168: 59D2D2D2D2D2D2D5 = 433
30176: 5353204B45595320 = 546
30184: 3120544F20342054 = 444
30192: 4F2043484 14E4745 = 533
30200: 204355525245 4E54 = 579
30208: 204F5054494F4E2C = 549
30216: 205220544F22565320 = 492
30224: 444546494E452054 = 543
30232: 4845204548595320 = 521
30240: 4F522045 4E444552 = 575
30248: 0544F20524554552 = 534
30256: 524E20544F2054 48 = 542
30264: 4520544954 4C4520 = 519
30272: 5343524454 4EA02D = 653
30280: 534E414B4553 2041 = 550
30288: 4C49564520454754 = 586
30296: 20205F2031393834 = 418
30304: 20575245545454 4E = 589
30312: 204259204 4EE522E = 461
30320: 412E20202020202020 = 329
30328: 20202020 2043412 = 420
30336: 4546554C4C59204D = 574
30344: 414E4F4555565245 = 610
30352: 204B414B4E4205448 = 510
30360: 4520534E414B4520 = 503
30368: 4 4424F5554205448 = 567
30376: 4520484F55534520 = 521
30384: 414E4420494553 20 = 515
30392: 47524F554E445320 = 490
30400: 20544F2042 4F4C4C = 525
30408: 4543544204E494E45 = 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.



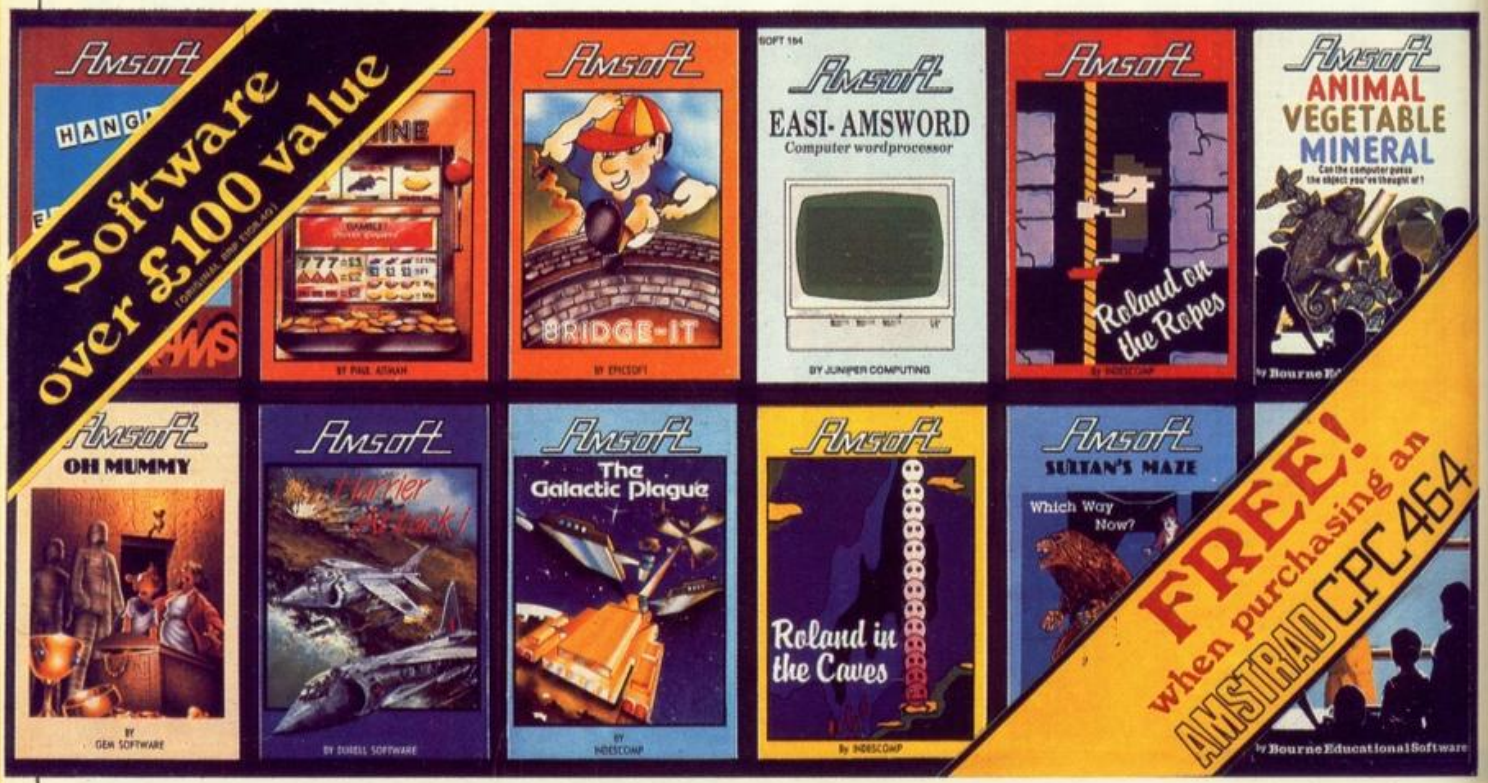
David Aspinall presents a totally non-violent but, nevertheless exciting, game for the Spectrum featuring Kahn the snake.

AKES ALIVE

```
30416: 2045474753205748 = 517
30424: 494348204B41484E = 534
30432: 204841532004C4F53 = 522
30440: 542E2057484542E20 = 500
30448: 414C4C2045474753 = 543
30456: 204841564E204245 = 491
30464: 454E204841F454E44 = 559
30472: 4C2020454553544E = 556
30480: 20544F2054484552 = 584
30488: 535441532544945E47 = 620
30496: 204C4F434154494F = 555
30504: 4E2E2E2E2041564F = 478
30512: 4944205459494E47 = 568
30520: 204841484E20494E = 505
30528: 20484E4F5453204F = 542
30536: 5220464154414C20 = 506
30544: 434F4C4F4E532494F = 606
30552: 4E532057495442E20 = 541
30560: 414E59544894E47 = 610
30568: 20454C53458120020 = 439
30576: 202D202D202D2570 = 343
30584: 524553532044F2046 = 530
30592: 4F522047414D4520 = 507
30600: 4F5054494F4E532C = 600
30608: 204F522053205344F = 503
30616: 20535441532542020 = 494
30624: 20202033B3D3D4020 = 372
30632: 20202020A0000647 = 365
30640: 2041204D20452020 = 371
30648: 204F205020542049 = 444
30656: 204F204E20D32D2D = 554
30664: 2D2D2D2D2D202020 = 321
30672: 2D2D2D2D2D2D2D2D = 360
30680: 2D2D2D20AD484559 = 573
30688: 424F415244C2041 = 501
30696: 532D4345D4FD743 = 667
30704: 5552534F52204A4F = 596
30712: 5953544943CB494E = 750
30720: 5445524641434520 = 538
30728: 49C94854D505354 = 742
30736: 4F4E204A4F595354 = 598
30744: 494JCB26500E0806 = 489
30752: 202EFFAFCB162D10 = 794
30760: FB240020F2FB78F3 = 1186
30768: C921E18A11E25A01 = 863
30776: 1CD877ED80C9CDA1 = 1127
30784: 75CDAD653E1FCD31 = 943
30792: 7811A07721000422 = 500
30800: A95BCD33662C2604 = 704
30808: 22A958CD33660604 = 662
30816: 3AD85B883E052002 = 653
30824: 3E0732A75BF64008 = 695
30832: 26052C2C22A95BEB = 660
30840: C5E5116013E390CD = 913
30848: 5265D1CD3366C110 = 959
30856: D7110E00CDD76A00 = 772
30864: 044B4559424F4152 = 529
30872: 4420434F4E454524F = 569
30880: 4C53204E4F572044 = 535
30888: 4546494E45442041 = 524
30896: 53000JA021110322 = 333
30904: A95B21D058060411 = 619
30912: E85DC5E5CD3366E1 = 1534
30920: D55E23E5A7CD977B = 1217
30928: CD1D677CEE10E610 = 961
30936: F60367E610200220 = 676
30944: 2C22A95BE1D1C110 = 981
30952: D921D975A7C30D79 = 1080
30960: 4F3E359132DB5BCD = 904
30968: A175C3497BCD9E6A = 1135
30976: 3E00C01CC81D5721 = 631
30984: 050219778E922DC5B = 704
30992: 1732011F8AF00CD = 917
31000: 1B78D5CDFD78D14F = 1226
31008: 3A815C1F79300CFE = 745
31016: 53CA3375FE4FCA3E = 1050
31024: 781013FE52CA2C7B = 868
31032: FE0DCA9275FE3138 = 1091
31040: 05FE35DAF0781AE6 = 1146
31048: 7F6F26002929290l = 400
31056: 007D00084F080608 = 243
31064: D5EB21FF5DE5793C = 1194
31072: 471A0710FDE60106 = 786
31080: 772413C110EFD108 = 839
31088: 3CE60720A1081A13 = 543
31096: C87F2898E2ADC5B10 = 902
31104: 93CDAD6521007D22 = 818
31112: 6B653E0632A75B11 = 601
31120: C17BAF32FB792100 = 946
31128: 0022A95BCDF4793E = 926
31136: 0232FB793E0532A7 = 708
31144: 5B11347C210D0222 = 359
31152: A95BCDF4791E0D0E = 887
31160: 0521C05DE521BB75 = 889
31168: 3E4732A75B060816 = 477
31176: 0AE3CDE57910FB14 = 1079
31184: 14E30606CDE57910 = 830
31192: FB1C1C3E4432A75B = 745
31200: 0D20E2F1C97EEBD5 = 1267
31208: C522A95BCD1D67EB = 1063
31216: C1E123C9CD33661A = 1038
31224: 3CC02805C522A95B = 641
31232: 10F211BB75E05D5 = 819
31240: 080621D8651ABE23 = 616
31248: 13200710F8F10D20 = 608
31256: EEC9D13807210600 = 750
31264: 19EB18F2D50600C5 = 942
31272: 00281E0C21D27511 = 472
31280: D5757987878181AF = 1061
31288: ED68C1C521DF5D11 = 1177
31296: E7D7987878747FED = 1166
31304: 55C1D1215065ED68 = 1007
31312: 910E05EDB021BB75 = 918
31320: 1116660E05EDB021 = 607
31328: B85D0E0803D20FC = 653
31336: E5CDAD65110700CD = 937
31344: D76A0006202057A5 = 547
31352: 4C4C20444F4E4521 = 511
31360: 2120594F5520414I = 487
31368: 5645204143484945 = 533
31376: 564541202020204F4E = 476
31384: 45204F4620544845 = 507
31392: 204549544520484F = 479
31400: 4748455354202020 = 478
31408: 2020202020205343 = 342
31416: 4F52455320544F44 = 576
31424: 41592E2E2E2E2E2E = 430
31432: 2020202020202020 = 256
31440: 2020202000004504C = 288
31448: 4541534520545950 = 571
31456: 4520594F5552204E = 546
31464: 414D453A0047A0E1 = 725
31472: 0608E5C5CDA17837 = 978
31480: CD1B7B3C28F630FE = 1016
31488: 0D280EF5CD1D67F1 = 890
31496: C1E1772310E4C3A1 = 1172
31504: 78C1E1362023107B = 923
31512: C9A1780E0A17E20 = 996
31520: FBCD9E6A20F67E20 = 1066
31528: F81D186C21D05806 = 747
31536: 04C5E5C5CDA175CD = 1315
31544: AD65110802CDD76A = 827
31552: 0045505245535320 = 498
31560: 5245515549524544 = 609
31568: 204B45592046AF52 = 528
31576: 3AADC1210E0A22A9 = 684
31584: 5B11E5D1E0490CD = 848
31592: 3066A7CD1B7BE1C1 = 1090
31600: 73545D48003E0590 = 583
31608: 471A05280828BE20 = 415
31616: F9EB4118ACD5C508 = 1163
31624: CD1D67C141E18310 = 871
31632: A0CDA175C33E7808 = 1028
31640: 2105021600197E21 = 246
31648: B57B0604BE280423 = 583
31656: 10FAC9010400908 = 489
31664: 30010097EC9E30D0E = 639
31672: 2011515177FFD0FF = 641
31680: 2027222320272228 = 285
31688: 2027222820262026 = 285
31696: 2027222320272223 = 408
31704: 222B2020222922220 = 282
31712: 223E2222222A2220 = 304
31720: 222B2020222AB5D22 = 473
31728: 2820222222222222 = 272
31736: 2222222252022222 = 325
31744: 2320222222222F22 = 475
31752: 2022222022222222 = 273
31760: 2022292220222B20 = 282
31768: 20202FA2252225E20 = 470
31776: 2420242024202420 = 272
31784: 2420242052223220 = 330
31792: 2522DEFFA2722820 = 693
31800: 2620202026202620 = 274
31808: 2620272223204622 = 410
31816: 3E2202222202022 = 292
31824: 2022222222222220 = 273
31832: 20A2222222222220 = 394
31840: 20e0222222e02220 = 262
31848: 2222232022222922 = 406
31856: 2022202020222022 = 262
31864: 2A2220225B2020A4 = 461
31872: 2420242052223220 = 330
31880: 24205D225E205D22 = 448
31888: 2320DCFF00042D9 = 825
31896: 49CE41D44FCE5448 = 997
31904: C500474152444544E = 630
31912: 20534845C4014341 = 585
31920: 4242414745205041 = 514
31928: 5443C80047524150 = 649
31936: 452056494E45D303 = 621
31944: 4C4157CE00484544 = 643
31952: 47C50046454E43C5 = 749
31960: 02444F4F52535445 = 546
31968: D00148414C4C5741 = 650
31976: D9035354441495203 = 818
31984: 0153504152452052 = 494
31992: 4F4FCD014D414946E = 657
32000: 20424544524F4FCD = 660
32008: 014C4956494E4720 = 490
32016: 5F4FFC0139014154 = 677
32024: 485741D901424143 = 740
32032: 4B2042454452F4F = 550
32040: CD034C414E44494E = 646
32048: C7014241544852F = 648
32056: 4FCD0047415241147 = 638
32064: C501535452454504 = 797
32072: 0246524F4E542044 = 495
32080: 4F4FD2005O4F4E44 = 673
32088: 2020202020A00043 = 387
32096: 4F4E504F53542048 = 586
32104: 4541D0004845447 = 522
32112: 45524FD700465255 = 662
32120: 4954205452454503 = 704
32128: 0057414CCC025354 = 601
32136: 52454554204342F52 = 564
32144: 4E45D20347415244 = 646
32152: 454E205041454C800 = 608
32160: 669988868199660O = 909
32168: F9898DEB8989F900 = 1285
32176: 669988661199660O = 765
32184: 4EA9894E2894800 = 742
32192: 2ACDFFC217B619AC = 1098
32200: 1AA21C991E901F88 = 710
32208: 2160237925722868 = 615
32216: 2A652C5F2F593254 = 552
32224: 354F384B3B463F42 = 521
32232: 423E463A4B374F34 = 517
32240: 5430592E5E2B7D42 = 598
32248: 3F88A730D34FFF00 = 959
32256: 0000000000000000 = 0
32264: 1818181818001800 = 144
32272: FF00FF00FF00FF00 = 1020
32280: F800FE00FE00F800 = 1004
32288: FF00FF007E003C00 = 696
32296: 1F007F007F001F00 = 316
32304: 3C007E00FF00FF00 = 896
32312: 07003F007F00FF00 = 452
32320: E000FC00FE00FF00 = 985
32328: FF00C3003C003100 = 709
32336: 0008510003C3003C00 = 519
32344: FC00F0008000F000 = 860
32352: 0000000183006000 = 168
32360: 0000007E0000000 = 126
32368: 0000000000303000 = 96
32376: 3F000F0007001F00 = 116
32384: 7C668A92A2C27C00 = 1022
32392: 0818000808081C00 = 92
32400: 7CC2023C4080FE00 = 826
32408: 7CC2023C02C27C00 = 668
32416: 0818284484FE0800 = 414
32424: FC6060FC02C27C00 = 1080
32432: 3C4080FC82827C00 = 888
32440: FE02043E08101000 = 362
```

(continued on page 76)

Now Amstrad gives you over £100 to play with.



£239
complete with green screen VDU (GT64)

£349
complete with colour monitor (CTM640)

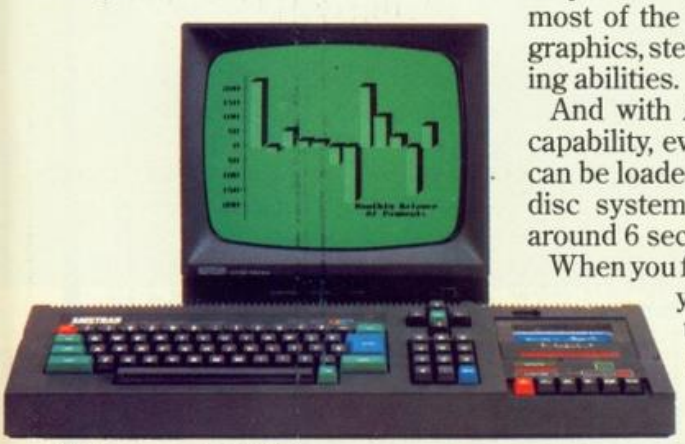
CPC464 complete with monitor and datacorder

Free software worth over £100 is the name of the game.

Along with your new CPC 464 (colour monitor or green screen VDU) you'll receive a software starter pack of 12 (yes, twelve) cassettes absolutely free.

There's something for everyone. From Roland-on-the-Ropes to Easi-Amsword word processing.

That's *one* good reason for making Amstrad's CPC 464 your new home computer.



CPC 464 green screen VDU (GT64)

Here are the others.

The CPC 464 comes complete with its own colour monitor or green screen VDU and built-in cassette data recorder. (Optional disc drives are now available with CP/M* and DR. LOGO* supplied as standard.)

It has a typewriter-style keyboard and numeric keypad. 64K of RAM, 32K of ROM and a very fast extended BASIC with real time features.

And it costs a great deal less than the price of a comparable system.

The CPC 464 can handle the trickiest computer games (if you can), revision for exams, cataloguing and budgeting.

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Amsoft. A ton of software.

Yes. Now there are over 100 titles from Amsoft and independent publishers. And the list is still growing.

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AMSTRAD User club
CPC 464
MEMBERSHIP NUMBER
REGISTERED NAME
EXPIRY DATE
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ADDRESS

POSTCODE

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PRICES CORRECT AT TIME OF GOING TO PRESS. NOT ALL STORES STOCK ALL PRODUCTS.

YC9

(continued from page 73)

```
32448: 7C82827C82827C00 = 892
32456: 7C82827E02020200 = 516
32464: 0010100000101000 = 64
32472: F8FDCDCDCDFDF900 = 1618
32480: F0F898F8F8989800 = 1440
32488: FFF03AAA8B2BABFF = 1581
32496: FF00230081100E700 = 810
32504: 7C8282041000100 = 428
32512: FF35D535D1DD3DFF = 1320
32520: 7C8282FE8282C600 = 1096
32528: FC42427C4242FC00 = 892
32536: 7C86600000867C00 = 900
32544: FC444242424442F800 = 830
32552: FE4040784040FE00 = 854
32560: FE4040784040E000 = 854
32568: 3C466808E82443800 = 654
32576: C68282FE8282C600 = 1170
32584: 7C10101010107C00 = 328
32592: 0E0404044C4847800 = 474
32600: E2444870484E6600 = 848
32608: 0000000000082FE00 = 1024
32616: 82C6AA928282C600 = 1102
32624: 86C2A2928A86C200 = 1102
32632: 3844828282443800 = 638
32640: FC42427C4040E000 = 860
32648: 3844828282443A00 = 648
32656: FC42427C4844E200 = 874
32664: 7C86807C02C27C00 = 830
32672: FE92101010103800 = 528
32680: C6828282828277C00 = 972
32688: C6828282442810000 = 712
32696: C6828292928542800 = 874
32704: C6442810284 4C600 = 628
32712: FE4428101010 3800 = 410
32720: FE4428102842FE00 = 762
32728: FC00F00E000F800 = 964
32736: 00183C7E7E3C1800 = 420
32744: FF007F003F000700 = 985
32752: FF00FE00FC00E000 = 1116
32760: 3C66DBB1B1DB663C = 1116
```

Listing 3.

We'll take you beyond the Spectrum.

Four great new add-ons from Ram, Number One in everything for the Spectrum...

TURBO INTERFACE

Outperforms any other Spectrum interface. Supports Kempston, Protek, Interface 2 and ROM cartridge software, with a full expansion bus at the rear. The Turbo works with two standard joysticks, making the most of the Quickshot II's rapid-fire action. Features a unique built-in power safety device. Amazing value at £22.95.

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(Please state issue 2 ☐ or 3 ☐)

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Expiry Date____/____/____

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Trade and Export enquiries welcome.

Hex dump.

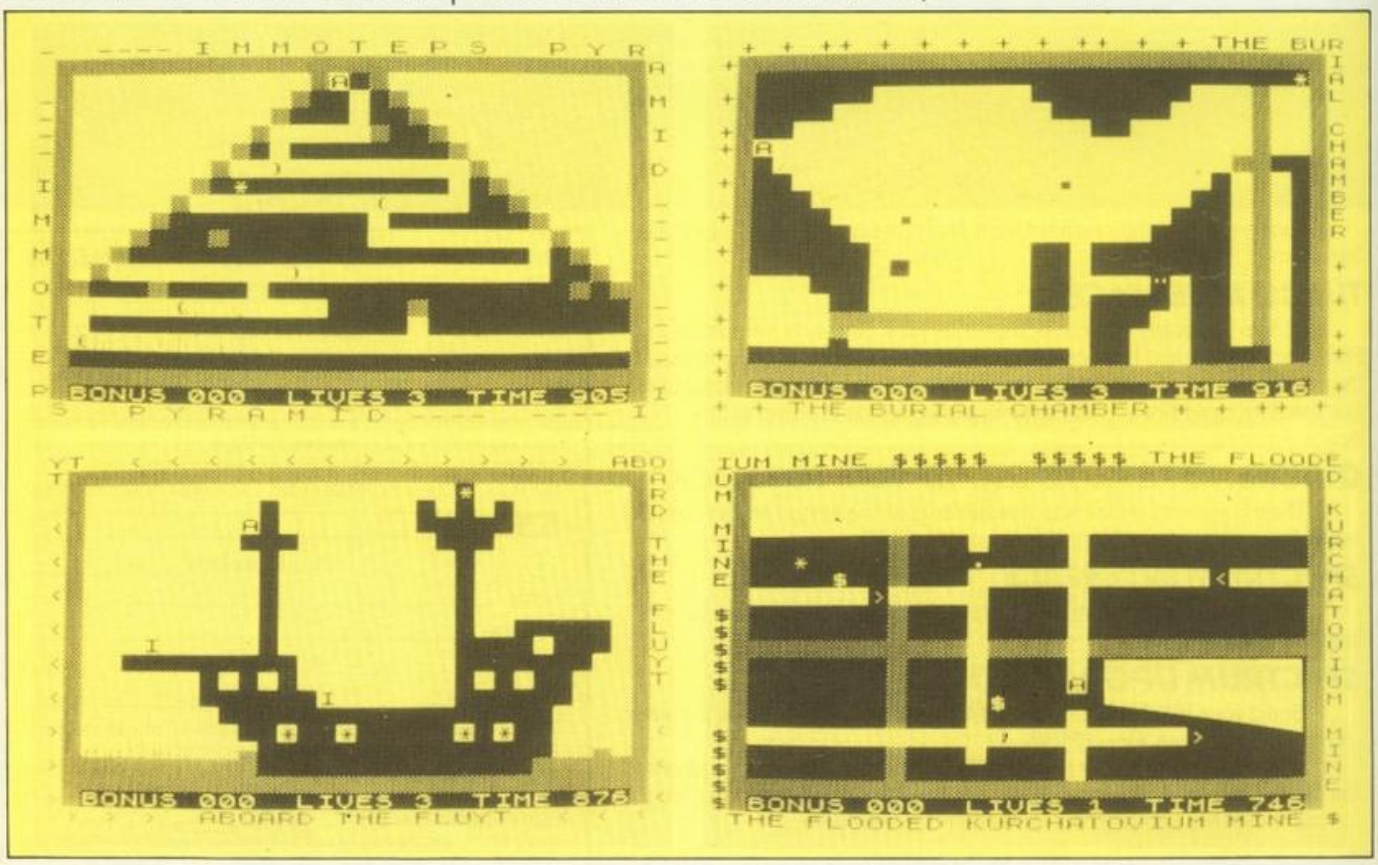
SURV

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).

```
19450-)012E2E0101E001E3 =547
19456-)01DD012E2E010138 =373
```

```
19465-)023B023B02000901 =120
19471-)0139023C023B0200 =177
19477-)0200090101700090 =66
19483-)00001D020017000E =66
19489-)0200170026020017 =66
19495-)0400000000000000 =66
19501-)003C000000000000 =66
19507-)0000004000000000 =66
19513-)0004000000000010 =66
19519-)0010001000000100 =66
19525-)0000010000010010 =66
19531-)0001001400010005 =66
19537-)0001005400010005 =66
19543-)0A0BB5000210005E =66
19549-)2105000000000000 =66
19555-)0000000000000000 =66
19561-)0000000000000000 =66
19567-)0000000000000000 =66
19573-)0000000000000000 =66
19579-)0000000000000000 =66
19585-)0000000000000000 =66
19591-)0000000000000000 =66
19597-)0000000000000000 =66
19603-)0000000000000000 =66
19609-)0000000000000000 =66
19615-)0000000000000000 =66
19621-)0000000000000000 =66
19627-)0000000000000000 =66
19633-)0000000000000000 =66
19639-)0000000000000000 =66
19645-)0000000000000000 =66
19651-)0000000000000000 =66
19657-)0000000000000000 =66
19663-)0000000000000000 =66
19669-)0000000000000000 =66
19675-)0000000000000000 =66
19681-)0000000000000000 =66
19687-)0000000000000000 =66
19693-)0000000000000000 =66
19699-)0000000000000000 =66
19705-)0000000000000000 =66
19711-)0000000000000000 =66
19717-)0000000000000000 =66
19723-)0000000000000000 =66
19729-)0000000000000000 =66
19735-)0000000000000000 =66
19741-)0000000000000000 =66
19747-)0000000000000000 =66
19753-)0000000000000000 =66
19759-)0000000000000000 =66
19765-)0000000000000000 =66
19771-)0000000000000000 =66
19777-)0000000000000000 =66
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19801-)0000000000000000 =66
19807-)0000000000000000 =66
19813-)0000000000000000 =66
19819-)0000000000000000 =66
19825-)0000000000000000 =66
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19837-)0000000000000000 =66
19843-)0000000000000000 =66
19849-)0000000000000000 =66
19855-)0000000000000000 =66
19861-)0000000000000000 =66
19867-)0000000000000000 =66
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19879-)0000000000000000 =66
19885-)0000000000000000 =66
19891-)0000000000000000 =66
19897-)0000000000000000 =66
19903-)0000000000000000 =66
19909-)0000000000000000 =66
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19939-)0000000000000000 =66
19945-)0000000000000000 =66
19951-)0000000000000000 =66
19957-)0000000000000000 =66
19963-)0000000000000000 =66
19969-)0000000000000000 =66
19975-)0000000000000000 =66
19981-)0000000000000000 =66
19987-)0000000000000000 =66
19993-)0000000000000000 =66
19999-)0000000000000000 =66
20005-)0000000000000000 =66
20011-)0000000000000000 =66
20017-)0000000000000000 =66
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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,&B7F2
90 'ORG &BD2B
100'JP start
110'END
```

