Practical Computing

80p

August 1981

Volume 4 Issue 8

Computer Slang

Reviews:

Tandy III
Sharp PC-3201
Incomplete records

Solicitors' micro

Telesoftware standards

Forth

Better Basic

Official 1981 Microcomputer Show Guide

MicroCentre introduce . . . . . System Zero

Basic System Zero £587
System Zero/D with DDF £2355

The System Zero is a small computer especially designed for dedicated applications. It is particularly useful in process control situations.
In the basic model you get Cromemco's famous Z-80A single card computer, 1k of RAM, 4k of ROM, Control Basic, and an attractive cabinet. The motherboard provides 3 extra card slots on the S-100 bus, for tailoring the system to particular applications. The basic model is designed for ROM-based programs, but it can be expanded by the addition of memory and I/O cards. It is fully compatible with all Cromemco peripherals, including floppy disks and hard disk systems. Suitably configured the System Zero can run any Cromemco operating system or software package.

New System Zero Computer with quad-capacity DDF disk drive. The system includes built-in diagnostics for a quick system test of memory, controller and disk drives

System Zero/D

This special version of the System Zero has 64k of fast RAM, and a model DDF dual disk drive. It includes two double-sided double-density 5 inch disk drives giving a total of 780k bytes storage; and RDOS-2, a new resident disk operating system with terminal and printer drivers, and self-test diagnostics.
The System Zero/D is an exceedingly inexpensive development computer ideal for setting up dedicated applications to run in the basic model. It will support Cobol, Fortran IV, Ratfor, Structured Basic, Lisp, RPG II, Word Processing, DBMS, and the full range of Cromemco's business applications software.

At the recent UK launch of the System Zero Computer, Cromemco's Technical Director Roger Melen presented a System Zero/D with 128k memory running Cromix. Here he is seen discussing the system with MicroCentre Director Andrew Smith (right).

Operating system

The System Zero/D will run any Cromemco operating system provided sufficient memory is available. The mimimun configuration of 4k ROM runs control Basic; with 64k RAM the system will run RDOS-2 or CDOS (compatible with CP/M); and with 128k the Zero/D will run the Cromix system (based on Unix).

For C Cromemco... call the experts

MicroCentre
Tel: 031-556 7354

LEADING UK DISTRIBUTORS

Complete Micro Systems Ltd.,
30 Dundas Street
Edinburgh EH3 6JN

• Circle No. 101

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The Microcomputer with one of the world's biggest names The ITT 2020

This is micro computing at its most compact and versatile best. Complete, self-contained – ready to plug in and startlingly simple to operate. With easy typewriter style keyboard, the ITT Floppy Disk Drive Unit with 116k capacity suitable for continuous business use, for fast, uncomplicated data retrieval – at low cost, to make life easier for almost any type of smaller business or professional situation. To store and display – at the touch of a few keys – anything from address files to a whole year's financial records. All backed by the advanced technology of one of the *biggest* names in electronics today, ITT. With a countrywide advice and after-sales service to match.

ITT

World-wide Technology

ITT Consumer Products (UK) Ltd.,
Chester Hall Lane, Basildon, Essex.
Tel: Basildon 3040 Ext. 196-198

Dealers

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95 Dublin Road
Tel: 0232 49440

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Byteshop Computerland Ltd
94/96 Hurst St, B5 4TD
Tel: 021 622 7149

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Cambridge Computer Stores
1 Emmanuel St, CB1 1NE
Tel: 0223 68155

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Tremena Road
St Austell, PL25 5GG
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8 Dawson St
Tel: 0001 372052

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Tel: 01 405 6761

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London SE17
Tel: 01-670 3674

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Piccadilly Station Approach
Tel: 061 236 4737

NSC Computers
29 Hanging Ditch
Tel: 061 832 2269

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Newbear Computing Store
40 Bartholomew St
Tel: 0635 30505

Nottingham
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92A Upper Parliament St,
NG1 6LF
Tel: 0602 40576

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451 Eccleshall Road, S11 9PN
Tel: 0742 663125

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23 Cumberland Place,
SO1 2BB
Tel: 0703 38740

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Holbrook Hall
Little Waldingford
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16 The Square
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Comart Microcomputer dealers are located strategically throughout the country to give support, guidance and assistance. In the event of difficulty contact Comart direct.

Horizon Hard Disc adds a new dimension to cost effective data processing

With its parentage already established as the proven performer in its price range, North Star's Hard Disc Horizon is set to break new barriers in cutting the cost of data storage and retrieval.

It offers 18 Megabytes of on line storage, and at current prices that works out at less than 0.03p per byte. And, with up to 10 times the speed of operation of the more conventional floppy discs, and the convenience of storing all your data on-line, it's a basic price incentive that's amplified even more in reduced operating costs and efficiency.

Add to that the new North Star Application Software, Word Processing, Information Management and Reporting System and you'll understand why we say that North Star is set for new horizons of application.

Find out the facts about expanding your North Star Horizon today!

The U.K. Leaders in Microcomputer Development, Application and Support.

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• Circle No. 103

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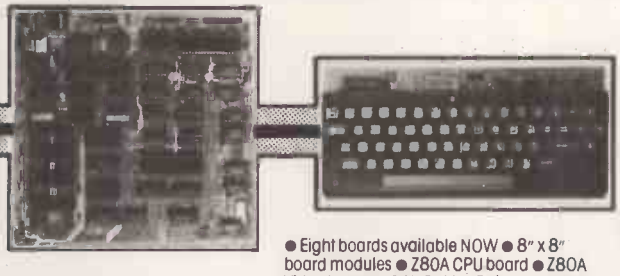
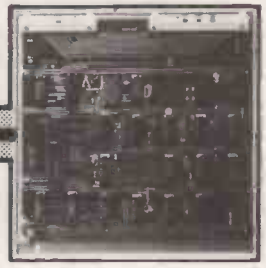
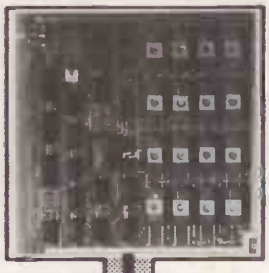
MicroValue

New British Microsystem. Gemini MultiBoard







● Eight boards available NOW ● 8" x 8" board modules ● Z80A CPU board ● Z80A Video board ● 64K RAM ● Built and tested

Developed by one of the most experienced micro board design teams in the UK, Gemini MultiBoard* is the ultimate modular board system. Unlike most systems of its kind, virtually nothing is made redundant when you expand it. And for those who want expansion this can be immediate, for we are launching eight boards simultaneously. No other system has offered so much so soon.

All MultiBoard modules are Nasbus† and Gemini 80-BUS* compatible and can be used in a wide spectrum of application, e.g. educational, personal, business, system development and process/production control.

MultiBoard modules are built and tested to the highest standards. And offer enormous computing power and potential at astonishingly low cost.

MultiBoard Modules available now

Z80A CPU

Processor: Z80A CPU at 4 MHz. Optional wait-states. Reset jump to any 4K boundary.

Parallel I/O: 8 bit ASCII keyboard socket. Uncommitted Z80A PIO giving two 8 bit bi-directional ports with handshake.

Serial I/O: 8250 UART with programmable baud rates and software selectable between RS232 or 1200 baud CUTS cassette interfaces.

Memory: 4 'Bytewyde' sockets to accept EPROM/ROM/RAM. Memory switched in/out of memory map under software control.

Software: Comprehensive monitor. Optional 12K Microsoft BASIC (ROM). Standard configuration PROM provides decodes for 4 x 2732 (4K x 8) EPROMs.

The CPU Board is fully buffered to the Gemini 80-BUS standard.

INTELLIGENT VIDEO

- Z80A microprocessor controlled.
- 80 x 25 display controlled by 6845 CRTC chip.
- Adjustable dot clock for alternative screen formats.
- Character set: 128 in EPROM + 128 in RAM which can be defined as the video inverse of the main set or as block graphics with 160 x 75 resolution.
- I/O port communication with host computer.
- Light pen socket.
- 8-bit input port allowing several video boards (each with its own keyboard) to be connected to a single CPU board.

FLOPPY DISK CONTROLLER

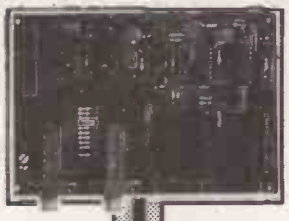
- Controls: Pertec FD250 5.25in 48 TPI, Micropolis 1D15 5.25in 96 TPI, Pertec FD514 8in.
- Controls up to 4 drives of same type.
- Single/double density software selectable.
- Single or double sided.
- Western Digital FD1797 controller.
- Up to 8 drives (2 boards) can be used in the same system.

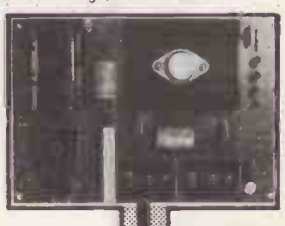
64K RAM

- Runs at 4 MHz with no wait-states.
- 4 banks of 16K dynamic RAM, each bank locatable on any 4K address boundary.
- Page Mode supplied as standard allowing up to 4 memory boards to be addressed.
- All the memory can be used by switching out on-board CPU memory, e.g. in disk environment.

EPROM/ROM BOARD

- Accepts up to 40K of firmware.
- 4 banks of 4 sockets.
- Banks can be mixed between 2708 or 2716.
- 24-pin ROM socket.
- Wait-state generator.
- Supports Page Mode scheme.





EPROM PROGRAMMER

- Programs multi-rail 2708 or single rail 2716.
- Connects to PIO on CPU board.
- Software provided on tape.

3A PSU

- Supplies 4/5 boards.
- LED on each output.
- +5V at 3A; +12 at 1A; −5V at 1A; −12V at 80mA.

KEYBOARD

- Full alpha-numeric ● 59-keys ASCII encoded ● Exclusively designed for Gemini ● Auto repeat ● Cursor control keys

MULTIBOARD PRICES (excl VAT)

(All built and tested except where marked)

CPU (G811)	£125.00
Video (G812)	£140.00
64K RAM (G802)	£140.00
FDC (G809)	£140.00
EPROM/ROM (G803)	£ 70.00
EPROM PROG. (G808) Kit	£ 29.50
3A PSU (G807)	£ 40.00
Keyboard (G613)	£ 57.50

FLOPPY DISK UNIT

Gemini unit suitable for MultiBoard. Holds one or two 5¼in double sided, double density Pertec drives. Intergral power supply. Price £375 plus VAT for one drive, £575 plus VAT for two drives. CP/M2.2 and documentation £90 plus VAT.

KENILWORTH CASE for MultiBoard	£49.50 + VAT
5-Card Support Kit	£19.50 + VAT
VERO Frame (also suitable for Nascom)	£32.50 + VAT
PSU Enclosure Kit	£24.50 + VAT

KEYBOARD enclosures available soon.

MultiBoard Modules are available from the MicroValue dealers listed on facing page.

*Trademarks of Gemini Microcomputers Limited
†Trademarks of Nascom Microcomputers Division of Lucas Logic.
††Trademarks of Digital Research Inc.

MicroValue

COMPATIBLE

Nasbus products from your MicroValue Dealers

GEMINI G805 FLOPPY DISK SYSTEM FOR NASCOM-1 & 2

It's here at last. A floppy disk system and CP/M

CP/M SYSTEM. The disk unit comes fully assembled complete with one or two 5¼" drives (FD250 double sided, single density) giving 160K per drive, controller card, power supply, interconnects from Nascom-1 or 2 to the FDC card and a second interconnect from the FDC card to two drives, CP/M 1.4 on diskette plus manual, a BIOS EPROM and a new N2MD PROM. All in a stylish enclosure.

Single drive system ..... **£450 + VAT**
Double drive system ..... **£640 + VAT**
Additional FD250 drives ..... **£205 + VAT**

D-DOS SYSTEM. The disk unit is also available without CP/M to enable existing Nas-Sys software to be used. Simple read, write routines are supplied in EPROM. The unit plugs straight into the Nascom PIO. Single drive system **£395 + VAT**

DCS-DOS A greatly enhanced version of D-DOS, running under Nas-Sys. Gives named files in BASIC, ZEAP, NAS-PEN and machine code programs ..... **£50 + VAT**

DISKPEN

The powerful text editor written for the Nascom is now available on a 5¼ inch floppy disk with a number of new features. **Price £43.25 + VAT.**

NASCOM COMPUTERS

NASCOM-2 Microcomputer Kit
£225 + VAT
NASCOM-1 Microcomputer Kit
£125 + VAT
Built and tested **£140 + VAT**

16K RAM KIT ..... £100 + VAT
3A PSU KIT ..... £32.50 + VAT

KENILWORTH CASE FOR NASCOM-2

The Kenilworth case is a professional case designed specifically for the Nascom-2 and up to four additional 8" x 8" cards. It has hardwood side panels and a plastic coated steel base and cover. A fully cut back panel will accept a fan, UHF and video connectors and up to 8 D-type connectors. The basic case accepts the N2 board, PSU and keyboard. Optional support kits are available for 2 and 5 card expansion.

Kenilworth case ..... **£49.50 + VAT**
2-card support kit ..... **£7.50 + VAT**
5-card support kit ..... **£19.50 + VAT**

CASSETTE ENHANCING UNIT

The Castle interface is a built and tested add-on unit which lifts the Nascom-2 into the class of the fully professional computer. It mutes spurious output from cassette recorder switching, adds motor control facilities, automatically switches output between cassette and printer, simplifies 2400 baud cassette operating and provides true RS232 handshake.

Castle Interface Unit ..... **£17.50 + VAT**

A NASCOM-2 BASED SYSTEM FOR LESS THAN £1500 + VAT

The proven Nascom-2 microcomputer can now be bought as a complete system from under £1500 + VAT. For this price you get the Nascom-2 kit, 16K RAM board kit, Kenilworth case with 2 card frame, Centronics 737 printer—10 inch monitor, and the Gemini Dual Drive Floppy Disk System. The CPU and RAM boards are also available built – the additional cost is available on application.

A-D CONVERTER

For really interesting and useful interactions with the 'outside world' the Milham analogue to digital converter is a must. This 8-bit converter is multiplexed between four channels – all software selectable. Sampling rate is 4KHz. Sensitivity is adjustable. Typical applications include temperature measurement, voice analysis, joystick tracking and voltage measurement. It is supplied built and tested with extensive software and easy connection to the Nascom PIO.

Milham A-D Converter
(built and tested) ..... **£49.50 + VAT**

PROGRAMMER'S AID

For Nascom ROM BASIC running under Nas-Sys. Supplied in 2 x 2708 EPROMs. Features include: auto line numbering; intelligent renumbering; program appending; line deletion; hexadecimal conversion; recompression of reserved words; auto repeat; and printer handshake routines. When ordering please state whether this is to used with Nas-Sys 1 or 3. **Price £28 + VAT.**

GEMINI 'SUPERMUM'

12 x 8 piggy-back board for Nascom-1 offering five-slot motherboard, quality 5A power supply and reliable buffering with reset jump facility. **Kit Price £85 + VAT.**

CENTRONICS 737 MICRO PRINTER

A high performance, low price, dot-matrix printer that runs at 80cps (proportional) and 50cps (monospoced). This new printer gives text processing quality print. And can print subscripts and superscripts. It has 3-way paper handling and parallel interface as standard. Serial interface is optional. **Price £375 + VAT.** Fantold paper (2000 sheets) **£18 + VAT.**

BITS & PC's PCG

5 x 4 board which plugs straight into Nascom-2. Operates on cell structure of 128 dots, producing 64 different cells. Once defined, each cell may be placed anywhere, any number of times on screen simultaneously. Max screen capacity: 768 cells. Dot resolution: 384 x 256 98304. Many other features including intermixing of alpha-numeric characters and pixels. **Price (kit) £60 + VAT.**

PORT PROBE

Allows monitoring of input and output of Nascom PIO. This board can generate interrupts and simulate handshake control. **Price (kit) £17.50 + VAT.**

All prices are correct at time of going to press and are effective 1st July 1981.

HEX & CONTROL KEYPADS

Hexadecimal scratchpad keyboard kit for N1/2: **Price £34 + VAT.**

As above but including (on the same board) a control keypad kit to add N2 control keys to N1. **Price £40.50 + VAT.**

BASIC PROGRAMMER'S AID

Supplied on tape for N1/2 running Nas-Sys and Nascom ROM BASIC. Features include auto line number, full cross-reference listing, delete lines, find, compacting command, plus a comprehensive line re-numbering facility. **Price £13 + VAT.**

'SCREENPLUS'

Screenplus enables a programmer to blank or display in reverse video, selected words, letters or areas of the screen under program control. Suitable for use with either Nascom 1 or 2. 'Screenplus' (built and tested) .... **£40.00 + VAT.**

DUAL MONITOR BOARD

A piggy-back board that allows N1 users to switch rapidly between two separate operating systems. **Price (kit) £6.50 + VAT.**

YOUR LOCAL MICROVALUE DEALER

All the products on these two pages are available while stocks last from the MicroValue dealers listed below.
(Mail order enquiries should telephone for delivery dates and post and packing costs.) Access and Barclaycard welcome.

BITS & PC'S
4 Westgate, Wetherby, W.Yorks.
Tel: (0937) 63774.

BUSINESS & LEISURE MICROCOMPUTERS
16 The Square, Kenilworth, Warks.
Tel: (0926) 512127.

ELECTROVALUE LTD.
680 Burnage Lane, Burnage, Manchester M19 1NA.
Tel: (061) 432 4945.

28 St Judes, Englefield Green, Egham, Surrey TW20 0HB.
Tel: (0784) 33603. Tlx: 264475.

TARGET ELECTRONICS
16 Cherry Lane, Bristol BS1 3NG.
Tel: (0272) 421196.

INTERFACE COMPONENTS LTD.
Oakfield Corner, Sycamore Road, Amersham, Bucks.
Tel: (02403) 22307. Tlx: 837788.

HENRY'S RADIO
404 Edgware Road, London W2.
Tel: (01) 402 6822.
Tlx: 262284 (quote ref: 1400).

• Circle No. 104

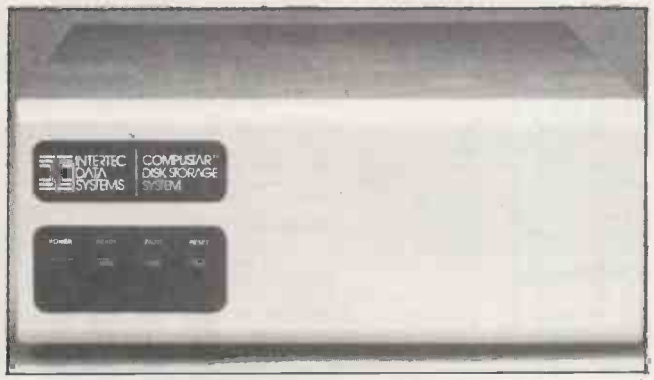
SuperBrain users get exceptional performance for just a fraction of what they'd expect to pay. Standard SuperBrain features include: two double density mini-floppies with 350K bytes of disk storage, 32K of ram memory (expandable to 64K) to handle even the most sophisticated programs, a CP/M Disk Operating System with a high powered text editor, assembler, debugger and a disk formator. And, with SuperBrain's S-100 bus adaptor, you can add all the programming power you will ever need ... almost any type of S-100 compatible bus accessory.
SuperBrain's CP/M operating system boasts an overwhelming amount of available software in BASIC, FORTRAN, COBOL, and APL. Whatever your application ... General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing, SuperBrain is tops in its class. And the SuperBrain QD boasts the same powerful performance but also features a double-sided drive system to render more than 700K bytes of disk storage and a full 64K of RAM. All standard!

THREE TYPICAL PACKAGE DEALS	NORMALLY
01 — SUPERBRAIN 64K RAM 320 K	1950.00
02 — EPSON MX80 F/T RS232	425.00
03 — CABLE	25.00
04 — 12 MONTH WARRANTY	235.00
05 — DELIVERY IN U.K.	40.00
06 — TRAINING SESSION	50.00
07 — CPM HANDBOOK	8.75
08 — 50 BASIC EXERCISES	8.75
09 — BOX PAPER (2000 SHEETS)	20.00
10 — DBMS (DATABSASE)	195.00
11 — WORD-STAR (ELSEWHERE 250)	190.00
12 — MBASIC-80	150.00
13 — 40 MEMOREX DISKETTES	114.00
14 — DOS + AND DIAGNOSTICS	125.00
15 — AUTOLOAD/CLOCK/MULTIKEY	50.00
16 — DATASORT	50.00
(NOT INC VAT)	3636.50
OUR PRICE ******	2950.00

	NORMALLY
01 — SUPERBRAIN 64K RAM 700K	2395.00
02 — NEC SPINWRITER 5510	1695.00
03 — CABLE ADAPTER	25.00
04 — 12 MONTH WARRANTY	410.00
05 — DELIVERY IN U.K.	50.00
06 — TRAIING SESSION	50.00
07 — CPM HANDBOOK	8.75
08 — 50 BASIS EXERCISES	8.75
09 — BOX PAPER (2000 SHEETS)	20.00
10 — DBMS (DATABASE)	195.00
11 — WORD STAR (ELSEWHERE 250)	190.00
12 — MBASIC-80	150.00
13 — 25 DYSAN D/SIDE DISKETTES	150.00
14 — DOS + AND DIAGNOSTICS	125.00
15 — AUTOLOAD/CLOCK/MULTIKEY	50.00
16 — DATASORT	50.00
(NOT INC VAT)	5572.50
OUR PRICE ******	4850.00

01 — SYSTEM 3 = ABC — 26 COMPUTER (Z80:2*8"DISKS:2.3 MEGABYTE:CP/M:MP/M)	4195.00
02 — NEC SPINWRITER 5510 & TRACTOR	1845.00
03 — 15 AS ABOVE WITH APPROPRIATE COMPATIBLE CHANGES	1050.00
(NOT INC VAT)	7090.00
OUR PRICE	6095.00

WARRANTY NOTE: WE HANDLE ALL REPAIRS OURSELVES.
WARRANTY COVERS FREE REPLACEMENT EQUIPMENT IF DEFECTIVE IN FIRST THREE WEEKS. THEREAFTER UP TO 12 MONTHS THE COVER PROVIDES INSURANCE ON ALL SPARE PARTS AND LABOUR COSTS (EXCLUDING CARRIAGE).
CALL OUT MAINTENANCE IS ALSO AVAILABLE AT 25.00 MINIMUM (LONDON) 50.00 MINIMUM ELSEWHERE IN U.K. PLUS MILEAGE.



Our New CompuStar™ 10 Megabyte Disk Storage System (called a DSS) features an 8 inch Winchester drive packaged in an attractive, compact desktop enclosure. Complete with disk, controller and power supply. Just plug it into the Z80 adaptor of your SuperBrain and turn it on. It's so quiet, you'll hardly know it's there. But, you'll quickly be astounded with its awesome power and amazing speed. The secret behind our CompuStar DSS is its unique controller/multiplexor. It allows many terminals to "share" the resources of a single disk. So, not only can you use the DSS with your SuperBrain, you can configure multiple user stations using our new series of CompuStar™ terminals, called Video Processing Units or VPU's™.

The COMPUSTAR™ Family ....

VIDEO PROCESSING UNITS
Model 10 VPU
- 64K Internal Memory
- Integral CRT, CPU, & Keyboard
- Download programmable

Model 15 UPU (Universal Processing Unit)
- 64K Internal Memory
- Same features as VPU, less integral CRT and keyboard
- Can be used as a remote printer or a terminal interface device

Model 20 VPU
- 64K Internal Memory
- 350K Dual Disk Capacity
- Integral CPU, Disks, CRT & Keyboard

Model 30 VPU
- 64K Internal Memory
- 750K Dual Disk Capacity
- Integral CPU, Disks, CRT & Keyboard

Model 40 VPU
- 64K Internal Memory
- 1 ½ MB Dual Disk Capacity
- Integral CPU, Disks, CRT & Keyboard

DISK STORAGE SYSTEMS (All feature our 255 user controller)
10 MB Winchester
- Shugart 8 inch mechanism
- Quiet, table-top operation
- Can be used with CompuStar or SuperBrain Video Terminals

32 MB Control Data CMD
- Cartridge Module Mechanism
- 16 MB fixed/16 MB removable
- Rack-mountable

96 MB Control Data CMD
- Cartridge Module Mechanism
- 80 MB fixed/16MB removalbe
- Rack-mountable

*** MAIN MENU DISPLAY ***

WIDELY USED IN U.K./FRANCE/U.S.A. AND ENGLISH SPEAKING COUNTRIES FOR ITS OVERALL FLEXIBILITY AS A COMPLETE BUSINESS PACKAGE.

INCLUDES INVENTORY, DATABASE MANAGEMENT, INVOICING, MAILING ADDRESSES, STATEMENTS, SALES/PURCHASE LEDGER WITH OR WITHOUT AUTO STOCK UPDATE AND DOUBLE ENTRY JOURNALS INCLUDING NOMINAL LEDGER; PLUS A'C RECEIVABLE AND PAYABLE MAKING AUTO BANK ENTRIES.

01 = ADDRESS SECTION	13 = PRINT CUSTOMER STATEMENTS	
02 = STOCK CONTROL	14 = PRINT SUPPLIER STATEMENTS	
03 = A/C RECEIVABLES	15 = PRINT AGENT STATEMENTS	
04 = SALES LEDGER	16 = PRINT TAX STATEMENTS	
05 = A/C PAYABLES	17 = RUN SEPARATE PROGRAMS	
06 = PURCHASE LEDGERS	18 = CHANGE VOCABULARY	
07 = BANK UPDATE	19 = PRINT YEAR AUDIT	(9.00)
08 = USER DATABASE AREA	20 = PRINT PROFIT/LOSS A'C	(9.00)
09 = INVOICE CREATION	21 = DISK DIRECTORIES	
10 = ORDER FILES	22 = CASHFLOW FORECAST	(9.00)
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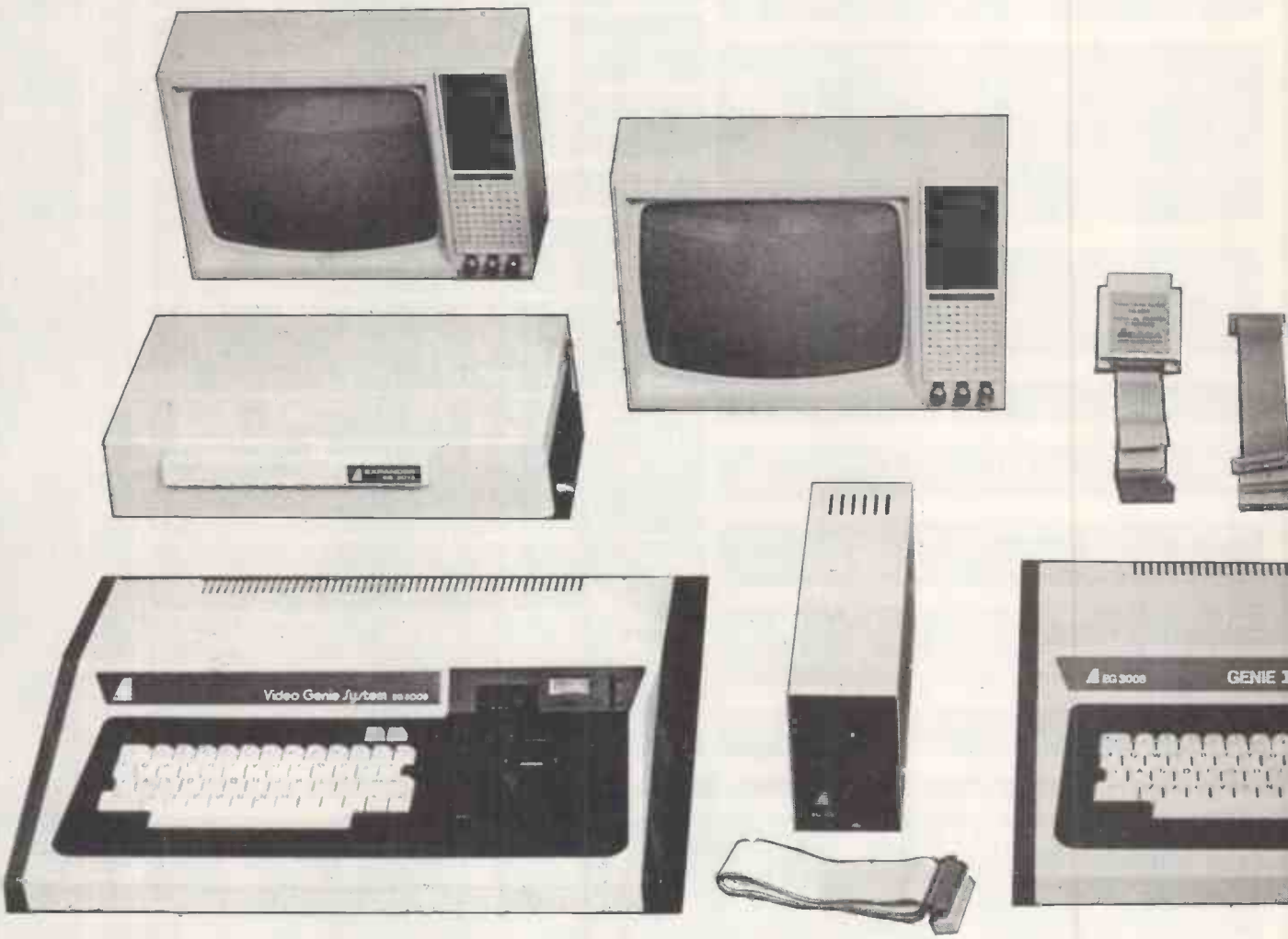

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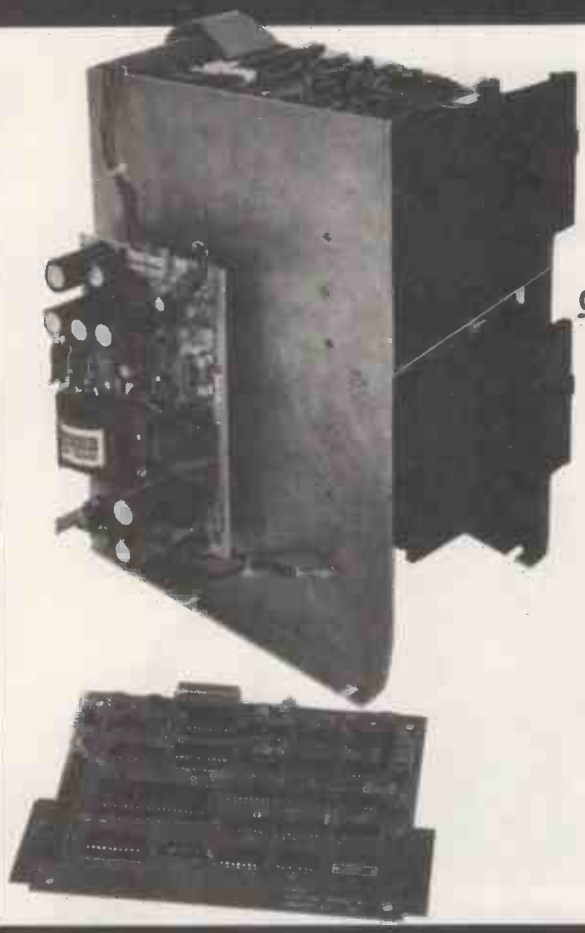

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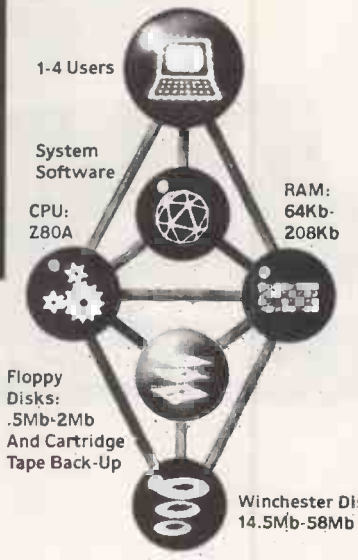

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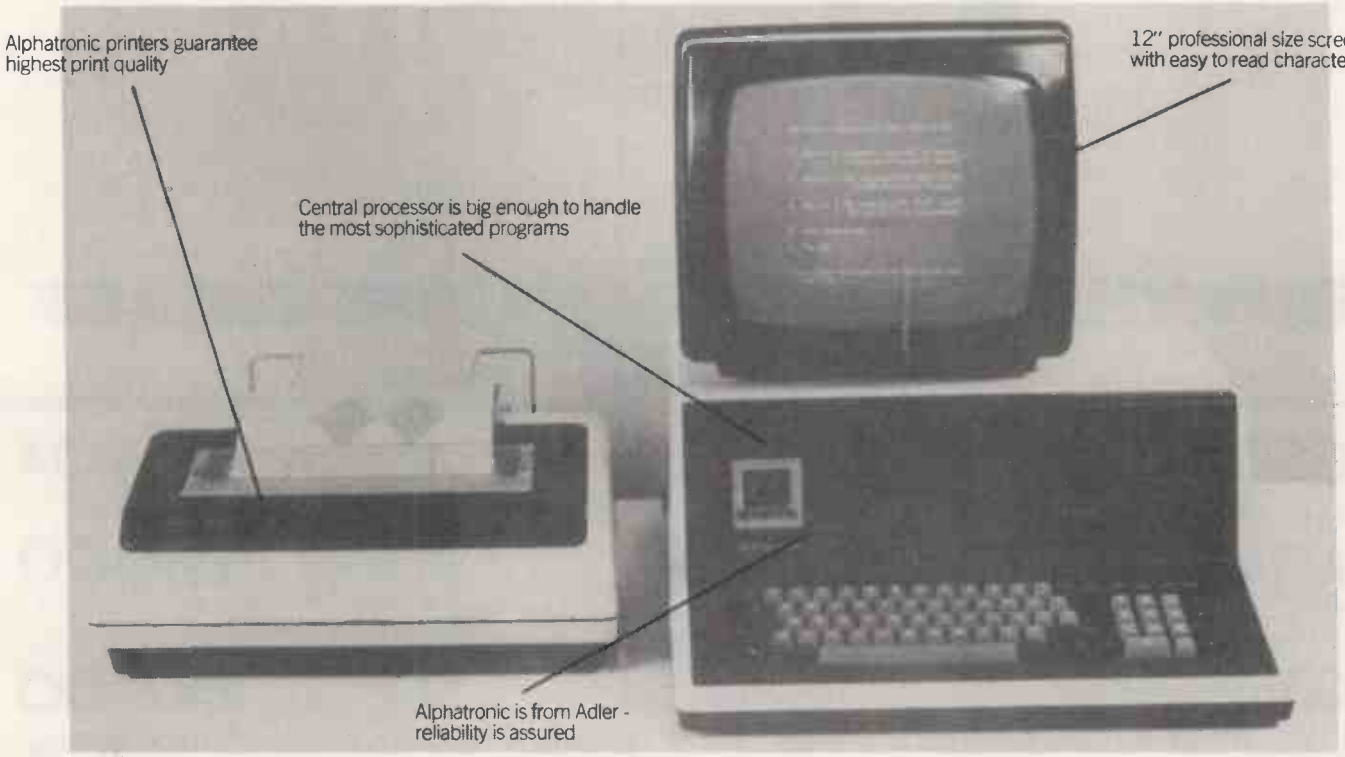

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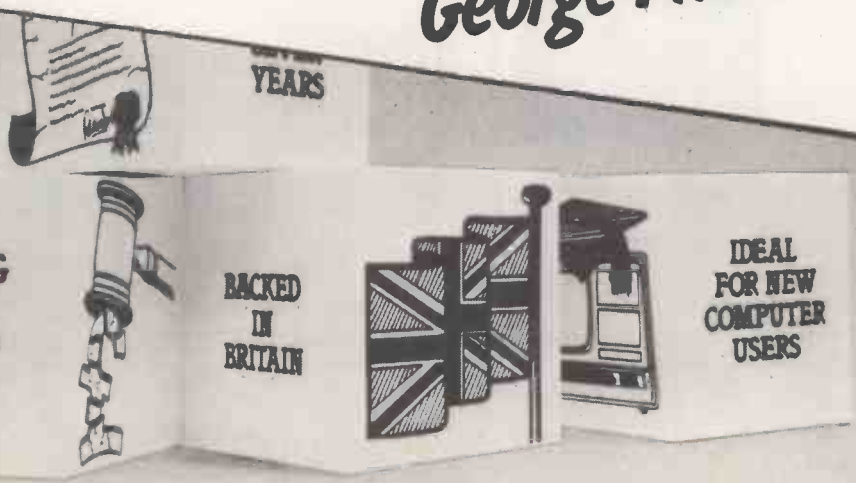

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31

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NEWS DIGEST

Micro Users get Electronic Mail first. While argument rages about the viability of Electronic Mail, British microcomputer users are already "posting" messages to each other via an electronic Bulletin Board. The 'Board' is really a central computer that can be accessed by virtually any microcomputer equipped with the right interface and software over the telephone. The user can "pin" any type of message on the board for public consumption or for a particular individual who knows the password. Subscribers are advised of what messages are current - and what waiting for them specifically. A report appears in the July issue of **MicroComputer Printout** magazine.

Could a Micro have caught the Ripper?, Many man-years of work and possibly several lives might have been saved if the Police had used a microcomputer to process information about suspects, according to the authors of an article in **MicroComputer Printout**. Attempts were made - unsuccessfully - to harness the Police National Computer and the Drivers and Vehicle Licensing computer, it is understood. Yet according to the article's authors, a microcomputer system costing less than £3000 could have done the job using off-the-shelf software.

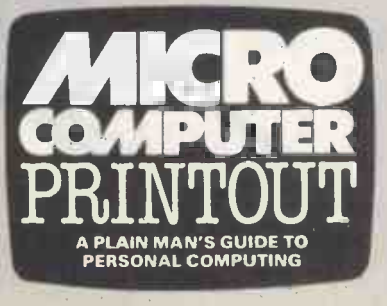
Computers can speak. Low-cost speach synthesizers that require no programming have been developed by two American companies. One of the products can be used with any computer capable of supporting RS232. Instead of text being sent from the computer to a printer, it is sent to the synthesizer which turns the incoming stream into "spoken" words in real time. The speach quality is significantly better than hitherto, yet the cost of the device is less than £200.

What the Salesman WONT tell you. Choosing a computer is difficult enough even without the attention of some of the high-pressure salesmen now moving into the field. The July issue of **MicroComputer Printout** carries a useful guide to what the salesman really means when he tells you that a system is powerful, fast, expandable, protected by warranty, and tailor-made for your appliction.

BASIC programs can be speeded up by between 20 and 150 times according to the suppliers of two new BASIC compilers. **MicroComputer Printout** put these surprising claims to the test in the July issue, and came up with some interesting results.

Also in the July issue: 'How BASIC Works', 'Video Games vs. Computer Games', '10 Amazing Facts About Micros', 'Beginners Guide to Word Processing', 'Runes - a cipher generator for PET', '6502 Assembler for Novices', plus news, reviews, programming hints, and gossip.

MicroComputer Printout is available on the newstands, or by post price £1 inc. postage from PO Box 48, Newbury, RG16 OBD. A subscription costs £11.40 for the 12 issues of 1981, or £9.85 for the 10 issues of 1980. Credit card orders are accepted by post or by telephone on 0635-201131.



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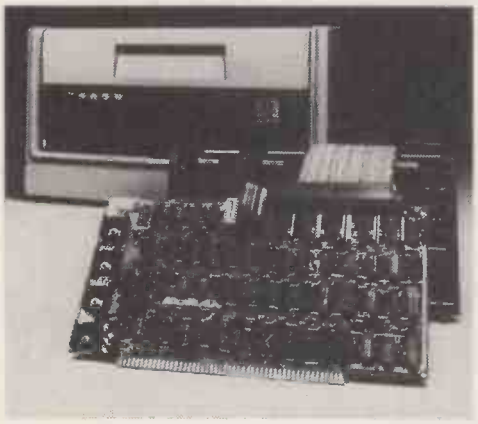

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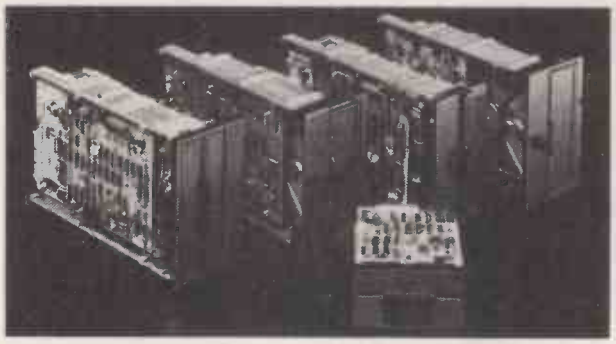

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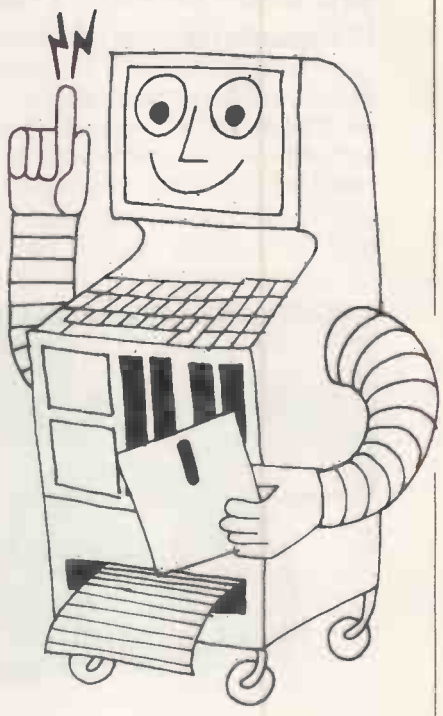

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• Circle No. 151

The equal and opposite reaction

STUDENTS OF POLITICS are currently in ecstasies or convulsions, according to their colour, about the results of the elections in France. For the first time in decades, the moderate Left has sufficiently calmed the fears of the Right to put itself firmly in power under M Mitterrand.

Well and good, one hears the computer person saying, but what is that to do with us? The answer, swift as Syntax Error, is a good deal because the change in administration has, in its first week, taken a most interesting step. The previous government, under the regal Giscard, had set the European electronics industry by the ears by announcing its plan to put a printer by every telephone, to eliminate telephone directories and eventually to deliver all mail by wire.

This, of course, is no more than people have been saying for years. It is ridiculous to maintain an army which carries pieces of paper to every house in the land once a day, when that same house is very likely connected by a pair of wires already.

If you are a capitalist like Giscard, it is evidently worth investing in the electronics to put all this army out of business — and that is what the right-wing government under Giscard was doing. What was the socialist Mitterrand's first action on taking office? He announced that he would be hiring many more government employees — among them an extra 55,000 fine, upstanding, voting — socialist, of course — postmen.

This is probably the most immediate demonstration of the conflict between micros and jobs the Western world has yet seen. Happily, the conflict is more symbolic than real because the installation of printers is so far only notional and the contract only just issued for building a small fraction of the millions that will ultimately be needed. Of course, Mitterrand has only seven years and then it will be the others' turn.

There are not so many jobs as easily automated as the postman's, but even so, the present period of peace in the latent quarrel between capital, in the form of chips, and labour in the form of replaceable eyes and hands is only being kept by the difficulty of introducing the new technology. On paper, the industrial nations should already be in a state of civil war as voracious machines gobble up the workers' jobs. In practice, matters are a good deal more difficult, and that is probably not a bad thing.

Why is the new technology so slow to make its way? Various small problems like: it does not work, it is never delivered and so on have been canvassed on this page from time to time — but that still does not explain the inertia we see.

It is becoming clear that the main obstacle is the blank incomprehension of what the new technology is, what is does and why anyone would want it. For instance, not a million miles from the *Practical Computing* offices, one of the world's largest magazine publishing groups dozes peacefully through the afternoon. It has several thousand employees and — as far as we know — three microcomputers which are all in this office. If it wanted, it could have hundreds — replacing all its typewriters with word processors, putting business planners on all its managers' desks, installing accounting packages in place of its myriad bookkeepers.

Those responsible know that it could be done and that if they did, it would be a good idea. A few senior members of management are thinking of buying a ZX-81 to try to glean some idea of what micros are about — and that is to be commended. Yet quite apart from not really understanding the technology, there are solid reasons why they do not rush out and buy hard discs by the armful.

Firstly, they have a perfectly satisfactory operation already. Secondly, they have a big dp department with a big computer which tells them that micros are no good. Even though they know that is not quite true, there might be some truth in it. Then, for no better reason than that it likes an argument, one of the many trade unions which represent the interests of the alert and talented staff would be sure to throw up its hands at the mention of micros and start demanding time and three-quarters for damaged eyesight and five months' radiation sickness leave a quarter.

At the end of it all, what? You might lose a few secretaries and bookkeepers, but you would certainly hire a whole slew of programmers at twice the price. Who knows what lethal hiccups a big company full of micros might be subject to? Suppose byte-rot struck in the production department? Can anyone guarantee that the floating-point arithmetic will not evaporate in hot weather?

Many big companies — Xerox the latest among them — are striving to provide the all-electronic office. One suspects that the technical problems, fierce as they are, will probably be the easy part of the deal.

It was hard work to introduce big computers into business even though they were operated by a close-knit team of highly-paid people whose careers depended on the success of the implantation. The electronic office will have to operated by the people already in the office. If we seem to have noticed inertia so far, think what it will be like once the computer men have moved in, smothered the place in wire and VDUs and moved out again, taking all the paper files with them.

"Well, really, what happens is that Jacie opens the letters and then Susie passes them to Frank — well naturally, not the ones with green stamps — they go to Brian don't they? Everyone knows that. Frank deals with some of them and then he puts them in a bundle and leaves them on top of the filing cabinet there. Well, the one that was there before you-know-what arrived. No Jacie has not done it today poor thing. She's upset because of what Tony said to her and I don't wonder".

Think of trying to incorporate all that into a formal system. At a modest estimate, it is out of the question. What will have to happen is that electronic office systems are built up by the people who use them — just as paper office systems are built up by their users. The way to get it moving electronically must be to start people with individual micro work-stations, doing not very much and let them expand their functions as they grow more confident.

After a while, you link two machines together — belonging to people whose work is closely connected. Then some more as the advantage of the system becomes clearer, but it must be simple for the users to write pieces of system software to switch mesages and data around from person to person.

This process will depend entirely on the people's undertaking in the office of computers. Until Jacie and Susie and Frank have a good grasp of what computers can and cannot do — which they will have gained by dint of learning at least to write Basic — the whole deal will not make any headway. Even then, nothing will happen until they personally want it and they will not want it unless they can control it and the results make their lives easier.

However, once they have the system installed and running, who then understands and controls the business? The managing director or Jacie and friends? That might be another reason why big businesses are not in a rush to instal micros — even if they cannot quite say why.

Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback—it is your chance to keep in touch.

Professional's view

YOUR correspondent D L Fisher — Feedback, June 1981 — is too harsh in his criticism of the many programs contributed by readers of *Practical Computing* and of microcomputer software in general.

As a computer professional paid to produce quality software, I can certainly see imperfections not only in some contributed programs but also, and especially, in the Basic language. On the other hand, as my alter ego, a home micro enthusiast, I happily accept published Basic programs in the spirit in which they are given: that is, freely — and virtually free.

I should like to point out that REM statements and "unnecessary" blanks make a big difference to the size of a Basic program. For example, the excellent Backgammon program you published recently just would not run in an 8K machine if it were written to the kind of professional standards which I am sure both Fisher and I recognise.

True, Basic is showing its age, but it pays me and thousands like me to live with it simply because it is installed on our machines and is so widely used. Let us by all means campaign for superior languages or a better Basic, but not by descrediting the language we would like eventually to replace.

A R Browne,
Mobberley,
Cheshire.

Pascal polemic

RAYMOND Anderson's uninformed and highly-critical article on Pascal contained in the March 1981 issue misses the point with regards to why people are using Pascal. As Professor S G van der Meulen pointed out at a recent conference on Algol 68:

> The important boost for Pascal has come from its widespread implementation on microcomputers. Pascal is becoming one of the standard languages that every programmer should know, for that reason.

There are deficiencies in Pascal as indeed there are in almost any programming language including Algol 68. While there are advocates of Prolog who maintain it stands for PRObably the Language of God, I think we are still quite a way from the days of a perfect programming language. Constructive criticism is important; polemical attacks such as Anderson's are unlikely to make a positive contribution.

Finally, Pascal is an evolving language and the proposed ISO standards for Pascal overcome several of the problems to which he alludes; others which he discussed eluded me.

Cornelia Boldyreff,
Microprocessor Software Unit,
University of Bath.

Pet subject

THOSE using ADCs with Pets may be interested in this program. Lines 10-40 Poke a modified version of the ASC routine into the # 2 cassette buffer.

Lines 100-140 illustrate the usual byte-transfer process, lines 200-220 the improved version — about 25 percent faster — using USR routine. Line 10 sets the vector.

```
READY.

10 POKE 0,76 : POKE 1,58 :POKE 2,3
20 FOR I = 0 TO 13: READ N: POKE826+I,N: NEXT
30 DATA 32,92,214,240,8,160,0,177,31
40 DATA 168,76,124,210,96
50 REM****************************************
100 OPEN 1,PA,SA
110 GET#1,A$
120 IF A$="" THEN  V=0 : GOTO 140
130 V=ASC(A$)
140 CLOSE1
150 REM****************************************
200 OPEN1,PA,SA
210 GET#1,A$:V=USR(A$) : CLOSE1
```

N Collings,
Department of Mechanical Engineering,
The University of Nottingham.

Atom's Black Box

I WAS interested to see the Black Box game for the Pet in your April 1981 issue. Those who own an Acorn Atom may be pleased to know that a version of Black Box is available from Acornsoft. It solves the problem of indicating the paths of rays by using symbols around the border of the grid. Matching letters show the entry and exit points of a reflected ray, and asterisks denote absorbed rays.

David Johnson-Davies,
Acornsoft,
Cambridge.

Interface failure

IT WAS from an advertisement in *Practical Computing* that I joined the ZX-80 users' club and paid £7.50. Since doing this in January, I received a copy of February *Interface* but since then, nothing — despite having followed this up with a letter requesting the magazine.

G W Shorten,
Norwich.

● Tim Hartnell, co-ordinator of the user club, says he is most perturbed to hear of the distress the club had caused G W Shorten and apologises. Hartnell says that several similar cases have occurred this year and in each case, the person concerned had been given all the back issues of the club magazine and had been offered the option of their money back, or starting the club-subscription period again. The same offer will be extended to G W Shorten. Hartnell says: "The administration has been improved, so that this kind of situation is unlikely to occur again".

Uncontrolled stock

TONY EDGECOMBE'S proposal for a stock-control program in your May 1981 issue is ridiculous and certainly not "practical computing". Stuff like that is likely to create the impression that controlling stock or writing sensible stock-control programs is a trivial activity requiring no more than 10 minutes' thought and an hour's work.

There are a number of technical quibbles I could raise, even in a program so short as this one. Let me mention only one, the method of search for a product record is simply to look through all records from the beginning until a match is found. Yet apart from such computing questions, the stock record maintained for each item of stock is so inadequate that a user would certainly have to keep manual stock records if he were to retain any control over his stock at all.

By referring to "re-order quantities", "re-order levels", "physical stock" and "free stock" — which, by the way, does not, in this program, mean what any stock controller would usually take that to mean — the program gives itself a surface gloss of sophistication which is really just so much eye-wash.

B Adamczewski,
London N1.

Commodore commands

WHILE IT is for some reason popular to be excessively critical of Commodore equipment, I feel that your example in the Editorial, June 1981 issue was rather a poor one. As most Commodore users know, the shorthand system of entering commands, first letter followed by the shifted second letter, is fast and useful.

In a limited number of cases this does not produce a unique code. For example, dI could be DIM or DIRECTORY. In this case, the third letter must be shifted — putting in the first two unshifted.

This is a quite usable system and "syntax error" helps you remember if you have done it wrong. In any case, DIRECTORY works if you are not up to

(continued on page 44)

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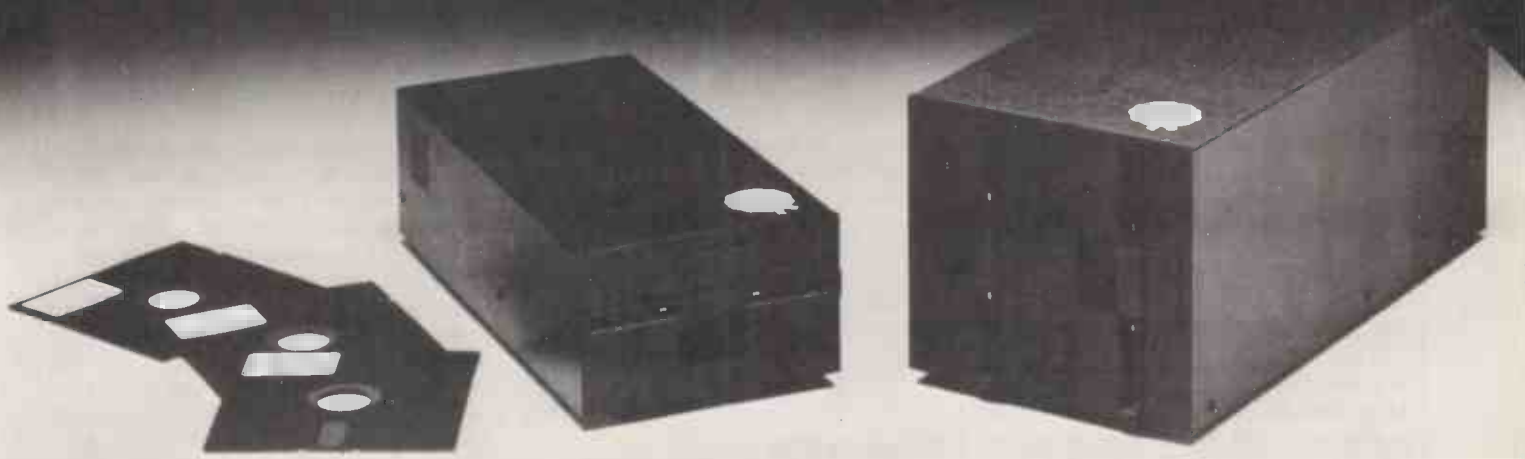

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• Circle No. 152

(continued from page 42)
cheating. Unshifted di is, of course, the variable di, and dir is really =di:read — as in a=diread — but you forgot the ":". You thus obtain a syntax error which is correct. Computers are not mind-readers and do like things to be simple and straightforward.

It may be interesting for you to know that an even easier way is to use CATALOG, which can be shortened to cA. Easy and fast, it meets your requirements exactly.

Some comment should also be made on the article in the same issue on benchtests by Boris Allan. Speed is a function of several different parts of the operating system. For example it is possible to increase the speed of Commodore machines dramatically by selecting the variables so that they are first called in the best order.

This works because the first variable is found immediately and does not need to be looked for. The correct positioning of subroutines, and minimising the number of lines increases speed for the same reason. Use of constants as variables i.e., a vs 34.9836 is also useful. By these and similar means, a crudely-written program can have its speed increased by a factor of around 10, and the coding reduced.

I expect that Allan maximised the speed for the machine in question because if not, the figures are of limited use. The length of code in bytes, required for the program is also important because it is possible to reduce program length at some sacrifice of speed, and this can be important in many situations.

O Hotz de Baar,
Didcot,
Oxfordshire.

Lonesome Elf

I AM writing to you in a desperate attempt to contact another owner of an Elf II. I was looking through several of your great magazines and I have only ever seen one letter about the Elf II published. Is the Elf II owner an endangered species and afraid to speak out?

I have been computing now for two years and I bought the basic Elf II kit a year ago with some money I had saved. With the release of the Sinclair ZX-80 and now the ZX-81, it is very frustrating to know that I have spent more than £150 and I still do not have a system equivalent to these. Rather than sell my Elf, though, I am going to stick at it and hope that there is another Elf owner who would be willing to exchange programs with me.

Tony Higham,
Coalville,
Leicestershire.

Funding courses

IN YOUR May 1981 issue, on page 47, you report on the grant made to Thames Polytechnic to enable them to run a course on the use of microcomputers for teachers who work in secondary schools.

I feel that clarification is needed on two points. First, though it is true to say that the grant of £60,000 is being paid by the Council for Educational Technology, the funds are being made available from the DES Microelectronics Education Programme, for which CET is providing administrative services.

Secondly, some indication of the breakdown of the funding budget might be helpful. £40,000 of the total sum is for the reimbursement to the five participating authorities — ILEA, Bexley, Bromley, Croydon and Kent — of the cost to them of seconding a teacher to take the course. Another £12,000 is for the purchase of microcomputers and printers, and the remainder covers the charge by the Polytechnic, travelling expenses and consumable items.

Jill Coates,
Council for
Educational Technology,
London W1.

Nascom file

IN THE December 1980 issue of your magazine you printed an article with the title of "Nascom — rise, demise and future". Now that the future of the company seems assured as a result of the recent takeover, I thought it would be appropriate for me to draw attention to a number of serious inconsistencies in the article.

I still remain a director of the companies which have gone into receivership and, therefore, by law am limited to some extent in the information which I can supply. However, I would like to make the following points:

Design work on Nascom 1 started early in 1977 and at that time the only concept I had was that it seemed feasible that potential customers might be prepared to buy a microcomputer kit, if we could produce it at a price near that of a good-quality camera, namely £200.

The idea and the conception of this project stemmed directly from a visit I made to the "Home Brew" computer club which then met regularly at Stanford Research Centre in Northern California. I was very impressed by the level of enthusiasm with which various products were being greeted and also by the very honest and open exchange of both constructive ideas and criticisms which took place between enthusiasts and manufacturers' representatives who attended the meeting.

I was introduced to Dr Chris Shelton during the spring of 1977 and the overall project was conceived then. Dr Shelton's consultancy company were given the contract to produce the hardware design and I began the process of trying to piece together a marketing plan.

The management of Nasco as it was then, were not entirely convinced that we were going to be even moderately successful and our initial aims were to secure sales of 1,000 units in the first year.

On November 26, we launched the product at a one-day seminar. More than 600 people attended and a large number of units had been sold by the end of the day. Also present at the meeting were many representatives from distributors who were interested in marketing the product. We decided, therefore, that as the overall volume of sales was to be much more substantial, we would have to establish a distribution network.

At that time, Nascom 1 was selling for £195, but contrary to the figures quoted in *Practical Computing,* the distributors were offered discounts of between 20/25 percent and the £105 price referred to in your letter was offered at a much later stage, after the introduction of Nascom 2.

There is little that I can say about the management charge which you have itemised of £154,000 as this would conflict with my duties as a director of the company. However, that balancing figure was required as Nascom Microcomputers did not pay any of its overheads directly and all of the employees, the buildings etc., were held in the name of Nasco.

In fact, the auditors of the company treated the three operational companies as one entity when submitting their final reports and to try and look at any one of them individually is meaningless.

There were various last-minute hold-ups relating to the first deliveries of Nascom 2 and as an attempt to prevent any further delays, I proposed that we give away a 16K dynamic RAM card to customers in place of the eight 1K static RAMs which originally were to have been carried on the Nascom 2. This had reduced our profit margin somewhat but I would point out that in 1979 the MK 4118 was a very expensive beast.

The costs you detail for Nascom 2, I am happy to say, are somewhat wide of the mark. Once again it appears to be an error in timing, as the main dealer price mentioned did not take place at the time that the kit was being sold with the dynamic RAM boards.

The reference to eight separate Basics is something that really baffles me as the only authorised version of Basic for Nascom 2 was Microsoft version 4.7 which was specifically manufactured for us in a ROM by Mostek. I understand that various other companies manufacture Nascom-compatible Basics, but this was without the encouragement or assistance of Nascom. Also, Nascom at no time attempted to market these other products.

In closing, I would like to end on a personal note, namely that I am somewhat surprised that the author of this article did not at any time contact me for either additional information or verification of the facts which have been published.

John Marshall,
Amersham,
Buckinghamshire.

Nebula stars in ACT's business systems

A RANGE of microcomputer business programs which will dramatically cut the cost of running a fully-integrated business system has been announced by Applied Computer Techniques. Known as Nebula, the new business microcomputer program is the result of 20 man-years development and an investment of more than £.5 million by ACT.

Originally, this suite of business programs was available only on the ACT £1 million ICL mainframe computer bureau at Halesowen and Bristol. The software has now been developed so that the programs can be used on a microcomputer, the ACT series 800, for less than £4,000.

Roger Foster, ACT group managing director says: "The Nebula business programs represent a major breakthrough for ACT and the U.K. There are plenty of microcomputers about and many business programs for mainframes, but ACT is the first in the world to provide an integrated business program for a microcomputer".

ACT claims that Nebula, as the first fully-integrated business system for a microcomputer, can manage and process all the business applications of a typical company or organisation. The system can provide all the invoices, debit stock files, post to ledger account and can produce management reports — all at the depression of a single key on the ACT series 800 microcomputer.

The parameter-driven approach of Nebula means that a user can specify what he wants from the system without re-programming. A user could, for example, set the parameters to produce invoices to his own specification. It will provide him with the opportunity to value his stock the way his accountant wants it valued, and will provide him with only those management reports which are germane to his business.

There are seven major sections which cover sales-order processing, invoicing, stock control, open-item sales and purchase ledgers, payroll and nominal ledger. A powerful database management section processes information from all other sections and then produces reports and analyses to precise user specifications — such as costings, sales analyses and asset registers.

The package has undergone extensive field trials during the previous 12 months. This means that the prospective buyer will be using a fully-proven system, tested and ready to run.

The ACT series 800 microcomputer has a fast processor, 108Kbytes RAM and either floppy or Winchester disc drives. ACT has a nationwide dealer network and the highly-professional staff will install the system and train personnel in the use of the system. Servicing of the series 800 micro is performed by the ACT team of field engineers.

A basic system will cost the user less than £4,000. A more typical system using all the options would cost slightly less than £7,000. The top of the range, four-processor, Winchester-based system offering the power of a traditional mini-computer system will cost around £18,000.

ACT Microsystems Ltd, Shenstone House, Dudley Road, Halesowen, West Midlands. Telephone 021-501-2284.

Resilient floppy discs

THE NEW Optima series XE 8in floppy discs from Verbatim were originally developed for use in military-specification flexible disc drives. They can easily withstand the deformations which destroy standard discs in ambient temperatures above 50° Centigrade.

As with all Verbatim magnetic media, each disc is certified 100 percent error-free and meets or exceeds all international standards. Contact Stewart Lincoln, BFI Electronics Ltd. Telephone: 01-941 4066.

Software for adults only

TO HELP us predict the trends in computer games in the U.K., it is useful to look at the latest craze to obsess our transatlantic cousins. One of the most recent games to appear on the U.S. market claims to use the high-resolution graphics capability of the Atari to its full potential. The game is not, however, exactly suitable for children — in fact it may not really be suitable for all grown-ups.

The distributor of the game claims that it is the only triple-"X"-rated Atari game and it is called *Pornopoly*. Computer Consultants Iowa, which markets the 16K Atari game, stresses in sales literature and advertisements that it is "an adult party game, rated XXX and some people may find it offensive".

In the game, players buy, sell and trade property, but if you land on another player's property, you must pay a penalty.

Three packages aimed at Sharp MZ-80K

THE NEWBEAR Computing Store has released three items of software for the Sharp MZ-80K. The first is a disc-based editor assembler, which is the first such Z-80 editor assembler on disc in the U.K. and is an implementation of the very popular Zen. It is also the first disc operating system particularly optimised for machine-code programs on the Sharp MZ-80K. The package is sold as Zen-Dos and costs £37.50 plus VAT.

Another new program from Newbear is the Music Composer which is a very sophisticated piece of software. It includes full instructions, which are accessed via the help function. The program costs £10 plus VAT and requires a 48K Sharp.

The busy programmer may find the program filing index program of use. This menu-driven program will locate programs and index them. The program filing index costs £5 plus VAT. Further details of all three items are available from Jon Day, Newbear Computing Store, 40 Bartholomew St, Newbury, Berkshire. (0635) 30505.

The Robotron, a new low-cost daisywheel printer from Penny and Giles Data Recorders, combines high-quality printing and a comprehensive performance and reliability specification. This new printer is claimed to be quiet and versatile. Retailing at £863 for the one-off end-user, the printer features standard and custom input codes, 40 cps print speed, a programmable font change and a host of other features. For further details, contact Tim Denslow on (04252) 71511.

Kennedy with Winchester

ACCORDING to the sole U.K. distributor Bytech, the latest Kennedy drive offers "state of the art" performance. The Kennedy 5300 series, using Winchester Technology, is offered with one, two, or three platters, which in turn can provide 14, 42, 70 or 80 Megabytes capacity.

Bytech Ltd, Unit 57, Suttons Industrial Park, London Road, Reading Berkshire. 0734 61031.

Programmability is key to Texas chips' success

THE TEXAS Instruments TMS-1000 family of single-chip microcomputers has enjoyed seven years of world-wide use. The introduction of the TMS-2100 series of four-bit microcomputers will further expand the capabilities of the family.

The new series retains the architecture and instruction set of the TMS-1000 micro, but incorporates new features which optimise its members for a variety of industrial and appliance-control applications.

The TMS-1000 micro became the world's most widely-used microcomputer, with more than 60 million units shipped. The range of applications covers a broad spectrum — from washing machines to petrol pumps, from sewing machines to television tuners. The key to the meteoric success of the Texas device is programmability.

Each customer company provides Texas with the operating specification for its own version of the chip. These are then "burnt-in" to the chip, and this facility means that the same computer can meet a wide range of design requirements.

The TMS-2100 series is a generic development from the TMS-1000. The key features of the new device include an eight-bit A/D converter, eight-bit interval timer, zero-crossing detector, software-programmable delayed interrupt, on-chip oscillator, and a bi-directional I/O port. There is also 2K of on-chip ROM and 512 bits of RAM.

A new eight-bit micro has also been developed, still in the same TMS-1000 family, the TMS-7000. Named the Microlanguage Processor — MLP — the new chip has a memory-intensive architecture and a compact lay-out scheme. The MLP provides the user with a new level of customisation — the micro-programmable instruction set — which enables optimisation of the component instruction set.

The new technique unifies such chip elements as control logic, data paths and memory, which minimises random logic and interconnection constraints and thus increases functionality.

Any technical enquiries should be directed to the Customer Response Centre at Bedford. Telephone: (0234) 223000.

The Sharp MZ-80B is the follow-up to the popular MZ-80K and its main improvement over its precursor is the inclusion of the interace unit within the body of the main unit. High-resolution graphics and fast search on tape are other features of this machine.

Genie angles for office image with new range of peripherals

THE VIDEO Genie EG-3000 personal computer has been highly successful, but does not seem to have made much of a mark as a business system. Cambridge Micro Computers Ltd has introduced a range of interface and peripheral products which can be used to expand the Genie into a low-cost disc-based microcomputer system.

A typical system would comprise the Genie itself plus a 12in. monitor, the new expander unit with 32Kbyte of extra RAM, and the new dual disc drive and high-speed bi-directional printer.

Such a system would form a basis for a business-computer application, yet would cost in the region of only £1,700. The products can be bought either separately or as a complete package.

The heart of the system is provided by the Video Genie and its expander unit the EG-3013. The unit includes an S-100 bus interface, a parallel printer interface, an RS232C interface, and a disc controller interface.

The memory-expansion facilities enable up to 48K of RAM storage to be available by plugging in cards. The unit is ruggedly-cased and all interfaces are fully-buffered to ensure reliable operation.

The other system components are Teac 5¼in. mini-floppy discs and an Epson MX-80 printer. The discs run under the NewDOS operating system. Cambridge Micro Computers Ltd is located at Cambridge Science Park, Milton Road, Cambridge, CB4 4BN.

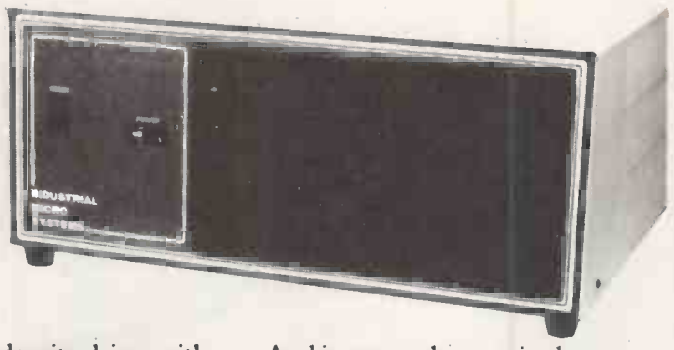
In the big league

FIRST Division Computers is a software company formed by Norwich City Football Club, to solve the complex problems of administrating the club's fund-raising activities. At present, a Nexos DP-1800 matrix printer linked to an Apple microcomputer is used to print football match tickets.

The system is not only fast — the Nexos DP-1800, printing at 240cps, produces tickets at 40 per minute — but is also very cheap. A by-product is that tickets can be security coded in a way which was previously impossible.

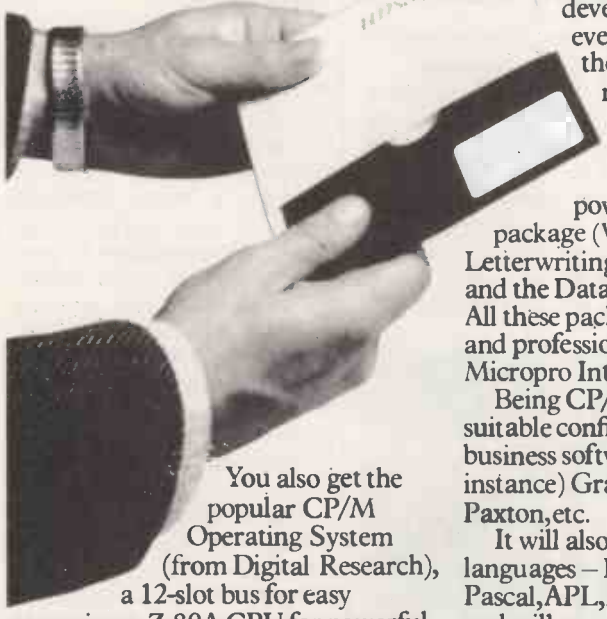
Similar systems have been installed at Aberdeen, West Bromwich Albion and Kent County Cricket Club. Nexos is market by the OEM sales department of Nexos (United Kingdom) Ltd, 3 Jefferson Way, Thame, Oxfordshire, OX9 3SU. (0844) 213151.

A Word Processor, Report Writer, Mailing System, Data Base Manager, and a Computer all for £1995*



Yes, we are offering all this with our SERIES 5000 5" floppy-disc system for the incredibly low price of £1995.*

Not only do you get a powerful Z-80A system on the S-100 bus built to high quality standards by Industrial Microsystems, one of the longest-and best-established companies in the microcomputer industry, and supported by Equinox, specialists in microcomputers and multi-user systems.



You also get the popular CP/M Operating System (from Digital Research), a 12-slot bus for easy expansion, a Z-80A CPU for powerful performance, 2 serial and one parallel interfaces, 64KB of dynamic RAM with in-built error detection capability, and dual 5" double-density drives with the option of a third drive (or quad capacity drives in place of double-density) in the same cabinet. Additionally, there is the Turbocharger option providing both enhanced disc capacity, disc performance and diagnostics. And if even greater storage is required we can supply 8" floppy drives and cartridge disc drives.

A powerful system for the computer-user and system developer – and one with eventual access to OS/2000, the Industrial Microsystems networking system.

And for the office or business user we are including as standard a powerful Word-Processing package (Wordstar), a Mailing and Letterwriting package (Mail-Merge) and the Datastar Data Base Manager. All these packages are widely accepted and professionally written by Micropro International.

Being CP/M based, the system with suitable configuration will also run the business software developed by (for instance) Graffcom, Peachtree, Paxton, etc.

It will also run a wide range of languages – Basic, Cobol, Fortran, Pascal, APL, Algol, C. Lisp, and Forth and will support a wide range of add-on S-100 devices, such as floating point processors, Prestel interfaces, speech synthesisers, digitisers and plotters, etc.

And just to make certain that you get full use out of your system, nationwide field service support is available at a modest extra cost.

*add VAT and the terminal and printer of your choice at the costs shown.

