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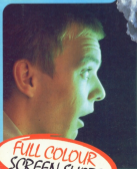
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William Wobbler is the latest game from Tony Crowther—a most exciting adventure game. Through the underworld of dark powers in search of golden treasure William struggles against all odds to vanquish foes and reach his goal. A game of skill and excitement.



**VOLUME 2
NUMBER 3
DECEMBER 1985**

Editor:
Stuart Cooke

Assistant Editor:
Mark Curry

Advertisement Manager:
Mike Sargent

**Advertisement Copy
Control:**
Laura Champion

Group Editor:
Gavin Bradshaw

**Group Managing
Editor:**
Wendy Palmer

Managing Director:
Peter Mathison

Origination:
Edging Typesetting

Design:
Angus Design

Editorial & Advertisement Office
No 1 Golden Square,
London W1R 3AB.
Telephone: 01-437 0828
Telex: 881188E

Four Commodore is a monthly
magazine appearing on the first
Friday of each month.

Distribution by: Angus Press
Sales & Distribution Ltd, 12, 18
Paul Street, London EC2A 4BB.
Printed by: Malvern Publishers
& Sales Ltd, Tost, Malvern,
Kern.

Subscription rates upon
application to Four
Commodore Subscriptions,
Department, 100001, Tandy
Stores, 179 The Malvern,
Somerhampton, Hants, SP1
1BB.

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Five C128s to be won in our jig-saw competition.

E DATA STATEMENTS

Wizards and Wars

US GOLD HAS TWO NEW RELEASES IN the shops.

The Wizard and the Princess is the second release in US Gold's All American Adventure series and features the Wizard Henlin who has done the usual dirty deed of kidnapping a princess and imprisoning her in a tower. Your task - to rescue her.

The game is available on disk or cassette at £14.95 and £9.95 respectively.

Doughboy features a little soldier in the trenches who tries to collect the supplies scattered around, of course there are enemy troops and fire to avoid on the way. It also costs £9.95 on cassette and £14.95 on disk and US Gold can be contacted at Unit 10, The Parkway Industrial Centre, Hengrave St, Birmingham B7 4J.



Hordes of Henries

ENGLISH SOFTWARE HAS JOINED THE pre-Christmas rush to release compilations and brought out Henry's House and Friends, Volumes 1 and 2.

Each tape contains four titles including Henry's House, Jet Boat Jack, Stranded, Neptune's Daughters and Soldier of Fortune, the only previously unreleased title.

Each retail at £9.95 and are available from English Software, 3rd Floor, 1 North Parade, Farnborough Gardens, Manchester M4 6PZ.

£25,000 richer

MATTHEW WOODLEY IS THE WINNER of Denmark's £25,000 prize for completing Eurotel and finding out the secret telephone number to claim his prize.

Matthew phoned the number four times before he had the courage to leave his name because he was too shy to speak to the answer phone.

The game was translated into French and German so thousands of people all over the world have been trying to win the prize. Denmark co-founder, Henrik Strachan said: "When the collector rang to tell me that the prize had been won, I nearly fell off my chair! Matthew has beaten everybody to it and we are all delighted for him."



128 and 1571 for £399

THE NEW COMMODORE 128 COMPUTER is to be offered complete with a disk drive for £499.99.

The Commodore 128 is a single handed 6.5 Megabyte 3 1/2 inch floppy disk drive designed specifically for the 128. However, it is fully compatible with all other Commodore home computers.

The drive supports sequential, relative and user files in Commodore standard format, with 500K formatted storage capacity.

Explaining the rationale behind the package, Commodore's marketing manager, Chris Kestey said: "In order to get the best out of the 128 and run CP/M effectively, a 3 1/2 inch disk drive is needed, so we have decided to subsidise part of the cost involved. At £499.99, the result is one of the most competitive small business systems on the market."



Wash 'n' Wipe

FED UP WITH ALL THOSE SCRATCHED-

out labels on your old cassette tapes? Wash 'n' Wipe's reusable labelling kit could be the answer to your prayers.

For a mere £1.49 you can buy 12 labels plus a wiper pen from Wash 'n' Wipe, 23 Weston Rd, London NW11 2JL, or from selected high street stores.



Scooby Doo Where Are You?

ELITE IS RELEASING A COMPUTER GAME version of the ever popular television cartoon series, Scooby Doo.

Elite describes the game as "The first ever computer cartoon". The game features Shaggy and Scooby trying to unravel the mysteries of Murder-Castle.

The game is mainly graphic, and uses speech bubbles for communication.

Steve Wilson, Elite's sales director said: "The best comparison we can draw is with the laser disk games, the player's role is very much as the director of an interactive cartoon."

The game is out now and costs £7.95. Elite can be contacted at Anchor House, Anchor Road, Aldridge, Walsall B69 8PW.

Hexxon Game on 64

HEXXON CONSULTANTS HAS RECENTLY released a new game for the Commodore Paradox.

The player find himself in an intergalactic freighter using an Inference Device to suppress a mutinous android crew.

Full colour high resolution graphics depict 20 decks on the freighter, which is equivalent to 400 screens, according to Hexxon.

Andrew Hexxon said: "We're bringing our original games style to Commodore owners and they're liking it."

The game costs £7.95 and is available from Hexxon Consultants, 88 Milton Trading Estate, Milton, Abingdon, Oxon OX14 3LZ.



AIR COMBAT EMULATOR



Air Ace

ACE — AIR COMBAT EMULATOR, A program which was originally released for the C-16 is now available for the C64.

Manufacturers, Cascade Games, claim great things for the title. According to Cascade you can feel what it's really like to fly a high performance military jet with the most sophisticated, fastest and most detailed cockpit view yet seen on a micro. There are views of hills, trees, tanks SAM sites, helicopters, ships and enemy aircraft, all in 3D.

The Emulator is priced at £3.95 and Cascade's address is 1-3 Hayward Crescent, Hatfield, North Herts HG1 9BC.



ADVANCED AVIONICS FLIGHT CONTROL SYSTEM

Log On Please

ACTIVISION HAS ANNOUNCED A NEW game which brings the world of hacking that much closer to the average, home computer user.

Hacker is a new game which allows the player to stumble into someone's computer system. You have absolutely no idea who the system belongs to or what its function is but you realise that it's important to find out these things.

The only message you get to start you off is "Log on please". After that you must fend for yourself.

There is no instruction booklet, no rules and no clues. You're completely on your own and eventually realise that your actions in this situation could help save the world. Again!

Activision is at 18 Harley House, Marylebone Road, London NW1.

Jump for Joy

CONGRATULATIONS TO THE 49 winners of our August competition which appeared in our August issue. They will each be receiving a copy of Amiga's OS4 game, Jump In.

Paul Couchman, Nuneaton; Frank T Bedford, Potterswell; Carl Keller, Hauxton; M Gorman; Andrew Kinnearley, Banbury; Simon Watts, Kilburn; Derek Tommas, Woodstock; Richard Sir, Dracelife; C De Haan, Rotterdam; ER Clarke, Bridgford; Philip Wood, Poynton; T J Safford, Kingsway; Glen Harrison, Bredley; Brian Buckley, Man; Robert Mowquame, Epworth; Ben Pearson, Kettering; Anne Blair, St Ives; Ian Hill, Brixworth; Samantha James, London; ER Russell, Great Yarmouth; AC Ross, Penrith; Dick P Wake, London; Sean McCarrick, Hindley; Craig McFarlane, Resende; Tony McCarrick, Co Down; Suzanne James, Durham; David Anderson, Dalmeilington; M Sarmada, Grimsby; D Woods, M Helton; Mark Hopkins, Redditch; Ian C Small, High Wycombe; Andrew Smith, Brixworth; Neven Juby, Scarborough; Alexander Zwart, Bruggel, Holland; Thomas Watson, Windward; Richard Jeffrey, Castle Donington; AG Perini, London; Paul Taylor, Middlesbrough; Darren Harris, Rotherham; Philip Vincent, Hastings; Rachel Fox, Aberystwyth; Peter D Bowen, Bolton-le-Sanday; J Beabout, Salford; J Crane, Liverpool.

Llama League

LANASOFT AND ARDASHIFT ARE joining forces to market new Lamasoft releases.

The first game to be offered by the deal is Batalya, produced on the Lamasoft stand at the PCW show. Priced at £12.95 on disk and £9.95 on cassette it features six sub-games to keep the player engaged.

Andrey Gray of Ardashaft commented: "We're delighted to be working closely with one of the UK's leading computer games software houses. Batalya is one of the best arcade and strategy mix games to be released and it's a guaranteed chart buster."

Thousands Attend Show

ATTENDANCE FIGURES AT THE PCW show broke all records this year.

Over five days more than 81,000 visitors arrived to view the latest in software and hardware.

Glen Powell, Director of organisers Mansfield Limited, said: "This is the largest attendance at any computer event in the UK, and the business audience is greater than for any of the other specially business computing shows."

The ninth Personal Computer World show will again be held at Olympia from 3-7 September 1986.

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| Gencom — Combined Home Pack | d | £34.00 |
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L.A.R.C.A.D.I.A.

Alec Hawkins, Newbury: "I am also trying for the \$1,000,000 mark, so if Chris Rogers reads this, I challenge him once more to get that amount of money..." Here for, Chris!

John A. Morrison, Sheffield: "I reached this figure a couple of months ago, and since I could go no higher, I stopped playing. I always used the 1983 board and opened the marshmallow sensor."

Paul Inoué, Québec: "This score was achieved over about four months. The score mentioned by David Crane (999,999) must be wrong, as the last two digits are always '89'. Oh, so I misquoted him, so about me... [BANG! AAAAA!]

Chris Mansell, Gloucester: "I tried typing a \$10,000 code into the computer. Instead of the \$10,000 it gave me this: \$999,999. Over one million! When I tried to use it again it told me very nicely there was no such account number!" Dash it!

Simon Hadden, Belgium: "I devised several rules for adding together account numbers, which enabled me to increment my score from \$30,000 to \$40,000 in one go. The rules are quite complex, but one of the simplest, is to add 10,000 to add one to the third digit, and add two to the fifth. This will work especially when the fifth digit is less than six." It's cheating, Simon, but I love it! Full marks!

Impossible Mission

In Arcadia regular, Chris Rogers writes to me about Impossible Mission: "I believe I have done the impossible with Impossible Mission - I have completed it without losing a life! It took 29 miles 12 secs, giving me a score of 30798!" Nice one, Chris. How about sending us a few tips on how to finish the game? I'm sure there are a lot of folks out there who would love to join you in the hi-score table. Well, everyone enjoyed Stephen Asmung, the guy. "My highest score is 82548. It's not one bit lost in an Alliance. The other guys want! I have completed Jan Alligate, Comarand, Transcrite, Aparagath, Antiochia, Butterfly... and I think the one I'm working on is called Scandal!" Haha! No problems there, I think. Except I think the password you're looking for is... hawwidi!

- Other hi-scores this month are:
- Chris Murray, Co. Antrim 218500
 - Exploding Fish 218500
 - Terry Baker, Middleham 14752
 - Boulder Dash 175700
 - Jaxxon 175700
 - Petal II 145238

- Pain Position 107400
- David Over Watson, Wigan 842000
- Road Over Watson 842000
- Impossible II 478300

So, that's the mailing. Thanks a million for all your letters, keep them coming, because as you know, this is your column too!

Fave Raven

Games I've been playing in the last few months include Rockford's Hot - Boulder Dash II, Summer Games II, Archon II, My Star, Sky Vs. Sky II, and I still can't leave (like I'd allow you a whole lot of new stuff... Oh, so most of them are requests to preview their successes, but in all cases they are better than the originals, with better graphics and more complex game-play. I'll be featuring tips from all these games as and when I can sort them all out.

Oh, by the way, I've been waiting for a letter from you about your favourite game. I've got one from everyone else, where's yours? It's OK, but don't let it happen again!

News...News...News

Rescue On Fractalus and Ball Blaster are the first two releases on the Activision label, by Lucasfilm Games, the computer games wing of the movie company that brought you Star Wars. Raiders of the Lost Ark and all their sequels. The games are brilliant. The graphic quality of these games really makes them stand out as coming from the George Lucas stable, and I comfortably predict they will become firm favourites. I've heard a whisper that the next release from this firm will be the most advanced computer game on the 64 ever made... but then again, aren't they always!

A bulging mail bag has given
Flippo plenty of reading
matter this month. Read on
to meet the ghostbusting
experts.

ONCE MORE INTO THE BREACH, DEAR friends. Hey, sorry I've been absent, but a lot of things have been happening. I went on my back seven or so miles and had to take a break sometimes! I and as well as that I've had a job of mail from you guys that would choke a cow. So, enough chattering the cat, let's chaw into the mailbox.

Ghostbusted!

Since I spoke to you last, I've had a big wedge of mail about Ghostbusters taking up the challenge to beat the \$1,000,000 mark. Hmmm! Well, it ain't like you long, so here is the upshot of all your scores.

| Name | Acc. no. | Score |
|------------------|----------|---------|
| Tai Ling Wu | 3172228 | 999,999 |
| Stephen Asmung | 3184218 | 999,999 |
| Kevin Cheetham | 3122198 | 999,999 |
| Alec Hawkins | 2782184 | 911,700 |
| John Tolleray | 4071184 | 910,000 |
| John A. Morrison | 3184248 | 900,900 |
| Phil Truscott | 2871948 | 999,900 |
| Chris Rogers | 3171418 | 886,738 |
| Simon Hadden | 3112048 | 999,998 |

Phew! What a great showing from my beloved readers! Well, guys and gals, I'm proud of you. Here's what some readers added to their hi-scores.

Mrs Tai Ling Wu, Edgbaston: "The great I've had news for Chris Rogers of Bhd, his hi-score has been broken. My next goal is to become an Elite!" Happy shooting, Tai Ling!

Kevin Cheetham, Newcastle Upon Tyne: "There is my hi-score... does this make me a mega-ghostbuster?" Could be, Kevin!



OUT NOW *by* JEFF MINTER

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JOHN TAMBORE
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This month Joe

Nicholson deals with

sound commands on

the C-16.

Sound

THIS CHAPTER EXPLAINS how to operate the C-16's two channel sound generator outside the standard SOUND and VOLUME commands. First we deal with the control registers and then go on to discuss interrupt driven sound.

The Registers

Volume — bits 0-4 of address \$B2F7 (\$BFF7) are used to control the volume. It will accept all numbers between zero (off) and 15 (max). However values from eight to 15 are all maximum volume. Bits four to six of this register must remain unchanged, so to set the volume in basic the following instruction is necessary:

```
POKE $B2F7,$B0:$B2F7:AND $0F:VOLUME
```

To set the volume to five in machine code use these instructions:

```
LDA $BFF7  
AND $10  
ORA $05  
STA $BFF7
```

Channel select — The three voices are selected by bits four and six of the register at \$B2F7 (\$BFF7) as follows:

bit 4 (the 16's bit) selects voice 1 for music (1 on/off)
bit 5 (the 32's bit) selects voice 2 for music (1 on/off)
bit 6 (the 64's bit) selects voice 2 for noise (1 on/off).

All other bits must remain unchanged, therefore to set voice 1 to music and voice 2 to noise enter:

```
POKE $B2F7,$B0:$B2F7:AND $40:$40
```

Or in machine code:

```
LDA $BFF7  
AND $40  
ORA $40  
STA $BFF7
```

MASTERING THE C-16

Sound reload value — Bit seven of address \$B2F7 controls the sound reload value. When this bit is set, sound is cut off in a way similar to VOI 0, until the bit is reset. This bit is useful in the C-16 SOUND command when changing notes and appears to be the reason why there is an audible 'click' between notes — both sound channels are turned off momentarily between notes.

To turn the sound reload 'on', i.e. disable sound, use:

```
POKE $B2F7,$B0:$B2F7:AND $20
```

In machine code:

```
LDA $BFF7  
AND $FF  
STA $BFF7
```

Notes As all the POKEs dealing with volume, channel select and sound reload are all to the same address, it is possible to set up all three with a single POKE.

e.g.: POKE \$B2F7,\$5

which resets the sound reload bit, selects voice 1 and voice 2, and sets volume to zero.

Or try: POKE \$B2F7,\$3

which resets the sound reload bit, turns off voice 1 and voice 2, and sets the volume to zero.

Frequency/Voice #1 — the frequency is held in a 18 bit number. Address \$B294 (\$BFF8) contains bits zero to seven and address \$B296 (\$BFFC) holds bits eight and nine. It is important that bits two to seven of register \$B296 remain unaltered when setting bits zero and one. For example, to set the frequency of voice #1 to 500:

```
POKE $B294,$0:$B294:AND $20:$20  
to set the multiples of 256 — for 500 there are two multiples hence the *2. Then
```

```
POKE $B294,4 to set the remainder.
```

In machine code:

```
LDA $BFFC  
AND $FC  
ORA $4  
STA $BFFC  
LDA $B84  
STA $BFF8
```

Frequency/Voice #2 — The address \$B295 (\$BFF9) contains bits zero to seven, and bits zero and one of address \$B296 (\$BFFC) hold bits eight and nine of the frequency of voice #2. Unlike voice #1, bits two to seven of register \$B296 do not have to remain unaltered, hence to set the frequency of voice #2 to 500:

```
POKE $B296,2 and  
POKE $B295,4
```

In machine code:

```
LDA $B82  
STA $BFF9  
LDA $B84  
STA $BFFC
```

Duration — the duration is controlled by the IRQ (interrupt request) to be explained later. The duration of each voice is controlled by two registers each incrementing once per frame, so 1/50 of the second, and they both reach zero when that voice is turned off.

The registers
voice #1: 1276 (\$4FC) low byte, 1278 (\$4FE) high byte.
voice #2: 1277 (\$4FD) low byte, 1279 (\$4FF) high byte.

The general equation for each voice is therefore:

$A = 6256 - \text{no. of } 1/50\text{ths second}$
POKE low byte, A-(\$4F)(A/256)*256
POKE high byte, (A/256)

| Address | Hex | Function |
|---------|--------|---|
| \$B295 | \$04FC | voice 1 low byte duration |
| \$B296 | \$04FD | voice 1 low byte duration |
| \$B295 | \$04FE | voice 2 high byte duration |
| \$B296 | \$04FF | voice 2 high byte duration |
| \$B294 | \$BFF8 | voice 1 frequency bits 0-7 |
| \$B295 | \$BFF9 | voice 2 frequency bits 0-7 |
| \$B296 | \$BFFC | voice 2 frequency bits 8-9 bit 8 is bit 8 of frequency bit 9 is bit 9 of frequency |
| \$B297 | \$BFF7 | bits 0-1, VOLUME 0-15 bit 3 sets max volume bit 4 select voice 1 bit 5 select voice 2 bit 6 select voice 2 noise sound/reload (1 enable, 2 disable) |
| \$B298 | \$BFFC | voice 1 frequency bits 8-9 bit 8 is bit 8 of frequency bit 9 is bit 9 of frequency note some other bits are not changed when altering frequency |

| | | |
|--|-----|------------------------------------|
| In machine code (assuming the duration is not 255 pitches, i.e. 3.7 sec) | SBC | 500 |
| LDA #0 | SBC | low byte of duration, 1/500ths sec |
| LDA #0 | STA | low byte result |
| LDA #0 | LDA | 500 |
| LDA #0 | SBC | high byte of duration |
| STA #0 | STA | high byte result |

If the number of pitches exceeds 255 then the following routine should be used:

The various functions of the control registers are summarized in Figure 1.

```
START: 10000 :PLAY COMMAND
```

```
10010 :CSINGLE CHANNEL
```

```
10020 :C11000 JOE NICHOLSON
```

```
10030 :
```

```
10100 :TURN ON...
```

```
10110 ORG 4000
```

```
10200 :OH 001
```

```
10210 LDA #024
```

```
10220 STA #014
```

```
10230 LDA #005
```

```
10240 STA #015
```

```
10250 LDA #0FF
```

```
10260 STA #04FC
```

```
10270 STA #04FE
```

```
10280 CLI
```

```
10290 RTS
```

```
10300 :TURN OFF...
```

```
10310 :OF 001
```

```
10320 LDA #000
```

```
10330 STA #0014
```

```
10340 LDA #000
```

```
10350 STA #0015
```

```
10360 CLI
```

```
10370 RTS
```

```
10380 :PLAY CONTROL...
```

```
10390 ORG #024
```

```
10400 :PL LDA #04FC
```

```
10410 CMP #0FF
```

```
10420 BEQ R:P2
```

```
10430 :P1 JMP #C02E
```

```
10440 :P2 LDY #000
```

```
10450 LDR #000
```

```
10460 :P3 LDA #000,Y
```

```
10470 STA #02,X
```

```
10480 :P4 DNY
```

```
10490 :HX
```

```
10495 :TX
```

```
10500 CMP #0
```

```
10505 BNE R:P3
```

```
10510 LDA #00
```

```
10515 ADC #0
```

```
10520 STA #00
```

```
10525 BCC R:P4
```

```
10530 :INC #01
```

```
10535 :PA LDA #02
```

```
10540 CMP #0FF
```

```
10545 BNE R:P5
```

```
10550 :JER :OF
```

```
10555 :PB CLC
```

```
10560 BCC R:P5
```

Play Command

Many commercial arcade games have a tune which plays while the game is running. This section shows how this can be done on the C-16 by using the hardware interrupt.

Every 1/500 of a second (or jiffy) the computer executes a service routine which reads the keyboard, handles the internal

jiffy clock and the duration of sound. Locations 700-810 (and 700 jiffies) hold the vector pointing to this routine. To make the computer access an additional routine every jiffy, these vectors should be changed to point to the new routine which in turn ends with a jump to the service routine.

When using the PLAY command the new routine plays a series of notes from a list in memory. The routine senses when each note is finished by examining the duration registers looking for the value 0FF in both registers. However, it does not wait for them to be reset and then the note subsequently turned off, in order to avoid the annoying clicking sound which occurs between notes. It then switches smoothly to the new note.

Figure 2 shows a C-16 Assembler listing of the PLAY command. Lines 10000 to 10290 contain the routine which switches on the PLAY command, first it disables the hardware interrupt (04) to ensure that there are no interrupts while the interrupt vector values are being changed — otherwise the machine may crash. It also turns off any notes playing at that time and sets the start of the list of notes to address 0000 (0000). The interrupts are then enabled by the CLI instruction.

The routine at lines 10300 to 10470 turns off the PLAY command restoring the interrupt vector to the normal routine at 0C00 (0290). Lines 10480 to 10590 begin the PLAY routine by checking whether the last note has finished; if it has it gets the next note values (three bytes) from the table and after checking to see if they are special commands (e.g. to set the volume) it loads these values into the frequency and duration registers.

The complete routine can be relocated by changing the ORG command at lines 10310 and 10315 and making the switches routine set the interrupt vector to its new value. The internal registers used by the PLAY command are listed between 800 and 809 (006-007). As explained in the first article, this is a free area of zero page.

The list of notes is stored in

```
11100 :PB CMP #0FE
11110 BNE R:P2
11115 LDA #00
11120 STA #00
11125 LDA #00
11130 STA #00
11140 LDA #01
11150 STA #00
11160 LDA #04
11170 STA #01
11180 CLC
11190 BCC R:P2
11200 :P2 CMP #0FD
11210 BNE R:P0
11220 LDA #05
11230 STA #00
11240 LDA #00
11250 STA #01
11260 CLC
11270 BCC R:P2
11280 :P0 CMP #0FC
11310 BNE R:P0
11320 LDA #FF11
11330 AND #240
11340 ORA #03
11350 STA #FF11
11360 CLC
11370 BCC R:P2
11380 :P0 EOR #0FF
11390 STA #04FC
11395 STA #04FE
11400 LDA #0FF
11410 STA #04FE
11415 AND #052
11420 ORA #04
11425 STA #FF12
11430 LDA #03
11435 STA #FF0E
11440 LDA #FF11
11450 ORA #010
11455 STA #FF11
11460 CLC
11465 BCC R:P0
```

```
>> ORC.
```

memory as follows: the first byte is the duration which may be one jiffy (1/30 sec) to 247 jiffies (about five secs). The next two bytes are the low and high bytes of the frequency which can be between 2000 and 1024, as far as the SOUND command. This interrupt-driven routine plays Voice #1, which leaves Voice #2 free to be used for additional explosions and so on.

Instructions

The PLAY command has its own special instructions which are stored in the table being identified only by their duration values. Numbers between \$98 and \$99 are reserved for these special instructions.

The new commands are:

MC (\$98) volume: This can be used to change the volume inside a tune. The low byte of the frequency contains the new volume setting, zero to eight. The high byte should be present but is ignored.

MP (\$99) This is a type of GOSUB instruction. It jumps to the address stored in the frequency bytes. Also it stores the old pointer address in memory allowing the tune to return, so that tunes can have sub-tunes although nesting is not allowed. This can also be used as a GOTO instruction.

SP (\$9A) This is the return instruction which makes the PLAY command resume after the last GOSUB instruction. The two frequency bytes must be present but can have any value, preferably zero.

SW (\$9B) This completely turns off the PLAY command.

Figure 3 shows a demo program playing Target's famous (Havoc advertisement). The machine code for the PLAY command is stored from line 1008 to 1700 and the data for the tune is stored from line 285 to line 289 in the form of duration and frequency values. The data is written from address \$0889 (1712). Line 1000 POKS the number into the tune pointer. The SYS 116 at line 1700 executes this routine.

It is possible to improve the performance of the PLAY command by simulating the attack, decay, sustain and release functions of a sound synthesizer. This will be explained next month.

```

100 RESTORE 1080:FORA=1536TO1789:READB:PO
KEA,B:NEXT
110 POKE200,176:POKE209,6
120 RESTORE280
130 FORA=1712TO1831:STEP3:READB,C
140 POKEA,B:POKEA+1,C-(INT(C/256)*256)
150 POKEA+2,INT(C/256)
160 NEXT
170 UOL7:SYS1536
190 REM
195 REM TUNE DATA
280 DATA254,1727,254,1796,254,1796,254,1
727,254,1712
210 DATA20,685,20,739,40,739,20,685,20,6
43,40,596,20,643,20,685
220 DATA20,739,20,685,80,643,20,685,20,7
39,40,739
230 DATA20,685,20,643,40,596,20,643,20,6
85,20,643
240 DATA20,596,80,596,253,0
250 DATA20,770,20,810,40,810,20,796,20,7
39,40,770
260 DATA20,770,20,810,20,796,20,739,60,7
70,253,0
390 REM
395 REM PLAY COMMAND DATA
1080 DATA120,169,30,141,20,3,169,6,141,2
1,3,169,255,141,252,4
1010 DATA141,254,4,88,96,120,169,14,141,
20,3,169,206,141,21,3
1020 DATA88,96,255,0,173,252,4,201,255,2
40,3,76,14,206,168,0
1030 DATA182,0,177,208,149,210,200,232,1
30,201,3,200,245,165,208,185
1040 DATA2,133,200,144,2,230,209,165,210
,201,255,208,6,32,21,6
1050 DATA24,144,216,201,254,208,19,165,2
00,133,213,165,211,133,208,165
1060 DATA209,133,214,165,212,133,209,24,
144,196,201,253,208,11,165,213
1070 DATA133,208,165,214,133,209,24,144,
181,201,252,200,13,173,17,255
1080 DATA41,240,5,211,141,17,255,24,144,
164,73,255,141,252,4,169
1090 DATA255,141,254,4,173,18,255,41,252
,5,212,141,18,255,165,211
1100 DATA141,14,255,173,17,255,9,16,141,
17,255,24,144,162

```



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SPRITE RIGHT

THOM OF THOU MIND OWN C64s may be fascinated by the effect which can be created using the machine's sprite graphics features. However you may not have attempted to play with sprites yourself due to the complexity of handling them from Basic. This article is a simple tutorial on playing with sprites and takes you step-by-step through most of the functions concerned with them, explaining how each works, and giving a demonstration of each stage. The demonstration is handled by a program which you type in one section at a time, adding on one feature as you go.