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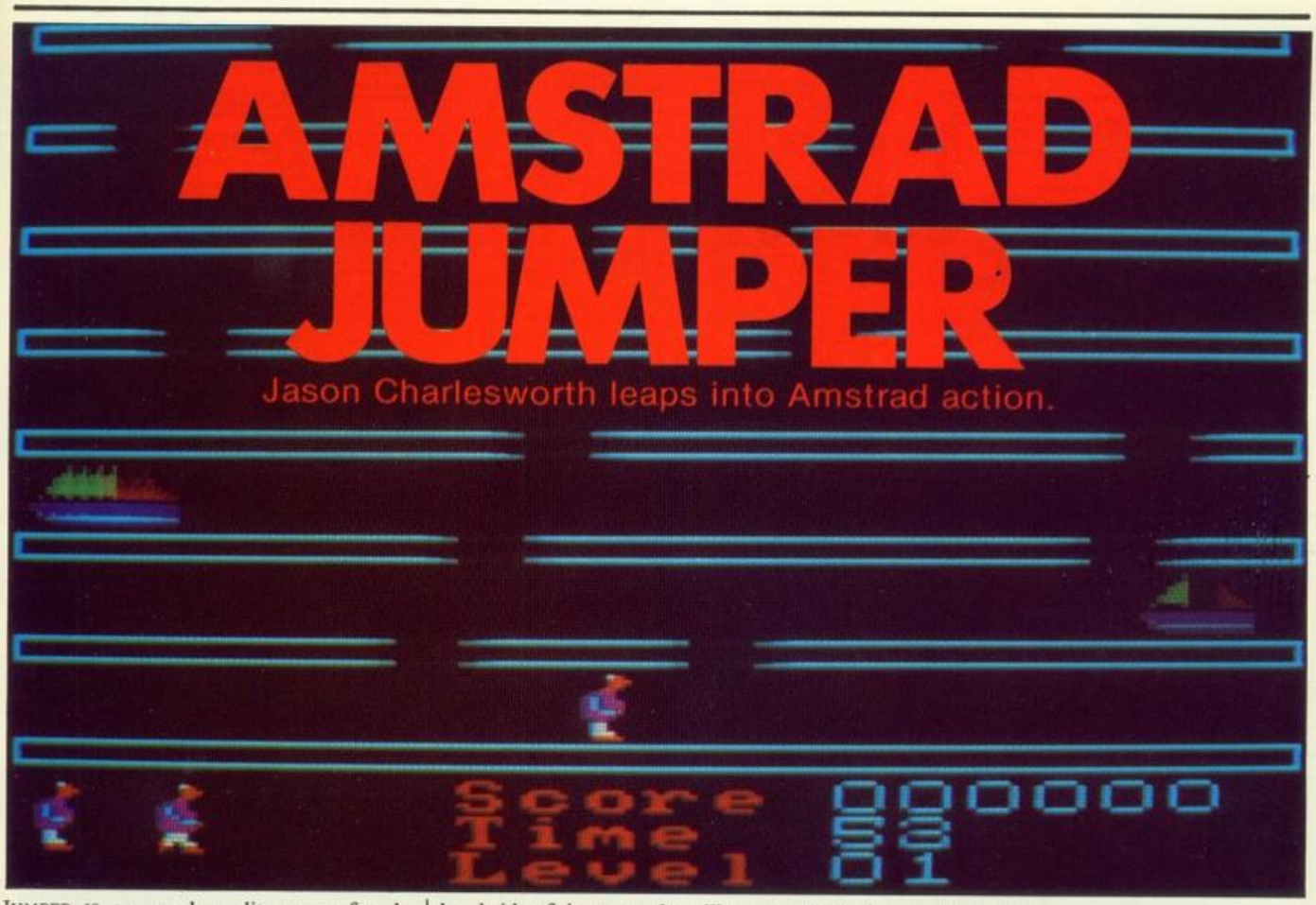
AMSTRAD JUMPER

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 22767:MODE 2:PRINT"Poking 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$:IF LEN(a$)<>2 THEN
70
40 t=0:FOR b=0 TO 79:z=VAL ("&"+MID$(a$,b*2+1,2)):t=t+
z:POKE a,z
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+90:END
80 DATA 10086,9982,6333,5836,8340,6667,8478,8333,8831,
10393,8698,8912,6886,10163,9924,9238,9424,8415,9840,95
81,8835,10313,8585,9383,
6397,1519,3422,3899,3471,3684,3664,3975,4571,2877,1895
,9518,6621,3832,4090,3e93,0,7432,2353,6859,5267,6313,1
917
90 DATA CD7CBE3E01F532E793CDA29BCD2191CD7C90B600C9CD19
BDCDB690CD89FBCD98ECD38BEC118EDF13CFE1020D8C9CD7CBE3E
6032E1939732199432159421
239622E593CDA29BCD2191CD7C90CD2C0FCD
100 DATA DF8ECD190DCD2092CDB690CD8FBFCD088ECD38BECDF20
D3A1994FE01CA728D3A1594FE0020D63AE7933CE40F32E7933AE79
33D87078759F16021FA0L19E
597CD0EBC2183002276932IF48C86A7E23CD
110 DATA F4921F9E1E86007E23CDF4921F90A84CD19B01F8C36
D0C4C4556454C204F4E4520202020205457420202020205440524
5452020204A6F5552202020
0A6495645202020205345202020202020
120 DATA 5A4554E202020454944748542020204E494E4520202085
44454E2020202020454C4556454E2020545745454C5645202054440495
254454544E464F55525445454
E4A6496454454E4E2B3AF5933D32F593FE00C8
130 DATA 0632CD1980D18FB97CD8EBC3AF5932180FE02200321D
8BDB1820AE0437693860A7
E23CDF4921BF9866CD19B01
0F8C36D8C434152454554CD4F4E4C592054
140 DATA 574F4C495645533204C4546544341524544554C204F4E4
C59204F4E454C4946452020
0C036E132378E3A1C94EE013
21C94C997323780E3E20CD1E8D2002F1C93E2C
150 DATA CD1E8B0CD0B6C210000110000CD1800D3E3CCD1E8B20E
DC0B9BCC9803A1C94FE00C03E02CDA8CE6079FE04D02A1A947E239
322184928202B7E327A8E235E235AED5376BE
160 DATA 2173BCCDAABCC9020000EF00000F5A00013FB02110941
1A0 DATA 21738CCDAABCC9020000EF00000F5A00013FB02110941
1DE93ED9BC9CD08D7CFE01C87DFE2CD0D62C2e80CD1B8D3A1C94F
E012806210D6BECDAABC3AE19
7D6012732E193FE0020063E0132199497B18D
DF492C9B1B1000CD1000832D0ED4BE5933A1694FE0020853D321A9
4C93EB398AF79075F16006250
D1D8C7EFE00C823232323237EFE00C03E0CED49
180 DATA 15F9F521C594CD0893ED4BE5933D4ED43E593F13D20E
BCD0A923E3232219B4C93A1B94FE00C03E48CD1E8BCBED4BE5933EC
498AF79075F260054CD1DBC7
EFE00C8232323237EFE00CED4BE593F8FE8A
190 DATA 20063E01321594C93E10F5217594CD0893ED4BE593050
5ED43E593F13D3D20EACDBA923E8432169A3AE7933CE6FE1FCD7B9
3C93A1794FE0020857321794
4C93E8132179A3E8721F69306B0F5C54E235E
200 DATA 79034FFE01200216E1FE47200216FF732B712323E5C5C
DF4BFC1613A0693FE01201C4E235E79034FFE01200216E1FE47200
216FF732B712323E5CDF4BFE
1C178C61847F1320204C978EAF86F26002950
210 DATA 5429291916C0591950543A0C84A6233A0018FB2336C8
6846B7AC4B0475736F3ED6A2336000028FA2336F318EB6B7AC4B0
7368C8686233600180B2336
CC9E5D53A14943CE61F3214945F1600215190
```

```
220 DATA 197ED1E1C9F8EC60741D8C4765289A7B4973B7B7B0B0
FC23876A6216EAF4B9ACF11F44F9EE8A6DAE1D8E3B848C80117392IF
6930607CD3B905FE67E1FC60
5772378E6823D772323EEFE772878E63FC605
230 DATA 77232318E8C7921AE9811E8938100008D80C9468723374
6673C973AE79321BC941EB93CB47C4E6902IBC9711EA93CB4FC4E
690218C9711EC953CB57C4E69
0210C9811EE93CB5FC4E69BC9F5EB4E2346BD
240 DATA 2B15E521BC988CCDCA92E1BE46A78CA1847FEA03B02060
7702971EBCDCA922AE5937C3CB8200D7DC6B491FE0C3805E01321
994F1C997CD8EBC3EC7F5CDC
791F1D610FE8720F53E85CD988B21871622769
250 DATA 9321F9218A8A7ECDF4922318F997CD7893218717227269
3219991068076CDF4922318F921871022769321C191068A7E23CDF
4921BF93AE7930AFF84D60A3
0FBC4B4AF7BC63BCDF49279C630CDF4923AF3
260 DATA 9321789411154B0010000F5C5D5E5C08893E1D119C179C
6004FF13D20ED210000110000CD18BDC9536367F226520854A96D652
020363B4C657665AC2026006
F29E53E02CDDEB811000CDEAB8117C02E1E5
270 DATA CDF6BBE111B0A07ED52E5117C02CDF6BBE1118000E5C
DF6BBE1118A081E5111000CDF4BBE13E0DCDBB8A84C52828E51
10480CDEABB11E5111BEAC93A1894FE0020737D321894C3
280 DATA 8A92CD8792787EE0CA8A92ED43BE5933AE4938B2025790
54FFEFF200C218C9B8E0004CDCA92050E4AFE4B200CBE4821BC980
4CDCA9205BE0087832E493ED4
3E5933AE3935F3AE2938332E293FE000004FE
290 DATA 8920043EFEA85F7B32E393C38A92217B9432AE493FE012
0D3217E953AE293EE4FC1F1F11000FE01200311A00FE02200311B
E4ACD1EB8209B1103E48CD1EBB200111C9F5C5
300 DATA 05E5E5798716806259F3EC798AFCD1D8CD18610C5E5010
000EBED00EBE1CD26B0C11B0E1D1C1F1C9E5D5C5F5FE3B3B5CFE3
A3B50B63817171F52A76937
D8787B75F1608E1894878787C6876F2A00CD
310 DATA 1D8CF1C6BC1A795FB6714D50E031E00A717CB1317CB1
35797CB4B2023E0BCB432082C6A0477237A8020E311FD871D1131
8072176934F1C1D1E1C92A7
4933E1FCD5A6B2C7DC05ABB247CCD5ABBF1CD
320 DATA 5AB9217A9334C1D1E1C90F17E5D5C5F5210D162276932
49279E60FC630CDF4922B10E0F1C1D1E1C9E5
330 DATA 79071600625F3EC798AFCD1D8CD18612C5E5810500EBE
D86E1CD26BCC11BFBC9010000040001012796BF184F3B97100
70E37000000000034101200
1CFF1A0117FF0501C810CFF37FF2A811A01
340 DATA 30FF12011FFF0000000000000000000000000000000000
101279681000000000000000
0000000000000000000000
350 DATA 0000000000000000000000000000000000000000000000
000000000000000000000000
000000000000000000000000
360 DATA 0000000000000000000000000000000000000000000000
000000000000000000000000
000000000000000000000000
370 DATA 0000000000000000000000000000000000000000000000
000000000000000000000000
000000000000000000000000
380 DATA 0000000000000000000000000000000000000000000000
000000000000000000000000
000000000000000000000000
390 DATA 0000000000000000000000000000000000000000000000
000000000000000000000000
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400 DATA 0000000000000000000000000000000000000000000000
000000000000000000000000
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410 DATA 0000000000000000000000000000000000000000000000
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420 DATA 0000000000000000000000000000000000000000000000
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430 DATA 0000000000000000000000000000000000000000000000
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440 DATA 0000000000000000000000000000000000000000000000
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450 DATA 0000000000000000000000000000000000000000000000
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460 DATA 0000000000000000000000000000000000000000000000
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470 DATA 0000000000000000000000000000000000000000000000
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480 DATA 0000000000000000000000000000000000000000000000
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490 DATA 0000000000000000000000000000000000000000000000
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500 DATA 0000000000000000000000000000000000000000000000
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510 DATA 0000000000000000000000000000000000000000000000
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530 DATA 0000000000000000000000000000000000000000000000
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540 DATA 0000000000000000000000000000000000000000000000
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550 DATA 0000000000000000000000000000000000000000000000
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000000000000000000000000
```


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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 ? CAAD90CEC931F023=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 ? 95CC9848A9048C83=4CC
51168 ? CE20D8C968A82025=4C4
51176 ? CD2095CC9848A906=4C5
51184 ? 8D83CE20D8C9ADA7=5E3
51192 ? CE85FBADA8CE85FC=6EA
51200 ? 68A82060CBA90185=38A
51208 ? B885B998A293A0CE=539
51216 ? 20BDFFAEA9CEACAA=567
51224 ? CEE8D001C8202CD=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 ? CC20ECCCE87CED0=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 ? 08BD7DCEAD7CCE49=460
52296 ? 10BD7CCE2E7CCE2E=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=3C7
52496 ? 49026A6A6860200C=223
52504 ? CDB0FB8D01DE20EC=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 ? 5445532126205553=285
52624 ? 45201220535445 0=26D
52632 ? 2092205445205245=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 ? 4D205449544C4520=237
52784 ? 204D41582031362 0=1E5
52792 ? 4348415227532920=219
52800 ? 21124E4F54205641=21B
52808 ? 4C4944922C205452=2A5
52816 ? 5920414741494E20=249
52824 ? 3A2021444953432 0=216
52832 ? 4F5220544150452 0=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$)
50 IF A>&6FB7 THEN 200
60 IF A<&2A00 OR A>&6FE7 THEN 20
70 PRINT "^A" ;
80 INPUT ":" B$,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 6FB7
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 :A9C8A0FEA20120F4,4C6
6A08 :FF20616C20486DC9,38A
6A10 :31F08BC934F8E9C9,4CB
6A18 :35F0864C8C6A4C47,200
6A20 :6AA98C20E3FFA9E8,4B2
6A28 :A000A2FF20F4FFA9,4FD
6A30 :03A20020F4FFA902,363
6A38 :A20220F4FFA9C0A0,4C0
6A40 :FEA20020F4FF6BA9,4BC
6A48 :8C20E3FF20F76BA9,439
6A50 :15A20120F4FFA800,3EB
6A58 :A9FF8B9856FD0FA,587
6A60 :A915A20120F4FF20,394
6A68 :8C6C98FB200C6CB0,34B
6A70 :FBA0008477847B84,416
6A78 :79847A8478857820,38B
6A80 :D56DA57829F8C980,489
6A88 :D8E2200C6CB8D899,468
6A90 :7100C820D56DC009,364
6A98 :D0F8A000A5742980,422
6AA0 :D008A51CB5761BA5,354
6AA8 :1D6573857720DC6C,289
6AB0 :B0B528E3FFC820D5,524
6AB8 :6DC810D0F0A5732D,435
6AC0 :B26D200C6CB0A0C5,3CC
6AC8 :7AF00BA95820E3FF,478
6AD0 :20E7FF4C676A200C,34F
6AD8 :6C00CC57BF00BA9,40C
6AE0 :5820E3FF20E7FF4C,4AC
6AE8 :676AA573A8B9856F,43E
6AF0 :D08E28E7FFA90B20,3B8
6AF8 :E3FF4CB36B4C676A,469
6B00 :A000847AB47B200C,2C9
6B08 :C80F291762085D6D,477
6B10 :C8C475D8F1200C6C,45A
6B18 :B8E3C57AF00BA958,4CE
6B20 :28E3FF28E7FF4C67,4BB
6B28 :6A200C6CB0CFC57B,3C1
6B30 :F00BA95820E3FF4C,447
6B38 :676A28C76B20E7FF,429
6B40 :A573A8A9009856F,3F6
6B48 :A58AC902D05828D7,419
6B50 :6BA9C828556CA955,3BB
6B58 :20306EA9502556C,29B
6B60 :A915A20120F4FF20,394
6B68 :F76BA417C808B985,585
6B70 :6FD85198D0F7A90C,4A4
6B78 :28E3FF28A56DA95A,437
6B80 :85B2A96F8583A907,3D7
6B88 :20806E28F86D20AB,2DB
6B90 :6DA9852800A6A98B,2DA
6B98 :28E3FF28F86DA9D2,582
6BA0 :20E0FF4C8C6AA955,3BF
6BA8 :20306EA99620556C,2DE
6BB0 :8BD0FA200C6C200C,316
6BB8 :6C4C486B4C6C6AA9,336
6BC0 :2820E3FFA96F28E3,43D
6BC8 :FFA96B20E3FF6BA9,51E
6BD0 :9CA000A68AE802D0,41E
6BD8 :8BA2132BF4FFA212,3B7
6BE0 :20F4FF6BA29720F4,4C8
6BE8 :FFA29620F4FF6BA9,553
6BF0 :9CA000A68AE802D0,41E
6BF8 :EBA25328F4FFA252,4E7
6C00 :20F4FF6818A99685,44F
6C08 :8F847EA991A20820,3BD
6C10 :F4FFB009C007D005,448
6C18 :6B684C0C6AA47E20,2D4
6C20 :496CC68FD0023868,374
6C28 :A5BAC902D0862079,369
6C30 :6E80EC6A991A201,447
6C38 :20F4FF98A47E80DF,55C
6C40 :680AA2D2CA8ECAD0,5AA
6C48 :FBAA68A980847EA8,458
6C50 :20496CB8D8FAA47E,449
6C58 :60A9E8A000A2FF20,452
6C60 :F4FFA9008580A98C,468
6C68 :20E3FF20A86DA984,3E4
6C70 :20806EA9B9852A9,2F8
6C78 :6F8503A00020F86D,39C
6C80 :20156DC941F80BC9,370
6C88 :42F011C943F8174C,3A2
6C90 :616CA9808A2120F4,335
6C98 :FF4CB76CA980A203,3C4
6CA0 :20F4FF4CB76CA980,433
6CA8 :A28420F4FFE68AA5,4CE
6CB0 :7C20E3FFA47E20AB,46B
6CB8 :6DA9B2800A6E28F8,2C4
6CC0 :6DA81720156DC941,2D0
6CC8 :F80BC942F811C943,413
6CD0 :F8174C616CA907A2,372
6CD8 :0120F4FF4C896DA9,37F
6CE0 :87A20320F4FF4C89,314
6CE8 :6DA907A20420F4FF,3D6
6CF0 :E68AA58AC902D809,443
6CF8 :A9E8A000A20120F4,3E8
6D00 :FFA57C20E3FF2853,495
6D08 :6C20536C6020AB6D,2E3
6D10 :A9852800A6E20F86D,2C1
6D18 :20AB6DA9852800A6E,274
6D20 :20FB6D20AB6DA985,36B
6D28 :20806E28F86D20AB,2DE
6D30 :6D847EA9832800A6E,2A9
6D38 :A9D220E0FF857C60,4DB
6D40 :31D3FF3E0F320F5C,385
6D48 :328D5C32485C3E01,250
6D50 :D3FE21915CC89EFB,56B
6D58 :CD5BEDC366EACD15,52F
6D60 :EECD66ED3E01D3FE,556
6D68 :2165EE3E00CD8FEC,442
6D70 :CD84ECCDA3ECCDA6,654
6D78 :EC23CD77ECCD77EC,58F
6D80 :CDA8ECCD84ECCDA6,661
6D88 :EC233E0DCD8FECCD,4CF
6D90 :84EC23CDA3EC3E03,490
6D98 :CD8FECCD84ECC9CD,68B
6DA0 :A3EC3E07CD8FECCD,561
6DA8 :84EC23C97EFE80C8,520
6DB0 :CD8BED23FEF328C5C,574
6DB8 :C9F513E6F8CB1FCB,60C
6DC0 :1FCB1FCB1FF630FE,4CF
6DC8 :3AFAC6ECC6071213,498
6DD0 :F1E60FF630FE3AFA,686
6DD8 :D4ECC6071213C921,46C
6DE0 :CDEEE5CD84ECE186,69C
6DE8 :173E20772318FC3E,339
6DF0 :0077C9E5217BEFAE,53B
6DF8 :77C50E087EA7CB17,449
6E00 :300D7EEE80773A6F,3C9
6E08 :A98D220E0FF857C60,4DB
6E10 :A991A20820F4FFB0,49F
6E18 :09C007D005608604C,2C1
6E20 :496CC68FD0023868,374
6E28 :A5BAC902D0862079,369
6E30 :6E80EC6A991A201,447
6E38 :20F4FF98A47E80DF,55C
6E40 :680AA2D2CA8ECAD0,5AA
6E48 :FBAA68A980847EA8,458
6E50 :20496CB8D8FAA47E,449
6E58 :60A9E8A000A2FF20,452
6E60 :F4FFA9008580A98C,468
6E68 :20E3FF20A86DA984,3E4
6E70 :20806EA9B9852A9,2F8
6E78 :6F8503A00020F86D,39C
6E80 :20156DC941F80BC9,370
6E88 :42F011C943F8174C,3A2
6E90 :616CA9808A2120F4,335
6E98 :FF4CB76CA980A203,3C4
6EA0 :20F4FF4CB76CA980,433
6EA8 :A28420F4FFE68AA5,4CE
6EB0 :7C20E3FFA47E20AB,46B
6EB8 :6DA9B2800A6E28F8,2C4
6EC0 :6DA81720156DC941,2D0
6EC8 :F80BC942F811C943,413
6ED0 :F8174C616CA907A2,372
6ED8 :0120F4FF4C896DA9,37F
6EE0 :87A20320F4FF4C89,314
6EE8 :6DA907A20420F4FF,3D6
6EF0 :E68AA58AC902D809,443
6EF8 :A9E8A000A20120F4,3E8
6F00 :FFA57C20E3FF2853,495
6F08 :6C20536C6020AB6D,2E3
6F10 :A9852800A6E20F86D,2C1
6F18 :20AB6DA9852800A6E,274
6F20 :20FB6D20AB6DA985,36B
6F28 :20806EA9B9852A9,2F8
6F30 :6F8503A00020F86D,39C
6F38 :20156DC941F80BC9,370
6F40 :42F011C943F8174C,3A2
6F48 :616CA9808A2120F4,335
6F50 :FF4CB76CA980A203,3C4
6F58 :20F4FF4CB76CA980,433
6F60 :A28420F4FFE68AA5,4CE
6F68 :7C20E3FFA47E20AB,46B
6F70 :6DA9B2800A6E28F8,2C4
6F78 :6DA81720156DC941,2D0
6F80 :F80BC942F811C943,413
6F88 :F8174C616CA907A2,372
6F90 :0120F4FF4C896DA9,37F
6F98 :87A20320F4FF4C89,314
6FA0 :6DA907A20420F4FF,3D6
6FA8 :E68AA58AC902D809,443
6FB0 :A9E8A000A20120F4,3E8
6FB8 :FFA57C20E3FF2853,495
6FC0 :6C20536C6020AB6D,2E3
6FC8 :A9852800A6E20F86D,2C1
6FD0 :20AB6DA9852800A6E,274
6FD8 :20FB6D20AB6DA985,36B
6FE0 :20806EA9B9852A9,2F8
6FE8 :6F8503A00020F86D,39C
6FF0 :20156DC941F80BC9,370
6FF8 :42F011C943F8174C,3A2
```

Figure 1. Spectrum.

```
  5 REM SPECTRUM 48k        fig 1
 10 REM Hex Code Loader
 15 CLEAR 59000
 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 m=1 TO 3
200 LET x$=b$(17+m TO 17+m)
205 GO SUB 300: LET y=y*16+x
210 IF e=1 THEN LET a=a-1: GO TO 260
220 NEXT m
230 IF t=y THEN PRINT ";";b$: GO TO 50
240 PRINT "Checksum Error"
250 LET a=a-8: GO TO 50
260 PRINT "Typing Error"
270 LET a=8*INT (a/8): GO TO 50
280 SAVE "download"CODE 60000,1136
290 POKE 23658,8: STOP
300 LET e=0: LET x=CODE x$-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 :58ECDD47EE38FBCD,5AF
60024 :BBEDFE31CA99EAFE,69A
60032 :35CA87EAC366EACD,5D8
60040 :15ED3EFACDB4EDCD,5FD
60048 :15EDC9CD15EDC366,553
60056 :EACD66ED11E5EE06,58C
60064 :803EFF121310FCCD,458
60072 :15EE11CDEEB6173E,3D2
60080 :2812131BFCCD1FED,3DA
60088 :38F0CD58EDCD1FED,5BB
60096 :38FB3265EF3E0832,3E9
60104 :6CEF326FEF327BEF,544
60112 :3A65EFCDEBEC3A65,5A1
60120 :EFE6F0FE0020DE0E,627
60128 :891165EFCD1FEDDA,581
60136 :AAEA1312CDEBEC0D,552
60144 :28F23A69EFE60828,51A
60152 :0D2148B5C3A68EF0E,36C
60160 :0847B9226BEF0E08,1DA
60168 :11CDEECD1FED389A,47F
60176 :12130CCDEBEC79FE,45C
60184 :1820F83A68EFCDB1,447
60192 :ECCD1FEDDAAAEA21,574
60200 :6FEFBE2B133E5811,326
60208 :E0EE1213E0812CD,340
60216 :D7ECCDAE6CC3AAEA,6B1
60224 :CD1FEDDAAAEA2170,518
60232 :EFBE20E121E5EE3A,524
60240 :60EF856F3E000C67,3CC
60248 :3E00BE200BCDD7EC,40F
60256 :3E2132085CC3FFEB,4B2
60264 :3E00326FEF3270EF,3C7
60272 :ED5B6BEF0E00CD1F,40C
60280 :EDDAAAEA3273EFCD,634
60288 :EBEC3A68EFFE0028,586
60296 :853A69EFE6803A73,432
60304 :EF12138C3A6AEFB9,3FC
60312 :20DCCD1FEDDAAAEA,5DB
60320 :216FEFBEC22DEBCD,504
60328 :1FEDDAAAEA2170EF,5A2
60336 :BEC22DEB3E6F32E2,509
60344 :EE3E6832E3EE3E00,498
60352 :32E4EE3A885CFE21,581
60360 :2803CD15EECDD7EC,553
60368 :CDA6EC21E5EE3A68,5C5
60376 :EF856F3E000CA736,422
60384 :0821E5EEED4B66EF,561
60392 :0C7EFE00C28DEA23,4FC
60400 :0D20F63EFACDB4ED,5B9
60408 :3E01D3FEC366EACD,5E8
60416 :1FED30FBC3BDEAF3,594
60424 :B603AFD3FF10FB3E,3DB
60432 :40D3FF3EFFD3FF3E,56F
60440 :31D3FF3E0F320F5C,385
60448 :328D5C32485C3E01,250
60456 :D3FE21915CC89EFB,56B
60464 :CD5BEDC366EACD15,52F
60472 :EECD66ED3E01D3FE,556
60480 :2165EE3E00CD8FEC,442
60488 :CD84ECCDA3ECCDA6,654
60496 :EC23CD77ECCD77EC,58F
60504 :CDA8ECCD84ECCDA6,661
60512 :EC233E0DCD8FECCD,4CF
60520 :84EC23CDA3EC3E03,490
60528 :CD8FECCD84ECC9CD,68B
60536 :A3EC3E07CD8FECCD,561
60544 :84EC23C97EFE80C8,520
60552 :CD8BED23FEF328C5C,574
60560 :C9F513E6F8CB1FCB,60C
60568 :1FCB1FCB1FF630FE,4CF
60576 :3AFAC6ECC6071213,498
60584 :F1E60FF630FE3AFA,686
60592 :D4ECC6071213C921,46C
60600 :CDEEE5CD84ECE186,69C
60608 :173E20772318FC3E,339
60616 :0077C9E5217BEFAE,53B
60624 :77C50E087EA7CB17,449
60632 :300D7EEE80773A6F,3C9
60640 :A98D220E0FF857C60,4DB
60648 :A991A20820F4FFB0,49F
60656 :09C007D005608604C,2C1
60664 :496CC68FD0023868,374
60672 :A5BAC902D0862079,369
60680 :6E80EC6A991A201,447
60688 :82A96E8583A00020,361
60696 :F86D20AB6D20996D,3C0
60704 :2B996D2B996D20AB,317
60712 :6DA98A20086E28F8,2C6
60720 :6D20AB6DA9822000,270
60728 :6E28F86D20AB6D20,34B
60736 :E7FFA9D220E0FF40,5A8
60744 :A90FA20820F4FF60,3D5
60752 :F5DBFF3A81EFFE00,5C7
60760 :20843E361802E37,187
60768 :D3FFDB7FF1C9F53A,675
60776 :81EFFE0020843E36,376
60784 :D3FFCD50EDF1C93E,644
60792 :00DBFFE60837C8DB,59.
60800 :FFE60237C8DBFFE6,626
60808 :302004DB7FA7C93A,3E0
60816 :81EFFE0020843E37,397
60824 :1802E36D3FFDB7F,452
60832 :C9CD47ED3A73EFD8,5DE
60840 :F1C366EAF53ED23D,5EE
60848 :20FDF1C9CDACED3D,62A
60856 :20FAC9C5D5E5F5FE,78D
60864 :7F2813CDF9EDFE8C,537
60872 :208CFE0D20053E28,28A
60880 :D73E0DD71810E28,34F
60888 :D73E08D73A885CFE,4E8
60896 :212003E08D73E5F,2E6
60904 :D73E08D7F1E1D1C1,640
60912 :C9FE07281CFECB20,4F3
60920 :19FE0C2814FE0D28,388
60928 :18FE0D208CFE28FA,367
60936 :0FEEFE08FA11EE3E,48A
60944 :08C93E07C9CD6B0D,32C
60952 :3E02CD0116E1832,1C4
60960 :895CC93E12160ICD,382
60968 :1122C93E121600CD,257
60976 :1122C9C5D5E53E02,3EB
60984 :CD0116CD47EE38FB,451
60992 :CD5CEEE1D1C1C93A,5CD
61000 :3B5CCB6F208C3A00,20F
61008 :5CF5213B5CCBAEF1,4C3
61016 :A7C937C9F5111000,3DE
61024 :CD18EDF1C9444F57,4D6
61032 :4E4C4F4144494E47,2B4
61040 :2B4D454E55003120,216
61048 :2828524543454956,276
61056 :4500352020204553,217
61064 :697420746F204261,328
61072 :736963002020573,2DF
61080 :652053796D626F6C,393
61088 :2853686966742020,38B
61096 :2B4700746F205265,2C9
61104 :7475726E2074 6F20,39C
61112 :4D454E5520290845,27B
61120 :4E5445522D4E554D,389
61128 :424552200000000,1C1
```