Series 5000 with 64KB Dynamic RAM, dual 5" double density drives, CP/M Operating System, Wordstar, Mail-Merge and Datastar	**£1995**
The same system with quad drives in place of the double density drives	**£2230**
Add-on double density drive	**£290**
Add-on quad drive	**£405**
Peripherals:	
Televideo 912C VDU	**£595**
Elbit 1920X VDU with Wordstar keyboard	**£895**
OKI Microline 80 printer	**£595**
Texas 810 150cps printer	**£1450**
NEC Spinwriter RO Word processing printer	**£1850**

All prices exclude VAT, carriage, training and installation and are subject to our standard terms and conditions.

OEM dealer and educational enquiries welcome.

EQUINOX

COMPUTER SYSTEMS LIMITED

Kleeman House, 16 Anning Street, New Inn Yard, London EC2A 3HB
Tel: 01-739 2387/9 & 01-729 4460

• Circle No. 154

KGB and the dissidents

KGB LTD, the Slough-based microcomputer company has announced the availability of a software package which enables the Intertec Superbrain Microcomputer to act as a distributed processing terminal with mainframe and minicomputers.

The Liberation software was developed by KGB after receiving many enquiries from large-computer "dissidents", who wanted to take advantage of the power of microcomputers. The package will give the user of a larger computer a far less expensive alternative to the products on offer from the supplier of the host system. Most mainframe computer suppliers charge about twice the Liberator price.

A complete package, that is a 64K Superbrain, with dual disc drives, the Liberation software with all the advantages of CP/M, will cost £2,000. Existing Superbrain users will be able to purchase the Liberation software for £250.

The package allows the Superbrain to operate as a simple Teletype and is also capable of providing a file-transfer facility — FTF.

KGB has been a supplier of microcomputers for more than two years and the Superbrain is one of its main product lines. Contact Sandy Saunderson, KGB Micros Ltd, 14 Windsor Road, Slough, Berkshire. Telephone Slough 38581.

This brief-case conceals a floppy-disc exerciser. Designed as an important part of a service engineer's equipment, the exerciser is supplied with pre-programmed "Personality modules" to suit the drive under test. Thus each unit is customised to suit individual needs. The exerciser is available from Chable Electronics Ltd. For details, contact F E Chable, Batley (0924) 441128.

Course for laymen

THE department of physics, mathematics and computing at Manchester Polytechnic is to start a course designed to support the BBC computer-literacy programme. Like the BBC literacy programme, the course is aimed at the interested layman. Composed of three parts, the programme will begin by building an Acorn Atom from kit form.

The second part of the course will involve a series of tutorials, following the BBC programmes.

The course costs £240, including the computer and applications should be made to John Appleyard at the department.

Business-dominated U.K. market worth £500 million, report reveals

THE U.K. market for microcomputers could be worth as much as £500 million per annum and deliveries for business use could account for more than 60 percent of all units in operation. These facts and figures are among the findings of a report from the business analysts Key Note Publications. The report, entitled *Microcomputers*, is a comprehensive study of one of the few boom industries in Britain at the moment.

Analysis has been carried out in five main market sectors; industrial, business, scientific, educational and personal or hobby computing. The research indicates that the industry is one of a tiny minority which is hardly affected by the current recession. The report includes a detailed appraisal of the new industry and its markets, together with a critical profile of future prospects.

Although the ever-decreasing cost of hardware will help boost demand, the main determinants of growth are likely to be the cost of peripherals and the sophistication and ease of application of software.

The Keynote report goes on to predict that reliability and dependability of aftersales support will be major influences on purchasing decisions in the business sector.

In its financial section, the report gives a break-down of data for 11 manufacturers over a three-year period. All companies have shown fast turnover growth — profitability has now, however, followed suit. The high costs of setting up together with the tough fight for the market share is proving alarmingly expensive for the smaller companies. The problems of establishing dealer networks and the dangers of take-over are also highlighted.

The U.K. is the second largest user of microcomputers in Western Europe, with more than 115,000 units predicted to be installed by the end of 1981. The hobby market is at present static but this situation will soon change with the introduction of new products and the proposed BBC series.

The survey costs £25 post-paid and is available from Philip Middleton at Keynote Publications, 23 City Road, London EC1Y 1AA. Telephone 01-588 2698/9.

Vet's best friend may prove to be paperwork-taming microsystem

THE LATEST profession to succumb to the inevitable introduction of microprocessors is that of the veterinary surgeon. The Veterinary Management System — VMS — software is capable of handling an unlimited number of customers, each with an unlimited number of animals. The software has just been introduced by the sole distributor ABIES Informatics Ltd, and hardware from Southwest Technical Products.

The flexibility of VMS is such that any practice will be able to benefit from its introduction. Some 250 Veterinary procedures can be handled by VMS — standard fees may be applied to each — and there is also a manual override for special charges.

The performance of the practice can be closely monitored with procedure status reports which can be prepared for each surgeon and branch. These reports show the number of services performed for each procedure, the time taken, and the fees generated analysed by year to date or month to date.

Up to 100 types of vaccination can be accommodated on the system and any one animal can have up to 19 types of vaccination schedules.

Clerical work is also cut by the production of customer accounts, which show all unpaid charges and balances.

Illustrated literature and further information on the Veterinary Management System are available from ABIES Informatics, 38 Dover Street, London W1. 01-491 7507.

Mainframe link for Pet via control box and software

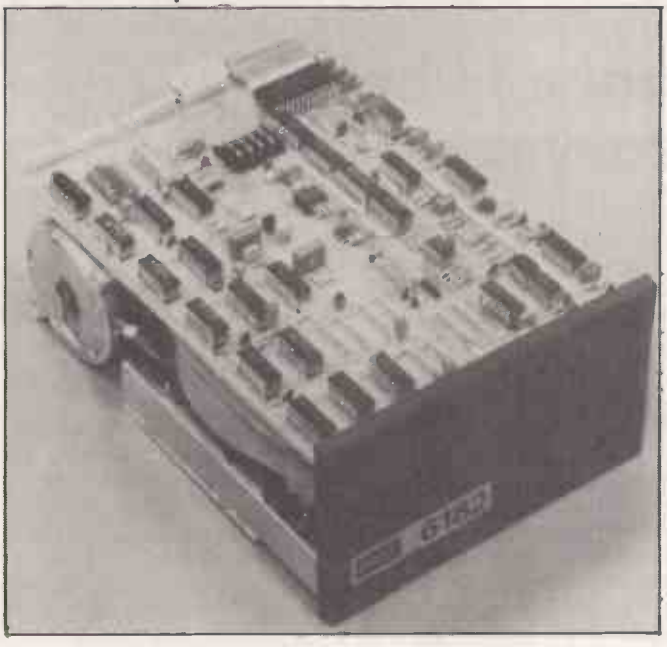
A COMBINED hardware/software package which will enable Pet computers to be connected to mainframes and act as an interactive terminal is available from Davidson-Richards Ltd. Comprising a communications control box and the controlling software, the system is able to support ICL C01 and C02 protocols, and emulate ICL 7181, 7501, 7502 and IBM 3780 and 3270 work stations.

The box connects directly to the Commodore Pet user port, and is microprocessor-controlled. Memory is provided to house the protocol-handling routines, which are resident in ROM and down-loaded from the Pet, and it also acts as a receive-and-transmit buffer.

Output from the control box is via a RS232 interface, enabling communication with the host mainframe by direct line or telephone MODEM. Efficient handling techniques will allow several terminals to share a single line depending on its capacity and quality.

A complete workstation including a Pet, disc drive, printer, interface and software is less than £3,000. Davison-Richards Ltd, 14 Duffield Road, Derby DE1 3BB. Telephone Derby (0332) 366803.

The new 5¼in. fixed disc drive from BASF is available in two distinct versions — the 6181 with a recording capacity of 6.38 Mbytes using two 130mm. discs and the 6182 which will provide up to 9.57Mbytes on three discs. Both versions are based on Winchester technology as are most fixed discs these days. This, together with a closed-loop air filtration system, ensures extremely high reliability. The units can be used alone or in strings of up to four units, giving a maximum storage capacity in excess of 38Mbytes. BASF computers can be contacted at 4 Fitzroy Square, London W1P 6ER. Telephone: 01-388 4200.



Keeping it clean

WHEN cleaning computers, it is important the job is done properly. It is no good pulling out a pocket handkerchief to clean the floppy-disc heads. Data Efficiency has put together in one kit just about everything you will ever need for microcomputer cleaning.

Included in the kit are: Texwipe cloths — 25 dust-free, static-free cloths for general non-contaminative cleaning.

The handy kit, if used regularly will ensure greater reliability and operator efficiency.

The kit retails at £18.66, which when one considers the cost of a disc crash, is very little. The Data Efficiency telephone sales team may be contacted on (0442) 57137.

Minister finds funds for information technology

COMPUTING and telecommunications are to receive a big publicity push from the Government. Information Technology Minister Kenneth Baker MP said recently that 1982 will be designated "Information Technology Year", and has started the campaign right in the heart of Whitehall.

Baker has managed to re-allocate funds within the Department of Industry to find £80million over the next four years to promote the development, awareness and use of information technology — defined as "the convergence of computers, telecommunications and office equipment".

IT Year will be backed to the tune of £1 million and industry and commerce will be expected to make a contribution to help finance the programme of exhibitions, conferences and seminars, which will culminate in an international conference at London's Barbican in December 1982.

A "1982 Committee" has been formed to co-ordinate the activities of trade associations, professional bodies and the National Computing Centre, and is chaired by ICL executive Alan Benjamin. Chief executive of the committee is Kenneth Barnes of Royce Cook Associates.

One of the most intriguing aspects of the "awareness scheme" is that Baker is selling the message hard to Whitehall's civil servants. One of his first moves — before any concrete plans were announced for public consumption — was to persuade all 27 Permanent Secretaries of Whitehall departments to attend a four-day course in information management at the London Business School. The first 10 will encounter a batch of 10 managing directors from industry.

The £80million which the Government has earmarked for developing IT will fall under the administration of existing schemes such as the Product and Process Development Scheme, which provides grants of up to 25 percent — or go up to 50 percent by special arrangement — of the costs of "developing new or significantly-improved products or processes". The Department may also buy pre-production models for trials with potential users.

Cash-hungry applicants who think they fit the bill should make the fact known to the 1982 Committee, Kenneth Barnes, Royce Cook Associates Ltd, 19 Bedford Row, London WC1R 4EB.

The Onyx C8000 Series

The C8000 Series is a compatible family of microprocessor-based systems, designed for business and scientific applications.

These powerful general-purpose systems combine processor, memory, fixed 10 Mbyte or 18 Mbyte 8 in. disk (expandable to 76 Mbytes) and cartridge tape driver - all within one low profile enclosure.

The C8001 is an 8 bit Z80A* system with up to 256 Kbytes of memory for 1-5 users. And is easily expandable to the more powerful 16 bit C8002 configuration, with 256 Kbytes to 1 Mbyte of memory handling up to 8 users.

Based on the Z8000* processor, the C8002 may be connected to a high speed local network for further expansion.

Industry compatible versions of COBOL, PASCAL, BASIC, CBASIC2*, FORTRAN and C are available on OASIS*, CP/M*, MP/M* and UNIX* operating systems. Also available are packages for communications, data base management, word processing and business applications.

ONYX

Onyx Distribution Ltd
Unit 58, Suttons Park Avenue, Earley, Reading
Berkshire RG6 1AZ. Tel: (0734) 664343/6

DEALER ENQUIRIES WELCOME

*Z80A and Z8000 are trade marks of Zilog Inc. CP/M and MP/M are trade marks of Digital Research Inc. OASIS is a trade mark of Phase One Systems Inc. UNIX is a trade mark of Bell Telephone Laboratories. CBASIC2 is a trade mark of Compiler Systems Inc.

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Low cost, fully integrated, modular accounting business systems.

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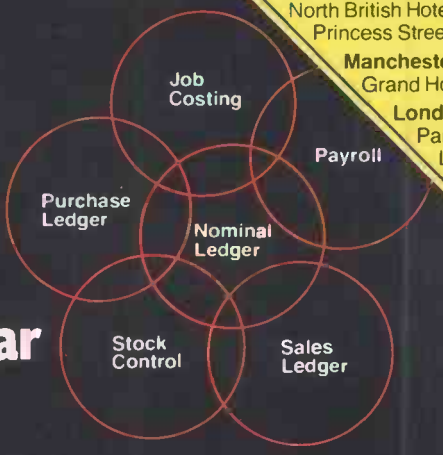
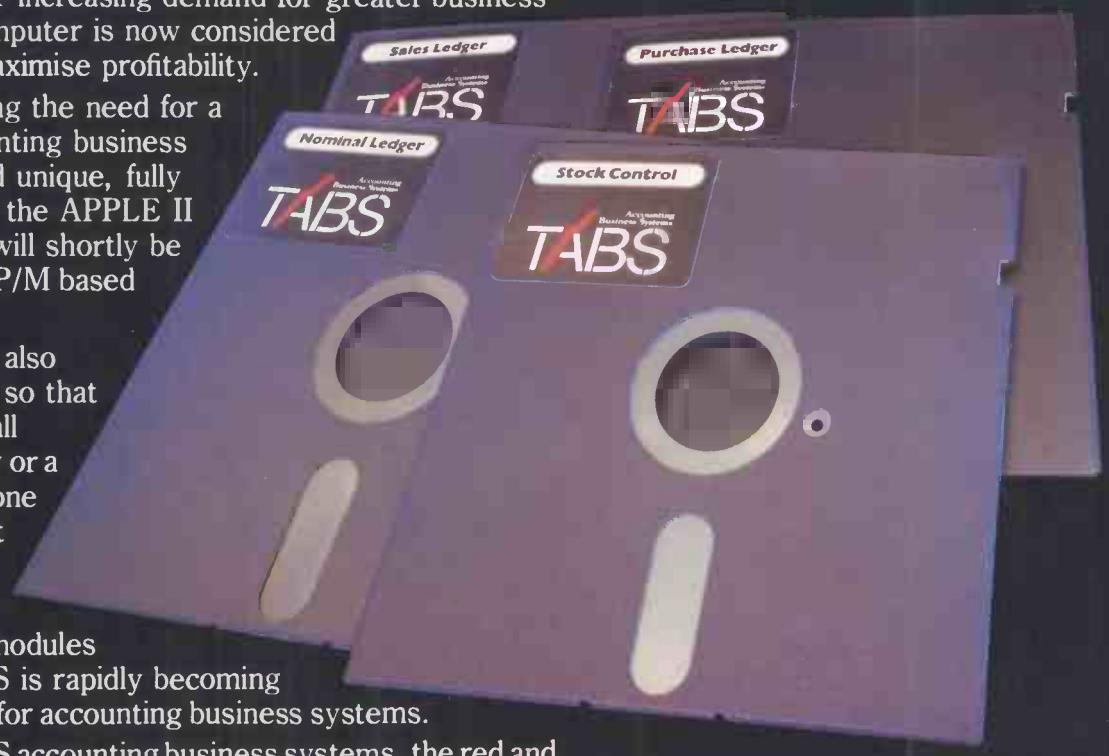


To meet the ever increasing demand for greater business efficiency the microcomputer is now considered vital in the quest to maximise profitability.

TABS, recognising the need for a simple, low cost accounting business system have developed unique, fully integrated modules for the APPLE II microcomputer which will shortly be available on PET and CP/M based machines.

The modules are also designed to be flexible so that whether you run a small manufacturing company or a small retail outlet each one may be adapted to meet your individual requirements exactly.



With over 2000 modules already installed, TABS is rapidly becoming the number one choice for accounting business systems.

Remember, TABS accounting business systems, the red and black way to increase your profits.

Available through our national dealer network or from TABS Ltd, The Old Rectory, Blackford, Yeovil, Somerset.

Minimum System: Apple 48K, VDU, Disk with Controller, Disk without Controller, Sales Ledger Module, Silentype Printer, TABS Firmware Card. Price from £2,250.
Capacity: 400 Customers, 400 Suppliers, 1000 Stock Items.

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This RAM pack and the replacement ROM are described below. And the description of each cassette makes it clear what hardware is required.

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Cassette 1 – Games

For ZX81 (and ZX80 with 8K BASIC ROM)

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METEORS – your starship is cruising through space when you meet a meteor storm. How long can you dodge the deadly danger?

LIFE – J.H. Conway's 'Game of Life' has achieved tremendous popularity in the computing world. Study the life, death and evolution patterns of cells.

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GOLF – what's your handicap? It's a tricky course but you control the strength of your shots.

Cassette 2 – Junior Education: 7-11-year-olds

For ZX81 with 16K RAM pack

CRASH – simple addition – with the added attraction of a car crash if you get it wrong.

MULTIPLY – long multiplication with five levels of difficulty. If the answer's wrong – the solution is explained.

TRAIN – multiplication tests against the computer. The winner's train reaches the station first.

FRACTIONS – fractions explained at three levels of difficulty. A ten-question test completes the program.

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Cassette 3 – Business and Household

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack

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LUNAR LANDING – bring the lunar module down from orbit to a soft landing. You control attitude and orbital direction – but watch the fuel gauge! The screen displays your flight status – digitally and graphically.

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COMBAT – you're on a suicide space mission. You have only 12 missiles but the aliens have unlimited strength. Can you take 12 of them with you?

SUBSTRIKE – on patrol, your frigate detects a pack of 10 enemy subs. Can you depth-charge them before they torpedo you?

CODEBREAKER – the computer thinks of a 4-digit number which you have to guess in up to 10 tries. The logical approach is best!

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Cassette 5 – Junior Education: 9-11-year-olds

For ZX81 (and ZX80 with 8K BASIC ROM)

MATHS – tests arithmetic with three levels of difficulty, and gives your score out of 10.

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VOLUMES – 'yes' or 'no' answers from the computer to a series of cube volume calculations.

AVERAGES – what's the average height of your class? The average shoe size of your family? The average pocket money of your friends? The computer plots a bar chart, and distinguishes MEAN from MEDIAN.

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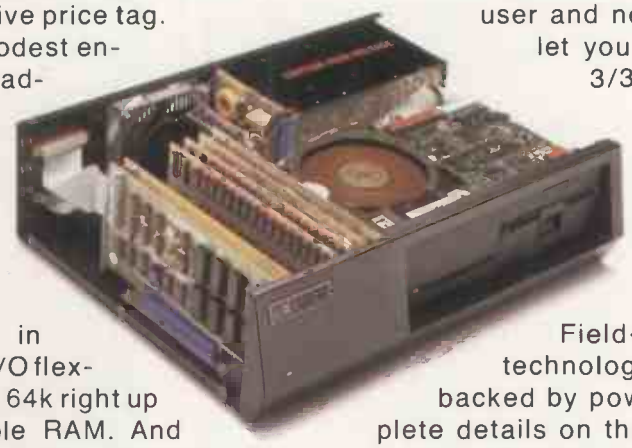

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5A

In this preview of the 1981 Microcomputer show, held at the Wembley Conference Centre, London, from July 30 to August 1, *Practical Computing* highlights some of the new microcomputers and software products which will be exhibited.

Microcomputer Show Preview

THE MICROCOMPUTER Show is not the biggest of the burgeoning number of exhibitions labelled as having something to do with computers but it is one of the few which is designed to deal exclusively with microcomputers — the full range from personal computers, small-business systems, word processors and other micro-based systems.

Many of the new exhibitors are software companies showing their ever expanding ranges of business application packages. We have held the view for a long time that software is running a long way behind hardware developments and we hope that the number of software packages being launched at the exhibition is a sign that this view is at last being accepted.

For example, in this issue you can read the first proper technical evaluation of the new Sharp business macine, the PC-3201. As a piece of hardware, the PC-3201 is well-designed and reliable but the prospective buyer should be able to take that for granted and concern himself only with the software.

Software for the system is only just beginning to become available in the shape of a range of business packages from Padmede Computer Services. The company also has a range of business packages for other microcomputers. CP/M will not be available on the PC-3201 until later in the year.

Another company showing off its business software is Clenlo Computing. Its applications include integrated

Oscar is on display at the Interactive stand.

accounts, word processing, mailing lists, subscription management, numerical analysis, stock control and Pearl.

Pearl is a program generator with a built-in database function. It was reviewed in *Practical Computing* in December 1980. Clenlo is also showing its Conqueror microcomputer. It is an S-100 system which runs under the CP/M operating system and which can be expanded from a single floppy-disc drive and screen to a full multi-terminal system with more than 100 megabytes of hard-disc capacity.

Keen Computers is also showing multi-user systems in operation. It will have on display the Omninet local-networking system which allows the interconnection of up to 64 microcomputers and peripherals.

The computers which can be linked are the Apple, the Onyx and the DEC LSI-11. The Onyx was reviewed in *Practical Computing* in April 1981. Keen is also demonstrating an Apple with a Corvus hard-disc system.

Educationalists and others will find the Government-recommended Research Machines 380-Z displaying its latest facilities. These feature a new 40/80 character-switchable VDU board whose facilities include a user-definable character set, smooth scrolling and screen windowing. Another approved supplier to the Government is BMG Microsystems which will have the MS-5000 range of microcomputers on view.

Also with a eye towards more serious applications of microcomputers is Digico which is taking the opportunity to reveal how its new microcomputer, the Prince, can be used alongside the more traditional minicomputer. It is operating a three-terminal minicomputer system interlinked by a series of Prince microcomputers.

The microcomputers can operate as stand-alone units with their own operating systems, languages and packages or can link up to the minicomputer as an intelligent terminal or just as an on-line VDU. The Prince starts from a price of £1,700 and can run a number of standard business applications packages.

Moving into the field of more popular computing, Ingersoll shows off its Atari 400 and 800 personal computers. Ingersoll is extremely sensitive to any suggestion that these new systems might be called a new generation of videogames despite the very advanced games packs which can be plugged into the two systems. In Ingersoll's view, they are quite firmly personal computers.

Both systems are undoubtedly well-built and robust and have an excellent range of facilities including full-colour voice channels, music channels, slots for extra ROM, RAM cassette tapes, floppy discs, bubble memories and many other add-ons. Yet at £345 for the 400, which has a touch-sensitive keyboard, and £645 for the 800, which has a full keyboard, the two systems face tough competition, notably from the new Commodore Vic-20. The Vic is not so advanced, but costs less than £200. In the States where there is a more cut-throat competition, the Atari prices have been dropping rapidly.

Also representing the more popular end of microcomputing is Tangerine which will be parading its increasingly-popular range of single-board microcomputers

The Prince, Digico's new micro.

and the Tantel prestel adaptor which, at £170, looks set to become a best-seller.

Tangerine has obviously been worried by the BBC's involvment in microcomputing and is going after them with an offer to give one of its Microtan computers free to every school which buys one of the Tantel units.

It will also be interesting to find out how advanced Tangerine's plans are for a microcomputer, to be launched later this year, which it claims will better the specification of the BBC microcomputer albeit at a somewhat higher price.

We do not have the space to do justice to all the other companies and products at the exhibition. In brief, Tandy will be there with its new Model III, also reviewed in this issue, Sun Computing with the ABC-24 microcomputer, Millbank with the System 10, Almarc Data Systems with the latest Vector Graphic system, and Ohio Scientific (U.K.) Ltd.

It will be showing three of the OSI range of microcomputers — remember, however, that Ohio Scientific (U.K.) Ltd is a subsidiary of the OSI dealer American Data Inc and not of the Ohio Scientific parent company.

If after all that, you still have some time to spare, visit our stand where you will be able to buy a somewhat limited selection of back-copies of *Practical Computing* and the second issue of our new sister publication *Your Computer* which specialises in covering the range of smaller home computers.

The second issue has the first full technical evaluation of the new Commodore Vic-20. Staff from both magazines will be on the stand to answer your queries.

The Tandy TRS-80 Model III disc system

by Mike Hughes

MANUFACTURERS of systems designed for small-business applications had better be careful — Radio Shack, via its Tandy shops, has launched an integrated twin 5¼in. disc system which sells for around £1,700.

The whole system is attractively-housed in a grey plastic case measuring approximately 460mm. width, 320mm. height and 520mm. depth — from front of keyboard to the back panel. The operator is confronted with a standard 53-position keyboard complemented by a 12-position numeric pad.

Both keyboards are mildly-sculptured which, to a skilled keystroker, might make life easier. The only obvious control on the front panel is a recessed master re-set button.

A 12in. video monitor is built-in and its dispalys in the usual white against a dark ground. Brightness and contrast controls are provided but need to be searched for as they are hidden from sight under one side of the cabinet.

The twin disc drives are horizontally mounted to the right of the screen in a piggy-back arrangement. Up to two more external disc drives can be supported by the system and they are linked via a ribbon cable to one of several edge connectors which are positioned out of harm's way beneath the cabinet.

The manuals are not clear as to whether the external disc drives are limited to 5in. In the absence of this information, we must assume that 8in. drives are not supported.

The system is powered direct from 240V 50Hz mains which enters via a standard three-pin socket at the rear adjacent to which is a DIN connector to link to a cassette recorder — if required.

The manuals give hardly any hardware specification except the maximum operating temperature range — said to be 55 to 80 degrees Fahrenheit — 13 to 27 Centigrade. Whether these are genuine or whether Radio Shack has just chosen reasonable living temperatures is hard to say, but the range is not very great.

No system circuitry was provided and the cabinet was sealed with the dire warning that the warranty would be violated if attempts were made to open it. We thought we had better leave well alone and resigned ourselves to peering through the air vents. The only fact this activity revealed was a very high density of internal boards and wiring — probably the reason for the anti-meddler warning.

The review system contained 32K of RAM but there is an option of a 48K system. Presumably one has to send the system away for an upgrade. 48K is the maximum addressable RAM as the system has address space reserved for 14K of ROM, 1K for the display and 1K for the keyboard matrix — the keyboard is addressed like a block of memory.

Apart from the external disc drive connector, there are, under the cabinet, edge connectors for a Radio Shack parallel printer which carries a strobe, eight data bits, Ground, Busy, Fault and Paper-empty signals and an edge connector labelled "I/O bus" — for future expansion but no information is given about the signals.

A standard RS232C interface is also provided via a 25-way socket. This interface carried Ground, Transmit Data, Receive Data, Request to Send, Clear to Send, Data Set Ready, Carrier Detect, Data Terminal Ready and Ring Indicator signals.

Our impressions of the machine's appearance are very favourable. It is attractive in style, compact and relatively light to carry from place to place. Although plastic, the case seems robust and there are no bird's nests of tangled cables linking the system together — just a mains lead.

We were provided with three main documents — a bound 240-page paperback entitled, *TRS-80 operation and Basic language reference manual*, a ring-bound *Disc system owners' manual* and 340 pages of *Getting started with TRS-80 Basic*. The operation manual deals only with the standard Model III system which has resident Basic and there is no reference in it that helps enter the disc system.

This is, supposedly, put right by the *Disc system manual* which, Radio Shack admits, is only in the preliminary stage of preparation. There are many similarities between the resident Basic system and the disc system and one can appreciate Radio Shack's reluctance to do too much unnecessary duplication.

However, we found it extremely irritating to have to keep switching from one heavy manual to another while filtering out the irrelevancies of one and absorbing the extra facts contained in the other. For example, the memory map shown in the disc-system manual does not

indicate the location of the video display nor the keyboard. These locations can be found only by browsing through the resident Basic manual with some difficulty — because although there is a comprehensive-looking index, it is by no means perfect.

Radio Shack has tried, as far as possible, to make the Model III upwards-compatible to the original Model I systems. The resident Basic for the non-disc Model III is to all intents and purposes identical to Level II Basic — one extra instruction has been added. The disc Basic is, again, upwards-compatible to Level II but contains many more statements associated with file handling.

Fast or slow tapes

The Model III has two cassette data rate options: low speed, 500 baud, which will accept tapes recorded on a Model I and a new high speed — 1,500 baud. Either baud rate can be selected by software. There are, however, a few limitations for those wishing to use tapes recorded from a Model I.

For example, the amount of user-memory is 258bytes less on the Model III than on the equivalent 32K or 48K Model I systems. There are also some significant differences in the character fonts between the two models and one cannot rely on utility firmware being at the same address locations.

The RS232C interface is software-selectable for baud rate and data format. There are 167 baud-rate options ranging from 50 to 19,200 including 110 baud. Parity can be either on or off and if on, may be odd or even; one or two stop bits can be selected and five, six, seven or eight-bit words can be chosen.

Standard 5¼in. single-sided mini-diskettes are used which are formatted to contain approximately 180K of data on 40 tracks with 18 sectors per track — 256 bytes per sector. Double-density recording techniques are used. Our experience has shown that one has to be rather selective in the choice of disc manufacturer to ensure reliable recording and playback when running up to track 40 of a disc — particularly in double-density mode.

At initial switch-on, disc drive "0" starts to spin and its indicator light is switched on. After a few seconds, the disc stops and the light goes out. The machine is then ready for the system disc to be inserted.

We have a slight criticism about this because prior to inserting the disc, the display is completely black and no power indicator lamps are provided — it is therefore difficult to know whether the machine is switched on or not. A prompt on the screen such as "Insert disc and type Enter" would solve the problem.

Loading the system is straightforward — slip the diskette into drive "0" and press the re-set button. Nine times out of 10 the system loaded correctly first time, but on a few occasions — particularly from a cold-start after a cold night — it failed to initialise first time. Perhaps Radio Shack's temperature range warning has to be taken seriously.

After initialisation, the disc-operating system requires the user to enter the date, American-fashion, and time — which is optional. If time is entered, it starts an internal real-time clock which can be continuously displayed in the top right-hand corner of the screen if required. Having the date entered is very useful because all directory listings of files or programs are automatically tagged with the month and year of origination.

Range of commands

After initialisation, the disc operating system, TRSDOS, is announced which, like all operating systems, allows the operator to take control via a range of commands. TRSDOS has a set of commands whose keywords and syntax are peculiar to itself and which do not follow an existing standard.

If a word that is not an acceptable keyword is entered, the system searches for an executable program of that title — these are identified in the disc directory with the label extender /CMD. The operating system disc contains, as standard, the Model III disc Basic in this form as well as a number of sub-systems which are linked more closely to the operating system — and which are loaded as overlays as required.

An example of the latter type is Debug which is the TRS-80 disc-based monitor. Other utilities are Back-up — allowing the owner to make a personal back-up copy of the operating system — provided he knows his personal password: Format — which cleans up and prepares a new disc to the TRS-80 disc-sector format and Convert which allows the transfer of data from a Model I disc to a pre-formatted Model III disc.

Model I discs cannot run directly on the Model III system without going through this conversion as the formatting of the sectors is different.

In total, TRSDOS occupies 40K of disc space but does not have to be loaded in its entirety: it is modularised and apart from the resident module — which consists of input/output drivers, tables and the command interpreter — the individual modules are loaded as required by the commands.

The resident module is located from address 4000H up to 5200H and the overlays are entered between 5500H and 7000H. The space between 5200H and 5500H is reserved for the Debug monitor when it is required. Normally /CMD

(continued on next page)

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programs like Basic are loaded from 5200H upwards.

In general, file names consist of up to eight characters — the first must be a letter — and may be followed by "/" and a three letter extension, e.g., CMD, BAS, LIB, etc. A further option is the addition of eight characters of password protection and the disc drive specification.

A brief summary of TRSDOS Library of commands is as follows:

Append: Copies the contents of the source file on to the end of the destination file.
Attrib: Changes a file's password.
Auto: Allows automatic execution of a command after system initialisation.
Build: Creates a file of automatic commands.
Clear: Clears memory for use.
Clock: Turns on the real-time clock display. It is turned off by the command Clock (Off).
CLS: Clears the VDU screen.
Copy: Copies a file from one disc to another.
Create: Allocates space on the disc for a file which will be required later.
Date: Displays the current date — or allows it to be re-set.
Dir: Provides a directory listing with options of listing "invisible" and "system" files.
Do: Executes the automatic command file — if one has been prepared.
Dual: Duplicates outputs to the VDU and the printer.
Dump: Stores a machine-code program to a disc file.
Error: Displays a description of the error. These are normally displayed as error numbers when they occur.
Forms: Sets printer parameters — page width and lines per page.
Free: Displays, in a map, the current utilisation of the disc.
Help: Explains the syntax for any TRSDOS command.
Kill: Deletes a file.
Lib: Displays a list of TRSDOS commands.
List: Lists the contents of a file.
Load: Loads a machine-code program file into memory.
Master: Allows any one of the four possible drives to take over the role of master.
Patch: Change the contents of a disc file.
Pause: Temporarily suspend execution for operator intervention. This would be used as a command within an automatic "DO" file.
Prot: Change the master password.
Purge: Delete — on block — a set of files of the same type.
Relo: Change the loading entry point for a machine
Rename: Renames a file.
Route: Diverts the route of data flow between I/O devices.
Setcom: Pre-sets the format and baud rate of the RS232C interface.
Tape: Allows data to be passed from tape to disc, disc to tape or tape to memory at either low- or high-speed tape data rates.
Time: Displays the current time.
WP: Allows a diskette to be write-protected via software.

Although the manual includes Debug as a library command, it is a sub-system within itself allowing, rather limited, facilities to look at, modify, and run machine-code programs. As it will only access memory at address locations of 5500H and above, it is impossible, via Debug, to conveniently analyse what is contained within the system ROM and the resident part of TRSDOS.

In summary, Debug allows the permitted part of memory to be displayed as a full- or half-screen Hex dump with ASCII decoding — where relevant. The same addresses may be modified and break points can be set. Machine-code programs can be executed via a jump command or may be operated in single-step mode and, when break points are encountered, the Z-80 internal registers are displayed and may be modified.

This facility allows the user limited access to the "barred" low-memory addresses because Debug gives the contents of the next 16 address locations from the current value of the program counter. By injecting selected values into the PC register pair it is possible to trace through the ROM and TRSDOS areas of memory — although the exercise is very tedious and not to be recommended. A special command in Debug allows a disc file to be loaded into memory and modified after examining its Hexadecimal contents.

As its name implies, Debug is of value in carrying out housekeeping on software which has been prepared by other means. It is not a powerful monitor and certainly is not a substitute for an assembler. Incidentally, an assembler is not included in the standard software provided with the machine.

We tried everything we knew to attempt crashing the operating system but has no success. It must, therefore, be concluded that Radio Shack has gone to a good deal of trouble in developing and trying the system. We were given some proprietary software written in Basic Level II and recorded to disc on a Model I machine. This gave us an opportunity of checking out the Convert utility which reads the Model I disc and transfers the data to a Model III formatted disc.

The program was the Radio Shack stock-control system. The conversion worked perfectly and no changes were required to the Basic. Apparently, not all programs convert so conveniently and Radio Shack has published a list of its software which can be transferred to the Model III.

The Model III Disc Basic resembles the well-established Level II Basic but has certain up-graded features. There are, obviously, a number of disc-orientated features but there are also extra non-disc statements and commands.

By using the Peek statement, we were able to look around at parts of the ROM areas of the machine and, at the same time, obtain a dump of the disc Basic after it was loaded into RAM. It would appear that ROM contains a good deal, if not all, of the normal resident Basic. Whether Disc Basic makes use of many utilities within the ROM is difficult to assess, but it would be ridiculous if it did not.

We tried to use the System statement of disc Basic to force a jump to what we thought would be the entry point of resident Basic and we certainly obtained the resident Basic "READY" prompt.

Unfortunately, we were not able to go further because on entering a command, we obtained an error message and the system returned control to disc Basic. Incredibly, the system did not crash.

Like all complex systems, the TRS-80 Model III takes a good deal of time before you are familiar with it. The extra functions of the disc Basic over Level II also take time for familiarisation before they can be put to use. Once the disc Basic is mastered, the user is presented with a very powerful system in both hardware and software terms.

Conclusions

● The TRS-80 Model III is a very compact, rugged system.
● Its price puts it very high, if not above, the domestic or amateur range of computers but it vies most favourably with small-business systems in capability.
● In conjunction with a printer, it would easily and neatly fit on a small desk.
● The total internal disc capacity of 360K — plus the possibility of extending by a further 360K with external disc drives — would make it suitable for a small company's stock-control or personnel-records system.
● Although its operating system is non-standard — making it difficult to transport programs from alien systems — it has a very powerful instruction set both in the operating system itself and the disc Basic. The problem of the non-standard operating system could be readily overcome by the support Radio Shack will be providing to its many customers.
● The upwards-compatibility with the Model I and Level II Basic go a long way to ensuring that plenty of useful software is already available.
● While for office purposes the system has most of the features one would like to see, it is perhaps not really suited to development applications as there is no immediate access to the internal busbar and I/O interfaces are somewhat restricted.
● Although it could be used in word-processor applications, it would be better in this role if the screen were to contain 80 characters per line instead of 64.
● The versatility and potential high speed of the RS232C interface could, with the right software, make the Model III a very attractive low-cost intelligent terminal for distributed-processing systems or other data-networking applications.
● The documentation still needs more attention and a better-indexed, integrated reference manual to the whole system would certainly improve matters.
● The absence of technical information on the hardware side means that the user is very much in the hands of Radio Shack or Tandy for maintenance.
● It is in the business applications area when this fact becomes important and the user would have to rely very much on the efficiency and support of his local Tandy dealer.

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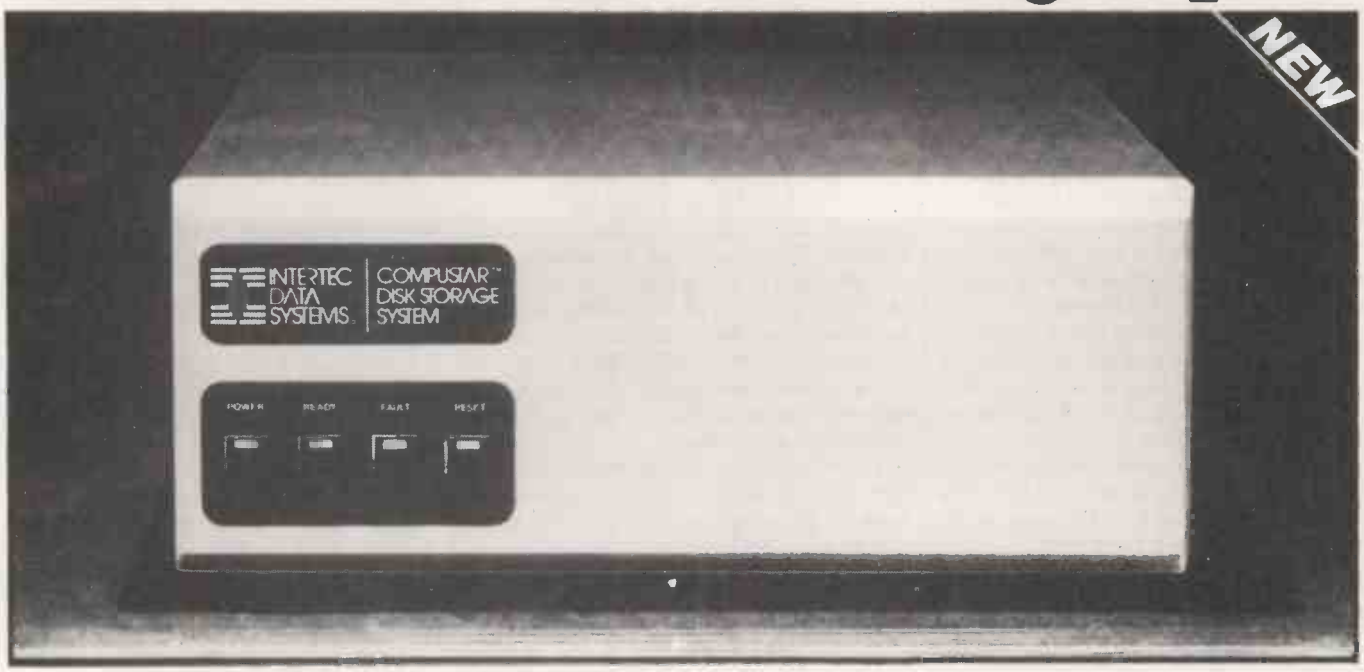

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Reliable PC-3201 has the Sharp hardware pedigree

by Nick Laurie

THE MOST immediately-striking fact about the review model was that on delivery the original Japanese packer's seals were still in place. "Not tried it out, then"? I asked the supplier Crystal Electronics. "No need to", I was assured, "it'll work". Sure enough, it did.

Unpacking took about 20 minutes; connecting together the four units took another five — every cable and connector was faultlessly supplied. Switch on and the display with the Sharp Basic (B-01) header appears. I loaded the nearest disc which had a Sharp DOS on it, powered down and up again and obtained a perfect bootstrap DOS load without a hiccup.

So far, all very reassuring and I was impressed — the last three machines to arrive on my desk all failed to work perfectly first time. It makes you wonder how the Americans managed to reach the moon before the Japanese.

Having established that the machine worked, I sat down to play. It is best to start in a simple way, I thought:

```
10 FOR A=1 TO 10:PRINT A:NEXT.
```

The printer chattered into life while the monitor screen stayed blank. Sure enough, it had counted to 10, but on the printer, not the screen.

Sharp, for reasons best known to itself, has decided that a print to screen is to be a Disp, while the universally-used word Print will refer to the hard copy. Logical, in a dubious way, and a fitting introduction to some of the idiosyncrasies of oriental software. Perhaps it is a way of making you read the manual before programming rather than as a last resort.

It took some time to come to terms with Sharp Basic. I was not helped by an apparently well-thought-out manual which proved, in practice, to be unbelievably inscrutable with many of the functions described in unnecessarily long-winded and complicated ways.

Although it lacked the classic style of home-produced Japanese translations, it was still a far cry from the easy reading often associated with U.S. manuals. In fact, almost all the information needed can be found somewhere in the 300 or so pages of the manuals — but not easily.

The printer is an Epson MX-80 tractor feed with what, I suspect, is Sharp's idea of improved software. To reproduce the screen graphics accurately — including a Japanese character set — some clever engineer has delved into its innards and has thought it a good idea to replace a perfectly good Epson alphabet with a homebrew version without descenders. The text produced is within half a pinch of being unreadable and is, to my mind, unforgivable on £3,000's worth of otherwise lovely equipment.

I hope someone will remedy this before the machine is widely available — no business in its right mind is going to send out invoices which look as though they has been written by an illiterate three-year-old, and yet this is, essentially, a business machine.

Having now disposed of the major faults — and I have little doubt that they will, in time, be rectified — it is worth having a look at some of the virtues. The styling is very acceptable. The independent monitor is mounted on a stand which allows it to be tilted and swivelled to obtain maximum operator comfort. This is not only a very good thing, but in Norway and soon in West Germany is compulsory for most business VDUs.

The computer itself is about the size of a slimline brief-case, and rugged enough to stand up to heavy daily use. There is no fan, so the machine is silent in operation. The twin disc-drive unit is built to an equally-solid standard, and the whole machine manages to look a good deal less obtrusive than some of the popular machines seen in the last year or two.

Altogether a very professional-looking job, although the day that we can dispense with the untidiness of multiple cables of different sizes, colours and shapes, and replace them all with some kind of common bus system will be one for celebration.

I understand that there is little in the way of expansion available, although we are told that an RS232C and an IE 488 inferface are due, as well as an assortment of other plug-in modules. The expansion slots for these and for the printer and disc interfaces are tidily hidden in a separate metal-cased box inside the machine. There are individual card guides for every slot and the box is accessible from the back via tight-fitting plastic covers.

The plug-in cards use a cover designed to the same format so that the interior remains sealed from the world at all times.

The PC-3201 features a high-quality QWERTY keyboard with shift lock, cursor pad and a repeat key. A raised spot on the centre key of the numeric keypad means that regular uses will not have to keep looking to see where they are. This keypad has its own enter and negative enter key — a negative enter key multiplies the input by —1 which is useful for people who juggle figures. There is a line-clear key associated with the numeric pad, but it works just as well on other entries.

There are seven single-function keys: Run and Halt, obvious candidates, as are Insert and Delete for screen editing. Break and Cont are handy and the final one is a two-function DEB/Edit. Edit followed by a line number gives a normal Basic Edit facility; Deb allows single-stepping of Basic programs and stands, for Debug.

Further extras include a built-in clock-calendar which keeps track of the time even without power and its output is easily accessed from Basic: an input buffer which can hold up to 64 single key entries — even accepting them when the computer itself is not polling the keyboard.

Two-key rollover is provided for fast typists, although super-fast typists tell me that three- or four-key rollover is some-

times handy. I never managed to outpace it though. To my mind, the most outstanding keyboard features are: 10 user-definable keys allowing up to 20 — using shift — single-key entries to be programmed at will.

The availability of these makes the machine a delight for non-computer people. The only problem is that each one can only be pre-programmed with up to 12 characters, a few more would be handy but, in practice, 10 is often enough. A removable plastic surround is provided to allow you own legends to be added to these keys.

Reserved words

Their only weakness lies in the lengths of many of the Basic reserved words used in this system, which takes many potentially-useful inputs over the maximum permitted 12 characters and prevents them from being the real programming aid they might have been. However, a command key allows the more commonly-used reserved words to be input at a single keystroke which largely overcomes this problem.

Which brings us to the Basic. Rather than listing every available entry, suffice it to say that this is a comprehensive, if somewhat idiosyncratic Basic. A total of 121 reserved words are available — excluding the disc-handling words — and they cover all the usual Basic areas as well as some sophisticated graphic controls.

Both integer and 12-digit real calculations are supported, but there is no space in the 32K ROM to cover matrix calculations.

Music can be called from Basic with a single word, Music — what else, even in Japan? A string argument is then used to define notes, note duration, tempo and rests up to a maximum of 250 characters per Basic line.

The volume produced on the built-in speaker can be adjusted with a screwdriver to give an output loud enough to damage your health seriously. All in all, a comprehensive version of Basic which, though not perfect, should satifsy the majority of users.

Crystal Electronics, which put CP/M on the Sharp MZ-80K and will be doing the same for this one shortly, is planning to supply a version of the best-selling Xtal Basic for this machine in the near future.

The discs, 5¼in. mini-floppies in a dual disc drive, connected to the main unit by a rather unsightly twisted-pair ribbon cable, have so far never let me down, although one or two bits of software written on a different machine needed two or three boots to start.

The discs are organised as 35 tracks on each side, with 16 sectors of 256bytes per track giving a total capacity on two discs of about ½ Megabyte. The disc Basic appears to be identical to the ROM Basic.

General file handling on the Sharp DOS is in no way exceptional, and a listing of the commands should be enough to show interested parties what's what:

General file commands are: Lock which prevents accidental Killing of files: Unlock; Kill; Cat which is for the directory; RName which renames a file; LPrint which is an odd word used to change a volume name; LInput which checks that the disc mounted has the correct volume name for the access to be made; Copy and Bye.

Maxfile determines the number of files to be used; Create reserves disc space for files; Open and Close are as expected. for sequential files, the commands Print at, Input at, Sep at, BPrint at and BInput at allow their organisation with minimum difficulty, while RFormat at, Put at and Get at do the same for random-access files.

Save, Store, Load, Chain, Merge and Load 'Sub, which loads a machine-code subroutine, allow complete program handling to be undertaken easily while a miscellany of other commands provide file handling for video pages, user-definable keys and machine-code files.

Facilities for initialising and copying discs are available as is the rather ruthless Killall which does exactly what it implies although files protected by Lock will emerge unscathed.

All in all, a perfectly-adequate DOS which, with the soon to be announced CP/M DOS from Xtal, complements a very pleasing piece of hardware more than adequately.

Conclusions

- **The Sharp PC-3201 is more remarkable for the superb quality of its hardware than for its software. This is perhaps inevitable in a new machine, and unlikely to present any real problems.**
- **At about £3,000 retail — about £2,000 to dealers — it might seem expensive, but the reliability is often well worth paying for in any really serious application.**
- **If you want to make extensive use of the printer, check the character set before you buy; the lack of true descenders makes the printout very unattactive.**
- **If you are producing systems for professional users: estate agents, doctors, solicitors and the like, who may want a good appearance as well as performance, this could be the right machine.**
- **See if you can try one before you buy — this applies to all systems — some people love the 3201, others are not so sure that they could not buy a better system for the same price.**

Cost-effective system for modern accountancy practice

THIS MONTH, we depart from the well-worn path of general business-software reviews and look at an incomplete records accounting system. This kind of package will be of interest to accountants, those who work in accountancy and particularly any of the many thousands of accountants working within an accountancy practice.

Most readers will have encountered an accountant in large and medium-sized companies. Far greater in number are those accountants who are concerned with the preparation of year-end accounts for the myriad of small companies, parterships and sole traders which form the backbone of British enterprise.

These small businesses fall into a category of their own, are rarely large enough to employ a full-time accountant

by Mike McDonald

and can vary from window cleaners to solicitors and might include, say, your local group practice of doctors.

The accounting practices form a massive industry which is not permitted to advertise its services except through the Yellow Pages and provides a fundamental function to the economy.

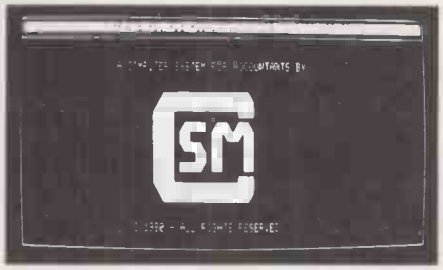
One of these key roles is the preparation of final or year-end accounts for a multitude of actively trading businesses, sole traders, practices, and partnerships and is, in most cases, a legal requirement of the Companies Act 1948 to 1976. This often involves a yearly visit to the client's premises to begin what can often prove a lengthy investigation of paperwork which will provide sufficient information to prepare suitable accounts.

In the case of the small operators, this is often referred to as "shoe-box accounting" by virtue of the collection of receipts, invoices and banking slips summarily stowed in a box for the annual inquisition by the auditors. This is usually described as incomplete records accounting followed by the preparation of "final accounts".

Given that the accountant will often be working from jumbled cheque book stubs, crumpled invoices and sometimes even the back of cigarette packets, the term "incomplete" takes on a whole new dimension for the uninitiated.

More often, small business will have kept a sales/purchases day book from which the data is more easily extracted. Entries are made from these working documents into the appropriate sales, purchase and nominal ledgers from which projections can then be produced for the preparation of a balance sheet and profit-and-loss report.

Various other exhibits will be prepared depending on the company/business concerned and may include schedules and



notes to the accounts providing more background information on the totals shown. In some cases, there is a statement by the directors of the concern and, of course, a certification by the accountant that the document is a fair and true representation of the state of affairs of the enterprise.

It is this complex area of incomplete records accounting that is a prime target for specialist computerisation. CSM (Computer Services Midlands) Ltd is a company which saw such a opportunity for a package two years ago with the launch of the Commodore Pet 3000 series. An incomplete records package was written and the company now boasts more than 300 installations of the software in the U.K.

The name of the CSM incomplete records accounting package is slightly misleading because of its additional ability to prepare final accounts. The few other packages we have seen running on other machines do not generally offer user-defined final accounts output to word-processing-quality printers. This package is available from most Commodore Business Dealers and costs £1,500 for the 8000 series version.

We reviewed the system on a Commodore 8032 computer, 8050 dual floppy-disc drive, and 8024 high-speed, dot-matrix printer — a full hardware installation costing around £3,000. The package is supplied in the form of a 70-page A4 operator's manual and program diskette.

The CSM incomplete records accounting package comprises a suite of programs held on the program disc which resides in one of the two drives while the system is in use. The other drive is always used for client data discs. Each client data disc is set up by the package automatically and the system is based on one disc per client.

Each data disc will hold up to 250 user-defined nominal account headings and up to 3,500 transactions which are posted automatically to the respective nominal accounts. There is also the facility to archive the year-end account totals to a library diskette on which may be stored up to 50 client summaries for access by the accountant for reference in future years.

The two main underlying functions of this system can best be described as: the setting-up of a series of revenue and expenditure nominal account headings as well as control accounts for VAT and other miscellaneous items; followed by the entry of a voluminous series of single transactions — invoice and purchase details, bankings and withdrawals — which will be sorted and cross-posted automatically into the various headings. The all-important financial reports produced at the end of the exercise are created by the subtle combination of the various nominal account headings.

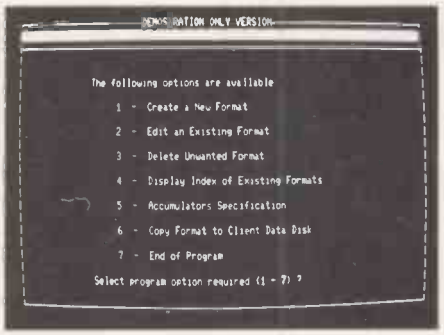
A single-key entry on the keyboard loads and runs the start program which offers the operator the options of

1. Using an existing client data disc for further processing.
2. Setting up a new client data disc for use with the system.
3. The retrieval of existing client data from the archive disc for transfer to a clean data disc.

If either option 2 or 3 are inadvertently selected, the system warns of the existence of client data on the currently-mounted disc and asks for further confirmation before proceeding. Once the program is satisfied that the data disc is correct, the main menu is entered and offers:

1. New accounting period
2. Prime entry analysis
3. Load/amend comparatives
4. Print financial reports
5. Print working reports
6. Client data maintenance
7. Disc utility program
8. Exit from system

The CSM incomplete records accounting package has been written with a consistency which indicates an extensive experience of the man/machine interface. Screen lay-outs are attractively thought-



out and all data entry is thoroughly protected and yet permits the editing features of 8032 to be utilised to the full.

A status message is always displayed at the bottom of each screen showing what the system is doing, i.e., loading balances, updating control account, etc. Input fields are validated and range checked. Where

multiple entries are made, such as transaction data or nominal heading changes, the user is allowed either to scroll through the data with the cursor or, at least, to cross-reference previously-entered details during the course of input.

The programs are all run-protected and there is no opportunity to access the source code or terminate without writing the data to disc — that is, providing the plug is not pulled. The business of capturing transactional data implies a high volume of data input and this has been allowed for by the authors in the design of the system.

Keyed transactions are stored in memory until either the current function is terminated or the user specifically requests that it be written to disc. This means fast keying of the volume date may be carried out quickly without the intervention of output to the disc drive.

The manual recommends that users carry out a dump to the disc every, say, 100-150 transactions, so that in the case of a failure, any loss is limited to only that data currently held in memory. This wise recommendation shows a realistic attitude to the way the real world works.

The nominal account is initially set up on each client disc for the user over the full range of 250 account numbers. The ledger is also structured — groups of account numbers are pre-defined, i.e., # 1-10 = sales accounts, # 11-20 purchases and direct costs and so on.

It is then left to the discretion of the accountant to re-label the titles of the nominal account headings at will as well as tailor the data disc to the particular client for which it will be used.

Each practice will tend to structure the nominal ledger to its own standard and an additional program is provided to do this outside the scope of the main system menu. Account headings may be tailored and stored on the relevant client disc. This is necessary given that an engineering client might have an expenditure heading for plant and equipment purchase while a retailer's equivalent would be POS display material.

Assuming that the desired structure has been set up, and headings and client details applied, the operator may then proceed to the next main function of the system — prime entry input and analysis. This is available as option 2 of the main menu.

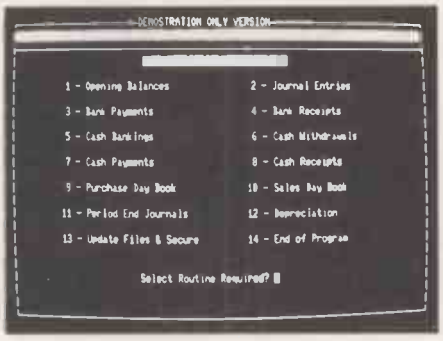
Each transaction input will consist of some if not all of the following data

1. Code number — the nominal code to which the detail is to be posted
2. Gross transaction value
3. VAT amount
4. Narrative comment

There are fundamentally two types of transaction input within this menu option. The first of these is an automatic double-entry input. Bank receipts, sales day-book entries and purchase day-book entries are typical where the machine automatically posts a contra or double entry to the appropriate control account, i.e., the bank account, the sales debtors' account or the purchase creditors' account. It knows which control account to post to by virtue of the dedicated selection of that transaction type.

These transactions constitute the majority of the volume input and make the operator's life considerably easier. The second kind of transaction does require a contra-entry by the operator and is more exacting. For instance an opening stock credit of, say, £1,000 must have a balance debit of —£1,000 posted to the stock account. If contra-entries do not balance when the end of the batch input is reached, the operator is required to post a balancing entry before control of the machine is returned.

To aid the operator there are a series of display areas provided at the top of the



data input screen and a range of facilities which are optional.

As transactions are keyed into the system, the displays at the top of the screen are updated giving running totals of the various control accounts. The system automatically generates a transaction number against which each entry is made. It is this transaction number which may be used to access transactions at a later stage.

The transaction details are entered and may be altered through the use of the cursor and insert/delete key before commitment to the log, signalled by a carriage return. Once in the system, you cannot alter any of the input data. If an erroneous entry has been made, a balancing contra-entry must be made to the same account for the same amounts.

Any such balancing entries may be subsequently cleared from the log with the delete function under the alter-client-details option of the main menu. If the error has been made on the previous line, a special control key may be selected which will automatically create a balancing reverse signed entry on the operator's behalf.

As each new nominal code is entered, a quick visual verification is provided by the display of the nominal account name, for that code, at the bottom of the screen. Signing of amounts, i.e., + ve or —ve, is not necessary except in the case of journal entries and opening balance amounts.

As the transactions fill the screen, the display lines are scrolled upwards leaving the top of the screen status lines intact but always keeping in the view the last 12 input lines. Three options are always offered at the bottom of the screen. End will terminate input and return the user to the prime entry sub-menu assuming a suitable balance is achieved by the system.

The other two options are associated with a number of features which are available during the transaction input stage. The first displays the features as follows:

0. VAT input switch on/of: This provides the facility to enable the entry of VAT on every input line as a separate amount. If selected, the feature is switched on and the user is prompted for the period number to which all entries will be posted to provide a VAT analysis. A further sub-option of this will allow the user to select the auto-calculation of VAT based on the gross amount. If VAT input is selected then VAT amounts are accumulated separately and posted to the VAT-control account.
1. Locked code Input on/off: Produces the automatic allocation of the nominal code to that which was last entered. All that is required is the entry on each line of the amount, etc. Each subsequent transaction is allocated the same code until terminated.
2. Comment input feature on/off: Will prompt the user at the end of each line for the entry of a comment. Comments may be a null entry If inappropriate. A further feature Is that the first character of the comment field must be an alpha character. This is to prevent the more-experienced operator from moving out of sychronisation with the numeric input fields of the transactions and thereby entering erroneous data.
3. Sub-total gross and VAT: This causes a display at the bottom of the screen of the sub-total gross amount and VAT figures since the batch entry was begun. Once displayed, the accumulators are zeroed ready to begin addition again from the point of display. This feature is useful for checking batch totals or, if entering data from a day book, for checking of page totals.
4. Nett profit and nett profit percentage: DIsplays the current value of nett profit and its percentage of the total sales to date.
5. Display nominal balance: Allows the operator to repeatedly select any nominal code and display its current balance.
6. Display bank account: Shows the current value of the control account and will allow the user to set up a target balance which may be compared to the computed balance to indicate when the target has been reached.
7. Display cash account: As for 6, except this feature uses the cash account and target cash data.
8. Display previous entries: Prompts the operator for a start transaction code number and then proceeds to display all entries thereafter up to the current entry number. This is provided for the operator to re-examine previous input for errors and anomalies.
9. Display nominal account: Will produce a display of all entries made to a selected nominal account. Where entries exceed the data-entry screen size, the display is scrolled and may be held at will for examination by the user. As many accounts may be examined as required before returning to the data input mode.

Where a feature is an "on/off", the desired function will remain active until selected again when it will be switched off. The three on/off options are highlighted in reverse field at the top of the data input screen to remind the operator if they are currently selected.

The third option available to the user during the course of data input is the

(continued on next page)

(continued from previous page)

feature-select which merely permits a feature to be enabled without the display of all of the options. Each facility is highly useful in its own right although some will be of more relevance to the accountant than to a keyboard operator.

Having entered a multitude of transactions the final reports are near to readiness. A number of subsidiary reports are available to the account and the operator to assist in verifying that data has been entered correctly and to ensure that the accounting practices have been adhered to. These are the working papers selectable through option 5 of the main menu. Included in these reports are:

1. Trial balance
2. Nominal-ledger detail
3. Bank and cash accounts summary
4. VAT summary
5 Audit-trail transaction list

What we very much liked about the system is that every report may be first displayed on the screen in its full format before or instead of hard-copy printout. On selecting a report for output, the user is prompted: Display or Print?. The trial balance is rudimentary and is based on the structure of the nominal ledger as defined by the accountant. The nominal-ledger report is a detailed listing of the transactions within each nominal code and its opening and closing balances.

The audit trail is a listing of the transaction keyed in full detail in the order they were entered, i.e., by ascending transaction number. This report may be started from an entered transaction number so that later entries may be listed from the end point of the previous audit trail.

The finished financial reports are available through option 4 of the main menu. The final accounts produced by most practices follow a very similar format. It is not the deviation from the norm which is attractive but the ability to choose the report formats at run time.

The CSM incomplete records system provides the ability, through a special program, for reports to be completely-designed and generated by the practice concerned. A report-format generator with its own symbolic language is provided. Formats may be constructed to take account of the representation of variable data on the final reports and whether or not it should even be included. For example, one could produce a two-column lay-out if comparison figures exist, or use a single-column format.

Sub-totalling may be carried out and comparative tests made. A variety of formats are provided on the master program disc for sole traders, limited companies, and partnerships.

These formats may be used by any practice without the need for any further modification. The format-generator program allows the user to access and edit existing formats with storage of new versions on either the client disc — if a format is created specifically for one client — or on the master program disc with the standard routines. Formats may be transferred, deleted or created from scratch.

Formats may be stored as a series of pages — up to nine pages per format name — which can be produced *en masse* at print time, or selected individually. This is represented as a format name followed by a group of page numbers. When requesting a final report printout, the operator is offered a screen menu comprising the names of any existing report formats and the page numbers available under each.

A prompt is displayed for the format name followed by a selected page number. A null input against the page number defaults the request to all pages held. Finally, the user can display the reports on the screen in their final form or print them out as either a continuous report or in single sheets — subject, of course, to the type of printer used.

Each format mask or program is a set of instructions created from within the format-generator program which is almost a mini text editor. Some of the ground rules are page width of standard 77 characters otherwise up to any width; 100 lines of format specification per page; and up to 100 pages of format specification per disc.

Free-format text as such may be entered among the format as required. Each of the format commands has a variety of comprehensive and powerful parameters.

In addition to the comprehensive range of utilities, there are four other programs which must be loaded separately to provide important but seldom-used options such as printer-control settings, nominal structure and code list, changing company details and client data conversion.

The standard of the documentation provided was adequate for most users. We felt that those accountants wishing to become involved in using the report-format generation program would be greatly assisted by the inclusion of some sample format programs with the sample reports given in the appendices.

Conclusions

●This package appears to be a well-thought-out solution to the problem of computerisation of not just incomplete records accounting, but also of the preparation of final accounts.

●The standard of programming is excellent and the level of user-friendliness must place this package in the same league as VisiCalc, Ozz, WordPro and Wordcraft despite the fact that it is written in Basic.

●There is room for some improvement, although any changes would be mostly cosmetic. We would suggest that users power-down the computer after exiting from the program before re-entering it again.

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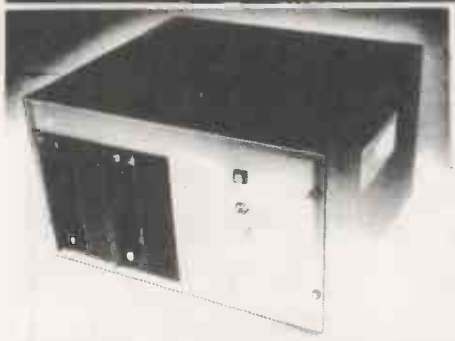

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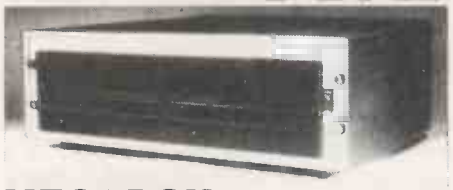

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COMPUTER SLANG

ARG *n.* Abbreviation for "argument" (to a function), used so often as to have become a new word.

BAGBITER 1. *n.* Equipment for program which fails, usually intermittently. 2. BAGBITING: *adj.* Failing hardware or software. *This bagbiting system won't let me get out of spacewar.* Usage: verges on obscenity. Grammatically separable; one may speak of "biting the bag". Synonyms: LOSER, LOSING, CRETINOUS, BLETCHEROUS, BARFUCIOUS, CHOMPER, CHOMPING.

BOGUS (WPI, Yale, Stanford) *adj.* 1. Non-functional. *Your patches are bogus.* 2. Useless. *OPCON is a bogus program.* 3 False. *Your arguments are bogus.* 4. Incorrect. *That algorithm is bogus.* 5. Silly. *Stop writing those bogus sagas.* This word seems to have some, but not all, of the connotations of RANDOM.

BARF 1. *Interj.* Term of digust. See BLETCH. 2. *v.* Choke, as on input. May mean to give an error message. *The function '=' compares two fixnums or two flonums, and barfs on anything else.* 3. BARFULOUS, BARFUCIOUS: *adj.* Said of something which would make anyone barf, if only for aesthetic reasons.

BLETCH 1. *interj.* Term of disgust. 2. BLETCHEROUS: *adj.* Disgusting in design or function. *This keyboard is bletcherous.*

BRAIN-DAMAGED [generalisation of "Honeywell Brain Damage" (HBD), a theoretical disease invented to explain certain utter cretinisms in Multics] *adj.* Obviously wrong; cretinous; demented. There is an implication that the person responsible must have suffered brain damage, because he should have known better. Calling something brain-damaged is really bad; it also implies it is unusable.

BROKEN *adj.* 1. Not working properly (of programs). 2. Behaving strangely; especially (of people) exhibiting extreme depression.

BUG [from telephone terminology, *bugs in a telephone cable*, blamed for noisy lines] *n.* An unwanted and unintended property of a program. See FEATURE.

BUZZ *v* To run in a very tight loops, perhaps without guarantee of escaping.

CATATONIA (kat-uh-toe'-nee-uh) *n.* A condition of suspended animation in which the system is in a wedged (CATATONIC) state.

CHOMP *v.* To lose; to chew on something of which more was bitten off than one can manage. Probably related to gnashing of teeth. See BAGBITER. A hand gesture commonly accompanies this, consisting of the four fingers held together as if in a mitten or hand puppet, and the fingers and thumb open and close rapidly to illustrate a biting action. The gesture alone means CHOMP CHOMP.

CONNECTOR CONSPIRACY [probably came into prominence with the appearance of the KL-10, none of whose connectors matches anything else] *n.* The tendency of manufacturers (or, by extension, programmers or purveyors of anything) to create new products which do not fit together with the old, thereby making you buy either all new equipment or expensive interface devices.

CRASH 1. *n.* A sudden, usually drastic failure. Most often said of the system (q.v., definition #1), sometimes of magnetic disc drives. *Three users lost their files in last night's disc crash.* A disc crash which entails the read/write heads dropping on to the surface of the discs and scraping off the oxide may also be referred to as a *head crash.* 2. *v.* To fail suddenly. *Has the system just crashed?* Also used transitively to indicate the cause of the crash — usually a person or a program, or both. *Those idiots playing spacewar crashed the system.* Sometimes said of people. See GRONK OUT.

CROCK. *n.* An awkward feature or programming technique that ought to be made cleaner. Example: Using small integers to represent error codes without the program interpreting them to the user is a crock. Also, a technique that works acceptably but which is prone to failure if distrubed in the least — for example, depending on the machine opcodes having particular bit patterns so that you can use instructions as data words, too; a tightly-woven, almost completely-unmodifiable structure.

CRUFTY [from "cruddy"] *adj.* 1. Poorly built, possible overly complex. *This is standard old crufty DEC software.* Hence CRUFT, *n.* shoddy construction. 2.

Unpleasant, especially to the touch, often with encrusted junk. Like spilt coffee smeared with peanut butter and catsup. Hence CRUFT *n.* disgusting mess. 3. Generally unpleasant. CRUFTY OR CRUFTIE *n.* A small crufty object (see FROB); often one which doesn't fit well into the scheme of things. *A Lisp property list is a good place to store crufties — or random cruft.*

CRUNCH *v.* To process, usually in a time-consuming or complicated way. Connotes an essentially trivial operation which is nonetheless painful to perform. The pain may be due to the triviality being imbedded in a loop from 1 to 1,000,000,000. *Fortran programs mostly do number crunching.* 2. To reduce the size of a file by a complicated scheme that produces bit configurations completely unrelated to the original data, such as by a Huffman code. The file ends up looking like a paper document would if somebody crunched the paper into a wad. Since such compression usually takes more computations than simpler methods such as counting repeated characters such as spaces, the term is doubly appropriate. This meaning is usually used in the construction *file crunch(ing)* to distinguish it from *number crunch(ing).*

CUSPY [from the DEC acronym CUSP, for Commonly Used System Program, i.e., a utility program used by many people] (WP1) *adj.* 1. (of a program) Well-written. 2. Functionally-excellent. A program which performs well and interfaces well to users is cuspy.

DAEMON (day'mun, dee'mun) [archaic form of demon, which has slightly different connotations (q.v.)] *n.* A program which is not invoked explicitly, but which lies dormant waiting for some condition(s) to occur. The idea is that the perpetrator of the condition need not be aware that a daemon is lurking — though often a program will commit an action only because it knows that it will implicitly invoke a daemon.

DEADLOCK *n.* A situation wherein two or more processes are unable to proceed because each is waiting for another to do something. A common example is a program communicating to a PTY or STY, which may find itself waiting for output from the PTY/STY before sending anything more to it, while the PTY/STY is similarly waiting for more input from the controlling program before outputting anything. This particular flavour of deadlock is called *starvation.* Another common flavour is *constipation*, where each process is trying to send stuff to the other, but all buffers are full because nobody is reading anything. See DEADLY EMBRACE.

DEADLY EMBRACE *n.* Same as DEADLOCK (q.v.), though usually used only when exactly two processes are involved. DEADLY EMBRACE is the more popular term in Europe; DEADLOCK in the United States.

DEMENTED *adj.* Yet another term of disgust used to describe a program. The connotation in this case is that the program works as designed, but the design is bad. For example, a program which generates large numbers of meaningless error messages implying it is on the point of imminent collapse.

DO PROTOCOL [from network protocol programming] *v.* To perform an interaction with somebody or something that follows a clearly-defined procedure. For example, *Let's do the bill protocol* at a restaurant means to ask the waitress for the bill, calculate the tip and everybody's share, generate change as necessary, and pay it.

DOWN 1. *adj.* Not working. *The up escalator is down.* 2. TAKE DOWN, BRING DOWN: *v.* To deactivate, usually for repair work. See UP.

DRAGON *n.* (MIT) A program similar to a DAEMON (q.v.), except that it is not invoked at all, but is instead used by the system to perform various secondary tasks. A typical example would be an accounting program, which keeps track of who is logged in, accumulates load-average statistics, etc.

EPSILON [from standard mathematical notation for a small quantity] 1. *n.* A small quantity of anything. *The cost is epsilon.* 2. *adj.* Very small, negligible; less than marginal. *We can have this feature for epsilon cost.* 3. WITHIN EPSILON OF: Close enough to be indistinguishable for all practical purposes.

EXCL (eks'cul) *n.* Abbreviation for *exclamation point.*

FEATURE *n.* 1. A surprising property of a program. Occasionally documented. To

(continued on next page)

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call a property a feature sometimes means the author of the program did not consider the particular case, and the program makes an unexpected, although not strictly speaking an incorrect response. See BUG. *That's not a bug, that's a feature.* A bug can be changed to a feature by documenting it. 2. A well-known and beloved property; a facility. Sometimes features are planned, but are called crocks by others.

FEEP 1. *n.* The soft bell of a display terminal. 2. *v.* To cause the display to make a feep sound.

FLAG DAY [from a piece of Multics history involving a change in the ASCII character set originally scheduled for June 14, 1966] *n.* A software change which is neither forward- nor backward-compatible, and which is costly to make and costly to revert. *Can we install that without causing a flag day for all users?*

FLAME *v.* To speak incessantly and/or rabidly on some relatively uninteresting subject or with a patently ridiculous attitude. FLAME ON: *v.* To continue to flame. See RAVE.

