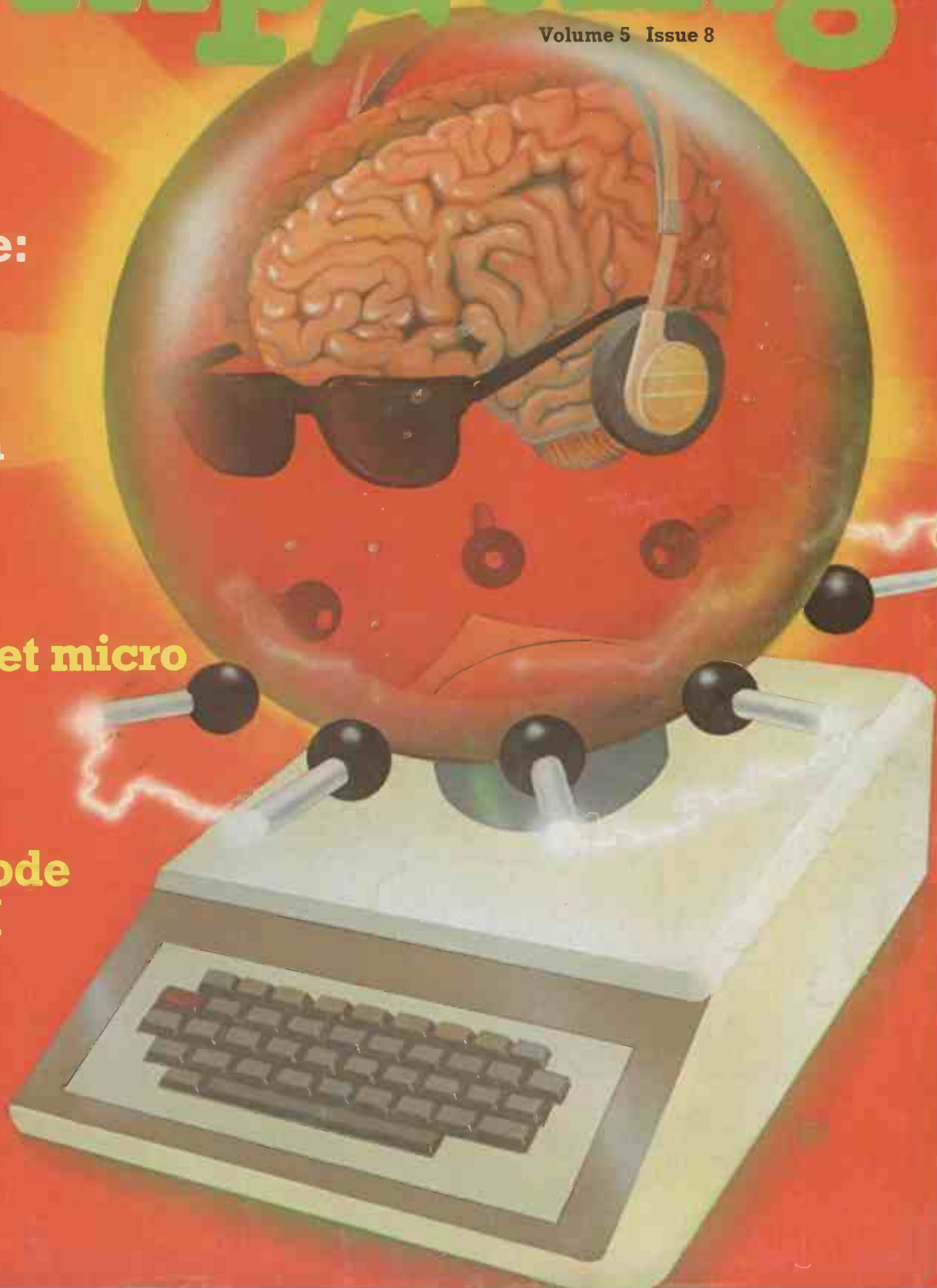
80p

Practical Computing

August 1982

Volume 5 Issue 8



Machine intelligence: Game strategies Pattern recognition

Reviews: Hard-disc Televideo Sharp pocket micro Oasis

The selling message

Machine code with CP/M

Cromemco System One

MicroCentre introduce Cromemco's new System One computer, available with an integral 5 megabyte Winchester hard disk, at a new low price.

The System One supports the full range of Cromemco interface cards, including high resolution colour graphics, and software packages. The choice of operating systems includes CDOS, CP/M and CROMIX—Cromemco's answer to Unix.

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2

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Machine intelligence — page 77

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Every effort is made to check articles and listings but *PC* cannot guarantee that programs will run and can accept no responsibility for any errors.

CONTENTS

The Network has arrived...

and with it, the cost effective alternative to dumb terminals and expensive minimainframes.

The TeleVideo computer family from Encotel puts total processing power where it's needed — in the hands of the user — while allowing expansion without compromise to individual terminal performance.

MmmOST* and CP/M® together protect both software investment and the route to upwards expansion. They provide all the house-keeping required to run a multiple user database and ensure that application programs will not have to be re-written no matter how big the system grows. Any of today's most popular languages, such as **COBOL, BASIC** and **FORTRAN** can be used.

The TeleVideo family will expand from the stand-alone System I with its 64Kbytes of user RAM and 1Mbytes of floppy disk up to the 16-user System III with its 70Mbytes of hard disk Winchester, without hardware redundancy.

Furthermore, the RS422 800Kbit/second data links make each highly intelligent terminal look like a mainframe.

Only the low price says it isn't.

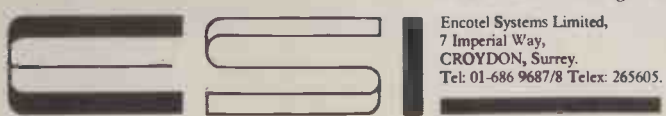
For instance the six terminal System 2 with its 7.5Mbytes of hard disk and 384Kbytes memory starts at around **£10,000†**.

As expected from a world class terminal manufacturer like TeleVideo the TS800 terminals used to expand Systems 2 and 3 are exceptional. The 64Kbytes of RAM, serial printer port and separate processors for compute and display ensure that they will never lack power.

And that the user will never be out of pocket.

**Multiuser multitask multiprocessor Operating Systems Technology®*

†based on 2$ exchange rate.

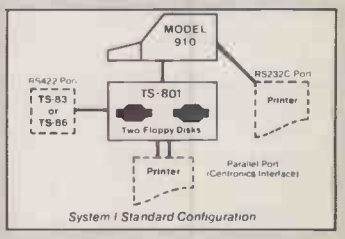


Encotel Systems Limited,
7 Imperial Way,
CROYDON, Surrey.
Tel: 01-686 9687/8 Telex: 265605.

From the people who believe in Quality, Reliability and Support.

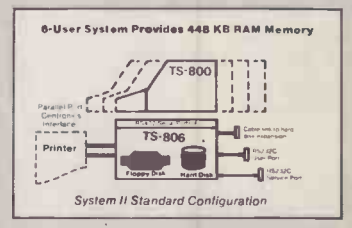
Specifications

System I
Single-board processor containing 1 Z80A 64K of RAM memory.
4K EPROM for diagnostics
1.0Mbytes of on-line mini-floppy disk storage
TeleVideo Model 910 CRT terminal
with all Model 910 capabilities (950 terminal optional).
£2,280.00



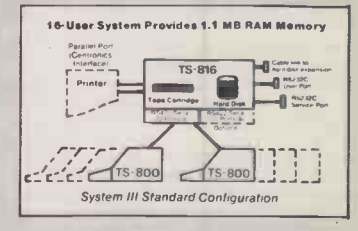
System I Standard Configuration

System II
Supports up to six users
Single board design
Z80A, 64K of RAM memory
4K EPROM
7.5Mbytes 5¼" Winchester disk drive
0.4Mbyte mini-floppy disk back-up unit
Parallel port and two serial ports for printer attachment and servicing
With one TS800 **£5,130.00**



System II Standard Configuration

System III
Supports up to 16-users processing network contains,
Z80A, 64K of RAM memory,
4K EPROM
23.5Mbyte 8" Winchester disk drive
MmmOST* Service Processing System. 2 x TS80 **£9,995.00**



System III Standard Configuration

TS 80 Satellite User Station
6502 CPU for video control Z80A for computing
64K of RAM memory 4K EPROM RS 422 Networking Serial Port
Full-screen editing and graphics capabilities **£1,026.00**

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6504-250	550
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6521	115
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6804	160
6805	670
6808	520
6809	820
6810	115
6820	115
6821	115
6840	395
6843	£12
6845	720
6847	850
6850	135
6852	255
6875	500
74C922	295
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81LS96	85
81LS97	85
81LS98	85
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8212	150
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8215-300	00
8216	70
8224	180
8226	250
8228	250
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8602	320
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8T28A	120
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ZN423E	138
ZN424E	130
ZN425E-8	345
ZN426E-8	300
ZN427E-8	590
ZN428E	410
ZN429E-8	210
ZN459	570
ZN1034E	200
ZN1040E	675
ZNA234E	850