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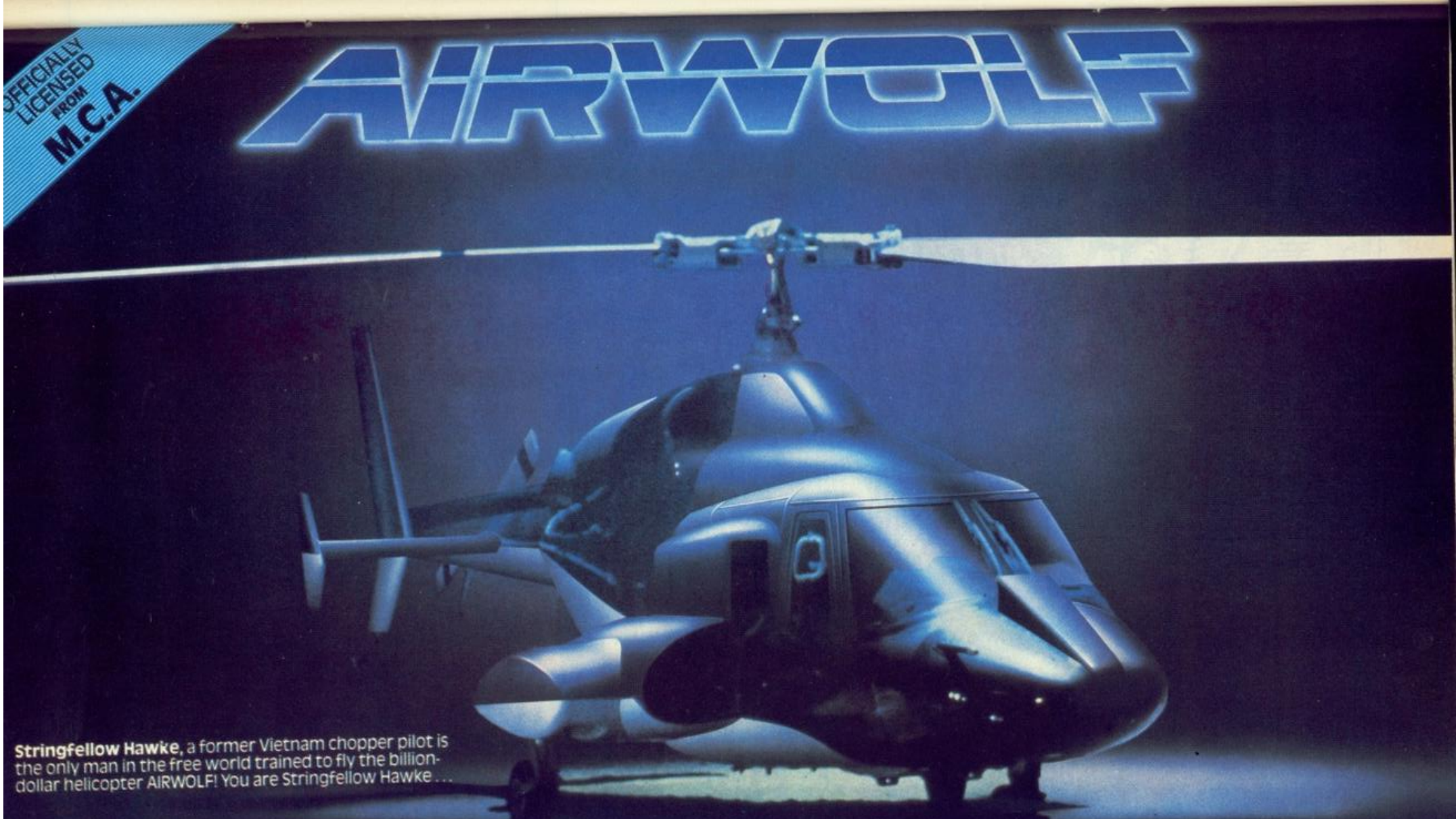

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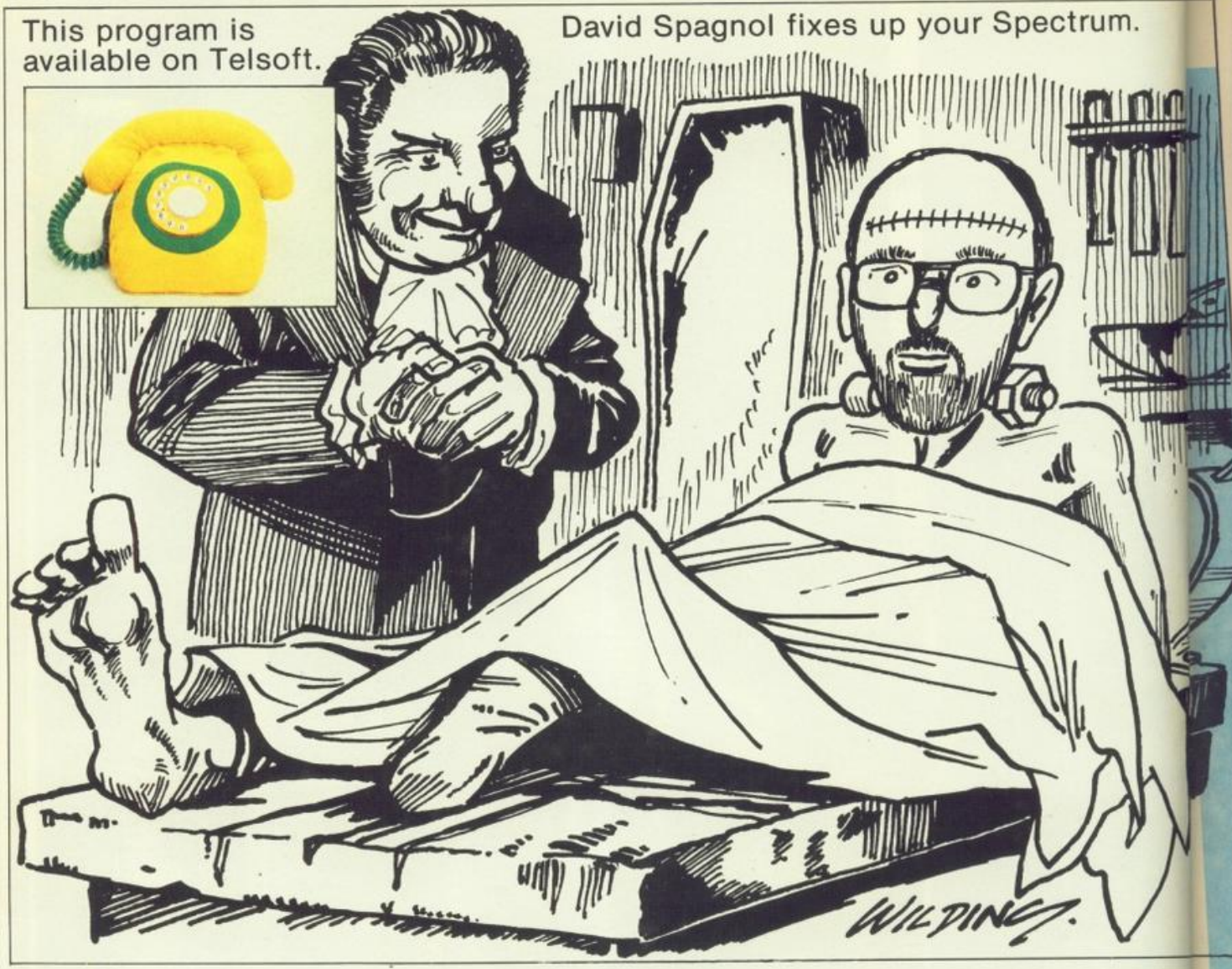

TOOLKIT

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=10: 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$(3 TO )
220 LET address=address+1
230 IF a$<>"" 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$,i$,"Tool Load"
500 REM  SAVE LOADER
510 SAVE a$+"m";1;"Tool Load"
520 VERIFY a$+"m";1;"Tool Load"
530 STOP
600 REM  SAVE CODE
610 SAVE a$+"m";1;"Toolbytes"CODE 60000,5360
620 VERIFY a$+"m";1;"Toolbytes"CODE 60000,5360
630 STOP
1000 DATA "216A0EA5ED73C9EC214AEFE5CD6FED0D2828282828282
8202828285385435455255542004AF4FAC4B495400D04120416C74657
2205872F677216A0204E204175746F",5953
1010 DATA "AC696E65204F4E2028204E204175746F6B656E2828432043
41544120AF204C6F43617465205446F6B656E2828432043AF70792
04C696E6573282828282828282828282828282828282828282828282
E6E7328282828282828282828282828282828282828282828282828
5202828285920556E63AF727275787420202020202020202020202020
5202828285920556E63AF727275787420202020202020202020202020
4657369676E6572202020202020202020202020202020202020202020
2A0617469AF6E2020205A204C697374",4423
1050 DATA "2056617269616261726C6573204D6572765204C696E6
5732020202020202020202020202020202020202020202020202020
2204361736528282828282828282828282828282828282828282828
1060 DATA "542F5728AF6666202020AF204C6F7765722041736
5202828285920556E63AF727275787420202020202020202020202020
04C696E6573282828282828282828282828282828282828282828282
1070 DATA "65204F6E2020202020202020202020202020202020202020
0435972044F4C4C4F5745442042592045AE5445522C00206F72206
1080 DATA "A0652066AF72206A656E75EF7EF38D1981820DCDF7E
ECD8D23C3F5E4DF0641972110E05F1608195E2356A5C93E23D77CC
D9EEC7CCDA2EC7DCDAEEC7C1004F1F",7714
1090 DATA "1F1FEAAFFFE0A3002C607C3EF151EFF01F0D8CD2A190
118FCCD2A1981C9FFCD2A190EF4CD2A197D18E14AEA6BEA57FFF10
3400073000000100600000000000",5978
1100 DATA "00000000000000000000000000000000000000000000
00000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000
1110 DATA "FA9AF518FA3FFE6EFF9B1FA77F125FBA4FCF7FC83FD2
4F374FD91FE3CFCEBFD5CF385F9F7FD8FA6EF93EFF35FF52F419F
5FE7F2B043818D7C94F2A515C232323",10790
1120 DATA "237EFE5320285FE5079200736200779D7C94FE63F47C
803E7EFCD1160111B131AA7CA34EEFE",7949
1130 DATA "203843FE1E03873F202EFE112052FE122863FE13203AF
E14282DFE152921FE19CA57EE3047D61A074F040005ED21CBEC897
32372ED111C2E5CDCECD110B07C85",7519
1140 DATA "2007CD4EF04D5E5CD51ED61D110AA05CDA9EED110A
3D5E5CDADECE1D1109A131AD5A721D7EC200321FAEC01210DCD9AE
ED1180513140D5A721D7EC200321FAEC",9158
1150 DATA "4E2346236EDC03C2B011BE7D61705CDA1EED110DED5E
511EBEFD5AFCD04C01820DCDF7EEEADFFE592005ED79CE9CC9D13
1160 DATA "C9220283A0FAF1164002AD1EC37ED52D0CD44AEFB12AC
BECED5DCDE37ED52D0CD44AEF02210C27ED5BCFECED5230081 9ED5
BCDECDE5D220DCD44EF03E5CDF7EEE171",8921
1170 DATA "237023E8ED00AF12C9810400DCDF7EE210000FE2328I
CFE8DC8444029290293080FCD1B2D5D0A6300600AF131A0930EA1
0D7131AFE00C82929292CD1B2DCDE9",5795
1180 DATA "EE36ED643800004F0910E7E6DFD641D8FE0637D0CA3
AC9C52A515CE5AFCD01116CD6E0DFDC002EDCDBF162171CCBEEC8F
EE501010F7340022585CCD2C0FCD4E",8033
1190 DATA "0DE1CBAEC8BEE1CD1516FD36220026A635CED5B615C3
7ED52C1ED423880A9444D79B11AC81821CD4AEF00CD6E0DE17E11A
BEFCD840C2184011804202CDB5D3810",6775
1200 DATA "00CD3D1FCD3D1FED7BC9ECC9541736D2036AF6D706
C65746E45261A6E67652045727246F24E756D626572732052657666
5727365E4496E76616C696420C696E",7013
```

```
1210 DATA "65204E756D626572F2D6E4F7420416C6C6F7
7A5E44C6965732077667756C642B4F7665726C61FD4EAF20526F6
F6D206174204465737469766E617469766F",6473
1220 DATA "EE5A65726F20426C6F636B1B0D0D2045584553554
53FA059B0D0D414445245530353534415D2446494E4953CB3173F45
54E414644454354454544455554496F",5858
1230 DATA "4154494F6C494E4352454D454ED44C494EC54E554D4
245D244454C4554CC454D4F56C5434F50D9524554E5540424502424C4
3C04C4953D4524555D4C4143C54FAC4E44E4507535452494E7E7245C
0555585045026C6F7765F2434153C544",6926
1250 DATA "45C34845D4D4D4552475C53F2020383D6E6AFA94352454
154C553594D424FCC42595E4A5D294C4546",6502
1260 DATA "D44C4546E4754CB5641524941424CC546494CC5555534
5522052414D494E5445525255505453D4E4F524D41CC4449564552S
4454C4415645205350414744E4F524D41CC4449564552S
5434F4D504143D4434F4C5540CE492F4F2028AF6E2F6F6666A9494
E2851554F5445533F2020592F4E9141",5566
1280 DATA "5554CF41424354464F4D4CFE205872A563656465E0206E4F7
3A9CD8FED0DE0203B9128C919E0C5DD",7386
1290 DATA "FE9F1404A01819FD3652FF10EFCD0FED0D52026D7F
EC1801351A14FEC2031B1C14FED89A1100120FFED99A11011201F
ED6A2131D141617100CD99F22ACBEC",7118
1300 DATA "CD6E1910032A05EC22D3ECCD0819ED5305EC5623SE2
3E52ACDECA7ED52E1D84E23462311D9EC1ABE2814ECD0B6102806
1310 DATA "E137E52AD7ECED42E1380AE5CD4B07EC1ABE1323082
807E1DDE5C10810C4780120E0ED4B07ED2AFAECA7ED42C5E5444D0
4851FE1C1E3CDE819E5ED4BFAECC5CD",9866
1320 DATA "5816C1D121FCECED80C1D52AD5EC0922D5ECA7ED52E
52AD3EC23235E2356E809EB7227D732823A01EA72804CD5510D7C
1E1C303F2ED4B07EC11D9ECCDB6F2DC",9341
1330 DATA "D3F230F1ED4BFAEC11FCECCDB4F2DCD3F238F1C9545
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337C9D5E5E52A505CE322505CDFCD1B7",8931
1340 DATA "2D300CFEC42000E1220505CE1E1A7C9CD9B2CDF81010
0CDB4F2E1225D5CE1308A6F023801A7C9EBA7ED52EB424B01ED0D3
E0E12132A65CB1858AF7ED4222655C",7496
1350 DATA "ED0837C9CD8FED0DCA19CD39F3CD44F5CD4DF3CDBBF
3C319F5CD92ED0CDCECFFEC180131A14FEC3C4B0131B14FE85131C1
DECCD6E1913ED53D3ECED58CFEC2A555CCDCFF4300D46234E23712
37023CDC4F410EE1E505ED5B0D3ECA7",9481
1370 DATA "ED5201E1D8E4722342E732371237023E52AD1EC19EBE
1CDC4F410DE3EF5CDFCD1162A535C232323CD4EF4D252F4545D060
004237EFEE2E003E1B0EF0E2BF223",7547
1380 DATA "232323237EFE3A2B04FE0D28EA78FE0530E5D5210
00A1AFE200F0638404429298294FB6B0911310EC4D442A535C2
323CDCFF43803E118AD237EB3807237",5357
1390 DATA "23CDC4F410EA2B2004F7EB938F2284E2846E1E5EBC5C
0E519C1225B5CCD1B1AC12A5B5CAF23772377237123772377E11
8C62A535C2323CDCFF43054SD2323CD",7478
1400 DATA "0005535E2356E23E37907ED52E1D02323CDC4F438ED37C
9AF4FCDDBF0E2AA535C23234E2346282828787237123232323CDC4F43
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1410 DATA "2346282828303030383C5E5EBCD4E19C1E5C5CD5516C
1E1E09E5C5EDB0C1E1CDEB1918D52AECBECCD4E19111000044234E2
3E52ACDECA7ED42E1380A2B0132323",7436
1420 DATA "CDC4F418EB2AD1ECCDD4AEF862ACBECED5BCFECA7ED5
2D02ACDECED5D2081E7CDDBFED0DC819",9659
1430 DATA "CDDFF3CDD7F5CD44F52ACBECCD4E19E52ACDECCD4E1
1440 DATA "0D2A485CE505ED534B5CED53D3ECED5BCFEC2A535CC
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1450 DATA "B0131B1C14181782ACBECCD4E19E52ACDEC23CD4E1
9D1ED5228D1198C3E519CDBFED80E3D8C7FEC780131B1C141FFEAC1
31D1415FEA41100120000ED49D1EC83",7105
1460 DATA "83C5830303032180000ED42D2E2ED2ACFECE5C5CD4E1
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B2773780120F9233680C90000000000000000000CD8FED80D2D
1470 DATA "CD92ED5FED5B2AD1EC4D442929092923232323232D3EC2
5DA78CE210000221DECA7B5C22CBEC",5646
1480 DATA "EB2A05EC292929192D22CDEC1032CD8FED0D0D1D3D
4FEC1801351A14FEC2003181AFEC1B7C7B01781C14FEE5EA871318I
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CFE44280FFE402804CD4AEF01111300",8209
1510 DATA "2919180E2AD1EC4D442929092923232323232D3EC2
1520 DATA "291918E2AD1EC4D442929092923232323232D3EC2
ACFECCD6E1922585C3EFFCD0116ED5BCBEC2ACDECA7ED52D8CD9DF
```

```
77AB3CB2ACFEC2322CFEC180EAED4803",7951
1530 DATA "ECD5CD051FD12A5B5CE52ACFEC7CD77DD7D7D73EE4D
72AD1EC3AD9ECE4DFFE442B1001000003E2D71AE52604AF09444DE
1D5F5CD99EECF1CDA2ECD12B7CB5132087",8925
1540 DATA "847AB32BE53E2073E2CD71B231807 3E2CD71A4F060
0C5CDC4FEC13E0ED7AFD7AFD7790778D7AFD7297CB5132087A852
0G03E80D7C12A5B5CB3833376427C",7862
1550 DATA "02007D02C9FDCB01CE3E02CD0116FDCB014ECCA8003
E02CD0116CD977ED80E8E9FEEAA81921000019ED5B655CED52CD97E
D14E7FECFAC192A485CED5B535CA7ED",7750
1560 DATA "52CD97ED14E7FEEDAE192A595CED5B4B5CA7ED52CD9
7ED14E7FEAF192AB25CED5B535CA7ED52CD97ED14E7FEF81 9ED57F
E3F200 7CD97EDF219008SCD97EDF119",9218
1570 DATA "2A515C232323237EFE53200 2E5CCBCF8CD97EDFE7
FF3801 9C37BECCD97EDFE92FE2819B6153E5690D718FA3E80D73E2
0D7801533EA598D718FA3E80D7C9CD0F",8053
1580 DATA "ED6E053FE192A485CE5EC1CDB819D57EFE80203D311
6C5E5EBCDADECE1C110EF3E29D7180FCD0FE80D5D226A6FEC1801
31A14FEC200131B1C14FE1879A1180",7326
1590 DATA "1200002ACBECCD4E19CD8019D5E556235E23E52ACDE
CA7ED52E13803C1C9C2323111D9ECED4BD7EC7EFE802007E1E1180
0E1180E57ECDB4180DF1ABE20F213",8402
1600 DATA "2A07B0120EFE1EC1D5518D7E110BACD0FED0D08C9F
EC1801351A14FEC2B0131B1C14FE1817002ACBECCD4E19223223D3E
CCD8019ED53D5EC5623SE23E52ACDEC",8182
1610 DATA "A7ED52E1D023237EFE2138FAFEEA200CED5B03EC2AD
1630 DATA "A7ED52E1D023237EFE2138FAFEEA200CED5B03EC2AD
5ECCDE5191802008237EDB61020AFFE21",8139
1640 DATA "38F3EEEB2007E2D5ECDE519ED5B03EC13131
3A7ED52E8723282318DCD9FED8DF4D2FE9511081200193EFEC
D01163E1AD73E05D7ED7CD97EDF4C7",8676
1650 DATA "F0F9193EFECD81161108FBAFCDBAECD4C6F80680C53
E28073E0995FC630721 6C3F7B8467E4E80CB113E2030023E8FD
718F5C178C630D73E0D7180 7CD4EF",7367
1660 DATA "CD97ED80203E2B3E2B5DFDFE201 93EFECD8116CDC4F0810
E6CC63F67131E4DFFE413807FE4938",7870
1670 DATA "03D64047AF371F10FD4F131AE6DFFE492809FE4F208
E792F46180279B677C5AFFA131AE6DFFE563D3206413BA7B787875
F1600A2AFB5C19EB216C4000007E1224",6876
1680 DATA "1310FAC381FA3E160735E87AFD7CD97ED20FC80193
EFECD8116C921AFFAE5FE5A204CD8216C400408FE592028FE58281
8FE57280776F772418FAC9B0811 6C474E1A777912241510
1690 DATA "1F8020F4F7241BF4C9B0811 6C474E1A777912241510
0F7C9110240D5E0D1A87CB1E3E20035F8020F5D11C2410EDC9210
03EED5B7B5C81A000E1D0C9160871046",5632
1700 DATA "554E4354494F4E5300D063941203955204E54E455
2205544470D0D0639562049455445255450D0A3957204C4546547
D5249474854800D0639595020555502D444F",3859
1710 DATA "5720E0D0639595020524F5441544500D0639595020524F
5547455444 7D3CDBFED0DF7CFFEC180131A14FEC200131B1C14FE1
817002ACBECCD6E19CD9019462342 3",5993
1720 DATA "E52ACDECA7ED42E1DBE5E4E2346237EFEEA2004EBC11
0E21E00CD861820FBFE00200BE1712370280F1CFFE2220011CFE2
1737E30E4CB4320E2B2C5CD1810IC100",7485
1730 DATA "AF5F1E0BFE0DFE00E1CFC753FEC180131A14FEC2001
31B1C14181782ACBECCD4E1923235450 4E2346023A3E52346234
E23E52ACDECA7ED42E13817 4E2346E5",6953
1740 DATA "EB5E2356EB09EB7220737E1D1231 3CDE5191BC9E1360
D9C9DDFED0DDD3DC19BE8810DDFED0DDCD3DD190E80C5CD92E
D0EFEC180131A14FEC200131B1C14181",7947
1750 DATA "17FEBA11001200002ACDEC23CD4E19E52ACBECCD4E1
9D1C13AD9ECE6DFFE592001 8C8600223232323A7ED52D0197ECD8
61820FBFE0D20AF4F2220014CDB9D2C",7144
1760 DATA "38FCAE840200 4CB4120DECBEECB7928 08CBAE18DACDB
FED80F9C7C8FE861310141516002AD1EC224FFF210FFDC341FF3A5
2FF4720182A825C3E200DCB3E17BCC0",8121
1770 DATA "3A005CFE0DCB3A305CB7D03E843D3252FF2A495CED5
DC800FFAF3C8938FCED42C2FE5320 0",8374
1780 DATA "5C213050CDBEEE13A52FFC9CD0FED80EAE8002144FE1
6003E652AD1EC9532S1FF2121FEC341",6089
1790 DATA "FF3EBF0FE6072FE6420F4FE822018A51FF01F4012
100005450ED883D20F32A455C180AA72A535CED5B655CED5211BF5
0ED5353FF81F000CD70FE811BFCCD70",7600
1800 DATA "FE819CFFCD70FE81FFFFAF3C938FCE
D42078787C6705F1E3EC5ED53F23225 3FF8601A77132418FAE1C
9CDBFED02D44E4F44C0CEC3E4FEC7",8692
1810 DATA "0D1EC1417002ACFECCD6E19C44AEF8323232323C
D9700CD2049 53FE9F148A01819C9E5D56B69CDADECD1E1C900000
0000000000C052F41100002A53",6189
1820 DATA "5C137223732342342307E5D4E485CA7ED42E138E
BC900000000000001FFFFF3C05E5F5CD10FFF1E1D1C1FBC92
1830 DATA "7FDBFECB4F280721 3B5C3ED7A6772A4DFF7CB5C8E9F
33E3FED47ED5AFBC9210000F3224DFF3EFEED47ED5EFBC9000000
00A000FF5D1300E3EDC342427E424280",7181
9999 RANDOMIZE USR 60000
```

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