Creating Sprites

A sprite is a user-defined graphic block which is 32pixels wide by 21 pixels high (equal to a picture element i.e. the smallest single dot available on the screen). Sprites can be moved around very easily as a block, rather than by replotting all the individual pixels. Other functions are also available, as we will demonstrate.

The pixels are arranged in three adjacent parallel columns of 21 bytes (see bytesight bit), each bit can be zero or one, corresponding to a pixel on or off. Thus, for example, if all bits are off, the byte will have value zero, and if all bits are on, it will have value 255 (11111111-11-111111-111).

The Commodore manual explains how to create sprites in your own designs but for our purposes, we will use a solid sprite with all bytes set to value 255. The bytes are arranged in a consecutive block in memory, and must start at an address which is a multiple of 64 (e.g. we will use 10744-8312) — the sprite is said to be in block 13 of

memory, which is an area unused by other functions).

The sprites are controlled by a number of control registers, each being one byte of memory. In general, each sprite (right are available at once) is controlled by one bit in each of these bytes, e.g. bit 0 of all the registers corresponds to sprite 0, etc., and if this bit is 1, the function is "on", or if it is 0, the function is "off". Each control register will be explained as we go on.

Starting the Program

The program has been kept as simple as possible so that you can see exactly how the sprites are controlled. It will be introduced in sections, so after reading the description, type in the next section of the program and RUN it. This will let you see what the new section of program does to affect the sprite's behaviour. Do not type NEW after each section.

BASIC statements have also been included in the program to detail its functions, but these may be omitted if you like to save typing, and the program will function normally. If the sprites are obstructing the screen when you want to type, then enter "POKE 53289,0" and press RETURN.

Section 1 - Introduction (Lines 10-80)

Most of the sprite control registers are in a block of memory commencing at address 53248. To avoid using those large numbers, we will set a variable V to 53248 (line 40) and access the other registers by adding on numbers, e.g. V+1, V+8, V+20 etc. Lines 50 and 60 set up two strings for printing messages during the program.

Screen Colour Registers: The registers which hold the screen colours are in this memory region at V+120(border) and V+132 (screen background). POKEing values from zero to 15 into these registers will change the colour of the screen, in this program, they are both set to colour six (blue) at line 60.

Section 2 - Setting up the Sprites (Lines 90-140)

Lines 100 and 110 set the 63 bytes of sprite data to 255 to give a solid sprite, starting at memory address 812. Try experimenting with different values of 8311 (line 100) to see the effect on the shape of the sprites.

Sprite Data Pointers: The computer knows where you have put the sprite shape data by looking at the data pointers at locations 2040 (for sprite 0) to location 2047 (for sprite 7). The value to be POKE'd to these registers is the data block number, in this case 8311-8413 (line 120).

Sprite Position Registers: Each sprite has an X (horizontal) and Y (Vertical) position co-ordinate, measured from an origin at the top left of the screen (usually, this origin is underneath the screen border, the actual top left of the visible screen being at V+24, V+68). These positions are stored in registers V+8 to V+15 as follows:

V+0 Sprite 0 X co-ordinate
V+1 Sprite 0 Y co-ordinate
V+2 Sprite 1 X co-ordinate
V+3 Sprite 1 Y co-ordinate

Line 130 sets the positions of the sprites, just sprites 0-3 will be used in this demonstration program so that they will be diagonally across the screen.

Sprite Enable Registers: Each

sprite can be turned on and off (visible or not) by setting (on) or clearing (off) its corresponding bit in the sprite enable register at V+21. We are using sprites 0-3 so this register is set to 11110400111 (line 140).

Section 3 - Colouring the Sprites (Lines 149-188)

Sprite Colour Registers: Each sprite has a one byte register which contains its colour as a number from zero to 15, in the same way as the screen colour registers. These colour registers are at V+116 for sprites 0, V+40 for sprite 1, and so on up to V+44 for sprite 7. Here, the colours have been set so that the sprites are clearly visible on the background, lines 150-188 but by changing the numbers after the comma, the sprites may be changed to any other colour you wish.

Section 4 - Moving the Sprites (1) (Lines 200-210, 900-1180)

The sprite position registers have already been described. Making the sprites move is simply a case of changing the number held in these registers, so that the sprite changes position. Subroutine 1000 is called (line 200) to move the sprites across the screen (X-direction) and subroutine 1100 is called (line 210) to move them down the screen.

This paragraph describes subroutine 1000. Subroutine 1100 is similar in structure, but operates on different position registers.

Firstly, the sprite's current position is read in (line 9018) and stored in variable P24. Two is then added to this position, and if P24 exceeds 255, it is



reset to zero, as the maximum position number is 255. The new position is then PCARD to the position register (line 1058). This process continues until the sprite has returned to its starting position. The movement loop is executed for the four sprites.

Section 5 - Moving the Sprites [2] (Lines 219-244)

X-Coordinate: 1498 register. You will have seen from the previous section that the maximum sprite position is 255, but this only gets the sprites about two-thirds of the way across the screen in the X-direction. In order to move the sprite to the right-hand side of the screen, the Most Significant Bit of the X-co-ordinate must be set. This register, containing one bit for each of the sprites is at Y+16. By setting a bit in this register, the corresponding sprite appears in the right-hand part of the screen.

To demonstrate this, we move 4 sprites to the right part of the screen (line 220), call the movement subroutine again (line 230) and then move the sprites back (line 240). Note that for most of the movement section, the sprites are invisible under the right hand edge of the screen. In a program, the right-hand part of the screen would be accessed by a statement such as: `SP04=SP04+1:IF SP04=256 THEN SP04=0:POKE Y+16,SP04` with a corresponding statement for return to the main part of the screen.

Section 6-sprite expansion (Lines 249-408, 1479-1520)

Sprite Expansion Registers: By setting the appropriate bits in these registers (Y+2) for X-expansion, Y+3 for Y-expansion, the corresponding sprite will appear larger as large in that direction. These can be used independently to give tall or wide sprites, or together to give a large sprite.

Subroutine 1508 automatically expands the next sprite in a given direction, then incurs a delay, and returns to the main program. Finally, we set the required expansion mask to

X (line 260), then call subroutine 1500 for the four sprites (lines 270-290), the X-expansion is then turned off (line 300), and the loop repeated for Y-expansion (lines 310-330). Repeating the X-expansion gives sprite expansion in both directions (lines 340-400).

Section 7 - Sprite overlay (Lines 194, 429-530)

All the sprites on the screen have a display priority, that is they are each assigned a "depth" on the screen. Thus if two sprites are overlapped, either partly or entirely, the one which is "deeper" will not be seen as if it was behind the other sprite. This function allows three-dimensional effects to be constructed quite easily.

Unfortunately, however, the priority is not easily controllable. The "depth" of the sprite is controlled by its number: sprite 7 is the deepest, and so will appear behind all others, and sprite 0 will appear in front of all the others. The next section of program demonstrates this by overlapping all the sprites. You can see that the green sprite is at the back, and the black sprite is at the front (unless you've changed the colours!). Line 194 has been included so that you don't have to run through the movement demonstration everytime.

Section 8 - Sprites/Text Overlay (Lines 570-738, 1979-2040)

Sprites/Text Priority Register: Although the sprites are fixed in relation to each other by number, each sprite can be individually set to be behind or in front of any text or graphics on the screen.

To demonstrate this, we will show the text layer by a grid covering the screen. This allows you to see sprites both in front of and behind the text. To control this position, we use the sprite/text priority register at Y+2. Normally this register contains 0 making all sprites appear in front of the text. However, by setting the bits in this register, the corresponding sprites appear behind the text

layer. This section is in three parts, with each part calling subroutine 2000 to move the sprites across the grid. This is done in a similar way to subroutine 1508 explained above.

The first part demonstrates all sprites in front of the grid. Next, the sprites (starting with the "deepest" ones) are moved behind the grid, and you can see that it appears behind both the text, and the other sprites as

before. Finally, the sprites are brought back in front of the grid as before, again starting with the "deepest". However, note the strange effect that this produces. As the sprites move across the grid, you can see that the deeper ones are in front of the grid, but still behind the other sprites which are behind the grid! This is a three-dimensional impossibility, unless you are Doctor Who, but visual logic apart, it



```

10 REM 100 PLAYING WITH SPRITES 000
20 REM 100 BY IAN MURRAY (C) 1995 000
30 REM 100 FOR YOUR COMMISSION 000
40 P=0:FOR N=0 TO 10:PRINT N:GOTO 100
50 CLG:FOR I=1 TO 10:FOR J=1 TO 10:POKE I+J,0:GOTO 100
60 FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0:GOTO 100
70 PRINT CLG
80 POKE Y+2,0:POKE Y+3,0
90 FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0
100 BYTE=000
110 FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0:GOTO 100
120 FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0:GOTO 100
130 FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0:GOTO 100
140 FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0:GOTO 100
150 POKE Y+2,0
160 FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0
170 FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0
180 POKE Y+2,0:GOTO 100
190 FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0
200 GOTO 100:FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0
210 GOTO 100:FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0
220 FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0
230 POKE Y+2,0
240 GOTO 100:FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0
250 PRINT CLG:"SPRITES EXPANSION IN X-DIRECTION"
260 POKE Y+2,0:FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0
270 FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0
280 GOTO 1500
290 WAIT 5000
300 POKE Y+2,0:FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0
310 POKE Y+2,0:FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0
320 PRINT CLG:"SPRITES EXPANSION IN Y-DIRECTION"
330 FOR I=0 TO 9:FOR J=0 TO 9:POKE I+J,0
340 GOTO 1500

```


COMPETITION

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Entries will not be accepted from employees of Argus Specialist Publications, US Gold and Alliance Publications and fans. This restriction also applies to employee's families and agents of the companies.

The how to enter section forms part of the rules. The Editor's decision is final and no correspondence will be entered into.

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There are a few differences between the two pictures. Study them carefully and circle the differences on the picture attached to the coupon. Fill in the coupon clearly and seal the picture and coupon in an envelope. Write clearly the number of differences you found on the back of the envelope.

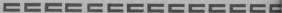
Post your entry to: Adventure Competition, Your Commodore, No 1 Golden Square, London W1R 3AB. The closing date is first post on Tuesday 31st December 1985. You may enter as many times as you like but each entry must be on an official coupon - not a copy - and sealed in a separate envelope.

Important: Please follow closely the guidelines on entering - incomplete coupons and entries with no numbers on the back cannot be considered. If you are a winner, the coupon will act as a label for your prize so clear writing is essential.



Name
Address
.....
..... Post code.....

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Send to: Adventure Competition, Your Commodore, No 1 Golden Square, London W1R 3AB. Write clearly and fully and don't forget to put the number of differences you found on the back of the envelope.



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So, next time you are after an Olog to put in your new game, have a look in this section of the magazine and you may find just what you are looking for.

SPRITE IDEAS

Saucer:

```

SATW000,000,000,000,000,000,000
SATW000,000,000,000,000,000,000
SATW000,000,000,000,000,000,000
SATW000,000,000,000,000,000,000
SATW004,002,002,000,040,000,104,170
SATW002,170,170,170,170,040,170,160
SATW002,170,130,000,130,000,000,040
SATW000,000,000,000,000,000,000
  
```

David Bran, Canterbury



Rocket:

```

SATW000,000,000,000,000,000,000
SATW000,000,000,000,000,000,000
SATW000,000,000,000,000,000,000,004
SATW002,000,070,040,000,000,170,000
SATW002,040,000,000,000,000,070,000
SATW002,040,000,000,000,000,000,000
SATW000,000,000,000,000,000,000,000
SATW000,000,000,000,000,000,000,000
  
```

Mike Roberts, Sittingbourne

Crane:

```

SATW000,000,000,000,000,000,000,000
SATW000,000,000,000,000,000,040,000
SATW004,140,000,000,100,000,000,170
SATW000,000,170,000,070,000,000,104
SATW040,002,040,000,170,130,000,170
SATW010,000,040,010,100,010,040,140
SATW000,000,170,000,000,000,000,000
SATW000,000,000,000,000,000,000,000
  
```

David Bran, Canterbury





Tacan:

001A000,000,000,000,000,000,000,000
 001A000,000,000,000,000,000,000,000
 001A000,000,000,000,000,000,100,000
 001A000,100,000,000,170,000,000,100
 001A00A,002,100,000,174,170,000,200
 001A170,170,000,170,170,200,170,100
 001A190,170,100,000,000,000,000,000
 001A000,000,000,000,000,000,000,000

Mike Roberts, Sittingbourne

Explosion:

001A021,000,000,000,000,000,000,000
 001A000,004,000,010,000,000,000,000
 001A000,002,000,120,134,004,072,010
 001A000,000,000,000,000,000,102,110
 001A021,000,000,000,000,000,000,004
 001A072,004,100,120,134,000,000,002
 001A000,072,000,004,000,010,000,120
 001A120,001,120,170,021,000,040,000

Mike Roberts, Sittingbourne



Craber:

001A000,000,000,000,000,000,000,000
 001A000,000,000,000,000,000,000,000
 001A000,000,000,000,000,000,000,000
 001A000,000,000,000,000,000,000,000
 001A040,001,000,170,021,000,170,002
 001A000,170,100,100,234,002,170,200
 001A010,170,200,000,100,102,000,000
 001A000,000,000,000,000,000,000,000

David Bruar, Canterbury

Chaser:

001A000,000,000,000,000,000,000,000
 001A000,000,000,000,000,000,000,000
 001A000,000,000,000,000,000,000,000
 001A000,000,000,000,000,000,000,000
 001A000,000,000,000,002,100,000,000
 001A170,000,170,100,000,200,000,002
 001A101,000,000,170,100,000,000,170
 001A000,002,100,000,000,000,000,000

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This month's
programming project
shows how to draw
contour maps for
representing tables of
numbers. By Garry
Marshall.

PROGRAMMING PROJECTS

HAVE YOU EVER WONDERED how to write a program to draw a contour map? They crop up all over the place and, most recently, have been seen on the new, computerized BBC weather forecasts. A contour map is always a good way to represent a large table of numbers, whether they record meteorological data or anything else, in a way that is easy to understand.

The uses of contour maps include the maps showing the heights of the terrain as found in an atlas, and the stress contours generated by computer-aided design programs that can provide a guide to the structural integrity of a building or an aeroplane. This month's project is to write a program which, when given a table of numbers, can draw the corresponding contour map.



Figure 1. Contour map

To give an example of what we want to do, the contour map shown in Figure 1 was produced from the numbers in the following table.

```

1 2 3 2 1 2 3 2 1 2
1 4 4 4 4 4 4 4 4 2
1 8 8 8 8 8 8 8 8 2
1 4 4 4 4 4 4 4 4 2
1 4 8 8 8 8 8 8 8 2
1 4 8 8 8 8 8 8 8 2
1 4 8 8 8 8 8 8 8 2
1 4 4 4 4 4 4 4 4 2
1 2 2 4 4 4 4 4 2
2 2 2 2 2 2 2 2 2

```

When related to a weather map, this rectangular array of numbers corresponds to data collected from weather stations positioned neatly in a rectangular grid. This is the situation which our program will deal with. Naturally, weather stations are not positioned regularly in practice, and have to be placed whenever it is suitable and convenient. The program we shall develop in this project can be generalised readily to draw a map for a set of numbers each of which has a position associated with it.

The solution

The program will start by reading a square array of even numbers. Then it will draw the contours for the odd numbers lying in between these even numbers in such a way as to fill the screen.

The even numbers are

| | | | | | | | | | | |
|-----|---|---|---|---|-----|---|---|---|---|---|
| 4 | · | 6 | · | 8 | · | 4 | 5 | 6 | 7 | 8 |
| · | · | · | · | · | · | 5 | 6 | 6 | 7 | 7 |
| 6 | · | 6 | · | 6 | · | 6 | 6 | 6 | 6 | 6 |
| · | · | · | · | · | · | 7 | 7 | 7 | 7 | 7 |
| 8 | · | 8 | · | 8 | · | 8 | 8 | 8 | 8 | 8 |
| (1) | | | | | (1) | | | | | |

| | | | | |
|-------|---|---|---|---|
| 4 | · | 6 | · | 8 |
| · | · | · | · | · |
| 6 | · | 6 | · | 6 |
| ----- | | | | |
| 8 | · | 8 | · | 8 |
| (1) | | | | |

Figure 2.

marked so that, for every number, the number next to it must be the same as it or the next even number above or below it. By restricting the numbers in this way, we can get on with drawing the contours as quickly as possible. If we allow the table to contain any type of number, then we must spend a great deal of time computing such things as the range of the numbers and the values for the contours. This only obscures the point of the project, which is to draw contours. Once you have seen how the program does this it is not at all difficult to start to draw contour maps for less restricted tables of data.

Restricting the numbers so that a neighbouring number can only be one of three possibilities, corresponds to dealing with situations in which the data is 'bumpy', and this is how it is in the majority of situations encountered in practice. Most terrain are

smooth, with cliffs occurring quite rarely, and meteorological data is usually smooth, with only something like a hurricane providing the exception.

We can illustrate the way in which our program finds contours with the aid of Figure 2. We start with a table of numbers, such as:

```

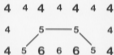
4 5 6
5 6 6
8 8 8

```

We then find a value for each point marked in Figure 2a that is mid-way between the numbers in each row and column. The table in Figure 2b is obtained by working out these values by taking the average of the numbers on either side of it. The contours can then be drawn, as in Figure 2c, by joining any of those points that has an odd number to an adjacent point with the same number.



(a)



(b)

Figure 3.

The joining lines can be horizontal, vertical or diagonal. A little experimentation will show that there are only a few ways in which these lines can be drawn. From the mid-points in the top row, row 1, or in any odd numbered row, the lines can be drawn diagonally or vertically as shown in Figure 3a. From the mid-points in even numbered rows, the lines can be drawn diagonally or horizontally, as shown in Figure 3b.

This is exactly how the program for drawing contours will work. It reads a table of numbers, computes the values at the mid-points between the data points, and then joins up any adjacent points that contain the same odd number. In this way, the program gives the contours for all the odd

numbers lying between the highest and the lowest (even) numbers in the original table.

The program

To make the program deal with a table of numbers of any size, it begins by reading a value for N, the number of rows and columns in the table. This is dimensions the array, A, into which the table is to be read, and the array B, which is to hold the numbers of the original array and the numbers between them, as shown in Figure 3b. This gives:

```
10 INPUT N
20 DIM A(N, N), B(2*N, 2*N)
```

Strictly speaking, if A has N rows and columns, then B will

have N+1 (2N-1), that is 2N+1. But by dimensioning B so that it has 2N rows and columns, we can place zeros in row and column 0 as well, to create a surround for the important part of the array, and to avoid some nasty edge effects in subsequent calculations.

Next, the table can be read into A, its entries copied into the appropriate elements of B, and the surround for B created with:

```
30 FOR Y=1 TO N: FOR X=1 TO N
40 READ A(Y, X)
50 B(2*Y-1, 2*X-1)=A(Y, X)
60 NEXT X: NEXT Y
70 FOR X=0 TO 2*N
80 B(0, X)=B(2*N, X)+1
90 NEXT X
100 FOR Y=0 TO 2*N
110 B(Y, 0)=B(Y, 2*N)+1
120 NEXT Y
```

Here, as elsewhere in the program, Y is used to number the rows in the array and X the columns. The values at the points mid-way between the original data points can now be computed, first along the rows, and then down the columns, and placed in B by:

```
130 FOR Y=0 TO 2*N-1 STEP 2
140 FOR X=2 TO 2*N-2 STEP 2
150 B(Y, X)=.5*(B(Y, X-1)+B(Y, X+1))
160 NEXT X: NEXT Y
170 FOR Y=0 TO 2*N-1 STEP 2
180 FOR X=2 TO 2*N-2 STEP 2
190 B(Y, X)=.5*(B(Y-1, X)+B(Y+1, X))
200 NEXT Y: NEXT X
```

With the data entered and the preliminary computations complete, we can prepare the high-resolution graphics screen by calling our usual routine with:

```
210 GOSUB 300
```

When the contours are plotted, we could use the row and column numbers of the elements of B as screen coordinates. But, to ensure that the contour map fills the screen and is as large as possible, we shall scale these numbers up by multiplying the column numbers by $128/(2*N)$ and the row numbers by $200/(2*N)$. These factors are calculated by:

```
220 X5=(N+1)*128/N: Y5=(N+1)*200/N
```

Now we are ready to plot the contours, and the lines starting from any points in the odd numbered rows of B can be dealt with by ignoring all but the values that are odd and, for these, testing to see if one of the diagonal lines or a vertical line needs to be drawn. Where a line is to be drawn, it is only left to place the necessary values in X1, Y1 and Y2 and to call the line-drawing subroutine starting at line 300, which draws a line from (X1, Y1) to (X2, Y2). This can be done by:

```
230 FOR Y=1 TO 2*N-1 STEP 2
240 FOR X=2 TO 2*N-2 STEP 2
250 IF B(Y, X)=2*N+1*(B(Y, X)/2) THEN 290
260 IF B(Y, X)=B(Y+1, X-1) THEN 210*Y5: Y1=Y+1*Y5
270 GOSUB 300
280 IF B(Y, X)=B(Y+1, X) THEN 210*Y5: Y1=Y+Y5
290 IF B(Y, X)=B(Y+1, X+1) THEN 210*Y5: Y1=Y+2*Y5
300 NEXT X: NEXT Y
```

In similar vein, the even numbered rows of B can be dealt with by:

```
300 FOR Y=2 TO 2*N-2 STEP 2
310 FOR X=2 TO 2*N-2 STEP 2
320 IF B(Y, X)=2*N+1*(B(Y, X)/2) THEN 310
330 IF B(Y, X)=B(Y+1, X-1) THEN 310*Y5: Y1=Y+1*Y5
340 IF B(Y, X)=B(Y+1, X) THEN 310*Y5: Y1=Y+Y5
350 IF B(Y, X)=B(Y+1, X+1) THEN 310*Y5: Y1=Y+2*Y5
360 NEXT X: NEXT Y
```

Line 350 must be included to avoid exceeding the array limits for B, if we had not given B its surround of zeros, we should have had for most values of this kind.

The complete program, with data and subroutines, is listed in Figure 4.

Further developments

As already suggested, there are a number of developments that can extend the program. To begin with, they will centre on

ways of reducing the restrictions on the data initially accepted by the program. At present, the data must be smooth enough that not more than one contour passes between any pair of the initial points. If the data is less smooth

than this then the array must be made correspondingly larger so that it can hold more points in between the initial points to allow more contours to pass between them.

The way in which our program draws contours is

sufficiently robust to be used with tabulated numbers of any kind and, indeed, any numbers each with their own associated position.

Finally, a way of labelling the contours would improve any contour map.

Program Listing

```

10 READ N
20 DIM A(N,N), B(2*N, 2*N)
30 FOR Y=1 TO N: FOR X=1 TO N
40 READ A(Y, X)
50 B(2*Y-1, 2*X-1)=A(Y, X)
60 NEXT X: NEXT Y
70 FOR X=0 TO 2*N
80 B(X, X)=0: B(2*N, X)=0
90 NEXT X
100 FOR Y=0 TO 2*N
110 B(Y, 0)=0: B(Y, 2*N)=0
120 NEXT Y
130 FOR Y=1 TO 2*N-1 STEP 2
140 FOR X=2 TO 2*N-2 STEP 2
150 B(Y, X)=0.5*(B(Y, X-1)+B(Y, X+1)+B(Y, X-1), X+1))
160 NEXT X: NEXT Y
170 FOR X=1 TO 2*N-1 STEP 2
180 FOR Y=2 TO 2*N-2 STEP 2
190 B(Y, X)=0.5*(B(Y-1, X)+B(Y+1, X))
200 NEXT Y: NEXT X
210 GOSUB 500
220 X8=INT(160/N): Y8=INT(100/N)
230 FOR Y=1 TO 2*N-3 STEP 2
240 FOR X=2 TO 2*N-2 STEP 2
250 IF B(Y, X)=2*INT(B(Y, X)/2) THEN
260 IF B(Y, X)=B(Y+1, X-1) THEN X1=X*
X8: Y1=Y*Y8: X2=(X-1)*X8: Y2=(Y-1)*Y8
: GOSUB 2000
270 IF B(Y, X)=B(Y+1, X+1) THEN X1=X*
X8: Y1=Y*Y8: X2=(X+1)*X8: Y2=(Y+1)*Y8
: GOSUB 2000
280 IF B(Y, X)=B(Y+2, X) THEN X1=X*X8
: Y1=Y*Y8: X2=X*X8: Y2=(Y+2)*Y8: GOSUB
2000
290 NEXT X: NEXT Y
300 FOR Y=2 TO 2*N-2 STEP 2
310 FOR X=1 TO 2*N-1 STEP 2
320 IF B(Y, X)=2*INT(B(Y, X)/2) THEN
330 IF B(Y, X)=B(Y+1, X-1) THEN X1=X*
X8: Y1=Y*Y8: X2=(X-1)*X8: Y2=(Y-1)*Y8
: GOSUB 2000
340 IF B(Y, X)=B(Y+1, X+1) THEN X1=X*

```

Figure 4. Complete program listing.

Scratchpad

**More bits and pieces
to make you and
your computer work
better together.**

THIS MONTH'S SELECTION of short routines starts off with a very handy routine from T. Smith of Sheffield.

The Commodore 1520 glaze printer is a very useful little device, especially when you realize how much cheaper it is than a standard printer. Unfortunately the 1520 has a device number of six while other printers for the C64 have a device number of four. This makes the 1520 incompatible with most C64 programs that output to the printer. I Woz's short machine code program makes the 1520 compatible with most programs.

The program works by changing the Kernal Open Vector and placing the device number which it is to use. Once you have RUN the program you will be able to access the 1520 as device number four. Your 1520 will now work with a number of programs for the first time.

Judging by the number of telephone calls we get in the office about the subject, it would appear that a lot of readers want to know how they can make characters flash on the screen as on the Spectrum or BBC. Unfortunately there is no easy way to perform this function on a C64 but this neat

utility from Steve Mather not only gives you the ability to flash characters but will also let you centre a line of text on the screen.

The flash routine allows you to have any text you wish flashing between one colour and another. It is started by the following command:

```
SYS 5279A,B,C
```

where A and B are the two colours, and C is the speed. A speed of 50 would cause one colour to be held on for one second, 100 for two seconds and so on. To stop the flashing either make A and B the same and call the routine again or see:

```
SYS 5286*
```

The second routine will print a line of text neatly in the centre of the present line. It is used as follows:

```
SYS 5288A,B
```

where AB is the string to be printed. It can contain any of the 256 characters, but cursor characters will upset the centering.