74S Series

74S00	30
74S02	32
74S03	32
74S10	40
74S20	40
74S32	70
74S74	75
74S132	110
74S133	60
74S138	125
74S139	150
74S158	195
74S188	210
74S189	158
74S194	320
74S201	350
74S225	525
74S241	390
74S260	50
74S262	850
74S287	300
74S288	210
74S289	290
74S301	000
74S365	000
74S3745	365
74S470	325
74S471	620
74S472	1150
74S475	825
74S571	620

75 Series

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75110	90
75150	125
75154	150
75182/3	99
75188/9	55
75322	140
75450	86
75451/2	52
75454	85
75491/2	65

TTL74

7400	11
7402	11
7404	13
7408	14
7410	14
7411	15
7423	18
7414	20
7420	15
7422	20
7427	22
7430	14
7432	22
7442	32
7447	40
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7473	24
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7489	205
7490	20
7491	35
7492	25
7493	25
74100	80
74116	50
74121	25
74123	40
74125	35
74126	35
74143	210
74148	70
74150	50
74151	50

74151	40
74153	40
74154	55
74174	54
74175	50
74186	470
74188	250
74259	150
74383	99
74490	120

74 LS

LS00	11
LS02	11
LS04	12
LS10	13
LS11	13
LS13	20
LS14	30
LS20	13
LS22	12
LS27	12
LS30	12
LS42	28
LS47	35
LS48	55
LS63	120
LS73	18
LS74	18
LS75	20
LS85	48
LS86	16
LS90	24
LS91	60
LS92	32
LS93	23
LS125	24
LS126	25
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LS139	28
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LS153	40
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LS158	30
LS175	50
LS240	55
LS241	55
LS242	55
LS243	55
LS244	60
LS245	70
LS373	60
LS374	55
LS393	42
LS471	629
LS640	180
LS641	180
LS645	180
LS668	125
LS669	120
LS670	150
LS673	550

CMOS

4000	10
4001	10
4002	12
4007	14
4008	32
4009	24
4010	24
4011	50
4012	16
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4082	13
4093	20
4094	70
4095	95
4096	70
4097	190
4098	75
4099	75
4160	95

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4174	99	4584	48
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4411	690	4597	330
4412	790	4598	290
4502	60	4599	290
4503	35	40100	215
4511	46	40104	95
4519	30	40105	115
4539	90	40106	75

40107	60
40108	450
40109	100
40110	300
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The Motherboard (interfaces with the computer) has capacity to accept up to five daughter cards and can be paralleled for even more daughter cards.

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100KHz	270	8 0MHz	150
200KHz	295	8 08333	395
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1.008M	290	9.375M	350
1.6MHz	392	10 0MHz	175
1.8MHz	395	10.7MHz	150
1.843M	220	10.24MHz	200
2.0MHz	240	12 0MHz	290
2 4576M	220	12.528M	300
3.2768M	150	14 31818	170
3.57594M	98	16 0MHz	250
3.6864M	300	18 0MHz	180
4.0MHz	150	18 432M	150
4.032M	290	19 968M	150
4 80MHz	200	20 0MHz	325
4.1943M	200	24 0MHz	170
4.433619	170	24 930M	325
5.0MHz	160	26.69M	150
5.185M	300	26.67M	325
5 24288	390	27.125M	295
6.0MHz	140	27 145M	190
6.144MHz	225	38.6667	175
6.5536M	200	48 0M	175
7 0MHz	150	100.0M	375
7 168MHz	160	116.0M	300

IDC CONNECTORS

(Speed Block type)	PCB Plug with latch Strt Pins	PCB Plug with latch Angle Pins	Female Header Socket	PCB Pins Strt	PCB Pins Angle
2x5 way	90p	99p	85p	60p	65p
2x8 way	130p	150p	110p	70p	78p
2x10 way	145p	166p	125p	80p	92p
2x13 way	175p	200p	150p	95p	110p
2x17 way	205p	236p	160p	110p	135p
2x20 way	220p	250p	190p	125p	150p
2x25 way	235p	270p	200p	150p	175p

JUMPER LEADS: Ribbon Cable Assembly DIL Plug (Headers)
Single Ended Lead. 24" Long

Length	14pin	16pin	24pin	40pin
24"	145p	165p	240p	380p

Double Ended Leads

6"	185p	205p	300p	465p
12"	198p	215p	315p	490p
24"	210p	235p	345p	540p
36"	230p	250p	375p	595p

ID Header Socket Jumper Leads

	20pin	26pin	34pin	40pin
24"				
1 end	160p	200p	260p	300p
2 ends	290p	370p	480p	525p

DIL SOCKETS

	Low Prof	Wire Wrap
8pin	8p	25p
14pin	10p	35p
16pin	10p	42p
18pin	16p	52p
20pin	22p	60p
22pin	25p	70p
24pin	25p	70p
28pin	28p	80p
40pin	30p	99p

RIBBON CABLE

Ways	Grey	Colour
	Price per Foot	
10	12p	22p
16	25p	40p
20	25p	40p
26	35p	52p
34	48p	60p
40	55p	70p
60	75p	115p

DIL PLUGS (Headers)

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2x23way	210p	—
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2x28way (Spectrum)	230p	—
2x30way	245p	—
2x36way	295p	—
2x40way	315p	—
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Angle	160p	210p	250p	350p
Pins	120p	130p	195p	295p
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Solder	110p	160p	210p	350p
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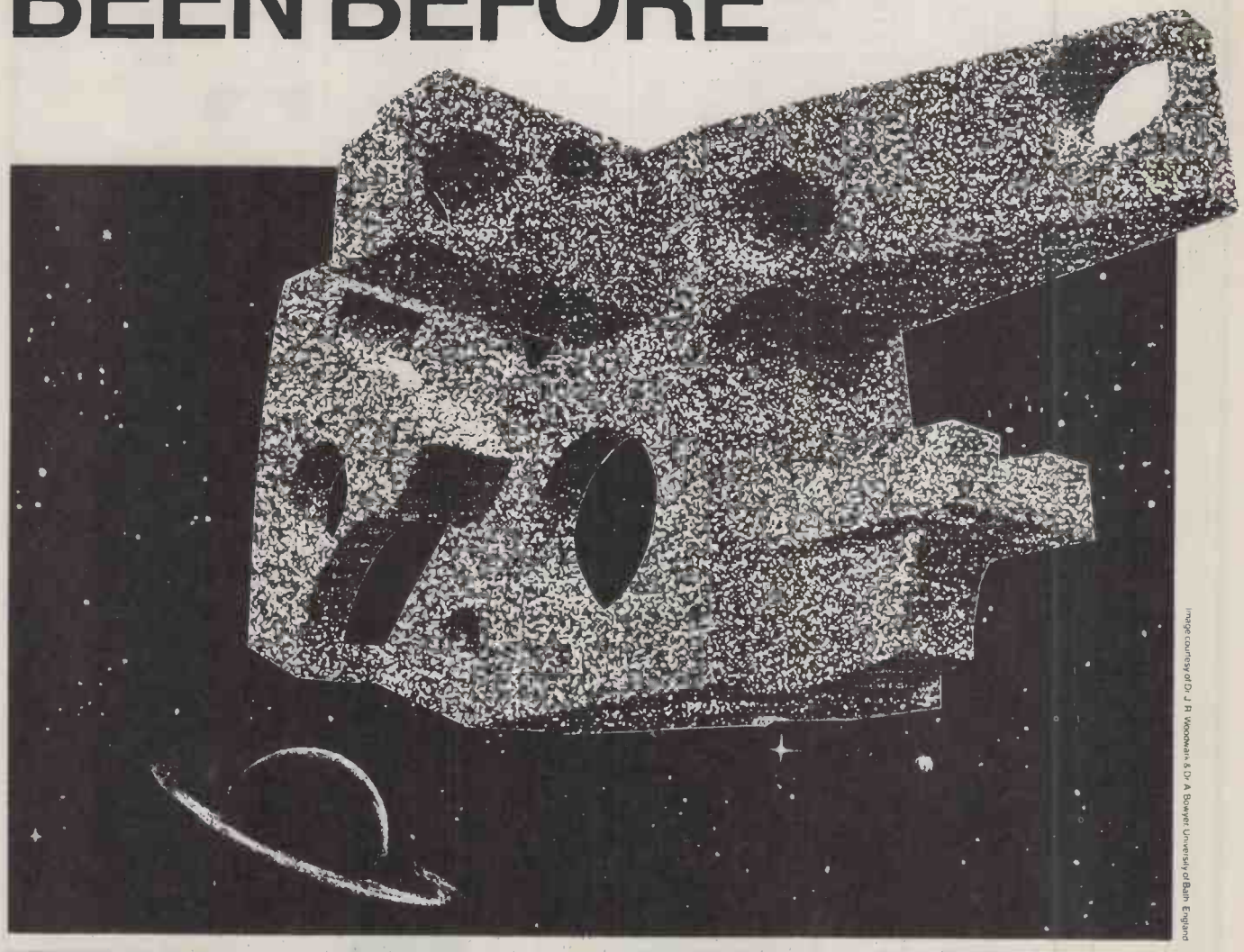
"TO BOLDLY GO WHERE NO ONE HAS BEEN BEFORE"