```
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
```

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 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 1[
String 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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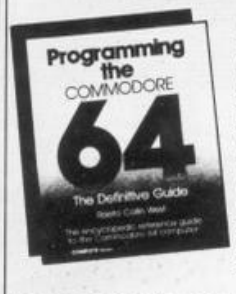

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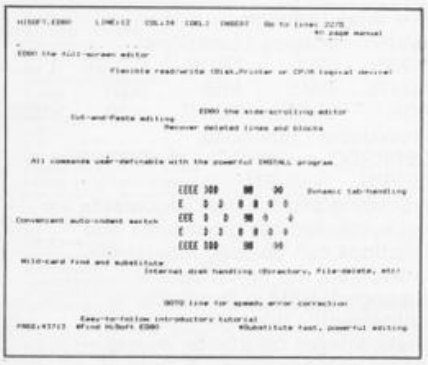

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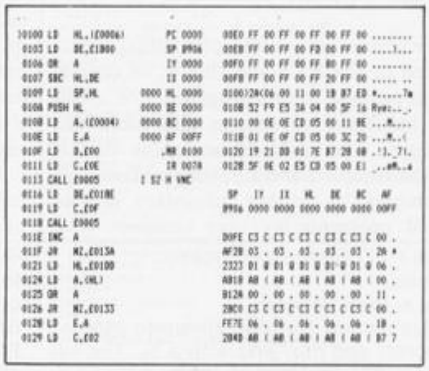

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COMP

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=7040
 130
 140MODE7:PROCT
 150PROCSETUP
 160PROCOPEN
 170TX=FNCH:AX=FNCH:PROCLX
 180PROCprog:CLOSE#CX%
 190IFNL%>ML% PROCEM(5)
 200IFNEX>MB% PROCEM(4)
 210IFEX<CX+MCX PROCEM(6)
 220IFENX GOTO290
 230PROCFIX
 240IFENX GOTO290
 250
 260PROCNE:PROCDUMP
 270END
 280
 290PROCEE
 300END
 310
 320DEFFNL(B1%,B2%,B3%)
 330B3%=B3%*256+B2%-&4848
 340IFB1%MOD&10=0 B3%=B3%+1&384:B1%=B1%+4
 350IFB1%<&44 B1%=64 ELSEIFB1%<&54 B1%=0 ELSEIFB1%<&6
4 B1%=192 ELSEIFB1%<&74 B1%=128
 360=B1%+B3%
 370
 380DEFPROCTOK
 390IF?&0015=5089%=&7FF1 ELSEB%=&7FED
 400X=&82ED:DIMTK 100
 410FORI%=BTO3STEP2:P%=TK:[OPTI%
 420CMPE128:BCCXX:BEQ LX
 430TAX:LDA&9XDIV256:STA&71:LDA&9XMOD256:STA&70:LDY#1
20
 440.DX TXA:CMP(&70),Y:BEQ CX
 450INC &78:BNE DX:INC &71
 460LDA&71:CMP &XDIV256:BNE DX
 470LDA&78:CMP &XMOD256:BNE DX:BEQ FX
 480.CX LDX#0
 490.HX DEY:INX:LDA(&70),Y:CMP#127:BCCHX
 500INY:INY:DEX:DEX:TXA:CMP#9:BCS FX
 510.EX LDA(&78),Y:JSR &FFEE:INY:DEX:BNE EX
 520.FX RTS:.XX JSR &FFEE:RTS
 530.LX LDA#65:JSR &FFEE:LDAC78:JSR &FFEE:LDAC&0:JSR
&FFEE:RTS:]:NEXT
 540ENDPROC
 550
 560DEFPROCSETUP
 570PROCTOK
 580PRINT"SELECT STORAGE ALLOCATIONS"
 590INPUT''"ENTER MAX. NUMBER OF LINES"''"NOT LESS THAN
 10 >"ML%
 600IFML%<10GOTO590
 610INPUT''"ENTER NUMBER OF VARIABLES"''"BETWEEN 5 AND
256 >"MB%
 620IF MB%>256 OR MB%<5 GOTO610
 630INPUT''"ENTER SIZE OF CODE SPACE IN BYTES"''"NOT LE
SS THAN 100 >"MCX
 640IF MCX<100 GOTO630
 650DIM $#(MB%),B% 3+MB%,LX 4+ML%
 660$#=STRING#(40," "):B#=""
 670NL%=B:NB%=B:BNX=B:ENX=B:ELX=B
 680DIM CX MCX:CX=CX+4
 690NL%=toprts-CX+4:MCX=MCX-4
 700P%=CX:EX=CX+MCX
 710for=&E3:to=&B0:step=&B8:next=&ED
 720vdu=&EF:print=&F1:tab=&BA:proc=&F2
 730def=&DD:endproc=&E1:rem=&F4
 740goto=&E5:and=&E8:inkey=&A6:if=&E7
 750else=&8B:line=&DD:then=&8C:dim=&DE
 760eq=&3D:geq=&1:leq=&2:gt=&3E:lt=&3C
 770neq=&3:lb=&28:rb=&29:tr=&89:fl=&A3
 780plus=&28:minus=&20:slash=&2F
 790times=&2A:ping=&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:or=&8
 850end=&80:or=&84:eor=&82:fn=&A4
 860time1=&D1:time=&91:pc=37:sp=38
 870mode=&E8:cls=&D8:clg=&DA:gcol=&E6
 880colo=&FB:draw=&DF:move=&EC:plot=&F8
 890rnd=&83:sgn=&B6:sgn=&B4:abs=&94
 900get=&A5:adv=&96:pos=&B1:vpo=&BC
 910poi=&98:call=&D6:not=&AC:env=&E2
 920ENDPROC
 930
 940DEFPROCOPEN
 950#OPT1,1
 960#OPT2,1
 970PRINT''"ENTER NAME OF PROGRAM TO"
 980INPUT"COMPILE >"F#
 990IX=OPENUPF#
1000PRINT''"START OF COMPILATION"''
1010#OPT1,8
1020ENDPROC
1030
1040DEFPROCDUMP
1050IFLENF#>8 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=ABC"N"GOTO1170 ELSE
1090
1100PRINT''
1110#OPT1,1
1120XX=OPENOUTF#
1130PRINTEXX,CX,F%,EX,F#
1140FOR IX=CX-4 TO EX:BPUTEXX,?IX:NEXT
1150CLOSEEXX
1160GOTO1070
1170#OPT
1180PRINT'':ENDPROC
1190
1200DEFFNCH:=BGETEZ%
1210DEFPROCA:CALL TK:AX=FNCH:ENDPROC
1220
1230DEFPROCLX
1240IFEL% TX=B:ENDPROC
1250IFTX=eop:ENDPROC
1260IFTX=eoln PROCNL
1270IFAX=spc:REPEAT PROCA:UNTILAX<>spc
1280IFNOTFNAL(AX) GOTO1320
1290PROCIB:IFAX=pc B#=B#+"%":PROCA
1300IFAX=lb TX=ar ELSETX=id
1310PROCB:ENDPROC
1320IFAX<>proc ANDAX<>fn GOTO1350
1330TX=AX:PROCA:IFNOTFNAL(AX) TX=B:ENDPROC
1340PROCIB:PROCB:ENDPROC
1350IF FNDN(AX) PROCDNB ELSEIF AX=sp PROCA:PROCHNB EL
SEIF AX=rem PROCRB ELSEIF AX=squote PROCSB ELSEIF AX=l
ine PROCLB ELSEPROCTB
1360ENDPROC
1370DEFFNAL(AX):=(AX)>64ANDAX<91)OR(AX)96ANDAX<123)
1380DEFFNDN(AX):=(AX)47ANDAX<58)
1390DEFFNHN(AX):=(AX)47ANDAX<58)OR(AX)64ANDAX<71)
1400DEFPROCLB
```

(listing continued on next page)

(listing continued from previous page)

```
141BNX=FNL(FNCH,FNCH,FNCH)
142BT%=lino:A%=FNCH:B$=$T%+NX
143BPROCB
144BPRINT;NX;
145BENDPROC
146BDEFPROCI@
147BB$="":REPEAT:B$=B$+CHR$A%:PROCA:UNTIL NOT(FNDN(A%
)ORFNAL(A%))
148BENDPROC
149BDEFPROCDN@
150BNX=@:REPEAT NX=NX+10:NX=NX+A%-ABC"B":PROCA:UNTILN
OTFNDN(A%)
151BT%=const
152BENDPROC
153BDEFPROCHN@
154BNX=@:REPEAT NX=NX+16
155BIFFNDN(A%) NX=NX+A%-ABC"2":PROCA ELSEIFFNHN(A%) N
X=NX+A%-ABC"A"+10:PROCA
156BUNTILNOTFNHN(A%)
157BT%=const
158BENDPROC
159BDEFPROCR@
160BREPEAT PROCA:UNTILA%=eoln:T%=A%:PROCA
161BENDPROC
162BDEFPROCB@
163B$="":PROCA
164BREPEAT:B$=B$+CHR$A%:VDUA%:A%=FNCH:UNTIL A%=dquote
ORA%=eoln:IFA%=eoln PROCEM(1) ELSE PROCA
165BIFA%=dquote GOTO164@
166BT%=string
167BENDPROC
168BDEFPROCCLI@
169B@@=CHR@A%
170BREPEAT:PROCA:B$=B$+CHR$A%:UNTIL A%=eoln:T%=A%:PRO
CA
171BENDPROC
172BDEFPROCT@
173BT%=A%:PROCA
174BIFT%=gt ANDA%=eq T%=geq:PROCA
175BIFT%=lt ANDA%=eq T%=leq:PROCA
176BIFT%=lt ANDA%=gt T%=neq:PROCA
177BIFT%=col ANDA%=col REPEATPROCA:UNTIL(A%<>col)AND(
A%<>spc)
178BIFT%=col ANDA%=eoln:T%=A%:PROCA
179BENDPROC
180BDEFPROCNL
181BIFA%=eop:ENDPROC
182BL%=A%*256+FNCH:LL%=FNCH
183BIFNL%>ML% ENX=ENX+1:@OTO188@
184BL%?(NL%+4)=L%IDIV256
185BL%?(NL%+5)=L%IMOD256
186BL%?(NL%+6+2)=P%DIV256
187BL%?(NL%+6+3)=P%MOD256
188BNL%=NL%+1
189BPRINT;L%; TAB(4);:A%=32
190BENDPROC
191@
192@DEFPROCB
193@IF NB%)MB% ENX=ENX+1:ENDPROC
194@BNX=-1:REPEAT BNX=BNX+1
195@UNTIL (B@(BNX)=B@ AND B%?(3+BNX)=T%) OR B@(BNX)="
"
196@IFB@(BNX)="" B@(BNX)=B@:NB%=NB%+1:B%?(3+BNX)=T%:B
%?(3+BNX+1)=@:B%?(3+BNX+2)=@
197@ENDPROC
198@
199@DEFPROCprog
200@IFT%=eop PROCEND:ENDPROC
201@PROCstate:IFT%=col ORT%=eoln PROCLX:@OTO2@@@
202@ENDPROC
203@DEFPROCdef:PROCEND
204@PROCLX:IFT%<>proc ANDT%<>fn PROCC(proc)
205@@B%?(3+BNX+1)=P%DIV256
206@@B%?(3+BNX+2)=P%MOD256
207@IFT%=fn PROCLX:@OTO212@
208@PROCLX
209@IFT%=eop ORT%=endproc @OTO211@
210@PROCstate:IFT%=col ORT%=eoln PROCLX:@OTO2@@@
211@PROCC(endproc):PROCLX:PROCRT@:ENDPROC
212@IFT%=eop ORT%=eq @OTO214@
213@PROCstate:IFT%=col ORT%=eoln PROCLX:@OTO212@
214@PROCC(eq):PROCLX:PROCexp:PROCRTF:ENDPROC
215@
216@DEFPROCstate
217@IFT%=eoln ORT%=col ORT%=else:@OTO245@
218@IFT%=id PROCassign:@OTO245@
219@IFT%=ar PROCarassign:@OTO245@
220@IFT%=pling PROCassign:@OTO245@
221@IFT%=tim@ PROCtassign:@OTO245@
222@IFT%=proc PROCproc:@OTO245@
223@IFT%=rep PROCrep:@OTO245@
224@IFT%=vdu PROCvdu:@OTO245@
225@IFT%=if PROCif:@OTO245@
226@IFT%=for PROCfor:@OTO245@
227@IFT%=goto PROCgoto:@OTO245@
228@IFT%=print PROCprint:@OTO245@
229@IFT%=end PROCend:@OTO245@
230@IFT%=def PROCdef:@OTO245@
231@IFT%=sound PROCsound:@OTO245@
232@IFT%=env PROCenv:@OTO245@
233@IFT%=call PROCcall:@OTO245@
234@IFT%=dim PROCdim:@OTO245@
235@IFT%=time@ PROCCLI@:PROCCLI:@OTO245@
236@IFT%=mode PROCmode:@OTO245@
237@IFT%=colo PROCcolo:@OTO245@
238@IFT%=gcol PROCgcol:@OTO245@
239@IFT%=move PROCmove:@OTO245@
240@IFT%=draw PROCdraw:@OTO245@
241@IFT%=plot PROCplot:@OTO245@
242@IFT%=cls PROCLX:PROCVDL(12):@OTO245@
243@IFT%=clg PROCLX:PROCVDL(16):@OTO245@
244@PROCEM(7):PROCELP
245@IFELX PROCELP
246@IF(T%<>eoln ANDT%<>col ANDT%<>else) PROCEM(7):PRO
CELP
247@ENDPROC
248@
249@DEFPROCend:PROCEND:PROCLX:ENDPROC
250@DEFPROCassign:LOCALST%,BT%=BNX
251@PROCLX:PROCC(eq):PROCLX:PROCexp
252@PROCST%:PROCADR(P%-3,ST%):ENDPROC
253@DEFPROCarassign:LOCALST%,BT%=BNX
254@PROCgoa:PROCC(eq):PROCLX:PROCexp
255@PROCST%:PROCADR(P%-3,ST%):ENDPROC
256@DEFPROCtassign:PROCLX:PROCC(eq):PROCLX:PROCexp:PRO
CST%:ENDPROC
257@DEFPROCtassign:PROCLX:PROCC(eq):PROCLX:PROCexp:PRO
CST%:ENDPROC
258@DEFPROCproc:PROCJBR:PROCADR(P%-3,BNX):PROCLX:ENDP
ROC
259@DEFPROCfn:PROCJBR:PROCADR(P%-3,BNX):PROCLX:ENDPRO
C
260@DEFPROCvdu
261@PROCLX
262@PROCexp:IFT%=ecol PROCVDD ELSEPROCVDU
263@IFT%=comma @OTO2618 ELSEIFT%=ecol PROCLX:IFFNEXP
@OTO2628
264@ENDPROC
265@DEFPROCif:LOCAL L1%,L2%
266@PROCLX
267@PROCexp
268@L1%=P%:PROCJMC
269@IFT%=then PROCLX:IFT%=lino PROCJMP:PROCADR(P%-3,B
NX):PROCLX:@OTO2718
270@PROCstate
271@IFT%=col:PROCLX:@OTO2708
272@IFT%<>else PROCADR(L1%,P%):ENDPROC
273@L2%=P%:PROCJMP:PROCADR(L1%,P%)
274@PROCLX
275@IFT%=lino PROCJMP:PROCADR(P%-3,BNX):PROCLX:@OTO27
7@
276@PROCstate
277@IFT%=col:PROCLX:@OTO2760
278@PROCADR(L2%,P%)
279@ENDPROC
280@DEFPROCfor:LOCAL ST%:PROCLX
281@PROCC((id):@T%=BNX:PROCLX
282@PROCC(eq):PROCLX:PROCexp
283@PROCST%:PROCADR(P%-3,ST%)
284@PROCC((to):PROCLX:PROCexp
285@IFT%=step PROCLX:PROCexp ELSEPROCLDL(1)
286@PROCLX:PROCFOR%:PROCADR(P%-3,BTX)
287@IFT%=eop ORT%=next @OTO2898
288@PROCstate:IFT%=col ORT%=eoln PROCLX:@OTO2878
289@PROCC(next):PROCLX:PROCNXT:ENDPROC
290@DEFPROCgoto:PROCLX:PROCC(lino):PROCJMP:PROCADR(P%
-3,BNX):PROCLX:ENDPROC
291@DEFPROCprint:LOCALT1%
292@IFT1%=T%:PROCLX
293@IFT%=equote PROCVDL(13):PROCVDL(18):@OTO2928
294@IFT%=ecol @OTO2928
295@IFT%=string PROCSTR%:@OTO2928
296@IFT%=comma PROCVDL(32):@OTO2928
297@IFT%=tab T1%=T%:PROCVDL(31):PROCLX:PROCexp:PROCC(
comma):PROCLX:PROCVDU:PROCexp:PROCC(rb):PROCLX:PROCVDU
:@OTO2938
298@IFNEXP T1%=id:PROCexp:PROCPRI:@OTO2938
299@IFT1%(>ecol PROCVDL(13):PROCVDL(18)
3@@@ENDPROC
301@DEFNEXP:=T%=plus ORT%=minus ORT%=id ORT%=lb ORTX
=poling ORT%=const ORT%=inkey ORT%=timer ORT%=tr ORT%=f
n ORT%=sgn ORT%=eqn ORT%=abs ORT%=get ORT%=ad
302@DEFPROCSTR
303@IFLENS@=1 PROCVDL(ABC9@) ELSE PROCVD@
304@ENDPROC
305@DEFPROCexp:PROCterm
306@IFT%=or PROCLX:PROCterm:PROCORA:@OTO3@6@ ELSEIFT
%=eor PROCLX:PROCterm:PROCEOR:@OTO3@6@
307@ENDPROC
308@DEFPROCterm
309@PROCfact
310@IFT%=and PROCLX:PROCfact:PROCAND:@OTO31@@
311@ENDPROC
312@DEFPROCfact:LOCAL T1%:PROCexp
313@IFT%(>gt ANDT%(>lt ANDT%(>geq ANDT%(>leq ANDT%(>e
q ANDT%(>neq @OTO316@
314@T1%=T%:PROCLX:PROCexp
315@IFT1%=gt PROCSTT ELSEIFT1%=lt PROCLTT ELSEIFT1%=g
eq PROCGEQ ELSEIFT1%=leq PROCLEQ ELSEIFT1%=eq PROCEQU
ELSEIFT1%=neq PROCNEQ
316@ENDPROC
317@DEFPROCexp
318@IFT%=plus PROCLX:PROCterm ELSEIFT%=minus PROCLX:P
ROCterm:PROCNEG ELSE PROCterm
319@IFT%=plus PROCLX:PROCterm:PROCADD:@OTO319@ ELSEIF
T%=minus PROCLX:PROCterm:PROCSUB:@OTO319@
320@ENDPROC
321@DEFPROCfactor:LOCAL ST%:@T%=BNX
322@IFT%=id PROCLX:PROCLDA:PROCADR(P%-3,ST%):ENDPROC
323@IFT%=ar PROCgoa:PROCLDM:PROCADR(P%-3,ST%):ENDPROC
324@IFT%=const PROCLX:PROCLDL(NL):ENDPROC
325@IFT%=pling PROCLX:PROCterm:PROCLDI:ENDPROC
326@IFT%=tim@ PROCLX:PROCLDT:ENDPROC
327@IFT%=fn PROCfn:ENDPROC
328@IFT%=lb PROCLX:PROCexp:PROCLX:ENDPROC
329@IFT%=inkey PROCLX:PROCterm:PROCINK:ENDPROC
330@IFT%=sgn PROCLX:PROCterm:PROCSGN:ENDPROC
331@IFT%=abs PROCLX:PROCterm:PROCABS:ENDPROC
332@IFT%=adv PROCLX:PROCterm:PROCADV:ENDPROC
333@IFT%=pos PROCLX:PROCexp:PROCPOS:ENDPROC
334@IFT%=vpo PROCLX:PROCexp:PROCVPO:ENDPROC
335@IFT%=rnd PROCLX:PROCDI:ENDPROC
336@IFT%=tr PROCLX:PROCLDL(&FFFF):ENDPROC
337@IFT%=get PROCLX:PROCGET:ENDPROC
338@IFT%=poe PROCLX:PROCPOE:ENDPROC
339@IFT%=vpo PROCLX:PROCVPO:ENDPROC
340@IFT%=!! PROCLX:PROCLDL(@):ENDPROC
341@IFT%=not PROCLX:PROCterm:PROCNOT:ENDPROC
342@PROCC(1)
343@ENDPROC
344@DEFPROCterm
345@PROCfactor
346@IFT%=times PROCLX:PROCfactor:PROCMUL:@OTO346@ ELS
EIFT%=slash PROCLX:PROCfactor:PROCDIV:@OTO346@
347@IFT%=div PROCLX:PROCfactor:PROCDIV:@OTO346@ ELSEI
FT%=mod PROCLX:PROCfactor:PROCMOD:@OTO346@ ELSEI
348@ENDPROC
349@DEFPROCterm
350@IFT%=plus PROCLX:PROCfactor ELSEIFT%=minus PROCLX
:PROCfactor:PROCNE@ ELSE PROCfactor
351@ENDPROC
352@DEFPROCsound
353@PROCLX:PROCexp:PROCC(comma)
354@PROCLX:PROCexp:PROCC(comma)
355@PROCLX:PROCexp:PROCC(comma)
356@PROCLX:PROCexp:PROCSND:ENDPROC
357@DEFPROCenv
358@LOCALI%:FOR I%=1TO13
359@PROCLX:PROCexp:PROCC(comma):NEXT
360@PROCLX:PROCexp:PROCENV:ENDPROC
361@DEFPROCcall:PROCLX:PROCexp:PROCCAL:ENDPROC
362@DEFPROCdim:LOCAL ST%
363@PROCLX:IFT%(>ar @OTO366@
364@ST%=BNX:IF B%?(BNX+3+1)<>@ PROCEM(@):PROCELP:ENDP
ROC
365@PROCgoa:PROCLDL(B%?(BTX+3+2)):PROCDMA:PROCADR(P%-
3,ST%):B%?(BTX+3+1)=1:@OTO368@
366@IFT%(>id ENDPROC
367@ST%=BNX:PROCLX:PROCexp:PROCDMM:PROCADR(P%-3,ST%)
368@IFT%=comma:@OTO363@
369@ENDPROC
370@DEFPROCgoa:LOCAL I%
371@PROCLX:PROCLX:I%=B%?(BTX+3+2):IFIX=@:I%=1:@OTO374
@
372@REPEAT I%=I%-1:PROCexp:IFI%(>@ PROCC(comma):PROCL
X
373@UNTILI%=@:PROCC(rb):PROCLX:ENDPROC
374@PROCexp:IFT%=comma:I%=I%+1:PROCLX:@OTO374@ ELSEPR
OCC(rb):PROCLX:B%?(BTX+3+2)=I%:ENDPROC
375@DEFPROCmode:PROCLX:PROCexp:PROCVDL(22):PROCVDU:EN
DPROC
376@DEFPROCcolo:PROCLX:PROCexp:PROCVDL(17):PROCVDU:EN
DPROC
377@DEFPROCgcol:PROCLX:PROCVDL(18):PROCexp:PROCVDU:PR
OCC(comma):PROCLX:PROCexp:PROCVDU:ENDPROC
378@DEFPROCplot:PROCLX:PROCVDL(25):PROCexp:PROCVDU:PR
OCC(comma):PROCLX:PROCexp:PROCVDU:PROCC(comma):PROCLX:
PROCexp:PROCVDD:ENDPROC
379@DEFPROCmove:PROCLX:PROCVDL(25):PROCVDL(4):PROCexp
:PROCVDD:PROCC(comma):PROCLX:PROCexp:PROCVDD:ENDPROC
380@DEFPROCdraw:PROCLX:PROCVDL(25):PROCVDL(5):PROCexp
:PROCVDD:PROCC(comma):PROCLX:PROCexp:PROCVDD:ENDPROC
381@DEFPROCrep:LOCALL1%:PROCLX:L1%=P%
382@IFT%=eop ORT%=until @OTO384@
383@PROCstate:IFT%=col ORT%=eoln PROCLX:@OTO382@
384@PROCC(unt):PROCLX:PROCexp
385@PROCJMC:PROCADR(P%-3,L1%):ENDPROC
386@DEFPROCLFIX(@X%)
387@L1%=VAL@%(@NX)
388@IX%=@:REPEAT
389@IFL1%=LX?(4+IX)*256+LX?(4+IX+1):@X?(@X%+1)=LX?(4+
IX+2):@X?(@X%+2)=LX?(4+IX+3):IX=NLX
390@IX=IX+1
391@UNTIL IX>=NLX
392@IFIX=NLX PROCEM(2)
393@ENDPROC
394@
395@DEFPROCIFIX(@X%)
396@IFLEN@=(@NX)=2:IFRIGHT@(B@(@NX),1)="%":IX=ASCLEFT
@(B@(@NX),1):IF(IX)64ANDIX<91):IX=(IX-65)*64+484:@X?(@
X%+1)=IX DIV256:@X?(@X%+2)=IX MOD256:ENDPROC
397@@X?(@X%+1)=P% DIV256:@X?(@X%+2)=P% MOD256:ENDPROC
:ENDPROC
399@DEFPROCAFIX(@X%)
399@IFB@%?(@X%+1)=@ PROCEM(9)
4@@@@X?(@X%+1)=P% DIV256:@X?(@X%+2)=P% MOD256:ENDPRO
C:ENDPROC
401@DEFPROCPFIX(@X%):IFB@%?(@X%+1)=@ PROCEM(3)
402@ENDPROC
403@DEFPROCFIX(@X%):IFB@%?(@X%+1)=@ PROCEM(3)
404@ENDPROC
405@DEFPROCFIX
406@PRINT''"FIX UP STAGE"
407@EX=P%:BNX=@:REPEAT
408@IFB@%?(3+BNX)=lino:PROCLFIX(3+BNX)
409@IFB@%?(3+BNX)=id PROCIFIX(3+BNX) ELSEIFB@%?(3+BNX)=
ar PROCAFIX(3+BNX)
410@IFB@%?(3+BNX)=proc:PROCPPIX(3+BNX)
411@IFB@%?(3+BNX)=fn:PROCFFIX(3+BNX)
412@BNX=BNX+1:UNTILB@(BNX)=""
413@P%=P%+CX:~4=(P%+RL%)+&10000-EX+RL%
414@P%=CX:REPEAT:IX=?P%:IFIX=48P%=P%+1
415@IF(IX(64@RIX)>10@) P%=P%+1:@OTO4218 ELSEP%=P%+3
416@IFIX=74@OTO4218
417@IFIX=99 ORIX=92:P%=P%+(P%?-2)-1:@OTO4218
418@IFP%?-1<>@ @OTO42@@
419@NX=P%?-2:P%?-1=@%?(NX+3+1):P%?-2=@%?(NX+3+2)
42@@PROCRL
421@UNTIL P%)=EX
422@PRINT''"FIX UP NOW COMPLETE"
423@ENDPROC
424@DEFPROCRL
425@NX=256*P%?-1+P%?-2
426@IFNX<&E@@ ENDPROC ELSENX=NL+RL%
427@P%?-1=NX DIV256:P%?-2=NX MOD256
428@ENDPROC
429@
43@@DEFPROCADD:PROCPP(1,2):ENDPROC
431@DEFPROCSUB:PROCPP(1,4):ENDPROC
432@DEFPROCMUL:PROCPP(1,6):ENDPROC
433@DEFPROCDIV:PROCPP(1,8):ENDPROC
434@DEFPROCBTT:PROCPP(1,10):ENDPROC
435@DEFPROCLTT:PROCPP(1,12):ENDPROC
436@DEFPROCBEQ:PROCPP(1,14):ENDPROC
437@DEFPROCLEQ:PROCPP(1,16):ENDPROC
438@DEFPROCEQU:PROCPP(1,18):ENDPROC
439@DEFPROCNEQ:PROCPP(1,20):ENDPROC
44@@DEFPROCNE@:PROCPP(1,22):ENDPROC
441@DEFPROCVDU:PROCPP(1,24):ENDPROC
442@DEFPROCINK:PROCPP(1,26):ENDPROC
443@DEFPROCRTB:PROCPP(1,28):ENDPROC
444@DEFPROCLDI:PROCPP(1,30):ENDPROC
445@DEFPROCBTI:PROCPP(1,32):ENDPROC
446@DEFPROCEND:PROCPP(1,34):ENDPROC
447@DEFPROCPRI:PROCPP(1,36):ENDPROC
448@DEFPROCMOD:PROCPP(1,44):ENDPROC
449@DEFPROCVDD:PROCPP(1,46):ENDPROC
45@@DEFPROCPPP(BX,CX)
451@IFFNC(@X) ?P%=CX:P%=P%+@X
452@ENDPROC
453@DEFPROCVDL(LX):IFFNC(3):?P%=48:P%?1=LX:P%=P%+2
454@ENDPROC
455@DEFPROCBND:PROCPP(1,5@):ENDPROC
456@DEFPROCLDT:PROCPP(1,52):ENDPROC
457@DEFPROCBTT:PROCPP(1,54):ENDPROC
458@DEFPROCAND:PROCPP(1,56):ENDPROC
459@DEFPROCORA:PROCPP(1,58):ENDPROC
46@@DEFPROCEOR:PROCPP(1,6@):ENDPROC
461@DEFPROCRND:PROCPP(1,62):ENDPROC
462@DEFPROCJMP:PROCPP(3,62):ENDPROC
463@DEFPROCJBR:PROCPP(3,66):ENDPROC
464@DEFPROCJMC:PROCPP(3,68):ENDPROC
465@DEFPROCLDA:PROCPP(3,7@):ENDPROC
466@DEFPROCBTA:PROCPP(3,72):ENDPROC
467@DEFPROCFIX:PROCPP(3,76):ENDPROC
468@DEFPROCLDM:PROCPP(3,8@):ENDPROC
469@DEFPROCBTM:PROCPP(3,82):ENDPROC
47@@DEFPROCDMA:PROCPP(3,84):ENDPROC
471@DEFPROCDMA:PROCPP(3,86):ENDPROC
472@DEFPROCLDL(LX)
473@IFFNC(3) ?P%=74:P%?1=LX MOD256:P%?2=LX DIV256:P%=P%
+3
474@ENDPROC
475@DEFPROCVD@
476@IFFNC(2+LEN@) ?P%=9@:P%?1=LEN@:@$(P%+2)=@$:P%=P%
+2+LEN@
477@ENDPROC
478@DEFPROCCLI
479@IFFNC(2+LEN@) ?P%=92:P%?1=LEN@:@$(P%+2)=@$:P%=P%
+2+LEN@
48@@ENDPROC
481@DEFPROCB@R:PROCPP(1,1@2):ENDPROC
482@DEFPROCSB@:PROCPP(1,1@4):ENDPROC
483@DEFPROCA@@:PROCPP(1,1@6):ENDPROC
484@DEFPROCBET:PROCPP(1,1@8):ENDPROC
485@DEFPROCADV:PROCPP(1,11@):ENDPROC
486@DEFPROCPOS:PROCPP(1,112):ENDPROC
487@DEFPROCVPO:PROCPP(1,114):ENDPROC
488@DEFPROCPOI:PROCPP(1,116):ENDPROC
489@DEFPROCCAL:PROCPP(1,118):ENDPROC
49@@DEFPROCNOT:PROCPP(1,12@):ENDPROC
491@DEFPROCENV:PROCPP(1,122):ENDPROC
492@DEFPROCRTF:PROCPP(1,126):ENDPROC
493@DEFPROCNXT:PROCPP(1,132):ENDPROC
494@DEFPROCADR(P%,A%)
495@IFP%<CX OR P%+2)EX ENDPROC
496@P%?2=A%DIV256
497@P%?1=A%MOD256
498@ENDPROC
499@
5@@@DEFFNC(@X)
5@1@IFP%+@%)=EX ENX=ENX+1:EX=EX-@%:=FALSE ELSE:=TRUE
5@2@DEFPROCERT:PRINT"<RETURN> TO CONTINUE ";:REPEAT U
NTIL INKEY-74:PRINT:ENDPROC
5@3@DEFPROCEM(IX)
5@4@ENX=ENX+1
5@5@IFIX=1 PRINT"missing ,"
5@6@IFIX=2 PRINT"no such line number "+@$(BNX)
5@7@IFIX=3 PRINT"no such fn/proc "+@$(BNX)
5@8@IFIX=4 PRINT"too many variables"
5@9@IFIX=5 PRINT"program needs ";2*NCX+CX-EX;" bytes
"
51@IFIX=6 PRINT"program needs ";NL%;" lines"
511@IFIX=7 PRINT"syntax error !"
512@IFIX=8 PRINT"array already dim'd"
513@IFIX=9 PRINT"array "+@$(BNX)+" not dim'd"
514@PROCERT:ENDPROC
515@DEFPROCC(DX)
516@IF ELX ENDPROC
517@IF TX=DX ENDPROC
518@PRINT"missing ";
519@ELX=TX:TX=AX:AX=DX
52@@IFAX>32 ANDAX(>)lino THEN CALL TX ELSEIFAX=id PRIN
T"id / variable";ELSEIFAX=ar PRINT"array dim'd";ELSEIFA
X=1 PRINT"expression"; ELSEIFAX=lino PRINT"line number
";
521@AX=TX:ENX=ENX+1:PRINT;TX=@:PROCERT:ENDPROC
522@DEFPROCELP
523@IFELX=eoln OR ELX=eop TX=ELX:ELX=FALSE:ENDPROC
524@ELX=FALSE:REPEAT PROCLX:UNTIL TX=eoln ORTX=eop
525@ENDPROC
526@DEFPROCEE
527@PRINT'''";ENX;" ERRORS - COMPILATION STOPPED"
528@ENDPROC
529@DEFPROCNE
53@@PRINT"COMPILATION COMPLETE"
531@ENDPROC
532@DEFPROCT
533@FDRIX=@TO23
534@VDU129+(IX/2)MOD5,157,141,135
535@PRINT"<<< T.C. BASIC COMPILER >>>"
536@NEXT:IX=INKEY15@:CLS
537@ENDPROC
```