Well that's it for this month. If you have any handy little routines that may be of use to other people or any hints which may help other users with their programming then why not send them into Scratchpad, Your Commodore, No 1 Golden Square, London W1R 3AB.

```
100 REM *FLASH* AND *CENTRE* ROUTINE.
```

```
110 REM
```

```
120 REM
```

```
130 REM COPYRIGHT STEVE MATHER, MAY 1983
```

```
140 REM
```

```
150 REM
```

```
160 B=5279A:C=0+AB+CS
```

```
170 FOR L=0 TO 255:L=C+1
```

```
180 FOR B=0 TO B:READ B:POKE B+AB,B
```

```
190 AB=AB+1:C=C+1:B=L:C=L+1
```

```
200 NEXT:READ B:C=C+1+B
```

```
210 IF LC=0 THEN 200
```

```
220 NEXT:IF C=148070 THEN 400
```

```
230 PRINT:PRINT"ALL DATA IS CORRECT.*:END
```

```
240 PRINT:PRINT"DATA ERROR IN LINE %1L$3+500
```

```
310 STOP
```

```
400 PRINT:PRINT"SERIOUS DATA ERROR. TWO OK"
```

```
410 PRINT"MORE ERRORS IN DATA AND LINE"
```

```
420 PRINT"CHECKSUM.*:STOP
```

```
500 DATA 76,86,206,129,168,14,141,20,3,837
```

```
505 DATA 169,206,141,21,3,88,76,198,253,1173
```

```
510 DATA 248,3,76,49,234,169,137,141,33,1852
```

```
515 DATA 239,165,2,133,293,169,4,133,187,1344
```

```
520 DATA 169,8,133,250,169,216,133,352,168,1483
```

```
525 DATA 8,177,254,91,15,197,254,258,7,1130
```

```
530 DATA 165,158,145,250,76,69,206,197,158,1425
```

```
535 DATA 208,4,165,254,145,250,208,208,238,1665
```

```
540 DATA 239,352,198,187,208,232,169,250,140,1862
```

```
545 DATA 13,209,76,49,234,32,352,174,32,1880
```

```
550 DATA 158,182,134,254,12,253,178,32,158,1378
```

```
555 DATA 182,134,158,32,253,178,32,158,182,1387
```

```
560 DATA 134,2,76,3,206,46,67,91,82,423
```

```
565 DATA 46,77,69,73,69,87,45,77,45,407
```

```
570 DATA 89,32,49,57,54,51,32,253,174,793
```

```
575 DATA 32,158,173,32,166,187,201,48,178,1140
```

```
580 DATA 20,74,131,159,149,28,56,229,159,1819
```

```
585 DATA 176,149,32,32,216,235,292,208,250,1320
```

```
590 DATA 76,31,171,162,23,108,8,1,129,676
```

```
595 DATA 149,49,141,20,5,149,234,141,21,447
```

```
600 DATA 1,88,76,325,0,235,0,235,0,235
```

```
10 REM ***** FLUTTER CHANGE *****
20 DATA 169,11,141,24,3,167,172,141,27,1,76,4,71,145
40 DATA 169,261,4,288,4,167,3,133,186,194,86,74,74,243
50 DATA 46,217,248,171,165,61,61,0,0,0,0,0,0
60 DATA 132,71,69,197,167,167,167,167,167,167,167
70 DATA 41,2
```



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8/21

Peter Thomas has risked

trouble and mortal injury

to bring you this review.

GAME

of the month

HOLD ONTO YOUR JOYSTICKS FOR A thrilling contest amid the snow and ice in the follow up to Summer Games I and II, with Winter Games.

All the old familiar graphics remain, the white doves flying across the screen as the torch glows brightly in the background, only this time the background is realistically covered in snow.

Prior to commencing basks against the wintry conditions you first choose the country you wish to represent, then decide the number of participants, between one and eight, and go for gold.

The star athlete will practice before commencing in competition against other human opponents, spent time preparing for an assault on the World record.

The excitement begins with the Hot Dog Arête. You start perched high up on a ski slope clad in your protective clothing, which is a must to prevent bodily damage, and a pair of skis. The aim is to dazzle the judges with your artistry as you flip through the air attempting such manoeuvres as a 'Duffy', 'Back Kick' or 'Mule Kick', to name just three. Or, if you really want to score high try combining a 'Mule' and 'Flip' in mid-air. The main problem is that you have to land on your feet. Learing the skis off your boots only sets as a third degree burn.

If you survive the Hot Dog Arête without getting too much mustard on your face and without breaking a leg you move onto the Bialfion. Armed with a J.J.Callos rifle you ski uphill and downhill until you are confronted with the targets. Quickly, you aim your gun, pull the trigger and fire - bullseyes! But, beware because although speed is of the essence, if your heart beats too fast it will affect your accuracy. So, keep an eye on your pulse rate and don't get too overheated.

Something everyone will enjoy is the compulsory one-minute figure skating. You have 60 seconds to complete seven movements as you gracefully whirl around the ice rink. Skate forwards and backwards attempting such delights as double and jumps and sit spins. Falling or moving awkwardly will not impress the judges, can you emulate Torvil and Dean and score a one of perfect stars?

The music changes dramatically as you crouch low at the top of the ski jump. Speed, timing and joystick control are of the essence in this very exciting event.



Then, you gather speed in a crouched position travelling down the slope, prepare for take-off and soar through the mountain air. While in mid-flight you hastily re-adjust your position to gain maximum distance and reduce wind resistance. Practising this event while you strain every muscle to achieve an extra meter will while away many a happy winter evening.

After the exhilaration of the ski slope comes the Blegch speed skating. Race against the clock with either computer or human opposition. This has a similar setting to the cycling in Summer Games II so the split level screen allows you to view how far your foe is lagging behind as he tries to compensate rhythm for brute strength.

Calm your pulse rate and get your blood pressure down by re-entering the

ice rink for two minutes of free skating. If you over spin your skater will become dizzy and unceremoniously fall on the ice - painful!

The last event you start on your knees instead of finishing on it as is most of the other events. Sit back, shut your eyes, sip a very quick prayer and off you career down a very fast bobbleigh track. I advise caution before you attempt the hair-raising turns before entering the final straight at Blegch. Go too fast and you land up in hospital. One last bit of advice don't drink and drive. It is dangerous to your health.

Again US Gold has come up with a winner. I eagerly await a Winter Games II in the hope it will contain a downhill slalom, by then I might have regained my balance.

P.M.





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Not content with studying other people's adventures, Runecaster has now been creating his own. Read on to find out how.



Do-It-Yourself... Almost

WE HAVE MEN PROGRAMS TO ENABLE the non-programmer to write text adventures, some of which even allow reasonable graphics to be added. We have also had a selection of games creators that can be used to put together fairly rudimentary arcade games.

Now, into this games creator camp for the CBI, comes Amalsoft, with a very comprehensive package for the graphics adventure field. Only available on disc, the Adventure Construction Set at \$14.95, gives the user a sensible base of ready-made characters, objects and facilities from which to build a dream adventure!

Not only can you create the whole adventure yourself but, if you get bogged down, lazy or just inquisitive, there you can hand over the completion of the game to the Adventure Construction Set

either graphically or their attributes (strength, weight, associated text etc.) changed.

The basic format for any of these adventures consists of a 'world map' that your players explore (up to four characters may be chosen — each taking turns to move). Within this area there will be scenic points (doors, candles etc.) to further regions where the majority of the action will take place.

The world map is 80 x 80 squares, all which a 80 x 15 area is visible — the map scrolls as your players move across it. There may also be isolated 'rooms areas' in addition to the main regions.

in ancient Egypt, that should keep even the hardened adventure fans!

When you start using the Adventure Construction Set, you will have to create a working 'adventure disc'. This involves quite a lot of disc swapping (the ACS-disc and your 'adventure disc'), so do not expect to be playing an adventure in just minutes — allow yourself time.

Before creating this work disc, you must decide what options you want on the disc. You will need a separate work disc for each adventure — either use you are about to construct or one of the two already on the ACS disc. It is probably wise to start with The Land of Amalsoft.

Playing and creating adventures is mainly carried out by using a joystick (or joy-pad/card) and all the on-screen operating instructions are clear and well explained. The program is well thought out and appears to be almost bug-free, even at this stage this is apparent, if you have inserted an unformatted disc (for your working disc), it checks, and formats it if necessary!

Once you have a working disc with The Land of Amalsoft on it, you can play the game, learning as you go. Or you can practice editing what is already there.

Playing the adventures will initially present you with the choice of creating or adding a new player. Again one is quite impressed with the vast number of options you are given for the graphical representation of your character.

Admittedly there are in fact all the characters/objects that may appear within the framework of the game but even so, given a hundred odd icons to choose from does tend to leave one a little confused!

On the Track

Having chosen and named your characters, the screen displays part of the world map, complete with trees, mountains, seas, candles, doors etc. But

Adventure Construction Set



Amalsoft

— just sit back and let it take over where you left off and it will create a working adventure from your base bones! Mind you this can take anything up to 40 minutes.

Although large numbers of characters, objects etc. have already been created and are at your beck and call, all of these may be altered to your specifications.

Two to Start With

Two adventures are included on the disc, one, The Land of Amalsoft, contains a tutorial adventure plus six other mini-adventures to help the newcomer 'get the feel' of what is possible. The second, Beasts of Light, is a complex adventure set

of colour on either side of the screen display how much time for movement your player has left on this turn and also his/her current "power" and "life force".

Four lines beneath the map are used for text messages, text actions and further menus. You may now either move, using the joystick, or "select other options" by pressing the "fire button".

Other options displays 17 possibilities, including: use object, drop object, use power (spells, traps, new weapons or armour, quit, save, fire (remote weapons) and portals. Most of these have fairly obvious uses, the last — "portal" — gives you a complete inventory of your character. Not only will it tell you what is being carried but also a full breakdown of their constitution, wisdom, strength, dexterity, visible skill, magic skill, life force, "purr" skill etc! All of which may assist in helping you decide what course of action to take next.

There are plenty of creatures wandering around but you may try and identify which are worth attacking. If you have a suitable weapon you may attack from a distance, although how well you are, is dependent upon your character's powers with missile weapons (check your profile).

Just as each player has a certain time each turn to move so take any other action so too do all the creatures you meet! You may choose to ignore them but they may be more aggressive and choose not to ignore you! If battle is joined, then the results of each blow are shown in the first window below the display.

Objects initially seem as you enter a location may not be all that is there, often further items are hidden underneath! As in most adventure games there is plenty of treasure around but carry too much and movement may become difficult.

Also, even if you don't understand a particular action very clearly, at least the vague memory of a certain possibility may well trigger off something useful later!

The initial stages require you to choose a new working title for you could practise by editing the game already on your adventure disk (save). For your next adventure you will probably wish to start from scratch. Here is your first of many hundreds of decisions.

There are three types of adventure construction sets available: Fantasy, Science Fiction or Espy/Mystery. The basic concepts of all three are similar with world maps, regions, portals etc. but the sets of ready made characters, objects and terrain possibilities, are tailored to each subject.

Having chosen the set you want just follow the on-screen instructions — you now have the basic tools of the trade. Although there are plenty of "things" with



Watch Out

As you roam around one of two things may happen: First, you can "fall" (goor) "out" of the map (creatures), these may be friendly and have something to give you, so be wary of launching an unprovoked attack! Should you do this they may then unpleasantly change from friend to foe.

Secondly, you may enter a "square" (wall, portal, door etc), that will transport you somewhere else, to one of the many regions within the game. These regions consist of a number of interlinked "rooms", where you will find all the major puzzles that you have to solve, to win through to the end.

There are weapons, armours and spells to be found — all graphically portrayed — just move your character as though you want to stand on top of them and they are yours. Some you'll wish you never found!

With each complete adventure there is a final goal (i.e. some object/character that has to be found and taken, rescued etc). Needless to say, this goal should not be one that can be achieved without completing other parts of the quest. Indeed, there are conditions that can be set on whether doors or portals will or will not operate, dependent upon items carried.

Roll Your Own

The instruction booklet provides clearly printed paper, draws the comparison between the program and making a movie. There are many comments, you have to choose your cast, your locations and all sorts of interesting props.

Although the presentation of menus and instructions "on-screen" are usually clear and explicit, read the written instructions first! At the first read they may seem too much to grasp but as you become more familiar with the program, they will all make sense!

which to create the map and the creatures and the objects to be found and used, there is no substitute for plenty of forward planning!

You may have more than a rough idea of what you want your adventure to achieve.

First, the world map — think carefully of what you want to represent. What areas should characters be able to travel across freely? What obstacles do you wish to put in their path and, having put these there, what is their purpose? Does the placing of your special regions make any sort of sense?

Secondly, the regions — presumably at least some of these will need to be visited in the correct order (items found in one required to find items in another etc.). Think carefully about the overall coverage of your game before you start creating regions willy-nilly!

Thirdly, consider the objects and creatures that are going to be found — both in the vital regions and also in one-



all encounters while wandering around the world map. Does their placement make some sort of sense?

Anyone using this package can create a working adventure — it's almost fool-proof — but only with careful planning and attention to detail. Can you produce a game with that added something that others are really keen to play and solve?

Do Your Own Thing

You may think that because all items are given the same traits, objects and treasure, all ACS adventures would have a certain similarity...not so! Not only may you alter the graphical representation of all the current graphics, you can also create new creatures and objects up to a maximum of 128 in each case.

Each creature, object and terrain option has certain conditions and attributes to create the most options. 20 different basic attributes — not counting variations on each of these or which of optional objects they may possess. These attributes may be modified to suit your adventure.

Having altered the name, shape, and attributes for a creature in the master list, you may then alter them again when you place him/her/it actually in the location of your choice. So although you may have a general basic gem, specific gems may be stronger, faster or better armed than others elsewhere!

Each of these attributes is explained fully in the instruction booklet, so really what appears in your adventure is solely limited by your imagination. You can even have a creature attack until the player hits it — it then turns tail and brings out of the way!

If fixed events are not enough then facilities exist to have random creatures appearing you choose the creature and the percentage of time that you wish it to be present.

There are of course a range of spells available. You may well ask how those are applicable to Top/Wizard or Science/Fiction adventures. Spells basically affect either the player or their surroundings, so a spell of decreasing life force from the fantasy world could be likened to a poisoned drink in a detective bar in Marseille.

There are similar parallels to be drawn in other systems. Think about it, there are some interesting philosophical questions raised by this line of thought.

Decisions between locations can come in a variety of forms, from simple text way passages open to all to locked doors to portals only accessible to those with certain objects in their possession.



regular intervals — do not be tempted to be lazy, remember to pad the disc that is not in the drive, back machines! The law of conservation of mass and energy into effect and damage the expanded disc... you have been warned!

There is just not enough space here to list all the variations possible with *Academy's Adventure Construction Kit*. The only real snag for those to whom it appeals is likely to be: will their computers have worn out before they have explored all the possible 'alternative realities' available from ACS?

Exodus Update

Those of you who read and believed my rant about US Gold's *Exodus: Ultima IV*, will have sought out a copy for yourselves. You will either feel I over-reacted or will be hooked, and deep in the wilds of Somalia.

First, for those of you that did not get copies of the booklet explaining the Wizard's Spells or the Cleric's Spells — all in the box, just send a stamped addressed envelope (144 inches or bigger) to US

Gold, Unit 30, The Parkway Industrial Centre, Henrage Street, Birmingham B47 4JY. State where you bought your software and the missing books will be sent to you.

Secondly, have you progressed? Have you realised that if you red load British in his castle after a character has increased in 'level', then your maximum hit points increase! Have you found a boat and sailed the seven seas? Not! Try attacking one of those giant ships! Do time your attack to coincide between cannon-fire and always approach the gates along a vertical or horizontal line — rapidly.

Talk to those you meet, especially in far-off places — and write down what they say. Followers enable a party to 'regain time' — exceedingly useful if there are dragons about! Has anybody found the tower of Dazel?

What form of 'party' do you find best? Do you change the members of the team for special missions? Are you able to find your companions regularly with MAGIC? Cleric's Spell 'C' is long, not the spell of wonder and exploration last.

Finally

The suggestion that one of this program you will probably be changing discs at last!



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BUSINESS FILE



Dave Crisp looks at a

wordprocessing package and gives a run-down of printers and interfaces.

A Wordprocessor Package

WORD PROCESSING AGAIN! WELL, it may seem so but apart from games this is what you will find most computers doing most often.

After trying many printers, countless interfaces and almost every wordprocessor, I think I am now in possession of the most versatile package available at this time.

I am not going to go over the pros and cons of wordprocessors software, because I want to have a look at the new wordpro from Packard first in case it's even better than the Visawrite which at the moment is the best I have seen. That will be in a later issue. Instead I will, very briefly, mention the Wordpro software and then go onto the other end of wordprocessing, the printer.

There are basically two types of wordpro. Pre-formatted and post-formatted. The post-formatted type works on the principle that format characters typed into the document take effect only when the document is printed or when the document is viewed. This means that you cannot see the document as it will be printed without leaving the text editor. Pre-formatted wordprocessors allow you to 'see' the effect that the formatting symbols will have as you type.

Script is an example of a post-formatted type, and Visawrite is of the pre-formatted variety.

Personally I prefer the pre-formatted software though it seems that opinion between users is split 50/50.

The problem with the C64 is that it can only display 40 characters of text at a time. This means that if your page is set anywhere over 40 characters you have to scroll over the page in order to see exactly what it looks like. A disadvantage but one that I have learned to live with.

There are many functions involved with text editing and so it is important to choose one which has logical commands as nothing slows down typing more effectively than constant referral to a manual to find out how to insert a tab and so on. For this reason I go for Visawrite.

Hardcopy

Going onto printers and printing you come across the problem of printer compatibility. The Commodore range of printers is not too bad, indeed over the

last 12 months Commodore has brought out some nice machines. However it seems that a lot of people want a printer from the Epson stable or one similar. This is a good choice though the first problem is that it is not compatible.

There is now a massive range of interfaces available in order to run electronics printers from the Commodore. They start at about £15 and go on up to around £200.

Before you rush out and buy one, stop and see what you need/will be. If you only seem to use a printer for listing programs and simple jobs then a simple local and daisy software may be all you need. This should cost between £15 and £20. It is simple, cheap and does the job. If you use the more popular commercial software you may find that software is built in which will drive the printer, with just the lead to think - before you spend - before you print.

If you are in a position where you use a lot of varied software and are never set to suit what you may need, it may be worth splashing out and getting a more versatile interface. These do not come cheap but can save hours of frustration when trying to re-locate machine code driver software in order to avoid conflict with an expensive piece of new software.

The best of these 'HARD' interfaces plug into the serial port of your Commodore. This means that you can keep your own port free and use your printer in exactly the same way as a Commodore printer.

Some months ago I wrote about the off-the-shelf interface. I used about it and said it was the best thing since wheelbarrow (hum). It was brilliant, it still is but I have one remaining reservation. It is the Micro Control System Interface. It consists of a circuit board and five pin to five-pin lead.

This board fits inside the printer and on some versions allows nine characters to fit in the printer case so you can date check your peripherals as though it was a Commodore printer. Excellent versions are available for Epsons, Kays, Canons and more.

There is a small built in buffer which frees your computer quite quickly with smaller documents and it can be reached either with jumpers or through software to allow you to choose different modes. These are all Commodore emulation, transparent, plus more depending on the version you have.

Commodore graphics are supported

and for the first time I am now able to get good screen dumps from software such as Kays and daisy.

Fitting the board into the printer ranges from easy to lumpy depending on which printer you have so if in doubt ask someone who knows what they're doing as printers tend to be fussy about where you poke wild screwdrivers.

Because these boards offer you five-pin sockets it means there is a certain port space. For those of you with more than one machine it means that you can have both plugged into one printer. By the side of my printer I have a 64 and on the other there is a Series. If one is printing and you try to print from the other it will just wait. At first I thought I may get printed garbage but that is not the case.

Once the Micro Control System interface is in place you can forget about it, it does not get in the way, it does not require constant watching in order to make it work and it does not clog up your own port or require a 5V power supply from the cassette port.

This interface is the best thing since sliced wheelbarrow bread!

The choice of printer depends a lot on finance. Prices are dropping but you should still expect to pay £200 plus for a versatile and fast dot matrix printer. That's not to say that anything costing less is sub-standard. It may be just slower and have less facilities such as ribs, proportional spacing, underlining, double strike, italics and near letter quality type etc, etc.

I am stuck on my Canon. It's fast, (100 cps) quiet, compared to my Smith Corona daisywheel, and cheaper (than an Epson 6-80).

It will cope with friction fed single sheet paper, fanfold and roll paper, without having to buy a roll holder in its own right. Near letter quality is as good as anything I have seen on a matrix printer. It seems bulky but the space it takes up on the desk is about the same as most, it is just unusually high. Paper jams are rare and loading paper whether roll, sheet or fanfold is simplicity itself.

In the End

If I were popping down to the local hobby printer set up to go with a 64, I would not hesitate and I would heartily recommend the Micro Control System Printer Interface and in the printer dept the CANON PB-100A. Not cheap but very impressive.



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EPSON



R.O.U.

RELIABLE

Mike Hart brings you another article to make life easier — this month he deals with the Exclusive-or routine.

Exclusive-or Routine

THIS MONTH, I AM GOING to explore the workings of an Exclusive-or routine which is often used in cases where there is a need to "encrypt" or "lock" the data in some form.

Obviously this is most useful where one wishes to protect data or programs and it should prove useful if you are already thinking along these lines. But first it is necessary to explain how an Exclusive-or works and how it differs from an Inclusive-or.

To understand both we need to look at the bit patterns of a couple of numbers to visualize the operations that are performed.

Two numbers and this is why 200 (Inclusive-or) 100 gives the number 296. You may confirm this by typing in direct mode PRINT 200 OR 100 and this is the answer provided by the third row of the table. On the other hand, an Exclusive-or will only return a bit pattern of one if either (but not both) of the bit patterns is a one and therefore 200 XOR 100 is 172. This is actually quite complicated to demonstrate in Basic and is one of the few instances where machine-code is actually much easier than its high-level equivalent — all you need to code in machine code is LDA, XOR followed by ORA #44 to get SAC (= 172) in Basic you will need to type the following:

```
PRINT (200 OR 100) AND NOT (200 AND 100)
```

Having got our "coded" number, what are we going to do with it? We could use the data in this encoded form. The really interesting thing is to observe what happens when we Exclusive-or our "new" number with the second of our original numbers. The second half of the table shows that

| | 2 ⁷ | 2 ⁶ | 2 ⁵ | 2 ⁴ | 2 ³ | 2 ² | 2 ¹ | 2 ⁰ |
|----------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 100 = SAC | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 200 = SAC | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 200 Inclusive OR 100 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 200 Exclusive OR 100 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 100 = SAC | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 172 = SAC | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 100 Exclusive OR 172 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

The first two rows of the table are the decimal numbers 200 and 100 converted into their binary patterns. An Inclusive-or is performed if there is a one in either of the

performing an Exclusive-or with the number we derived with the second number gives back the original numbers. In order to encode a section of data, or even a whole

program, all we need to do is encode the bytes that form our program with a sequence of numbers. The result is apparent gibberish but technically no information has been lost. If we can generate the sequence of numbers used to encode the program this can be used as a key to "unlock" or "decode" the encrypted code.

Some Exclusive-or routines make use of the fact that the data in ROM is fixed in silicon, as it were, and therefore use the ROM data to provide a sequence of numbers to encode the original. However this is alright so long as you stick to your own machine but it is not uncommon for Commodore to make small and unannounced changes to its ROMs and this might create difficulties for the future. The approach I have taken in the sample program is to make use of a simple algorithm which generates a sequence of numbers in the range 0-255. These are used for encoding.

In the sample program, you will see that line one is a SYS call followed by a ROM, quote mark and then exactly 65 asterisks finished with a final quote. Type in this line with no spaces at all and it will just fit on to 66 spaces. To operate the program type "RUN 2" and it will read the DATA statements for a machine code routine into the space provided by the asterisks. The rest of the program is of no consequence but merely a way of doing something.

When you list the program the machine code in the ROM statement in line one will be converted to tokens and will look decidedly strange but do not worry. Now type (ESC) 275 200. If you list the program it will not be encoded and will probably stop with a syntax error. Now RUN the program



EXCLUSIVE - OR

```

1 SYS2001=R0M"XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
2 REHD15ABLE=POKE 809,100:POKE 809,34
3 LH=PEEK(40)+809:PEEK(44)+12
4 FOR J=0 TO 84:REPEAT 3:IT=I
5 POKE LH+J,C NEXT
6 IF T=1070? THEN PRINT"DATA ERROR!" :END
7 :
10 DATA 100,03,133,34,105,44,139,38
11 DATA 139,2,100,2,10,10,30,101
12 DATA 0,130,2,100,1,177,34,240
13 DATA 10,107,2,240,4,80,2,140
14 DATA 34,230,34,200,200,230,35,200
15 DATA 225,200,177,34,200,17,34,240
16 DATA 13,24,100,3,201,34,133,34
17 DATA 144,200,230,35,170,200,00,3,140
18 :
19 :
100 FOR J=1 TO 30
110 PRINT J,J+J,800/(J)
120 NEXT J
200 REM - RECODE SYS LH

```

and after a slight pause, while the data is read back, the program will be converted to its original form and will run as normal.

Obviously, to save a program its encoded form all you have to do is make a call to SYS 2001 and then run it. After it has been loaded back the call to SYS 2001 will read in and then activate the code which will do the conversion job before running the program. If you wish to stop people breaking into the program you can activate the RUN/STOP disable by removing the R0M part from line two and re-encode the program as soon as it is coded by the SYS call in line 200.

To hide the SYS call completely then adapt the following procedure.

1. Make a new line reading 0 SYS2001=R0M" and press RETURN. Now place the cursor over the second of the quote marks and press SHIFT+DEL 16 times to open up a gap of 16 spaces. Now just press DEL 16 times which just involves taking your finger off the SHIFT key and a reverse E (delete) sign will appear. When the cursor is flashing over the last quote mark press space and RETURN.
2. Remove the SYS call in line one but keep the R0M statement intact.

3. Make the 12 in line three a 13, the checksum in line six, 8000 and the 80 in line 10,104. Now RUN it as before and remember that the new SYS call is 2002 not 2001. On listing, line 0 will appear but be flashed off before it can be read by anyone.

```

0+
PC SR AC DR TR SP
:1000 00 00 00 00 00
:
0000 A0 03      LDA #003
0001 00 00      STA #00
0011 A0 0C      LDA #0C
0013 00 03      STA #03
0015 00 0C      STA #0C
0017 A0 0C      LDA #0C
0019 0A        ROL
001A 0A        ROL
001B 00        SEC
001C 00 00      ADC #00
001E 00 00      STA #00
0020 A0 01      LDA #01
0022 01 00      LDA #0001,Y
0024 A0 10      LDA #0010
0026 00 00      CFF #00
0028 F0 04      DCR #0004
002A 40 00      EOR #00
002C 01 00      STA #0001,Y
002E 00 00      INC #00
0030 00 00      SNE #0017
0032 00 20      INC #00
0034 00 01      SNE #0017
0036 00        DNY
0037 01 00      LDA #0001,Y
0039 00        DNY
003B 11 20      ORA #0011,Y
003D F0 00      DCR #0000
003E 10        CLC
0040 A0 00      LDA #0000
0041 00 00      ADC #00
0043 00 00      STA #00
0045 00 00      DCR #0017
0047 00 20      INC #00
0049 00 00      DCR #0017
004B 00        RTS
004D 00 0C      ORA #0C

```

Teacher's

Margaret Webb, our resident school mistress, demonstrates how music packages can be educational as well as fun.

ONE OF MY GREATEST DREAMS IS waking up on Christmas morning to discover that some kindly relative has given one of the children a trumpet or drum kit. It's not that I'm antisocial. In fact, I believe that music is an important part of life and the playing of an instrument is a great skill. However, there are lots of computer packages that are more accurate than the physical instruments and are quieter. The programs range from a pre-school package through to one which offers the capabilities of a synthesizer.

You may be aware that there are a range of powerful systems using keyboards driven by the MIDI interface. Most of these systems are rather expensive and outside my field of interest. All of the packages discussed here cost less than £30 and only one offers a MIDI facility. Notwithstanding their lower prices, many of these programs offer useful facilities.

I have carefully chosen a range of software which encompasses a range of age groups and prices. Since you may wish to use this article as a possible shopping list, I have used price to categorise the software.

Under £10

Make Music with MasterTone by MasterTonic is the cheapest of the packages I want to describe but notwithstanding this, it's very good value. The program provides an aid to composing music. The complexity of music possible is a little limited by the fact that a single staff is offered with a maximum of one note. Up to seven screen lengths of music may be written and saved to tape as required.

Five different sounds are provided — piano, guitar, trumpet, recorder and tambourine. The actual sounds are only approximate but sound possible. The full range of simple note values and rests are provided and a useful option is provided to enable you to make hard copies of the score.

