

40 Rock

POPULAR Computing WEEKLY

35p 18 November 1982 Vol 1 No 31

This Week

Exclusive

Tim Langdell reviews the 48K Lynx from Computers — a low-cost micro to rival the Spectrum, Dragon and BBC machines. See page 12.

BBC assembler

Can you assemble machine code? Gareth Jones shows you how to make the most of your BBC assembler on page 26.

Spectrum unifile

A utility program that enables you to store and manage data. See page 30.

Dragon Data

The future of the Dragon. David Kelly travels to Swansea to talk to Tony Clarke, managing director of Dragon Data. See page 10.

Vic20 Starfighter

How many enemy starships can you destroy before being overwhelmed? Find out in Terence Wilson's new game for the Vic20 on page 8.

News Desk

Sony launches micro-drive

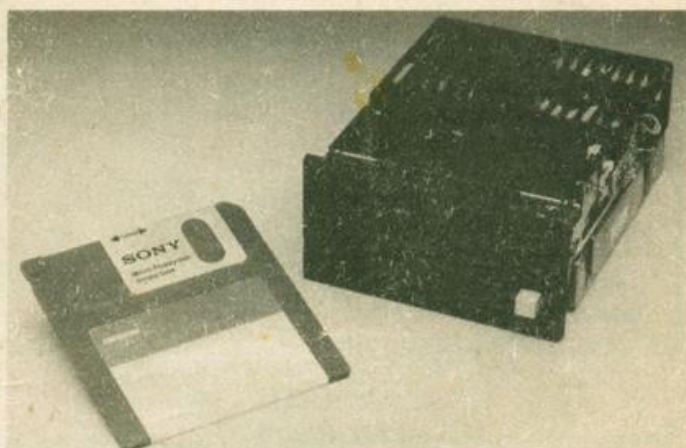
SONY has launched its new 3½-inch micro-floppy disc drive in the UK.

Priced at £235, the new drive could become an industry standard. It operates with two new single-sided 3½-inch discs developed by Sony in Japan. The single-density disc has a storage capacity of 218.8K at 135 tracks per inch. The double-density disc has a capacity of 437.5K.

The Sony micro-floppy disc goes part of the way towards providing the sort of cheap mass-storage promised by the Sinclair micro-drive. Quite how successful the Sony disc drive will be depends on development of the necessary disc controllers to enable it to be used with a range of personal computers.

Micro-drive awaits application

THE new Sony £235 micro-floppy disc drive is capable of storing approximately four times as much data as a typical 5¼-inch unit.



Sony's new 3½-inch microfloppy disc drive.

However, before the Sony system can be applied to any of the big-selling microcomputers, controllers must be developed.

These disc interfaces allow the computer to access information from, and control the operation of, the disc drive.

Already Hewlett-Packard has produced such a unit to enable the Sony drive to be used with its range of new personal computers.

Acorn Computers is evaluating the system for use with

its BBC machine. A spokesman commented "We are looking to cut the cost of disc storage for the BBC machine, but a system, if it is to be adopted, would have to be approved both by us, and by the BBC."

Dragon Data currently has no plans to adopt the Sony drive for its micro. Tony Clarke, Dragon's managing director, explained: "The 5¼-inch disc drive Dragon will launch next Spring will include a controller that will only

Continued on page 5

Classified

Computer Swap 01-930 3266

Free readers entries to buy or sell a computer. Ring 01-930 3266 and give us the details.

ATARI VCS WITH INVADERS, Asteroids, PacMan, Backgammon, Othello, Outlaw, Basketball, Blackout, Missile Command, two joysticks and four paddles. Offers for all or part. Tel: Halifax 244562 after 7 pm.

ATARI FOR SALE, £60 only. Tel: 908 3729 (after 5 pm).

Classified

TI 59 CALCULATOR and PC 100C Printer — Legnu Library and electrical engineering modules. Worth more than £250. For sale at £200 or part exchange for a 48K Spectrum. Tel: 01-427 2563 after 6.30 pm.

VIDEO GENIE, EG3003 16K Ram 12K Rom, with VU meter and five issues of Micro '80, internal cassette recorder, £230 ono. Tel: David Hannigan — Shrewsbury 790495 or write, Nills Farm, Pontesbury, Shropshire SY5 0YN.

UK101 8K cased Mono 2 Toolkit, joysticks, mini Eprom board, PSG assembler, more software, £210. Tel: Bradford (0274) 727635, after 5 pm.

Classified

You could win a fortune if you are the first person to solve an intriguing new puzzle called Lojix. Lojix has been designed for the 16K ZX81. For each puzzle that is sold, £1 will be placed in an independent bank account. The first person to send the correct solution to us will win the contents of the independent account. The puzzle is recorded on a high quality cassette and costs only £4. Cheques and PO payable to: The Puzzleman, 13 Cherry Tree Walk, Newport, Mid-Glamorgan CF7 8RG.

VIC20 cassette unit. Super expander books and over £60 of software. £230.

Classified

DRAGON 32 FAMILY PROGRAMS

Quality programs for all the family on cassette, including Quiz, Tunes, Battle, Maths, Finance, Oddjob Ringo and Sarah. Send cheque/PO for £5 to:

Shards Software, 10 Park Vale Court, Vine Way, Brentwood, Essex CM14 4UR

Got a DRAGON 32 or TANDY colour computer? Then you need your own monthly magazine "RAINBOW" for colour computer users. Send £1.50 and large sae for sample issue to: ELKAN ELECTRONICS (Dept. POP), FREEPOST, 28 Bury New Road, Prestwich, Manchester M25 6LZ. Telephone 061-798 7613 (24-hour service).

Continued on page 32

WE GIVE YOU MORE—EVERY THURSDAY

CAMPBELL SYSTEMS

The very best in machine code for
Spectrum and ZX81

SPECTRUM 16K GULPMAN. Game of the xxxMAN variety with 15 mazes, four chasers, laser defence, nine grades, nine speeds, demo mode, choice of joystick control. "An extraordinarily good program" raves Boris Allan for *Popular Computing Weekly*. We think you will agree. £5.95.

SPECTRUM 48K MASTERFILE. Business/domestic filing and reporting system. So flexible it is equally usable for your mailing lists, catalogues, stock control... applications are endless. Fully user-defined data and report display format, dynamic variable-length file, records, and data items. Menu-driven, with powerful search facilities, sorting, total/average, update, multiple independent files, printing. Yes, we aim to support Microdrive when Uncle delivers. Nearly all the 8K we use is machine code, so you get 32K per file. Comes with example file and 12-page manual. £15.00.

SPECTRUM SPDE Disassembler and Editor, fast self-relocating development tool. Shows all Z80 op codes and operands. £5.95. We used it to develop the above.

ZX81 16K GULP II. Almost identical spec to Gulpman. £4.75.

ZX81 16K-64K. THE FAST ONE is the predecessor to Masterfile and it's in use all over the world now. Specification very similar to Masterfile. £12.

All programs supplied double-recorded and mailed 1st class by return. Prices include VAT and postage within Europe. SAE for full list.

CAMPBELL SYSTEMS

(Dept PCW)
15 Rous Road, Buckhurst Hill
Essex IG9 6BL, England



*SPECTRUM MONITOR
*SPECTRUM EDITOR/
ASSEMBLER
*ZX81 SCREEN KIT 1
*ZX81 ZX-MC *ZX81 REMLOAD

FAST MAIL ORDER-SEND TODAY!

SPECTRUM MONITOR. Machine Code Debug/Disassembler
• Enter, Run, Debug machine code programs. • Compatible with Basic • Breakpoints and Registers Display • Disassembly to screen and/or ZX Printer • 16K and 48K versions on one cassette + 30 page manual. **£7.50**

SPECTRUM EDITOR/ASSEMBLER. A powerful and essential machine code programming aid. 16K & 48K on same cassette with full documentation. Major features include:
EDITOR with Auto Line Numbering. 40 Column screen display, tabulated into fields for easy reading. 5 character Label Names: simple Line Editing and Cursor Control. SAVE/LOAD Text Buffer to cassette: output to ZX PRINTER
TWO-PASS ASSEMBLER accepts all Z80 mnemonics (plus many unpublished mnemonics): Decimal or Hex numbers: simple arithmetic on operands. Assembler Directives — ORG, END, DEFB, DEFW, DEFL, EQU, DEFM
WE CANNOT FULLY DESCRIBE THIS IMPORTANT UTILITY HERE. AND ASK YOU TO SEND A S.A.E. FOR COMPLETE DETAILS OF THIS AND ALL OUR PROGRAMS. **£8.50**

ZX81 SCREEN KIT 1. More power to your screen in all your Basic programs
BORDERS any size, anywhere on screen. SCROLL in all 4 directions. CLEAR and REVERSE PART OF SCREEN. FLASHING CURSOR anywhere on screen — simulates INPUT. DATA FILES SAVE AND LOAD Basic variables: Double Speed. 880 bytes machine code for INSTANT RESPONSE. Becomes part of Basic Program. **£5.70** 4K to 64K

ZX81 ZX-MC. Machine Code Debug/Monitor
• ENTER, RUN, DEBUG machine code programs • SAVE, LOAD, VERIFY at double speed • BREAKPOINTS and REGISTERS DISPLAY • Self contained — cannot be used with Basic • Cassette plus 36 page manual. **£7.50** 4K to 64K

ZX81 REMLOAD. Machine Code Debug/Monitor
• A version of ZX-MC without the Save/Load/Verify facility • Compatible with Basic • CREATE A REM LINE of any length • BREAKPOINTS and REGISTERS DISPLAY • Cassette plus 30 page manual. **£6.95** 16K to 64K

SEND S.A.E. NOW FOR DETAILS
6 Corkscrew Hill, West Wickham,
Kent BR4 9BB.
Prices include VAT & P&P

PICTURESQUE PICTURESQUE PICTURESQUE

NEED MORE ZX81 MEMORY?

WHY WAIT ANY LONGER, WHEN YOU CAN HAVE THE BEST 16K RAM PACK AVAILABLE NOW FROM GROUND CONTROL? Built to high-quality standards using a unique design of **custom moulded plastic case** and **gold-plated edge connector**, the RAM PACK clips on to the ZX81 tightly, ensuring no "wobble" or disconnection problems. A switchable **keyboard sounder** is available inside the case as an extra, enabling faster entry of programs from the keyboard and less eyestrain, due to the decreased amount of time necessary referring to the screen to verify data entry. The sounder operates in fast mode and gives a beep every time a key is pressed. The RAM PACK is memory mapped from 16384 to 32767, the same as the Sinclair 16K RAM.



Please send SAE or IRCs with any enquiries for the above or details of our 16K RAM and I.O. BOARD still available at £32 for kit version.

Same-day despatch for cash, P.O. or credit card orders, five days for cheques. Access and Barclaycard accepted.

PRICES. All inclusive for UK.

16K RAMPACK (S) £24.95

16K RAMPACK £19.95

European postage add £2. Others add £5. Mail order only. Please make cheques, etc, payable to GROUND CONTROL and send with orders to: Dept POC

Ground Control

Ground Control
Alfreda Avenue
Hullbridge
Essex SS5 6LT
ENGLAND

Telephone No: 0702 230324. 10 am to 6 pm

The Team

Editor

Brendon Gore

News Editor

David Kelly [01-930 3271]

Sub-editor

Ninette Sharp

Editorial Secretary

Theresa Lacy

Advertisement Manager

David Lake [01-839 2846]

Advertisement Executive

Alastair Macintosh [01-930 3840]

Managing Editor

Duncan Scot

Publishing Director

Jenny Ireland

Popular Computing Weekly,
Hobhouse Court, 19 Whitcomb Street,
London WC2

Telephone: 01-839 6835

Published by Sunshine Publications Ltd.

Typesetting, origination and printing by
Chesham Press, Chesham, Bucks

Distributed by S M Distribution
London SW9. 01-274 8611. Telex: 261643

© Sunshine Publications Ltd 1982

Subscriptions

You can have *Popular Computing Weekly* sent to your home: the subscription rate is £19.95 per year, for addresses in the UK, £37.40 overseas.

How to submit articles

Articles which are submitted for publication should not be more than 1,000 words long. The articles, and any accompanying programs, should be original. It is breaking the law of copyright to copy programs out of other magazines and submit them here — so please do not be tempted.

All submissions should be typed and a double space should be left between each line. Please leave wide margins.

Programs should, whenever possible, be computer printed.

We cannot guarantee to return every submitted article or program, so please keep a copy. If you want to have your program returned you must include a stamped, addressed envelope.

Accuracy

Popular Computing Weekly cannot accept any responsibility for any errors in programs we publish, although we will always try our best to make sure programs work.

This Week

News

5

Sony micro-floppy disc,
Spectrum joystick.

Starfighter

8

A new game for Vic20 by Terence Wilson.

Street Life

10

David Kelly talks to Tony Clarke (*below*) of Dragon Data.



Reviews

12

Tim Langdell delves inside the Lynx.

Open Forum

14

Six pages of your programs.

Programming

26

BBC Assembler routines by Gareth Jones.

Machine Code

27

Opcode reference.

Dragon

29

Tim Langdell explains how to create user defined graphics.

Spectrum

30

Unifile module.

Peek & Poke

31

Your questions answered.

Competitions

35

Puzzle, Ziggurat.

Editorial

Copyright is an issue which seems to recur with increasing regularity in the micro world.

Over the past few months, a growing number of programs have appeared based on popular books and tv series such as the *Hitchhiker's Guide to the Galaxy*. Unless permission has been obtained from the author and/or publishers, such programs are breaches of copyright.

Little action has been taken so far, mainly, I suspect, because most authors and publishers are unaware that these programs exist.

Software companies who want to base programs around books and films must obtain permission first.

While on the subject of copyright, there has also been an increase in the number of software libraries. Many of these libraries, which hire out tapes at about £1 a time, pay no royalties to the authors of these programs.

Irrespective of the legal position, software libraries should be morally obligated to pay royalties (preferably at least 20 percent) to program authors. Even the public book lending libraries have finally agreed to this principle.

Next Thursday

Can you defend your base against the marauding invaders? Find out in *Missile Strike* — a new game for 16K ZX81 by David Lawrence.

Other features next week include a look at the musical abilities of the Atari, Vic20 and Dragon 32. Jon Chambers compares these modern micros and sees how they measure up to Mozart and Beethoven.

Also next week, Colin McCormick presents a machine code monitor for the Vic20.

Subscribe to Popular Computing Weekly

I would like to subscribe to *Popular Computing Weekly*.

Please start my subscription from the issue.

I enclose my cheque to *Popular Computing Weekly*, for
£19.95 for the UK — £37.40 for overseas.

Name

Address

Please send this form, and cheque, to *Popular Computing Weekly*, Subscription Dept., Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.



7 LEVELS, RAPID FIRING, LASER SHIELD, MOTHER SHIP, RE-FUELLING, SMART BOMBS, 3 WAVES, HIGH SCORE SPECTRUM VERSION HAS SOUND AND GRAPHICS. ONLY £4.50. FOR SPECTRUM OR 16K ZX81. P.C.W. "ONE OF THE BEST SINCLAIR GAMES YET". Y.C. "THE ACTION IS FAST."

AND NOW SPECTRUM SCRAMBLE

"CONDITION RED", M/CODE ACTION, 8 DIRECTIONAL KEYS, MISSILES, FUEL DUMPS, METEORS, USER GRAPHICS, SOUND. MOVE, FIRE AND BOMB AT THE SAME TIME. HIGH SCORE, FAST ACTION AND DELIVERY. £4.95

"ZX81 CONDITION RED", ZX81 VERSION. MOVE UP/DOWN, FIRE LASERS. FAST M/CODE. HIGH SCORE TABLE. BY ARCADE GAMES FOR ZX81 USERS. £3.95.

DRAGON, ZX81, SPECTRUM PROGRAMS WANTED

WORK FORCE. 140, WILSDEN AVENUE, LUTON, BEDS.



THE ADVENTURE GAME THAT'S FOR REAL !!!!

£6,000 PRIZE! FREE HIT SINGLE! 48K ZX SPECTRUM (16K ZX81 VERSION NOW AVAILABLE)

Will you be the first to locate the Golden Sundial of Pi in time and space, and be rewarded with the original? Exquisitely crafted by the winner of the De Beers Diamond International Award, from gold, diamond and the most precious of the earth's riches.

PIMANIA where saxophones turn into hanggliders, where music meets madness and where the Pi Man rules supreme! He'll talk with you, he'll befriend you, he'll betray you, he'll even do the Hokey-kokey! Animated cartoon graphics! Full musical score! Spectacular colour and sound effects! Includes free hit single "Pimania", with vocals by Clair Sinclair and the Pi-Men!

It could take you a week to play, it could take you a lifetime! PIMANIA, "the best evidence that computer gaming has come of age... an adventure enthusiast's dream!" (Computer & Video Games)

An investment at £10 (48K Spectrum) £8 (16K ZX81)



Automata Ltd. (PCW)
65a Osborne Road
Portsmouth PO5 3LR
England

SILVERSOFT

NEW!

SPECTRUM - ZX81

STARSHIP ENTERPRISE

Soar through the stars as a starship commander in this exciting new space ship simulation. This new, advanced version of Star Trek uses the full colour graphics and sound facilities of modern micros. Full 3D - Klingon attacks, graphic hyper-warp, plus all the normal 'Star Trek' features and a whole lot more. add up to one of the best games in the galaxy!!

48K Spectrum £5.95.

ORBITER

Fast and furious action is what you get in this amazing Defender-style program for the ZX-Spectrum.

ORBITER is written entirely in m/c code and has full arcade features, including scanners, reverse, hyper-space, continuous scoring and sound effects, plus humanoids, landers, mutants and all the other alien nasties. 16K or 48K Spectrum £5.95.

GROUND ATTACK

Survival is the name of the game in this exciting Scramble-type arcade game for the ZX-Spectrum.

Your mission is to pilot your spaceship through torturous caverns while destroying the enemy missile launchers and fuel dumps.

GROUND ATTACK is written completely in machine code. And has full arcade features including lasers, bombs, explosions, continuous scoring and sound effects, plus rockets, fuel dumps and airborne aliens. 16K or 48K Spectrum £5.95.

Any hiring, lending or copying (except backup) of Silversoft software is strictly forbidden without written permission from Silversoft.

GENEROUS DEALER DISCOUNTS AVAILABLE
Silversoft Ltd, 20 Orange Street, LONDON WC2H 7ED.

NEW! ZX81-COMPILER

Yes! Now you can write machine code on your ZX81. No more messing about with assemblers and disassemblers simply type in the BASIC program and the machine does the rest. ONLY £5.95.

ZX81 ARCADE ACTION (New low prices)

MUNCHER Exciting pacman game for the ZX81	£4.95
ASTEROIDS "Just the thing for asteroid addicts"	£4.95
INVADERS "Probably the best version of INVADERS"	£3.95
ALIEN-DROPOUT Exciting ORIGINAL arcade game	£3.95
STARTREK YES! you can be a starship commander	£3.95
GRAPHIC GOLF 18 graphically displayed holes	£3.95
SUPERWUMPUS An underground adventure	£3.95
GAMES PACK 1 Fantastic value for money, nearly 50K of programs on one cassette! Only	£3.95

Please send me _____

I enclose a cheque/PO for £ _____

Name _____

Address _____

Silversoft Ltd, 20 Orange Street, LONDON WC2H 7ED.

Sharp products and profits increased

TWO new Sharp microcomputers have gone on sale in Japan at the same time as the company has announced increased profits for 1982.

Selling at £175, the MZ-700 has 64K Ram. A colour prin-

Sinclair joysticks for Spectrum

SINCLAIR is to produce its own joystick for the Spectrum microcomputer.

The device will plug into the edge connector on the Spectrum and is of the switching type. It will be able to recognise eight directions and have a 'fire' facility. Software being developed now by Sinclair will be compatible with the new device.

The Sinclair joystick is planned for launch early next year but no price has so far been decided.

Kempston Electronics already market a joystick compatible with the Spectrum which is priced at £19.95.

Sony micro-drive from page 1

operate up to 80 tracks per inch. With the Sony discs' 135 tracks per inch you would either not be able to use them to full capacity, or you would need to design a new disc operating system to run them. Such a system — a direct memory access system — would cost us about £80. Our 5¼-inch drive will be complete with its own operating system and cost about £250."

Sinclair sceptical

Martin Brenan at Sinclair Research was sceptical that the Sony drives would find application with the Sinclair Spectrum. "Although a floppy-disc based system will be much faster than the Sinclair micro-drive — which has a three-second access time — it is also more than four times the price. Our micro-drive, when it comes out, will revolutionise mass storage thinking."

At £235 for the disc drive plus about £80 for the operating system the Sony micro-floppy would offer 437K of storage.

ter is also available for the computer, priced at £85. At about £690, the MZ-3500 has 128K Ram and single disc drive. High sales are anticipated and the Japanese company hopes to produce 20,000 MZ-700s and 5,000 MZ-3500s per month. As yet there are no plans to launch the machines in the UK.

The computers are an exten-

sion of Sharp's MZ range. Both of the other MZ computers are available in Britain: the MZ-80A at £549 and the MZ-80B at £1,034 — each with built-in cassette drive and display.

The Japanese company has reported interim pre-tax profits up 19.4 percent to over £47m. Full year net profits are expected to top £54m.

Cromemco launches new system for £1100

CROMEMCO'S Personal Computer is scheduled to go on sale in the UK by the end of December.

The basic C10 unit is Z80A-based with 64K Ram and 24K Rom, RS232, parallel and serial printer ports. It is supplied with integral 12in green screen monitor, but without keyboard, for £795. A keyboard is available at £140, a 5¼-inch floppy disc drive costs £395, and a low-speed daisy-wheel printer is £565.

With a 25 × 80 character display, 20 function keys, four character sets (three text, one graphics), and capable of running CDOS (Cromemco's CP/MR software compatible sys-

tem), the machine emulates a large-scale unit.

The Personal Computer will be marketed in the UK as the C10 SuperPak. This option includes the C10 unit, keyboard, single disc drive and three software packages. The software packs are the Cromemco Word Processing Pack, 32K Structured Basic and Financial Spreadsheet calculator. The C10 Superpak will cost £1095.

Like the rest of Cromemco's range of microcomputer systems, the Personal Computer will be available from usual UK importers including: Microcentre Ltd, 30 Dundas Street, Edinburgh and Comart Ltd, St Neots, Cambridge.

Plans for 50 more IT Centres

INFORMATION TECHNOLOGY Minister, Kenneth Baker, has announced plans to set up 50 more IT Centres.

This means that 150 centres are now proposed. Of the 100 first planned in 1981, 27 are in operation and 32 more have been finally approved.

The expansion is to go ahead despite criticism that the present IT Centres are lacking in training material. Kenneth Baker said that the IT Centres were "one of the most effective initiatives in post school training."

Youngsters going through the scheme are for the most part without formal educational qualifications and most of the new centres announced will be located in high unemployment city areas.



Kenneth Baker.

Dragon Users Group

EVERYONE who buys a Dragon 32 microcomputer is being offered free membership of the Dragon Users Group.

The group is being organised by Dragon themselves and will publish its first free users' newsletter before the end of the year. The issue will feature software and hardware news and programs for the Dragon.

Teletext on BBC micro in January

ACORN has begun manufacture of its teletext adaptor for the BBC microcomputer.

The receiver will only be for use with the BBC Model B machine and will take the form of a hardware/software combination. It will convert the computer to access the teletext system and download tele-software at a rate of 128K per second.

The adaptor has two parts: a main unit which connects to the computer through the 1MHz bus and a plug-in Rom which must be fitted into the computer.

Available in early January, the complete unit will cost £225.

Competition winners



Nick Lambert.

ROY Butterfield of Keighley, Yorkshire, has won a Dragon 32 in the *Popular Computing Weekly Whizzkid '82* competition.

His winning *Auto-Sonics* program provides more than 20 different sound effects for the ZX Spectrum. You can vary the tone and tempo of each sound to create your own individual effects.

The *Auto-Sonics* program was chosen from more than 70 entries by *Popular Computing Weekly* Editor Brendon Gore and Quicksilver's Nick Lambert.

Other programs to be commended in the competition included Kevin Kirkland's *Gobble Garden*, Peter Donn's *Snakes and Ladders* and Silas Patrick's *Woods of Winter* adventure.

A special mention goes to Michael Kern of Paris, our first overseas entrant.

NEWSOFT PRODUCTS

16K SOFTWARE FOR SINCLAIR ZX81 AND SPECTRUM

3D SPECTRAL MAZE

Fast action. 3D maze. Superb plot and draw routines. Make this specially commissioned program one that you must see.

SPECTRUM ONLY

SECRET VALLEY

A complex role-playing adventure with great graphics and full sound effects!

ZX81 OR SPECTRUM

TIME BANDITS

Two programs for the price of one! Side A has five fast action games. Practice them now before running Side B or you will not survive long in this magical adventure.

"Perhaps the most original of the new graphic adventure games (Eric Deeson, Your Computer, November).

ZX81 OR SPECTRUM

THE GREAT WESTERN

Arcade Adventure in the Wild West. Shoot Moose, hunt the gold or fight the Indians. You have to be fast to survive the journey.

ZX81 OR SPECTRUM

ROULETTE

The Original Microcomputer Roulette. The only program to allow all legal bets within 16K. Excellent graphics. Can be used to test any system!

ZX81 OR SPECTRUM

The Black Dwarfs Lair

An impossible chase through the underground tunnels of the Black Dwarfs Caverns. Virtually unbeatable. Try it if you dare.

SPECTRUM ONLY

Cassettes £4.95 each — £8.00 for any two.

Please specify which version required — ZX81 or Spectrum

NEWSOFT PRODUCTS

12 WHITE BROOM ROAD, WARNERS END
HEMEL HEMPSTEAD, HERTS, HP1 3PU

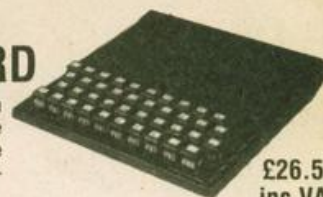
KEMPSTON (MICRO) ELECTRONICS

PRICE BREAKTHROUGH!

SPECTRUM JOYSTICK complete with interface and full instructions for use in basic. £19.50 inc VAT

ZX81 KLIK-KEYBOARD

This is a moving keyboard with 41 real keys that fits in the recess left after peeling off the existing 'touch sensitive' membrane keypad.



