

POPULAR ^{40 look} **Computing** WEEKLY

35p 26 May-1 June 1983 Vol 2 No 21

This Week

Spectrum utilities

Tony Bridge weaves his way through a maze of utility programs including *Masterkey*, *Disassembler* and *Machine Code Test Tool*. See page 13.

Dragon keyboard

Peter Chase presents a m/c routine to enhance keyboard responses and extend the use of colour on the Dragon. See page 22.

ZX81 label maker

R Luxton explains how to make your own labels on the 16K ZX81 on page 17.

New releases

All the latest software releases including news of *Valhalla*, an animated graphics adventure for the Spectrum. See page 53.

★ STAR
Depth Charge
on Vic20.
See page 10.
GAME★

News Desk

Dragon goes across the pond!

DRAGON microcomputers will go on sale in America in August.

This is the result of negotiations, now in the final stages, between Dragon Data and the American manufacturer Tano, who will assemble, distribute and sell the computer in the US.

The American Dragons will be the first fruits of a new joint venture, set up by the two companies, called Dragon Tano Inc. Dragon Data holds a 49 percent share in the new company — Tano holds the remaining 51 percent.

Tano will begin by manufacturing 2,000 machines a week, supplemented initially by machines built by Dragon in this country.

The Dragon 32 will sell for \$300 (about £185) and the Dragon 64 will sell for \$400 (about £250). As well as being adapted to work with the US NTSC television system, the American Dragons differ from their UK relatives in that they

Continued on page 4

Softek compiler payments dispute

SILVERSOFT and Softek have clashed head-on in a dispute over royalty payments for a program written using a compiler.

The argument concerns the Silversoft program *Slippery Sid* which was written using the *Super C* Spectrum compiler from Softek.

Softek is claiming that Silversoft has infringed copyright and broken a contract of sale of the *Super C* program, by using the compiler to develop a commercial arcade game without permission. The company is insisting — and Silversoft is steadfastly denying — that a royalty payment must be made by Silversoft to Softek on every *Slippery Sid* tape sold.

Softek is now considering legal action, possibly involving an

injunction this week, to halt sales of the *Slippery Sid* program pending resolution of the dispute.

Softek's Tim Langdell explained that the *Super C* program — written by Andrew Glaister — is sold subject to the condition that it is not used to write commercial programs:

Continued on page 4



Classified

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Continued on page 8

★★ ADVENTURE COMPETITION — WIN A 64 ★★

WINDOW ON ANOTHER WORLD

NEW RELEASES

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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.

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Editorial

The decision to hold a General Elec-
tion on June 9 has resulted in the
death of the Data Protection Bill. With
insufficient time left to pass the Bill
before the dissolution of the present
Parliament, the government decided
to drop it.

The Data Protection Bill, you may
remember (*Popular Computing Week-
ly*, 31 March — 6 April), was bitterly
opposed by a variety of groups includ-
ing the British Medical Association
and the Law Society.

However, it looks likely that the Bill
will be resurrected after the election
if the Tories are re-elected.

Opponents of the Bill are not
against data protection legislation as
such, but they are concerned that
there should be adequate safeguards.
The old adage of garbage in/garbage
out is particularly applicable. If there
are no checks on what goes into a
computer, there will be few on what
comes out.

Perhaps there is a need for some
sort of data protection ombudsman —
an independent guardian conversant
with the intricacies of computer re-
cords.

Data protection is an extremely
thorny subject, but it is one that will
affect all of us. The time to lobby the
government for adequate safeguards
is now — it will be too late once a new
Bill has been passed.

Next Thursday

See if you can avoid the aliens in this
Invader's type action game, where you
are the city bomber trying to keep clear
of the flying anti-matter disc! New York
— next week's Star Game for the 16K
Spectrum by P. Watson.

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Compiler dispute

Continued from page 1

"If it is used in this way then the software house must reach agreement with us over a royalty payment. This is individually negotiated with each software house concerned, but is typically around five percent of the wholesale price.

"We think that this is a small price to pay for the saving that the *Super C* program makes in terms of the time needed to create a machine-code program.



Andrew Glaister

"If this is unacceptable, then the purchaser can send it back and we will refund the money.

"Silversoft bought our compiler in December and used it to produce the *Slippery Sid* program, without negotiating a royalty payment with us.

"What they appear to be saying is that they don't agree with the idea of royalties on compilers."

Softek claims copyright has been infringed in the so-called run-time routines in the *Super C* program that are used in the *Slippery Sid* program. Explained Tim: "Our compiler is different from other compilers found on main-frame and mini-computers. *Super C* produces a sort of mini-Rom. Instead of calling routines from the Spectrum's Rom it uses its own — which actually form part of any program written using the compiler. When a character is printed on the screen it is our run-time routine that does that."

Silversoft's David Patterson vigorously denies that any copyright has been infringed or contract breached in Sof-

tek's compiler: "Tim's main argument is that his compiler goes through a two-stage operation. The main compiler takes the Basic source code and converts it into machine-executable code. The second part of the program then executes it. He is claiming that because the executive code is an integral part of the program then we are in breach of his copyright. That is like trying to sell a paint-brush without a handle.

"We have absolutely no intention of paying a royalty to Softek on each *Slippery Sid* tape sold, and if he wants a fight then he's picked the right company.

"We bought his compiler by mail-order and there was no mention that Softek wanted to charge a royalty on programs developed using it in the mail-order advertisement — at the point of sale.



David Patterson

"When you write a programming tool like a compiler you either keep it to yourself or put it in the public domain. Trying to charge a royalty on programs written with it is laughable. We have no intention of doing anything about his request for a royalty and if he wants to sling mud — let him go ahead."

● Andrew Glaister, who wrote the *Super C* program for Softek, is a former Silversoft programmer. He wrote *Orbiter* for them last year. He receives 25 percent of any income gained by Softek on the *Super C* compiler, either through sales of the compiler itself or from royalties on programs written using it.

patible computer which they import from the Far East and they will use the dealer network set up for that product to sell the Dragons. At the same time we will hope to expand the network to pick up a considerable number of new dealers."

Tano is based in New

Design your own Forth micro!

POTENTIAL purchasers of a new Forth microcomputer are to be consulted over the final design of the machine.

The new machine, as yet unnamed, will be designed and manufactured by Remsoft and Advanced Test Systems.

It will run Forth, be priced between £300 and £500 and the first prototypes should be working by the end of June. The computer will be 6502-based with either 64K or 128 K Ram, 16K Forth 79 Standard Rom and an on-board disc operating system for Sony 3½ inch 70 track micro floppy disc drives.

Other features are yet to be determined and will be decided by potential purchasers of the machine. Advertisements will be placed in a variety of magazines inviting members of the public to fill out a questionnaire to help determine the final specification of the new machine. It will probably have an RS232, Centronics and RGB outputs, have a bit-mapped screen display in eight colours and a second Rom port.

Dragon drop their prices

DRAGON Data has cut the price of the Dragon 32 computer from £199.50 to £175.

First to react was Boots who introduced the new pricing last week and other retailers are expected to follow.

The price drop is recognised as a reaction to cost cutting two weeks ago of the Sinclair Spectrum machines. Boots' merchandising controller, John Flatman, commented: "It is a general trade price reduction which we think retains the correct price differential between the Dragon and the Spectrum."

Orleans and began by manufacturing control systems for the oil, gas and shipping industries.

Dragon has been looking for a suitable US manufacturer since the autumn of last year and the computer was first exhibited over there at the Comdex Fair in Atlanta this year.

Remsoft already supplies a range of software for the Jupiter Ace Forth micro and plans to convert much of this material for the new machine in time for its launch later in the year. A word processing package and database program are also planned.

Explained Paul Wynter of Advanced Text Systems: "It is an experiment but, for the first time, the public will play a part in the design of a machine they might buy."

"The design is an up-rating of an existing 6502 board that we currently manufacture. The exact form of that up-rating is still very much undecided — and what form it will take depends very much on the results from our questionnaire."

If you would like to take part in the survey then write for your questionnaire to Remsoft, Freepost, Brighton BN1 1ZW.

Cyborg disc drive versions under way



CYBORG'S 5¼ inch disc drive is now working with the ZX81, Spectrum and Oric computers and work is under way on versions for the Vic20, Commodore 64 and Dragon.

The system's claim to fame is that the discs are transportable from machine to machine involving only a change of connector. This is possible because the disc operating system is designed with its own 6500/12 processor on board and the operating system software need therefore not be compatible with the host micro (see Popular Computing Weekly, May 5).

The system should go into production some time in late June.

Across the pond

Continued from page 1

are equipped with an RS232 interface as standard.

Tony Clarke, Dragon's managing director, explained the strategy for the US: "Tano already sell an Apple com-

Low-cost networking



A LOW-COST simple 'networking' system for any machines that load from an ordinary cassette player is available from Network Computer Systems.

The Multiload system makes use of a computer's Save and Load commands to direct programs from one machine to another.

No facility is provided to protect against message collisions but a four-computer arrangement costs only £6.95. Additional connecting cable costs around 50p per metre.

The system will only transfer information satisfactorily between computers of the same type, but will work with ZX81s, Spectrums, BBCs, Orics and Aces.

Details from Sue Clarke, Network Computer Systems, 39 Bampton Road, Luton, Beds.

Timex dispute at an end

THE sit-in by 350 workers at the Timex plant, which had halted development work on the Sinclair Research flat-screen tv project, has ended.

Normal working is due to be resumed this week, bringing to an end a dispute which has lasted for more than six weeks. Union officials of the AUEW and TASS have accepted an agreement involving 425 more job losses, delayed for 90 days.

Clive Sinclair commented that he was "absolutely delighted" that the dispute has been resolved.

Now it's Ms Pac-Man!

IF you hoped you had seen the last of Atari's gobbling *Pac-Man* then you will be disappointed.

Now the company is offering a follow-up — *Ms Pac-Man*. Atari claims "this little lady is a screen sensation, more dynamic and more talented than even *Pac-Man* himself".

Ms Pac-Man is a cartridge for the Atari VCS and costs £29.99.

Sinclair joystick option

THE Sinclair Research Rom cartridge adaptor (see *Popular Computing Weekly*, May 19) will also operate as a joystick interface.

The joystick port has been in the pipeline for some time. Indeed, some software packages from Psion — *Hungry Horace* for example — contain the necessary software hooks to run with the joystick.

● There is still no sign of the Sinclair £40 microdrives — originally mooted over a year ago. Although much of the development work is now complete, industry sources suggest that Norfolk-based DK'Tronics has been brought in to assist with the project.

Argus cassette magazine

ARGUS Specialist Press, publisher of *Computer Today*, *ZX Computing* and *Micro Update*, is to launch the first magazine for computer users written entirely on cassette.

The cassette magazine —

Memory expansion boards for the BBCs

JOHN Richardson Computers plans a range of add-on memory expansion boards for the BBC microcomputer.

The company will sell 64K and 128K boards which, just like a Ram pack, simply plug into the computer via the 1MHz bus.

Although not addressable from the machine's Basic, the memory is seen by the computer as a 'book' of pages each containing 256 bytes. Access to the pages is via machine-code *Peeks* and *Pokes*. Just as with an array, it is possible to *Peek* in and *Poke* out of the pages keeping track of the page number.

The pages can be used to store data or sections of completed programs. Four pages can be linked together to hold a single screen of information. Such a technique could hold

displays used in simple animation or perhaps locations in a graphics adventure.

"The big limitation with the BBC machine," explained company founder, John Richardson, "is its memory. The advantage of our system compared with loading information off discs is speed. We can use a full 64K to store something like a mailing list or telephone directory in alphabetical order and get out data much quicker than is possible with a disc."

The 64K board should be available by the end of June and will cost around £140. The 128K board will follow at a price in the region of £175. More details from John Richardson Computers Ltd, Unit 337, Walton Summit, Bamber Bridge, Preston, Lancs.

Oric joins up with Cosmic in the Orient!

ORIC has formed a new company to manufacture and sell its computers in Japan and South East Asia.

The new venture — Oric Japan — is half-owned by Oric Products and half-owned by a consortium including one of Oric's far east manufacturers and Cosmic, a Japanese retail chain.

Oric's manufacturers are making the necessary changes

to the machine to operate with Japan's NTSC television system and Oric are also developing software which will run using the Japanese Kana character set.

Sales of the Oric computer in Japan are planned to commence in July.

● It is also hoped that a version of the NTSC Oric will be produced by the same manufacturer for sale in the US.

Microfairs to be held in June

THE beginning of June sees shows in London for both Sinclair and Commodore.

The 7th ZX Microfair will be held at Alexandra Palace on Saturday, June 4. Entry costs £1 and the fair will be open from 10 am to 6 pm.

Spectrum Computing — is for Spectrum owners and is compatible with both 16K and 48K models. The first issue — May/June — contains over 80K of programs and software reviews presenting on-screen extracts from the games.

Spectrum Computing will be published bi-monthly and will be available from W H Smith and John Menzies, price £2.99.

The 4th International Commodore Computer Show will be held at the Cunard International Hotel, Hammersmith from Thursday, June 9 to Saturday, June 11. Again, entry costs £1 and the show will be open from 10 am to 6 pm on Thursday and Friday and from 9 am to 5 pm on Saturday.

Texas price reduction

Correction: To take full advantage of Texas Instrument's special price deal for the 99/4A computer (see *PCW*, May 19) it is necessary to buy a selection of software cartridges.

To get a free Speech Synthesiser — worth £49.95 — or cassette recorder, you must also purchase six TI Rom software packs.

ZX MICROFAIR

THERE'S ROOM FOR EVERYONE AT THE BIGGEST ZX MICROFAIR OF ALL TIME!



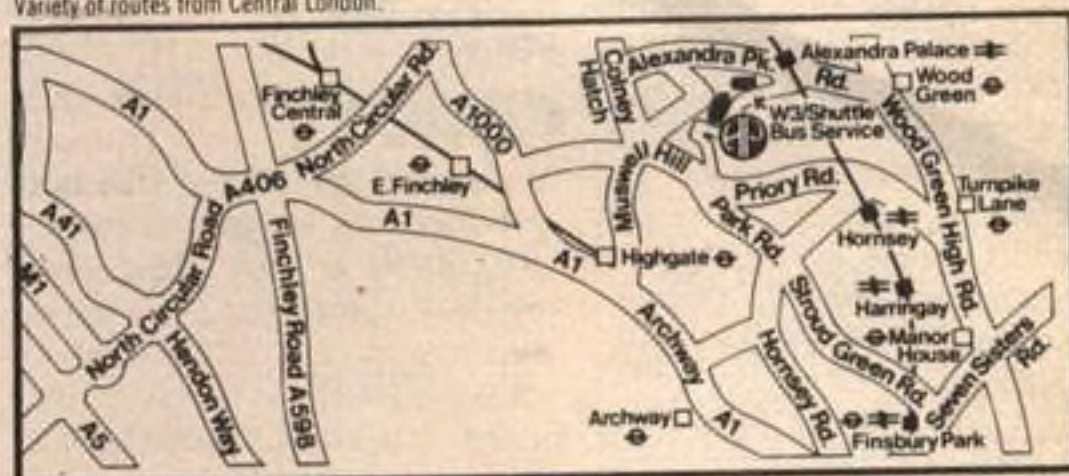
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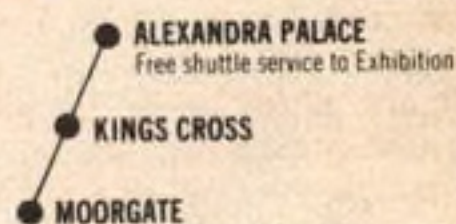
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By British Rail
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By London Transport
Underground: Victoria Line from Victoria (also Oxford Circus, Kings Cross/St Pancras) to Highbury and Islington — change (cross platform) to BR Suburban Service to Alexandra Palace — free shuttle bus or 5 minute walk from there!



Alternative: Piccadilly Line (from Heathrow etc) to Finsbury Park or Wood Green — Link with W3 bus service to the fair.

HEATHROW ← Piccadilly Line

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7th
ZX MICROFAIR
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SATURDAY JUNE 4th at ALEXANDRA PAVILION, ALEXANDRA PALACE, WOOD GREEN, LONDON N22. FROM 10am to 6pm.

Advance tickets available from: Mike Johnston, 71 Park Lane, Tottenham, London N17 0HG. Adults £1.00. Kids (under 14) 50p.
Please make cheques payable to ZX MICROFAIR and enclose S.A.E.

Sensible solution?

I am writing to you on two subjects — the inevitable software library topic and the letter from Ashley Buss in your March 31 issue.

Dealing with the latter first, may I suggest to your reader that he refers to the Dragon manual (p. 17) for the easy method of listing programs, ie, pressing *Shift* and *@* together to stop the list at any point and then pressing any key to continue.

On the subject of software libraries, I find the attitude of certain manufacturers hard to accept. I know that this is a young industry, but surely some sense must prevail soon.

Instead of trying to fight the libraries, why do the manufacturers not enter into agreements with them? A similar situation to this happened in the video industry until the major companies realised that the market was primarily interested in renting tapes. Consequently, instead of selling their tapes to dealers, the video companies entered into rental agreements.

Now, I know that renting a film is not quite the same situation as renting software, but there are similarities. It does not matter how good the software is, there comes a time when its appeal wears off, and then what happens? It is swapped or sold to a friend — albeit illegally.

I am a member of a software library, and I find its services invaluable. I have, in the past, bought several tapes (up to £10 each) that were of disgraceful quality and on these occasions have felt somewhat cheated out of my hard-earned cash. Bad software had in fact discouraged me from making purchases for some time.

This is where the software library comes in. If I obtain a poor program, I don't mind having wasted £1.50, and if I obtain a good program, I will support that company again in the future.

One of the most interesting points is that I spend the same amount of money renting instead of buying. Now, assuming that is the situation with everyone else, there must be the same amount of money going into the system. There-

fore, it is just a question of getting the distribution of this money right.

There seem to be two alternatives. Firstly, the manufacturers could rent libraries their tapes on a monthly basis instead of selling them. Secondly, manufacturers could charge the libraries about 50p every time they lend a tape.

I am sure that given a sensible arrangement, the only people to suffer would be the manufacturers of poor quality software, and that would be no bad thing!

Iain Mackenzie
16 Dudley Drive
Glasgow G12 9SB

Who's to blame?

I feel I must reply to the letter from A J Prestwich (*Popular Computing Weekly*, April 28-May 4) concerning his trouble with obtaining his 32K expansion from ELR for his issue 1 Spectrum.

I also own an issue 1 and have received and fitted an expansion from ELR, and I don't really believe ELR should take all the blame. Sinclair has released more issue 1s than it has led people to believe and I will be very interested to see if Sinclair produces an expansion for it. By the way, my expansion operates perfectly even after one stretch of eight hours non-stop use.

PS. I thought Clive Curry's *Magical Software* letter was hilarious.

G Bloomfield
Britannia
7 Edmund Close
Downend
Bristol BS16 5EJ

Free reign with railcards!

Hot on the heels of sensational revelations in certain magazines last week, concerning software houses and the cars their employees drive, Bug-Byte's co-director Tony Baden has let it be known that he is awaiting delivery of a Reliant Robin, complete with "GT stripe". Sales Manager John Phillips and Assistant Sales Manager Barbara Smathers share a 1973 Mosk-

wich van and newly appointed creative and artwork head Les Harvey is believed to have ordered a Skoda Estelle. "Even though it's a bit flash," he says.

The rest of the staff have unlimited access to all buses and trains. "We allow them a free reign with their student railcards," says Baden, "And our UK Office Manager, Matthew Thomas, who I believe is 12, has his sister's bike." Baden hopes the news will not upset the company's customers, "I'd hate them to think we were wasting their money," he said.

Stop Press. Harvey distraught. Estelle not available. Yugo ordered.

Matthew Thomas
Bug-Byte
100 The Albany
Old Hall Street
Liverpool L3 3AB

This letter follows a news item about *Imagine Software* and its new range of company cars in *Home Computing Weekly*, May 17-23. We are eagerly awaiting new developments in this Liverpoolian saga. Watch this space.

Extended life!

Users of microcomputers may have seen a parallel between computer software and what has been known as the "soul" of a person, occupying the body's computer, the brain. The conclusion may have been drawn that were it possible to somehow record the program from the brain, then immortality could result, if it could be played into a replacement body.

Such science-fiction may well become fact, but not within the lifetimes of many of those now living. However, some Americans have been exploring the ideas of cryonic suspension, where the bodies of deceased people are stored in liquid nitrogen until such time as the freezing damage, cause of death and ageing damage can be reversed.

Work is in progress to enable British people to take part in the cryonics program, and the cost needn't be high within life, as long as sufficient assets are available upon death to pay for suspension and stor-

age. As you can't take them with you, the perceived financial loss if this unproven process doesn't work needn't be high. An associated group is also working on ways to retard ageing now, and collates available scientific information as well as funding its own research. It has achieved much publicity from appearances on US television and the publication of a best seller, *Life Extension - A Practical Scientific Approach* (Pearson & Shaw, Warner, \$20, 1982).

I have been researching the cryonics and life extension programs, and can send free details to anyone interested.

John de Rivaz
West Town House
Porthtowan
Truro
Cornwall TR4 8AX

One Point Two

They do say that in a certain part of Cambridgeshire there is a creature strange called *One Point Two MOS*. 'Tis affirmed twas borne of an Acorn by the Good Fairie Beebeecce.

If all 'tis said is true, *One Point Two* is a wondrous benevolent creature, serving as page to many Roms, making men especial Word Wise. It doth destroy the many tiny vermin in cassettes and renders sundry things possible.

Time and again the wise men have joyously foretold the coming of *One Point Two* throughout the realm. They look deeply into their crystal balls but often and sadly do turn away, their cash tills silent.

I have conversed with travellers and those in far places demanding of them "what doth the creature resemble". Though many have heard tell of it, I have met none who have yet seen it.

Despairing then I will hie me hence to a monastery or a Sinclair or a Dragon or anywhere that reacheth specification. Ere I go I must forewarn my family, friends and neighbours gainst th'illusions of life and the Model B.