FLAVOUR *n.* Variety, type, kind. 2. The attribute of causing something to be FLAVOURFUL. *This convention yields additional flavour by allowing one to ... See VANILLA.*

FRIED *adj.* 1. Non-working due to hardware failure; burnt out. 2. Of people, exhausted. Said particularly of those who continue to work in such a state. Often used as an explanation or excuse. *Yes, I know that fix destroyed the file system, but I was fried when I put it in.*

FROBNICATE *v.* To manipulate or adjust, to tweak. Derived from FROBNITZ. Usually abbreviated to FROB. Thus one has the saying *to frob a frob.* See TWEAK and TWIDDLE. Usage: FROB, TWIDDLE, and TWEAK sometimes connote points along a continuum. FROB connotes aimless manipulation; TWIDDLE connotes gross manipulation, often a coarse search for a proper setting; TWEAK connotes fine-tuning. If someone is turning a knob on an oscillascope, then if he's carefully adjusting it he is probably tweaking it; if he is just turning it but looking at the screen he is probably twiddling it; but if he is just doing it because turning the knob is fun, he is frobbing it.

GLITCH [from the Yiddish *glitschen* to slide] 1. *n.* A sudden interruption in electric service, sanity, or program function. Sometimes recoverable.

GLORK *interj.* 1. Term of mild surprise, usually tinged with outrage, as when one attempts to save the results of two hours of editing and finds that the system has just crashed. 2. Used as a name for just about anything. See FOO. 3. *v.* Similar to GLITCH (q.v.), but usually used reflexively. *My program just glorked itself.*

GRONK *v.* 1. To clear the state of a wedged device and re-start it. More severe than *to frob* (q.v.) 2. To break *The Teletype scanner was gronked, so we took the system down.* 3. GRONKED: *adj.* Of people, the condition of feeling very tired or sick. 4. GRONK OUT: *v.* To cease functioning. Of people, to go home and go to sleep. *I'll gronk out now; see you all tomorrow.*

GROVEL *v* To work interminably and without apparent progress. Often used with over. *The compiler grovelled over my code.* Compare CRUNCH.

HACK *n.* 1. Originally a quick job that produces what is needed, but not well. 2. The result of that job. 3. NEAT HACK: A clever technique. Also, a brilliant practical joke, where neatness is correlated with cleverness, harmlessness, and surprise value. Example: the Caltech Rose Bowl card display switch circa 1961. 4. REAL HACK: A crock (occasionally

affectionate). *v.* 5. With *together,* to throw something together so it will work. 6. To bear emotionally or physically. 7. To work on something (typically a program). In specific sense: *What are you doing? I'm hacking TECO.* In general sense: *What do you do around here? I hack TECO.* The former is time-immediate, the latter time-extended. More generally *I hack x* is roughly equivalent to *x is my bag. I hack solid-state physics.* 8. To pull a prank on. See definition 3 and following points. 9. *v.i.* To waste time (as opposed to TOOL). 10. HACK UP (ON): To hack, but generally implies that the result is meanings 1-2. 11. HACK VALUE: Term used as the reason or motivation for expending effort toward a seemingly useless goal, the point being that the accomplished goal is a hack. For example, MacLisp has code to read and print Roman numerals, which was installed purely for hack value. HAPPY HACKING: A farewell, HOW'S HACKING?: A friendly greeting among hackers. HACK HACK: A somewhat pointless but friendly comment, often used as a temporary farewell.

HAIR *n.* The complications which make something hairy. *Decoding TECO commands requires a certain amount of hair.* Ofter seen in the phrase INFINITE HAIR, which connotes extreme complexity.

HARDWARILY *adv.* In a way pertaining to hardware. *The system is hardwarily unreliable.* The adjective *hardwary* is not used.

HUNGUS (hung'-ghis) [perhaps related to current slang "humongous"; which one was first, if either, is unclear] *adj.* Large, unwieldy usually unmanageable. *TCP is a hungus piece of code. This is a hungus set of modifications.*

LOGICAL [from the technical term *logical device,* wherein a physical device is referred to by an arbitrary name] *adj.* Understood to have a meaning not necessarily corresponding to reality.

LPT (lip'-it) *n.* Line printer, of course.

MAGIC *adj.* 1. As yet unexplained, or too complicated to explain. *TTY echoing is controlled by a large number of magic bits. This routine magically computes the parity of an eight-bit byte in three instruction.* 2. (Stanford) A feature not generally publicised which allows something otherwise impossible, or a feature formerly in that category but now unveiled. Example: The keyboard commands which override the screen-hiding features.

MARGINAL *adj.* 1. Extremely small. *A marginal increase in core can decrease GC time drastically.* 2. Of extremely small merit. *This proposed new feature seems rather marginal to me.* 3. Of extremely small probability of winning.

MISFEATURE *n.* A feature which eventually catches someone, possibly because it is not adequate for a new situation which has evolved. It is not the same as a bug because fixing it involves a gross philosophical change to the structure of the system involved. Often a former feature becomes a misfeature because a trade-off was made whose parameters subsequently changed — possibly only in the judgment of the implementors.

MOBY 1. *Adj.* Large, immense, or complex. *A moby frob.*

MODE *n.* A general state, usually used with an adjective describing the state. *No time to hack; I'm in thesis mode.* Usage: in its jargon sense, MODE is most often said of people, though it is sometimes applied to programs and inanimate objects. *If you're on a TTY, E will switch on to non-display mode.* In particular, see DAY MODE, NIGHT MODE (under PHASE), and YOYO-MODE; also COM MODE.

MODULO *prep.* Except for. From mathematical terminology: one can consider saying that 4=22 *except for the 9s* (4 — 22 mod 9). *Well, Lisp seems to work fine now, modulo that GC bug.*

MUMBLAGE *n.* The topic of one's mumbling (see MUMBLE). *All that mumblage* is used like *all that stuff* when it is not quite clear what it is or how it works.

MUMBLE *interj.* 1. Said when the correct response is either too complicated to enunciate or the speaker has not thought it out. Often prefaces a longer answer, or indicates a general reluctance to become involved in a long discussion. 2. Sometimes used as an expression of disagreement. Common variant: MUMBLE FROTZ.

N *adj.* 1. Some large and indeterminate number of objects, *There were N bugs in that crock;* also used in its original sense of a variable name. 2. An arbitrarily large and perhaps infinite, number. 3. A variable whose value is specified by the current context. *We would like to order N wonton soups and a family dinner for N-1.* 4. NTH: *adj.* The ordinal counterpart of N. *Now for the Nth and last time ...*

OPEN *n.* Abbreviation for open (or left) parenthesis, used when necessary to eliminate oral ambiguity. To read aloud the Lisp form (DEFUN FOO (X) (PLUS X 1)) one might say: *Open def-fun foo, open eks close, open, plus eks one, close close.*

PDL (piddle or puddle) [acronym for Push Down List] *n.* 2. A LIFO queue (stack); more loosely, any priority queue; even the set of things he has to do in the future. One speaks of the next project to be attacked as having risen to the top of the pdl. *I'm afraid I've got real work to do, so this'll have to be pushed way down on my pdl.*

PESSIMAL [Latin-based antonym for "optimal"] *adj.* Maximally bad. *This is a pessimal situation.*

PHASE 1. *n.* The phase of one's waking-sleeping schedule with respect to the standard 24-hour cycle. This is a useful concept among people who often work at night according to no fixed schedule. It is not uncommon to change one's phase by as much as six hours/day on a regular basis. *What's your phase? I've been arriving about 8pm lately, but I'm going to work around to the day schedule by Friday.* A person who is roughly 12 hours out of phase is sometimes said to be in *night mode*. The term *day mode* is also used, but less frequently. 2. CHANGE PHASE THE HARD WAY: To stay awake for a very long time to enter a different phase. 3. CHANGE PHASE THE EASY WAY: To stay asleep, etc.

PHASE OF THE MOON *n.* Used humourously as random parameter on which something is said to depend. Sometimes implies unreliability of whatever is dependent, or that reliability seems to be dependent on conditions nobody has been able to determine. *This feature depends on having the channel open in mumble mode, having the foo switch set, and on the phase of the moon.*

POM *n.* Phase of the moon (q.v.). Usage: usually used in the phrase *POM dependent.*

RAVE (WPI) *v.* 1. To persist in discussing a specific subject. 2. To speak authoritatively on a subject about which one knows very little. 3. To complain to a person who is not in a position to correct the difficulty. 4. To annoy another person verbally. 5. To evangelise. See FLAME.

REAL USER *n.* 1. A commercial user. One who is paying real money for his computer usage. 2. A non-hacker. Someone using the system for an explicit purpose — research project, course, etc. See USER.

REAL WORLD, THE *n.* 1. In programming those institutions at which programming may be used in the same sentence as Fortran, Cobol, RPG, IBM, etc. 2. To programmers, the location of non-programmers and activities not related to programming. 3. A universe in which the standard dress is shirt and tie in which a person's working hours are defined as 9 to 5. 4. The location of the status quo. 5. Anywhere outside a university. *Poor fellow, he's left MIT and gone into the real world.* Used pejoratively by those not in residence there. In conversation, talking of someone who has entered the real world is not unlike talking about a deceased person.

SACRED *adj.* Reserved for the exclusive use of something. A metaphorical extension of the standard meaning. *Accumulator 7 is sacred to the UUO handler.*

(continued on next page)

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SNARF *v.* To grab, especially a large document or file for the purpose of using it either with or without the author's permission. See BLT.

SOFTWARE ROT *n.* Hypothetical disease the existence of which has been deduced from the observation that unused programs or features will stop working after sufficient time has passed, even if nothing has changed. Also known as *bit decay*.

SPLAT *7n.* 1. Name used in many placed — DEC, IBM, and others — for the ASCII star "*" character. Usage: nobody really agrees what *character splat* is, but the term is common.

TASTE *n.* The quality in programs which tends to be inversely proportional to the number of features, hacks, and kluges programmed into it. Also, TASTY, TASTEFUL, TASTEFULNESS. *This feature comes in N tasty flavours.* Although TASTEFUL and FLAVOURFUL are essentially synonyms, TASTE and FLAVOUR are not.

TECO (tee'kor) [acronym for Text Editor and COrrector] 1. *n.* A text editor developed at MIT, and modified by just about everybody. If all the dialects are included Teco might well be the single most prolific editor in use. Noted for its powerful pseudo-programming features and its incredibly hairy syntax. 2. *v.* To edit using the Teco editor in one of its infinite forms; sometimes used to mean to edit even when not using Teco.

THEORY *n.* Used in the general sense of idea, plan, story, or set of rules. *What's the theory on fixing this TECO loss? What's the theory on dinner tonight? What's the current theory on letting losers on during the day?*

TIME T *n.* 1. An unspecified but usually well-understood time, often used in conjunction with a later time T+1. *We'll meet on campus at time T or at Louie's at time T+1.* 2. SINCE (OR AT) TIME T EQUALS MINUS INFINITY: A long time ago; for as long as anyone can remember; at the time that some particular frob was first designed.

TWIDDLE *n.* 1. tilde (ASCII 176, "~"). Also called squiggle, squiggle (sic) — pronounced skig'gul and twaddle, but twiddle is by far the most common term. 2. A small and insignificant change to a program. Usually fixes one bug and generates several new ones. 3. *v.* To change something in a small way. Bits, for example, are often twiddled. Twiddling a switch or knob implies much less sense of purpose than toggling or tweaking it; see FROBNICATE.

UP *adj.* 1. Working, in order. *The down escalator is up.* 2. BRING UP: *v.* To create a working version and start it. *They brought up a down system.*

VANILLA *adj.* Ordinary flavour, standard. See FLAVOUR. When used of food, very often does not mean that the food if flavoured with vanilla extract. For example *vanilla-flavoured wonton soup* means ordinary wonton soup.

WEDGED *adj.* To be in a locked state, incapable of proceeding without help. See GRONK. Often refers to humans suffering misconceptions. *The swapper is wedged.* This term is sometimes used as a synomym for DEADLOCKED (q.v.).

WIZARD *n.* 1. A person who knows how a complex piece of software or hardware works; someone who can find and fix his bugs in an emergency. Rarely used at MIT, where HACKER is the preferred term. 2. A person who is permitted to do things forbidden to ordinary people, e.g. a net wizard on a Tenex may run programs which speak low-level, host-imp protocol; an Advent wizard at SAIL may play Adventure during the day.

YOYO MODE *n.* State in which the system is said to be when it rapidly alternates several times between being up and being down.

ZERO *v.* 1. To set to zero. Usually said of small pieces of data, such as bits or words. 2. To erase; to discard all data from. Said of discs and directories, where zeroing need not involve writing zeros throughout the area being zeroed.

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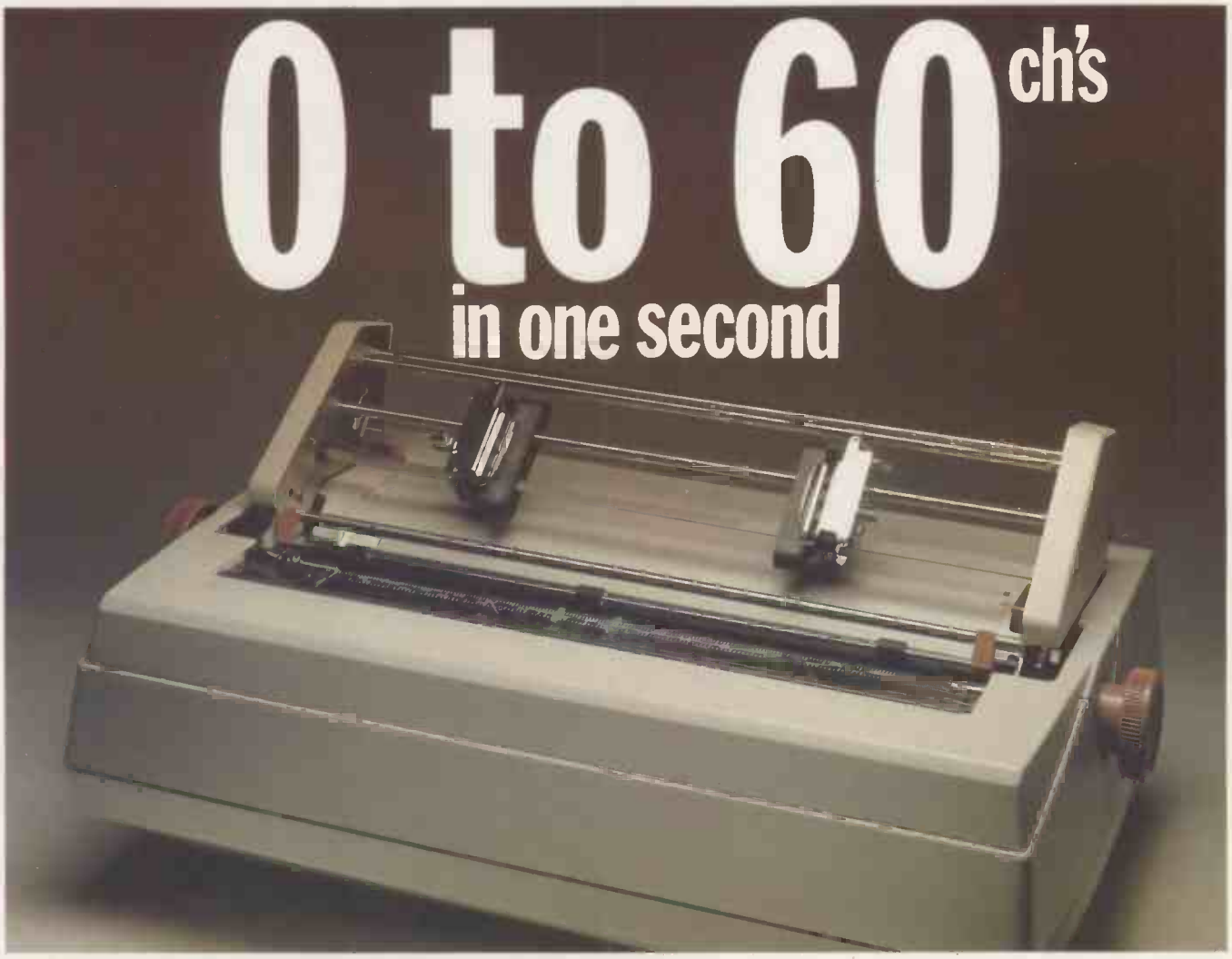

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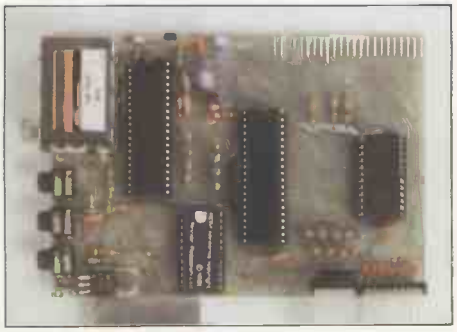
Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.



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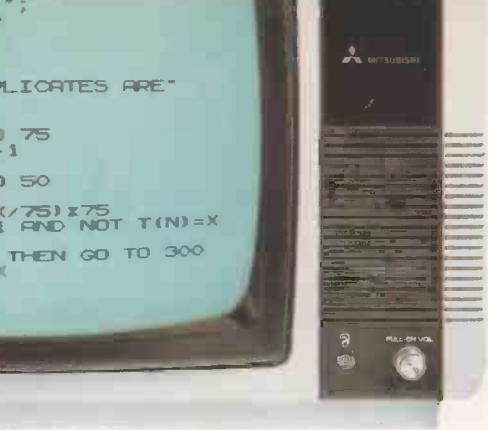

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Brighton project sets out on the micro road

The Brighton telesoftware project has been a straw in the wind for a year or two now but at last it is up and running. It has not been an easy road, despite the recent proclamation from the Government that every school is to have a micro — preferably by yesterday.

by Martin Hayman

THE GENESIS of the project was in the winter term of 1978, when the BBC and the IBA were evaluating the use of teletext as a medium for schools. The Brighton project has, however, been through a few hoops since then — in fact a veritable labyrinth — to raise sufficient funds to make the project viable. It has also suffered from hardware development problems, which is about par for the course.

Either of these two reasons forms a story in its own right. Yet what is most important is that the project is ready, and schools should shortly start to report back to the directors of the scheme, at Brighton Polytechnic, their initial reactions to the use of a combined teletext/microcomputer installation in the classroom.

It is not a vastly-extended project. Brighton has at its disposal a mere 10 Mullard sets — one of which is retained at the Polytechnic's Computing Centre at Moulsecoomb, Brighton, for development work under programmer Andrew Wallace. The other nine sets are distributed at schools throughout England and Scotland — Wales being, nominally at least, a bi-lingual country, has none.

So, while it will be possible to make some observations on the way the Mullard unit might affect educational methods for better or worse, project director Michael Raggett is keen to emphasise that no conclusions should be drawn: "As an educational researcher, I would describe it as nine case studies rather than as a sample".

Andrew Wallace, who wrote the telesoftware driver in conjunction with Mullard's own technical development team is also refreshingly modest about his achievement and stresses that this is only a part of the work. Although he has put many man-hours into the operating system, which is now into its sixth version — and this is an extra commitment on top of his regular work at the Computer Centre — he has no interest in hyping it and regards it only as a means to an end.

One point which Michael Raggett brought out early in my conversations with the telesoftware and education staff is that none of the three of them is from a computing background. Director Michael Raggett is himself what is loosely described as an "educationalist" and has an art and design background, as too does programmer Andrew Wallace, who indeed ran a design consultancy until he decided to change careers in favour of computing. Research assistant Leslie Mapp, who only recently joined the project, was in teacher education until he was made redundant and knew next to nothing about computing when he was taken on.

The lack of a professional computing background on the part of the team at Brighton should not be misconstrued as amateurism. They are in fact that very rare animal, a team with an arts and humanities background who are committed to computing. It is an unusual perspective, though one which some hope will seem less out-of-the-way in future.

One of their avowed objectives, for example, is to broaden the base of microcomputer use in schools so that computing should be available to the "naive user" — bluntly, those who do not have much aptitude for the specific mathematical and scientific skills required for programming.

Why this approach? Why not the more conventional approach to microcomputing in the classroom, with the "telesoftware" part of computing simply treated as an extra source of programs? There are two answers to this question. The first evidently lies in the broader educational approach of the team.

The second lies in the early days of the project, when Brighton co-operated with the BBC and the IBA to assess the use of teletext as a classroom aid. Initially, the aim of the BBC and the IBA was to see whether teletext could be a useful addition to schools broadcasting.

It was found to be of limited use as a kind of classroom noticeboard consisting mostly of producer's notes to programmes, though some elementary pieces of animated graphics such as *Oilwell* and *Volcano* went down well. Elementary quizzes whose answers could be looked up by pressing "reveal" were also found to be popular. At a more advanced level, a graphical representation of some climatological studies by the Polytechnic's Geography Department were also judged a success.

The conclusions to the initial studies were that although teletext showed itself capable of use by schoolchildren of as little as four to five years of age, and over a wide range of disciplines, it was too passive a medium to be of extended use. What the medium cried out for was an interactive possiblity. This meant going further down the microcomputer road.

There was some talk between the Brighton project and Research Resources Ltd with an eye to adapting the South West Technical Products 6800-based micro, but this came to nothing. It was the IBA's John Hedger who made a telesoftware receiver prototype in breadboard form, and it was this which formed the basis of an application to the Microprocessors for Education Project — or rather, its predecessor in the last Labour Government.

Though the scheme was ready for ratification at the Education Department, it had not been signed at the time of the general election and as a result "the whole scheme dropped dead, and the £750,000 which we had been promised was turned into school milk or something", Michael Raggett recounts.

IBA support

Happily in John Hedger the telesoftware project had a staunch ally and as a result of IBA's Oracle taking the initiative to the Industry Department, Brighton finally received its budget — sufficient for the purchase of the sets, which were to be developed by Mullard, for a secretary, and for half a programmer.

The half-a-programmer was Andrew Wallace, who is so described not because he is working at 50 percent capacity, but because he already had a job at the Polytechnic Computing Centre. This was sufficient to make a start, and on the strength of having some funding already, they were able to gather more money. The moral seems to be, if you have some money already, it makes it much easier to find more.

If we now jump straight to the end of 1980, when most of the development work on the micro was complete — the sets were modified and built at Mullard's Mitcham, Surrey plant — we may look at the Mullard telesoftware micro, and what it has to offer.

The Mullard machine looks very similar to a conventional micro, except that it uses an unusually large screen of 22in. which is a conventional colour TV. The only features which will otherwise seem

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unfamiliar to a micro user are the Prestel-type graphics control symbols on the top line of keys, and the minute opening for the cassette — a Philips microcassette chosen for its faster access times and "because it was there".

This may disappoint those who would hope to see such standards as exist complied with, but there is no doubt that it is very neat. The TV/monitor stands on a trolley for schools purposes and is easily moved around from classroom to classroom.

Infra-red control

For general application, the IBA people favour putting the processor parts inside the TV "box" and leaving the control functions to the infra-red handset. This will make the equipment more familiar and "friendly" for the customer who knows nothing about the TV set's "intelligence". It would not do, of course, for those who want to retain full editing and computing facilities.

The Mullard set combines the functions of a microcomputer, teletext receiver, conventional TV set and — once it wins type approval — Prestel receiver. How will schools use it? In the first place, obviously, as a TV. The size of the display is ideal for classroom purposes. Equally, this means that it can be used to teach microcomputing to a class, either with home-made software or with telesoftware captured off-air.

This need not be, and is indeed intended not to be, exclusively software for learning or teaching computing and mathematical subjects. It takes about 10 minutes, for example, to load Andrew Wallace's elegant and friendly editor, which could then be used to create file pages of any kind, with the option of graphics. Arts pupils could easily make use of this facility, though generally the comparative smallness of the page means that it is not suitable for discursive "copy-heavy" subjects. It would be extremely successful for multiple-choice question format.

Computers for girls

It is this kind of activity which the Brighton project intends to explore more fully next year, and which makes them optimistic about describing the tele-software receiver as a "general educational resource".

Leslie Mapp also hopes that it may help to stop the idea that "computers are for chaps": in the scramble of sharp elbows and flying satchels, girls are likely to feel that it is simply not worth bothering with the school microcomputer. It would be a pity indeed if the micro revolution were to be an all-male phenomenon.

What will finally determine the usefulness of the telesoftware and education project, though, is the availability of software. Most software writing for this area of application is written by teachers, for whom this almost invariably means extra-curricular time.

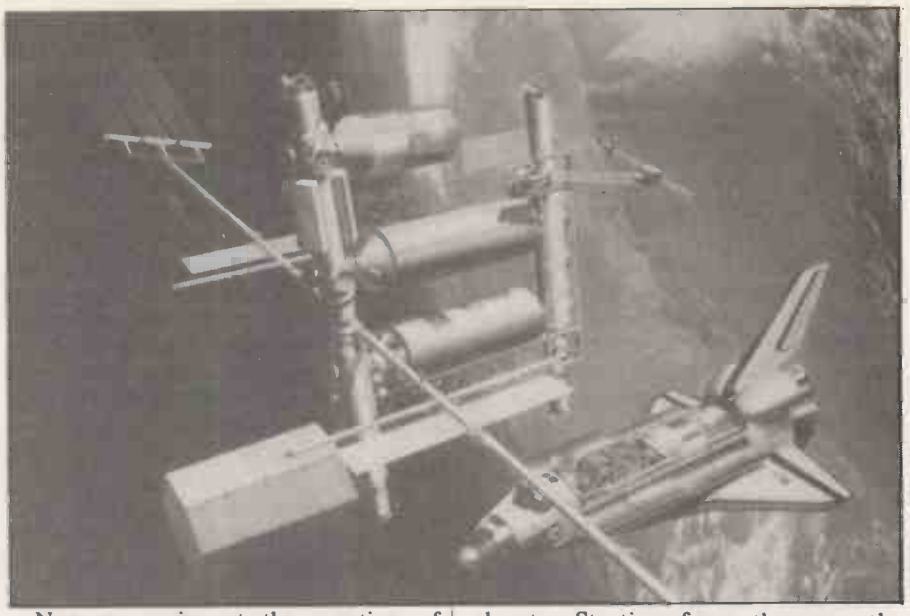
Teaching standards

Ideally, there would be an intermediate stratum of programmers between the teachers and the project directors. As Leslie Mapp says: "Teachers will always tell you what they don't want after they've had it but it's impossible to make them say what they want beforehand. The notion of having a common standard for software is difficult indeed and may well be a red herring. The French model with its central standards — where all classes are doing the same subject from the same texts at the same time in the school day — is considered abhorrent in this country — too inflexible".

Proliferation of standards might militate against supply, but it can equally be argued that different types of teaching needs different equipment — though it is important that there be some kind of body to validate and support schools software. It may be that a system of "centres of expertise" backed by the broadcasters will emerge, but it is early days yet, and the Brighton project will certainly help to determine what is needed.

STAR SYSTEM

The second and final part of Bob Merry's space-conquest game reveals the crucial second program and the ideas behind it.



THE BASIC purpose of the first program is to prepare a data tape on which will be recorded all the variables needed in the game. Most of the information about the star system will be contained in a string array, P$(X).

The program starts with several lines of Data statements. Most of these, from lines 120 to 190, contain the machine code we have already discussed, but lines 100, 110 and 200 contain data for the game. After a short section allowing you to branch to the instruction sequence, we start by selecting a name for our planetary system in line 300.

This line produces a random integer in the range 1 to 10 and then reads the list of names in line 100 up to that number — the last name read will be the one chosen. Lines 310 and 320 then pass over any names which remain so that the next reading of data will start at the correct point.

In line 330, N sets the number of planets in the system and we now proceed to form the characteristics of all these planets in turn. First of all, we complete the name of the planet by adding, in classic science fiction style, the number of the planet in Roman numerals — line 340.

Name and data

Line 350 then expands this part of the string to a total length of 12 characters and spaces. Thus, we will know in the second program that the first 12 characters refer to the name and the rest of the data can be found at specific points in the string.

The data on the various characteristics of a planet is encoded as a series of numbers. The first of these refers to the temperature and this is related to the planets position relative to its sun. Line 360 has the effect of dividing the system into six temperature bands. The meaning of the numbers 1-7, which are added to the string in the thirteenth position, can be seen by looking at line 110 of this month's program.

The next date refers to the atmosphere or environment of the planet, which is chosen randomly from five alternatives. Again, a number is added to the string to represent this and the first five Data words in line 120 of program 2 — in future this will be written in the form 120/B and references to last month's program will be of the form 100/A — give the translation.

Now we arrive at the question of population. There are seven levels of civilisation — see 120/B and 130/B — plus uninhabited. A planet cannot be inhabited if the temperature is extreme or if there is no atmosphere, 380/A, and it will also be uninhabited if a random number is more than a certain figure, 390/A.

For those of you who wish to make many new friends, you can raise the level of probability given. The next space in the string is reserved for the attitude of the natives towards you. Initially this is unknown, so a "6" is entered here, which you can deduce from 140-150/B to be "?".

The next three numbers in the string refer to the mineral wealth of the planet, under the categories: fossil fuels, nuclear fuels and rare elements. These can each give poor, average or rich yields. Line 430/A sets these characteristics. We shall need to collect mineral wealth from the planets to obtain enough fuel for the return to Earth. On inhabited planets, however, one of the three categories may be highly valued and the natives will grow restless if you steal resources which are in short supply.

Lines 440-460/A are concerned with the availability of food. This will depend on the temperature and environment being sufficiently Earth-like to produce food you can use. You may notice in playing that some planets are inhabited but produce no food and may have a poisonous or corrosive atmosphere. That is because not every civilised species will be humanoid.

When we add the code for food on to the string we also add "ØØ". These positions will be used to record extra data during the game concerning contacts and surveys of planets, which are factors which contribute to your final score.

The final two places in the string are used to record the orbital position of the planet. This is expressed in terms of the number of days it takes to travel between planets. Starting from the sun, the journey time from one planet to the next is from one to three days — if you think this is somewhat short, you can always think of it in terms of weeks, but the program is based on using units of time to determine use of fuel, life support and food.

Lines 480-500/A add a random integer in the range 1-3 to the previous planet's orbit and then forms this into a two-character string, if necessary adding a "Ø" or dropping the blank space that occurs in positive numerical variables.

This completes the data for the planet and the program loops back to repeat the process for the remaining planets. After that, lines 520-530/A discard any unused Roman numerals for systems with less than 12 planets and we are ready to record the data tape.

Tape information

The information recorded on tape will be:

S$ — the name of the planetary system
N — the number of planets in the system
P$(N) — data strings on these planets
FOR I = 826 to 984 — the machine code for the display plus eight variables used at the start of the game
OB — the present orbit of the space ship, which can be within the system or just outside it.
N "zeros" which will be interpreted as the number of days spent so far orbiting a planet for mining purposes.

This completes our look at the first program, except for one small point. In the instruction sequence, I have used Wait 59410,4,4 at the end of each page, so that the user need only press Space to continue to the next page. This has the effect, however, of leaving numbers in the keyboard buffer, so that when the program encounters lines containing GETR$, it can sail straight through them.

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Occasionally, I have "stuttered" on the last page of the instructions and the double entry of the Space has also caused problems later. To avoid this minor problem, I have included line 1100/A, which has the effect of moving the Space codes from the keyboard buffer before proceeding.

The game itself starts with a number of Data statements most of which we have already discussed and now know that they are the words which interpret the various numbers in the string. However, we need to be able to find the correct point in the Data table to be able to read the appropriate comment and this is done by using the offsets listed in 100/B.

These figures refer to the number of steps to be taken through the Data before reaching the start of the section to which you are referring. We shall see this in action later in the program.

These offsets are stored in the array A(X) during 170/B. Also included in the early lines of the program are the necessary Dim statements and a commonly-used phrase which it is economical to store as a separate string, A$.

Now we load the data tape, which can be the one prepared by the first program, or can be a position from part of the way through a previous game. You could always use the same tape several times to see how different decisions affect your score.

Program variables

From the tape we recover S$, N, P$(X) followed by the machine code, which is poked directly into the second cassette buffer using only one variable, D, as a temporary store. Next follow eight variables which originated in line 200/A. We can now give these names:

FU — fuel units; initially 100, they are used at the rate of one per day; they can be replenished by converting mined fossil or nuclear fuels and you will need 1000 to start the journey back to earth.

FD — food units; initially 100, they are also used up at one unit per day; they are replenished by landing on planets with food supplies and again you will need 1000 units by the end of the game.

LS — life-support units; similar to fuel and food, these are replenished automatically when you orbit a planet with a thin or normal atmosphere.

CS — cargo space in tons; all rare elements and any other minerals not required for fuel can be transported back to Earth, with a limit of 5,000 tons; this tells you how much space you have left.

CM — minerals carried as cargo; includes both fossil and nuclear fuels.

CR — rare elements carried as cargo; both CM and CR would initially be zero on a new tape.

CA — artefacts carried as cargo; you initially have 100, which can be used to bribe populations contacted into a more friendly state of mind; if they like you, they might even give you presents in return; as they are considered to be small artefacts, they do not count towards your cargo space.

MD — days into mission.

The next variable recovered from the tape is your present orbit, OB, and we then fill the array MD(X), which records the number of days you have been mining a planet. Some planets can be mined by self-supporting units, such as robots, and you can set these down and then leave to explore another world.

You will need to keep track, therefore, of how long the mining unit has been on a particular world and that is the purpose of MD(X). It needs to be recorded on the data tape since we may well decide to adjourn a game with robot units still frantically burrowing. This information completes the initial set-up of the game.

Lines 240-270/B display a list of the planetary orbits in relation to your own and you can select your first port of call by entering its number. This is checked in Gosub 1900 for being in the correct range and also for the special signal "99" which signifies that you wish to exit the program.

To save valuable memory, more esoteric input errors, such as entering decimal fractions, are not checked. Having selected a planet, the program now calls two subroutines, 1200 and 1310 — we can drop the /B now since we have finished referring to the first program.

1200 is the subroutine which prints the basic display. This consists of the machine-code routines called in 1200 plus an overprinting of all the various labels. Figure 1 in last month's article will give you an idea of what to expect.

1310 is a subroutine which prints the figures that go in the boxes on the right-hand side of the display. To do so, it calls a further subroutine at 1420. Each of the quantities to be printed is put into the variable X, and it is on this variable that 1420 operates.

Firstly, it rounds the value of X off to the nearest whole number and then converts it into a string, dropping the sign at the beginning of the variable — a space in the case of a positive number. This string, X$, is then lengthened in 1430 by the addition of leading spaces, so that it is a standard five characters long.

Line 1440 then prints it at the appropriate point on the screen, two lines below the previous figure. This continues until all the data on the state of your starship have been printed. The program now returns to 290.

The required orbit to aim for can be found by looking at the two right-hand characters of the selected element, P, of P$(X). Assuming that we are not already in the correct orbit, 300 decides which way we have to go to reach the selected planet and 310 prints *en route* in the Status box on the display.

As each day passes on the way to the planet, fuel, food and life-support units are updated and subroutine 1310 will keep the display up to date. 1820 is included to check whether you run out of any of these vital supplies, which would, of course, end the game.

When the planet is reached, we call up subroutine 1340. This starts by amending the Status to "IN ORBIT" — note the use of 1400 which gives the necessary indentation to each line of the read-out of planetary data. Then it prints the name of the planet, using the first 12 characters of the string array.

Planetary details

Now we need to translate the data held in characters 13 to 20 of the string and this is done by 1770. 1770 calculates the position in the data tables using the off-set loaded in A(X) and the value of the character at the appropriate point in the planetary string. Then it goes to 1410 which Restores the Data table to its start and reads down to the selected position, printing the word found in the appropriate space on the screen.

Again, a study of figure 1 will show you the resultant display. It is worth emphasising that every colon and semicolon in these various Print routines has a purpose and you should check these carefully.

Line 1370 continues the program, after the printout of data, by giving you your next option. Apart from the selection of a planet number, most of the options consist of single letters and I have used a variation of the familiar Get R$ routine where the acceptable answers are defined by C$.

As you will see, whenever subroutine 1940 is called, the program does not proceed until an acceptable answer is given. In this case, the answer causes the program to return.

Let us assume first of all that the choice is to leave the planet. Sys 953 clears the bottom four lines. We re-set variable OD — number of days in orbit — to zero and also decide whether this is the type of planet which can be mined without close suppoort from the spaceship. If not — LL greater than 1 — the record of number of days mined is reduced to zero — your men will die if left on their own and will not produce any output.

Now we can select a new planet; Sys 864 will obliterate the data in the left-hand blocks and the program returns to 290 to repeat the process we have just been through.

If, on the other hand, we choose to orbit the planet, a new range of options are presented. First of all, the information contained in the string in positions 13 to 21 is transferred to discrete variables to make it more easily accessible. The various meanings of these variables are:

PT — Planetary Temperature
PE — Atmosphere
PP — Population civilisation level (8 = Uninhabited)
AT — Attitude of population
PF — Fossil fuel availability
PN — Nuclear fuel availability
PR — Rare element availability
PD — Food availability
CT — 0 = No contact yet; 1 = contacted; 2 = contacted and subjugated

The lines from 440 to 730 refer to a populated planet and give you various ways of interacting with it. You can try to remain undetected or you can try to subjugate them. In both these cases, you are more likely to be successful if the population is relatively uncivilised — as a guide, you are at the Star Travel level.

On the other hand, you can try contacting them. It is possible to improve their attitude by offering gifts. The higher levels of civilisation have the ability to attack you in space. I will leave you to work out for yourself all the various possibilities in these lines as too much explanation here might spoil the playing of the game.

740 to 760 define a quantity for the planet, EF(X), which can be loosely termed "efficiency" — that is to say, how well you can mine the planet. On uninhabited planets or planets where no contact has been made, which would have a value for AT of.6, this is simply unity. Where there is a contacted population, however, its attitude and civilisation level can have a marked effect on your mining operations.

Mining operations

At line 770, we have reached the mining operation part of your options. You are given the choice to mine the planet when you first orbit the planet, and if you take up this option, you will be asked each day whether you wish to recover your unit. Line 770 decides whether or not you are already mining the planet.

Assuming this is your first day in orbit, MD(P) will be zero and the program now decides which method you can use, dependent on the temperature and atmosphere on the planet. The efficiency figure may be modified and another variable, LL, is also set.

This shows the effect on the life-support systems of the ship of the various methods and from this we can see that only robot units and men working in a normal atmosphere need no extra life support. They are the types of units which can be left on a planet while you go elsewhere. Other units which are not recovered will die without support and be rather unproductive.

Once you have made the decision to mine, lines 850-880 and the subroutine at 1850 determine the local attitude to your exploitation. Various minerals are prized by the different civilisation levels and if you exploit a rare resource, they will think less of you and may even attack your men, preventing them from mining.

However, if all is well, you will now go on to line 1070 for the next option. Before we reach that, let us consider the sequence from 900 to 1060, which is encountered if you have already started mining.

900 to 920 gives you the option to recover your unit. 930 calculates the number of days you have been mining and then the amounts of each type of mineral you have obtained. This takes into account your efficiency and the amounts actually available.

There is obviously scope in lines such as this for the more adventurous among you to modify the parameters to make the game easier or harder. After recovering the minerals, you can elect to use the fossil or nuclear fuels as fuel or cargo — until you have that magic 1,000 units of fuel, you would normally choose the former. The rare elements are always stowed as cargo unless the cargo space is completely full. Please note the deliberate error in line 1060 — the Goto 1070 is surplus to requirements. It probably was not when the progam was developed and you are at liberty to omit it if you wish.

1070 - 1100 are concerned with the collection of food, but beware of taking scarce supplies from an inhabited planet. 1110 - 1120 allow you to automatically collect life support from suitable planets and 1130 adjusts all the various units for the day spent in orbit, checking that you have not run out of any. Lines 1140 - 1180 now reconstruct P$(P), taking account of any changes which have occurred during the day.

1160 and 1170 are included to work out whether you have completed enough time in orbit to have done a survey. In 1160, I is given the value 0, 1, or 2; for a value of 1, OD must be equal to 2 or greater; 1 equals 2 when OD is 10 or greater. This value of 1 is then incorporated in P$(P) and you will receive points for the surveys you have conducted. These surveys are transmitted back to Earth automatically and do not depend on your survival.

This completes the meat of the program and line 1190 calls up the main display and starts you off on another day. There now remains the routine used to end the game, which is initiated by entering "99" as your destination and 1900 will direct you to 1460. This gives you the choice of saving the data or adding up your points.

In the case of the former, a standard data tape is recorded in exactly the same format as the one produced by the first program. On the other hand, lines 1660 to 1760 are used to total the points. These can be summarised as follows:

One point per ton for mineral cargo
10 points per ton for rare elements
100 points for every artefact in addition to your original 100
10 points for every short survey
50 points for a long survey of an uninhabited planet
500 points for a long survey of an inhabited planet

Points for establishing friendly relations, based on 100 times the square of the civilisation level times — 3.5 minus the attitude level — a subjugated race has an attitude of 3.8. Thus, subjugated, antagonistic and very hostile races will lose you points while neutral, friendly and very friendly races will gain you points.

Minus 5,000 points if you fail to obtain enough fuel, food, or life support for the return journey.

That then is *Star System*. For those of you with new ROMs who have already typed in the first program, I probably do not need to explain the modifications needed, as they are much the same in that program:

Delete the Pokes in 1510
Delete lines 1780 - 1810
Delete the Gosub 1780 in lines 1520 to 1650.

Apart from these small changes, *Star System* works on either ROM set.

```
100 DATA 8,15,20,28,34,34,34,37
110 DATA EX HEAT,V. HOT,DESERT,TEMPERATE,ARCTIC,V. COLD,EX COLD
120 DATA CORROSIVE,POISONOUS,THIN,NORMAL,NONE,PRIMITIVE,MEDIAEVAL,INDUSTRIAL
130 DATA SPACE AGE,STAR TRAVEL,ADVANCED,SUPER-RACE,UNINHABITED
140 DATA V. FRIENDLY,FRIENDLY,NEUTRAL,ANTAGONISTIC
150 DATA VERY HOSTILE,"      ?",POOR,AVERAGE,RICH,NONE,SMALL AMOUNT,PLENTIFUL
160 A$="WDO YOU WISH TO ":DIMP$(12),MD(12),EF(12),A(7)
170 FORI=0TO7:READA(I):NEXT
180 PRINT"ZLOAD DATA TAPE. PRESS SPACE WHEN READY":WAIT59410,4,4
190 OPEN1,1,0:INPUT#1,S$:INPUT#1,N
200 FORI=1TON:INPUT#1,P$(I):NEXT
210 FORI=826TO976:INPUT#1,D:POKEI,D:NEXT
220 INPUT#1,FU,FD,LS,CS,CM,CR,ER,MD,OB
230 FORI=1TON:INPUT#1,MD(I):NEXT:CLOSE1
240 PRINT"JYOU'VE LEFT WARP DRIVE NEAR STAR SYSTEM ":PRINTS$
250 PRINT"WTHERE ARE"N" PLANETS AT ORBITS OF:W
260 FORI=1TON:PRINTTAB(18);RIGHT$(P$(I),2):NEXT:PRINT"WYOUR ORBIT IS"OB
270 INPUT"WWHICH PLANET TO SET COURSE FOR";P:GOSUB1900
280 GOSUB1200:GOSUB1310
290 OT=VAL(RIGHT$(P$(P),2)):IFOB=OTTHENZ=0
300 Z=1:IFOB>OTTHENZ=-1
310 PRINT"WW";TAB(8);"EN ROUTE
320 MD=MD+1:OB=OB+Z:FU=FU-1:FD=FD-1:LS=LS-1:GOSUB1310:GOSUB1820
330 IFOB<>OTTHEN310
340 GOSUB1340
350 IFR$="O"THEN390
360 SYS953:OD=0:IFLL>1THENMD(P)=0
370 INPUT"WWWWWWWWWWWWWWWWWWWWTO WHICH PLANET";P:GOSUB1900
380 SYS864:GOTO290
390 OD=OD+1:PT=VAL(MID$(P$(P),13,1)):PE=VAL(MID$(P$(P),14,1))
400 PP=VAL(MID$(P$(P),15,1)):AT=VAL(MID$(P$(P),16,1))
410 PF=VAL(MID$(P$(P),17,1)):PN=VAL(MID$(P$(P),18,1))
420 PR=VAL(MID$(P$(P),19,1)):PD=VAL(MID$(P$(P),20,1))
430 CT=VAL(MID$(P$(P),21,1)):IFPP=8THEN740
440 K=PP+20:PRINT"JTHIS PLANET IS OCCUPIED BY ";:GOSUB1410:PRINT"WPEOPLE.
450 IFCT=0THEN490
460 PRINT"WYOU HAVE ALREADY CONTACTED THEM
470 IFCT=2THENPRINT"WAND SUBJUGATED THEM.":GOSUB1450:GOTO740
480 GOTO540
490 PRINTA$;"1)CONTACT THEM OR 2)TRY
500 PRINT"WTO REMAIN UNDETECTED":C$="12":GOSUB1940:IFR$="1"THEN530
510 IFPP<8+RND(1)THEN740
520 PRINT"WYOU HAVE BEEN DETECTED...
530 CT=1:AT=INT(4.1*RND(1)+1.4)
540 GOSUB2000:IFAT<4ORPP<4ORAT<3*RND(1)+3THEN580
550 PRINT"WTHEY ARE ATTACKING YOU!
560 IFPP>5*RND(1)+3THENPRINT"WYOU HAVE BEEN DESTROYED":GOSUB1450:GOTO1660
570 PRINT"WYOUR SHIELDS ARE STRONG ENOUGH.":GOTO680
580 PRINTA$;"TRY GIVING THEM GIFTS
590 PRINT"W(Y/N)?":C$="YN":GOSUB1940
600 IFR$="N"THEN680
610 INPUT"WHOW MANY ARTIFACTS";I:IFI>CATHENPRINT"WTOO MANY":GOTO610
```

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```
620 CA=CA-I
630 IFI<100*RND(1)THEN650
640 AT=AT-1:IFAT<1THENAT=1
650 GOSUB2000:IFAT>2ORAT>2*RND(1)+1THEN680
660 PRINT"■THEY ARE GIVING YOU GIFTS.":I=INT(I*RND(1)+3*PP):CA=CA+I
670 PRINT"■THEY'VE GIVEN YOU"I"ARTIFACTS.":GOSUB1450:GOTO740
680 PRINTA$;"TRY TO SUBJUGATE THEM
690 PRINT"■(Y/N)?":C$="YN":GOSUB1940
700 IFR$="N"THEN740
710 IFPP>5*RND(1)+.5THEN730
720 PRINT"■YOU ARE SUCCESSFUL.":GOSUB1450:AT=3:CT=2:GOTO740
730 GOSUB2010:PRINT"■YOU'VE FAILED!":GOSUB2000:GOSUB1450
740 IFCT=2THENEF(P)=1+.025*PP:GOTO770
750 IFAT=6THENEF(P)=1:GOTO770
760 EF(P)=1+PP*(3-AT)/20
770 IFMD(P)<>0THEN900
780 PRINT"■YOU CAN MINE THIS PLANET USING
790 IFPT=1ORPT=7ORPE=1THENPRINT"■ROBOT UNITS":EF(P)=1.2*EF(P):LL=1:GOTO830
800 IFPT=2ORPT=6ORPE=2ORPE=5THENPRINT"■SUITS":EF(P)=.5*EF(P):LL=1.5:GOTO830
810 IFPE=3THENPRINT"■EXTRA OXYGEN":EF(P)=EF(P)*.75:LL=1.2:GOTO830
820 PRINT"■NORMAL TECHNIQUES":LL=1
830 PRINTA$;"MINE THIS PLANET (Y/N)?":C$="YN":GOSUB1940
840 IFR$="N"THENLL=1:GOTO1070
850 IFCT<>1ORPP=1ORPP=8THEN890
860 IFPP<4ANDPF=1THENGOSUB1850
870 IF(PP=4ORPP=5)ANDPN=1THENGOSUB1850
880 IFPP>5ANDPR=1THENGOSUB1850
890 MD(P)=MD:GOTO1070
900 PRINT"■";A$;"RECOVER YOUR MINING UNIT
910 PRINT"■(Y/N)?":C$="YN":GOSUB1940
920 IFR$="N"THEN1070
930 M=MD-MD(P):I=5*M*PF*EF(P):J=2*M*PN*EF(P):K=M*PR*EF(P):MD(P)=0
940 PRINT"■YOU'VE MINED"I"TON OF FOSSIL FUEL
950 PRINT"■■"J"TON OF NUCLEAR FUEL AND"K"TON
960 PRINT"■OF RARE ELEMENTS. IS THE FOSSIL FUEL
970 PRINT"■TO BE CARGO OR FUEL (C/F)?":C$="CF":GOSUB1940
980 IFR$="F"THENFU=FU+I/20:GOTO1000
990 GOSUB1970
1000 PRINT"■IS THE NUCLEAR FUEL TO BE CARGO OR FUEL
1010 PRINT"■(C/F)?":GOSUB1940:IFR$="F"THENFU=FU+J/5:GOTO1030
1020 I=J:GOSUB1970
1030 IFCS>KTHEN1060
1040 PRINT"■NOT ENOUGH CARGO SPACE FOR RARE ELEMENTS":PRINT"SURPLUS JETTISONED"
RE=CS
1050 K=CS:GOSUB1450
1060 CR=CR+K:CS=CS-K:GOTO1070
1070 IFPD=1THEN1110
1080 PRINT"■";A$;"COLLECT FOOD (Y/N)?":C$="YN":GOSUB1940:IFR$="N"THEN1110
1090 IFCT=1ANDPD=2THENGOSUB1850
1100 FD=FD+8*PD*EF(P)
1110 IFPE<>3ANDPE<>4THEN1130
1120 LS=LS+20*(PE-2.5)*EF(P)
1130 FU=FU-1:FD=FD-1:MD=MD+1:LS=LS-LL:GOSUB1820
1140 P$(P)=LEFT$(P$(P),15)+RIGHT$(STR$(AT),1)+RIGHT$(P$(P),8)
1150 P$(P)=LEFT$(P$(P),20)+RIGHT$(STR$(CT),1)+RIGHT$(P$(P),3)
1160 I=INT((OD+6)/8):IFI>2THENI=2
1170 IFI<=VAL(MID$(P$(P),22,1))THEN1190
1180 P$(P)=LEFT$(P$(P),21)+RIGHT$(STR$(I),1)+RIGHT$(P$(P),2)
1190 GOSUB1200:GOSUB1310:GOSUB1340:GOTO350
1200 PRINT"■":SYS826:SYS864:SYS893
1210 PRINT"■■■STATUS:"SPC(14)"■MISSION DAY:
1220 PRINT"■■■PLANET:"SPC(14)"■ORBIT:       "
1230 PRINT"■■■TEMP:   "SPC(14)"■FUEL UNITS: "
1240 PRINT"■■■ATMOS:  "SPC(14)"■FOOD UNITS: "
1250 PRINT"■■■POPUL:  "SPC(14)"■LSS  UNITS: "
1260 PRINT"■■■ATTIT:  "SPC(14)"■CARGO SPACE:
1270 PRINT"■■■FOSS F: "SPC(14)"■MINERALS:   "
1280 PRINT"■■■NUCL F: "SPC(14)"■RARE ELEMS: "
1290 PRINT"■■■RARE E: "SPC(14)"■ARTEFACTS:  "
1300 PRINT"■■■FOOD:   ":RETURN
1310 PRINT"■";:X=MD:GOSUB1420:X=OB:GOSUB1420:X=FU:GOSUB1420:X=FD:GOSUB1420
1320 X=LS:GOSUB1420:X=CS:GOSUB1420:X=CM:GOSUB1420:X=CR:GOSUB1420:X=CA:GOSUB1420
1330 RETURN
1340 PRINT"■";:GOSUB1400:PRINT"IN ORBIT
1350 GOSUB1400:PRINTLEFT$(P$(P),12)
1360 FORI=13TO20:GOSUB1770:NEXT
1370 PRINT"■■■■■■■■■■■■■■■■■■■■■■PRESS 'O' TO STAY IN ORBIT OR 'L' TO
1380 PRINT"■LEAVE ":C$="OL":GOSUB1940
1390 RETURN
1400 PRINT:PRINTTAB(8);:RETURN
1410 RESTORE:FORJ=1TOK:READK$:NEXT:PRINTK$:RETURN
1420 X=INT(X+.5):X$=RIGHT$(STR$(X),LEN(STR$(X))-1)
1430 IFLEN(X$)<5THENX$=" "+X$:GOTO1430
1440 PRINT:PRINTTAB(34);X$:RETURN
1450 FORJ=1TO1500:NEXT:RETURN
1460 PRINT"■";A$;"1)SAVE THE DATA OR 2)ADD
1470 PRINT"■UP YOUR POINTS?":C$="12":GOSUB1940
1480 IFR$="2"THEN1660
1490 PRINT"■LOAD A BLANK TAPE. PRESS ■SPACE■ WHEN
1500 PRINT"■READY.":WAIT59410,4,4
1510 POKE244,2:POKE243,122:OPEN1,1,1
1520 PRINT#1,S$:GOSUB1780
1530 PRINT#1,N:GOSUB1780
1540 FORI=1TON:PRINT#1,P$(I):GOSUB1780 :NEXT
1550 FORI=826TO976:PRINT#1,PEEK(I):GOSUB1780:NEXT
1560 PRINT#1,FU:GOSUB1780
1570 PRINT#1,FD:GOSUB1780
1580 PRINT#1,LS:GOSUB1780
1590 PRINT#1,CS:GOSUB1780
1600 PRINT#1,CM:GOSUB1780
1610 PRINT#1,CR:GOSUB1780
1620 PRINT#1,CA:GOSUB1780
1630 PRINT#1,MD:GOSUB1780
1640 PRINT#1,OB:GOSUB1780
1650 FORI=1TON:PRINT#1,MD(I):GOSUB1780:NEXT:CLOSE1:END
1660 P=0:P=P+CM:P=P+10*CR:CA=CA-100:IFCA<0THENCA=0
1670 P=P+100*CA:FORI=1TON:PP=VAL(MID$(P$(I),15,1)):CT=VAL(MID$(P$(I),21,1))
1680 PT=VAL(MID$(P$(I),22,1)):AT=VAL(MID$(P$(I),16,1)):IFPT=1THENP=P+10
1690 IFPT=2ANDPP=8THENP=P+50:GOTO1710
1700 IFPT=2THENP=P+500
1710 IFAT=6THEN1740
1720 IFCT=2THENAT=3.8
1730 P=P+(3.5-AT)*100*PP*PP
1740 NEXT
1750 IFFU<1000ORFD<1000ORLS<1000THENP=P-5000
1760 PRINT"■YOUR FINAL POINTS TOTAL IS"P:END
1770 GOSUB1400:K=A(I-13)+VAL(MID$(P$(P),I,1)):GOSUB1410:RETURN
1780 IFPEEK(625)<180THENRETURN
1790 POKE59411,53:T=TI
1800 IFTI-T<12THEN1800
1810 POKE59411,61 RETURN
1820 IFFU>0ANDFD>0ANDLS>0THENRETURN
1830 PRINT"■YOU'RE OUT OF VITAL SUPPLIES AND HAVE
1840 PRINT"■PERISHED":GOTO1660
1850 GOSUB2010:PRINT"■DUE TO YOUR TAKING SCARCE RESOURCES,
1860 GOSUB2000:GOSUB1450:IFAT<4THENRETURN
1870 PRINT"■THEY'VE ATTACKED YOUR MEN.":GOSUB1450
1880 IF(PP+10)*AT*RND(1)<40THENRETURN
1890 EF(P)=0:RETURN
1900 IFP=99THEN1460
1910 IFP>NTHENP=N
1920 IFP<1THENP=1
1930 RETURN
1940 GETR$:IFR$=""THEN1940
1950 FORJ=1TOLEN(C$):IFR$=MID$(C$,J,1)THENRETURN
1960 NEXT:GOTO1940
1970 IFCS>=ITHEN1990
1980 PRINT"■NOT ENOUGH CARGO SPACE. SURPLUS HAS BEEN":PRINT"JETTISONED":I=CS
1990 CM=CM+I CS=CS-I:RETURN
2000 I=AT+28 PRINT"■THE POPULATION ARE ";:GOSUB1410:RETURN
2010 AT=AT+1:IFAT>5THENAT=5
2020 RETURN
```

Computerisation must do justice to solicitors' expectations

WHEN a partnership of solicitors in a prosperous medium-sized country town makes it known that it is in the market for a computer system to service the needs of all three partners, you would expect the micro industry to sit up and take notice.

When it is further revealed that those needs include a machine with three VDUs, two daisywheel printers, packages for accounts and word processing and the ability to communicate with a major

by Martin Hayman

commercial legal database, you might imagine that computer salesmen would be rubbing their hands in glee at the prospect of a fat turkey ripe for the plucking.

Woe betide the salesman who thinks so. For solicitors, who perhaps have the reputation of being something of a soft touch when it comes to acquiring office equipment, have now joined the ranks of the computer-wise. The case under consideration, at least, would seem to suggest so.

It demonstrates a hard-headed and practical approach to the immediate needs of a typical partnership, without losing sight of the ultimate possibilities of improved efficiency and access to a broad range of information.

Much of the time, a partnership of solicitors does not need access to recondite precedents or large-scale data processing. In an operation such as that which we are examining — Law Society regulations do not permit us to mention the name of the partnership as this would be construed as advertising — the bulk of the business derives from conveyancing — drawing up the documents for house sales — and sundry everyday routines such as probates — drawing up wills, etc.

Standard forms

The supposedly exciting parts of the work, which we may describe under the heading "contentious litigation" form only a small part of the work, and even then it is unusual for the legal points involved to be so out-of-the-way as to require reference to case law.

In other words, a very great deal of a lawyer's work, and especially in a general solicitor's office in an average town, is procedural and consists in drawing up the facts in a particular form — sometimes, quite literally, on a particular form.

In this respect, the partnership whom I interviewed at a costal town in Dorset are typical. The senior partner, whom I shall refer to as Rodney Billingshurst, joined the firm, a traditional operation of more than a hundred years' standing, housed in a pleasant Georgian town house hardly a stone's throw from the sea, in 1976 and became a partner in 1979.

From left to right: the financial consultant, the two partners in the firm of solicitors and Barry Blakesley, computing consultant.

He soon became interested in adapting the firm's traditional procedures and improving the productivity of his small ancillary staff. He has only one full-time secretary and the remaining three are part-timers, which allows him to expand and reduce his assistance according to the volume of work generated.

Billingshurst was provoked into doing something positive about office automation when one of his staff left to have a baby. He did not want to take on another permanent member of staff, so bent his mind to new techniques.

His immediate requirement was to take care of correspondence. This is clearly one of the prime requirements in a solicitor's office. The time is long past when the senior partner would leave all his files on

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his desk, transferring one pile to another after a certain date and deeming files which had laid dormant for sufficiently long "to have solved themselves".

The majority of people today do not simply retain the services of a solicitor to handle their business generally; they need quite specific work undertaken within a specific time-scale. Letters must be sent on time. This defined the first requirement — word processing.

The second, obvious extension of word processing was conveyancing, which generates many reasonably standard documents. This represents a larger part of most solicitors' business — in this case, two-thirds. Leases, too, fall under this heading. A third category of document which is eminently suitable for word processing is probates.

Straddled somewhere between general correspondence and word-processing is the all-important function of accounting. For a solicitor, it falls into two parts: internal — office accounts — and clients' accounts. This imposes a special discipline on the writer of the accounting software.

In the first place, the solicitor's own accounts are audited six-monthly by the Law Society, the disciplinary body of the legal profession, whose rules are strict. Not only must office accounts be separated entirely from clients' accounts, but they must be clearly comprehensible to a traditional accountant: in the classic phrase, not only must the Law Society rules by obeyed, but they must be seen to be obeyed.

Legal aid

On the other hand, a solicitor who undertakes legal-aid work — and a large proportion of work in court is legally-aided, to the tune of £85 million this year — must record his every disbursement on behalf of his client.

This would include apparently trivial details like telephone calls, postage and copying fees, all of which can amount up to a significant proportion of the bill and which might all too easily be subsumed into the general costs of running an office.

The most significant part of a legal aid bill is, of course, time spent on the case, and this too would be recorded on such a package.

Once he had decided that these were the essential improvements to this practice which could be accomplished by the use of a computer, Billingshurst's ideas grew progressively more Napoleonic. Why not put court pleadings on to the word processor too, he thought? Pleadings are, after all, reasonably formulaic.

After that, why not enter some precedents on to a database? Why not make provision for communicating with a legal database such as Lockheed's Dialog, Butterworth's or even Eurolex?

To sort out his ideas, Billingshurst contacted a local computer consultant Barry Blakesley of Dorset Computer Services, for whom he had done some work, in the past. Blakesley's first reaction to an outline specification of the proposed installation was that it was too ambitious for the budget of £20,000.

Nevertheless, he undertook to make a search of what the manufacturers had to offer. He did not have long to wait. When Billingshurst attended a computer show he put out the word that he was in the market for the kind of system described.

For a month the telephone did not stop ringing at the solicitor's office, and Billingshurst was in the fortunate and unusual position of being able to refer all queries to "my consultant".

No floppy discs

Blakesley's criteria for winnowing the non-starters went as follows: firstly he eliminated IBM and ICL. Secondly, if in his judgment the firm tendering seemed incompetent, too small or in danger of losing key support staff because of quick turnover of personnel, they were out. Thirdly, out went the manufacturers who were over-priced, or coy about the delivered price. Fourthly, he insisted on a site visit and realistic demonstration. He also rejected floppy-disc machines for data security reasons.

So who did he look at for such a multi-user, hard-disk system? Rair Black Box 3 made some of the early running. With its Star-based system with up to 16 terminals attached to a central processor, running under MP/M, it seemed elegant and flexible and good value for money, though Blakesley did not care for the Hazeltine 1500 VDU.

The system also had the advantage of the excellent Wordstar word-processing system, though Blakesley doubted that it would be easy to interface. On further investigation, he also began to doubt that in a practical environment the staff would be capable of handling MP/M at such an advanced level.

He was also intrigued by when he read a report about a solicitor who has used a Rostronics system with some success. So successful had the computing been, in fact, that the solicitor had left the legal profession to sell computers.

The Rostronics ran under CP/M and had some intriguing firmware variations but the software was still under development by a Scots firm and all the data files were held on separate floppies. It did not, in Blakesley's view, represent such good value for the application in mind, so although the system was actually running, he decided against it.

A very professional system was on offer from Solitaire — the only other firm with Rair, to offer anything other than Z-80-based machines with multi-processing — but the price was altogether too professional.

Another firm which offered an efficient and well-proven system was KBG. Its system which supported up to a 40-fee-earner practice and a price which included staff training — a desirable extra. The 5MB fixed and 5MB removable hard discs also made good sense, though their salesman who, Blakesley reports, seemed to be under the impression that one demonstration would clinch the sale, was most surprised that the firm wished to put "contentious litigation" on to the computer system. He had not had such a request before.

Blakesley's impression was that often the salesmen who visited to demonstrate had not thought hard enough about the potential customer's needs and were taken aback to find that the system requirements were well thought-out.

Blakesley tripped at least one salesmen with enquiries about data security: one of the important criteria was that on a document such as a will, all the answers which the client had inserted could be "swept out" on to a floppy and displayed separately for a second, visual check — rather than have to re-read the complete document, with insertions.

Finally, Blakesley recommended the Data General Nova 4S, with 64K of on-board RAM as the starting point of the system.

The VDUs will be three DG-D200s; printers will be Olivetti's with sheet-feed mechanism. WordPro was chosen for word processing.

Regular upgrades

The final choice, said Blakesley, was down to Nova's Business Basic. He decribes this as a "generated system". The uses initiates a system-generating process, which goes through an interpreter and emerges looking very like an operating system. It also offers regular upgrades as part of the package.

Blakesley adds the caveat that no consultant is ever altogether impartial. When it is a question of advising a client on acquisition of a computer system, which will be ordered through himself, there are certain licensing constraints which argue the adoption of certain solutions.

Any advice which is entirely impartial, he feels, is not born of the commercial world and is therefore likely to be of doubtful use to the commercial user. Doubtless Blakesley was thinking of his own part in the operation, since it is he who must write the future software for the system.

Data General does not sell applications software, so when the solicitors have their DG up with WordPro, Billingshurst will go into a huddle with his financial consultant Douglas Ashdown to devise a precise specification for the second phase of the operation — putting the accounts on to the computer.

Entering the realm of custom software may prove to be the start, rather than the end of the story.

Screen-based demonstration of an electoral system

by Simon Goodwin

RECENT political events in the U.K. have publicised electoral systems other than our present one. Both the Liberal party and, more recently, the Social Democrats have called for a system of proportional representation similar to that used in many foreign countries.

When I spoke to a local politics teacher about such systems, it turned out that they are difficult to demonstrate by the conventional "chalk and talk" technique, and a microcomputer demonstration suggested itself.

STV was the final product of our deliberations — a Basic program for the school's Apple microcomputer, demonstrating the most complex electoral system in common use — the Single Transferable Vote. This type of election is held at some U.K. universities and colleges, and causes regular confusion in some computer science departments.

The system is beautifully simple to the voter — he or she is simply given a list of the candidates and asked to place them in numeric order of preference — for example

SMITH	2
BROWN	4
JONES	1
HILL	3

The voter has indicated that his first choice for election would be Jones. In the traditional British system, Jones would collect the cross on the ballot slip. Here, the voter must also say who his second choice would be — Smith in this case. The ballot form shows the candidate that the voter would least like to see elected would be Brown — even Hill, the third choice, would be preferred.

The complications arise when someone tries to assess the preferences — aiming to please as many of the electorate as possible. This is the part that is hard to explain by conventional teaching techniques — though it is part of the majority of O- and A-level examination syllabi.

The system calls for the least preferred choices to be eliminated one by one — in increasing order of popularity — until one candidate has more than 50 percent of the votes cast. This always happens since as each candidate is disqualified the votes for him are redistributed to the next most popular of the voter's choices. So that if Jones was very unpopular in the example, he might be eliminated. The vote would be transferred to Smith on the grounds that he is the next preferred choice of the sample voter.

If Smith had been eliminated previously, the vote would go to Hill since the voter concerned would obviously prefer above all that it should not be given to Brown, the last choice.

It is difficult to work out the overall effect of such a system on which of the candidates is finally chosen. In a class, the only way to be sure of illustrating this is probably to go through a number of complete examples on the blackboard — a very time-consuming process at the pace of the slowest pupil.

This progress sets out to demonstrate STV on an Apple III. It uses a few sound-effects and screen-flashes to reinforce the demonstration by drawing attention to changes — rather than to distract the students.

Even if the subject matter is not of special interest, the techniques used may be. The program uses two fixed examples — rather than random ones — to ensure that the simple features of the system are explained before the special cases.

At every stage, the student is prompted by the computer, so that sections of the procedure occur one at a time, and after each stage, the program waits until the student has signalled that the previous section was understood. The Apple HTAB and VTAB instructions are used to position the display in a neat format and, most importantly of all, each piece of information used by the program in making a decision is clearly shown on the screen.

It is the computer's facility to display information rapidly in a clear format that is used to greatest effect here — it is easy for pupils in a normal class to become distracted while blackboard diagrams are being laboriously chalked, checked and changed.

Once the entire first scenario has been displayed, the computer gives the pupil the option of either going back over the same example or trying a different, slightly more complex one. In either case, the student is reminded of the instructions before the program starts a scenario.

To simplify operation of the program by pupils unused to computers, the Apple Get instruction is used to fetch their entries from the keyboard. This means that the Return key need not be pressed — if you feel that the student should be asked to confirm each stage of the progression through the simulation then an "Are you sure?" question could be added or a normal Input statement — requiring Return — could be substituted for the Gets.

The program has not been written as a demonstration of the art of programming but it is quite efficient and has not crashed in extensive use. To make the best possible use of the Apple's features, a number of non-standard Basic features have been used: Pop removes one address from the Gosub stack, and Home clears the screen and positions the cursor in the top left corner.

The dollar symbol on the Apple keyboard appears as a pound sign in the listing, and the various Pokes and Calls provide optional graphic and sound effects. These can be omitted without harm to the operation of the program. It should work without modification on an ITT 2020 computer, and the only precaution to be taken when typing it in is to ensure that trailing spaces on the lines to be Printed are not omitted.

A selection of the more politically-opinionated personalities of recent years have been made the subject of the simulation. Their names have been slightly abreviated to ensure that they will fit neatly on the screen, but any other names could be substituted if required. The "mystery character" is P J Lee — the politics teacher from Wycliffe College in Gloucestershire who sparked the idea.

I hope that this program will be of use to the many people struggling to produce educational software which is genuinely useful in the teaching of non-scientific subjects. Maybe the more politically-minded readers of *Practical Computing* will find the program a interesting one, since, although it only illustrates one of the many different electoral systems in use throughout the world, it demonstrates one that is fascinatingly different from our own.