Overall this is a cheap and very cheerful program which works well and provides a simple but effective means to create music.

Pet

Fisher-Price's Song Maker is one of a series of high quality cartridge based packages from this toy maker firm. The child is presented with a line of music notes on a chess board. This selection is made with a joystick. The musical pieces range through well known nursery rhymes such as Twinkle Twinkle Little Star and Pop Goes the Weasel. Play School favourites such as Row Your Boat and Farmer in the Dell and songs such as Frère Jacques and Cuckoo in the Room. Overall there are 28 titles plus an option for the child to create an original tune.

Though at first sight this program may seem to be purely a play item, it does have an element of education. As the tune is played, a simple score is shown on the screen. Initially each note is represented by the normal notation allowing the child to see the relationship between the pitch of a note and its position on the musical staff. The child can then overwrite any note by an animal shape. Each animal actually represents a different voice or sound. Daisy the Duck quacks a note, Betsy the Bee buzzes, Oliver the Octopus rings a bell, Mary Monkey uses his tail as a violin and Wilbur the Whale plays a note on his water speed. Using the joystick, the child can change the voice playing any specific note.

This game offers hours of fun whilst subtly reinforcing the educational aspect.

The Music Interface cassette by Longman Software is joystick or keyboard controlled and is aimed at the over threes. It is, however, simple enough for younger children to use. The program allows the child to compose tunes using a cartoon man who holds the note and is guided into the correct position on the chosen staff. Rather than allow random music, however, the program forces the use of the conventional notes of simple chords. Not only does this allow interesting compositions, but a feel for the total structure of music is given. Only two versions of staff are given but by use of the memory form of repeat (i.e. AABA where A is staff 1 and B is staff 2) but options are given to chose the key (C, F and G) and the tempo (march of waltz).

There is a built in teaching element in this program and a test sequence provided, but in spite of this, the game gives hours of fun.



£10 to £20

The Music Studio by Activision moves away from the strict teaching angle towards composition and musical theory. This package provides the environment for the detailed manipulation of up to three voices and their incorporation in musical scores. Two distinct options are offered. For the more serious user, there is a versatile music editor. For those seeking to simply create tunes without emphasis on musical accuracy, there is the music paint box.

In keeping with modern trends, the program uses icons with a pointer to select options. This system is simple to use and easy to understand.

Up to 15 pattern sounds are available, each denoted by a colour. These are selected by simply pointing at the corresponding colour on the note palette.

The idea of total rotation is most emphasized in the paint box. In this option you put the notes of your choice on the staff or bass staves. Rather than use the full note shapes, notes are simply shown as coloured blocks with lines proportional to the duration. You can edit or change the composition and readily play it back.

The music editor is similar in many respects to the paint box but offers many of the facilities of music. Full rotation is used and there are options for the full range of note values, accidentals (sharps, flats etc.), tied notes, dotted notes and rests. The system acts rather like a word processor with commands to copy and move phrases.

The value of both systems is that the music scrolls as it plays showing how sequences of notes sound — always a difficult step when trying to read music. A sound engineer version allows the manipulation of almost all aspects of the music enabling you to create almost any sound. Finally, options are given to save music, include lyrics and make a hard copy on a printer.

This is an excellent and complex package which will appeal to users of all ages.

Music Construction Set from Electronic Arts has disk based package and is similar in many respects to the Acropolis program. Again an icon driven system is provided by which you take notes and place them on the musical staves. There are 11 preset voices provided ranging from harpsichord and oboe through to drum and flute. There is no facility to edit the sounds but the presets provided are useful and effective. The general feel of this package is of more musical accuracy with a more serious flavour. Several time signatures are supported and a counter lets you know if you try to staff in too many notes per bar.

The disk is full of excellent demonstration pieces. To test the basis, a memory quiz is provided.

Both this package and the Acropolis program offer more limited educational facilities in themselves. Where they do score, is as supplementary tools for use in connection with study of musical theory. As such, they are really of most value for children above eight years old.

Music Master by Supersoft returns to the idea of using the computer as a musical instrument. In effect the program turns your C4 and C 16 into synthesizer with a rhythm generator and a sequencer.

Graphically this package on Laserdisc is one of the others, but in many ways it's more powerful. Most operations are

performed by specific screens with instructions provided at every step. There are also three help screens.

The package comes in two main versions. First you have a real time synthesizer where the keyboard can be used to play notes on up to three voices, full control over the voices is provided with the ability to make them interact in an almost infinite manner. Using this facility you can create the most mind boggling sounds. A rhythm is provided which will drive up to two of the voices allowing you to play in an accompaniment. This is great fun.

In a manner similar to the Acropolis and Electronic Arts packages, the program can be used to compose music. True musical notation is not used but the system acts more like a sequencer remembering a sequence of notes.



MUSIC MASTER



Over £25

Commodore Music Maker by Commodore UK is marketed as a music maker for beginners and musicians alike. It comprises of a plastic keyboard which clips over the computer. The keys activate the top two rows of the computer keyboard providing the means of generating sound. The package also includes some software and a tutor.

The software effectively turns the 64 into an electric organ rather than a synthesizer. Using the function keys you can control the octave used, select monophonic or polyphonic and alter the sound of the voices. The means of changing the voices isn't very easy to use but it works after a fashion. A simple sequencer is provided to allow you to create and save compositions.

A keyboard tutor is provided in the package. This gently cues the learner through the steps of learning about music, the relationship between the keyboard and the name and musical notation. The tutor consists of 27 notes starting with a very simple Au Clair de la Lune and finishing with Amazing Grace with its key changes and accidentals.

There is a series of tutorials to go with the Music Maker keyboard covering a variety of musical titles — everything from the Beatles to Classics.

Another piece of software to go with the keyboard is the Playalong Series of Albums. These are cassette and booklet sets which allow the user to play along with programmed tunes. One album is a selection of popular classics ranging from Beethoven's Ninth to the March of the Toysmiths. Others include Beatles hits and Bruce Springsteen.

Summing Up

Your choice of package depends not only on the cost but what you want from it. The majority of the software described allows the creation of musical scores aimed at differing degrees of complexity. The best course of action is to try them out at your local shop, if possible, and weigh up the facilities against your needs.

The play-along types of program are in the minority but they offer more for those who simply want to have fun at the keyboard without the need to learn music. These also have an educational value since by playing with the name, the child will pick up a feel for notes and the inter-relationships between notes.

Surprisingly, only the Supersoft package offers both facilities — and does so quite well.

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STEALTH

Arifolsoft (S) '95



STEALTH IS ANOTHER ARCADE OFFERING from Arifolsoft in collaboration with Broderbund.

You are in command of a stealth starfighter sent from Earth to destroy evil Dark Tower which is the nerve center of a formidable force governed by the mysterious and evil "Council of nine".

You have been sent to this strange and forbidding planet to destroy this tower so as to protect the earth, as our green and sometimes not so pleasant land is to be their next target of domination.

After loading the game you will see a screen filled with the huddles you will have to face if you are to succeed in your mission, with their respective points for their destruction. (One of the good things about this game is that you don't have to

read the inevitable twaddle on the relay card and if you do I'm sure, like me, you will also find said twaddle to be not too short of misleading, but I suppose Arifolsoft would argue poetic license.

The game starts with the rear end view of your stealth starfighter hovering just above the surface of this forbidding planet, which is a lovely vivid green and to my mind doesn't look at all forbidding. To make the ship go faster you just push the joystick forward and as you do so you will notice that the distance read out display counts down faster. This, as you have probably already worked out, is how far you have to go before you are in a position to dial the final blow on the tower which you can see on the horizon and which doesn't appear to get any

closer even though the read out tells you that it should.

As you hustle towards it, the council of nine (presumably) check every piece of destructive hardware at their disposal in your direction. In addition to this there are certain "natural" hazards which you must contend with, like anti-energy clouds and on the higher levels active volcanoes. As you are hit by the defending fire-power and poofly through the anti-energy clouds, your power level is reduced. It also diminishes as you proceed and shoot back. The state of your energy is displayed on the screen at all times and when it gets to a critically low level the read out flashes, which unless you can find a positive energy field to fly through, heralds your demise.

If you have been able to avoid all these malignant forces you will notice that the distance reading will eventually flash at zero and all you have to do is blast the tower which, if you're successful will disappear in a cloud of smoke and opening rubble, whereupon you lose control as your starfighter glides off into the somewhat bizarre screen warping to the next level where you regain control and the antics are nastier.

In short, Stealth is by and large (what a stupid expression - but you know what I mean) a good game. It is very "playable" and so the beginner level acts as introduction to the shoot-'em-up world but I can't see it holding the attention of any seasoned campaigner for too long.

DA

WIZARD

Arifolsoft (S) '95



WIZARD IS YET ANOTHER PLATFORM, jump and collect game to hit the streets and it will undoubtedly appeal to those of you who appreciate a little strategy in an arcade game.

As the program loads you are welcomed to Wizard and told to "prepare

to wield the joystick" and attempt to explore the various levels within. The tools are your agility, running and magic.

You get first given a choice of demonstration, playing the game or constructing your own game - which gives you full control of everything from the placement of your wizard to the amount of monsters and walls you're up against. All very clever stuff, but I would advise looking at the demonstration and playing the game before you start creating your own havoc because things do get just a shade weird as you progress throughout the various levels.

Before play starts you are asked to select level, number of players and speed once done a mere flick of the fire button brings your wizard to life. The basic idea of this game is indeed a simple one. You must proceed along the platforms up and

down rope ladders and lifts, collecting goodies while hunting for a key which you must take to a lock to get you through to the next level.

This first level completed, you are next introduced to your first ghost which shares your account in the effort to end your mystical life. A mirrorball (here a star) when you do expire and tumble to the base of the screen your wizard's hat falls off and he ends up on his back with stars floating above his head.

The graphics are quite simple but effective and the levels of play do get harder as there are more hazards to contend with which present new problems as you go.

At 99.99, I think it's a bit overpriced for what it is especially since, if it was less expensive, I think it would be worth a look.

DA



Karateka

Atari/Amiga £9.95



EVEN A SUPERLATIVE HOME COMPUTER such as the OS4 has limitations and this game demonstrates its graphics capabilities to best advantage but at the inevitable cost of speed. The animation is by far the best I have seen but these movements are reminiscent of the slow motion sequences in a Bruce Lee film.

As a karate expert (the karateka of the title) you have undertaken the task of releasing the imprisoned Princess Mariko from the dungeon deep inside the castle of Lord Akuma. Each section of the game is loaded separately from tape and the first sequence shows the imprisonment of the Princess in a sequence worthy of any cartoon on television.

The first action screen takes up the story from the point where the karateka hauls himself up over the edge of the cliff upon which the castle stands. Immediately before him is the gate to the castle courtyard and a guard ready for combat. Fortunately for our hero this heroism of Akuma is relatively unskilled in the art of karate and soon you are on your way past his huddled corpse, running through the courtyard prepared to fight your way to the side of the prison.

There are two modes for our fighter in this game, one is the fighting position and the other is running. When behind the karateka who inadvertently runs into a guard unprepared for battle, the first blow is always fatal and with only one life to lose his years of training will prove fruitless.

After gaining entry to the castle more guards are encountered but these battles are often preceded by an attack from Lord Akuma's trained bird of prey which will deplete your stamina unless you kick or punch your way out of trouble.

Successfully fighting your way through the main hall brings you to a challenge which helps to set this game above the plethora of karate simulations which

appear to be flooding the market at the moment. You are faced with the problem of passing a bamboo curtain which acts like a portcullis. The unwary karateka meets a sticky end and at this point under the sharpened stress of the curtain and a little thought is required to pass this barrier.

The next phase lies still deeper in the castle. Even the Princess has heard the stirrings outside her prison and hopes springs anew. The next opponent is a grim faced man, a karateka of immense ability whose defeat leads you to a doorway which is apparently impenetrable. Each attempt to rush through results in a loss of stamina and much thought and forward planning is required to breach this barrier.

For my money Karateka for outside any karate game which I have played, including Melbourne House's highly successful Exploding Hat. Despite the slow reaction of the main character, I found myself too involved in ding dong battles to notice. If I were to suggest a top 10 of OS4 games essential to anyone's collection this would certainly feature if only for the quality of the graphics.

D.B.

TERRORMOLINOS

Melbourne House £7.95



IT HAS TAKEN SOME TIME FOR THE authors of Hampstead to come up with their next offering but I can assure you that Terrormolinos is at least as sensationally amusing as its predecessor.

The object of this "well crucial" adventure is to survive two weeks in the God-forsaken hole called Terrormolinos

and take 10 (good) holiday snaps to prove you've suffered it, too believe me when you've only got to the front door you're going to need a holiday!

The game starts with you as husband and father (the authors are obviously chauvinistic) at home doing the packing which you've left till the last minute while

the taxi is on its way to take you to the airport. Simple, you may think, but there are certain things you have to find before you will even be allowed in the taxi, which presents a problem as the arrival of the taxi, to a certain extent, heralds the end of your packing time, and if you haven't finished your packing or, conversely, if you've packed too much, the taxi will drive off and leave you and that will be the end of your holiday. As you proceed through the game you will experience some quite funny pictures which are displayed whenever you have made a fatal mistake or you want to recall one of your snaps to find out if it is a good one. This is important as you only have a film with 12 exposures and, as already mentioned, you've got to take 10 pics to win the game - that is if you accept that there are any winners in a game like this.

In short this adventure is everything you would expect from the shape that created Hampstead and I'd like to congratulate them on not only a great follow up but allowing us all into the secret of what a good holiday is not about.

D.B.



HENRY'S HOUSE AND FRIENDS

English Software (6.9)

7 8 9 9

HENRY'S HOUSE AND FRIENDS IS, AS the name suggests, a compilation package, from English Software, comprising four of the old favourites.

Three are arcade games and the last one, *Wounded*, is an adventure with graphics not too dissimilar to *Level Nine's* game, but unfortunately that's where the similarity ends.

They have been presented on one cassette with two games on either side. Side one carries *Henry's House* and *Jet-Boot Jack*, both of which are platform games which are even at the lower levels quite difficult.

In *Henry's House* you find yourself as little Henry in the clothes-cupboard of the royal household. It wonder if of ED knows what the little honor is up to, bliss his little spun-gold socks, but if she doesn't you'll find out when you play the game.

Your task is to guide Henry round the screen collecting various goodies and avoiding some really gruesome obstacles, like boos which, if you're not quick enough, stamp on the little chap, so you (and HRH of course) can proceed to the next level. It's a good game with really good graphics but it needs some perseverance as the collision detection can only be described as feeble, which is something I found with all three arcade games in this bundle.

Next is *Jet-Boot Jack*. It's much the same as the previous game but I didn't think it was as good, although it is quite difficult to get used to, and therefore will worth playing.



Jack is a musical fiend and with *Jet-Boots* flanking he steps up and down lifts and along slides in an attempt to cross the largest music collection in the galaxy. This you can safely assume is not without its attractions, namely bugs and germs which are bent on stopping the intrepid Jack. These little bighorns are disposed of by jumping up and down on the platforms above them till they lose their grip and fall to their doom.

That's one side of the tape done. On the other side is the adventure branded and another arcade game called *Neptune's Daughters*.

The adventure isn't that good, basically due to its complete lack of any atmospheric descriptions and its irritatingly small vocabulary. It is to say

the least completely uninspiring, but I suppose it's a good break from all that climbing, collecting, and rapping you get in the other three.

Neptune's Daughters is a sub-separate maze game where your task is to rescue the daughter who has been captured by the evil sea serpent. To do this you must face various hazards such as deadly snake plants, swarms of amoeba, morose crabs and an indestructible octopus. This, as I'm sure you can imagine is all great fun.

HRH and *Friends* is as a package well worth looking into. It will give hours of fun at a reasonable price. An ideal family entertainment substitute for those boring film repeats at Christmas time - besides with four games on one tape it'll save space. **D.P.**

MONDY ON THE RUN

Genie Graphics/C4/18.95

3 9 7 9



Mondy's out! After breaking jail in *Mondy on the Run*, this game picks up the story of his life on the outside.

As you might imagine, *Mondy's* world is jam as full of hazards as his imprisonment was and a nimble joystick will be needed if you are to help him complete his escape.

Each screen is filled with crushing rocks, bouncing beams and tumbling servers. Add to this the accompaniment of some of the best music I have heard in a game and the stage is set for fun and excitement.

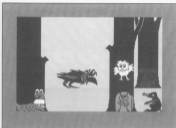
One feature which lifts this out of the hundreds of other platform games is *Mondy's Freedom Kit*. At various points in the game *Mondy* will reach impossible barriers, impossible that is if the correct item is not in *Mondy's Kit*.

The list of objects for use in the kit consists of over 20 potentially useful items but only five of them can be used. My favourite objects are the ladder and the barrel of rum. With these items you can at least guarantee that if *Mondy's* stick he can always climb the ladders, jump into the rum and go out smiling. The graphics for the game are quite varied but it is obvious that it is a conversion from the original Spectrum version though a few extra drawings have been added to improve the look of it.

The animation of *Mondy* is rather cute. Instead of jumping he somersaults everywhere throughout this fascinating game. **I.C.**

ORM AND CHEEP: THE BIRTHDAY PARTY/NARROW SQUEAKS

Macmillan Software £ each



ORM AND CHEEP HAVE QUICKLY established themselves as firm favourites on ITT's children's programmes and their adventures are ideal for a computer game or two.

These two cassettes from Macmillan Software bring the whole cast to the computer screen in a series of games which should hold a child's interest for quite some time. The games are by no means simple to play and require quite sophisticated mental abilities. On the other hand the control of all the games is the same and one key is all that is needed. This can be on the keyboard or joystick so anyone can play.

The Birthday Party is Orm's celebration but the guests have to be found. This is Cheep's job but first he must help Orm to find the ingredients for the birthday cake.

As Orm crawls under a shelf or juts a symbol appears which indicates the content of each jar in turn. When Orm reaches the edge of the screen a speech bubble appears with an ingredient symbol and Cheep hovers over each jar in turn. When you think he is over the correct jar, a keypress will reveal if you are right. If you are not all of the jars crash to the floor one by one and the game starts again.

The next challenge is to wander through a simple maze to find the other party guests, Mouse, Hedgehog and Owl. While it is in his underground tunnels which form a second, more difficult maze to explore.



Reaching the first three is quite easy except that Hedgehog tends to be trapped by one of the villains of the piece: Crow, Rat or Cat. If Cheep is accompanied by the correct combination of friends, each of their enemies will disappear.

Each junction has a signpost whose arms change colour one by one. When a key is in the right direction you press a key and off Cheep goes.

Eventually the entrance to Mole's home is found and Cheep must enter alone, find Mole and get out again. At this point I would strongly advise mapping the maze because it is difficult to keep track of where you are.

Each tunnel leads to a small chamber with more tunnels leading from it. When you enter a new chamber the tunnel you have just used is always at the bottom of the screen so even using a map you have to turn it this way and that to follow Cheep's progress. To add to the complication, some of the tunnels are blocked by Rat, Cat and Crow.

Returning to the outside world the group makes its way back to Orm's house for the party. Orm is a little fussy and insists that everyone sit down in a particular place. As you move each guest around the table Orm switches his head and a beep is heard for each place which is correctly filled by a guest. Since Orm's empty space is also indicated by a beep this game can be difficult to play and even I found it a challenge. It's a bit like playing Mastermind.

Once you succeed, Orm disappears to get his cake and Crow pops his head in causing everyone to panic and change places at the table. This does not suit Orm when he returns and once again the guests have to be rearranged into a new order under his direction before the party can at last proceed.

The second cassette, Narrow Squeaks, has a different set of problems to be solved. It begins with Cheep trying to make Orm by piling up coconuts which then crashes into a broken pile. This certainly makes Orm and I'm surprised Cheep doesn't end up as Orm as Vin after such appalling behaviour.

Next Orm is trapped by Crow and can only be rescued by watching the movements of his friends. When the pattern of movements change a keypress will cause Crow to move further away until he eventually disappears off the screen and Orm can escape.

The friends are then trapped in a tree hollow by Rat and Hedgehog to protect them as he guides them out. This means keeping him between Rat and his friend as they move across the screen.

Finally a flood has floated Orm away on his bed. As he is carried along by the flow he means the enemies floating on branches. He must steer his way so that he just touches the edge of each branch, spilling the enemy into the water.

After each section a scoreboard is shown but, instead of giving a numerical score, or sections of a picture is revealed.

Both packages are nicely illustrated in graphics and sound but I did feel that one or two of the games were extremely difficult for a young audience though perhaps with parental advice this could teach skills which would not be learned so easily in any other medium.



DONALD DUCK'S PLAYGROUND

US Gold £19.95

7 5 7 7

WALT DISNEY'S SECOND MOST popular cartoon character paves the way for the much heralded education series distributed by US Gold.

Very American in flavour, this is an excellent vehicle for teaching children about the relationship between work, pay and spending in an ideal world. Well, an ideal Capitalist world anyway.

After selecting one of the three levels of play we find Donald in the high street with shops to the left and workshops to the right. Using a joystick you can guide him into any of these buildings but lacking money it's best to give the shops a miss and try a bit of good honest toil instead. No dishing the world of work, Donald.

The choice is between working in a signal box, a toy shop, produce market (fruit and veg market to us) or at an airport.

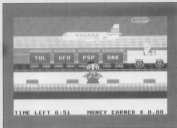
No matter which option you select the first task is to decide how long the job will last. Duration can be anything from one to eight minutes and as each job is completed a sum of money is added to Donald's earnings.

As a signaller, Donald must control six sets of points on a railway network to get the Amosack Express to its destination by the shortest possible route. Each time a journey is completed a new destination is indicated and so on until the time runs out.

The toy shop tests a child's skill at matching colours and shapes. A toy will appear on the conveyor belt to the right of the screen and Donald has to position a ladder by the correct colour of shelves, collect the toy and then climb up and place the toy on the correct shelf. To add to the fun, the Amosack Express passes when a clock ticks down to zero and if Donald doesn't pull the shutters across all of the toys will fall off the shelves and smash to pieces.

Boxing fruit and vegetables is the task at the produce market. As each item is thrown from the back of a lorry, Donald must catch it and drop it in the correct box. If he misses a catch or drops the item in the wrong box, Donald's wife is criticised as he babbles his dissatisfaction. It's speaking as I thought.

The final option is to be a porter at the airport. A conveyor belt carries boxes with three letters on them which relate to the letters on luggage cars being towed across the screen. With the kind of care and attention one've grown to expect from luggage handlers world wide, Donald is made to grab a box and throw it in the general direction of the relevant track. If it lands in the correct one Donald earns



some money; if it lands in the wrong one nothing is said, but like the real world, isn't it?

Once a sum of money is earned Donald can go to the shop to buy various items to add to the playground for his nephews Huey, Dewey and Louie. The three shopkeepers are Mickey Mouse, Minnie and Goofy.

Each item for the playground has a price and Donald can flick through the catalogue until he finds something he can afford. The picture then shows Donald's stack of money and a till. Using an arrow cursor, coins can be moved one by one into the transaction square until the value is equal to or higher than the item he wishes to buy. If he needs change the till opens and you are invited to sort out the correct amount.

Care must be taken to select a sensible collection of items for the playground because it is three floors high so at least three ladders or cargo nets should be provided so that the nephews can climb up to play on the top level.

One strong complaint I have to make is that all the money is in dollars. Granted the instructions state, rather badly, that this was maintained because of the complexity of the program and that it's good to learn about other people's culture is culture the correct word? If the designer's are a group of educationalists they ought to understand that this kind of play can completely disassociate children from linking the game with the real world around them. Please US Gold request permission to change this (and the questions to Monster Truck) and you will increase your turnover.

Despite this niggle the game is excellent and well structured. Potentially a useful learning tool.

E.D.

▶ ACTION REPLAY



FRANK BRUNO'S BOXING

File Systems: 17.00 (hard) 133.00 (disk)



THE GLOVES ARE OFF IN THE BATTLE for the boxing simulation market and I predict that this is the one which will take the championship.

The game is quite complex to play requiring the use of either a joystick and the keyboard or two joysticks. This means that it would be best if you had a joystick which could be held down by rubber suckers but I've seen that some of the inventive minds out there will find their own solution to the problem.

of both fighters, below the line is the boxing ring itself.

At first the range of movements are limited to ducking, dodging left or right, head punches and body punches. As each of Bruno's punches makes contact, a line moves across the bottom of the scoreboard towards a KO symbol. When this symbol is reached the meter flashes going Bruno the ability to use his strong right hand and uppercut to floor his opponent.

Each bout is a one round fight and either of the boxes hit the canvas three times within the round they are out for the count and the bout ends. This is the only way to decide a fight, a points decision is not catered for.

The view of the ring is an interesting one from behind Bruno. This makes a pleasant change from the usual lateral view that other versions use and is visually more dynamic. The opponents are monstrously large sprites and the quality of the game is very high indeed.

Playing the role of Frank Bruno, there are eight opponents to be defeated on your way to the World Championship. Each new fighter has an amusing name according to his nationality and they become progressively more skilled and difficult to beat as you rise in status. Each fighter must be beaten before you can go on to meet the next one. This is because of the security system. On winning a match you are given an Ite Video Boxing Association Membership Card which is calculated according to your initials. On selecting the lead option from the menu, you are asked for this code before loading will take place.

The game is found inside one and the data for the boxes is located on side two of the cassette version. The only problem I found with this system is that the code is difficult to read but perseverance will eventually bring success.

The screen display is split horizontally and above the middle line you can see the score chart flanked by a cartoon portrait

PARADROID

Homeon Consultants 47.95



A PARANOID ANDROID, OR INFLUENCE device as it is more correctly called, has been set up to suppress or destroy the rogue androids on a large space freighter. Its communication system beams out a signal to your computer and from the image received it is possible to clear the decks of danger and reposition the ship.

As a follow up to the ultra-rare Gibby's Day Out, this game displays the same concepts involving screens when the paratroid is moved around the decks,

A parasite needs a host as an energy source and this is such a device is no exception. When a droid is encountered the decision must be made whether to blast it with a beam from the twin laser guns or to suppress it. If the latter option is selected then the host droid will move and the screen changes to show a direct interface with the paratroid. As the top of the paratroid towards is a square which must be changed to the correct colour of your influence device if you are to succeed in gaining control. Failure results in an

explosion which will destroy both host and parasite, taking you back to the start of the game.

Limited energy reserves make it essential to change host regularly or an alternative is to recharge at the power points scattered around the ship. To find these places often means logging on to one of the many computer links found on every deck. From here it is possible to call up a small scale map of the current level to see where the recharging stations are situated. It is also possible to display an overview of the arrangement of levels within the ship to plan your next move or gain information about the other droids.

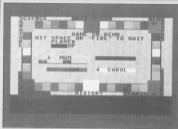
After blasting your way around a particular level the lights are automatically dimmed to indicate that there are no more droids around and it is time to find a lift to another floor where the whole process of blasting and repositioning starts again until the whole ship is cleared.

Although the programming is of a high standard and the concept is sound, I found the game to be a little monotonous. However, I describe the game as 'the thinking man's shoot-em-up' but I would expect a few more challenges before I'd accept that title. **E.D.**



TRIVIA UK

Amiga / C64/128k



Trivial Pursuit at a price everyone can afford courtesy of Amiga.

What you get for your money is a twin cassette pack containing the master program and plenty of questions to keep you busy but more than that, there is an editor program which allows you to create your own questions on tape.

The appearance of the game is fairly unimpressive and it is obviously written in

Basic with no soundings. This does not detract too much from the game and there are two interesting features over any other version which I have seen.

Firstly, the questions are tailored for the British market though they are not too demanding, more like a junior version of paraits. For example, which player scored three goals for England in the 1966 World Cup final and which famous DJ was

once married to actress Tessa Wyatt?