£26.50
inc VAT

NEW! ZX81 AUTO REPEAT MODULE	£6.50
ZX SPECTRUM PPI PORT	£16.50
ZX TWO-SLOT MOTHERBOARD	£16.95
ZX STACKABLE CONNECTOR	£5.50

SEE US AT THE NORTHERN COMPUTER FAIR 25-27 NOVEMBER

This is a most attractive keyboard which will enhance the appearance and improve the performance of your ZX81. Why pay more for an oversized keyboard?

PLEASE NOTE OUR NEW ADDRESS
Cheques/Postal orders made payable to:
KEMPSTON (MICRO) ELECTRONICS
180A Bedford Road
Kempston, Bedford
MK42 8BL. Tel: 0234 852997

Please add £1 for postage. Delivery 21 days from receipt of order. SAE in all correspondence please.

GEMINI SOFTWARE

ZX81 (16K) SPECTRUM (48K) STARTREK

Features an 8 x 8 Galaxy, Klingons and Starbases, short and long range scans, Torpedoes and Phasers, Computer etc.

PLUS Normal or Hyperdrive: choose your speed but watch the energy level.

Galaxy Map: keep track on where you have been. Also, shows whether any Klingons remain there, and where the starbases are.

Visual display of Enterprise's position and movement.

Visual display of photon torpedo.

Messages from crew members.

5 levels of play. And much more.

Cassette plus full instructions.

ZX81 £4.95

Spectrum £5.95 (colour and sound too)

Sae for other programs.

GEMINI SOFTWARE

36 BADMINTON ROAD, LEICESTER LE4 7RQ
TEL: (0533) 64915

XAVIERSINE

HIGH RESOLUTION PLANNERS for the

SPECTRUM

and the

DRAGON/TRS 80

Featuring full screen — 256 x 192

ONLY £3.00 including postage

PLEASE STATE WHICH COMPUTER

XAVIERSINE

SPECTRUM SOFTWARE

PONTOON: Play against the machine, the Banker.

★ Gambling

★ Reshuffle at Pontoon

★ Full graphic display

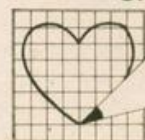
With STAKEOUT: A fruit machine.

★ Nudge. ★ Hold. ★ Cancel Hold £4.00

CHARACTER PROCESSOR

This is not just a generator, this is a processor. The program allows the user to: Build, Alter, Rotate, Invert, Move and Exchange as well as Selective Saving, Verify and Loading. £3.50.

All prices include postage and packing
Cheques payable to Xaviersine



XAVIERSINE
55 HIGH STREET
MIDSOMER NORTON
BATH AVON BA3 2DQ

THE WORKING SPECTRUM

A LIBRARY OF PRACTICAL SUBROUTINES AND PROGRAMS

By David Lawrence

The Working Spectrum is based on a collection of solid, sophisticated programs in areas such as data storage, finance, calculation, graphics, household management and education.

There is also a chapter of utility routines including a Basic renumbering program which can handle GOTOs and GOSUBs.

Each of the programs is explained in detail, line by line. And each of the programs is built up out of general purpose subroutines and modules which, once understood, can form the basis of any other programs you need to write.

Advanced programming techniques spring out of the discussions explaining each subroutine. The result is not only to advance your programming skills but also to leave you with a wide range of practical applications programs which might otherwise only be available to those prepared to buy cassettes or those capable of writing substantial programs for themselves.

Expert or novice — whatever your experience, you will find this the most useful and valuable book for the Spectrum.

THE WORKING SPECTRUM

A LIBRARY OF PRACTICAL SUBROUTINES AND PROGRAMS



DAVID LAWRENCE

Please send me a copy of The Working Spectrum.
I enclose a cheque/postal order for £5.95.

Name.....

Address.....

Signed.....

Please make your cheques payable to Sunshine Books.

Please send your order to The Working Spectrum, Sunshine Books, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

We can normally deliver within four to five days.

FINANCIAL MODELLING CASH FLOW FORECAST BUDGETTING

13 columns
number of rows dependent on memory used

Row and column arithmetic
incl. % calculation
Each row on screen if needed
Printout for columns wanted

Extensive manual

For SPECTRUM 48K only

£40.00 incl.

C.P.S.

14 Britton Street
London EC1M 5NQ

ZX SPECTRUM SOFTWARE

SUPERDRAW 16 £5.00 SUPERVIEW 48 £5.00

List of Features

- 16K Spectrum graphics pack
- Full screen high resolution colour
- Moving cursor control
- Large alphabet facility
- Pictures saved on cassette
- Automatic "slide show" option
- Menu driven, easy to operate, crash proofed
- Documented to usual high Video Software standard
- Demonstration slide show
- Audio commentary on reverse of cassette

List of Features

- 48K Spectrum personal viewdata
- Page creation with moving cursor
- Large alphabet option
- 48 full screen two colour pages OR
- 24 full screen full colour pages
- Random page recall
- Continuous page rotate
- Print option
- Full operating manual to our usual standard
- Audio commentary on reverse of cassette

VIDEO SOFTWARE LTD

Stone Lane Kinver, Stourbridge,
West Midlands, DY7 6EQ

Prices include VAT, P&P Immediate delivery.
Full range of ZX81 software still available.

Starfighter

A new game for Vic20
by Terence Wilson

In the aftermath of the Alderean wars, the Galactic Federation has broken up. Individual star systems have set themselves up as mini empires. Communications between the different reaches of the galaxy have broken down.

Born on the planet Deneb, you grew up in the shadow of a tyrannical warlord. But, you were not content to remain a dirt-scratcher — one of the planet bound. You wanted to become a spacer.

Stealing one of the warlord's ships, you escaped from the Deneb system, hotly pursued by the warlord's imperial guard. As a rebel starfighter, without a home system, you are on your own against Deneb and all the other burgeoning empires.

Starfighter runs on an unexpanded Vic20. You control a laser cannon with which you must shoot down as many enemy ships as possible. But, watch out for the meteors. They are made of anti-matter. Hitting a meteor will cause a chain reaction that will blow up the universe.

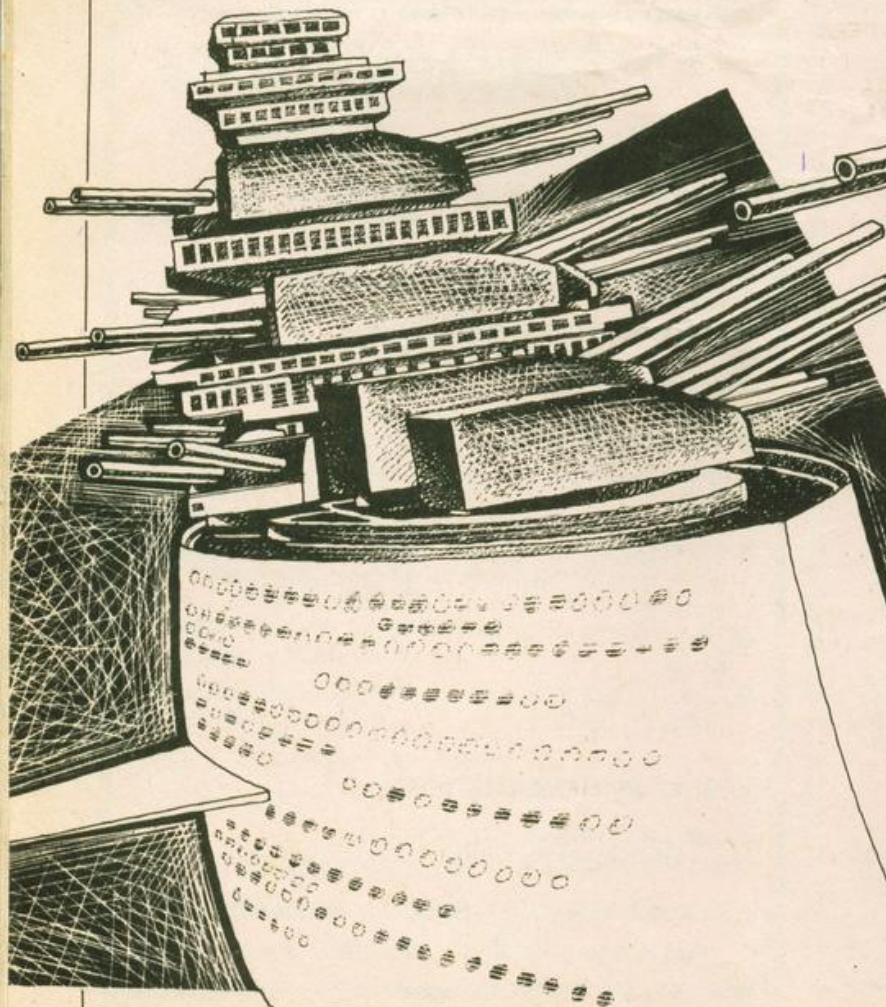
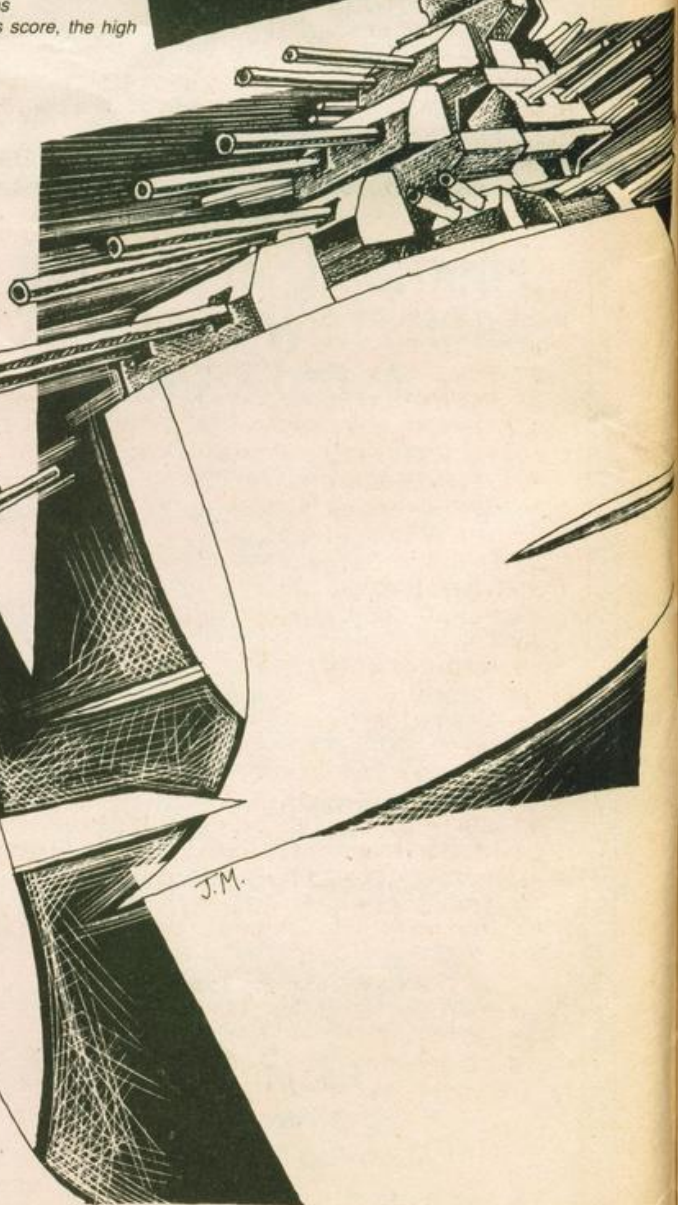
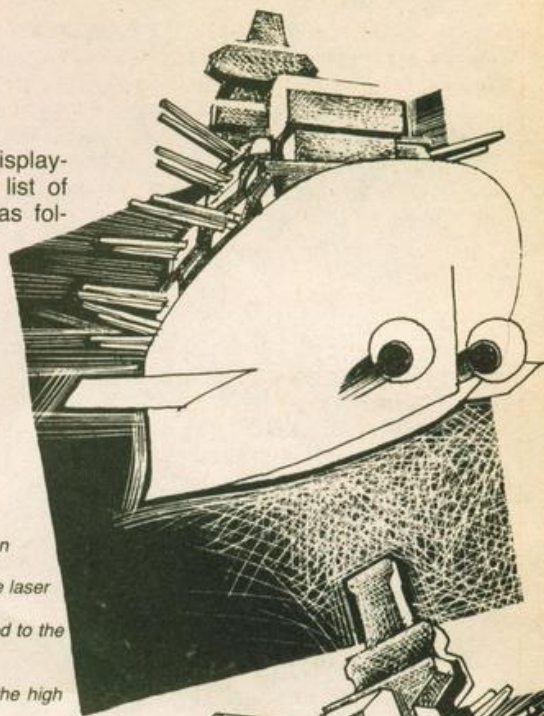
Your score and the stardate are displayed at the top of the screen. The list of variables and program notes are as follows:

LIST OF VARIABLES

A(I)=DIRECTION OF LASER
SC=SCORE
A=INPUT FROM KEYBOARD
B=OLD POSITION OF LASER
X=NEW POSITION OF LASER
S2=SOUND REGISTER
VI=VOLUME REGISTER
HS=HIGH SCORE
AE=YOUR RANKING

PROGRAM NOTES

Lines 0 to 7 set up the variables and the screen
Line 8 inputs the players move
Lines 13 to 21 calculate the new position of the laser
Lines 22 to 30 print out the player's laser
Lines 42 to 44 work out the points to be added to the player's score
Lines 49 to 83 print out the instructions
Lines 95 to 107 print out the player's score, the high score and the ranking achieved.




```

0 A(1)=1:A(2)=22:A(3)=-21:GOSUB57:R=81
1 U=U+1:S2=36876:Y=30720:C0=36879:
V1=36878:POKEC0,14
2 POKEV1,15:DEFFNR(X)=INT(RND(1)*X+1)
3 PRINT"J":FORI=1TO200:A=FNR(439)+7724:
POKEA,46:POKEA+Y,FNR(6):NEXT:X=7910
4 FORI=7702TO7723:POKEI,160:POKEI+Y,1:
POKEI+462,160:POKEI+Y+462,1:NEXT
5 FORI=7724TO8142STEP22:POKEI,160:POKEI
+Y,1:POKEI+21,160:POKEI+Y+21,1:NEXT:TI$=
"000000"
6 N=1:C=FNR(439)+7724:IFPEEK(C)=
160THEN6
7 PRINT"TIME:"RIGHT$(TI$,3);
SCORE:"SC
8 A=PEEK(197):IFA=640R(A<17ANDR<33AND
A<29ANDR<30ANDR<37)THEN30
9 IFFNR(30)>1THEN12
10 K=FNR(439)+7724:IFPEEK(K)=160THEN10
11 POKEK,42:POKEK+Y,FNR(5)+1
12 IFA=37THEN30
13 IFA=17ANDPEEK(X-22)=160THEN30
14 IFA=33ANDPEEK(X+66)=160THEN30
15 IFA=29ANDPEEK(X-1)=160THEN30
16 IFA=30ANDPEEK(X+3)=160THEN30
17 B=X
18 IFA=17THENX=X-22
19 IFA=33THENX=X+22
20 IFA=29THENX=X-1
21 IFA=30THENX=X+1
22 POKEB,32:POKEB+1,32:POKEB+2,32:POKEB
+22,32:POKEB+24,32:POKEB+44,32:POKEB+45,32
23 POKEB+46,32:B=X
24 IFPEEK(B)=42ORPEEK(B+1)=42ORPEEK
(B+2)=42ORPEEK(B+22)=42ORPEEK(B+24)=42
THEN48
25 IFPEEK(B+44)=42ORPEEK(B+45)=42ORPEEK
(B+46)=42THEN48
26 POKEX,112:POKEX+1,68:POKEX+2,110:
POKEX+22,93:POKEX+24,93:POKEX+44,109:
POKEX+45,70
27 POKEB+46,125
28 POKEX+Y,1:POKEX+Y+1,1:POKEX+Y+2,1:
POKEX+Y+22,1:POKEX+Y+24,1:POKEX+Y+44,1
29 POKEX+Y+45,1:POKEX+Y+46,1
30 IFN=0THEN35
31 IFFNR(10)=1THENR=65
32 IFFNR(20)=1THENR=90
33 B=A(FNR(3)):IFPEEK(B+C)=160THEN
POKEC,32:N=0:GOTO7
34 POKEC,32:C=C+B:POKEC,R:POKEC+Y,
1:GOTO7
35 N=1:C=FNR(439)+7724:IFPEEK(C)
=160THEN35
36 IFR=65ORR=90THENR=81
37 GOTO7
38 POKEC0,120:POKEX+1,66:POKEX+22,67:POK
EX+24,67:POKEX+45,66
39 FORL=1TO20:FORM=250TO240STEP-1:POKES
2,M:NEXTM:FORM=240TO250:POKES2,M:NEXTM
40 POKE$2,0:NEXTL:POKEC0,14
41 IFR=65ORR=90THENR=81
42 T=PEEK(X+23):IFT=81THENS=SC+10:GOTO
46
43 IFT=65THENS=SC+100:GOTO46
44 IFT=90THENS=SC+1000:GOTO46
45 GOTO7
46 POKE36877,220:FORL=15TO0STEP-1:POKEV
1,L:FORM=1TO150:NEXTM:NEXTL:POKE36877,0
47 POKEX+23,32:POKEV1,15:GOTO35
48 FORI=8TO255:POKEC0,I:NEXT:POKEC0,27
49 PRINT"J"STARFIGHTER"
50 PRINT"YOU HAVE JUST CAUSED"
51 PRINT"A SUPER-NOVA TO BLOW"
52 PRINT"UP THE GALAXY..HOWEVER"
53 PRINT"YOU DID SURVIVE FOR"
54 PRINTMID$(TI$,3,2)"MINUTES"RIGHT$
(TI$,2)"SECONDS"
55 PRINT"AND SCORED";SC(U);"POINTS"
56 GOSUB86:RESTORE:GOTO95
57 PRINT"J"STAR FIGHTER"
58 PRINT"YOU ARE THE COMMANDER"
59 PRINT"OF A GALACTIC SPACE"
60 PRINT"ORBITER,AND YOU HAVE"
61 PRINT"BEEN ATTACKED BY A"
62 PRINT"FLEET OF ASTRO-MUTANTS"
63 PRINT"YOUR TASK IS TO SHOOT"
64 PRINT"THEM WITH YOUR LASER"
65 PRINT"[.] = FIRE [/] = RIGHT"
66 PRINT"[,] = LEFT [A] = UP"
67 PRINT"[Z] = DOWN"
68 PRINT"WHIT A KEY TO COMMENCE"
69 GETA$:IFA$=""THEN69
70 PRINT"J"STAR FIGHTER"
71 PRINT"YOU HAVE UNLIMITED"
72 PRINT"TIME TO DO THIS BUT"
73 PRINT"YOUR TASK BECOMES"
74 PRINT"HARDER AS MORE METEORS"
75 PRINT"APPEAR (*) IF YOU HIT"
76 PRINT"ONE YOU WILL DESTROY"
77 PRINT"THE ENTIRE UNIVERSE"
78 PRINT"AND GOD WILL GET MAD!"
79 PRINT"POINTS,AS FOLLOWS"
80 PRINT"● = 10 POINTS"
81 PRINT"▲ = 100 POINTS"
82 PRINT"◆ = 1000 POINTS"
83 PRINT"WHIT A KEY TO BEGIN"
84 GETA$:IFA$=""THEN84
85 RETURN
86 S2=S2-1
87 READP
88 IFP=-1THENRETURN
89 READD:POKES2,P
90 FORN=1TOD:NEXT
91 POKES2,0:FORN=1TO20:NEXT:GOTO87
92 S2=S2+1:RETURN
93 DATA195,800,0,80,195,600,0,80,195,200,
195,800,0,80,203,600,201,200,0,80,201,600
94 DATA195,200,0,80,195,600,0,80,195,200,
0,80,195,1000,-1
95 PRINT"YOU HAVE ACHIEVED THE"
96 PRINT"RANK OF....."
97 IFSC>-1THENA$="GRANNY"
98 IFSC>20THENA$="LOWER COMMANDER"
99 IFSC>40THENA$="SPACE CAPTAIN"
100 IFSC>70THENA$="ADMIRAL OF THE FLEET"
101 PRINTA$
102 IFSC>HSTHENHS=SC
103 PRINT"THE HIGHEST SCORE"
104 PRINT"YOUR SCORE:"
105 PRINTTAB(5)SC
106 PRINTTAB(5)HS
107 PRINT"CAN ANOTHER GO (Y/N)?"
108 GETA$:IFA$<"N"ANDR<"Y"THEN108
109 IFA$="Y"THEN1
READY.

```


The number of the beast

David Kelly talks to Tony Clarke about the Dragon 32 and its prospects.

That the manufacturer of Corgi model cars should branch out and produce a highly successful microcomputer always seemed faintly bizarre.

And, indeed, three weeks ago Mettoy was forced to sell more than 80 percent of the Dragon venture to help overcome spiralling debts arising from the collapse of its toy market.

At the time, however, looking out from within Mettoy, the move seemed perfectly natural.

The Dragon 32 was the brain-child of Mettoy director, Tony Clarke. Having pursued a dual career as management consultant and electrical engineer — ending as financial director of Mettoy — he was in an ideal position to spot the potential.

Two years ago Tony bought an Apple for himself. "I started to look at what it did — and to compare it with the other machines on the market," he explains. "It struck me



Twenty-four-hour soak-testing.

that our company could do a better job — in terms of value for money.

"Mettoy is a strange animal. It has enormous resources — machine tool making, plastic moulding, high-volume manufacturing capacity and marketing skills. All the things in fact that infant computer manufacturers lack.

"If you look at most of the British microcomputer manufacturers, they do not have the organisational and non-computing skills necessary for producing a high-volume product. They end up subcontracting much of that work out — leading to all sorts of problems.

"Mettoy has 200 plastic moulding machines of various sizes and over 1000 assembly workers used to working on small intricate assemblies."

So Mettoy appeared well placed to



Tony Clarke, Dragon managing director designate.

produce a computer — especially since it has dabbled in electronic products before — like radio-controlled cars. In addition, Mettoy was very keen to diversify.

The company has shown a financial deficit over the last two years totalling £5.6m, caused by the collapse of its traditional markets. Mettoy has always regarded the three to 14 age range as the purchasers of its toys. In the last couple of years all that has changed. It now sells to three- to eight-year-olds. The over-nines now buy electronic goods — computers, video games, tape recorders and television.

"So an ex-employee of Mettoy — Gerry Quick (who did a PhD in computer science) and I, got together," says Tony. And the result of those discussions formed the basis of what is now called the Dragon.

"I looked at the various available microprocessors. We had a major advantage over other manufacturers in that we were not committed to any particular processor — such as the Z80 or 6502. The 6809 which was chosen for the Dragon was particularly suitable for graphics — its 16-bit register makes them fast. We also chose the SAM (Synchronous Address Multiplexer) chip which carries out many of the functions that would usually go into Rom on a Z80- or 6502-based machine.

"The combination of these two chips makes the computer very cheap to manufacture and very powerful in use.

"We chose Microsoft Basic because it was there — and we didn't have to get the whole of the UK debugging the software in service — all that was already done. Microsoft is very powerful. The 16K Rom gave us all the features we wanted and easy-to-use graphics. We took the version of Basic from Microsoft that is used on the Tandy Colour Computer and wrote our own input/output drivers. That is why the Dragon is faster than the Tandy.

"In September 1981 we persuaded the Mettoy Board to agree to the manufacture

of a prototype — and the PATS Centre in Cambridge was engaged to build it. The Board took a lot of convincing that they should give the go-ahead. In the end I persuaded them to hold a board meeting down at the 1981 *Personal Computer World* show. They saw hundreds of kids hammering away at keyboards programming micros in ways they couldn't begin to comprehend and they were convinced!

"The prototype was finished at the end of November. When they saw what it could do they gave full agreement to the project and the PATS Centre was contracted to engineer the production."

The Dragon 32 went into production in July this year. Its launch, manufacture and sales have all gone off untarnished by the kind of production difficulties which habitually plague its rivals.

"The reason for that is quite simple," explains Tony. "Mettoy is a manufacturing company. Its whole life is devoted to production in high volume, and we just tapped into that resource. A few thousand Dragons per week really makes very little difference to the plant at Swansea. I suppose Mettoy must make getting on for half a million Corgi toys every week. Besides, at the moment, assembly of the boards is being carried out by Race Electronics in Llantrisant.

"When we designed the Dragon we tried to make it well built and good value for money. We could have made the Dragon a 16K machine and done just as well with it — but that is not our philosophy. Ram is cheap if you design it in the first place — and we are not into ripping people off. We tried to make it robust — and we gave it a good keyboard. That board costs ten times more than the one on the Spectrum — but it was worth it. I'm convinced that it is one of the reasons the Dragon sells.

"It was really designed with my own family in mind — I have three sons aged between 10 and 15. Their interests are in

graphics and in games. On the Apple we had at home, the graphics were difficult to get at. I decided the Dragon must have fast, easily-accessible graphics — so it has the *Draw, Circle, Line* and *Paint* commands. And it has been designed to be well suited for games playing.

"A lot depends on production — our only constraint at the moment. We are now turning down retail orders for Christmas and only taking 1983 orders. Even so we will produce 30,000–35,000 machines this year.



"It was a very positive decision to sell the Dragon in high street shops. At £200 the machine is a considered purchase. There is only so much information you can get from an advertisement — and actually being able to try out the machine in the shop is very important. You can't do that through mail-order.

"All the big chain stores are going through a transition period — they are learning that they cannot sell computers in the same way as a tv or hi-fi. The big multiples will, I am sure, end up with special micro display areas within the stores staffed with people who know what they are doing. A computer is a specialist sale.

"We see a great future for the Dragon. It will continue as a product at least until 1985 with enhanced features. It is big — and the inside can change an awful lot without needing to change the moulding.

"February or March next year should see a disc-operating system and discs. The disc controller will operate any 40 tpi or 80 tpi 5¼in double- or single-sided disc drives. We will be offering a 40 tpi drive. The operating system and discs will be available together for around £250.