M G Goldsmith
2 Pulsborough Close
Georgeham
Braunton
Devon EX33 1JX

GEMINI

more programs

GEMINI SPECIAL FREE OFFERS
3 for the price of 2 - SAVE £19.95!
5 for the price of 3 - SAVE £39.90!
7 for the price of 4 - SAVE £59.85!
(CASHBOOK & FINAL ACCOUNTS NOT INCLUDED)



CASH BOOK ACCOUNTS PROGRAM FOR BBC 32K, TORCH, SPECTRUM 48K
NEW £59.95

ACCOUNT	DEBIT	CREDIT
1 Sales (1)		4000
2 Sales (2)		4000
3 Purchases (1)	2000	
4 Purchases (2)	2000	
5 Cash Sales & Recd		1000
6 Cash Payments	1000	
7 Bank Interest		100
8 Bank Charges	100	
9 Bank Overdraft		1000
10 Bank Loan		1000
11 Bank Repaid	1000	
12 Bank Balance		1000
13 Bank Interest		100
14 Bank Charges	100	
15 Bank Overdraft		1000
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17 Bank Repaid	1000	
18 Bank Balance		1000
19 Bank Interest		100
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291 Bank Overdraft		1000
292 Bank Loan		1000
293 Bank Repaid	1000	
294 Bank Balance		1000
295 Bank Interest		100
296 Bank Charges	100	
297 Bank Overdraft		1000
298 Bank Loan		1000
299 Bank Repaid	1000	
300 Bank Balance		1000

One of the most innovative business programs on the market. Replaces a manual cash book system, e.g. Simplex and 'All-in-One'. Written by practising Chartered Accountants, this practical program is simple to use and will replace your manual cash and bank records. By giving you access to vital management information as and when you want it, it will enable you to keep more positive financial control of your business.

The software is extremely well and lucidly documented, and Gemini provide a full technical back-up and product up-date policy. Take a look at the information this program will provide:-

- * Summary of VAT information for VAT returns
- * Cumulative receipts and payments report analysed over the standard profit and loss and balance sheet headings
- * Option for departmental analysis of sales and purchases
- * Audit trail printout of all transactions.
- * Journal routine for entering transfers between accounts and year end adjustment for debtors, creditors etc.
- * Trial balance at any interval
- * Interfaces to 'Final Accounts' program to produce balance sheet and trading and profit/loss account etc.
- * Spectrum version may be used with Sinclair OR 80 column printer.



FINAL ACCOUNTS PROGRAM FOR BBC 32K, TORCH, SPECTRUM 48K £59.95

Requires Cash Book module. This program will take your cash book data to the logical conclusion of balance sheet, trading and profit/loss account and notes to the accounts i.e. fixed assets, land and buildings and capital accounts. Final accounts (BBC version) links to 'Beebplot' for graphic data presentation.

Format: Torch disk, BBC disk/cassette, Spectrum cassette.
Special Offer - Cash Book and Final Accounts together - £95

BALANCE SHEET AT 31/12/81		TRADING AND PROFIT/LOSS ACCOUNT		NOTES TO THE ACCOUNTS - FURTHER	
Fixed Assets	1000	1000			
Current Assets	2000	2000			
Less Current Liabilities	(1000)	(1000)			
Net Assets	2000	2000			
Capital	1000	1000			
Reserves	1000	1000			
Profit	1000	1000			
Loss	(1000)	(1000)			
Dividends	(1000)	(1000)			
Interest	1000	1000			
Charges	(1000)	(1000)			
Overdraft	(1000)	(1000)			
Loan	1000	1000			
Repaid	(1000)	(1000)			
Balance	1000	1000			
Interest	1000	1000			
Charges	(1000)	(1000)			
Overdraft	(1000)	(1000)			
Loan	1000	1000			
Repaid	(1000)	(1000)			
Balance	1000	1000			
Interest	1000	1000			
Charges	(1000)	(1000)			
Overdraft	(1000)	(1000)			
Loan	1000	1000			
Repaid	(1000)	(1000)			
Balance	1000	1000			

"Gemini's range of software is in the vanguard of the releases for 'serious' micro users..."
(WHICH MICRO AND SOFTWARE REVIEW)



INVOICES AND STATEMENTS . . . £19.95

Compatible with most micros. See table. Ideal for the small business. A complete suite of programs together with generated customer file for producing crisp and efficient business invoices and monthly statements on your line printer. All calculations include VAT automatically, and the program allows your own messages on the form produced. This program gives you superb presentation and saves time on one of the most tedious tasks in the office.



COMMERCIAL ACCOUNTS . . . £19.95

Compatible with most micros. See table. A gem of a program, all for cassette, with the following features:- Daily Journal. Credit Sales. Cash Sales. Credit Purchases. Purchases—other. Sales Ledger. Purchase Ledger. Bank Account. Year to date summary. A fully interactive program suitable for all businesses. Files can be saved and loaded and totals from one file carried forward to another on cassette. Particularly useful from a cash flow point of view, with an immediate accessibility to totals for debtors and creditors. Bank totally supported with entries for cheque numbers, credits and, of course, running balance.



MAILING LIST . . . £19.95

Compatible with most micros. See table. A superb dedicated database to allow for manipulations of names and addresses and other data. Gemini's unique 'searchkey' system gives you a further ten 'user-defined parameters' to make your own selections. Features include the facility to find a name or detail when only part of the detail is known, it will print labels in a variety of user specified formats.



DATABASE . . . £19.95

Compatible with most micros. See table. The program that everyone needs, the most valuable and versatile in your collection. Facilities include sort search, list print if required. Can be used in place of any card index application; once purchased you can write your own dedicated database to suit your particular needs with a limitless number of entries on separate cassettes.



STOCK CONTROL . . . £19.95

Compatible with most micros. See table. Dedicated software with all that's necessary to keep control of stock. This program will take the tedium out of stock control and save time and money. Routines include stock set up, user reference number, minimum stock level, financial summary, line print records, quick stock summary, add stock, delete/change record and more.



HOME ACCOUNTS . . . £19.95

Compatible with most micros. See table. Runs a complete home finance package for you with every facility necessary for keeping a track of regular and other expenses, bank account, mortgage, H.P., etc. This program also allows you to plot graphically by Histograms your monthly outgoings.



WORD PROCESSOR . . . £19.95

Compatible with most micros. See table

Programs for more computers!



SPREADSHEET ANALYSIS BEEBCALC £19.95 DRAGONCALC £19.95

NEW

FOR BBC AND DRAGON 32. Spreadsheet processors have proved to be important tools for using micros in business, scientific and domestic financial applications.

POSITION	A1	RC	SPACE	5185	T
II	A	II	B	II	C
1	- J.B. SNOOKER T/A POT - BLACK				
2	PROJECTED CASH FLOW				
3				YEAR	ENDED
4				Oct.	Nov.
5				£	£
6	INCOME				
7	Sales				
8				11786	10944
9	REVENUE EXPENDITURE				
10	Purchases				
11				500	500
12	Advertising				
13				500	1000
14	Director's salary				
15				1596	1596
16	Salaries				
17				2216	2216
18	Rent				
19					
20	Telephone				
					300
	Insurance				
					200
	Printing, stationary				
					400
	Repairs & renewals				
	Hire of equipment				
				60	60
COMMAND BCDEFGPRSTW'?					

Without any programming knowledge at all, you may:-

- Set up a computerised spreadsheet, with chosen row and column names.
- Specify formulae relating any row or column to any other.
- Enter your source data and have the results calculated.
- Save the results on tape (or disk - BBC) for later reloading and manipulation.
- Print the tabulated results in an elegant report format.
- Experienced users may access saved files and write their own reporting or graphics presentation programs for the results.

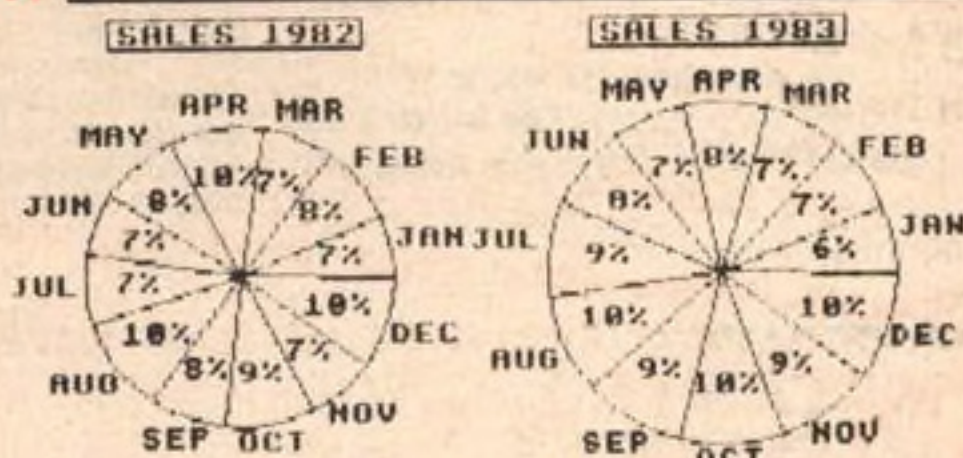
Some typical applications:-

- Small business accounting applications, e.g. profit and loss statements and cashflow projections, break-even analyses etc.
- Investment project appraisal - anything from double glazing to oil rigs!
- Comparing rent/lease/buy options.
- Processing the results of scientific experiments or field studies.
- Engineering calculation models.
- In fact, anything that involves repeated re-calculation of results presented in tabular or spreadsheet format.

Program Availability Chart:-

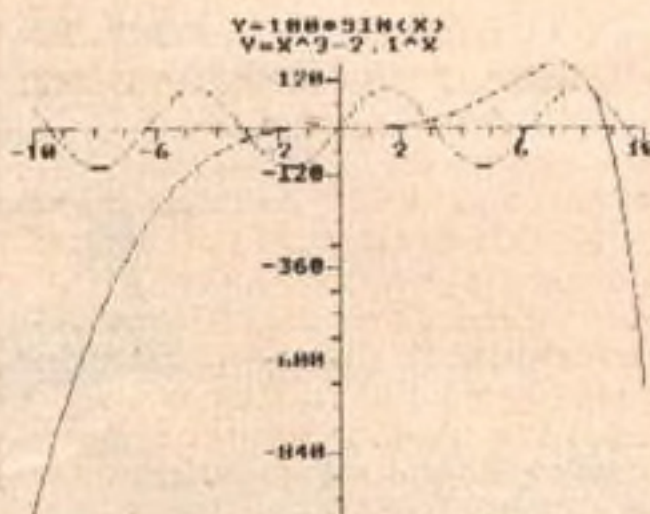
	Database	Stock Control	Mailist	Invoices & Statements	Spread sheet Analysis	Cashbook Accounting	Word processor	Home Accounts	Commercial Accounts	Plot	Final Accounts
Sinclair Spectrum 16k or 48k	●	●	●			●		●	●	●	●
Dragon 32k or 64k	●	●	●	●	●			●	●		
VIC 20 (16k +)	●	●	●	●				●	●		
Sinclair ZX81 (16k +)	●										
Grundy Newbrain	●										
Sharp MZ80A	●	●	●	●				●	●		
Sharp MZ80K	●	●	●	●				●	●		
Sharp MZ80E	●	●	●	●				●	●		
BBC Micro model A or B 32k	●	●	●	●	●	●	●	●	●	●	●
Atari 400/800	●										
Torch	●	●	●	●	●	●	●	●	●	●	●
Epson HX-20	●										
Commodore 64	●										

BEEB PLOT & SPECTRUM PLOT £19.95 NEW



100% = 60055

100% = 70005



Important new additions to the Gemini family. Present numeric and string data together in easily-understood pie chart, histogram or graph format. Beebplot has a built-in interface to Beebcalc, and both Beebplot and Spectrumplot have built in interfaces to the Final Accounts program of Cashbook. The facility for mathematical function

plotting is also provided. The BBC version has a high resolution screen dump for the Epson or CP-80 printers, and the Spectrum version dumps to the Sinclair printer via the 'copy' key. A very useful program that will give superb results either from direct input of data from the keyboard or via simple access to other software data files. A must for business and education.

Dealer/Trade enquiries invited - generous trade discounts for quantity.

Special ACCESS card instant sales hotline for prompt despatch... 24 hr Ansaphone Service.

All enquiries other than credit card sales to 03952-5832

Tel: 03952 5165

Gemini. Functional Software Specialists. 9, Salterton Road, Exmouth, Devon. EX8 2BR

PLEASE SEND URGENTLY

(Please note: Items as priced except BBC/TORCH DISKS: please add £4 extra for 40 track and £5 for 80 track format)

Name _____

Address _____

Machine Type _____ Memory Size _____

I enclose _____

Make cheques and postal orders payable to Gemini Marketing Ltd.

Access Number _____

Signature _____



Gemini
MARKETING LIMITED

Gemini. Functional Software Specialists,
9 Salterton Road, Exmouth, Devon EX8 2BR

Depth Charge

A new game for the Vic20 by Robert Irvine

In this game you are a warship patrolling the ocean, trying to clear it of enemy submarines. You move with the joystick, left, right, and use the fire button to drop a depth charge.

You have 20 depth charges to score as many points as possible. The lower a sub is in the water, the more points it is worth.

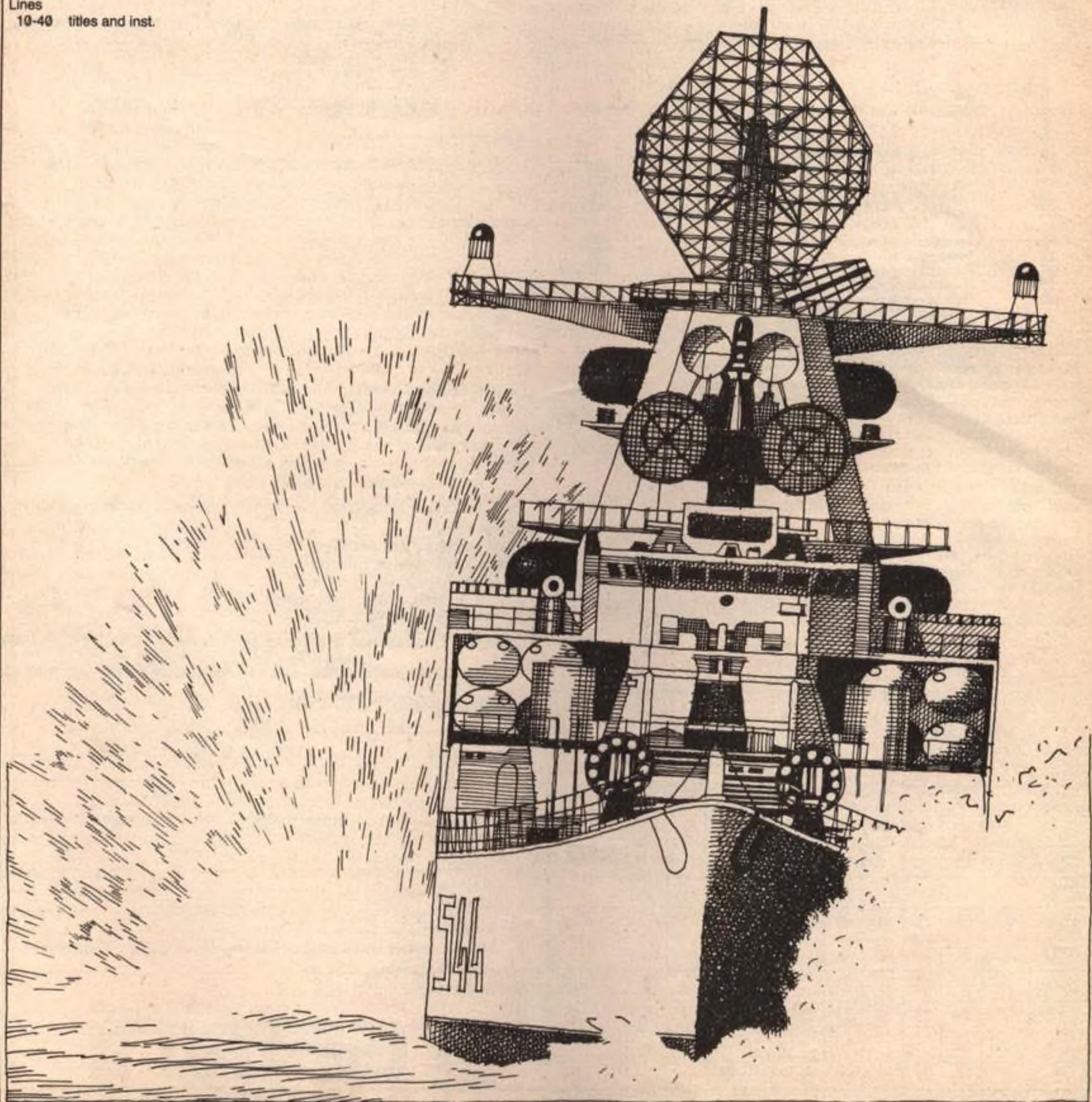
51-71 user def. graphics and joystick pokes
100-130 set up screen and define variables
130-140 decide where sub comes from and print it on screen
151-170 joystick peeks
175 checks if you have charges left
186 checks if you have hit a sub
190-230 firing sequence
300-325 sub hit routine
400-500 end graphics routine
500-530 end or restart routine

Variables used

dp — depth charge position
sp — ship position
sr — level of sub (depth)
sl — start location of 'sub' routine
se — end location of 'sub' routine
sv — score value (of sub)
sc — total score
fd — depth charge has fallen
vl — volume level (sound)
vv — volume level (sound)

Program notes

Lines
10-40 titles and inst.



READY.

```
10 PRINT "███"; "  DEPTH CHARGE█"
15 PRINT "███BY ROBERT IRVINE (C)"
20 PRINT "███YOU CONTROL THE SHIP,"
25 PRINT "███TRY TO 'DEPTH CHARGE'";PRINT "███THE SUBMARINES THAT"
26 PRINT "███MOVE BENEATH YOU."
27 PRINT "███YOU HAVE 20 CHARGES.";PRINT "███THE LOWER SUBS SCORE";PRINT "███MORE POINTS"
"
30 PRINT "███GOOD LUCK!!"
35 PRINT "███PRESS ANY KEY TO START█"
40 GETPP$:IFPP$="" THEN40
51 POKE36876,220
55 FORY=7168TO7168+71:READJT:POKEY,JT:NEXTY
61 DATA0,0,0,0,0,0,0,0
62 DATA4,4,63,15,255,106,63,31
63 DATA128,128,248,224,225,255,254,252
64 DATA0,0,0,0,14,255,111,63
65 DATA64,224,236,232,232,255,246,252
66 DATA0,0,40,124,40,0,0,0
67 DATA255,255,255,255,255,255,255,169,148,74,170,53,210,74,89
68 DATA16,56,56,16,16,56,16,40
69 POKE36869,255:F=0:FD=22:DP=0:M=0:SC=0:DL=20
71 POKE37151,0:PA=37151:PB=37152:RB=37154
100 REM SET UP SCREEN
105 POKE36879,238:PRINT "███"
110 FORJK=7680TO8185:POKEJK,0:NEXTJK
115 FORHN=38510TO38510+22:POKEHN,0:NEXTHN
116 FORLM=38532TO38905:POKELM,6:NEXTLM
120 PRINT "█"
125 SP=7000
126 POKESP,1:POKESP+1,2
130 REM MOVE SUB
131 SR=INT(RND(1)*8):IFSR=<10RSR>=8THEN130:SE=0:SL=0:K=0:U=0:Q=0:SG=0
132 VV=15
133 IFSR=2THENSL=8142:K=1:U=1:Q=1:SG=20:SV=15:GOTO146
134 IFSR=3THENSL=8052:K=-1:U=1:Q=-2:SG=-20:SV=10:GOTO146
135 IFSR=4THENSL=7922:Q=1:U=1:K=1:SG=20:SV=5:GOTO146
136 IFSR=5THENSL=8162:K=-1:U=1:Q=-2:SG=-20:SV=15:GOTO146
137 IFSR=6THENSL=8032:Q=1:U=1:K=1:SG=20:SV=10:GOTO146
138 IFSR=7THENSL=7942:K=-1:U=1:Q=-2:SG=-20:SV=5:GOTO146
140 REM PINT SR
146 SE=SL+SG
147 IFSL<>SETHENSL=SL+K:POKESL,3:POKESL+U,4:POKESL-Q,0
148 IFVV>0THENVV=VV-1
149 POKE36878,VV:IFSL=SETHENPOKESL,0:POKESL+U,0:POKE36878,0:GOTO131
150 PRINT "███SCORE"SC:PRINT "███CHARGES LEFT"DL"███ "
151 A=PEEK(PA):POKERB,127:B=PEEK(PB):POKERB,255
155 IF(BAND128)=0ANDF<>1ANDSP<7010THENSP=SP+1:POKESP,1:POKESP+1,2:POKESP-1,0
160 IF(AAND16)=0ANDF<>1ANDSP>7790THENSP=SP-1:POKESP,1:POKESP+1,2:POKESP+2,0
170 IF(AAND32)=0ANDDL>0THENF=1
175 IFDL=0THENGOTO400
180 IFF<>1THENGOTO147
185 DP=SP+FD+1
186 IFPEEK(DP)<>0ANDPEEK(DP)<>5THENGOTO300
190 POKEDP,5:IFM>0THENPOKEDP-22,0
210 M=M+1:FD=FD+22
220 IFM=17THENDL=DL-1:POKEDP,0:F=0:FD=22:M=0:DP=0:GOTO230
230 GOTO147
300 POKEDP-22,0:POKEDP+1,7:POKEDP-1,7:POKEDP,7
310 POKE36876,0:POKE36877,220:FORL=15TO0STEP-1:POKE36878,L
315 FORLL=1TO100:NEXTLL:NEXTL:POKE36877,0:POKE36876,220
320 POKEDP,0:POKEDP+1,0:POKEDP-1,0
325 M=17:SC=SC+SV:SL=SE:GOTO220
400 POKE36878,0:POKE36876,0:POKE36877,128:VL=0
405 POKESL,0:POKESL+1,0:POKESL-1,0
410 POKESP,0:POKESP+1,0:POKESP-1,0
420 POKE7800,1:POKE7801,2
430 POKE8152,3:POKE8153,4
440 FORPM=8131TO7823STEP-22:VL=VL+1
445 POKEPM,0:IFPM+22<>8153THENPOKEPM+22,0:POKE36878,VL
446 FORTJ=1TO100:NEXTTJ
450 NEXTPM
455 POKE7800,7:POKE7801,7:POKEPM+22,0
460 POKE36877,220
465 FORGU=15TO0STEP-1:POKE36878,GU
470 FORHJ=1TO150:NEXTHJ
480 NEXTGU
485 POKE7800,0:POKE7801,0:PY=0
490 POKE36878,0:POKE36877,0:POKE36876,220
495 VL=15:FORDB=8152TO8184:POKEDB,3:POKEDB+1,4:POKEDB-1,0:POKE36878,VL:VL=VL-0.
75
496 IFVL=0THENVL=15
497 FORT=1TO50:NEXTT
498 NEXTDB
499 POKEDB,0:POKEDB-1,0
500 POKE36876,0:POKE36878,0:POKE36869,240:POKE36879,27:PRINT "███"
505 PRINT "███YOU WERE ELIMINATED";PRINT "███WITH A SCORE OF"SC"."
510 PRINT "███ANOTHER GAME (Y/N)"
515 GETXX$:IFXX$="" THEN515
520 IFXX$="Y" THEN530
525 PRINT "███":END
530 RESTORE:CLR:GOTO51
```

32K* RAM PACK FOR YOUR COMMODORE VIC20

SPECIAL OFFER

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Programs for programs

Tony Bridge looks at the growing range of utilities for the ZX Spectrum

The vast majority of those people now buying home computers do so, apparently, to play games. Walk into the average software store, and the assistant will almost certainly ask you, "Which game would you like, Sir/Madam?"