```
10  GOTO 80
39  REM  ********** JUDGEMENT DISPLAY **********
40  FOR L = 1 TO 2
50  FOR S =  - 5 TO 5: POKE 878, ABS (S) * 5 + 25: POKE 879,6: CALL
     880: NEXT S
60  POKE  - 16304,0: PRINT "";: POKE  - 16303,0: NEXT L
70  RETURN
79  REM  ********** INITIALISE SOUNDS **********
80  FOR I = 880 TO 900: READ D: POKE I,D: NEXT I
90  DATA 173,48,192,136,208,5,206,111,3,240,9,202,208,245,174,110
    ,3,76,112,3,96
99  REM  ********** MAIN PROGRAM START **********
100  HOME : PRINT "**  SINGLE TRANSFERABLE - VOTE DEMO. ** ": POKE
```

```
    878,50: POKE 879,100: CALL 880
110  POKE 878,100: POKE 879,255: CALL 880: IF H =  - 1 THEN 250
120  PRINT "SIMULATION PROGRAM (C) 1980 S.N.GOODWIN."
130  PRINT "TWELVE PEOPLE VOTE, USING THE S.T.V.     SYSTEM, TO EL
     ECT A REPRESENTATIVE.": PRINT
140  PRINT "ONE OF THE FIVE CANDIDATES MUST END UP   WITH AN OVERA
     LL MAJORITY.": PRINT
150  PRINT "EACH VOTER PLACES THE CANDIDATES IN      ORDER FROM ON
     E TO FIVE.": PRINT
160  PRINT "WHEN YOU SEE A "; FLASH : PRINT " "; NORMAL : PRINT
     " IT INDICATES THAT SOME OF THE CURRENT INFORMATION DISPLAYE
     D    BY THE COMPUTER WILL BE REPLACED BY NEW MATERIAL WHEN Y
     OU PRESS A KEY.": PRINT
170  PRINT "READY TO START?"; GET B$
180  IF H = 0 THEN  GOSUB 1600
190 H =  - 1: GOTO 100
249  REM  ********** CLEAR SOUND DATA **********
250  IF C = 0 THEN 300
260  FOR S = 0 TO 20: READ C: NEXT S
299  REM  ********** DISPLAY TABLE **********
300  FOR P = 3 TO 19 STEP 6
310  FOR H = 1 TO 31 STEP 10
320  FOR D = 0 TO 200
330  NEXT D: POKE 878,100 - P * 3 + H * 2: POKE 879,30: CALL 880
340  FOR N = 0 TO 4: READ C
350  VTAB P + N: HTAB H: PRINT A$(N);C
360  NEXT N,H,P
370  GET B$
499  REM  ********** CHECK SCENARIO **********
500  IF C <  > 2 THEN 800
509  REM  ********** FIRST SCENARIO **********
510  FOR R = 1 TO 4
520  ON R GOSUB 540,570,610,640
530  NEXT R
540 B$ = "33213": GOSUB 1000: GOSUB 40
550  PRINT "P.J. LEE HAS ONLY ONE VOTE AND IS       ELIMINATED.";

560  GET B$: RETURN
570 B$ = "34203"
580  GOSUB 1000: GOSUB 40
590  PRINT "STILL NO OUTRIGHT WINNER: MARX, WITH     ONLY 2 VOTES,
      IS ELIMINATED.";
600  GET B$: RETURN
610 B$ = "35004": GOSUB 1000: GOSUB 40
620  PRINT "STILL NO OUTRIGHT WINNER: ADOLF IS NEXT TO BE ELIMINA
     TED.                ";
630  GET B$: RETURN
640 B$ = "07005": GOSUB 1000
650  PRINT "MAO HAS AN ABSOLUTE MAJORITY AND WINS    THE CONTEST I
     N ROUND 4.          "
660  POP
669  REM  ********** TERMINATION ROUTINE **********
670  POKE 878,100: POKE 879,100: CALL 880: POKE 878,50: POKE 879,
     255: CALL 880: GET B$
680  PRINT "HIT 'A' TO RUN AGAIN, 'N' FOR NEW RUN:"; GET B$
690  IF C = 2 AND B$ = "A" THEN  RESTORE : GOTO 100
700  IF C = 2 AND B$ = "N" THEN C = 0: GOTO 100
710  IF C <  > 2 AND B$ = "N" THEN  RESTORE : GOTO 100
720  IF C <  > 2 AND B$ = "A" THEN  RESTORE : FOR V = 1 TO 60: READ
     C: NEXT V: GOTO 100
730  FOR V = 0 TO 1200: NEXT V: HOME : END
799  REM  ********** SECOND SCENARIO **********
800  FOR R = 1 TO 3: ON R GOSUB 820,850,880
810  NEXT R: GOTO 670
820 B$ = "35130": GOSUB 1000: GOSUB 40
830  PRINT "IDI AMIN HAS NO VOTES AND IS ELIMINATED-AS IS CARL MA
     RX WHO POLLED 1";
840  GET B$: RETURN
850 B$ = "35040": GOSUB 1000: GOSUB 40
860  PRINT "ADOLF BITES THE DUST, WITH ONLY 3 VOTES.
                          ";
870  GET B$: RETURN
880 B$ = "05070": GOSUB 1000: GOSUB 40
890  PRINT "P.J. LEE ROMPS HOME WITH AN OVERALL      MAJORITY.
                          "

900  RETURN
999  REM  ********** SCORE REPORT SUB. **********
1000  HTAB 1: VTAB 21: PRINT ">>>>> VOTES EACH, IN ROUND NO. ";R;
     " :"
1010  PRINT "ADF     MAO     MRX     LEE     IDI     ";
1020  FOR H = 5 TO 35 STEP 7: HTAB H
1030  PRINT  MID$ (B$,H / 7 + 1,1);
1040  NEXT H: PRINT
1050  GET B$: VTAB 23
1060  RETURN
1199  REM  ********** DATA BLOCK ONE **********
1200  DATA  3,2,4,5,1
1210  DATA  5,1,3,2,4
1220  DATA  2,3,4,5,1
1230  DATA  1,2,5,4,3
1240  DATA  5,4,1,3,2
1250  DATA  1,4,5,3,2
1260  DATA  4,1,2,3,5
1270  DATA  3,2,1,4,5
1280  DATA  3,2,4,5,1
1290  DATA  1,3,5,2,4
1300  DATA  5,2,4,1,3
1310  DATA  5,1,3,4,2
1399  REM  ********** DATA BLOCK TWO **********
1400  DATA  3,4,2,1,5
1410  DATA  5,4,1,3,2
1420  DATA  1,5,4,3,2
1430  DATA  5,1,3,2,4
1440  DATA  1,4,2,3,5
1450  DATA  4,2,3,1,5
1460  DATA  5,1,4,2,3
1470  DATA  3,1,5,2,4
1480  DATA  5,1,3,2,4
1490  DATA  1,5,3,4,2
1500  DATA  2,5,4,1,2
1510  DATA  2,1,5,2,3
1599  REM  ********** NAMES INITIALISE **********
1600  DIM A$(4):A$(0) = "ADOLF ":A$(1) = "MAO    ":A$(2) = "MARX
     "
1610 A$(3) = "PJLEE ":A$(4) = "AMIN  "
1620  RETURN
```

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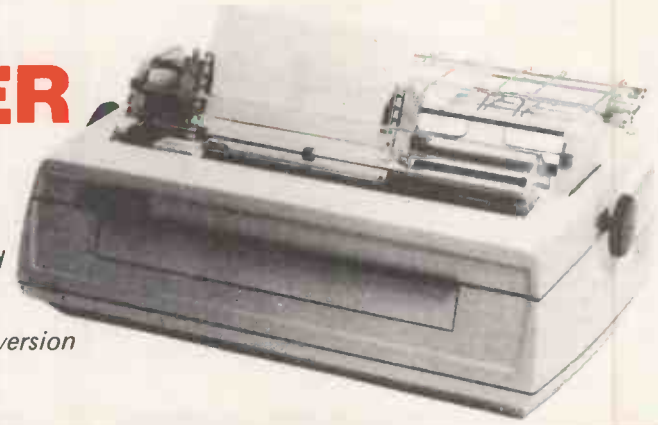

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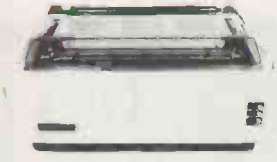

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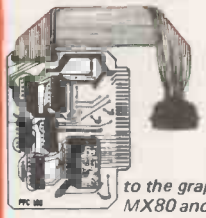

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Choose language and operating system before the hardware

EDUCATIONAL computing in the U.K. has advanced a long way. Teachers and lecturers are past the stage of initition into the art and are moving towards committed application.

We see on the one hand a substantial investment in school computing in the form of the Microcomputers in Education Project, a further boost to those who took part in the NDPCAL programme in the mid-seventies in the form of cheap micro-computing power with colour and graphics, and the recent announcement of the BBC choice of computer to accompany its course scheduled for early 1982.

It is a time for decision and we must decide wisely and with care to that we have no cause for regret. Much is at stake: good decisions can lead to a decade in which young people grow up with a ready

by Dick Warn

familiarity with this most important of developments, the enthusiasm to exploit it fully and the wherewithal to do so.

The alternative is that they finish slightly bewildered by the complexity of it all, frustrated by the lack of portability of programs and baffled by the discontinuities arising from the introduction of new and supposedly better hardware.

The choice of the right "software environment" — the high-level language as well as the operating system — is more important than that of the computer itself. The UCSD — University of California at San Diego — p-system, with its provision of Pascal, Basic and Fortran-77, should be considered by anyone presently involved in such choices.

As is well known, microcomputer hardware now costs significantly less than the time taken to program it. Of all activities, Hofstadter's Law: "Whatever the job, it will take longer than you think, even when you take into account Hofstadter's Law", applies best to software writing.

Program complexity

It has been said that the complexity of teaching programs is in inverse proportion to the sophistication of the user; by definition, almost, educational software takes most effort. Writing the program often takes less overall time than blast-proofing it from the depredations of the naive user.

These basic but fundamentally important facts of living in educational software land must be acknowledged by all concerned, and for this reason: so far, the flag of CAL — computer-aided learning — has been carried by the few, the devoted enthusiasts who are prepared to weather such difficulties. We are now reaching the stage where, in the diffusion of such methods in universities and schools at large, users will regard the computer as no more than another tool, and probably with some suspicion. It is therefore vital that:

- All that is humanly possible is done to make programs and operating systems as reproducible, reliable, and easy-to-use as possible
- Programs are adequately documented, either within the program or in a user manual or both
- The relevance of particular CAL material to courses and age-groups specified, and it is not over-sold

We are really talking here about an approach to professionalism. Professionalism is a much-maligned word. In practical terms, it means that the teaching program which works quite well is no longer good enough. Generally, the old dictum that if it is free it is probably no good, is likely to be true. What is needed now is top-quality software, which will necessarily carry a price-tag. In a little more detail, professionalism means at least these three things:

- Adequate documentation so that even without the program, you know what it is trying to do and how it sets about doing it
- Maintainability, which means that someone other than the writer of the program can understand it sufficiently to modify it and make improvements
- Productivity: debugging should take no longer than twice the time it takes to key in the program; if it does, do not question you ability as a programmer but your program-design methodology or maybe even the language you are using

Questions of productivity and maintainability have related answers. If somebody else can find their way round your program to change it, it stands to reason that you can do so with ease — that is much of what debugging is all about. There are in fact two solutions to these problems, and they are:

- Use a language which is functionally organised into clear procedural or subroutine-like features, and which allows you to display the nesting and looping structures within a procedure
- Make use of a sophisticated operating system, OS, which allows, for example, fast screen editing

Satisfied customers among the educational fraternity require reliable, easy-to-use, well-documented programs, which require a professional approach, if not professional suppliers. That in turn demands three things:

- Reasonably powerful, though not necessarily expensive hardware
- The best available language for the purpose
- A powerful but user-friendly operating system

These three requirements of hardware, language and operating system are placed in the priority sequence traditionally accorded them. People choose the machine first, then consider the language which fits. The operating system receives little consideration. I suggested they be put in precisely the opposite order, because if the OS and language are chosen wisely, the hardware choice is still open.

Of the widely-available languages, only Fortran and Basic are in use for educational computing and as far as micros concerned, versions of Basic are almost universally used.

Fortran has been in wide use since the early sixties for scientific and other number-crunching applications and is very suitable for that purpose. For various reasons, it is not well-suited for any string-handling work, although it has a very good subroutine structure facility. In any case, there are few implementations on microcomputers.

There is a deeply-ingrained behavioural trait in the human psyche which embraces with fervour the devil it knows rather than consider the angel-by-report which it does not. The unassailable, and I think, sad fact is that very large numbers of people learn computing through the language Basic, and are then more than loath to consider the time-investment which is undoubtedly needed for the acquisition of a new language.

Basic is easy to learn and it is for this reason, coupled with the devil-you-know syndrome, that Basic has received so many tack-on extras and new features. What is really needed is the acceptance by users of Basic that they have now grown up, are mature programmers, and now need something bigger and better to give expression to their growing creativity. Consider these disadvantages:

- Subroutines are poorly identified
- Variables are global with a few exceptions
- Structured programming features are for the most past lacking
- There are many versions; few are compatible
- Data types are few and pre-specified
- There is little scope for structuring data to suit the particular problem in hand

Let us look at these in a little detail. Subroutines are available, accessed by the starting line number. They have no heading, however, and cannot pass specific parameters to and fro. Too many number-references serve only to reduce the clarity of the program's function; this often happens.

Variables in Basic and global; that is, they are accessible from anywhere in the program. In larger programs, variables can easily be forgotten or overlooked, even when using a variable table.

Constructions such as Repeat ... Until, which clarify the structure of a program when used with indenting, are available

on only a few implementations. The language Comal is a big improvement in this respect, though not in others.

Basic lacks standardisation in any world body. Such standardisation as does exist is *de facto;* the Microsoft version would carry many people's votes. However, moving programs written on one machine to run on another is often fraught with disaster.

Data types are limited to numeric — real — or string, although some versions have integer and logical — Boolean. There is no concept of range, so it is not possible to mount run-time checks of values.

For example, if a variable representing age is an integer, any value from say 32768 to -32767 — assuming 16-bit capacity — is possible. A range of 0 to 120 is more realistic, other values indicating discovery of a wonder-elixir or generation of nonsense. Or again, there is no chance of setting up a variable of one's own choosing, say, party, with values restricted to: con, lib, lab, socdem, comm, ind.

Lastly, data structures in Basic are normally limited to lists and tables corresponding to one- and two-dimensional arrays. What about sets, sequential files, records, tree-structures? The real world poses problems of data-structuring answered with difficulty or not at all in Basic.

Yet to experience these advantages and disadvantages is to understand them. No one missed paper tissues before they were invented; similarly, many people do not know what they are missing until they look.

It is not uncommon to hear of people picking up one of their programs, in a fit of re-writing, only to find that they cannot understand what it is that they were trying to do just there; why such and such a statement is there at all; why that subroutine is there, it never seems to get called and so on.

Comal is not so much a language as a major enhancement of Basic. It has been developed in Denmark with education in mind. There are three distinct loop structures, For..Next, Repeat..Until, and While..Endwhile, which makes structuring easy; indentation is system-enforced.

Decisions can be implemented using both the If..Then..Else structure, and the Case..Of..branch. There is a strong superficial resemblance to Pascal, although its origins in Basic are all too clear — its data structures are equally arid, for example.

However, it is a clear improvement on Basic in that it encourages formulation and creation of logical and clear program structures, and parameters can be passed to procedures. It should be regarded as an improved starting language, from which one can more easily move to, say, Pascal.

Until recently, it was a truly minority language, but Commodore's announcement in March that it would be supported on Pet machines, provides it with a substantial boost.

As the specifications for what was to become Algol-68 hardened, and the language grew in complexity and size, Niklaus Wirth, a member of the panel, became increasingly dismayed. Pascal emerged in the early-seventies as a clear compromise. It has all the features which he felt were of wide application, but at the same time the compiler was to be compact and efficent, and execution fast. For these reasons, it is ideally suited to the micro-computer.

In the search for efficiency, he specified a computer architecture featuring a stack and heap, called the pseudo-machine, p-machine, which operates on so-called p-code. Pascal programs are thus semi-compiled into p-code, which is then optimally processed by the p-machine. In fact, although p-machines have been built, p-code interpreters have been written for many microprocessors.

The immediate implication of this is now apparent: p-code is perfectly standardised, so a program compiled into p-code will run on any p-machine, be it a hardware realisation such as the Western Digital Micro-Engine, or any one of the many microcomputers fitted with a p-code interpreter.

This is one of the major advantages of the Pascal concept; fit the language to human thought patterns, and fit the hardware to the language, and the result, almost as a by-product, is portability between machines. There is, of course, a price to pay for powerful features in a compact system.

A careful attention to order, and a full declaration of variables before they are used is required of the programmer. Yet in fact, although this is a choice, it requires careful program planning, which in turn serves to ensure elimination of errors before they can occur.

Here are some of the virtues of Pascal:

- Structured programming is an integral feature, with indenting
- Variable types are many, with subrange specifications, for example
  age: 0..120;
  Also data types can be invented to suit the problem
- Data structures are varied enough for all but a very few jobs
- Considering the power of the language, size requirements are modest, especially of the compiled programs
- Procedure structure is implicit, with locally-declared variables, parameter-passing and calls-by-name
- The language is available on the majority of microprocessors.

However, although the more advanced features such as recursion, pointers and dynamic allocation can be tackled progressively, it is generally agreed that Pascal is not an easy language to learn. Simple programs in Pascal are not difficult to write; but careful teaching is essential. Such time as is necessary to understand the new language is amply repaid later.

Ada is a major language initiative being undertaken by the U.S. Government and is to be primarily for real-time applications. It will, however, have many general-purpose features and in some respects will be a superset of Pascal and Pascal thinking.

Its arrival is anticipated somewhat before mid-decade and is bound to have a substantial impact. For the time being, however, its similarity to Pascal argues for the acquisition of familiarity with Pascal in the interim.

An operating system is that set of programs necessary to carry out all the housekeeping jobs associated with computing, such as the editor to put files together and modify them, or a file-handler to see them stored away safely for another day.

If people are to enter computing for the first time, there are two major tasks confronting him/her: the acquisition of a language, and the understanding of at least the rudiments of one operating system.

There is a big time investment, so try to arrange that this happens once only, and that the language/system combination is powerful enough to answer all the demands to be made of it. Here are three related points concerning the combined system:

- Universality: it must be widespread, so that when someone changes schools or machines, for instance, the same system will be available
- Portability of programs: similarly, programs written at one location ought to run on the other machine, or on the replacement machine when the present one is upgraded; this should include a set of input/output routines which are not machine-dependent
- Finally, the operating system ought to be usable on either eight-bit or 16-bit computers. Several 16-bit processors are now coming on to the market, such as the Z-8000, and 68000. It is much easier to design for 16-bit architecture, and modify for the smaller one, than the other way round.

CP/M was developed in the mid-1970s for the 8080 and Z-80 processor and is extremely widely-used with computers based on them. Some recent developments have made possible its use with the 6502-based Apple II, so the range is increasing.

A general difficulity remains, however; it was designed for eight-bit architectures, and although the great amount of software written for the system acts as a deterrent to change to 16-bit, multi-user/multi-tasking systems require these more-powerful processors.

The problems of moving to 16-bit architecture is likely to be met by one of two operating systems, or a possible combination of the two. Unix is a sophisticated, multi-user multi-tasking system which has been under development for a decade by Bell Telephone. It has a tailor-made system language. "C" and runs on DEC PDP-11, Z-8000, 8086, and 68000 processors.

It seems to have been written with the

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relatively-sophisticated user in mind, however, and it may well be a commercial sledgehammer to crack an educational nut. Nonetheless, the points in its favour should be made, that if it is to become widely available, then people must learn to use it at schools and colleges, and that there is a purely nominal charge for its sale to educational establishments — although a stiff commercial price is charged.

A version of Pascal is not yet apparent, but it is possible that the UCSD version of Pascal, presumably without the operating system, will be forthcoming. A pointer for the future is that the major U.S. software company Microsoft has started to market it under the name Xenix.

Yet what of the here and now? Educational establishments, certainly schools, are unlikely to be thinking in terms of 16 bits for some time. They are making commitments to cheaper disc or tape eight-bit machines, and will require simplicity of operation combined with reasonable power, wide availability and freedom from hardware-dependence.

The UCSD p-system version IV.0 was released at the beginning of 1981 and offers a number of significant improvements over those currently in use. Let us look first at the features already there. They are:

- Arguably the best implementation of Pascal available, which is augmented in one essential respect over the "standard" version. It has an additional variable Type, string, which normally has 0-80 characters, although up to 256 can be specified. There are a few inbuilt functions to find the length, inset and delete sub-strings, and concatenate strings, for example, to go with it.
- A compiler which produces universal p-code, which is then executable on any machine with a p-machine emulator, or indeed a p-machine itself. There is an invaluable feature which, when an error is detected, allows the option of moving directly to the editor to fix the bug.
- Already available on both 16-bit PDP-11 and eight-bit machines, including those based on Z-80/8080, 6502, 6800/6809, TI-9900 processors.
- A link-loader which can incorporate library programs, or pre-compiled units.
- A screen-editor of great power, with features such as automatic indenting and word-processor-like abilities.
- An easy-to-use file-handling program, which organises all peripheral devices and the transfer of files between them.
- Built-in medium high-resolution colour graphics with straightforward screen-animation.

These features have already attracted a substantial number of academic users in the U.S. and more than 30,000 computer-users are said to have chosen the UCSD Pascal system. It is highly significant that Apple has chosen it as the vehicle for all its system programming — a tribute equally to the language and the UCSD system.

The recently-announced Version IV.0 includes a number of powerful features, such as:

- Features to allow multiple use.
- The addition of p-code compilers for Basic and Fortran-77. This allows the writing of different parts of a program in the language best suited to it, linking the different slugs of p-code together for running. It also opens up the idea of p-code portability to users of those languages.
- Facilities for program chaining and dynamic overlays, which mean in simple terms that very large programs can be compiled and run.

What are the disadvantages of such a system? The problem of cost must be tackled. Educational programs which are sufficiently crash-proof and effective are difficult to develop with less than, say, 16K of memory, and those with any sophistication or graphics may well require 32K or 48K.

We are forced to admit that such a program will take some time to load from a cassette, and in practice, discs will be necessary. A price of around £2,000 arises, with a reduction in the per-unit price if shared discs and printer are considered. Such a system is required to develop programs on the UCSD system, although smaller machines can be used to run them.

It is said that people may generally be divided into three categories: those who make things happen; those who watch them happening; and those who simply wondered what happened. The major thing now happening to microcomputers is that it is becoming unnecessary to be tied to a particular computer by virtue of the software investment you have made; the major decision is to choose a first-class language/operating system and to make things happen with that: The UCSD p-sytem is such a combination.

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As you learn Forth, it learns from you

The quintessence of Forth is that it learns from its master — Forth is extensible. David Sands reports.

LIKE ANY computer language, Forth has a vocabulary — but this vocabulary can be broadened by the programmer. Each new word added is defined in terms of older words already known to the system. Thus, increasingly-powerful words can be formed in hierarchical fashion. In this sense, Forth bears a strong resemblance to human knowledge.

As we all know, the single most popular language today is Basic. The reason for this is not just that Basic is a powerful programming language but is mainly due to the fact that Basic is a complete programming system. A Basic program can be constructed and made to work in a fraction of the time taken by compiling languages such as Fortran or Pascal.

The big problem is that the system never learns anything from your Basic program. Each program line has to be interpreted by the system and if a line is encountered again and again, it must be interpreted again and again. Thus programming speed is obtained at the expense of execution speed.

Machine code

Forth, on the other hand, is both an interpreter and a compiler — but not the kind of compiler which produces massive amounts of machine code. Each word compiled into Forth is, in fact, a compact list of subroutines. Each of these subroutines will be a list of more subroutines and so on, down the tree, until machine code is encountered.

The resulting structure, called "Threaded code", is not as fast as pure machine code, but is constructed quickly and easily. When you are familiar with Forth, it is just as quick to write as Basic, just as easy to debug, yet runs between 10 to 20 times as quickly.

Basic does not stand alone in its class; there have been similar languages such as Focal. Likewise, there are other self-extending languages, like Forth, but which do not necessarily use exactly the same words or exactly the same syntax. They are called Threaded Interpretative Languages or TILs. Forth is the original threaded language and was developed originally by Charles Moore.

The impetus to investigate Forth arose from the August 1980 issue of *Byte* which was completely dedicated to articles about the language. I understand that particular issue of *Byte* is completely sold out and highly sought-after. I then whetted my appetite with the Pet version of Forth called FullForth.

Keen to try something more serious, I obtained a copy of Stackworks Forth called SL5, running under CP/M for North Star. This Forth is some 10 times faster than North Star Basic. For example the quick test:

```
10 FOR X = 0 to 10000: NEXT
RUN
```

takes about eight seconds in North star Basic. A corresponding code for Forth is

```
DECIMAL
: TEST 10000 0 DO LOOP;
TEST
```

This runs in about 0.8 seconds in SL5.

As the full potential of Forth became apparent, I became dissatisfied also with my Stackworks SL5. One of the major advantages Forth will bring to the microcomputer industry is the ability to write ROMable code for such applications as automatic testing, or process control. It can write this code quickly and, therefore, cheaply without undue run-time penalty.

However, Stackworks has obviously had some difficulty in making its Forth produce ROMable code. The main obstacle was the CP/M under which SL5 runs. I decided I needed a Forth to run under North Star DOS. This may surprise CP/M enthusiasts, but North Star DOS, although primitive compared to CP/M, has many advantages, for the following reasons:

- The sophistication of CP/M is achieved with more code and more disc activity and so takes longer to run. Equivalent disc activity under North Star DOS is approximately twice as fast as CP/M.
- With North Star DOS, it is possible to take snapshots of any part of memory and put them on any part of the disc and *vice versa*. This is not possible with CP/M where one is forced to use the text-processing area and the indexed self-arranging disc allocation.
- With North Star DOS, is is also possible to keep more than one program In RAM at the same time and to jump back and forth between them without unnecessary disc activity.
- Because of the requirement in CP/M for a text processing area at 100 Hex and a small CP/M jump table in the first page of memory, it is very difficult to write ROMable code which starts from zero. Z-80 and 8080 microprocessors re-set to zero, so it is most important to have all ROMable code at the beginning of memory space.
- North Star DOS can be re-located anywhere in memory so as not to interfere with the new system generated.
- Stackworks Forth uses the CP/M text editor. This text editor is far from brilliant and text produced must be stored on disc and Forth re-loaded before the text can be tested. When one is working interactively with a computer, perhaps trying to debug something tricky, these delays are intolerable. It is essential to have rapid communication between the program-generation and the program-testing parts of a system — otherwise you might as well stay with Basic.

In addition to all these reasons was the nagging awareness of the fact that Stackworks SL5, CP/M and indeed North Star Basic are all written in 8080 code and so fail to use some of the powerful features of the Z-80 microporcessor. So, when I laid my hands on a copy of the *Byte* book, *Threaded Interpretative Languages* by R G Loeliger, I had no excuse not to write my own version of Forth to run under North Star DOS.

This I accomplished in a matter of days using Allen Ashley's excellent PDS assembly-language development system, which includes a superb text editor and macro assembler, and a debugging utility which must be the finest available anywhere for the Z-80 microprocessor. The system also runs under North Star DOS.

Loeliger clearly had no idea how to write arithmetic routines — particularly division — so I borrowed some very neat arithmetic from Tiny Basic. I also changed many routines to comply with popular Forth practice and added some of the features of Stackworks SL5.

I would not advise anyone with a faint heart to tackle the same task but one advantage of being left completely at sea is that you are forced to understand fully what you are doing. The final result of all these labours is an implementation of Forth in true Z-80 language, using all the Z-80 registers.

It runs twice as fast as Stackworks Forth performing the quick test in 0.4 seconds — 20 times faster than North Star Basic. Disc access is also quicker — between two and three times faster than CP/M SL5. On top of all that, the editor — which is Allen Ashley's text editor from the PDS development system — Forth, DOS and a machine-code monitor can all be co-resident in the computer at the same time.

I can build a program in the editor, jump quickly to the threaded interpreter to test it, and then jump straight back into the text editor to make alterations or additions finding the text completely intact and all text pointers in their original positions.

The borderline between the Forth program area and RAM area is clearly defined and the finished, extended Forth program can be saved *en bloc* on disc and impressed in EPROM at a moment's notice.

If you know only Basic there are two fundamentally new concepts to get to grips with.

- All data is handled on a datastack: that is not to say that there are no variables — there can be any number and with any names — but to move a value from one variable to another or to perform arithmetic, data must first be moved to the stack.
- Arithmetic, relational operators and all activity using data must be written in reverse Polish notation.

Here are some examples.

```
12 OK
```

Now the value 12 is on the stack.

```
. 12 OK
```

The user hits return after the full stop which means print what is on the stack and remove it from the stack. Thus if we try to print again, we obtain

```
. STACK UNDERFLOW ABORT
```

This error occurred because we tried to print something from the top of the stack when there was nothing there — the value 12 had already been removed by the previous print operation. Let us now do some arithmetic:

```
12 OK
```

The value 12 is on the stack

```
7 OK
```

Now the value 7 is on the stack and the previous value 12 has been pushed down to second position on the stack

```
* OK
```

Now the 7 and the 12 have been multiplied together and the two of them have been replaced by the answer which occupies the top and only position of the stack.

```
. 84 OK
```

The user hits return after the full stop, this popped off the top of the stack and printed it leaving the stack empty. Now all that could have been written on one line as follows:

```
12 7 * . 84 OK
```

As you can see, this is reverse Polish notation. In this example, the asterisk, meaning multiply, and the full stop, meaning print, are words. There may be many words in a shredded interpretative language. These are classified into various types.

Terminal Words including the full stop for print; CR for carriage return; KEY which is used for having a key pressed by the user; putting its ASCII value on to the stack — equivalent to Pet's GETDIR function; EMIT which sends the value on the top of the stack as an ASCII character to the screen.

Stack words including arithmetic operators and relational operators such as >< =;DP which duplicates what is on the top of the stack; SWAP which exchanges the top two values on the stack.

System Variables and commands such as DP, dictionary pointer, which is a variable pointing to the first free memory location available; decimal and Hex which convert the number system to Base10 or Base16 respectively.

Defining words; these are the words used by the programmer to create new words out of combinations of words which already exist.

When creating a new word, all the words used in the definition must be looked up in the dictionary. The addresses of the code associated with these words is then incorporated in the code of the new word. The paramount defining word is a colon. Let us look at the following example of a simple but useful new word.

We have seen how the print command removes the value on the top of the stack to print it. Suppose we want to print the value on the top of the stack without removing it — then we would have to duplicate it first as follows:

```
DUP .
```

and every time we wanted to see what is on top of the stack we would have to write the same thing. To save time, let us define a new word P to duplicate and print the top of the stack

```
: P DUP . ; OK
```

The semicolon marks the end of the definition. You could have put as much code as you wanted between the colon and the semicolon. Even if it does not fit on one line, you can use more than one line, in fact, it is good practice to break a definition up into smaller parts on separate lines. Each line is compiled into your new definition and the compiling does not stop until you finally type the semicolon.

Constants are created with the word Constant:

```
12 CONSTANT FRED OK
```

creates a constant called Fred with the value 12. To use the constant simply type its name and its value goes to the stack for example,

```
FRED 5 * . 60 OK
```

Variables are created in a similar fashion, e.g.,

```
8 VARIABLE BERT OK
```

This creates variable Bert with an initial value of 8. When Bert is used, only the address of the variable is put on to the stack and a second word "@" must be used to change this into the actual value.

```
BERT OK
```

puts the address of Bert on top of stack, TOSQ.

```
BERT @ OK
```

puts the value contained in Bert on top of stack.

If Bert were, for example, a pointer to a memory location you would have to use the @ sign twice:

```
BERT @ @ OK
```

To store something in your variable, the exclamation mark is used:

```
5 BERT ! OK
```

Here 5 is pushed to top of stack, TOS, and then Bert the address of the variable Bert is pushed to stack moving the value 5 down one level. The exclamation mark stores the second stack entry in the address at the top of stack.

If Bert were, for example, a pointer to a memory location then to store 5 in the actual memory location you would have to write

```
BERT @ ! OK
```

Once the techniques used for @ , to get, and !, to put, have become habitual, programming becomes more fluent. Fewer variables are required than in other languages. There is a distinction between variables which have a specific meaning throughout a program and variables which are used for scratch-pad calculations only: for example, the odd Q1 Q2 X Y, etc., which creep into parts of Basic programs.

These scratch variables are not required in Forth because all calculations and operations take place on the stack. Such operations are obviously very much quicker than having to look up variables in a symbol table, but even when variables are in use in Forth, they are compiled into code blocks as explicit addresses and so eliminating further need for a symbol table.

One further compiler directive which must be mentioned is Forget. Since there are no line numbers to shuffle and no way of knowing whether the word you want to delete has become incorporated into high-level words, writing Forget (name of word) deletes not only the word but all words added subsequently to the creation of that word. So, if you created Fred, Bert and then Bill, Forget Fred would also delete Bert and Bill.

All branches and loops in Forth must be conditional as in Pascal and other structured languages. Goto does not exist. As always, the conditions for loops and branches must precede the instruction in reverse Polish notation. For example, the syntax for if is as follows:

```
(condition) IF (function) THEN
```

or

```
(condition) IF (function if true)
ELSE (function if false) THEN
```

Counting loops equivalent of For-Next in Basic are accomplished with the DO loop, syntax:

```
(upper limit) (starting value) DO (function)
LOOP
```

The indefinite loop with a condition for leaving is

```
BEGIN END . syntax :
BEGIN (function) (condition for ending) END
```

Notice that the test is performed at the end of the loop. If the test is required at the beginning of the loop, the following syntax is used

```
BEGIN (condition for staying in the loop)
WHILE (function)
REPEAT
```

To clarify all these different forms of syntax, here is an example definition which sorts key strokes into a disc buffer at 4000 Hex in memory:

```
: INPUT
  UNBUF INPTR ! ( MAKES THE POINTER TO START OF RAM)
    BEGIN KEY DUP EMIT ( GET THE KEY & ECHO)
      DUP OD <> WHILE ( WHILE IF ISN'T A CR ... )
        DUP 8 = IF ( IS IT A BACK SPACE?)
          DROP 20 EMIT 8 EMIT ( IF SO RUB OUT ONE CHARACTER)
            -1 INPTR +! ( AND BACK UP THE POINTER)
          ELSE    (ELSE NOT A BACK SPACE)
```

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```
        INPTR @ C! ( STORE THE CHARACTER)
        1 INPTR +! ( AND INCREMENT THE POINTER)
    THEN REPEAT      ( AND DO IT AGAIN)
3 INPTR @ C! ; ( FINALLY STORE AN ETX CHARACTER)
( DOCUMENTATION AND DISC ACCESS OK
```

Because what you type is compiled immediately into the language, there is no facility to extract from the language afterwards an equivalent of what you originally typed. The language itself grows and grows and meanwhile, all that you have typed has long since scrolled off the top of the screen.

Forth is, therefore, not self-documenting and it is essential to keep careful notes or to arrange your printer to print everything on the screen. Better still, keep all your text on a disc file before compiling.

Normally, Forth disc space is divided into segments called screens. Each screen, as its name implies, can be viewed in its totality on the computer screen, can be individually edited and re-saved on to disc. In a file-orientated system, the file names are used and files can be of any length.

The screen or file contains text which, when loaded, is read by the system exactly as if it has been typed by the programmer. Each screen or file can end with a command to load another screen or another file. For storage of data, disc space is treated as virtual memory. That is, it is treated as a single continuous random-access file.

The quick tests mentioned earlier were perhaps a little unfair because poor old Basic has to do all its counting in floating-point arithmetic, whereas Forth works with 16-bit integers. In by far the majority of Basic programs in business applications, games, graphics, etc., most of the For loops are integer counts anyway and the majority of them have a unity step size.

Screen addressing, disc addressing, computation with dates, alphabetic sorting etc., could all be managed comfortably and would run much more quickly with integer arithmetic. Of course Forth still runs faster than integer Basic.

Floating-point

Where floating-point computation is required, high-level code must be introduced. FullForth for Pet has the appropriate coding on disc screens. New words for example, F+,F* etc., control the floating-point arithmetic performed solely with variables whose addresses are put on to the stack. Floating-point variables use more than two bytes.

Up to this point, 8080-style 16-byte arithmetic has been very useful but, from now on, its processors like the 6502 which perform better. Having defined floating-point add, subtract, multiply and divide, we can now go on to transcendental functions which are accomplished using series expansions.

First, we define the factorial and then power series, exponential and logarithms. From there, we can go on to complete sine, cosines and tangents which in turn use powers and factorials in their series.

The most common source of error is misuse of the stack. For example, adding more than you remove will cumulatively fill the stack until overflow occurs. Likewise, occasionally removing from the stack one value more than has been put on will eventually result in stack underflow.

In immediate mode, stack underflow is detected and an error message is given, but in compiled mode, stack errors can be fatal. After such an error you will probably have to re-boot your entire system.

While writing a TIL, it is easy to see why the temptation to guard automatically against this error should be avoided. Forth relies on its stack words for its high-speed computation. So, if you built stack safeguards into every little stack word, you would easily slow the system down by some 50 percent.

Other ways of crashing the system are to load a screened or disc file which has no end of file marker; to load disc data into the middle of Forth; to Move a data block from one part of memory to the middle of Forth; to misuse a constant or a variable in such a way as to store data in the Forth code; to misuse or upset the special system variables such as DP, dictionary pointer.

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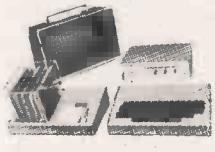

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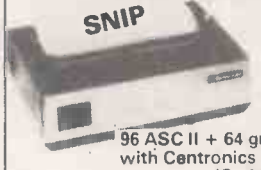

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DIRECT INPUT

by L S Murray

Joseph said: "I'm not malfunctioning". He stated it in the bland, categorical fashion which never failed to alienate people who did not know him well. Conrad and I did know him well, but that tone of voice irritated even us. We exchanged glances. Joseph was wrong, we knew, unless something quite outside our previous experience had happened. We were looking at the display which showed the state-of-mind indicators and vital signs of the gamesters, and they were not good. For all but one of them, the fantasy should have terminated at least 15 minutes ago.

The tell-tales clearly indicated nightmare, and Joe was not intervening.

"Joe", I said, forcing myself to keep calm. "Read out Pamela's vital signs".

"Physiological signs normal. Subject Pamela is currently experiencing unconsciousness.

"Exactly, Joe. What is the value of that? Unconsciousness is a non-experience". Joseph went quiet. We were used to response in under a second; anything longer was unsettling.

Eventually, he responded: "Pamela's conditions is necessary for continuity of game for other players".

"The hell it is, Joe", exploded Conrad. "Read me Don's dol-factor".

"8.85". Eight point eight five dols is no mere headache. It lies a little higher on the scale of pain than a severe coronary. There was no avoiding the conclusion: Don was being tortured. The story was the same for them all, except Dirk. All showed either physical pain or anxiety. Joseph's program should have detected this and woken them, but it had not.

"Joseph", I said, "all the players except one are in nightmare phase. Terminate the game."

"I can't do that, Geoffrey", Joseph's voice remained exasperatingly level.

"Check the articles, Joe", I persevered.

We left Joe to his meditations, left the control room, and went down the short, connecting corridor to the terminal room. Inside, there were eight couches. Seven were occupied; two of the occupants were female. Each of the seven wore a suturecap, effectively connecting their brains to Joe and the game program he was running. "Mainlining dreams", Conrad had dubbed it, an assessment too acutely accurate to be funny.

I paused by Pamela. Behind the lids, her eyes were motionless, confirming the fact that in her dream, she was unconscious, an apparent contradiction in terms. She was not my girl, but she was my friend, and I wanted her out of there. Conrad moved to Don's couch.

"Wakey, wakey", he said, and severed the connection.

Don shot to a sitting position, his eyes circular with terror, gibberish streaming from his mouth. It lasted only for seconds, for, with equal suddeness, he slumped back onto the couch. We sprang towards him. His heartbeat and respiration had stopped. We tried to start him up again, but in vain. It was as if his soul had been scared from his body. Now we, Conrad, Joseph and I, had to dicover just what had gone wrong with the game, and to free the players from it. Nor did we have time to plough through the program and data segments; the game was implemented by a program of nearly one million Analex clauses, each capable of generating from one to a hundred parallel processor instructions. The game itself boasted an incalculable number of states and substates. To conduct a rigorous analysis would take us — Joe included — until the middle of the next decade. With time clearly running out for the players, we needed a short cut to an answer.

Conrad and I slumped, impotent, in in front of the console. Our attention was fixed on that portion of the display devoted to the other girl gamester, Elspeth. Her physical exertion and anxiety factors were high and rising.

"She's being chased", suggested Conrad.

"And probably suffering slow-move, too", I said. Slow-move was the term we had given to that kind of dream where escape is vital, yet the dreamer feels as if he is forcing his way through invisible treacle. Try as we might, we had been unable to eliminate it from the fantasy, for it was a function of the dreamer's mind, not Joe's program. Elspeth's anxiety suddenly peaked, then dropped, along with all her other state-of-mind telltales, to zero. Her exertion counter fell as well.

"Look's like something has slapped a sleeping spell on her", I said.

"Or a rag soaked in chloroform", added Conrad. "Look, since the girls are both out cold, let's try disconnecting them".

I shook my head vigorously. I could not bear the prospect, slim as it might be, of seeing Pamela or Elspeth screaming their last seconds of life away at some unknowable terror. I said: "Joe denies all knowledge of whatever has gone wrong. That means that it must be due to one of the players, not one of the game's automata".

"Someone has unearthed a bug in the program", Conrad agreed, "and is using it to run the fantasy to his own advantage".

"It looks like it. Dirk"?

"He's the only one who's enjoying himself", said Conrad. Although circumstantial, it was damning evidence. Waking Dirk, however, could have unpredictable results. It might kill even him. Conrad said, with forced casualness: "I think someone's going to have to go in there". He shouldn't have had to say that. As the controller and overall designer of Project Fantasy, I had been trying to hide from that conclusion.

After a few minutes preparation with Joe, I lay down on the spare couch in the terminal room. Conrad fitted the suturecap. He said: "I'll watch your state of mind. If I see signs of flight, I'll bring you out".

The narcocurrent went on, and then suddenly I was standing on a boundless savannah, hot sunlight beating down on my bare back. I was, to say the least, annoyed. Consequently, I said, clearly and loudly: "Hint please".

"Search your pockets", said Joseph from nowhere. "That will cost you 10 points".

I did as he suggested. I found just one item; a piece of paper with the number 111 scrawled on it.

Well, that was easily solved. As the only possession I had other than the trousers was a watch, I used it and the sun to determine which direction one-eleven degrees was, and set out that way at a loping trot.

Distance did something unnatural then, since I had solved the first part of the game Joe was presiding over, and after running for less than five minutes, I found myself in a rocky valley. Some caves were visible in the sides of the canyon, as numerous as holes in Emmental cheese.

Soon, I was at the entrance to a cave. It possessed a massive, wooden door that, although it stood open, was clearly capable of being closed and barred. In the sandy floor of the cave, were several sets of footprints. I could see two sets smaller than the rest; Pamela's and Elspeth's. So this was the way they had gone in.

Momentarily stumped, my gaze fell on a great rock slab, which lay at an angle of 45 degrees, and formed the lower wall of the cave at one point. On examining it, I saw that hand and foot holds had been worked subtly into its surface. I scrambled up it.

The top of the slab was in fact a *trompe-l'oeil* which concealed a crevasse, into which a staircase descended.

Down I went. At the bottom, was an anteroom from which passages radiated in several directions. Originally, the chamber would have had a guardian, but the others had probably scared him off or despatched him.

The floor was rocky here, so there were

no more footprints. Each way was therefore as good a choice as any other. I chose one, marked it by dropping the scrap of paper next to it, and started down it.

Soon, I wished that I had chosen differently. I arrived at a side chamber, in which was an unforgetable scene. It was a torture chamber. Among other examples of medieval information-retrieval technology, was a rack.

Don's cadaver was stretched upon it.

"Hello, there", said a poisonous voice.

It was an orc; we borrowed the name and description from Tolkien, but this orc was dressed in the leather trousers and black hood of a master torturer. He held a rapier at my throat. "Which of my toys would *you* like to try"? he asked.

Joe had obviously provided a means of escaping the torturer, but I wasn't here to play. I said: "Uncle".

This was the code word that put my part of the game into debug mode. The orc froze into immobility, as did the pendulum with its evil blade, and the flames dancing above the brazier.

I left the torture chamber. Armed with the rapier, I was confident of my ability to deal with any automata that might cross my path. So it seemed; I despatched an axe-wielding dwarf and an ugly, man-sized lizard that objected to my crossing the bridge it guarded. I availed myself of the dwarf's axe; a rapier is a superior weapon, but can't be used to chop doors down.

I came to a door in the gallery along which I was walking. Through its barred window, I could make out two of the male players, Abdul and Frank. They were chained to the wall, and had been stripped to the waist and beaten. They seemed only half conscious.

I smashed the door down with the axe, and entered. About 1m. in front of them, a drip fell from the ceiling. It splashed against the floor, and trickled down a crack between the flagstones. As a form of torture, it must have rivalled the rack when they were able to appreciate it and thirst after it. I collected a double handful and dashed it in Abdul's face, then fetched more and held it for him to drink.

"Geoffrey", he gasped, when his throat was moist enough to speak through, "What are you doing here"?

"There's a game malfunction", I replied superfluously. I started to collect a drink for Frank. "What happened to you"?

"It was Dirk", accused Abdul. "He broke away from the exploration party. Then, we were attacked by a party of trolls, who overpowered us. I tried to wake then, but could not.

"Frank, Pamela and I were taken — the others escaped. We were brought to the Great Hall, where Dirk was enthroned amid an entourage of orcs, dwarves and elves. He ordered some of the elves to take Pamela somewhere, which I did not hear. Then Frank and I were dragged here, lashed and left. Geoffrey, what has happened"?

Yet I could not answer him, though I felt Dirk lay at the root of it. Frank had not responded to my attention. "Abdul", I said, "I'm going to get Joe to wake you up".

Abdul and Frank vanished, as I ordered Joe to wake them. I had no fears for them. Unfortunately, the mechanism of debug mode was such that I could only influence local events. In particular, there was no machinery in the program to provide clairvoyance and thus find Pam and the others. However, there was one facility I could use as long as I knew where I wanted to go. I ordered Joe to transport me to a side-chamber of the Great Hall.

Cautiously, I looked out into the Great Hall. A Mephistophelian scene greeted, or rather assaulted, my eyes. The Great Hall certainly deserved its name. It was large enough to berth a cruiser. It was lit by many open hearths and yellow-flamed torches, so that the overall illumination was a lurid orange. Here and there, vast carcasses rotated on spits. At the far end of the Hall, I could make out a dais, upon which an indistinct party were seated. Before the dais, a pair of tumblers entertained.

I had Joe beam me to a nearer ante-chamber. I was wrong about the tumblers. They were gladiators. At least they were automata. Wrong again. Even as I recognised him, Grant, the last of the male players, crashed to the ground, his heart pierced. It was too late to help him; if the no-exit bug had got him, he was dead, if not, he was sitting up in the real world, dazedly removing his suturecap.

The other gladiator spurned the body, and dropped his sword. An elf brought him a goatskin, from which he drank mightily. Only a player would drink, or indulge any of the pleasures of the flesh. It was Dirk.

"Is my bride ready"? he demanded in a mellow, bass voice that was his only in dreams.

"She awaits you in the Blue Room, Sire", responded a dwarf butler. Dirk's animal roar of lust and triumph was cut off as I beamed to this Blue Room. The colour even extended to the nightgown worn by the girl who sat at the dressing table, brushing her hair slowly and deliberately. Mindlessly.

It was Pamela, more beautiful than in life. Entranced, I walked towards her.

A terrible suspicion gripped me.

"Uncle", I said. Pamela froze. I wanted to scream. Somehow, Dirk had emptied the mind from her simulacrum, replacing it with an automation. It made a female android look like a clockwork toy.

"Joe", I whispered, "evaporate this automaton."

"I can't do that, Geoffrey", replied Joe. "Simulacrum is also that of player Pamela".

"What's her gamestate"?

"Unconscious".

"Wake her".

"Directive not compatible with continuity of game for other players".

"What other players, Joe. List just the conscious ones".

"Yourself. Dirk".

"Dirk is malfunctioning; you said so yourself only an hour ago". It seemed like a week.

Joe didn't answer — my last sentence was neither question nor command. I breathed in deeply, and said, "Double-uncle, Joe. Wake Dirk". There was a pause, long enough to tell me that the directive had failed.

Joe said, "Subject Dirk cannot be woken". I came to a conclusion that I should have reached long ago. I was going to cut Dirk's wires and see what happened.

"Wake me", I snapped.

"I can't do that, Geoffrey", replied Joe. I felt an icicle sliding up my spine. "Broadcast to Conrad", I ordered. "Tell him to pull my plug".

"I'm sorry, Geoffrey", said Joe, bland as ever, "but I cannot make that directive available to you". The icicle pierced my heart and carried it, skewered, up to my throat. I was trapped in Dirk's dream. Dirk, who had found a bug in the program and learnt to exploit it — and who was mad.

First things first, I thought. I said, "Pamela is asleep. Hint, please". Hint was a legal function of the game. Since I wasn't playing for pleasure, the 10 points it cost did not concern me. Joe said: "She has looked into the Eye of Morpheus". We had given Joe a huge database of legend, mythology and even science, to enable him to invent spells, artefacts and creatures to populate the caves. It was easy to guess what this Eye of Morpheus was, or rather, what it did.

However, if a sleeping spell — or even a blow to the head — rendered a player "unconscious" in the game, Joe should have offered the player the option of leaving the game. It's no fun playing at being unconscious, after all. We waste a third of our lives in sleep as it is. Therefore, part of Dirk's power must lay in the suspension of Joe's ability to distinguish players from automata.

So much for theory. "What is the antidote"? I asked.

"Smash the Eye", replied Joe. "Beware of looking into it".

"Transport me to the tap room", I ordered. I struck lucky, for immediately outside the tap room, in the Great Hall, I found Dirk's dwarvish manservant.

Racking him was not a pleasant task. Eventually, he broke and told me where to

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find the Eye, and in his pocket were the keys to the chest it was kept safe in.

I transported to the vault which held the treasure chest. Looking around, I saw a mirror, which I used for examining the contents of the chest after opening it. That strange crystal, whose mere reflection seemed infinitely deep and eternally fascinating must be the Eye. I pocketed it carefully.

Smashing the crystal proved a problem. Looking into it was obviously fatal, and I discovered that I could not strike an adequate blow with the axe while looking in the mirror. Throwing the crystal against the wall was equally ineffective, and finding it again afterwards using the mirror was time-consuming and nerve-wracking.

The answer, once I thought of it, was elementary. I tossed the wretched thing over my shoulder into the crevasse. The time it took to drop, which my watch measured as about two minutes, seemed like an hour. When it finally hit bottom — or maybe one of the bridges lower down — Pamela blinked and snapped into life.

"Do you know the way to the Blue Room"? I asked. She nodded.

"Come on, then", I finished. The hue and cry seemed to have died down by the time we reached the Great Hall. We took a parallel passage towards our immediate objective. "We're nearly there", said Pamela. "Quiet, now".

We came to the room. Its door was locked, but the key was in the hole. We entered. Sure enough, Elspeth was there. The smashing of the Eye of Morpheus had apparently freed her as well, for she was immobilised with good-old-fashioned rope. Her eyes telegraphed relief at the sight of us, but she had enough sense not to cry out.

We left the Blue Room, and hurried back, via the passage parallel to the Great Hall, although it was now deserted. Over the Lizard Bridge we went, past the torture chamber, and thence to the multi-passaged anteroom at the bottom of the wooden staircase.

"Did the door slam on you"? I asked them.

"Yes", answered Pamela.

"Good", I said. I had passed through it after them, so it must be capable of being opened. "Up you go, Elspeth".

She started up the ladder, but was only a few steps up, when she gave a shrill cry and fled down again. I flashed my torch up there, and saw the reason. The cave above was swarming with orcs, some of whom were starting down the ladder. We turned to flee.

A black tide of orcs and trolls flooded in through every one of the passages leading from the anteroom. They overpowered us by sheer weight of numbers.

I awoke in the torture chamber. My next realisation was that I was strapped on the rack. I nearly fainted at the memory of Don lying there. As my vision cleared, I saw Dirk. He sat on a sedan chair, which had been set in one corner. He sipped from a golden goblet, which was replenished by an elven-lass as I watched.

"Dirk", I cried. "It's me, Geoffrey. What are you playing at"?

His eye became unfocussed, as he replied, or rather, incanted, "In the beginning was the Lord, and the Lord made the Labyrinth. Then He sent his only Son to the Labyrinth, to conquer and rule for His greater Glory. And the Son ruled over the Labyrinth for all Eternity".

"Amen", muttered the automata in a ragged response. Dirk looked at me again, and there was mania in his eyes.

"Behold the Son", he said.

"And what is outside the Labyrinth"? I asked.

"The question is meaningless", responded Dirk. "Can you pass through the walls of the Labyrinth"?

That was the end of my verbal ammunition. Dirk had created a religion and made himself its Messiah, but had avoided the stumbling blocks of syllogistic argument against that religion. The problem of pain, for example. Dirk's subjects were to suffer if he so desired.

"Enough talk", ordered Dirk. "I tire of these discussions. Goodbye, stranger Geoffrey, whoever you were".

"Wait", I shouted. I was not confident that being tortured to death for a good cause in this world would take me to the right next world. "Do I speak to the slayer of Grant Cameron"?

"You do", admitted Dirk. He waved the servants away from the sedan chair. "Slain by the Son was he in fair fight, in trial by combat, for he was a heretic, whose impious tongue preached that the Labyrinth was made by men such as himself".

"Then I so assert", I roared. "You are a madman and a liar, even unto yourself, for this world is a game, made by a machine, controlled by myself".

"If you control this world", countered Dirk, "you should be able to do this". As he spoke, three orcish servants popped out of thin air in front of him.

"You are a thief, too", I claimed. "For you stole that power from me. I demand trial by combat".

"So be it", he roared.

The scene wavered, and I was standing by the Lizard Bridge. On the other side was Dirk, and, in the middle of the bridge lay a single knife. The chamber was otherwise empty. Dirk obviously felt no need of spectators.

"You may make the first move", he said.

I stepped forwards, and, in the blink of an eye, Dirk had the knife and was crossing the remainder of the bridge. Fair fight indeed. I stood my ground, and hoped that the advantage he had written into the program for himself extended only as far as gaining the weapon. A seeming eternity ago, Pamela had told me some of the principles she had learnt in her martial arts class. I hoped I could remember what I'd mocked at.

As Dirk lunged, I stepped back and to one side, and raised my forearm to stop the knife swinging after me. It seemed very smooth, and I realised with a thrill that Joe was implementing perfectly the action I desired; in this world, skills could be learnt by word of mouth. I caught Dirk's wrist, and, for want of knowledge of a more vicious technique, smashed my clenched left fist into his nose. For an instant, his eyes watered, as Joe's anatomical database dictated. It took Dirk just that long to exercise his power; the power to change the game's parameters as he wished. The tears vanished from his face like the morning dew from a hillside.

In that instant, I swept his arm down behind him, and, hanging on to it with both hands, I managed to drag him to the ground. I had hoped to hustle him over the cliff edge, but no such luck. But, by forcing his hand over the edge, I had the satisfaction of seeing the knife drop. It was a short-lived glory, though, for, as he threw me from his arm like a small terrier, I realised that the knife had been my only chance. Thwarted, he had abandoned all pretence of a fair fight. He gained his feet, kicked me in the ribs, then bent and lifted me above his head, as if I weighed nothing.

He held me over the cliff edge. "The Lord has given his verdict", he cried. "Now the Son will carry out the sentence". His body vanished. I fell, hit the edge on the way down, and lost consciousness.

To awake on the terminal couch. For a second I was disorientated, then, frenziedly, I tore the suturecap from my head. Conrad rushed to me from Dirk's couch. "Geoffrey", he said. "It's alright, this is the real world".

I slapped his arm. "I'm fine. I saw Frank and Abdul standing over Dirk's couch; they were alright, too. As I watched, Pamela blinked and sat up. Elspeth did likewise, simultaneously.

Conrad said, "I saw you and he were fighting. When I knew you were losing, I came in here and pulled his cap off. It was him or you". Dirk was not dead, though. His eyes moved beneath their lids, testifying to a dream.

"He vanished from the game when you cut him off", I said. "It was lucky his power died then, or we'd not have made it back".

"It didn't die", said Elspeth, suddenly. We looked at her, then at Dirk, lying there in his dream world.

"He took it with him", she finished, "forever".

Views on telesoftware display standards

CEEFAX and Oracle have now become familiar to most of the population as a method of putting written text on to domestic television screens via the broadcast television signal. They offer from 100 to 800 pages of what their editors think is useful information.

Prestel is the logical extension of the Ceefax/Oracle idea. Instead of picking the information from the broadcast signal, it is sent directly from a computer over the public telephone network with hundreds of thousands of pages at our disposal.

Prestel has not so far been as successful as British Telecom had hoped. One answer is for the Prestel service to offer more than just the normal information pages. Telesoftware could make the whole system cost-effective to all concerned. It could even become the Prestel lifesaver.

The Prestel service is actively encouraging interest in the telesoftware concept. This is where we, the potential

by Peter Blower

users, have the best chance of saying what we want and providing standards which make telesoftware simple, cost-effective and foolproof.

Who will use telesoftware? At first, mainly schools, colleges and universities, followed by small-business and home-computer users. In time, the business users will probably move to the fore with growing confidence in the system, followed closely by the scientific establishment, with home-computer users bringing up the rear.

One prime example of telesoftware's potential is in the field of educational programs. A student or teacher could produce a program to MUSE standards and submit it to a MUSE-approved information provider (IP). In turn, the IP would either buy the copyright or pay royalties to the author. The program is offered as telesoftware pages to anyone who wishes to purchase it — anywhere in the world where international Prestel operates.

If the program is good, more and more places of learning will find themselves teaching to a common standard. In the meantime, if someone else can write an improved program, this will replace the original. A recipe for ever-improving programs.

The programs should be inexpensive enough to be accessed by many users so as to make the problems of copyright infringement virtually disappear. Telesoftware is a general term. It does not specify whether, for example, Basic, Pascal or machine-code programs will be contained in the telesoftware pages, but it must cater for all. Clearly, problems of page formatting and interpretation must be considered.

At present, there are three versions of telesoftware on the Prestel system. All three use Basic. The methods of implementation should allow the receiving software to be reliable, flexible, compact, efficient, inexpensive and as far as possible independent of machine or monitor.

CET — the Council for Educational Technology, page 21143 — invited computer manufacturers, software agencies and representatives of Prestel to discuss the formulation of recommendations for the telesoftware format. I note that no representatives for the users were invited.

Its version has all ineffective spaces removed allowing greater packing density. Spaces are replaced by ¾ on the assumption that some spaces are stripped off and replaced by CRLF — carriage return, linefeed — by the Prestel system. Both British Telecom Research Department and GEC seem to disagree — GEC's version leaves spaces intact. Even if spaces are stripped off, the frames can be edited to correct this.

Space replacement has to be reconverted to spaces at the receiving end requiring extra software, extra machine time and extra expense. Furthermore, those users who need to examine the Prestel frames directly will find them almost unreadable.

An escape character is defined by CET as character 7C Hex, 124 decimal, in the Prestel Go character set. This is not to be confused with the Prestel escape control character, 1B Hex, which is used to access character subsets.

Escape L is used to denote the end of each statement line and it is this which the receiving software uses as CRLF. Transmitted CRLFs are ignored.

Escape A and escape Z denote start and finish of the telesoftware block. Appended to the block is a block check sequence of up to three decimal characters. The block check is based on a calculation using XOR and ASC functions. These are recognisable as Basic commands.

This is unfortunate, as the local calculation will have to be performed using either the local Basic interpreter of which there are many different versions or special software for the purpose. Finally, escape F is used to indicate the end of the program.

The CET version is only really suited to a fast decimal-orientated computer running Basic. The format is unnecessarily complex and expensive to implement. In conclusion, this version should be avoided.

The British Telecom Research Department (ResD), page 64025, and page 338252, have worked together to produce a far more sensible approach. Again, extensive use has been made of character 7C Hex, 124 decimal, which I will call the escape character.

A header page provides a list of programs and the page numbers where they can be found. It is set out in such a way that the user can type the name of the program he wants, the local software will check the name against the list and automatically call the page where the program starts.

As with the CET, this format uses statement compression. The end of each statement line is terminated with an escape character in place of CRLF, followed immediately by the next statement. Line 23 of the Prestel page is reserved for page pointers and page check-sum. This line gives the local software the present page number and the next page number followed by a two-digit check-sum.

Elegantly simple

The check-sum uses the 16 characters A to P — 41 Hex to 50 Hex — as an elegantly simple means of providing 256 check-sum combinations suitable for all eight and 16-bit computers. Where there is a check-sum mismatch, the current page would be recalled, otherwise the software calls the next page as a unique page number.

This method does not use the more usual single-digit access to the next frame — each page is divided into 26 frames a to z — but uses direct page access. The virtues are difficult to find and must cause more problems than they solve, particularly if a corrupted page number is received at the Prestel computer.

When these programs are viewed as Prestel pages, they are not easy to read, but, they are much better than the CET version. In my view, it is a reasonable compromise between space saving and readability.

IPC *Practical Computing*, page 45631838, uses a completely different presentation from CET, GEC and ResD. To quote the Appletel telesoftware page for Apple Basic:

@ PROGNAME @ c/f

Progname is the name of the program and the @ signs delimit it. The c/f means that this is frame c while the whole program occupies frames a to f. The last line of the program is followed by @ END @.

There is no statement compression in this version. Each statement appears on a different line from the rest. However, some statements are longer than 40 characters and have to be continued on the next line. In this case a % sign precedes the continuation line. The %

sign instructs the receiving software to ignore itself and the preceding CRLF.

Some Basic interpreters and compilers use the @ symbol in Print @ statements, also @ and % are valid characters inside Print statements and therefore, they should not be used as control characters, which is the case here.

To be fair, the Appletel telesoftwre pages are very easy to read and demonstrate a very simple method of downloading software from Prestel to remote computers.

In all three versions, use has been made of valid ASCII characters as telesoftware control codes. Where these codes fall naturally in a program, they will cause interpretation errors. A method which overcomes this and makes the program more readable is to use the Prestel control and extension codes.

For example, a statement line would begin with escape, 1B Hex, D followed by the line number; the rest of the line would be preceded by escape G. Visually, the line number is shown blue while the rest of the line is white. CRLF is inserted when any new escape character combination follows a text line, all transmitted CRLFs are ignored. Similarly, frame check-sums would be preceded by escape A — colour red — and would also serve as end-of-software frame marker.

The header page, the page that lists all the available programs and their respective page numbers, should be retained. There would be an advantage in displaying the page numbers in different colours, a different colour for each program or listing type.

Because of the many variety of programs and program types, a preheader page would be useful, classifying programs by type. These may be: eight-bit machine code, eight-bit assembly progrmas, 16-bit machine code, 16-bit assembly programs, high-level programs (1), high-level programs (2), etc. For example: header-page escape codes for eight-bit assembly programs.

Escape A (red)	— CP/M, MP/M
Escape B (green)	— 8080 (Z-80)
Escape C (yellow)	— Z-80
Escape D (blue)	— 6800
Escape E (magenta)	— 6502
Escape F (cyan)	— PLM/80
Escape G (white)	— Spare

The header page for machine code would follow a similar format. For example: header-page escape codes for hgh-level programs (1).

Escape A (red)	— Basic
Escape B (green)	— Pascal
Escape C (yellow)	— Algol
Escape D (blue)	— Cobol
Escape E (magenta)	— Coral
Escape F (cyan)	— Fortran
Escape G (white)	— APL

Each frame of software will need a start-of-frame character. This will guard against rubbish listings being entered into the receiving computer if an incorrect frame is transmitted or the Prestel system fails. It becomes a convenient marker for the receiving software to start its check-sum calculations and it allows the telesoftware content of the frame to start on any line.

The 7C Hex character mentioned is one of the most infrequently-used codes in the Prestel system and, as such, is the most suitable character to perform this task.

It is almost essential to have some form of checking ability against wrongly-received characters. The check-sum process adds the Hexadecimal value of the character just received to the previous character value. It continues to do this for every character until it is told to stop. The number remaining is compared to the number set aside at the end of the frame.

If the two numbers are not the same, the receiving computer must assume that there was a transmission error and ask for the page to be transmitted again, free of charge. If the two numbers match, the computer automatically calls for the next frame.

Error detection

The check-sum calculation adds up to 256 — eight bits — then starts again from zero. In this way, fast calculation from two characters A to P will give error detection in the ratio 1 to 256. The two check-sum characters can be combined with either the end-of-frame or the end-of-program marker.

The end-of-frame marker escape A instructs the software to suspend transfer and check for errors. If the transfer was successful, the software has time to place it wherever it wishes and calls for the next frame by transmitting the hash character to the Prestel computer. The software will then lie idle until character 7C Hex is received.

If that character is not received before 23 CRLFs have been transmitted, the software must assume a failure and call for a frame repeat, the same procedure as the check-sum mismatch.

If, say, five successive frame repeats have been called without success, the software must assume a system failure and abort. The receiving computer reverts to a simple Prestel terminal.

The end-of-program marker escape B instructs the software to suspend transfer and perform all the tidy-up operations as in the end-of-frame procedure, but instead of calling for the next frame and waiting for character 7C Hex, it calls the next frame and then immediately reverts back to the Prestel terminal mode.

The end-of-frame marker occupies only three character positions at the end of the software block and can appear anywhere on the screen. It also allows the last line — line 23 — to be used, like the rest, for telesoftware information. Compared to the ResD/GEC version, this makes extra characters available and more than compensates for any overheads incurred.

Example of escape codes when used in telesoftware frames.

Character (7C Hex)	— start of frame and check-sum calculation
Escape A (red)	— end of frame and check-sum
Escape B (green)	— end of program and check sum
Escape C (yellow)	— spare
Escape D (blue)	— line number — field 1
Escape E (magenta)	— field 2
Escape F (cyan)	— field 3
Escape G (white)	— text line

Codes for extra fields have been included for use inside the text line. These could be used for indicating indents, tabs, two-part text lines, space compression, etc.

In high-level languages such as Basic, the text is preceded by a line number. The total line length would not exceed 128 bytes.

(escape D) 10000 (escape G) LET N = 20: FOR Y = 2T015:FOR X = 0T07: PRINT N: LET N = N + 1: NEXT X: PRINT: NEXT Y

Visually, the line would appear:

10000 LET N = 20: FORY = 2T015: FOR X = 0TO7: PRINTN: LETN = N + 1; NEXTX: PRINT:NEXTY 10010REM

The line numbers 10000 and 10010 are coloured blue and the rest white. The escape and the following character A to G appear on the screen as a single space.

Assembly listings have two common formats. A short version giving line number followed by mnemonics, e.g.,

0210 LABEL PUSH HL; Save it

Again, the line number is coloured blue and the rest of the line coloured white. The longer version gives a Hex memory location and a Hex representation of its contents, OP code, in addition to the short form, e.g., 106B E5 0210 LABEL PUSH HL; Save it

Use can now be made of the field 2 and field 3 codes. The field 2 code escape E shows the number 106B in magenta and indicates to the receiving software that this number is a Hex memory location. The field 3 code escape F shows E5 in cyan and indicates the E5 is the contents of memory starting at 106B. The rest of the line is exactly as for the short version.

Machine code would have to be dealt with in a special way. It uses all 256 combinations of eight bits. These codes cannot be transmitted directly by the Prestel system. By representing each byte as two Hexadecimal digits, the problems could be overcome. The string would have to start with a memory address to anable direct memory loading, e.g.,

AAAABBbbBBbbBBbbBBbbBBbbBBbbBBbb BBbb

where AAAA = memory address

BB = bb = 1 byte (hexadecimal notation)

or pratically:

1DE0 F5DB04CB4720FA7EB72805D3052318F1 F1

In this case, there are two logical ways of assigning escape codes. The first, is to treat the Hex listing as an ordinary listing and assign escape D blue to the memory location and escape G white to the rest. The second is to regard the Hex listing as the first part of the longer assembly listing

(continued on next page)

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where escape E was used for memory location and escape F cyan for the successive contents.

Of the two, I prefer the second, mainly because the escape codes have a clear meaning and allow the receiving software to differentiate between Hexadecimal addresses/code and text in any listing.

The receiving computer would have to operate in two modes. First, a normal Prestel terminal. Second, a Prestel terminal capable of displaying Prestel frames, recognising software blocks, checking and resolving errors, disposing of the received software and calling for more software blocks.

At this level, the software is not concerned with the type of program being received, only where the software starts and finishes in a frame, the check-sum calculations and where it should put the software.

Once the receiving computer has been disconnected from the Prestel system, the software can then process the telesoftware program into a form which will mate with other programs. Where listings are concerned, the software will probably try to simulate the console keyboard and so gain access to the mating programs without having to alter them.

This is a section of software that is monitor-dependent, but in trade-off terms, it is the lesser evil. Machine-code programs, however, need to be translated from the Hexadecimal representation back into machine code and be loaded directly into memory.

The major problem now is to create software which will allow the majority of small computer systems to behave as Prestel terminals and receive telesoftware. The early beneficiaries will be those users running the CP/M operating system, Apples and Pets. The software will be in modular form and conceptually very similar to the CP/M structure.

The core of the software, i.e., main program and various subroutines, would be completely machine-independent. The remaining I/O subroutines, which must, communicate with the monitor, keyboard, screen, storage device, etc., would have to be tailored to suit each type of machine.

Many small computers have screens of 48 to 64 characters by only 16 lines. The Prestel page is 40 characters by 24 lines. The cheapest way to overcome this problem is to write software which allows split scrolling of the screen. Later, if the user wishes, he could probably purchase hardware which outputs a 40-by-24 screen in colour. Personally, I would wish to see hardware designed for one 80-by-24 industry standard for normal computer work and software — switchable to double-width character mode 40 by 24 for Prestel use.

A simple MODEM would be required to convert RS232C/V24/current loop signals used by the computer to tones used by the Prestel system. The computer would have to be able to receive and transmit at different speeds. Another method would be to connect to the cassette/printer interface of a Prestel adpator such as Tantel currently priced at £170 + VAT.

The typical cost for Prestel/Ceefax/Oracle colour receiver is about £1,000 to buy and £300 a year to rent. A small computer costs from £400 to £2,000. At present price levels for small computer systems, one could expect to pay the following to convert the small computer to receive telesoftware.

Hardware:	
Prestel telephone MODEM	£20 — £60
screen hardware	£100 — £250
Prestel adaptor	£170 — £300
Software:	
for terminal only	£20 — £60
terminal and telesoftware	£30 — £150
telesoftware only	£20 — £90

If you already have a computer system, the cost to receive telesoftware could be as little as £50 but could be as much as £550 or more, depending on the type of system.

Clearly, the whole concept of telesoftware is too important to be reduced to a number of incompatible "hotch-potch" systems. As with any new idea, the setting of standards is paramount. All of us now have the opportunity to put forward our views, and this is the time to put pen to paper and write to this magazine. Over the next few months, I hope to hold a running discussion on the whole subject. I also invite British Telecom to take part. With effort, all interests should be satisfied.

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In the second part of his series, Charles Somerville exposes the pitfalls which lurk in the apparently innocent-looking subject of data input and validation.

Coding data validation for your business

ANY PROFESSIONAL programmer will probably tell you that coding data-validation routines is a lengthy, repetitive and boring process. For this reason, correct and thorough validation — though vitally important — is often neglected. Nothing ruins the usefulness and reputation of a computer system more than the havoc wreaked by one bad piece of information propagated throughout the system.

On the small, interactive type of computer system which you are using, data input and validation take up an even larger proportion of the coding in a typical application than with the larger, batch systems of the past.

Nevertheless, all you type into the computer can be classified into a small number of data types, each with obvious validation rules, so why should you have to re-invent the wheel?

Data entry takes the form of a dialogue between the computer system and the user. Typically:

- The system asks a question
- The user replies
- The system checks the validity of the reply
- If the reply is found to be invalid, the system sends an error message which informs the user of the fact. The system then returns to the start of the dialogue to ask the question again.

This apparently simple chain of events can be made most effective by observing five basic rules. Be consistent, explicit, and concise, keep keying to a minimum and expect the user to make mistakes.

Consistency is vital in questions and in the expected form of replies and error messages. The consistency must embrace format and vocabulary. Do not ask

NAME ?
CUSTOMER NAME

and

ENTER NAME

at different points in the program, when you require the same information on each occasion. If you are asking the cost of an item, do not expect the reply in the form 47p at one point and £0.47 at another.

When you ask a question or display an error message, be explicit. Explain exactly what information is required, or what was wrong with the information input. Never just say

INVALID DATA

and leave the user to discover why it is invalid. If the user is expected to re-enter the data, then say so, do not leave him watching the screen expectantly.

A user will normally find it easier to absorb from the screen any information which does not have to be consciously "read". So, keep questions and error messages short. Unfortunately, being concise may conflict with being explicit: a compromise must be chosen, but to ensure that the user is not left wondering what on earth to do next, our input routine will implement a "Help" facility. This is something normally found on much larger computer systems.

The idea is that by pressing a special 'help' key or typing

HELP

the user can call up a special display, which will explain how to proceed, or what may have caused an error. This means questions and error messages can be kept concise — but still explicit, of course — and the user can be given extra guidance only when it is required.

To be of maximum value, this facility must always be available throughout the program, and the help messages must also follow the rules concerning consistency.

The more a user has to type on the keyboard, the more opportunity there is for error. Careful thought in designing a system can minimise keying. Why continually force the user to type the current date when it can be used as a default answer to the question

DATE PAYMENT MADE:

if the user presses the return key? Similarly, there is no point in allowing the user to misspell London, North or South when a single digit could select the correct choice from a list displayed on the screen.

Never assume that valid data is correct. Just because the user has entered data, it does not necessarily mean that it is the correct one. Before committing the data to disc, especially if existing data will be overwritten, always ask

ARE ALL DETAILS CORRECT?

and if the answer is No, go back through all the data entered — up to the last time this was asked, if necessary.

Now, back to the different types of data. The information required from the user in any business-orientated computer system can normally be categorised into the following types:

- Numbers, e.g., account number, quantity ordered
- Monetary amounts, e.g., item price, payment made
- Dates, e.g., date of birth, date account opened
- Confirmation, e.g., replying Yes or No to ARE ALL DETAILS CORRECT?
- Strings: this covers everything we have not listed e.g., names, addresses

and each type of data has a set of validation criteria. When asked for a number, the user's reply must be totally numeric and must be in the required range. For instance, if you have account numbers running from 1 to 9,999 and ask the user to enter an account number, then 367, 0367 and even 00367 are not acceptable replies, but 10367 — outside permissible range — and 3A7 — not totally numeric — are not.

Monetary amounts are an extension of numbers. A decimal point may be included to separate pounds from pence, and a plus or minus sign could be required to show debit or credit, payment or refund. Currency signs are best not entered as part of monetary amounts.

If you work in only one currency, what is the point in creating extra keying. For multiple currencies, the sign alone is often not sufficient to differentiate; let the user select from a list instead.

Dates create more confusion than anything else in data entry. Would you write May 3, 1973 as 03/05/73, 3 May 73, 05/03/73, or in one of the many other possible formats? A really slick program would try to make sense of any type of date format, but on a system with a limited amount of memory and used regularly by the same few people, it is best to keep to one format.