"We have more or less finished design work on a multi-tasking operating system for the machine — an OS9 system. Using it the Dragon will be able to do more than one thing at a time. The OS9 system can also support a whole range of compilers — Forth, Pascal, Cobol, Unix and 09-structured Basic, all of which will enhance the value of the machine to the serious micro user.

"We will also do a special version for use in education — with built-in RGB monitor and cassette player — and a networking system is being developed.

"There will be an expansion box early next year, giving a 64K Dragon. The expansion kit will include the OS9 system, an editor/assembler, and 09 Basic — all for less than £150.

"The whole theme from Dragon is good quality and good value for money — and



we try very hard not to offer what we don't have. We will be going for Roms on the disc-operating system in the next two or three weeks — and we will announce the launch to the public at the time we can manufacture it, and not before.

"As the machine grows, software is going to become more and more important. We have a range of small business software — using the disc system — planned for the Spring. This will be followed by more games, home utilities — again making use of the discs — and a range of educational software for schools."

All of which explains Mettoy's decision to sell Dragon to a consortium in which it holds only an 18.61 percent share. Such an ambitious development program requires considerable capital expenditure — expenditure which Mettoy at present can ill afford.

The sale — giving Prutec (the Prudential Group's high-technology investment company) a 40.74 percent stake in Dragon Data — will raise £2.4m to fund the development programme. Mettoy retains the option to buy back into the company, to the tune of 35 percent, in 1984–85, and will continue to manufacture and assemble the body of the Dragon micro.

"Dragon Data will manufacture between 150,000 and 200,000 machines next year of which at least half will be exported, first to Europe and then the US and Japan. The only problem is compatibility with the various tv systems. We will have a SECAM version for France in a few weeks. NTSC is easy, and of course we already have a PAL version.

"Dragon also has an entirely new machine, scheduled for the third quarter of 1983. It will complement the Dragon — not replace it — and is aimed at another very specific undeveloped area of the market. It will not be 6809 but will run both 6809 and 68000 software.

"We may call it the Super Dragon — but we will sort out the name when we get a little closer to it!"



Assembling and quality-checking.

The Lynx: pause for thought

Tim Langdell presents the first review of the 48K Lynx from Computers — a low cost micro that is equally at home in the house or the office.

At £225, the Lynx from Computers of Cambridge promises to be one of the most exciting new micros to arrive on the scene this year. It offers 48K of Ram as standard, expandable almost without limit in 64K blocks, and 32K of video memory (leaving 16K of workspace) expandable to 64K for even higher resolution graphics. Its Basic is among the most advanced available, and its potential for future expansion is among the best there is.

The heart of the Lynx is a Z80A CPU as used in the Spectrum, ZX81, early Tandy machines and the Research Machines 380Z. The Z80A is probably the most advanced 8-bit CPU presently available (although lovers of the 6809 may argue differently). It has a well-structured machine language which makes the design of a sophisticated micro relatively easy compared with the less sophisticated 6502 chip (as used on the BBC machines for instance). However, using the Z80A with more advanced high-resolution colour micros can lead to problems with screen handling — but more of that later.

The Lynx comes with 48K of Ram and 16K of Rom. Of the 48K Ram, 32K is used as video Ram allowing a bit-addressable high-resolution graphic display of 248 by 256. The eight available colours are bit-addressable, too. Thus the Lynx can put all

The 48K Lynx.

eight colours in a single character square, unlike its nearest rivals the Spectrum or the Dragon 32. The text is 40 columns by 24 rows and is thus teletext compatible — again unlike the Dragon or the Spectrum.

The Ram can be extended indefinitely in banks of 64K, much as the NewBrain can be. Being Z80A based and capable of such Ram upgrade, the Lynx is able to run CPM TM, unlike all other micros in this price range. Although the video memory is standard at 32K, it can be upgraded to 64K by a very simple modification, giving 80-column text display instead of the regular 40-column version. The potential for the business market is clear. Moreover, a disc drive card which plugs inside the casing will become available soon. It has an RS232 interface as standard, and a parallel interface is an integral part of the disc card.

What Computer's programming expert, Davis Jansons, has managed to cram into the 16K of Rom in the Lynx is quite incredible. He has created a new Basic with similarities to Microsoft, BBC Basic



John Shirreff and Davis Jansons.

and Sinclair Basic, too. The Lynx's Basic is structured as the BBC machine's is — with *Procedures*, *If-Then-Else*, and so on — but goes further than the BBC by having *While* and *Wend*, too.

Davis has made the entry of machine code from Basic a superbly easy task for the more serious programmer. The keyword *Code* has been included to indicate that what follows are *Hex* bytes of machine code. The keyword *Call* then enables the user to call the machine code routine from Basic and *Lctn xxx* allows the user to indicate that the machine code routine is in line number xxx. All of which adds up to an extremely useful tool.

The more usual Basic keywords are, of course, also there, with many enhancements. For instance, as well as offering *Goto* and *Gosub*, the Lynx offers *Goto Label* and *Gosub Label* which allows the user to give a subroutine or part of a program a label rather than refer to it by its starting line number. The Spectrum also effectively supports such a facility because it will allow numeric variables to have full names. However, the Lynx, while only allowing single character variables, does offer a more obviously structured Basic.

The attention given to making programs clear, easy to read and write, is laudable. Computers has even made the Lynx's listings indented, with *For-Next* loops being more indented than other statements, and so on. While this feature is possible on the BBC machines, too, it is a relief not to have to type in additional commands to achieve this useful feature.

In brief, then, the Lynx's Basic is superbly complete, offering many luxuries such as auto line numbering, deletion of line num-



The Lynx.

REVIEW

bers, direct entry to the monitor (*Mon*), renumber, and even a keyword *Ext* which allows the user to add extra Basic keywords called from Ram or stored on Eproms or Roms.

Davis Jansens has aimed to make Lynx Basic among the fastest around. While no 'bench test' type figures are available yet, running many standard tests of speed on the Lynx puts it in a class alongside the BBC machines.

However, while the Lynx Basic's speed of execution is fast, its screen handling is rather slow. This seems to be due to the inherent problem of screen handling with a Z80A when high resolution colour and graphics are being supported. When displaying to the screen, the Lynx seems to be several orders of magnitude slower than machines using the 6502 (such as the BBC) or the 6809 (such as the Dragon). This is a great pity, given that the availability of colour definition at the pixel level makes the writing of colourful games very tempting — without recourse to good machine code writing though, fast-moving games on the Lynx may not be possible.

This said, there is no other micro for its price (except perhaps the recent MPF2 from Multitech) that allows true high resolution colour. The Lynx also has many built-in graphics commands such as *Draw*, *Move*, *Plot*, *Paint*, *Ink* and *Paper* (at least some of Sinclair Basic has caught on). The Lynx also offers a *Window* facility, enabling the user to define a text window within the normal screen area — much as the BBC machines do.

Autorun

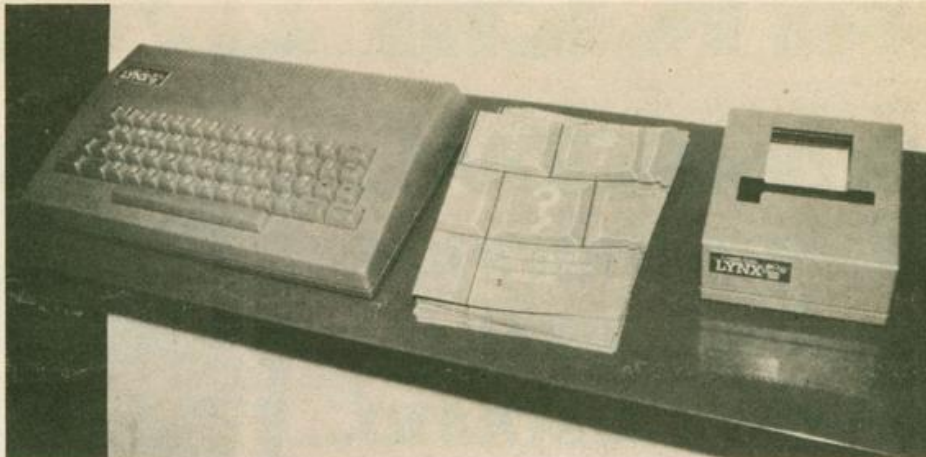
As with the ZX Spectrum, programs can be *Saved* to tape followed by both a name and *Line* which causes the program to autorun upon *Loading*. Unlike the Spectrum, though, the Lynx makes it easy to have *Appended* (ie *Merged*) programs autorun, too.

Other non-standard features also, are rather nice. For instance, the Lynx has an immediate calculator mode where you simply type in the numbers, eg 4*65, no keywords such as *Print* being necessary.

Whereas you would normally type in a program in full on the Lynx, as with most machines, it is also possible to have Spectrum-like single-key entry of just about every command. Simply press the *Escape* key along with any of the main keyboard keys. This feature is excellent, and once again shows the great deal of thought that has gone into the Lynx.

The keyboard also deserves a mention, as does its general appearance. The keyboard is among the best I have used on a micro — standing alongside the BBC machine as my favourite for touch-typing. The quality seems up to the standard of many word processors at least. The casing of the Lynx is both functional and elegant — the sort of design which would be equally suited to the home as to the office.

The room for expansion of this machine is very good indeed. A 5¼in disc drive



Lynx computer and printer.

should be available soon, and a 40-way bus at the rear of the machine brings out most of the connections necessary for hardware additions. The Lynx comes standard with rgb+sync, composite video and pal outputs all available from sockets at the back.

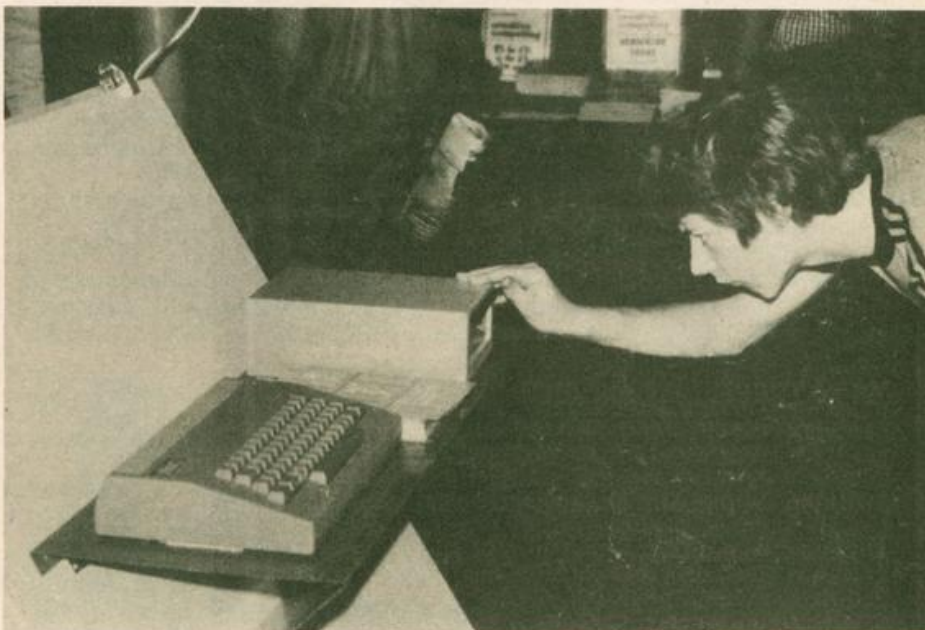
In conclusion, Lynx seems to have struck a very good middle ground in trying to please the serious user, the first time buyer of a home computer, and the small business user. In many ways the Lynx must rival micros costing at least twice as much (such as the BBC model B and new SuperBrain) in the business sector, as well as offering extremely strong competition to micros in the £175 to £225 region such as the Dragon 32, the Vic and the 48K Spectrum.

The Lynx is perhaps less well equipped than some others in the market for games playing (the screen handling is slow, and there is no ready provision for joysticks or plug-in Roms), but it does offer a full eight colours in true high resolution which no other similar-priced micro can offer.

All in all, the Lynx is excellent value at £225 for the standard 48K version.



Computers' Lynx.



Taking a closer look at the Lynx.

Sinclair ZX Spectr

**16K or 48K RAM...
full-size moving-
key keyboard...
colour and sound...
high-resolution
graphics...**

**From only
£125!**

First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power— personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can update later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.



Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

There's no need to stop there. The ZX Printer—available now—is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232 / network interface board.



Key features of the Sinclair ZX Spectrum

- Full colour—8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound—BEEP command with variable pitch and duration.
- Massive RAM—16K or 48K.
- Full-size moving-key keyboard—all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution—256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set—with upper- and lower-case characters.
- Teletext-compatible—user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE—16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC—incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

um

The ZX Printer— available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set—including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.



The ZX Microdrive— coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy.

The transfer rate is 16K bytes per second, with average access time of 3.5 seconds. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum.

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.



How to order your ZX Spectrum

BY PHONE—Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST—use the no-stamp needed coupon below. You can pay by cheque, postal order, Access,

Barclaycard or Trustcard.

EITHER WAY—please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt—and we have no doubt that you will be.

ZX Spectrum software on cassettes—available now

The first 21 software cassettes are now available directly from Sinclair. Produced by ICL and Psion, subjects include games, education, and business/household management. Galactic Invasion... Flight Simulation... Chess... History... Inventions... VU-CALC... VU-3D... 47 programs in all. There's something for everyone, and they all make full use of the Spectrum's colour, sound and graphics capabilities. You'll receive a detailed catalogue with your Spectrum.

RS232/network interface board

This interface, available later this year, will enable you to connect your ZX Spectrum to a whole host of printers, terminals and other computers.

The potential is enormous. And the astonishingly low price of only £20 is possible only because the operating systems are already designed into the ROM.

sinclair

Sinclair Research Ltd, Stanhope Road,
Camberley, Surrey GU15 3PS.
Tel: Camberley (0276) 685311.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR.

Order

Qty	Item	Code	Item Price £	Total £
	Sinclair ZX Spectrum—16K RAM version	100	125.00	
	Sinclair ZX Spectrum—48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

Please tick if you require a VAT receipt ☐

*I enclose a cheque/postal order payable to Sinclair Research Ltd for £

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable

Signature

PLEASE PRINT

Name: Mr/Mrs/Miss

Address

POC811

FREEPOST—no stamp needed. Prices apply to UK only. Export prices on application.

Open Forum

Open Forum is for you to publish your programs and ideas.

It is important that your programs are bug free before you send them in. We cannot test all of them.

Contributions should be sent to: Popular Computing Weekly, Hobhouse Court,
19 Whitcomb Street, London WC2H 7HF.

How to contribute

Each week the editor goes through all the programs that you send to Open Forum in order to find the Program of the Week.

**The author of that program will qualify for DOUBLE the usual fee we pay for published programs.
(The usual fee is £6.)**

Presentation hints

Programs which are most likely to be considered for the Program of the Week will be computer printed and accompanied by a cassette.

The program will be well documented, the documentation being typed with double spacing between each line.

The documentation should start with a general description of the program and then give some detail of how the program has been constructed and of its special features.

Listings taken from a ZX Printer should be cut into convenient lengths and carefully stuck down on to white paper, avoiding any creasing.

Please enclose a stamped, self-addressed envelope.

Panic

on ZX81

On a distant planet in a far galaxy lives a gardener. He was once very happy until one day as he was gardening he saw two green eyes peeping over his hedge. As he walked around a small alien pest followed him, so he grabbed his spade in order to kill it. He swung his spade at it and it vanished. But who was to know that his garden was ridden with another four of these pests.

In this game for the ZX81 you are the gardener armed with a spade. You must beat the alien garden pests without them, or you, bumping into each other. Unfortunately life is not as simple as that because every time you kill an alien it leaves an uncrossable hole that must be avoided.

Once you clear one sheet of them another sheet appears, but after each sheet there are more holes which make you have to take diversions and are more

difficult to avoid. For each alien killed you are awarded ten points. You are represented as **A** and the alien pests are represented as letter **M**s which wander along the garden hedges. The controls are: 5 Left, 8 Right, 6 Down, 7 Up, 0

Spade.

The variables are:

A/B Position of gardener.

D/E Alien, positions.

S Score.

CS, DS, ES, FS, GS Aliens.

```

1 REM ZX-PANIC
10 LET 7 BY SIMON COX (C) 82
100 CLS S=0
101 PRINT "SCORE= 0000"
110 PRINT
120 PRINT
130 PRINT
140 PRINT
150 PRINT "H" H H
160 PRINT "H" H H
170 PRINT "H" H H
180 PRINT "H" H H
190 PRINT "H" H H
200 PRINT "H" H H
210 PRINT "H" H H
220 PRINT "H" H H
230 PRINT "H" H H
240 PRINT "H" H H
250 PRINT "H" H H
260 PRINT "H" H H
270 PRINT "H" H H
280 PRINT "H" H H
290 PRINT "H" H H
300 PRINT "H" H H
310 PRINT
320 PRINT
330 PRINT
340 PRINT "ZX-PANIC"
I C
350 PRINT
360 LET A=3
370 LET B=1
380 LET C=2
390 LET D=0
400 LET E=0
410 LET G$=""
420 LET H$=""
430 LET I$=""
440 LET J$=""
450 LET K$=""
460 PRINT AT 3,E;D$;AT 7,E+14,E
470 LET 11,E;7,F$;AT 15,E;C$;AT 15,
510 LET E=E+0
520 PRINT AT A,B
530 LET A$=CHR$(PEEK (PEEK 16399)
540 LET B$=CHR$(PEEK (PEEK 16399)
550 PRINT AT A+1,B
560 LET C$=CHR$(PEEK (PEEK 16399)
570 PRINT AT A,B,"A"
580 IF Z$="" THEN GOTO 1000
590 IF A$="H" THEN GOTO 1000
600 IF B$="H" THEN GOTO 1000
610 IF C$="H" THEN GOTO 1000
620 IF D$="H" THEN GOTO 1000
630 IF E$="H" THEN GOTO 1000
640 IF F$="H" THEN GOTO 1000
650 IF G$="H" THEN GOTO 1000
660 IF H$="H" THEN GOTO 1000
670 IF I$="H" THEN GOTO 1000
680 IF J$="H" THEN GOTO 1000
690 IF K$="H" THEN GOTO 1000
700 IF L$="H" THEN GOTO 1000
710 IF M$="H" THEN GOTO 1000
720 IF N$="H" THEN GOTO 1000
730 IF O$="H" THEN GOTO 1000
740 IF P$="H" THEN GOTO 1000
750 IF Q$="H" THEN GOTO 1000
760 IF R$="H" THEN GOTO 1000
770 IF S$="H" THEN GOTO 1000
780 IF T$="H" THEN GOTO 1000
790 IF U$="H" THEN GOTO 1000
800 IF V$="H" THEN GOTO 1000
810 IF W$="H" THEN GOTO 1000
820 IF X$="H" THEN GOTO 1000
830 IF Y$="H" THEN GOTO 1000
840 IF Z$="H" THEN GOTO 1000
850 IF A$="H" THEN GOTO 1000
860 IF B$="H" THEN GOTO 1000
870 IF C$="H" THEN GOTO 1000
880 IF D$="H" THEN GOTO 1000
890 IF E$="H" THEN GOTO 1000
900 IF F$="H" THEN GOTO 1000
910 IF G$="H" THEN GOTO 1000
920 IF H$="H" THEN GOTO 1000
930 IF I$="H" THEN GOTO 1000
940 IF J$="H" THEN GOTO 1000
950 IF K$="H" THEN GOTO 1000
960 IF L$="H" THEN GOTO 1000
970 IF M$="H" THEN GOTO 1000
980 IF N$="H" THEN GOTO 1000
990 IF O$="H" THEN GOTO 1000
1000 IF P$="H" THEN GOTO 1000
1010 IF Q$="H" THEN GOTO 1000
1020 IF R$="H" THEN GOTO 1000
1030 IF S$="H" THEN GOTO 1000
1040 IF T$="H" THEN GOTO 1000
1050 IF U$="H" THEN GOTO 1000
1060 IF V$="H" THEN GOTO 1000
1070 IF W$="H" THEN GOTO 1000
1080 IF X$="H" THEN GOTO 1000
1090 IF Y$="H" THEN GOTO 1000
1100 IF Z$="H" THEN GOTO 1000
1110 IF A$="H" THEN GOTO 1000
1120 IF B$="H" THEN GOTO 1000
1130 IF C$="H" THEN GOTO 1000
1140 IF D$="H" THEN GOTO 1000
1150 IF E$="H" THEN GOTO 1000
1160 IF F$="H" THEN GOTO 1000
1170 IF G$="H" THEN GOTO 1000
1180 IF H$="H" THEN GOTO 1000
1190 IF I$="H" THEN GOTO 1000
1200 IF J$="H" THEN GOTO 1000
1210 IF K$="H" THEN GOTO 1000
1220 IF L$="H" THEN GOTO 1000
1230 IF M$="H" THEN GOTO 1000
1240 IF N$="H" THEN GOTO 1000
1250 IF O$="H" THEN GOTO 1000
1260 IF P$="H" THEN GOTO 1000
1270 IF Q$="H" THEN GOTO 1000
1280 IF R$="H" THEN GOTO 1000
1290 IF S$="H" THEN GOTO 1000
1300 IF T$="H" THEN GOTO 1000
1310 IF U$="H" THEN GOTO 1000
1320 IF V$="H" THEN GOTO 1000
1330 IF W$="H" THEN GOTO 1000
1340 IF X$="H" THEN GOTO 1000
1350 IF Y$="H" THEN GOTO 1000
1360 IF Z$="H" THEN GOTO 1000
1370 IF A$="H" THEN GOTO 1000
1380 IF B$="H" THEN GOTO 1000
1390 IF C$="H" THEN GOTO 1000
1400 IF D$="H" THEN GOTO 1000
1410 IF E$="H" THEN GOTO 1000
1420 IF F$="H" THEN GOTO 1000
1430 IF G$="H" THEN GOTO 1000
1440 IF H$="H" THEN GOTO 1000
1450 IF I$="H" THEN GOTO 1000
1460 IF J$="H" THEN GOTO 1000
1470 IF K$="H" THEN GOTO 1000
1480 IF L$="H" THEN GOTO 1000
1490 IF M$="H" THEN GOTO 1000
1500 IF N$="H" THEN GOTO 1000
1510 IF O$="H" THEN GOTO 1000
1520 IF P$="H" THEN GOTO 1000
1530 IF Q$="H" THEN GOTO 1000
1540 IF R$="H" THEN GOTO 1000
1550 IF S$="H" THEN GOTO 1000
1560 IF T$="H" THEN GOTO 1000
1570 IF U$="H" THEN GOTO 1000
1580 IF V$="H" THEN GOTO 1000
1590 IF W$="H" THEN GOTO 1000
1600 IF X$="H" THEN GOTO 1000
1610 IF Y$="H" THEN GOTO 1000
1620 IF Z$="H" THEN GOTO 1000
1630 IF A$="H" THEN GOTO 1000
1640 IF B$="H" THEN GOTO 1000
1650 IF C$="H" THEN GOTO 1000
1660 IF D$="H" THEN GOTO 1000
1670 IF E$="H" THEN GOTO 1000
1680 IF F$="H" THEN GOTO 1000
1690 IF G$="H" THEN GOTO 1000
1700 IF H$="H" THEN GOTO 1000
1710 IF I$="H" THEN GOTO 1000
1720 IF J$="H" THEN GOTO 1000
1730 IF K$="H" THEN GOTO 1000
1740 IF L$="H" THEN GOTO 1000
1750 IF M$="H" THEN GOTO 1000
1760 IF N$="H" THEN GOTO 1000
1770 IF O$="H" THEN GOTO 1000
1780 IF P$="H" THEN GOTO 1000
1790 IF Q$="H" THEN GOTO 1000
1800 IF R$="H" THEN GOTO 1000
1810 IF S$="H" THEN GOTO 1000
1820 IF T$="H" THEN GOTO 1000
1830 IF U$="H" THEN GOTO 1000
1840 IF V$="H" THEN GOTO 1000
1850 IF W$="H" THEN GOTO 1000
1860 IF X$="H" THEN GOTO 1000
1870 IF Y$="H" THEN GOTO 1000
1880 IF Z$="H" THEN GOTO 1000
1890 IF A$="H" THEN GOTO 1000
1900 IF B$="H" THEN GOTO 1000
1910 IF C$="H" THEN GOTO 1000
1920 IF D$="H" THEN GOTO 1000
1930 IF E$="H" THEN GOTO 1000
1940 IF F$="H" THEN GOTO 1000
1950 IF G$="H" THEN GOTO 1000
1960 IF H$="H" THEN GOTO 1000
1970 IF I$="H" THEN GOTO 1000
1980 IF J$="H" THEN GOTO 1000
1990 IF K$="H" THEN GOTO 1000
2000 IF L$="H" THEN GOTO 1000
2010 IF M$="H" THEN GOTO 1000
2020 IF N$="H" THEN GOTO 1000
2030 IF O$="H" THEN GOTO 1000
2040 IF P$="H" THEN GOTO 1000
2050 IF Q$="H" THEN GOTO 1000
2060 IF R$="H" THEN GOTO 1000
2070 IF S$="H" THEN GOTO 1000
2080 IF T$="H" THEN GOTO 1000
2090 IF U$="H" THEN GOTO 1000
2100 IF V$="H" THEN GOTO 1000
2110 IF W$="H" THEN GOTO 1000
2120 IF X$="H" THEN GOTO 1000
2130 IF Y$="H" THEN GOTO 1000
2140 IF Z$="H" THEN GOTO 1000
2150 IF A$="H" THEN GOTO 1000
2160 IF B$="H" THEN GOTO 1000
2170 IF C$="H" THEN GOTO 1000
2180 IF D$="H" THEN GOTO 1000
2190 IF E$="H" THEN GOTO 1000
2200 IF F$="H" THEN GOTO 1000
2210 IF G$="H" THEN GOTO 1000
2220 IF H$="H" THEN GOTO 1000
2230 IF I$="H" THEN GOTO 1000
2240 IF J$="H" THEN GOTO 1000
2250 IF K$="H" THEN GOTO 1000
2260 IF L$="H" THEN GOTO 1000
2270 IF M$="H" THEN GOTO 1000
2280 IF N$="H" THEN GOTO 1000
2290 IF O$="H" THEN GOTO 1000
2300 IF P$="H" THEN GOTO 1000
2310 IF Q$="H" THEN GOTO 1000
2320 IF R$="H" THEN GOTO 1000
2330 IF S$="H" THEN GOTO 1000
2340 IF T$="H" THEN GOTO 1000
2350 IF U$="H" THEN GOTO 1000
2360 IF V$="H" THEN GOTO 1000
2370 IF W$="H" THEN GOTO 1000
2380 IF X$="H" THEN GOTO 1000
2390 IF Y$="H" THEN GOTO 1000
2400 IF Z$="H" THEN GOTO 1000
2410 IF A$="H" THEN GOTO 1000
2420 IF B$="H" THEN GOTO 1000
2430 IF C$="H" THEN GOTO 1000
2440 IF D$="H" THEN GOTO 1000
2450 IF E$="H" THEN GOTO 1000
2460 IF F$="H" THEN GOTO 1000
2470 IF G$="H" THEN GOTO 1000
2480 IF H$="H" THEN GOTO 1000
2490 IF I$="H" THEN GOTO 
```

```

901 IF A=7 AND B+1=E+14 OR A=7
AND B+1=E+14 THEN LET E$=" "
902 IF A=11 AND B+1=E+7 OR A=11
AND B-1=E+7 THEN LET F$=" "
904 IF A=15 AND B+1=E OR A=15 A
ND B-1=E THEN LET C$=" "
905 IF A=15 AND B+1=E+14 OR A=1
5 AND B-1=E+14 THEN LET G$=" "
906 IF A=3 AND B+1=E THEN PRIN
T AT A+1,B+1,"M";AT A+1,B+1," "
907 IF A=3 AND B-1=E THEN PRINT
AT A+1,B-1,"M";AT A+1,B-1," "
908 IF A=7 AND B+1=E+14 THEN PR
INT AT A+1,B+1,"M";AT A+1,B+1," "
909 IF A=7 AND B-1=E+14 THEN PR
INT AT A+1,B-1,"M";AT A+1,B-1," "
910 IF A=11 AND B+1=E+7 THEN PR
INT AT A+1,B+1,"M";AT A+1,B+1," "
920 IF A=11 AND B-1=E+7 THEN PR
INT AT A+1,B-1,"M";AT A+1,B-1," "
930 IF A=15 AND B+1=E THEN PRIN
T AT A+1,B+1,"M";AT A+1,B+1," "
940 IF A=15 AND B-1=E THEN PRIN
T AT A+1,B-1,"M";AT A+1,B-1," "
941 PRINT AT 3,E,D$;AT 7,E,E+14
E+14;G$;AT 15,E,D$;AT 15,
E+14;G$
942 IF U$="H" OR Y$="M" THEN LE
T S=8+10
995 PRINT AT 0,15,5,"██████████"
996 IF C$=F$ AND D$=" " AND
O$=" " THEN GOTO 1065
998 GOTO 500
1010 PRINT AT A,B,"M";AT A,B,"A"
1030 PRINT AT 19,12,"GAME-OVER"
1040 IF 19>PRESS$ ANY KEY
1041 GOTO 11 INKEY$=" " THEN GOTO 1010
1050 CLS
1060 RUN
1065 PRINT AT A,B," "
1070 LET A=3
1080 LET B=1
2000 GOTO 410

```

[illegible]

Panic
by Simon Cox

Turn to page 21

How to make the best home computer in the world even better.