But surely, sooner or later, the squeaks and explosions of the Invaders and Scramblers and hungry little Pacmen must pall for many people. It is then that the more serious programs come into their own.

The Sinclair Spectrum is particularly well-served in this area, as a well-trodden path for the Hobbyist has been forged from the ZX80, to the ZX81, and on to the Spectrum. The beauty of the Sinclair range is the excellent selection of software readily available for light relief, and the sheer — sorry about the jargon — "friendliness" of the machines.

So, in this review we shall take a look at some of the Utility programs — programs that make it easier for you to make your own programs work. In addition we'll look at Business Utilities — programs that make it easier for you to make your (small) business work.

Programming is a rather esoteric art, shrouded in mystery to the uninitiated. But it is rapidly becoming clearer to many people, as they take the plunge into the murky waters.

To the serious programmer, a Toolkit is a necessity. Workforce, run by Derek Tidman, has a number of programs which will be of interest. *Programmers Dream* (or *PD*, author Dr Robert Rayment), is loaded before work starts, and includes several useful features. *Renumber* is a powerful facility which renumbers your fledgling program from any start point, in any step size, to any finish point. All *Gotos*, *Gosubs*, *Restores*, etc, which will be affected, are taken care of along with the renumbering.

Block Move is a similar facility, allowing the programmer to move a whole chunk of lines to another place within the listing, renumbering being handled along the way. *Erase* will do just that to any number of lines — but beware, *Gotos* and *Gosubs* are not handled by this command (but this shouldn't be a problem — the program would, on Run, go on to the next line after a *Goto* to a non-existent line).

Change String will change either every occurrence of a string, or selected occurrences. *Dump* (strange name) prints on the screen the variable names and values. Finally, but not leastly, the size of your program, together with the variables, can be inspected. All this is pretty standard

fare for Toolkits, and contains nothing new, but Dr Rayment has written a very compact program (just 1450 bytes) which, along with the comprehensive documentation, is an absolute gem. The program is very easy to use — just *Clear* space above Ramtop, and then begin working on your own program. *PD* will be ready when needed.

Another compact little beauty from Dr Rayment and Workforce is the *Spectrum Disassembler*, which allows you to peek at the secrets of your machine code programs. The screen display contains, on the left, the address, and in the centre, the code of the bytes at that address. On the right is the mnemonic associated with the code. As you enter your machine code program, the *Disassembler* will translate the bytes into mnemonics for your inspection. The program is well-documented, and assumes the user to be completely familiar with machine-coding techniques.

As an introduction it is very useful

The final Utility from Workforce is *Display* a character generator, written by Gloster Software. Now, there are many CGs on the market, all pretty much the same, though each has its own attractive points — all Spectrum owners will already have a good one on the Horizon tape from Psion, and of course this one is free with the computer. Good value for money!

However, the tape from Gloster/Workforce is a different proposition entirely. As you will know, the Spectrum supports 21 User-Defined Graphics (UDGs) in addition to the 96 standard characters — *Display* will provide you with a massive 273 extra shapes (on the 16K machine) or 336 shapes on the 48K machine. To put it another way, the normal 21 UDGs allowed by the Spectrum may be held in sets of "pages" in memory and called up as needed — 16K will hold 13 pages and 48K will hold 16 pages. *Display* enables you to show all these pages on-screen at the same time.

A demo program is *Loaded* first. This consists of a title page, the text of which is set out in characters of 64 (to the line) width. Around the introductory text is arrayed a large number of UDGs, any of which may be set into animated motion at the touch of a key. You will see, for example, a rocket taking off, rifles shooting at a poor little bird, jugglers, munching Pacmen, dancers, spinning wheels and many more.

The main program follows on the tape. Once this is *Loaded*, a work space is

displayed along with a display "sheet".

Now is the time to *Load* into this space any characters you may have previously created, should you wish to work on them. Following the main program are several "pages" containing the characters from which the demo title page was built — you are advised to *Load* these and use them to gain insight into the workings of *Display*.

The Basic method to amend characters is: *Pick* from the display "sheet" or (if you are creating your own) *Fetch* a standard character from the Spectrum's keyboard, and move the character to the work space. Now the character may be *Turned* clockwise or anti-clockwise by 1/4 or 1/2 turns.

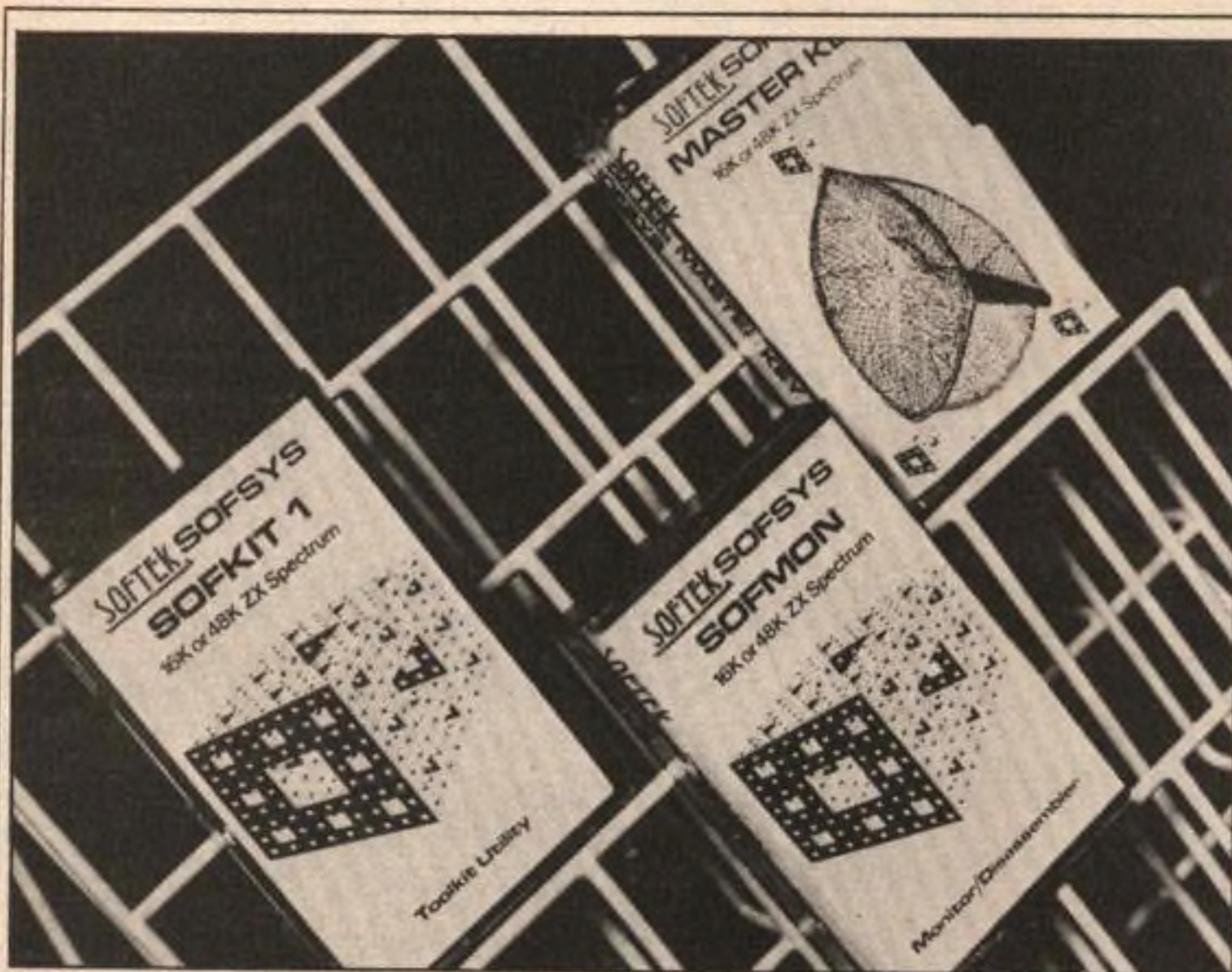
You may also *Invert* (or flip over) the character, *Reverse* back-to-front, *Expand* the character (so that any quarter will fill the whole square), and finally *Shift* the whole thing by one pixel at a time to the left, right, up or down. During this procedure, any of the pixels within the character square may be turned on or off. Finally, your amended or newly-created shape may be returned to the display sheet, ready for eventual *Saving* to tape.

By typing *Help*, a page of options is presented, and this along with the usual good Workforce documentation, ensures that the user is never left helpless. Advice on creating animated graphics is included, and all in all, it is hard to imagine a more useful UDG-generating aid than this.

Another machine code programming aid has been published by Oxford Computer Publishing Ltd. Written by F O Ainley, the *Machine Code Test Tool* comes nicely packaged in a shiny, sturdy box, slightly smaller in size than a paperback. The accompanying manual is described as a Tutorial in machine code, and fulfills this function quite well. A 32-page booklet cannot enter into quite as much detail as a full-blown book on the subject, but as an introduction it is very useful.

Your best course is to work through a book such as William Tang's *Spectrum* continued over the page





Machine Language for the Absolute Beginner, and return to the program with a better knowledge of the jargon and techniques of machine code programming. Write an exploratory program and use the *Test Tool* to run and debug your attempt. The contents of all the registers will be displayed for you to inspect and change as necessary.

As a bonus, a Character Generator (yes, another one!) is included on the reverse side of the cassette — it's fairly standard, with no surprises, but it's nice to get a little gift, isn't it?

Spectrum Machine Language for the Absolute Beginner is just one of many books now on the market (there'll be more!), all attempting to instruct the Spectrum user in the delights of machine coding. This book is one of the best I have seen on the subject — for once the title is on the nose! I can recommend this to anyone just getting interested.

The only quibble I have with the book is the amount of spelling mistakes — there is at least one per page, and the Great Spelling Mistake Hunt eventually become a major entertainment. Fortunately, this does not detract from the work as a whole, and only becomes a nuisance when a missing page throws the reader into momentary confusion.

A cassette is also available, containing some of the programs from the book.

Whilst on the subject of cassettes that come with books, let me mention once again Trevor Toms' *Spectrum Pocket Book*, which I spoke of briefly some weeks ago. Half of the book consists of the usual games listings, though for a change, these are original and actually quite good. They also, of course, contain a lot of useful routines for the reader's own games. And, incidentally, the line by line documentation of the program is exemplary.

The balance of the book is taken up with a very well-written introduction to machine code techniques.

A cassette is available for the games, and another for the machine code part of the book. Amongst other goodies on the second tape is a Screen Toolkit, which is a routine for scrolling up, down, left and right, as well as printing to any pixel.

Another system, recently released, is *Sofsys*, from Softek, Tim Langdell's company. The full system consists of five programs — to take full advantage of them, they should be *Loaded* into memory together. However, they maybe used individually.

Before work is begun, the heart of the system, *Masterkey*, should be *Loaded*. With the aid of this program, up to seven keys may be defined by the programmer. *Masterkey* comes with five keys pre-defined, which may be edited to suit the user's requirements. As they stand, they control, with one key-touch, entry of the Assembler which is another part of the system, entry of the Disassembler, and the operation of the Compiler.

Softek, confusingly, has another name for this program, *Softime*, which hints at its other facility, a clock.

With *Masterkey* in memory, *Softkit 1*, a programming toolkit maybe *Loaded*. This is a fairly straightforward toolkit — like many others, it enables the use to *Renumber* (with all *Gotos*, *Gosubs* and so on), *Erase* all *Rem* statements (thus saving memory), and examine the length of program and variables at any time. The program will also change upper case characters into lower, and vice-versa.

Probably the most important and unusual feature for a program at this price and this computer, is the *Trace* facility. Run the program through, and you'll see the line number and statement currently being processed. Thus, if the program

hangs up, the bug can be *Traced* very easily.

Softkit 1, like some of the other parts of *Sofsys*, has been written by Andrew Glaister, the author of several best-selling games for the Spectrum.

The next element of *Sofsys* is *Sofmon* (look, I didn't dream up these names!), the Disassembler/Monitor of the system. There are two versions, one for each of the memory sizes, but the facilities are the same in either case. Each command maybe accessed by one keystroke, thus, at one stroke relieving you of the need to buy *Masterkey*.

As will all the other parts of *Sofsys*, the documentation is precise and clear, guiding the user effortlessly through the highways and byways of the Utility. Twenty-five functions in all are available, including, in the Monitor section, *Erasing* or *Inserting* bytes in memory, decimal to Hex conversion, and vice-versa, *Moving* areas of memory, finding a series of bytes, and so on.

Probably the most intriguing part of the whole *Sofsys* package, however, and one that Softek obviously regard as the flagship of the system, is the Compiler, or *Super C*, as Softek couldn't refrain from calling it!

A number of things the Super C can't handle

Super C comes well-packaged in a large box that opens like a book to reveal the cassette nestling inside along with a 22-page instruction manual. The cover artwork shows, for some strange reason, a futuristic starship pilot fixing the viewer with an icy stare. Reflected in his visor is a — well, probably a Betelgeusian Battlecruiser! And just when you thought it was safe to go back to the Spectrum! Eye-catching, however, which is the object of the exercise.

The Compiler converts, more or less



instantly, your Basic program into machine code, thus endowing the program with all the benefits of machine code. Three small programs are included in the package, which demonstrate the point admirably. A screen printing routine is followed by a count from 0 to 1,000, and in both cases, the compiled program is orders of magnitude faster.

The most impressive demonstration is the third, a very simple *Invaders* program. In Basic it is very slow, and you wouldn't want to play it for more than a few seconds. When compiled, the program becomes very much faster, and the game is at least bearable for a couple of minutes.

Down to the operation now — and it's all clearly explained in the manual. If *Masterkey* has been *Loaded*, a key can be defined to handle the compiling command, but that's very quick to type anyway. Just *Load* your Basic program, and then simply key *Randomise Usr 49152* — a fraction of a second later, the program is in machine code!

Sounds simple, doesn't it? Well, it is, but don't get the idea that you can write anything in Basic and have it compiled for you. There are a number of things that *Super C* will not handle, and which necessitate extra thought when writing your original program.

First, variables can only be upper case (capital) characters, and you are only allowed to define 25 of them — A to Z. A second example is *Gotos*, *Gosubs* and *Returns*. These must all refer to an existing line, no more jumping to a vague line number and letting the computer find the next relevant line. *Super C* will not, moreover, recognise a calculated line number (so you cannot say *Goto 20*score*).

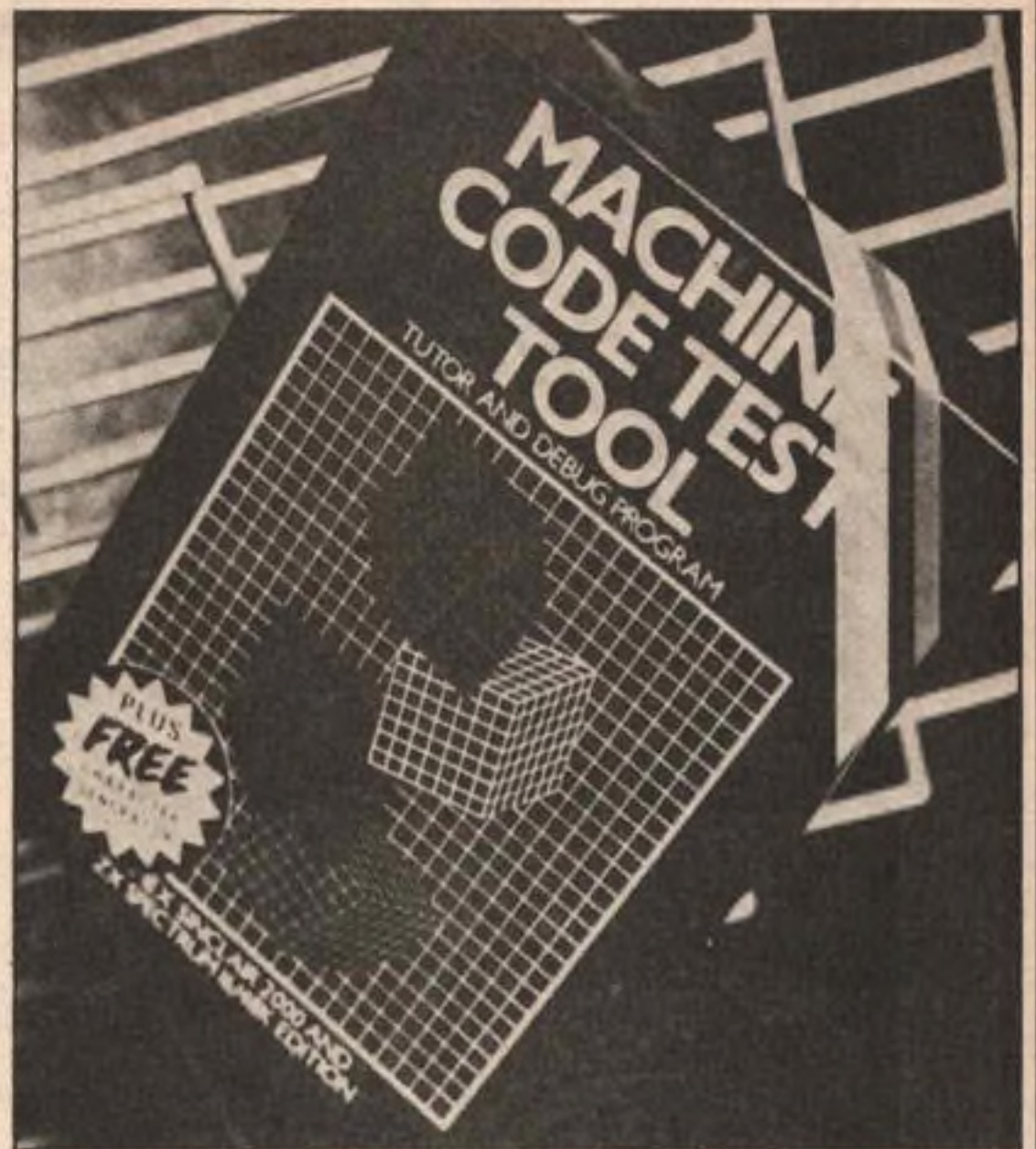
A stand that is morally indefensible

A final example here, although there are several more in the manual, is the restriction on local colour commands. You'll be used, in Sinclair Basic, to putting *Over*, *Inverse*, *Ink*, *Paper*, and so on within *Print* statements — these will not affect the rest of the screen or program. These will not be compiled by *Super C*. You will have to set the parameters globally, and then reset after the *Print* statement.

However, the most serious drawback in *Super C's* facilities is that it will not compile statements involving fixed-point arithmetic, and will not allow string-handling statements. An enhancement package will, says Softek, be available soon to enable the programmer to use these facilities in his Basic program.

I don't know if Softek intends to give the package to existing customers or will charge extra for them, but I think a program calling itself a Compiler should certainly include these facilities.

The total *Sofsys* package can be recommended, and the Compiler, in particu-



lar, though expensive at £15, is — with the caveat of the lack of some important facilities — worth every penny.

One final doubt nags me, however, and that is about the copyright notice at the beginning of *Super C's* manual. I've deliberately left this point out of my appraisal until now — it will only affect you if you intend to market your compiled program. Softek is very concerned that, as such programs must contain some of *Super C's* routines, the company must ask

you for a royalty. I think this stand is, morally at least, indefensible. There are many compilers in use much higher up the computing scale, at the minicomputer and mainframe level. Royalties are not sought by the original manufacturers of these programs, unless the actual compiler itself is passed on to a third party as part of a total package.

Legally, of course, Softek are entitled to ask whatever they desire — and *Sofsys* remains as a most important suite of programs for the programmer. ■

Firm	Program	Cost
Workforce 140 Wilsden Avenue Luton Beds	<i>Programmers Dream</i>	£6.95
	<i>Display</i>	£7.00
	<i>Spectrum Disassembler</i>	
Oxford Computer Publishing Ltd PO Box 99 Oxford	<i>Machine Code Test Tool</i>	£9.95
Melbourne House Glebe Cottage Station Road Cheddington Leighton Buzzard Beds	<i>Spectrum Machine Language for the Absolute Beginner</i>	£6.95
Phipps Associates 99 East Street Epsom Surrey KT17 1EA	<i>Spectrum Pocket</i>	6.50
Softek 329 Croxted Road London	<i>Masterkey</i>	£7.99
	<i>Sofkil 1</i>	£7.99
	<i>Sofmon</i>	£7.99
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Clearly labelled!

R Luxton explains how to make your own labels on the 16K ZX81

Label Maker is a routine for the 16K ZX81 to print your own personal label at the head of any program. It can take the form of a "copyright" mark, a special instructions panel, a fancy nameplate, or whatever you want. It is designed to be Poked above Ramtop, so that it can be quickly added to any existing program.