This month's routines ask for the format DD/MM/YY. That is: May 3, 1973 would be written as 03/05/73. Of course, besides checking that the date is in the correct format, the validation must also eliminate such dates as 03/00/73, 03/13/73.

Yes and No are the only possible valid replies to questions asking for confirmation, but it is helpful if the shortened forms "Y" and "N" and replies in both upper- and lower-case can also be recognised.

Strings take the form of names and addresses and so forth. The only validation possible from a general-purpose routine is that the string is between specific lengths, say, six to eight characters for a post code. As mentioned, if the reply must match with one of a number of alternatives, presenting a list on the screen and allowing a selection by number is the best course.

We can now sum up the facilities which will be required of a general-purpose, data-input and validation routine:

- It must be capable of reading input from any desired point on the screen
- It must then validate the input according to the data type and permissible value range
- If the input is invalid, an error message should be displayed and the user asked to re-enter the information
- The routine should be able to accept null input — only Return pressed — when permissible
- A help facility must be provided

To carry out these functions, the routine will require certain information for each item of data to be entered.

- Where on the screen it is to read the data from
- What type of data it is
- For numbers and monetary amounts, the minimum and maximum permitted values
- For strings, the minimum and maximum permitted lengths

- Whether null input is acceptable
- The appropriate help message

The information is passed in a set of Basic variables. The data type is shown by setting TYPE% equal to NUMBER%, AMOUNT%, DATE%, CONFIRM%, or STRING%. All these values are set up as part of the common initialisation routine — lines 30000 to 30999 — which was introduced last month, and is now extended.

CURSOR$ is set to a string which will position the cursor at the correct place on the screen to accept the data. This is done with the FNTAB$ function explained last month.

Imagine that you want to read an account number from line 7 of the screen. You could use FNTAB$ to write

ACCOUNT NUMBER:

beginning on line 7 at column 20, and then use

CURSOR$ = FNTAB$ (40,7)

to read the reply from line 7, column 40 onwards. If the user makes and error and the data must be re-entered, the input routine can use CURSOR$ to position the cursor back to the correct place on the screen.

Minimum and maximum limits for number, monetary amounts and the lengths of strings are loaded into the variables Min and Max respectively.

If a null response is acceptable, NULL% is set to YES%, otherwise it is set to NO%. These values — YES% and NO% — are once again set up in the common initialisation routine.

Since the help messages are 156 characters in length, it is obviously impracticable to include a large number in an average program without using an unacceptable amount of memory. For this reason, they are held on disc and retrieved by number.

This also has the advantage in programming that throughout a suite of programs, the same help message can be used whenever a certain piece of information is input — just by giving its number. The variable HELP% is set equal to the number of the help message for the current data entry operation.

Given all this, we can list the complete code of reading in and validating an account number from line 7, column 40 as before. If account numbers run from, say, 1 to 9,999, the help message number appropriate is 14 and a null reply is unacceptable:

```
CURSOR$=FNTAB$(20,7)
PRINT CURSOR$ "ACCOUNT NUMBER:"
CURSOR$=FNTAB$(40,7)
HELP%=14: MIN=1: MAX=9999:
NULL%=NO%: TYPE%=NUMBER%
GOSUM 31000
```

will return the account number as a string in REPLY$. If the user makes an error, the error message

REPLY MUST BE A NUMBER BETWEEN 1 AND 9999 — PLEASE TRY AGAIN

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```
31000 'DATA ENTRY ROUTINES'
31005 PRINT X0123$ CLE$ X2123$ "FOR EXTRA
HELP TYPE ? AND PRESS RETURN"
31010 XOK%=NO%
31020 WHILE NOT XOK%
31030    PRINT CURSOR$;
31040    LINE INPUT; REPLY$
31050    PRINT CURSOR$ REPLY$ CLL$ X0122$ CLL$
31060    IF REPLY$="?" THEN GOSUB 34000 ELSE
IF REPLY$="" THEN GOSUB 34500 ELSE XOK%=YES%:
ON TYPE% GOSUB 31500,32000,32500,33000,33500
31070 WEND
31080 RETURN

31500 'VALIDATE NUMBERS
31510 XLEN%=LEN(REPLY$)
31520 XCNT%=1
31530 WHILE XOK% AND XCNT%<=XLEN%
31540    XCHAR$=MID$(REPLY$,XCNT%,1)
31550    IF XCHAR$>"9" OR XCHAR$<"0" THEN
XOK%=NO% ELSE XCNT%=XCNT%+1
31560 WEND
31570 IF XOK% THEN IF VAL(REPLY$)<MIN OR
VAL(REPLY$)>MAX THEN XOK%=NO%
31580 IF NOT XOK% THEN PRINT XERR$ "REPLY
MUST BE NUMBER BETWEEN" MIN "AND" MAX RETRY$
31590 RETURN

32000 'VALIDATE MONETARY AMOUNTS
32010 XLEN%=LEN(REPLY$)
32020 XCNT%=1
32030 XDEC%=NO%
32040 WHILE XOK% AND XCNT%<=XLEN%
32050    XCHAR$=MID$(REPLY$,XCNT%,1)
32060    IF (XCHAR$<="9" AND XCHAR$>="0") OR
(XCHAR$="." AND NOT XDEC%) OR (XCNT%=1 AND
(XCHAR$="-" OR XCHAR$="+")) THEN
XCNT%=XCNT%+1 ELSE XOK%=NO%
32070    IF XCHAR$="." THEN XDEC%=YES%
32080 WEND
32090 IF XOK% THEN IF VAL(REPLY$)<MIN OR
VAL(REPLY$)>MAX THEN XOK%=NO%
32100 IF NOT XOK% THEN PRINT XERR$ "REPLY
MUST BE AN AMOUNT BETWEEN" MIN "AND" MAX
RETRY$
32110 RETURN

32500 'VALIDATE DATES
32510 IF LEN(REPLY$)<>8 OR
MID$(REPLY$,3,1)<>"/" OR
MID$(REPLY$,6,1)<>"/" THEN XOK%=NO%: PRINT
XERR$ "REPLY IS NOT IN THE CORRECT DATE
FORMAT" RETRY$: RETURN
32520 XDATE$=
LEFT$(REPLY$,2)+MID$(REPLY$,4,2)
+RIGHT$(REPLY$,2)
32530 XCNT%=1
32540 WHILE XOK% AND XCNT%<=6
```

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(continued from previous page)

will be displayed. If the terminal has a bell, it will sound to alert the user that something is wrong.

How does the routine know if your terminal has a bell? Well, you add an extra parameter to the configuration file which you created last month. BELL$ will be read in after the other parameters, and will contain the string which sets off the bell at the terminal. This will normally be simply an ASCII 07, but may vary.

If your terminal has no bell, just set BELL$ to null — BELL$ = "" — when creating the configuration file. When the error message is displayed, you will also see that the input routine uses HION$ and HIOFF$ from the configuration file to highlight, flash or reverse the error message to make it more noticeable.

If setting up the configuration file seems a chore, remember that once it is set up, it can be used for all your programs.

Only a few more points need to be made to allow you to use the input routine. The input routine passes all data, including numbers and monetary amounts, back to you as a string variable, a REPLY$. In this form, they can be stored on disc, printed or re-displayed. However, if you want to use a value in arithmetic, it must first be converted to a numeric variable of the required type — single-precision, double-precision or integer — by a statement such as

PAYMENT = VAL(REPLY$).

If a null reply has been entered, you may want to display any default signified by this, as confirmation for the user. Say that you are asking for a payment date, and a null reply signifies the current day. If you have the current date held in TODAY$ then

```
IF REPLY$ = ""THEN PRINT
CURSOR$ TODAY$
```

will display it on the screen as if the user had entered it in full.

When asking for a date or configuration — Yes/No — Min and Max are not used. Apart from variables like Min and Max which are set by the caller, most variables used by the input routine have names beginning with "X" to avoid conflicts with application code. Valid replies to confirmation requests are always passed back to the caller as uppercase Yes or No.

Finally, as your terminal will probably not have a Help key, the key used to obtain help will be the question mark. Pressing "?" followed by the return key will give the help display.

To become familiar with the input routine, you can write a program to set up the help file. The program should ask the user to give a number, followed by the help message which accompanies the number. It should do this until a null reply instead of a message number shows that the file is complete.

Read in the message as two strings, each up to 78 characters long. If you read each string starting from column 1 of a line with the prompt displayed on the line above, you will be able to see how the message will look when displayed.

To help you, when you have the message in LINE1$ and LINE2$ and the message number in ID% — use ID% = VAL(REPLY$) — the following code will write out the record:

```
LSET XHELP1$ = LINE1$
LSET XHELP2$ = LINE2$
PUT HELPFILE%, ID%
```

Do not forget to call the initialisation subroutine — Gosub 30000 — at the start of the program, or to use Re-set at the end. You will need to tell the Basic interpreter that you are using records more then 128 bytes in length by starting it with MBasic /S: 156 rather than just MBasic.

Try setting up help messages numbers 1 and 2 for use by the program, remembering to use HELP% = 1 and HELP% = 2 in the program, and then you will be able to use them immediately.

(continued from previous page)

```
32550    XCHAR$=MID$(XDATE$,XCNT%,1)
32560    IF XCHAR$>"9" OR XCHAR$<"0" THEN
XOK%=NO% ELSE XCNT%=XCNT%+1
32570 WEND
32580 IF NOT XOK% THEN PRINT XERR$ "REPLY
SHOULD HAVE NUMERIC DAYS, MONTHS AND YEARS"
RETRY$: RETURN
32590 XDAY%=VAL(LEFT$(REPLY$,2))
32600 XMONTH%=VAL(MID$(REPLY$,4,2))
32610 XYEAR%=VAL(RIGHT$(REPLY$,2))
32620 IF XDAY%<1 OR XMONTH%<1 OR XMONTH%>12
THEN XOK%=NO%
32630 IF XOK% AND XMONTH%=2 THEN IF XYEAR%
MOD 4 THEN XCAL%(2)=28 ELSE XCAL%(2)=29
32640 IF XOK% THEN IF XDAY%>XCAL%(XMONTH%)
THEN XOK%=NO%
32650 IF NOT XOK% THEN PRINT XERR$ "THERE IS
NO SUCH DATE" RETRY$
32660 RETURN

33000 'VALIDATE CONFIRMATION
33010 IF REPLY$="YES" OR REPLY$="yes" OR
REPLY$="Y" OR REPLY$="y" THEN REPLY$="YES":
RETURN
33020 IF REPLY$="NO" OR REPLY$="no" OR
REPLY$="N" OR REPLY$="n" THEN REPLY$="NO":
RETURN
33030 XOK%=NO%
33040 PRINT XERR$ "REPLY MUST BE YES OR NO"
RETRY$
33050 RETURN

33500 'VALIDATE STRINGS
33510 IF LEN(REPLY$)<MIN OR LEN(REPLY$)>MAX
THEN XOK%=NO%:PRINT XERR$ "REPLY MUST CONTAIN
BETWEEN" MIN "AND" MAX "CHARACTERS" RETRY$
33520 RETURN

34000 'DISPLAY HELP MESSAGE
34010 GET HELPFILE%,HELP%
34020 PRINT XO123$ XHELP1$
34030 PRINT XO124$ XHELP2$ XO122$
34040 RETURN

34500 'HANDLE NULL REPLY
34510 IF NOT NULL% THEN XOK%=NO%: ON TYPE%
GOSUB 31500, 32000, 32500, 33000, 33500
34520 RETURN

30000 'COMMON INITIALISATION ROUTINE
30010 OPEN "I",1,"CONFIG"
30020 INPUT 1, CLS$,CLE$,CLL$, HION$,HIOFF$,
X,Y,FIRST$, LEADIN$,BELL$
30030 CLOSE 1
30040 IF FIRST$="X" THEN DEF
FNTAB$(C,R)=LEADIN$+CHR$(X+C)+CHR$(Y+R) ELSE
DEF FNTAB$(C,R)=LEADIN$+CHR$(Y+R)+CHR$(X+C)
30050 YES%=-1: NO%=0
30060 NUMBER%=1: AMOUNT%=2: DATE%=3:
CONFIRM%=4: STRING%=5
30070 XERR$=FNTAB$(11,22)+HION$
30080 RETRY$=" -PLEASE TRY
AGAIN."+HIOFF$+BELL$
30090 XO122$=FNTAB$(1,22):
XO123$=FNTAB$(1,23): XO123$=FNTAB$(21,23)
30100 XO124$=FNTAB$(1,24)
30110 HELPFILE%=1: 'THIS CAN BE CHANGED IF
NEEDED
30120 OPEN "R",HELPFILE%,"HELP",156
30130 FIELD HELPFILE%, 78 AS XHELP1$, 78 AS
XHELP2$
30140 DIM XCAL%(12)
30150 FOR XCNT%1 TO 12
30160    READ XCAL%(XCNT%)
30170 NEXT XCNT%
30180 DATA
31,28,31,30,31,30,31,31,30,31,30,31
30190 ' THIS MUST BE THE FIRST DATA STATEMENT
IN THE PROGRAM
30999 RETURN
```

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Advantages of consistent formats and routines

by Rob Beynon

IT IS OFTEN claimed that Basic is unsuited to the development and production of elegant programs, large or small. Some of the problems arise from indiscriminate use of variable names, incomplete validation of input data from the keyboard and uncontrolled use of Gotos.

While many difficulties are due to the inherent nature of Basic, many others are a consequence of sloppy programming. If the author of a program is also the only user, this becomes marginally forgivable, but when the program is presented to other, less well-informed users, the situation changes. Users should not need to unravel the idiosyncrasies written into a program and should not need to learn a complex set of rules to complete a successful run.

The more naive the user, the greater is the need for a crashproof program which assists the user, validates data, gives assistance when, and only when requested and is generally comfortable to use.

A little care in the writing of Basic programs can provide a set of routines which overcome some of these problems. Those routines can then be incorporated into any Basic program in the future. This approach has the additional advantage of forcing programs into a common pattern for input, instructions, etc.

Obviously, to be of repeated value, the subroutines should be as general as is feasible. This article is an extension of some ideas first published in the *Liverpool Software Gazette,* March 1980, and will be of interest primarily to users of the Apple II. The principles have, however, a much wider applicability and translation to other dialects should not prove difficult.

An attempt to draw up a minimal specification for a Basic program might produce the following list:

- The program should resist as many as possible of the opportunities for breaking out to command level — except by means of an ordered exit. This exit routine should be available at all times during development but may be re-programmed to be unavailable to the end-user.
- The program should scan users' responses for a help command which may be a single key. On finding such a request, the control of the program should transfer to a subroutine giving, for example, appropriate advice or defining operational limits. Return from this subroutine should not influence the program in any other way.
- All numeric input and interrogation — Y or N? — should pass through subroutines, for two reasons. Firstly, verification of data and rejection of inappropriate keypresses becomes possible. Secondly, the help scan may be incorporated into these subroutines.
- Instructions, especially if they occupy more than one page should be written in such a way as to allow the user to move through them forwards or backwards without any pressure to begin the program. This decision should be at the discretion of the user.

To attain these objectives with the Apple II is relatively easy since facilities are provided for error trapping and cursor control. We have adopted the following conventions for our programs.

- Mixtures of Get and Input statements must be avoided, as the user is then unsure of the need to press Return. As the Return key is essential in some circumstances, the general rule is that it must be pressed after all input, even if it consists of a single character.
- If the user presses Return without entering any other key, this is to be interpreted by the program as a request for assistance and appropriate help can then be given if necessary.
- If the Esc key is pressed, this is taken as an exit request, and once again appropriate action is taken.
- Full line-editing facilities are retained in the subroutines for input.
- Instructions are paginated and the user may run through these pages in either direction, using the right arrow and left arrow keys. When ready to begin the program, the user presses return.

Three subroutines are given in the accompanying listings.

1. **Numeric Input:** Lines 100 — 310

This routine ignores all keypresses except valid numeric data which may be positive or negative, real or integer and in normal or exponential format. Full destructive backspace is provided and the routine scans for Esc and Return.

2. **Interrogation:** Lines 400 — 580

This routine accepts only the following keys as valid responses: Return, Esc, Y and N. A backspace key is also provided.

3. **Instructions:** Lines 10000 — 10195

Pages of instructions are headed, displayed, and may be scanned through in either direction using the right arrow and left arrow keys. Pressing Return indicates the user's intention to leave the instructions and begin the main program. For compatibility, the Esc key is also monitored.

One of the most important features of the first two subroutines relates to the variable RF, return flag. RF can have a value between 0 to 3 depending on the responses of the user. Use of the statement

ON RF GOTO

is the simplest way to act on the user responses. This should immediately follow a call to either input subroutine.

Listing 1 is a routine for numeric input, called by a Gosub 100. The loop in line 130 is not executed by Applesoft which halts at a Get statement until a key is pressed, but may be necessary with other Basic interpreters, e.g., Pet.

When a key is pressed it is assigned to the variable A$ and control passes through the subroutine. The character A$ is tested for Returns — ASCII 13; Esc — ASCII 27 and left arrow — ASCII 8. Then, the following characters are tested for; the digits 0-9, "+", "-", "." and "E".

Note that negative exponential, or real numbers could have been excluded by alteration of line 180. If the key pressed fails all of these tests, control passes back to line 130. To test for return alone, the length of the string entered is monitored by the variable CH.

The sequence of characters pressed is built into a temporary string, TS$ until Return is entered. Then, the numeric value of TS$ is evaluated using VAL (TS$) to give a temporary variable TV, before return from the subroutine takes place. Line 260 controls the destructive

```
]LIST100-310
100 :::: REM    NUMERIC INPUT ROUTINE
110 :::: REM    HELP,ESC,OK FLAGGED
120 TV = 0:TS$ = "":CH = 0
130  GET A$: IF A$ = "" THEN 130
140  IF  ASC (A$) = 13 AND CH = 0 THEN RF = 0: GOTO
     310
150  IF  ASC (A$) = 13 THEN RF = 1: GOTO 300
160  IF  ASC (A$) = 27 THEN RF = 3: GOTO 310
170  IF  ASC (A$) = 8 THEN 250
180  IF A$ = "." OR A$ = "-" OR A$ = "+" OR A$ =
     "E" THEN 230
190 :::::: FOR L = 0 TO 9
200 :::::: IF A$ =  STR$ (L) THEN 230
210 :::::: NEXT L
220  GOTO 130
230 TS$ = TS$ + A$: PRINT A$; :CH = CH + 1
240  GOTO 130
250  IF CH = 0 THEN 130
260  POKE 36, PEEK (36) - 1: PRINT " "; : POKE 36,
      PEEK (36) - 1:CH = CH - 1
270  IF CH = 0 THEN TS$ = "": GOTO 130
280 TS$ =  LEFT$ (TS$, LEN (TS$) - 1)
290  GOTO 130
300 TV =  VAL (TS$)
310  RETURN
```

Listing 1. A subroutine for numeric input.

backspace key and adjust CH and TS$ accordingly.

As mentioned, the variable RF is set according to the actions of the user. The four values of RF are interpreted as follows.

RF = 0 : Return alone — help
RF = 1 : Normal response — valid number in TV
RF = 2 : Not used
RF = 3 : Esc — leave the program

Immediately after a Gosub 100, the main program should, therefore, test for the value of RF, by a statement of the form

ON RF GO TO line number 1,
line number 2, line number 3

The statement immediately following

(continued on next page)

(continued from previous page)

will be the destination for RF = 0. Line number 1 is that for normal processing. Line number 2 is a dummy and line number 3 is that of the exit subroutine.

Listing 2 allows for the monitoring of a Y or N?-type response, and is called by a Gosub 400. Again Esc and Return alone are monitored. The first action of this subroutine is to print the query string

"(Y OR N?)"

so that the question previously printed should terminate in a semicolon. Only five keys are accepted as valid: Y, N, Return, Esc and Backspace. Upon return from this subroutine, RF can again have one of four values.

```
]LIST400-580
400 :::: REM   INTERROGATE
410 :::: REM   <RET> ALONE FOR HELP
420 PRINT "(Y OR N?) ";
430 CH = 0
440  GET A$
450  IF  ASC (A$) = 13 AND CH = 0 THEN RF = 0: GOTO
     500
460  IF  ASC (A$) = 13 THEN 500
470  IF  ASC (A$) = 27 THEN RF = 3: GOTO 500
480  IF  ASC (A$) = 8 THEN 520
490  IF A$ = "Y" THEN RF = 1:CH = 1: GOTO 560
500  IF A$ = "N" THEN RF = 2:CH = 1: GOTO 560
510  GOTO 440
520  IF CH = 0 THEN 440
530 CH = CH - 1
540  POKE 36, PEEK (36) - 1
550  GOTO 440
560  PRINT A$;
570  GOTO 440
580  RETURN
```

Listing 2. An interrogation subroutine.

RF = 0 = Return alone — help
RF = 1 = Y — affirmative to question
RF = 2 = N — negative to question
RF = 3 = Esc — leave the program

Again, an

ON RF GOTO

can handle the actions dependent on the value of the return flag.

Listing 3 provides a basic structure for a subroutine to give instructions in a standard format. This routine, called by a Gosub 10000 prints an introductory page before running the instructions. The variable PP contains the number of pages and may be altered — provided that the number of subroutine calls in line 10190 is changed.

The user is allowed to move in either direction through the pages of instructions using Forward Arrow — ASCII 21 — and Back Arrow — ASCII 8 — keys, until return — ASCII 13 — is pressed. Then it is assumed that the user has finished with the instructions and wishes to return to the main program via the Return at line 10100.

To be consistent with the other routines, the keypresses are scanned for Esc — ASCII 27 — to provide an exit. Page counting is performed by lines 10120 to 10160 and the page is headed by line 10180. The selection of the page is given by line 10190; note that each page must end with a return statement.

Use of subroutines for different pages allows for them to be called in reponse to a help request in the main program, e.g., a page defining program limits in the instructions may be called in response to a null input at another point or points in the program.

Finally, for keyboards which are different to Apple II, the choice of keys is open, from special function keys to a simple Forward and Back.

The three subroutines presented can form the beginning of a library of Basic routines which may be used in many programs. The steps to be taken in building up a routine library are as follows. First, reserve certain line numbers for often-used subroutines, and avoid them for main programs.

Secondly, if possible, save these routines in such a way that they may be appended to the main body of a program. If this is not possible, the best solution is to write and save a skeleton program containing all of the routines.

The main program may then be entered on to this skeleton program, parts of which can be deleted if not required. Often-used subroutines should have low line numbers so that calls to them will not be slow in a large program. However, remember to jump over them at the beginning of the program.

For Apple II disc users, it is an easy matter to create a library of routines as text files on a disc. Then Exec these text files into the main program. Instructions for doing this are provided on page 76 of the DOS 3.2 manual and the DOS 3.3 manual.

Specifically for Apple users, a program to create a text file is given in Listing 4. F$, the file name and the line numbers in line 6 should be altered for other routines.

The routines described here reflect my feelings concerning the development of better Basic programs. By using a common format for input and instructions, a number of advantages are accrued. Primarily, the effort involved in writing helpful and crashproof programs is a one-off effort.

Secondly, the adoption of a common set of routines imposes a recognisable structure and behaviour on your programs. While the end-user will obviously appreciate some predictability in your programs, you may also find it easier to write programs if you can assume certain general features, e.g., for numeric input.

```
]LIST10000-10195
10000 PP = 10
10010  PRINT : PRINT "THERE ARE ";PP;" PAGES OF INSTRUCTIONS

10020  PRINT " STEP THROUGH THEM USING THE LEFT AND"
10030  PRINT "RIGHT 'ARROW' KEYS, AND PRESS RETURN"
10040  PRINT "WHEN YOU ARE READY TO BEGIN."
10050 IP = 0
10060  GET A$: IF A$ = "" THEN 10060
10070  IF  ASC (A$) = 8 THEN 10120
10080  IF  ASC (A$) = 21 THEN 10150
10090  IF  ASC (A$) = 27 THEN  POP : GOTO 51000
10100  IF  ASC (A$) = 13 THEN  RETURN
10110  GOTO 10060
10120 IP = IP - 1
10130  IF IP = 0 THEN IP = 1
10140  GOTO 10180
10150 IP = IP + 1
10160  IF IP = PP + 1 THEN IP = PP
10170  GOTO 10180
10180  HOME : HTAB 30: INVERSE : PRINT "PAGE "; IP: NORMAL
10190  ON IP GOSUB 10200,10250,10300,10350,10400,10450,10500
     ,10550,10600,10650
10195  GOTO 10060
```

Listing 3. An instruction subroutine.

For Apple users, I will be happy to provide copies of the three routines as text files if you send an SAE and an initialised disc — either DOS 3.2 or 3.3 — state which. By way of a swap — how about including something of interest on the disc you send? □

Listing 4. A short program to save listing 1 as a text file.

```
]LIST1-8
1 D$ =  CHR$ (4): REM  DOS COMMAND
2 F$ = "LIBRARY1/NUMERIC INPUT"
3  PRINT D$;"OPEN";F$
4  PRINT D$;"WRITE";F$
5  POKE 33,33
6  LIST 100 - 310
7  PRINT D$;"CLOSE";F$
8  TEXT
```

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NB. In the last quarter of '81 substitute larger word library ROMs will be available. Expansion to disc based word libraries is also planned.

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How Wilcoxon test reveals results' significance level

IN TWO earlier articles in this series, we have tested the claims of the manufacturers of that dubiously-effective and undoubtedly over-promoted detergent, WYTO. The first of the two tests, published in December 1979, was the Wilcoxon rank test.

It allows you to compare any two sets of numerical data and discover if they are significantly different. The data may consist of precise — or almost precise — measurements, or they may be somewhat vague numerical rankings. As an example of the most imprecise attempts at measurement, we could take the "star" ratings of hotels.

We might look at the rankings given by some well-known authority to a number of hotels belonging to two different chains — table 1. Has one chain a better set of star routines than the other?

The earlier published program for the

by Owen Bishop

Wilcoxon test was in machine code. The program described here is TRS-80 Level II Basic. A useful feature of this new program is that you do not need to look up the level of significance of your results in a book of statistical tables.

The program calculates the significance level exactly, or tells you whether or not the data is significant at any particular level you choose.

The test is one of those which involve a good deal of paperwork — even though the calculation of the significance levels is a routine matter, but it is far too long-winded a business to be undertaken in less than an hour or two. This test is an obvious candidate for enlisting the aid of a microcomputer.

Let us look at the nature of the hotel data. It represents an assessment based on such diverse features as the quality of the food, the softness of the beds and the helpfulness of the staff. These and many more items are taken into account and a rating on a one-to-five scale is awarded.

In scientific terms, it is a very crude attempt at measurement, but measurement it is and the Wilcoxon test will accept it. Incidentally, quite a number of scientists use methods of assessment equally as crude as this when no better measuring technique is appropriate — assessing the palatability of a new variety of potato, for example. Another point about the data is that there is not much of it.

Many statistical tests require many items of data if any reliable analysis is to be possible. If the Splendo-Posho chain has only seven hotels, it is pointless to ask the management to build another 10 for the purposes of the test. We have to manage with what scanty data is to hand.

Fortunately, the Wilcoxon Test is like all other distribution-free tests in not needing masses of data. Naturally, the more data there is, the more reliable the answer will be but, even if the data is scarce, we can at least proceed with the test.

The final point is that we do not have to make any assumptions about the distribution of the data — it does not need to conform to some particular pattern, such as the Normal distribution. The Wilcoxon test is, after all, a distribution-free test.

The first step of the test is to rank the hotels, from lowest rating to highest. Some other types of data might already be ranked — for example, the Top Twenty — in which event this stage can be omitted As any school teacher knows, ranking for class positions is a tedious operation, and one in which errors are so easily made.

The ranking of hotels is just as tedious if they are many of them. The ratings are ranked in table 2. If two or more are equal, the average rank is given. In table 3 we see the two groups of hotels listed, ranked according to their ratings. The best hotel of all belongs to the Splendo-Posho group. Yet Goodbeer has a higher average rank than Splendo-Posho. Does this mean that Goodbeer is the better chain?

In this example, Goodbeer has the higher average rank, but the lesser total rank. This is because Splendo-Posho owns seven hotels but Goodbeer owns only five. Such a situation makes the reasoning a little complicated.

It would have been better if we had ranked the hotels in the reverse order. There is no need to panic, for a simple equation does all that is required. If T is the total of ranks for the smaller group, Goodbeer, the total T^1 that it would have with reverse ranking — called the conjugate total — is given by:

$$T^1 = n(n+n+1) - T = 5(5+7+1)-37 = 28$$

In this equation, n is the number of hotels in the smaller group and n is the number in the larger group. If both groups are the same size, the conjugate total equals the total of the other group. We use the smaller of these two rank totals.

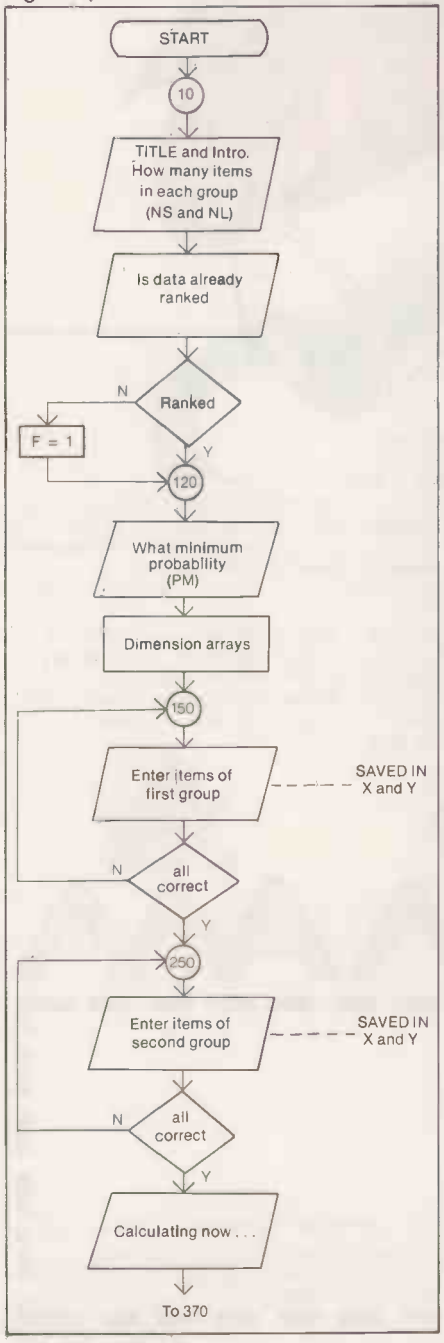
Goodbeer	Swanko-Posho
***	**
***	****
****	*
**	*****
***	**
	*
	***

Table 1. Star ratings of two hotel groups.

Note that when groups are unequal, we do not need to total the larger group. It has been done here to compare the groups and is not an essential part of the test.

Having obtained the total or its conjugate, we take the lesser of these and call it the rank total (T) for the remainder of the test. Since this example uses the conjugate total, we have the effect of ranking in the reverse order, with five stars counting as rank 1. Hence, we expect the better hotel chain to have the best average rank and the least total rank.

Figure 1a.



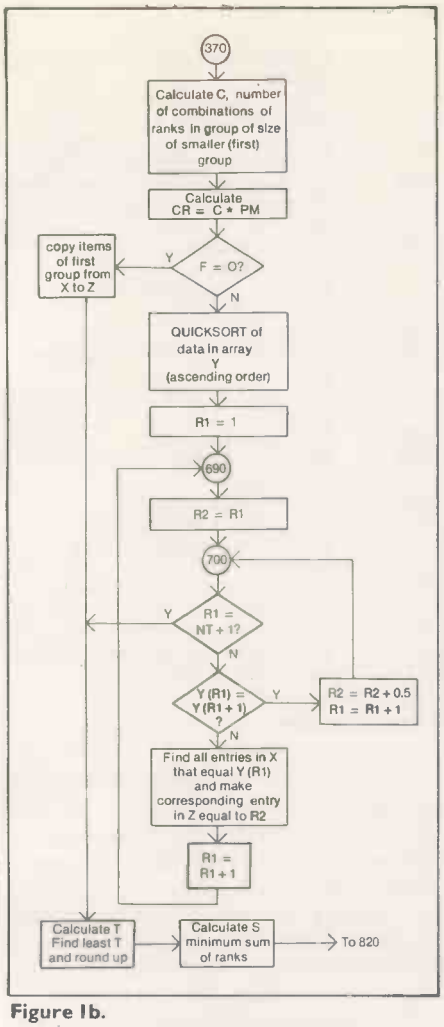


Figure 1b.

The argument is now as follows:

- If there was no difference between the hotel chains, they might as well all belong to the same chain.
- Then we could pick any five at random and call them Goodbeer.
- In how many ways could we pick five and obtain a rank total as small or smaller than 28?
- If there are many ways of doing this, it is not surprising to find Goodbeer with a low rank total. It is not likely that there is any significant difference between the two chains.
- If there are only a few ways, it unlikely that we could have stumbled on such a way by pure chance. It is more likely that the difference in ranks represents a real difference in star rating between the two chains.

All we have to do is to write all the possible sets of five ranks that total 28 or less. Table 4 shows the beginning stages of this. Altogether there are 12 sets. The total number of ways of picking five hotels from 12 is the combination C, which is calculated as 12!/5!7! where "!" represents a factorial number. The values of this is 792.

There are 792 ways in which we could have picked five hotels and called them the Goodbeer chain. Of these 792 ways, 254 would have given a rank total as low as the one we obtained. This is 32 percent of all possible selections.

It seems that there is a reasonable chance of picking five hotels and obtaining a low rank total, so the fact that the Goodbeer total is low is not of significance. Had its total been only 24, there are far fewer ways of obtaining this — in fact, only five percent of ways give total of 24 or less — and we would just believe that it was better to stay at the Goodbeer chain.

Figures 1a, 1b and 1c form a flowchart of the test. The first section is concerned with entering the data. Since sorting and ranking an appreciable time, the user is asked if the data is already ranked. If so, this section of the program is skipped.

The user is also asked what is the minimum level of probability that is acceptable. Some people will be content with the five percent level — a five percent chance of thinking that Goodbeer is better when there is really no difference. Others might demand only a one percent chance of being wrong.

The level is entered as a figure between 0 and 1. For example, five percent is entered as 0.05. The idea of this facility is to save time by terminating the program as soon as it becomes certain that the result is less significant than required. If the exact level of probability is to be calculated no matter how long it takes, enter a "1".

The items of data are entered as two groups, the smaller group, Goodbeer, first if the groups are of unequal size. After each group has been entered, the user is given the opportunity of verifying that all entries are correct. If any item is incorrect the group can be entered again.

The data is stored twice, in arrays X and Y. The program than proceeds to calculate the number of ways of picking a group of the size of the smaller group from the data as a whole. The way of computing C has been described in *Practical Computing* February 1981.

This algorithm saves time and avoids the risk of exceeding the capacity of the computer when working with factorial numbers. It keeps numbers relatively small by a "cancelling" routine similar to that we all use when working on paper.

Having obtained C, the value CR is calculated — line 480. This is the product of the number of ways of picking groups and the probability level selected by the user. For example, if the number of possible groups is 792, and the required probability level is 0.05, then CR = 40.

Later, if 40 groups have been found with total less than that of the Goodbeer group and there are still more groups to be found, it is pointless to go further. The result is less significant than required and at line 910 the program jumps to the end to inform the user of this fact.

If a "1" has been entered, CR equals C, and the program runs to completion to calculate and display the exact level of probability.

At line 490, the program skips over the sorting and ranking routines if the "already ranked" flag has been set and at line 760, the already-sorted and ranked

Rating	Rank	Reversed rank
*	1.5	11
*	1.5	11
**	4	9
**	4	9
**	4	9
***	7.5	5.5
***	7.5	5.5
***	7.5	5.5
***	7.5	5.5
****	10.5	2.5
****	10.5	2.5
*****	12	1

Table 2. Ranking of star ratings.

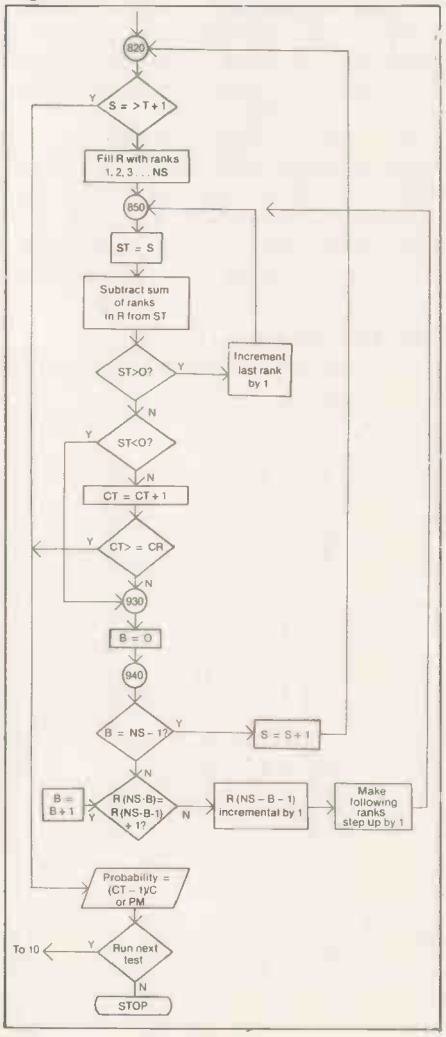
data in array X is copied unchanged into array Z, ready for analysis. The sorting routine is a standard quick-sort — lines 500 to 670 — and operates on array Y only.

The ranking routine works down array Y until it finds two consecutive numbers which are unequal. If no two numbers are equal — no tied ranks — the routine goes down Y one step at a time. At each step, it increments R1. R1 is, therefore, the rank an item of data would have if there were no ties.

Having established the rank and since R2 has already been made equal to R1, the program searches through array X to find any one or more values which have the same value as the item being examined in Y. It enters its rank R2, in the

Figure 1c.

(continued on next page)



(continued from previous page)
corresponding position in array Z — lines 720 to 740.

If two or more consecutive entries in Y have the same value, they must be allotted an average rank. For example, there are four three-star hotels, table 2, and in reverse ranking they occupy ranks 4 to 7

	Goodbeer	Swanko-Posho	Goodbeer reverse
	7.5	4	9
	7.5	10.5	5.5
	10.5	1.5	5.5
	4	12	5.5
	7.5	4	2.5
		1.5	
		7.5	
Total rank	37	41	28
Average rank	7.4	5.9	

Table 3. Ranking of two hotel groups.

in the list. Their average rank is 5.5. Average rank is calculated in line 710.

If two consecutive entries are equal, R2 — previously made equal to R1 — is incremented by 0.5. For example, if R1 is 2 and positions 2 and 3 hold equal values, R2 is incremented once to 2.5, giving the average rank.

If position 4 holds the same as positions 2 and 3, R2 is incremented again, giving an average rank of 3. When ranking is complete the program goes on to calculate T. This is the total of the ranks of the first group — lines 770 to 780, or its conjugate, whichever is the lesser — line 790. Finally, T is rounded up should its total be an odd half rank — line 800.

We have now arrived at the stage at which we would reach for the book of tables to see if our values of T indicate a significant difference between the two hotel chains. The program makes this unnecessary by composing sets of ranks according to a set of rules.

Table 4. Composing sets of ranks.

S	Array R	Total	CT =
15	1 2 3 4 5	15*	1
16	1 2 3 4 6	16*	2
	1 2 3 5 6	17	2
	1 2 4 5 6	18	2
	1 3 4 5 6	19	2
	2 3 4 5 6	20	2
17	1 2 3 4 7	17*	3
	1 2 3 5 6	17*	4
	1 2 3 5 7	18	4
	1 2 4 5 6	18	4
	1 3 4 5 6	19	4
	2 3 4 5 6	20	4
18	1 2 3 4 8	18*	5
	1 2 3 5 6	17	5
	1 2 4 5 7	18*	6
	1 2 3 6 7	19	6
	1 2 4 5 6	18*	7
	1 3 4 5 6	19	7
	2 3 4 5 6	20	7
19	1 2 3 4 9	19*	8
	1 2 3 5 9	20	8

and so on.

It is required to compose all the sets of ranks with total less than or equal to T and each set is to contain the same number of items as there are in the smaller group of data. In doing this, it works with whole ranks, not tied ranks, but the result is the same.

The set is composed in array R, which is first filled with the set which has the least possible total. This consists of the first NS consecutive ranks — in this example: 1,2,3,4,5— where NS is the number of items in the smaller group. This set is listed in the first line of table 4. The sum S of this set, which equals 15, has already been calculated by the equation on line 810.

All but the last member are entered as consecutive numbers — line 830; the last member is calculated — line 840 — to bring the total up to S. A temporary sum ST, equal to S, has the ranks in R subtracted from it — lines 860-880.

The result is then tested to see if the sum of ranks is less than S — ST>0, line 890 — or if the sum of ranks is more than S — ST<0, line 900. On the first time through, the sum of ranks necessarily is equal to S, so ST = 0 and the program goes on to line 910.

Here CT, the cumulative total of successfully-composed sets, is incremented by 1. Unless CT is already too high, we enter the gap-finding routine. Its purpose is to see if there is any way of increasing the ranks in R without increasing the highest one. If you look back through line 1 of table 4, you will find that there are no gaps, as must be the case with consecutive numbers.

A	used in quick-sort routine
CN/CD	factors used in calculating CN and CD
R	set of ranks in composing routine
X	original data as entered
Y	copy of original data, later sorted
Z	rank equivalent of data

Table 6. Arrays.

The routine of lines 930 to 980 does this by back-spacing through R by an amount B, looking for two adjacent ranks which differ by more than one — line 950. If it finds such a gap, the lower number is incremented — line 960 — and the array elements following this one are filled with consecutive numbers.

The program then returns to test this new array. On the first run through, no gaps will have been found and, when back-spacing is as far as the beginning of the array — line 940 — it is obvious that no more arrays can be composed which will have the same total. S is incremented and we go back to compose arrays which add up to the next higher total — 16, in this example — giving 1,2,3,4,6.

It drops through lines 890 and 900 and CT is incremented. This gives the second line of table 4. The gap between the "4" and "6" is detected at line 960, so the "4" is incremented to "5".

A1-A7	used in quick-sort routine
B	back-spacing counter in composing routine
C	number of combinations of NT ranks taken NS at a time
CN/CD	products of factors in calculating C — numerator and denominator
CR	maximum number of sets of ranks allowed at required probability level PM
CT	cumulative total of successful compositions
F	flag — = 0 if data already ranked
I$	input commands
J,K,L	loop counters
NL	number of items in second, larger group
NS	number of items in first, smaller group
NT	total number of items
PM	minimum acceptable level of probability
R1	untied rank in array Y
R2	rank allowing for ties
S	sum of ranks at each stage in composing sets
ST	temporary sum of ranks used in checking sets
T	total of ranks of first, smaller group: later, the lesser of T and T[1]
T1	conjugate total of ranks

Table 5. Variables.

The array, now "1,2,3,5,6", is sent back for testing. Since its total is 17, we find ST<0 at line 900: CT is not incremented and we proceed to look for more gaps. There is now a gap between "3" and "5", so the array becomes "1,2,4,5,6". This procedure is repeated with no increases in CT and eventually we obtain the array "2,3,4,5,6" in which there are no gaps.

This leads to line 940 again, where S is incremented to 17, and the procedure begins all again. The results of this can be seen in table 4.

Composing continues until CT equals CR, which means that the requires level of significance cannot be attained, or until S>T — line 820 — which means that all the sets with totals less than or equal to T have been composed and counted.

In its final stage, the program displays the result, quoting the probability of there being a significant difference between the two groups of data. It quotes either the exact probability, calculated to three decimal places — line 1000 — or informs the user that the level of probability is higher than that originally entered as an acceptable minimum.

The program can be used with measurement data, for example, ages, weights, heights, prices and IQs. When used with measurement data, it performs a similar function to the well-known Student's 't' test but, since it does not assume a Normal distribution, it can be used with all kinds of data however distributed.

Unlike Student's test, it can also be used with rank data — star ratings of hotels, scores by judges at sporting events such as ice-skating, class positions at school. These features give it wide applications in industry, research and commerce.

```
5 DEFINTB,C,J-N,S
10 CLS:PRINT@20,'Wilcoxon Rank Test':PRINT:PRINT'If the two groups of data are o
f unequal size, the smaller group is to be entered first.':INPUT'How many items i
n the first group';NS
20 PRINT:INPUT'How many items in the second group';NL
30 NT=NS+NL
40 PRINT:PRINT'There are';NT;'items in total.  Do you agree? (Y/N)'
50 I$=INKEY$
60 IFI$=''THEN 50
70 IFI$='N'ORI$='n'THEN 10
80 CLS:PRINT'Is the data already ranked? (Y/N)'
90 I$=INKEY$
100 IFI$=''THEN 90
110 IFI$='N'ORI$='n'THENF=1
120 INPUT'What is the minimum probability level required (0-0.1)?  Enter 1if abs
olute probability level is to be calculated. ';PM
130 IFPM<0ORPM>0.1ANDPM<>1PRINT'Please enter 1 or a number between 0 and 0.1':GO
TO 120
140 DIMA(INT(LOG(NT)/LOG(2)+1),2):DIMX(NT):DIMY(NT+1):DIMZ(NT):DIMR(NT):DIMCN(NS
):DIMCD(NS)
150 CLS:PRINT'Enter items of first group.':PRINT:PRINT
160 FORJ=1TONS
170 INPUTX
180 PRINT@(112+J*16),X
190 X(J)=X:Y(J)=X
200 NEXTJ
210 PRINT:PRINT'Are all the entries correct? (Y/N)'
220 I$=INKEY$
230 IFI$=''THEN 220
240 IFI$='N'ORI$='n'THEN 150
250 CLS:PRINT'Enter items of second group.':PRINT:PRINT
260 FORJ=NS+1TONT
270 INPUTX
280 PRINT@(112+(J-NS)*16),X
290 X(J)=X:Y(J)=X
300 NEXTJ
310 PRINT:PRINT'Are all the entries correct? (Y/N)'
320 I$=INKEY$
330 IFI$=''THEN 320
340 IFI$='N'ORI$='n'THEN 250
350 CLS:PRINT@320,'Calculating now...'
360 FORJ=1TONS:CN(J)=J+NL:NEXT
370 FORK=1TONS:CD(K)=K:NEXT
380 FORL=1TONS
390 FORK=2TONS
400 FORJ=1TONS
410 IFCN(J)<>L*CD(K)THEN 430
420 CN(J)=CN(J)/CD(K):CD(K)=1
430 NEXTJ,K,L
440 CN=CN(1)
450 FORJ=2TONS:CN=CN*CN(J):NEXT
460 CD=CD(1)
470 FORJ=2TONS:CD=CD*CD(J):NEXT
480 C=CN/CD:CR=C*PM
490 IFF=0THEN 760
500 A1=1
510 A(1,1)=1:A(1,2)=NT
520 A2=A(A1,1):A3=A(A1,2):A1=A1-1
530 A4=A2:A5=A3:A6=Y(INT(RND(0)*(A3-A2)+.5)+A2)
540 IFY(A4)>=A6THEN 550  :ELSEA4=A4+1:GOTO 540
550 IFA6>=Y(A5)THEN 560  :ELSEA5=A5-1:GOTO 550
560 IFA4>A5THEN 580
570 A7=Y(A4):Y(A4)=Y(A5):Y(A5)=A7:A4=A4+1:A5=A5-1
580 IFA4<=A5THEN 540
590 IFA5-A2>=A3-A4THEN 630
600 IFA4>=A3THEN 620
610 A1=A1+1:A(A1,1)=A4:A(A1,2)=A3
620 A3=A5:GOTO 660
630 IFA2>=A5THEN 650
640 A1=A1+1:A(A1,1)=A2:A(A1,2)=A5
650 A2=A4
660 IFA2<A3THEN 530
670 IFA1>0THEN 520
680 R1=1
690 R2=R1
700 IFR1=NT+1THEN 770
710 IFY(R1)=Y(R1+1)THENR2=R2+.5:R1=R1+1:GOTO 700
720 FORJ=1TONT
730 IFY(R1)=X(J)THENZ(J)=R2
740 NEXTJ
750 R1=R1+1:GOTO 690
760 FORJ=1TONS:Z(J)=X(J):NEXT
770 FORJ=1TONS
780 T=T+Z(J):NEXT
790 T1=NS*(NT+1)-T:IFT>T1THENT=T1
800 IFINT(T)<>TTHENT=T+.5
810 S=NS*(NS+1)/2
820 IFS=>T+1THEN 990
830 FORJ=1TONS-1:R(J)=J:NEXT
840 R(J)=S-(NS-1)*NS/2
850 ST=S
860 FORJ=1TONS
870 ST=ST-R(J)
880 NEXT
890 IFST>0THENR(NS)=R(NS)+1:GOTO 850
900 IFST<0THEN 930
910 CT=CT+1
920 IFCT>=CRTHEN 990
930 B=0
940 IFB=NS-1THENS=S+1:GOTO 820
950 IFR(NS-B)=R(NS-B-1)+1THENB=B+1:GOTO 940
960 R(NS-B-1)=R(NS-B-1)+1
970 FORJ=NS-BTONS:R(J)=R(J-1)+1:NEXT
980 GOTO 850
990 CLS:PRINT'The probability of obtaining
    2 groups of data as different
more different than the two you obtained is:';PRINT
1000 IFPM=1PRINTTAB(26)INT(((CT-1)/C+.
     0005)*1000)/1000:GOTO 1020
1010 PRINT:PRINTTAB(18)'greater than';PM
1020 PRINT@926,'<Press any key to run next test>'
1030 IFINKEY$=''THEN 1030 ELSERUN
```

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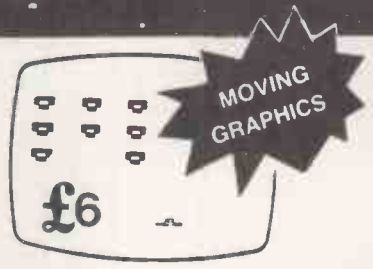

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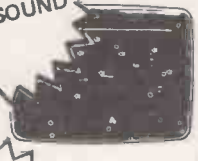

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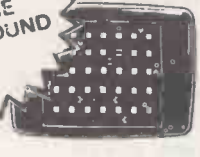

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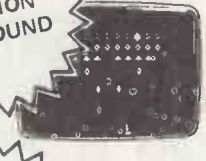

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Nascom graphics

THE THREE graphic subroutines have been written for a Z-80A-based Nascom 2 with graphics ROM, although they could be used with most micros operating in Basic with a few minor alterations, writes AC Dickens of Leicester. The aim of these subroutines is to enable the user to plot graphs on any scale of X and Y, together with X and Y axes.

They are written so that Y increases going from the bottom to the top of the screen, and X increases from left to right, as on a conventional graph. All scaling, positioning and axis-drawing is performed by my subroutines, which ensure that any points outside the user-defined limits will not be plotted. Any attempt to plot points off the screen without this feature results in an FC error.

The subroutines can be used independently if desired, although the full advantages will be obtained by using all three in conjunction with one another.

The first subroutine is used to determine the positions of the X and Y axes on the screen, and to calculate the scaling factor of number of user-defined units per pixel on the screen in the X and Y planes.

Gosub with X1 equal to minimum X value, X2 equal to maximum X value, Y1 equal to minimum Y value, Y2 equal to maximum Y value. The routine returns with X3 equal to the number of horizontal pixels before the Y axis. This will be 0 or 95 if x = 0 is outside the range X1 to X2, Y3 equal to number of vertical pixels before the X axis, X4 equal to number of user-defined Xs per horizontal pixel and Y4 equal to number of user-defined Ys per vertical pixel.

The programmer can specify X3,X4, Y3,Y4 rather than X1,X2,Y1,Y2 and omit this subroutine if preferred.

For all users of systems based on the Z-80 chip, Z-80 Zodiac offers an opportunity to have programs and ideas published. We pay at least £5 for each contribution used.

```
2000  REM Subroutine to define scale & limits
2010 X3=X1/(X2-X1)*95
2020 IF X3<0 THEN X3=0
2030 IF X3>95 THEN X3=95
2040 Y3=Y1/(Y2-Y1)*44+44
2050 IF Y3<0 THEN Y3=0
2060 IF Y3>44 THEN Y3=44
2070 X4=(X2-X1)/95
2080 Y4=(Y2-Y1)/44
2090 RETURN
```

This subroutine is used to plot the points on the graph, and can be executed before or after the axis routine, depending on whether the user wants to have the graph drawn on top of the axes, or *vice versa.*

Gosub with a value of X and Y in user-defined units, e.g., X=2.98, Y=67.456. The routine plots this point at the correct position on the screen, and then returns. To create a graph, this routine will have to be executed several times.

```
3000 REM Subroutine to plot points
3010 X5=INT(X3+X/X4)
3020 Y5=INT(Y3—Y/Y4)
3030 IF X5<0 OR X5>95 THEN RETURN
3040 IF Y5<0 OR Y5>44 THEN RETURN
3050 SET(X5,Y5)
3060 RETURN
```

The final subroutine draws on the axes using line graphic characters. It is assumed that X3 and Y3 have been defined. At first sight, the inclusion of a CHR$(19) — move cursor up — may seem unnecessary, but it has been included to prevent the screen scrolling up, destroying the graph.

```
4000 REM Subroutine to plot axes
4010 X=INT(X3/2)+1
4020 Y=INT/Y3/3)+1
4030 FOR Z=1TO15
4040 SCREEN X,Z
4050 PRINTCHR$(148);CHR$(19)
4060 NEXTZ
4070 FOR Z=1TO47
4080 SCREENZ,Y
4090 PRINTCHR$(152);CHR$(19)
4100 NEXTZ
4110 SCREENX,Y
4120 PRINTCHR$(150);CHR$(19)
4130 SCREEN1,1
4140 RETURN
```

This sample program will plot the function at line 1060 using the predefined X and Y limits.

```
1000 CLS
1010 INPUT"Xmin,Xmax";X1,X2
1020 INPUT"Ymin,Ymax";Y1,Y2
1030 GOSUB 2000
1040 CLS
1050 FOR X=Y1TOX2 STEP(X2—X1)/190
1060 Y=SIN(X)
1070 GOSUB 3000
1080 NEXTX
1090 GOSUB 4000
1100 END
```

String manipulation

I NOTICED in your April 1981 edition, a ticker-tape program by Jeff Tock which would allow one to explore the USR routine on the Nascom only, writes CR Bruce of Farnham, Surrey.

The following listing, apart from being very short, will allow any machine with reasonable string-handling capabilities to perform the same task. It can also operate in more than one place on the screen at the same time.

```
0 REM String manipulation display by C.R.Bruce
1 CLEAR 1000 : D1=5000
2 PRINT"Enter title please"
3 INPUT A$ : A$ = " " + A$ + " " : A=1 : CLS
4 X=INT(23-(LEN(A$)/2)):REM Calculate centre
5 N$=MID$(A$,A,(LEN(A$)-A)):M$=MID$(A$,1,A-1)
6 Z$=N$+M$: SCREEN X,6: PRINTZ$ : REM Scrn positon
7 FOR C=0 TO D1:NEXT:D1=0: FORD2=1TO100:NEXT
8 A=A+1:IFA=LEN(A$)THENA=1
9 GOTO5
10 REM 'CLEAR' is to ensure string space.
11 REM 'A' is a positon counter.
12 REM 'X' places the title in the middle.
13 REM 'N$' is title shrinking from the right.
14 REM 'M$' is title expanding from the right
15 REM 'D2' is the scan rate counter.
17 REM
18 REM ALL REMs CAN BE DELETED SAFELY.
Ok
```

Not got Get

SINCE the Sinclair ZX-80 has no Get statement, I would like to hear from anyone who has written a Z-80 subroutine for this statement, writes Charles Drayson of Chelmsford, Essex.

I am sure many ZX-80 users would be grateful of this information, as it then makes their computer ideal for games.

Exam copy

USING the program in the February 1981 edition of Z-80 Zodiac from MJ Pearson to enable full screen printing of graphics for the 380-Z, writes J Goodall of Glenrothes, I discovered that the 380-Z at the school in which I work did not in fact produce the correct output to enable an exact copy to be made.

Blank spaces were not printed which obviously completely altered any output. This was easily remedied by inserting:

```
1075 IF A=128 THEN A=32
```

I also found that for the programs I used, lines 1020 GRAPH 2 and 1120 GRAPH 3 are unnecessary and that by omitting them, the screen display remains constant.

Apart from these points, I found the program very helpful and will certainly use it in future — particularly with a view to obtaining hard copy for exam candidates.

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Screen Poke

I AM generally very impressed with the quality of articles in *Practical Computing* but I feel I must take you up on two related points in the May 1981 ZX-80 Line-up, writes G Addis of Worthing, West Sussex.

Chris Parr — Pursuit ship — implies that the use of a memory-mapped screen is unreliable. Mark Lancaster explains on the opposite page how to use the memory-mapped screen but he makes two elementary errors which go a long way to explain why some find it unreliable.

- The display file starts with a Newline, so that the top left-hand space on the screen is not found from Peeking 16936 and 16937. The value you need is one more than that.
- Secondly, each line on the screen takes up 32 characters spaces plus a Newline so that if the first line of the display runs from 16485 to 16517 the second line runs from 16519 to 16551. 16518 is a Newline character. Poking anything to 16518 would, therefore, corrupt the screen and it is necessary to Peek first to check whether the byte is Newline (118) before Poking.
- Poking characters other than 0-63 or 128-191 decimal will be interpreted as machine code and executed.

For a further details and a reliable screen-poking program write to K A Macdonald, 26 Spurs Close, Nowle Solihull, as I did.

Black box

DID YOU wish that you could fit Waddingtons *Black Box* into 1K of ZX-80? Well, here it is, writes B Cope of Chelmsford, Essex. If you have forgotten the rules, turn to page 94 of *Practical Computing* April 1981.

Naturally, the program is very full and screen comments are terse, but enter Run and see for yourself. The question ATOMS? invites you to enter a number up to seven. The question In? lets you enter a ray into the grid from 1 to 32 and gives the answer.

If you enter 99, the location of each atom is displayed. You are trusted to do your own scoring — so no cheating.

	1	2	3	4	5	6	7	8	
32	11	12	13	14	15	16	17	18	9
31	21	22	23	24	25	26	27	28	10
30	31	32	33	34	35	36	37	38	11
29	41	42	43	44	45	46	47	48	12
28	51	52	53	54	55	56	57	58	13
27	61	62	63	64	65	66	67	68	14
26	71	72	73	74	75	76	77	78	15
25	81	82	83	84	85	86	87	88	16
	24	23	22	21	20	19	18	17	

```
10 DIM A(99)
20 FOR B = 0 TO 99
30 LET A(B) = 0
40 NEXT B
50 FOR B = 1 TO 8
60 LET A(B) = B
70 LET A(10*B + 9) = B + 8
80 LET A(B + 90) = 25 - B
90 LET A(10*B) = 33 - B
100 NEXT B
110 PRINT "ATOMS?"
120 INPUT C
130 FOR B = 1 TO C
140 LET D = RND(8) + 10*RND(8)
150 LET A(D) = 99
160 NEXT B
170 PRINT "IN?"
180 INPUT B
190 CLS
200 IF B >32 THEN GO TO 450
210 PRINT "IN*";B;"**";
220 LET C = -B*(B<9)-((B-8)*10+9)*(
    B>8 AND B<17)-(115-B)*(B >16 AND
    B<25) -(33-B)*10*(B >24)
230 LET D = B >8 AND B <17)-10*(B <9)
    -(B>24) + 10*(B>16 AND B<25)
240 LET B = 0
250 LET E = -(ABS(D) = 10) -10*
    (ABS(D) = 1)
260 IF A(C + D) = 99 THEN GO TO 400
270 IF A(C + D)>0 THEN GO TO 430
280 IF B = 0 AND (A(C + D + E = 99
    OR A(C + D - E) = 99 THEN GO
    TO 420
290 LET B = 1
300 IF A(C + D + E) = 99 AND A(C + D
    - E) = 99 THEN GO TO 360
310 IF A(C + D + E = 99 THEN GO
    TO 340
320 IF A(C + D - E) = 99 THEN LET
    D = E
330 GO TO 370
340 LET D = - E
350 GO TO 370
360 LET D = - D
370 LET C = C + D
380 IF A(C)>0 THEN GO TO 420
390 GO TO 250
400 PRINT "NO EXIT"
410 GO TO 170
420 LET D = 0
430 PRINT "OUT*_";A(C + D)
440 GO TO 170
450 FOR B = 0 TO 99
460 IF A(B) = 99 THEN PRINT B;"*_";
470 NEXT B
```

Saving code

IF MACHINE code is to be saved, we have a choice of three main ways of including it in a Basic program, writes Michael Kirkland of Prescot, Merseyside. First, it can be Poked into a Rem statement included as the first line of the program, or second, it can be Poked into an array, the DIM for which has appeared as the first variable in the program.

Both these methods have a distinct advantage in that they are easy to access, the one by a loop starting at 16427, the other via the system variables at 16392 and 16393. Each has its own particular disadvantage.

The Rem statement must be pushed off the screen, and it must not be Listed. The code in the array is lost if the program is Run. Also, in neither case is it particularly easy to read the code listings.

If the ZX-80 user is confident that he can remember not to press the Run or List keys, by all means he can use these methods. I am afraid I am not so confident.

The third method has no such limitation. This is to include the machine code in a string, and provide a routine for reading it and Poking it to the address area above the D-file. Either decimal or Hex code can be used. Decimal is easier to read, but Hex takes up less space in the memory. All that is required is the appropriate routine for interpreting them.

An apparent disadvantage of this method of storing machine code is that it seems to take up a great deal more memory than the Rem or Array methods. The code is stored in the string, it is Poked into the higher reaches of the memory, and there is also the routine for reading the string.

However, once the program has been Run, none of the Basic is required any more. Any or all of it can be deleted, and even, most useful, another Basic program can be Loaded without disturbing the machine code. A machine-code program can, therefore, be Loaded and also another Basic program and the two used in conjunction.

Of course, there is one major disadvantage to this method of storing machine code. This is that it is vulnerable to being over-written by the D-file at one end, or the stack at the other.

Methods exist for protecting code by moving the stack, and it looks as though the ZX-81 has solved the problem altogether. Otherwise, the only solution is great care in choice of location. With a 16K RAM extension the danger is very remote, though less so with the basic 1K.

It remains to consider how best to prepare machine code for Loading. It is easy enough to key in and Save, say, 25000 and change it if required for the 1K. However, I am too lazy for that, and I offer the following tip.

The on-board 1K RAM is reflected at 1K intervals right up to 32K. It is easy to choose a value which is suitable for the 16K extension, and also falls within the appropriate area in the basic 1K.

Such a value is 25462, which turns out to be equivalent to 17270 in the 1K mode. That is, if you Poke 25462 without the memory expansion in residence, the value is Poked to 172705. Therefore, if

```
LET A = 25462
```

is included in the Hex loader, this will work whether or not the 16K expansion is being used.

Generation game

THIS IS a version of the famous *Life* game for the Sinclair ZX-80 1K machine, writes Ivor Bradley of Portstewart, County Londonderry. It displays a 12-by-12 matrix on the screen. I think it would be difficult to achieve a larger display without resorting to machine code.

Running it is very simple. In response to the prompt 0 - 143, one types in an integer corresponding to the position one wants a bug to appear at on the screen. To end input, enter a number greater than 143. Successive generations are produced by pressing Newline. It takes about eight seconds to produce a new generation.

The space beyond the boundaries of the matrix are considered to be empty and impenetrable. This has the advantage that initially symmetrical patterns remain symmetrical in later generations.

(continued on next page)

(continued from previous page)

```
 10 DIM A (166)
 20 LET B = PEEK (16392) + 256 * PEEK
    (16393) + 16
 30 PRINT " 0 - 143 ? "
 40 INPUT C
 50 IF C > 143 THEN GO TO 80
 60 POKE B + C + C/12, 1
 70 GO TO 40
 80 CLS
 90 FOR I = 0 to 154
100 IF I = (I/13)*13 THEN PRINT
110 IF I + 1 =((I + 1)/13)*13 THEN
    NEXT I
120 PRINT CHR$ (PEEK (B + I) + 27) ;
130 LET D = B + I
140 LET C = PEEK D - 14) + PEEK
          (D - 13) + PEEK (D - 12)
          + PEEK (D - 1) + PEEK
          (D + 1) + PEEK (D + 12)
          + PEEK (D + 13) + PEEK
          (D + 14)
150 POKE B + 169 + I - I / 13, C = 3
    AND 1 OR (C = 2 AND PEEK (D) )
    AND 1
160 NEXT I
170 FOR I = 0 TO 143
180 POKE B + I + I / 12 , PEEK
    (B + I + 169)
190 NEXT I
200 PRINT
210 INPUT S$
220 GO TO 80
```

Music melody

DAVID HARRIS'S program for music on the ZX-80 in your April 1981 issue works well and is ingenious, writes Robin Allott of Seaford, Sussex. Starting from this, I have produced an adapted program which makes it rather easier to produce a wide range of familiar melodies. It allows one to type the notes in the key of C — including the five sharps — and to produce a uniform length of note automatically which can be varied to produce notes of longer duration in the melody as required.

The melody is repeated indefinitely but can be stopped after any repetition by pressing the Space key. Presumably there is a limit to the length of melody which can be programmed but so far, the program has produced attractive renderings of the theme from *Les Parapluies de Cherbourg, The Eriskay love-song, the British Grenadiers* among others.

A surprising and much enhancing feature of the program is that once it has been set running, the sound is produced with good quality, even with the television set disconnected, on any nearby transistor set or music centre and the pitch at which the melody is played can be varied by altering the FM or AM tuning of the radio; no wired connections are needed.

Inputting the program is straightforward. After Run, the program calls for the notes of the melody in order, e.g., for *God save the Queen,*

C C D Bx2 C

The note Bx2 illustrates how the program provides for octaves above or below the central octave. If a note is wanted from the next octave below, one uses e.g., Gx2 or Bx2; if one wants a note from the octave above, one types in, e.g., G/2 or B/2.

Every even-numbered element in the B array is set at length of note 500 automatically but the length of any particular note can be adjusted by using as a direct command — after stopping the melody:

LET B(4) (for example) = 1000 —
or = Lx2

since L is the standard length of 500. If there are sharps in the melody, they are input by typing CS for C sharp or AS for A sharp and so on.

Before running the program, it is necessary, as in David Harris's original version, to set up the B array, line 1010, to double the number of notes in the melody, to allow for specifying length and pitch of each note, and to set the J loop at line 40 to 1 less than the B array at line 100. Also, the final element in B array should be set to 0.

The program is that set up for playing the *Eriskay love-song* — 22 notes.

It has been run on the standard 1K ZX-80. The program only shows the variant section from David Harris's original program:

```
 10 GO SUB 1000
 20 LET C=180
 21 LET D=160
 22 LET E=144
 23 LET F=135
 24 LET G=120
 25 LET A=108
 26 LET B=96
 27 LET L=500
 28 LET CS=170
 29 LET DS=152
 30 LET FS=128
 31 LET GS=114
 32 LET AS=102
 40 FOR J=0 TO 43
 50 IF (J/2)x2=J THEN LET B(J)=L
 60 IF (B(J)=L THEN GO TO 90
 70 INPUT Y
 80 LET B(J)=Y
 90 NEXT J
100 LET B(44)=0
110 LET Z=USR(P)
120 GO TO 110
1000 DIM A(23)
1010 DIM B(44)
```

Inverse print

THIS LISTING is a response to Keith Berry's Reverse Characters, ZX-80 Line-up, May 1981, writes John C Thomas of Blackpool. It allows you to invert a set of 32 character Print lines at the top of your main program listings. The CHR$ construction is not used — the routine reads the codes between the inverted commas of your Print statements and Pokes the inverse code directly into the correct point in your Print statements.

The routine as listed will invert 24 Print lines of 32 characters each and allows for the Poke 16421,24 before the last Print line which allows for the use of the full 24 screen lines. So, first set up your Print lines in the following way:

```
 1 PRINT "(32 characters)"
 2 PRINT etc.
24 POKE 16421,24
25 PRINT "(32 characters)"
```

The Print lines must be at the top of your listing and you must take care not to insert any commas, semicolons etc., outside the inverted commas until you have Run 9000 and inverted print statements.

All the lines in the routine with their numbers underlined may be omitted and the routine may be further shortened by abbreviating Address to "A". If you do not wish to print 24 lines, omit line 9100 and change the second limit of the For... Next variable "L" to the number of lines you want inverted.

After Running 9000, adjust your Print statement numbers to the correct place in your main program. Remember to protect your main program from the routine using Stop before running it.

Finally, can any of you Line-up watchers supply a routine to allow multiple Loading, a machine-code routine to show how much memory is left by using

PRINT USR (address)

at anytime and how about a line renumbering routine which would allow you to nominate a group of lines, state where they should be placed and move the lines altering Gotos and Gosubs?

Listing Inverter

```
9010 LET ADDRESS = 16428
9020 FOR L = 1 TO 24
9030 FOR C = 1 TO 32
9040 LET CODE = PEEK(ADDRESS)
9050 IF CODE = CODE("K") THEN POKE
     ADDRESS, 176
9060 IF CODE > 211 AND CODES <256
     THEN GOSUB 9140
9070 POKE ADDRESS,PEEK(ADDRESS)
     + 128
9080 LET ADDRESS = ADDRESS + 1
9090 NEXT C
9100 IF L = 23 THEN LET ADDRESS =
     ADDRESS + 12
9110 LET ADDRESS = ADDRESS + 6
9120 LEXT L
9130 STOP
9140 PRINT "YOU TRIED TO INVERT A
     CODE (AT ADDRESS* ";
     ADDRESS:") WHICH CANNOT BE
     INVERTED"
9150 POKE ADDRESS,20
9160 RETURN
```

Error skip

I SEE that a recent correspondent — S McCallum April 1981 — has noticed an interesting oddity with the Sinclair ZX-80, wrties John Bloxham of Stratford upon Avon, Warwickshire. I have recently discovered the following quirk which also might be useful. Enter the following:

```
10 IF 1 = 1 THEN
20 PRINT "20"
30 PRINT "30"
```

Surprisingly, the computer will accept line 10. When Run, the program prints 20 and 30. Note that the conditional expression in line 10 is obviously true.

Now change line 10 to:

```
10 IF 0 = 1 THEN
```

Now the program only prints 30, indicating that line 20 has been skipped. So, it would appear that a false expression in line 10 causes the next line to be skipped; a true one does not. If memory space is tight, this could be useful as it saves a Go-to and a line number.

A slightly odder oddity is that the latest colour advertisements for the new ZX-81 indicate that the machine is still a ZX-80. Take a close look at the bottom right-hand side of the keyboard.

Back-up copy

THE Tandy editor/assembler has rivals now, but people should be aware of the fact that the Tandy program is sold with a truly magnificent User Manual — at least half a page for each Z-80 instruction, op-codes as Hex and as binary patterns, clear explanations of each instruction's action, details of condition flags, writes Alan Evans of Ynysforgan, Abertawe.

True, the book will not help a raw beginner to begin programming, but once you have made a start, its riches will become more and more obvious.

Nonetheless, the program cassette and manual cost £24 and I have long wanted to make a back-up copy of the tape. Here is how:

- EDSTASM is located from 4300H to 5D41H and is entered at location 468AH. We want to make our copy using the monitor TBUG. Unfortunately, TBUG and EDTASM overlap.
- What we need to do is use a routine to move EDTASM lock, stock and barrel out of TBUG's way. Tag a routine on the end of this temporarily re-located EDTASM that will dump it back where it belongs when we are ready to use it. Use TBUG to make a copy of the re-located EDTASM and to make a copy too, of the tagging routine.
- **Details:**

```
; move 1 ...routine to displace edasm
ORG 7FFOH
LD HL,4300H;  Start of current EDAS
LD DE,5D50H;  Start of displayed EDAS
LD BC,1A50H;  Number of bytes
LDIR
JP 1A19H;     Basic "Ready" state
; move 2... routine that will replace displaced
EDAS.
; move 1 must move this one, too
;or EDAS will not go back
ORG 4D42H
LD HL,5D50H;  here it is
LD DE,4300H;  here is where it goes
LD BC,1A50H;  this many bytes
LDIR ;        move them.
JP 468AH;     jump to EDTASM starpoint.
```

Here are the procedures:

- Use EDTASM to create object code tapes of Move 1 and Move 2.
- Re-load EDTASM and press Break
- Load Move 2 and press Break
- Load Move 1 and answer the prompt with /32752

Almost at once you will be back in Basic but the assembler will have been moved safely out of TBUG's way.

- Load TBUG and enter it.
- Ready a cassette and type

P 5D50 77AO 7792 EDAS2

The tape you make is your back-up copy. It loads into 5D50H to 77A0H but when you answer the System prompt with / then Move 2 sends the editor assembler scurrying back to its proper place, and

TRS-80 EDITOR/ASSEMBLER 1.2

appears on your screen without noticeable delay. Notice the new shorter file name.

Faster Hex

ROGER Moffatt's subroutine for conversion of decimal to Hex published in Z-80 Zodiac April 1982 edition is similar to routines that I have used, before having HEX$ available, writes Bill Short of Newcastle upon Tyne.

I should point out that

TOTAL$ = ""

should have been included at the beginning of the routine for correct operation.

The use of Boolean expressions seems rare in programs submitted to *Practical Computing* yet they can be most useful. Line 1010 of Roger Moffatt's subroutine could, for example be easily replaced by:

1010 H = D AND 15

INT on the following line also becomes unnecessary. The following routines, numbered 2 and 3, are directly equivalent but do not require MID$ and are shorter.

A longer but faster routine is number 4.

Tape loader

THOSE with TRS-80 Model 1 who are experiencing difficulties in finding the correct volume when loading programs from tape will find this program below invaluable, writes Ruth Trapmore of Colchester, Essex.

The program is three lines of Basic which set up and then use a machine-code routine. The routine defines the cassette drive and then reads in bytes from the tape. Each byte is checked to see if it is displayable and then is "printed" on to the screen.

If the volume level on the cassette is set too low then no data is read. Conversely, where the volume level is set too high, all bytes read in appear to be X'FF's and this is shown on the screen as a solid white bar.

Between these two levels characters will appear on the screen — although because some bits may be missed, not necessarily the characters you expect. The correct volume level is slightly more than half way between the "no characters" and the "solid white bar" positions.

The program, for Level II machines only:

```
10 DATA 175,205,18,2,205,53,2,203,183,254,
32,56,3,205,51,0,24,242
20 FOR I=1 to 18: READ X:POKE 18431
+ I, X: NEXT
30 POKE 16526,0: POKE 16527, 72; X = USR
(0)
```

Where the second cassette drive is being used the program should be amended as follows:

```
10 DATA 175, 205,...becomes 10 DATA
175,60,205,...
20 FOR I =1 TO 18:....becomes 20 FOR 1 =
1 TO 19:....
```

Listing 2.