Peripherals to turn a powerful computer into a super-computer for the professional.

With VIC, you have the finest home computer money can buy. And the more you use it, the more you will ask it to do.

Pretty soon, you'll want to extend VIC's vast potential to the full; and there is a wide range of VIC peripherals to help you do it.

Disk drives, disk-based software, a printer, cassette unit, joysticks, paddles—with these, VIC computing becomes total computing: giving you true professional power and capability.

We describe the major units here.

VIC PRINTER



The VIC Printer, like all VIC peripherals, offers a very high specification at a very competitive price.

It will print programs, letters, business data, graphic displays and so on.

Its main features include: 80 characters per line • Tractor feed dot matrix • 30 characters per second print speed • Full alphanumerics and graphic printing • Double-size character capability • All cables and leads.

VIC FLOPPY DISK UNIT

The VIC single-drive Disk Unit provides a fast, accurate and efficient means of storing and retrieving data and programs.

Together with the Printer, it transforms the VIC 20 into the ideal system for the small businessman or serious computer programmer.

Features include: 174,848 bytes capacity • Uses soft-sectored standard 5¼" single density floppy disks • Direct interface to VIC •

Direct compatibility with Printer Intelligent system independent of VIC.

(VIC RAM not required to run it).



EXPANSION MEMORY CARTRIDGES

Special plug-in cartridges are available to expand VIC's memory. 3K, 8K and 16K RAM packs plug directly into the computer.



A Memory Expansion Board is also available to develop VIC's capabilities to the maximum.

For full details of VIC 20, its peripherals and software, and a list of your local dealers, contact: The Commodore Information Centre, 675 Ajax Avenue, Slough, Berkshire, SL14BG. Tel: Slough (0753) 79292.



commodore
VIC 20

The best home computer in the world.

Let Commodore expand your horizons.

VIC 20 is the finest home computer that money can buy.

And the better you get to know it, the more confident, adventurous and ambitious you'll become.

You'll want to take advantage of the vast range of VIC software: a superb and constantly-growing selection of programs, embracing business systems, entertainment, education and many applications in the home.

Every program in the series has been designed by experts, and chosen for its quality and value for money.

VIC business software covers a wide range of applications, including spread-sheet analysis, stock control, information handling and word-processing.

A mind-blowing range of games including Scott Adams' world-famous 'Adventure' series.

Advanced space games, including the sophisticated 'Omega Race'.

Learn subjects as diverse as English Language, programming, and biology.

And 'home' software ranges from IQ tests to Robert Carrier menus.

In addition, there is a range of VIC software, like programmers' aids and graphics packages—



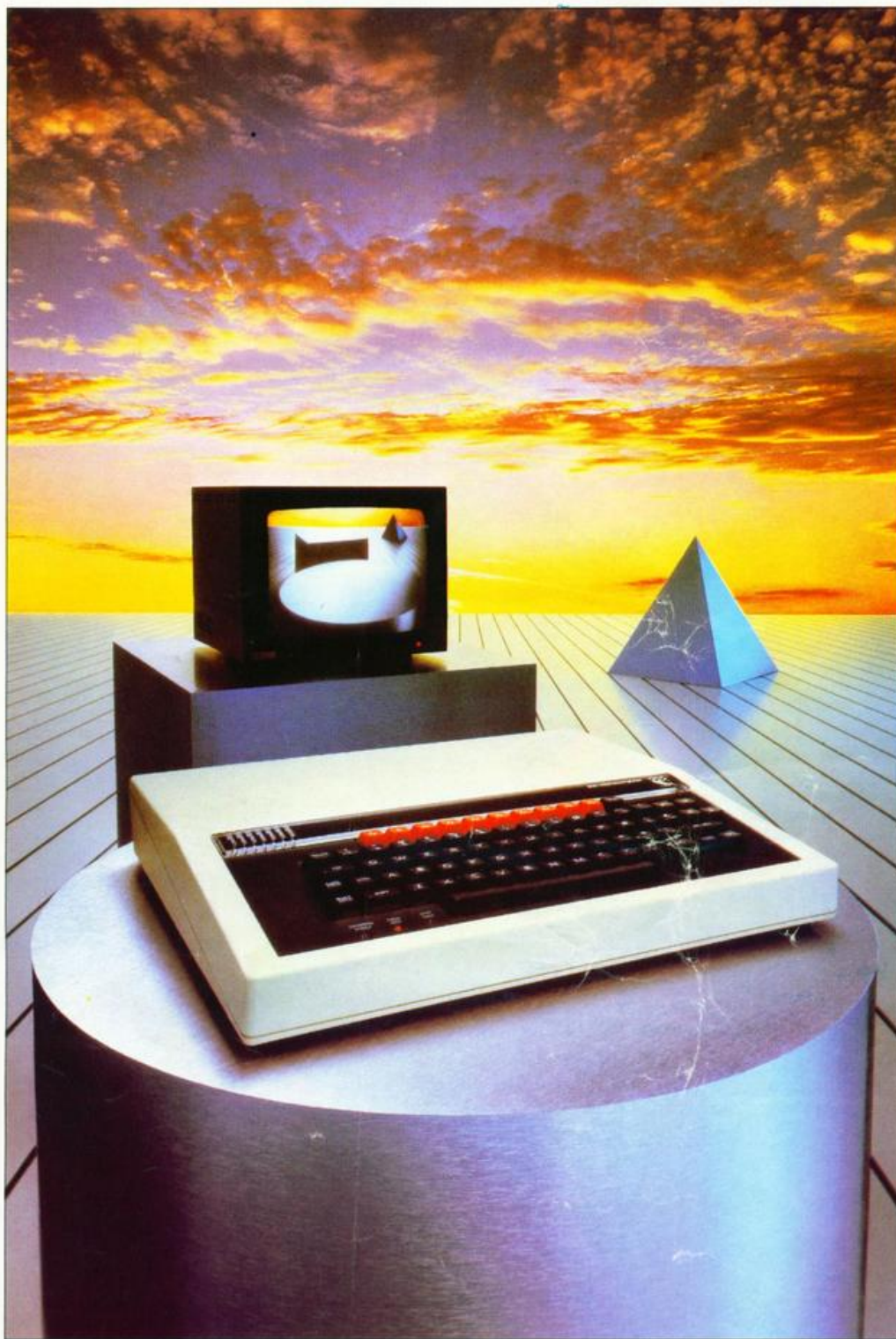
to add to your understanding and enjoyment of computers and computing.

There's even a special 'VicSoft' Club for VIC 20 enthusiasts, with many advantages including special offers to club members.



PRICES RANGE FROM £4.99 to £24.95 INC. VAT.

VCPCY 11/82



Broader horizons

BBC Model B Microcomputers are available for immediate despatch by courier to your door.

If you would like to take advantage of our special delivery offer just fill in this coupon, but remember this only applies to the Model B, and only in the UK. Any other items have to be ordered on the standard order form or from a BBC Computer Stockist.

BBC Microcomputer System Offer
c/o Vector Marketing
Dennington Estate
Wellingborough
Northamptonshire NN8 2RL

Whether your interests lie in business, educational, scientific, control or games applications, this system provides a possibility for expansion which is unparalleled in any other machine available at present,' comments Paul Beverley in the July 1982 edition of *Personal Computer World*.

The BBC Microcomputer can genuinely claim to satisfy the needs of novice and expert alike. It is a fast, powerful system generating high resolution colour graphics and which can synthesise music and speech. The keyboard uses a conventional layout and electric typewriter 'feel'.

You can connect directly* to cassette recorder, domestic television, video monitor, disc drives, printers (dot matrix and daisy wheel) and paddles. Interfaces include RS423, inter-operable with RS232C equipment, and Centronics. There is an 8-bit user port and 1MHz buffered extension bus for a direct link to Prestel and Teletext adaptors and many other expansion units. The Econet system allows numerous machines to share the use of expensive disc drives and printers.

BASIC is used, but plug-in ROM options will allow instant access to other high level languages (including Pascal, FORTH and LISP) and to word processing software.

A feature of the BBC Microcomputer which has attracted widespread interest is the Tube, a design registered by Acorn Computers. The Tube is unique to the BBC Microcomputer and greatly enhances the expandability of the system by providing, via a high speed data channel for the addition of a second processor. A 3MHz 6502 with 64K of RAM will double processing speed; a Z80 extension will make it fully CP/M** compatible.

The BBC Microcomputer is also at the heart of a massive computer education programme. The government has recommended it for use in both primary and secondary schools. The BBC Computer Literacy Project includes two series of television programmes on the use and applications of computers.

There are two versions of the computer. Model A, at £299, offers 16K of RAM and Model B at £399 has 32K of RAM.

For technical specification and order form, send stamped addressed envelope to P.O. Box 7, London W3 6XJ and for details of your nearest stockist ring 01-200 0200.

Please send me by courier 1 BBC Model B Microcomputer(s) at £399 including VAT and delivery.

Cheque enclosed for £ 399 payable to BBC Microcomputer System readers a/c or charge ACCESS ☒ BARCLAYCARD ☒

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Signed Simon Gray
Name SIMON GRAY
Address 40 ROCK ROAD
CAMBRIDGE
Postal Code CB1 4UF

Co Reg No 1403810

VAT No. 215400220

The BBC Microcomputer System

BBC Microcomputer System Offer, c/o Vector Marketing, Dennington Estate, Wellingborough, Northamptonshire NN8 2RL.

*Model A has a limited range of interfaces but can be upgraded to meet Model B specification.

**CP/M is a registered trade mark of Digital Research.

The BBC Microcomputer is designed, produced and distributed in the UK by Acorn Computers Limited.

Open Forum

from page 16

City Bomber

on Vic20

The object of City Bomber is to land on the city — but before you can land, you must destroy the buildings. This version has only one control — Fire (controllable by any key). Only one bomb may be falling at any time.

There are nine skill levels (1-9). One is the hardest, nine the easiest. These are selected at the beginning of the game. When a city is destroyed, you are given a bonus and start on a new city, but on a slightly higher level.

Program notes:

Lines 0 to 50 — set up buildings and jump to instructions etc. at 500.

Lines 60 to 150 — main game.

Lines 200 to 300 — ending routine.

Lines 350 to 400 — landing routine.

Lines 500 to 600 — instructions.

Lines 1000 to 1035 — Hi-res routine.

Lines 1040 to 1202 — data for Hi-res.

```
0 DIML,I,B,H,C
1 GOSUB500
2 POKE36878,15
3 DEFFNA(X)=PEEK(828)+256*PEEK(829)
4 DEFFNB(X)=INT(X/256)
5 FORF=2200STEP-1:POKE36866,(F)OR128:POKE36867,F#20R128:
6 POKE36876,F#2+128
7 POKE36864,(22-F)+12:POKE36865,(22-F)+38:FORL=0TO10:NEXT
8 L,F
9 PRINT"City Bomber";POKE36879,11:POKE36869,255
10 FORF=0TO22:POKE36866,(F)OR128:POKE36867,F#20R128:
11 POKE36876,F#2+128
12 POKE36864,(22-F)+12:POKE36865,(22-F)+38:FORL=0TO10:
13 NEXT L,F
14 POKE36867,46+128:POKE36876,0
15 FORF=22*22TO22*22+21:POKEF+7680,47:NEXT
16 LE=INT(LE/1.5)+1
17 FORA=0TO21
18 RH=INT(RND(1)*10)+5+LE:RC=INT(RND(1)*7)+1
19 IFRH=21THENRH=20
20 FORB=21TORHSTEP-1
21 IFB=RHTHENPOKEA+B*22+7680,48:POKEA+B*22+38400,RC:GOTO50
22 POKEA+B*22+7680,39:POKEA+B*22+38400,RC
23 POKE36876,A#4+128
24 NEXTB,A:POKE36876,0
25 B=0:L=0:H=0:G=36876
26 POKE781,H:POKE782,L:SYS65520:PRINT"
```

```
75 L=L+1:IFPEEK(L+H*22+7681)=40THENPOKE36876,32:POKE36876,L,1:
76 GOTO200
77 IFINT(L/22)*22=LTHENH=H+1:L=0
78 POKE782,L:POKE781,H:SYS65520:PRINT"Level ";L
79 X=PEEK(197)
80 PRINT"Score";TAB(11)"High";FNA(1)
81 IFX=32ANDB=0THENB=L+22*H+22+7680
82 IFB=0THENFORF=0TO30:NEXT:GOTO141
83 POKEB,32:POKE36876,B,1:B=B+22
84 IFPEEK(B)=39ORPEEK(B)=40THENS=S+10
85 POKEB,43
86 IFC=0THENC=230
87 POKE36876,C
88 C=C-1:IFC<128THENC=0:POKE36876,C
89 V=7
90 IFB>8141THENPOKEB,32:B=0:C=0:POKEG,B
91 V=7
92 IFL+22*H=469THEN350
93 GOTO70
94 POKEG,0:POKEG+3,B:FORF=15TO0STEP-1:POKEG+1,220:
95 POKEG+2,F:FORL=0TO100:NEXTL,F
96 POKE36877,0:POKE36879,8:POKE36869,240:PRINT"City Bomber";
97 "CRASHED!"
98 PRINTTAB(5)"-----"
99 PRINT"Score";S
100 IFS>FNA(1)THENPRINT"New High Score!";B=FNA(1):
101 POKE829,B:POKE828,S-B*256:GOTO260
102 PRINT"High Score";FNA(1)
103 PRINT"Another Go?";
104 GETX:IFX="N"THEN270
105 IFX="Y"ANDX<"N"THEN270
106 POKE36879,27:PRINT"Go!"
107 POKE36867,128+46:POKE650,0
108 IFX="Y"THENRUN
109 END
110 FORL=1TO3
111 PRINT"*****BONUS 100 POINTS*"
112 FORM=200TO220+L*2:POKE36876,M:FORL=1TO25:NEXTL,M
113 PRINT"*****"
114 FORF=1TO25:NEXT
115 NEXTL
116 S=S+100:GOTO6
```

```
500 PRINT"City Bomber";
501 PRINT"MI. HEGERTY"
502 PRINT"LAND THE SHIP ON THE CITY! YOU MUST DESTROY THE
503 SKYSCRAPERS USING SPACE";
504 PRINT"TO DROP A BOMB."
505 PRINT"Each level of a building is worth
506 10 points."
507 PRINT"IF YOU CRASH, YOUR GO IS OVER."
508 PRINT"Level 9 is the easiest 1 is the hardest"
509 GOSUB1000
510 PRINT"SELECT LEVEL (1-9)";
511 SYS65508:LE=VAL(CHR$(PEEK(780))):IFLE<10RLE>9THEN582
512 PRINTLE
513 PRINT"*****PRESS ANY KEY*"
514 WAIT198,1:RETURN
515 END
516 POKE56,28:POKE55,0
517 IFPEEK(7300)=64THEN1020
518 FORF=7168TO7680:POKEF,PEEK(25600+F):NEXT
519 FORF=7424TO7431:POKEF,0:NEXT
520 POKE828,0:POKE829,0
521 FORF=7480TO7487+8*8
522 READXX:POKEF,XX:NEXT
523 IFPEEK(0)=76THENPOKE0,0
524 PRINTCHR$(142),CHR$(8)
525 RETURN
526 DATA127,127,73,73,73,73,127,127
527 DATA8,8,8,28,62,62,127,127
528 DATA128,128,255,255,159,255,17,55
529 DATA0,0,240,240,232,252,0,129
530 DATA0,56,16,16,56,56,16
531 DATA17,19,19,255,255,19,19,17
532 DATA60,66,157,145,145,157,66,60
533 DATA0,0,0,0,0,8,8,16
534 DATA170,85,170,85,170,85,170,85
535 DATA140,40,0,5,140,40,0,5,150,40,0,1
```

City Bomber
by Ian Hegarty

Draw

on BBC Micro

This program will run on the BBC model A or B. It can be used to experiment with drawing rectangles, polygons, circles, or cones. Shapes drawn can easily be erased, redrawn, translated or scaled.

Program notes:

Lines
20 Selects a red background and yellow foreground.

50 Sets up a two line text window at the top of the screen.
60 Selects centre of shape, eg 640,512 is the middle of the screen.
70 Radii, if A = B shape is symmetrical, eg 100,100.
80 Number of sides to shape. With sides > 20 the closer shape becomes a circle.
90 to 100 Option to connect up corners of shape to a given point thereby producing a cone effect.
130 to 160 Input statement. Translate (T) moves object centre point to new position and redraws. Scale (S), multiplying factor; increases or decreases overall size of object. Clg (C), can be used to clear

180

240

300 to 430

440 to 480

entire graphics area and start again.
Input values used to translate shape.
Input string used to enable erase to work (if required) before using Val function to convert string to number.
Input multiplying factors to produce scaling. String used again as in line 180.
Procedure used to draw required shape.
Procedure used to erase last shape in response to input 'E'.

Turn to page 22

from page 21

```

10 CLS :MODE4
20 VDU 19,0,1,0,0,0,19,1,3,0,0,0
30 LET H=0:LET V=0:LET S1=1:LET S2=1
50 VDU 28,0,1,39,0
60 INPUT "CENTRE X Y "HS,V$
70 INPUT "RADII A,B "A,B
80 INPUT "NUMBER OF SIDES "N
90 INPUT "CONE GEN(Y/N) "ZC$: IF ZC$="N" THEN 110
100 INPUT "POINT OF CONE X,Y " PX, PY
110 ANGLE=2*PI/N
120 CLS :PROCdraw
130 INPUT "(T)ranslate (S)cale or (C)LG...?"A$
140 IF A$="T" GOTO 180
150 IF A$="S" GOTO 240
160 IF A$="C" CLG
170 GOTO 30
180 INPUT "HORIZ SHIFT, VERT SHIFT " H$,V$
190 INPUT "(E)rase or (CR)...?" A$
200 IF A$="E" PROCdelete
210 LET H=VAL(H$):LET V=VAL(V$)
220 PROCdraw
230 GOTO 130
240 INPUT "HORIZ STRETCH, VERT STRETCH "S1$,S2$
250 INPUT "(E)rase or (CR)...?" A$
260 IF A$="E" PROCdelete
270 LET S1=VAL(S1$):LET S2=VAL(S2$)
280 PROCdraw
290 GOTO 130
300 DEF PROCdraw
310 C=COS(ANGLE):S=SIN(ANGLE)
320 XA=1:YA=1
330 FOR I=1 TO N+1
340 X=XA*C-YA*S:Y=XA*S+YA*C
360 XA=X:YA=Y
370 IF I>1 THEN 380 ELSE 390
380 DRAW ((A*S1)*XA+HS)+H,((B*S2)*YA+VS)+V
390 MOVE ((A*S1)*XA+HS)+H,((B*S2)*YA+VS)+V
400 IF ZC$="N" THEN 420
410 MOVE PX, PY: DRAW((A*S1)*XA+HS)+H,((B*S2)*YA+VS)+V
420 NEXT I
430 ENDPROC
440 DEF PROCdelete
450 GCOL 0,0
460 PROCdraw
470 GCOL 0,1
480 ENDPROC

```

Draw
by Barry Wells

```

1 REM
2 LET I=PEEK 23635+256*PEEK 2
3635: LET end=PEEK 1)+2)+256*PEEK
K (1+3)
5 LET start=1+5: LET instr=st
art-1
6 LET amnt=end-2
15 BRIGHT 1: CLS : LET Z$=""
20 PRINT "*****
***** DATA build
er program *****
L Newman *****
*****
25 PRINT "This program allows
entry of numeric, alphabetic or
mixed data which is built in
to a DATA line."
30 PRINT "Data is entered in
e this --- Nfor n12.3 -- for
numeric --- Afor abcd -- for al
phabetic
35 BEEP .2,30: PRINT "Use sym
-shift A to finish": GO SUB 550
40 INPUT FLASH 1: "Data value ?

```

```

", LINE A$: IF A$="" THEN GO TO
40
42 IF A$=" STOP " THEN GO TO 6
10
45 GO SUB 500: IF I<>-1 AND LE
N A$>1 THEN GO TO 55
50 BEEP .2,10: GO TO 40
55 IF I=1 THEN GO TO 55
60 FOR J=2 TO LEN A$
65 IF A$(J)="" THEN GO TO 75
70 IF A$(J)="" OR A$(J)="" T
HEN GO TO 60
75 NEXT J: GO TO 55
80 PRINT AT 21,0;Z$:AT 21,0: F
LASH 1: "Error in numeric data"
PAUSE 100: PRINT AT 21,0: FLASH
9:Z$: GO TO 40
85 LET I=LEN A$-1+2*(I=1)
90 IF LEN A$-2+1+2*(I=1)=2001
THEN GO TO 570
95 BEEP .2,30
100 IF I=0 THEN GO TO 110
105 POKE start,34: LET start=st
art+1

```

Data Statement Builder on Spectrum

The construction of Basic *Data* statements can be a very tedious task especially when there is a lot of mixed (numeric and alphabetic) data in the line. This might often be the case when very complex displays are being *Drawn* or *Plotted*. This program was designed to make the construction of a complex *Data* statement a little less tedious. It relieves the user of the need to remember the interval commas, and the quotes round alphanumeric data.

The data to be stored is housed in a *Rem* statement which the program converts to a *Data* line at the finish of the program. The user only needs to edit the line to remove surplus bytes at the statement's end — and your *Data* statement is ready for the rest of your program. The length of line 1 must be equal at least to the amount of data you want to store.

Lines 550 and 560 check for the presence of the *Rem* and the amount in it, if present. Lines 2 to 8 determine the start of the *Basic* program, the address of the first byte after *Rem* and the amount of space in it.

Data is entered in two forms — A Test for alphabetical data (strings); and N 12.45 for numeric data. The presence of illegal characters in numeric data is checked in lines 60 to 75. Line 85 determines the length of the whole string to be poked into the *Rem*, viz the enclosing quotes for string variables plus the comma following the value.

Subroutine 500 is the routine that checks the type of data present. Only N or A prefixed data is allowed. Lines 105 to 130 *Poke* the data into the *Rem* with enclosing quotes if needed, and follow with a comma. The data just entered is printed on-screen at line 140 and the available bytes up-dated and checked in subroutine 560. Accepted data is signalled by a high *BEEP*, rejected data or an error condition by a low *BEEP*.

It would be possible to shorten line 1 after all data is entered, though it was felt that the need to edit out the trailing bytes was a useful point at which to visually inspect the line. Note that the *Rem* must be in line 1, though it could be anywhere if its address is known.