Fig 1 Label Maker

```

1 REM .....
.....
.....
20 FAST
30 REM =====
40 REM INPUT TITLES
50 REM =====
60 PRINT "ENTER PROGRAM TITLE"
" (MAX 25 CHARACTERS)"
70 INPUT A$
80 IF LEN A$ > 25 THEN GOTO 70
90 PRINT
100 PRINT "ENTER COPYRIGHT LINE"
" (MAX 25 CHARACTERS)"
110 INPUT B$
120 IF LEN B$ > 25 THEN GOTO 110
130 REM =====
140 REM SET-UP GRAPHICS
150 REM =====
160 LET A=137
170 FOR I=16513 TO 16635
180 IF I=16540 THEN LET A=136
190 IF I=16604 THEN LET A=138
200 POKE I,A
210 NEXT I
220 LET A=133
230 FOR I=16513 TO 16609 STEP 3
240 POKE I,A
250 NEXT I
260 LET A=5
270 FOR I=16539 TO 16635 STEP 3
280 POKE I,A
290 NEXT I
300 LET A=0
310 FOR I=16540 TO 16608
320 IF I=16545 THEN LET I=16572
330 IF I=16577 THEN LET I=16604
340 POKE I,A
350 NEXT I
360 REM =====
370 REM POKE IN TITLES
380 REM =====
390 LET C=1
400 LET Z=INT ((26-LEN A$)/2)
410 FOR I=16546+Z TO 16546+Z+LE
N A$
420 POKE I, CODE A$(C)
430 LET C=C+1
440 IF C > LEN A$ THEN GOTO 460
450 NEXT I
460 LET C=1
470 LET Z=INT ((26-LEN B$)/2)
480 FOR I=16578+Z TO 16578+Z+LE
N B$
490 POKE I, CODE B$(C)
500 LET C=C+1
510 IF C > LEN B$ THEN GOTO 530
520 NEXT I
530 CLS
540 GOTO 560
550 STOP
560 PRINT "IF LINE 1 IS OK," "E
NTER GOTO 600 AND NEWLINE." "IF
NOT," "ENTER GOTO 20 AND TRY AG
AIN."
570 PRINT
580 PRINT
585 PRINT
590 LIST
600 LET A=16513
610 FOR I=32645 TO 32767
620 POKE I, PEEK A
630 LET A=A+1
640 NEXT I
1000 REM =====
1010 REM REMOVE WHOLE PROGRAM
1020 REM =====
1030 NEW
2000 SAVE "LABEL MAKE"
2010 RUN
    
```

First, type in the listing in Fig 1 starting with 1 Rem and exactly 122 full stops (enter as a direct command "Print(Peek 16511)-2" to check that you have the right number) and then Save the program before Running. Next, clear the ZX81 by switching off for three seconds or so, and then switch on again. Enter as direct commands; "Poke 16388,133" "Poke 16389,127" and "New", then Load and Run the routine.

You will be asked to enter your prog-

ram's title, and then the copyright line, after which the screen will go blank for a few seconds, and will then List showing your label in 1 Rem. If the label is correct, just enter Goto 600 and Newline. If not, then enter Goto 20 and Newline, and enter it again. When the label is right, enter Goto 600 and Newline, and the computer will Poke your label above Ramtop.

Now Load the program on which the label is to appear and add a 1 Rem with exactly 122 full stops, and the lines in Fig 2, preferably at the end of the program. Then enter Goto 9000 and the label will be down-loaded from above Ramtop to the head of your program. Also, enter as a direct command "Poke 16510,0" to change the line from 1 to 0, where it is safe from accidental erasure.

The program will not Run in the usual way, although Run will still clear the variables. You should start your program by "Goto (the second line)" or "Run (second line)", if the variables need resetting.

As an extra, add lines 8999 and 9025 (Fig 3) and then enter as a direct command "Print A\$" after you have down-loaded your label. It will then be in A\$ as well as at the head of your program. This is very useful for calling from anywhere throughout the program as a natural break or just as a piece of advertising. Or, just enter "Lprint A\$" for the printer to produce a convenient sized label for sticking to cassettes or cassette cases. ■

Fig 2

```

1 REM .....
.....
.....
9000 LET A=32645
9010 FOR I=16513 TO 16635
9020 POKE I, PEEK A
9030 LET A=A+1
9040 NEXT I
    
```

Fig 3

```

8999 DIM A$(123)
9025 LET A$(I-16512) = CHR$
PEEK A
    
```

Examples of labels

```

ZX81 LABEL MAKER
(C) 1983 R.G. LUXTON
    
```

```

DO NOT ENTER *RUN*
TO START ENTER *GOTO 10*
    
```

The Pit — part two

Paul Sellin presents part 2 of The Pit — a text adventure for the 16K Spectrum

This week, having initialised the arrays and variables to start the game, we shall look at one of the most important elements in an adventure game — the monster.

Lines 3015 to 3075 contain the monster routine, with the data being stored in line 3100. The routine is really very simple: once the monster has been 'chosen' from the data, either it attacks you (line 3025), you attack it (lines 3030 to 3035) or you retreat.

If you are still 'alive' after the monster has attacked you, then the program moves on to the 'attacking the monster' sequence. If the monster survives, which is checked at the end of line 3035, then the

program jumps back to line 3025 and puts you under attack again!

On entering the monster routine, the computer must randomly select which monster to present. This occurs in line 3015 — by looping a random number of times, each time reading a set of data, the current data after the last loop becomes the chosen monster.

Line 3100 contains five pieces of data for each monster: first its name, which is a string and is assigned to *p\$*, then four variables representing in turn its strength, psi power, dexterity and intelligence, each in the range 0 to 20. These are assigned to the four variables *st*, *ps*, *de* and *in*. Notice how the monster's variables differ from the

player's variables of *s*, *p*, *d* and *i*.

If you survive the monster's attack, then you have the chance to fight back. Depending on your dexterity, the computer allows you a certain amount of time in which to attack — if the time runs out, then the monster attacks again.

The computer allows you to attack in one of three ways: either by casting a spell (key *s*), by giving it a thought problem (key *t*), or by just attacking normally (any other key except *t*). Pressing the *r* key allows you to retreat.

The spell routine is in lines 3050 and 3055. It prints up a suitably fiendish spell and then calculates its effects by comparing the variables *p* and *ps*. If the monster dies, then the whole monster routine is exited via line 3040; if not, then the monster attacks again with the program jumping to line 3025.

The 'thought' routine works in a similar way in lines 3060 to 3070. The computer

```

2530 DATA "a potion of sight", "c
hoking gas!!!", "Flash!!, an expl
osion!", "an old skeleton", "a set
of bonuses!", "nothing", "a set o
f bonuses!", "nothing"
2540 IF x$( TO 2) = "Fl" THEN LET
si=0: GO TO 8500
2545 IF x$( TO 2) = "ch" THEN PRIN
T "It weakens you...": LET d=INT
(d-RND#8): LET i=INT (i-RND#8):
LET s=INT (s-RND#5): GO TO 8000
2550 IF x$( TO 3) = "a p" THEN PRI
NT "You boost your powers of si
ght...": LET si=1: GO TO 1000
2560 GO TO 1000
2705 IF NOT si OR NOT fl THEN GO
TO 8500
2710 IF y<2 OR x<2 OR y>9 OR x>1
9 THEN PRINT "No Flares here,
dear creature...": BEEP .2, -12
: GO TO 1000
2715: CLS : PRINT "Here goes wi
th one precious flare...":
FOR f=y-1 TO y+1: PRINT TAB 12;
PAPER 2; " "; FOR e=x-1 TO x+1:
PRINT INK 7; PAPER 2; a$(z, f, e);
": NEXT e: PRINT " ": NEXT f: P
RINT AT 5,15; "+"; INK 0: LET fl=
fl-1: PRINT " ": GO TO 1000
2720 GO TO 1000
2800 PRINT "Oh dear! " " You've f
ound a Time Warp...": LET z=1+IN
T (RND#3): LET x=1+INT (RND#19):
LET y=1+INT (RND#9): FOR h=36 T
O -12 STEP -1: BEEP .05, h: NEXT
h: PRINT "You are now at Level
": z "At position "; x; ", "; y": GO
TO 8000
2900 LET e=1+INT (RND#9): LET fl
=fl+e: PRINT "You found "; e; " fl
ares.": LET a$(z, y, x) = " ": GO TO
8000
3015 RESTORE 3100: FOR f=1 TO IN
T (1.5+RND#7): READ p$, st, ps, de,
in: NEXT f: PRINT "You have foun
d "; p$: "Status Report: " "Stre
ngth", st "Psi Power", ps "Dexteri
ty", de "Intelligence", in: FOR f=
1 TO 300: NEXT f: IF d-de>0 THEN
IF 5#RND#d>de*2 THEN GO TO 3030

```

generates a random multiplication sum in line 3065 — the accuracy of the monster's 'answer' is dependent on *in*, its intelligence, plus a random factor.

There are a few little extras, such as you not being allowed to 'think' if *i* is less than 10, whereupon you will immediately be attacked again. Also, a stupid monster, where *in* equals zero, will ignore your sums and proceed to attack regardless.

'Retreating' is contained in line 3033 which just prints up a suitable message and exits the monster routine to line 8000. But, your strength is reduced significantly if you retreat from a weak monster.

Normal attacking revolves around line 3035 which calculates the monster's damage and subtracts it from its strength. If *st* is still greater than zero, then the monster attacks you again with the program jumping back to line 3025.

On killing the monster and reaching line 3040, your psi power is increased according to that of the monster. The *m* character

in the main array is replaced by a space, ensuring that the monster really is dead. If you kill the *Warlord*, which is the strongest monster of them all, then you could pick up treasure if the program jumps to the 'treasure' routine in line 2000.

On leaving the monster routine in line 3045, the program jumps to line 8000. This is just one big multi-statement line, which prints out all the variables and strings of the player. *Poking* 23692 just lets the screen scroll automatically. This routine then jumps back to the main loop at line 1000.

A couple of other useful blocks of program are those which give the player his 'eyes'. These are the 'flare' routine (lines 2700 to 2715) and the 'map' routine (lines 9201 and 9220). Both are accessed directly during the game by pressing keys *f* or *m* respectively (lines 1003 and 1004). If you are blind and *si* equals zero, then both routines will jump to line 8500 and then back to the main loop.

The 'flare' routine prints out the eight positions all round your current position and draws a box around them, at the same time taking one off the *fl* variable, and then returns to the main loop at line 1000. But, note that the flares will not work on the edges of the array (line 2710 — why do you think that is necessary?).

Finally, the map routine in line 9220 prints out horizontally the 10 rows of that 'page' of the array and marks your current position. Note the double *Pause* statements before jumping to the Status Report; this is to get round the Spectrum Rom bug which sometimes ignores a single *Pause* statement.

Next week we shall look at the final part of *The Pit*. ■

● *The Pit* has been split into three parts. Enter part 2 of the program now and *Save* it on tape. Part 3 will be published next week. You will need to enter all three parts of the program before *Running* it.

```

3025 BEEP .1,0: PRINT "The mons
ter attacks...": PAUSE 100: LET
h=ABS (INT ((st#RND)-ar#RND/2)/
2)): PRINT "You take ";h;" damag
e.": LET s=s-h: PRINT "Your stre
ngth: ";s: PAUSE 30: IF s<=0 THEN
GO TO 9800
3030 BEEP .1,24: PRINT FLASH 1';
"***Strike Now***": PAUSE 1: PAU
SE d#5: IF INKEY$="" THEN PRINT
"Too late...": GO TO 3025
3031 IF INKEY$="s" THEN GO TO 30
50
3032 IF INKEY$="t" THEN GO TO 30
60
3033 IF INKEY$="r" THEN PRINT "
Cowardly Creature!!": LET s=s-IN
T ((21-st)/4): GO TO 8000
3035 PRINT "You attack...": PAU
SE 50: LET h=ABS (INT ((st#RND*2
)-de#RND)/2)): PRINT "Monster ta
kes ";h;" damage.": LET st=st-h:
PRINT "Its strength: ";st: IF st
>0 THEN GO TO 3025
3040 PRINT "You have killed the
monster.": LET p=p+INT (ps/4): L
ET a$(z,y,x)=" ": IF p$="the War
lord" THEN IF RND#10>6 THEN PRIN
T "You're lucky, the monster was
carrying treasure...": GO TO
2010
3045 GO TO 8000
3050 PRINT " INVERSE 1: "Rest th
y time, thou ferocious andaccurse
d creature": FOR e=1 TO 80: NEXT
e: PRINT "The monster staggers.
. . .": PAUSE 1: PAUSE 100: IF RND#
p#8>ps#2 THEN PRINT "...and dies
. . .": GO TO 3040
3055 PRINT "...and recovers.": L
ET p=p-ps/4: GO TO 3025

```

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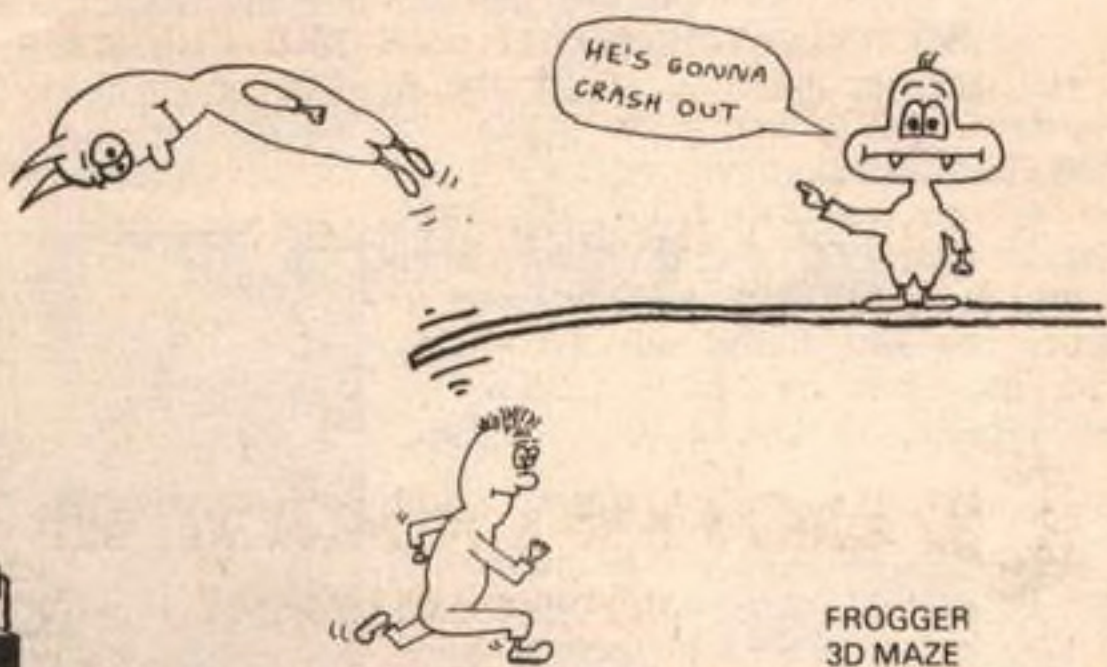
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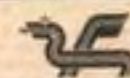
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All keyed up!

Peter Chase explains how to use machine code to enhance the Dragon's keyboard

This article is aimed both at readers who have assembler packages and may be wondering what to do next, and for those who would like to extend the capabilities of the Dragon by using machine code routines in their Basic programs. The following routines are designed to improve keyboard responses and to extend colour and text usage.

The *Inkey\$* function will only tell that one key is being pressed. If more than one key is pressed then neither key will register. Similarly, if one key is already being held down, a second one will not register.

Using machine code, it is possible to check if any key is being held down, regardless of how many other keys are being pressed. This has very many applications. For instance, it allows diagonal movements by pressing two arrow keys or, in action games, one key can be used as an 'accelerator' and another for 'steering', etc.

To find out if a key is being pressed, it is necessary to place its column number into location *&HFF02* and then to check the appropriate bits in location *&HFF00*. Listing 1 *@KEY* shows how this can be programmed in assembly language.

The program works by storing the *A* register in the column select register at *&HFF02* and then comparing the *B* register with the contents of the row input register at *&HFF00*. Table 1 shows what values to put in the *A* and *B* registers to check any key. If the selected key is depressed, then the *Z* flag in *CCR* will be set, allowing the use of *BNE* and *BEQ* jumps.

For those without assemblers, lines 15-60 of Listing 2 show how the routine can be entered into Basic programs by *Poking* the hex codes into locations starting with *&H7001* (the additional codes allow the row and column numbers to be *Poked* into locations *&H7002* and *&H7003*). The routine is then accessed with *Exec &H7001*.

Listing 2 itself is a program showing one use of the *@KEY* routine. It allows hi-res drawing in eight directions with the four arrow keys. Pressing the arrow keys alone gives movement, while depression of shift and arrow keys together allows drawing on the screen. You can produce very intricate 3-dimensional drawing with this program which can then be *Saved* as screens on cassette.

One of the major drawbacks of the Dragon 32 is that it is not possible to have text and hi-res graphics together using Basic alone. Also, the number of colours in hi-res modes is very limited. However, the video chip used in the Dragon is capable of producing many more modes. One of the

most useful of these is alpha semigraphics mode 24, which allows usual text, 64 x 192 hi-res graphics and nine colours all to be used at once. In a previous issue of *Popular Computing Weekly* it was explained how to get into mode 24 from Basic using *Poke &HFFC5,0:Poke &HFFC3,0:Poke &HFFC0,0*.

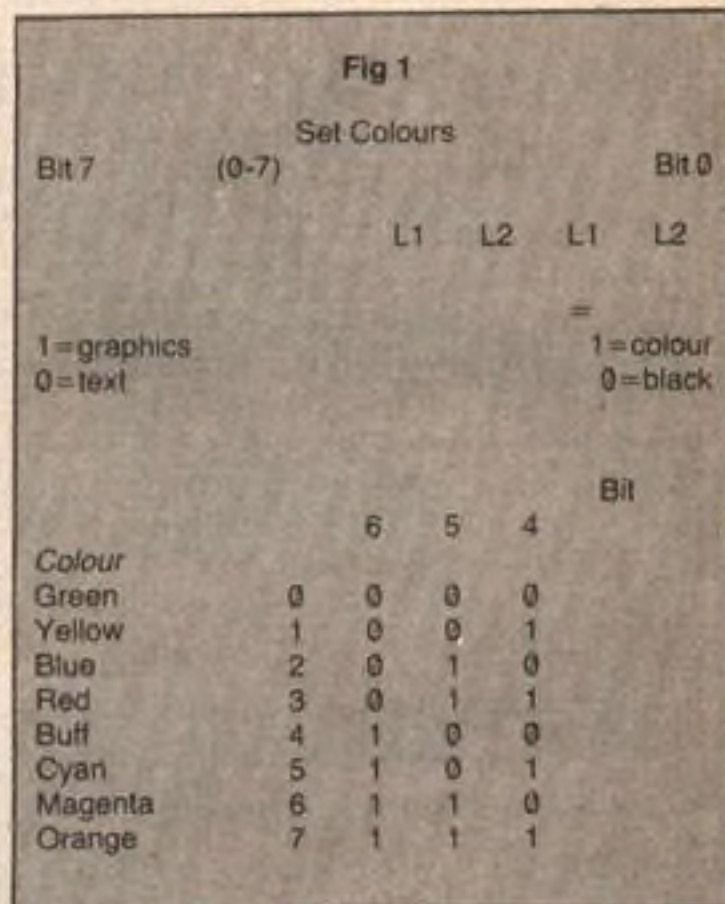
For those with assemblers, Listing 3 contains five routines for printing text in mode 24. *@SEL24* selects mode 24, while *@CLS24* fills the mode 24 screen with the character stored in location *&HFF0*. *@PT2* prints the character stored in the location *&HFF2* at co-ordinates stored in *&HFF0* and *&HFF1*.

@SCRL24 scrolls the screen up one line. *@MSG24* prints a message to the screen from the address pointed to by the *Y* register. To use the latter routine, both *@PT2* and *@SCRL24* must be in memory as well.

If you want to use these routines from Basic, then the first four can be entered as shown in lines 15-60 of Listing 2 by *Poking* the hex codes (column two of Listing 3) into addresses starting *&H7FF0* and then *Exec* the address of the routine. To use *@MSG24* from Basic, it is first necessary to define *Def Usr0 = &H7080* at the start of your program and then use *N = Usr0(Varptr(A\$))* where *A\$* is the

string you wish to print.

The real advantage of mode 24 is the mixing of text with 9-colour hi-res graphics. The display memory in mode 24 goes from 1024 to 7168 (decimal). Each of the 192 rows contains 32 bytes and each byte is organised as in Figure 1.



For example, to set the top left pixel yellow, then the binary for the appropriate byte is *10011010* which equals 154 in decimal. So in Basic, the command would be *Poke 1024,154*. The equivalent assembly instruction is *LDA #154 Sta 1024*.

Listing 4 is an assembly program to show the mode 24 9-colour hi-res graphics. Listing 5 is a version of this for use without an assembler and shows the mixing of text with hi-res graphics.