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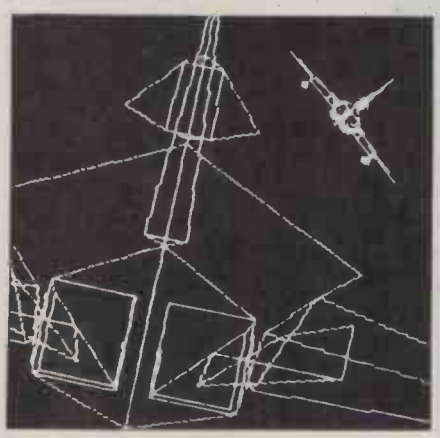

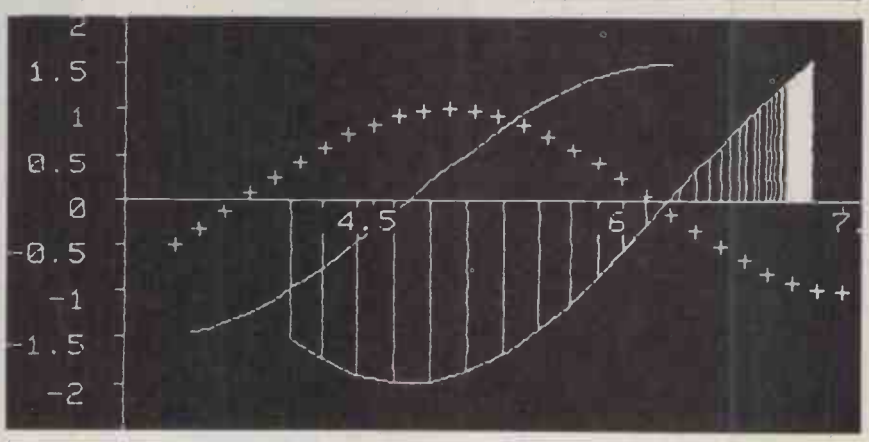

Above left. 3D wire objects in true perspective.
Top picture. Display of three-dimensional solid object.

Above right. Bar charts, histograms and scatter plots.

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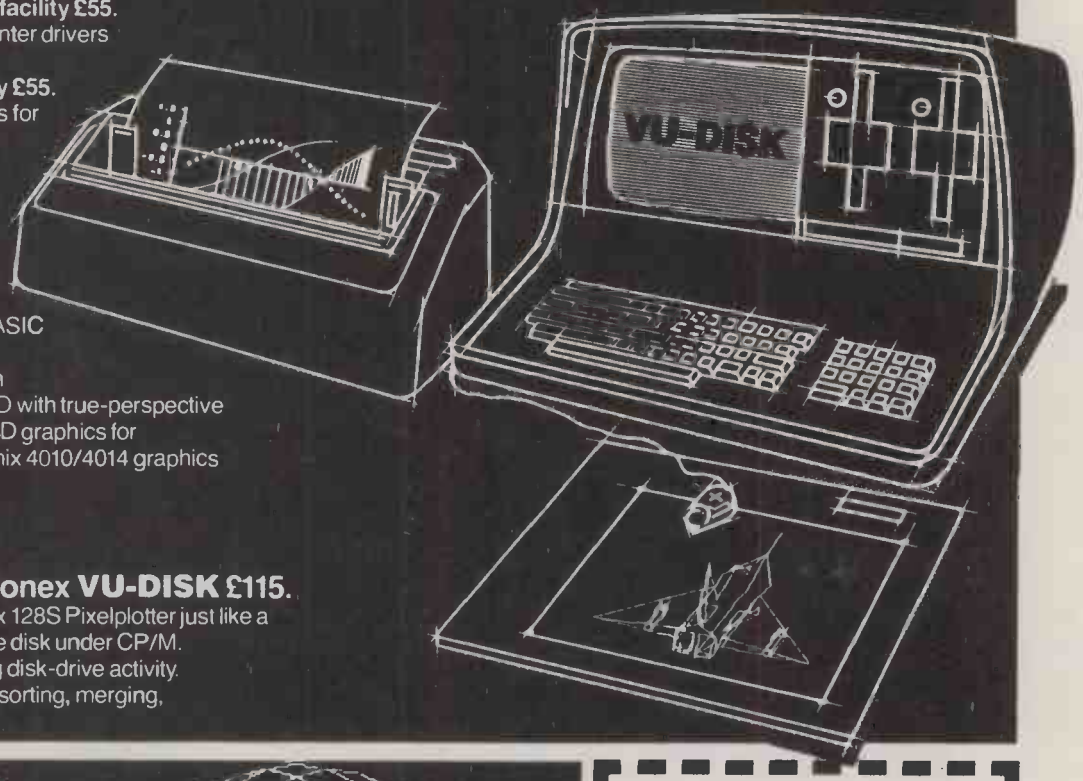

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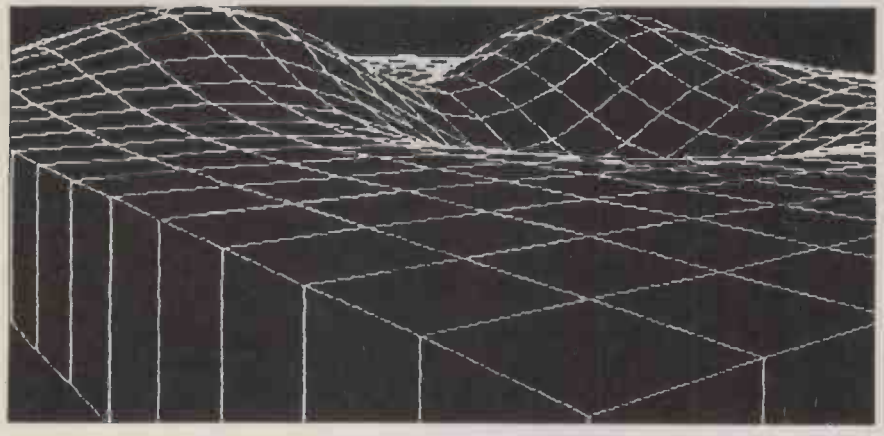

Above picture. Close-up detail of high resolution graphics surface plot in 3D with true perspective and hidden-line removal, viewed from any angle.

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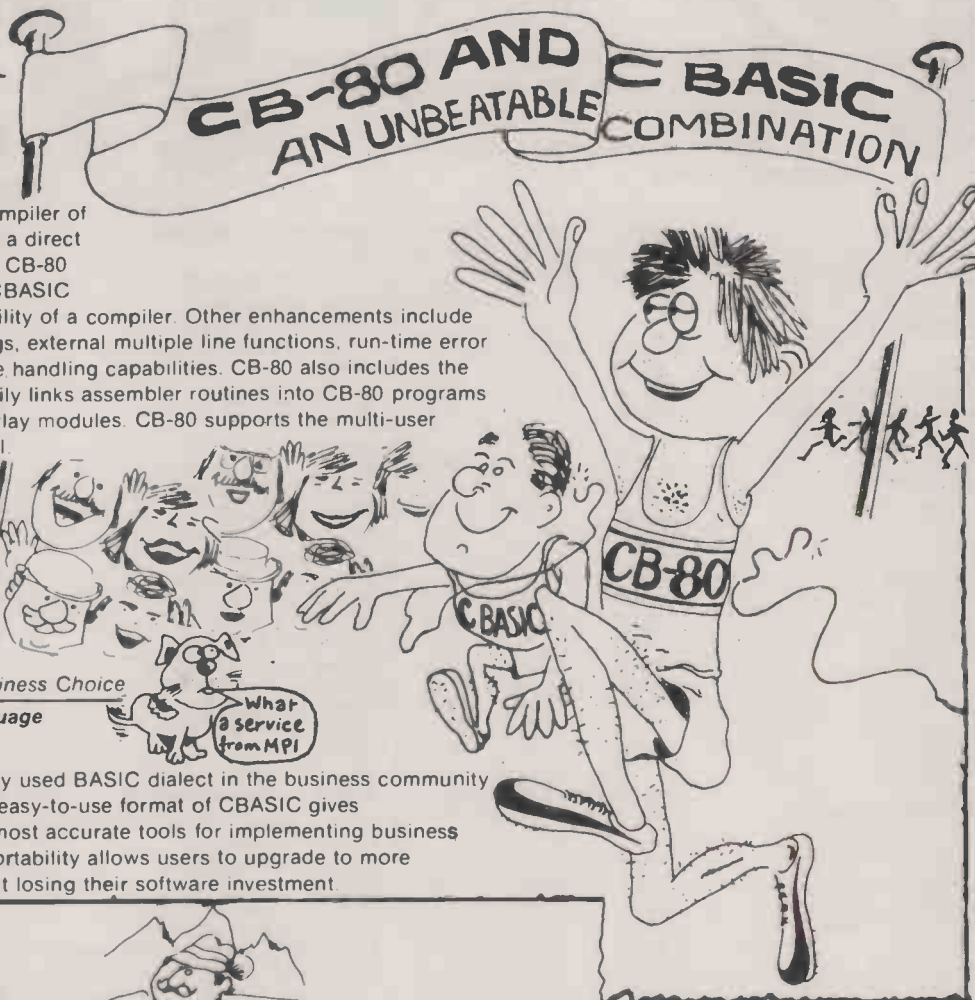

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NEW OPTIMISER. A linear programming system for finding the best practical solution to resource allocation and planning problems. Easy to learn. Easy to use. Immediately available. Please ring for more details. **£295**

NEW CARDBOX. Described simply, Cardbox is an electronic card index system. Choose your own format for cards, and categorise the information to your own specification. Cardbox provides an immensely powerful method of handling large amounts of information. **£155**

COMMUNICATIONS

BISYNC-80/3780 and BISYNC-80/3270 are full function IBM 2780, 3780 and 3270 emulators for micro computers. BISYNC-80/3780 gives you a Remote Job Entry terminal for the price of a micro! BISYNC-80/3270 combines the local processing power of a micro with a sophisticated screen capability. Make your dumb terminal smart! MET/TTY will connect your micro to a Timesharing service in simple teletype emulation.