Secondly, instead of typing the answers into the computer each player must call out his answer and on pressing a key the correct answer is revealed and the computer asks if you got it right. This eliminates problems such as entering World War II only to find that the computer says that you are wrong and that the answer is the Second World War. Of course this does not eliminate the work of nubile fingered cheats.

The questions fall into one of six categories and the board consists of a square ring of boxes each with a color corresponding to one of these subject areas. The corner squares and the central square on the top and bottom rows are larger boxes squares.

The computer rolls a dice to decide how many moves the current player can make. If the question is answered correctly, the player moves around the board. If the player is on a larger square a piece of pie is awarded and the first player to collect six pieces is declared the winner on answering a question from a category chosen by his opponents.

The one serious drawback to this game is that it doesn't speed load the questions and it takes ages to load each block of questions (30-40mins). Hell was through the game the computer may have to load up another set which means another long wait. I hope there is a disk version on the way! **JL**

ANIS ASSASSIN

Amiga/128k C64



IT'S A LONG TIME SINCE I SAW AN home, a complicated shoot-em-up. In fact the last one I remember which was as frantic as this was *Gridman*.

Arcade fanatics will be familiar with the scenario. A three dimensional grid

disappears into the distance and various geometrically shaped objects work their way quickly towards you. You have a gun which fires along the near edge of the grid and you have to take everything that's thrown at you.

In this version a small spiky object appears on the grid and wastes your shots before the game starts. Then all the levels focus on various creatures hurtle along the grid switching lanes as they go. Some are intent on making it up to the edge that you are patrolling while others weave their own webs.

If you find yourself in a sticky situation with one or more 'things' on your back line you can move down the grid turn and fire back at them. Although this kind of activity can be totally absorbing, you

have to keep your wits about you and your eyes open because the web spiders will try to fill up a pathway and then it cannot be crossed so more of the dangerous kinds of creature can reach your row to menace you.

After a while, if you last long enough a giant spiky object appears which is the signal to look down one of the channels firing like crazy until you shoot off the reel and a new grid is drawn.

Each grid differs from the last in shape and poses fresh problems. One in particular can totally confuse you as to which way to move the joystick.

If you want a tip on how best to play this game I'll tell you. Keep firing and panic like crazy and with a bit of luck you'll win through. **LD**

COMMODORE 64



"IMHOTEP" recommended retail price £9.95 inc VAT.
Available from W.H. SMITHS, BOOTS, J. MENZIES, WOOLWORTHS
and all good software retail outlets. Also available from

ULTIMATE PLAY THE GAME, The Green, Ashby-de-la-Zouch, Leicestershire LE6 5JU
(P&P are included) Tel: 0530 411485



MACH 2

Here's part two of our
Machine Code
Development System
by Steve Carle. This
month we bring you
the Macro Processor.

The Macro Processor

This month I will give listings of the Macro Processor and I'll also explain more about MACROS and their use.

The Macro Processor is an "internal" command file which is loaded by the Monitor and executed as if it was an internal command. The program resides in memory at 8008 hex, and is called at this address. The call command should contain the names of the files which are to be processed—more on this later.

Type in the four basic listings given here. Again I suggest that you save them all before RUNNING.

When they are ready, RUN them in sequence up to first, then save the generated program with the command:

```
PO8141:PO8141:44:PO81  
45:11:PO8146:78:SAVE"  
MACRO2".L1  
PO8141:1:PO8146:81:NEW
```

so you can use the monitor's command giving MACRO:8008 and WLD as filename, first address and last address respectively. Either way, you should now have a copy of the finished program.

Running the Macro Processor

The syntax of the external command for calling the Macro Processor is:

```
MACRO (sourcefile) (targetfile) (macrolibraryfile)
```

The macro library file is optional and can be the name of a library file up to 80 in length. Note the spaces between each entry. These must be included. If file names are omitted from the command, the Macro Processor will request them by issuing the prompt ENTER FILENAME(s) whereupon you should enter the names of the files in the same format as above, without the command MACRO of course.

Macros and Their Uses

In a machine code program, there may be sections of code which are identical or nearly identical differing only in the operands. It can become rather tedious having to type in these copies of the same text. Wouldn't it be better to have some sort of "in-line" code generator which would accept some parameters and alter the text to suit?

This is basically what a MACRO is. A section of code which can be altered to suit a particular application. The programmer gives the MACRO a name and supplies parameters and the processor generates the code. MACROS may be kept in library files or appended onto the end of a program.

To make this a bit clearer, consider the following example. Suppose in a program, a sequence of three almost identical lines repeats itself on several different

occasions. On one occasion it may be:

```
DELAY1 L00: 80F  
DEL1 D13  
80E DEL1
```

and on another occasion it may be:

```
DEL:52 L10: 800  
DEL:2 D13 80E DEL:2
```

As you can see, they are very similar, differing only in operands and symbols. For reference only, I will call the first example DELAY1 and the second DELAY2. These are actually the symbols used and not the name of the MACRO.

OK let's make this section of code a MACRO. To form a MACRO we have to define it by preceding the actual code with a couple of lines containing the name and any parameters used. A MACRO of our routine thus becomes:

```
MAC  
: opening delimiter  
L DELCODE TIME  
: definition line  
L LDX @TIME  
: actual code  
DEL:58 D13  
80E DEL:58  
MNO  
: closing delimiter
```

Every MACRO has an opening and a closing delimiter. The definition line contains the name of the macro and any parameters used in the body of the routine itself. Here, L is a formal parameter for a label supplied by the MACRO call, TIME is a formal parameter for the actual delay amount and DELCODE is the name by which the MACRO is to be called.

Note that L is positioned in field 2 (beside the first line of the routine. If a parameter is declared in a MACRO definition, then the actual parameter must be supplied in the call. An exception to this rule is the symbol parameter in field 2 (here, this is the L). If this is declared in the definition, it may or may not be in the call. However, if any MACRO call contains more parameters than are in the definition, an error will occur.

One other thing here. Notice the DEL:58 symbol in this format, each time the MACRO is called this will generate a unique symbol by adding numbers onto the end of the DEL.

This number is a serial number which is incremented for each MACRO call. Thus, if the macro call is the first, the symbol will become DEL:000 and if the call is the eighth, it will become DEL:007.

Right, our MACRO is ready to be called. The format of the calling line is, in these cases:

```
DELAY1 DELCODE FF and  
DELAY2 DELCODE 80
```

Now, assuming our MACRO was to be called by the first of these two lines (i.e. DELAY1) then the generated code would be:

```
DELAY1 L00: 80F  
DEL:000 D13  
80E DEL:000
```

assuming that this was the first MACRO call.

Our second example, assuming it was the second MACRO call, would be:

```
DELAY2 L00: 800  
DEL:001 D13  
80E DEL:001
```



It, in the MACRO call, we leave out the label as in:

```
000006 #F
```

then the MACRO will be generated as:

```
000000 LDH    #F
000002 DEX
000004 BND    000007
```

assuming that this is the third MACRO to be called.

Let's try a program. When you have finished this example, keep the files that are created for next time when you will be able to assemble the code.

A Programming Example

Before starting this example, make sure you have the Monitor/Editor and Macro Processor programs on the same disk and that you have

made backup copies of them. Having a "working disk" with your utilities on it is by far the most convenient arrangement. If disaster strikes and you corrupt the disk, at least you will have a utility master disk as backup although you should of course backup any important source files too.

Another convenient thing is to have a small loader program as the first file on your working disk. Thus when starting out, all you have to type is:

```
LOAD"*.L"
RUN
```

and you'll load the Monitor.

A typical loader program, in Basic, would be:

```
10 A$=1:IF A=2 THEN GOTO 1000
20 PRINT "LOADING"
30 LOAD "MONITOR".L
```

Right now, on to the example. First, we will create a MACRO library file. MACRO definitions may be held at the end of a source program or in a library file. The latter is, I believe, the most convenient arrangement.

Load and enter the monitor. Now issue the command EDITOR to get into the editor.

The message NEW FILE will appear. Type the command A. The first line number will be printed and the cursor positioned at the start of field 1. Type in the following program. Remember that you can use the F1 key to TAB to the new field. As a guide, there is a heading giving the field numbers. Don't type it in!

| FIELD | FIELD | FIELD | FIELD |
|-------|---------|--------|----------------|
| 10 | | MAC | |
| 20 | 1 | CITUNE | PROMPT_POINTER |
| 30 | 1 | LDH, | MAC_SER |
| 40 | | LDH | MAC_SER |
| 50 | | ISA | \$A000 |
| 60 | | ISA | \$A000 |
| 70 | | STS | POINTER |
| 80 | | STS | POINTER-1 |
| 90 | | ISAP | \$B000 |
| 100 | MAC_SER | EXT | PROMPT |
| 110 | | BT | 0 |
| 120 | | END | |

In response to the prompt, type the filename MACLIB.p00 for MACRO library and hit return.

When the line number 120 appears, hit return to cancel auto-mode and type * to save

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the file and exit to the monitor.

What this MACRO does is to generate code which, when assembled, will output a prompt given by the user parameter PROMPT and accept a line of input from the keyboard. When return is pressed, the start address of the area of memory where the input line has been stored by the BASIC ROM routine \$AND is put into a pair of locations given by the user parameters POINT1.

Now we will deal with the actual program. When it is finally assembled, it will:

- 1 Clear the screen
- 2 Print a prompt
- 3 Accept input from the keyboard
- 4 Print out what was typed in.

It will use the MACRO GETLINE for steps two and three. Don't worry too much about the meanings of the various instructions such as ORG and EQU. These will be explained when I deal with the assembler.

Again, there is a bold heading to help you. Enter the editor and give the filename as MACTEST. Enter auto-numbering mode and type the following:

| FIELD1 | FIELD2 | FIELD3 | FIELD4 |
|--------|-----------|---------|-------------------------|
| 10 | | ORG | \$C80 |
| 20 | TEXTPOINT | EQU | \$H |
| 30 | CHROUT | EQU | \$T00 |
| 40 | | LDI | \$R1 |
| 50 | | SR | CHROUT |
| 60 | | SR | LINEINPUT |
| 70 | | LDI | \$ |
| 80 | LOOP1 | LDI | (TEXTPOINT) |
| 90 | | BEQ | END |
| 100 | | SR | CHROUT |
| 110 | | INY | |
| 120 | | BNE | LOOP1 |
| 130 | END | RTS | |
| 140 | LINEINPUT | GETLINE | YOUR-NAME, TEXTPOINT |
| 150 | | END | |

Join the editor using the * command and type ORG. You should now have two new files called MACLIB and MACTEST. To see them, use the TYP command in the form TYP MACLIB or TYP MACTEST. The Monitor will list them directly to the screen. Note that

the MACRO is to generate a subroutine and not, in this case, in-line code.

As you can see, the MACRO GETLINE is called in line 140. Notice the prompt parameter. Instead of spaces between the words, there are dashes. This is an unfortunate restriction imposed by the MACRO Processor. Parameters must not contain spaces. Multiple parameters should be separated by commas. The Macro Processor will only allow characters which are relevant to the assembler to be passed through.

Right. Now we will process the file MACTEST. Give the following Monitor external command:

```
MACRO MACTEST MACOUT  
MACLIB
```

Note that MACOUT is the name of the output file. The disk drive will activate and after a few moments, the screen will clear and the following message will appear:

```
COMMODORE 64 UTILITY  
$R15  
MACRO PROCESSOR V1.0  
©: THE S.D.C.
```

There will be much disk activity and, if all is well, the machine will reenter the monitor. Type ORG and you should see that a file MACOUT has been created. Use the TYP command to list the file to the screen. You should see that the processor has inserted the

MACRO where the call was and that the parameters have been inserted in their correct places. Note that, because the Macro Processor performs a renumber on the file, the line numbers will be different. Keep this program for later assembly.

Now, if you have been given an error message by the

Error Summary

There now follows a summary of error messages given by the Macro Processor. When an error is detected, the message is printed along with a line number, and the processing is aborted. The line number may not be all that helpful, so watch out!

| Error Message | Meaning |
|-------------------------------------|---|
| FIELD 2 LENGTH | All field 2 entries are limited to a maximum length of nine characters. This Macro Processor does not allow nested MACRO definitions. In other words, a second MAC was found before the first MEND. Note that nested calls are allowed. |
| ILLEGAL NESTING | The MACRO called does not exist. |
| UNDEF'D MACRO | The MACRO called does not exist. |
| MACRO NAME | name is too long or it is of an illegal type. |
| FIELD 3 LENGTH | same length conditions as field 2 apply to field 3 parameter syntax error. |
| FIELD 4 SYNTAX MISSING DELIMITER | applies to field 4 only. Although field 4 may extend for 31 chars, each entry may only be up to nine chars long. |
| MISSING PARAMETER | Field 4 again. There must be an equal number of actual and formal parameters in a MACRO call. |
| NO SUCH PARAMETER | no-MACRO name was given in the MACRO definition. |
| MISSING NAME | there was a problem with the disk typically the write protect was on. |
| FILE ERROR | MACRO calls may be nested up to six levels. This error is gen if this limit is exceeded. |
| PARAMETER STACK OVERFLOW | only the .SR format may be used to terminate a symbol. |
| ILLEGAL SERIAL FORMAT | |

processor, check your two source programs for mistakes. It has to be said that the error messages are not all they could be, but at least they are better than Sinclair-type numeric codes!

Next month will come the assembler listings and a description of the various symbols, instructions, etc. You will also be able to assemble the example program given earlier and run it.

More Listing 1

```

10 DATA 76,7,151,147,13,67,79,77,7
7,79,69,79,62,63,32,34
20 DATA 52,32,65,64,73,76,73,64,69
,37,63,69,62,73,63,63
30 DATA 13,77,66,67,62,79,32,60,62
,79,67,69,63,63,79,62
40 DATA 32,66,49,46,49,13,40,67,41
,32,49,67,66,63,32,63
50 DATA 48,69,48,67,66,13,13,0,69,
79,64,69,62,32,70,73
60 DATA 78,69,78,65,77,69,40,69,41
,39,0,147,13,77,65,67
70 DATA 62,79,32,60,62,79,67,69,63
,63,79,62,32,65,62,62
80 DATA 79,62,32,76,79,71,13,13,0,
70,73,63,76,69,32,60
90 DATA 32,76,69,79,71,64,72,0,73,
76,79,63,71,66,79,32
100 DATA 79,69,63,64,73,79,71,0,65
,79,69,69,70,39,69,32
110 DATA 77,65,67,62,79,0,77,65,67
,62,79,32,79,65,77,65
120 DATA 0,70,73,65,76,69,62,61,32
,76,69,79,71,64,79,0
130 DATA 70,73,69,76,69,32,62,32,0
3,69,79,64,65,69,0,77
140 DATA 73,63,63,73,79,71,32,69,6
9,76,73,77,73,64,69,62
150 DATA 0,77,73,63,63,73,79,71,32
,60,66,62,65,77,63,64
160 DATA 69,62,0,79,79,32,63,65,67
,73,32,60,65,62,65,77
170 DATA 69,64,69,62,0,77,79,63,63
,73,79,71,32,79,65,77
180 DATA 63,0,70,73,76,69,32,65,62
,62,79,62,0,60,65,62
190 DATA 65,77,69,64,69,62,32,63,0
4,65,67,75,32,79,66,69
200 DATA 62,79,76,79,67,0,73,76,76
,69,71,65,76,32,63,69
210 DATA 62,73,66,79,32,70,79,62,7
7,65,64,0,0,0,121,144
220 DATA 136,144,152,144,166,144,1
77,144,182,144,207,144,226,144,243
,144
230 DATA 9,145,19,146,29,145,51,14
5,65,69,67,65,79,69,65,63
240 DATA 76,66,67,67,66,67,63,66,6
9,61,66,73,64,66,77,73
250 DATA 66,79,69,66,60,76,66,66,7
9,66,66,67,66,66,63,67
260 DATA 76,67,67,76,69,67,76,79,6
7,76,66,67,77,60,67,60
270 DATA 69,67,60,69,69,69,69,67,69,6
9,69,69,69,69,69,69,62
280 DATA 73,79,67,73,79,69,73,79,6
9,74,77,60,74,63,62,76
290 DATA 69,69,76,69,69,76,69,69,7
6,63,62,79,79,60,79,62
300 DATA 65,60,72,66,60,72,60,60,7
6,65,60,76,60,69,79,76
310 DATA 62,79,62,69,64,73,62,61,6
9,63,66,67,63,69,67,63
320 DATA 69,69,63,69,73,63,64,65,6
3,64,69,63,64,69,61,65
330 DATA 69,64,65,63,63,64,63,69,64,6
0,65,64,69,63,64,65,65
340 DATA 77,65,67,77,79,69,69,69,7
0,69,69,64,61,69,64,67
350 DATA 62,69,69,66,69,79,62,71,6
9,61,65,65,79,69,69,69
360 DATA 64,32,121,0,209,19,169,72
,160,144,32,30,171,32,66,169
370 DATA 134,129,132,123,32,115,0,
240,232,32,9,190,142,204,2,132
380 DATA 251,160,2,132,292,160,0,1
77,261,193,205,2,200,204,204,2
390 DATA 144,245,169,0,141,208,2,3
2,121,0,32,9,130,142,240,2
400 DATA 132,251,160,2,132,252,160
,0,177,291,153,241,2,200,204,240
410 DATA 2,144,245,32,121,0,240,25
,32,9,130,142,209,2,132,251
420 DATA 160,2,132,262,160,0,177,2
51,153,209,2,200,204,209,2,144
430 DATA 245,96,165,1,41,254,133,1
,96,165,1,9,1,193,1,96
440 DATA 169,12,141,32,209,165,6,1
41,134,2,169,3,160,144,79,30
450 DATA 171,160,0,177,162,170,200
,177,162,133,123,134,162,96,165,0
460 DATA 133,63,133,70,133,71,141,
64,3,141,60,3,141,96,3,160
470 DATA 4,177,122,153,60,3,240,27
,200,152,14,144,244,177,162,153
480 DATA 69,3,240,15,200,132,24,14
4,244,177,122,153,72,3,240,3
1000 F0RKS=36864 TO 37631
1010 READ: F0RKS, A
1020 NEXT
1030 PRINT "FINISHED"

```

Macro Listing 1

```

10 DATA 200,208,246,180,0,186,84,3
,32,30,130,144,10,200,132,10
20 DATA 144,243,162,1,78,213,150,2
01,48,240,242,201,84,240,238,132
30 DATA 88,201,0,240,38,160,0,186,
80,3,32,30,130,144,10,200
40 DATA 192,10,144,249,162,5,76,21
3,130,132,70,201,0,240,12,160
50 DATA 0,186,86,3,240,3,200,208,2
48,132,71,86,186,70,201,3
60 DATA 208,48,168,104,162,145,133
,81,134,82,162,0,160,0,177,61
70 DATA 217,80,3,208,6,200,132,3,1
44,244,86,232,224,67,240,16
80 DATA 166,61,24,106,3,133,61,162
,62,106,0,133,62,76,82,147
90 DATA 24,86,160,0,9,48,72,168,84
,145,253,200,104,145,253,200
100 DATA 96,168,12,24,101,253,133,
253,168,254,105,0,133,254,168,0
110 DATA 168,145,253,86,186,0,32,1
30,147,162,63,145,253,240,17,200
120 DATA 162,0,189,84,3,145,253,20
0,232,288,68,144,246,32,145,147
130 DATA 96,134,2,188,86,3,32,30,1
30,144,8,145,253,200,232,208
140 DATA 242,201,84,240,246,201,36
,240,242,201,80,240,238,201,68,240
150 DATA 234,201,36,240,230,201,38
,240,228,201,37,240,228,201,43,240
160 DATA 218,201,48,240,214,228,2,
240,14,132,93,138,56,228,2,160
170 DATA 2,145,253,184,33,56,36,20
1,0,208,2,24,36,162,5,76
180 DATA 216,160,166,71,240,41,162
0,168,1,133,94,166,94,32,130
190 DATA 147,200,32,133,147,144,24
,200,32,145,147,230,34,189,36,3
200 DATA 240,13,201,44,208,4,232,7
6,88,148,162,5,76,215,160,36
210 DATA 168,0,162,138,133,253,134
,254,169,0,162,146,253,32,164,147
220 DATA 76,18,148,160,0,168,70,13
8,208,5,162,10,76,215,160,145
230 DATA 57,238,134,2,200,185,73,3
,145,57,200,186,2,144,246,160
240 DATA 10,168,58,145,57,200,166,
50,145,57,200,168,0,145,57,162
250 DATA 24,101,57,139,57,166,50,1
05,0,133,58,96,32,162,146,160
260 DATA 0,186,0,2,145,58,200,132,
4,144,246,186,0,2,145,58
270 DATA 240,3,200,208,246,200,152
,24,101,58,133,58,166,60,106,0
280 DATA 133,60,76,189,148,162,0,1
68,92,157,0,2,232,224,80,144
290 DATA 248,96,160,0,177,132,153,
0,2,200,192,4,144,246,96,160
300 DATA 0,162,4,168,68,240,52,186
,84,3,157,0,2,232,200,186
310 DATA 68,208,244,86,160,0,162,1
4,162,70,240,12,168,80,3,157
320 DATA 0,2,232,200,168,70,208,24
4,96,160,0,162,24,162,71,240
330 DATA 12,186,36,3,157,0,2,232,2
00,196,71,208,244,96,162,70
340 DATA 188,0,2,201,32,208,3,202,
208,248,232,188,0,157,0,2
350 DATA 96,168,0,162,138,133,30,1
34,91,86,168,12,24,101,30,133
360 DATA 96,168,81,105,0,133,51,86
,32,33,148,160,0,177,30,240
370 DATA 48,166,63,200,200,205,90,
208,34,200,162,0,177,30,221,84
380 DATA 3,208,24,200,232,228,63,1
44,213,160,0,177,90,163,84,3
390 DATA 200,177,90,163,84,3,200,1
32,83,58,96,32,48,148,76,53
400 DATA 148,24,86,162,255,160,255
,232,200,189,96,3,32,30,130,176
410 DATA 10,153,160,3,201,0,240,10
5,76,113,145,134,83,132,82,32
420 DATA 33,145,166,33,160,0,132,2
,177,90,208,24,166,33,124,32
430 DATA 188,96,3,32,30,130,144,20
5,153,160,3,201,0,240,66,200
440 DATA 238,76,160,148,200,200,17
7,50,133,84,200,189,96,3,202,30
450 DATA 208,53,200,232,230,2,165,
2,127,54,208,238,189,96,3,32
460 DATA 30,130,176,95,160,0,166,9
8,134,33,170,177,50,157,160,3
470 DATA 200,232,177,50,157,160,3,
232,134,82,164,32,168,33,76,121
480 DATA 148,200,132,71,76,255,148
,32,48,148,166,33,76,148,148,162
1000 FOR%27632 TO 30000
1010 READ A:POKE2,A
1020 NEXT
1030 PRINT"FINISHED"

```

Memory Listing 1

```

10 DATA 0,189,180,3,157,96,3,232,2
25,71,144,245,95,32,181,148
20 DATA 32,207,178,32,228,148,32,2
43,148,32,14,148,76,140,148,155
30 DATA 0,162,132,133,57,124,58,16
3,0,133,18,163,0,162,180,133
40 DATA 53,134,60,95,185,43,166,44
,133,162,134,123,180,1,177,122
50 DATA 208,18,168,18,208,3,160,0,
152,145,53,200,148,58,56,162
60 DATA 7,76,215,150,32,206,146,18
5,18,208,40,32,78,147,144,72
70 DATA 224,58,245,5,224,57,208,51
,162,7,76,215,150,169,255,133
80 DATA 18,32,133,146,52,208,146,3
2,83,148,32,54,148,32,13,150
90 DATA 78,168,168,32,78,147,144,2
3,224,57,208,10,168,0,133,18
100 DATA 32,13,160,78,168,150,224,
58,208,3,162,2,78,215,150,32
110 DATA 52,142,32,115,142,32,13,1
50,32,133,146,78,60,150,133,34
120 DATA 134,35,24,160,1,177,34,24
0,23,160,4,200,177,34,208,251
130 DATA 200,152,101,34,170,180,0,
145,34,168,35,105,0,200,145,34
140 DATA 134,34,133,75,144,221,96,
138,10,78,168,51,160,144,32,30
150 DATA 171,104,170,188,78,145,18
8,77,142,32,30,171,168,32,32,210
160 DATA 255,180,2,177,122,133,57,
200,177,122,133,58,32,184,188,32
170 DATA 18,130,162,26,108,0,3,32,
178,146,32,38,130,32,48,145
180 DATA 32,31,150,173,208,2,240,3
5,169,1,162,8,160,255,32,166
190 DATA 235,173,208,2,162,208,160
,2,92,189,235,169,0,27,32,213
200 DATA 235,144,6,162,31,78,215,1
50,32,52,150,169,1,162,8,160
210 DATA 235,32,188,235,238,32,208
,173,224,2,162,235,180,2,32,188
220 DATA 235,185,0,24,32,213,235,1
44,5,162,11,78,215,150,32,52
230 DATA 150,238,32,208,32,162,146
,169,0,162,180,32,174,150,32,169
240 DATA 146,32,108,162,32,173,161
,32,235,151,32,204,151,32,204,151
250 DATA 32,204,255,32,240,151,144
,3,78,57,152,32,208,148,32,78
260 DATA 147,176,6,32,60,158,78,13
1,151,224,65,208,3,78,54,152
270 DATA 224,58,208,3,78,57,152,32
,230,152,78,131,151,173,224,2
280 DATA 162,225,160,2,32,188,255,
169,3,162,8,160,3,32,188,255
290 DATA 24,32,150,255,178,21,32,1
84,255,208,16,32,32,207,255,238
300 DATA 32,208,72,32,188,255,208,
2,104,96,104,32,227,151,162,11
310 DATA 78,215,150,32,204,255,169
,3,78,185,255,162,3,78,138,255
320 DATA 32,235,151,162,4,134,2,32
,204,151,141,0,2,32,204,151
330 DATA 141,1,2,301,0,240,42,32,2
07,151,141,2,2,32,204,151
340 DATA 141,3,2,32,204,151,188,2,
157,0,2,201,0,240,8,232
350 DATA 134,2,208,238,32,204,255,
169,0,162,2,188,162,134,123,24
360 DATA 96,32,204,255,56,32,32,23
0,162,52,227,151,160,0,162,145
370 DATA 73,200,145,73,200,162,24,
101,73,133,45,166,74,105,0,133
380 DATA 45,165,43,166,74,32,174,1
50,32,33,130,32,147,162,168,15
390 DATA 32,185,258,78,0,130,163,9
,133,38,133,98,133,100,163,73
400 DATA 166,44,133,73,134,74,160,
0,152,146,78,200,145,73,169,15
410 DATA 32,185,255,32,36,130,162,
15,32,201,255,183,73,32,210,255
420 DATA 78,204,255,160,1,177,43,2
08,1,96,162,0,183,241,2,167
430 DATA 183,3,232,236,240,2,144,2
44,232,232,232,142,240,2,169,24
440 DATA 160,48,162,58,141,160,3,1
40,181,3,142,162,3,173,240,2
450 DATA 162,160,160,3,32,188,255,
169,1,160,235,162,8,32,188,255
460 DATA 188,43,165,45,164,46,24,3
2,218,255,178,7,96,32,183,255
470 DATA 208,1,95,75,222,161,165,7
3,165,74,133,53,134,60,32,140
480 DATA 148,165,58,166,50,133,73,
134,74,169,4,160,2,32,30,171
1000 FOR=38400 TO 39167
1010 READ A,P,OKES,R
1020 NEXT
1030 PRINT"FINISHED"