Table 1

	FE	FD	FB	F7	EF	DF	BF
FE	0	8	@	H	P	X	ENT
FD	1	9	A	I	Q	Y	CLR
FB	2	:	B	J	R	Z	BRK
F7	3	;	C	K	S	UP	
EF	4	,	D	L	T	DN	
DF	5	-	E	M	U	RT	
BF	6	.	F	N	V	LT	
7F	7	/	G	O	W	SPC	SFT

Put the number across the top into *A* or if using BASIC *poke* it into *&H7002*. Put the number down the side into *B* or *POKE* into *&H7003*.

continued on page 25

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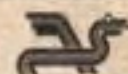
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Listing ONE-Keyboard Controller

```

7001          30 PRT
7001 047F    40 @KEY ANDA #127
7003 F7FF02 40 STB #FF02
7005 F0FF00 40 LDB #FF00
7007 C47F    40 ANDB #127
7009 3404    40 PSHS B
700B 01E0    40 CRPA ,5+
700F 33      40 RTS
7010          50 END @KEY
    
```

LISTING TWO-DRAWING WITH @KEY

```

15 CLEAR 1000,M2000
16 RESTORE
20 I=M2000
30 I=I+1
40 READ A#
50 IF A#="Z" THEN 100 ELSE POKE I,VAL("M"+A#):GOTO30
60 DATA CC,00,00,7F,70,FF,F7,FF,02,F6,FF,00,34,04,A1,E0,
    26,03,73,70,FF,30,Z
100 FMODE4,1:IFCLS:SCREEN1,1
110 X=120:Y=96:C=5
120 DIMC(7,7)
130 PUT(X-3,Y-3)-(X+3,Y+3),C,NOT INPUT(X-3,Y-3)-(X+3,Y+3),C,NOT
140 POKEM2002,MHF:POKEM2003,MZF
170 EXECM2001:IFPEEK(M200F)THEN C=SELSE C=8
180 POKEM2002,MHF
190 POKEM2003,MZF:EXECM2001:IFPEEK(M200F)AND Y>7THENY=Y-1
200 POKEM2003,MZF:EXECM2001:IFPEEK(M200F)AND Y<13THENY=Y+1
210 POKE M2003,MZF:EXECM2001:IFPEEK(M200F)ANDX>7THENX=X-1
220 POKEM2003,MZF:EXECM2001:IFPEEK(M200F)ANDX<258THENX=X+1
230 PSET(X,Y):GOTO150
    
```

Listing Three-Routines for MODE 24

```

7001          30 PRT
7001 3402    50 @SEL24 PSHS A
7003 00FF22 50 LDA #FF22
7005 04F0    50 ANDA #255-15
7007 07FF22 50 STA #FF22
7009 7FFFC5 50 CLR #FFC5
700E 7FFFC3 50 CLR #FFC3
7011 7FFFC0 50 CLR #FFC0
7014 3502    50 PULS A
7016 33      50 RTS
7017 3412    70 @CLS24 PSHS A,X
    70 LDX #1024
701C 067FF0 70 LDA #7FF0
701F A700    70 @CLOOP STA ,X+
7021 0C1030 70 CMPX #1024+0144
7024 25F3    70 BLD @CLOOP
7026 3512    70 PULS A,X
7028 33      70 RTS
7029 3430    90 @PT2 PSHS D,X,T
702B 0E0400 90 LDX #1024
702E 067FF1 90 LDA #7FF1
7031 2702    90 BEQ @NADD
7033 30030100 90 @MODL LEAX 304,X
7037 40      90 DECA
7038 20F3    90 BNE @MODL
703A 067FF0 90 @NADD LDA #7FF0
703D 3000    90 LEAX A,X
703F 000C    90 LDA #12
7041 F07FF2 90 LDB #7FF2
7044 E704    90 @PRI STB ,X
7046 300020 90 LEAX 32,X
7049 40      90 DECA
704A 20F0    90 BNE @PRI
704C 7C7FF0 90 INC #7FF0
704F 067FF0 90 LDA #7FF0
7052 0120    90 CRPA #32
7054 2512    90 BLD @END
7056 7F7FF0 90 CLR #7FF0
7059 7C7FF1 90 INC #7FF1
705C 067FF1 100 LDA #7FF1
705F 0110    100 CRPA #16
7061 2505    100 BLD @END
7063 7A7FF1 100 DEC #7FF1
7066 0003    100 BSR @SCRL24
7069 3530    110 @END PULS D,X,T
706A 33      110 RTS
706B CC0C00 120 @SCRL24 LDD #3072
706E 100E0400 120 LDY #1024
7072 CE0500 120 LDU #1024+304
7075 AEC1    120 @SCRL LDX ,U++
7077 AFA1    120 STX ,Y++
7079 50      120 DECB
707A 20F3    120 BNE @SCRL
707C 40      120 DECA
707D 20F0    120 BNE @SCRL
707F 33      120 RTS
7080 06A0    130 @MSG24 LDA ,Y+
7082 0100    130 CRPA #13
7084 2703    130 BEQ @REND
7086 0A40    130 ORA #64
7088 077FF2 130 STA #7FF2
708B 003C    130 BSR @PT2
708D 20F1    130 BRA @MSG24
708F 33      130 @REND RTS
7090          140 END @SCRL24
    
```

Listing Four-Weird n' Wonderful Display

```

7001          35 PRT
7001 0E0000 40 @START LDX ##0000
7004 7FFFC5 50 CLR #FFC5
7007 7FFFC3 50 CLR #FFC3
700A 7FFFC0 50 CLR #FFC0
700D 7FFFD7 50 CLR #FFD7
7010 100E0400 60 LDY #1024
7014 0000    60 LDA #120
7016 A700    60 @CLS STA ,Y+
7018 100C1BE2 60 CRPY #7130
    701C 25F0    60 BLD @CLS
701E 100E0400 70 LDY #1024
7022 A000    80 @DEND LDX ,X+
7024 0A00    80 ORA #120
7026 A700    80 STA ,Y+
7028 0C0000 80 CRPX ##0000
702B 2503    80 BLD @XOK
702D 0E0000 80 LDX ##0000
7030 100C1BE2 80 @XOK CRPY #7130
7034 2505    80 BLD @YOK
7036 31A0E0 80 LEY -32,Y
7039 0D02    80 BSR @SCROLL
703B 20E5    80 @YOK BRA @DEND
703D 3470    90 @SCROLL PSHS X,D,Y,U
703F CC0C00 90 LDD #3072
7042 100E0400 90 LDY #1024
7045 CE0420 90 LDU #1056
7049 AEC1    90 @SCR LDX ,U++
704B AFA1    90 STX ,Y++
704D 50      90 DECB
704E 20F3    90 BNE @SCR
7050 40      90 DECA
7051 20F0    90 BNE @SCR
7053 3570    90 PULS X,D,Y,U
7055 33      90 RTS
7056          100 END @START
    
```

Listing Five-Text n' Hires

```

10 CLEAR 1000,M2000
20 I=M2000
30 I=I+1:IFENDM:IFM="X" THEN POKE I,VAL("M"+I):GOTO30
40 DATA 0E,00,00,7F,FF,C5,7F,FF,C3,7F,FF,C0,7F,FF,D7,10,0E,04,00,
    06,00,A7,A0,10, 0C,10,E2,25,F0,10,0E,04,00,06,00,0A,00,A7,
    A0,AC,00,00,25,03,0E,00,00,10,0C,10,E2,25,03,31,A0,E0,0D,
    02,20,E5,34,70,CC,0C,00,10,0E,04,00,CE,04,20,0E,C1,0F,A1,50
45 DATA 26,F9,40,26,F0,35,70,39
50 DATA#
60 EXECM2001
    
```

Cause and effect . . .

Calvin Woodings explains how to use the analysis of variance technique

In any set of experimental results, the variations which appear will have arisen from a number of different sources. At the very least, there will be the variation caused by the effects of the factor being investigated, along with the variation caused by the errors in measuring these effects.

More complex experiments can involve several factors being tried at several levels — unwanted variations can arise from the method of measurement, the operator carrying out the tests, the day on which the test was done, and even such apparently unlikely effects as the weather. Analysis of Variance (*Anovar*) is an extremely powerful statistical tool which enables you to quantify such variations, so that you can decide which of the deliberately created effects are important compared with the unwanted error or interaction effects.

Unfortunately, many different types of *Anovar* are required to cope with the many different types of experiment, and a general purpose program to suit all options is way beyond the scope of this article. So, in order to give the reader a taste of the possibilities, this program deals with experiments involving between two and six factors, each at two levels, and with all possible interactions of the factors being studied. Such experiments are known as 2^n Factorials, where n is the number of factors and 2 is the number of levels of each factor (this notation also tells you how many trials are involved overall; eg, three factors at two levels means 2^3 or 8 separate trials). Such an experiment is frequently used at the outset of an investigation, when you are interested in looking at several different effects to decide which ones merit a more detailed study.

Suppose you are interested in improving the fuel consumption of your car. Suppose also you feel that the grade of fuel, the tyre pressures, and the maximum speed used are going to be important. You decide to measure the consumption over a standard route with two star versus four star fuel, 20 psi versus 30 psi in the tyres, and 50 versus 70 mph as speed limits. The complete factorial experiment will involve 8 runs as shown in Figure 1.

Each run involves a different combination of factors and the table illustrates these runs arranged in the 'standard order' to suit our method of analysis (devised originally by F Yates in 1937). Notice how the levels of the factors alternate going down the columns. The order is *Lo/Hi* for factor 1, *LoLo/HiHi* for factor 2, and *LoLo-LoLo/HiHiHiHi* for factor 3.

While it is important to arrange the results in this way prior to analysis, in this sort of trial it is also important not to carry out the runs in the same order. In fact, the run order should be randomised so that any unwanted effects (eg, the weather) are not easily confused with the factors being investigated.

Lets assume you carry out the trial and obtain the results shown in the last column of Figure 1. You run the program typing in 3 for the number of factors, *fuel*, *tyres*, and *speed* for the factor names, and *MPG* for the results name — then you type in the results in the order requested. You then have an opportunity to edit the data.

The next prompt, asking for an estimate of the error variance from other similar trials needs some explanation. In *Anovar*, the significance of effects and their interactions is estimated by dividing the variance (or mean square) due to the effect under

review by the variance due to experimental error. This error variance may be available from the analysis of other trials. Such 'external' estimates of error are to be preferred if available, but if not the full factorial experiment enables you to get an error estimate by treating the more unlikely interactions as errors.

The ratio of effect to error variance is known as the variance ratio or F-ratio. Statistics text books generally contain tables of F-ratio which enable the calculation of the significance of the effects being studied.

In this case, we have no external error estimate so answer *No* to the prompt. The first *Main Effects* table appears (Fig 2) and informs you that increasing *Fuel* (ie, changing from 2 star to 4 star) adds 1.13 miles to your gallon, while increasing *Tyres* (ie tyre pressure) adds 3.63 mpg. Increasing speed reduces mpg by 2.92. The error mean square shows 0 because you did not have one from other trials — you are advised to be prepared to note the numbers of those interactions which you are willing to sacrifice in the interests of significance testing.

Continuing to the next screenful, the 1st order interactions (ie, the interactions of all possible pairs of main effects) appear (Fig 2). In this example they are all relatively unimportant as indicated by the small *Mean sq* figure. Similarly, the second order interaction (only one possible interaction of groups of three effects in this case) is unlikely to be of any great experimental interest. Note that the numbers of the interactions are the numbers of the 'standard order' used for data entry, and not the order in which they appear on the screen.

Now that you have decided that none of the interactions are of any value, you can pool their variances to estimate the error variance. Enter 3,5,6 and 7 followed by 0 to end and say *Y* to look at the tables again. This time the F-ratios for each effect are given, along with the value of F-ratio corresponding to the 90 percent confidence level (Fig 3). You can now see that

```

=====
STANDARD | FUEL GRADE | TYRE PRESS | SPEED | RESULTS
ORDER    | level | value | level | value | level | value |
-----|-----|-----|-----|-----|-----|-----|
1        | lo   | 2    | lo   | 20   | lo   | 50   | 28.9
2        | hi   | 4    | lo   | 20   | lo   | 50   | 30.0
3        | lo   | 2    | hi   | 30   | lo   | 50   | 32.6
4        | hi   | 4    | hi   | 30   | lo   | 50   | 33.3
5        | lo   | 2    | lo   | 20   | hi   | 70   | 26.1
6        | hi   | 4    | lo   | 20   | hi   | 70   | 26.7
7        | lo   | 2    | hi   | 30   | hi   | 70   | 29.1
8        | hi   | 4    | hi   | 30   | hi   | 70   | 31.2
=====
    
```

Figure 1. Standard order for results in 2^3 Factorial

the tyre pressure effect is not only the biggest factor in improving fuel consumption, but also the effect of highest significance. Speed is the next most important effect, and is highly significant in reducing the miles per gallon figure. Fuel is less important.

Program notes

Procdataload and *Procentry* control data

input, the standard order being computed by lines 610 to 650. *Procanalysis* calculates the effects of the changes and the corresponding mean squares using Yates' method. Note that for 2 level factorials the effect and mean square are exactly equivalent and that the mean square is also the sum of squares (mean squares = sum of squares/dof, and dof or degrees of freedom are 1 in a 2 level experiment). The

arrays required for the standard order labels and Yates' analysis of a six factor experiment use up nearly all the available memory on the Model B.

Proprintout, along with *Procheading*, prints out the results of the analysis for the main effects, and *Procints* handles the interaction pages.

Procerror calls for interactions which can be used to estimate error variance. Given the standard order numbers of the unwanted interactions, it simply averages their mean squares. The degrees of freedom are used in three different ways for calculating error variance (dof), as a flag to check if another interaction has been added to the estimate (dof), and as an approximation with which to enter the F-ratio table (d).

Procext deals with an external estimate of error variance. The data at the end of the program consists of the probability points of the F distribution, for cases when the experiment has only 1 degree of freedom per effect, and a 90 percent confidence level is required. The F-ratios correspond to increasing degrees of freedom in the error variance estimate (up to 27 dofs) followed by one F-ratio for 28 to 59 dofs (ie, 2.85), and another for more than 59 dofs (ie, 2.75). ■

MAIN EFFECTS

No.	Change	Effect on M.P.G.	Mean Sq
1	Increasing FUEL	1.13	2.53
2	Increasing TYRES	3.63	26.3
4	Increasing SPEED	-2.92	17.1

Error Mean Square = 0
From 0 Degrees of Freedom

Note No's of interactions you wish to use as estimate of error variance from the following tables.

Press any key to continue

1st ORDER INTERACTIONS

No.	Change	Effect on M.P.G.	Mean Sq
3	FUEL TYRES	0.275	0.151
5	FUEL SPEED	0.225	0.101
6	TYRES SPEED	0.125	3.12E-2

Press any key to continue

2nd ORDER INTERACTIONS

No.	Change	Effect on M.P.G.	Mean Sq
7	FUEL TYRES SPEED	0.475	0.451

Enter No's of interactions you want to use as estimate of the error variance.
('0' to finish)

Figure 2. Print out on first Pass

MAIN EFFECTS

No.	Change	Effect on M.P.G.	F-ratio
1	Increasing FUEL	1.13	13.8
2	Increasing TYRES	3.63	143
4	Increasing SPEED	-2.92	93.1

Error Mean Square = 0.184
From 4 Degrees of Freedom

If F-ratio > 4.54 then effect of change is significant at >90% level.

If F-ratio = 0 then effect has been chosen to estimate error.

Figure 3. Print out on second Pass

Continued over the page

```

10  REM STATISTICS/ANALYSIS OF VARIANCE
20  REM FOR 2^N FACTORIAL EXPTS.
30  REM (C) C.R.WOODINGS/MAY 1983
40  REM FOR BBC MICRO MODEL B
50
60  MODE7:PROCTitle
70  CLS:PRINTTAB(0,12)"Enter number of
   factors (min=2:max=6) ";
80  f=VALFNINPut(1,49,55):r=2^f
90  DIM F$(f),data(f,r),name$(f),efec(r),
   mnsqr(r),lbl$(r),int$(r)
100 fctr=f:rslt=r:ext=0
110 PROCdataLoad
120 REPEAT:dof=0:erv=0
130 CLS:IF FNyes_no(10,12,"Edit the data")
   :PROCreview
140 CLS:PRINTTAB(15,12)"COMPUTING":
   PROCanalysis
150 CLS:IF FNyes_no(1,11,"Do you have a good
   estimate of error variance from other
   trials") THEN PROCext:GOTO180
160 p=0:REPEAT:PROCprintout(p):PROCerror
   (p):p=p+1
170 UNTIL NOT FNyes_no(5,VPOS+1,
   "See the tables again")
180 UNTIL NOT FNyes_no(10,VPOS+1,
   "Another run")
190 MODE7:PROCdouble_height(11,"BYE",132)
   :END
200
210 DEFPROCtitle
220   PROCdouble_height(8,"STATISTICS",132)
230   PROCdouble_height(12,"Analysis of 2^n
   Factorial Experiment",131)
240   PROCcontinue:ENDPROC
250
260 DEFPROCdouble_height(row,words$,colour)
270   column=INT((40-LEN(words$))/2)-2
280   FOR I=row TO row+1:PRINTTAB(column,I),
   CHR$(141);CHR$(colour);words$
290   NEXT:ENDPROC
300
310 DEFFNyes_no(x,y,A$)
320   LOCAL ans:PRINTTAB(x,y);A$;"(Y/N) ? ";
330   REPEAT:ans=(GET AND &DF):UNTIL ans=&59
   OR ans=&4E:PRINTCHR$(ans)
340   =(CHR$(ans)="Y")
350
360 DEFPROCcontinue
370   PRINTTAB(7,23)"Press any key to
   continue ";:REPEATUNTILGET:ENDPROC
380
390 DEFFNINPut(len,loASC,hiASC)
400   LOCAL K%,Z%:K%=0:In$="":PRINT STRING$(
   len,".");STRING$(len+1,CHR$(8));" ";
   :*FX15,1
410   REPEAT:Z%=GET
420   IF Z%=127 AND K%>0 THEN K%=K%-1:In$=
   LEFT$(In$,K%):VDUZ%,46,8:GOTO450
430   IF Z%>loASC AND K%<len AND Z%<hiASC
   THEN K%=K%+1:In$=In$+CHR$(Z%):VDUZ%:GO
   TO450
440   IF NOT(Z%=13 AND K%>0) VDU7
450   UNTIL Z%=13 AND K%>0
460   =In$
470
480 DEFPROCreview
490   FOR N%=0 TO rslt-1
500   PROCentry("EDITING")
510   PRINT;data(0,N%):IF FNyes_no(8,15,
   "Change entry") THEN PRINTTAB(8,17)"NE
   W RESULT = ";:data(0,N%)=EVALFNINPut
   (10,40,58)
520   NEXT:ENDPROC
530
540 DEFPROCdataLoad
550   FOR N=1 TO fctr:CLS
560   PRINTTAB(3,12)"Enter a name for factor
   ";N;" ";
570   name$(N)=FNINPut(5,32,127):NEXT
580   CLS:PRINTTAB(5,12)"Enter a name for
   results.";
590   rslt%=FNINPut(6,32,127):CLS:PRINTTAB
   (15,12)"COMPUTING"
600   REM rest of Procedure gets results in
   standard order for Yates Method
610   X=1:R=0:REPEAT
620   FOR N%=1 TO rslt/X
630   FOR M%=1 TO X
640   IF N%DIV2<>N%/2 THEN F$(R)=F$(R)+"
   Lo" ELSE F$(R)=F$(R)+" Hi"
650   NEXT:NEXT:X=2*X:R=R+1:UNTIL R=fctr
660   FOR N%=0 TO rslt-1
670   PROCentry("LOADING")
680   data(0,N%)=EVALFNINPut(10,40,58)
690   NEXT:ENDPROC
700
710 DEFPROCentry(B$)
720   CLS:PRINTTAB(12,1)"DATA ";B$:PRINTTAB
   (0,11-fctr);
730   FOR X%=0 TO fctr-1:level$=MID$(F$(X%),
   N%*3+1,3)
740   PRINTTAB(10);name$(X%+1);TAB(17)"at";
   level$;" level"
750   IF B$="EDITING" THEN 780
760   IF level$="Hi" THEN level$="H" ELSE
   level$="L"
770   lbl$(N%)=lbl$(N%)+level$
780   NEXT:PRINT'TAB(10)"Result = ";:ENDPROC
790
800 DEFPROCanalysis total=0
810   FOR M%=0 TO fctr-1
820   FOR N%=0 TO rslt-1 STEP 2
830   data(M%+1,N%/2)=data(M%,N%)+data
   (M%,N%+1)
840   data(M%+1,N%/2+rslt/2)=data(M%,N%+1)
   -data(M%,N%)
850   NEXT:NEXT
860   FOR N%=0 TO rslt-1
870   efec(N%)=data(M%,N%)/2^(M%-1)
880   mnsqr(N%)=data(M%,N%)^2/rslt
890   NEXT:mnsqr(0)=0:ENDPROC
900
910 DEFPROCprintout(Pass) @%=&308
920   CLS:PRINT:PROCheading("MAIN EFFECTS")
930   N=1:FOR M=1 TO fctr
940   PRINT;N;TAB(3);"Increasing ";name$(M);
   TAB(23);efec(N);TAB(32);
950   IF Pass=0 THEN PRINT;mnsqr(N) ELSE
   PRINT;mnsqr(N)/erv
960   N=N*2:NEXT:PRINT'"Error Mean Square =
   ";erv'"From ";dof;"Degrees of Freedom"
970   IF Pass THEN PRINT"if F-ratio>";f_ratio
   ;" then effect of change is sig
   nificant at >90% level."'"If F-ratio=0
   then effect has been chosen to estimate
   error."
980   IF ext OR Pass THEN 1000
990   PRINT"Note No's of interactions you
   wish to""use as estimate of error v
   ariance""from the following tables."
1000  FOR N=2 TO fctr:PROCcontinue
1010  PROCints(N-1,Pass)
1020  NEXT:@%=10:ENDPROC
1030
1040 DEFPROCints(order,Pass) VDU26:CLS
1050  IF order=1 THEN S$="st" ELSE IF order=2
   THEN S$="nd" ELSE IF order=3 THE
   N S$="rd" ELSE S$="th"

```

```

1060 PRINT ;order;S$;:PROCheading(" ORDER
INTERACTIONS")
1070 FOR N%=3 TO rslt:int$(N%)="":flag=-1
1080 FOR X%=1 TO fctr
1090 IF MID$(lbl$(N%),X%,1)="H" THEN int$(
N%)=int$(N%)+ " "+name$(X%):flag=fla
g+1
1100 NEXT
1110 IF flag=order THEN PRINT;N%;TAB(2);
int$(N%)TAB(23);efec(N%);TAB(32);:GOT
O1120:ELSE GOTO1130
1120 IF Pass=0 THEN PRINT;mnsqr(N%) ELSE
PRINT;mnsqr(N%)/erv
1130 IF VPOS>21 THEN PROCcontinue:VDU28,0,
24,39,5:CLS
1140 NEXT:ENDPROC
1150
1160 DEFPROCheading(C$)
1170 PRINTC$;:TAB(21)"Effect on"
1180 PRINT"No. ";TAB(4)"Change";TAB(23);
rslt$;TAB(32);
1190 IF Pass=0 THEN PRINT"Mean Sq" ELSE
PRINT"F-ratio"
1200 PRINTSTRING$(39,"_"):ENDPROC
1210
1220 DEFPROCerror(Pass) Dof=0
1230 IF ext THEN 1310
1240 IF Pass THEN PRINTTAB(2,9)"Add
interactions to error estimate? "ELSE
PRINTTAB(0,9)"Enter No's of interac
tions you want to""use as estimate of
the error variance."
1250 PRINTTAB(12)"('0' to finish)"
1260 REPEAT:err=VALFNinput(2,40,58):VDU9,9
1270 IF err=0 OR mnsqr(err)=0 THEN 1300
1280 erv=erv+mnsqr(err)
1290 mnsqr(err)=0:dof=dof+1:Dof=dof
1300 UNTIL err=0
1310 d=dof:IF Dof=dof erv=erv/dof
1320 IF dof>27 AND dof<60 THEN d=28
1330 IF dof>=60 THEN d=29
1340 FOR N%=1 TO d:READ f_ratio:NEXT
1350 RESTORE:ENDPROC
1360
1370 DEFPROCext
1380 ext=-1:CLS:PRINTTAB(1,12)"Enter the
error variance estimate ";
erv=VALFNinput(5,40,58)
1390 CLS:PRINTTAB(1,12)"Enter the degrees
of freedom on which this error va
riance is based.";
1400 dof=VALFNinput(5,40,58)
1410 PROCerror(1):PROCprintout(1):ENDPROC
1420
1430
1440 DATA 39.9,8.53,5.54,4.54,4.06,3.78,3.59,
3.46,3.36,3.28,3.23,3.18,3.14
1450 DATA 3.1,3.07,3.05,3.03,3.01,2.99,2.97,
2.96,2.95,2.94,2.93,2.92,2.91
1460 DATA 2.90,2.85,2.75:REM 90% Probability
points of f_ratio for 1 to 27,>27,
and >59 degrees of freedom

```

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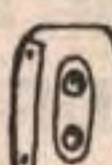
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OPEN FORUM

Open Forum is for you to publish your programs and ideas. Take care that the listings you send in are all bug-free. Your documentation should start with a general description of the program and what it does and then give some detail of how the program is constructed. We will pay the *Program of the Week* double our new fee of £6 for each program published.