Note that in line 42 *Stop* is the token *Stop*. In line 560 "@" AND amount 'less than sign' 10) will print a leading '@' when the byte count gets below 10. @ = space. Several possible uses could be made of this technique; viz building *Plot* and *Draw* data lines and large amounts of string data for screen printing.

```

110 FOR J=1 TO I-1-2*(I=1)
115 POKE start,CODE A$(J+1)
120 LET start=start+1: NEXT J
125 IF I=1 THEN POKE start,A$:
LET start=start+1
130 POKE start,44: LET start=st
art+1
135 LET amnt=amnt-1: GO SUB 550
140 PRINT AT 20,0;Z$:Z$:AT 20,0
; "last data=";A$(2 TO I)
145 GO TO 40
500 LET I=-1
510 IF A$(1)="" OR A$(1)="" T
HEN LET I=1: RETURN

```

To next page

Open Forum

```

520 IF a$(1)="N" OR a$(1)="n" T
HEN LET t:=0: RETURN
530 RETURN
550 IF PEEK (l+4)>234 THEN PRI
NT at 6,5; FLASH 1;"NO REM O.F.A.S.E
n": GO TO 600
560 PRINT at 6,4;" " AND (aand1
10);aand1;" bytes, indir. punctuation
n"
565 IF aand1:1 THEN GO TO 500
570 PRINT at 6,4; FLASH 1;"No r
oom - extend line 3 " : GO TO
600
580 RETURN
590 BEEP 1,-10: STOP
610 POKE instr,228
620 CLS : PRINT at 10,0;"!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!"Y

```

```

must now edit line 1 to ""elim
inate trailing dots/commas""!!!
!!!!!!!!!!!!!!!!!!!!!!
630 PAUSE 200; CLS ; LIST
700 SAVE "databuild" LINE 5

```

=====

DATA builder program
© Sept 1982 by P-L Newman

7 bytes,incl.punctuation

=====

```

This program allows entry of
numeric, alphabetic or mixed data
which is built into a DATA line.
Data is entered like this --
Nfor n|12.3 -- for numeric
Afor alabcd -- for alphabetic
Use sym-shift A to finish
last data= 12.98

```

Data Statement Builder

by Paul Newman

Grandprix

on Dragon

This game, for the Dragon 32 computer, is called Grandprix and uses full colour hi-resolution graphics and sound. The program simulates a day at the races; you start with £500 and must bet on which car will win; there are four races to each game.

After placing your bet, the lights will go red, yellow, green and away they go. Your

car will be shown in yellow. As well as being a fun game, this program demonstrates many of the Dragon's advanced graphic capabilities and if studied it should help clarify some of the short-comings of the manual.

When the cars are actually racing, the cassette player is switched on and any tape in it will be played through the tv speaker. I use a tape of real racing cars which is very effective with the graphics,

but music could be just as good.

Program notes:

Lines	
10 to 70	Define the racing cars and place them into the two arrays A & B: A is a blue car, B a yellow one (player's car).
80 to 210	Initialise and place bets, check if run out of money.
220 to 390	Draw the track, put the cars at the start, draw the traffic lights and work them and turns on cassette player.
400 to 480	Race the cars.
480 to 550	Results and messages also add winnings if necessary.

```

10 PMODE3,1:COLOR3,1:PCLS
20 AS="BM4,0R9D3L9NU3R4D4R1U3D4L5R28D7L28U7R20U5L2U1R5D1L2D4BD8D5R2D1L5
U1R2U5L15D5R4D3L9U3R4U5BU2BR4R9U3L9D3"
30 DRAW"C3XA$;"
40 PAINT(7,2),3,3:PAINT(7,21),3,3:PAINT(6,12),3,3:PAINT(15,12),4,3
50 DIM A(35,25):GET(0,0)-(35,25),A,G
60 PCLS:DRAW"C2XA$;":PAINT(15,12),4,2:PAINT(7,2),2,2:PAINT(7,21),2,2:PA
INT(7,12),2,2:DIM B(35,25):GET(0,0)-(35,25),B,G
70 PCLS
80 Y(1)=10:Y(2)=60:Y(3)=110:Y(4)=160:RA=0:PT=500
90 PCLS:'PLACE BETS
100 IF PT<=0 THEN 540
110 CLS
120 PRINT "RACE NUMBER"RA+1:PRINT
130 PRINT "YOU HAVE $"PT:SOUND 190,1
140 PRINT:SOUND190,1:INPUT "HOW MUCH DO YOU BET";PB
150 IF PB>PT OR PB<=0 THEN 90
160 PT=PT-PB
170 SOUND 190,1:PRINT
180 INPUT "WHICH CAR DO YOU BET ON (1-4)";PC
190 IF PC=1 OR PC=2 OR PC=3 OR PC=4 THEN 200 ELSE 170
200 PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT"          STAND BY":PRINT:
PRINT:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT
210 SCREEN 0,1:PLAY"T30V2002AEDCAEDCAEDCAEDC":FORDD=1TO1000:NEXTDD
220 'START RACE
230 SCREEN 1,0
240 X(1)=0:X(2)=0:X(3)=0:X(4)=0
250 FOR I=1 TO 4:PUT(X(I),Y(I))-(X(I)+35,Y(I)+25),A,PSET:NEXTI
260 COLOR 4,1:LINE(0,3)-(238,3),PSET:LINE(0,47)-(238,47),PSET:LINE(0,97)
-(238,97),PSET:LINE(0,147)-(238,147),PSET:LINE(0,192)-(238,192),PSET
270 FOR Y=3 TO 192 STEP8
280 LINE(242,Y)-(245,Y+3),PSET,BF:LINE(246,Y+4)-(249,Y+7),PSET,BF:NEXTY
290 COLOR3,1:LINE(100,55)-(120,90),PSET,BF
300 COLOR 4,1:LINE(106,58)-(115,63),PSET,BF:SOUND190,1:TIMER=0
310 IF TIMER<100 THEN 310
320 COLOR3,1:LINE(106,58)-(115,63),PSET,BF
330 COLOR2,1:LINE(106,68)-(115,73),PSET,BF:SOUND190,1:TIMER=0
340 IF TIMER<100 THEN 340
350 COLOR3,1:LINE(106,68)-(115,73),PSET,BF
360 COLOR1,1:LINE(106,78)-(115,83),PSET,BF:SOUND190,1:TIMER=0
370 IF TIMER<60 THEN 370
380 MOTOR ON:AUDIO ON
390 COLOR1,1:LINE(100,55)-(120,90),PSET,BF:COLOR3,1
400 C=RND(4)
410 FOR A=1 TO 4

```

Turn to next page

Open Forum

from page 23

```

420 X=X(C):X(C)=X(C)+RND(15)*2
430 FOR M=X+2 TO X(C) STEP 4
440 IF C=PC THEN PUT(M,Y(C))-(M+35,Y(C)+25),B,PSET ELSE PUT(M,Y(C))-(M+3
5,Y(C)+25),A,PSET
450 IF M>210 THEN 490
460 NEXT M
470 C=C+1:IF C=5 THEN C=1
480 NEXT A:GOTO 400
490 AUDIOOFF:MOTOR OFF:RA=RA+1:IF PC=C THEN 510
500 FORD=1TO500:NEXTD:SOUND100,4:SCRBN0,0:CLS:PRINT#266,"BAD LUCK!!!":I
F RA=4 THEN 520 ELSE FORD=1TO2000:NEXTD:GOTO90
510 PLAY"T25V3103ABCDEFGHABCDEFGHABCDEFGH":CLS:PRINT#266,"WELL DONE!!!":PRI
NT#330,"YOU WIN $"PB*3:SCREEN0,1:PT=PT+PB*3:FORD=1TO2000:NEXTD:IFRA<4THE
N90
520 CLS:PRINT#264,"***GAME OVER***":PLAY"T25V3102GFEDCGFEDCGFEDCGFEDC":P
RINT:PRINT:PRINT:PRINT"YOUR TOTAL NOW $"PT:PRINT:PRINT:SCREEN0,1
530 FOR D=1TO2000:NEXTD:END
540 *OUT OF MONEY
550 A$=CHR$(143+96):CLS7:PRINT#262,"YOU"AS"ARE"AS"OUT"AS"OF"AS"MCNEY":S
OUND100,1:FORD=1TO2000:NEXTD:PRINT#480,"":END

```

Grandprix
by Brian Cadge

Leopard

on ZX81

This is a game for the ZX81 with the 16K Ram. The program traps you in the jungle at midnight with a hungry leopard. You can only see the whites of his eyes and you have five bullets which are really more like guided missiles. Each bullet has a life of approximately 15 seconds before it explodes; the leopard moves about quickly from place to place.

Success in catching the leopard depends to some extent upon luck but also on the skill with which the operator moves about on the cursor keys. The moving display celebrates your success with the words "Well done, you are safe" but

failure results in a moving display which gives the disgusting sound of a leopard munching its prey (or at least, that's the intention!).

Program notes:

Lines:

- 1 Complaints that the game is too difficult have forced the compiler to include this Rem line, giving details of how to make it easier.
- 25 to 90 Gives instructions and explains the game.
- 200 to 220 Fills the screen with inverse spaces.
- 230 to 270 Sets up the variables: X and Y (position of moving bullet); G (length of time leopard stays in one place); Z (life of bullet); M (no. of bullets).
- 280 to 290 Prints information showing position of bullet and its number. Sends program to subroutine 3000, for position of leopard's eyes.

- 300 to 470 Loop for moving bullet; each trip through the loop adds 1 to the variables G and Z, checks their values, limits the values of X and Y to prevent going "off-screen" and checks the position of XY in relation to AB (the position of the leopard).
- 1000 to 1110 This subroutine shows the explosion of the bullet, adds one to M (no. of bullets used), reduces Z (life of bullet) to 0 and returns.
- 3000 to 3050 Changes the position of the leopard, signified by graphics character shifted E printed twice. Returns G to 0, G being the measure of the length of time the position of the leopard remains static.
- 4000 to 4080 When M = 6, all bullets are gone. A moving display is set up to tell you what has happened.
- 5000 to 5250 Gives a display showing the bullet hitting the leopard, gives the number of bullets used and celebrates with a moving display of congratulations!

```

1 REM : TO MAKE THE GAME EASI
ER, CHANGE LINE 490 TO: IF Z=100
THEN GOSUB 1000
10 REM : LEOPARD
20 REM : EVE GORTON
25 PRINT TAB 6,"SPOT THE LEOPA
RD"
30 PRINT AT 3,0;"MIDNIGHT IN T
HE JUNGLE...THERE IS A HUNGRY L
EOPARD AFTER YOU...ALL YOU CAN
SEE ARE THE WHITES OF HIS EYES"
40 PRINT AT 10,3;"YOU HAVE 5 B
ULLETS - CONTROL KEYS 5,6,7 AND
8"
50 PRINT AT 15,0;"A BULLET LAS
TS 15 SECONDS, THEN IT GOES BANG"
70 PRINT AT 10,0;"WATCH OUT-LE
OPARDS MOVE QUICKLY"
80 PRINT AT 20,0;"PRESS 0 TO G
O ON"
90 IF INKEY$<"0" THEN GOTO 90
200 FOR N=0 TO 20
210 PRINT AT N,0;"
220 NEXT N
230 LET G=0
240 LET Z=0
250 LET M=1
260 LET X=20
270 LET Y=10
280 PRINT AT 20,10;"E";AT 21,10
;"BULLET NO. "M
290 GOSUB 3000
300 REM MOVING BULLET
310 PRINT AT X,Y;"E"
320 LET G=G+1
330 LET Z=Z+1
340 PRINT AT X,Y;"E"
350 IF INKEY$="7" THEN LET X=X-
1
360 IF INKEY$="6" THEN LET X=X+
1

```

```

370 IF INKEY$="5" THEN LET Y=Y-
1
380 IF INKEY$="8" THEN LET Y=Y+
1
390 IF Z=45 THEN GOSUB 1000
400 IF G=10 THEN PRINT AT A,B;"
410 IF G=10 THEN GOSUB 3000
420 IF X<0 THEN LET X=0
430 IF Y<0 THEN LET Y=0
440 IF X>20 THEN LET X=20
450 IF Y>30 THEN LET Y=30
460 IF X=A AND Y=B OR X=A AND Y
=B+1 THEN GOTO 5000
470 GOTO 300
1000 REM BANG
1010 PRINT AT X,Y;"BANG"
1020 FOR J=0 TO 9
1030 NEXT J
1040 PRINT AT X,Y;"E"
1050 LET Z=0
1060 LET X=20
1070 LET Y=20
1080 LET M=M+1
1090 IF M=6 THEN GOTO 4000
1100 PRINT AT 21,10;"BULLET NO. "
1110 RETURN
3000 REM LEOPARD MOVE
3010 LET A=INT (RND*18)+1
3020 LET B=INT (RND*28)+2
3030 PRINT AT A,B;"E"
3040 LET G=0
3050 RETURN
4000 REM BULLETS GONE
4010 CLS
4020 PRINT AT 5,0;"ALL BULLETS G
ONE - YOU ARE"
4030 LET A$=" LEOPARDFOOD - MUNC
H SLURP CROMP"
4040 FOR X=0 TO 45
4050 PRINT AT 10,0,A$
4060 LET A$=A$(2 TO )+A$(1)
4070 NEXT X

```

```

4080 STOP
5000 REM DEAD LEOPARD
5010 PRINT AT A,B;"E"
5020 FOR J=0 TO 5
5030 NEXT J
5040 PRINT AT A,B;"E"
5050 FOR J=0 TO 5
5060 NEXT J
5070 PRINT AT A-2,B-2;"GOTTIN"
5080 FOR J=0 TO 20
5090 NEXT J
5100 PRINT AT 21,1;"NO.OF BULLET
S USED. "M
5110 LET A$=" WELL DONE -- YOU
ARE SAFE --"
5120 FOR X=0 TO 45
5130 PRINT AT 10,0,A$
5140 LET A$=A$(2 TO )+A$(1)
5150 NEXT X

```

GRAPHICS

- Line 210 32 inverse spaces
- Line 310 inverse *
- Line 340 inverse space
- Line 400 2 inverse spaces
- Line 1040 4 inverse spaces
- Line 3030 2 shifted Es
- Line 5010 2 inverse *s
- Line 5040 2 inverse dollar signs

Leopard
by Eve Gorton

Open Forum

Four Up

on Spectrum

This game is based on the children's game Connect Four where you must try to get four in a row (vertical, horizontal or diagonal) before the computer. The program can give you a tough time but not so tough that you can't win.

After the opening moves the Spectrum appears to be thinking — it keeps pointing to different slots which sometimes will have you bytng your nails. It is fully automatic, will keep score and inform you of the winner.

```

5 REM FOUR UP By Jim Walsh.
10 GO SUB 2000: GO SUB 3000
15 DATA 7,15,31,63,127,255,255
255,255,255,255,255,255,255,255
17 DATA 127,63,31,15,7,255,255
255,255,255,255,255,255,255,255
19 DATA 15,8,4,2,1,0,2,4,8,16,
32,64,128
25 RESTORE : FOR n=1 TO 47: RE
AD a: POKE 32600+n,3: NEXT n
30 a=0: b=0: c=0: d=0: e=0: f=0: g=0: h=0: i=0: j=0: k=0: l=0: m=0: n=0: o=0: p=0: q=0: r=0: s=0: t=0: u=0: v=0: w=0: x=0: y=0: z=0: aa=0: ab=0: ac=0: ad=0: ae=0: af=0: ag=0: ah=0: ai=0: aj=0: ak=0: al=0: am=0: an=0: ao=0: ap=0: aq=0: ar=0: as=0: at=0: au=0: av=0: aw=0: ax=0: ay=0: az=0: ba=0: bb=0: bc=0: bd=0: be=0: bf=0: bg=0: bh=0: bi=0: bj=0: bk=0: bl=0: bm=0: bn=0: bo=0: bp=0: bq=0: br=0: bs=0: bt=0: bu=0: bv=0: bw=0: bx=0: by=0: bz=0: ca=0: cb=0: cc=0: cd=0: ce=0: cf=0: cg=0: ch=0: ci=0: cj=0: ck=0: cl=0: cm=0: cn=0: co=0: cp=0: cq=0: cr=0: cs=0: ct=0: cu=0: cv=0: cw=0: cx=0: cy=0: cz=0: da=0: db=0: dc=0: dd=0: de=0: df=0: dg=0: dh=0: di=0: dj=0: dk=0: dl=0: dm=0: dn=0: do=0: dp=0: dq=0: dr=0: ds=0: dt=0: du=0: dv=0: dw=0: dx=0: dy=0: dz=0: ea=0: eb=0: ec=0: ed=0: ee=0: ef=0: eg=0: eh=0: ei=0: ej=0: ek=0: el=0: em=0: en=0: eo=0: ep=0: eq=0: er=0: es=0: et=0: eu=0: ev=0: ew=0: ex=0: ey=0: ez=0: fa=0: fb=0: fc=0: fd=0: fe=0: ff=0: fg=0: fh=0: fi=0: fj=0: fk=0: fl=0: fm=0: fn=0: fo=0: fp=0: fq=0: fr=0: fs=0: ft=0: fu=0: fv=0: fw=0: fx=0: fy=0: fz=0: ga=0: gb=0: gc=0: gd=0: ge=0: gf=0: gg=0: gh=0: gi=0: gj=0: gk=0: gl=0: gm=0: gn=0: go=0: gp=0: gq=0: gr=0: gs=0: gt=0: gu=0: gv=0: gw=0: gx=0: gy=0: gz=0: ha=0: hb=0: hc=0: hd=0: he=0: hf=0: hg=0: hh=0: hi=0: hj=0: hk=0: hl=0: hm=0: hn=0: ho=0: hp=0: hq=0: hr=0: hs=0: ht=0: hu=0: hv=0: hw=0: hx=0: hy=0: hz=0: ia=0: ib=0: ic=0: id=0: ie=0: if=0: ig=0: ih=0: ii=0: ij=0: ik=0: il=0: im=0: in=0: io=0: ip=0: iq=0: ir=0: is=0: it=0: iu=0: iv=0: iw=0: ix=0: iy=0: iz=0: ja=0: jb=0: jc=0: jd=0: je=0: jf=0: jg=0: jh=0: ji=0: jj=0: jk=0: jl=0: jm=0: jn=0: jo=0: jp=0: jq=0: jr=0: js=0: jt=0: ju=0: jv=0: jw=0: jx=0: jy=0: jz=0: ka=0: kb=0: kc=0: kd=0: ke=0: kf=0: kg=0: kh=0: ki=0: kj=0: kl=0: km=0: kn=0: ko=0: kp=0: kq=0: kr=0: ks=0: kt=0: ku=0: kv=0: kw=0: kx=0: ky=0: kz=0: la=0: lb=0: lc=0: ld=0: le=0: lf=0: lg=0: lh=0: li=0: lj=0: lk=0: ll=0: lm=0: ln=0: lo=0: lp=0: lq=0: lr=0: ls=0: lt=0: lu=0: lv=0: lw=0: lx=0: ly=0: lz=0: ma=0: mb=0: mc=0: md=0: me=0: mf=0: mg=0: mh=0: mi=0: mj=0: mk=0: ml=0: mm=0: mn=0: mo=0: mp=0: mq=0: mr=0: ms=0: mt=0: mu=0: mv=0: mw=0: mx=0: my=0: mz=0: na=0: nb=0: nc=0: nd=0: ne=0: nf=0: ng=0: nh=0: ni=0: nj=0: nk=0: nl=0: nm=0: nn=0: no=0: np=0: nq=0: nr=0: ns=0: nt=0: nu=0: nv=0: nw=0: nx=0: ny=0: nz=0: oa=0: ob=0: oc=0: od=0: oe=0: of=0: og=0: oh=0: oi=0: oj=0: ok=0: ol=0: om=0: on=0: oo=0: op=0: oq=0: or=0: os=0: ot=0: ou=0: ov=0: ow=0: ox=0: oy=0: oz=0: pa=0: pb=0: pc=0: pd=0: pe=0: pf=0: pg=0: ph=0: pi=0: pj=0: pk=0: pl=0: pm=0: pn=0: po=0: pp=0: pq=0: pr=0: ps=0: pt=0: pu=0: pv=0: pw=0: px=0: py=0: pz=0: qa=0: qb=0: qc=0: qd=0: qe=0: qf=0: qg=0: qh=0: qi=0: qj=0: qk=0: ql=0: qm=0: qn=0: qo=0: qp=0: qq=0: qr=0: qs=0: qt=0: qu=0: qv=0: qw=0: qx=0: qy=0: qz=0: ra=0: rb=0: rc=0: rd=0: re=0: rf=0: rg=0: rh=0: ri=0: rj=0: rk=0: rl=0: rm=0: rn=0: ro=0: rp=0: rq=0: rr=0: rs=0: rt=0: ru=0: rv=0: rw=0: rx=0: ry=0: rz=0: sa=0: sb=0: sc=0: sd=0: se=0: sf=0: sg=0: sh=0: si=0: sj=0: sk=0: sl=0: sm=0: sn=0: so=0: sp=0: sq=0: sr=0: ss=0: st=0: su=0: sv=0: sw=0: sx=0: sy=0: sz=0: ta=0: tb=0: tc=0: td=0: te=0: tf=0: tg=0: th=0: ti=0: tj=0: tk=0: tl=0: tm=0: tn=0: to=0: tp=0: tq=0: tr=0: ts=0: tt=0: tu=0: tv=0: tw=0: tx=0: ty=0: tz=0: ua=0: ub=0: uc=0: ud=0: ue=0: uf=0: ug=0: uh=0: ui=0: uj=0: uk=0: ul=0: um=0: un=0: uo=0: up=0: uq=0: ur=0: us=0: ut=0: uu=0: uv=0: uw=0: ux=0: uy=0: uz=0: va=0: vb=0: vc=0: vd=0: ve=0: vf=0: vg=0: vh=0: vi=0: vj=0: vk=0: vl=0: vm=0: vn=0: vo=0: vp=0: vq=0: vr=0: vs=0: vt=0: vu=0: vv=0: vw=0: vx=0: vy=0: vz=0: wa=0: wb=0: wc=0: wd=0: we=0: wf=0: wg=0: wh=0: wi=0: wj=0: wk=0: wl=0: wm=0: wn=0: wo=0: wp=0: wq=0: wr=0: ws=0: wt=0: wu=0: wv=0: ww=0: wx=0: wy=0: wz=0: xa=0: xb=0: xc=0: xd=0: xe=0: xf=0: xg=0: xh=0: xi=0: xj=0: xk=0: xl=0: xm=0: xn=0: xo=0: xp=0: xq=0: xr=0: xs=0: xt=0: xu=0: xv=0: xw=0: xx=0: xy=0: xz=0: ya=0: yb=0: yc=0: yd=0: ye=0: yf=0: yg=0: yh=0: yi=0: yj=0: yk=0: yl=0: ym=0: yn=0: yo=0: yp=0: yq=0: yr=0: ys=0: yt=0: yu=0: yv=0: yw=0: yx=0: yy=0: yz=0: za=0: zb=0: zc=0: zd=0: ze=0: zf=0: zg=0: zh=0: zi=0: zj=0: zk=0: zl=0: zm=0: zn=0: zo=0: zp=0: zq=0: zr=0: zs=0: zt=0: zu=0: zv=0: zw=0: zx=0: zy=0: zz=0
100 CLS: BORDER 0: PRINT AT 2,
0: "": FOR n=1 TO 6: PRINT INK 2
,"": NEXT n
105 PRINT INK 2: "
110 PAUSE 20: FOR n=0 TO 2: PRI
NT PAPER 5, AT n,0: "
115 PAUSE 20: FOR n=3 TO 21: PR
INT AT n,0: PAPER 5: "
120 PAUSE 20: FOR n=3 TO 31: PR
INT AT n,27: PAPER 5: "
125 PAUSE 50: BEEP .5, -20: PRIN
T AT 0,5: INK 0: "Press any key t
o start": PAUSE 0
130 PRINT AT 0,5: PAPER 5: "
134 REM 32600-32767: BEEP .25,25
135 LET r=INT (RND*10+1):
IF r>5 THEN LET go=1
137 LET z=0: LET d=6: LET found
=0: LET move=0
140 FOR n=1 TO 900: NEXT n
145 LET move=move+1: LET go=go+
1: IF move>42 THEN GO TO 1100
152 IF go=1 THEN GO TO 300
155 PRINT AT 0,14: BRIGHT 0: PA
PER 6: INK 1: "My Move": BEEP .25
157 PAUSE 100
160 PRINT AT 0,14: BRIGHT 0: PA
PER 5: "
165 LET sf=1: LET z=2: LET x3=0
166 IF move<5 THEN GO TO 275
168 GO SUB 650
170 LET z=1: GO SUB 650
173 LET z=2: IF found=1 THEN LE
T a(y+1,x)=0
174 IF found=1 THEN GO TO 850
175 IF x3<>0 THEN GO TO 870
176 LET u=INT (RND*7)+2: IF a(2
,u)<>0 THEN GO TO 275
177 LET y=2: LET x=0
180 PRINT AT 1,d: PAPER 5: "
AT 2,d: "AT 1,3+((x-1)*3): IN
K 1: FLASH 1: "AT 2,3+((x-1)*
3): "PAUSE 100: "
183 GO SUB 400
185 PAUSE 100: PRINT AT 1,3+((x
-1)*3): PAPER 5: "AT 2,3+((x-
1)*3): "
190 GO TO 250
195 PRINT AT 0,12: INK 1: PAPER
6: BRIGHT 1: "Your Move": BEEP .
25,35
200 PAUSE 100: LET sf=0
205 PRINT AT 0,12: BRIGHT 0: PA
PER 5: "
209 LET c=1: LET d=15: LET x=5:
LET y=2: LET z=1
210 PRINT PAPER 5: INK 0: FLASH
1: AT c,d: "AT c+1,d: "
215 PAUSE 1: LET z=INKEY$: IF
z$="" THEN GO TO 315
217 IF z$="0" OR z$="8" OR z$=" " THEN GO TO 320
218 GO TO 315
220 BEEP .2,12: PRINT AT c,d: P
APER 5: "AT c+1,d: "
225 IF z$="0" THEN LET d=d+3
226 IF z$="8" THEN LET x=x+1
230 IF d>24 THEN LET d=24
231 IF x>8 THEN LET x=8
235 IF z$=" " THEN LET d=d-3
236 IF z$=" " THEN LET x=x-1
240 IF d<6 THEN LET d=6
241 IF x<2 THEN LET x=2
245 IF z$="0" THEN GO TO 355
250 GO TO 310