```

Main Listing 4

```

10 DATA 76,18,130,160,0,177,95,208
17,230,95,208,2,230,96,96
20 DATA 169,12,24,101,65,133,95,16
5,96,105,0,133,96,76,5,133
30 DATA 166,95,166,95,133,253,134,
254,96,162,2,181,98,24,105,1
40 DATA 201,10,240,3,143,98,96,169
0,149,98,202,16,237,96,169
50 DATA 0,162,132,133,57,134,58,16
2,0,160,0,177,57,208,5,162
60 DATA 3,76,216,150,177,57,187,70
,208,28,200,177,57,221,80,3
70 DATA 208,20,200,232,256,70,144,
243,160,10,177,57,170,200,177,57
80 DATA 133,68,134,57,58,96,169,12
,24,101,57,133,57,166,56,105
90 DATA 0,133,68,76,71,153,165,18,
10,10,170,32,162,146,160,0
100 DATA 177,57,167,0,187,232,200,
177,57,167,0,187,32,169,146,232
110 DATA 166,95,157,0,187,232,165,
96,157,0,187,96,165,18,10,10
120 DATA 170,188,0,187,133,57,232,
189,0,187,133,58,232,189,0,157
130 DATA 133,95,232,169,0,157,133,
96,96,32,162,146,160,0,177,57
140 DATA 170,200,177,57,133,58,134,
57,76,169,146,32,162,146,160,0
150 DATA 177,57,153,0,2,200,182,4,
144,246,177,57,153,0,2,240
160 DATA 3,200,208,246,168,0,162,2
,133,132,134,123,76,169,146,133
170 DATA 94,32,32,163,160,0,177,25
3,240,26,200,177,253,187,84,208
180 DATA 3,200,56,96,169,12,21,101
,253,133,253,165,254,105,0,133
190 DATA 254,70,4,154,165,54,201,4
8,240,5,162,8,76,215,150,24
200 DATA 56,165,63,240,48,173,64,3
,201,64,208,42,173,65,3,32
210 DATA 255,163,176,6,169,0,133,6
5,240,27,177,253,133,68,162,0
220 DATA 200,177,253,201,46,208,5,
138,168,76,117,154,157,64,3,200
230 DATA 232,238,68,144,238,96,160
0,185,64,3,201,46,240,8,200
240 DATA 196,68,144,244,96,162,0,1
81,98,9,48,163,64,3,232,200
250 DATA 234,3,144,243,182,10,144,
5,162,3,76,215,150,132,68,96
260 DATA 166,71,240,24,180,255,162
,255,232,200,189,96,3,201,64,240
270 DATA 15,201,48,240,11,153,160,
3,201,0,208,236,200,132,71,96
280 DATA 134,93,132,92,201,48,240,
58,232,185,96,3,232,134,93,32
290 DATA 255,153,176,5,162,8,76,21
5,150,177,253,133,2,200,152,24
300 DATA 101,2,133,2,166,92,177,25
3,201,46,208,5,134,92,76,27
310 DATA 155,157,160,3,232,200,186
,2,144,208,134,92,168,93,184,32
320 DATA 76,154,154,232,185,96,3,2
01,83,208,25,232,168,96,3,201
330 DATA 68,208,17,230,189,96,3,20
1,82,208,9,232,189,96,3,92
340 DATA 30,130,144,5,162,13,76,21
5,150,134,93,162,0,164,82,181
350 DATA 58,3,48,153,160,3,200,232
,224,3,144,243,132,92,166,93
360 DATA 76,154,154,32,48,154,32,1
44,154,76,255,149,169,0,162,130
370 DATA 133,95,134,95,169,0,168,1
45,96,136,132,18,32,32,153,32
380 DATA 41,153,32,63,153,230,18,1
66,18,201,6,144,5,162,12,76
390 DATA 215,150,32,104,147,32,18,
148,162,18,201,1,144,3,32,238
400 DATA 166,32,201,163,32,218,153
,32,206,146,32,76,147,144,47,224
410 DATA 57,240,25,32,51,155,163,7
3,166,74,133,58,134,80,32,13
420 DATA 150,165,58,166,60,133,73,
134,74,76,113,155,32,41,153,198
430 DATA 18,165,18,201,255,208,1,9
6,32,172,153,76,116,166,32,134
440 DATA 153,32,3,163,76,76,166,16
0,0,177,58,240,48,200,177,58
450 DATA 187,2,208,26,200,162,0,17
7,53,200,132,83,164,92,145,253
460 DATA 200,132,92,232,224,10,176
,21,164,83,76,189,155,183,12,24
470 DATA 101,58,133,58,185,60,105,
0,133,60,76,163,155,96,166,18
480 DATA 202,138,10,10,170,232,232
,185,0,187,133,55,232,169,0,187
490 DATA 133,60,32,32,153,160,0,17
7,253,240,37,200,200,200,177,253
500 DATA 201,64,208,12,200,177,253
,133,2,136,136,132,92,32,183,165
510 DATA 169,12,24,101,253,133,253
,162,254,106,0,133,254,76,5,166
520 DATA 96
1000 FORB=39168 TO 30000:
1010 READ A:POKEB,A
1020 NEXT
1030 PRINT"FINISHED"

```



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David Janda been put
through his paces on First
Software's ADA Training
Course.

UNLIKE PREVIOUS ISSUES IN WHICH I have featured one language and reviewed packages, this month I will concentrate on one package — the ADA Training Course. It's the only implementation of the ADA language currently available for the C64, but probably not the last.

The package is available from First Software on disk only. Readers should note that it is only a training course, and in no way can be considered as a full implementation of the language. Having said that, it is possible to compile ADA source into stand-alone machine code.

The Package

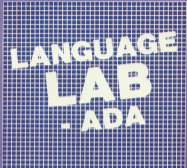
You pay your money and get the goods. In the case of the ADA training course, that's quite a lot. The documentation consists of a 77 page instruction manual and tutorial which is packaged in a metal ring binder. The system disk contains numerous files including several ADA source examples, an editor, assembler and disassembler plus others.

At this point I must comment on the documentation which can best be described as poor. This is probably because since it was produced in West Germany, it has suffered in the translation to English. As it stands, it's very confusing with parts that are cryptic, and others that are very hard to understand.

The documentation starts with a description of how to use the (very good) editor which is supplied with the package. After that, a section is devoted to each particular aspect of the ADA compiler (e.g. loops, decisions, assignment and so on). There then follows some (not very well written) text on how the compiler operates. It takes several readings to appreciate (and understand) what the author is trying to say, but it will worth the effort.

The final part of the documentation includes references to ADA grammar, a list of keywords and so on. This is probably the most confusing part of the documentation as there is no mention of the ADA keywords that are implemented in this version of the language.

The system disk contains 21 files in all, six of which are source demonstration examples, plus a large ADA example in source and object code form. An editor is also supplied in the package. Unlike the Commodore editor, the ADA editor works on a line-by-line editing basis. The user interface allows the colour of the



foreground/background to be changed and several disk operations can be carried out from within the editor.

Most of the compilation process is controlled by the editor, with the user being unaware that a lot is being done 'behind the scenes'. This includes the initial compilation which involves performing three comprehensive analytical tests on the ADA source code (more on this subject later).

The other files on the disk include an assembler which is used to produce a machine code file from the ADA assembly language file. A nice feature of the assembler is that it can be used for post-own assembly programs as well. Also supplied is a disassembler, which although slow in operation is very handy. Instructions on how to use the assembler and disassembler are included in the ADA instruction manual.

The Language

The ADA programming language was designed by committee. That is, instead of one man designing it, a working group (headed out originally over a number of years) saying what the language should and should not incorporate.

As a result of this, the language specification is large — very large! And ADA is code suitable for mainframe computers. This new language has been adopted by the American Department of Defense (DoD) as its official language so

ADA will probably become one of the primary programming languages of the near future. Anyone wishing to get a programming job in defence (or eventual scientific programming) could do themselves a favour by learning this language.

ADA itself is a high-level structured language which bears some resemblance to Pascal (i.e. it is a block-structured language, as with all languages). ADA has a number of keywords (table 1), but the language also has packages. A package performs a specific set job. In the case of the ADA training course there are two packages, one for test handling (standard ADA), and the other for machine specific routines (non-standard). The two packages are called HX3-AD and CEM-AD.

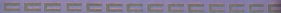
Here is a very simple example of an ADA program.

```
procedure SIMPLI-PROC; N
-- This is a comment
begin
null;
end SIMPLI-PROC;
```

The example itself achieves nothing, but does demonstrate some of ADA's features.

First, there are no line numbers (and in ADA, although the editor treats them for reference, they notice that an ADA program can be entered in upper or lower case — it doesn't matter which).

The program is called SIMPLI-PROC and contains just one ADA statement 'null', which, as the name suggests does



nothing! Notice how the procedure is enclosed with 'begin' and 'end', and how the procedure name follows the 'end'.

This example uses the TEXT-10 package.

```
with TEXT-10; use TEXT-10;
procedure DEMO is
begin
  PUT("Hello Your Commodore
  screen");
end DEMO;
```

Notice how a package is declared before anything else in the program.

Data types in ADA are numerous, and the ones explained in the manual are real, longer and string. Constants may be declared from any of the types available.

Another aspect of the language is that ADA is a strongly typed language and will object if you try to assign an integer variable with a floating point value. There are, however, methods of type conversion available.

```
with TEXT-10; use TEXT-10;
with CBM-84; use CBM-84;
procedure DECLAR is
```

```
  fixed : constant Integer:=1;
  flo : constant Float:=0.34;
  str : constant string:="Hello world";
  int : integer;
  int : integer:=21;
  alpha:float:=alpha : float;
  str : string;
begin
  null;
end DECLAR;
```

This example shows how variables can be assigned. Notice they can be assigned with an initial value when they are declared. The example also points out how initialization is allowed within the same program.

Decision handling is quite simple yet very versatile. The IF, THEN, ELSE construct is supported in the following manner:

```
if E1 then
  set of instructions;
else
  another set of instructions;
end if;
```

The example shows that a whole number of instructions can be placed between the IF and ELSE, or ELSE and END IF. If there is no alternative set of instructions to be executed, a simpler construct may be used.

```
if E1 then
  do something;
end if;
```

As in the case with Basic, a number of logical operators may be used in the comparison including: =, < (meaning not equal to), >, <=, >= and <>.

Flow of control is catered for by LOOP, and the more familiar FOR loop. Because

there are no line numbers in ADA, it is necessary to reference by label.

```
FRID : loop
  a sequence of instructions
end loop FRID;
```

The example demonstrates that the loop has a label called FRID. The example above is a bit silly as it is an endless loop. A loop can be exited in the following manner.

```
FRID : loop
  instructions
  exit FRID when condition-is-met
end loop FRID;
```

It is a simple matter to include a loop counter within the loop and exit when the counter reaches the required value.

Another feature of ADA is that the loops can be nested.

```
TOM4 : loop
  instructions
  DICK : loop
    instructions
    and TOM when condition-is-met
  end loop DICK;
end loop TOM4;
```

From this you can see that it is possible to exit any level of loops by simply specifying the loop name.

A far simpler method of using loops is available by using the FOR loop.

```
for I in 1..10 loop
  number of instructions
end loop;
```

Using the Compiler

The editor provided with the ADA tutorial can best be described as comprehensive. Not only does it allow programs to be loaded/saved to disk, but a directory can be displayed without disturbing any program currently in memory.

One of the options in the menu-driven editor is for compiling the source code, and this is where things start to get interesting!

The editor will ask whether you are sure, whether a trace will be required and whether the code should first be saved to disk. (a nice thing to do!).

There then follow three analytical checks on the source code, which can take a long time, depending on the size of the source code. The first check to be performed is the lexical analysis which 'filters' the program and checks to see if the program contains words that it doesn't understand.

The next check is the syntactical analysis checks to see if the program follows the rules of ADA grammar. Should an error occur a detailed error message is displayed together with an option of displaying the contents of the stack. ADA keywords have a value attached to them, and by observing the stack it is possible to

see where the mistake has crept in!

When the lexical and syntactical checks are being performed, the screen displays the line number that is currently being examined.

The final 'check' is the semantic analysis which performs two operations. First it checks to see if your program makes 'sense', and secondly it produces an assembly language version of the source file. The assembly language is saved to disk and displayed on the screen or printer, together with the line number currently being produced.

The final stage of compilation involves assembling the file produced by the semantic analysis program. A 6150 machine code program is saved to disk and displayed on the screen whilst this is being done.

Summary

The steps involved in compiling an ADA program may appear to be boring, but they are not. The idea behind the ADA tutorial is to give the user an understanding of ADA, as well as the low-level aspects of compiler operation. The package, in my opinion, succeeds in doing this, and I can see many people having hours of fun just poking about the assembly files trying to match up the code with the ADA source.

Having said this, I must criticise the documentation that is supplied with the package. Just 149.95 is better value people are entitled to expect a lot better than this. The manual is so vague, that I still don't know the number of keywords (listed in listing 1) in this version of ADA. Because of this, I would strongly recommend any potential buyer to purchase one of the ADA tutorial books which are now being published.

David Jankis is prepared to enter into correspondence with regard to languages on the CBM. He can be contacted on the following electronic mail services:

```
Prosol: 9599A267
One-To-One: 141F081
```

Table 1 — ADA Reserved Words

Please note that this list includes ADA keywords and supported by the compiler: abort, accept, across, all, and, array, at, begin, body, case, constant, declare, delay, digits, do, else, exit, end, exit, exception, exit, for, function, generic, goto, if, in, is, limited, loop, mod, new, not, null, of, or, others, out, package, program, private, procedure, raise, range, record, ren, reserved, return, reverse, select, separate, subtype, task, terminate, then, type, use, when, while, with, xor.

First Software can be contacted at: Unit 308, Hinton Road, Hove, Sussex BN1 3RQ, Pangbourne, Berks.

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Find out how you can bring
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Title:

The Century Computer Programming Course for the Commodore 64

Editors:

Professor Peter Morse and Brian Hancock

Publisher:

Century Publishing

Price:

£10.95

THIS IS ESSENTIALLY A PROGRAMMER'S book and is a very good one indeed; although it is intended for those wishing to learn Basic it is also a good reference book for the more advanced programmer.

Peter Morse and Brian Hancock have edited the programs in a constructive and efficient manner and, apart from an introductory section to get you acquainted with your C64, the subsequent chapters follow a logical pattern.

Part two contains the essentials of Basic programming which are discussed in some detail with particular reference to 'flow charts' with accompanying programs based on such structural design. Here you will find a complete series of programming methods involving control with simple Basic statements.

Arithmetic functions are well handled as are logical operations. At least we have a version on string handling and loops which will make sense to the beginner.

Subroutines, of course, are an integral part of Basic and good examples are given. All programs are quite unimagative.

Part three is called the 'Complete Programming Method' and provides a great deal of theoretical data for your consideration involving design, control, decision structures and error trapping.

Colour, sound and sprites are not neglected and are adequately handled for a book of this size. There is a good section on high-resolution mode with big mapping and colour control.

Lists, arrays and sorting are not overlooked and a brief rumour of Machine Code is given. In effect, this is quite sufficient, as M/C is a language of its own requiring much more detailed instructions; perhaps the authors might oblige in this field with an equally instructive book!

REFERENCE



Last of all there is an Appendix section for reference plus a 'Program Library' - a mixed dozen of routines including two short games.

If your interests lie in structured programming then I would most certainly recommend this book - great value for the price.

EAJ

Title:

Commodore 64 Colour Graphics: A Beginner's Guide

Author:

Shafter and Shafter

Publisher:

The Repton Computer Group

Price:

£14.50

THIS IS A REASONABLY WELL STRUCTURED book which is hidden amidst excessive waffle; there is far too much advice given on how to type in the programs and much of the program analysis is duplicated.

If you can ignore the superfluous 'chat flow' and get to the programs then you will find that you have, initially, a complete system for drawing and painting. Indeed the colourful frontpage can be reproduced! This will take you through to chapter five with various side issues on the way about drawing, angles, squares etc.

However, let it be said that this is all done in Basic and is painfully slow. Your final picture will take some 15-20 minutes to appear on the screen - as pointed out by the authors.

A Twoflex is laboriously built up to enable you to do this. Fortunately it is listed in its complete form in Appendix B.

The Z8P procedure is quite ingenious and will put you into drawing and painting mode by retaining all the subroutines.

The Twoflex also has a sprite handling routine which is fairly standard.

Cauterally, you can speed up all the drawing and painting routines which you have so carefully listed by going to Appendix D where you will find the speedy machine code numerical data listed with check-sum errors (no blocks of data). A routine is included to save pictures to tape or disk.

Well - the choice is yours between Basic and M/C. Obviously the latter is preferable as read the book thoroughly first of all and then make your decision. As the authors say "Stop, run the program and you've done". Agreed!!

All programs are functional but the book is considerably overpriced.

EAJ

Title:

Filing Systems and Databases for the Commodore 64

Authors:

A.P. & D.J. Stephenson

Publisher:

Collins

Price:

£5.95

THIS BOOK IS A MUST FOR ANY C64 user who is interested in the more serious side of computing.

The authors will be familiar to Your Commodore readers for their succession of interesting and informative articles on various aspects of C64 use.

The book, overall, is easy to read and packed full of information. The style makes it suitable for all levels of user from novice to would-be expert. All but the most knowledgeable can learn from it.

There are one or two "Michael Carter" in it, such as - did you know that "the first stored-program computer was constructed at Cambridge University in 1946?" and "we have to thank an MIT engineer called Shugart for the development of the floppy disk"! Not a lot of people know that!

The Stephensons have extended user friendliness to the rest of their book and provide enough diagrams, explanations and examples to make a complex and potentially dry subject very straightforward and interesting.

Example programs are used throughout the book to illustrate the various processes, becoming increasingly sophisticated as you progress.

By the time you have reached Chapter four you will know how a filing system is

LIBRARY



created and maintained, so much food for thought is provided that you will be tempted to get straight to the keyboard and start creating. However, there are more gems to come...

Acceding dry academic analysis, Chapter five deals very succinctly with searches and sorts, culminating in an impressive machine code routine which handles two-dimensional string array sorts at a great rate of knots.

The ensuing Chapters give a good description of file structures, explaining the pros and cons of the various types - again, in language which is plain enough for a newcomer to grasp and sufficiently in-depth to satisfy even the experts. Clearly, there are useful program routines to expand upon the text.

The appendices incorporate a true glossary and a list of IBM intercodes.

A nice touch is the self-test written at the end of each Chapter. A good guide to whether you have understood the content.

All in all, this book should prove a great asset to any C64 user who wishes to progress from playing games to making serious home/business use of the C64 or to anyone who wants to continue a filing/database system currently in use but does not fully appreciate the intricacies of data handling in relation to computer disks and tapes.

This book achieves all it sets out to do - a comprehensive perspective of the basic on/tile techniques available on the C64, giving simple but instructive guides to efficiency whether using T841 units or tape drives.

Thoroughly recommended! In my opinion - great value, well presented, full

of useful hints, tips, and information. My copy will remain in a prominent position on my bookshelf alongside such weighty tomes as 'The Will Alternative' and 'O, Joe Cramer'.

D.C.

Title:
The Koala Pad Book
Author:
David D. Thornberg
Publisher:
Addison Wesley
Price:
£12.95

THIS BOOK WAS WRITTEN BY THE inventor of the touch tablet or Koala Pad. He has an axe to grind in the sense of wishing to promote the idea that the Koala Pad is all things to all computer users but in keeping with his earlier books, on graphics and LOGO, he has resisted the temptation to follow this idea through.

In the case of a peripheral like the Koala Pad people buy one, plug it in, use the pretty picture type software to do a few wobbles on the screen, load some pictures thoughtfully provided by the manufacturer in case what can be produced and then, if they lack a certain tenacity, they put it away and never use it again. This book will stop you doing that.

Clearly, Mr Thornberg is an enthusiast and this enthusiasm is demonstrated on almost every page, beginning with a little history about Koala Pads.

Chapter Two is called "How to get the most out of the illustration software". This is the software which accompanies the Koala pad and you immediately find that there is more to this than meets the eye. The book is liberally illustrated with a very large number of pictures plus the occasional plug for some additional software and books which are available.

Chapter Three, "Getting pictures on paper", is a useful one. It emphasises that the choice of the correct or at least appropriate printer is all important in getting a decent reproduction. The Epson series is rightly praised in this regard. There is a substantial discussion about interlacing and we even find a section on photographing the pictures on your screen - an inspired thought. Video-taping your pictures is also covered.

Chapter Four deals with other applications for the Koala Pad other than drawing pretty pictures. It turns out to be nothing more than a list of other programs available for use with the Koala Pad. These are available in the United States but not here and as such this

chapter is of little value. There is a tendency for these programs to be rather expensive so their importation into the UK seems unlikely. You can of course arrange to import them yourself which is not a particularly difficult thing to do. One of the programs involved is a LOGO Design Master, and an interesting idea demonstrated is the use of an overlay card which clips on to the Koala Pad aiding handling this.

I was a little disappointed to see that COMAL was not covered since it can be used with the Koala Pad. The procedures to do this and indeed to print Koala Pad pictures have been written and are in the public domain and COMAL of course contains the entire Logo capabilities anyway.

Chapter Five is particularly interesting and is called "Replacing the joystick, the Koala Pad alternative". This is very close to numb and honest appraisal. I quote, "You will find that the cursor or game piece under your control will drift to the upper left hand corner of the screen when you lift your finger off the tablet, unlike joystick Koala Pads (unless special co-ordinators to let the computer know when the finger or stylus hand is lifted. Most joystick programs interpret this lifting signal as a command to read the upper left hand corner of the screen." Well, you can't be fairer than that!

There follows a discussion on a variety of games and their performance with the Koala Pad. A number of these are available in the UK, notably Pinball Construction Set and Chopchop, plus Droll and Lode Runner.

Chapter Six is interesting, covering the use of the Koala Pad within your own programs. I think it's fair to say that if you do not use your Koala Pad within your own programs then you must have been wasting your money. This chapter shows how to use the Koala Pad with Logo, Plot and Basic.

Chapter Seven is called "What next", and includes some ideas for your own Koala Pad application. These include using the Pad in a game board and as a musical instrument. Many applications can benefit from the use of the Koala Pad as a custom keyboard.

Then follow appendices of references and resources. These include the suppliers of many of the programs listed. There is also a glossary of terms, which helps the novice to understand some of the jargon which is thrown about and there is a comprehensive index.

Summing up this book is difficult. It is extremely expensive so is the Koala Pad, so presumably if you can afford the one you can afford the other. It is something of a privilege to have the designer of a revolutionary piece of equipment sitting at your elbow telling you how to get the best out of it. Users of the Koala Pad will find this is a worthwhile purchase.

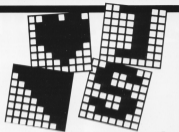
B.M.

Listings will be much easier to enter with our new system.

COMMODORE LISTINGS ARE RATHER well known for the horrible little black blob that always abound. Unfortunately the graphics characters which are used to represent graphic and control characters do not reproduce very well and they are also difficult to find on the Commodore keyboard.

For this reason your Commodore started to provide any control characters with a REM statement on the previous line that explained exactly what the black blob was meant to be. Unfortunately the graphics characters were not documented and these still cause some confusion. For this reason we are starting to use a new method for marking the control and graphic characters in our listings.

In future all control and graphics commands will be replaced by mnemonic within square brackets. This mnemonic is not typed out as printed in the magazine but rather the corresponding key or keys on the keyboard are pressed. For example [RIGHT] means press the cursor right key, you do not type in [RIGHT]. All of the keywords, what keys to press and how they are shown on the screen are shown below.



LISTINGS

Any character that is accessed by pressing shift and letter will be printed as [s LETTER]

[s A] shift and A

[s C] shift & C

Any character that is accessed by pressing the Commodore key and a letter will be printed as [c LETTER]

[c A] Commodore & A

[c C] Commodore & C

[c 1] Commodore & 1
Any control key will be printed out as a number. For example [001]. Control codes are accessed by pressing the CTRL and a letter at the same time [001] is CTRL & A, 002 is CTRL & B etc. See the manual for more information about control codes.

[001] CTRL & A
[002] CTRL & Z

| Mnemonic | Symbol | what to press |
|----------|--------|------------------|
| [RIGHT] | | left/right |
| [LEFT] | | shift left/right |
| [UP] | | shift & up /down |
| [DOWN] | | up/down |
| [F1] | | F1 |
| [F2] | | shift & F1 |
| [F3] | | F3 |
| [F4] | | shift & F3 |

| Mnemonic | Symbol | what to press |
|-----------|--------|-------------------|
| [F5] | | F5 |
| [F6] | | shift & F5 |
| [F7] | | F7 |
| [F8] | | shift & F7 |
| [F9] | | shift & CLR /HOME |
| [CLEAR] | | CLR/HOME |
| [HOME] | | CLR/HOME |
| [PAGE] | | CTRL & F |
| [REVERSE] | | CTRL & B |

| Mnemonic | Symbol | what to press |
|----------|--------|---------------|
| [BLACK] | | CTRL & 1 |
| [WHITE] | | CTRL & 2 |
| [RED] | | CTRL & 3 |
| [CYAN] | | CTRL & 4 |
| [PURPLE] | | CTRL & 5 |
| [GREEN] | | CTRL & 6 |
| [BLUE] | | CTRL & 7 |
| [YELLOW] | | CTRL & 8 |



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Fill in the coupon carefully and seal it in an envelope. Write clearly on the back of the envelope the letters of the extra pieces.

Post your entry to: 128 Competition, Four Commodore, No 1 Golden Square, London W1R 3AB.

The closing date of the competition is the first post on Tuesday, 31 December 1985.

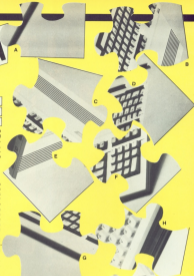
You may enter as many times as you wish but each entry must be on an official coupon - not a copy - and sealed in a separate envelope.

Important: please follow closely the guidelines on entering - incomplete coupons and entries with no letters on the back of the envelope cannot be considered.

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The How to Enter section forms part of the rules. The editor's decision is final and no correspondence will be entered into.



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Name

Address

.....

.....

..... post code

Telephone

The letters of the extra pieces are:

.....

Send to: 128 Competition, Your Commodore, No 1 Golden Square, London W1R 3AB. Write clearly and don't forget to put the letters of the extra pieces on the back of the envelope.

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wizard

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TOP DRAW

This month our

graphics man, Allen

Webb, shows you how

to get those

backdrops scrolling.

HOLD THERE, I THINK YOU'LL find this month's offering rather useful if you're into graphical adventures or platform type games.

I'm sure you've come across titles such as Monkey Isle, Boulder Dash and Spelunker which use a huge backdrop for the game. The screen normally shows a small area of the backdrop and the backdrop scrolls as you roam to a new play area. Got the idea? This article will provide you with the technology to go for it a similar task. What it doesn't use single pixel movement à la Crocifer, it works well enough for most purposes.

In what are we doing? Consider Figure 1. The normal screen holds 1000 locations in which we can store a picture. Under the Basic ROM there are eight kilobytes of memory which can be used to hold pictures. If we also use the area between the BASICs there are 12 kilobytes of memory. The idea is to extract a portion of the picture and put it on the normal screen.

The window on the screen can be any rectangle of WW characters wide and WH characters high. The position of the square can be specified by the co-ordinates XY and YW of its top left-hand corner. We also need to know which part of the map to display. The top left hand corner of the map data is specified by X and Y. The width of the map under the ROM is

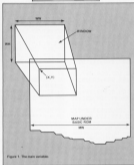


Figure 1. The basic variables.

specified by MW. The width of the map is up to you but is limited to no more than 256 characters wide (RAM+256). Here are some examples of the size of map possible using the UK available.

| Map width | Map height |
|-----------|------------|
| 256 | 60 |
| 80 | 150 |

From this you can see that it is possible to have up to 12 screensful! The selection of the map width really depends on the type of map. You will probably find it easier to design maps smaller than 80 characters wide — I will explain why later.