Jackpot

on ZX81

The screen displays a fruit machine and all

the winning combinations possible. These can very easily be changed by changing lines 20 to line 35.

Line 47 to line 79 choose three different reels at random to be displayed for the

winnings. These can also very easily be changed by altering line 47. Add as many characters to the variable B\$ as you like, then alter line 50 (let $J = \text{Int}(\text{Rnd} \times ?) + 1$). The question mark should always be one more than the amount of characters in B\$.

When all this is done and it is exactly as you desire it to be, save it on tape by typing *Goto 120*. You are now ready to run it. Hit key "R" to spin the reels.

Graphics note

Line 47 = OX* (SHIFT T) (SHIFT H) (INV SPACE) (SHIFT Y) (INV E) (INV ?).

LISTING FROM JACKPOT I

```

1 REM "JACKPOT"
2 PRINT "
3 PRINT "
4 PRINT "
5 PRINT "
6 PRINT "
7 PRINT "
8 PRINT "
9 PRINT "
10 PRINT "
11 PRINT "
12 PRINT "
13 PRINT "
14 PRINT "
15 PRINT "
16 PRINT "
17 PRINT "
18 PRINT "
19 PRINT "
20 PRINT AT 0,12;"
21 PRINT ""
22 PRINT AT 2,12;"
:90"
23 PRINT ""
24 PRINT AT 4,12;"
:70"
25 PRINT ""
26 PRINT AT 6,12;"
:60"
27 PRINT AT 8,12;"
:50"
28 PRINT AT 10,12;"
0:50"
29 PRINT AT 12,12;"
0:50"
30 PRINT AT 14,12;"
0:30"
31 PRINT AT 16,12;"
0:20"
32 PRINT AT 18,12;"
0:10"
33 PRINT AT 20,12;"

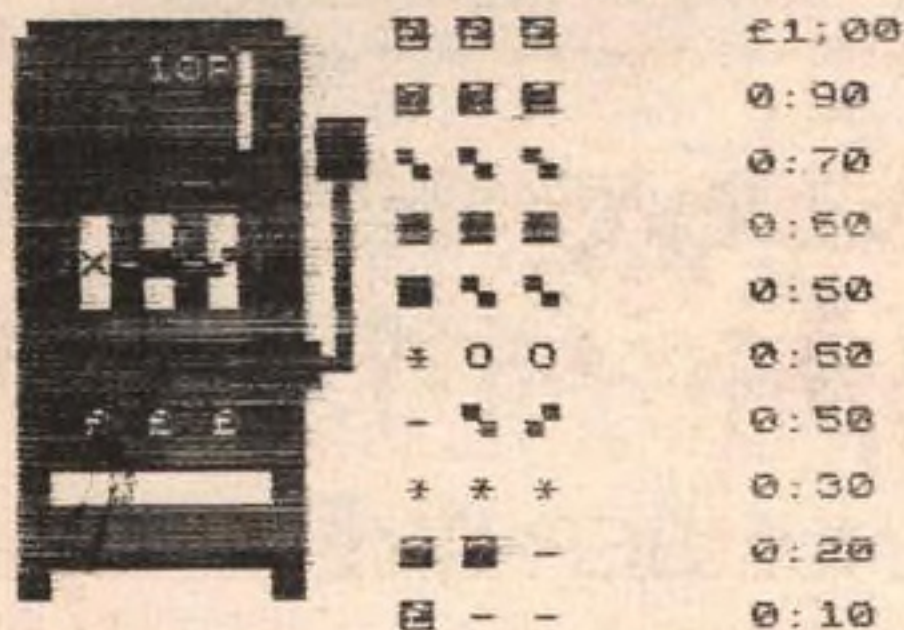
```

```

46 IF INKEY$(">"R" THEN GOTO 45
47 LET B$="OX*
48 DIM A$(3)
49 FOR F=1 TO 3
50 LET J=INT (RND*10) +1
78 LET A$(F)=B$(J)
79 NEXT F
80 FOR F=1 TO 3
82 FOR J=1 TO 7
83 PRINT AT 7,0+2*F;D$(J)
84 NEXT J
85 IF RND<.5 THEN GOTO 82
86 PRINT AT 7,0+2*F;A$(F)
90 NEXT F
100 IF INKEY$(">"R" THEN GOTO 46
105 CLS
106 RUN
110 STOP
120 SAVE "JACKPOT"
130 RUN

```

EXAMPLE FROM JACKPOT I



Jackpot
by Peter Morton

Prism

on BBC

This program will produce a prism, which will rotate first in one direction, then the

other. The speed is controlled by the number added to A in the subroutines.

By adding a few points, a cube or more complex shape could be made.

Program notes

5 Cursor off

- 18-31 Draws the prism
- 32 This colour is easier on the eyes than normal white
- 39 Draws the foreground square
- 40-49 Decides which subroutine to use
- 51 Calls appropriate subroutine
- 1000,2000 Subroutines. Try altering the numbers.

```

5 VDU23;8202;0;0;0;
10 A=100:GOS=1000
11 XXX=100
15 MODE4
17 C=A+600
18 MOVE A+XXX,500:DRAW C+XXX,500
20 MOVE A+XXX,500:DRAWA,900
21 MOVE C+XXX,500:DRAWC,900
30 MOVE C+XXX,500:DRAWC,300
31 MOVE A+XXX,500:DRAW A,300
32 GCOL0,1
39 DRAWA,900:DRAWC,900:DRAWC,300:
DRAWA,300:GCOL0,2
40 IF A+800>1280 THEN GOS=2000
48 IF A<0 THEN GOS=1000
49 IF XXX=1200 THEN GOS=1000
51 GOSUB GOS
55 GOTO15
1000 A=A+10:XXX=XXX-10:RETURN
2000 A=A-10:XXX=XXX+10:RETURN

```

Prism
by M Weatherill

Lunar Lander

on Spectrum

In the game you are a ground-based flight controller responsible for the guidance and safe landing of several modules returning to the moon's surface at bases A and B.

More points are awarded for landing at

B, as it is more difficult than landing at A. The real problem is bringing the landing speed of the modules down to required limits before fuel is used up.

Once a module has crashed the game is over.

Program notes

User defined graphics: 1-2, 2026.

Draws scenery: 10, 100, 2001, 2025, 9813 & 9825.

Sets up variables: 110, 306, 2027.

Movement of module: 140-155, 300 & 310, 2020-2023, 2030, 9821-9835.

Draws border: 2013.

Checks module striking scenery: 305 & 2029.

Prints red border — fuel low: 311 & 2031.

Module landing: 2040.

Instructions: 8999.

Module crash routine: 9998-9999.

```

1 LET Q1=0: GO SUB 8999: PAUSE
2 CLS: GO SUB 9002: FOR X=0
TO 7: READ A: POKE USR "A"+X,A:
NEXT X: DATA 126,195,255,126,24,
36,66,231: LET a=1: LET b=1: POK
E 23658,8: LET SCORE=0: FOR X=0
TO 7: READ A: POKE USR "B"+X,A:
NEXT X: DATA 3,31,56,53,53,53,31
,7: FOR X=0 TO 7: READ A: POKE U
SR "C"+X,A: NEXT X: DATA 192,248
,60,252,252,252,248,224
2 FOR X=0 TO 7: READ A: POKE
USR "E"+X,A: NEXT X: DATA 192,22
$,112,56,28,62,0,0: FOR X=0 TO 7
: READ A: POKE USR "D"+X,A: NEXT
X: DATA 3,7,14,28,56,124,0,0
10 CLS: PLOT 0,56: DRAW 24,8:
DRAW 8,-6: DRAW 16,0: DRAW 0,-2
: DRAW 16,0: DRAW 56,84: DRAW 24
,4: DRAW -24,-64: DRAW 16,-56: D
RAW 8,0: DRAW 12,56: DRAW 20,4:
DRAW 8,52: DRAW 48,8: DRAW 16,-8
100 PRINT AT 15,6: "E"; AT 14,20:
"0"
110 LET FUEL=35: LET SPEED=0: L
ET a=1: LET b=2
140 IF INKEY$="" THEN LET b=b+1
: LET SPEED=SPEED+1: PRINT AT a-
1,b-1: " "; AT a,b: " ": PRINT AT a
,b+1: " ": LET a=a+1
141 IF FUEL<9 THEN BORDER 2
143 IF INKEY$="6" THEN PRINT AT
a,b+1: "0": LET FUEL=FUEL-2
145 IF INKEY$="8" AND b<30 THEN
LET FUEL=FUEL-.5: LET SPEED=SPE
ED+.5: PRINT AT a,b+1: " ": LET b
=b+1: BEEP .1,20
150 IF INKEY$="5" AND b>0 THEN
LET FUEL=FUEL-.5: PRINT AT a,b+1
: " ": LET SPEED=SPEED+.5: LET b=
b-1: BEEP .1,20
151 PRINT AT 3,17: BRIGHT 1: IN
K 6: "0": BRIGHT 0
155 IF INKEY$="7" AND a>0 THEN
PRINT AT a,b+1: " ": LET SPEED=SP
EED-3: LET FUEL=FUEL-1: LET a=a-
1: BEEP .1,20
300 IF a=14 AND b=5 OR a=14 AND
b=4 THEN CLS: GO TO 9800
301 PLOT 248,0: DRAW 0,175: PLO
T 0,175: DRAW 0,-175
302 IF FUEL<0 THEN LET FUEL=0
303 IF SPEED<1 THEN LET SPEED=S
PEED+4
304 PRINT AT 3,17: BRIGHT 1: IN
K 2: "0": BRIGHT 0
305 IF SCREEN$(a,b)<>" " THEN
FOR f=0 TO 7: POKE USR "q"+f,RND
*255: NEXT f: PRINT AT a,b+1: IN
K 6: "0": FOR f=1 TO 100: NEXT f:
CLS: GO TO 9000
306 PRINT AT 0,0: "VELOCITY "; SP
EED: " "; AT 21,10: "SCORE "; SCORE
: AT 0,15: "FUEL "; FUEL: FOR f=0 T
O 15: PRINT AT a,b+1: "X": NEXT f
310 IF a=10 AND b=20 OR a=10 AN
D b=19 THEN GO TO 2000
311 IF FUEL<1 THEN LET a=a+1: P
RINT AT a-1,b+1: " "; AT a,b+1: "X"
: GO TO 300
900 GO TO 111
2001 CLS: IF Q1=0 THEN PLOT 152
,0: DRAW 56,16: DRAW 0,16: DRAW
-8,0: DRAW 16,48: DRAW -8,32: DR
AW 8,40: DRAW 38,0: PLOT 48,0: D
RAW 8,24: DRAW 8,0: DRAW 0,16: D
RAW 16,64: DRAW -24,40: DRAW -56
,0: LET Q=3: LET W=15: PRINT AT
0,W: "A"; AT 0-1,W: "0"
2013 PLOT 0,0: DRAW 255,0: DRAW
0,168: DRAW -255,0: DRAW 0,-168
2020 IF INKEY$="8" THEN PRINT AT
0,W-1: " "; AT 0-1,W-1: " "; AT 0-1
,W+2: " "; AT 0,W+2: " ": LET W=W+1
2021 IF INKEY$="5" THEN PRINT AT
0,W+2: " "; AT 0-1,W+2: " "; AT 0,W
-1: " "; AT 0-1,W-1: " ": LET W=W-1
2022 IF INKEY$="7" AND 0-1>1 THE
N LET Q=0-1: PRINT AT 0+1,W: " "

```

```

: LET SPEED=SPEED-3: LET FUEL=FU
EL-1
2023 IF INKEY$="" THEN LET Q=Q+1
: PRINT AT 0-2,W: " ": LET SPEED
=SPEED+1
2024 PRINT AT 0,W: "A"; AT 0-1,W:
"0"
2025 IF Q=19 AND Q1=0 THEN CLS:
LET Q1=1: LET Q=3: IF Q1=1 THE?
PLOT 120,32: DRAW INK 3,16,0: P
LOT 120,16: DRAW 16,0: DRAW 0,8:
DRAW 48,0: DRAW -16,32: DRAW 8,
32: DRAW -16,24: DRAW -8,16: DR
AW 8,40: PLOT 120,16: DRAW 0,8: D
RAW -24,0: DRAW -32,40: DRAW 24,
40: DRAW -24,32: DRAW -16,32
2026 PRINT AT 0,W: "A"; AT 0-1,W:
"0"
2027 IF SPEED<1 THEN LET SPEED=0
2028 IF FUEL<1 THEN LET FUEL=0
2029 IF SCREEN$(0+1,W)<>" " AND
ATTR (0+1,W)<>3 THEN GO TO 9998
: IF SCREEN$(0+1,W+1)<>" " AND
ATTR (0+1,W+1)<>3 THEN GO TO 999
8: IF SCREEN$(0,W-1)<>" " AND A
TTR (0,W)<>3 THEN GO TO 9998: IF
SCREEN$(0,W+2)<>" " AND ATTR (
0,W)<>3 THEN GO TO 9998
2030 IF INKEY$="6" THEN PRINT AT
0,W: "A"; AT 0-1,W: "0": LET FUE
L=FUEL-2
2031 PRINT AT 1,0: "VELOCITY("; SP
EED: ") FUEL("; FUEL: ") SCORE ("
; SCORE: ") "; IF FUEL<2 THEN PRI
NT AT 0-2,W: " "; AT 0-1,W: " ":
LET Q=Q+1: GO TO 2024
2032 PRINT AT 1,0: "VELOCITY("; SP
EED: ") FUEL("; FUEL: ") SCORE ("
; SCORE: ") "; IF SPEED<0 THEN LET
SPEED=3
2033 PRINT AT 0,W-2: " ": PRINT A
T 0,W-1: " "; AT 0-1,W-1: " "; AT 0,
W+2: " "; AT 0-1,W+2: " "
2040 IF Q=15 AND W=15 AND Q1=1 A
ND SPEED<5 AND SPEED>0 THEN PRIN
T AT 0-1,W: " "; AT 0,W: " ": PRI
NT AT 0+1,W: "0"; AT 0+2,W: "A":
PLOT 120,31: DRAW INK 2,16,0: LE
T SCORE=SCORE+4: FOR F=0 TO 150:
NEXT F: GO TO 9911
2041 IF FUEL<10 THEN BORDER 2
8997 GO TO 2010
8998 STOP
8999 CLS: BORDER 0: PAPER 0: IN
K 7: CLS: PRINT AT 21,0: "Press
any key": PRINT AT 0,11: "MESSAGE
TO": AT 2,8: FLASH 1: "0";
"0"; FLASH 0: AT 4,4: "BY DAVI
D DYER (AGE 11)": AT 10,6: "THE KE
YS ARE AS FOLLOWS: "; AT 12,10: "8-
RIGHT"; AT 14,10: "5-LEFT"; AT 16,1
0: "6-HOLD"; AT 18,10: "7-THRUST":
RETURN
9000 CLS: PRINT AT 8,2: "END OF
MISSION"; AT 10,2: "MODULE DESTROY
ED"; AT 12,2: "COLLISION VELOCITY
WAS "; SPEED: "
KNOTS"; AT 16,2: "YOUR
SCORE IS "; SCORE
9001 STOP
9002 CLS: PLOT 15,149: DRAW 176
,0: PRINT AT 2,2: "TOUCH DOWN VEL
OCITIES. "; AT 5,2: "BASE 'A' 0-2 K
NOTS. SCORE+2": PRINT AT 7,2: "
BASE 'B' 0-5 KNOTS. SCORE+4"; A
T 21,0: "Press any key to contact
module": PAUSE 0: CLS: RETURN
9813 LET g=3: LET h=12: PRINT AT
g-1,h+1: "0"; AT g,h+1: "A"
9814 PRINT AT 1,1: "VELOCITY("; SP
EED: ") "; AT 2,1: "FUEL("; FUEL: ") ";
AT 3,1: "SCORE("; SCORE: ") "
9815 PLOT 0,32: DRAW 70,16: DRAW
24,40: DRAW 0,-32: DRAW 40,0: D
RAW 0,40: DRAW 24,-24: DRAW 48,0
: DRAW -8,-64
9820 PRINT AT g-1,h+2: " "; AT g,h
+2: " ": PLOT 0,0: DRAW 255,0: DR
AW 0,175: DRAW -255,0: DRAW 0,-1
75

```

```

9821 IF INKEY$="" THEN LET g=g+1
LET SPEED=SPEED+1: PRINT AT g-
2,h," "
9822 IF INKEY$="7" AND g-1>3 AND
SPEED>0 THEN LET SPEED=SPEED-2:
LET FUEL=FUEL-1: LET g=g-1: PRI
NT AT g+1,h," "
9823 IF INKEY$="5" AND h>5 THEN
LET h=h-1: PRINT AT g,h+2," ";AT
g-1,h+2," "
9824 IF INKEY$="6" AND h<26 THEN
LET h=h+1: PRINT AT g,h-1," ";A
T g-1,h-1," "
9825 PLOT 0,32: DRAW 70,16: DRAW
24,40: DRAW 0,-32: DRAW 40,0: D
RAW 0,40: DRAW 24,-24: DRAW 48,0
: DRAW -8,-64
9827 IF SPEED<0 THEN LET SPEED=5
SPEED+4
9829 IF INKEY$="6" THEN PRINT AT
g-1,h,"●";AT g,h,"▲": LET FUE
L=FUEL-2
9830 IF FUEL<0 THEN LET FUEL=0:
IF FUEL<1 THEN LET g=g+1: PRINT
AT g-2,h," " : PRINT AT g,h,"▲"
:AT g-1,h,"●": IF SCREEN$(g+1,
h)<>" " THEN GO TO 9999: IF SCRE
EN$(g+1,h+1)<>" " THEN GO TO 99
99: GO TO 9825
9832 IF SCREEN$(g,h-1)<>" " AND
ATTR(g,h)<>3 THEN GO TO 9999
9833 IF SCREEN$(g,h+2)<>" " AND
ATTR(g,h)<>3 THEN GO TO 9999
9834 PRINT AT g,h-1," ";AT g-1,h
-1," "; PRINT AT g-1,h,"●";AT g
,h,"▲"
9835 PLOT INK 3,104,64: DRAW INK
3,16,0: IF g=13 AND h=13 AND SP
EED>0 AND SPEED<3 THEN PAUSE 0:
LET SCORE=SCORE+2: FOR F=0 TO 20
0: NEXT F: CLS : GO TO 9900

```

```

9836 PRINT AT 1,1,"VELOCITY(";SP
EED;") ";AT 2,1,"FUEL(";FUEL;")"
:AT 3,1,"SCORE(";SCORE;")"
9837 IF FUEL<10 THEN BORDER 2
9880 GO TO 9820
9911 BORDER 0: CLS : PAUSE 50: P
RINT AT 10,0;"ALPHA-CORRECT SURF
ACE CONTACT.";AT 11,0;"STANDBY C
ONTROLLER FOR NEXT MODULE AR
RIVING ON SCHEDULE:" " "Press any
key to contact next module":
PAUSE 0: GO TO 10
9996 BORDER 0: FOR F=0 TO 9: FO
R X=1 TO 8: POKE USR "0"+X,RND#25
5: NEXT X: PRINT AT 0,W-1; INK 6;
FLASH 1,"8888";AT 0-1,W-1; INK
6; FLASH 1,"8888": FLASH 0: NEXT
F: PRINT AT 0,W; " ":AT 0-1,W;"
": CLS : FOR F=0 TO 21: PAUSE
5: PRINT AT F,8;"END OF MISSION
";AT F-1,8;" ": NEX
T F: PRINT AT 10,0;"Press any ke
y for another game": PAUSE 0: RU
N
9999 BORDER 0: FOR F=0 TO 10: FO
R X=0 TO 7: POKE USR "0"+X,RND#2
55: NEXT X: PRINT AT g,h; INK 6;
FLASH 1,"8888";AT g-1,h; INK 6;
FLASH 1,"8888": NEXT F: PRINT AT
g,h;" ";AT g-1,h;" ": CLS :
FOR F=0 TO 21: PAUSE 5: PRINT AT
F,8;"END OF MISSION";AT F-1,8;"
": NEXT F: PRINT A
T 10,0;"Press any key for anothe
r game": PAUSE 0: RUN

```

Lunar Lander
by G Dyer

Colour Mix

on BBC Micro

I have enclosed a utility program for either

model of the BBC computer which will allow the user to intermix any two colours from a range of eight available colours.

This will produce fairly reasonable colours you would expect if you mixed the colours as if they were paint.