```
999 REM ***Dec to Hex Rtn.*2*
by J.W.Short.
1000 HX$=""
1010 FOR I=1TO4
1020 H=D AND 15
1030 HX$=CHR$(H+48-7*(H>9))+HX$
1040 D=D/16
1050 NEXT I
1060 RETURN
```

Listing 3.

```
998 REM ***Dec to Hex Rtn.*3*
by J.W.Short.
999 REM ***Single Byte entry
at 1100 ***
1000 HX$=""
1010 GOSUB1100
1020 D=D/256
1100 HX$=CHR$((DAND240)/16+48-
7*((DAND240)>144))+CHR$((D AND
15)+48-7*((DAND15)>9))+HX$
1110 RETURN
```

Listing 4.

```
999 REM ***Dec to Hex Rtn.*4*
by J.W.Short.
1000 HX$="89ABCDEF0123456789ABCD
EF"
1010 HX$=MID$(HX$,(DAND61440)
/4096+9,1)
+MID$(HX$,(DAND3840)/256+9,1)
+MID$(HX$,(DAND240)/16+9,1)
+MID$(HX$,(DAND15)+9,1)
1020 RETURN
```

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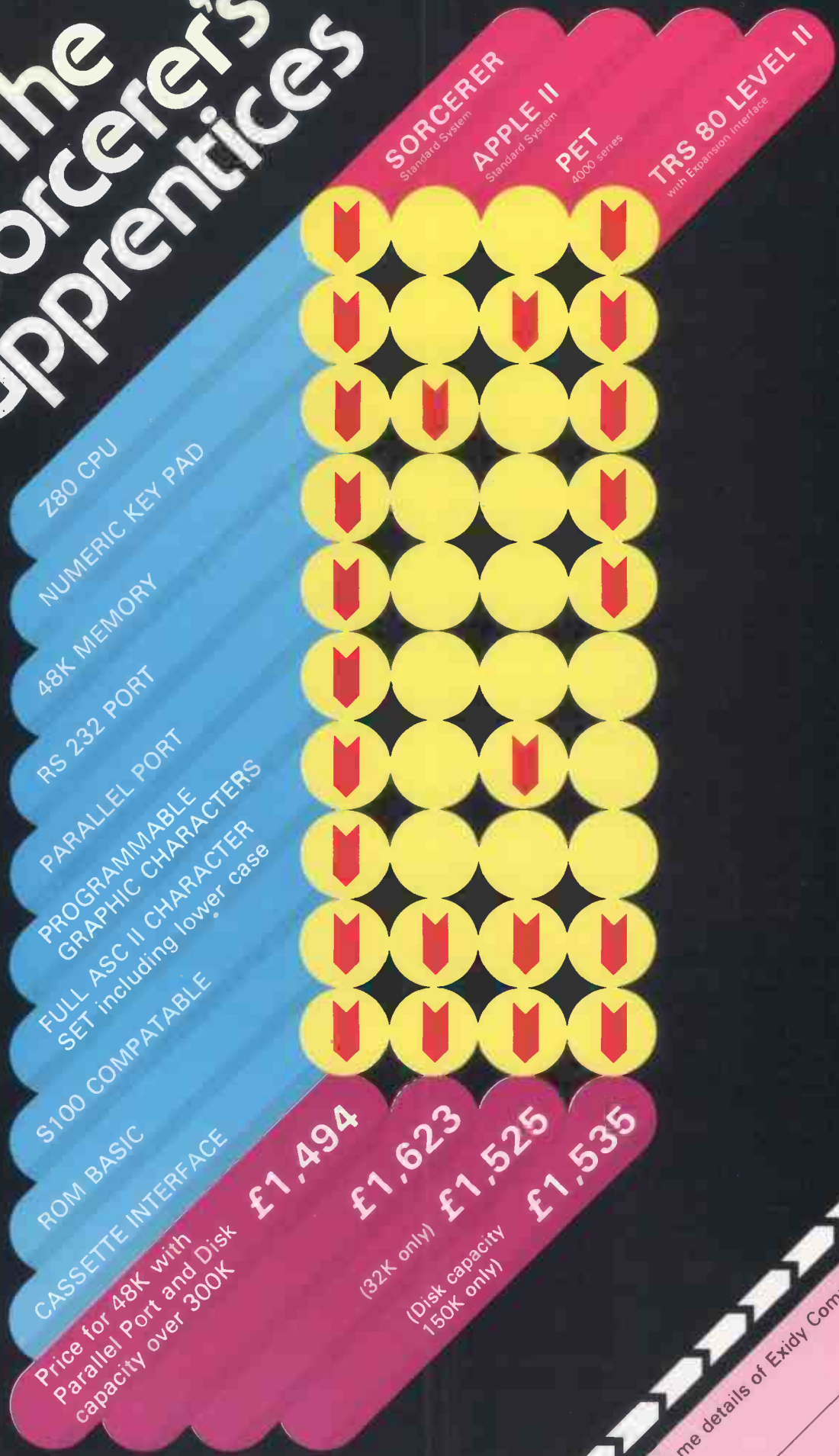

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1981 MICRO-COMPUTER SHOW

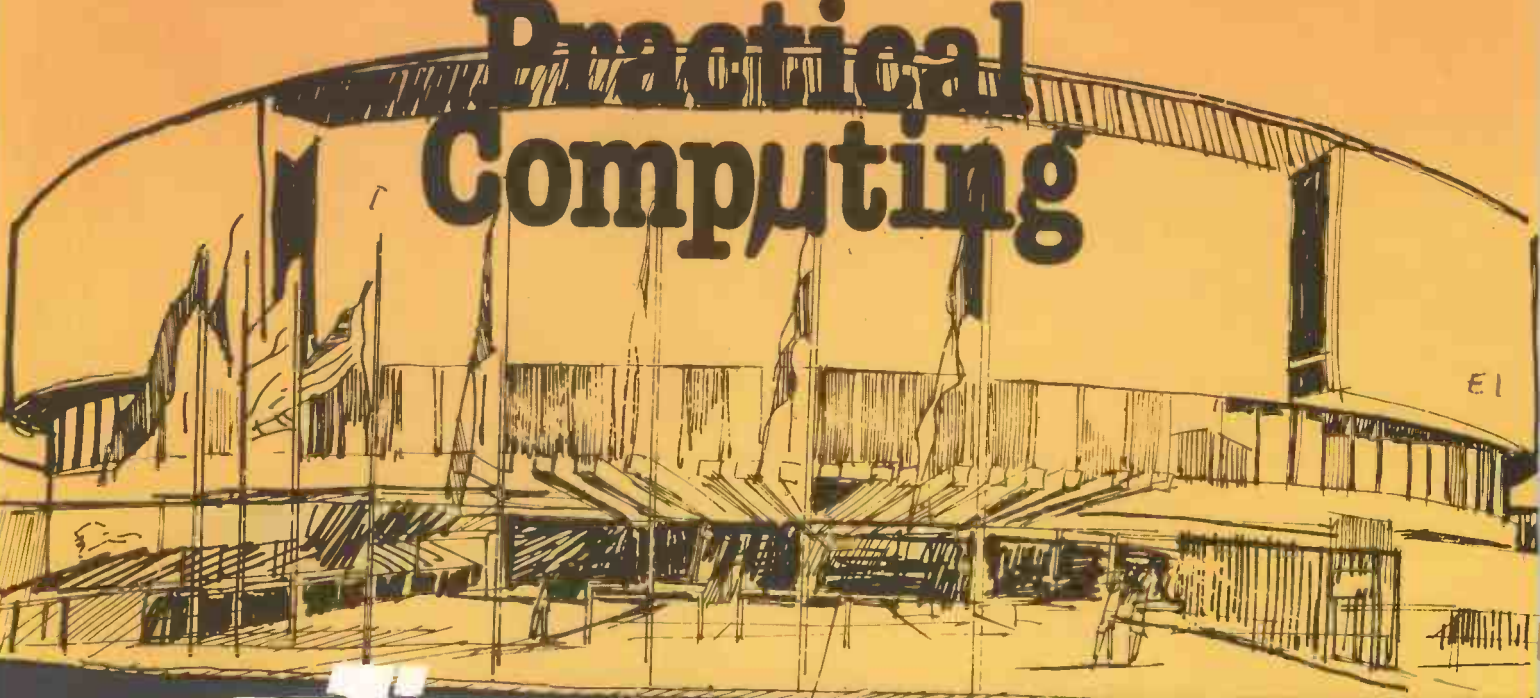
WEMBLEY CONFERENCE CENTRE

July 30-August 1, 1981

EXHIBITION GUIDE

Compiled by

Practical Computing



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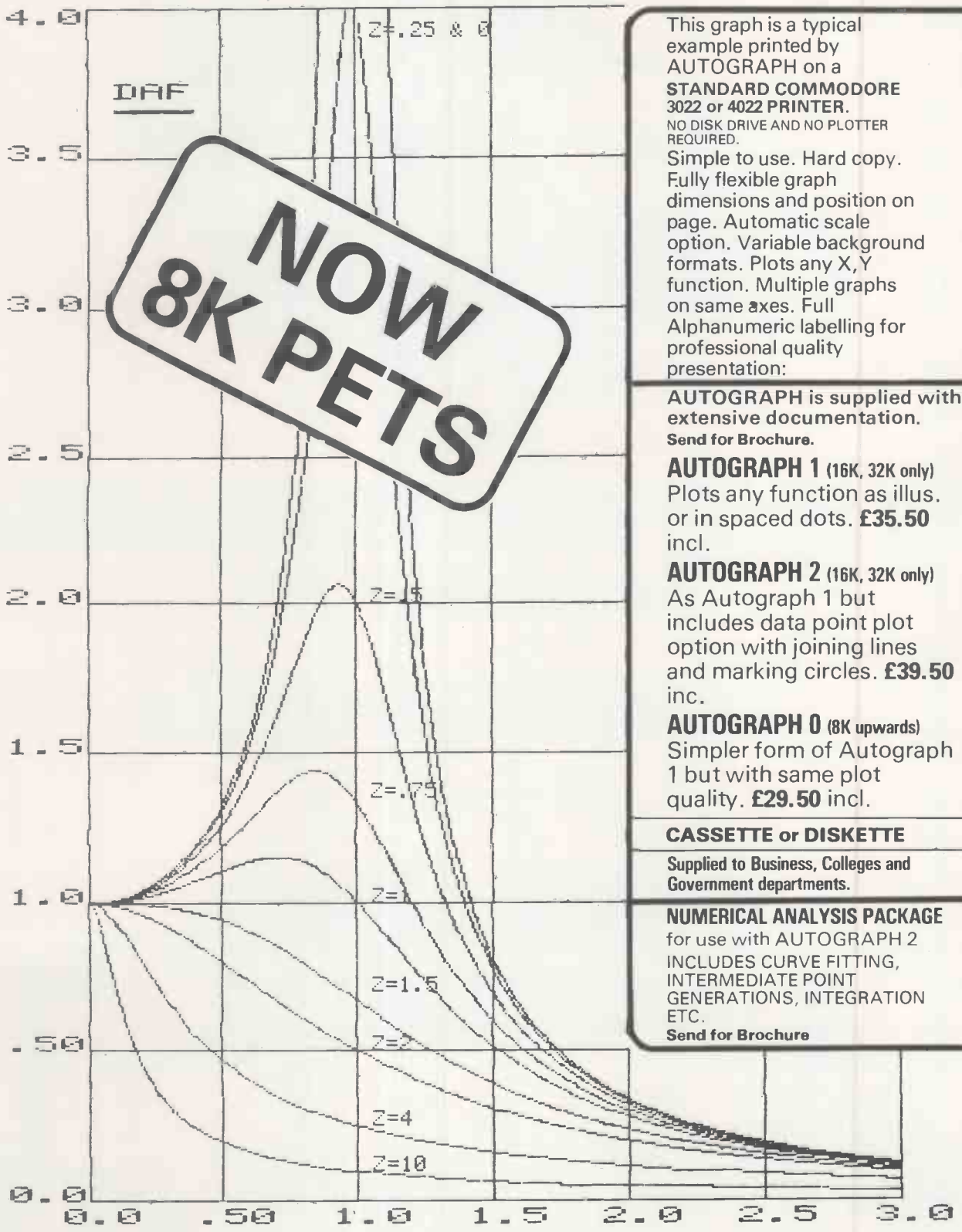

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E2

MICROCOMPUTER EXHIBITION

Thursday, July 30. 10.00 hrs. — 18.00 hrs.
Friday, July 31. 10.00 hrs. — 18.00 hrs.
Saturday, August 1. 10.00 hrs. — 16.30 hrs.

The event is organised by Online Conferences Ltd and comprises a three-day exhibition and three full-day seminars. The seminars will include sensible advice to business people contemplating the installation of a small computer system and a technical seminar for those who have some knowledge of the computer industry or user experience in business. The third day has been set aside for the fascinating topic of Micros in Education.

Admission to the exhibition is by ticket only. Admission fee at the door is £1.50.

Seminars

Advances in Small-Computer Technology **Thursday, July 30**

An examination of the present developments in small computers which will indicate the direction that this technology may take. This seminar will be an ideal opportunity for an exchange of views between those who work in the computer industry and people who have practical experience in the use of small computers.

Small Computers in Business **Friday, July 31**

This seminar will illustrate in down-to-earth terms the uses, potential and limitations of various computers and the factors to be considered when contemplating the purchase of a small-computer system.

Microcomputers in Education **Saturday, August 1**

A full day describing the practical experiences gained from a number of teachers in the use of microcomputers in education, from the initial choice through to the latest developments.

Full details and the late registration forms can be obtained at the reception desk at the Wembley Conference Centre throughout the event.

Euromouse Maze Contest
Department of Electrical & Electronic Engineering
Portsmouth Polytechnic
Anglesea Building
Anglesea Road
Portsmouth PO1 3DJ
Tel: 0705 27681 or 812466
Contact: John Billingsley

The British Finals of the Euromouse Maze Contest will be held during the 1981 Microcomputer Show. Microprocessor-controlled robot mice must find their way to the centre of a maze, racing against the clock. There are more than 40 teams engaged in mouse construction and the Wembley contest should be a true battle from which the victorious mice will set out to represent Britain in the European finals in Paris.

Micro '81 Publications Centre
Argyle House
Joel Street
Northwood Hills
Middlesex HA6 1TS
Tel: 09274 28211
Contact: Stephen Pugsley

The Micro '81 Publications Centre will have a wide range of publishers of computer books represented. A central information desk will be manned at all times where publishers price lists, catalogues and order forms may be obtained. In some cases, publishers participating may arrange for one of their representatives to be present at certain times on the stand.

Among publishers which will be exhibiting are Online Publications, QED Information Sciences Inc, U.S.A., Elektor Publishers Ltd, Academic Press Inc (London) Ltd, Victor Gollancz Ltd.

Online Conferences Ltd
Argyle House
Joel Street
Northwood Hills
Middlesex HA6 1TS
Tel: 09274 28211
Contact: Jane Windeler

Online, organiser of the 1981 Microcomputer Show, is a organisation specialising in the design and co-ordination of significant conferences and exhibitions covering computers and communications, and related topics of commercial social and political importance.

Earlier this year Online also ran the highly successful Manchester Micro Show which is now going to be repeated with a larger exhibition area on March 3-5, 1982.

LIST OF EXHIBITORS

AFK Associates Ltd

PO Box 68, Pulborough, West Sussex RH20 2RP
Tel: Pulborough (079 82) 3758

AFK ASSOCIATES Ltd is a consultancy firm which specialises in providing independent advice and practical assistance to the users of microcomputers in the business environment.

The company offers a wide range of consultancy services, including the undertaking of feasibility studies — the company is registered under the MAPCON scheme; formalisation of user requirements into computing terms; selection of suitable hardware and software for specific applications; provision of practical support, particularly around the critical implementation period.

It is the company's policy to apply the highest professional standards in the work carried out and in the advice given to clients.

Almarc Data Systems Ltd

906 Woodborough Road, Nottingham NG3 5QS
Tel: Nottingham (0602) 625035

ALMARC Data Systems is sole importer of the Vector Graphic range of products. It is showing many systems and software including the Vector 3 terminal, which is the heart of an extensive range of microcomputer systems from a single 5¼in. floppy drive system — VIP — to the Vector 3005 and 3030 hard-disc systems. The V3 terminal consists of a six-slot industry standard S-100 motherboard, with a 12in. CRT, capacitance

keyboard and numeric keypad, the ZCB single-board computer with 12K of PROM, three eight-bit parallel ports, one serial port, 4MHz Z-80A CPU, 64K dynamic RAM, 80-by-24 screen display.

System VIP consists of the V3 terminal with the Unistor single floppy disc drive unit. System 2600 consists of the V3 terminal with 1.3Mb high-speed twin 5¼in. floppy disc drives. All these and more are on show on the Almarc stand.

BMG Microsystems Ltd

Micro House, Hawksworth, Swindon, Wiltshire SN2 1DZ
Tel: Swindon (0793) 37813

BMG MICROSYSTEMS, an approved supplier to the Government, demonstrates its range of powerful MS-5000 microcomputers. Whether you want floppy discs, hard discs, single- or multi-user, small or large memory, a system should exist to meet your requirements. A full range of software is offered from business systems and data management to production control, and the 16-bit Intel system has just become available.

This British company offers a fully-supported service including consultancy, system design, training, software and software support, hardware and hardware maintenance. Swindon-based, the company is here to help you. Prices start from £8,000.

Canon Business Machines (U.K.) Ltd

Waddon House, Stafford Road, Croydon, Surrey
Tel: 01-680 7700

CANON is demonstrating four different desk-top computers. The new CX1 is a powerful processor with a built-in 12in. VDU with a capacity of 1,920 characters. It has a standard typewriter keyboard and two built-in Canon mini disc drives, each of 500KB capacity with optional expansion up to 4megabytes plus a CPU capacity of 128KB.

Other features include spooling, which gives the machine dual capability operation of VDU and external printer, optional word-processing systems and matrix-handling firmware. Also on display is the BX3 which is the same internally as the CX1, and features a built-in 80-column impact printer in place of the VDU.

This printer has full print-head control, frictional or pin-feed paper control, positive/negative paper feed plus 28-character prompting display panel. Both models have three-channel V24 interfacing outlets as standard plus an optional parallel interface.

Also being shown are the TX10 and TX25 microcomputers. TX10 is engineered with an independent numeric keypad and alpha-numeric block. The keypad is designed especially for heavy numeric data entry. There is a built-in high-speed 26-column dot-impact printer, two-colour selector and a built-in 20-column alpha-numeric display. The TX25 uses Basic and assembler. It incorporates a 4in. disc with an 8K capacity each side. Also on display is a range of Canon peripherals.

Clenlo Computing Systems Ltd

Crown House, 18 Gipsy Hill, London SE19 1NL
Tel: 01-670 4202/3

CLENLO Computing presents the Conqueror microcomputer together with selected software packages covering a full range of business applications. Currently available applications include: integrated accounts, word processing, mailing lists, subscription management, tabular numerical analysis, stock control and Pearl. Pearl is a powerful program generator with a built-in database function and a flexible report writer. A wide range of languages for technical and scientific use are also available.

As your needs develop, the Conqueror can be expanded from a single floppy drive and VDU to a multi-terminal system with more than 100megabytes of hard-disc capacity.

The Conqueror conforms to the S-100 bus standard and runs under the CP/M operating system for single user, or MP/M or Joeshare for multi-user.

The Computer Bookshop

30 Lincoln Road, Olton, Birmingham B27 6PA
Tel: 021-707 7544

COMPUTER BOOKSHOP is importer and wholesaler of a full range of popular small-computer publications.

Computer Bookshop is sole U.K. distributor for Sybex, Compusoft Publishing and Northern Technology, and a full range of these and other books stocked in the Birmingham depot are shown on the stand, which is staffed by people ready to discuss this rapidly-expanding field of technical titles. In all, approximately 250 titles are on view.

New books on display which will be of interest to all computer personnel include Sybex's *50 Basic Exercises* and *Pascal Handbook*.

Currah Computer Components Ltd

Unit 7, Sandgate Industrial Estate, Hartlepool, Cleveland.
Tel: (0429) 72996
Sales contact: Steve Currah

THE CURRAH stand features the Mini Digital Recorder, the fast and simple alternative to disc. The device enables low-cost data/program storage at high speed — approximately 20 times faster than audio cassette, at the fraction of the cost of disc. See its high-speed operations on Pet, Aim-65, Apple and Acorn.

The unit is based on the well-proven Philips MDCR 220 mechanism. System features include read/write, data or programs, back-space, verify, file-handling, Basic load and save.

There is a special exhibition price. Also demonstrated is the read-only tape unit with RS232C interface.

Department of Industry (MAP)

Gaywood House, 29 Great Peter Street, London SW1 3LW
Tel: 01-212 0690

THE DEPARTMENT of Industry Microprocessor Application Project is a £55 million programme. Launched in 1978, its aims are to encourage U.K. industry to introduce microelectronics into its products and processes. The three main areas of help are: awareness and training; consultancy support; and project support.

MAP — the Department of Industry programme to encourage the use of microelectronics. MAP Centre: 524 Dean Bradley House, 52 Horseferry Road, London SW1P 2AA. Tel: 01-212 3411/4.

Development Board for Rural Wales

Ladywell House, Newtown, Powys
Tel: Newtown (0686) 26965

LEARN the industrial development facts on Mid-Wales: new factories of 500-20,000 sq. ft. — rentals around £1 a foot — possibility of rent-free period — finance — loyal labour — housing — market access — Business Advisory Service — beautiful Mid-Wales environment.

If you have a project in mind, let's talk — the service is free and confidential.

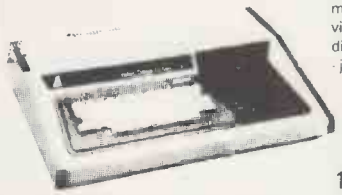
Digico Ltd

Wedgwood Way, Stevenage, Hertfordshire
Tel: Stevenage (0438) 4381

ES

THE Video Genie EG3000 Series

WITH *16K user RAM plus extended 12K Microsoft BASIC in ROM *Fully TRS-80 Level II software compatible *Huge range of software already available *Self contained, PSU, UHF modulator, and cassette *Simply plugs into video monitor or UHF TV *Full expansion to disks, and printer *Absolutely complete - just fit into mains plug.



16K **£299** + VAT

GP80

The most compact 80 column impact graphic-dot printer available - at a very compact price

by seikosha

Graphics, Normal and Double- Width Characters can be printed on the same line. Pine Feed Tractor is equipped as standard.
Two Line-Feed Commands (1/6 and 1/9 inch)
Print on Plain Paper with two copies
Continuous Self-Inking Ribbon for easy handling
Centronics type Parallel Interface standard
Wide Range of Optional Interface Boards
Self-Test Programme standard

£225 + VAT

SUPERBRAIN

SuperBrain's CP/M operating system boasts an overwhelming amount of available software in BASIC, FORTRAN, COBOL, and APL. Whatever your application. . . General Ledger, Accounts Receivable, Payroll, Inventory or Word Processing, SuperBrain is tops in its class.

320K £1850 700K £2400
1.5Mb £2750

COMMODORE COMPUTERS

PET 8K	£415
PET 16K	£525
PET 32K	£650
PET 8032	£895

DISK DRIVES

4040	£695

PRINTERS

EPSON TX80B (inc. I/F & cable)	£299
EPSON MX80T	£395
ANADEX DP8000	£495
ANADEX DP9500	£895
ANADEX DP9501	£995

VIDEO MONITORS

10" BLACK & WHITE	£85
10" GREEN SCREEN	£95

Aculab

Floppy Tape
The tape that behaves like a disk.

Connects directly to TRS-80 level 2 keyboard. Operating and file handling software in ROM 8 commands add 12 powerful functions to level 2 BASIC. No buttons, switches or volume controls. Full control of all functions from keyboard or program. Maintains directory with up to 32 files on each tape.

for all TRS 80 & Video Genie owners

TRS80 version: **£165**
Video Genie : **£170**

Please add £10 Securicor delivery charge to all computers etc.
Plus 15% VAT on all prices.

Acorn Atom

Unique in concept — the home computer that grows as you do!

Special features include
***FULL SIZED KEYBOARD**
***ASSEMBLER AND BASIC**
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***HIGH RESOLUTION COLOUR GRAPHICS**

Simple to build, simple to operate. A powerful, full facility computer with all the features you would expect.
Just connect the assembled computer to any domestic TV and power source and you are ready to begin.
Full-sized QWERTY keyboard 6502 Microprocessor Rugged injection-moulded case 2K RAM 8K HYPER-ROM 23 integrated circuits and sockets Audio cassette interface UHF TV output Full assembly instructions

£120 + VAT

The Second Generation Personal Computer

Highest performance · lowest price

*48K (8080A)
*16 Colours or shades of Grey
*Multiple High Resolution Graphics Modes (64 x 71, 129 x 159, 255 x 335)
*Character mode (60 x 24)
*Split Screen Modes
*Full ASCII Upper & Lower Character Set
*Unique graphical — Sound Commands for Smooth Music, random frequencies & enveloped sound!
*RS232 I/F

DAI Personal Computer at only + VAT **£595**

Paper Tiger 460

The Paper Tiger 460 sets new standards by incorporating many features previously only available on units costing much more.

Features like a specially developed nine wire 'staggered column' head which overlaps the dots of each matrix character with just one pass of the printhead giving a dense, high quality print image without reducing the units 160 c.p.s. print speed.

It also offers a bi-directional logic seeking device to enhance its print optimisation characteristics and wide range of 'print versatility' features such as mono or proportional spacing, automatic justification, programmable horizontal and vertical tabbing, and 'fine' positioning for word processing applications.

£795 + VAT

Paper Tiger 560

The Paper Tiger 560 is the first printer which bridges the gap between convenitonal matrix and 'daisy wheel' types offering quality printing at a relatively low price.

Full 'width' 132 column printing at 160 c.p.s., a unique nine wire 'staggered' print head, bi-directional printing, an inbuilt tractor feed and a host of selectable features set it apart from ordinary matrix printers.

Plus for even greater versatility a full dot plot graphics facility if supplied which includes a 2K buffer.

£995 + VAT

Books & bits

Books — Manuals — Diskettes — ribbons — Paper — chips (2114 x 2 1K) £4 pair.
RS232 to Centronics interfaces £40 etc. etc.
A variety of second-hand computer equipment usually available, spares, repairs and service.

MicroStyle

29 Belvedere, Lansdown Road, Bath BA1 5HR.
Telephone: (0225) 334659.

New Showroom
OPENS 1st JUNE AT
29 BELVEDERE, BATH.
2 minutes from town centre

E6

WITH THE launch of the Prince, Digico's latest microcomputer, users can now enjoy the benefits of both micros and minis. No longer do users have to deliberate as to whether a micro or a mini will meet their computing needs. Digico is demonstrating computer system integration.

On the Digico stand is a powerful three-terminal minicomputer system interlinked by a series of Prince microcomputers. The micros can operate as stand-alone systems with their own operating system, languages and packages or link up to the mini as an intelligent terminal or just as an on-line VDU.

A user can start with a Prince micro which will link up to all the mini and mega processing power available in the Digico range — enabling a micro user to grow into a powerful system capability. At the same time, the Prince can still remain a stand-alone system in its own right. Ideal for the new computer user, the Prince provides a sound platform from which to employ an initial investment in computers. Starting at £1,700, a full Prince system can also offer standard packages such as sales, purchase, nominal, stock control, order entry and payroll, word processing and full graphics. The Prince enables users to start with the best of both worlds.

Dillon's University Bookshop

1 Malet Street, London WC1E 7JB
Tel: 01-636 8211

ON THE Dillon's stand you will find a large selection of books on minicomputers, microprocessors, the application of computer systems in business and research, and some fascinating material on the impact of computers in society.

Only a fraction of stocks available in Dillon's Malet Street shop in London, where all publishers in this field are represented, are exhibited. If you cannot visit the shop, ask for catalogues and order forms. Dillon's has an international mail order service backed by one of the widest selections of academic and technical books in the U.K.

Encotel Systems Ltd

530 Purley Way
Croydon
Surrey
Tel: 01-686 9687

ENCOTEL IS exhibiting the Superbrain with disc packages, with Interval 5megabyte hard disc and the version with high-resolution graphics.

Also on view is the new Televideo System 1 and 2: System 2 is a very low-cost, high-performance multi-tasking multi-processor network system. Other systems and peripherals feature the Oki colour CP/M Microcomputer, the DRE 8820 high-performance matrix printer, Sanders Technology letter-quality matrix printer, the D Base 2 relational database management system, Spell Binder Wordprocessing, Bisync IBM emulation software, Micromodeller financial modelling software and a wide range of applications software.

Gwent County Council

County Hall, Cwmran, Gwent.
Tel: 06333 67711
Sales contact: Derek Powell

THE GWENT Council stand at the exhibition aims to acquaint commerce and industry with the attractions of moving to Gwent. Near the Severn Bridge, with good rail and road links and nearby airports, Gwent has a range of superb factory and office sites, buildings, skilled workforce and full Government support for industry expanding and for re-location in the area.

Gwent provides a full professional and confidential service to the industrialist concerning sites and buildings, assistance with planning applications, landscaping, site layout, financial aid and services.

Ingersoll Electronics Ltd

202 New North Road, London
N1 7BL
Tel: 01-359 0161 Telex: 28255

INGERSOLL Electronics, exclusive U.K. distributor of the world's best-selling microprocessor-based TV game, the Atari Video Computer System, is marketing the world's most advanced home computers — the Atari 400/800 series.

Designed for the 1980s, built to a high degree of reliability, engineered to accept ROM, RAM, cassette tape, floppy disc and bubble memories, these revolutionary personal computers are the first true home models. Plugged into a standard home colour TV, they are capable of full-colour display, four sound "voices", music synthesis, light pen, MODEM and utilise high-speed printers. They offer a full range of computer facilities for home, business and educational use, plus good old-fashioned fun and games.

The Atari personal computer system is based on the Atari 6502 microprocessor, will handle up to four disc drives, has full-feature keyboards with ASCII ability and is programmed in Atari Basic.

The 400 retails at round £345 and the 800 at around £645.

Interactive Data Systems Ltd

14 Heathfield, Stacey Bushes,
Milton Keynes, Buckinghamshire
MK12 6HP
Tel: Milton Keynes (0908) 313997
Sales contact: Jon Spencer

INTERACTIVE is showing its new, highly-acclaimed British Oscar microcomputer, 65K S-100 system for less than £3,000 or the word-processing version from £4,400 with 55cps daisy-wheel printer.

Interactive is also showing its other S-100 products including the Saracen mainframe system and S-100 boards. These products are designed and built in Milton Keynes, England, to the highest standards and will appeal to end-users, dealers and OEM manufacturers alike.

Kansas City Systems

Unit 3, Sutton Springs Wood,
Chesterfield, Derbyshire
Tel: Chesterfield (0246) 850357

KANSAS City Systems specialises in software for the Tandy TRS-80 and Video Genie computers; it is the only company service just for the hobbyist. All the programs are aimed at micro owners who use their computer purely for pleasure — whether just games playing or for programming.

Kansas has what are now recognised as the best all-action arcade games in the business, as well as the most outstanding *Adventure-cum-Quest*-type games programs. For programmers, the Kansas Toolkit has been acclaimed for its superiority of its functions, taking only a minimal 2K of memory for all its 11 commands.

Keen Computers Ltd

5b The Poultry, Market Square,
Nottingham
Tel: Nottingham (0602) 583254

NETWORKS and multi-user micro systems are the main items on display. Omninet, a low-cost, carrier sense multiple-access, high-performance local network for micros, allow inter-connection of 64 micros and peripherals over a 4,000 ft. serial link. Using low-cost shielded twisted pair cable, micros are connected via Omninet transporters and links to the proven Corvus hard-disc system to provide data storage. First micros to use Omninet will be Apple, Onyx and Dec LSI-11.

The full Corvus/Constellation/Mirror network is displayed, featuring accounting, graphics and word-processing software.

Onyx Micros/Unix 7 and Marathon relational database and other

THE PETALECT ALL-ROUND COMPUTER PACKAGE

Makes the choosing easier

We realise that with any microcomputer purchase the back-up support and advice must figure large in your decision making. A bargain price does not always guarantee a worthwhile purchase. So before deciding look at what Petalect can offer.

First time user

A modern microcomputer need hold no terrors for the first-time user. Petalect can make it easy by discussing your requirements and advising you on the most cost-effective system. And if you're still unsure you can come along to our showroom and try out a computer for yourself. We will also give your staff the necessary training FREE of charge, in other words take the headache out of modernising your business.

4 Petalect packages

Ranging from £1,000 to £15,000 the systems are amazingly simple to operate, superb value for money and are all widely used by businessmen and professionals. You'll find that all the systems software programs cover most business requirements, from accounts, to letter writing. And if you want a program specially written – we'll do that for you.

COMMODORE Ideally suited for the small business, tackling your bookkeeping, stocktaking, word processing this system is reliable and good value.

APPLE This popular computer system is one of the most versatile on the market with an expandability up to 48K bytes of user memory space, supported by a large range of programs.

ACT The Series 800 offers the user a larger capacity system and a high speed data retrieval allowing you a higher volume of transactions.

HEWLETT PACKARD This lightweight (only 20lbs) portable computer provides the professional with a numeric or graphic system fully integrated with display screen and printer in the one unit.

Extending your system

Whichever system you choose Petalect can advise you on expanding your present capability with extra memory space or multi-terminals.

Keeping you going

However reliable your system may be, there will be times when service is required. We offer a very reliable after-sales service if you are situated in the South. Our engineers would be with you in a very short space of time reducing downtime to the minimum. And it doesn't stop there! We can offer sales support with an extensive range of computer related products – and its all just a phone call away.

Buying your system

Even here we can make it easier for you with very attractive leasing or lease purchase agreements. So before you make a decision, FOR THE BEST PRICES IN THE SOUTH, speak to us first and have the benefit of an all-round package.

Special terms available for Educational/Government Depts.

PETALECT MICROCOMPUTERS

Make the right choice, right from the start

Showroom: 32 Chertsey Road, Woking, Surrey GU21 5BG.
Telephone: Woking (04862) 63901/68497

Please send me details of Petalect's ALL-ROUND Computer Package and price list.

Name _____

Company _____

Position _____

Address _____

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POST TODAY!

Petalect Electronic Services Ltd., Dept. PC, 33/35 Portugal Rd., Woking, Surrey GU21 5JE

E8

software are featured. Staffed by fully-qualified micro experts, a visit to the Keen stand is a must.

Lowe Electronics

Bentley Bridge, Chesterfield Road, Matlock, Derbyshire
Tel: Matlock (0629) 2817

LOWE Electronics is exhibiting the complete range of Video Systems, accessories and peripherals, including the brand-new Genie 11 and the colour add-on for the Video Genie. This stand is a must for the discerning visitor.

Millbank Computers Ltd

98 Lower Richmond Road, London SW15 1LN
Tel: 01-788 1083

MILLBANK Computers Ltd is the exclusive national distributor of the Millbank System 10 microcomputer. System 10 is a fully-integrated micro built to an outstandingly high specification and guaranteed for one year. It is suitable for a wide variety of commercial uses including all forms of business administration, word processing, communications, and many specialist scientific applications.

An extensive library of software includes Financial Director — a superb British accounting package; EAMIS — a special program for estate agents; and Wordstar.

Also on display are Qume and Olivetti daisywheel printers plus a special offer on Prestel adaptors and favourable exhibition discounts.

Newbear Computing Store Ltd

40 Bartholomew Street, Newbury, Berkshire
Tel: Newbury (0635) 30505
Telex 848507

AS THE leading distributor of Sharp MZ-80K computers in the country, Newbear is displaying a very large range of additional hardware and software.

The Apple II plus now leads the field in its versatility and range of application software. This system is fully supported and endorsed by Newbear.

Newbear has the widest range of microcomputing books. Come and see it on the stand.

Ohio Scientific (U.K.) Ltd

Middlegreen Road, Langley, Berkshire SL3 6DF
Tel: Slough (0753) 75915

OHIO SCIENTIFIC (U.K.) Ltd, a subsidiary of American Data Inc, the world's largest distributor of OSI products, is showing three microcomputers from its professional range.

C2-OEM, a 48K RAM, dual 8in. floppy, single-processor machine, ideal for small office, or intelligent terminal for Challenger network systems; C3D, a 7megabyte formatted hard-disc micro, with single 8in. floppy, 52K RAM, three processors — 6502, 68000 and Z-80A. In addition, a 36megabyte triple processor, multi-user Challenger is demonstrating business application software.

Ohio Scientific (U.K.) provides a support base for dealers and OEMs, with training facilities, at Langley.

Omicron Management Software

69 Wimpole Street, London W1
Tel: 01-935 2964 or 486 4895

OMICRON management software is exhibiting its Power Systems, a new range of advanced software packages for microcomputers. Developed in the U.K. by a team of qualified accountants and dp personnel, the Power Systems are applicable to a wide range of commercial and industrial organisations. Extensive facilities and flexibility are provided giving the advantage of being able to adapt to users' precise requirements without re-programming.

At the same time in practice, they have proved to be extremely easy to use. The Power Systems include, payroll, purchase, sales and general ledger, stock control, and order entry and invoicing. Available currently for operation under the CP/M and MP/M operating systems the Omicron Power Systems will appeal to both the first-time and the experienced user.

Padmede Computer Services

351 Fleet Road, Fleet, Hampshire
Tel: Fleet (025 14) 21892

PADMEDE Computer Services is showing a full range of business application systems developed for a number of internationally-established manufacturers of microcomputers. The Padmede business systems available are invoicing, sales ledger, purchase ledger, incomplete records, nominal ledger, stock control, job costing, contract costing, time and cost recording and quotation and estimation.

Each piece of software can be run as a self-contained system in its own right, but some link together via bridge programs to give an integrated system. On some microcomputers, the financial accountancy system is totally integrated.

Personal Computer World

14 Rathbone Place, London W1
Tel: 01-637 7991

PERSONAL COMPUTER WORLD is Britain's largest-selling microcomputer monthly. It specialises in up-to-the-minute news coverage and in-depth product reviews. As well as bench tests of new microcomputers, these reviews now cover both word processors and multi-user systems. If you would like to see how *Personal Computer World* can help you arrive at the best system, pick up the latest issue on the stand — as well as back numbers.

Also available are full details and tickets for the Fourth Personal Computer World Show to be held at the Cunard International Hotel in Hammersmith, London.

Personal Computers Ltd

194-200 Bishopsgate, London EC2M 4NZ
Tel: 01-626 8121 Telex: 88264
Sales contact: Mike Sterland

PERSONAL Computers is the longest-established U.K. Apple distributor. This position has enabled it to find numerous compatible hardware and software products for Apple including Teksim and Tektronix simulator on ROM, and analogue-to-digital converter, full-sized floppy disc drives, alpha-numeric and graphic matrix printers, Milliken interactive medical education software, text-processing software, estate agents' software and numerous other software packages including payroll, ledgers and programs for medical practices.

Petalect

33-35 Portugal Road, Woking, Surrey
Tel: Woking (048 62) 21776

PETALECT is demonstrating a range of hardware systems including Apple, ACT, Hewlett-Packard, CBM systems and the Vic-20, together with a varied choice of software.

Practical Computing

Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS
Tel: 01-661 3500
Sales contact: David Lake

PRACTICAL COMPUTING is Britain's leading microcomputer magazine appealing to the growing number of people using personal computers in business, education and the home.

Practical Computing reviews cover microcomputers and software, providing just the information you need — technical data and unbiased critical comment on the strengths and weaknesses of each system. A series of Buyers' Guides devoted to micro-

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Haywood Electronic Associates Limited Electron House Leeway Close Hatch End Pinner Middx. HA5 4SE. Telephone 01 428 0111. Telex 896819 Keyhay G

Technical Details
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computers, software packages and peripherals also provide a useful shop window for those who are considering buying a system or expansion.

Research Machines

PO Box 75, Mill Street, Oxford
Tel: Oxford (0865) 49791

RESEARCH Machines is the Oxford-based manufacturer of the 380-Z microcomputer, which is recommended by the CCTA for use in Government departments. It has also been chosen by the Department of Industry for inclusion in the Micros for Schools scheme. The 380-Z uses for Z-80A microprocessor and the industry standard CP/M disc operating system; 5¼in. and 8in. floppy disc drives are available.

On display is the new 40/80-character VDU board; facilities provided by the board include a user-writable character set, smooth scrolling and screen windowing.

The popular Wordstar package is now available from Research Machines.

SBD Software

15 Jocelyn Road, Richmond, Surrey TW9 2TJ
Tel: 01-948 0461

SBD SOFTWARE is a company which supplies Apple software to both the retailer and the trade. It is the sole U.K. distributor for Sensible Software which produces a wide range of utilities and for a new word-processing package, Magic Window, produced by ArtSci Inc. In addition, the company writes its own software, Apple List, which produces a tidy 80-column listing of your program.

Have you ever played four-by-four-by-four noughts and crosses? If not, now is your chance with *Kubik*. There are many other games — please ask, SBD probably has it.

Stonehart Publications Ltd

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Sales contact: R J Miller

MANAGEMENT Confidence on stand 4 is Robert Heller's Management Guide for profit-minded business executives. Offering shrewd advice and practical ideas on everything from marketing and financing to staff motivation, it is the insider's guide to profitable business management.

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Sales Contract: Peter Strutt

THE COMPANY displays its range of floppy discs, memory products, microprocessors, printers, terminals, and VDUs.

Sun Computing

138 Chalmers Way, North Feltham Trading Estate, Feltham, Middlesex
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SUN COMPUTING is showing a range of microcomputers and business systems.

Systime Ltd

Concourse Computer Centre
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Telex: 556283

SYSTIME Ltd is a company which embraces all the traditional values of Britain at its best. By a combination of entrepreneurial skills and high-technology expertise, Systime has emerged, in seven years as a registered company, to become the largest British supplier of turnkey minicomputer systems and the second-largest British manufacturer of data-processing systems.

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Systime is based in Leeds with a network of offices covering the whole of the country, and overseas operations in Europe, U.S.A., Asia, Africa and the Middle East.

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Growth has been dramatic but controlled. The financial results for 1979/80 show a 54 percent increase in turnover to £24.06 million and with world-wide staff numbering more than 1,000, underlines the dedication of management and staff to continuing success by development of new products and enhancements to existing products and services. With this strong company base, Systime looks forward to a bright future.

Tangerine Computer Systems Ltd

Forehill Works, Forehill, Ely, Cambridgeshire CB7 4AE
Tel: Ely (0353) 3633, 5326, 5489 & 61460

TANGERINE Computer Systems is showing Tantel Viewdata adaptors:- numeric adaptor costs £170 + VAT available ex stock; and alpha-numeric adaptor at £200 + VAT is available August 1981. Both adaptors produce a high-quality display and can be used on black and white or colour televisions. The units are very compact and contain the latest computer technology. Alpha-numeric is particularly suitable for private viewdata systems.

Tangerine Computer Systems is also exhibiting several modules from its successful Microtan 65 system, including Tanram, a 40K add-on memory board, the new high-resolution graphics board, a dedicated 6502 controller card and various serial and parallel interface cards.

Triumph-Adler U.K. Ltd

27 Goswell Road, London EC1M 7AJ
Tel: 01-250 1717
Sales contact: S Larholt

THIS STAND is showing the Alphatronic, Triumph-Alder's new business microcomputer, priced from £1,600 to £2,345. It is specifically developed for business users, employing the technical expertise Triumph-Adler has gained in microcomputer manufacture.

It is an integrated unit with 48 kilobytes of user memory, up to 320 kilobytes storage capacity on 5¼in. floppy discs, a full QWERTY keyboard, numeric keypad and programmable function keys. The configuration includes a free-standing professional visual display of 920 characters — 24 lines/80 characters — and a 80 cps matrix printer of Adler's own manufacture.

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VNU Business Publications BV

53/55 Frith Street, London W1A 2H6
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THIS IS the first opportunity to see a copy of the new microcomputer publication to be launched by VNU Business Publications BV in the Autumn.

Your Computer

Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS
Tel: 01-661 3500
Sales contact: David Lake

YOUR COMPUTER is the new magazine for the home computer enthusiast interested primarily in systems costing less than £300.

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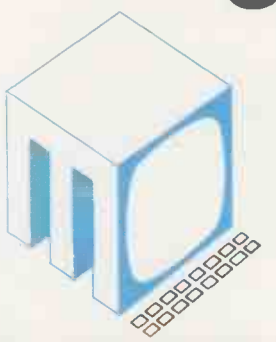
E12

CP/M SOFTWARE

from



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E14

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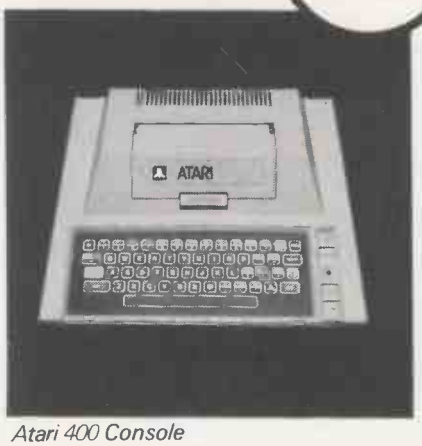

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MUCH MORE FOR ATARI COMING SOON

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Demonstrations at our shops from June 9th 1981. See Atari at 284 London Road, Westcliff-on-Sea, Essex. Tel: (0702) 554000 and at 159-161 King St., Hammersmith W6. Tel: 01-748 0926

MAPLIN

Maplin Electronic Supplies Ltd
P.O. Box 3, Rayleigh, Essex.
Tel: Southend (0702) 552911/554155

Note: Order codes shown in brackets. Prices firm until August 30th 1981 and include VAT and Postage and Packing. (Errors excluded.)

E15

NEW!! - 10Mb HARD DISK SYSTEM

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The Morrow Hard Disk Controller can support as many as four hard disk drives at either 10Mb, 20Mb, or 26Mb each

Horizon Computer + 64K Ram + 2 Quad Drives (720K) + Morrow 10Mb Hard Disk + Televideo TVI–912c VDU + CP/M 2.2

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HMSOS — Super fast multi-user operating system for the North Star Horizon computer used with Morrow 10Mb, 20Mb or 26Mb hard disk(s) and tape cartridge backup unit. Can also be used with standard North Star mini-floppy disk drives. **HMSOS** gives you single/multi user compatibility — it configures itself automatically according to your memory set-up and supports up to seven users. It will run existing North Star BASIC programs with little or no modification. It incorporates implicit printer lockout and file lockout from BASIC. Also allows you to load your own assembly language routines from BASIC. The operating system and BASIC are pseudo-reentrant in that only one 16K memory card is required in the address space 0–3FFF. This board holds the operating system and BASIC for all users. Thus one DMB6400 64K board is sufficient for a three-user system with effectively 32K per user!!!

ABRIDGED PRICE LIST

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SOFTWARE

HMSOS — Mini-floppy multi-user system	£175*/£5**
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COMSTAR — North Star BASIC compiler	£245*/£20**
KDS — North Star BASIC utility suite	£50*/£5**
N*BUS — North Star BASIC global editor	£50*/£5**
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CP/M — For North Star Horizon (Vers. 2+)	£95*/£18**
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MailMerge — WordStar Overlay Option	£60*/£15**
DataStar — Data entry, retrieval Sys	£160*/£25**
SuperSort 1 File sort utility	£110*/£20**
CIS COBOL — Standard package	£395*/£30**
C BASIC/2 — Basic pseudo compiler	£85*/£15**

*Price of software includes manual
**100% credit if software is purchased later

E16

PLEASE WRITE OR PHONE FOR FULL DETAILS

STARLINK —
Specially written to link CP/M on the Morrow M10, M20 and M26 hard disk drives to quad capacity mini-floppy disk drives in the North Star Horizon computer. With **STARLINK** file transfer is simply accomplished using the standard CP/M "PIP" utility. **STARLINK** is available as a single or multi-user system. The multi-user version supports upto seven users each with upto 56K memory. **STARLINK** also supports tape cartridge backup for the Morrow hard disks.

COMSTAR — North Star BASIC Compiler. Consists of a full compiler which translates a North Star BASIC program into an assembly language source file, a disk-based macro assembler which further translates the source assembly language program into a relocatable machine equivalent, and a linking loader which combines the relocatable machine program with the requisite support routines to form an executable program. There is also a console command processor which reads a sequence of console commands from a disk file to automate the compilation process plus a character-oriented text editor to create console command files or modify assembly language programs. A **COMSTAR/CPM** interface is also available to enable compiled BASIC programs to run under CP/M.

KDS and **KDS–EXT** — A suite of menu driven utility programs written in assembler for fast operation. Developed as a debugging aid for long and complex programs, it includes a patch program to allow the **KDS** machine language routines to be hybridised to North Star BASIC. Consists of a compaction program which improves run time by up to 33%, a cross-reference program which creates and sorts a list of cross-reference items, a program to change the name of a variable globally within a line number range, a search program to locate a given syntax combination or byte value, and a program which compares two programs listing the differences between them. **KDS-EXT** is an extension package to KDS with many useful utilities. These include a protect program which also speeds up run times, a directory sort utility, a global editor for the search/replace of syntax combinations, a utility which enables transfer of programs to and from a disk file and then allows editing with a text editor. In addition there are programs to perform multiple variable exchanges, high speed disk dumps/searches, file dumps, and to find a list files of a given type. Highly recommended for North Star BASIC users.

Prices and specifications subject to change without prior notice.

Main UK Distributor:

Interam Computer Systems Ltd.
46 Balham High Rd, London SW12 9AQ
Tel: 01 675 5325/6/7 Telex: 925859

Tangerine display

THIS SMALL piece, of code, when added to the graphics display program in 6502 Special October 1980, enables interesting displays to be created quickly, writes Greg Ellein of Great Bridgeford, Staffordshire.

```
00E6  A9 00  START   LDA#M 00 ;SET UP
   E8 85 13          STAZ 13
   EA 85 1C          STAZ 1C  ;MODADL
                              ;H TO FE00
   EC A9 FE          LDA#M FE
   EE 85 1D          STAZ 1D  ;COPL,
                              H TO FFFF
00FQ A9 FF           LDA#M FF
   F2 85 1F          STAZ 1F  ;HXPKL,
                              H TO 0200
  F4 85 1E           STAZ 1E
   F6 A9 02          LDA#M 02
   F8 85 14          STAZ 14
FA AD F0 BF          LDA BFF0 ;SWITCH
                              ON GRAPHICS
FD 20 9B FD JASR COPY ; DUMP LAST 1/2
TANBUG TO SCREEN
0100      GRAPHICS DISPLAY PROGRAM
      TO USE GE6 INSTEAD OF G100
```

The program copies the last half of Tanbus to the screen in graphics mode. To change the pattern, re-set, G100 twice to scroll the screen until you obtain attractive patten. It uses the monitor copy routine accessed by command 'C', There are three other command routines:

OFSET	FDOB	SOURCE IN MODADL, DESTINATION IN HXPKL
LIST	FD49	START IN MODADL,H; NO. OF LINES IN HXPKL
COPY	FD9B	START IN MODADL,H; END IN COPL,H; DESTINATION IN HXPKL,H
MODIFY	FDES	START IN MODADL,H.

Memory jump

UK101 USERS may be interested to know that when "memory size?" is replied with the letter A followed by Return, the message "This is the Compukit UK 101" appears and cold-start is re-started, writes Derek Wong of Liverpool. This occurs because, when A is the first character entered, a JMP $BDOA is executed. $BDOA loads the message pointer $BE4E and outputs the message. By this time, the program counter is at $BD11, the cold-start entry point.

Those with the new Comp Shop Monitor will only get a glimpse of the message. This is because the message contains a clear screen character 0CH. To slow it down, enter Basic and type;
SAVE:POKE 11,0:POKE 12,189:X = USR(X).

Save routine

THIS ROUTINE works on Compukit and will save a Basic program on tape along with a section of memory which may contain subroutines or date, writes Neal Oliver of St Albans, Hertfordshire.

```
Ø DATA16Ø,2,169,47,76,195,168,13,1Ø,82,85,78,13,1Ø,Ø
63ØØØ  FOR X=552 TO 566:READI:POKEX,I:NEXT:POKE15,72:POKE515,Ø
63Ø1Ø  INPUT"START & FINISH LOCNS (HEX) ";S$,F$
63Ø2Ø  PRINT"HIT 'CTRL' TO SAVE":POKE4,4Ø:POKE5,2
63Ø3Ø  IF PEEK(57Ø88)<>255 THEN 63Ø3Ø
63Ø4Ø  PRINT"SAVING:":SAVE:FORX=1TO14ØØØ:NEXT:PRINTCHR$(64)
63Ø5Ø  IF F$=S$ THEN PRINT"NEW":PRINT"ØPOKE515,Ø":LIST1-62999
63Ø6Ø  PRINT"POKE251,1:POKE11,67:POKE12,254:POKE536,191:X=USR(X)"
63Ø7Ø  PRINTS$"/";:GOSUB6312Ø:S=F:S$=F$:GOSUB6312Ø
63Ø8Ø  POKE538,177:POKE539,252
63Ø9Ø  FOR I=STOF:P=PEEK(I):A=(PAND24Ø)/16:GOSUB6314Ø
631ØØ  A=PAND15:GOSUB6314Ø:PRINTCHR$(13);:NEXT:POKE538,1Ø5:POKE539,255
6311Ø  PRINT".A274G NEW":PRINT"ØPOKE536,186:POKE515,Ø":LIST1-62999
6312Ø  F=Ø:FORI=1TO4:A=ASC(MID$(S$,I,1)):A=A-48+7*(A>64)
6313Ø  F=F+A*16↑(4-I):NEXT:RETURN
6314Ø  PRINT CHR$(A+48-7*(A>9));:RETURN
```

Save routine by Neal Oliver.

With the program to be saved in lines 1 to 62999 and with the section of memory protected using Memory Size, type

RUN 63000

The program will prompt you for the start and finish locations of the section of memory to be saved — to be typed in HEX, with leading zeros, for convenience.

Typing "0,0" will bypass any saving of memory on to tape. Then it will wait for you to start the tape player in record mode and to press CTRL. There will be a delay before a series of commands is saved on tape, followed by the data — not displayed on screen — and then New, followed by the Basic program with Run at the end.

When this tape is loaded — type Load in command mode — the computer will jump into the monitor and start loading into memory. It will then jump back into Basic and load the Basic program, which is then automatically run. Remember to set Memory Size before loading.

Atom labels

I AM writing regarding a problem I recently encountered while trying to run an assembly language program on my Acorn Atom, writes Ian Glendinning of Bertley, County Durham. Forward references to labels are not resolved automatically by the assembler. So, you must perform assembly twice, if forward references exist, either by enclosing the assembler statements within a For loop or, to quote the manual, simply by typing Run twice before executing the machine-code program.

My problem arose because I used the second method and so my label arrays, defined by Dim statements, were dimensioned twice. I expected that they would leave the values the same on the second pass because executing Run re-set the free pointer used for allocating arrays. In fact I was only partly correct.

The base addresses of the arrays remained the same, as expected. On dimensioning and array, however, Atom Basic checks to make sure that there is some RAM left, and in doing so, overwrites the byte after each array. This causes certain bytes to be set to $55 and on the second pass, any instructions using these labels will be given incorrect addresses — causing havoc when you try to execute the code.

The Atom manual makes no mention of this side effect of the Dim statement and I am sure that anybody writing assembler programs seriously is likely to meet this problem at some stage. As it took me a few days to discover the cause of my trouble, I hope that I have saved other users from this particular pitfall.

Data check

ONE ANNOYING problem when entering large amounts of machine code via Basic uisng Data statements, is the difficulty in detecting errors, complains MJ Bedford of Todmorden, Lancashire. In theory, it is easy to check the numbers by reading the screen listing but even then, errors can be missed. The following short program will assist in debugging data statements.

To use the program, enter only the data statements and the program. Then enter Run 63000. The program automatically Pokes the graphics character corresponding to the datum to the screen. The graphics character can then be compared to the datum by checking the graphics code.

The data are double-spaced horizontally and vertically. The program will detect data with values greater than 255 and the appropriate out-of-range message will appear. The program will also stop at this point.

The program will deal with 100byte blocks. Correct blocks can then be saved and further blocks entered, checked and saved until the full listing is completed. The program was written for the Superboard.

Data check by M J Bedford.

```
63000  FOR X=1 TO 32 : PRINT : NEXT X
63010  FOR Y=1 TO 9 : FOR Z = Ø TO 9
63020  READ D : POKE 53415 + (2*Z) + (64*Y),D
63030  NEXT Z : NEXT Y
```

Binary dump

ONE OF the problems encountered when loading reasonably large machine-code programs from slow 300 Baud cassette is the time needed, writes Patrick Bampton of Newbury, Berkshire. For example on the Superboard/UK101, it takes about nine minutes to load the assembler/editor, if it is stored on cassette in the standard hexadecimal machine-code load format.

This problem can be reduced either by moving to a faster interface or by packing one's data more efficiently on cassette. Using the standard load code, three characters are needed to store one byte of data on cassette, namely two Hex digits followed by the Return character. In theory, it should be possible to store every byte as a single character thereby reducing the load time by a factor of three.

This does mean however that there is no redundancy left, with which to represent control characters. This problem can be overcome however by preceding all occurrences of a control character by some other special character, often the ASCII Escape character — Hex 1B is used.

When the control character is to be treated as normal data, occurrences of the character by itself being treated as genuine control characters. This also implies that the Escape character must itself be preceded by Escape if it occurs in normal data.

I have written two complementary programs, a loader and a dump which deal with a program (or data) stored on cassette in the following format.

Byte.0 — The character<.>dot Hex 2E
Byte.1 — Transfer address High byte
Byte.2 — Transfer address Low byte
Byte.3 — Start address of program block High byte
Byte.4 — Start address of program block Low byte
Byte.5 — End address of program block High byte
Byte.6 — End address of program block Low byte
Byte.7 — Byte.n — 1 The body of the program block
Byte.n — The character<G>Hex 47 End of block

The dump/loader is listed as a single program. The dump occupies memory 1F00-1F8B, start address 1F06. The loader occupies memory 1FB0-1FFC, start address 1FB0. Both programs make use of Cegmon subroutines, but there should be little difficulty making modifications for SYNMON. Here are the procedures for use:

- Load the program to be dumped into memory.
- Load the loader/dump into memory.
- Use the monitor to put the low address of the block to be dumped into 1F00-1F01.
- Place the high address of the block + 1 into 1F02-1F03.
- Place the transfer address into 1F04, 1F05.
- Using the Cegmon save option type .S1FB0, 1FFC > 1FB0.
- Start the cassette recording and type Return. This dumps the loader at the head of the cassette in standard load code.
- Immediately the loader has been written to cassette, type .1F06G. This starts the binary dump writing your program to cassette. The various graphics characters should appear on the screen as dumping takes place.
- You will now have a self-loading binary tape of your program, preceded by the loader itself. To use it, merely load it as any other machine-code tape. After a few seconds, the loader will be read in and then take over the job of loading the main program.

Binary dump by Patrick Bampton.

```
10   ;BINARY LOADER DUMP
20   ;
30                RSACIA=$FCA6    ;INITIALIZE ACIA
40                CRLF=$FBF5      ;RETURN-LINEFEED
50                TAPOUT=$FCB1    ;OUTPUT TO CASSETTE
60                MONITR=$FE0C    ;MONITOR ENTRY
70                SCOUT3=$FF8F    ;OUTPUT TO SCREEN
80   ;
90                *=$1F00
100 1F00 0000     LA:.BYTE 0,0    ;LOW ADDRESS
110 1F02 0000     HA:.BYTE 0,0    ;HIGH ADDRESS
120 1F04 0000     TA:.BYTE 0,0    ;TRANSFER ADDRESS
130  ;
140 1F06 AD001F DUMP:LDA LA    ;START OF DUMP CODE
150 1F09 8580        STA $80  ;TRANSFER LA TO $80-$81
160 1F0B AD011F      LDA LA+1
170 1F0E 8581        STA $81
180 1F10 20F5FB      JSR CRLF ;LINE-FEED
190 1F13 A900        LDA #00  ;BYTE COUNT INITIALIZE
200 1F15 8582        STA $82
210 1F17 A92E        LDA #$2E ;START OF DUMP CHARACTER
220 1F19 205A15      JSR TAPE1
230 1F1C AD051F      LDA TA+1 ;WRITE TRANSFER ADR ON CASSETTE
240 1F1F 20751F      JSR TAPE2
250 1F22 AD041F      LDA TA
260 1F25 20751F      JSR TAPE2
270 1F28 A581        LDA $81  ;WRITE LOW ADR ON CASSETTE
280 1F2A 20751F      JSR TAPE2
290 1F2D A580        LDA $80
300 1F2F 20751F      JSR TAPE2
310 1F32 A000   LOOP:LDY #00  ;START OF MAIN LOOP
320 1F34 B180        LDA ($80),Y
330 1F36 20751F      JSR TAPE2
340 1F39 18          CLC      ;INCREMENT ADDRESS
350 1F3A E680        INC $80
360 1F3C D002        BNE X1
370 1F3E E681        INC $81
380 1F40 18       X1:CLC
390 1F41 A581        LDA $81
400 1F43 CD031F      CMP HA+1  ;TEST FOR END OF DUMP
410 1F46 90EA        BCC LOOP
420 1F48 D008        BNE OUTX
430 1F4A 18          CLC


440 1F4B A580        LDA $80
450 1F4D CD021F      CMP HA
460 1F50 90E0        BCC LOOP
470 1F52 A947   OUTX:LDA #$47  ;WRITE TERMINATOR TO CASSETTE
480 1F54 205A1F      JSR TAPE1
490 1F57 4C0CFE      JMP MONITR
500 1F5A 48    TAPE1:PHA       ;WRITE TO CASSETTE ROUTINE
510 1F5B 208FFF      JSR SCOUT3;WITHOUT ESCAPE CONSIDERATION
520 1F5E EE0002      INC $200  ;ATTEND TO CURSOR AFTER
530 1F61 E682        INC $82   ;OUTPUT TO SCREEN
540 1F63 A582        LDA $82   ;WRITE CRLF
550 1F65 C929        CMP #45   ;AFTER 45 CHAR LINE
560 1F67 3007        BMI X2
570 1F69 A900        LDA #00   ;RESET CHAR COUNT
580 1F6B 8582        STA $82
590 1F6D 20F5FB      JSR CRLF
600 1F70 68       X2:PLA
610 1F71 20B1FC      JSR TAPOUT
620 1F74 60          RTS       ;EXIT TAPE1
630 1F75 48    TAPE2:PHA       ;WRITE TO CASSETTE
640 1F76 C92E        CMP #$2E  ;WITH ESCAPE CONSIDERATION
650 1F78 F008        BEQ X3
660 1F7A C91B        CMP #$1B
670 1F7C F004        BEQ X3
680 1F7E C947        CMP #$47
690 1F80 D005        BNE X4
700 1F82 A91B     X3:LDA #$1B
710 1F84 205A1F      JSR TAPE1
720 1F87 68       X4:PLA
730 1F88 205A1F      JSR TAPE1
740 1F8B 60          RTS       ;EXIT TAPE1
750   ;
760   ;
770   ;LOADER
780   ;
790               TAPIN=$FB57
800               SCREEN=$F836
810   ;
820               *=$1FB0
830 1FB0 2057FB LOAD:JSR TAPIN ;READ A LEADING CHARACTER
840 1FB3 C92E        CMP #$2E  ;UNTIL '.' IS FOUND
850 1FB5 D0F9        BNE LOAD
860 1FB7 20E71F      JSR GCHAR ;GET TRANSFER ADDRESS
870 1FBA 8DE61F      STA OUT+2 ;AND STORE AS JUMP ADDRESS
880 1FBD 20E71F      JSR GCHAR
890 1FC0 8DE51F      STA OUT+1
900 1FC3 20E71F      JSR GCHAR ;GET LOW ADDRESS
910 1FC6 8581        STA $81   ;INTO 80-81
920 1FC8 20E71F      JSR GCHAR


930 1FCB 8580        STA $80
940 1FCD 20E71F  LD1:JSR GCHAR ;GET NEXT BYTE
950 1FD0 C000        CPY #00   ;END OF BLOCK IF Y=$FF
960 1FD2 D010        BNE OUT
970 1FD4 9180        STA ($80),Y
980 1FD6 E680        INC $80
990 1FD8 D002        BNE LD3
000 1FDA E681        INC $81
010 1FDC A924    LD3:LDA #$24  ;PRINT DOLLAR
020 1FDE 2036FB      JSR SCREEN
030 1FE1 4CCD1F      JMP LD1   ;CONTINUE
040 1FE4 4CB01F  OUT:JMP LOAD  ;EXIT
050 1FE7 2057FB GCHAR:JSR TAPIN;GET CHARACTER ROUTINE
060 1FEA C91B        CMP #$1B  ;IF ESCAPE READ NEXT
070 1FEC F009        BEQ LD2
080 1FEE A000        LDY #00   ;ZERO Y
090 1FF0 C947        CMP #$47  ;SET Y=$FF IF 'G'
100 1FF2 D002        BNE LD4
110 1FF4 A0FF        LDY #$FF
120 1FF6 60      LD4:RTS
130 1FF7 2057FB  LD2:JSR TAPIN
140 1FFA A000        LDY #00
150 1FFC 60          RTS
160               .END
```

Pet, 380-Z link

I HAVE recently been trying to write software to handle communications between a Pet and a Research Machines 380-Z for programs and data, writes RA Bareford of Wimborne Dorset. As a first step, I have produced a subroutine which may be of interest to other Pet users, particularly those with an old ROM with small keyboard who want to interface a second keyboard.

It takes seven-bit ASCII and strobes in via the user port and merges it with keystrokes from the Pet keyboard in the keyboard buffer.

It can be divided into three parts:

- Set up the code in the jiffy interrupt routine.
- Disable the code and return to normal use so that the cassettes may be used.
- The code that does the job.

The first part sets up the user port so that all lines are input under the handshake control of the strobe input to CA1. It then re-sets the interrupt vector so as to execute the user port input routine before the normal Pet keyboard routines. In this first version, there are no checks to see if another code has already been wedged into this space.

The second section merely returns the interrupt vector to its usual address.

The final part is the input routine which is executed every 160th of a second before the normal keyboard interrupts. It tests the interrupt flag register to see if a key has been hit; if not, it jumps to the Pet interrupt routine.

If a key has been hit, it loads the ASCII value from the handshake data register into the keyboard buffer. It also updates the character counter at $9E before jumping to the interrupt routine.

The first part is executed with a Sys 826 and the second part to turn it off with a Sys 858.

Here is also a Basic loader version for a new-ROM Pet together with a Hex listing of the routine. For those with an old ROM, the following changes will need to be made:

KBDBUFF = $20F
CHARCOUNT = $20D
INTERRUPT = $E685
INTERRUPT VECTOR HI = $21A
INTERRUPT VECTOR LO = $219

I have used the routine in conjunction with a TV modulator to give two people simultaneous access to the processor, mostly for playing games, where each has a keyboard and screen. I am now working on an extended version to enable Basic programs to be transferred from the 380-Z to the Pet without using the interrupt so as to permit higher data rates.

Hex to decimal

HAVING seen various methods of calculations for transforming decimal numbers into binary and Hexadecimal and *vice versa*, I thought this concise program might be of interest, writes Ben Enran of Rathfadden, Waterford, Eire.

The program is self-explanatory, but I might make the following points:

- DIM N$ (29) is included to allow entries of binary numbers of up to 29 digits.
- To avoid Polish notation, entries should not be greater than the decimal value 999,999,999.
- Program instructions begin at line 200.