The package uses two commands. The first has the syntax:

```
SYN 40152,WH,MH,MW,WW,XY
```

The routine sets up the position and size of the screen window and the width of the map. This can be changed at any time without corrupting any map data. Obviously, this command must be called before any attempt is made to display the map.

The second command actually draws the map in the window and has the syntax:

```
SYN 40165,L1
```

This command takes a rectangle of data with top left hand co-ordinates X,Y from the map data under the ROM and puts it in the window on the screen.

Since the map data (i.e. the characters put to the screen, occupy a lot of space, it follows that an equal amount of RAM would be required for the colour data. This is obviously not so and I chose another approach to the problem of colours. Starting at location 40489 is a table 256 bytes long. This is used to hold the colour that each character will adopt. The position of each character in the table is determined by its POKE value. For example, the character uses the first position 40489. As a general rule, the position of a character is given by:

Position in table = 40489 + POKE value

Some further examples are:

To get red 'A' POKE 40489+1,2
To get blue 'Y' POKE 40489+6

Demonstration 1 gives a simple idea of how to use the routines. Lines 29-50 fill the area under BASIC with a simple sequence of characters offset by one to give diagonal stripes. Line 60 fills the colour table. Line 63000 sets up a 10 character wide, 25 character tall window, at the extreme left of the screen. The map is set to 60 columns wide. The remainder of the program allows you to scroll the map in all directions using the cursor keys but without running off the map horizontally.

The routine is set up with the assumption that the screen is at the normal position of 60000,70200. If you want to have the screen elsewhere, you should include the following line early in your program:

```
POKE 40265,PEEK(648):  
POKE 40491,256-PEEK(648)
```

This tells the routine the current page of the screen.

Listing 1

```

1 DATA76,237,167,76,22,169,0,0,0,0
  ,0,0,60,40,26,0,32,63,167,32,117,1
  67,169
2 DATA94,133,1,162,0,160,0,177,253
  ,146,261,32,200,167,32,214,167,200
  ,204,13
3 DATA157,208,240,32,171,167,32,18
  2,167,232,236,14,167,208,226,169,6
  6,133
4 DATA1,96,72,162,72,138,72,169,0,
  133,251,169,4,133,252,173,21,167,2
  40,11
5 DATA180,0,32,171,167,200,204,11,
  167,208,247,173,10,167,240,14,24,1
  66,251
6 DATA103,10,167,133,261,166,262,1
  06,0,133,262,104,170,104,169,104,9
  6,72,162
7 DATA72,138,72,169,0,133,263,169,
  160,133,254,173,6,167,240,21,160,0
  ,32,166
8 DATA157,200,204,6,167,208,247,17
  3,6,167,240,14,24,166,263,109,6,16
  7,133
9 DATA253,166,264,106,0,133,264,10
  4,170,104,169,104,96,24,166,261,10
  6,40,133
10 DATA261,166,262,106,0,133,262,9
  6,24,166,263,109,12,167,133,263,16
  6,254
11 DATA105,0,133,264,96,72,166,261
  ,133,170,24,166,262,106,212,133,17
  1,104
12 DATA6,142,15,167,170,183,41,16
  8,145,170,174,15,167,56,32,253,174
  ,32,138
13 DATA173,32,247,183,56,32,227,15
  7,183,20,141,13,167,32,227,167,183
  ,20,141
14 DATA14,167,32,227,167,166,20,14
  1,13,167,32,227,167,166,20,141,10,
  167,32
15 DATA227,167,166,20,141,11,167,9
  6,32,227,167,166,20,141,6,167,32,2
  27,167
16 DATA166,20,141,6,167,78,18,167,
  0,1,2,3,4,5,6,7,8,9,256
17 REM
18 FOR I=40155 TO 40485
19 READ X, Y:Y=X
20 POKE I,X
21 NEXT
22 POKESG,167:CLR
23 REM
24 REM*****
25 REM* LOADER *
26 REM*
27 REM* MAP PLOTTER NEW 1985 *
28 REM*****

```

```

29 REM*****
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1000 REM*

```

Since most of you will be using a redefined character set, a relocated screen is mandatory. Listing 1 will relocate the screen to 40400 (1280) and the characters to 50800. Lines 40-

49 move the characters one down to its new position. Please note this routine takes a while to run. While this demonstration is easy, the problem is how to

create a map. Clearly you have to somehow design and then put a map into the screen. The first map must be to draw the map on graph paper. This can then be converted into a file which can be used in the machine. The obvious approach would be to use an editor which allows you to draw part of the map on screen

and then transfer it to the RAM under ROMM. Due to space limitations, I have not included one here. If any of you out there come up with such a program, I suggest you either submit it to this magazine or let me know since such a tool would be most useful. Demonstration 2 shows another method.

Demo 1

```

0 REM DEMO 1
1 REM
10 I=10*4096:POKE53281,C
20 J=1
30 FOR K=01055:POKE I+K,K:J=J+1:IF J=130 THEN GOTO
  50
40 J=J+1:IF J=130 THEN GOTO 50
50 I=I+60:GOTO 30
60 FOR I=01055:POKE 40489+I,I:NEXT
70000 SYS 40192,10,25,60,0,0
80000 MW=10:SYS 40195,0,0
90000 SET18:IF18="" THEN 43006
90010 IF18=CHR$(28) AND X<60-W THEN X=X-1
90020 IF18=CHR$(16) AND X>0 THEN X=X-1
90030 IF18=CHR$(17) AND Y=130 THEN Y=Y+1
90040 IF18=CHR$(145) AND Y=0 THEN Y=Y-1
90050 SYS40195,X,Y:GOTO60006

```

Demo 2

```

0 REM DEMO 2
1 REM
2 40=10*4096:X7=60545
3 DATA 24,24,128,24,24,36,66,0
10 POKE 40866,PEEK(648):POKE40401,
  216-PEEK(648)
20 GOSUB10000
30 POKE 40489+102,8:POKE 40489+230,
  5:POKE53281,0
35 FOR I=0107:POKE52016+I,8ND(1)*26
  6:NEXT
40 FOR I=0107:POKE53040+I,8ND(1)*26
  6:NEXT
47 FOR I=0107:READX:POKE52472+I,X:N
  EXT

```



Device 1 (cont)

```

+3C0 +3C0 +3
C0 +3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +
3C0 +3C0 +3C0 +3* :$08UB89000
10180 AB**"1C0 +3C0 +3C0 +3C0 +
3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +
3C0 +3C0 +3
C0 +3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +
3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +
3* :$08UB89000
10190 AB**"1C0 +3C0 +3C0 +3C0 +
3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +
3C0 +3C0 +3
C0 +3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +
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3C0 +3C0 +3
C0 +3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +
3C0 +3C0 +3C0 +3* :$08UB89000
10140 AB**"1C0 +3C0 +3C0 +3C0 +
3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +
3C0 +3C0 +3
C0 +3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +
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3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +
3C0 +3C0 +3* :$08UB89000
10150 AB**"1C0 +3C0 +3C0 +3C0 +
3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +
3C0 +3C0 +3
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3C0 +3C0 +3
C0 +3C0 +3C0 +3C0 +3C0 +3C0 +3C0 +
3C0 +3C0 +3C0 +3* :$08UB89000
10160 RETURN
50000 REM
50010 REM CONVERT STRING TO POKE V
ALUES
50020 REM
50030 F=(C1>31)AND(C4N3)*I+(C1>63
)AND(I>97)*64+(C1>191)AND(I>294)*
=128
50040 F=F+(C1>558)AND(I>192)*64+(
I>255)*163
50050 IFF=-1:THEN=I:RETURN
50060 C=I+F:RETURN
62900 REM
62910 REM EXTRACT MAZE FROM STRING
S AND POKE THEM INTO RAM UNDER BMS
1C B0H
62920 REM
63000 PRINT#K,K=K+1,FORJ=1TOW4
63010 I=ASC(108*(AB,J,1))
63020 $08UB89000
63030 IFC=108*(AB,K,1):S,THEN=290
63040 POKE#G,C:WD=WD+1:NEXT:RETURN

```

Since this demonstration shows an actual maze, I'll describe it line by line.

```

LINE
2 AD holds start of
map. BMS is position
of man
5 design of maze
10 screen is at $C00
20 inputs map
30 sets maze charac-
ters to orange and
green
35-40 random designs for
maze characters
40 maze
41 fills screen with
Browsen reverse
spaces
50 positions cursor
60-100 print text
1000 sets up window by
9 by 8 at 3,5 and
map to 40 charac-
ters wide
1010 WW is used to limit
map scroll. Prints
top left corner of
map and man.
1020-1070 move map subject
to position con-
ditions. User cursor
key.
10800-
10900 strings holding
map design
10950 convert ASC to
POKE value
11000-
11010 convert each line
of map design to
POKE values and
put them under the
BMS4.

```

If you want to use this method of entering a maze or display, you will have to convert each line of the picture on graph paper to a string. This becomes trickier as your design grows larger than 80 characters since you will have to split the string over more than one line of BMS.

Lines 1020 to 1070 give the impression of the man moving about the maze by:

a) The man starts in the center of the window.

b) The map only scrolls if an open way exists in the direction he wishes to move.

While the code to do this is simple since no special logic is required to handle situations where the man approaches the maze sides, it is inefficient in its use of RAM since the maze sides must be artificially thickened. Type it in and you'll see what I mean.

To help you to save your designs, I have provided Loader 1. The syntax is:

```

SYS 870 "filename" Device,1
Start Address, End Address

```

Where Device #1 for cassette or 8 for disk. You can use a machine code monitor to do the job but don't forget to switch the Basic ROM out before saving and back in afterwards. To load a design use the command:

```

LOAD "filename" Device,1

```

Loader 1

```

10 DATA 32,12,225,32,253,174,32,13
8,173,32,247,183,165,20,72,165,21,
72,32,253
20 DATA 17,32,138,173,32,247,183,1
65,1,41,224,133,1,165,20,164,21,10
7,133,21
30 DATA 10,133,20,169,20,32,25,225
,165,1,3,1,133,1,25
%0 FOR I=0%0 TO 3%4 : READ X: POKE
1,I,X: T=T+X: NEXT
50 IF T<>5040 THEN PRINT"ERROR IN
DATA"
60 REM*****
70 REM* LOADER 1 *
80 REM* BLOCK NAME *
90 REM* SAVES ANY BLOCK *
100 REM* OF RAM BETWEEN *
110 REM* $0000 AND $CFFF *
120 REM*****

```

READY.

Nick Hampshire brings you four new commands to add to your extended Basic.

IN THE LAST TWO ARTICLES IN THIS series I have given all the initialization and wedge routines needed to add extra commands to the Basic of a C64 computer.

Also, I have now given the code to add five new commands to Basic. These are, CTL, WRIND, CHANGE, DUMP and FIND.

This month I am adding a further four commands. They are, AUTO, CHAIN, DELETE and RECALIBRE. These four commands like the four given last month are very useful "toolkit" type commands for editing a program and are consequently all used in direct mode (except CHAIN which can be used in program mode).

All four new commands require that the wedge and installation code (given in the first article in this series) are present in memory at the correct locations and that their command names and entry points are stored in the correct tables. These four commands are independent of the previously added commands and can therefore be used without last month's routines. To ensure that you have the wedge and new routines correctly positioned the Basic loader at the end of this article is a repeat of last month's with the four new commands added.

The programs in this series of articles are modified extracts from the book *Advanced Commodore 64 Basic Revealed* by Nick Hampshire and published by Collins.

AUTO

Abbreviated entry: A[dd]@U

Abbreviated Basic Abbreviations: None

Token: Hex \$B1, \$B4, Decimal 288,4

Mode: Direct and program

Recommended Mode: Direct only

Purpose: To save time when entering a program by providing the user with the next line number to be entered. To enable the AUTO line numbering, enter AUTO followed by the line number increment. To disable AUTO just enter AUTO without a number. The next line number is picked up from the previous line typed in, so if you enter a line 10 with the auto step at 10, the next line number would be 20. If you changed this number to, say, 100 and entered that line, the next line number displayed would be 110. A new line number is not displayed if there is nothing entered on the line.

Syntax: AUTO [step]

Errors: Syntax error — if the step value is greater than 65535 (maximum line number).

BUILD A BETTER BASIC

Use: The command is used in direct mode to enable or disable AUTO line numbering. When enabled, AUTO will produce line numbers after entering a line until it is disabled with AUTO without an increment value. If you wish to exit from the AUTO facility when a line number has been displayed, either press return (which will delete that line if it exists), or cursor down off that line.

Routine Entry Point: \$B37

Routine Operation: First, this routine checks to see if there is a number following it. If not it will disable AUTO, otherwise it will read the number and store as the step and enable AUTO. The actual routine is wedged into the crunch tokens link. It first checks that the first non-space character in the input buffer is a numeric character and sets a flag to say yes or no. The line is then tabulated and if there was no line number, or there was nothing following the line number, the routine exits. If the previous line typed in had a line number with something following it, the line number is read from the pointer. The step is then added to it, and the number converted to ASCII and inserted into the keyboard.

CHAIN

Abbreviation: CHA[in]@U

Abbreviated Basic Abbreviations: None

Token: Hex \$B1, \$B7, Decimal 288,7

Mode: Direct and program

Recommended Mode: Either

Purpose: To load and run a Basic program from tape or disk. After the program has been loaded, variable pointers are set to the end of the program.

Syntax: As in LOAD.

Errors: As in LOAD.

Use: CHAIN is used to load and run a Basic program. It will work from another program or in direct mode having the same effect. If used from another program, it is more convenient than LOAD as LOAD does not set the variable pointers and, if the program you load is larger than the one in memory, when variables are used they will corrupt the end of the program.

Routine Entry Point: \$B64

Routine Operation: The CHAIN routine

simulates the LOAD routine as far as the program has been loaded. From there, variable pointers are set to the end of load, the run mode flag is set, and then three operations cause the program to run:

[R] \$A600 / perform CLR

[R] \$A608 / recharges pointers to the start of program

[R] \$A7A0 / execute NEXT command

DELETE

Abbreviated Entry: DE[lete]@U

Abbreviated Basic Abbreviations: None

Token: Hex \$B1, \$B6, Decimal 288,6

Mode: Direct and program

Recommended Mode: Direct only

Purpose: To delete a range of unwanted lines from a Basic program.

Syntax: DELETE [start line]-[end line] - although all parameters are directed as optional, at least one of the parameters must be given.

Errors: Syntax errors — if DELETE is used without parameters.

Syntax error — if either of the line numbers is less than zero or greater than 65535.

Use: DELETE is used to delete a range of lines in a Basic program. These can be lines of, say, a data generating program after the DATA has been created. For example:

DELETE 100-150 — deletes lines 100 to 150 inclusive.

DELETE -1000 — deletes all lines up to line number 1000.

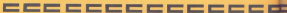
DELETE 2000 — deletes all lines from 2000 to the end of the program.

DELETE 0 — deletes the whole program.

Program lines that have been DELETED cannot be recovered as they have been wiped from memory.

Routine Entry Point: \$B6AD

Routine Operation: DELETE first gets the range of the delete and then loops, moving the memory above the range-out the top of the deleted area.



RENUMBER

Abbreviated Entry: R[*start*][*stop*]
Abbreviated Basic Abbreviations: READ — R[*start*][*stop*]
Address: Hex 0E,10h, Decimal 26,32

Mode: Direct and program
Recommended Mode: Direct only
Purpose: To renumber a basic program's every line number range. All RLOCs, GOTIAs, GO TOs, GOSUBs, and RETURNs are renumbered if found.

Syntax: RENUMBER start,stop — where start and stop are values between one and 65535 (variables are not allowed).
Error: Syntax error — if the syntax above is wrong.

Syntax error — will occur in part one if a number following any of the commands mentioned in "Purpose" are 0 or 65535. Undefined xxxxx in old line yyyyy — if a line does not exist.
Syntax Error — will occur in part two if the new line number is greater than 65535. Use RENUMBER is useful for opening up program lines for the insertion of more

lines or just making the program tidy after it is finished. All commands that contain line numbers will be changed so that the new line number is inserted.

RUN xxxxx
 GOTO xxxxx
 GO TO xxxxx
 GOSUB xxxxx
 THRU xxxxx
 ON TOP GOTOxxxx,xxxx,xxxx,....
 ON TOP GOSUBxxxx,xxxx,xxxx,....

Routine Entry Point: 19A1D
Routine Operations: The start and stop are read in and syntax error is output if they

are out of range. Part one is displayed and performed. At each occurrence of a branch or above the routine will print a "." character. If the line does not exist, the error message "undefined xxxxx in old line yyyyy" will be displayed and replaced with the number 65535 (illegal). This is done throughout the program until the end is found. Then part two is displayed and the line numbers are changed to the new values.

Note: If syntax error is encountered in either of the parts, the renumber process will be stopped but the program will be partly renumbered and thus will not run.

AUTO LISTING

```

1000 AUTO00000000 ; NO STOP, RUN 1030 RTD ; DON'T DO IT
1001 000 ; 1030 AUTO00000000 ; CHECK FOR BLANK
1002 000 ; 1040 END AUTO000 ; INPUT LINE
1003 000 ; 1050 RTD
1004 000 ; 1060 AUTO000 LBA AUTO000 ; ADD STEP TO P
1005 000 ; 1070 CLR ; LINE NUMBER
1006 000 ; 1080 ADC #04
1007 000 ; 1090 TAD
1008 000 ; 1100 LBA AUTO000+1
1009 000 ; 1110 ADC #15
1010 000 ; 1120 RTD
1011 000 ; 1130 AUTO000 LBA WORK000 ; DISABLE BIT
1012 000 ; 1140 0
1013 000 ; 1150 RTD #0004
1014 000 ; 1160 LBA WORK000
1015 000 ; 1170 RTD #0005
1016 000 ; 1180 RTD
1017 000 ; 1190 AUTO000 AND #
1018 000 ; 1200 0
1019 000 ; 1210 AUTO000 LBA #0000 ; CHECK FIRST CHAR
1020 000 ; 1220 RTD
1021 000 ; 1230 CMP #000 ; IN INPUT BUFFER FOR
1022 000 ; 1240 BCC AUTO000 ; A NUMBER
1023 000 ; 1250 CMP #000
1024 000 ; 1260 BCC AUTO000
1025 000 ; 1270 LBA #000 ; SET FLAG TO 001
1026 000 ; 1280 RTD #00 ; DO IT
1027 000 ; 1290 END AUTO000
1028 000 ; 1299 AUTO000 LBA #0000 ; SET FLAG TO 001
1029 000 ; 1300 RTD #00 ; DON'T DO IT
1030 000 ; 1309 AUTO000 JOP CHECK000 ; CHECK INPUT
1031 000 ; 1310 LBA #00 ; CHECK FLAG
1032 000 ; 1320 END AUTO000
    
```

CHAIN LISTING

```

1000 CHAIN JOP #C104 ;GET NAME
1001 LBA #000
1002 STA #FF ;SECONDARY ADDRESS=0
1003 LBA #00
1004 LOP #CC ;ADDRESS TO LOAD AT
1005 JOP #FF00 ;LOAD IT
1006 BCC CHAIN1 ;LOAD WAS NOT B.R.
1007 STA #00 ;SAVE END OF LOAD
1008 STA #0F ; ADDRESS IN VARIABLE
1009 STA #00 ; POINTERS
1010 STA #00
1011 STA #00
1012 STA #00
1013 LBA #000 ;PRINT CH
1014 JOP #FF00
1015 LBA #000 ;SET TO RUN
1016 STA #00
1017 STA #0000 ;CLEAR REPEAT STACK
1018 JOP #A000 ;L.R
1019 JOP #A000 ;SET CHARACTER POINTER
1020 JOP #A000 ;RUN
1021 CHAIN1 JOP #00FF ;END ERROR MESSAGE
1022 #000
1023 #000
1024 #000
    
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RENUMBER LISTING

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1000 REN000 JOP #A000 ;SET START 1070 LBA #0 ;L.R
1001 LBA #04 ;L.R 1080 STA #00FF ;STORE IT
1002 LBA WORK000 ;STORE IT 1090 LBA #0 ;#00
1003 LBA #0 ;#00 1100 STA #00FF+1 ;STORE IT
1004 STA #0000+1 ;STORE IT 1110 JOP #A000 ;SET CHARACTER POINTER
1005 JOP #00FF ;SCAN "." 1120 JOP #0000 ;SEND PAGE MESSAGE
1006 JOP #A000 ;SET STOP 1130 JOP #00FF ;PAGE 1
1070 REN001 JOP #A000 ;SET CHARACTER POS 1140 JOP #00FF ;DO PAGE 2 AND END
1071 RTD 1170 ;
    
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| | | |
|---------------------------------------|--|-------------------------------------|
| 2710 STA #16 ;STORE IT | 3260 JBR #0073 ;GET NEXT CHAR | 3690 LDA #PFI,F |
| 2720 LDA #70 ;R1 | 3270 REMOV (MP #*, IIS IT A COMMA? | 3695 STA |
| 2730 ABC #000 | 3280 BRB #0017 ;YES | 3699 BRB |
| 2740 STA #70 | 3290 JMB #0012 ;TRY NEXT CHAR | 3699 LDA #PFI,F |
| 2750 JMP#14 JBR #0002 ;GET BYTE | 3300 JMP#12 JMB #0006 ;DO NEXT LINE# | 3699 JBR #0002 ;PRINT LINE NUMBER |
| 2760 STA #0000,2 ;STORE IT | 3310 ; | 3699 LDA #0000 ;CARRIAGE RETURN |
| 2770 BRB #0010 ;END OF LINE | 3320 ;CALCULATE NEW LINE NUMBER | 3699 JBR #0010 ;PRINT IT |
| 2780 STA | 3330 ; | 3699 LDA #0017 ;ILLEGAL LINE NUMBER |
| 2790 BRB #0010 ;ALWAYS | 3340 JMP#10 JBR #0008 ;GET CHARACTER FOR | 3699 STA #02 ;ASCII |
| 3000 JMP#12 STA | 3350 ; | 3699 STA #02 |
| 3010 CLC | 3360 LDA #0000 ;GET LINE NUMBER | 3700 BRB #0010 ;ALWAYS |
| 3020 ABC #000 ;INCREASE BUFFER POINTS | 3365 STA #02 | 3710 JMP#10 JBR #0000 ;GET BYTE |
| 3030 STA #00 ;AND STORE IT | 3370 LDA #0000+1 | 3720 CMP #10 ;ISAS AS LINE#? |
| 3040 LDA #0000 ;GET NEXT START UP | 3380 STA #02 | 3730 BRB #0010 ;NO |
| 3050 STA #0000 ;STORE IT | 3390 JMP#10 JBR #0000 ;GET BYTE | 3740 JBR #0000 ;GET BYTE |
| 3060 LDA #0000 ;R1 | 3400 JBR #0000 ;GET BYTE | 3750 CMP #10 |
| 3070 STA #0000+1 ;STORE IT | 3410 BRB #0010 ;NOT END OF PROG | 3760 BRB #0010 ;NO |
| 3080 LDA #0000 ; GET NEXT START | 3420 LDA #0000 | 3770 JMP#12 LDA #0000 |
| 3090 STA #0000 ; VECTOR TO RETURN | 3430 JBR #0010 | 3780 BRB |
| 3100 LDA #0000+1 ; TO PROGRAM | 3440 LDA #0000 ;FLAG ERROR | 3790 JBR #0000 ;CONVERT LINE |
| 3110 STA #0000 ; AFTER MAKING CHANGE | 3450 JBR #0010 | 3800 JMB #0000 ;NUMBER TO ASCII |
| 3120 LDA #00 ;GET BUFFER POINTER | 3460 LDA #0000 | 3810 JMP#10 JBR #0000 ;GET BYTE |
| 3130 JMB #0004 ;CHANGE LINE | 3470 LDA #0000 | 3820 JMP#12 LDA #02 ;RUMP NEW LINE |
| 3140 JMP#14 LDA #0000 ;RESTORE NEXT | 3480 JBR #0000 ;PRINT | 3830 STA #NUMBER BY |
| 3150 STA #0000 ;START VECTOR | 3490 LDA #02 | 3840 ABC #0000 ;STEP |
| 3160 LDA #0000+1 | 3500 LDA #04 | 3850 STA #02 |
| 3170 STA #0000 | 3510 JBR #0000 ;PRINT NUMBER | 3860 LDA #02 |
| 3180 BRB #0000 | 3520 LDA #0000+1 | 3870 ABC #0000+1 |
| 3190 LDA #0000 ;MOVE TO END OF | 3530 LDA #0000 | 3880 STA #02 |
| 3200 CLC ;NEW LINE# | 3540 JBR #0000 ;PRINT | 3890 JMP#10 JBR #0000 ;GET BYTE |
| 3210 ABC #0000 | 3550 LDA #0000 | 3900 BRB #0010 ;NOT END OF LINE |
| 3220 STA #16 | 3560 STA #70 | 3910 BRB #0010 ;ALWAYS |
| 3230 LDA #0000+1 | 3570 LDA #0000+1 | 3920 ;END |
| 3240 ABC #000 | 3580 STA #7C | |
| 3250 STA #70 | 3590 LDA #00 | |

BASIC LOADERS LISTING

| | | |
|--------------------------------------|--------------------------------------|------------------------------------|
| 000 BRB ##### | 330 BRB | 0790 BR1045,255,25,80,252,21,71 |
| 010 BRB #00000 FOR BASIC EXTENSION 0 | 340 BRB | 0795 BR1050,22,70,120,85,21,227 |
| 020 BRB #P00000 | 0 0000 BR1055,126,23,126,170,174,205 | 0800 BR1060,21,190,227,169,120,121 |
| 030 BRB #P000000 W0000 AND THE 0 | 0100 BR1065,49,129,227,121,164,201 | 0810 BR1070,211,54,121,54,167,0 |
| 040 BRB #P000000 | 0 0020 BR1075,156,120,267,170,29,111 | 0820 BR1080,21,121,21,121,25,169 |
| 050 BRB #P0000,CHANGE,CY, JUMP,AUTH | 0 0040 BR1085,75,178,0,99,219,68 | 0830 BR1090,140,120,21,45,220,162 |
| 060 BRB #P000,DOWN,DELETE,NUMBER 0 | 0060 BR1095,71,204,74,241,145,242 | 0840 BR1095,204,200,175,247,13,22 |
| 070 BRB #P000000 C0,0,0,0 | 0 0080 BR1100,140,88,240,21,240,244 | 0850 BR1100,21,20,42,42,42,42 |
| 080 BRB #P000 #P00000 | 0 0100 BR1110,292,244,237,246,42,240 | 0860 BR1105,49,88,84,88,76,88 |
| 090 BRB ##### | 0120 BR1115,242,88,128,162,294,227 | 0870 BR1115,88,10,29,21,22,66 |
| 100 0=1,0=0,0=02700 | 0140 BR1120,20,199,246,12,225,220 | 0880 BR1120,81,71,67,21,86,49 |
| 110 #0000-0A-FFFF0000 | 0160 BR1125,2,76,114,234,22,162 | 0890 BR1125,21,42,42,42,42,12 |
| 120 #0000,0 | 0180 BR1130,22,224,12,70,120 | 0900 BR1130,21,24,22,71,21,42 |
| 130 0=0=0-1+1=0=0+0 | 0200 BR1135,204,255,169,0,121,19 | 0910 BR1135,21,22,81,89,83,89 |
| 140 #00000 | 0220 BR1140,122,244,88,162,128,76 | 0920 BR1140,21,22,21,0,182,11 |
| 150 #P000000000000000000000000 | 0240 BR1145,227,162,21,166,128,124 | 0930 BR1145,7,128,127,0,81,292 |
| 160 #P000000000000000000000000 | 0260 BR1150,122,176,160,12,171,160 | 0940 BR1150,247,76,22,85,256,87 |
| 170 #P0=000000000000000000000000 | 0280 BR1155,16,2,126,4,246,169 | 0950 BR1155,204,40,80,80,49,76 |
| 180 #P0=000000000000000000000000 | 0300 BR1160,16,12,241,142,2,140 | 0960 BR1160,25,80,80,287,87,80 |
| 190 BRB TO RUN ROUTINES 070=0470 | 0320 BR1165,2,76,142,21,236,22 | 0970 BR1165,25,76,177,47,77 |
| | | 0980 BR1165,76,71,177,47,72,62 |

1290 BAFW11,266,47,82,81,76,67
1400 BAFW04,48,67,74,67,66,67
1410 BAFW12,11,22,66,68,77,76
1420 BAFW07,14,81,77,268,69,66
1430 BAFW04,179,76,77,76,176,71
1440 BAFW04,177,76,67,217,77,65
1450 BAFW13,77,67,62,71,177,77
1460 BAFW06,74,66,77,268,69,66
1470 BAFW07,14,81,77,268,69,66
1480 BAFW04,210,82,67,66,67,65
1490 BAFW22,81,76,82,212,84,82
1500 BAFW45,67,67,76,268,69,66
1510 BAFW45,67,67,76,76,176,66
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1540 BAFW17,66,268,76,77,67,67
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1590 BAFW23,162,167,123,26,162,122
1600 BAFW17,21,142,24,142,23,162
1610 BAFW04,162,41,162,44,162,49
1620 BAFW11,120,160,152,142,152,162
1630 BAFW08,162,41,162,64,162,67
1640 BAFW14,76,142,73,142,76,142
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1670 BAFW23,266,47,252,266,244,266
1680 BAFW32,246,24,122,6,266,24
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1720 BAFW14,76,126,164,266,46
1730 BAFW11,11,164,122,266,266,169
1740 BAFW25,1,266,266,266,49,169
1750 BAFW25,1,266,24,24,211,26
1760 BAFW04,4,266,73,266,2,122
1770 BAFW15,24,266,66,266,174,122
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1840 BAFW26,169,1,122,11,266,252
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1860 BAFW46,262,261,126,266,126,166
1870 BAFW12,251,11,266,166,246,122
1880 BAFW04,266,166,266,266,226
1890 BAFW06,4,122,11,124,164,122
1900 BAFW02,266,122,169,4,2,24
1910 BAFW07,126,166,246,242,261,126
1920 BAFW08,4,76,266,127,164,122
1930 BAFW23,11,266,127,127,16,16
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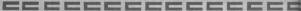
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3080 BAFW14,126,6,22,22,124,124
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5340 BAFW144, 88, 132, 281, 124, 232, 52
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5440 BAFW116, 229, 52, 131, 162, 162, 88

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5460 BAFW44, 1, 231, 124, 44, 32, 89
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5500 BAFW13, 76, 208, 18, 76, 8, 170
5510 BAFW32, 197, 169, 52, 77, 168, 37
5520 BAFW13, 8, 248, 12, 261, 171, 208
5530 BAFW38, 52, 131, 8, 31, 167, 169
5540 BAFW28, 258, 142, 26, 2, 26, 208
5550 BAFW6, 149, 201, 132, 26, 132, 31
5560 BAFW6, 52, 187, 148, 148, 28, 141
5570 BAFW44, 148, 142, 21, 141, 201, 148
5580 BAFW22, 252, 174, 52, 167, 167, 142
5590 BAFW26, 141, 244, 148, 142, 21, 141
5600 BAFW47, 148, 31, 142, 144, 32, 148
5610 BAFW48, 76, 88, 141, 21, 162, 144
5620 BAFW32, 178, 248, 76, 5, 141, 169
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5640 BAFW68, 148, 76, 26, 171, 42, 42
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5680 BAFW22, 42, 42, 42, 42, 42, 20
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5940 BAFW41, 208, 182, 261, 24, 248, 208
5950 BAFW28, 248, 32, 76, 141, 261, 1
5960 BAFW28, 187, 148, 88, 12, 216, 252
6000 BAFW13, 112, 8, 144, 2, 76, 126
6010 BAFW42, 142, 132, 141, 248, 148, 142
6020 BAFW13, 148, 249, 148, 148, 8, 177

6030 BAFW122, 204, 281, 48, 144, 4, 204
6040 BAFW6, 144, 248, 134, 136, 148, 254
6050 BAFW48, 142, 122, 208, 2, 168, 132
6060 BAFW98, 132, 132, 132, 0, 32, 167
6070 BAFW67, 52, 138, 141, 171, 232, 148
6080 BAFW13, 132, 137, 132, 148, 131, 132
6090 BAFW22, 76, 141, 132, 24, 52, 76
6100 BAFW41, 132, 31, 142, 8, 52, 76
6110 BAFW41, 72, 142, 132, 192, 208, 148
6120 BAFW28, 7, 142, 132, 248, 248, 148
6130 BAFW44, 7, 164, 137, 4, 2, 232
6140 BAFW28, 132, 164, 148, 0, 162, 0
6150 BAFW1, 248, 2, 137, 8, 2, 208
6160 BAFW13, 208, 244, 148, 252, 248, 172
6170 BAFW24, 148, 148, 181, 132, 132, 132
6180 BAFW13, 132, 168, 8, 131, 132, 37
6190 BAFW1, 141, 137, 0, 2, 248, 0
6200 BAFW22, 208, 248, 138, 24, 132, 0
6210 BAFW13, 11, 178, 2, 2, 141, 252
6220 BAFW48, 172, 2, 1, 10, 228, 148
6230 BAFW48, 72, 141, 2, 2, 169, 142
6240 BAFW41, 2, 168, 1, 76, 148
6250 BAFW14, 172, 232, 148, 141, 2, 0
6260 BAFW175, 232, 148, 141, 2, 1, 208
6270 BAFW22, 148, 171, 252, 148, 24, 169
6280 BAFW48, 148, 132, 132, 132, 248, 148
6290 BAFW48, 8, 132, 132, 132, 132, 0
6300 BAFW16, 148, 148, 2, 76, 141, 148
6310 BAFW6, 141, 131, 2, 132, 208, 148
6320 BAFW14, 148, 132, 99, 172, 248, 148
6330 BAFW13, 88, 131, 78, 141, 52, 76
6340 BAFW14, 208, 42, 149, 137, 31, 218
6350 BAFW22, 148, 248, 32, 218, 202, 148
6360 BAFW18, 148, 148, 32, 26, 171, 142
6370 BAFW1, 148, 30, 268, 189, 148
6380 BAFW16, 148, 148, 32, 26, 171, 172
6390 BAFW28, 148, 132, 231, 172, 231, 148
6400 BAFW13, 232, 148, 177, 231, 178
6410 BAFW28, 177, 231, 31, 268, 169, 148
6420 BAFW13, 216, 252, 148, 201, 132
6430 BAFW9, 132, 88, 48, 74, 52, 76
6440 BAFW41, 177, 26, 208, 14, 32, 76
6450 BAFW41, 167, 21, 208, 12, 162, 148
6460 BAFW6, 21, 71, 208, 24, 222, 169
6470 BAFW32, 76, 141, 168, 89, 24, 169
6480 BAFW24, 148, 132, 76, 168, 88, 169
6490 BAFW47, 148, 131, 88, 12, 76, 141
6500 BAFW28, 231, 248, 128, 76, 131, 148
6510 BAFW78, 8, 172, 76, 8, 172, 76
6520 BAFW1, 32, 76, 8, 172, 76, 8
6530 BAFW78, 14, 172, 76, 8, 172
6540 BAFW28, 172, 76, 8, 172, 76, 8
6550 BAFW78, 14, 172, 76, 8, 172
6560 BAFW1, 8, 172, 8, 252, 8, 252, 899



DELETE LISTING