BISYNC-80/3780 **£445/£20**
BISYNC-80/3270 **£445/£20**
MET/TTY **£145/£20**

FINANCIAL REPORTING

REPORT WRITER You input the values. Report Writer will perform your calculations and produce a report with your headings, totals and summaries. **£70/£10**

GLECTOR General Ledger option in Selector III, requires Selector III and C BASIC II. **£125/£30**

NEWLY RELEASED SOFTWARE

INFO STAR from MICROPRO **TBA**

POINTS TO REMEMBER

● All software is Ex-Stock and available on standard 8" disks or 5" disks for Vector MZ, Superbrain, Dynabyte and NEC PC 8000.
● Prices shown as Software with manual/manual only.
● tm! WORD-STAR is a trademark of Micropro.

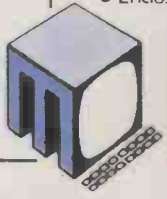
HOW TO ORDER

● State disk type and size ● Add 15% VAT
● Include £2 per Software item for Postage and Packing
● Enclose cheque/PO's payable to METROTECH

Mail to METROTECH MAIL ORDER, WATERLOO ROAD, UXBRIDGE, MIDDLESEX UB8 2YW

CREDIT CARDS - Telephone orders welcome: Tel: UXBRIDGE (0895) 57048/9

TRADE ENQUIRIES WELCOMED



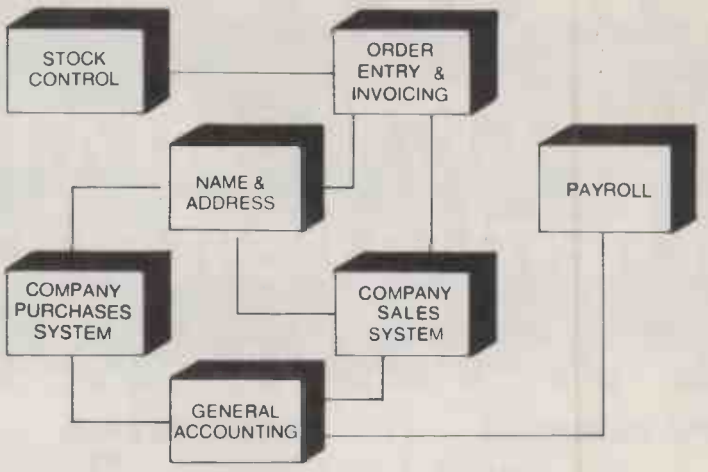
METROTECH

A MEMBER OF THE GRAND METROPOLITAN GROUP

● Circle No. 108

ISBS-F

A FULLY INTEGRATED ACCOUNTING SYSTEM FOR THE SMALLER BUSINESS USER. DESIGNED FOR TWIN FLOPPY DISK SYSTEMS



A totally Integrated Small Business System designed for single user floppy disk based systems. Each package can be used stand alone or can be built into an integrated system depending on user requirements. All packages are fully supported and maintained, and are supplied with comprehensive reference manuals. ISBS-F is easy to install and ideal for the first-time small business user with no previous computer experience. Some of the main features of ISBS-F include:

STOCK CONTROL
- Optimum stockholding to keep costs to a minimum.
- Trends shown by monitoring stock movement and showing fast and slow moving lines.
- Accurate stock valuation at any time.
- Fast interrogation of any stock line for answering your customers enquiries.

ORDER ENTRY & INVOICING
- Accurate tracking of orders to make sure all your orders are fulfilled.
- Order acknowledgements to confirm customers orders quickly.
- Automatic reference to the back orders and drawdown of stock when invoicing, to prevent double entry.
- Flexible invoice layout to suit most companies needs.
- Sales analysis reports by product code and your own classification code to provide comprehensive sales monitoring.

NAME AND ADDRESS
- All your customers, suppliers and enquiries stored and maintained by one central system.
- Flexible report generation allowing you to design your own reports.
- Selective mailing labels to make light work of mailshots.

PAYROLL
- Flexible pay periods and methods to suit most professions and industries.
- Comprehensive in year and year end reports to save endless form filling
- Coin analysis for workers paid by cash helping to speed up pay packet preparation.
- Tax or national insurance updates as and when required to make budget changes easy.
- Overtime and special credits and deductions can be handled with ease.
- Security check prevents unauthorised use.

COMPANY PURCHASES
- Open Item or Balance Forward accounts depending on the nature of the goods being supplied.
- Credit control reports to ensure payments are made within your own target dates.
- Computerised cheque writing to save manual preparation.
- V.A.T. returns can be prepared speedily from V.A.T. analysis reports.

COMPANY SALES
- Invoices can be posted directly from the Order Entry and Invoicing System to save re-entry.
- Open Item or Balance Forward accounts to suit different customer types.
- Statements for your customers can be produced easily and at anytime.
- Comprehensive reports to assist credit control and maintain a healthy cash flow.
- V.A.T. returns can be prepared speedily from V.A.T. analysis reports.

GENERAL ACCOUNTING
- Flexible cost coding system which can be designed for your own company structure.
- Automatic generation of the Profit and Loss Account and Balance Sheet reflecting the financial position of your company at anytime.
- Budget controls over flexible periods to ensure expense accounts are not overrun.
- Data automatically retrieved from the Company Sales, Company Purchases and Payroll Systems which means that data is only entered once.

2020

WP2020 WORD PROCESSOR

WP2020 is an advanced word processing system which runs on selected 8080 based microcomputers. In addition to all the standard features of a word processing system such as margins, tabs, pagination, global search and replace, proportional spacing etc., the system also offers the following:
- Special set of coloured function keytops supplied as standard.
- Menu driven system designed for typists and secretaries — there are no complicated control codes to remember.
- Advanced facilities such as a spelling checker, merge documents module, communications, and integration with ISBS-F supplied as standard.
- Supports background printing whilst working on other documents.

CM 2020 CONFIGURABLE MANAGER

CM2020 is a powerful information retrieval system which the user can configure to suit individual needs. It has been designed for the user without any special computer background. The user has total control over the application environments by defining the basic filing system, input screen formats and output reports. CM2020 is easy to learn and use, an application which might normally require weeks or months without CM2020 can be set up and running in a matter of hours or days. For the technically minded there is also a FORTRAN and RATFOR compiler available so that other programs can be developed to interface with a CM2020 data base. Some of the typical applications for CM2020 would be:
- PERSONNEL MANAGEMENT
- PARTS FILES
- MAILING LISTS
- PROJECT MANAGEMENT
- QUESTIONNAIRE ANALYSIS
- SALES ENQUIRIES AND LEADS

FP2020 FINANCIAL PLANNER

The FP2020 provides a new approach to management planning, whether it is financial, budget, job cost, cash flow, product pricing, engineering etc., FP2020 will accurately forecast the effect of proposed actions. Data is entered interactively having defined the size of the model or 'spreadsheet'. The user can then use the standard functions to calculate cell values or use the special functions (mathematical or statistical) to perform more complex arithmetic. Models and definitions are stored on disk and can be retrieved at a later stage. The user can define his own output reports as required and graphic output can also be obtained.