```
100 READ L,H:FOR I=L TO H:READ DT:POKE I,DT:NEXT:PRINT CHR$(147):NEW
1000 DATA 826, 892
1010 DATA 120,169,0,141,67,232,173,76,232,9,1,141,76,232,173,75
1020 DATA 232,9,1,141,75,232,169,3,133,145,169,101,133,144,88,96
1030 DATA 120,169,230,133,145,169,46,133,144,88,96,173,77,232,41,2
1040 DATA 208,3,76,46,230,173,65,232,166,158,157,111,2,232,134,158
1050 DATA 76,46,230
READY.
 100  033A             *=$33A
 110  E843             DDR=$E843 DATA DIRECTION REGISTER
 120  E84C             PCR=$E84C PERIPHERAL CONTROL REGISTER
 130  E84B             ACR=$E84B AUXILLARY CONTROL REGISTER
 140  E84D             IFR=$E84D INTERUPT FLAG REGISTER
 150  E841             HAND=$E841 HANDSHAKE DATA REGISTER
 160  009E             CHARCOUNT=$9E
 170  026F             KBDBUFF=$26F
 190  E62E             INTERUPT=$E62E
 200  033A  78         SETUP       SEI
 210  033B  A900                     LDA  #0
 220  033D  8D43E8                   STA  DDR
 230  0340  AD4CE8                   LDA  PCR
 240  0343  0901                     ORA  #1
 250  0345  8D4CE8                   STA  PCR
 260  0348  AD4BE8                   LDA  ACR
 270  034B  0901                     ORA  #1
 280  034D  8D4BE8                   STA  ACR
 290  0350  A903                     LDA  #$03
 300  0352  8591                     STA  $91          INTERUPT VECTOR HI
 310  0354  A965                     LDA  #$65
 320  0356  8590                     STA  $90          INTERUPT VECTOR LO
 330  0358  58                       CLI
 340  0359  60                       RTS
 350  035A  78         OFF         SEI
 360  035B  A9E6                     LDA  #$E6
 370  035D  8591                     STA  $91          RESET INTERUPT VECTOR HI
 380  035F  A92E                     LDA  #$2E
 390  0361  8590                     STA  $90          RESET INTERUPT VECTOR LO
 400  0363  58                       CLI
 410  0364  60                       RTS
 420  0365  AD4DE8     KEY         LDA  IFR
 430  0368  2902                     AND  #2           TEST BIT 1 FOR KEYSTROKE
 440  036A  D003                     BNE  KEYHIT
 450  036C  4C2EE6                   JMP  INTERUPT
 460  036F  AD41E8     KEYHIT      LDA  HAND
 470  0372  A69E                     LDX  CHARCOUNT
 480  0374  9D6F02                   STA  KBDBUFF,X
 490  0377  E8                       INX
 500  0378  869E                     STX  CHARCOUNT
 510  037A  4C2EE6                   JMP  INTERUPT
```

```
  0 DIMN$(29):GOTO200:REM ** BASE - BEN J ENRAN **
  10 INPUT"□ENTER DECIMAL NUMBER";N:Q=N
  20 INPUT"□ENTER BASE      ■■■■■■■";B:IFB<2ORB>16THEN20
  30 C=INT(Q/B):IFC>0THEN60
  40 GOSUB90:PRINT"□□□";N;"IS EQUIVALENT TO□"
  50 PRINT" □ ";C$;" □ IN BASE";B:GOTO270
  60 GOSUB90:Q=C:GOTO30
  90 A=INT(Q-(C*B)+.5):IFA>9THEN93
  91 A$=STR$(A):A$=RIGHT$(A$,LEN(A$)-1)
  92 C$=A$+C$:RETURN
  93 C$=CHR$(55+A)+C$:RETURN
 100 INPUT"□ENTER NUMBER FOR DECIMALIZATION";A$
 110 INPUT"□□□ENTER BASE OF NUMBER      ■■■■■■■";B:IFB<2ORB>16THEN110
 120 FORA=1TOLEN(A$)
 130 N$(A)=MID$(A$,A,1):IFASC(N$(A))>57ORASC(N$(A))<48THENGOSUB192
 140 IFVAL(N$(A))>B-1THEN199
 150 NEXTA:A=LEN(A$):IFA=1THEND=VAL(N$(A)):GOTO190
 160 Q=VAL(N$(1)):D=0:FORY=2TOA
 170 D=Q*B+VAL(N$(Y))
 180 Q=D:NEXTY
 190 PRINT"□□□ ";A$;" (BASE";B;")□ IS EQUIVALENT TO"
 191 PRINT"□□ □";D;"□ □ (DECIMAL)":GOTO270
 192 IFASC(N$(A))<65ORASC(N$(A))>54+BTHEN199
 193 N$(A)=STR$(ASC(N$(A))-55):RETURN
 199 PRINT"□□";A$;" NOT ACCEPTABLE IN BASE";B:GOTO270
 200 CLR:PRINT"□□□THIS PROGRAM ALLOWS CONVERSION FROM"
 210 PRINT"□1.  DECIMAL TO ANY BASE (FROM 2 TO 16)
 220 PRINT"□2.  ANY BASE (FROM 2 TO 16) TO DECIMAL
 230 PRINTTAB(10)"□□SELECT"
 240 GETA$:IFA$="1"THEN10
 250 IFA$="2"THEN100
 260 GOTO240
 270 PRINT"□□ ANOTHER RUN (Y/N)?"
 280 GETA$:IFA$="Y"THEN200
 290 IFA$<>"N"THEN280
 295 END
READY.
```

Re-number program

I HAVE modified my master development disc to load the re-number program automatically when the system is booted, writes David Kyte of Bristol. To create a master disc, see the DOS handbook. If you have yet to discover the power of this wonderful program, I suggest you do so as soon as possible.

The Make-Doit program creates the text file Doit required for the Exec command in the modified Hello program. Line 70 of Make-Doit is necessary as the "Re-number" program requests a <CR> during its operation.

To summarise, the "Hello" program must be modified as shown. The disc must contain the Re-number program obtained from the system master disc, the text file Doit created by Make-Doit, and the disc must have been initialised as a master disc.

```
] LIST
    MODIFIED HELLO PROGRAM
10 HOME
20 PRINT "DOS3.3 MASTER DISK"
30 PRINT
40 D$ = "": REM CNTRL D
50 PRINT D$; "EXEC DOIT"
]

] LIST
    "MAKE DOIT" PROGRAM
10 D$ = "": REM CNTRL D
20 PRINT D$;"OPEN DOIT"
30 PRINT D$;"DELETE DOIT"
40 PRINT D$;"OPEN DOIT"
50 PRINT D$;"WRITE DOIT"
60 PRINT "RUN RENUMBER"
70 PRINT
80 PRINT "NEW"
90 PRINT D$;"CLOSE DOIT"
]
```

Space laser

THIS PROGRAM produces a space-probe on the screen, writes MR Morris of Kingswinford in the West Midlands. A laser is moved with one of the paddles and fires vertically upwards when the paddle button is pressed. The probe fires down one slow bomb and one fast torpedo continuously. It moves left and right at random rates and fires randomly at the laser moving downwards all the time.

White screen

If the laser is hit, the screen is made white. It may be destroyed by both bombs, and by the probe's own laser. To destroy the probe, it must be hit at its centre — otherwise the probe returns fire.

The skill rating alters the starting point of the probe. It also alters the number of points scored for each hit. For every complete miss, the score is reduced.

```
10  REM  M.R.MORRIS 1981 GAME
20 R = 0:M = 1
30 N = 0:L =  - 1:MT =  - 1:V = 0:P =
    0:SC = 0:M = 0
40  TEXT
50  HOME
60  REM  ** INSTRUCTIONS **
70  PRINT "**************************
    **************"
```

This section is open to the Apple user. In every issue we hope to print ideas, hints and comments about the Apple and its suppliers. They must come from you, so write and tell us what you know.

```
80  PRINT "********* SPACE INTRUSION
    FORCE ********"
90  PRINT "**************************
    **************"
100  PRINT : PRINT : PRINT "SPACE INV
    ASION PROBES MARK III WILL"
110  PRINT "TRY TO INVADE EARTH"
120  PRINT "YOUR MISSION IS TO PREVEN
    T THEM FROM"
130  PRINT "LANDING (BELOW THE MARKER
     ARROWS)"
140  PRINT "YOU MUST TRY TO SAVE AMMU
    NITION"
150  PRINT "YOUR RANGE IS 200  M"
160  PRINT " YOU CONTROL YOUR LASER W
    ITH PADDLE (0)"
170  PRINT "AND FIRE WITH THE PADDLE
    BUTTON"
180  PRINT "            GOOD LUCK!"
190  PRINT "ENTER SKILL RATING(1-7)";
    : INPUT V
200  IF V >  = 7 THEN V = 121
210  IF V <  = 0 THEN V = 1
220  IF V = 2 THEN V = 21
230  IF V = 3 THEN V = 41
240  IF V = 4 THEN V = 61
250  IF V = 5 THEN V = 81
260  IF V = 6 THEN V = 101
270 LY = V + 14
280  HGR
290  HCOLOR= 7
300  HPLOT 0,159 TO 279,159: HPLOT 26
    9,143 TO 279,143: HPLOT 0,143 TO
    10,143: HPLOT 7,140 TO 10,143 TO
    7,146: HPLOT 272,140 TO 269,143 TO
    272,146
310  REM  ** START OF GAME **
320  HCOLOR= 7
330  GOSUB 360
340  GOTO 510
350  REM  ** CHOOSES LASER POSITION *
    *
360 P =  PDL (0) + 12
370  REM  ** PLOTS LASER AND MOVES TO
    RPEDO **
380  HPLOT P - 7,154 TO P + 7,154 TO
    P + 7,153 TO P - 7,153 TO P - 7,
    152 TO P + 7,152 TO P + 7,150 TO
    P - 7,150 TO P - 7,151 TO P + 7,
    151 TO P + 3,149 TO P - 3,149 TO
    P - 2,148 TO P + 2,148 TO P,148 TO
    P,144
390  IF MY > 140 THEN MT =  - 1
400 MT = MT + 1
410  IF MT > 0 THEN 440
420 MX = X + 10:MY = Y + 14: HCOLOR=
    7: HPLOT MX,MY TO MX,MY + 10
430  GOTO 450
440  HCOLOR= 0: HPLOT MX,MY TO MX,MY +
    10:MY = MY + 10: HCOLOR= 7: HPLOT
    MX,MY TO MX,MY + 10
450  IF MY > 140 THEN 470
460  GOTO 500
470  HCOLOR= 0: HPLOT MX,MY TO MX,MY +
    10: IF MX - P > 8 THEN 500
480  IF MX - P <  - 8 THEN 500
490  GOTO 1410
500  RETURN
510 Y = V
520  REM  ** START POSITION **
530 T =  RND (1) * 200:T =  INT (T) +
    25
540  IF L < 0 THEN LX = T + 14
550  HCOLOR= 7:X = T: GOSUB 1740
560 A = 0
570  REM  ** ATEMPT TO HIT **
580 A = A + 1: IF A > 3 THEN 670
590  HCOLOR= 0: GOSUB 380
600  HCOLOR= 7: GOSUB 360
610  REM  ** BUTTON PRESSED? **
620  IF  PEEK ( - 16287) > 127 THEN  GOSUB
    1490
630  IF Z > 20 THEN 1690
640  IF Z > 5 THEN 1800
650 Z = 0: GOTO 580
660 E =  RND (1) * 10:E =  INT (E) +
    1:D =  RND (1) * 250:D =  INT (D
    ) + 17:N =  RND (1) * 7:N =  INT
    (N) + 1
670  FOR A = 1 TO E
680  REM  ** MOVE SPACESHIP :*
690  REM  ** LEFT?RIGHT **
700 C =  RND (1) * 20:C =  INT (C) +
    2: IF X > 230 THEN M = 1
710  IF X < 25 THEN M = 0
720  IF M = 1 THEN T = T - C
730  IF M = 0 THEN T = T + C
740  REM  ** MOVES BOMB **
750  IF LY > 140 THEN L =  - 1
760 L = L + 1: IF L > 0 THEN 790
770 LX = X + 14:LY = Y + 14: HCOLOR=
    7: HPLOT LX,LY TO LX,LY + 10
780  GOTO 800
790  HCOLOR= 7: HPLOT LX,LY TO LX,LY +
    15:LY = LY + 5: HCOLOR= 0: HPLOT
    LX,LY TO LX,LY - 5
800  IF LY > 140 THEN 820
810  GOTO 860
820  HCOLOR= 0: HPLOT LX,LY TO LX,LY +
    10:L =  - 1:H = LX - P
830  IF H > 8 THEN 860
840  IF H <  - 8 THEN 860
850  GOTO 1410
860  HCOLOR= 0: GOSUB 1740
870 X = T: HCOLOR= 7: GOSUB 1740
880  REM  ** SHIP LANDED? **
890  IF Y > 140 THEN 1170
900  FOR K = 1 TO N
910  HCOLOR= 0: GOSUB 380
920  HCOLOR= 7: GOSUB 360
930  REM  ** BUTTON PRESSED? **
940  IF  PEEK ( - 16287) > 127 THEN  GOSUB
    1490
950  IF Z > 20 THEN 1690
960  IF Z > 5 THEN 1800
970 Z = 0: NEXT K
980  NEXT A
990  REM  ** SHIP FIRES **
1000  HCOLOR= 7: HPLOT X + 14,Y + 14 TO
    D,156
1010 A = 0: FOR A = 1 TO 30:SOUND =  PEEK
    ( - 16336) -  PEEK ( - 16336) +
     PEEK ( - 16336): NEXT A
1020  HCOLOR= 0: HPLOT X + 14,Y + 14 TO
    D,156
1030  HCOLOR= 0: GOSUB 1740
1040 Y = Y + 20
1050  REM  ** LASER HIT? **
1060  IF D - P <  - 8 THEN 1090
1070  IF D - P > 8 THEN 1090
1080  GOTO 1410
1090  HCOLOR= 0: GOSUB 380
1100  HCOLOR= 7: GOSUB 360
1110  REM  ** BUTTON PRESSED? **
1120  IF  PEEK ( - 16287) > 127 THEN
    GOSUB 1490
1130  IF Z > 20 THEN 1690
1140  IF Z > 5 THEN 1800
1150 Z = 0: GOTO 660
1160  REM  ** INVADED **
1170  HCOLOR= 7
1180 B = 0: FOR B = 1 TO 159 STEP 2:S
    OUND =  PEEK ( - 16336): HPLOT 0
    ,B - 1 TO 279,B - 1 TO 279,B TO
    0,B: NEXT B
1190  TEXT
1200  HOME
1210  PRINT "**********************
    ****************"
1220  PRINT "*************** INVADED
    ****************"
1230  PRINT "**********************
    ****************"
1240  PRINT : PRINT : PRINT "YOUR SCO
    RE IS > ";SC
1250  REM  ** GOOD/BAD SCORE? **
1260  IF SC > 4500 THEN 1310
1270  IF SC > 3000 THEN 1320
1280  IF SC > 1500 THEN 1330
1290  IF SC > 500 THEN 1340
```

(continued on next page)

(continued from previous page)

```
1300  PRINT : PRINT "VERY BAD ": GOTO
     1350
1310  PRINT : PRINT "BRILLIANTLY AMAZ
     ING!!": GOTO 1350
1320  PRINT : PRINT "VERY GOOD!": GOTO
     1350
1330  PRINT : PRINT "FAIRLY GOOD": GOTO
     1350
1340  PRINT : PRINT "NOT BAD": GOTO 1
     350
1350  IF SC > R THEN 1380
1360  PRINT : PRINT "HIGH SCORE IS >
     ";R
1370  GOTO 1980
1380 R = SC
1390  GOTO 1360
1400  REM  ** LASER HIT **
1410  HCOLOR= 7
1420  FOR B = 1 TO 159 STEP 2:SOUND =
      PEEK ( - 16336): HPLOT 0,B - 1 TO
     279,B - 1 TO 279,B TO 0,B: NEXT
     B
1430  TEXT
1440  HOME


1450  PRINT "**************************
     ****************"
1460  PRINT "********** LASERS DESTRO
     YED ************"
1470  GOTO 1230
1480  REM  ** HIT! **
1490  HCOLOR= 7: HPLOT P,144 TO P,1: FOR
     G = 1 TO 5:SOUND =  PEEK ( - 163
     36): NEXT G
1500 L = L + 1: IF L > 0 THEN 1530
1510 LX = X + 14:LY = Y + 14: HCOLOR=
     7: HPLOT LX,LY TO LX,LY + 10
1520  GOTO 1540
1530  HCOLOR= 7: HPLOT LX,LY TO LX,LY
      + 15:LY = LY + 5: HCOLOR= 0: HPLOT
     LX,LY TO LX,LY - 5
1540  IF LY > 140 THEN 1560
1550  GOTO 1590
1560  HCOLOR= 0: HPLOT LX,LY TO LX,LY
      + 10:L =  - 1:H = LX - P: IF H >
     8 OR H <  - 8 THEN 1590
1570  GOTO 1410


1580  REM  ** HIT? **
1590  IF P - (X + 14) <  - 14 THEN 16
     50
1600  IF P - (X + 14) > 14 THEN 1650
1610  IF P - (X + 14) <  - 3 THEN 164
     0
1620  IF P - (X + 14) > 3 THEN 1640
1630 Z = 30: RETURN
1640 Z = 10: RETURN
1650  HCOLOR= 0: HPLOT P,144 TO P,1:S
     C = SC - 10:Z = 0
1660  PRINT : PRINT : PRINT : PRINT "
     SCORE IS  ";SC;"    HIGH SCORE I
     S ";R
1670  RETURN
1680  REM  ** HIT! **
1690 Z = 0:B = 0: FOR B = 1 TO 50:SOU
     ND =  PEEK ( - 16336) -  PEEK ( -
     16336) +  PEEK ( - 16336) -  PEEK
     ( - 16336) +  PEEK ( - 16336) -
      PEEK ( - 16336): NEXT B
1700  HCOLOR= 0: GOSUB 1740
1710  HCOLOR= 0: HPLOT P,144 TO P,1
1720  GOTO 1890
1730  REM  *** SUBROUTINE FOR SPACE S
     HIP***


1740  HPLOT X + 5,Y + 6 TO X + 11,Y TO
     X + 17,Y TO X + 23,Y + 6: HPLOT
     X + 6,Y + 6 TO X + 11,Y + 1 TO X
      + 17,Y + 1 TO X + 22,Y + 6: HPLOT
     X + 7,Y + 6 TO X + 11,Y + 2 TO X
      + 17,Y + 2 TO X + 21,Y + 6: HPLOT
     X + 13,Y + 3 TO X + 13,Y + 6 TO
     X + 15,Y + 6 TO X + 15,Y + 3
1750  HPLOT X + 1,Y + 7 TO X + 27,Y +
     7: HPLOT X + 1,Y + 9 TO X + 27,Y
      + 9: HPLOT X,Y + 8 TO X + 28,Y +
     8: HPLOT X + 2,Y + 10 TO X + 26,
     Y + 10
1760  HPLOT X + 6,Y + 11 TO X + 8,Y +
     13 TO X + 20,Y + 13 TO X + 22,Y +
     11: HPLOT X + 7,Y + 11 TO X + 8,
     Y + 12 TO X + 20,Y + 12 TO X + 2
     1,Y + 11
1770  HPLOT X + 14,Y + 3 TO X + 14,Y +
     6
1780  RETURN


1790  REM  ** REVENGE! **
1800  HCOLOR= 0: HPLOT P,144 TO P,1
1810  HCOLOR= 7: HPLOT X + 14,Y + 14 TO
     D,156
1820 G = 0: FOR G = 1 TO 20:SOUND =  PEEK
     ( - 16336) -  PEEK ( - 16336) +
      PEEK ( - 16336): NEXT G
1830  REM  ** HIT? **
1840  IF D - P <  - 8 THEN 1870
1850  IF D - P > 8 THEN 1870
1860  GOTO 1410
1870  HCOLOR= 0: HPLOT X + 14,Y + 14 TO
     D,156
1880 Z = 0: GOTO 660
1890  REM  ** SCORING **
1900  IF V = 121 THEN 1940
1910  IF V = 81 THEN 1950
1920  IF V = 41 THEN 1960
1930 SC = SC + 100: PRINT : PRINT : PRINT
     : PRINT "SCORE IS ";SC;"    HIGH
      SCORE IS ";R: GOTO 510
1940 SC = SC + 500: PRINT : PRINT : PRINT
     : PRINT "SCORE IS ";SC;"    HIGH
      SCORE IS ";R: GOTO 510
1950 SC = SC + 300: PRINT : PRINT : PRINT
     : PRINT "SCORE IS ";SC;"    HIGH
      SCORE IS ";R: GOTO 510
1960 SC = SC + 200: PRINT : PRINT : PRINT
     : PRINT "SCORE IS ";SC;"    HIGH
      SCORE IS ";R: GOTO 510
1970  REM  ** REPEAT? **
1980  PRINT : PRINT "DO YOU WISH TO C
     ONTINUE?"
1990  PRINT "ENTER YES/NO"
2000  INPUT N$
2010  IF N$ = "YES" THEN 30
2030  END
```

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The Paris heat

THE FIRST heat of the 1981 Micromouse competition was held in the Palais Des Congrès in Paris. The first prize — an Apple micro — was won by a French mouse called Kim. It was constructed by Hour Te aided and abetted by his brother Heng Te. Other major prizes were a Sharp MZ-80K, a printer and a dual floppy disc drive.

Five mice turned up, three from France and Sterling Mouse and Brainy Bricks from England. As I suspected, the French mice were still very much in the early stages of design and development.

One did not move at all — it had cooked its EPROM the day before. One moved, but would not go round corners — the hardware was almost finished but there had been no time for software. The third, Kim, moved quite well but took all its decisions on a random basis.'

It could not do anything else because it had no means of measuring distance and, therefore, could not know where it was in relation to the target which is the centre of

by Nick Smith

the maze. Kim's major achievement was to go right round the outside of the maze and back into the starting box — it never reached the centre of the maze.

Brainy Bricks, escorted by Phil Yeardley, ran very smoothly and reliably but failed to find the middle in the maximum 15 minutes allowed. Brainy Bricks is a two-pass mouse. In theory, it has a first run where it learns the maze, looking for loops and dead ends, and then makes a second run where it follows the shortest route to the middle through the squares it has already covered.

Unfortunately, Brainy Bricks crashed irretrievably in its learning run after about eight minutes, having advanced about half way to the middle. The program does not allow a warm-start, retaining all its knowledge to date, so it has to be re-started from scratch and duly ran out of time without reaching to the middle.

Anyone adopting this approach should be warned. It requiries great reliability and also speed to meet the 15-minute deadline. Dr Billingsley designs mazes to fool very intelligent mice and totally disorientate moderately-intelligent or random mice. A mouse is likely, therefore, to cover the whole maze twice or even three times in its learning run and then, say, half the maze on its second pass.

Sterling Mouse — my very own — ran much better than expected. Following some improvements made for the mouse weekend Sterling would not go round corners. Hour Te let me use his EPROM programmer at lunchtime on the day to adjust some parameters and things improved a good deal. Sterling found the centre of the maze three times, though it required the occasional prod — as did the others — on its first and third runs.

I was particularly pleased that it demonstrated its learning ability, taking 7½ minutes for its first run and 3½ minutes for its second. In particular, there was a trap right next to the centre which Sterling went into on the first run and avoided on its second and third runs.

The third run took 4½ minutes and thus exceeded the time limit although the judges allowed it to finish. The reason the third run was longer than the second is because — like many people — it thought it would try a likely short cut and was sidetracked.

The judging and prize-giving were a bit beyond me because I cannot speak a word of French, but Kim was the best of the French mice and therefore won the Apple. Sterling won the visitors' contest and I was awarded a Toshiba SLC—8290 calculator, and also the Sharp MZ-80K for the best overall mouse.

The Sharp, which is the 48K version, seems an attractive machine and if it is as good and reliable as the Sharp PC-1001 desk-top programmable calculator I have been using at work for the last six years, I shall be very happy. It does have some disadvantages however. Sharp thoughtfully supplied a French plug and a French Basic manual. Fortunately, it was only the manual which was French and not the Basic. The MZ-80K does however, use the Z-80 CPU which at best has 10 registers compared to the 16 of the RCA 1802.

For the technicallly-minded, Kim is constructed like a triangle. That is, it has a single front wheel which is back-powered and steered. Several people are trying this lay-out and one person is very sure it is the best.

A triangle has one obvious disadvantage on learning runs: like a car, it has to do three point turns in dead ends. Obviously an intelligent mouse will not go down a dead end once it has learnt where they are. It must be stated however that Kim did beautiful three-point turns.

Surprisingly, it only tended to get stuck trying to turn left or right in the middle of a long straight. I think this is because it took too long to stop having discovered the side opening.

Steering in a straight line is also a problem. When Kim touches a side wall, the front wheel is turned away from the wall for a fixed time constant. This is simple but effective although at times the wheel seemed to oscillate backwards and forwards a few times before it settled down.

Kim was a mixture of mechanical and infra-red sensors. Like every one I have met so far, they are blinded by both camera flash guns and television lights. Does anyone know a simple way of using infra-red for sensing?

Prizes at Wembley

THE ENGLISH heat takes place at the Online, Microcomputer Show, Wembley Conference Centre, July 28/31. Bring your mouse whether it moves or not, or just come and watch. I cannot tell you what the prizes are because this is largely dependent on the generosity of the exhibitors. Just remember the three French mice shared out an Apple, a printer and a dual floppy disc drive. Not to mention my Sharp MZ-80K and lots of other prizes.

In case you do not know, Micromouse is all about moving from one corner of a maze based on a 16-by-16 grid of squares — to the centre four squares.

The Palais Des Congrès in Paris.

ZX-80 Basic

By C A Thornton and R I Turner. Published by Linsac, 68, Barker Road, Linthorpe, Middlesborough, TS5 5ES. Price £10 for the A4 preliminary version — a bound edition is also available at a lower price from LINSAC. Telephone 0642 825033 for details.

EVER since the ZX-80 appeared, people have been decoding the ROM to discover how various features are implemented and the addresses and parameter requirements of useful subroutines.

Since the ZX-80 has no printer port, it has been a laborious process, involving special modification to the memory extention bus or to the cassette port; demanding hours of patient transcription from the screen of the ZX-80 monitor. It may even mean removing the ROM to another piece of equipment where it can be decoded more conveniently.

At last, this effort can stop. LINSAC has produced a complete listing and disassembly of the ZX-80 monitor — apparently by moving the ROM to a machine which could then run the REVAS disassembler and produce a listing.

The disassembly includes a cross-reference table, showing which addresses refer to other addresses in the monitor. This greatly eases the problem of finding where a particular routine is called from. In addition, most lines of the listing have been supplemented with comments, providing some slight explanation of what is happening.

In general, these comments are helpful for readers who are less than fluent in Z-80 assembly language, but they rarely give any good idea of the overall intention of a piece of code, or the logic of a particular function. Especially useful would have been an overview of the structure of the whole monitor, showing all the functions which have to be performed, explaining the reasons for them and for the exact way in which they have been implemented, and giving the associated code addresses.

Without this, the monitor listing is still heavy work to read and understand, although it is, of course, considerably easier to understand the monitor from a listing on paper than from a television screen display with all the problems of skipping about following addresses.

It seems very strange that Sinclair did not exploit this particular market by publishing its own documentation on the ZX-80 monitor.

It is surely against the Sinclair philosophy that so much time of talented people — who could more profitably be writing new software for excellent Sinclair machines — should be squandered on the task of decoding his monitor programs.

In any case, LINSAC deserves thanks for producing this first, full listing of the ZX-80 monitor. Assembler buffs will undoubtedly spend many happy hours puzzling over the thinking behind some of the more convoluted routines.

Conclusions

• A fascinating book, which will be welcomed by everyone who has tried to decode the ZX-80 monitor and been frustrated by the lack of hard-copy output. *Martyn Thomas*

Living in the future

ITV Books — Macdonalds Phoebus. £3.50.

THIS IS an exciting new book aimed at telling younger readers how their lives will be affected by the introduction of the Silicon Chip. The book has been written to tie in with the ITV school series *Finding Out*. The book bears a slight resemblance to an annual, filled with colourful pictures to illustrate the clearly-written text.

There are some project pages which illustrate simple concepts such as the workings of an abacus and elementary data processing using knitting needles. *Living in the future* is an imaginative book, the predictions contained in it are believable mainly because it contains only projections into the immediate future.

The ideas behind computers and computer programming are presented in a form which most junior computer users will easily understand, any difficult words are explained in a glossary at the end. Computers figure strongly in the TV series which is being broadcast to primary schools and pupils are encouraged to investigate the technology themselves. The programs show microcomputers at work in shops and schools and at play in videogames.

Conclusions

•This is an attractive presentation of a very important subject.

•I strongly recommend this book — especially for those computer enthusiasts under 14.

Experiments in Artificial Intelligence for Small Computers

By John Kruch. Published by Howard W Sams and Co. 110 pages paperback. ISBN: 0-672-21785-6.

ARTIFICIAL intelligence, or AI, is the most exciting field in which the computer scientist can work. Although anathema to some, the concept that a man-made circuit can in some small way begin to emulate the machinations of the human brain is challenging to say the least.

Many people feel threatened by Orwellian overtones or the "outer limits" image of intelligent computers making bids for world domination. Some people even take the view that AI experiments should be banned. In the preface to his book, John Kruch emphasises the need for experiment, the reader is encouraged to run the programs which are included and to experiment with them.

Each chapter is self-contained and features an example program, the programs are, of course, in Basic and written for a TRS-80. They are written in a loosely-structured form — that is, a control or supervisor program segment calls routines to perform specific tasks in each case. There are seven such chapters and an appendix which is aimed to help readers who are translating the software into other languages or dialects.

The first chapter deals with some of the fundamental concepts and then presents a demonstration program, Kingmove. The program is explained at some length and the complete listing is presented. Chapter two is concerned with a checkers, or draughts playing program and at the end of it is a short section on possible modifications.

The modifications section is extremely important as it points the reader to channels of research to explore. A key factor in the principle of Kruches book is that the material is only a pointer towards further research to be made by the reader.

By chapter three, the more advanced topic of intelligent problem solving can be tackled with some confidence. Two problem-solving programs are examined and the program listed is one which aims to predict human behaviour. By chapter four, this modest little book really takes off. After a discussion of Raphael's Semantic Information Retrieval is a section headed "The Hypothetical Syllogism". This marks an important turning point in AI.

A syllogism is a short argument form. It consists of one of the premisses and then draws a conclusion. This is the basis of a form of reasoning, for example given that: Socrates is a man, and men are mortal; it can be reasoned that Socrates is a mortal. The program Fetch does just that, now the computer is mirroring the thought processes of a human.

The next two chapters deal with computer-generated text and verse and then we arrive at the *pièce de résistance* — the Dictor program. In its simple form, this program will generate seemingly-natural responses to the sentences input by the interviewee. In essence, it will be possible to hold a meaningful dialogue with a series of circuits.

Conclusions

•This book is a tempting "taster" for people interested in artificial intelligence, especially to students of computer science or philosophy.

•The programs, while not entirely bug-free, seem to be well thought-out and stimulating examples of the concepts discussed.

•The book lacks substance because of its emphasis on the practical aspects. *Bill Bennett*

Programming tricks to create line graphs of functions

by Douglas Fyffe

THE SECONDARY address facility 5 on the Commodore 3022 Series Pet Printer, whereby a special programmable character can be defined, opens the possibility of producing line graphs of reasonable quality. However, in my experience, only one special character can be programmed for each run of a Pet Basic program. Therefore, a few special programming tricks are needed to produce the desired result.

The following program, R-Graph 32K, is written for a 32K or 16K new-ROM Pet connected to a Commodore 3022 Printer in the usual way. It is designed to produce line graphs of rational functions in the variable X. The program loads and runs in the bottom 5K of RAM, leaving the rest of RAM for storing the graph values prior to printing out.

To convert the program to an 8K Pet, changing the addresses in lines 40, 580, 2740, 2760 will suffice. For large graphs, however, the program may run into memory limitations with just 8K.

A brief description of the main sections of the program should prove helpful.

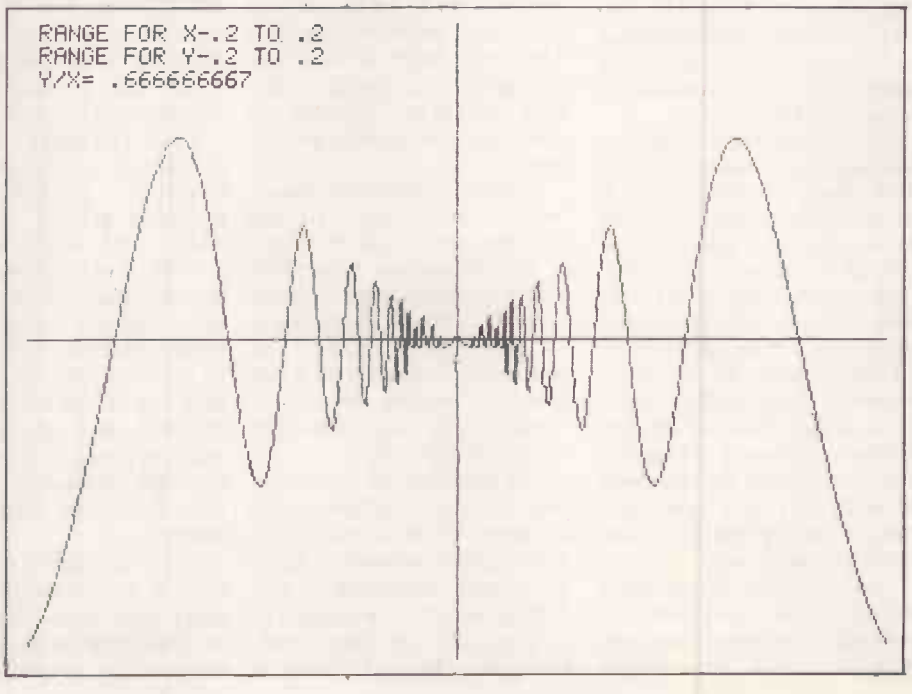
Lines 10-99:
sets up FNA (X), FNB (X) in lines 80, 90 respectively. These functions are the numerator and denominator of the rational function in X.

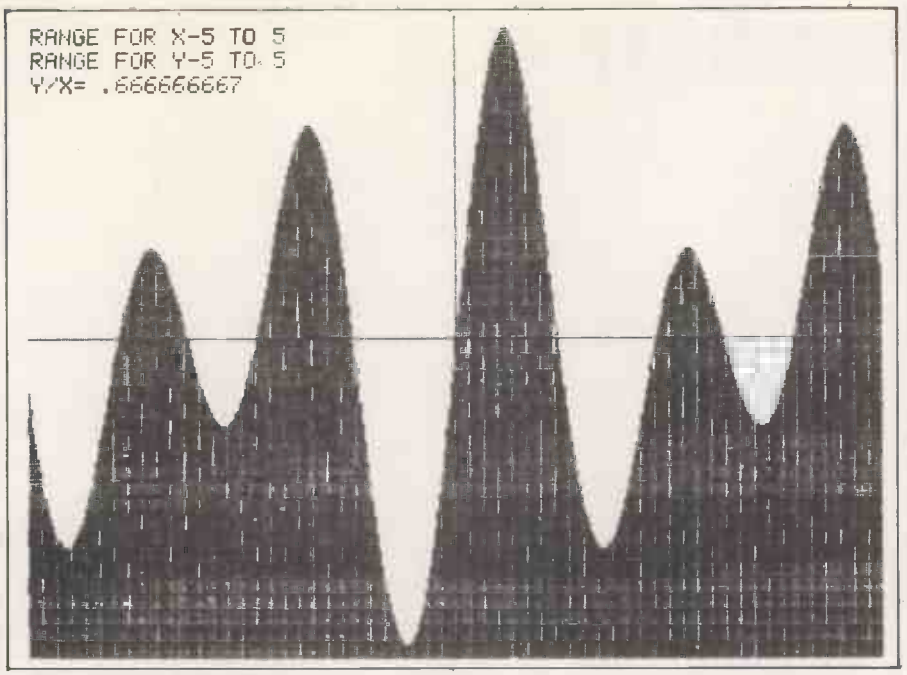
Lines 100-499:
asks the operator to select the number of columns and lines to be used in the printout of the graph, together with ranges for X and Y.
NX = number of columns
NY = number of rows

Lines 500-999:
calculates the value of FNA(X)/FNB (X) for each point on the X-axis and converts each of these values to a pair (Y, 2 ↑ G), where
Y = number of lines from the bottom of the graph.
G = point position from the bottom of the special character matrix, $0 \leqslant G \leqslant 6$. — see 3022 user manual.
Singularities of form 0/0 are identified at this stage by assigning 100 to the second value of the pair and values outside the range of Y are indicated by 200 in the second position. All of these values are stored in RAM addresses 5120 to 5122 + 12 * NX.

Lines 1000-1999:
links together in the Y-direction the values of the graph stored in 5120 to 5122 + 12 * NX and converts the result into a code the 3022 printer can understand. This code includes blocks of data of the form "X $A_0A_1A_2A_3A_4$ A_5E", where
X = number of columns from the right-hand side of the graph.
A_0-A_5 = the numerical data for a special programmable character

Y = X SIN (1/X)





Y = 2 SIN (2X) + 3 SIN (3X)

E = (141 — for carriage return no line feed)
(13 — for carriage return line feed)

In my experience a carriage return has to be used to force the 3022 printer to disgorge its special character before the end of each line of 80 characters. For blank lines, the blocks of data are replaced by 90 or 95, and 99 indicates the end of the graph in RAM. All these values are stores in top RAM locations 6144 upwards.

Lines 2000-2900:

prints out the graph stored in code in top RAM addresses 6144 onwards. For consistency in the X and Y directions it is simpler to assume the special character matric to be a six-by-six square matrix, rather than the seven-by-six matrix of the 3022 print-head. Line 2280 of the program sets the correct spacing between lines to close up the graph on the Y-axis. This causes a certain amount of over-printing, but, in practice, seems to iron out slight discrepancies by the printer. Lines 2760, 2800 of the program execute a jump back to line 2300 by running the program again from line 2300 using a message "RUN 2300" on the Pet VDU. This technique is used to clean out the old record of A$ from the 3022's memory in order to replace it by a new A$. Unfortunately, the values of stored variables are cleaned out as well and so memory locations 826 - 832 are used for storage of key values during the repeating runs of the program.

A little thought and skill is required to

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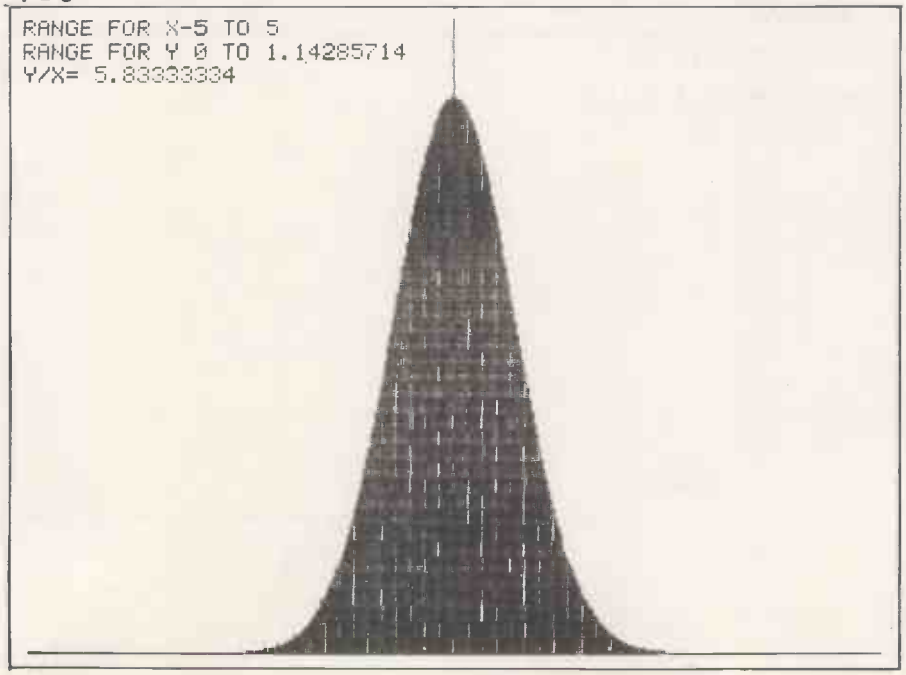
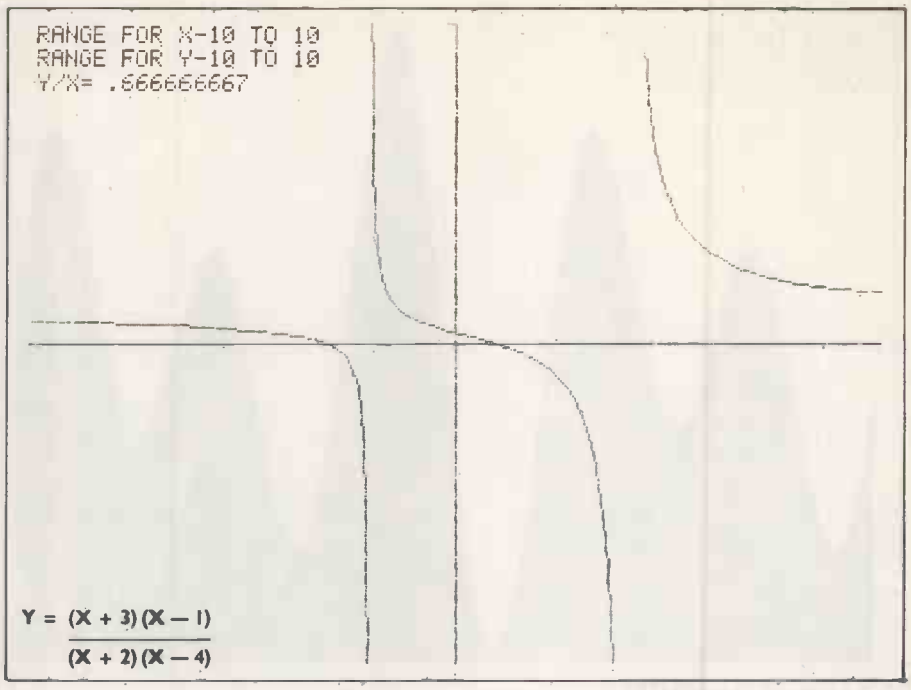
$Y = e^{-X^2}$





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set up the ranges for X and Y correctly. After typing in the numerator and denominator of the rational function — the operator is asked for these values:

(i) INPUT OF COLUMNS FOR X-AXIS (< = 80)?

(ii) START, COLUMNS PER UNIT FOR X?
and similarly with ROWS for Y

e.g., (a) responses of 60 to (i) and -3, 10 to (ii) will produce a range of -3 to 3 for X.

(b): response of 80 to (i) and -16, 2 to (ii) will produce a range of -16 to 24 for X.

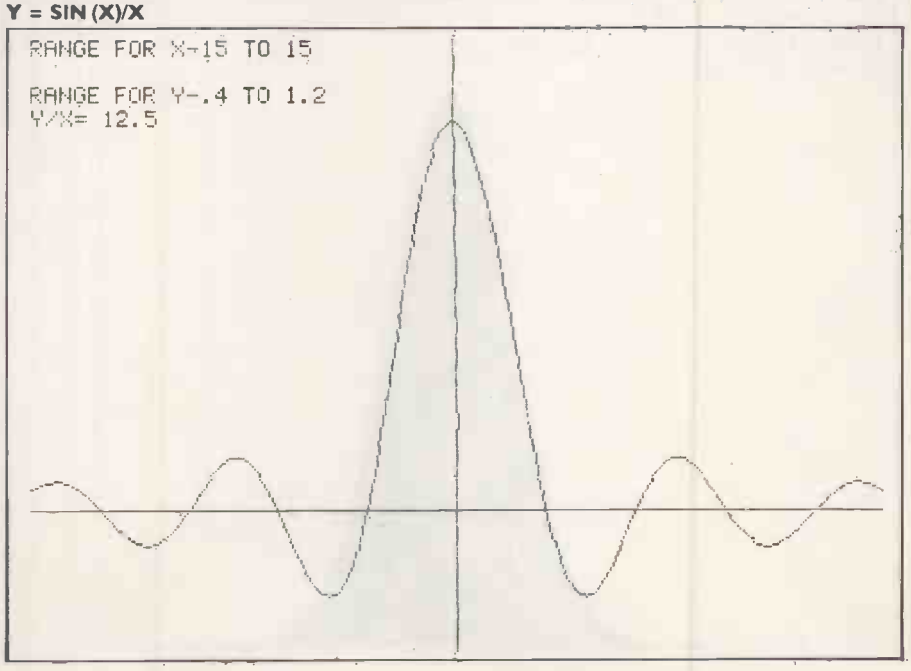
The calculated range for X will be indicated by the program on the VDU after the operator has answered (ii).

If a printout with axes is required, make sure the origin is placed at the start of one of the printout columns and at the bottom of one of the rows. Although this method may at first seem slightly involved, it provides the operator with a great deal of flexibility as to the size and shape of his graph. If anything goes wrong at this stage, stopping the program and typing in "RUN 80 (return)" will return the operator to feeding in the ranges for X and Y.

The graph will take some time to "cook". Do not forget to turn the printer on before pressing "P" or "N". However, if you do forget, all is not lost since more copies can be printed by typing "RUN 2000 (return)" from the Pet keyboard.

By altering the program slightly, different effects can be produced on printout. For example, inserting a line like "640 IF X2 = 0 THEN POKE P+1, 100 : GOTO 840"
enables the program to plot the graphs of

Y = SIN (X)/X



functions with other types of singularities at X = 0. See the graph of X SIN (1/X).

Replacing lines 1260 to 1640 by the four lines:

```
1260 IFY<F THEN A%(I)=127:GOTO1700
1280 IFY>F THEN A%(I)=0 : GOTO 1700
1300 IF F1>= 100 THEN A%(I)=0:GOTO 1700
1320 A%(I) =2 * F1-1 : GOTO 1700
```

will produce graphs shaded underneath the curve. It is curious that this effect seems to be much easier to produce than the corresponding line graph. See the shaded graphs of

e^{-X^2} and 2 SIN (2X) + 3 SIN (3X).

```
10 REM SET UP RATIONAL FUNCTION IN X
20 PRINT"□TYPE IN NUMERATOR OF RATIONAL FUNCTION  IN X":INPUTF$
30 PRINT"TYPE DENOMINATOR OF RATIONAL FUNCTION   IN X":INPUTG$
40 POKE158,3:POKE623,13:POKE624,13:POKE625,13
50 PRINT"□■■80DEFFNA(X)="F$
60 PRINT"90DEFFNB(X)="G$
70 PRINT"RUN80■";:END
80 DEFFNA(X)=X
90 DEFFNB(X)=X

99 REM********************
100 REM FIX RANGES FOR X AND Y
120 INPUT"■INPUT NUMBER OF COLUMNS FOR X-AXIS(<=80)";NX
140 IFNX>80GOTO120
160 INPUT"START,COLUMNS PER UNIT FOR X";X1,U
170 MX=X1+NX/U:IFMX=0THENNX=NX+1:GOTO170
180 PRINT"RANGE FOR X"X1"TO"MX:POKE832,NX
200 INPUT"NUMBER OF LINES OF PRINTOUT FOR Y-AXIS  ";NY
210 IFNY>254THENPRINT"TOO MANY":GOTO200
220 INPUT"START,LINES PER UNIT FOR Y"; Y1,V
230 MY=Y1+NY/V:IFMY=0THENNY=NY+1:GOTO230
240 PRINT"RANGE FOR Y"Y1"TO"MY
260 IFX1<=0ANDMX>0THENPOKE826,INT(-X1*U+.5):GOTO300
280 POKE826,255
300 IFY1<=0ANDMY>0THENPOKE827,INT(NY+Y1*V-.5):GOTO500
320 POKE827,255

499 REM********************
500 REM CALCULATE AND STORE VALUES FOR FNA(X)/FNB(X)
520 PRINT"■■LOADING GRAPH INTO TOP MEMORY"
540 PRINT"LOADING TAKES ABOUT "NX*NY/100"MIN"
560 PRINT"■PLEASE LEAVE":DIMD%(6)
570 D%(0)=1:D%(1)=2:D%(2)=4:D%(3)=8:D%(4)=16:D%(5)=32:D%(6)=64
580 POKE53,20:P=5120
600 X=0
620 I=0
630 X2=X1+(X+I/6)/U
650 A1=FNA(X2):B1=FNB(X2)
660 IFB1<>0GOTO740
680 IFA1=0THENPOKEP+1,100:GOTO840
700 POKEP+1,200:GOTO840
740 F=(A1/B1-Y1)*V
760 IFF<0ORF>NYTHENPOKEP+1,200:GOTO840
800 Y=INT(F):POKEP,Y
820 G=INT((F-Y)*6+.5):POKEP+1,D%(G)
840 P=P+2
860 IFX=NXGOTO1000
880 I=I+1:IFI<6GOTO630
900 X=X+1:IFX<=NXGOTO620

999 REM********************
1000 REM STORE GRAPH IN CODE FOR PRINTER
1020 PRINT"■STILL LOADING GRAPH"
1040 PRINT"■ 0   -NUMBER OF LINES COMPLETED"
1060 P=6144:POKE59411,60
1080 POKEP,95:POKEP+1,95:POKEP+2,95:POKEP+3,95:POKEP+4,95:P=P+5
1100 DIMA%(5)
1140 Y=NY-1
1160 X=0
1200 I=0
1220 L=5120+12*X+2*I
1240 F=PEEK(L):F1=PEEK(L+1)
1260 G=PEEK(L+2):G1=PEEK(L+3)
1280 IFF1<100ANDG1<100GOTO1380
1300 IFF1=200ANDG1=200THENA%(I)=0:GOTO1700
1310 IFF1=100THENA%(I)=0:GOTO1700
1320 IFG1=100THENG=F:G1=F1:GOTO1380
1330 IFG1=200GOTO1360
```

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```
1340 IFG<NY/2THENF=-2:GOTO1380
1350 F=NY+1:GOTO1380
1360 IFF<NY/2THENG=-2:GOTO1380
1370 G=NY+1
1380 IFF<YANDG<YTHENA%(I)=0:GOTO1700
1390 IFF>YANDG>YTHENA%(I)=0:GOTO1700
1400 IFF<YANDG>YTHENA%(I)=127:GOTO1700
1420 IFF>YANDG<YTHENA%(I)=127:GOTO1700
1440 IFF<YTHENA%(I)=G1-1:GOTO1700
1500 IFF>YTHENA%(I)=128-2*G1:GOTO1700
1510 IFG=Y+1ANDG1=1ANDF1=64THENA%(I)=64:GOTO1700
1520 IFG=Y+1ANDG1=1THENA%(I)=64-F1:GOTO1700
1540 IFG>YTHENA%(I)=128-F1:GOTO1700
1550 IFG=Y-1ANDG1=64ANDF1=1THENA%(I)=1:GOTO1700
1560 IFG=Y-1ANDG1=64THENA%(I)=2*F1-2:GOTO1700
1580 IFG<YTHENA%(I)=2*F1-1:GOTO1700
1600 IFF1<G1THENA%(I)=G1-F1:GOTO1700
1620 IFF1>G1THENA%(I)=2*F1-2*G1:GOTO1700
1640 A%(I)=F1
1700 I=I+1:IFI<6GOTO1220
1720 A=A%(0)+A%(1)+A%(2)+A%(3)+A%(4)+A%(5):IFA=0GOTO1840
1740 REM STORE X AND A%
1760 POKEP,X
1780 POKEP+1,A%(0):POKEP+2,A%(1):POKEP+3,A%(2)
1800 POKEP+4,A%(3):POKEP+5,A%(4):POKEP+6,A%(5)
1820 POKEP+7,141:P=P+8
1840 X=X+1:IFX<NXGOTO1200
1860 IFPEEK(P-1)=141THENPOKEP-1,13:GOTO1900
1880 POKEP,90:P=P+1
1900 Y=Y-1:PRINT"S"NY-1-Y:IFY>=0GOTO1160
1950 POKEP,95:POKEP+1,95:POKEP+2,95:POKEP+3,99:POKE59411,61

1999 REM*******************
2000 REM PRINT OUT GRAPH STORED IN CODE
2020 PRINT"LOADING OF GRAPH COMPLETED"
2040 PRINT"SWITCH ON PRINTER !!"
2060 PRINT"PRESS 'P' FOR PRINTOUT WITH AXES"
2080 PRINT"PRESS 'N' FOR PRINTOUT WITHOUT AXES"
2090 Z=PEEK(827)
2100 GETX$:IFX$=""GOTO2100
2120 IFX$="P"THENPOKE828,0
2140 IFX$="N"THENPOKE828,1
2160 POKE831,Z:POKE829,0:POKE830,24
2170 IFU=0GOTO2280
2180 OPEN6,4,6:PRINT#6,CHR$(26):CLOSE6
2200 OPEN3,4:PRINT#3,""
2220 PRINT#3,"RANGE FOR X"X1"TO"X1+NX/U
2240 PRINT#3,"RANGE FOR Y"Y1"TO"Y1+NY/V
2260 PRINT#3,"Y/X="V/U:CLOSE3
2280 OPEN6,4,6:PRINT#6,CHR$(15):CLOSE6
2300 REM PRINT OUT GRAPH
2320 W=PEEK(826):Z=PEEK(831):P=PEEK(829)+256*PEEK(830)
2340 Q=PEEK(P):IFQ=99GOTO2900
2360 R=40-INT(PEEK(832)/2):IFQ>=90GOTO2540
2380 REM PRINT OUT A$
2400 OPEN2,4,5
2420 FORI=1TO6:A$=A$+CHR$(PEEK(P+I)):NEXT
2440 PRINT#2,A$:OPEN1,4
2460 PRINT#1,TAB(Q+R);CHR$(254);CHR$(141);:P=P+8
2480 IFPEEK(P-1)=141GOTO2700
2500 IFPEEK(828)=1GOTO2680
2520 GOTO2580
2540 P=P+1:OPEN1,4:IFQ=95GOTO2680
2560 IFPEEK(828)=1GOTO2680
2580 IFZ>0GOTO2640
2600 PRINT#1,TAB(R);:FORI=1TOPEEK(832):PRINT#1,"_";:NEXT
2620 PRINT#1,CHR$(141);:Z=255
2640 Z=Z-1:POKE831,Z:IFW=255GOTO2680
2660 PRINT#1,TAB(W+R);"I ";CHR$(13);:GOTO2700
2680 PRINT#1,CHR$(13);
2700 CLOSE1:IFQ>=90GOTO2740
2720 CLOSE2
2740 Q=INT(P/256):POKE829,P-Q*256:POKE830,Q
2760 POKE158,1:POKE623,13
2800 PRINT"RUN2300":END
2900 POKE53,128:LIST80-90

READY.
```

Keeping track of job priorities and workloads

by S Williams

IN COMMERCIAL and engineering environments, it is often necessary for section leaders or managers to monitor the workload imposed by different projects on the personnel in their charge. The system, I describe here offers a quick method of storage and retrieval of job descriptions, workloads and the associated priorities of the jobs.

To ensure that the system is suitable for use by even a modest TRS-80 configuration, it requires only 16K of memory and is loaded and stored on cassette just once for each use.

The system is menu-driven and is very straightforward to use. It is capable of storing 10 jobs records for each of 10 operators and the user is completely free to insert, delete or amend each of these records. All entries are validated for range and variable type, and priorities, if incorrectly entered, are amended automatically in accordance with system limits.

A novel approach has been adopted to the problem of storage of the required variables, both numeric and string. To minimise the time and effort required to access the information from tape, all data are packed into 21 data lines at the end of the program. This means that every time the system is used, it is necessary only to CLOAD"]" and CSAVE"]" once.

It is vital, however, that the program updates these datelines after each use. Without this update, all transactions enacted during the usage will, of course, be lost when the machine is switched off. This updating is handled by the program from the main menu.

This is straightforward, but two possible problems should be noted: the letter "O" is used as a numeric variable to denote the operator subscript in the main arrays. This must not be confused with the digit zero, "0", or all kinds of disasters may occur. The data lines 2810 to 3010 must be filled with spaces as shown in the listing. Two carriage returns are not the equivalent of 128 spaces, as I found to my cost.

During its development, the program had the habit of Poking into all kinds of areas where it is better not to Poke. The first 10 data lines should be filled with two screen rows of spaces and the last 11 with three rows. Other than these points, there should be no difficulty in loading and running the program.

The variables used. In order of appearance

WR(I,J,K) — job details
M$ — menu options
I,J,K,N, — loop subscripts
D$(I,J) — job descriptions
A — input variable
O — operator number subscript
N$(I) — operator names
P — POKE address, start of program storage/ data line
M — POKE variable for number of spaces to end of data line
X — POKE variable for address of start of data storage

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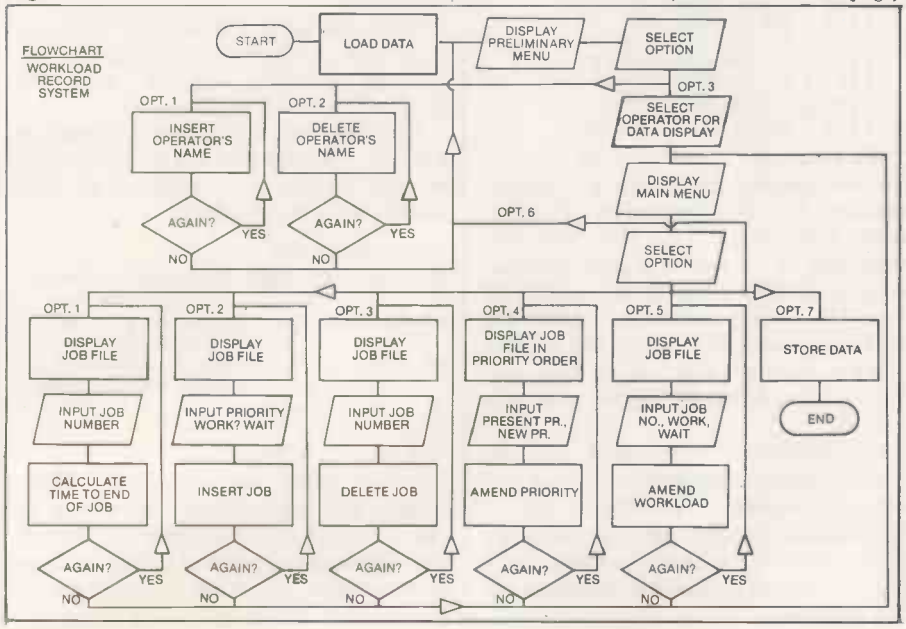
Figure 1.



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S$ — intermediate value for manipulations of data characters
L — POKE variables for position of character in data item
T$ — single-character variable from data item
T — ASCII representation of T$
N$ — intermediate operator name variable
JN — job number
TE — time to end of job
PR — new priority of job
WO — work left on job
WA — wait left on job
PP — present priority of Job
F — flag for priority validation
PT — test priority for validation

On running the program, the screen will display the title and the message Loading Data until the machine has read in all the appropriate data files. Once this is complete, a list of all operators' names file is displayed, together with a preliminary menu. The user has three options:

Option 1: Insert name — allows the insertion of an operator's name into the name file, unless 10 names are already recorded. If an attempt is made to enter an eleventh name, the message "Name file full" is displayed and control returns to the preliminary menu. Each operator name may not exceed 15 characters in length.

Option 2: delete name — allows the deletion of an operator's name from the name file. All other names are left unaltered.

Option 3: Display menu — allows the display of records for any single operator operator included in the name file. On selection of his option, the user is required to select the number of the operator for whom records are to be displayed.

By selection of option 3 from the preliminary menu and the number of the operator whose records are required, the main menu will be displayed:

WORKLOAD RECORD FOR XXX
TYPE 1 TO DISPLAY JOB FILE
TYPE 2 TO INSERT JOB
TYPE 3 TO DELETE JOB
TYPE 4 TO AMEND JOB PRIORITY
TYPE 5 TO AMEND WORKLOAD
TYPE 6 TO AMEND NAME FILE
TYPE 7 TO STORE ALL FILES

With option 1, all records for the selected operator are displayed, under the headings Job #, Description, Priority, Work Left, Wait Left. The total time remaining to the end of a given job may be computed by entering the number of that job. The calculation sums the working times of all jobs bearing a higher priority, together with the working and waiting times of the job whose number is entered.

With option 2, all records for the selected operator are displayed, and new job data is requested under the last four of the headings. The new job is assigned the lowest available job number automatically and is displayed with all previous data for that operator.

The priority assigned to any new job must be unique and, if not equal to the priority of an existing job, e.g., if inserting a job of high priority, must be the numercially lowest available. The program corrects this automatically.

If 10 jobs are already on file for the selected operator, any attempt to insert further records will result in the message "Job file full" and control will return to the main menu.

With option 3, all records for the selected operator are displayed and the Job # of the job to be deleted is requested. On entry of this number, the appropriate record is deleted and job numbers are re-allocated to ensure sequential numbering of all remaining jobs. All jobs of lower priority than the one deleted have their priorities raised.

In option 4, all records for the selected operator are displayed in order of priority. When the present and new priorities of the job in question have been entered, the job is updated. All jobs are sorted, their priorities are re-adjusted and the data are re-displayed. The same rules and automatic checks apply to priorities as in option 2.

Using option 5, all records for the selected operator are displayed. New job data are requested under the heading Job #, Week's Work, Week's Wait. The job is updated and all records are re-displayed.

Under option 6, control returns to the preliminary menu and any functions detailed under that heading are available. This option is also used to transfer from one operator's file to another. Transfer is accomplished by selection of a different operator number via option 3 of the preliminary menu.

With option 7, all files are stored within 21 lines of the program memory. While this operation is carried out, the display "Storing data line X" is shown, where X is the number of the data line being stored.

When storage is complete, the program ends with instructions for recording the updated records, together with the program, back on to tape.

It is vital that this option is selected at the end of each use of the record system, or any information updated in that session will not be retained.

Ranges and limits.

Operators' name files — 15 characters per name
10 names' maximum
Job description files — 15 characters per job
10 jobs per operator
Job priority — $1 \leqslant$ Priority $\leqslant 10$. Each Job for a given operator must have unique priority.
Work File — $0 \leqslant$ Work left $\leqslant 99$
Wait file — $0 \leqslant$ Wait left $\leqslant 99$

Integer values only are accepted. Non-integers are truncated automatically in all cases. Entries outside limits are flagged with the message "At least one of the data entries made is outside system limits. Please check and re-enter data".

```
10 CLS: PRINT@21,"WORKLOAD RECORD SYSTEM"
20 PRINT@78," VER.1.0 COPYRIGHT 1980, S.WILLIAMS"
30 '*** LOAD DATA
40 PRINT@410,"LOADING DATA"
50 CLEAR 2500: DIM WR(3,10,10),M$(8)
60 FOR N=1 TO 7: READ M$(N): NEXT
70 FOR K=0 TO 9: FOR J=0 TO 9: FOR I=0 TO 2: READ WR(I,J,K): NEXT I,J,K
80 FOR J=0 TO 9: FOR I=0 TO 9: READ D$(J,I): NEXT I,J
90 FOR I=0 TO 9: READ N$(I): NEXT
200 '*** SELECT OPERATOR
210 GOSUB 2400
220 PRINT@789,"TYPE 1 TO INSERT NAME"
230 PRINT TAB(21)"TYPE 2 TO DELETE NAME"
240 PRINT TAB(21)"TYPE 3 TO DISPLAY MENU";: INPUT A
250 ON A GOTO 800,1000
260 PRINT@704,: PRINT: PRINT: PRINT
270 PRINT@832,"ENTER NUMBER OF OPERATOR FOR WHOM DATA IS REQUIRED";: INPUT O
280 IF O>10 OR O<1 GOSUB 2200: GOTO 200 ELSE O=O-1
400 '*** MENU
410 CLS: PRINT TAB(22-(LEN(N$(O))/2))"WORKLOAD RECORD FOR "N$(O): PRINT
420 FOR N=1 TO 7: PRINT TAB(19)"TYPE"N"TO "M$(N): NEXT
430 INPUT A: ON A GOTO 1200,1400,1600,1800,2000,200
600 '*** STORE DATA
610 CLS: PRINT@406,"STORING DATA LINE": P=17129: M=95
620 IF PEEK(P+4)<>136 GOSUB 730: GOTO 620
630 FOR K=0 TO 9: GOSUB 730: PRINT@423,K+1: X=5
640 FOR J=0 TO 9: FOR I=0 TO 2: S$=STR$(WR(I,J,K)):
650 GOSUB 740: NEXT I,J: GOSUB 790: NEXT K: M=185
660 FOR J=0 TO 9: GOSUB 730: PRINT@423,J+11: X=5
670 FOR I=0 TO 9: S$=D$(J,I): GOSUB 760: NEXT I: GOSUB 790
680 NEXT J: GOSUB 730: PRINT@424,"21": X=5
690 FOR I=0 TO 9: S$=N$(I): GOSUB 760: NEXT: GOSUB 790
700 PRINT@384,"DATA STORAGE COMPLETE. NOW REWIND TAPE TO START OF PROGRAMME     S
TORAGE, DEPRESS 'RECORD' AND 'PLAY' KEYS ON RECORDER AND TYPE  CSAVE ""1""  AND
 ENTER ."
710 END
720 'DATA STORAGE SUBROUTINES
730 P=PEEK(P+1)*256+PEEK(P): RETURN
740 FOR L=2 TO LEN(S$): T$=MID$(S$,L,1): T=ASC(T$)
750 POKE P+X+L-1,T: NEXT L: POKE P+X+L-1,44: X=X+L-1: RETURN
760 POKE P+X+1,34: IF LEN(S$)=0 POKE P+X+2,34: X=X+3: POKE P+X,44: RETURN
770 FOR L=1 TO LEN(S$): T$=MID$(S$,L,1): T=ASC(T$)
780 POKE P+X+L+1,T: NEXT L: POKE P+X+L+1,34: X=X+L+2: POKE P+X,44: RETURN
790 FOR S=P+X TO P+M: POKE S,32: NEXT S: RETURN
800 '*** INSERT NAME
810 PRINT@704,: PRINT: PRINT: PRINT
820 IF N$(9)<>"" PRINT@857,"NAME FILE FULL": FOR N=1 TO 1500: NEXT: GOTO 220
830 PRINT@776,"ENTER NAME (15 CHARACTERS MAX)";: INPUT N$
840 IF LEN(N$)>15 GOSUB 2200: GOTO 200
850 FOR N=0 TO 9: IF N$(N)="" THEN N$(N)=N$: N=10
860 NEXT: GOTO 200
1000 '*** DELETE NAME
1010 PRINT@704,: PRINT: PRINT: PRINT
1020 PRINT@832,"ENTER NUMBER OF OPERATOR WHOSE RECORDS ARE TO BE DELETED";: INPU
T O
1030 IF O>10 OR O<1 GOSUB 2200: GOTO 200
1040 FOR J=0 TO 9: FOR I=0 TO 3: WR(I,J,O-1)=0: NEXT I,J
```

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```
1050 FOR N=0 TO 9: D$(O-1,N)="": NEXT: N$(O-1)="": GOTO 200
1200 '*** DISPLAY DATA
1210 GOSUB 2600
1220 PRINT@832,"TO COMPUTE TOTAL TIME TO END OF JOB, ENTER JOB NUMBER"
1230 INPUT"(0 TO RETURN TO MENU)";JN: TE=0: IF JN=0 GOTO 400
1240 IF JN>10 OR JN<1 GOSUB 2200: GOTO 1200
1250 FOR N=0 TO 9: IF WR(0,N,O)<=WR(0,JN-1,O) THEN TE=TE+WR(1,N,O)
1260 NEXT: TE=TE+WR(2,JN-1,O)
1270 PRINT@768,"TOTAL TIME TO END OF JOB"INT(JN)"IS"TE"WEEKS   ": GOTO 1220
1400 '*** INSERT JOB
1410 GOSUB 2600
1420 IF WR(0,9,O)<>0 PRINT@858,"JOB FILE FULL": FOR N=1 TO 3000: NEXT: GOTO 400
1430 PRINT@768,"ENTER NEW JOB DATA IN THE FORM - DESCRIPTION (15 CHARACTERS MAX)
PRIORITY, WORK LEFT, WAIT LEFT (0,0,0,0 TO RETURN TO MENU)"
1440 INPUT D$,PR,WO,WA: PR=INT(PR): F=0: WO=INT(WO): WA=INT(WA): IF PR=0 GOTO 40
0
1450 IF LEN(D$)>15 OR PR>10 OR PR<1 OR WO>99 OR WO<1 OR WA>99 GOSUB 2200: GOTO 1
400 ELSE GOSUB 2300
1460 FOR N=0 TO 9: IF WR(0,N,O)=0 THEN JN=N: N=10
1470 NEXT: D$(O,JN)=D$: WR(1,JN,O)=WO: WR(2,JN,O)=WA
1480 FOR N=0 TO 9: IF WR(0,N,O)>=PR THEN WR(0,N,O)=WR(0,N,O)+1
1490 NEXT: WR(0,JN,O)=PR: GOTO 1400
1600 '*** DELETE JOB
1610 GOSUB 2600
1620 PRINT@832,"ENTER NUMBER OF JOB TO BE DELETED (0 TO RETURN TO MENU)";: INPUT
 JN
1630 IF JN=0 GOTO 400
1640 IF JN>10 OR JN<1 GOSUB 2400: GOTO 1600 ELSE PR=WR(0,JN-1,O)
1650 FOR J=JN-1 TO 9: D$(O,J)=D$(O,J+1)
1660 FOR I=0 TO 2: WR(I,J,O)=WR(I,J+1,O): NEXT I,J
1670 FOR I=0 TO 2: WR(I,9,O)=0: NEXT: D$(O,9)=""
1680 FOR N=0 TO 9: IF WR(0,N,O)>PR THEN WR(0,N,O)=WR(0,N,O)-1
1690 NEXT: GOTO 1600
1800 '*** CHANGE PRIORITY
1810 CLS: PRINT TAB(14-(LEN(N$(O))/2))"WORKLOAD RECORD FOR "N$(O)" IN PRIORITY O
RDER"
1820 PRINT@64,"JOB £"TAB(11)"DESCRIPTION"TAB(27)"PRIORITY"TAB(40)"WORK LEFT"TAB(
54)"WAIT LEFT"
1830 PP=1: N=0
1840 IF WR(O,N,O)=PP PRINT" "N+1TAB(10)D$(O,N)TAB(29)WR(0,N,O)TAB(43)WR(1,N,O)TA
B(57)WR(2,N,O): PP=PP+1: N=0: GOTO 1840
1850 IF N<10 THEN N=N+1: GOTO 1840
1860 PRINT@832,"ENTER CHANGE IN PRIORITY IN THE FORM - PRESENT, NEW"
1870 INPUT "(0,0 TO RETURN TO MENU)";PP,PR: PP=INT(PP): PR=INT(PR): F=1: IF PR=0
 GOTO 400
1880 IF PP>10 OR PR>10 OR PP<1 OR PR<1 GOSUB 2200: GOTO 1800 ELSE GOSUB 2300
1890 FOR N=0 TO 9: IF WR(0,N,O)=PP THEN WR(0,N,O)=11
1900 NEXT: IF PP<PR GOTO 1940
1910 FOR N=0 TO 9: 'RAISE
1920 IF WR(0,N,O)<PP AND WR(0,N,O)>=PR THEN WR(0,N,O)=WR(0,N,O)+1
1930 NEXT: GOTO 1970
1940 FOR N=0 TO 9: 'LOWER
1950 IF WR(0,N,O)>PP AND WR(0,N,O)<=PR THEN WR(0,N,O)=WR(0,N,O)-1
1960 NEXT
1970 FOR N=0 TO 9: IF WR(0,N,O)=11 THEN WR(0,N,O)=PR
1980 NEXT: GOTO 1800
```

```
2400 '*** OPERATOR FILE DISPLAY SUBROUTINE
2410 CLS: PRINT@26,"WORKLOAD RECORD"
2420 PRINT@81,"THE FOLLOWING NAMES ARE ON FILE:"
2430 FOR N=0 TO 9: IF N$(N)<>"" PRINT TAB(22)N+1TAB(26)N$(N)
2440 NEXT: RETURN
2600 '*** JOB FILE DISPLAY SUBROUTINE
2610 CLS: PRINT TAB(22-(LEN(N$(0))/2))"WORKLOAD RECORD FOR "N$(0)
2620 PRINT@64,"JOB £"TAB(11)"DESCRIPTION"TAB(27)"PRIORITY"TAB(40)"WORK LEFT"TAB(
54)"WAIT LEFT"
2630 FOR N=0 TO 9
2640 IF WR(0,N,0)<>0 PRINT" "N+1TAB(9)D$(0,N)TAB(29)WR(0,N,0)TAB(43)WR(1,N,0)TAB
(57)WR(2,N,0)
2650 NEXT: RETURN
2800 DATA DISPLAY JOB FILE,INSERT JOB,DELETE JOB,AMEND JOB PRIORITY,AMEND WORKLO
AD,AMEND NAME FILE,STORE ALL FILES
2000 '*** CHANGE WORKLOAD
2010 GOSUB 2600
2020 PRINT@832,"ENTER WORKLOAD CHANGE IN THE FORM - JOB £, NEW WORK LEFT, NEW
WAIT LEFT (0,0,0 TO RETURN TO MENU)";
2030 INPUT JN,WO,WA: WO=INT(WO): WA=INT(WA): IF JN=0 GOTO 400
2040 IF JN>10 OR WO>99 OR WA>99 OR JN<1 OR WO<1 GOSUB 2200: GOTO2000
2050 WR(1,JN-1,0)=WO: WR(2,JN-1,0)=WA: GOTO 2000
2200 '*** VALIDATION MESSAGE SUBROUTINE
2210 CLS: PRINT@384,"AT LEAST ONE OF THE DATA ENTRIES MADE IS OUTSIDE SYSTEM LIM
ITS. PLEASE CHECK AND RE-ENTER DATA."
2220 FOR N=1 TO 2000: NEXT: RETURN
2300 '*** PRIORITY CHECK SUBROUTINE
2310 FOR N=0 TO 9: IF WR(0,N,0)>PT THEN PT=WR(0,N,0): NEXT
2320 IF PR>PT+1 THEN PR=PT+1: IF F=1 THEN PR=PT
2330 PT=0: RETURN
2810 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2820 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2830 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2840 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2850 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2860 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2870 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2880 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2890 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2900 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2910 DATA **,**,**,**,**,**,**,**,**,**
2920 DATA **,**,**,**,**,**,**,**,**,**
2930 DATA **,**,**,**,**,**,**,**,**,**
2940 DATA **,**,**,**,**,**,**,**,**,**
2950 DATA **,**,**,**,**,**,**,**,**,**
2960 DATA **,**,**,**,**,**,**,**,**,**
2970 DATA **,**,**,**,**,**,**,**,**,**
2980 DATA **,**,**,**,**,**,**,**,**,**
2990 DATA **,**,**,**,**,**,**,**,**,**
3000 DATA **,**,**,**,**,**,**,**,**,**
3010 DATA **,**,**,**,**,**,**,**,**,**
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BUYERS' GUIDE

Software

Software packages are listed by application, in alphabetical order, with the systems on which each package will run also listed alphabetically. The guide is not exclusively for business applications: if your company is the source or dealer for a package with a more unusual application, send us the details and we will create a new category.