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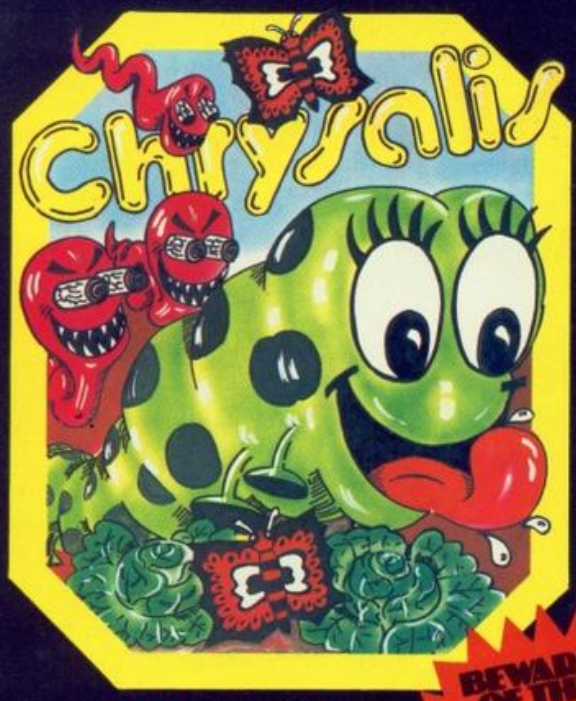

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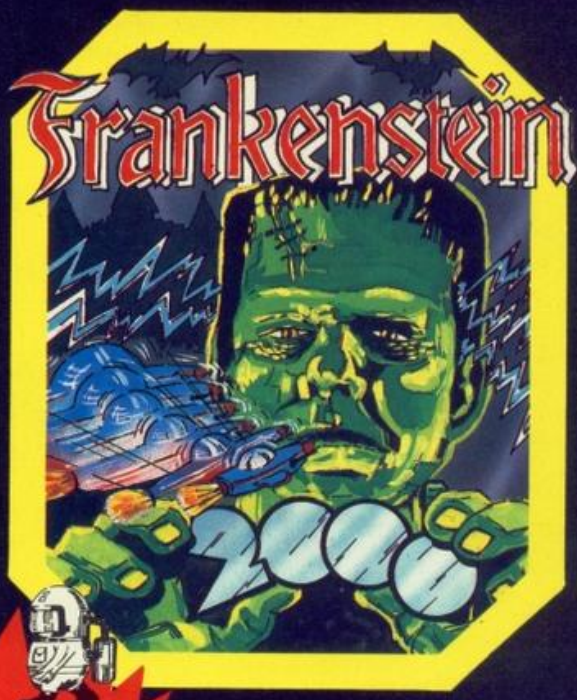

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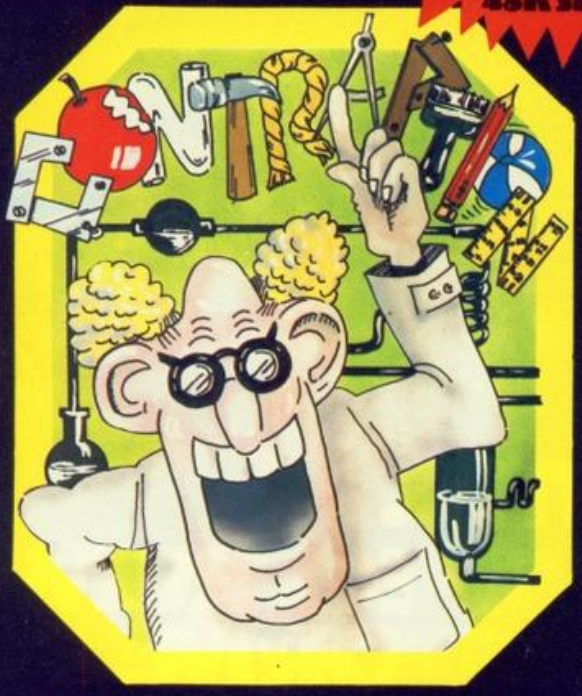

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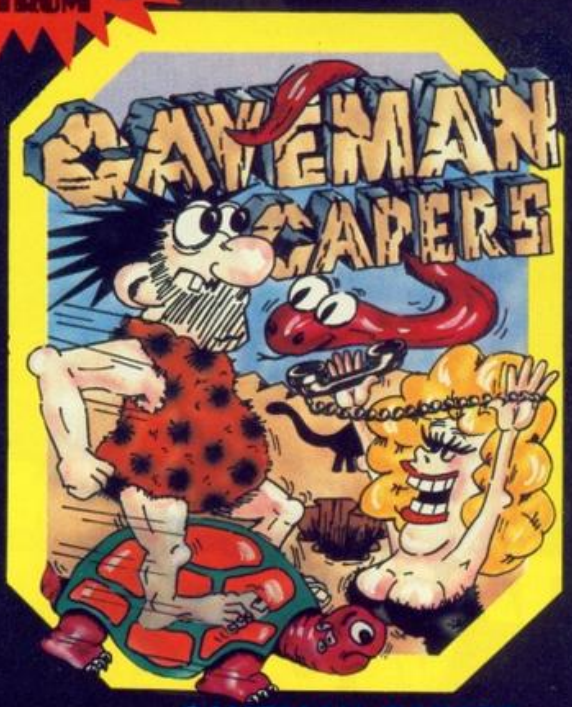

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Hex loader.

```
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$)-1 TO LEN(h$)-1)
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_ERRO   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 01d4           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     DEVNAMI
          MOVEQ     #1,D0
          TRAP      #2
          TST.L     D0
          BNE.S     END_JOI

          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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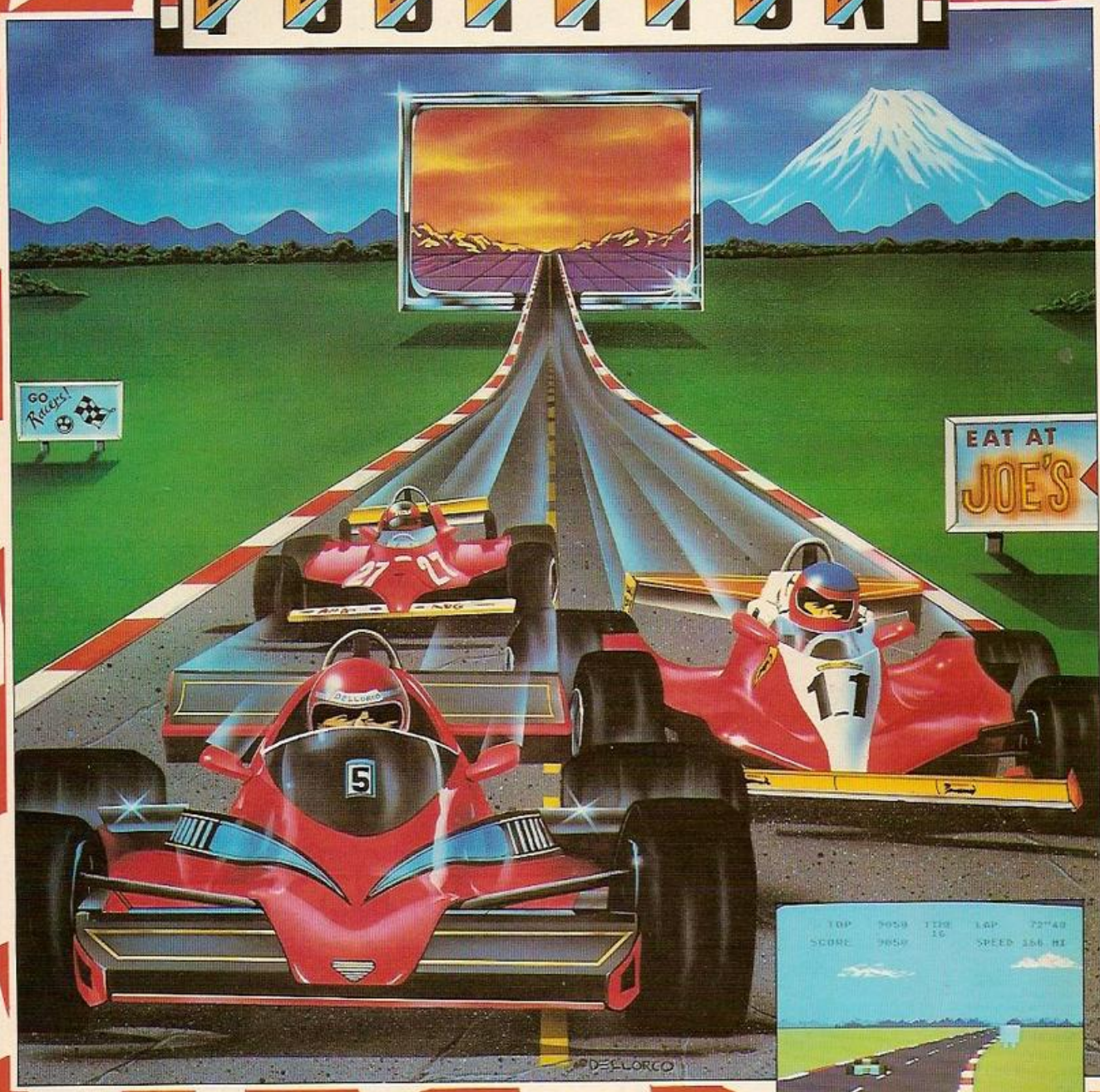

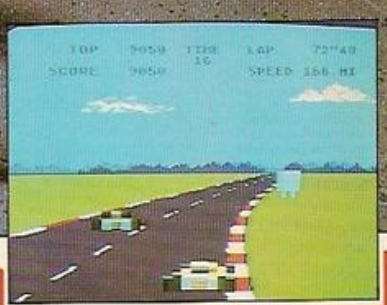

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(listing continued from page 99)

```
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_ERRO,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
```

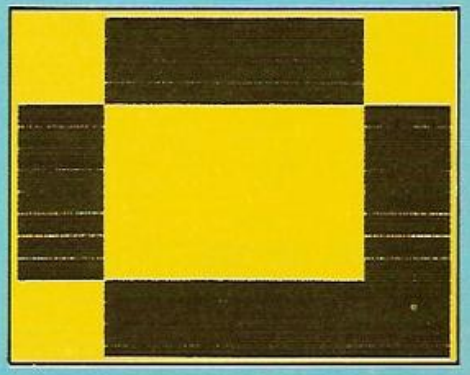
Therre are two different ways of running the Zoom-code and I will describe both here.

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=4k
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 96,22,85,10,101,236,62,63,255,4,81,4,97,250,82
,207,72,2,100,134,0,41,103,255,0,65,0,3,0,34,104,76,22
7,40,0,3,239,2,2,196,96,14,255,0,203,41,0
15 REMark
20 DATA 78,82,68,85,4,78,4,97,250,83,207,96,18,62,66,2
55,167,2,66,54,2,0,34,104,100,0,254,28,1,2,65,2,73,0,1
5,0,74,0,68,112,6,227,240,135,41,0,126
25 REMark
30 DATA 96,65,103,69,81,117,96,42,62,66,255,4,81,3,97,
250,126,66,102,1,128,0,2,65,228,7,2,3,226,65,102,65,82
,252,28,3,34,0,1,7,227,29,203,41,0,1,112
35 REMark
40 DATA 10,83,12,103,206,66,4,81,3,97,250,83,207,96,6,
78,0,0,0,34,52,0,65,102,76,58,3,2,14,0,74,0,65,198,3,2
28,124,210,254,144,11,81,41,0,1,76,0
45 REMark
50 DATA 97,66,101,6,255,135,82,207,96,38,62,65,255,4,8
1,117,68,255,0,124,12,0,1,0,2,68,0,3,96,255,226,3,26,6
0,2,14,0,194,218,1,227,208,0,0,141,159,78
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*47+f,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-D3,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,D3             ROTATE 1ST COLOUR BYTE
      LSL.B     #1,D6             ROTATE 2ND COLOUR BYTE
      ROL.B     #1,D5             ROTATE MASK OVER  E.G 111100:1
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
```

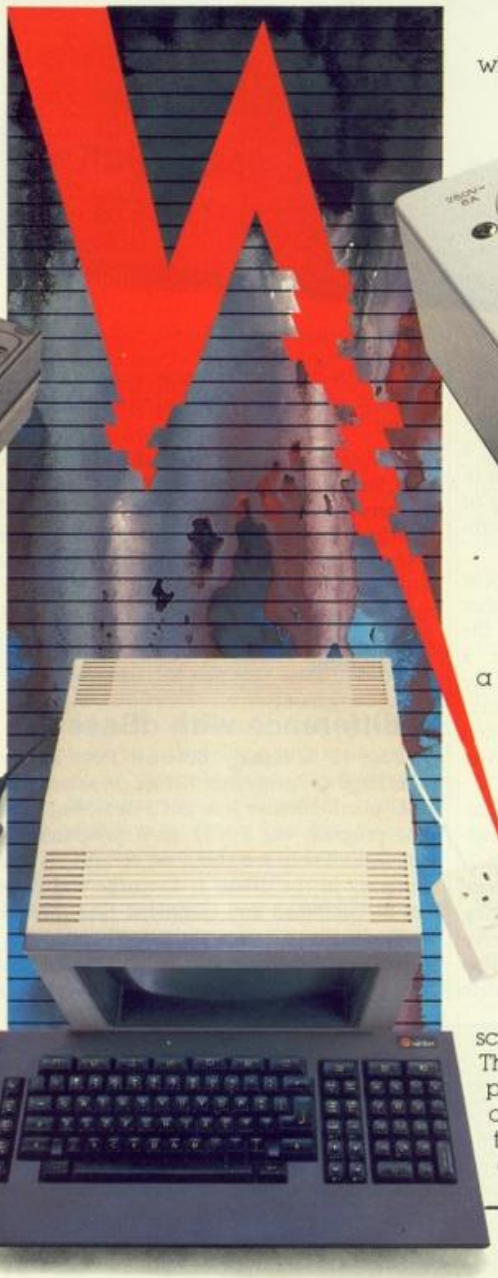
CONNECT PROTECT

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.

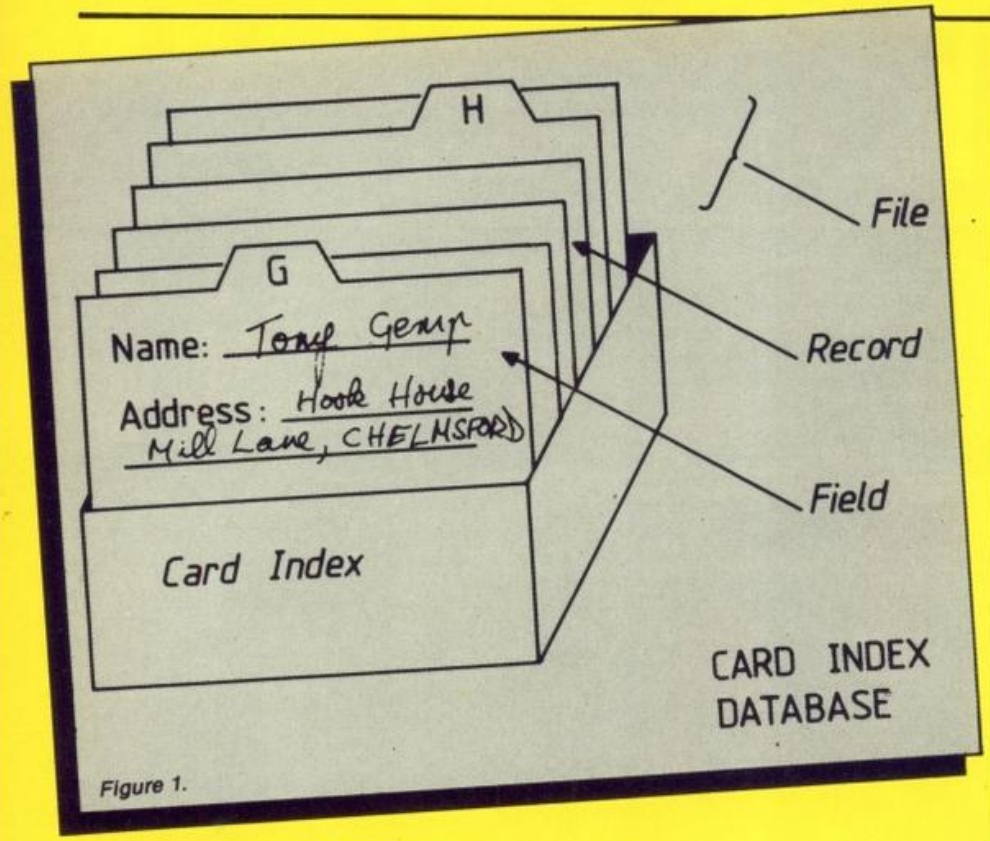


Figure 1.

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.....

.....

.....

.....

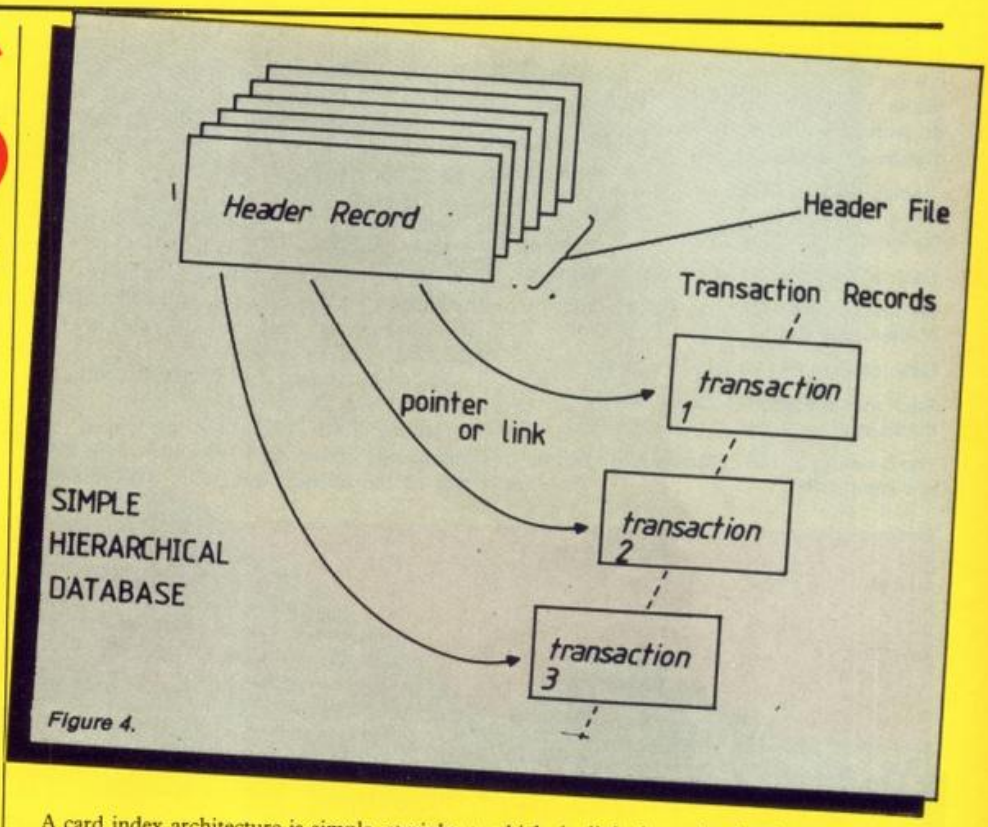


Figure 4.

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	5918
MARKS. B	101 RUTLAND RD.	6664
WEBB. E	4 UPPER LANE	3350
WEBB. F	271 WARWICK ST.	2218
DAWSON. R	11 ABBEY CLOSE	7253

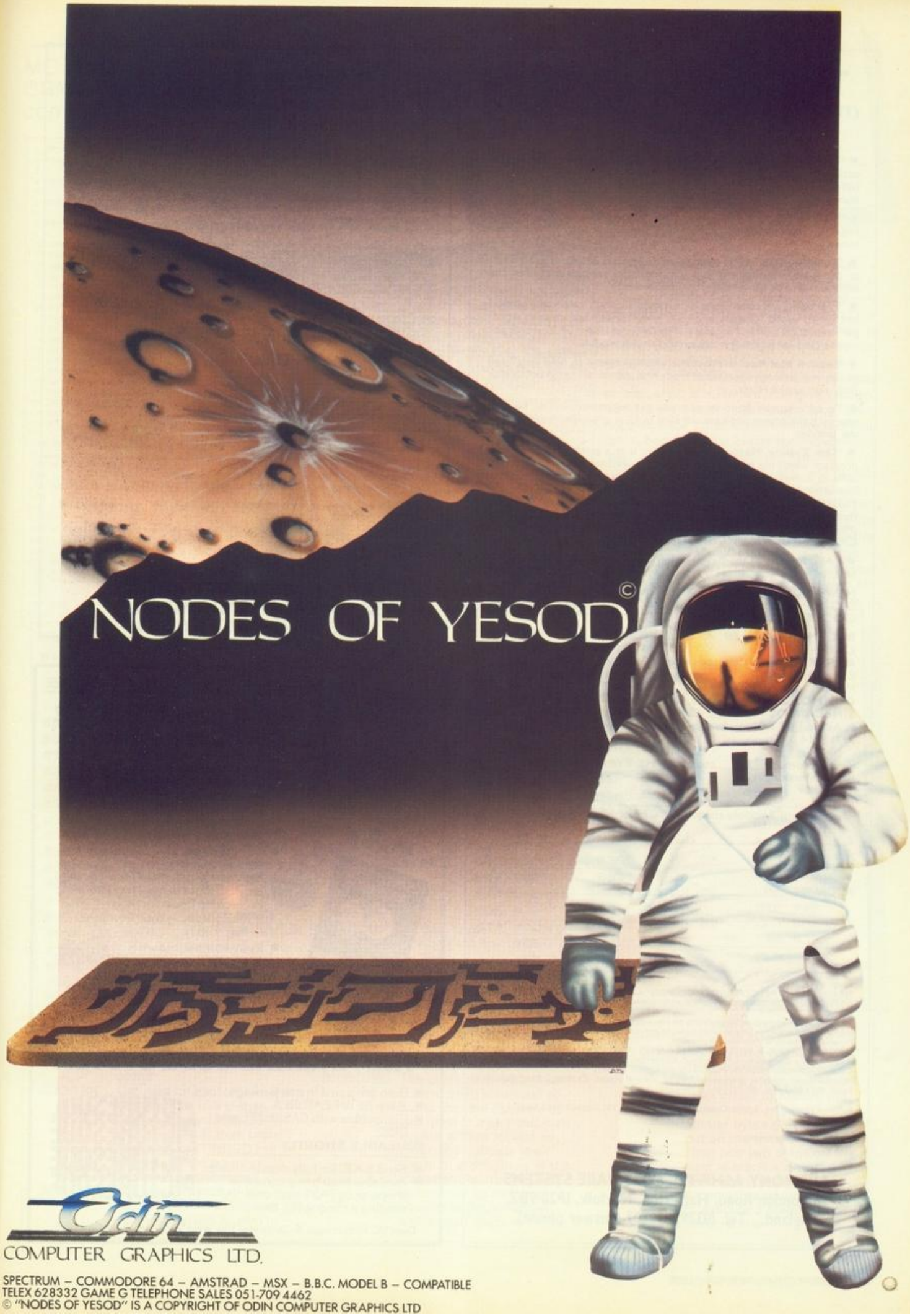
Prescriptions

no.	date	drug	dose
4914	6/11/83	SALBUTAMOL	2 x 3(1)
3149	5/11/83	PENICILLIN	2 x 4(48)
1772	6/11/83	WARFARIN	1 x 4(80)
5918	6/11/83	PENICILLIN	2 x 4(48)
6664	6/11/83	NITRAZEPAM	2 x 1(30)
3149	10/11/83	PHENERGAN	1 ABN(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	4.85

Figure 5.



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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.

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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,
Software Limited, No. 2 Alice Owen Technology Centre, 251 Goswell Road, London, EC1. Tel. (01-833) 1173.

In case of difficulty contact:

ANTHONY ASHPITEL SOFTWARE SYSTEMS
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DEF KEY user definable keys
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DPOKE double poke
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)
ON ERROR trap errors (with LINE, STAT and ERROR)
PLOT a string (may contain cursor control codes)
POKE a string
POP Basic's stack
PROC, DEF PROC, END PROC (for named procedures)
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SCROLL like ROLL, but without wrap-round
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SPLIT program lines
TRACE program execution
UNTIL used with DO or LOOP
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 16,248,96,201,38,208,230,32
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.