GRAFFCOM SYSTEMS GROUP

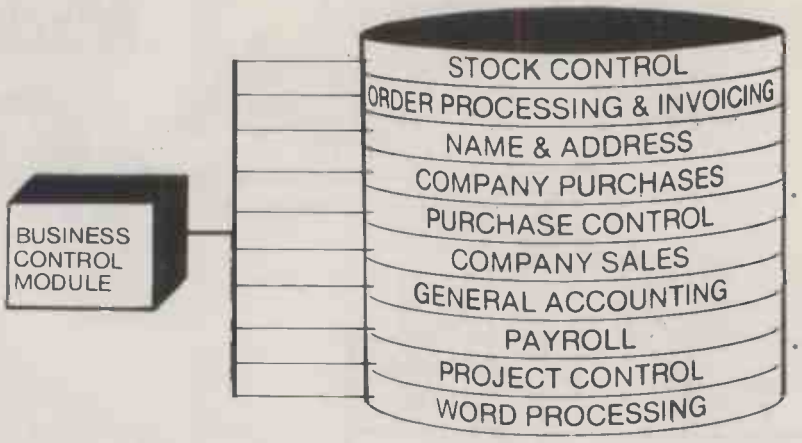
Application software for 8 and 16 bit micros

GRAFFCOM SYSTEMS LTD. 102 PORTLAND ROAD, HOLLAND PARK, LONDON W11 4LX TEL: 01-727 5561

ISBS-W

AN INTEGRATED OFFICE ACCOUNTING AND ADMINISTRATION SYSTEM TO MEET MULTIWORKSTATION REQUIREMENTS. DESIGNED FOR HARD DISK BASED SYSTEMS

A professional Integrated Business System designed for microcomputers which use Hard disks or Winchester disks. ISBS-W is ideal for the small to medium business where data storage and processing speed exceeds the capabilities of floppy disk based systems. Users of ISBS-F can upgrade to ISBS-W as the business expands using GRAFFCOM's System Migration Plan — SMP. The user can choose from any combination of modules and add others at a later stage if required. All modules are fully maintained and supported and comprehensive documentation is supplied for each application. Some of the main ISBS-W features include:



*Check for release date

BUSINESS CONTROLLER
The Business Control Module acts as a task manager and supervisor for the ISBS-W system. It takes care of system definition parameters such as the number of hard disks, numbers of workstations and printers. Operators will feel at ease with the Business Control menu which will prompt for application tasks such as word processing, accounting modules or, order processing etc. The controller will also take care of file protection and authority of access via a password system. It also incorporates a data archieve and retrieval option allowing the user to make back-up copies of the data system as often as required.

ACCOUNTING MODULES
All standard accounting tasks are catered for and include sales, purchases and nominal ledgers. The payroll module is fully supported in terms of legislative changes. Standard managements reports include budgetry control, Profit and Loss Statements and Balance Sheets.

STOCK CONTROL AND ORDER PROCESSING
Orders can be entered as received and the system provides a comprehensive tracking mechanism until all goods have been shipped. Invoice production provides automatic release of stock and drawdown of order items.

WORD PROCESSING
An advanced automated office computer system would not be complete without an integrated word processing module. This module provides all the standard word processing facilities and has in addition a merge document feature for personalised letters and a built-in spelling checker. The word processing terminal will have custom keytops which makes light work of all word processing tasks for the operator.

SPECIAL INTEREST

LEASE, RENTAL & HIRE PURCHASE SYSTEM
The LR & HP System is designed to control agreements and contracts that are payable at regular intervals by fixed amounts. The system, is designed to interface with the ISBS-F Company Sales System and the Name & Address System.

TIME RECORDING SYSTEM
The TRS is designed for those organisations which offer a 'service' rather than a 'product'. Typical users would be Accountants, Solicitors, Management Consultants, Architects, Quantity Surveyors etc. The system controls manhour expenditure and expenses by job or account numbers.

MIPS — MANAGEMENT INFORMATION PLOTTING SYSTEM
MIPS is a standard package which interfaces with ISBS-F, ISBS-W and the 2020 series to produce a range of management graphs and charts. It is designed to support industry standard plotters from the Hewlett Packard and Tektronix range. (Check with us direct for a complete list of supported plotters).
Graphics output includes:
- ISBS-F — budget comparisons, sales analysis, cash flow etc.
- ISBS-W — budgetry control, sales and product analysis, cash flow etc.
- FP2020 — various, depending on characteristics of Model.

LINKS PROCESSOR
This is a interprocessor link program designed to attach two processors back to back for CP/M file transfer. One processor is defined as the master and the second as a slave.

INTEL 8048 ASSEMBLER
The 8048 assembler produces 8048/35 romable machine code. Source input is created using the CP/M editor ED. Output is to disk in Hex format or printed listing.

Software is suitable for use with the following systems:

AI ABC24,26
ARCHIVES
CIFER
COLUMBIA DATA PRODUCTS
CROMEMCO
COMART COMMUNICATOR
DEC VT18X
DURANGO
DYNABYTE
HEATH
HEWLETT PACKARD 125
IBM DISPLAYWRITER
IBM PERSONAL COMPUTER
IMS
MILLBANK
NEC PC8000
NORTHSTAR
PET (with softbox)
RAIR
SHARP
SIRIUS 1
SUPERBRAIN
TANDY MODEL II
TEI
TRANSAM
TVI
XEROX 820
plus many more

For further details on system requirements check with your dealer or call us direct.

For more Information on GRAFFCOM products please complete the form. ▶

ISBS-F ☐ ISBS-W ☐ 2020 ☐ SPECIAL ☐

NAME..... COMPANY.....

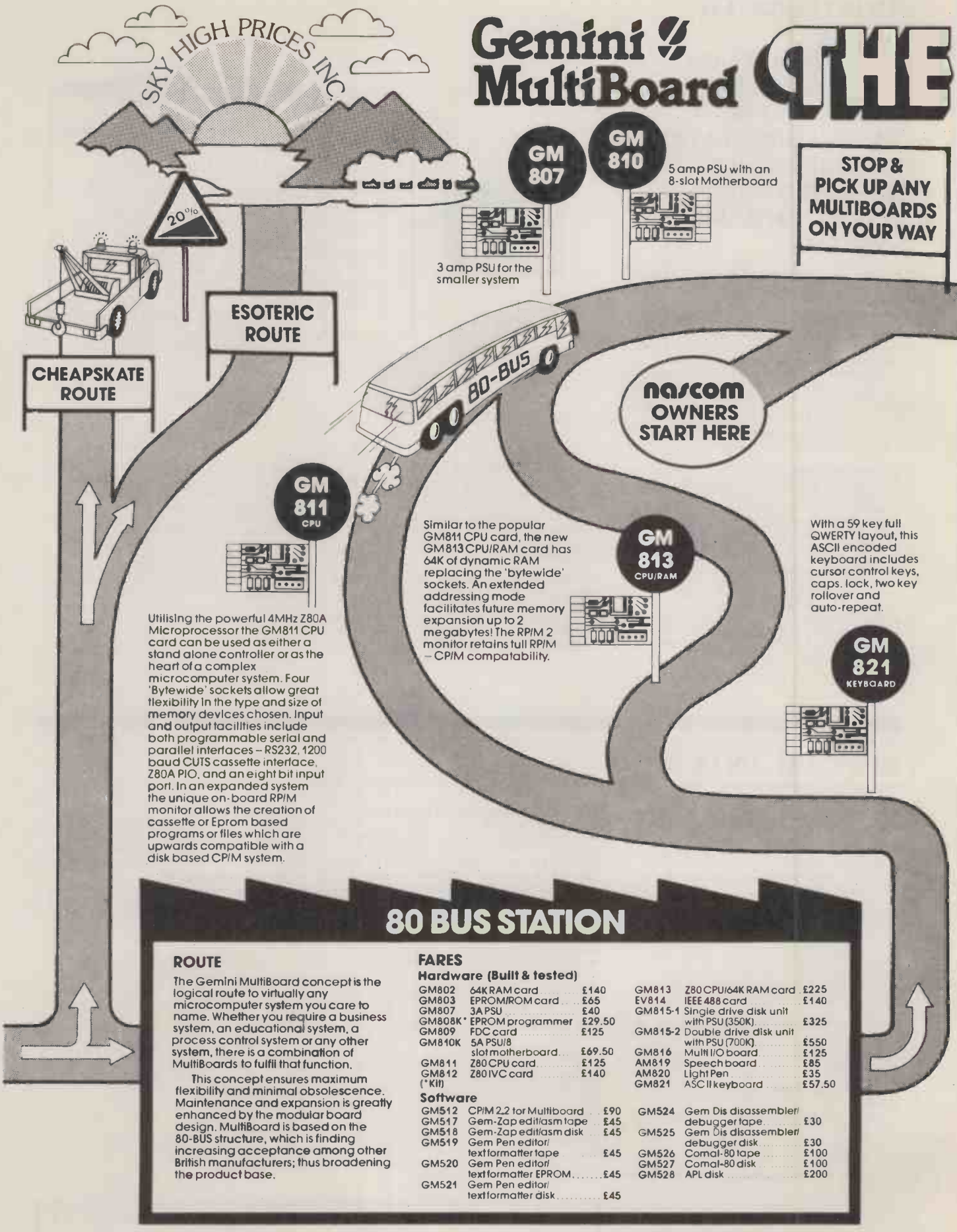
ADDRESS.....

.....

Please tick as required and return to
102 Portland Road, London W11 4LX

GRAFFCOM SYSTEMS GROUP

● Circle No. 109



Gemini MultiBoard THE

80 BUS STATION

ROUTE

The Gemini MultiBoard concept is the logical route to virtually any microcomputer system you care to name. Whether you require a business system, an educational system, a process control system or any other system, there is a combination of MultiBoards to fulfil that function.