```

```

355 IF a(2,x)<>0 THEN GO TO 309
356 GO SUB 400: REM drop
358 GO SUB 700: IF found=1 THEN
GO TO 1000
395 GO TO 250
400 REM drop
401 IF a(y+1,x)=0 THEN LET y=y+
1
405 IF a(y+1,x)<>0 THEN GO TO 4
20
410 GO TO 401
420 LET a(y,x)=z
450 LET a=1: LET b=3
455 IF z=1 THEN LET in=6
460 IF z=1 THEN LET pa=1
465 IF z=2 THEN LET in=1
470 IF z=2 THEN LET pa=6
475 LET a=a+(y-1)*3: LET b=b+(x
-1)*3
480 PRINT INK in: PAPER pa: AT a
,b: "AT a+1,b: "
485 RETURN
500 IF sf=0 THEN RETURN
505 PRINT AT 1,d: PAPER 5: "
AT 2,d: "
510 LET d=5+INT (RND*5)*3
515 PRINT INK 1: FLASH 1: AT 1,d
,"AT 2,d: "REM Graphics
520 PAUSE 5: RETURN
530 LET n=0: LET temp=0
535 LET t=a(y+n,x): IF t=z THEN
LET temp=temp+1
540 LET n=n+1: IF z=t THEN GO T
O 535
545 IF temp>=4 THEN LET found=1
546 IF temp>2 AND z=1 THEN LET
x3=x
550 RETURN
555 LET n=0: LET temp=0
560 LET t=a(y+n,x): IF t=z THEN
LET temp=temp+1
565 LET n=n+1: IF t=z THEN GO T
O 555
567 LET t=a(y,n,x+n): IF t=z THEN
LET temp=temp+1
569 LET n=n+1: IF t=z THEN GO T
O 567
570 IF temp>=4 THEN LET found=1
571 IF temp>2 AND z=1 THEN LET
x3=x
572 RETURN
575 LET n=1: LET temp=0
577 LET t=a(y+n,x+n): IF t=z TH
EN LET temp=temp+1
579 LET n=n+1: IF t=z THEN GO T
O 577
581 LET n=0
583 LET t=a(y-n,x-n): IF t=z TH
EN LET temp=temp+1
585 LET n=n+1: IF t=z THEN GO T
O 583
587 IF temp>=4 THEN LET found=1
588 IF temp>2 AND z=2 THEN LET
x3=x
589 RETURN
590 LET n=0: LET temp=0
595 LET t=a(y+n,x-n): IF t=z TH
EN LET temp=temp+1
610 LET n=n+1: IF t=z THEN GO T
O 595
615 LET n=1
620 LET t=a(y-n,x+n): IF t=z TH
EN LET temp=temp+1
625 LET n=n+1: IF t=z THEN GO T
O 620
630 IF temp>=4 THEN LET found=1
632 IF temp>2 AND z=2 THEN LET
x3=x
635 RETURN
640 LET found=0
645 FOR x=2 TO 8: FOR y=7 TO 2
STEP -1:
650 LET a(y,x): IF t=0 THEN G
O SUB 690
655 IF found=1 THEN GO TO 800
660 NEXT x: NEXT y
675 LET y=2: RETURN
680 IF a(y+1,x)=0 THEN RETURN
691 LET a(y,x)=z: GO SUB 700
692 IF found=0 THEN LET a(y,x)=
0
693 IF found=1 THEN LET y1=y
694 IF found=1 THEN LET x1=x
695 RETURN
700 GO SUB 500: GO SUB 530
705 GO SUB 550
710 GO SUB 500: GO SUB 575
715 GO SUB 600
720 RETURN
800 IF z=1 THEN GO TO 675
802 PRINT AT 1,d: PAPER 5: INK
1: "AT 2,d: "AT 1,3+((x-1)
*3): INK 1: FLASH 1: "AT 2,3+
((x-1)*3): "
805 PAUSE 50
810 GO SUB 450
815 GO TO 1000
850 LET found=0: PRINT AT 1,d:
PAPER 5: "AT 2,d: "AT 1,3+
((x-1)*3): FLASH 1: "AT 2,3+
((x-1)*3): "PAUSE 100: PRINT
PAPER 5: AT 1,3+((x-1)*3): "AT
1,3+((x-1)*3): "
860 GO SUB 400
865 PAUSE 100: GO TO 250
870 LET x=x3: GO TO 650
1000 IF z=1 THEN LET you=you+1
1002 BEEP .5,3: BEEP .2,6: BEEP
.5,3
1005 IF z=2 THEN LET me=me+1
1010 IF z=1 THEN PRINT AT 0,11:
BRIGHT 1: PAPER 6: INK 1: FLASH
1: "YOU WIN"
1015 IF z=2 THEN PRINT AT 0,11:
BRIGHT 1: PAPER 6: INK 1: FLASH
1: "I WIN"
1020 FOR n=1 TO 1000: NEXT n
1025 PRINT AT 0,11: PAPER 5: "
1027 PRINT AT 11,1: PAPER 5: INK
0: "Me": AT 13,2: me: AT 11,20: "You
": AT 13,29: you

```

```

1030 LET a=1: LET b=3
1035 FOR x=2 TO 8: FOR y=7 TO 2
STEP -1
1037 LET a(y,x)=0
1040 PRINT PAPER 7: AT a+((y-1)*3
),b+((x-1)*3): "AT a+1+((y-1)
*3),b+((x-1)*3): "
1045 LET r=INT (RND*12)+1: BEEP
.02,r
1050 NEXT y: NEXT x: PRINT AT 1,
6: PAPER 5: "
AT 2,6: "
1055 GO TO 135
1100 PRINT PAPER 5: INK 0: AT 0,9
: "It's a draw"
1105 FOR x=1 TO 775: NEXT x
1110 PRINT AT 0,9: PAPER 5: "
1115 GO TO 1030
2000 PAPER 6: INK 1: BORDER 6: C
LS: PRINT AT 9,0: "FOUR'S UP!!"
"By Jim Walsh"
2005 PAUSE 300: RETURN
3000 BORDER 7: PAPER 7: INK 0: C
LS
3005 PRINT "Beat the 'Spectru
m to get 'four on the same ve
rtical, 'horizontal or diagona
l. 'Press 0 to go left 'and '0' to dr
op."
3010 PRINT AT 18,5: FLASH 1: "PRE
SS ANY KEY": PAUSE 0: CLS: RETU
RN

```

Four Up

by Jim Walsh

Accounts

on Spectrum

This program should be useful to those who have a building society account. It enables you to work out how much interest you would gain in a certain time, or the percentage of interest you gain for a certain time.

After entering the program you must *Poke* 16518,100 in order to give the variable Z in line 1 the value 100. This, along with a lot of other memory saving techniques, enables the program to fit into the 1K machine.

```

1 LET Z=CODE "?"
2 PRINT "1: CHOOSE: "I
INTEREST: "2: PERCENTAGE: "2
3 INPUT I
4 IF E<>SIGN PI AND E<>VAL "2"
THEN GOTO PI
9 CLS
10 IF E<>SIGN E THEN GOTO Z
20 PRINT "INTEREST: "AT PI+
PI, NOT PI: "ENTER BALANCE: "
30 INPUT A
40 PRINT "E": A, "ENTER INTERE
ST RATE: "
50 INPUT B
60 PRINT B: "PC: "OVER HOW
MANY YEARS? "
70 INPUT C
75 PRINT C
90 LET X=INT (Z*(B/Z+A*C)+VAL
"5")/Z
93 PRINT
T "E": A, "OVERALL"
100 PRINT "PERCENTAGE: "AT E
XP E, NOT PI: "ENTER BALANCE: "
110 INPUT A
115 PRINT "E": A, "ENTER INTERE
ST: "
120 INPUT B
125 PRINT "E": B, "OVER HOW MAN
Y YEARS? "
130 INPUT C
135 PRINT C
CENT INTEREST

```

Accounts

by Mike Dipol

Running on Acorn 6502

Gareth Jones throws some light on the intricacies of the BBC's assembler.

Acorn has supplied an excellent assembler in the BBC machine's Rom. However, the User Guide assumes the reader has a prior knowledge of 6502 machine code. For those Beeb owners who do not have this knowledge, but are interested in machine code, this article will hopefully throw a little light on the subject. Learning how to write simple machine code programs is easy once you have grasped the difference between machine code and Basic. The effort is well worthwhile.

The 6502 is an 8-bit processor, ie it can only deal with numbers in the range 0-255. It can, however, address 64K directly so 16 bits (2 bytes) must normally be used for addressing.

Numbers cannot be stored in variables, as in Basic, they must be stored directly into memory locations one byte at a time. To do this, the number must be in one of three registers, the Accumulator, X register or Y register (all 8 bits long). The instructions to store the contents of these registers are *Sta*, *Stx* and *Sty*. These instructions must be followed by an address to tell the computer where to store the number (different forms of addressing are obtained by using brackets and/or the X and Y registers to give 'indexed addressing').

Status register

Another of the 6502's registers is the Status register. This cannot be used by the programmer directly, but the different bits are set or cleared by the processor according to the outcome of different operations. For example, if an addition was performed and the answer was over 255, the carry flag/bit would automatically be set to 1. You could then subsequently branch (BCS) to another part of your program.

Program 1 inverts the whole of the screen using Basic (see UG page 250 for *Eor*). Next, it clears the screen and assembles the machine code version of 'invert'. Note that it does not execute the code.

In line 70 the Basic variable *Start* was given the address of the first instruction by the assembler. If you now type in 'Call *Start*', control will be transferred from Basic to the code (note the *Return* subroutine (*Rts*) command at the end which passes control back to the Basic interpreter). You may notice that the machine code version is slightly faster.

Program notes — as in Basic you must use a counter to run through all the screen addresses. There is spare memory from &70 to &8F so &70 and &71 can be used to hold the 16-bit address. First, you must *Load* the accumulator with &58 — the high byte of the start of screen memory, then

store it in location &71 (the #&58 means the actual number (immediate addressing), *Lda* &58 loads in the number contained in location &58 (absolute addressing)). The low byte is then stored in &70.

If you are going to have a loop, you must jump back to somewhere, hence line 110. Since you want to *Eor* each memory location with 255, first load the number into the accumulator, then *Eor* it with the number stored in the address given by your counter (&70,&71). The actual syntax for the address is (&70),y which takes the lowest byte from &70, the highest byte from &71 and adds the number in the Y register on to this, ie $\text{address} = (?&70 + (?&71 * 255) + Y)$.

The result of this operation is held in the accumulator, so you must store it back into screen memory. In this example the Y register takes no part in the addressing (line 100 loaded it with 0) but it is necessary in the syntax of the instruction.

The next step is to increment the counter. First, load the lower byte into the accumulator (line 150) then *Add* 1 with *Carry* (*ADC*) to this. Line 140 clears the carry initially.

The highest byte, however, must only be incremented when the lower byte overflows. Adding (0+carry) achieves this. The result is still in the accumulator even after storing the result in memory, therefore you can compare it with the number &80 (high byte of the end address). If they are not the same, branch back to *Label*.

In the user guide there are references to certain routines being 'vectored'. What this means is that when the computer wants to write a character to the screen, it puts the

ASCII code of the character into the accumulator (A) then jumps to subroutine (*JSR*) &FFEE. At &FFEE there is a *Jmp* (&20E) instruction (*Jump*). The brackets serve the same purpose as in program 1, but this time no Y is needed, so control is transferred to the address contained by &20E and &20F, namely &E1BB (the address of the routine to print the character). This seems a rather long way of going about it, a *Jsr* &E1BB would have done the same job. However, if you change the addresses in &20E,&20F you can change the way the computer writes to the screen. This is what program 2 does.

Line 40 calls the subroutine to print the character. Since all of the various routines have a *Rts* at their end, control will be passed back to line 50. Everything sent to the screen now will be printed twice (the *Rts* at the end will this time pass control back to the program which called the modified print routine).

Lastly, you must make &20E and &20F point to the routine. *Double* holds the address, so line 70 places the lower byte in &20E and line 80 places the highest byte into &20F (because of the way the 6502 is designed, you must put the lower byte before the higher byte — the assembler automatically changes round the two bytes when you specify a 16-bit address). This method will work wherever the code is assembled. Once you run the program, there is no need to *Call* it since the machine will do it for you.

Program 2 demonstrates some of the possibilities of relatively simple machine code programs. Program 1 could be useful but it is slow for a machine code program.

```

5 REM ** PROG1 ** GLJ SEP 82 **
10 MODE4:FOR L=1TO100:DRAWNRD(1280),RND(1024):NEXT
20 FOR X%=&5800TO&8000:Y%=?X%:EOR 255:NEXT
30 MODE4
40 FOR Q=0TO1
50 DIM P%100
60EOPT Q*3
70.START
80 LDA #&58:STA &71
90 LDA #0:STA &70
100 LDY #0
110.LABEL
120 LDA #255
130 EOR (&70),Y
135 STA (&70),Y
140 CLC
150 LDA &70:ADC #1:STA &70
160 LDA &71:ADC #0:STA &71
170 CMP #&80:BNE LABEL
180 RTS
190J
200 NEXT
    
```

```

5 REM** PROG 2 **
10 P%=&80
20C
30.DOUBLE
40 JSR &E1BB
50 JMP &E1BB
60J
70 ?&20E=DOUBLE AND &FF
80 ?&20F=(DOUBLE AND
&FF00)/&FF
    
```


Into the subset

Experiment, by altering the values being added (just *Poke* new values into 17154 and 17156 and *goto* 220). Alternatively put the result somewhere else — say 17153. See how it changes the program? Try adding 240 to 100 (decimal). The result is not 340! Why? Think about it in binary:

$$\begin{array}{r} 240 \quad 11110000 \\ 100 \quad + 01100100 \\ \hline 01010100 = 84 \\ \downarrow \\ 1 \end{array}$$

The sum generates a 1 in the ninth bit, which cannot be held in an 8-bit byte, so it falls off the end. The quoted result is too small by the value of that ninth bit — 256. No check has been made, no helpful error message printed. When you write machine code you are on your own. What you do not test for, you do not find out about.

Here's how to modify the *loader* program to accept hex, by combining it with the decimal/hex converter in *Machine Code*, September 23.

Change lines 120, 130, 140, 150 to:

```
120 INPUT C$
130 IF C$="S" THEN GOTO 180
140 PRINT C$
150 POKE A, 16* (CODE C$(1)-28)+CODE
    C$(2)-28
```

The procedure is exactly as before, but now at each input you key in the hex code: 3E, then 04, then 06, etc. Do not omit the zeros. Use "S" to end the inputs, in place of the previous "negative number" delimiter.

In the previous description, we assumed you might only have 1K of memory. Machine code is of course a useful space-saver with 1K, but anyone interested in it is likely to have 16K. Further, some of our later routines using the display file need at least 4K. To reserve a 256-byte attic in 16K, proceed as follows:

```
POKE 16389, 127
NEW
```

Now *load* in the machine code. Replace 4300 hex by 7F00 hex and 17152 decimal by 32512 decimal. From now on, we are only going to give the hex codes, for which you can use the modified *loader* program.

It is a terrible nuisance that the ZX81 needs a *new* before it recognises changes to *ramtop*. You are half way through typing in a basic program, with some machine code to accompany it later... and you have forgotten to allocate memory.

Using what we have told you so far, all you can do is *save* on tape, reset *ramtop*, then *load* back in, and continue. But there is a way to avoid this, by using a Rom routine.

Suppose you want to allocate a 256-byte attic, leaving your precious Basic intact. From the keyboard, type:

```
POKE 16389, 127 [reserve space]
PRINT USR 1040 [call from ROM]
```

You will get a listing and the program will halt. Restart with Run (this technique loses your variables anyway). That's it. For different sizes of attic, change the 127 (and *Poke* 16388 with the junior byte if this is not zero).

You can use this in a program, but the program will halt after the *USR* 1040, and need a manual restart. And directly entered variables will be lost.

We are not going to describe one of the 694 opcodes the Z80 has — that would be tedious and unnecessary. Instead we will look at a subset of 30-odd types of instruction (covering about 230 actual commands). Unfortunately, not all of them can use all the addressing modes. Here is a quick reference table showing with which instructions can use what:

Address Mode	o	LD	ADD ADC	INC	JR	JP	JPZ	LD	ADD	INC
	p		SUB SBC	DEC	JRC		JPNZ		ADC	DEC
	c		AND	SLA	JRNC		JPC		SBC	PUSH
	a		OR	SRA	JRZ		JPMC			POP
	d		XOR	SRL	JRNZ		JPP			
	e		CP		DJNZ		JPM			
Register		LD r, s	ADD A, r	INC r					ADD HL, r	INC r
Immediate		LD r, n	ADD A, n			JP nn	JPZ nn	LD r, nn		
Direct		LDA, (nn) LD (nn), A						LD HL, (nn) LD (nn), HL		
Indirect		LD A, (HL) LD (HL), A	ADD A, (HL)	INC (HL)		JP (HL)				
Indexed		LD A, (IY + d) LD (IY + d), A	ADD A, (IY + d)	INC (IY + d)	JR d					

8-bit operations

16-bit operations

The notation in the table needs some explanation. Some of the opcodes will be unfamiliar, but we will deal with those later. Otherwise, the conventions are:

- 1) Each entry in the table shows an example of the format of the instruction type. Any of the other opcodes in that column could be substituted.
- 2) "r" or "s" denotes any register. Whether this is an 8-bit or a 16-bit register depends on which part of the table the instruction is in. For instance, in the *Ldr, s* instruction, r and s are any 8-bit registers (A, B, C, D, E, H or L), but in *ADD HL, r* "r" is one of Bc, De, Hl, Sp.
- 3) "n" is any 8-bit number. "nn" is an 16-bit number.
- 4) If a register is explicitly stated, as in *Ld A, (nn)*, then this is the only register which may be used for this purpose.
- 5) "d" is any 8-bit number, but it is always added to some 16-bit value. In other words, it is an indexing displacement.

This is a wild oversimplification. Sometimes, other registers are usable. But the set of instructions we have shown are *always* OK and you can worry about extending your vocabulary of instructions when you are handling this lot confidently.

Now let's look at the new opcodes:

And

This operation takes the contents of the A-register, and another 8-bit field, and examines these, bit by bit. Only if corresponding bits are both "1" does it put a "1" back in this position in the A-register. Otherwise it inserts a "0".

For instance, *And A, 07* has the following effect:

```
A-register before the operation: 00110101
07: 00000111
A-register after the AND: 00000101
```

See how the junior three bits have been transmitted? So you can use *And* to select a portion of a byte.

OR

This works in a similar way to *And*, but this time, the resulting bit is a "1" if either of the initial bits is a "1". So *Or A, 05* gives:

```
A-register before: 01001011
05: 00000101
A-register before: 01001111
```

Now, certain bits are being forced to "1" regardless of their original value.

Xor

Here the initial bit values must be different for the result to be a "1". *Xor A, B3* gives:

```
A-register before: 01011010
B3: 10110011
A-register after: 11101001
```

It is particularly useful for flipping a register from 0 to 1 and back again. If a A-register contains 0 to start with, every time the instruction *Xor A, 01* is executed, the value in the A-register will flip. (0 to 1, back to 0, back to 1 and so on.)

Cp

This is the "Compare" instruction. The contents of the A-register are compared with those of another 8-bit field. That raises a problem, though — how is the result of the comparison signalled?

This is what the *F* (or *flags*) register is used for. Each bit of the *F*-register holds some information about the effect of the last instruction to alter them (Not all instructions do alter them).

Reproduced from *Machine Code and better Basic*, by Ian Stewart and Robin Jones (price £7.50), by kind permission of Shiva Publishing Ltd, 4 Church Lane, Nantwich, Cheshire CW5 5RQ.

ABERSOFT

7 MAESAFALLEN, BOW ST, DYFED, SY24 5BA

ZX81 & Spectrum Games

Chess 1.4: Ten levels m/c graphic screen display.
16K ZX81 £8.95

Invaders: Very fast m/c action. Includes mystery ship and increasingly difficult screens.
16K ZX81 £4.45

Mazeman: A fast action m/c game that reproduces the spirit of the original. The Spectrum version includes excellent graphics.

16K ZX81 £4.45 - Spectrum £4.95

Can also be used with AGF joystick.

Adventure 1: Based on the original game by Crowther, this game was the start of the Adventure craze. Reviewed Sinclair User, issue 2. Features Save game routine as the game can literally take months to complete.

16K ZX81 £8.95 - 48K Spectrum £9.95

See us at the 5th ZX Microfair.

We have full stock of all programs and supply by return of post (which is included in the price)

Salamander Software

Software from the south for the DRAGON 32 (D) and BBC Model B (B) microcomputers.

WIZARD WAR The mighty mages of the Tri-Suns strive for supremacy in a fearsome battle of skill and strategy! £6.95 (D)

STAR TREK A full version of this classic game for the Dragon; features Faerie Queen, hyperprobe, tractor beams, time travel and more! £6.95 (D) (J)

VULCAN NOUGHTS AND CROSSES Pit your wits against the Dragon or your friends in this three-dimensional game of logic! £6.95 (D)

DRAGON RIDER Can you destroy the enemies from the sky before your fiery steed runs out of puff! £6.95 (B)

TANKS! Variable wind and terrain make this exciting two-player game a challenge for everyone! £6.95 (B)

GAMES COMPENDIUM DI A selection of games for all the family, including Blackjack, Donkey-Derby, Kingdom, Lunar-Lander and Hunt the Wumpus! £6.95 (D) £

Cheques or postal orders payable to Salamander Software, 27 Ditchling Rise, Brighton, East Sussex BN1 4QL. Tel: 0273 686454

Discount for bulk orders and retail: send SAE for catalogue.

All joystick games (J) feature non-joystick version on reverse.

Programmers wanted: good royalties paid!



ATARI



LOW PRICE PACKAGE DEALS

400 (exc BASIC)	£173.04
400 (inc BASIC)	£216.52
800 (exc BASIC)	£390.43
800 (inc BASIC)	£433.91

ATARI PACKAGE DEALS

400 (16k) + BASIC + Recorder + Joystick + Manuals + 5 Blank Cass. + Free Programs	£251.30
400 (32k) + All above items	£307.83
800 (48k) + All above items	£546.96
800 (48k) + Disk Drive + Joystick + 3 Blank Disks + BASIC + Demo Disks	£734.78

SHARP

MZ80A	£434	VIC 20	£129.50
MZ80B	£789	GENIE 1 & 2	£289
		ATOM	from £150

+ PERIPHERALS + SOFTWARE + BOOKS + MAGAZINES + CHESS COMPUTERS + GAMES FOR ZX81 and APPLE

DRAGON 32

32K + COLOUR + HIGH RES. GRAPHICS + SOUND + TYPEWRITER KEYBOARD + SLOTS FOR JOYSTICKS + CARTRIDGES EXPANDABLE TO 64K

ALL FOR £173.00 + VAT

NEW ATARI SOFTWARE

Tumblebugs, Canyon Climber, Shooting Arcade, Pacific Coast Highway, Clowns and Balloons, Protector, Chicken, Slime, Apple Panic, Track Attack — ALL AT £17.35

Micropainter £19.56

Shamus (16K/C) £17.35

+ ATARI, INTELLIVISION & HANIMEX TV GAMES + CARTRIDGES BY IMAGIC & ACTIVISION

GAMER

24 GLOUCESTER ROAD

Tel: 698424

BRIGHTON



PLEASE ADD 15% VAT TO ALL PRICES



Plotting on micros

Tim Langdell explains how to create user-defined graphics characters.

The Dragon 32 does not have any easy way to allow you to create your own graphics characters, unlike machines such as the Spectrum. However, using *Get* and *Put* you can store your characters created by plotting to the screen, and place them anywhere on the screen.

One advantage this system can offer on the Dragon is that you are not restricted to 8 by 8 character squares, as on other machines. Since the character is stored in an array it can be virtually as small or as large as you wish. For simplicity though I will restrict myself to an 8 by 8 character for space invaders as an example.

The first stage is to plot the points which make up the character onto the screen using *Pset* in, say, *Pmode* 4. I have chosen *Pmode* 4 because it gives you the maximum resolution available to define detailed characters. The program requires you to type in the character as 8 rows of 8 zeros and ones (pressing *Enter* between each digit), and then translates this pattern of zeros and ones into the character you have designed. The choice of zeros and ones was made to enable you to get an idea of how the graphic character will appear.

Lines 120 to 150 do the actual plotting on the screen in a box 8 pixels by 8 pixels in size. Line 160 uses a *Get* statement to store the box containing the character in an array (*C*). In the first bracket of the *Get* statement is the co-ordinate of the upper left-hand corner of the box. The second bracket contains the co-ordinate of the bottom right-hand corner of the box.

Once the graphic is stored as the array '*C*' you can clear the screen (*PCLS*) and place the graphic anywhere using a *Put* statement. This statement in line 180 is, as you can see, very similar to the *Get* statement — with the contents of the brackets referring to the two corners of the new box's position.

The problem with using *Pmode* 4 is that you can only have either white (buff) and black or green and black (with *Screen*1, and *Screen*1,0 respectively). To get some colour into the game you would need to use *Pmode* 3. But in *Pmode* 3 the resolution is exactly half as good and you will need to design your characters with care. The zeros and ones to *Input* for this program to get a space invader are:

```
00111100
01011010
01111110
00111100
00011000
00100100
01011010
00000000
```

If you do not wish to design your own



character but wish to use one already planned, then you might be better advised to employ *Read* and *Data*. In this case you might consider storing the co-ordinates for the *Pset* statements in the form of *Data*, and use a *For/Next* loop to *Read* the *Data* onto the screen in the form of *Pset* dots. Thus the form would be:

```
10 FOR X = 1 TO 3
20 READ A : READ B
30 PSET (A,B,2)
40 NEXT
50 DATA 10,10,10,11,10,12
```

The final part of the formula, to put the character on the screen and move it about, involves *Putting* the character at a position and then a moment later *Putting* the same character at that position as *Reset* (which *Resets* the points which were *Set* before — ie blanks them out). This *Put* statement will thus look like this:

```
PUT (110,110) - (118,118),C,RESET
```

The character is then *Put* in the next position on the screen, cleared again and so on.

```
1 REM USING GET AND PUT
2 REM FOR CHARACTER DEFINITION
10 DIM A$(9,9)
20 FOR N=1 TO 8:FOR M=1 TO 8
30 INPUT A$(N,M)
40 NEXT M
50 FOR T=1 TO 8: FOR S= 1 TO 8
60 PRINT A$(T,S);:NEXT:PRINT:NEXT
70 NEXT N
80 PMODE 4,1
90 PCLS
100 SCREEN 1,1
110 DIM C(9,9)
120 FOR X=1 TO 8: FOR Y=1 TO 8
130 LET K=0: IF A$(X,Y)="1" THEN K=1
140 PSET(9+Y,9+X,K+1)
150 NEXT: NEXT
160 GET(10,10)-(18,18),C
170 PCLS
180 PUT(110,110)-(118,118),C
190 GOTO 190
```


Common characters

1.1 Unifile/Spectrum page

Sooner or later most micro owners realise that their new digital friend comes into its own when it is storing information, processing it and presenting it in ways that would be laborious if done manually. They soon begin the task of writing simple programs which will store their friends' names and addresses or catalogue their stamp album. They may end up with half a dozen programs, all of them using roughly the same method but working on different types of information. In this series of extracts from *The Working Spectrum* we examine how a single program can be written to cover a variety of filing tasks without the need for constant re-writing every time a new usage comes along.