```

1000 DELETE JOB DEL000 ;SET DELETE NAM
01
1010 LDA #0F ;SET START OF DELETE
1020 LDA #2F+1 ;MEMORY POINTER
1030 STA #0F ;STORE IT
1040 STA #0F+1
1050 JOB #0000 ;FIND ADDRESS OF
1060 LDA #0F ;END OF DELETE
1070 LDA #0F+1
1080 NCC DEL000
1090 LDT #0001
1100 LDA #0F+1 ;
1110 NCC DEL001
1120 TAA
1130 DCT
1140 LDA #0F+1 ;
1150 ;
1160 ; ... I HOLD THE POINTER TO THE E
ND
1170 ; OF DELETE RANGE.
1180 ; #F+1, #F+1 HOLD THE POINTER TO THE
1190 ; START OF DELETE RANGE.
1200 ;
1210 DELETE STA #0A ;STORE #00F AND
1220 STA #0A+1 ;OF DELETE POINTER
1230 LDA #0F
1240 NCC
1250 SBC #0A ;SET VARIABLE POINTER
1260 TAA ;TO END OF PROGRAM #F002
1270 LDA #0F+1 ;DELETE
1280 SBC #0A+1
1290 TAA
1300 NCC DEL000 ;NO FULL PAGE
1310 SBC #0A+1 ;INCREMENT BY BYTE
1320 SBC #0F+1 ;POINTERS
1330 LDA #0B+1 ;STORE LENGTH
1340 CDP #0F+1
1350 NCC DEL000 ;NOT YET
1360 DELETE JOB #0011 ;RE-CHAIN PROG
1370 LDA #0B
1380 LDA #0E
1390 ELC
1400 HCC #002
1410 STA #0B ;SET NEW POINTERS
1420 NCC DEL000
1430 TAA
1440 DELETE STA #0B+1
1450 JOB #001F ;PROGRAM "JOB"
1460 ; "READY."
1470 ;
1480 ;SET RANGE FOR DELETE
1490 ;
1500 NCC DEL000 ;SET CURRENT CH
0
1510 NCC DEL001 ;NO RANGE, ERROR
1520 CDP #0000 ;IS A NUMBER
1530 CDP #0000 ;IS IT --?
1540 NCC DEL000 ;NO, ERROR
1550 LDA #0B ;SET START ADDRESS OF
1560 STA #0F ;DELETE TO START
1570 LDA #0C ;OF PROGRAM
1580 STA #0F+1
1590 NCC DEL000 ;ALWAYS
1600 DELETE JOB #0010 ;OUTPUT (FORM) I
0000
1610 DELETE JOB #0010 ;SET NUMBER
1620 JOB #0012 ;FIND ADDRESS OF LINE
1630 JOB #0017 ;SECOND VALUE?
1640 NCC DEL000 ;NO
1650 CDP #0000 ;IS IT --?
1660 NCC DEL000 ;NO, ERROR
1670 DELETE JOB #0012 ;SET NEXT CHa
1680 JOB #0018 ;SET NUMBER
1690 NCC DEL000 ;NOT END OF INPUT
1700 DELETE LDA #14 ;IS SECOND LINE II
00?
1710 NCC #0+1
1720 NCC DEL000 ;NO
1730 LDA #0F ;SET TO NEW LINE#
1740 STA #0A
1750 STA #0A+1
1760 DELETE RTS ;RANGE DONE
1770 JOB
    
```

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Write now for details of Durell's
Great New Competition also
T-shirts, Calendars
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TOY TROUBLE

The local toyshop was never as bad as the one in this game by F. Tout.

IT IS LATE AT NIGHT. A strange force has taken control of the local toy factory. Peaceful toys have been turned into lurking monsters.

You, again, equipped with a bidirectional laser, you are

mankind's last hope. Your task is to destroy the toys while avoiding the Bombs that fly around the factory.

Your laser can fire up or down and you can rotate three times. The laser is controlled by a joystick in port two of your C64 laser pack.

Push left to go left

Right to move right

Forward to scroll top sector

Back to scroll bottom sector

Forward and fire to fire up

Back and fire to fire down

Program details

Program 1

- 0 sets screen and border colours
- 5 loads machine code
- 10 loads graphics
- 15 loads sprites
- 20 loads data

Program 2

- 30 sets up main colour mode
- 35-40 set up sound registers
- 51-59 set up sprite positions
- 66-120 print scores
- 120-205 sound effects
- 200-305 print score
- 300-395 title page
- 400-495 calls IRQ and sets speed
- 2000-2010 main loop
- 2000 hits toy
- 4000 cleared toys
- 5000-5916 hit Bomb
- 6000-6950 high score table
- game over
- V - Vlc chip
- 51, 52, 53 - sound registers
- k - score
- H - high score
- 11 - lives
- QQ - start of machine code

Program Listing 1

```

0 PRINT"COLOR$@:YELLOW":PRINT$@
(14)"PLEASE WAIT":POKE$3000,0:POKE
5300,0
5 FOR=4810205044:READA,POKET,A,
NEXT:SV$=0270
10 FOR=070207:READA,POKE:2000+T,A
NEXT
15 FOR=130651013031:READA,POKET,A
NEXT
20 DATA100,40,133,251,100,4,133,25
2,100,,133,254,100,
25 DATA177,251,133,253,100,1,177,2
51,136,145,251,200,200,192
34 DATA10,200,245,100,39,100,253,1
45,253,100,251,100,39,133
35 DATA251,144,2,230,252,230,254,1
66,254,224,11,200,213,90
38 DATA100,40,133,251,100,4,133,25
2,100,,133,254,100,30
30 DATA177,251,133,253,100,39,177,
251,200,145,251,136,136,192
32 DATA255,200,245,100,,100,253,14
5,251,100,251,100,39,133
34 DATA251,144,2,230,252,230,254,1
66,254,224,11,200,213,90
36 DATA100,0,133,251,100,0,133,252
,100,,133,254,100,
38 DATA177,251,133,253,100,1,177,2
51,136,145,251,200,200,192
40 DATA40,200,245,100,39,100,253,1
45,251,100,251,100,39,133
42 DATA251,144,2,230,252,230,254,1
66,254,224,11,200,213,90
44 DATA100,0,133,251,100,0,133,252
,100,,133,254,100,30
46 DATA177,251,133,253,100,39,177,
251,200,145,251,136,136,192
48 DATA255,200,245,100,,100,253,14
5,251,100,251,100,39,133
50 DATA251,144,2,230,252,230,254,1
66,254,224,11,200,213,90
52 DATA100,,133,103,100,39,133
54 DATA177,251,133,253,100,39,177,
251,200,145,251,136,136,192
56 DATA100,100,173,14,200,41,254,1
41,14,200,100,1,41,251
58 DATA133,1,100,255,200,177,100,1
45,103,100,200,200,247,100
60 DATA104,200,134,104,100,100,200
,100,100,200,00,200,231,100
62 DATA104,200,134,104,100,100,200
,100,100,200,00,200,231,100
64 DATA101,210,100,173,0,200
,201,75,240,0,200,0,200,90
66 DATA00,1,141,100,0,200,10,200,2
39,,200,90,173,
68 DATA200,201,204,240,3,200,,200,
00,00,100,2,201,
70 DATA40,20,173,,200,201,,240,4,

```

Program Listing 1 (cont.)

```

206 .208.96.183
72 DATA 141.188.2.208.16.208.208.1
208.96.173.208
74 DATA201.98.240.3.208.1.208.96.17
3.188.2.201.1.240
76 DATA8.201.2.240.5.96.32.96.182.
96.32.1.182.96
78 DATA173.188.2.201.1.240.5.201.2
.240.5.96.32.112
80 DATA132.96.32.188.182.96.173.2.
208.201.255.240.1.96
82 DATA238.16.208.208.16.208.238.2
.208.96.173.2.208.201
84 DATA.240.96.208.16.208.208.16.
208.208.2.208.96
86 DATA173.3.208.208.201.81.240.35.201
.60.240.31.208.3.208
88 DATA208.3.208.32.16.194.96.173.
3.208.201.255.240.14
90 DATA201.255.240.18.238.3.208.83
8.3.208.32.16.194.96
92 DATA173.1.208.141.2.208.173.1.20
8.141.3.208.183
94 DATA141.252.3.141.253.3.141.18.
212.96.188.84.141.18
96 DATA122.188.1.141.18.212.173.18
.208.141.18.212.188.21
98 DATA141.18.212.26.188.16.141.11
.212.188.183.141.18.212
100 DATA173.4.220.141.8.212.188.19
5.141.11.212.96.173.262
102 DATA3.201.1.240.1.96.32.206.12
3.96.173.253.3.201
104 DATA1.240.1.1.96.32.227.193.96.1
73.254.3.201.1.240
106 DATA8.201.1.240.5.96.32.190.18
3.96.32.130.193.96
108 DATA173.232.201.123.208.20.96
.96.193.32.30.194.188
110 DATA1.141.188.2.188.2.141.188.
2.234.234.234.96.201
112 DATA18.208.20.32.78.188.32.96
.194.188.1.141.188.2
114 DATA188.2.141.188.2.234.234.23
4.96.201.188.208.5.188
116 DATA1.141.234.3.234.234.234.96
.201.188.208.3.188
118 DATA141.254.3.234.234.234.96.2
01.110.208.9.188.1.141
120 DATA252.3.32.244.194.96.201.10
3.208.9.188.1.141.253
122 DATA3.32.238.194.96.96.252.3.2
01.240.8.173.253
124 DATA3.201.1.240.1.96.173.208.1
41.2.208.173.1
126 DATA208.141.3.208.234.234.234.
96.188.1.141.252.3.96
128 DATA188.1.141.253.3.96.173.252.
3.201.1.240.1.96
130 DATA173.253.3.201.1.240.1.96.17
3.208.141.2.208
132 DATA173.1.208.141.3.208.234.23
4.234.96.96.188.188.141
134 DATA.212.188.11.141.3.212.188
.18.141.1.212.188.138
136 DATA141.4.212.96.255.1.47.1.35
.10.62.1.36
138 DATA38.32.223.107.11.255.1.25
5.1.255.1.32
140 DATA223.255.255.36.255.1.32.32
.170.123.32.188.183
142 DATA32.60.194.32.72.194.32.250
.124.32.104.194.32.75
144 DATA196.32.13.196.32.102.196.7
8.48.234.120.168.80.141
146 DATA20.3.188.196.143.21.3.99.9
6.120.188.48.141.20
148 DATA3.188.234.141.21.3.99.96.1
60.5.188.8.4.84
150 DATA105.1.153.8.4.201.58.144.8
.188.48.153.8.4
152 DATA126.208.235.202.96.232.194
.96.32.27.125.32.136.195
154 DATA234.234.234.96.32.182.32.
188.192.96.16.194.32
156 DATA28.194.32.27.196.238.32.20
8.238.32.208.96.238.199
158 DATA2.78.174.188.188.1.141.188.
2.173.188.8.201.1
160 DATA240.8.238.188.2.78.174.188
.188.1.141.188.2.141
162 DATA188.2.96.182.188.4.208.23
4.4.208.188.188
164 DATA6.208.201.140.240.8.254.5.
208.232.232.224.10.208
166 DATA240.188.187.5.208.173.18.
208.187.4.208.96.96
168 DATA88.173.140.2.201.10.240.4.
238.190.2.96.188
170 DATA141.190.2.32.33.126.96.173
.250.7.201.212.240.7
172 DATA238.250.7.32.58.126.96.188
.208.141.250.7.32.58
174 DATA198.96.173.250.7.141.251.7
.141.252.7.141.253.7
176 DATA141.234.7.141.255.7.96.173

```



Program Listing 1 (cont.)

```

191,2,201,3,240,4
178 DATA238,191,2,96,169,,141,191,
2,32,237,195,96,92
180 DATA184,195,173,18,208,98,173,
30,208,201,8,208,12,189
182 DATA,141,9,208,32,98,188,141,4
,208,98,201,10,208
184 DATA12,183,,141,7,208,32,98,18
8,141,8,208,98,201
186 DATA18,208,12,183,,141,9,208,3
2,98,195,141,8,208
188 DATA98,201,34,208,12,188,,141,
11,208,32,98,198,141
190 DATA10,208,98,201,98,208,12,18
9,,141,13,208,32,98
192 DATA98,,141,12,208,98,201,130,
208,12,189,,141,15,208
194 DATA32,98,198,141,14,208,98,20
1,8,240,98,201,9,240
196 DATA52,201,17,240,48,201,33,24
0,47,201,98,240,48,201
198 DATA129,240,38,201,7,240,32,20
1,13,240,98,201,13,240
200 DATA24,201,38,240,20,201,67,24
0,16,201,131,240,12,183
202 DATA,141,30,208,141,208,2,234,
234,234,98,189,1,141
204 DATA208,2,234,98
206 DATA85,101,26,26,6,6,1,1,86,86
,84,84,80,80
208 DATA4,64,2,8,8,2,3,6,26,106,1
20,32,32,120
204 DATA9,80,84,86,16,83,83,243,2
43,243,255,83,240,252
208 DATA28,207,207,207,255,252,82
,82,82,83,80,12,18,3
208 DATA62,62,62,83,60,48,240,192,
86,86,90,90,106,111
210 DATA175,175,149,149,166,166,16
3,243,250,250,175,175,111,106
212 DATA90,90,86,86,260,260,248,16
3,165,165,148,148,,
214 DATA6,22,88,88,101,101,,80,14
8,101,101,88,88
216 DATA89,89,101,101,148,80,,101
,101,88,88,82,8
218 DATA,,20,21,81,81,86,81,21,5,2
0,84,88,88
220 DATA89,84,84,80,4,5,1,1,1,,1,1
6,80
222 DATA64,64,64,,231,218,,
224 DATA,,18,18,,8,8
226 DATA,,12,12,,85,85,85,85
228 DATA85,85,85,85,170,170,170,17
0,170,170,170,170
400 DATA88,,8,88,80,8,48,24,140,88
,,80,88,14,80
402 DATA112,7,24,224,3,255,192,48,
233,140,120,90,200
404 DATA255,255,,255,255,252,120
,80,90,48,231,140
406 DATA3,255,192,7,24,224,12,60,4
8,28,90,88,90,24
408 DATA140,88,80,8,98,,8,127,,...
,
410 DATA,,12,,12,,12,,12,,
412 DATA,,12,,12,,12,,12,,
414 DATA12,,12,,
416 DATA,,
418 DATA,127,,
420 DATA18,,31,254,,127,127,129,2
54,83,255,252,31,127
422 DATA18,31,143,248,31,248,248,
63,254,124,127,255,254,255
424 DATA129,255,254,,127,248,31,,
,,
426 DATA,,240,,
428 DATA,,124,,82,127,,254
430 DATA63,195,252,83,255,248,79,1
27,240,79,143,240,79,248
432 DATA40,63,254,120,63,255,252,
127,195,254,127,,254,124
434 DATA,62,,
436 DATA,,240,,
438 DATA,,248,31,3,248,15,207,
240,15,258,224
440 DATA15,255,224,19,207,192,19,2
43,152,15,255,192,15,255
442 DATA24,31,255,248,31,195,248,
31,,248,,
444 DATA,,240,,
446 DATA,,7,3,224,15
448 DATA237,224,31,255,224,15,255,
192,48,266,129,32,229,129
450 DATA32,251,128,48,255,128,19,2
55,192,83,255,224,15,255
452 DATA224,7,195,224,,
454 DATA,,240,,
456 DATA,,219,,1,127,192,2,83,1
82,4
458 DATA31,128,4,31,128,12,31,128,
8,31,,12,31,
460 DATA49,83,188,8,83,188,3,127,12
8,3,254,,
462 DATA,,240
464 DATA,,124

```

Program Listing 1 (cont.)

```

468 DATA,138,1,7,2,7,2,3,2
469 DATA,2,3,2,3,1,7,1,135,
470 DATA,142,124,.....
472 DATA,.....249,.....
474 DATA,.....85,.....102,.....200
476 DATA,148,1,188,128,1,148,128
1,188,128,1
478 DATA123,128,1,123,1,123,1,102,
,120,
480 DATA,.....,32
500 POKEX28,2,POKEX31,13,LOAD

```

Program Listing 2

```

10 V=53248,POKEV=22,PEEK(V-22)OR16
-POKEV+24,29,POKEV+32,0,POKEV+33,0
-POKEV+34,2
20 POKEV+35,10
22 S1=54276,S2=54277,S3=54278,S4=5
1-1,POKES3+14,15,POKESU,78
30 POKES1+20,31,POKES1+29,245,GOTO
1000
32 G=10,FORT=475248STEP2,POKEV+T,0,
POKEV+T+1,G,G+31,NEXT
35 POKEV+21,255,POKEV,0,POKEV+1,13
9,POKEB040,204,POKEB041,205,POKEV+
39,3
37 POKEV+40,3,POKEV+35,13,POKEV+31
,2,POKESU+7,8,POKESU+14,18
39 FORT=5042030H7,POKET,206,NEXT
40 POKE1020,0,POKE1021,0,POKEB00,0
-POKEV+30,0
45 G=10,FORT=5015STEP2,POKEV+T,0,
0+0+27,NEXT
54 POKES4275+14,20
55 IF00=1THENSC08500,00T0800
100 A$="Ca B1c C1e B1e B1c B1c P1c
e B1c B1c B1c B1c B1c B1c B1c B1c
10LEFT10LEFT
10LEFT10LEFT10LEFT10LEFT10LEFT10L
FT10LEFT10DOWN10C B1c B1c B1c K
10e K1c L1C
e B1c B1c B1c B1c T1CUP1":DE-1
102 B$="Ca B1c U1"DO$="CDOWN1"/P
RINT"DO$":,FORT=01011,PRINTDO$,
:NEXT:PRINT"
1c B1c Y1",FORT=01007,PRINTB$,
103 NEXT:PRINT"Ce Y3",
104 PRINT"DOWN1",FORT=0104,FORT
=0103,PRINTB$,:DOSUBSC08:NEXT:PRIN
T"DOWN1":,N
EXIT:PRINT"CHOICE1WHIT1"

```

Program Listing 3 (cont.)

```

105 A=1004,B=120,POKES1,0,POKES2,3
1
106 FORT=01000STEP2,POKEA+RND(1)*8
,85,SC08500,NEXT:POKES1,24
107 FORT=0010100STEP2,POKEA+RND(1)
*8,B7,SC08500,NEXT:POKES1,64
108 FORT=16002040STEP2,POKEA+RND(1)
*8,B6,SC08500,NEXT
110 1PCL=1THENSC08500:00T0800
112 SC08500
120 00T0800
200 POKES3,1,POKES1,71:RETURN
205 POKES1,128,POKES2,12,POKES3,50
:POKES1,135:RETURN
500 PRINT"CHOICE1RED3 SCORE CYA
M100000 CRED31 (CYAN) (RED3HIGH
SCORE (CYAN)
0 (c B1":00=1
501 PRINT"CHOICE1CYAN0":PRINTTAB(
18),L1,TRAB(83):H1(1)
505 1PCL=1THENRETURN
600 FORT=175202STEP-1,POKES9,T,POK
ES1,135,POKEV,177-T,NEXT:GOTO1999
1000 PRINT"CLEAR1(DOWN1DOWN1000
NICDOWN1DOWN10 B1":POKES2823,10:
POKEV+21,0,0
D=0
1020 PRINT" (e B1c L1c K1
1c B1 (e B1c K1
1035 PRINT" (e K1 (e B1C
e B1 (e B1c B1
1040 PRINT" (e B1c B1 (e B1
(e B1)c K1 (e K1c L1c K1 (e L1
(e L1c K
1045 PRINT" (e A1c B1 (e K1c
L1c K1c L1c K1c L1c K1 (e L1
(e L1 (e K1
(e K1 (e L1 (e B1c T1
1050 PRINT" (e L1 (e
K1c L1c K1 (e L1 (e L1 (e K
1
1055 PRINT" (e B1c U1c U1c
U1c U1c U1c U1c U1c U1c U1c
e U1c U1c
U1c U1c U1c U1c U1c U1c U1c
U1c U1c U1c U1c U1c U1c U1c
e U1
1060 PRINT" (e K1c L1c K1
(e L1c K1c L1c K1 (e L1 (e K1
(e L1c K1 (
e K1c L1c K1 (e L1
1080 PRINT"CGREEN1(DOWN1DOWN1) BY
FRANK TOUT : 1985 : SPACE TO PLAY.
":G=53248,PO

```



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