This concept ensures maximum flexibility and minimal obsolescence. Maintenance and expansion is greatly enhanced by the modular board design. MultiBoard is based on the 80-BUS structure, which is finding increasing acceptance among other British manufacturers; thus broadening the product base.

FARES

Hardware (Built & tested)

GM802	64K RAM card	£140
GM803	EPROM/ROM card	£65
GM807	3A PSU	£40
GM808K*	EPROM programmer	£29.50
GM809	FDC card	£125
GM810K	5A PSU/8 slot motherboard	£69.50
GM811	Z80 CPU card	£125
GM812 (*Kit)	Z80 IVC card	£140
GM813	Z80 CPU/64K RAM card	£225
EV814	IEEE 488 card	£140
GM815-1	Single drive disk unit with PSU (350K)	£325
GM815-2	Double drive disk unit with PSU (700K)	£550
GM816	Multi I/O board	£125
AM819	Speech board	£85
AM820	Light Pen	£35
GM821	ASCII keyboard	£57.50

Software

GM512	CP/M 2.2 for Multiboard	£90
GM517	Gem-Zap edit/asm tape	£45
GM518	Gem-Zap edit/asm disk	£45
GM519	Gem Pen editor/ text formatter tape	£45
GM520	Gem Pen editor/ text formatter EPROM	£45
GM521	Gem Pen editor/ text formatter disk	£45
GM524	Gem Dis disassembler/ debugger tape	£30
GM525	Gem Dis disassembler/ debugger disk	£30
GM526	Comal-80 tape	£100
GM527	Comal-80 disk	£100
GM528	APL disk	£200

LOGICAL ROUTE

GM 812 – IVC

The GM812 Intelligent Video Controller card features an on board Z80A processor to provide independence of the host processor and the ability to redefine the functions and parameters of the display.

Normally used in an 80 x 25 mode the card contains a programmable character generator allowing three additional modes of operation – inverse characters, 160 x 75 block graphics, or user defined characters.

A keyboard socket allows buffered character input, and a light pen socket is provided for specialist applications. Being I/O mapped the card does not occupy any system memory space.

GM 809 FDC

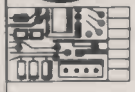
GM 815 DRIVE UNIT

GM 809 FDC

The GM809 floppy disk controller card can support up to four disk drives in either single or double density modes. The card uses the Western Digital 1797 controller and has variable write precompensation and phase locked loop data recovery circuitry.

GM 815 Drive unit

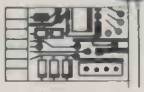
The GM815 floppy disk housing contains one or two 5¼" double density, double sided Pertec FD 250 drives. This gives a storage capacity of 350K per drive. Power for the drives is provided by an integral supply unit.



AUTO-EXCHANGE
All your RP/M software automatically transferred to CP/M

GM 802 RAM

The GM802 RAM board provides a full 64K of dynamic memory. The 80 BUS RAMDIS signal is fully supported so that any EPROM in the system is given priority over the RAM, preventing any possibility of bus contention. Page Mode is also supported by the card which, with the appropriate software, allows up to four memory boards to be used in a system.



FILL-UP WITH SOFTWARE

RP/M

RP/M software is available on tape and includes Editor/Assembler; Text Editor/Formatter; Disassembler/Debugger; Pascal and Comal-80. These packages can also be run under CP/M.

CP/M 2·2

A CP/M 2.2 package is available with the GM 809 card and Pertec drives. On-screen editing auto single/double density selection and parallel or serial printers are supported. Running under CP/M is a wide range of utilities, application software and languages.

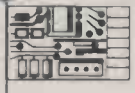
ONE WAY

GM 803 EPROM BOARD

The GM803 Eprom Board will accept up to 16 2708 or 2716 Eprom devices. This allows the addition of up to 32K of firmware to the system. The board supports the Page Mode system and consequently need not occupy any memory space when not in use.

GM 816 I/O BOARD

The Gemini I/O board provides a unique solution for interfacing to "the real world". The board contains 3 PIO's, a CTC and a real time clock with battery back up. "Daughter" boards may also be added and these include A-D, D-A, opto-coupling and serial interface boards.

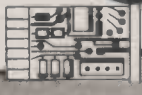


A number of manufacturers are busy working on additional 80-BUS boards which will progressively increase the potential of your MultiBoard system.

MEN AT WORK

PROTO-TYPING BOARDS

80 BUS compatible prototyping boards are available from both Vero and Winchester Technology. These allow the user to easily add a card of their own design to the system.



GM 808 EPROM PROGRAMMER

The GM808 Eprom programmer connects to the PIO on the CPU card and allows the user to program 2708 or 2716 type Eproms.

AM 819 SPEECH BOARD

AM 820 LIGHT PEN

This low cost light pen can be used with the GM812 IVC for many applications, including answer selection, editing, menu selection and movement of displayed data blocks.

EV 814 IEEE 488

The EVC IEEE 488 Controller card has been designed to fully implement all IEEE 488 interface functions. This card gives the user a very versatile method of controlling any equipment fitted with a standard IEEE 488 or GPIB interface at minimal cost.

The Arfon Microelectronics speech board utilises the National Semiconductor Digitalker chip set. This gives a vocabulary of over 140 words and sub sounds. Output is from an on-board speaker.

GEMINI MULTIBOARDS – BUY THEM AT YOUR LOCAL MICROVALUE DEALER

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

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

COMPUTER INTERFACING & EQUIPMENT LTD.,
The MICRO-SPARES Shop, 19 Roseburn Terrace, Edinburgh EH12 5NG
Tel: (031) 337 5611

E. V. COMPUTING
700 Burnage Lane, Burnage, Manchester M19 1NA.
Tel:(061) 431 4866.

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

SKYTRONICS,
2 North Road, The Park, Nottingham.
Tel: (0602) 45053/45215

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

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

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

LEEDS COMPUTER CENTRE,
62 The Balcony, Merrion Centre, Leeds.
Tel: (0532) 458877

● Circle No. 110

Practical Computing

Olivetti DM 5100 – Price: £900.00

Olivetti DM80/180cps – Price: £1995.00

Olivetti DY211 – Price: Only £900.00!

Qume Sprint 5 Range – Prices from: £1700.00

Olivetti DY311 – Price: £1050.00

Olivetti DY811 – Price: £1995.00

Practical Computing is not only the name of a magazine. It is also a philosophy about which we feel strongly at Millbank Computers.

Practical computing solutions which meet the needs of the user is the basis on which we have built up our range of hardware, software and services.

We start with the **Millbank System 10** – the 'heavy duty' micro computer available exclusively from us and our appointed dealers. With 700K, 1.6 MB and hard disc options, the **Millbank System 10** is arguably the most reliable micro available in the UK – supported, naturally, by twelve months full warranty.

Our range of printers covers dot matrix and letter quality printing at virtually every acceptable speed, specification and price point.

The CP/M disc operating system opens up a vast range of readily available software – including 'Financial Director' – a British Accounting suite of stunning quality and E.A.M.I.S. a new Management System for Estate Agents.

Service and support is an integral part of our practical computing philosophy.

Call us today.

MILLBANK COMPUTERS

Millbank Computers Limited, Millbank House, Amyand Park Road, Twickenham TW1 3HN. Tel: 01-891 4691.

·and where to find it.

BIRMINGHAM

Based in the heart of the professional area of Birmingham, Midland Micro Ltd provides a comprehensive computer service to users in the Midlands.

We supply everything from a single diskette to an advanced network or Mini-computer system using standard software and tailor-made packages.

Services provided by our experienced staff include consultancy,training, maintenance, and full after-sales service.

Contact: Ernest Willcox or Ian Willcox
Midland Micro Ltd
George House, George Road
EDGBASTON, Birmingham B15 1PG
Telephone: (021) 455 7431

CALNE, Wiltshire

Suppliers of accounting and related business software in particular, the Financial Director package incorporating bought and sales ledgers, cash book, nominal ledger, budgets and monthly management accounts.

Other software, eg. order entry, invoicing and stock control, tailored to individual user requirements.

Microshade provides a total sales and support service for the System 10.

Contact: Bryon Horton
Microshade (Business Computers) Ltd
Westhill House, 4 Market Hill
CALNE, Wiltshire
Telephone: (0249) 814879

CAMBRIDGE

The Avery Computer Company showroom caters specifically for the needs of local small businesses. A wide range of systems cover applications from financial modelling, forecasting, payroll etc. to large multi-user systems which can carry out all the functions of the electronic office.

We supply standard and customised software, special computer-aided learning courses and, above all, maintain close client liaison before and after installation.

Contact: Michael Avery or David Spry
The Avery Computer Company
13 The Mall, Bar Hill
CAMBRIDGE CB3 8DZ
Telephone: (0954) 80991

CHELTENHAM

'We won't blind you with science' is the basis of this locally owned company's services to businesses, institutions and individuals.

Partners have wide-ranging business and computer experience and have built up an impressive range of books, manuals, personal computers, business computers, standard software and consumables.