Before we write the program we must decide on an economical way of storing the data we wish to file. Small programs can afford to fudge this issue since they are unlikely to make use of all the available memory anyway. Such a small program might, for instance, declare an array with dimensions of 50,4,20. This would allow the storage of up to 50 entries, each with four constituent items, each item being up to 20 characters long. The advantage of this is that each entry to the file would be clearly identifiable since entry X would be made up, if the array were called AS, of:

AS(X,1), AS(X,2), AS(X,3) and AS(X,4).

The disadvantage of this method is that for most filing uses it is likely to result in an enormous waste of space within the limited amount of memory available. The reason for this is simply that the length of the fixed space you allocate to each item must be adequate to the longest item you are likely to input. If, for instance, you want to store the names of your friends and one of them is graced with the surname Farquarson-Smythe, then you will have to set aside at least 17 characters for every surname, despite the fact that the rest of your friends are nowhere near so impressively named. The space allocated to most of the names would be more than half empty.

This is a problem encountered by any storage method which allocates a fixed amount of memory to each item regardless of its size. But if each entry is not to be allocated a fixed amount of space then the file in which the data is stored will not be divided up in any regular way. This makes it difficult for the program to keep track of the position of individual entries or even to identify where one entry ends and another begins.

Take the following example of two entries in a file which have been allocated precisely the right amount of space:

SMITHJOHN331255645677HIGH
STTHOMASBILL45109567851EDEN AV.

You probably had no difficulty in identifying the names of the two men, but your Spectrum is not as familiar as you with common surnames. Even you probably did not guess that each name is followed by the age, file number, telephone number and street number of the man in question. How is the program to identify each of these given that any of them can vary in length?

The answer to such problems is normally provided by a combination of indicators and pointers. Indicators are markers set into the main body of data which allow the program to identify the length of the items which make up an entry. Pointers are normally set outside the main body of data. They consist of a list of the positions, in memory, of all the entries, enabling the program to jump into the middle of a long and complex file and unerringly find the first character of the desired entry.

The program below uses indicators and pointers to manage a file made up of 25,000 characters, made up of perhaps hundreds of separate entries all packed together in a seemingly random way. The program is called **Unifile**. I hope it will come to play a valuable part of your program library. More importantly, the techniques employed are essential tools for everyone who wants to pack his Spectrum, 16K or 48K, with the maximum amount of information.

Module 1.1

As a rule of thumb, a utility program that does not commence with a fairly clear-cut menu of the functions available is a bad program. If you do not agree with this now, you certainly will some time when you have to return to a complex but useful program which you have not used for some time and have to spend hours going through the listing trying to work out just what you have to do to make the program work for you.

```
1000 PAPER 7: CLS: BORDER 7: IN
K 6: PAPER 0: PRINT PAPER 2:
UNIFILE
1010 PRINT "FUNCTIONS AVAILABLE
1020 PRINT " 1) SET UP NEW F
ILE"
1030 PRINT " 2) ENTER INFORM
ATION"
1040 PRINT " 3) SEARCH/DISPL
AY/CHANGE"
1050 PRINT " 4) STOP"
1060 PRINT "PLEASE ENTER WHICH
YOU REQUIRE."
1070 INPUT Z$
1080 CLS
1090 IF Z$="1" THEN GO SUB 1210
1100 IF Z$="2" THEN GO SUB 1440
1110 IF Z$="3" THEN GO SUB 2160
1120 IF Z$="4" THEN GO SUB 1150
1130 CLS
1140 GO TO 1000
1150 PRINT AT 10,5: INK 7: PAPER
2: "FILING SYSTEM CLOSED"
1160 BEEP 2,2
1180 INPUT "Have you input new i
nformation you wish to save? (Y
/N)"; Q$
IF Q$="N" THEN STOP
1190 SAVE "UNIFILE": PRINT "Re
ind tape, then press any key to
VERIFY": PAUSE 0: VERIFY "UNIFIL
E": STOP
```

In this module the user is requested to choose between four numbered functions. No particular attempt is made to guard against mistaken inputs. Mistakes at this stage are not serious. If a number or character other than 1-4 is input, the program ignores it. The module also contains, as one of the four menu choices, the

Stop function. This serves the purpose of marking an end of the use of the program and reminds the user to re-record any new data which has been entered.

Commentary

Line 1000: Every program on the Spectrum which is not going to be in black on white needs to declare somewhere near the start the colours to be used for:

- a) the border around the screen
- b) the screen
- c) the ink with which the characters appear on the screen.

There are three separate *Paper* instructions in this line. The first instruction stands alone and, with the CLS command, sets the screen to white. In the second instruction the *Paper* colour is set to black so that the menu stands out boldly from the white background. The third *Paper* instruction is tied to a *Print* instruction. It makes no permanent difference to the paper colour, but ensures that the word Unifile is printed on a red background.

It is important that you can distinguish between those colour commands which stand alone and set a colour, and those colour commands which refer only to the single *Print* statement to which they are tied. A single *Print* statement can have every characteristic set by such tied commands. For example:

```
PRINT FLASH 1; OVER 1; INVERSE 1; PAPER 7; INK 0;
"HELLO"
```

None of these colour commands will have any effect on *Print* statements in other parts of the program.

Line 1070: When you have an input to a program menu do remember to check that the variables you use are not duplicated in other parts of the program.

Line 1080: The menu is printed on white paper in bold black strips. But the last *Paper* command sets the background to black so this CLS command sets the whole screen black. It remains black until the program returns to the menu.

Line 1190: For any data storage program it is far more convenient to have a *Save* instruction built into the program rather than having to enter it in direct mode every time new data has been added.

Testing Module 1.1.1

A rough and ready test of the module is simply to *Run* it and enter numbers in the range 1 to 3. The program should then stop with the report 0 OK followed by the appropriate line number from 1090-1110. Input of 4 should result in a prompt to *Save* and then *Verify* the program. Any other input should be ignored.

More of the Unifile program will be presented next week.

This is an extract from *The Working Spectrum*, by David Lawrence (price £5.95) published by Sunshine Books, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

Is there anything about your computer you don't understand, and which everyone else seems to take for granted? Whatever your problem *Peek* it to Ian Beardsmore and every week he will *Poke* back as many answers as he can. The address is *Peek & Poke*, PCW, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

OLIVER ASKS FOR MORE

Jason Derry of Rosehill Way, Guildford, writes:

Q I have a Vic20 and want to expand it. But, as I am limited to my pocket money, I would like to know if there is any other way of adding memory, apart from buying the super expander. I can borrow a soldering iron if necessary. Is there anyone who makes a kit for extra memory, preferably more than 3K? If not, is there any way I can add the extra memory myself?

A This is the sort of question that needs a whole article in answer. I do know that 2114 chips, such as the Vic uses, have been 'Piggy backed', so as to effectively double the memory available to the user. However, this was done on a ZX80, I do not know if it has been tried on the Vic.

As there seem to be three unused control lines on the unexpanded Vic, it may well be possible to add 3K yourself, though this would void your guarantee. Unfortunately, I do not know how you should go about adding 3K on your own. Does anyone have any ideas?

KACK-HANDED

Paul Thompson of Rowan Drive, Newbury, Berkshire, writes:

Q In February I bought a Vic20 after selling my ZX81. I would like to know if there is a numeric keypad available for it, with a built-in Return key. But, as I am left handed, it would have to have enough cable to reach around the left-hand side of the machine.

A The Vic keyboard is an 8 × 8 matrix. The only number pad I know about is made by Dk'tronics for the ZX81. It costs £10 and should be possible to convert to the Vic20.

Alternatively, it should be possible to make one, as described by Stephen Adams in

his book *20 Simple Electronic Projects for the ZX81 and other computers*. The lines that you will have to deal with are line 7, which will give you the even numbers, and line 0, which will give you the odd digits. Return is line 1, H. The keyboard connectors for the Vic are on the left as you look at the computer, so the length of wire you will need should not be a problem.

But such a conversion, unless it can be done through your Commodore dealer, will void your guarantee.

LANGUAGE SPECIFICATIONS

Joe Laine of Yew Road, Stockport, writes:

Q I am very interested in the new Jupiter Ace, but I am unsure whether or not to buy it. I was going to get a ZX81 or Spectrum to learn on, because I am going to start learning computing at school soon. What I want to know is, will I have to learn two languages, one at school and one on a Jupiter Ace? Also will there be software coming out for the Ace? I do not want to buy a computer that has no software.

A The Jupiter Ace has caused quite a lot of interest, and not a small amount of decision taking. It is not an easy choice to make if you want to buy a computer, even if you do believe that Forth is a better language than Basic.

What you say about school is very important. I know that last year the London Board specified any high level language for the O-level, but only Basic for the A-level. This year the AEB has not specified Basic only. The thing to do in this case is to talk with your teachers, find out what the syllabus asks and what they are going to teach. While an increasing number of staff are becoming computer literate, I doubt if many of them are conversant with Forth.

My worry with the Ace is

that it is in a Catch 22 situation, where everyone is waiting for 'Everyone Else' to buy the machine, so that it generates enough interest for software companies to write programs for it. I feel that it is a very good choice for a second machine, and I can see it picking up some extra trade if the Spectrum problems continue. As to whether you should make it your first choice — I would again suggest you talk to your teachers before deciding.

BAR CODE DEVICE

Dermott Bicker of Skipton Street, Morecambe, Lancashire, writes:

Q Is it possible to use a bar code to program computers. I have seen this idea used with an electric organ to play tunes. Would it be a quick and easy method of programming simple 1K games on the ZX81?

A This can be done. Apparently a device to use a bar code has been marketed in the United States by Mindware. Unfortunately, I have no other details. As far as I know, there is no comparable device available over here.

The address of Mindware is 15 Tec Circle, Natick, Mass 01760, USA.

MODULATING IMAGING

Rodney Bennett of Oxford Gardens, London, W10, writes:

Q I have a ZX81 and have recently acquired a video recorder, an excellent Sony C5. However, when I tried to use the ZX81 through my video recorder, replacing the aerial input in the normal way, the result was a much inferior screen image. I have had to return to feeding my ZX81 directly into the television set.

This is a pity, as I had hoped that one use of the ZX81 would be to generate captions that could be used on video tapes. This is possible but only with a very poor quality screen image. Is there any way to improve this?

Also I am hoping to use my Spectrum (when it arrives) for the same purpose. Will I find the same problems?

On a related subject, I find it almost impossible to keep my

television set tuned so that I get the best possible image from my computer without having to adjust it each time I use it. I have reserved a special channel but this does not seem to help. Is there any way around this?

A I think this problem is due to the fact that both machines are using the same RF signal. Like the computer a video has an in-built modulator, and it is almost an industry standard to pre-tune these to channel 36. I do not know the Sony C5 model specifically, but is there a small screw visible whereby you can slightly re-tune its modulator?

If you can, do this, and then fine-tune your ZX81 or Spectrum to the one on the video.

As regards the re-tuning of your ZX81 in normal use, the problem you have is so common that it is usually considered to be just part of the setting-up routine. If you use more than one computer on a single set you will find that a signal does tend to wander off station slightly.

BROADCASTING CONFUSION

I Baker of Kingsman Street, Woolwich, London, writes:

Q I have ordered a Spectrum, and have been following the correspondence and articles about television and video. However, I am now more baffled than ever.

What is the difference between video and television? Are videos available on retail? Is there any particular video or television that works well with the Spectrum?

A These two words are easy to confuse. Essentially a television is a screen display that has been tele'd. That is it has been broadcast and the material has come across the airwaves. This signal then has to be picked up and translated into the picture you see.

A video display does not have to go through this process. The display you see is fed directly into the television. Thus a computer gives a video picture when plugged in to a domestic television. A monitor cannot receive broadcast signals. It boils down to the different ways in which a signal gets to the cathode ray tube which gives the screen display.

Classified

WHAT IS THE AXON GROUP? WHY NOT JOIN US?

SEE 25th NOVEMBER
ISSUE OF
POPULAR
COMPUTING WEEKLY

FREE COMPUTER GAMES

when you subscribe to **The War Machine**, the monthly magazine of computer simulation gaming.

TWM has been covering the computer gaming scene since July 1981, with detailed reviews and advice on how to design your own computer games.

Every third issue of the magazine now includes a sophisticated computer game, which may be a wargame, an adventure or a science-fiction game. The map and counters come with the magazine, and the program is supplied on tape for the 16K ZX81 and TRS-80/Video Genie.

Current issue (without tape): £1 (overseas £1.70). 6-issue inclusive subscription: £12.50 (overseas £19). 6-issue subscription (without tapes): £6 (overseas £10).

Cheques payable to: **Emjay, 17 Langbank Avenue, Rise Park, Nottingham NG5 5BU, England.**

ATARI GAME! Alien Attack. Great game from basic! DLI! Charset redefined. 11 Wimborne House, Harewood Avenue, London NW1 (S. Ahmad).

VIC20 ADVENTURE VAULTS OF DUNGOR (pits, magic, monsters, 15 levels), super expander required. With 3 Hi-res programs, Send £3.95 to M. Conway, 10 Alder Grove, Chester.

ZX81 16K Scrunch. Brilliantly simple new game, plus free maths program. Cassette £2. Jeanette Fenner, 237 Overdale, Scarborough YO11 3RE.

MORSE TUTOR PROGRAM for Spectrum 16 or 48K. More than just a random morse generator this program will teach you from absolute beginner to amateur radio morse test. A flexible user friendly program on cassette for only £3.95, post paid. From Jim Grice G4JNO, 116 Churchfields Lane, Glasshoughton, Castleford, W. Yorkshire WF10 4DB.

LOVE — a 16K ZX81 women's adventure game

set in the riotously funny Poke Hall. Meet the voluptuous Griselda, the rude Sinclair, Indian mystic Mr Ram Pac, and more. Interactive, machine coded and fast. Cassette £3.95 inc instructions. **REMSOFT, 18 George Street, Brighton BN2 1RH (tel: 0273 602354).**

MICRO — BACK?

Foldaway Workstation: Raises hardware up and over lap — becomes storage case when collapsed. You won't need to be a budding Chippendale to follow these extremely simple plans: £1 inc. p and p. Available from Robert Morgan, School House, Cross Inn, Llanon, Dyfed, Wales. A kit of parts can be supplied £18 plus p and p.

**VIC20
3K MEMORY EXPANSION
MODULE £18.50 inclusive of
VAT and postage and packing.**

Send cheque or Postal Order to:

**P.C.B. CONCEPTS LTD
1 Scott Crescent,
Rayners Lane
Harrow, Middlesex**

DRAGON 32 SOFTWARE on tape, from £1.95. Send s.a.e. for list. ATL(D), 115 Crescent Drive South, Brighton, BN2 6SB.

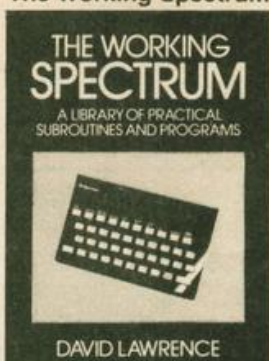
SOFTWARE AUTHORS. Interesting and ingenious programmes wanted for ZX81 games, educational and business. Phone 031-447 2789.

DK'TRONICS SPECTRUM KEYBOARD. Brand new (keyboard logos are fitted), only £38 plus £1 p & p. Phone 01-863 4304 evenings/weekends.

LINK-4-PLUS. A fast, challenging, advanced 4-liner game for BBC 16K. Four skill levels, 0/1/2 player and speed games, thinking times and sound-video options. Cheque/PO for £6.95 to ABC Software, Freepost (no stamp required), Chorley, Lancs, PR7 1BR.

BBC MICRO Pools Predictor. Model A or B. Easy data entry. Uses powerful mathematical and statistical forecasting model. User tunable facility. On cassette with full instructions, £4.99. Mayday Software, 181 Portland Crescent, Stanmore, HA7 1LR.

New book for Spectrum The Working Spectrum



Published in association with **Popular Computing Weekly.**

Send cheques/postal orders, for **£5.95, to The Working Spectrum, Sunshine Books, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.**

We can normally deliver in four to five days.

VIC MOON MUGGER (unexpanded), colour, hi-res graphics, sound, keyboard or joystick, £3.90. P. Killick, 41 Reachfields, Hythe, Kent CT21 6LS.

16K ZX81 GAMES. Space Invaders, Pilot, Pacman, Frogger, on one high quality cassette, only £5. P. Sands, 25 Corsewall Street, Coatbridge ML5 1PX.

ATARI VCS with Combat, Asteroids, Chess, Space Invader, Night Driver, Breakout, Activision Tennis. v.g.c. £120. Tel: 01-654 6522.

SPECTRUM GAMESTAPE, Pontoon, Jackpot, Hangman, Fighter Target Patterns, £3. N. Henderson, 33 Rayleigh Drive, Wideopen, Tyne and Wear.

DON'T BUY RUBBISH. 16K Spectrum, m/c Othello. Amazing strategic play. Introductory price, £3.50. M. R. Davies, 14 Slade Road, Barry, S. Wales.

SPECTRUM/BUG. Booklets of 50 for text, graphics, U.S.R. character planning. Only £1. From A. Qureshi, The Yews, Colmere, Shropshire.

SPECTRUM RENUMBER. Instantly rennumbers all or part of program. All Gotos, Gosubs, etc included. The first and probably the best in m/c for only £3.95. David Webb, Southholme, 9 Park Road, Woking, Surrey.

BBC MICRO DISASSEMBLER/monitor on tape for model A/B, £5. To David Knell, 13 Northumberland Road, Leamington Spa, Warwickshire, or £1 for manual only (refundable on purchase of program).

16K SPECTRUM programme wanted of exceptional quality for early marketing. High royalties paid. Educational tapes welcome. Microjuice, 46 Ainger Road, London NW3. Tel: 586 4740.

SPECTRUM SOFTWARE: Simulation teletext programs with accurate 24-hour clock and alarm. Five more programs make up a total of six for only £5. Some of these other programs are a predictor and a Christmas card maker. Send £5 cheque or P.O. to: D. Kerr, Nethermoss, Rumbling-Bridge, Kinross, Scotland KY13 7QD.

MAKE THINGS FLY WITH ZX81 WINDOW 16K Cassette £1.99

Fantastic M/C routine lets you define NOT 1, NOT 2, but ANY number of Windows, of ANY size in ANY position on your screen. (Full screen, 1 line, 4 character block; you name it!) Graphics or text in each Window can be 'scrolled' in ANY direction simultaneously or individually against ANY character background (including inverse). OR 'roll' your asteroids off one edge of your window back on to the opposite side. (Wrap-around effect.)

You won't be able to stop yourself thinking of hundreds of possible applications for this HIGH SPEED (in SLOW mode) SCREEN-HANDLING PHENOMENON!!

**KEN OSBORNE
17 SHAFTESBURY WAY, ROYSTON, HERTS
SG8 9DE**

BBC (32K) VIC20 (6.5K)

Guaranteed programs for home and school. "INVISIBLE MAN" — interactive, teaches co-ordinates and compass points, fun to play! "INKOSI" — be an African King in this original adventure game... **£5.95 each.** SAE for details and complete list.

**CHALKSOFT, Lowmoor Cottage, Tonedale, WELLINGTON, Somerset
TA21 0AL.**

ZX81 16K ASTRO-INVADER. Fast machine code for fantastic graphics! Personalised scoring! four types of Alien! Mystery points! Bonus ship! Cassette only £3.50. I. Morrison, 17 Winton Circus, Saltcoats, Ayrshire.

VIC20 GAMES: Funfair, Road Race, Brands Hatch, Patrol Boat, Battlefield. All on one cassette for only £5. Send to: N. Geere, 323 Jersey Road, Osterley, Isleworth, Middlesex.

VIC20 + 3K RAM, car race, Puckman, user-defined colour graphics, £3.50. M. Ryan, 16 Mountgrace Road, Luton LU2 8EJ.

ZX PRINTER WITH PAPER, excellent condition, only £40. ZX81 pools predict listing, £2.50. VIC20 cassette, £3.85, listing £3. Send cheque/P.O. To D. J. Wyatt, 77 Redgrave Gardens, Luton, Beds.

JOYSTICK for all ZX computers. Build it for under £5. Send £1 plus sae for instructions. Peters, 29 Windsor Road, Newport, Gwent.

BBC SOFTWARE: Send sae for catalogue to: E.P.M. Software, Newlands, Harrow-on-the-Hill, Middlesex HA1 3JD (50p voucher free!).

3K RAM plus machine code monitor in one cartridge, £40. Telephone Derek 0740 53133.

EPROM PROGRAMMING SERVICE. 2K-4K EPROMs supplied programmed to your requirements. Send SAE for details to: Trent Micro Systems, 2 Parkdale Court, Kenilworth Road, The Park, Nottingham NG7 1DD.

VIC20 UNEXPANDED. Gobbler, Bomber, Sprogger, Hangman and Slot. Addictive. Excellent colour, sound and defined characters, all for £4.50. Peter Robinson, 24 Butterfield Road, Bolton, BL5 1DU.

16K SPECTRUM GAMES, m/code, City Bomber, Alien, Tank Battle, Computer Art, Simon. All on one cassette, only £3.50 plus P & P, 50p. D. Hem-brow, 8 Apex Drive, Highbridge, Somerset.

BBC MICRO 32K arcade games, Frogger, Fast M/code, colour graphics and sound, £6. Crazy Race, Guide The Swaying Balloon, £6. JSD Software, 28 Woodvale Gardens, Wylam, Northumberland.

A COMPUTER FOR CHRISTMAS?

WE STOCK SHARP, GENIE, VIC20 AND DRAGON COMPUTERS

We have a good range of software for home entertainment, business and education, and accessories for the computers as well.

For helpful and friendly service, try:

**everyman
computers**

**14 Edward Street
Westbury, Wilts
BA13 3BD
Tel: (0373) 864644**

Computer Swap

01-930 3266

Free readers entries to buy or sell a computer.
Ring 01-930 3266 and give us the details.

Spectrum for sale

SPECTRUM 48K, £180. Tel: Wantage 67778.

SPECTRUM 48K, as new, £170. S. R. Wilkinson. Tel: (work) 01-686 0555/4296; (home) 0732-359077.

SPECTRUM 16K, hardly used, still boxed, with manuals, offers welcome. Tel: weekdays after 7 pm. 01-898 0792.

SPECTRUM 16K, unused, still in original box, £125 ono. Tel: 0908 320075.

48K SPECTRUM + PRINTER, with accessories worth £60. Please write to: Mr. A. Saggat, 88 High Street, Southall, Middx. Best offer for immediate delivery.

16K SPECTRUM, unused, with some software (you name price). Tel: 01-578 8645.

48K SPECTRUM, 2 months old, original packing, magazines, s/w, Abacus controller. £220 ono. Mr J. L. Molinghen 01-643 7097 (before 5 pm).

ZX81s for sale

ZX81 + 16K Ram pack. Sinclair-built complete with PSU, manual and software. £50. Tel: 01-651 2782.

ZX81 + 16K + fuller keyboard, books and cassettes. All for £75. L. Pancuk, 42 St Kilda Road, London W13.

16K ZX81 Sinclair-built, still under guarantee and in box, excellent condition. Also software. £70. For details telephone (041) 944 1483.

16K ZX81, with Kempston keyboard, keyboard sounder, manuals, £45 of software, £80. Tel: (0206) 322230.

ZX81 16K, good condition, £40, s/w, leads, books, for only £90. Tel: Leicester 540581.

ZX81, 1K, unused, boxed, £37 ono. Tel: Anthony 061-928 5737.

ZX81, 16K RAM, computer manual and two converted Atari joysticks, £75. Tel: (040 481) 4538.

ZX81 32K + software and user point, £60. Tel: 01-300 7384 (evenings).

ZX81, with 16K Ram, lots and lots of s/w, including Monster Maze, Flight Simulator etc., + piles of magazines + manual + leads, £90. Tel: York 798395.

ZX81 16K RAM books and software, eight months guarantee left, £50. Ring Wokingham 782614.

ZX81, 16K, manual and books, over £60 of cassettes, £75 ono. K. Redwood, Cardiff (0222) 762655.

ZX81 with Kaude Keyboard, excellent condition, many extras, magazines, tapes and books, £80. Ring 0924 891078.

ZX81, 16K + PRINTER, five rolls of paper, £30 of software, including Invaders and Defender, £90. Tel: 061 941 2553.

ZX81 SYSTEM, 16K Ram, printer, full size keyboard, G Rom, I/O port, etc., worth £300+. Bargain, £220 ono. Phone for details (0488) 58665, evenings. May split.

ZX81, 16K with printer, Haven keyboard with repeat key, £50 of software. Sinclair built, three months old, £110 ono. Tel: 01 445 1128.

ZX81 16K professional keyboard, £60 worth of software and books, only £80 ono. Tel: 01-542 6177, after 5 pm.

ZX81, 16K, seven software cassettes, on/off lead, two books, cost £140, yours for £75 ono. C. Brewer, 061-681 6972.

ZX81 16K, software and magazines, good condition, £60. Tel: 01-997 2017.

ZX81 16K Ram pack, 10 cassettes, two machine code books, £70 ono. Tel: 01-556 9310.

ZX81, 16K, leads and manual, Sinclair built, with magazines and software, excellent condition, still under guarantee, £40. Tel: Coventry (0203) 333310.

ZX81 + 32K, manual, leads, power pack, books and magazines, £60. Tel: Guildford 892896 (evenings).

16K ZX81, 3 tapes + book, very good condition, value £100. Mail anywhere in UK. Yours for £50 ono. Shaun Cassidy, Boldon (0783) 365645 (after 6 pm).