But as many readers will know they can't be mixed as well, as they are not 'pure' colours. The produced colours will not be true, but I hope this short program will help readers to make their choice for colour mixes good ones.

```

10
20 REM"          Colour Mix
30 A$="          Author:  Mark Colson
40
50 MODE7
60 UDU23;8202;0;0;0;
70 UDU23,224,170,85,170,85,170,
85,170,85
80 PROCIntro
90 MODE4
100 UDU23;8202;0;0;0;
110 UDU19,0,A-1;0;
120 UDU19,1,B-1;0;
130 FORA=1TO1240
140 UDU224
150 NEXT
160 A$=GET$
170 RUN
180
190 DEF PROCIntro
200 PRINTCHR$157
210 FORF=1TO2:PRINTCHR$157CHR$141
CHR$129CHR$136TAB(14)"COLOUR
MIX":NEXTF

```

```

220 PRINTCHR$157
230 PRINT" "CHR$131CHR$157CHR$130
TAB(6)A$" "CHR$156
240 PRINTCHR$157CHR$132"PICK TWO
OF THESE COLOURS (BY NUMBER)"
250 PRINTCHR$157
260 DATABLACK,RED,GREEN,YELLOW,
BLUE,MAGENTA,CYAN,WHITE
270 FORF=1TO8
280 READA$
290 PRINTCHR$157CHR$133TAB(5)F;"
"A$
300 NEXTF
310 PRINTCHR$157
320 PRINTCHR$133CHR$157CHR$135TAB
(4)"Press any key after to
continue "CHR$156
330 A=VAL(GET$)
340 B=VAL(GET$)
350 ENDPROC

```

>RUN

Colour Mix
by Mark Colson

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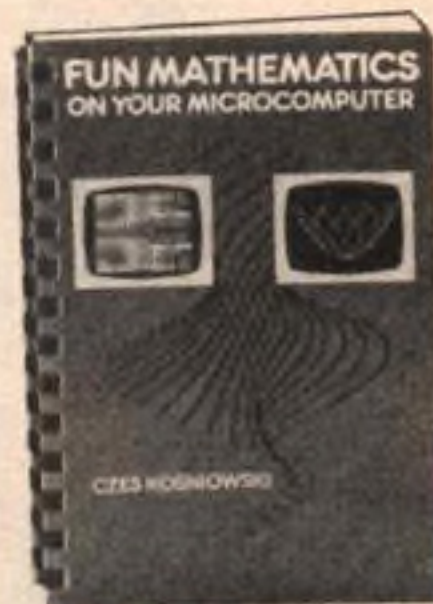
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Parachute Attack

on Lynx

This is a game for the Lynx involving falling parachutes.

You are on a hillside and parachutes are

falling from the sky and into a boat.

You must shoot them before they get there. You are given six skill levels which determine how and how fast the parachutes falls.

Shoot with the space bar — you have 20 shots. The computer will bleep when you

have hit a parachute.

Variables

- T=Total points
- E=Skill level and speed of parachute
- A+B=Co-ordinates
- O\$=Points or Point
- R = Parachutes that got away

```

100 REM *** PARACHUTE ATTACK ***
110 REM *** JOANNA GREENWOOD ***
120 LET R=0
130 LET T=0
140 LET M=0
150 LET X=100
160 LET U=190
170 LET P=0
180 LET N=0
190 CLS
200 INPUT "SKILL LEVEL (1 TO 6)";E
210 IF E>6 THEN GOTO 200
220 LET E=E+1
230 RANDOM
240 PAPER 1
250 CLS
260 INK 4
270 FOR D=135 TO 230
280 LET U=U-1
290 PLOT 0,U,D
300 PLOT 2,255,D
310 NEXT D
320 INK 0
330 FOR G=120 TO 134
340 PLOT 0,212,G
350 PLOT 2,215,G
360 NEXT G
370 INK 0
380 FOR L=115 TO 119
390 PLOT 0,190,L
400 PLOT 2,220,L
410 NEXT L
420 INK 5
430 FOR J=231 TO 247
440 PLOT 0,0,J
450 PLOT 2,255,J
460 NEXT J
470 INK 0
480 FOR Y=215 TO 229
490 LET X=X-1
500 LET M=M+1
510 PLOT 0,M,Y
520 PLOT 2,X,Y
530 NEXT Y
540 LET B=5
550 LET A=RAND(90)+10
560 INK 7
570 PLOT 4,A,B
580 PLOT 0,A-2,B+1
590 PLOT 2,A+2,B+1
600 PLOT 0,A-4,B+2
610 PLOT 2,A+4,B+2
620 PLOT 0,A-5,B+3
630 PLOT 2,A+5,B+3
640 PLOT 0,A-5,B+4
650 PLOT 2,A+5,B+4

```

```

660 PLOT 0,A-4,B+5
670 PLOT 2,A,B+13
680 PLOT 0,A+4,B+5
690 PLOT 2,A,B+13
700 PLOT 0,A,B+5
710 PLOT 2,A,B+13
720 IF N=9 THEN GOTO 1020
730 IF INK=1 THEN GOTO 770
740 INK 1
750 IF KEY#=" " THEN GOTO B20
760 GOTO 570
770 LET B=B+E
780 IF B>203 THEN LET R=R+1
790 IF B>203 THEN GOTO 540
800 IF KEY#=" " THEN GOTO B20
810 GOTO 560
820 INK 6
830 PLOT 0,189,117
840 PLOT 2,A,117
850 IF INK=1 THEN GOTO 900
860 LET P=P+1
870 IF P>20 THEN GOTO 1040
880 IF INK 1
890 GOTO B30
900 IF B+4=117 THEN GOTO 950
910 IF B+5=117 THEN GOTO 950
920 IF B+6=117 THEN GOTO 950
930 IF B+7=117 THEN GOTO 950
940 GOTO 570
950 LET T=T+1
960 BEEP 50,100,63
970 INK 7
980 PAUSE 2500
990 LET N=9
1000 INK 1
1010 GOTO 570
1020 LET N=0
1030 GOTO 540
1040 CLS
1050 VDU 24
1060 IF T<>1 THEN LET O$="S"
1070 ELSE LET O$=" "
1080 PRINT "YOU SCORED ";T;" POINT";O$
1090 PRINT "USING 20 SHOTS"
1100 IF R<>1 THEN LET O$="S"
1110 ELSE LET O$=" "
1120 PRINT R;" PARACHUTE";O$;" GOT AWAY"
1130 VDU 25
1140 PRINT @ 3,80;"WOULD YOU LIKE ANOTHER GO (Y/N)"
1150 IF GET#="Y" THEN GOTO 100
1160 END

```

Parachute Attack
by Joanna Greenwood

Early Bird

on Spectrum

You are a poor little bird who is stranded in Mr Green's garden with a broken wing. But be careful, a cat is on the prowl and out to devour you.

In the garden there is a puddle that slowly soaks away. You must avoid hopping into it or you will drown.

In order to recover you must catch 10 worms.

Full instructions are contained in the program.

Program notes

- 10-80 User defined graphics.
- 99-199 Initialise
- 200-299 Set up screen
- 300-320 Move bird and check position
- 325-350 Move cat and check position
- 360-380 Move worm and check position
- 800-987 Concluding comments
- 990-999 Instructions

```

1 GO SUB 990
20 FOR I=0 TO 50: READ A: PAPER
30 DATA 56,40,56,16,146,64,56,
40 DATA 165,90,189,90,83,24,24
50 DATA 24,24,36,219,219,36,24
60 DATA 0,3,4,100,166,144,0,0
70 DATA 199,135,130,254,254,25
80 DATA 6,135,68,56,56,16,16,2
90 DATA 0,0,0,0,0,0,0,0
100 DATA 96,225,34,26,28,8,8,24
110 LET SC=0: LET L=.5: GO SUB
120 GO SUB 295: LET A=6: LET B=
130 LET X=10: LET Y=30
140 LET WX=INT (RAND*21): LET WY
150 =INT (RAND*21): IF WITH (WX,WY) <

```

```

36 THEN GO TO 120
130 LET BS="H"
140 PRINT AT X,Y:BS:AT 5,B: INK
150 "E":AT WX,WY: INK 2:"D"
160 GO TO 300
200 PAPER 4: INK 4: INVERSE 0:
OVER 0: BRIGHT 0: FLASH 0: BORDE
R 4: CLS
210 FOR I=0 TO 31: PRINT INK 0:
AT 0,I:"#":AT 21,I:"#":AT I/11.5
220 "H":AT I/1.5,31:"E": NEXT I
230 PRINT AT 1,1: INK 1:"
240 FOR J=2 TO 6: PRINT AT J,1:
INK 1:"": NEXT J
250 FOR I=7 TO 20: PRINT AT I,1
INK 0:"": NEXT I: PRINT
INK 0:""
240 PRINT AT 2,2: BRIGHT 1: INK
5: PAPER 5:"WORM":CH: 4,4,2,2
250 PRINT PAPER 7:AT 3,2:"":AT

```

Continued on page 39

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OPEN FORUM

```

3,0;" "AT 5,2;" "AT 5,6;" "
260 FOR I=18 TO 20: PRINT AT I,
B; PAPER 0; BRIGHT 1;"
NEXT I
290 FOR I=1 TO 20: PRINT PAPER
0; INK RND#3+2; AT RND#2+18, RND#2
2+8; CHR# ((RND#2)+144); NEXT I
295 RETURN
296 LET X=10; LET Y=15
297 FOR F=1 TO 100: PRINT AT X,
Y; INK 5; "
298 LET X=X+RND#1.5-RND#1.5; LE
T Y=Y+RND#1.5-RND#1.5; LET X=X-(
X>17)+(X<1); LET Y=Y-(Y>30)+(Y<8
)
299 NEXT F: RETURN
300 LET X1=X; LET Y1=Y; PRINT A
T X,Y;"
305 LET X=X+(INKEY$="6" AND X<1
7)-(INKEY$="7" AND X>1); LET Y=Y
+(INKEY$="9" AND Y<30)-(INKEY$="
5" AND Y>0); IF Y<Y1 THEN LET B
$=CHR# (Y1-Y+150)
306 IF X=INT (WX+.5) AND Y=INT
(WY+.5) THEN GO TO 950
307 IF X=INT (A+.5) AND Y=INT (
B+.5) THEN GO TO 900
308 IF ATTR (X,Y)=37 THEN GO TO
850
310 IF ATTR (X,Y) <> 36 THEN LET
X=X1; LET Y=Y1
315 IF RND#.5<1 THEN PRINT AT R
ND#16+1, RND#22+8;"
320 PRINT AT X,Y; INK 2; B$
325 LET A1=A; LET B1=B; PRINT A
T A,B;"
330 LET A=A+I*(A<X AND ATTR (A+
1,B) <> 37)-I*(A>X AND ATTR (A-1,B
) <> 37); LET B=B+I*(B<Y AND ATTR
(A,B+1) <> 37)-I*(B>Y AND ATTR (A,
B-1) <> 37)
331 LET A=A+(A<1)-(A>17); LET B
=B+(B<8)-(B>30)
333 LET B2=B; LET A2=A
339 IF A=X AND B=Y THEN GO TO 9
00
350 PRINT AT A,B; INK 0;"E"
360 LET WX1=WX; LET WY1=WY
370 PRINT AT WX,WY;" "; LET WX=
WX+RND-RND; LET WY=WY+RND-RND; I
F ATTR (WX,WY) <> 36 THEN LET WX=W
X1; LET WY=WY1
380 PRINT AT WX,WY; INK 1;"D"
390 GO TO 300
850 FOR I=10 TO -11 STEP -2: BE
EP .05; F: BEEP .05; F+2: BEEP .05

```

```

F+3: NEXT I
850 PAUSE 30: BORDER 0: PAPER 0
INK 7: CLS
870 PRINT "Birds can't swim wi
th a broken wing."
880 GO TO 980
900 FOR I=20 TO 0 STEP -1.5: BE
EP .05; F: BEEP .1; 30: NEXT I
910 PAUSE 30: BORDER 0: PAPER 0
INK 7: CLS
920 PRINT "The cat needed a m
eat too..." "You needed to eat "
;10-sc;" more worms" "to amend y
our wing."
930 GO TO 980
950 LET SC=SC+1; LET L=L+.1; IF
SC=10 THEN GO TO 950
955 PRINT HI 4,4; INK 7; PAPER
0; BRIGHT 1; SC: FOR I=1 TO 17: P
RINT AT I,8;"
NEXT I: GO TO 100
965 PAUSE 30: BORDER 0: PAPER 0
INK 7: CLS
970 PRINT "Your wing is mended
and you can fly back to your nes
t."
980 PRINT "Another game (Y/N) ?"
985 INPUT G$: IF G$="Y" OR G$="
Y" THEN RUN 90
987 STOP
990 CLS: PAPER 7; INK 0: BORDE
R 4: CLS: PRINT TAB 8;"THE EARL
Y BIRD"..." Good morning, this m
orning you are a bird. A poor inj
ured bird helpless on the groun
d because your wing is broken.
Somewhere there are
ten little worms waiting to be a
te. But there is also a cat.
The cat is tired to begin with b
ut speeds up through the game.
There is a puddle in
the lawn that must be avoided
but this soaks into the ground
slowly."
991 PRINT "... To move use keys
5 to 8."
992 PRINT "... Press any key to s
tart."
995 IF INKEY$="" THEN GO TO 995
999 CLS: RETURN

```

Early Bird
by Richard Evans

DRAGON 32 ACE HIGH



Summer 1940. You are at the controls of a lone Spitfire unleashing its eight machine-guns on a squadron of Heinkel bombers. Dodge the Heinkels' guns. Look out behind for Messerschmitt fighters (rear mirror feature). Eyes peeled for sweeping frontal attacks — and shoot down that brave German who tries to take you head-on!

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FEATURING— The ZX Spectrum—Your Personal Computer

Ian McLean, Simon Rushbrook Williams & Peter Williams

Written in an informal, friendly style, this practical guide to the ZX Spectrum is ideal for first-time users. Clear diagrams show you how to master the Spectrum's keyboard and press the correct keys for various functions. Storing information, making calculations, sound, and graphics are carefully explained, and there is a special section on making music on the Spectrum.

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OPEN FORUM

Prime Number

on Vic20

This program works on any Vic20 and many other machines with the minimum of adjustment.

The user types in a number above 1 and the computer will then proceed to work out all the prime numbers between 1 and your number. The results will be printed out on the screen unless the following adjustment

is made to print it out on the printer:

```
add 85 OPEN 1,4:CMD1
change 120 PRINT#1:CLOSE:END
```

Other machine users (ie, the Sinclair ate command will have to be inserted to 1) Open the printer command channel in line 85, and 2) Close the printer command channel in the line 120.

Other machine users (i.e. the Sinclair ZX81 and Spectrum) will also have to delete the cursor commands in lines 60, 70 and 80.

Program notes

Line
 60 (Cursor command — Clear Screen) asks for the user to type in a number.
 70 (Cursor command — Cursor Down) demonstrates what the number shows.
 80 (Cursor command — Cursor Down) INPUTs the number and checks to see whether it is valid.
 90 PRINTs the first prime number (a 2) and starts the FOR-NEXT loop.
 100 Checks to see if the number is prime, and if it is, PRINTs it.
 110 Identifies that the number is not prime.
 120 Terminates the program.

```
10 REM:*****
20 REM*
25 REM* PRIME NUMBER FIND
30 REM*
40 REM* BY M.A. VALENTINE
45 REM*
50 REM:*****
60 PRINT"[CLR]ENTER LAST NUMBER TO BE CHECKED."
70 PRINT"[CD]I.E. '1000' CHECKS FROM 2 TO 1000."
80 INPUT"[CD]";N$:N=VAL(N$):IFN<2ORN<>INT<N>THEN80
90 PRINT" 2";:FORC=2TON
100 FORA=2TOSQR(C):IF(C/A)<>INT(C/A)THENNEXT:PRINT" C;:NEXT:GOTO120
110 A=SQR(C):NEXT:NEXT
120 END
```

Prime Number
by M Valentine

Adventure Competition

Write an adventure game and win a Commodore 64!

Popular Computing Weekly is offering a star prize of a Commodore 64 for the best adventure game written for any home micro — PLUS — a special prize of a Vic20 for the best essay on an adventure theme — PLUS — for the next 10 runners-up, two Commodore adventure games.

Each week during May, *Popular Computing Weekly* will publish a coupon — simply cut out any three and send them in with your entry.

The best adventure games are ideally a combination of action and logical riddles. For instance, to open a door, the player should not merely have to find the magic word, but have to solve a puzzle in order to progress to the next location. Good graphics obviously enhance a program — and we'll be looking for a game that makes imaginative use of graphics, although that does not mean that a text-only program will be eliminated.

Other things we will be looking for are the surprise twists that make a program worth coming back to again and again.

And remember, don't make your game too difficult in the early stages — adventuring novices should have a chance to get some way into the game before getting stuck!

For those of you submitting scenarios with your program, think of it as a guide line for a programmer. Draw a map showing location objects and other important details of your

adventure, and compile a dictionary of key words that your program will accept.

If you do not want to write a full-blown adventure game, you can still enter the competition by writing an essay (up to 2,000 words) on an original adventure theme. A Vic20 will be awarded to the essay which describes the most original and interesting adventure game.

The competition will be judged by Tony Bridge and *Popular Computing Weekly* editor Brendon Gore.

PRIZES

1. Commodore 64
2. Vic20
3. Two Commodore adventure games of your choice for 10 runners-up.

HOW TO ENTER

All you have to do to enter this competition is collect the coupons from three issues of the magazine and send them, together with your entry (stating which machine your game is for) to:

Popular Computing Weekly
 Adventure Competition
 Hobhouse Court
 19 Whitcomb Street
 London WC2 7HF

RULES

1. Each entry must consist of your adventure, or essay, together with three coupons, and your name and address.
2. Closing date for the Adventure Competition is 30 June 1983.
3. The judges' decision is final.
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Adventure Competition

4

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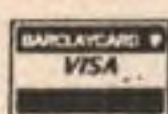
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If all this is familiar to you, then you have probably played *Dungeons and Dragons*. *The Valley*, from Kayde Software, is a program for the expanded Spectrum, Vic20, Dragon, Newbrain and Oric, based on the combat system and monsters of that most popular Role Playing game. *Computing Today*, over a year ago, featured a program of the same name. Documented in great detail, it was written in Petsoft, with conversions available for the TSR and Sharp machines.

Generally, the program works well, although a black mark must be given to Kayde as the program does not *Auto-run* after *Loading*. This is a silly mistake nowadays — it's so easy to include the routine, and gives a much better impression to the player.

However, the rest of the program is much better. After selecting the skill level you want to play at (for some reason called "Speed Level" — there's no speeding involved in this game!), you are asked to choose a character. In true *D&D* fashion you may be wizard, cleric, thinker, warrior or barbarian — they all have their own effect on the later stages of the game, and you'll probably have your own favourite.

Then, the first map is drawn. A winding road, the "safe path", crosses a barren landscape which contains a few swamps and forests. At either end of the road is a castle, a refuge at which you may rest and rejuvenate and to which you must return treasures found along the way.

The article accompanying the original program went into the background of the scenario in great detail, with one of those high-flown gothic stories of magic and chivalry. Unfortunately, there is none of that here.

The general atmosphere, however, is medieval — you can tell that because of the language (there are lots of "thees" and "thous"), and the shape that represents you, a shield with white cross.

While on the safe path, no harm will befall you, as no creature will attack — but that's rather boring, and you certainly won't progress that way. Step off the path and you're fair game for any passing creature. The object is to move across the map picking up experience points along the way, as well as treasure, of course, like any self-respecting knight. Each swamp and forest contains temples or lodges, with several rooms, in some of which may be secreted the various gems and hoards of gold. These buildings are surrounded by lakes, inhabited, naturally, or rather unnaturally, by watery monsters.

The database for monster generation contains such lovely things as ringwraiths, harpies, minotours and wyverns, amongst many others. The monsters are of two sorts — natural or supernatural. You must make the appropriate reaction to each kind, by using one of three kinds of spells, or using your sword to hack at a specified part of the creature.

The ultimate aim of the adventure is to go from lowly Monsterfood (rating #1) through Necromancer and Paladin to Master of Destiny (rating #28). To get your rating, you must return to one of the castles with the various rings and helms

that you've picked up in your travels.

On the H-scale (where Melbourne House's *The Hobbit* is assumed to have an arbitrary score of 20), *The Valley* must rate about 17. A vital point is lost because of the lack of the presentation at the start and for having no *Auto-run*. Another point off for not having a *Save* routine. This is fairly serious, as the game will obviously take many hours to play.

However, the reason for losing the third point (the program is written in slow Basic) may actually help you. The lack of speed is regrettable, though you can live with it, but being written in a high-level language the program is easily adaptable. It should be fairly easy to write in your own *Save* character and program routine.

So, although the program shows its age, the adventure is nevertheless going to give you hours of non-cerebral, bash-about, rip-roaring fun! ■

This series of articles is designed for novice and experienced Adventurers alike. Each week Tony Bridge will be looking at different Adventures and advising you on some of the problems and pitfalls you can expect to encounter. So, if you have an Adventure you want reviewed, or if you are stuck in an Adventure and cannot progress any further, write to: Tony Bridge, Adventure Corner, *Popular Computing Weekly*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

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Cruising

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Each month we will publish the name of the winner and the new *Cruising* high score. Are you good enough to accept the *Cruising* challenge?

The highest score sent in so far this month is 9968 from Carl Doran of Skidby Mill, N. Humberside. If you have a higher score, you could still win this month's £10 — but hurry, entries close on May 31.

Notes

- 1) Each entry must consist of a ZX printout and your name and address.

Can you beat the new high score?

- 2) Closing date for this month's *Cruising* challenge entries is May 31.
- 3) The highest score each month will receive £10.
- 4) High scores cannot be transferred from one month to another.
- 5) The judges' decision is final.
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Blind Alley

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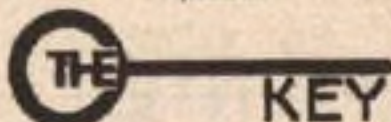
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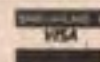
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DEMON ATTACK for Atari VCS to exchange for Parker Star Wars cartridge. Tel: 04862 70318.

ATARI VCS + five cartridges, £99.95 ono. Tel: Bookham 52289 (after 5 pm).

ATARI VCS + two cartridges, £60. Tel: Cobham (Surrey) 3503 (after 5 pm).

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16K RAM pack for ZX81 for £18, offers welcome. Tel: 01-722 7425, after 6 pm.

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ATARI VHS tapes: Pacman £20, Defender £20, Basketball £10, Skiing £10, Demon Attack £15, Space Invaders £15. Please ring 958 6161.

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VIC SUPER EXPANDER cartridge, £25. Tel: 808 6450.

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SWAP, Apple II Euro + for any software. Tel: Harrow 9527378.