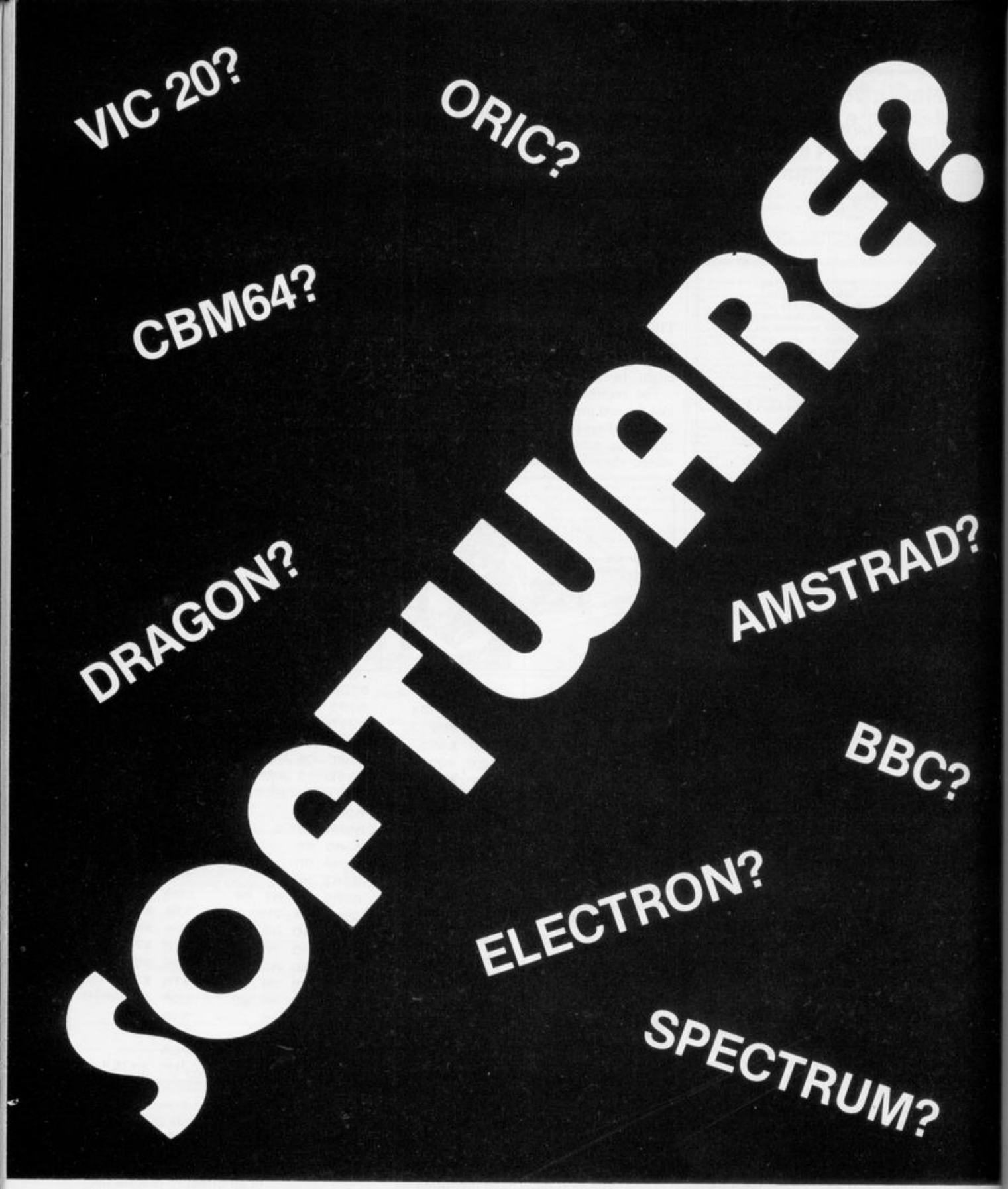
Notice also that the loop will always execute at least once: if a Do-While loop is required which may require the entire loop being skipped if the initial conditions are met then this is best tested for before the Repeat-Until loop is entered. When the routine is in operation, the interpreter will not 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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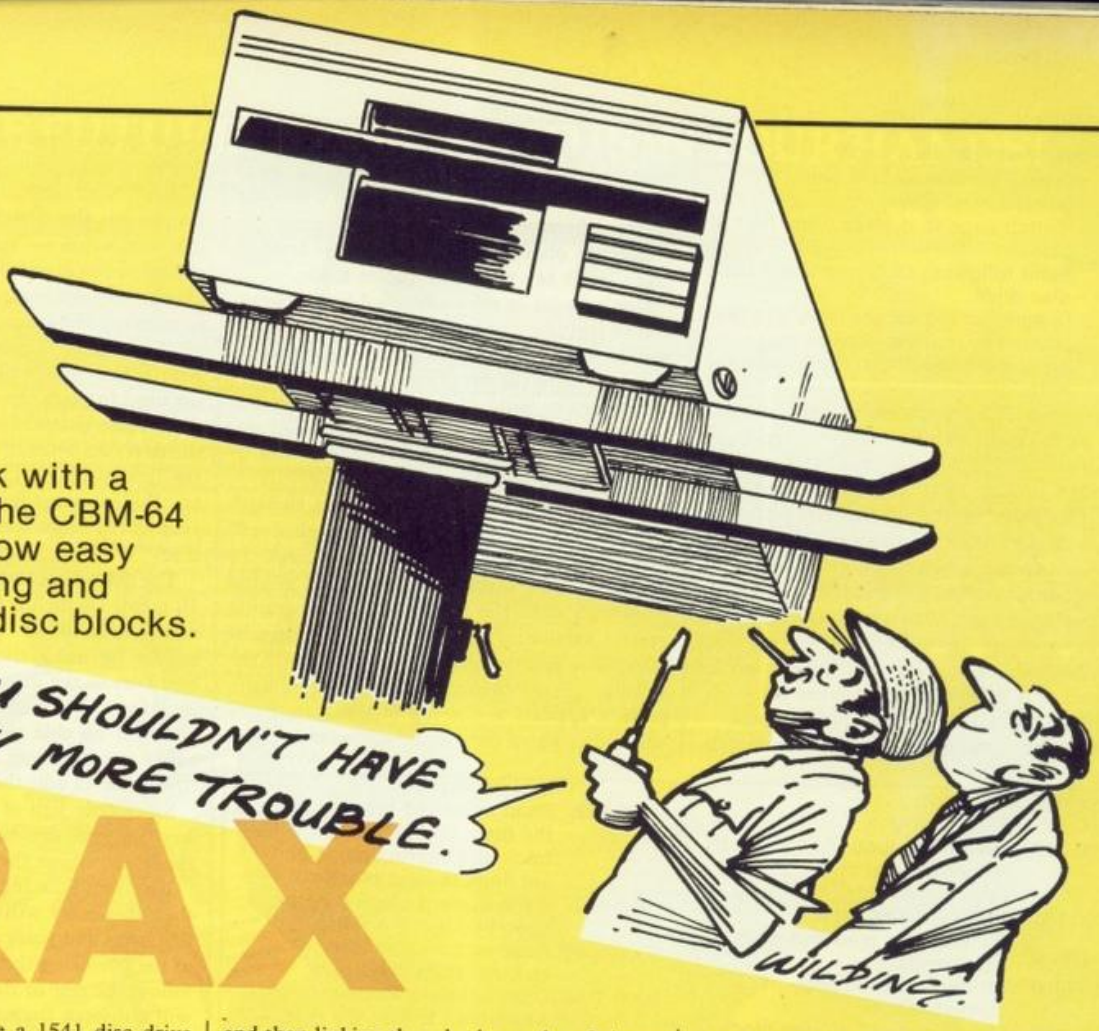

Keith Suddick with a program for the CBM-64 which will allow easy reading, writing and alteration of disc blocks.

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.

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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

34+0: c13a535441204849 2d4
34+8: 474848b9aa35000a 279
3500: 35b68a4c44412023 269
3508: 3600b035bb8a5354 272
3510: 4120484947484849 282
3518: aa36002635ca8a4c 2db
3520: 4441202350035235 167
3528: d48a535441205348 301
3530: 49454c44004635e8 231
3538: 8a4a535220534554 285
3540: 5241444152005735 1+6
3548: +48a5349c3434520 385
3550: 4c44582023000e0c 1c7
3558: 35+68a9c53494420 351
3560: 4c444120534+554e 236
3568: 442c58007d35+88a 2+c
3570: 535441204455053 244
3578: 49442c5800835+9 2c7
3580: 8a4c444120233000 1ce
3588: 9935+a8a53544120 35a
3590: 5748494348322c58 229
3598: 00a135+b8a494e58 34a
35a0: 00ad35+c8a435056 353
35a8: 202332300ba35+e 297
35b0: 8a424e45209c5349 2b7
35b8: 4400c235108b5254 27c
35c0: 5300d735748b5241 2+1
35c8: 53549a34204c4441 266
35d0: 2053415453910e2 2ce
35d8: 357e6b434d502023 261
35e0: 3100+235888b424e 2+b
35e8: 452046494e524153 228
35+0: 34000336928b4a53 227
35+8: 522042554c4c434+ 233
3600: 4c53001436976b4a 255
3608: 5352205348495043 23c
3610: 4+4c53002536908b 270
3618: 4a5352204d495343 23b
3620: 48444c5200353+a6 23b
3628: 8b46494e52415334 282
3630: 202c3000d2248d+2 2+c
3638: 563252454c204259 226
3640: 54203234382c3234 1a4
3648: 392c3235342c3235 193

3650: 3000ed2+93+25632 356
3658: 574156+5204259+4 242
3660: 2033332c33332c33 177
3668: 332c333300353094 1be
3670: +2545754+554e44 326
3678: 204259542030202c32 1bd
3680: 34302c31362c3232 187
3688: 342c33222c323033 18b
3690: 2c34382c31393222 18c
3698: 36342c3137362c38 198
36+0: 302c3136302c3936 18e
36+8: 2c3134342c313132 185
36b0: 2c3132303+e009e 213
36b8: +2+859505344554e 328
36c0: 44204259542030?c 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+2525465345+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+29153432042 35d
3750: 595420393620134 1cd
3758: 342c36342c313736 194
3760: 00+23018+6802022 2+2
3768: 535041434532222c 1ec
3770: 300000005c8c4445 1a9
3778: 58008b375+8c4a53 2a2
3780: 5220504c4+545341 245
3788: 5453009337648c52 2b3
3790: 545300ae37698c52 2d3
3798: 4153549a32204c44 264
37a0: 4120534154539120 24d
37a8: 214c4546540+b937 23c
37b0: 6e8c434d50202331 24e
37b8: 00c537738c424551 2d3

37c0: 20acaa3300cd3778 325
37c8: 8c52545300dc377d 315
37d0: 8c4c445820534341 26b
37d8: 5045500ee37820c 320
37e0: 4a535220434c4541 224
37e8: 525341545300+d37 2c1
37+0: 878c4c4458205343 2b1
37+8: 4150455000053889 1+4
3800: 03030+0+3+3+++++ 2a0
3808: ++++++++++++++++ 7+8
3810: 80a0e8eafafafafe+e 6e2
3818: 0000000080a0a8aa 272
3820: aaaaeaeafafafafe+c 716
3828: 80a0a080800000000 2c0
3830: 0000000000010205 008
3838: ea12a54890204080+ 398
3840: 7+00000001++00++ 27e
3848: ++00++000103064c 304
3850: +83060c080++00++ 4c6
3858: ++00++c080000001 33+
3860: 0103070604183048 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: 0000000000e+++++ 20d
38a0: 0++b+++dd++++++c 78+
38a8: 00000001?+++d++b 359
38b0: ++dd+++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++ee+ebd+d 759
38e8: ebd3b03b6d+d++c+ 5ec
38+0: 0000000101032377 09+
38+8: 7b+b+bd3+dec1d+e 6ee
3900: 0000000000000000 000
3908: dd+d7ded+b+3+7e+ 718
3910: 000081c1c367e7ed 440
3918: e+e6+6b5db+b+677 6c3
3920: b7cadbe+66+7db++ 685
3928: c0c0e4eeeb6++7+6 699

3930: b6+57b6bbdb5ede+ 5b+
3938: e+a+b7+af9cdb6++ 6ca
3940: 000633dc63cc63cc 2a3
3948: 330+03030303d3b 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: 0000000e0+83e00 296
3990: 0000001818000000 030
3998: 000000c3dbdb++db 452
39a0: dbe7db++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
39+0: ++c3dbd+d+dbc3++ 6+8
39+8: ++c7bb+7e+++e+++ 754
3a00: ++++++++++++++++ 7+8
3a08: ++++03330333333++ 39c
3a10: ++++07330733307++ 378
3a18: ++++03333+3303++ 3a8
3a20: .++++07333333?++ 3a4
3a28: ++++033+073+03++ 388
3a30: ++++033+073+3+++ 3c4
3a38: ++++033+33330++ 3a8
3a40: ++++33330333333++ 3cc
3a48: ++++03c+c+c+03++ 570
3a50: ++++03c+c+c+0+++ 57c
3a58: ++++33330733333++ 3d0
3a60: ++++3+3+3+3303++ 3+0
3a68: ++++33033333333++ 3cc
3a70: ++++033333333++ 3cc
3a78: ++++03333333303++ 39c
3a80: ++++0333033+3+++ 3b4
3a88: ++++033303+3+3++ 51c
3a90: ++++07330733333++ 3a4
3a98: ++++033+03+303++ 438

3b00: ++00++80000102e4 365
3b08: c912244890af40++ 3c5
3b10: 0000000000000000 000
3b18: 000000000000++++ 1+e
3b20: 00000000++++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: 000000007ee7e37e 2c6
3b78: 0000000000e391e 075
3b80: 0000000000000606 00c
3b88: 000000003c000000 03c
3b90: 0000000018000000 018
3b98: 1+7++08000c0+03c 3+a
3ba0: ++c0000000000007+ 23e
3ba8: c303010101107+++c 2cb
3bb0: ++++c3c3c3c3++++ 708
3bb8: ++++ebebebeb++++ 7a8
3bc0: ++++d7d7d7d7++++ 758
3bc8: ++9999++++999++++ 660
3bd0: ++e7e7++9999++++ 6+c
3bd8: 3+++c3c3c3c3++++ 648
3be0: +c++c3c3c3c3++++ 795
3be8: 0103070+1+3+7+++ 1+6
3bf0: 80c0e0+0+8+c+e++ 701
3bf8: 0000000003c3c5555 122
3c00: 0103070+1+3+7+00 0+7
3c08: ++99++99++99++++ 6c6
```

Available on Telsoft.

```
3c10: ++eleeb++eleeb++++ 7a8
3c18: ++c3c3++c3c3++++ 708
3c20: ++++++++++++++00 6+9
3c28: ++++99++99++++00 62d
3c30: ++00++00++00++00 3+c
3c38: ++55++55++55++55 550
3c40: +e+d+b+7e+d+b+7+ 6+9
3c48: 7+7e7c7870604000 301
3c50: 0000000000003+3+ 07e
3c58: 303030333+3+0000 141
3c60: 000+3+3+00000000 08d
3c68: 0000003c003cc3++ 23a
3c70: 3c3c3c3c++++3c3c 366
3c78: 3c3c++++3c3c3c3c 366
3c80: 0000000000+c+c 1+8
3c88: 0c0c0ccc+c+c0000 2e8
3c90: 00+0+c+c00000000 2e8
3c98: 000000300c330+30 0ae
3ca0: 0c300c300c300c30 0+0
3ca8: 0c300c300c7e7e++ 27+
3cb0: 0000000000+0+818 200
3cb8: 000000300c+0cc30 228
3cc0: 0000000000001+1+8 046
3cc8: 003cc3++00++003c 339
3cd0: 2a3+003c003c003c 11d
3cd8: 2a3+003c003c00++ 1e0
3ce0: a8+c003c003c003c 258
3ce8: a8+c003c003c00++ 31b
3cf0: 0000000001+3264++ 1b4
3cf8: 000000000++2244++ 264
3d00: 000+3b67++7+88++ 3b6
3d08: 0000+cb6+e+800++ 4a7
3d10: 0000000000++468c+8 2c9
3d18: 0000000101010000 003
3d20: 0000010307041e3d 075
3d28: 7+++00++++++0000 47b
3d30: 0103070+001e1e1e 074
3d38: 0000e0d0b060c080 400
3d40: +d+b07eed+be7d+0 5+7
3d48: e7d7b770e0c18101 508
3d50: ++++1+3e++03+70+ 463
3d58: debd7b+70eece8e0 5c+
3d60: +e+d1833ebdbb870 534
3d68: e0c0800000000000 220
3d70: ++++00++++++0000 44b
3d78: 0000070+1e3d7b+7 1e3
3d80: eedc38b0a0000000 3d2
3d88: 0000800080808000 200
3d90: 00001+307+00++d+ 2ac
3d98: +c++00++++dede++ 6b4
3da0: ++00++c0c0c0c0++ 5+d
3da8: 0000++00++00++++ 3+c
3db0: 00++00++++6666++ 4c8
3db8: ++30++e6++e6++++ 5c7
3dc0: 00++00++e16d6de1 49a
3dc8: ++00++67++67++++ 5c9
3dd0: 0000+00c+e00++++ 400
3dd8: 73++00++c3dbdbc3 5ad
3de0: ++00++++3333++++ 561
3de8: 3++++0+7+0+++0++ 703
3df0: 3+00030303030a2a 07+
3df8: ++0500000++0000 203
3e00: ++++03+3c3+303++ 5ac
3e08: ++5000000++0000 24e
3e10: +c++033333303++ 399
3e18: +c00c0c0c080a0a8 504
3e20: 000000++de++0378 357
3e28: 7e++++77+7+7+77+ 657
3e30: ++++dd++++32000 5ec
3e38: 000000+++bb+e10c 3a6
3e40: 77++++bbb+7+77+7 5dc
3e48: ++7+7b77++++d800 546
3e50: 000000++++d++926 3+c
3e58: 8++++b7b7+7+++e+ 5+0
3e60: e+7+e+++d+8e0500 4ce
3e68: 000000++d+++d0770 352
3e70: e+e+777++++7+777 638
3e78: d+d++++7777+3a10 4+4
3e80: 000000++e++++8339 3a9
3e88: 7++77773+b+b7+7+ 554
3e90: e+e++++7+77e0c00 555
3e98: 00000000c0+8bce+ 363
3ea0: c0+0+8dcbe+6a0d+ 6+2
3ea8: 80c0e060+00b8d87c 57c
3eb0: 0000000031+3d+7 156
3eb8: 030+1+3b7d6+db+b 32e
3ec0: 0103070501d1b3e 096
3ec8: 0000++++++++++ 5+a
3ed0: 00000107bc3+6c++ 1b8
3ed8: 030+387+e3++360+ 2+6
3ee0: ++391+3+1c070100 1ba
3ee8: 000050e030+c66++ 3+1
3ef0: c0+01c+ec7++3c+0 5b6
3ef8: ++9c+8+c38e08000 527
3f00: 0004+3++++04++00 3+8
3f08: +b05++00++00++00 3+d
3f10: +b04+++b++00++43 53a
3f18: ++00++00++00++++ 4+b
3f20: +b8c++00++00++73 4+7
3f28: ++00++00++00++00 3+c
3f30: ++00++00++00++00 3+c
3f38: ++00++00++00++57 453
3f40: ++00++04++00++01 401
3f48: ++00++++++00++++ 5+a
3f50: ++00++++++00+++e3 5de
3f58: ++00a+00++006101 33+
3f60: ++01++3a++00++00 437
3f68: ++++++00++00++00 4+b
3f70: ++00++00++00++00 3+c
3f78: ++00bc00++00++04 3bd
3f80: 01+b0cdb00+b03++ 3e0
3f88: 1+bc93++00++43++ 4ae
3f90: 04+b000c00++00b+ 2c9
3f98: 00++00++00++00++ 3+c
3fa0: 0c+b00++00++00c+ 374
3fa8: 00++00++2c++00++ 428
3fb0: 00++00++00++00++ 3+c
3fb8: 00++00++00++ac9+ 448
3fc0: 00++43+b00++03be 3+d
3fc8: 1b++934300++db43 40d
3fd0: 00++00++++++d3++ 5ce
3fd8: 00++00++00++++bc 4b8
3fe0: 00++00++00++00++ 3+c
3fe8: 00db00++00++00++ 3d8
3ff0: 00++00++00++43++ 43+
3ff8: 00++00++00++00++ 3+c
4000: 208a++4c50400012 237
4008: 40+54b4350582023 2ae
4010: 30002040+a4b424e 265
4018: 452053434c503200 1c9
4020: 2+40044c4c445920 1c8
4028: 5343415045580030d 201
4030: 40094c4a4d5020a2 23e
4038: 434+4c4d0055402c 1ec
4040: 4c54414b45534352 259
4048: 4+4c4c204c444120 1+8
4050: a96c8d1803a9408d 333
4058: 1903a99320d2++a9 3+2
4060: 0820d2++a9008d20 34+
4068: d08d21d0a2++9a78 501
4070: a90d8d1403a9418d 2d1
4078: 150358a9d08d16d0 35c
4080: a9006573850e8512 2ab
4088: 850+8510a9018511 269
4090: 850d8d1ad0ad11d0 397
4098: 297+8d11d0a9518d 39d
40a0: 12d0a9++8d19d0a9 4a9
40a8: 008d0edc20da4420 2d5
40b0: ec45208043 4c+04a 39a
40b8: a273a9009500e8e0 41b
40c0: 8bd0+9a99320d2++ 581
40c8: a93+854b85+da905 496
40d0: 85+ca9d965+ea011 537
40d8: a247a917209546a0 344
40e0: 29a91085+ca9c085 451
40e8: +ea95191+ba90091 4be
40+0: +da9011865+b85+b 49+
40+8: 85+da90065+c85+c 50d
4100: 1869d485+ec9++a9 570
4108: e0e84c0941a50dc9 3d9
4110: 01d030ad16d029e8 3a5
4118: a673e001+002050+ 300
4120: 8d16d0e60da9818d 41d
4128: 19d0ad11d0297+8d 3ac
4130: 11d0a9ca8d12d020 3e3
4138: 7b4820404320++53 228
4140: 4c+a41c902a02ba9 3+6
4148: 1+8d18d0ad16d029 350
4150: +89910050+8d16d0 298
4158: e60da9818d19d0ad 440
4160: 11d0297+8d11d0a9 3a0
4168: e28d12d020a9434c 3a9
4170: +a41c903d020ad6+ 413
4178: 528d21d0e60da981 3ed
4180: 8d19d0ad11d0297+ 3ac
4188: 8d11d0a9+b8d12d0 481
4190: 204c534c+a41c904 313
4198: d05da901850da900 312
41a0: 8d21d0a9138d18d0 3a+
41a8: ad16d029+88d16d0 427
41b0: a9818d19d0ad11d0 42e
41b8: 297+8d11d0a9518d 39d
41c0: 12d0203a44a511c9 2++
41c8: 02+013a50e38e510 2e5
41d0: 850e2980c980d014 369
41d8: 206b474cec41a50e 2fe
41e0: 186510850ec90830 221
41e8: 03201a48a50e2907 168
41f0: 850+850e2049534c 22+
41f8: 004268a868aa6840 30c
4200: a513c901d050a513 35c
4208: c900d04aa5c5c904 41a
4210: d007a90185154c56 2bd
4218: 42c905d007a90285 317
4220: 154c5642c93cd007 2d5
4228: a90385154c5642c6 2+0
4230: 14a514c900d01+a3 32e
4238: 148514ad+a044980 321
4240: 8d+a048d4a05ad+b 40+
4248: 0449808d+b04ad4b 351
4250: 0549808d4b05ad21 279
4258: 70c901+0034c4e43 30a
4260: a9008d0d70a9058d 2ee
4268: 0e70a200bc2270c0 32e
4270: 00d0034c344388bd 2db
4278: 0870290lc901+028 284
4280: de2270bd2370c900 38a
4288: +0034c34438845bc 352
4290: 4+70b96e709d0470 367
4298: b9d2709d057068a8 41d
42a0: bd08709091 9d0870 254
42a8: bd2770dd2870+006 3b+
42b0: +e27704c3443a900 301
42b8: 9d2770+e2570bd25 3a9
42c0: 70dd2670+0034c34 356
42c8: 43bd24701869019d 2b3
42d0: 2470bd3770690090d 2+e
42d8: 3770c904d005a900 2+2
42e0: 9d3770b960701870 362
42e8: 24708502b963707d 324
42+0: 377085039848a000 2a+
42+8: b1029d2670a9009d 32c
4300: 25706da8b9667018 34c
4308: 7d24708502b96970 32a
4310: 7d37708503a000b1 2+d
4318: 02c961d007ea2051 35e
4320: 434c6c429d4+70bd 355
4328: 087029+e9d0870a9 35d
4330: 019d2370e00e+015 325
4338: 8a186907aa4c6c42 2b6
4340: a200bd04709d00d4 344
4348: e8e019d0+5604c31 483
4350: eaa9019d23709d26 367
4358: 70a9009d2570a9++ 3+3
4360: 9d24709d3770bd28 35a
4368: 709d270bd0870029 302
4370: +e9d0870a9009a04 35d
4378: 709d05709d4c7060 33b
4380: a9058d0e70a9408d 32+
4388: 0+70a90a8d1070a9 2e8
4390: 008d1170a2002051 221
4398: 43a207205143a20e 250
43a0: 205143a9018d2170 27c
43a8: 60ce7a52ad7a52c9 43c
43b0: 00d01aa9048d7a52 2+0
43b8: ae7652e8e004d002 414
43c0: a2008e7652bd7e52 385
43c8: a0dc205945ce7b52 3d5
43d0: ad7b52c900d01aa9 3d6
43d8: 018d7b52ae7752e8 3ba
43e0: e004d002a2008e77 35d
43e8: 52bd8252a0dd2059 3d9
43+0: 45ce7c52ad7c52c9 425
43+8: 00d01aa9038d7c52 2+1
4400: ae7852e8e00ad002 41c
4408: a2008e7852bd8652 38+
4410: a0de205945ce7d52 3d9
4418: ad7d52c900d01aa9 3d8
4420: 018d7d52ae7952e8 3be
4428: e006d002a2008e79 361
4430: 52bd9052a0d+2059 3e9
4438: 4560a200ad5b4449 2dc
4440: 008d5b448d5e44c9 3a4
4448: 00d00+ee5c44ad5c 376
4450: 44c918d005a9108d 340
4458: 5c44bd00109d003+ 249
4460: e8e080d0+560a200 50+
4468: bd70529d6c52e8e0 4a2
4470: 04d0+5a91+8d4841 3a7
4478: 60a200a9009d6c52 306
4480: e8e004d0+8851385 4b1
4488: 73850e8510850460 284
4490: a200bd96529d0470 358
4498: 9d00d4e6e019d0+2 514
44a0: a9008d21706a9+a 3ca
44a8: 85+b85+da90485+c 530
44b0: a9d885+ea9018d01 43c
44b8: 70a914a22c209346 2+4
44c0: 207e4607e46a000 268
44c8: 209846a9008515a9 2ea
44d0: 148514a9018573852 2d4
44d8: 1360a900a2009d00 25b
44e0: d0e8e011d0+88d15 513
44e8: d08d17d08d1bd08d 449
44+0: 1cd0a9018d1dd0a0 3b0
44+8: c89848a9be201a49 392
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4518: d0+4c60a0008d0270 3c3
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4528: a2002bd34868aa68 357
4530: a8a93e91+bad0170 439
4538: 91+d98488a48bde2 4d+
4540: 50a03ea21420d348 31+
4548: 68aa68a8bde25091 4a2
4550: +be8c8cc0270d0c8 581
4558: 6085168418a90185 2c6
4560: 178519a200180616 1ab
4568: 261718261826189e8 1ba
4570: e003d0+1a000b116 40b
4578: 9118c8c008d0+760 460
4580: 20794420944a900 27a
4588: 8d370385+b85+da9 472
4590: 0485+ca9d885+ea9 532
4598: 078d0070a2668a20 2b6
45a0: 58468a48a20a20aa 2e6
45a8: 4668aaae062+00e 462
45b0: e88a205846caa00a 3a4
45b8: 20b9464c9e45a920 317
45c0: 20584ead37030a0a 1b9
45c8: 0a49++8d0c70ee37 380
45d0: 03ad3703c919d00e 2aa
45d8: a9138d4841a9008d 308
45e0: 0b708d0c7060207e 282
45e8: 464c9c4520794420 270
45+0: 9044a9008d3703a9 2ea
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4608: 0070a2638a205846 2bd
4610: 8a48a20a20aa4668 2+6
4618: aae8e067+00eca8a 52b
4620: 205846e8a00a20b9 329
4628: 464c0c46a9202058 225
4630: 46ad37030a0a8d 1d8
4638: 0c70ee3703ad3703 28b
4640: c919d00ea9008d0c 302
4648: 708d0b70a9138d48 309
4650: 4160206946+c0a46 20c
4658: a0004891+bad0070 391
4660: 91+d68c8c028d0+2 568
4668: 60a5+b38e92885+b 4c9
4670: 85+da5+ce90085+c 58d
4678: 1869d485+e60a5+b 4d8
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4688: +c690085+c1869d4 43b
4690: 85+ec0a0008d0270 382
4698: bde25091+bad0170 499
46a0: 91+dc8e6cc0270d0 54c
46a8: e+60a0e688eaeac0 5+1
46b0: 00d0+9caa000d0+2 535
46b8: 6088d0+d60a05+86 49c
46c0: a515c900d00ac000 31d
46c8: d0+5cae000d0ee60 56d
46d0: c903d00ea510c900 328
46d8: +005a9008515604c 2e4
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46e8: 53a90085+b85+da9 4a7
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4728: 209546a00+a21b20 297
4730: 7e46a9172095460 31+
4738: 0ea223207e46a917 277
4740: 209546a9078d0170 2a9
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4750: 4620646a01be921 29a
4758: a2d+209546206946 34b
4760: a019a91+a2d92095 3b1
4768: 4620646a9058d01 251
4770: 70a019a927a2e620 3a6
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4798: 9d2007b920db9d20 335
47a0: dbb948079d4807b9 388
47a8: 48db9d48dbb97007 413
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47c8: 9dc007b9c0db9dc0 515
47d0: dbe8c8e027d0c2a5 5b9
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(continued on next page)