Commodores for sale

WILL SWAP VIC20 Scott-Adams voodoo adventure for any other adventure, sargon or star battle. Tel: 01-954 4548.

8K PET + intravel cassette deck, much software including many games. £200. Tel: 01-940 2077.

VIC20 12K RAM + high res. + super expander + joystick + £30 software + manual + 5 copies of Vic Computing. £240. Mr. Cvenca 0276-61435.

19K VIC20 + C2M unit, under guarantee, also one book. £230 ono. Tel: 0234-46394.

VIC20 + disc drive + super expander + two cartridge games + VIC revealed and other software. £450 ono. Tel: Horley, Surrey 3025.

COMMODORE PET 4032, 32K, large k/board, cassette, toolkit, sound, s/w, and manuals, £450. Tel: 061-748 0705.

VIC20, under guarantee + data set, 8K high resolution, super expander, joystick, lots of software including Pacman, Invaders, Asteroids, Myriad, £230 ono. Tel: 0634 360847.

VIC20 + cassette deck + 8K Ram Pac, various books including Vic Revealed, Prog Ref Guide, 5 cartridge games, some software, joystick, 7 months old, £350 ono. Tel: 01-903 0459.

VIC20 19K, many extras, all half price or less, £200. Phone 0252 516700, Farnborough, Hants.

VIC20, 16K and 3K "stack" expansion, Rom socket and sockets for drop in memory, prog-ref guide, Datasette unit, much decent software, cost £440, sell £210 ono. Tel: 0934 24943.

VIC20, cassette, 16K expansion, super expander (all boxed), books, software and dust covers (at today's prices worth £350), accept £240 ono. Tel: Basingstoke 64889.

VIC20, cassette deck, joystick, Commodore Tutor Course, software + books, £180 ono, 3 months old. Marsh, Crawley (0293) 514948.

VIC20 plus C2N cassette unit, Super Lander cartridge, £150 or swap with Spectrum. Tel: 01-855 1402.

VIC20 colour computer, including: 3K super expander, 8K motherboard, Vic Revealed, Getting Acquainted with your Vic20, cassettes. All manuals included for £199. Telephone B. Kendon on 0327 61828.

VIC20 + cassette deck + super expander cartridge + joystick + three cassette games, £170. Tel: 0274 677667.

VIC20 + cassette, super expander cartridge, joystick + software, £200. Tel: 051-424 5668.

CBM 4000, 32K, cassette deck, cassettes, one year old, £400 ono, + printer (4022) £400 ono. Mr. Kyriakidis, Inverness (0463) 37471.

VIC20, plus cassette unit, 16K Ram and super expander cartridges, programmes reference guide, tapes, book and magazines, under guarantee, immaculate condition. £240 ono. Tel: Coventry (0203) 417492.

VIC20 and cassette, under guarantee, £150 ono, Super Slot, Rat Race, Spiders from Mars — cartridges £15 ono (each), seven cassettes of various games, £30 ono. Tel: 0253 592521, after 6 pm.

VIC20 + cassette deck, 3K Ram Road Race cartridge, machine code cartridge, various popular arcade games, Vic reference guide + all other Vic books and courses, boxed as new. You name price. Tel: 01-882 0083, after 5 pm and weekends.

VIC20, cassette, 3K, High Res, cartridge, Vic Revealed, programmer's ref guide, joystick, Super Lander cartridge, £230. Tel: 0703 775680.

Acorns for sale

ACORN ATOM, 12K Ram, 24K Rom including auto line reminder, lead and data, 4K Ross Eeprom, eight colour card and 5v 3a power supply. £200. Phone, day 01-727 7323, evening 01-628 3351, Ext 469 (or swap for any micro computer).

FULLY EXPANDED colour Atom, 12K + 16K, fitted with all interfaces, including Via and Bus Buffer with 5v 5a PSU, £250 ono. Tel: daytime, 0494 23598, evenings 084 421 6323. (software and books negotiable). Gary Marsh.

ACORN AROM, floating point Rom + toolbox, 12 + 12K with 20 cassettes of games etc + 5 books, loads of mags + s/w, £210. Tel: 01-992 8249.

BBC MICRO model B 32K plus software, still in box, £399. Tel: Newcastle (0632) 737654.

Ataris for sale

ATARI 800, 16K, two months old, still under two year guarantee, plus program recorder, joysticks, Star Raiders cartridge + many games on cassette, £400 ono. Tel: Symington, Ayrshire 830176.

ATARI video computer system, six cartridges, including Draughts, Chess, Night Driver, very good condition. £90. Tel: 0296 630401.

ATARI, + 7 cartridges including Asteroids, Space Invaders, etc, like new, little used, £125 ono. Tel: 01-458 4552 after 6 pm.

ATARI VIDEO GAME, + 18 games, including Space Invaders, Adventure, Superman, Circus, Indy, all with hand controls, extra paddles, worth £500, Christmas bargain at £280. Tel: 01-722 6863.

Mattels for sale

MATTEL INTELLIVISION TV game for sale with Soccer and three other cartridges, perfect condition, £130 ono. Tel: 0384 53730 after 6 pm (Martin).

Tandys for sale

TRS80 16K, level II, with VDU, cassette, numeric keypad, covers and over £100 worth of software, £300 the lot. 0703 615229.

TRS80 MODEL 1 LEVEL 2 — Ctr 80 cassette, £20 worth of books, £50 worth of games including Sargon 2 and Asylum, perfect for games player or beginner, only £240. Tel: 01-942 2385 anytime.

For sale

SHARP PC-1211 + printer and cassette interface. Any reasonable offer accepted. Mr Phillips Milton Keynes (0908) 679101 ext 371 (day time).

SHARP P.C. 1211 + printer, in Tandy carrying case. P.C.1211 has been adapted for optional use with a mains unit, all manuals. £95 ono. Tel: Chris after 6 pm, 01-363 9764 (Enfield, Middx.).

SHARP MZ 80K (48K) BASIC, Knights, Commander, David C., Forth, Pascal, Fortran, dust cover, green screen, software including Chess, Invaders, Backgammon, plus £250 worth of games, books + related literature, £475. Tel: Watford 46955.

SHARP MZ 80K, 48K plus Pascal, editor, assembler and symbolic debugger tapes, £300. Ashford (Middx) 45747.

SHARP MZ 80K, 48K, £200 of software, £400 ono. Mr. Cornelius, St. Albans (0727) 65580.

SHARP MZ 80K 48K, some software, 10 months old, £340. Tel: Eastbourne 21814, normal office hours.

INTELLIVISION VIDEO GAME plus 11 cartridges, Space Battle, Boxing, Skiing, Star Strike, etc. Soccer Free, £200 ono. Birmingham. Tel: 021-770 4730.

ZX PRINTER plus six rolls of paper for sale, £50. G. D. Potter, Batley 440389.

ZX81 16K RAM LEARNING LAB, worth £19, eight software tapes worth £30, £2.90 wanted. Tel: 061-980 4592 (evenings).

ZX81 64K AD ON KEYBOARD, magazines, manuals, price £140, 6 months old. Tel: 0628 30966.

MICROTAN 65 plus graphics, leather case, MM/board, Tanex 8K + 1/0 Xbug, basic keyboard, tangerine, bargain, £160. 061-865 5809 any time.

DAI, used demonstration only, plus joystick, Adventure cassette and hand-book. Bargain, £590. Everyman Computers, Edward Street, Westbury, Wilts. Tel: 0373-864644.

SHARP PC1500, colour printer, plotter, 8K RAM. £275. Tel: Bognor Regis 864021.

ZK Z+81 cassette player + five cassettes + three books. £55 ono. Tel: 061-790 7223.

HEWLETT PACKARD, HP, 41C, printer, cardreader, wand, three-memory module, three applications module. £475. Tel: Bognor Regis 864021.

APPLE 2 EURO PLUS, 64K, twin drives, Phillips Amber Monitor, Silent-type, 280 Soft-card, CPM, Basic '80 G. basic, d'base II, £195. Tel: Crawley (0293) 510786.

UK101 16K cased, fan cooled, 300/600 Boud, 32/16 lines, 1 meg/2 meg, mono 2/segmon. All switchable, Wamon and Eprom board + extra 3 amp supply, all leads, £180 ono. Tel: 0274 587181.

SWAP JELLY MONSTER Cartridge + Amok and Alien Blitz cassettes for Sargon 2 chess cartridge. Tel: Chesterfield 852009.

TANGERINE MICRO-TAN 65, plus fully expanded 8K Panex, including Basic, plus tool kit, keyboard, keypad, and all manuals. £150, will consider splitting. Tel: Milton Keynes (0908) 641722.

ALL NEW NOV '81. Barely used. ITT 2020 (Apple) 48K. Autostart Rom — £375 ono. Centronic 737 printer with interface card, £400 ono. Plus software: Applewriter 1.1, Upper and lower case generator, Go Between, Chain Mail, together £50 ono. Ring 01-379 3535.

DATABASE GAMES COMPUTER + five cartridges, including Invaders and Golf, worth £100, will accept £50. Tel: Saffron Waldon 22207, after 6 pm.

TELEVISION GAME, Radophon 1292 with seven cartridges, as new, £59 ono. Tel: Box 742777, after 4 pm.

DAI 48K COMPUTER with joysticks, recorder, software etc, eight months old, £350 or swap for BBC Micro. Banbury (0295) 4947.

VIDEO GENIE, 16K, sound, books, games on cassette, £200 ono. Robin Freeman, Great Missenden (02406) 5888.

EXIDY SOURCERER 32K, including tool kit, Tandy conversion tape, lots of software, including Asteroids, Chess, Invaders, Galaxions, Backgammon and Defender. Cassette motor control, £350 ono. Tel: Ivybridge 4088.

G700 by Phillips, £65 ono + computer tape + music + space invader game. Tel: 01-656 4142.

DATA GENERAL CS10 model C3, 2 Data General visual display units, still in original cartons. Best offer secures. Bolton 24431, Mr Cardwell.

2 ITT 20 20 COMPUTERS 48K, with disc controllers + 3 drives + visicalc for £1,000 the lot. Tel: 0371 820790. Mr Dawkins.

ROTRON TCS, cartridges including Space Invaders, £55 ono. Tel: 0691 830072.

COMPUKIT UK 101 8K CompuKit built (wooden case) software including Space Invaders, £100. Tel: Peter 01-981 5818, after 6 pm.

DRAGON 32, joystick and manuals, 2 months old, £230, want £170. Tel: 061-483 9121, after 2 pm.

ZX SPECTRUM PRINTER for sale, less than 12 inches paper used since new. Quick sale wanted, £45 ono. Ring 571 1309 (after 7 pm).

Wanted

VIC20. Adventure Land cartridge. Swap for another adventure. Tel: Stevenage (0438) 811634, after 6 pm, Mr Goodman.

SHARP MZ 80B COMPUTER, top price paid. Tel: Watford 46955.

WANTED. Dragon 32. Tel: Biggleswade (0767) 312870. J. Tasker after 5 pm.

POPULAR Computing WEEKLY

BACK NUMBERS

MAKE SURE OF A
REAL COLLECTORS' ITEM —
THE FULL SET OF PCW

We will mail any of the numbers you're missing from Issue 1 to the latest — for just **50p** an issue, including p & p.

(We have no more copies of Issues 2, 6, 7 or 11)

Send cheques/Postal Orders to:

Back Numbers
Popular Computing Weekly
Hobhouse Court
19 Whitcomb Street
London
WC2 7HF

COMPUTER SWAP 01-930 3266

Do you want to buy or sell a microcomputer? You can do it **FREE** in Computer Swap, a new regular service for *Popular Computing Weekly* readers.

All you have to do is phone Computer Swap on 01-930 3266 and give us details of your computer, the price you want for it, your name, address and telephone number.

Computer Swap entries are limited to a maximum of 30 words. They will be published in the first available issue.

POPULAR Computing WEEKLY

CLASSIFIED ADVERTISING

Computer Swap — Free/Private reader — 10p a word/Trade Advertisement — 20p a word/Semi-display — £5 a single column centimetre, minimum two-column centimetres.

Computer Swap — buy or sell your computer for free through Computer Swap. See box on left for details.

Private readers — other advertisements from private readers cost 10p a word.

Trade advertisements — cost 20p a word.

Semi-display — why not make your advertisement more substantial by choosing the semi-display rate. It is only £5 a single column centimetre.

Send your classified entries to Classified Department, *Popular Computing Weekly*, Hobhouse Court, 19 Whitcomb Street, London WC2. For semi-display enquiries call Alastair Macintosh on 01-930 3840.

Here's my classified ad.

Please continue on a separate sheet of paper

I make this words, at per word so I owe you £.....

Name.....

Address.....

Telephone.....

Brain teasers

by Gordon Lee

You are probably familiar with the sliding puzzle shown below which can be found in most toyshops.

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	■

It consists of a grid of 15 plastic squares which can slide freely around in a frame. The object of the puzzle is to rearrange the squares to form different patterns or to restore their order after they have been jumbled at random.

One of the earliest brain teasers using this puzzle involved lifting out the two tiles 14 and 15 and swapping them over. The task was then to rearrange them — by sliding only — to their original order. This problem is in fact insoluble, since the exchange of two tiles is said to alter the 'polarity' of the puzzle. There is no way that this can be reversed simply by sliding tiles.

If we remove all the tiles and replace them at random there are 20,992,789,888,000 different starting positions possible. The first tile can be placed in any one of 16 positions, the second in any of 15, and so on. The total number of starting positions given above is in fact $16!$ or $16 \times 15 \times 14 \times 13 \times 12 \times 11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 20,922,789,888,000$.

Only half of these starting positions can successfully be rearranged into the correct numerical order.

The Rubik cube has similar properties, but it contains 12 separate cycles — not two. If the elements of a Rubik cube are reassembled at random there is only a 1 in 12 chance that the cube can be completed. Of the 43,252,003,274,489,856,000 possible configurations of the cube, only 3,604,333,606,207,488,000 of them can be solved — still rather a formidable number.

An interesting variation uses letters instead of numbers.

R	A	T	E
Y	O	U	R
M	I	N	D
P	A	L	■

This forms the basis of a cunning trick. Show the puzzle to your friends, pointing out the wording and the two paired rows of differently coloured tiles. In full view, slide the tiles about and ask them to restore the original order. Try as they might, the closest they can get is "Rate your mind pla".

The catch is in the polarity of the puzzle. When you rearranged the tiles, apparently at random, you move the 'R' from the word 'Your' up to replace the 'R' from 'Rate'. Your friends naturally leave the 'R' from 'Your' in the top left as the start of the word 'Rate'. Unknown to them this reverses the polarity of the puzzle making it insoluble.

Puzzle No. 31

1	9	2
3	8	4
5	7	6

In this grid the middle number (384) is twice

the top one (192), and the bottom number is three times the top one. Each number has three digits and no digit is used more than once. How many other sets of numbers can be formed with these conditions?

Solution to Puzzle No. 5

Using the standard technique for identifying primes, we check the odd numbers in sequence, counting them off into successive groups. The count, C is started at 1 to account for the first (and only) even prime, 2.

```

Line
10 LET C=1
20 LET M=1
30 LET T=3
40 FOR N=3 TO (SQR T)+.5
50 IF T/N-INT(T/N)=0 THEN GOTO 80
60 NEXT N
70 LET C=C+1
80 LET T=T+2
90 IF T>M*1000 THEN GOSUB 200
100 GOTO 40
200 PRINT M*1000-1000: "TO": M*1000: "CONTAIN": C: "PRIMES"
210 LET M=M+1
220 IF M=11 THEN STOP
230 LET C=0
240 RETURN
    
```

This gives us the answer:

1	TO	1000	contain	168	primes
1000	TO	2000	contain	135	primes
2000	TO	3000	contain	127	primes
3000	TO	4000	contain	120	primes
4000	TO	5000	contain	119	primes
5000	TO	6000	contain	114	primes
6000	TO	7000	contain	117	primes
7000	TO	8000	contain	107	primes
8000	TO	9000	contain	110	primes
9000	TO	10000	contain	112	primes
0	TO	10000	contain	1229	primes

Winner of Puzzle No 25

The winner is: Ms H Eshun, Wolfe House, London W12, who receives £10.

ZIGGURAT



The Monkey Puzzle

It is worth wondering how people's minds work, and how, in particular, your mind works. Seymour Papert (in *Mindstorms*, 1980) poses the following puzzle: "A monkey and a rock are attached to opposite ends of a rope that is hung over a pulley. The monkey and the rock are of equal weight and balance one another. The monkey begins to climb the rope. What happens to the rock?"

There are three possible answers to the question: the rock goes up, goes down, or stays where it is — which is correct?

Papert notes that three quarters of several hundred physics students at MIT gave wrong answers, or were unable to make up their mind. I have asked people from many different occupations, of many different ages, and the ability to arrive at the correct response seems to be unpredictable. Obviously the correct answer

is that the rock goes up: those who were right, work out why you were right; and those who were wrong, try to work out why you were wrong.

This is, in essence, a very simple task, and it is only the solver who makes the task complex; the rock must rise, because the monkey is pulling on the rope. Asking people to justify incorrect answers is very illuminating. Those who have a knowledge of physics — sometimes dimly remembered — often talk about conservation of energy so that if the monkey goes up, the rock must go down, or sometimes they talk about inertia, so that the rock must stay where it is.

Sometimes people think that the rock must go up, but then think that this is too obvious so it must be one of the other solutions — these are people who are not sure of the solution, and naturally distrust easy answers.

What else can we learn from this example? One conclusion that Papert himself draws is that most (ie more than half) people cannot see the wood for the trees, that is, the structure of the problem is lost in the detail. When the problem is seen as a whole — after all, the rock is attached to monkey by the rope — the answer is obvious; but if attention is focused on to the rock (as it often is) then the integrity of the system is violated.

This is the way many people program: they are so concerned with the intricacies of tiny portions of programs, that the total way the program is designed is highly wasteful, and

confusing to follow.

A program is designed, but for many programmers the design is unknown to the designer: the program just grows from a few lines typed in at the keyboard, to a vast unwieldy monolith. A programmer is a designer, a programmer is an architect whose building bricks are ideas, and a program is only as good as the ideas it contains. If a program is very long and complex, then that program is either having to deal with a long and complex task, or it is badly written (or it might lie somewhere between these extremes).

When we try to evaluate programs, therefore, we should use design criteria and that usually means that the programmer needs to have had an appreciation of the program as an entity, an entity which has certain distinct parts or modules. Some languages are supposed to promote better programming practices than are other languages, but usually 'better' seems to mean neat and tidy (not a bad thing in itself) and the 'wholeness' is still lost.

The best designed programs do not come from a particular language, they come from programmers who understand the underlying structure of the problem for which they are writing a program. It is also a question of understanding what is the problem.

To write a program to use graphics to show addition in practice is not difficult. What are we to make, however, of a program for infant school children which puts three yachts on the screen, two cars, and five houses, and then tells the children that $3 + 2 = 5$?

ROMIK SOFTWARE

24 Church Street, Slough SL1 1PT. Telephone: Slough (STD 0753) 71535



**ROMIK PROMISE
A MINIMUM OF
ONE NEW GAME
EVERY MONTH**

Britain's leading games software house are proud to announce our new range of exciting games and other software for the Vic20. (Games for BBC, Dragon, Spectrum and Atari available soon.)

**ALL ACTION GAMES CARRY A FREE ENTRY TO NATIONWIDE COMPETITIONS WITH FANTASTIC PRIZES
ALL PROGRAMS ARE £9.99**

MARTIAN RAIDER

For unexpanded Vic20

Skim as close as you dare to the surface of the planet, devastating the Martian cities, destroying ammunition dumps (gaining more time), shooting down the ground-to-air missiles and UFOs, dodging or blasting the meteorites.



"A real action shot of the game"

MIND TWISTERS

For unexpanded Vic20

Four games to stretch your brain

Blackjack, Decipher, Four Thought and Teaser are our computerised versions of very popular home games and will test your mental agility and skill for many a long hour.

BLACKJACK

You start with £1,000, the objective being to break the bank, to do this you have to win (including your starting money) £20,000.

Instructions. You have to score nearer (but not over) 21, than the computer does. The computer deals your first card, you then place your bet and hit the return key, the computer then deals your second card. If you want another card hit the "C" key, if not hit the "S" key.

Points. Ace 1 or 11, Jack, Queen, King 10.

Scoring 21 points with 2 cards — you automatically win.

Scoring 21 points or less with 5 cards — you automatically win.

Draw — the computer wins.

Your kitty is automatically adjusted win or lose. If you lose all your kitty — game over.

DECIPHER

You have to guess what combination of colours the computer has selected — to enter a colour just hit the colour button on the computer, when you have entered your five choices of colour, the computer will display (a) Nothing at all — none right; (b) Black or white squares or both — for every black square you will have a correct colour in the correct position, for every white square you will have a correct colour in the wrong position. If you cannot find the complete combination, it will be displayed when you have had twelve attempts.

FOUR THOUGHT

You have to make a line of four squares — horizontally, vertically or diagonally BEFORE the computer does, taking turns to take a square (squares can only be placed at the bottom of the grid or on top of another square). **Keys.** Hit the number key of the column you want your square dropped in, then hit the return key.

TEASER

The aim of the game is to score "15" BEFORE the computer does, using any combination of three boxes. If you cannot score "15" then you must try and stop the computer from doing so and force a draw. **Keys.** Hit the number key of the box that you want (you can only select an empty box).

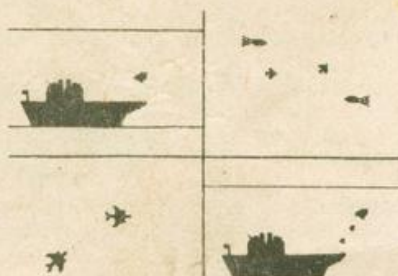
**ONE FULL-TIME FULLY
EXPERIENCED MACHINE CODE
PROGRAMMER WANTED
URGENTLY**

AIR-SEA ATTACK

For expanded Vic20

You can use 3K or 16K RAM

Can you plot a modern jet fighter? Take off from your aircraft carrier and engage enemy aircraft in battle. Shoot them down and then drop your bombs on the enemy aircraft carrier. Watch out — the enemy fighter is trying to do the same! If he gets past your air defence you are left to defend your own carrier with sea-air missiles. You each have three jets.



MULTISOUND SYNTHESIZER

For the unexpanded Vic20

The Vic Multisound Synthesiser is very flexible and can be played in more ways than can ever be explained here, to create music and special effects. For example, create any tune, up to 255 notes (after following appropriate instructions), then press "F1" or "F3", then key "9" and enjoy the added effect. Now hit "+", listen to the difference. For a surprise — hit "-" — Now add a melody over the top — hit key "8" then "7" — now play a melody, or experiment. *Have fun!*

NEW NEW NEW

SPACE ATTACK

For the unexpanded Vic20

NEW NEW NEW

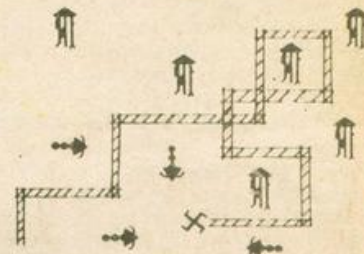
MOONS OF JUPITER

For expanded Vic20, 3K, 8K or 16K

SHARK ATTACK

For unexpanded Vic20

You are in shark-infested waters after being thrown overboard from a pirate ship. Your only protection being an atomic net which you trail behind you, trying to cover all the visible ocean and ensnare the sharks at the same time. Beware of stopping or covering your tracks for too long, if you do, then the sharks will escape and come after you. Watch out for the ever increasing deadly octopi (sometimes the sharks will eat part or all of one!)



"A real action shot of the game"

For the unexpanded Vic20

SEA INVASION

Fight off the attacking sea creatures for as long as you can. Shoot the whale for a surprise score, watch out for the crabs, starfish and octopi.

You are a commander of a fleet of destroyers. Looking on from the safety of Mother Ship, you send in one destroyer at a time to blast a passage through the

MOONS OF JUPITER.

Your destroyers have to dodge and blast the UFOs... Watch out for the Gologs, they can smash your destroyers, but you cannot harm them.

MACHINE CODE

ARCADE QUALITY GAME

SPACE ATTACK is a game of skill. You as the pilot of an intergalactic battleship have to fight your way through wave after wave of various alien spaceships.

MACHINE CODE

ARCADE QUALITY GAME

OUR GAMES ARE AVAILABLE FROM ALL GOOD HOME COMPUTER SHOPS, INCLUDING:

Meteclean, 92 Victoria Street, London SW1. 01-828 2511... Meteclean, 137 The Strand, London WC2. 01-240 2321... Meteclean, 177 London Road, Croydon. 01-686 8626... All branches of Laskeys, Vic Centre, 154 Victoria Road, Acton W3. 01-992 9904... A.C. Systems, Exeter... Microtrading, Birmingham... Supersoft, Harrow... Anlog Computers, Horley, Surrey. 346083... Ozwise Computers, Harrow. 429 1060... Cavendish Data Systems, South Norwood. 656 8941... Software Master, 30 Lincoln Road, Birmingham... Tomorrow's World, Dublin... Algray Software, Barnsley. 83199... Computer & Business Systems, Nelson, Lancs. 0282 601191... Dyad Developments, Oxon. 08446 729... Leisurronics/Blackpool Computer Stores. 0253 27091... Carlow Radio Ltd., Bedford. 60447... Byte Shop Computerland, Glasgow. 221 7409; Nottingham 40576; Manchester 236 4737... First Byte Computers, Main Centre, Derby. 365280... Simmons Magee Computers Ltd., Twickenham. 891 4477... Capital Computer Systems, Ilford. 553 3026... A.O.M. Business Systems, L.V.E. Building, Leicester. 548923... Jutea Ltd., Bridge, Near Canterbury, Kent. 0227 830083... Twickenham Computer Centre. 01-892 7896... Kent Microcomputers, Maidstone. 0622 52784... J. S. Simnett Computers Ltd., The Computer Shop, Kingston. 01-546 3793... Chris Denning Ltd., Poole. 0202 761859... Yorkshire Micro Computers, Scarborough, Yorks. 0723 78136... Taylor Wilson Systems, Oakfield House, Station Road, Dorrridge.