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SWAP, 48K Spectrum for 16K ZX81 plus £20. Tel: 01-460 4603.

VIDEO MASTER, Star Chess, £75. Tel: 01-304 1819 (after 4.30 pm).

FURTHER PROGRAMMING for ZX Spectrum (Shiva), £4.50 + Cartridge Colour Collection (book + tape), £6. Tel: 01-346 0986.

MISSION IMPOSSIBLE for Vic 20, £15. Donney Kemp, Wacky Waiters cassettes, £10. Tel: 01-508 9558.

VIC 20, software to swap. Tel: 01-205 9649.

WARRIOR + Star Trek for 16K ZX81 (Marconi Software), £2 each. Tel: 0908-568216.

CARTRIDGES including Demon Attack, Sub Hunt, Tron, 14 in all (Mattel Television), from £10 each. Tel: 041-882 8786.

TI 99/4a, unwanted Christmas present, includes speech synthesiser, speech editor module, TI Invaders module, Munchman module, joysticks, duel cassette cable, audio, cassettes and magazines. All for £250. Tel: Doncaster 0302-723571.

MZ 80A, as new + software, books, etc., £395 or exchange system. 01-908 1460.

ADULT DRAGON owner wishes to exchange tapes and cartridges, Eproms, large and varied selection from the serious and Teletext through to games and learning, tape/cartridge. Tel: Staines 58707 (after 6 pm).

OVER £100 SOFTWARE, will sell for £70, or will swap for other originals. Tel: Chester (0244) 378549.

SPECTRUM software, swap or sell. Tel: Chester 376682.

VIC 20, Mission impossible, Type-a-Tune + Cosmos, swap for the Vic m/c monitor cartridge. Tel: East Kilbride 42853.

48K LINX, 2 weeks old, 1 year guarantee, all leads, PSU, books, manuals + software, all in perfect condition, £220 no offers, will swap for BBC model A. Tel: Waltham Cross 28173.

VIC 20 cartridges for sale, includes Gorf, Chess, £15 each, also Star Battle, Road Race + many, many more, £12 each. Tel: 01-574 4122.

VIC20 CARTRIDGES: Jelly Monsters, Omega Race, Road Race, Star Battle, Rat Race and Meteor Run — £14 each. Scot Adam's Five Adventures for £17 each. Rabbit New 6 including Orbis Linkwell, £10. Call 01-387 8751.

SUPER STAR multi-mode CB transceiver, exchange for printer compatible for BBC. Tel: Mr Guthrie, Erith 33474.

ARTHON EXPANSION UNIT, for Vic20, £65 ono. Tel: 01-650 9701.

5 SPECTRUM BOOKS, inc Spectrum Handbook, £20. Tel: 0555-71502.

VIC20 CASSETTE, Pirate Cove swap for Voodoo Castle or Count Dracula. Tel: Atherton 895119.

SWAP, Arfon 8K expansion pack + many 8K games for your Commodore 8K pack. Tel: Stevenage 811634 (after 7.30 pm).

SHARP 1780K, 48K, Ram, manuals, games, tapes, etc, £250. Tel: Peterborough 204255.

SWAP, Atari 800 + 410 program recorder, joysticks, manuals in De/re Atari programs etc, 5 months old, for similarly equipped BBC computer. Eastbourne 641719.

HOMING PIGEONS + Bowling for the 16K ZX81, exciting programs written in Basic. For both games on one tape send a cheque to the value of £2 to C. Hume, 38 Long Craigs Terrace, Kinghorn, Fife KY3 9TD.

64K TUSCON SYSTEM Z80A, working at 4 megs, CPM disc system with 190K formatted, including CPM S100, cost £1,550, sell for £1,000 or swap for something useful. Tel: 466 6246.

ATARI SOFTWARE for Atari 400/800, 3 cartridges, Star Raiders, Missile Command, Asteroids, the three £55. Protector (cassette), £12. Tel: 0702 201637.

140 COMPUTER MAGAZINES, all popular titles, sell for £13 or swap Dragon Forth. Tel: Ware (0920) 68264.

INTEL SYSTEM development kit for 80/85, any offers. Tel: Layer 342 after 7 pm.

SHARP MZ, 80K, personal computer, 48K model, immaculate condition, hardly used, as new, cost £400, selling for only £350 ono, also includes dust cover, green screen and many programs. Tel: 061-773 3445.

Wanted

WANTED, BBC MICRO COMPUTER, Model A or B, must be in good condition. Tel: Havant 473069.

VIC20, swap Omega race for any adventure cartridge. Tel: Stevenage 0438 4086.

WANTED, BBC MODEL B, plus cassette and manuals etc, pay up to £320. Tel: Worthing 0903 6783.

WANTED, FELLOW SPECTRUM OWNER, living in or around Harpenden for exchanging software and ideas. Tel: Harpenden 69152 (after 6 pm).

I WANT A BBC MODEL B, instant cash paid. Tel: Harpenden 69152 (after 6 pm) with full details of your Beeb.

WANTED, BBC MODEL B with or without accessories and software. Tel: 01-741 1745.

WANTED, Cassette Recorder, Jack, Din Plugs, Counter. Tel: Chester (0244) 378549 (6-8 pm).

WANTED, BBC 32K A or B Micro-computer. Must be in good condition. Tel: Coventry (0203) 504485 (after 5 pm).

SWAP VIC20 Asteroids for other Vic20 games. Tel: 0341 280726 (after 6 pm).

WANTED, BBC MODEL B and software, offer exchange of Yamaha 250cc, 1981, US Custom motorcycle. 1,000 miles only, immaculate. Tel: 0443 671227.

NEW RELEASES

TEERING-OFF!

Vic Golf uses defined graphics and split screen techniques to enable you to play the game on your micro.

The game requires 3K extra memory and a joystick. Those who have brought material from the manufacturers of the tape — CP White — should note the new address given below.

Program *Vic Golf*
Price £4.00
Micro *Vic20 (+3K and Joystick)*
Supplier *CP White (Services)*
 52 Northfield Ave
 West Ealing
 London W13 95Y

KRAZY KONG



Krazy Kong is a ZX81 version of the popular arcade game of the same title.

The game features a pyramid you must climb, whilst knocking out the supports for *Krazy Kong* as you go. You reach him by climbing various ladders — and avoiding the rocks and barrels which are thrown at you.

The game has three screens and, it is claimed, all the features of the original.

Program *Krazy Kong*
Price £3.95
Micro *ZX81 16K*
Supplier *Personal Software Services*
 452 Stoney Stanton Rd
 Coventry CV6 5DG

INTO GEAR

Although lagging behind the seemingly endless range of books produced for the Spec-

trum, the Dragon book market is gradually getting into gear.

The Power of the Dragon is a new book from Microsource which uses 30 programs to illustrate different programming techniques. Each program has a line by line commentary, explaining how the program works.

Book *The Power of the Dragon*
Price £5.95
Micro *Dragon 32*
Supplier *Microsource*
 1 Branch Road
 Park Street
 St Albans
 (+50p P+P)

PROCESSED

Although *Telewriter* looks like becoming the flagship word-processor for the Dragon, its price (over £40) may lead people to look elsewhere.

Textstar is a Dragon word-processor which offers most of the usual wordprocessor functions like line insertion, find and display string, etc.

Total file length is up to six pages of A4 text. It is one of a developing range of Dragon programs from Personal Software Services.

Program *Textstar*
Price £12.95
Micro *Dragon 32*
Supplier *Personal Software Services*
 452 Stoney Stanton Rd
 Coventry
 CV6 5DG

PACKAGE DEAL

Ramtop is a company offering a complete package for the small business.

The package consists of three cassettes for the 48K Spectrum — a sales journal, a sales ledger and a purchase ledger. The three cassettes come with an explanatory booklet and incorporate routines which enable them to be used with a ZX printer.

Program *DIY Book Keeping*
Price £24.95 per tape
Micro *Spectrum 48K*
Supplier *Ramtop Software*
 12 Milnthorpe Rd
 Burtonwood
 Warrington
 Cheshire

WORD GAMES!



Few single programs have had better advance TV coverage than *Scrabble* from Psion.

For some reason this computer version of the popular board game has grabbed the media's attention — perhaps because the idea of a computer playing around with words has overtones of artificial intelligence.

The cassette comes in a box with an explanatory booklet. The rules of *Scrabble* are outlined, as is the use of the computer. One of the many options included in the game is a chance to see the computer thinking about its next move — this involves letters whizzing about as it searches through all the possible permutations.

It is perhaps not surprising that such a likely best-seller comes at a luxury price — £15.95 — but then I suppose someone has got to be paid for typing in the dictionary of words the computer understands — there are over 11,000 of them.

Program *Scrabble*
Price £15.95
Micro *Spectrum 48K*
Supplier *Psion*
 2 Huntsworth Mews
 Gloucester Place
 London NW1 6DD

SPIDER'S WEB!

Horace and the Spiders is the latest edition to the *Hungry Horace* series.

The plot sounds like a mixture of half a dozen arcade games put together. Firstly,

Horace has to climb the hills to the Spider mountains, jumping over the spiders that run at him. Then, he must negotiate the spider bridge, by using dangling threads as ropes, until finally he reaches the spider cave.

Once in the cave, *Horace* can attack the spiders and make holes in their web. *Horace* has four phials of serum which will protect him from spider bites.

Psion is now describing this game as an adventure and it certainly has a complicated plot.

What next I wonder — a 48K special *Horace* enters *Mastermind* perhaps?

Program *Horace and the Spiders*
Price £5.95
Micro *Spectrum 16/48K*
Supplier *Psion Melbourne House*
 2 Huntsworth Mews
 Gloucester Place
 London NW1 6DD

SINGING PI!



Pimania was an extremely successful game when it was issued on the Spectrum — indeed it would probably be rated one of the very best games for the machine.

It is now available for the Dragon 32 with most of the features of the original including an all singing and dancing PI man, a dreadful single on the reverse side, and of course valuable prize.

Program *Pimania*
Price £10
Micro *Dragon 32*
Supplier *Automata*
 65 Osborne Rd
 Portsmouth PO5 3LR

Ziggurat



Organising society

"A technology has no value outside of its social significance — alone it is dead metal."

So starts an interesting pamphlet by Paul Strassmann, Vice President of Xerox.

Just published, the pamphlet is a modified version of probably the most successful speech at the IT'82 Conference in the Barbican last December. At the time, the presentation was successful because it was one of the few which actually used information technology to good effect, and because it was one of the most intelligent and intelligible.

The central theme of Strassmann's talk was the productivity of organisations, and how the introduction of information technology can transform the role of people and of organisations. Paul Strassmann's first aim is the analysis of tasks, to examine how sensible automation can benefit productivity and quality. He points out that efficiency is achieved by eliminating many labour-intensive office tasks and he notes that such action will materially enlarge the work of the individuals who remain.

Attention is then turned towards the nature of administrative systems. The traditional structures are being changed — "management is not simple any more". Though the procedures remain the same, management, operations and customers are becoming increasingly diverse. This need to address wider horizons has been met by "adding more standard procedures without altering the traditional organisational concepts of division of labour". The trend towards centralisation and the increase in procedural complexity is measured by what he terms the "Parkinson Ratio" (after C Northcote Parkinson).

Parkinson's Ratio is given by the number of internal communications that are necessary to satisfy a single useful communication to a customer. Paul Strassmann reckons that for a very efficient organisation in a competitive industrial sector, it can take about 20 to 30

internal information transactions to satisfy a single customer enquiry.

In the public sector the average number of transactions is thought to be in excess of 100! The suggested reason is that only highly standardised methods of handling customers are fair and equitable to the public.

Information technology, intelligently applied, can help to reduce Parkinson's Ratio, by reducing the number of needless communications.

Strassmann's first key to information technology is, thus, the need for new forms of organisation made possible by IT. The acquisition of modern technology does not help unless new systems are created to make use of it in ways that are culturally acceptable. Smaller numbers of people will be needed to manage and organise information and this *should (can but might not)* be used to expand the provision of services.

"The huge coming expansion I see in the demand for information, on a global scale, will come from information being incorporated into socially useful services," says Strassmann optimistically.

Paul Strassmann considers that full employment is possible in productive or unproductive societies, and what matters is the total output of society. If output does not change with automation, then unemployment is produced. Or, to put it the other way, for a growth in output to be achieved, automation is now a necessity.

But what to do with the increased output? Strassmann suggests that the increased output be used to invest in the service sector's effectiveness, and that we should increase "value added" before cutting costs. By value added, he means that improvement investments should be channelled where they will increase value added through new services.

Improved effectiveness of organisations is derived from reduced overhead costs and decreased burdens from over complex administrations.

For maximum benefit, information technology should be used to *simplify* organisational processes rather than just to *mechanise* existing office procedures. Eliminating job steps is the key to simplification.

But the vital point is that we must think in terms of "new roles for people in organisations and in the framework of a new social economy based on new services".

The pamphlet by Paul A Strassmann is available from Rank Xerox, 338 Euston Road, London NW1.

Boris Allan

Puzzle

Down on the farm

Puzzle No 57

Within easy walking distance from Lower Muddecombe, are four farms, Hilltop Farm, Cowslip Farm, Dewdrop Farm and Mayfield Farm.

The farmyard of each is in the shape of a right-angled triangle having a perimeter fence of exactly 360 yards in length. Also, all the sides of the farmyards are an exact number of yards.

Curiously, though, the *areas* of each is different, ranging in size in the order given above, with the largest farmyard at Mayfield.

The other evening the four farmers were enjoying a drink together in *The Bull* when they each made the following statements:

Farmer Giles: My farmyard is the largest.

Farmer Miles: I live at Cowslip farm and have the longest side of all the yards.

Farmer Henry: All of my three fences are an even number of yards.

Farmer Stiles: My farmyard is the smallest.

Unfortunately, none of these statements was true. Who lives where?

Solution to Puzzle No 52

This problem requires us to find 10 primes with a common difference. The lowest prime would represent the number of soldiers sent out on the first day, and the common difference would equal the number in a full regiment. The primes are checked for in the subroutine at Line 300

```

10 LET N = 3
15 LET L = N
20 GOSUB 300
30 IF F<>0 THEN GOTO 140
40 FOR D = N + 1 TO INT (N/1) STEP 2
50 LET M = N
60 FOR T = 1 TO 9
70 LET M = M + D
75 LET L = M
80 GOSUB 300
90 IF F<>0 THEN GOTO 130
100 NEXT T
110 PRINT N, D
120 STOP
130 NEXT D
140 LET N = N + 2
150 GOTO 15
300 LET F = 0
310 FOR B = 3 TO (VAL STR$ SQR L) STEP 2
320 IF L/B = INT (L/B) THEN LET F = 1
330 NEXT B
340 RETURN
    
```

This gives the results: 210 soldiers in each regiment, but on the first day only 199 soldiers were sent. After 10 days 2,089 men had been sent with 11 held back from the first regiment.

Winner of Puzzle No 52

The winner is: Angus Kerr, Golf Road, Bieldside, Aberdeen, who receives £10.

Top 10

Dragon 32

- (1) The King (Microdeal)
- (2) Space War (Microdeal)
- (3) Planet Invasion (Microdeal)
- (4) Dragon Trek (Salamander)
- (5) Defence (Microdeal)
- (6) Alcatraz (Microdeal)
- (7) Wizard War (Salamander)
- (8) Chess (Dragon Data)
- (9) Katerpillar Attack (Microdeal)
- (10) Basic Tutorial (Ampsoft)

*Cartridge (Figures compiled by Boots & Co, London)

Spectrum

- (1) Flight Simulation (Psion)*
- (2) The Hobbit (Melbourne House)*
- (3) Penetrator (Melbourne House)*
- (3) Transylvanian Tower (Richard Shepherd)*
- (4) 3D Tanx (DK Tronics)
- (5) Planet of Death (Arcadia)
- (6) Horace Goes Skiing (Psion/Melbourne House)
- (8) Vu-3D (Psion)*
- (9) Sentinel (Abacus)
- (10) Escape (New Generation)

*Requires 48K.
(Figures compiled by WH Smith and Son Ltd)

Atari

- (1) Zaxxon (Datsoft)
- (6) Astrochase (First Star)†
- (3) Spider Invasion (Cosmi)
- (3) Helicat Ace (Microprose)†
- (2) Miner 2049er (Big Five)*
- (4) AE (Broderbund)§
- (9) Pharaoh's Curse (Synapse)†
- (4) Survivor (Synapse)††
- (4) Canyon Climber (Datsoft)
- (10) Protector 2 (Synapse)†

*Cartridge. †32K cassette. ‡32K disc. §48K disc.
(Figures compiled by Calisto Computers, Birmingham 021-632 6458)

Vic20

- (2) Panic (Bug-Byte)
- (1) Asteroids (Bug-Byte)
- (6) Cosmiads (Bug-Byte)
- (5) Wacky Waiters (Imagine)
- (4) Race (Commodore)
- (4) Arcadia (Imagine)
- (7) Super Expander (Commodore)*
- (9) Blitz (Commodore)
- (7) Introduction to Basic Part 1 (Commodore)
- (8) Amok (Audiogenic)

*Cartridge (Figures compiled by Boots & Co, London)

BBC*

- (1) Rocket Raid (Acomsoft)
- (2) Planetoid (Acomsoft)
- (4) Snapper (Acomsoft)
- (5) Monsters (Acomsoft)
- (5) Philosophers Quest (Acomsoft)
- (4) Arcadians (Acomsoft)
- (10) Creative Graphics (Acomsoft)
- (4) Chess (Program Power)
- (4) Meteors (Acomsoft)
- (4) Castle of Riddles (Acomsoft)

*All Model B.
(Figures compiled by Micro Management, Ipswich 0473 59181)

ZX81*

- (2) OS Scramble (Quicksilva)
- (5) Mazogs (Bug-Byte)
- (9) Night Gunner (Digital Integration)
- (1) Flight Simulation (Psion)
- (3) Monster Maze (New Generation)
- (4) Galaxians (Artic)
- (7) Chess (Psion)
- (6) Space Raiders (Psion)
- (8) Avenger (Abacus)
- (10) Asteroids (Silversoft)

*All 16K.
(Figures compiled by WH Smith and Son Ltd)

Books

- (4) Spectrum Machine Language for the Absolute Beginner, Tang (Melbourne House)
- (1) Enter the Dragon, Carter (Melbourne House)
- (6) Assembly Language Programming for the BBC Micro, Birnbaum (Macmillan)
- (4) Complete Forth, Winfield (Sigma)
- (2) Mastering the Vic20, Jones (Sigma)
- (3) The BBC Micro — An Expert Guide, James (Granada)
- (7) Z80 Assembly Language Programming, Leventhal (Osborne)
- (7) Vic Programmer's Reference Guide, Commodore (Commodore)
- (9) Compute!'s First Book of Vic, various authors (Compute!)
- (10) Commodore 64 Programmer's Reference Guide, Commodore (Commodore)

(Figures compiled by Watford Technical Books, Watford 0923 23324)

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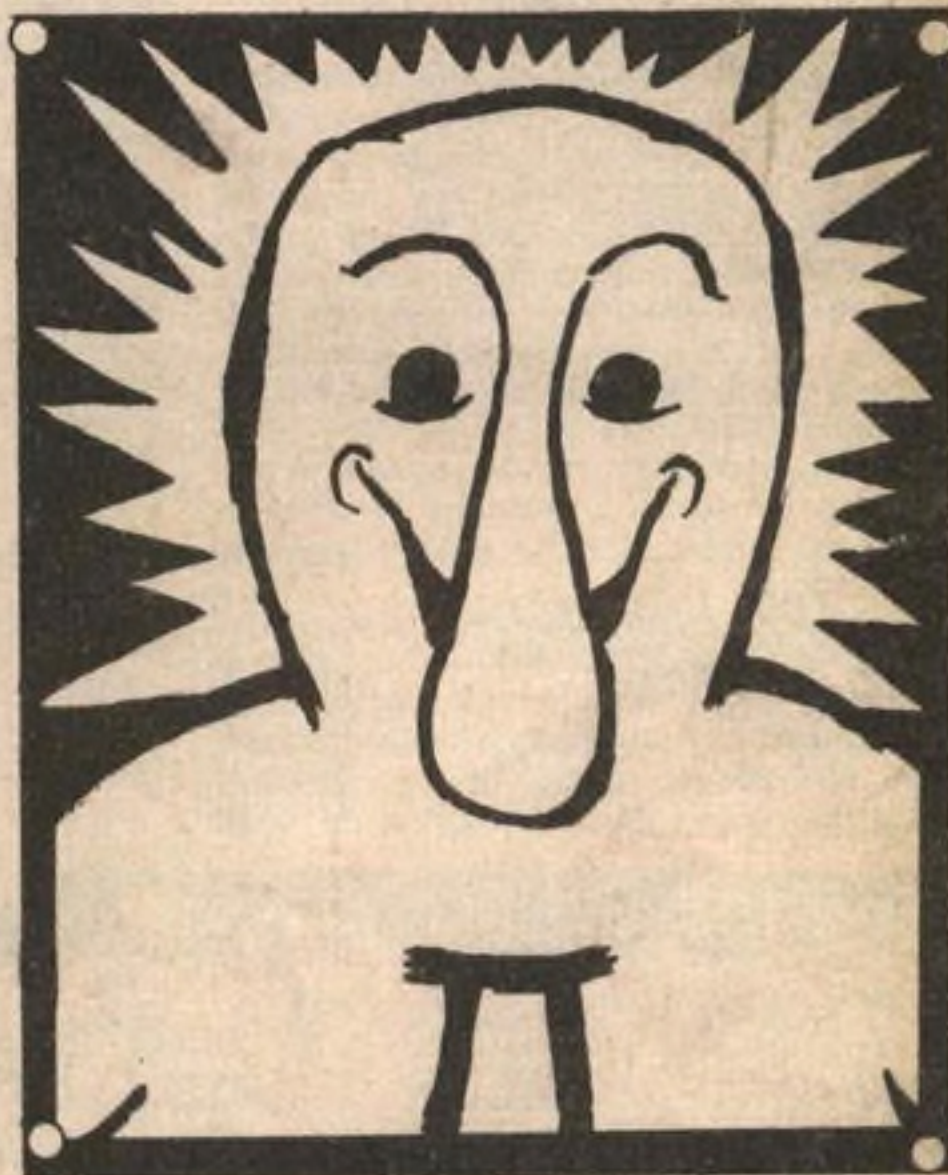
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