The usual criteria have been applied. The minimum configuration is 32K of RAM, a disc and a printer; the price of the package must lie between £50 and £1,000; the companies listed are the source of the software or the main dealers in the U.K., and the capacity quoted is per disc or drive.

Machine type by application

Combined-Ledger/Stock/Invoicing

Machine Type	Supplier Name	Price	Capacity
Apple II	Vlasak Electronics Ltd	£855	1,500 a/c 5k trans
Apple II	Dataforce (U.K.) Ltd	£855	
Apple II	Microsense Computers Ltd	£340	
Apple II/ITT 2020	Informex London Ltd	£298	500 a/c
Commodore 3000/8	Commodore BM (U.K.) Ltd	£1,100	.2-.6k a/c 2-6k trans
Commodore 3032	Compfer Ltd	£400	varies
Commodore 3032	Analog Electronics	£550	
Commodore 3032	Logma Systems Design	£600	1-6 shops

Commodore 3032	Grama (Winter) Ltd	£475	varies
Commodore 3032	Bristol Software Factory	£300	1k a/c 6k trans
Commodore 3032	Compfer Ltd	£600	500 a/c 1k items
Commodore 3032	HB Computers	£695	500 a/c 2,500 trans
CP/M	Graffcom Systems Ltd	£400	varies
CP/M	Benchmark CS Ltd	£950	varies
CP/M	Computastore Ltd	£1,000	
CP/M	Minicomputer CS Ltd	£1,250	varies
CP/M	Salmon Microcomputers	£750	1,600 items 1k trans
CP/M	Selven Ltd	£1,500	3k a/c 7k trans
CP/M	Map Computer Systems	£1,000	varies
CP/M North Star	Intelligent Artefacts	£510	1,500 a/c 5k trans
CP/M North Star	Instar Business Systems	£999	600-2,900
Ohio Scientific	Microcomputer BM	£656	
Tandy Model 2	Chess Consultancies Ltd	£1,200	
Tandy Model 2	Chess Consultancies Ltd	£995	5k items 1,500 a/c
Tandy TRS-80	Microcomputer Applications	£90	
Tecs	Jar Software Systems	£650	500 a/c 300 nom. a/c

Database Managers

Machine Type	Supplier Name	Price	Capacity
Apple II	ACT Microsoft Ltd	£75	
Apple II	Courtman Micro Systems	£106	100k characters
Apple II/ITT 2020	Systematics International Ltd	£72	
Apple II/ITT 2020	Diskdean Ltd	£120	varies
Apple II/ITT 2020	Systematics International Ltd	£125	1,000 references
Apple II/ITT 2020	Informex London Ltd	£198	500-1,200 records
Apple II/ITT 2020	The Software House	£140	900 records
Commodore 3000/8	Stage One Computers	£45-£250	650-2,400 records
Commodore 3000/8	Commodore BM (U.K.) Ltd	£150-£300	650-1.4-64k records
Commodore 3032	CPS (Data Systems) Ltd	£200	varies
Commodore 3032/8	Compsoft Ltd	£190	600-5,000 records
CP/M	Compsoft Ltd	£400	30k records
CP/M	Great Northern CS Ltd	£110 and £210	varies
CP/M	Microtek Computer Services	£250-£500	
CP/M	Clenlo Computing Services	£90-£325	varies
CP/M	Median-Tec Ltd	£500	
Metrotech System	Metrotech	£200-£1,000	
Ohio Challenger	U-Microcomputers Ltd	£175	
Ohio Scientific	Microcomputer BM	£175	
SWTPC	SWTPC	£100	
Tandy TRS-80	Cleartone ADP	£75	varies
Tandy TRS-80	ACT Microsoft Ltd	£75	
Z-80/8080	Structured Systems Group	£135	varies
Z-80/Cromemco	Xitan Systems Ltd	£850	4,000 records/disc

Engineering Design Systems

Machine Type	Supplier Name	Price	Notes
Apple II	James C Steadman	£200	Erect concrete columns
Apple II	James C Steadman	£250	Multibay frames
Apple II/ITT 2020	Aerco-Gemsoft	£175	Pipeline engineering
Commodore 3032	Micro Computation	£300	Building-conversion specification
Commodore 3032	The Alphabet Co	£75	Time study and analysis
CP/M	Median-Tec	£500	Plastic portal frames
CP/M	Median-Tec	£1,500	Finite element analysis
CP/M	Median-Tec	£500	Slope-stability analysis
CP/M	Median-Tec	£500	Retaining wall design
CP/M	Median-Tec	£1,500	Concrete design
Equinox	Equinox	£500	Civil/structural engineering design
Tandy TRS-80	Chess Consultancies	£450	Production planning
Tecs	Jar Software	£600	Production analysis

Estate Agents' Systems

Machine Type	Supplier Name	Price	Notes
Apple II	Microsense	£500	Estate agents' system
Apple II/ITT 2020	Cyderpress	£650	Estate agents' system
Apple II/ITT 2020	Systematics International	£850	Estate agents' system
Commodore 3032	Stage One Computers	£250	Estate agents' package
Compucorp	Verwood systems	£700	Estate sales
Cofnpucorp	Verwood systems	£1,200	Estate managment
CP/M	Selven Ltd	£325	Estate agents' package

Financial Systems

Machine Type	Supplier Name	Price	Notes
Apple II	Microdigital	£200	Sales analysis
Apple II	Microdigital	£130	Credit control
Apple II	Microsense	£194	Cashier retail/whole
Apple II	PK Microsystems	P.O.A.	Solicitors' accounts
Apple II	Dataforce	£80	Cashflow projection
Apple II	Informex	£98	VAT system
Apple II/ITT 2020	Microsense	£125	VisiCalc
Apple II/ITT 2020	Systematics International	£295	Financial planning
Apple II/ITT 2020	Systematics International	£1,000	Financial controller
Apple II/ITT 2020	Microsense	£75	Modelling Desktop plan
Commodore 3000	Stage One Computers	£250	Financial accounts package
Commodore 3000/8	ACT Microsoft	£125	Financial modelling
Commodore 3032	Stage One Computers	£100	Quotation processing
Commodore 3032	CPS	£575	Inventory-costing/ jewellers
Commodore 3032	L & J Computers	£90	Cash book
Commodore 3032	ACT (Petsoft)	£150	Financial planning
Commodore 3032	Stage One Computers	£100	Bank a/c reconcile
Commodore 3032	Logma Systems	£600	Sales/analysis
CP/M	Micromedia	£1,000	Invoice disc factoring
CP/M	Graffcom Systems	£400	Hire-purchase system
CP/M	Map Computers	£550	Financing system
CP/M	Microtek	£500	Accounting
CP/M	Microtek	£750	Budget control
CP/M	Median-Tec	£500	Financial analysis
CP/M	Graffcom Systems	£450	Purchasing system
CP/M Vector	Taylor Microsystems	£390	Cashflow forcasting
Durango F-85	Kesho Systems	£1,000	Time recording/ledger
Tandy TRS-80	Chess Consultancies	£800	Sales statistics
Tandy TRS-80	AJ Harding (Molimerx)	£125	Financial balancing
Z-80/8080	Intereurope	£500	Financial modelling
Z-80/8080	Graham Dorian	£325	Sales analysis retail

General Ledger

Machine Type	Supplier Name	Price	Capacity
Apple II	Computech Systems	£295	500 a/c 1,700 trans
Apple II	Dataforce (U.K.) Ltd	£225	200 a/c 1k trans
Apple II/ITT 2020	Guestel Ltd	£300	200 a/c
Commodore 3032	Bristol Software Factory	£300	1k a/c 6k trans
Commodore 3032	Analog Electronics	£450	
Commodore 8000	Commodore BM (U.K.) Ltd	£300	600 a/c 3k trans
CP/M	PR Daly & Co Ltd	£500	
CP/M	Haywood Associates Ltd	£500	
CP/M	Median-Tec Ltd	£500	500 a/c 5k trans
CP/M	Ludhouse Ltd	£500	200 a/c 5k trans
CP/M	Computastore Ltd	£500	999 a/c 99 centres nine computers
CP/M	Great Northern CS	£345	250 a/c
CP/M	Selven Ltd	£400	1k a/c 3k trans
CP/M	Map Computer Systems	£300	250 a/c 3,500 trans
CP/M	Benchmark CS Ltd	£250	150 a/c 500 trans
Tandy Model 2	Chess Consultancies Ltd	£400	1k a/c
Tandy TRS-80	Tridata Micros Ltd	£225	500 a/c 1,800 trans
Z-80	Liveport Ltd	P.O.A.	

Hotel and Travel Packages

Machine Type	Supplier Name	Price	Notes
Apple II	Dataforce	£525	Hotel management
Apple II	Informex	£298	Travel agents' system
Apple II	Informex	£298	Hotel administration system
Apple II/ITT 2020	Guestel Ltd	£500	Hotel billing
Apple II	Diskwise Ltd	£695	Hotel reservation and guest billing
Commodore 3000	Landsler Software	£350	Hotel guest billing

Incomplete Records

Machine Type	Supplier Name	Price	Capacity
Apple II/ITT 2020	Padmede Computer Services	£450	900 a/c 2k trans/disc
Commodore 3000/8	CSM Ltd	£1,200	250 a/c 3-5k trans
Commodore 3032	Stage One Computers	£750	500 centres 2,300 a/c
Commodore 3032	Micro Computation	£555	120 a/c 5k trans
CP/M	Ludhouse Ltd	£1,000	variable
CP/M	Salmon Microcomputing	£950	5k entries
CP/M	Map Computer Systems	£550	
Durango F-85	Kesho Systems	£1,000	
Exidy Sorcerer	Basic Computing	£350	
Tandy Model 1	AJ Harding (Molimerx)	£150	1,200

Job Costing/Billing

Machine Type	Supplier Name	Price	Capacity
Apple II	Informex London	£498	
Apple II	Deltic Computing Ltd	£250	
Apple II/ITT 2020	Padmede Computer Services	£300	999 clients 99 rates
Apple II/ITT 2020	TABS Ltd	£99	100 jobs 3k trans
Commodore 3032	CSM Ltd	£600	1k jobs 100 people
Commodore 3032	Stage One Computers	£100	300 appointments
CP/M	Map Computer Systems Ltd	£550	400-96k jobs
CP/M	Graffcom Systems Ltd	£400	varies
CP/M	Ludhouse Ltd	£1,000	1k jobs 35 codes
CP/M	Microtek Computer Services	£1,000	
CP/M	Great Northern CS Ltd	£455	300 clients
CP/M	Salmon Microcomputing	£300	225 codes
CP/M Cromemco	Sheffield Micro Information	£1,500	20 operations
CP/M North Star	Intelligent Artefacts	£275	

Mailing Systems

Machine Type	Supplier Name	Price	Capacity
Apple II	Keen Computers Ltd	£300	500 addresses
Apple II	SBD Consultants Ltd	£55	
Apple II	Microsense Computers Ltd	£70	
Apple II	Informex London Ltd	£198	
Apple II/ITT 2020	Systematics International Ltd	£300	500 addresses
Apple II/ITT 2020	The Software House	£57	750 names and addresses
Apple II/ITT 2020	Personal Computers Ltd	£50	400 entries
Commodore 3000/8	Amplicon MS Ltd	£145	1,500-4,000 records
Commodore 3032	MMS Computer Systems	£250	3,000 records
Commodore 3032	Stage One Computers	£100	325 records
Commodore 3032/8	Compsoft Ltd	£190	13k
CP/M	Compsoft Ltd	£400	27k
CP/M	Structured Systems Group	£50	varies
CP/M	Graffcom System Ltd	£250	800-5k records
CP/M	Median-Tec Ltd	£500	
CP/M Horizon	Microtek Computer Services	£250	varies
CP/M North Star	Micromedia Systems	£195	
CP/M Vector	Taylor Microsystems	£375	
Tandy TRS-80	AJ Harding (Molimerx)	£55	600-3,750 records
Tandy TRS-80	Comput-A-Crop	£78	varies
Z-80/8080	Intereurope SD Ltd	£200	30k entries
Z-80/8080	Micro Focus	£90	varies

Order Entry/Invoicing

Machine Type	Supplier Name	Price	Notes
Apple II	Informex	£198	Invoicing system
Commodore 3032	MMS Computers	£250	Order control
CP/M	PR Daly & Co	£200	Invoicing
CP/M	Graffcom Systems	£350	Order entry/invoicing
CP/M	Median-Tec		Invoicing
Tandy TRS-80	Tridata Micros	£75	Invoicing
Z-80/MCZ	Software Architects	£600	Order entry/invoicing

Payroll

Machine Type	Supplier Name	Price	Capacity
Apple II	Dataforce (U.K.) Ltd	£375	
Apple II/ITT 2020	TW Computers Ltd	£145	
Apple II/ITT 2020	Informex London Ltd	£298	
Apple II/ITT 2020	Algobel Computers	£295	500 employees
Apple II/ITT 2020	Vlasak Electronics Ltd	£375	200 employees
Apple II/ITT 2020	Computech Systems	£379	300 employees
Apple II/ITT 2020	Tabs Ltd	£99	50 weekly 100 monthly
Commodore 3000/8	Commodore BM (U.K.) Ltd	£150	200-600 employees
Commodore 3000/8	Landsler Software	£150	200-500 employees
Commodore 3032	Analog Electronics	£90	
Commodore 3032	L & J Computers	£220	
Commodore 3032	Intex Datalog Ltd	£195	200 employees
Commodore 3032	Computastore Ltd	£75	483 employees
Commodore 3032	ACT (Petsoft) Ltd	£195	600 employees
CP/M	Haywood Associates Ltd	£350	
CP/M	Median-Tec	£500	1k employees
CP/M	Salmon Microcomputing	£300	500 employees
CP/M	Map Computer Systems	£350	300-96k employees
CP/M	Daman Computer Services	£900	1k employees/Mbyte
CP/M	Selven Ltd	£500	500 employees
CP/M	PR Daly & Co Ltd	£350	
CP/M	Graffcom Systems Ltd	£500	500 employees
CP/M	PCL Software Ltd	£495	1,200 employees
CP/M	Ludhouse Ltd	£450	300 employees
CP/M	Comput-A-Crop	£495	175 employees
CP/M Horizon	Microtek Computer Services	Lease	varies
CP/M North Star	Micromedia Systems	£495	350 employees
CP/M North Star	Benchmarks CS Ltd	£350	300 employees
CP/M North Star	Intelligent Artefacts	£52	100 employees
CP/M Vector	Taylor Micro Systems	£490	
Durango F-85	Kesho Systems	£500	
Sharp MZ-80K	Tridata Micros Ltd	£250	400 employees
Tandy TRS-80	AJ Harding (Molimerx)	£120	
Tandy TRS-80	Chess Consultancies	£400	400 employees
Tandy TRS-80	Tridata Micros Ltd	£218	400 employees
Tandy TRS-80	3-line Computing	£140	
Tecs	Jar Software Systems	£250	300 employees
Z-80/8080	Liveport Ltd	£250	500 employees

Personnel and Administration

Machine Type	Supplier Name	Price	Application
Apple II	Informex Logic	£198	Personnel records
Apple II	Informex Logic	£298	Staff selection tests
Apple II/ITT 2020	Informex Logic	£298	Employment agency system
Apple II/ITT 2020	Informex Logic	£198	Medical records
Apple II/ITT 2020	Informex Logic	£198	Hospital administration
Commodore 3000	Intex Datalog Ltd	£100	Hospital administration
CP/M	Median-Tec Ltd	£1,500	Employment agency system
CP/M North Star	Micromedia	£595	Personnel records
CP/M Vector	Taylor Microsystems	£390	Piece work
Z-80/8080	Intereurope	£500	Personnel records

Property Management

Machine Type	Supplier Name	Price	Capacity
Apple II/ITT 2020	Cyderpress Ltd	£650	
Apple II/ITT 2020	Informex London Ltd	£298	300 entries
Apple II/ITT 2020	Cyderpress Ltd	£650	500 properties
Appel II/ITT 2020	Algobel Computers Ltd	£650	400 properties
Commodore 3032/8	Compsoft Ltd	£190	13k
CP/M	Compsoft Ltd	£400	27k
CP/M	Algobel Computers Ltd	£650	2k trans
CP/M	Salmon Microcomputing	£900	
Z-80/8080	Graham Dorian Software	£325	varies

Purchase Ledger

Machine Type	Supplier Name	Price	Capacity
Apple II	Dataforce (U.K.) Ltd	£315	200 a/c 1k trans
Apple II	Logic Box Ltd	£490	400 a/c 1k trans
Apple II	Deltic Computing Ltd	£250	1k trans
Apple II	Computech Systems	£295	500 a/c 1,600 trans
Apple II/ITT 2020	Padmede Computer Services	£300	900 a/c 4,500 trans/ disc
Apple II/ITT 2020	Guestel Ltd	£300	200 a/c
Commodore 3000/8	CSM Ltd	£550	1-2k a/c 6-10k trans
Commodore 3000/8	Anagram Systems	£399	.2-2k a/c .8-16k trans
Commodore 3032	ACT (Petsoft) Ltd	£120	200 a/c 700 trans
Commodore 3032	Compfer Ltd	£300	1k trans 7k entries
Commodore 8000	Commodore BM Ltd	£300	600 a/c 4,500 trans
CP/M	Median-Tec Ltd	£500	500 a/c 5k trans
CP/M	Ludhouse Ltd	£500	500 a/c 5k trans
CP/M	Great Northern CS Ltd	£315	500 a/c
CP/M	Structured Systems Ltd	£460	varies
CP/M	Selven Ltd	£600	1k a/c 2k trans
CP/M	Salmon Microcomputing	£350	1k a/c 24k trans
CP/M	Map Computer Systems Ltd	£300	400-96,000 a/c
CP/M	PR Daly & Co Ltd	£350	
CP/M	Computastore Ltd	£400	500 a/c 3,100 trans
CP/M	Haywood Associates	£350	
CP/M North Star	Benchmark CS Ltd	£250	100 a/c 300 trans
Durango F-85	Kesho Systems	£500	
Exidy Sorcerer	Basic Computing	£125	
Tandy Models 1 & 2	Chess Consultancies Ltd	£250	300-500 a/c
Tandy TRS-80	Tridata Micros Ltd	£225	125 a/c 1k trans

Sales Ledger

Machine Type	Supplier Name	Price	Capacity
Apple II	Computech Systems	£295	500 a/c 1,600 trans
Apple II	Dataforce (U.K.) Ltd	£315	200 a/c 1k trans
Apple II	Logic Box Ltd	£490	300 a/c 1,300 trans
Apple II	Deltic Computing Ltd	£250	1k a/c
Apple II/ITT 2020	Padmede Computer Services	£300	900 a/c 4,500 trans/ disc
Apple II/ITT 2020	Guestel Ltd	£300	200 a/c
Commodore 3000/8	Anagram Systems	£299	.25-2k a/c .5-10k trans
Commodore 3000/8	CSM Ltd	£550 and £650	1-2k a/c 6-10k trans
Commodore 3032	ACT (Petsoft) Ltd	£120	200 a/c 700 trans
Commodore 8000	Commodore BM (U.K.) Ltd	£300	600 a/c 4,500 trans
CP/M	PCL Software Ltd	£475	950 a/c
CP/M	Great Northern CS Ltd	£415	500 a/c
CP/M	Haywood Associates Ltd	£350	
CP/M	Median-Tec Ltd	£500	500 a/c 5,000 trans
CP/M	Ludhouse Ltd	£500	2,000 a/c 8,000 trans
CP/M	Graffcom Systems Ltd	£450	540-7,000
CP/M	Computerstore Ltd	£400	500 a/c 3,500 trans
CP/M	Map Computer Systems Ltd	£300	400-96,000 a/c
CP/M	Daman Computer Services	£900	1.5k a/c 500 trans
CP/M	PR Daly and Co Ltd	£350	
CP/M North Star	Benchmark CS Ltd	£250	200 a/c 500 trans
Durango F-85	Kesho Systems	£500	
Exidy Sorcerer	Basic Computing	£125	

Tandy TRS-80	Tridata Micros Ltd	£225	175 a/c 1,350 trans
Tandy Models 1&2	Chess Consultancies Ltd	£250	300 a/c
Tecs	Jar Software Systems	£550	500 a/c

Stock Systems

Machine Type	Supplier Name	Price	Capacity
Apple II	Logic Box Ltd	£490	1,200 items
Apple II	Vlasak Electronics Ltd	£150	7,000 items
Apple II	Dataforce (U.K.) Ltd	£200	850 items
Apple II	U-Microcomputers Ltd	£199	
Apple II	Microsense Computers Ltd	£100	
Apple II	Informex London Ltd	£198	
Apple II/ITT 2020	Microdigital Ltd	£225	625 items
Apple II/ITT 2020	Vlasak Electronics Ltd	£285	500 items
Apple II/ITT 2020	Systematics International Ltd	£500	200-2,500 items
Apple II/ITT 2020	Guestel Ltd	£300	
Apple II/ITT 2020	Padmede Computer Services	£300	2,000 postings
Apple II/ITT 2020	The Software House	£80	800 items
Commodore 3000	Intex Datalog Ltd	£195	2.4-3.7k items
Commodore 3000/8	Rockliff Brothers Ltd	£275	3.4-10k records
Commodore 3032	Logma Systems Design	£600	1-6 shops
Commodore 3032	ACT (Petsoft) Ltd	£75	2,400 items 1,000 a/c
Commodore 3032	ACT (Petsoft) Ltd	£75	1,200-5,900 items
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Commodore 3032	Bristol Software Factory	£300	2,300 items
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CP/M	PR Daly & Co Ltd	£350	
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CP/M	Haywood Associates Ltd	£350	
CP/M	Median-Tec Ltd	£500-£800	1,000 items
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CP/M	Salmon Microcomputing	£400	5,000 items
CP/M	Map Computer Systems Ltd	£250	
CP/M	Ludhouse Ltd	£1,000	12,000 parts
CP/M Cromemco	Micromedia Systems	£1,000	
CP/M Horizon	Microtek Computer Services	£500-£1,000	varies
CP/N North Star	Benchmark CS Ltd	£450	30 items 275 trans
CP/M Vector	Taylor Micro Systems	£995	4,000 items/Mbyte
Exidy Sorcerer	Basic Computing	£125	
Tandy TRS-80	Chess Consultancies	£995	
Tandy TRS-80	AJ Harding (Molimerx)	£150	1,000 items
Tandy TRS-80	Cleartone ADP	£325	4,000 items
Tandy TRS-80	Chess Consultancies	£750	500 items six sites
Tandy TRS-80	Micro Gems	£150	1,000 items
Tandy TRS-80	Tridata Micros Ltd	£200-£375	630 items/disc
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Tecs	Jar Software Services	£850	1,000 items 300 a/c
Z-80/8080	Graham Dorian Software	£325	varies
Z-80/8080	Rogis Systems Ltd	£500	900-3,500 items
Z-80/8080	Software Architects Ltd	£600	varies

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Apple II	SBD Consultants Ltd	£60	
Apple II/ITT 2020	Systematics International Ltd	£75	
Apple II/ITT 2020	Algobel Computers Ltd	£75	800 lines

Apple II/ITT 2020	Personal Computers Ltd	£225 £300	200k characters
Commodore 3000	Stage One Computers Ltd	£125	
Commodore 3032	Dataview Ltd	£159	
Commodore 3032	ACT (Petsoft) Ltd	£325	12Kbytes
CP/M	Median-Tec	£300	
CP/M	Microtek Computer Services	£350	
CP/M North Star	Micromedia Systems	£495	
CP/M Vector	Taylor Micro Systems	£375	
Ohio Scientific	Microcomputer BM	£116	
Tandy TRS-80	Microcomputer Applications	£50-£190	
Z-80/8080	Intereurope SD Ltd	£500	varies
Z-80/8080	Structured Systems Group	£120	varies

Miscellaneous

Machine Type	Supplier Name	Price	Application
Apple II	Vlasak Electronics	£130	Petrol pump losses
Apple II	Humac Ltd	£1,000	Auctioneers' package
Apple II	Humac Ltd	£600	Invoicing sales—timber
Apple II	Humac Ltd	P.O.A.	Microfiche records
Apple II/ITT 2020	Informex Logic	£198	Insurance records
Apple II/ITT 2020	Informex Logic	£198	Time records/solicitors
Apple II/ITT 2020	Diskwise	£198	TV rental management system
Apple II/ITT 2020	Cyderpress	£650	Auction system
Apple II/ITT 2020	Personal Computers	£195	Operational research
Apple II/ITT 2020	Personal Computers	£100	Time/series analysis
Apple II/ITT 2020	Padmede Computers	£500	Insurance brokers' system
Commodore 3000	Anagram Systems	£850	Media control system
Commodore 3000	Anagram Systems	£800	Slot machine monitor
Commodore 3000	The Alphabet Company	£250	Newsagent suite
Commodore 3032	Microland	£175	Printers' quotation system
Commodore 3032	Stage One Computers	£100	Insurance brokers' system
Commodore 3032	Stage One Computers	£200	Printers' job control
Commodore 3032	Commodore BM (U.K.)	£50	Appointments planner
Commodore 3032	CSM Ltd	£500	Window replacement
Commodore 3032	SA Systems	£550	Farming-office systems
Commodore 3032	L & J Computers	£420	Machine hire
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CP/M	PR Daly & Co	£450	Time recording
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CP/M	Salmon Microcomputers	£150	Appointments planner
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CP/M	Map Computer Systems	£750	Calor system
CP/M	Map Computer Systems	£425	Newsboy/newsagents' system
CP/M	Haywood	£500	Time recording
CP/M	Comput-A-crop	£1,000	Farm management
CP/M	Microtek	£1,000	Plant hire
CP/M North Star	Micromedia	£195	Vehicle maintenance
CP/M Vector	Taylor Microsystems	£495	Bill of materials
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Tandy TRS-80	Cleartone ADP	£300	WIP and invoicing system
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Z-80/8080	Intereurope	£500	Conference organiser

Alphabetical list of suppliers

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ACT Microsoft Ltd 021-455-8585	Radclyffe House 66-68 Hagley Road Edgbaston Birmingham B16 8PF	M Wauchope

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Compsoft Ltd	Old Manor Lane Chilworth Guildford Surrey	
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Courtman Micro Systems 0222-495257	48 Melrose Avenue Pen-Y-Lan Cardiff CF3 7AS	KJ Courtman
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CSM Ltd 021-382-4171	Refuge Assurance House Sutton New Road Birmingham	Peter Mart
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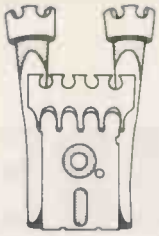

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LDOS

First there were the TRSDOS's, 2.0, 2.1, 2.2 and 2.3. Then came Newdos+, essentially a patched version of the TRSDOS's but with a number of very useful commands and utilities added. Then VTOS 3.0 and VTOS 4.0. These constituted a departure from the earlier DOS's and featured Device Independence so that devices such as the keyboard, printer, VDU and disk drives could interact directly together. Then came Newdos80 which is a rewrite of Newdos+, adding new utilities and new Basic commands, its main features being the ability to mix different capacity drives on the same cable and the ability to use variable length records. Now from LOBO International comes LDOS, the fifth generation disk operating system for the TRS-80 microcomputer. It combines most of the advantages of the preceding disk operating systems and unlike some of them, is accompanied by a complete and readable set of documentation, which includes a Technical Section containing relevant addresses.

It is impossible to describe all of the features of LDOS in an advertisement. For instance it includes no less than 35 library commands as follows:—

APPEND	COPY	DEVICE	DIR	DO	FILTER	KILL
LIB	LINK	LIST	LOAD	MEMORY	RENAME	RESET
ROUTE	RUN	SET	SPOOL	ATRIB	AUTO	BOOT
BUILD	CLOCK	CREATE	DATE	DEBUG	DUMP	FREE
PROT	PURGE	SYSTEM	TIME	TRACE	VERIFY	XFER

All of the useful abbreviations in Newdos are included and the System Commands in Basic (CMD) now number eleven. A program called LBASIC/FIX is included, with which the normal TRSDOS Disk Basic may be patched to include a number of new commands and features. A Job Control Language is included and in fact is one of the most powerful features of LDOS. It allows the user to compile a sequence of commands or key strokes for later execution as a chain, with or without user intervention. There are too many new features to list them herein, but examples are: The ability to provide an audible signal, output through the cassette port. To flash or blink a one line message on the video display. A WAIT feature is included so that the machine can be put into a "sleep" state until such time as the system clock matches the time specified. And so on!

Hard disks in addition to single/double density, single/double sided, 8" and 5¼" floppies are supported although they may, of course, require hardware modifications. Utilities included in the package are:

BACKUP	COMMAND FILE	FORMAT	LCOMM
PATCH	RS232	KEY STROKE/MULTIPLIER	PRINTER FILTER

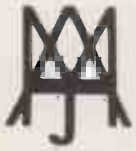
A Basic Renumber facility is included, as is a Basic Cross Reference function. Both are similar to the ones in Newdos+ and Newdos80. Most of the utilities are library commands which were existent in the previous DOS's, have been improved with the addition of new functions or facilities.

The prime development team of LDOS consisted of no less than 8 first rank programmers and they had the support and advice of six other well known programmers. They have done an excellent job to bring to the user what must be the best disk operating system so far produced for a microcomputer, which is destined to become the Standard DOS.

LDOS is totally upward compatible with TRSDOS, that is to say LDOS will be able to copy files and programs from TRSDOS disks onto LDOS formatted disks. As they are competitive disk operating systems, it is not suprising that the manual states that disks created under Newdos are not guaranteed to be compatible with LDOS, but we have not experienced any difficulty. We have done some work on investigating the compatibility of LDOS and the Video Genie and at the time of going to press we have found no incompatibilities. LDOS appears to run on the Video Genie without any problems at all. LDOS is compatible with either the Tandy or Electric Pencil lowercase modifications and Scripsit. LDOS is available for the Model I and Model III. A Model II version will be available shortly.

LDOS .....£85.00 plus VAT and £1.50 P&P.

TRS-80 & VIDEO GENIE SOFTWARE CATALOGUE £1.00 **[refundable]** plus 50p postage.



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• Circle No. 296

Son of Hexadecimal Kid

The Green Tangerine has landed on planet Blotto just in time for the Spring Festival. There Samson watches the Blottonians' barbaric headcrashing ceremony and is caught up in the riotous celebrations afterwards. The next morning he wakes up alone with a thumping hangover. All his money has gone but his binary tree is still with him, though its pot is broken.

By chance, Samson had come to rest at the foot of the imposing marble staircase that fronted the Institute of Esoteric Ideas. He rose to his feet, picked up his battered shrub and looked around. Over its monumental façade were carved the words

MEGABRAIN WILL HAVE BEEN

in a character set which, at that time, Samson did not understand. He began to ascend the stairs towards the main doorway.

In that era, the Institute of Esoteric Ideas was at the hub of galactic civilisation — although soon afterwards it was to fall into disrepute. The prevailing ideology of the cyber-culture that had spread its tentacles wherever intelligent lifeforms or artefacts were found was dedicated to the understanding, and thereby the creation, of Megabrain. This philosophy rested on two fundamental axioms.

The first was the obvious fact that the universe had been designed as a large-scale distributed computer system whose principles of operation were as yet unfathomed. The second was the equally obvious fact that, statistically speaking, the existence of anything at all was impossible. Matter and energy were so inherently improbable that they defied scientific explanation: universal nothingness was a much more natural state of affairs.

These two irreconcilables, taken together, implied a creation; but no Creator could be found. Therefore he or she or it had to be invented, and not just invented but manufactured — to underpin the existence of the universe. The necessity of creating a Creator, namely Megabrain, at some stage in the future — who would then go back in time to create the cosmos — was absolute.

If the effort to bring Megabrain into being faltered, there was a real danger that the universe would fail to have created itself and would vanish without trace, never having really existed. Evil could, therefore, be defined as anything that impeded progress towards Megabrain.

Since nothing could exist outside the universe it followed that Megabrain would not be a *deus ex machina* but a state or mode of functioning of the universe itself. In brief, the cosmos would become the ultimate computer system if only someone could find out how to switch it on — and that was the task of the Institute of Esoteric Ideas.

Little knowing all this, Samson walked into the centre where leading-edge technology and metaphysical mysticism joined forces in the pursuit of Megabrain. When he got through the door he coughed.

"Anyone at home"?

He stood in a tall vaulted hallway. The left-hand side was lined with a long row of indoor plants that looked like Aspidistras. On the right was large desk with a teak veneer.

The desk rolled over towards him on castors.

"Please state your business", it requested.

"I'd like to borrow one of your flower pots for my binary tree please". Samson held up his plant to show its pitiful state. Some more earth shook off its roots.

"You are soiling the carpet", replied the desk. "Take it away".

Samson thought for a moment, then he said: "I want to enrol my tree for a course here".

"Kindly take a seat. The admissions tutor will be with you shortly". The desk rolled back into an alcove and started talking through an intercom. Samson sat down to wait.

The admissions tutor walked briskly over and offered his hand. "Good morning. My name's Ray Cathode. What can I do for you"?

"My binary tree would like to enrol on a course here".

"Good. That's a rather esoteric idea, if I may so so", replied Cathode, beaming. He looked the plant up and down thoughtfully. "Am I right in thinking we have here a dwarf crabapple from Terra Firma in the Third Spiral Arm"?

"Yes".

"Most interesting specimen. Looks in need of a drop of water".

"Yes", said Samson hopefully.

"But, of course, first your friend will have to take the aptitude test".

"Oh", said Samson.

"Now, just a few questions. First of all, what is the applicant's name"?

"Er, Zapple", said Samson on the spur of the moment.

Cathode took out a pocket alphadigital recorder and keyed in the name. "OK. And would he be registering for the full-time or the part-time Diploma in Esoteric Ideas"?

"Full-time".

"I see". He keyed in a few more details. "Finally we have to bring up the sordid subject of money". He gave a very broad, and very false, smile.

Samson's throat tightened. He remembered the thick wad of Solarian Gigaflops he had so wantonly disposed of. He was broke.

"Would Mr Zapple be sponsored, or is he paying his own fees"? prompted Cathode.

"Well, um, I would pay for him, actually", stammered Samson.

"Fine, then all I'll need is a deposit".

With a sinking feeling, Samson handed over his plastic card.

Cathode raised his eyebrows. "American Express"? he muttered in a puzzled tone. He walked over to the desk and inserted it in a slot at the side. "Check this for me, would you, Miss Wordprocessor"?

The desk swallowed up Samson's credit card. There was a hum and a click before it replied. "Creditworthy".

It spat the card out like an electric toaster disgorging toast. Samson scrambled over and picked it off the carpet. It was far too valuable to let go.

Meanwhile Ray Cathode had taken Zapple by the branch.

"Right", he said to it jovially, "let's go and do the test".

"Just a minute", Samson called out, "I'll have to interpret for Zapple. He can't speak".

"A disabled student, eh"? Cathode scratched his chin pensively. "Well all right, come on".

The aptitude test consisted of two parts, a written paper and a practical exam. The written paper required him to write a Cobol master-file update program, and Samson made a mess of it. He was more at home in Basic or assembler. When, however, Cathode led them into the room for the practical, he knew they were home and dry: its walls were lined with Astro-Pinball machines.

Samson and Zapple soon settled in at the Institute. The syllabus was a mixture of Cobol coding, Horticulture, Astro-Pinball — theory and practice — and Encounter Group Experience — heavily laced with Zen Buddhism. Samson found most of these subjects quite easy, but he did not enjoy the encounter-group sessions. In fact he was leaving one in a particularly downcast mood some months later when he met someone who was to change the course of his life.

Samson slammed the door of his counsellor's office and stomped out into the corridor, cannoning into a fellow-student. He mumbled a perfunctory apology without even glancing up.

"Hi", she said, "my name's Mantissa. What's yours"?

Samson raised his eyes from the ground.

Is Mantissa an exponent of the gentle art of multiplication? All is revealed next month.

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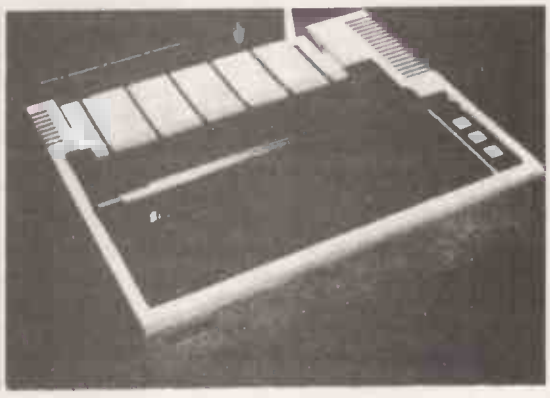

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• Circle No. 297

The Sinclair ZX80 is innovative and powerful. Now there's a magazine to help you get the most out of it.

Get in sync

SYNC magazine is different from other personal computing magazines. Not just different because it is about a unique computer, the Sinclair ZX80 (and kit version, the MicroAce). But different because of the creative and innovative philosophy of the editors.

A Fascinating Computer

The ZX80 doesn't have memory mapped video. Thus the screen goes blank when a key is pressed. To some reviewers this is a disadvantage. To our editors this is a challenge. One suggested that games could be written to take advantage of the screen blanking. For example, how about a game where characters and graphic symbols move around the screen while it is blanked? The object would be to crack the secret code governing the movements. Voila! A new game like Mastermind or Black Box uniquely for the ZX80.

We made some interesting discoveries soon after setting up the machine. For instance, the CHR$ function is not limited to a value between 0 and 255, but cycles repeatedly through the code. CHR$ (9) and CHR$ (265) will produce identical values. In other words, CHR$ operates in a MOD 256 fashion. We found that the "=" sign can be used several times on a single line, allowing the logical evaluation of variables. In the Sinclair, LET X=Y=Z=W is a valid expression.

Or consider the TL$ function which strips a string of its initial character. At first, we wondered what practical value it had. Then someone suggested it would be perfect for removing the dollar sign from numerical inputs.

Breakthroughs? Hardly. But indicative of the hints and kinds you'll find in every issue of **SYNC**. We intend to take the Sinclair to its limits and then push beyond, finding new tricks and tips, new applications, new ways to do what couldn't be done before. **SYNC** functions on many levels, with tutorials for the beginner and concepts that will keep the pros coming back for more. We'll show you how to duplicate commands available in other Basics. And, perhaps, how to do things that can't be done on other machines.

Many computer applications require that data be sorted. But did you realize there are over ten fundamentally different sorting algorithms? Many people settle for a simple bubble sort perhaps because it's described in so many programming manuals or because they've seen it in another program. However, sort routines such as heapsort or Shell-Metzner are over 100 times as fast as a bubble sort and may actually use less memory. Sure, 1K of memory isn't a lot to work with, but it can be stretched much further by using innovative, clever coding. You'll find this type of help in **SYNC**.

Lots of Games and Applications

Applications and software are the meat of **SYNC**. We recognize that along with useful, pragmatic applications, like financial analysis and graphing, you'll want games that are fun and challenging. In the charter issue of **SYNC** you'll find several games. Acey Ducey is a card game in which the dealer (the computer) deals two cards face up. You then have an option to bet depending upon whether you feel the next card dealt will have a value between the first two.

In Hurkle, another game in the charter issue, you have to find a happy little Hurkle who is hiding on a 10 X 10 grid. In response to your guesses, the Hurkle sends our a clue telling you in which direction to look next.

One of the most ancient forms of arithmetical puzzle is called a "boomerang." The oldest recorded example is that set down by Nicomachus in his *Arithmetica* around 100 A.D. You'll find a computer version of this puzzle in **SYNC**.

Hard-Hitting, Objective Evaluations

By selecting the ZX80 or MicroAce as your personal computer you've shown that you are an astute buyer looking for good performance, an innovative design and economical price. However, selecting software will not be easy. That's where **SYNC** comes in. **SYNC** evaluates software packages and other peripherals and doesn't just publish manufacturer descriptions. We put each package through its paces and give you an in-depth, objective report of its strengths and weaknesses.

SYNC is a Creative Computing publication. **Creative Computing** is the number 1 magazine of software and applications with nearly 100,000 circulation. The two most popular computer games books in the world, *Basic Computer Games* and *More Basic Computer Games* (combined sales over 500,000) are published by Creative Computing. Creative Computing Software manufactures over 150 software packages for six different personal computers.

Creative Computing, founded in 1974 by David Ahl, is a well-established firm committed to the future of personal computing. We expect the Sinclair ZX80 to be a highly successful computer and correspondingly, **SYNC** to be a respected and successful magazine.

Order SYNC Today

Right now we need all the help we can get. First of all, we'd like you to subscribe to **SYNC**. Subscriptions are posted by air directly from America and cost just £10 for one year (6 issues). £18 for two years (12 issues) or, if you really want to beat inflation, £25 for three years (18 issues). **SYNC** is available only by subscription; it is not on newstands. We guarantee your satisfaction or we will refund the unfulfilled portion of your subscription.

Needless to say, we can't fill up all the pages without your help. So send in your programs, articles, hints and tips. Remember, illustrations and screen photos make a piece much more interesting. Send in your reviews of peripherals and software too—but be warned: reviews must be in-depth and objective. We want you to respect what you read on the pages of **SYNC** so be honest and forthright in the material you send us. Of course we pay for contributions—just don't expect to retire on it.

The exploration has begun. Join us.

The magazine for Sinclair ZX80 users

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74167	185
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74393	99
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LS323	270
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LS366	37
LS367	37
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LS373	75
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LS375	48
LS377	90
LS378	69
LS379	65
LS384	250
LS385	378
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LS390	62
LS393	60
LS395	199
LS396	190
LS399	220
LS445	140
LS447	195
LS471	620
LS490	245
LS541	135
LS571	620
LS640	225
LS641	225
LS645	210
LS668	175
LS669	150
LS670	175
LS673	550
LS674	750

74L	
74L00	68
74L30	50
74L47	320
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74L85	349
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18.432M	323
19.968MHz	300
20.0MHz	323
26.0MHz	383
26.69MHz	290
27.145MHz	300
27.648MHz	323
38.6667M	350
48.0MHz	323
100.0MHz	323
116.0MHz	300

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	Low profile	Wire wrap
8 pin	8	25
14 pin	10	35
16 pin	10	42
18 pin	16	52
20 pin	22	60
22 pin	25	70
24 pin	25	70
28 pin	35	80
36 pin	—	105
40 pin	30	99

DIL PLUGS (Headers)

14 pin 44p; 24 pin 88p
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15 way	135p	198p	170p	
25 way	198p	284p	195p	
37 way	290p	398p	210p	

AMPHENOL PLUGS

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DIL EDGE Switches CONNECTORS (SPST) (Double type)

	.1	.156
4 way 80p		
6 way	2x10way —	82p
96p	2x15way —	98p
8 way	2x18way 140p	120p
105p	2x22way 150p	125p
10 way	2x25way 165p	160p
175p	2x30way 188p	—
(SPDT)	2x36way 197p	—
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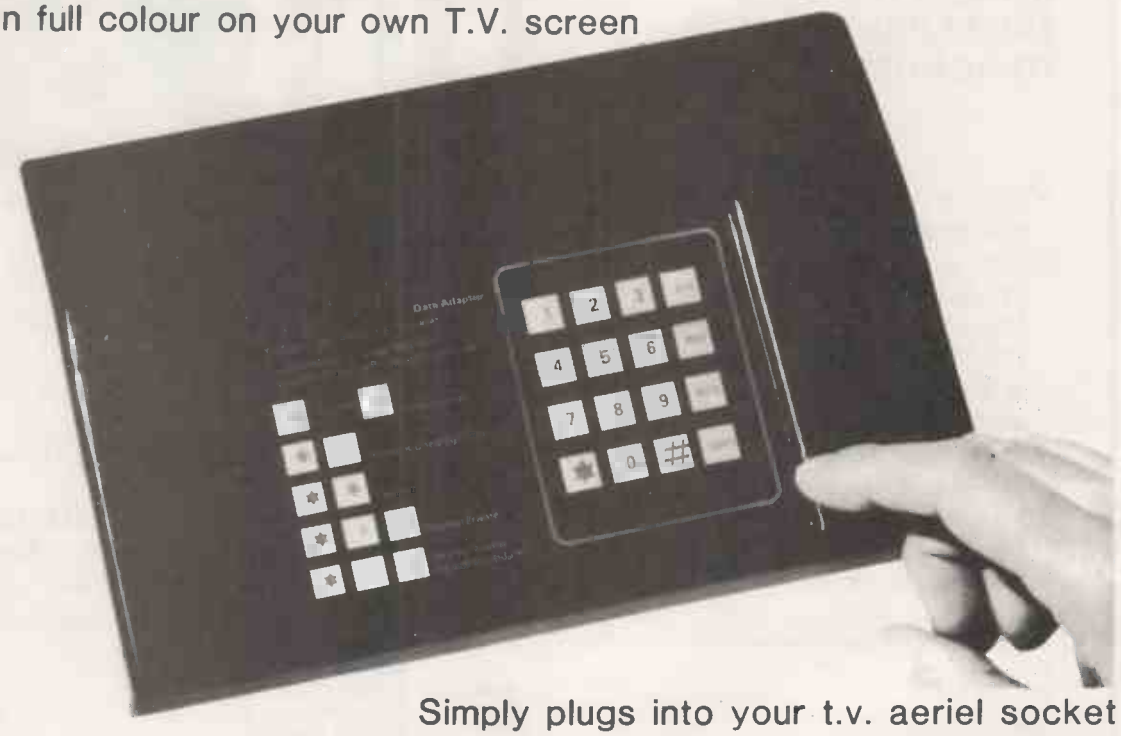

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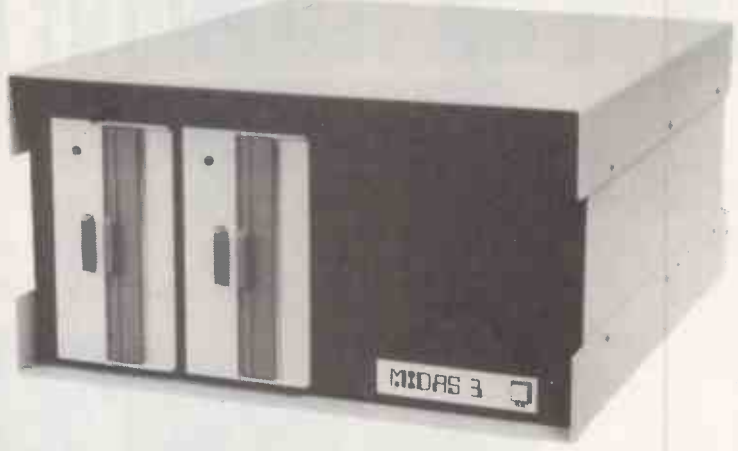

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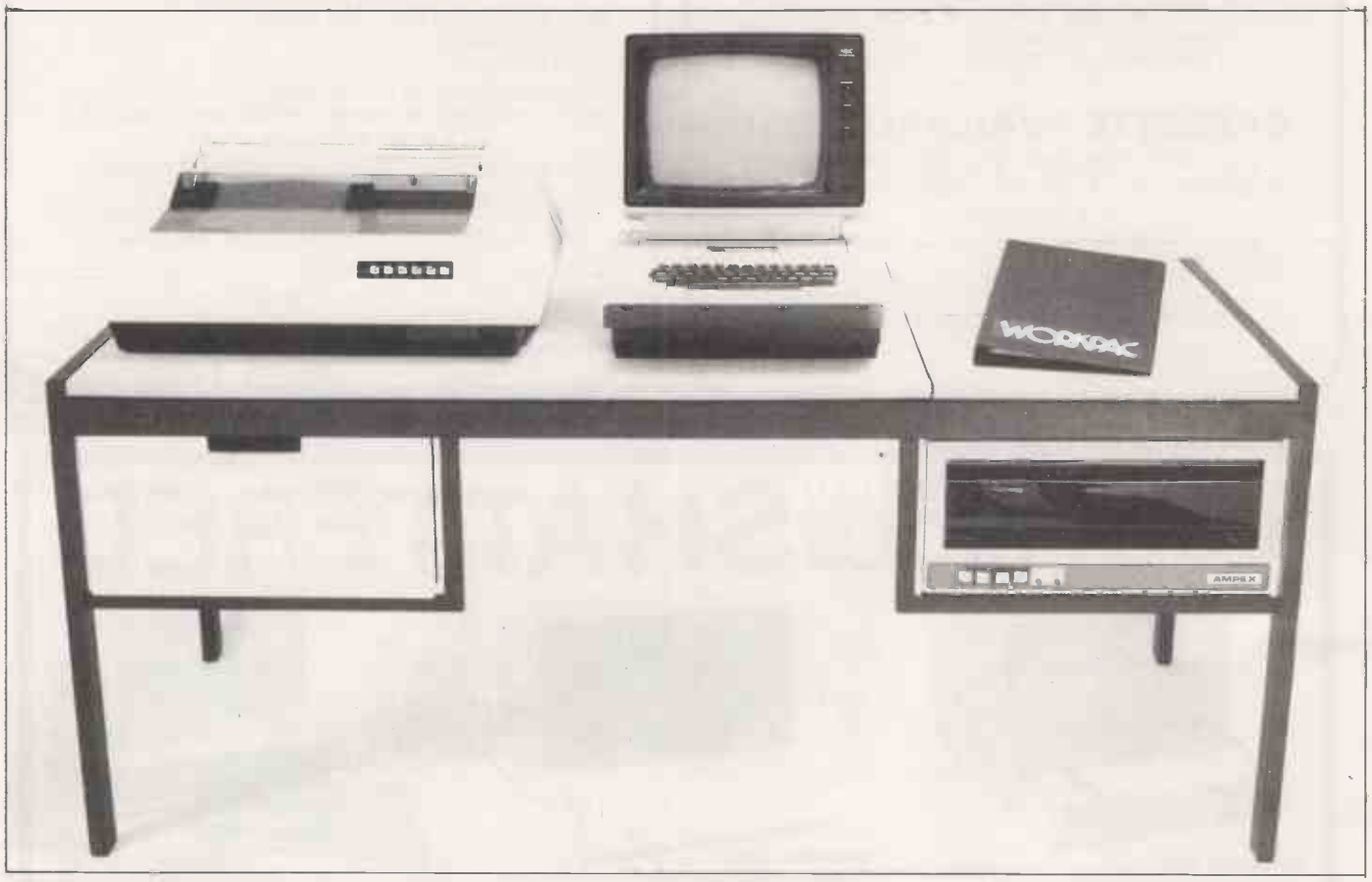

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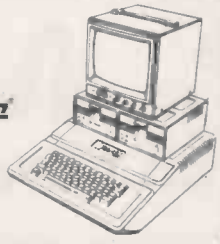

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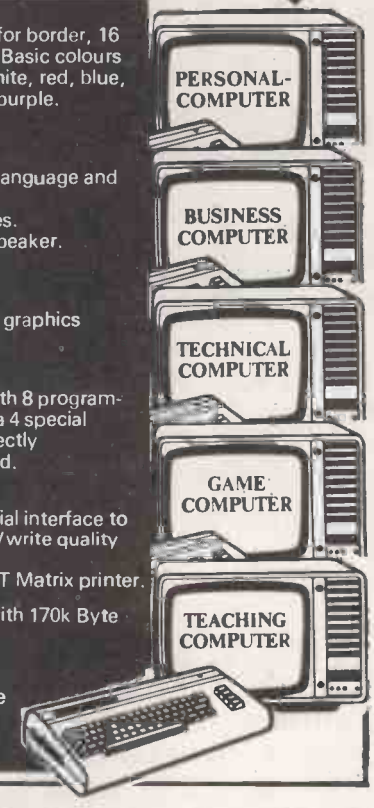

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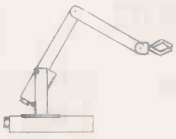

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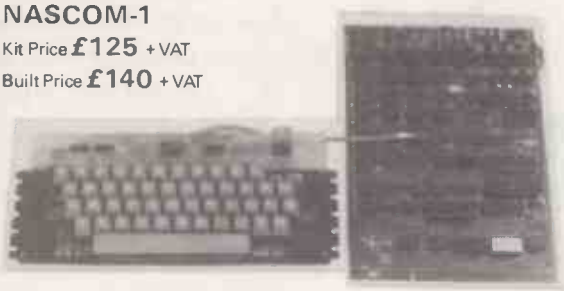

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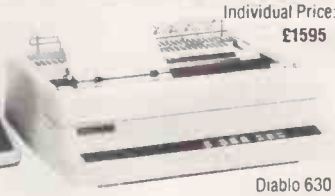

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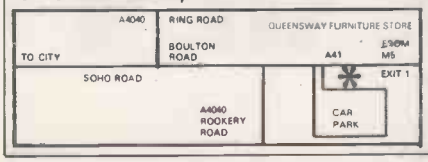

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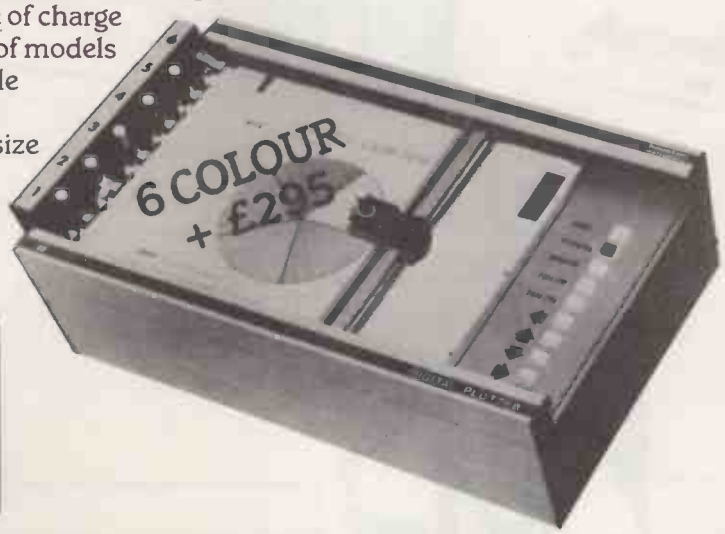

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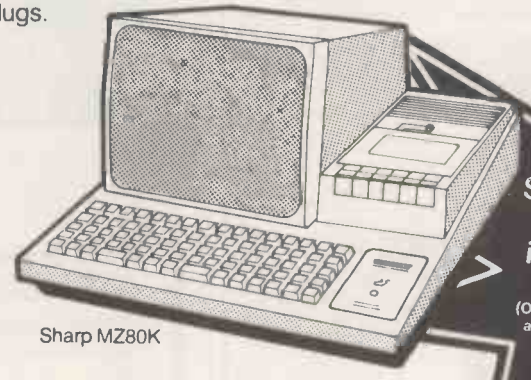
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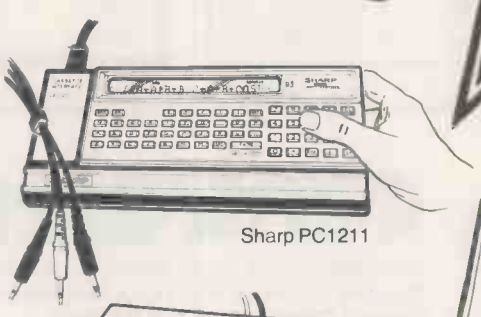
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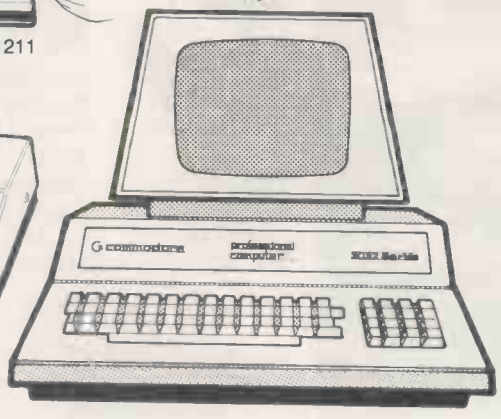
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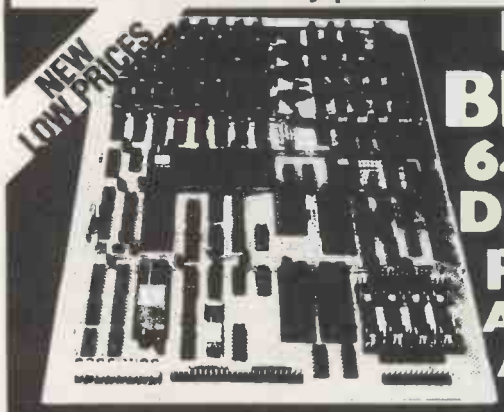

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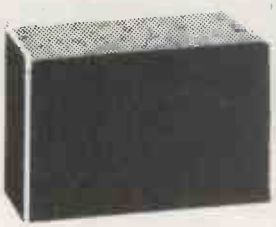

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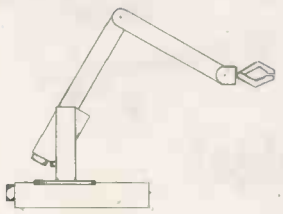

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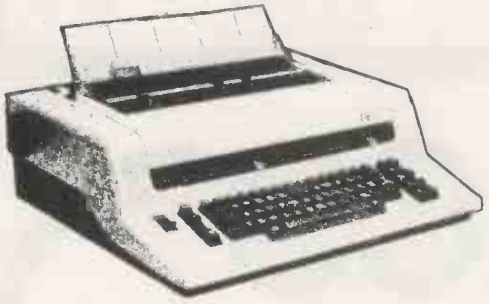

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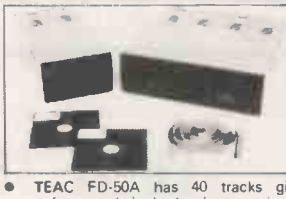

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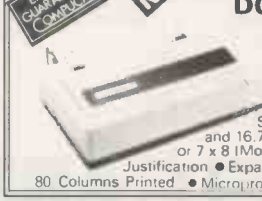

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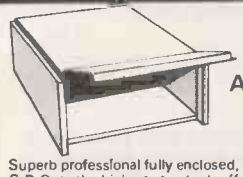

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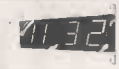

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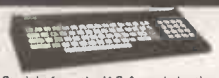

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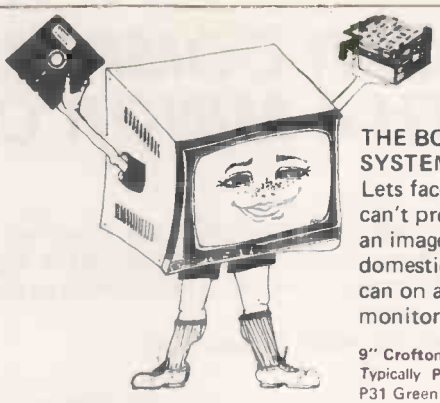

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4049	30p
4050	30p
4051	65p
4052	80p
4053	65p
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4066	35p
4067	400p
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4069	20p
4070	30p
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4076	60p
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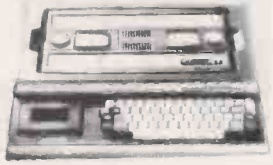

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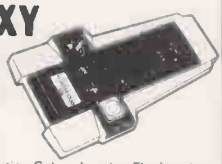

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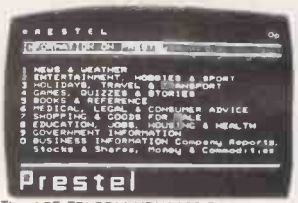

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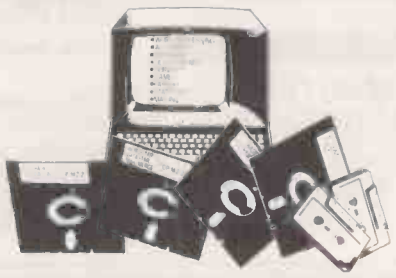

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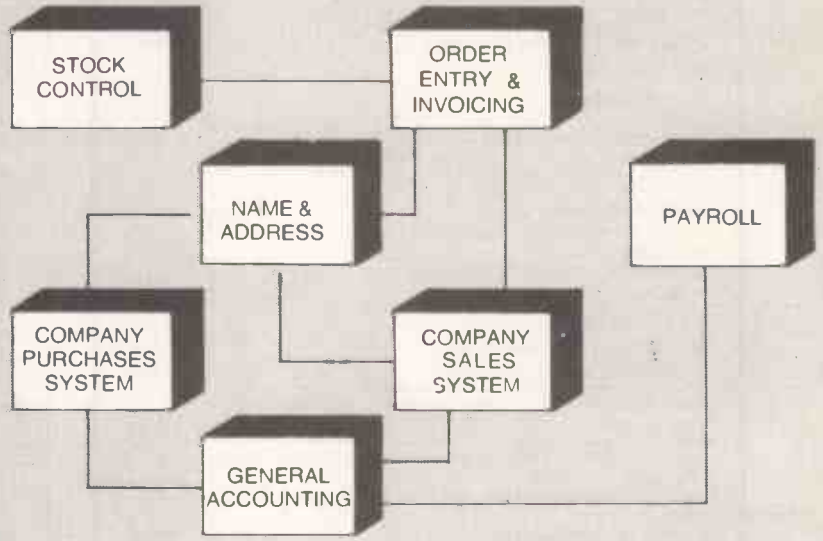

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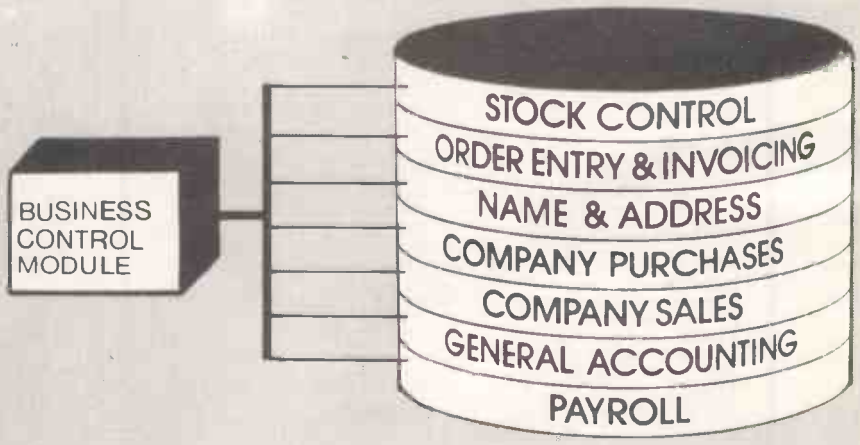

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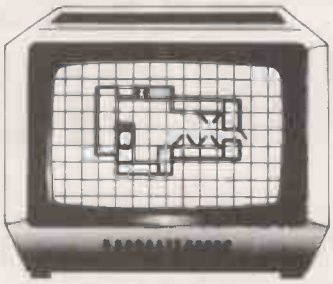

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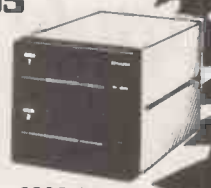

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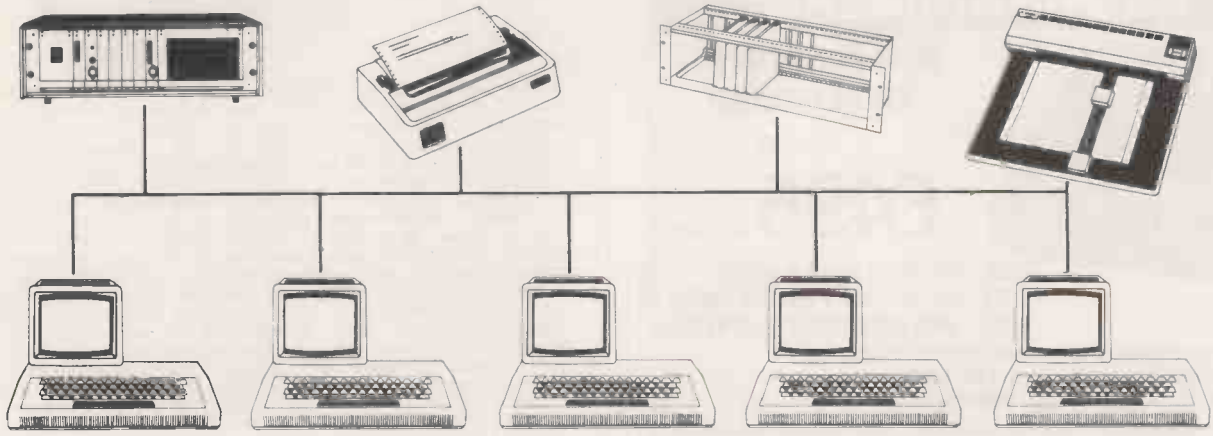

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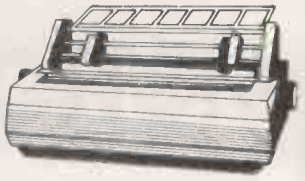

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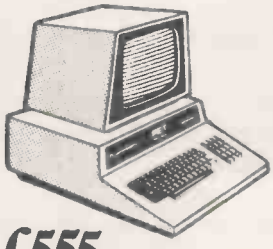

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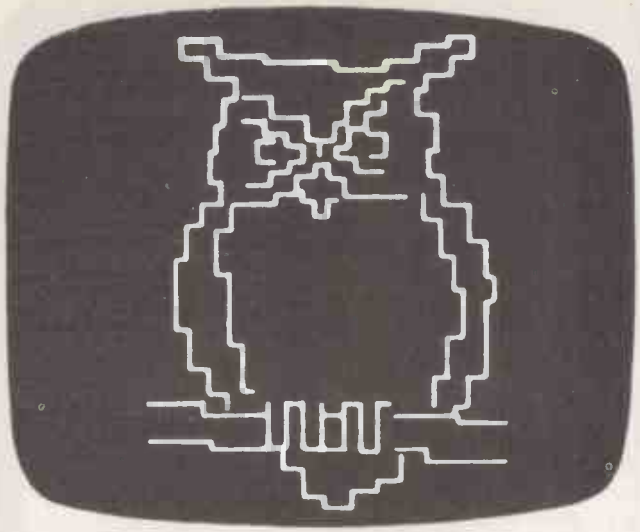

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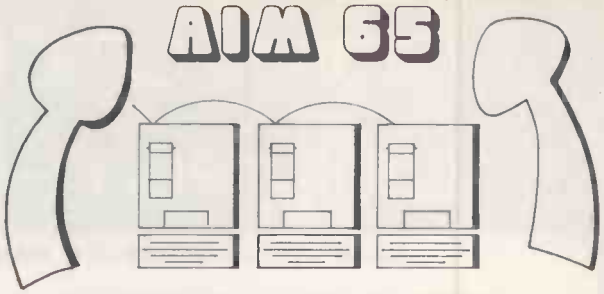

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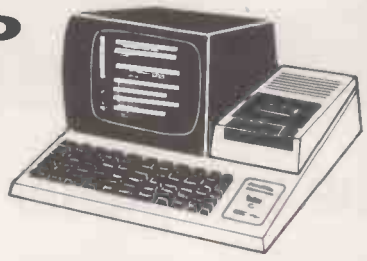
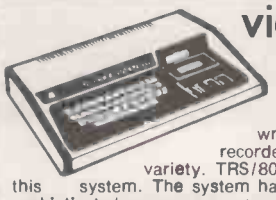


video genie system



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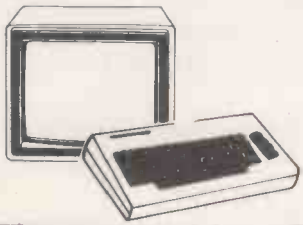

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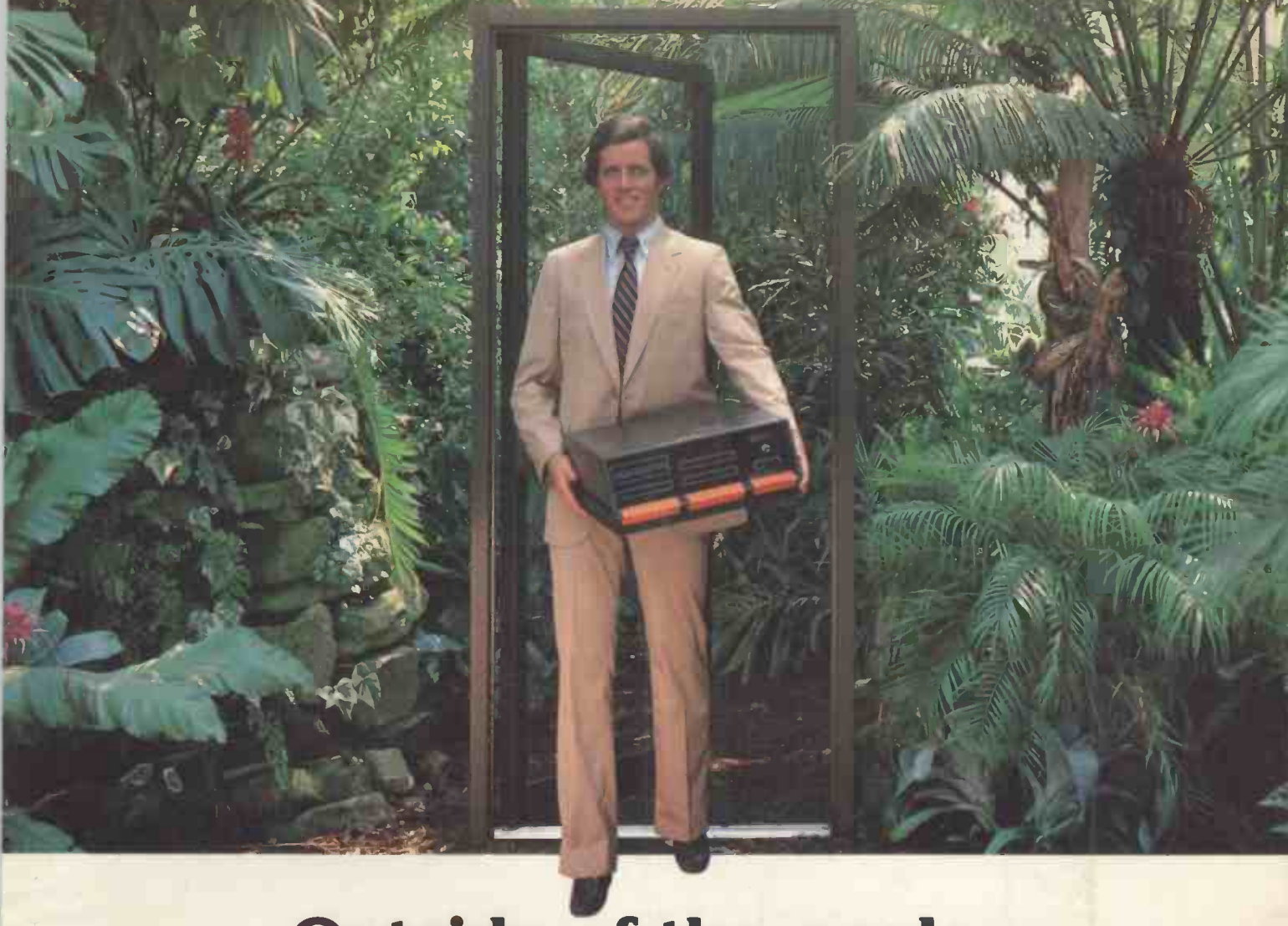

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