Contact: David Lewis,
Robin Phelps or Don Price
The Computer Shack
14 Pittville Street
CHELTENHAM, Gloucestershire
Telephone: (0242) 584343

EXETER

Teffont Business Systems have specialised in 'word communication' equipment throughout south-west England for the past three years.

The computer division markets Micro and Mini computers. We put strong emphasis on well-proven business software, word-processing, telecomunication, and professional service/training by experienced engineering and training staff.

We also supply 'Europe's No.1' range of facsimile machines and are Prestel dealers.

Contact: Stephen Taylor
Teffont Business Systems Ltd
48-49 High Street, EXETER EX4 3DJ
Telephone: (0392) 30438/9

EPSOM, Surrey

The primary business of Bryan Wright Ltd is the production of programmes to meet specialised and individual needs, exclusively for the Millbank System 10 Micro-computer range.

Consultancy and advice to potential Micro-computer users.

Specifications, analysis and programming. A personal after-sales service for users' operational problems, for changing requirements in programming, and system upgrading.

Address labels and mailing-list service, with statistical analysis by areas or other criteria including delivery within a reasonable distance from Epsom.

Contact: Bryan Wright or Denis Wright
Bryan Wright Ltd
1st Floor, 57 South Street
EPSOM, Surrey KT18 7PX
Telephone: (78) 22653

MANCHESTER

Calderbrook Technical Services (CTS) moved successfully into the Micro computer business in the mid 1970s and now offer a wide range of products from personal to business systems, plus a vast software library.

CTS apply a very high level of technical and engineering skills to system design, installation, training and after sales service & maintenance.

Contact: Peter Fawthrop
Calderbrook Technical Services
31-33 Church Street
LITTLEBOROUGH, Lancs OL15 8DA
Telephone: 0706 74342/79332

SWANSEA

Croeso Computer Services is a well established Micro computer systems house specialising in turnkey systems for financial companies, bakeries, licenced trade stock-taking and petrol stations.

We design specialist software systems for individual requirements in business, industry and the professions. A wide range of computer equipment is available.

Contact: Simon Shellard or
Michael Breach
Croeso Computer Services
516 Mumbles Road, MUMBLES
Swansea, West Glamorgan
Telephone: (0792) 61555/6

LONDON (C)

Forte Data Systems offer a complete business computer service from feasiblity study to implementation. We provide a wide range of evaluated business packages based on cost-effective solutions to user requirements, using customised software if necessary.

First-time users find our free consultation service an ideal starting point, existing users may be more interested in our main-frame and distributed data processing software development service.

Contact: Mr V. Sippy
Forte Data Systems
27 Rathbone Street, LONDON W1
Telephone: (01) 637-0164

LONDON (N)

B D Computer Systems brings 'mainframe' levels of skills and professionalism to the Micro market. Our experience in selling and installing large computers now provides full operational systems solutions in the Micro market.

Our customers range from a small professional user to a large Government department.

We are ideally placed to serve all London and Home Counties organisations north of the Thames.

Contact: Hugh Benham,
Susan Weitzkorn or Peter Hines
B D Computer Systems
2 Old Brewery Mews
Hampstead High Street
LONDON NW3 1PZ
Telephone: (01) 435-4442

LONDON (S)

Micro Automation Computing Ltd was formed in 1979 with over fifty man years of computer experience to provide and support systems and software based on Micro and Mini technology.

Special emphasis is placed on real time systems for commercial, industrial and engineering applications. Services available include the supply of complete computer systems, tailored turnkey systems and packages, data base applications, specialised drivers for word-processing and colour graphics, and systems software for Micros.

Contact: David Shorter
Micro Automation Computing Ltd
207 Putney Bridge Road
LONDON SW15 2NY
Telephone: (01) 874 2535

This is not a comprehensive list of Millbank dealers so if your area is not covered by any of the dealers listed here call us direct.

Millbank Computers Limited
Millbank House Amyand Park Road
TWICKENHAM TW1 3HN
Telephone: 01-891 4691

G. W. COMPUTERS LTD.

TELEVIDEO SYSTEMS

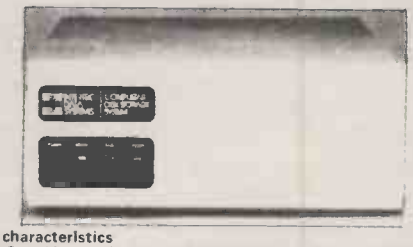
TeleVideo's TS 802 and TS 802H microcomputers are low-cost, powerful single-user integrated computer systems. TeleVideo has combined its top of the line CRT display with an advanced design single board computer (Z80, 64K RAM) with 5¼" floppy disks and Winchester hard disk all in one attractive table top enclosure. A detached typewriter-style keyboard is also included. The TS 802 computer features two 5¼-inch floppy disks for 1 Mbyte of on-line storage, and the TS 802H includes one 5¼-inch Winchester disk drive for 10 Mbytes of data storage, and a single 500 Kbyte minifloppy disk unit.

Both the TS 802 and 802H use the industry standard CP/M 2.2 operating system. This lets the user fulfill a wide variety of information and word processing needs using a multitude of commonly available application programs.

TS 802 & 802H Features:

- **Z80A 4 MHz processor with direct memory access**
- **64 Kbytes of RAM main memory**
- **4 Kbytes of EPROM for system diagnostics and boot loading**
- **Dual floppy disk controller (TS 802), and hard disk controller plus floppy disk controller (TS 802H)**
- **Dual minifloppy disks: 1 Mbyte capacity (TS 802)**
- **Single minifloppy disk (.5 Mbyte capacity), plus 10 Mbyte Winchester 5¼-inch hard disk (TS 802H)**
- **Green phosphor CRT (25 rows by 80 columns)**
- **Typewriter-style detached keyboard**
- **Full-screen attributes, editing, smooth scroll, 25th status line, 11 function keys, numeric key pad**
- **2 RS-232C serial ports. These are jumper selectable for any combination of modems or printers**
- **CP/M 2.2 operating system**
- **Attractive tabletop enclosure, fully integrated with CRT, CPU, RAM and disk drives**
- **1 RS-422 high-speed port**

MULTI-USER HARD DISKS



Functional characteristics

The CompuStar 10 megabyte Disk Storage System (DSS) consists of read/write and control electronics, read/write heads, a track positioning mechanism, a spindle drive mechanism, dual disks, an air filtration system, and our exclusive 255 user controller — all packaged in a compact desktop enclosure. Although designed primarily to accommodate multiple CompuStar Video Processing Units (described at left), the unit can easily be connected to a single SuperBrain Video Computer System to facilitate additional disk storage. When used with CompuStar VDUs, however, the integral Z80 based controls will permit up to 255 users to 'share' the resources of the disk with minimal CPU response degradation.

Read/Write Heads and Disks

The recording media consists of a lubricated thin magnetic oxide coating on a 200mm diameter aluminium substrate. This coating for mulation, together with the low load force/low mass Winchester type flying heads, permits reliable contact start/stop operation. Data on each disk surface is read by one read/write head, each of which accesses 256 tracks.

G. W. COMPUTERS LTD. 01-636 8210, 01-631 4818, TELEX 892031 TWCG

*** THE NEW DBMS (DATABASE) ***

DBMS2 is a *record relational* as well as a *file relational* database management tool that is capable of being at different times, many different things. The one core program can be set up to perform tasks normally associated with the following list.

Accounting	Budgeting	Cashflow
Stock control	Address mailing	Letter writing
Simulations	Time recording	Filing
Calc-type predictions	Hospital indexing	Profit analysis
Bureaux services	General analysis	Mathematics
Answer *what-if's*	Employees records	Tabulate values
Print reports	Sort files	Edit records

Within hours perform all the above in French or German.
The list is as endless as that which meets the requirements of your own imagination.
Within the appropriate frames of reference you could ask questions like the following:

Find someone whose name contains a W or X or Y or Z, who is either in London or Birmingham, and available for work at a salary of less than 10,000; and is under 40 years of age, not married, of credit worthiness grade 1, with a car, prepared to travel, and who likes horses, does not mind the hours he works, is congenial and has good references. When you find such persons produce a printed list of them showing their names, telephone numbers, and what their salaries are as well as their salary if increased by 10% and show their availability for work. At the end of the list enumerate the total of such persons.

Find all stock items that are codes *micro-computers* that are either in warehouse 1 or warehouse 2, where the quantity on hand is more than 50 units, the cost is less than 1,000, the selling price higher than 2000.00; that are not in cartons, bought from supplier 52, allocated more than 20, rated for tax at 15% and weigh less than 50 lbs. When you find such categories then print a report showing the description, cost price, quantity on hand, lead time for refills, what the selling price *should be if raised by 12.3%* as well as the profit in either per-cent or round figures of that projected selling price.

Find all patients who suffered from cold, that are either girls or women younger than 23 years old, and who live in London at a socio-economic grade higher than 3; do not smoke; have more than 3 children, are currently at work and where treatment failed to effect a cure in under 6 days. When you find such persons then print a list showing their age, marital status, income, and frequency of illness in the past 2 years.