(continued from previous page)

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48d0: 4cac488505c60934 2da
48d8: 07a901950e6505a2 26b
48e0: 0013260526061026 0ad
48e8: 072606e8e003d0+1 3c1
48f0: a000b105910796d8 2ce
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4928: 0666051866086607 1e4
4930: e8e002d0+160a000 48b
4938: a209e1059107e8c8 3a0
4940: e0d3d0+69848e609 408
4948: 20bd4e68a8c03+d0 402
4950: e760a00d0105918? 335
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4960: a000e105950e8c8 3a5
4968: c003d0+6b1058888 44+
4970: 889105c8c8c8c0 4+e
4978: 3+d0+1a200a03cb5 433
4980: 0a9105c8e8e003d0 403
4988: +660a20a2a03eb105 38e
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49e8: 0588b1052a9105a9 2ac
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4a10: f1c8b1058888888 48+
4a18: 9105c8c8c8c8c0 53e
4a20: 43d0e+b1058888888 450
4a28: 9105c8c8c8c07+ 4+5
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4b30: d2a219201a492036 266
4b38: 49a93985+b85+da9 4d6
4b40: 0e85+ca9da85+ea9 536
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4b68: c9bba0+1a9bb8d01 537
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4c60: 94a0d8201a492052 301
4c68: 49a20a20bd46ee0a 310
4c70: d0ad0ad0c9b8d0+1 599
4c78: a20a20bd46ce0bd0 378
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4+20: 50ad04d0c91ad0eb 46+
4+28: a9b88df+a07a920d 445
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4+68: 48a9008d10d0688d 353
4+70: 02d0ee04d020d150 3d5
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4+b0: 4aa2042?bd4668aa 325
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51b8: 4147454020010908 13+
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53b0: 7e46207e46209846 2a6
53b8: ce9a4660a9008512 34e
53c0: 209055a901851185 2ca
53c8: 10a20120bd46a512 28d
53d0: c9++d0+54c+04aa2 5e5
53d8: 008a951be8e00d0d 3da
53e0: +9a90185238524a2 396
53e8: 00207061a901a220 25d
53+0: 2070c1a900852+a9 2+7
53+8: 0085338525852?a9 2b6
5400: 3285278528a90585 2be
5408: 29852a206b5560a9 2c1
5410: 9320d2++a90e8d23 3eb
5418: d0a9098d22d0a900 3aa
5420: 85+b85+da904854c 530
5428: a9d885+ea9078d01 442
5430: 70a299a901a50b20 320
5438: 9546a01da2b5a927 3b+
5440: 209546a9098d0170 2ac
5448: a00ba2a3a91d2095 36b
```

To be continued.

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PERSONAL COMPUTER WORLD
September 1983

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HOME COMPUTING WEEKLY April 1984

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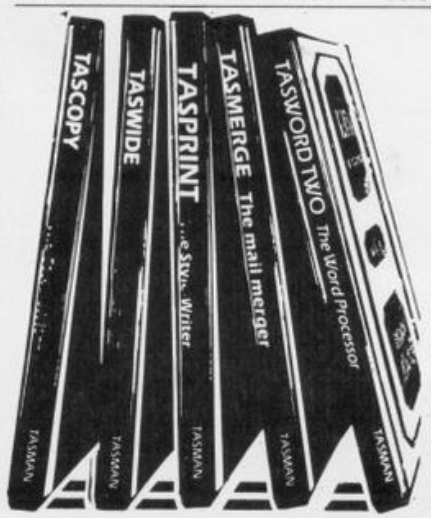
TASCOPY ZX Spectrum £9.90
TASCOPY 464 Amstrad CP 464 £9.90



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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 9210
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;
 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+1 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,
24,106,106,106,106,41,15,24,105,
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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25-way	.40	.65
26-way	.45	.70
34-way	.60	.80
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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 0,0,0,7,15,26,24,24,0,
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,
189,137,82,85,62,188,90,42,201,2
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=0: 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 m: LET h=h+h
 520 BORDER 1: PAPER 7: CLS : PR
INT AT 5,9; INK 0; FLASH 1;" UEL
L DONE! ";AT 8,6;" BONUS ";250*l
e/4;" POINTS "
 530 LET s=s+250*le/4: RESTORE 6
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;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;
```

(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(28073)
24030-110 82  221 102 89  (28682)
24035-62  9   188 56  7   (29004)
24040-45  205 16  93  32  (29395)
24045-43  44  62  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  (32550)
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(38766)
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 103,0,0,0,0,0,0,28,6: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 108,0,0,0,0,0,8,8,24
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 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 h 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:B%=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,B%,Y%-32,
1000:RETURN
360 IF Y%>39 THEN CALL SPRITE,B%,Y%-32,1000 ELSE CALL
 SPRITE,B%,Y%-16,1000
370 CALL SPRITE,B%,Y%,64
380 IF TEST(X%*8+14,Y%*2+10)<>0 THEN 400
390 RETURN
400 CALL SPRITE,B%-2,Y%+16,1000:CALL SPRITE,B%+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":PRINT CHR$
(22)+CHR$(1):PEN 2:LOCATE 1,1:PRINT"c c c c c c c c c
c c c c c c c c d d d d d d d d d d d d d d d d d d d
d d""
540 PEN 3:PRINT "           CARNIVAL SHOOTOUT"
550 PEN 1:PRINT"e e e e e e e e e e e e e e e e e e e
e f f f f f f f f f f f f f f f f f f f f":PEN 2:LOCAT
E 1,4:PRINT"g g g g g g g g g g g g g g g g g g g g g h
h h h h h h h h h h h h h h h h h h"
560 PRINT CHR$(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$(m TO m): LE 7010 CLS : INK ink: PAPER paper
" ink=VAL i$(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 (a$(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 (a$(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;"AAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAA";AT 1+e,0;"BBBBBBBBBBB
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 DIMP%(28,1):P%(20,1):C%(20,1):CP%(6)
 30 D$="■■■■■■■■■■":CL$="                    ":C1$=CL$+CL$+CL$+CL$+CL$:D1$=D$+CL
 $
 40 PL=4326:CO=37792:PR=PL+1:IL=-1:IR=1:TF=PL-158
 50 CL=0:CR=6:LL=0:RL=0:PA=0:LD=0:RD=0:SD=0:K1=-1:K2=K1
 60 IFNOTHEN140
 70 PRINT"■■■■■■■■■■1 BLOCK" PRINT"■■■■■■■2 DRAW" PRINT"■■■■■■■3 BERGEN"
 80 PRINT"■■■■■■■■SELECT GAME"
 90 GET#1,IFA#:IFA#<"1"ORA#>"3"THEN90
100 G=VAL(A#):PRINT"■■■INSTRUCTIONS? (Y/N)"
110 GET#1,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 IFNOTHEN170
160 NG=1:C=1:FORA=0TO6:FORB=A TO6: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)"■■DRAW":GOTO260
250 PRINT"■"TAB(8)"■■BLOCK"
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"■■■":GOTO200
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"■■THE(0)■■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<>THENC=A:P1=I
 30 NEXTI
 40 D=7:FORI=1TOCT:A=C%(I,0):B=C%(I,1)
 50 IFA=BANDA<>DTHEND=A:C1=I
460 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■■■EMYARD":GOSUB1170
640 RETURN
650 IFG=3ANDWT=1THENRETURN
660 GOSUB1200:RETURN
670 BE=0:DG=0:IFWT=2THEN1530
679 REM **PLAYER'S TURN**
680 POKE198,0:PRINTD1$D$:  IFG=1OR(G=2ANDBY=2)OR(G=3AND(BY=0ORBE=1))THEN700
690 PRINT"■■■■AY OR ■■RAW?" GOTO710
700 PRINT"■■■■AY OR ■■■OCK?"
710 GET#1,IFA#<>"P"ANDA#<>"D"ANDA#<>"K"THEN710
720 IFA#<>"P"THEN750
730 GOSUB770:IFPT=0THEN2000
740 GOTO670
750 IFA#="D"THEN1040
760 GOTO1110
770 PRINTD1$D$"■■WHICH DOMINO?";
780 GET#1,IFA#<"0"ORA#>"6"THEN780
790 PRINTA#",";
800 GET#1,IFB#<"0"ORB#>"6"THEN800
810 PRINTB#:A=VAL(A#):B=VAL(B#)
820 FORF=1TOPT:C=P%(F,0):D=P%(F,1):IFC=AANDD=BORC=BANDD=ATHEN850
830 NEXTF:PRINTD1$D$"YOU DON'T HAVE IT!":FORI=1TO2000:NEXT:IFSD=0THEN770
840 RETURN
850 IFSD=0THENGOSUB1250:DR=A:GOTO1010
860 IFA=DLORA=DRORB=DLORB=DRTHEN890
870 PRINTD1$D$"THAT WON'T MATCH!":FORI=1TO2000:NEXT:RETURN
880 IF(A=B)OR(DL=DRANDG<3)ORSD=1THEN960
890 IFG=3AND(RDORLD)ANDDL=DRTHEN920
900 IF(A=DLANDB=DR)OR(B=DLANDA=DR)THEN920
910 GOTO960
920 PRINTD1$D$"AT WHICH END (L OR R)?"
930 GET#1,IFA#<>"L"ANDA#<>"R"THEN930
940 IFA#="L"THENA=-D*(D=DL)-C*(C=DL):B=-D*(C=DL)-C*(D=DL):GOTO990
950 A=-D*(D=DR)-C*(C=DR):B=-D*(C=DR)-C*(D=DR):GOTO1000
960 IFA=DLTHEN990
970 IFA=DRTHEN1000
980 C=A:A=B:B=C:IFA=DRTHEN1000
990 GOSUB1250:GOTO1010
1000 GOSUB1390
1010 PT=PT-1:FORJ=FTOPT:P%(J,0)=P%(J+1,0):P%(J,1)=P%(J+1,1):NEXTJ
1020 IFSD>0ANDG=3ANDDL=DRTHENPS=PS+2:GOSUB2050:IFLDORRDTHENPS=PS+1
1030 GOSUB1170:GOSUB1200:SD=SD+1:WT=2:RETURN
1040 IFBY=0THENPRINTD1$D$"NO TILES IN YARD.":FORI=1TO3000:NEXT:GOTO680
1050 IFG=3ANDBE=1THENPRINTD1$D$"YOU CAN ONLY DRAW ONCE":FORI=1TO3000:NEXT:GOTO68
0
1060 IFG=1THENPRINTD1$D$"NO DRAW IN THIS GAME.":FORI=1TO3000:NEXT:GOTO680
1070 IFG=2ANDBY=2THENPRINTD1$D$"THE YARD IS FROZEN.":FORI=1TO3000:NEXT:GOTO680
1080 BE=1:PT=PT+1:P%(PT,0)=A%(BY,0):P%(PT,1)=A%(BY,1):BY=BY-1
1090 K1=DL:K2=DR
1100 GOSUB1170:GOSUB1200:GOTO680
1110 IF(G=2ANDBY>2)OR(G=3ANDBY>0ANDBE=0)THEN1130
1120 GOTO1140
1130 PRINTD1$D$"YOU MUST DRAW!":FORI=1TO3000:NEXT:GOTO680
1140 IFG=3ANDBY>0THEN1160
1150 PA=PA+1:IFPA=2THEN2000
1160 K1=DL:K2=DR:WT=2:GOTO670
1170 PRINT"■■■"CL$:PRINT"■■■■PS
1180 PRINT"■■■"SPC(4)CS:PRINT"■■■"SPC(10)PT:PRINT"■■■"SPC(14)CT:PRINT"■■■"SPC(18
)BY
1190 RETURN
1199 REM **DISPLAY PLAYER'S TILES**
1200 PRINT"■■■■C1$"■■■■■■YOUR ":PRINT"■■■■■■TILES":IFPT=0THENRETURN
1210 FORI=0TOPT-1
1220 J=-23*(I>7ANDI<19)-44*(I>18):POKETP+I*2+J,P%(I+1,0)+176:POKETP+I*2+J+CO,0
1230 POKETP+I*2+J+22,P%(I+1,1)+176:POKETP+I*2+J+22+CO,0:NEXTI
1240 RETURN
1249 REM **PUT TILE ON LEFT OF CHAIN**
1250 PA=0:LD=0:IFA=BTHENLD=1
1260 IFLLTHEN1350
1270 IFPEEK(PL)=96THENLL=1:GOTO1340
1280 POKEPL,A+176:POKEPL+CO,CL:IFA=BTHENPOKEPL-22,B+176:POKEPL-22+CO,CL:GOTO1310
1290 IFPEEK(PL+IL)=96THENPOKEPL+22,B+176:POKEPL+22+CO,CL:PL=PL+44:LL=2:GOTO1320
1300 PL=PL+IL:POKEPL,B+176:POKEPL+CO,CL
1310 PL=PL+IL
1320 CL=-6*(CL=0)
1330 DL=B:RETURN
1340 PL=PL+22-IL
1350 IFLL=3THEN1370
1360 POKEPL,A+176:POKEPL+CO,CL:POKEPL+22,B+176:POKEPL+22+CO,CL:PL=PL+44:LL=LL+1
GOTO1320
1370 IL=-IL:PL=PL+IL-22:POKEPL,A+176:POKEPL+CO,CL:PL=PL+IL:POKEPL,B+176:POKEPL+C
O,CL
1380 LL=0:GOTO1310
1389 REM **PUT TILE ON RIGHT OF CHAIN**
1390 PA=0:RD=0:IFA=BTHENRD=1
1400 IFRLTHEN1490
1410 IFPEEK(PR)=96THENRL=1:GOTO1480
1420 POKEPR,A+176:POKEPR+CO,CR:IFA=BTHENPOKEPR-22,B+176:POKEPR-22+CO,CR:GOTO1450
1430 IFPEEK(PR+IR)=96THENPOKEPR+22,B+176:POKEPR+22+CO,CR:PR=PR+44:RL=2:GOTO1460
1440 PR=PR+IR:POKEPR,B+176:POKEPR+CO,CR
1450 PR=PR+IR
1460 CR=-6*(CR=0)
1470 DR=B:RETURN
1480 PR=PR+22-IR
1490 IFRL=3THEN1510
1500 POKEPR,A+176:POKEPR+CO,CR:POKEPR+22,B+176:POKEPR+22+CO,CR:PR=PR+44:RL=RL+1
GOTO1460
1510 IR=-IR:PR=PR+IR-22:POKEPR,A+176:POKEPR+CO,CR:PR=PR+IR:POKEPR,B+176:POKEPR+C
O,CR
1520 RL=0:GOTO1450
1529 REM **COMPUTER'S TURN**
1530 PRINT"■":IFSD=0THEN1570
1540 J=0:FORF=1TOCT:A=C%(F,0):B=C%(F,1)
1550 IFA=DJTHENJ=A+B:I=F
1560 NEXT:A=C%(I,0):B=C%(I,1):F=I:DL=A:GOSUB2040:GOSUB1390:GOTO2000
1570 FORI=0TO6:CP%(I)=0:NEXT:FORJ=1TOCT:FORI=0TO6:CP%(I)=CP%(I)-(C%(J,0)=I)-(C%(
J,1)=I):
1580 NEXT:NEXT
1590 IFG<3ORSD<3THEN1680
1600 FORF=1TOCT:A=C%(F,0):B=C%(F,1)
1610 IF(A<>DLORB<>DR)AND(A<>DRORB<>DL)THEN1660
1620 J=(A=BLANDRD)+2*(A=BRANDLD)+3*(B=DLANDRD)+4*(B=DRANDLD)
1630 IFJTHENONJGOTO1870,1880,1890,1900
1640 IFA=DLANDB=DRTHEN1870
1650 IFA=DRANDB=DLTHEN1880
1660 NEXT
1670 IFBY>0RNDCT<=PTTHEN1920
1680 FORF=1TOCT:A=C%(F,0):B=C%(F,1)
1690 IFG=3ANDA=BTHEN1740
1700 IFA=DRAND(B=K1ORB=K2)THEN1850
1710 IFA=DLAND(B=K1ORB=K2)THEN1870
1720 IFB=DLAND(A=K1ORA=K2)THEN1830
1730 IFB=DRAND(A=K1ORA=K2)THEN1900
1740 NEXT
1750 FORI=4TO1STEP-1:FORF=1TOCT:A=C%(F,0):B=C%(F,1)
1760 IFG=3ANDA=BTHEN1790
1770 IF(A=DLORA=DR)ANDCP%(B)>ITHEN1870
1780 IF(B=DLORB=DR)ANDCP%(A)>ITHEN1890
1790 NEXT:NEXT
1800 J=0:FORF=1TOCT:A=C%(F,0):B=C%(F,1)
1810 IFG=3ANDA=BTHEN1840
1820 IF(A=DLANDB=DR)OR(A=DRANDB=DL)THEN1870
1830 IFA=BJANDJ=(A=DLORA=DRORB=DLORB=DR)THENJ=A+B:I=F
1840 NEXT:IFJTHENA=C%(I,0):B=C%(I,1):F=I:GOTO1870
1850 FORF=1TOCT:A=C%(F,0):B=C%(F,1)
1860 IFG=3ANDA=BANDCT<PT+3ANDBY>0THEN1910
1870 IFA=DLTHENGOSUB2040:GOSUB1250:GOTO2000
1880 IFA=DRTHENGOSUB2040:GOSUB1390:GOTO2000
1890 IFB=DLTHENGOSUB2040:I=A:A=B:B=I:GOSUB1250:GOTO2000
1900 IFB=DRTHENGOSUB2040:I=A:A=B:B=I:GOSUB1390:GOTO2000
1910 NEXTF
1920 IF(G=3ANDBE=1)ORG=1OR(G=2ANDBY=2)ORBY=0THEN1960
1930 PRINTD1$D$"■■I'LL HAVE TO DRAW.":FORI=1TO2000:NEXT
1940 BE=1:CT=CT+1:C%(CT,0)=A%(BY,0):C%(CT,1)=A%(BY,1):BY=BY-1
1950 GOSUB1170:GOTO1570
1960 PRINTD1$D$"■■I'LL HAVE TO KNOCK.":FORI=1TO3000:NEXT
1970 IFG=3ANDBY>0THEN1990
```

(continued on next page)

(continued from previous page)

```
1980 PA=PA+1:IFPA=2THEN2000
1990 WT=1:GOTO670
2000 CT=CT-1:FORJ=FTOCT:CX(J,0)=CX(J+1,0):CX(J,1)=CX(J+1,1):NEXTJ
2010 IFSD>0ANDG=3ANDL=DRTHENCS=CS+2:GOSUB2050:IFLDORDTHENCS=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$D$:IFLDORDTHENPRINT"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>=TTHEN2240
2210 IFDG=1THEN2290
2220 IFDG=0THENA$="I":GOTO2320
2230 GOTO2310
2240 IFPS<CTTHEN2260
2250 IFDG=2THEN2280
2260 IFDG=0THENA$="YOU":GOTO2320
2270 GOTO2310
2280 FORI=1TO6000:NEXT:GOTO40
2290 A$="BUT I":GOTO2320
2300 A$="BUT YOU":GOTO2320
2310 A$="AND"
2320 IFPS=CSTHENPRINTD$"■■■■■■■■ 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=0THEN2220
2380 FORI=1TOPT:A=A+CX(I,0)+CX(I,1):NEXTI:RETURN
2390 IFCT=0THENRETURN
2400 FORI=1TOCT:B=B+CX(I,0)+CX(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 FROMO 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"■PRESS ANY KEY TO CONTINUE"
2720 GETA$:IFA$=""THEN2720
2730 PRINT"■":RETURN

READY.
```

Sound experimenter

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Atari

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$="
":REM 35 SPACES
90 FOR I=0 TO 8:FOR J=0 TO 5:S(J,I)=0:NEXT J
:NEXT I
100 REG=5000:DIS=5100:FRE=5200:FRC=5300:OFF=
5400
102 CLD=5900:CLX=6000:VOL=6100:PDKAUD=6200:C
H=6300:START=6400:REGDIS=6500:BUZZ=6600
104 PDIS=6700:SDIS=6800:EDIS=6900
1002 GRAPHICS 0:POKE 752,1
1008 POSITION 2,0:? "AUDCTL (REG)ISTER 4"
1010 POSITION 2,1:? "                9 BIT POLY:(
B7):"
1020 POSITION 2,2:? "clock Ch.0 w/1.79 MHz:(
B6):"
1030 POSITION 2,3:? "clock Ch.2 w/1.79 MHz:(
B5):"
1040 POSITION 2,4:? "    clock Ch.1 w/Ch.0:(
B4):"
1050 POSITION 2,5:? "    clock Ch.3 w/Ch.2:(
B3):"
1060 POSITION 2,6:? "clock Ch.0 w/Ch.2 HiP:(
B2):"
1070 POSITION 2,7:? "clock Ch.1 w/Ch.3 HiP:(
B1):"
1080 POSITION 2,8:? "                   15 kHz:(
B0):"
1090 POSITION 2,9:? "  SOUND (REG)ISTER:"
1100 POSITION 2,10:? "       (DIS)TORTION:"
1110 POSITION 2,11:? "        (FRE)QUENCY:"
1120 POSITION 2,12:? "       FORCE OUTPUT:"
1126 POSITION 2,13:? "          (VOL)UME:"
1128 POSITION 2,14:? "X:"
1130 POSITION 2,15:? "D:"
1140 POSITION 2,16:? "USABLE COMMANDS:":POSI
TION 2,17:? "REG DIS FRE FRC VOL OFF CH PDIS
 SDIS"
1500 GOSUB START
2000 REM JUMP TABLE
2008 FOR ZZZ=1 TO 2 STEP 0
2010 POSITION 5,15:POKE 752,0:INPUT IN$: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 GOSUB 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$(125):REM CLEAR SCREEN
6690 RETURN
6700 REM PDIS
6705 GOSUB EDIS
6710 POSITION 2,22:? "POKE 53768, ";SUM
6720 POSITION 20,18:? "POKE 53761, ";S(0,1)+
S(0,4):POSITION 2,18:? "POKE 53760, ";S(0,2)
6730 POSITION 20,19:? "POKE 53763, ";S(1,1)+
S(1,4):POSITION 2,19:? "POKE 53762, ";S(1,2)
6740 POSITION 20,20:? "POKE 53765, ";S(2,1)+
S(2,4):POSITION 2,20:? "POKE 53764, ";S(2,2)
6750 POSITION 20,21:? "POKE 53767, ";S(3,1)+
S(3,4):POSITION 2,21:? "POKE 53766, ";S(3,2)
6780 GOSUB CLD
6790 RETURN
6800 REM PDIS
6805 GOSUB EDIS
6810 POSITION 2,19:? "SOUND 0, ";S(0,2);", "
;S(0,8);", ";S(0,4)
6820 POSITION 2,20:? "SOUND 1, ";S(1,2);", "
;S(1,8);", ";S(1,4)
6830 POSITION 2,21:? "SOUND 2, ";S(2,2);", "
;S(2,8);", ";S(2,4)
6840 POSITION 2,22:? "SOUND 3, ";S(3,2);", "
;S(3,8);", ";S(3,4)
6880 GOSUB CLD
6890 RETURN
6900 POSITION 2,18:? SP$
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

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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,BE,7E,451
340 DATA 15,BF,1,6B,BE,7E,5,BF,1,68,379
350 DATA BE,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 60,81,0,26,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,49,50,46,0,259
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,28,0,73
880 END
```

Sideways dump

M K Mostowyj,
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-(I$="("): P
OKE 65207,5
 51 IF NOT WAG THEN IF RND>.96
THEN LET WAG=1: POKE 65260,120:
POKE 65261,16: POKE 65267,255: P
OKE 65269,0: POKE 65268,1
 52 IF PEEK 65222=0 THEN POKE 6
5216,2-(4 AND RND<.5): POKE 6522
2,5
 54 IF I$="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 65245,42: 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
```

```
d 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
 UAG=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
 UAG=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$="  --- YOU HAVE SURVIVED
 --- ": GO TO 200
 180 IF HI=3 THEN LET CW=CW+1: L
ET S$="  --- 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 UAG
=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).5)); 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 (1-6;
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
,178,164,168,176,83,252,128,192
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
8,0,62,0,20,0,18,0,20,0,8,0,252,
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 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 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 machine code.

```
64551: 2A94FE22A0FE3A88 = 1089
64559: FE029DFEDD4E0EC5 = 1217
64567: 3A9DFEFEFF2004DD = 1235
64575: 3613AF3A8AFE329C = 904
64583: FE2AA0FEF56235E23 = 960
64591: 22A0FEED4B9CFECD = 1375
64599: AA2232999FE329EFE = 1123
64607: 2FE6073C329EFE32 = 893
64615: 9FFEDD86123829CFE = 1246
64623: DD361000CD85FCED = 1187
64631: 4B9CFEAF3299FE32 = 1167
64639: 9AFEDD3611086CDAA = 1083
64647: 224E5CDCEFC3A9CFE = 1243
64655: C6083829CFEED4B9C = 1134
64663: FECDAA223A9EFE32 = 1183
64671: 9BFE3A9FFE329AFE = 1338
64679: DD360F004ECDC3FC = 1020
64687: DD35130111081C94E = 910
64695: 3A99FEFE00280SCB = 967
64703: 013D20FB3A9BFEFE = 1066
64711: 002835FE08201S7A = 530
64719: DDCB184520042FA1 = 762
64727: 1806A1C40DFD7AB1 = 952
64735: 4F5371C9CB23CB12 = 935
64743: 3804CB01180FDDCB = 727
64751: 184528C7CB11DC0D = 594
64759: FD1802CB213D20E4 = 836
64767: 3A9AFEFE002805CB = 959
64775: 013D20FB71C9DDCB = 1083
64783: 09FEC9DD360900DD = 969
64791: CB027E28103AA3FE = 882
64799: FE002803FDDEE0023 = 803
64807: 1C3038181803A8AFE = 630
64815: DD360D329EFE3AA3 = 1051
64823: FEDD8600FEFF2823 = 1206
64831: DDBE14381EDDCB03 = 944
64839: 7E20083AA4FEFEAF = 1071
64847: 3040C93AA4FEDD96 = 1150
64855: 0E3CFE002834FEB0 = 850
64863: 3030C9DDCB09C6DD = 1149
64871: CB0546200D8AFDDCB = 1125
64879: 027E200553EFFDD96 = 853
64887: 0D32A3FEDDCB054E = 987
64895: 2006AF32991FE18BD = 875
64903: 3A8CFEED443938CFE = 1201
64911: 18E3DDCB09C6DDCB = 1258
64919: 0546202443EAFDDCB = 804
64927: 037E28053EFFDD86 = 845
64935: 0E32A4FEDDCB054E = 989
64943: 2005AF32991FEC93A = 920
64951: 8DFEED443938DFEC9 = 1345
64959: 3AA4FEFEB0D8C650 = 1400
64967: DDCB037E2802C660 = 889
64975: 32A4FEC9811B0FE11 = 1149
64983: 0F0005080C5D5E5E5 = 897
64991: DDE1DDCB08462008 = 991
64999: DDCB0CFEE1D1C119 = 1342
65007: 10EAC9DDCB0C7E28 = 1053
65015: 2BCD5DFED03618D1 = 895
65023: CD27FCDDCB097E28 = 1095
65031: 0ADDCB0646200 4DD = 767
65039: 3607003A8EFE32896 = 715
65047: FEDDE5E1D1C1C5D5 = 1741
65055: EDB018C8DD350020 = 955
65063: C3DD7E07FE0028C9 = 1044
65071: FEFF2803DD3507CD = 1038
65079: 5DFE3A8AFED08602 = 1154
65087: 32A3FE3A8BFEDD86 = 1273
65095: 0332A4FEDD361800 = 770
65103: CD27FCCD12FD23AA3 = 1177
65111: FE228AFE189E118A = 1017
65119: FE010F00D5DDE1ED = 1168
65127: B0C9F3F5C5D5E5DD = 1725
65135: E5CDD3FDDDE1E1D1 = 1778
65143: C1F1C3380003E09ED = 993
65151: 47ED5EC93E3EED56 = 1050
65159: ED47C900 = 509
```

Graphics 7 Paintbox

Christopher Jones,
Herne Bay,
Kent.

Atari

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 coverting 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
0000000000000000000000000000000000000
0000000000000000000000000000000000000
0000000000000000",1234
1010 DATA "000000000000000000000000
0000000000000000000000000000000000000
0000000000000000000000000000000000000
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(785)
 52 M(X)=X:N(X)=Y:Q=Q-1
 53 IF D=0 THEN GOSUB 6000
 54 IF D>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:Q=Q+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,K*2,0:PLAY 1,0,6,1000
 170 PRINT@ 16,0;A:PRINT@ 31,0;S
 180 PRINT@ 18,1;INT(P/(4-(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:PO=PO+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 Q>(597-PO) 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:NEXT H:R=111:GOT
O 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
3,30,30,63,45,63,33,51,63
 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 0,0,12,30,63,63,30,12,0,0,0,12,12,30,30,63,0
 2000 REM SET UP SCREEN
 2005 CLS:PAPER 0
 2010 PRINT CHR$(135):PRINT CHR$(135)
 2015 GOSUB 4000
 2020 PLOT 9,0,"LEVEL=":PLOT 24,0,"LIVES="
 2025 PLOT3,1,"POINTS=":PLOT16,1,"TIME=":PLOT25,1,"HIS
CORE="
 2030 FOR C=1 TO 55
 2040 IF C>32 THEN D=40 ELSE D=1
 2050 READ E,F
 2060 FOR G=E+40040 TO F+40040 STEP D:POKE G,40:NEXT G
,E
 2070 FOR H=40162 TO 40999:IF PEEK(H)=32 THEN POKE H,4
5
 2080 NEXT H
 2090 FOR I=40162 TO 49002 STEP 40:POKE I,32:NEXT I
 2100 FOR I=48199 TO 49039 STEP 40:POKE I,32:NEXT I
 2120 DATA 83,118,165,170,172,189,191,196,247,256,258,
260,262,274,327,334
 2130 DATA 409,416,450,459,463,465,491,499,542,544,571
,579,623,625,649,657
 2140 DATA 701,702,704,705,729,730,744,754,769,770,807
,808,812,818,824,829
 2150 DATA 833,834,850,858,885,890,894,900,902,907,911
,916,963,990,378,384
 2160 DATA 123,923,285,485,565,845,367,767,449,689,852
,892,296,376,298,338
 2170 DATA 619,699,780,868,421,661,782,862,384,344,346
,666,388,668,869,989
 2180 DATA 358,718,791,871,312,672,354,714,236,516,596
,876,158,958
 2200 RESTORE:RETURN
 3000 F=4X:G=AY
 3005 B=INT(RND(1)*3)+1:IF B=1 THEN AX=33:AY=21
 3010 IF B=2 THEN AX=24:AY=12
 3020 IF B=3 THEN AX=18:AY=21
 3030 IF A=F AND AY=G THEN 3005
 3040 IF O=25 THEN PRINT@ 2,0;CHR$(129):PRINT CHR$(129
)
 3050 RETURN
 4000 WAIT 200:CLS:PAPER 0:INK 4
 4005 PING
 4010 IF R=111 THEN G#="CONGRATULATIONS!"
 4020 IF R=777 THEN G#="Sorry you ran out of time!"
 4030 IF R=555 THEN G#="Sorry you ran out of lives!"
 4040 SA=(40-LEN(G#))/2
 4045 PRINT:PRINT CHR$(4)
 4050 PRINT:PRINT CHR$(27);"G";CHR$(27);"N";SPC(SA);G#
 4055 PRINTCHR$(4)
 4060 PRINT:PRINT" LEVEL=";TAB(10);CHR$(135);A#
 4070 PRINT:PRINT" GHOSTS KILLED=";TAB(18);CHR$(135);I
R
 4080 PRINT:PRINT" FRUIT OBTAINED=";TAB(30);CHR$(135);
PO
 4090 PRINT:PRINT" LIVES LOST=";CHR$(135);TAB(10);5-S
 4100 PRINT:PRINT CHR$(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$(P):PRINT:INPUT" Your NAME?";H$:H#=F
 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$(7),CHR$(28)
 4170 CLS:PAPER 4:INK 7:PING:CALL 583
 4180 PRINT:PRINT"Enter level 1,2 or 3";CHR$(135);
 4185 REPEAT:GET A#:UNTIL VAL(A#)>0 AND VAL(A#)<4:PING
:PRINT A#
 4190 LEV=(4-VAL(A#))*75+400
 4195 S=3:IR=0:PO=0:I=0:P=0:D=0:O=0:GOTO 10
 5000 CLS:PAPER 0:INK 2
 5010 PRINT CHR$(4)
 5020 PRINT CHR$(27);"G";CHR$(27);"N          ORIC GNA
SHER"
 5025 PRINT CHR$(4)
 5030 PRINT:PRINT:PRINT"Use Cursor keys to guide yours
elf"
 5040 PRINT:PRINT"through the maze but beware of Bollu
s"
 5050 PRINT:PRINT"the Gaelic Ghost' He can only be "
 5060 PRINT:PRINT"destroyed in the short time after yo
u"
 5070 PRINT:PRINT"have eaten the fruit found somewhere
"
 5080 PRINT:PRINT"in the maze."
 5085 PRINT:PRINT"    Your final objective being to ge
t"
 5087 PRINT:PRINT"to the flashing pyramid after eating
"
 5088 PRINT:PRINT"all the dots!":PRINT
 5090 PRINT TAB(8);CHR$(133);"Enter level 1,2 or 3";C
HR$(135);
 5092 REPEAT:A#=KEY$: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)
 6030 RETURN
```

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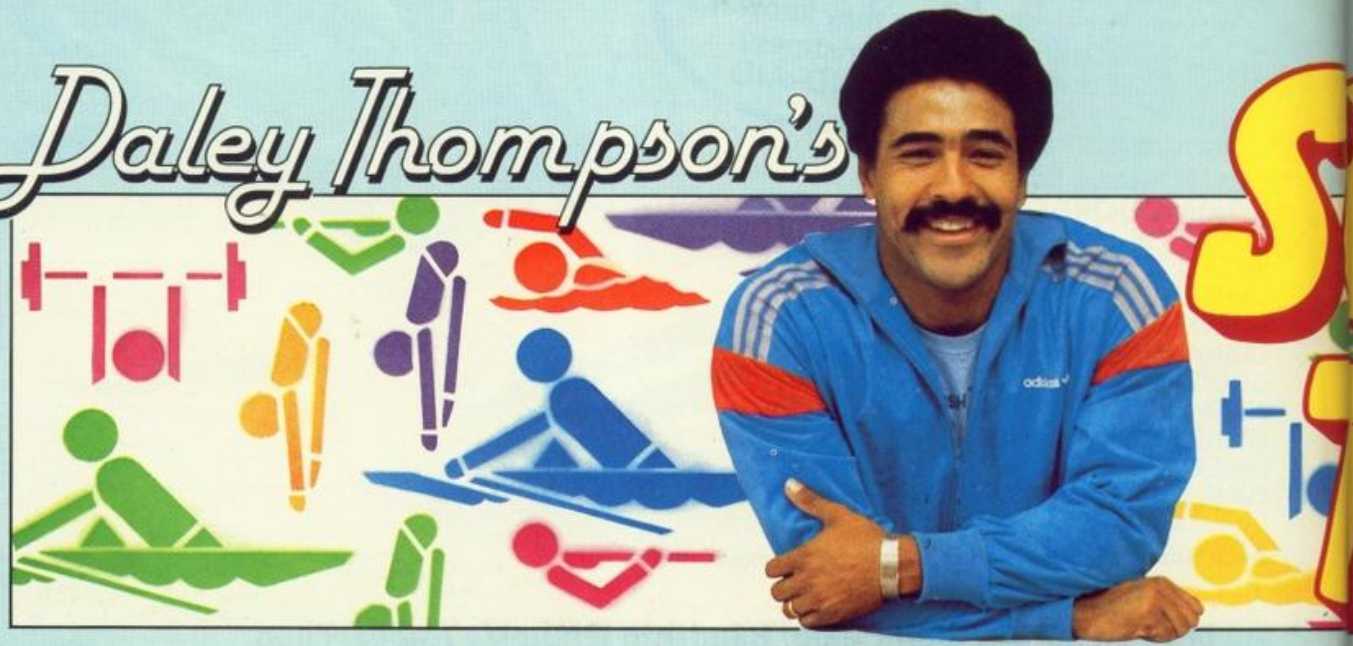

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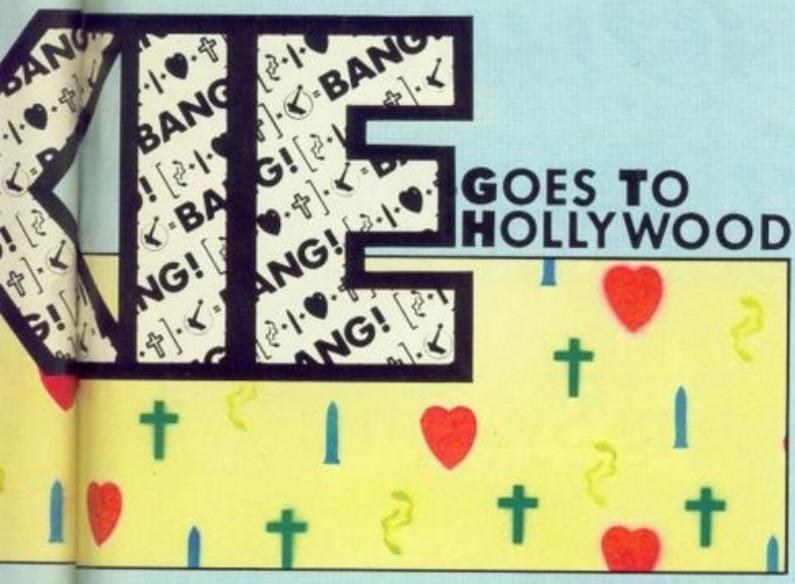

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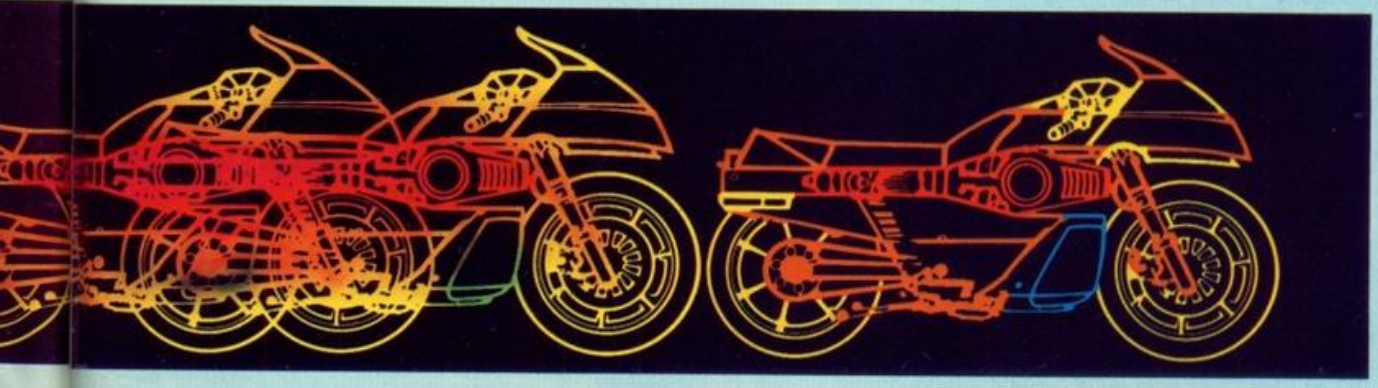

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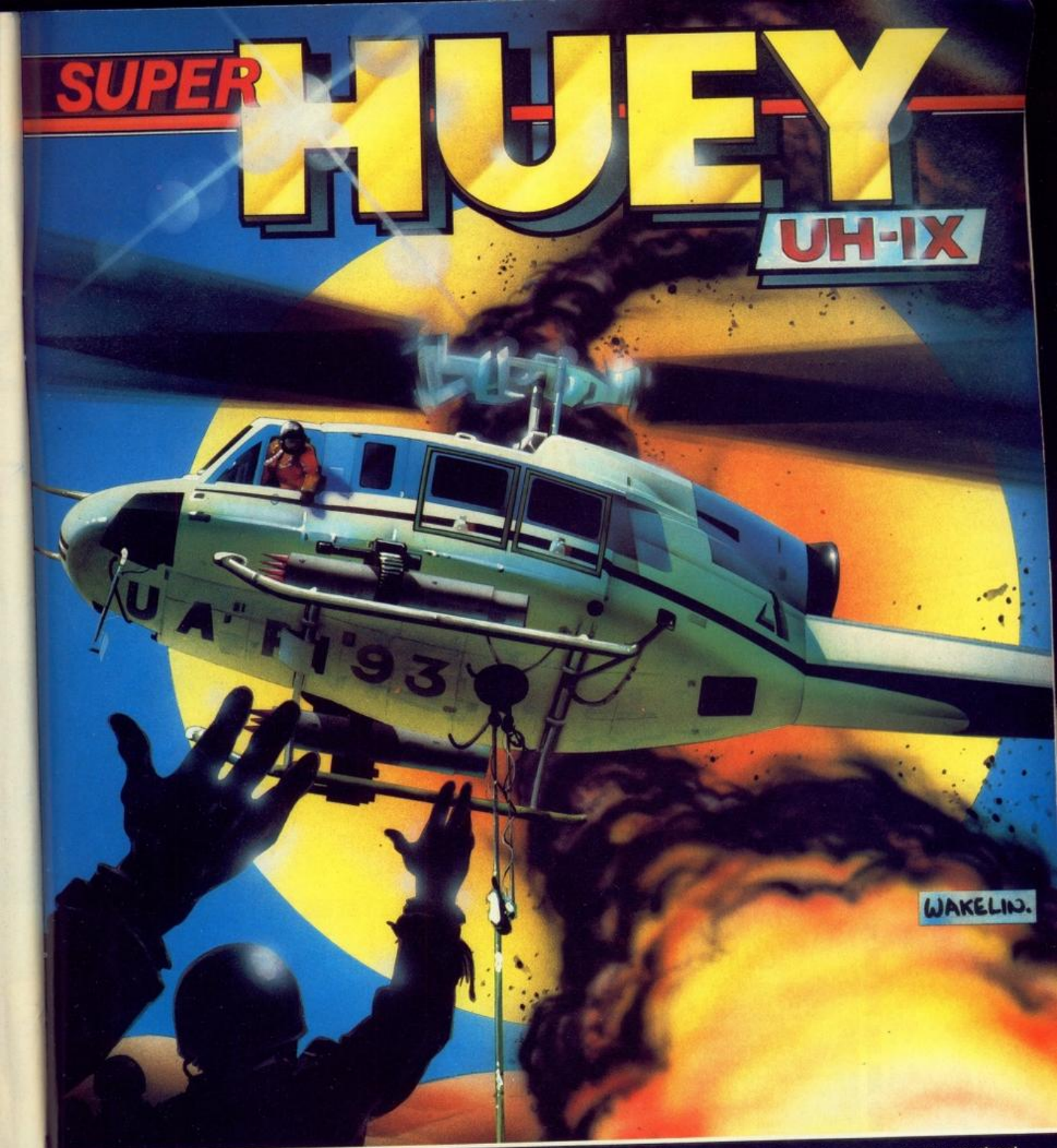

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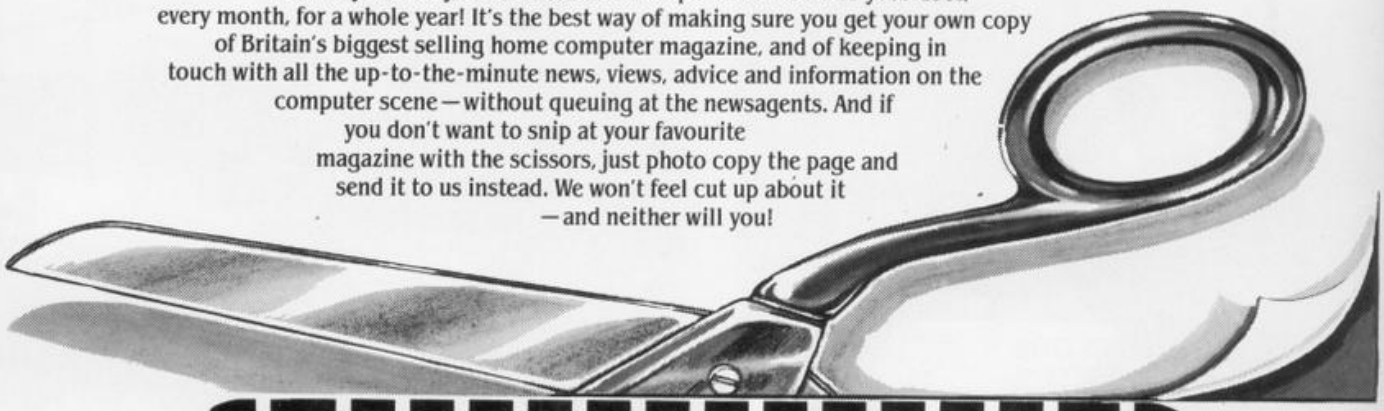

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Machine Lightning is an advanced games writing utility which includes a full Macro Assembler, a Monitor/Disassembler, a Sprite Generator Program and the object code for the White Lightning graphics routines which have almost 100 documented entry points in 3k of code. The comprehensive manual explains how to use two copies of the object code to run machine code routines concurrently using the Z80 interrupts. Games written using Machine Lightning can be marketed with no restrictions.

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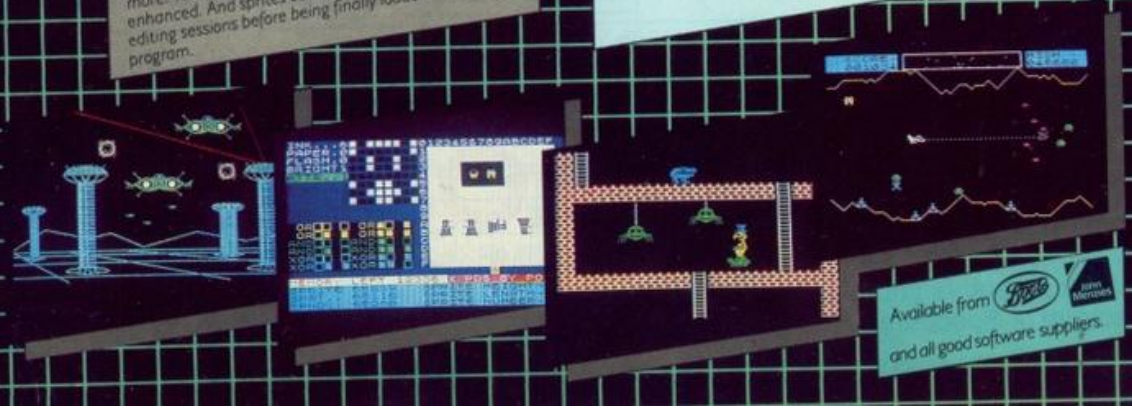

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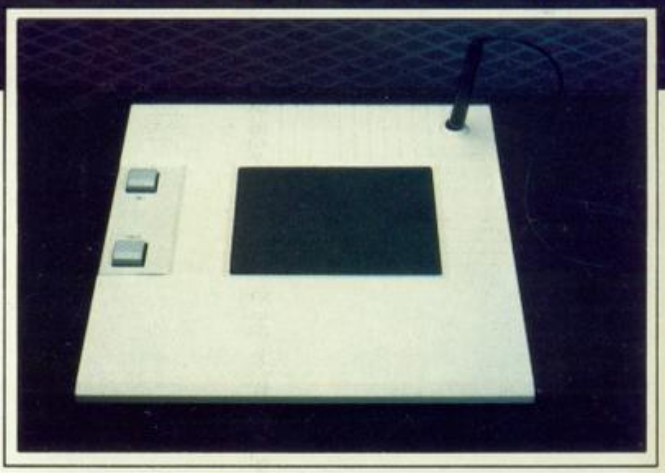

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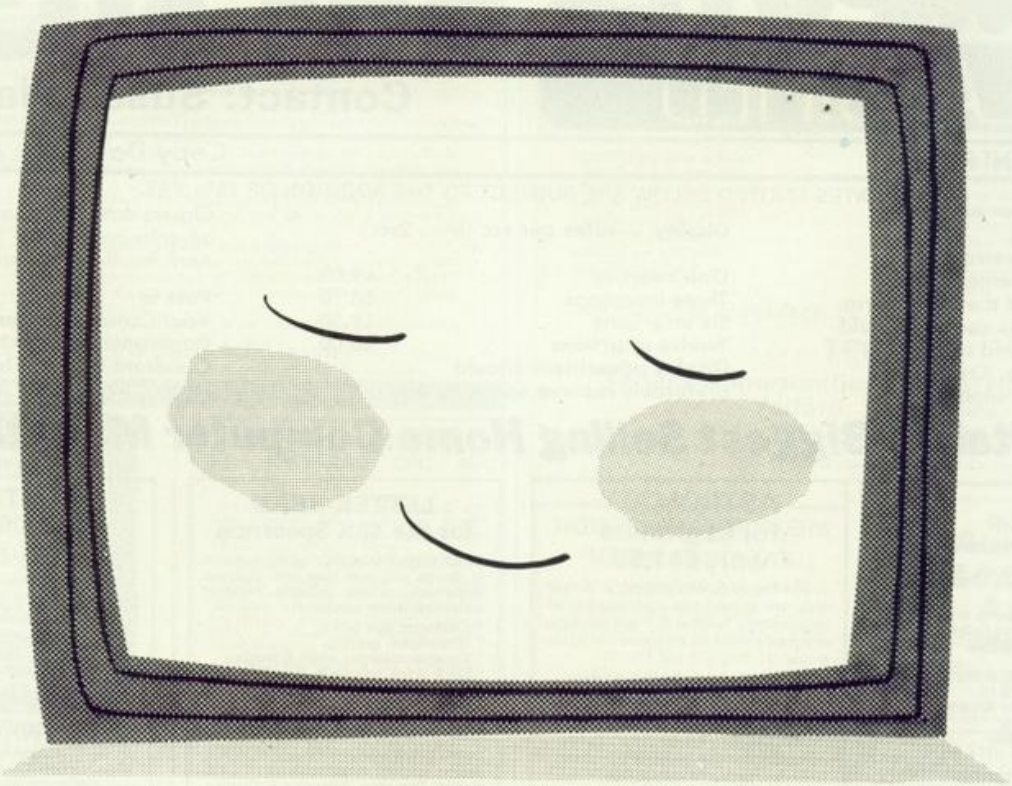

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See page 82

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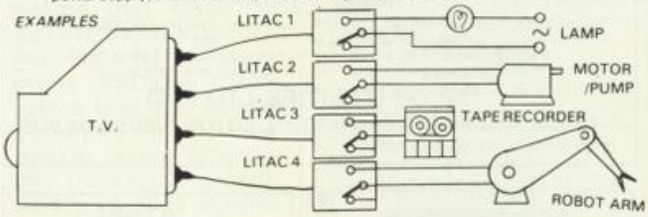

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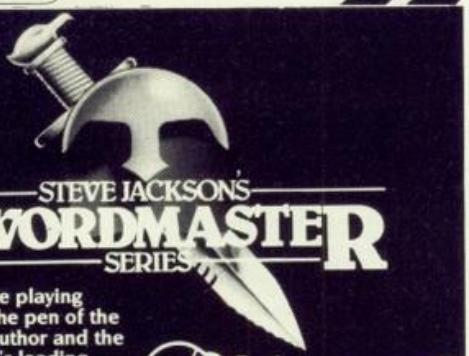

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A
Addictive Games 46
AGF Hardware 120
Amstrad 75, 75
Anirog IBC
Anthony Ashpital 108
Arnor 82

B
Beebug 70
Betasoft 108
British Telecom 22
Bubblebus 58

C
CBS 36, 37
Collinsoft 14, 15

D
Dennison Manufacturing Co Ltd 59
DK Tronics 26
Durrell Software 4

E
E.I. Systems 93
Electronics & Wireless World 28
Elite Systems 5, 89
Enterprise Computers 6, 7

F
Frel Ltd 34

G
Gilsoft 134

H
Haulsterm 34
HCCS 54
Hi-Soft 93

I
Icon Software 97
Imagine 85
Incentive Software 38
Industrial Process 82
Interface 34, 70, 134

K
Kuma Computers 63

L
LCL 134
Level Ltd 93

M
Memoco 69
Memorex 16, 17
Micro Business 118
Micro Gold 146
Micro X 24
Modem House 32

N
New Generation Software 10

O
Ocean Software 132, 133, BC
Odin Computer Graphic 107
Opus Supplies 44

P
Picturesque 108
Practical Programs 24, 120
P.V. Tubes 56

Q
Quest Int. Computers 42
Quicksilva 11

R
Ram Electronics 77
Rendar 103
Romantic Robot 56
RSD Connections 84

S
Saga Systems 138
Selec Software 84
Softaid 131
Software Communications IFC
Software Library 58
Swanley Electronics 70
Swescot 32

T
Tansoft 50
Tasman 117
Thoughts & Crosses 19
The British Computer Society 30
The Micro Workshop 82
Touchmaster 110

U
U.S. Gold 8, 9, 12, 13, 18, 40, 100, 113, 155

V
Visionstore 81
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Y
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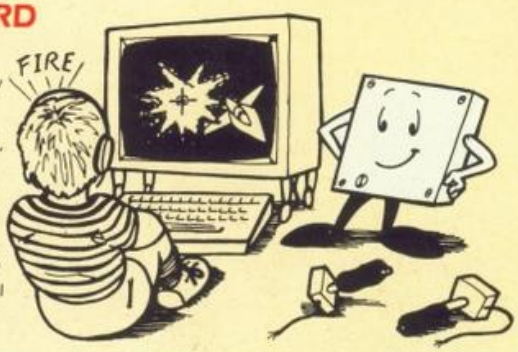

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The Voice Master comes completely with a quality head set microphone and earphone (similar to what telephone operators and pilots use), speech synthesis, speech recognition, voice harp software and detailed instruction manual. Demonstration clock and other programs are included in the software. A detailed manual with examples explain how to use speech synthesis and recognition in your own programmes.

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