Currently you can ask *7 types* of questions *20 times* for a single selection criterion, and then you can compute *10 mathematical relationships* between the questions for the individual *as well as* for the total number of matches. In all some 60 bits of information relating to one record or a group or records on simply one permutation of the selection criterion, with a cross referencing facility as well.

Every word in the system, as well as the file architectures, print masks, and field attributes, is capable of alteration by you *without* programming expertise (but with some thought).

ALL IN ONE PROGRAM FROM G. W. COMPUTERS. *THE DBMS2 !!*

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*** ALL YOU NEED FROM A COMPUTER SYSTEM ***

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05-TRACTER FEEDER	170.00
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08-DYSAN DISKS (6.00*35)	210.00
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(NOTE: The principle of this deal is that you pay (approximately) for hardware, warranty, consumables and 1 program. The rest is ***FREE***. You could make up your own package from our price list similarly.)

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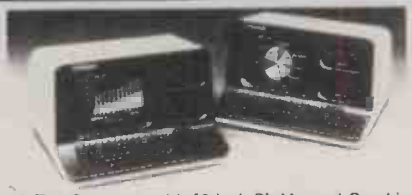
G. W. COMPUTERS LTD.

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 350kbytes 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 of 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!

Whatever model you choose, you'll appreciate the careful attention given to every engineering detail. A full ASCII keyboard with numeric pad and user-programmable function keys A non-glare, specially focused 12-inch CRT for sharp images everywhere on the screen. Twin Z-80 microprocessors to ensure efficient data transfer to auxiliary peripheral devices. Dual universal RS-232 communications ports for serial data transmission. And, a single board design to make servicing a snap!



Integrated Desk Top Computer with 12 inch Bit-Mapped Graphics or Character Display. 64Kb RAM, 4 MHz Z80A, ® Two Quad Capacity Floppy Disk Drives, Selectric Style 87 Key Keyboard, Business Graphics Software.

The North Star ADVANTAGE™ is an interactive integrated graphics computer supplying the single user witha balanced set of Business-Data, Word, or Scientific-Data processing capabilities along with both character and graphics output. ADVANTAGE is fully supported by North Star's wide range of System and Application Software.

The ADVANTAGE contains a 4MHz Z80A® CPU with 64Kb of 200 nsec Dynamic RAM (with parity) for program storage, a separate 20Kb 200 nsec RAM to drive the bit-mapped display, a 2Kb bootstrap PROM and an auxiliary Intel 8035 microprocessor to control the keyboard and floppy disks. The display can be operated as a 1920 (24 lines by 80 characters) character display or as a bit-mapped display (240x640 pixels), where each pixel is controlled by one bit In the 20Kb display RAM. The two integrated 5¼-inch floppy disks are double-sided, double-density providing storage of 3600Kb per drive for a total of 720Kb. The n-key rollover Selectric style keyboard contains 49 standard typewriter keys, 9 symbol or control keys, a 14 key numeric/cursor control pad and 15 user programmable function keys.

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★★★ THE NEW DBMS III (DATABASE) ★★★

The DBMS III is an enhanced version of DBMS II with additional facilities that make it (we believe) unsurpassed in overall capability world-wide.

For the first time, it is possible to pre-determine the entire route of this program from its own built in self-drivers. The notion of getting information 'at the touch of a button' is rarely even achieved by other programs whereas in DBMS III it is surpassed.

It will take you time to master the technique of setting up files that are particular to your activities, but when this is accomplished you will be able to 'clone-copy' the program DBMS III in such a manner that each copy may become dedicated functionaries to specific tasks for as long as you wish.

The end result will be a number of disks whose sole purpose in life will be to perform specific tasks WITHOUT ever touching a single key. Say your company is a garage; you want stock-level re-order reports; your stock file contains 20,000 records of parts where among other information you have 'MINIMUMS', 'MAXIMUMS', 'PRESENT STOCKS' and 'COST'. You design a report so that all records where stock is below minimum, the stock is subtracted from the maximum to produce a re-order report and the cost of such an order. Having set up the files and print report forms, you now enable the DMBS III SELF-DRIVERS, to pre-ignition.

Every time you want a stock-re-order-cost-report you simply follow this procedure, with the computer and printer switched on: Insert the 'STOCK-FILE DISK' and the 'DBMS III FUNCTIONARY DISK', close the drive doors, and walk away. On your return you will find your report ready for action.

Imagine being able to do that for most of the tasks you have about you? Hospital serum analysis reports, Production control process reports, Ledger analysis reports, Client address reports, Housing management reports. In fact most anything whose nature concerns information.

Additional features include field protection, classified fields, passwords to files, increased number of fields, screen form designing, automatic 10 second screen refresh for network systems, additonal search/maths functions.

A leader in database and information processing at this time. The DBMS III (£575.00 exc vat and exc mbasic 80). Only from G. W. Computers Ltd.

NOTE: the above menu options are subject to change without notice or obligation, the bus program 8.00 includes DBMS II if purchased at 675.00 and thus a number of program menus are available.

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Formats: (for Basic, DBMS II, N'STAR & SUPERBRAIN 5".) . . (for super-calc 8"; Zenith; Xerox; Apple; Vector. (for Magic Wand/Calc = N'Star & Superbrain)

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Example keys for WORDSTAR

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- ★ Micronex PIXELPLOTTER Graphics Hardware.
  High Resolution 1024×1024 pixels from £675.
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  Also available as a retro-fit for SuperBrain I.
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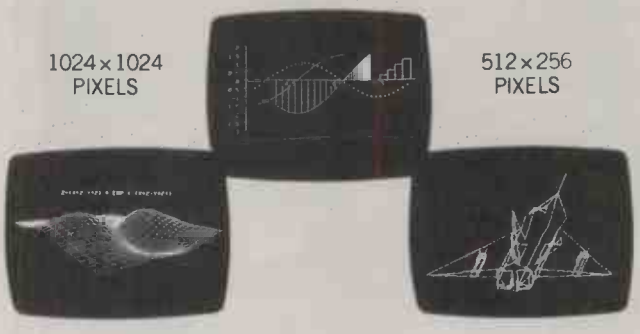
- ★ Micronex VU-DISK Software.
  Turns the memory on the graphics board into a pseudo disk — appears to the user as a very fast disk drive ideal for holding random access files.



Technical Support

- ★ Advice and assistance available from our programmers and engineers.
- ★ On-site and workshop maintenance on a contract or ad-hoc basis.

Helistar's Special SuperBrain II Prices

SuperBrain II	DD	350K	£1695
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including CP/M and Microsoft BASIC

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The T/Printer 35 is the lightest weight and lowest cost daisy wheel printer you can buy for your computer. So it will fit within your budget and you can carry it wherever you take your micro. Yet it is tough enough to give years of reliable service. Interchangeable typefaces (standard Olivetti 100 character daisy wheels), variable pitch, multiple copies—all the features you would expect of more expensive word processing printers.

Yet the T/Printer 35 costs only £475 with parallel interface. Operating speed under computer control is approximately 120 words per minute of letter perfect output. What typist can equal that?

Then when you're finished using it as a computer printer, the T/Printer 35 is ready to go right on working as an electronic typewriter.

That's the dual-purpose T/Printer 35—the versatile computer printer that fits your budget.

Orders are shipped within the UK carriage-free. To order or for more information about the T/Printer 35:

**The T/Printer 35 costs £475 with Centronics compatible parallel interface. With RS-232C interface it costs £535. Prices listed are exclusive of VAT.*

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Whatever your specialised line of business – personal computers; home computing; small business systems; associated software – this is the exhibition designed for you.

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DAISY WHEELS		
Olivetti Praxis, 11cps, KSR	480	**399**
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Prices do not include cables or interfaces to computers.
Apple computers parallel graphics or serial £70. Osborne £30.
Limited offer to 30 September.

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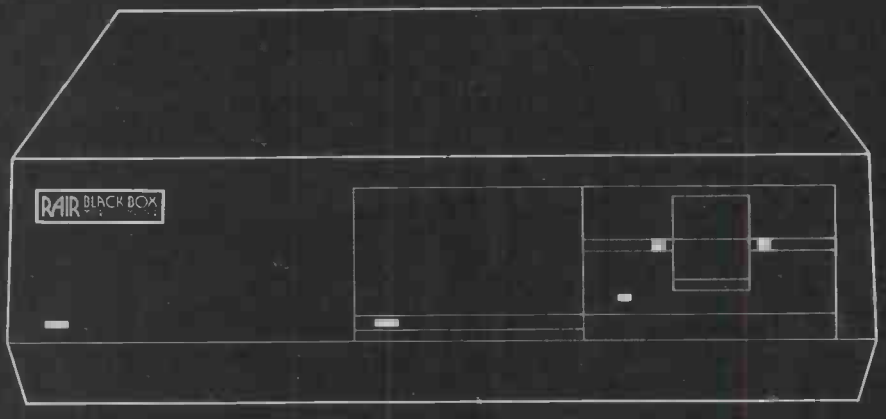

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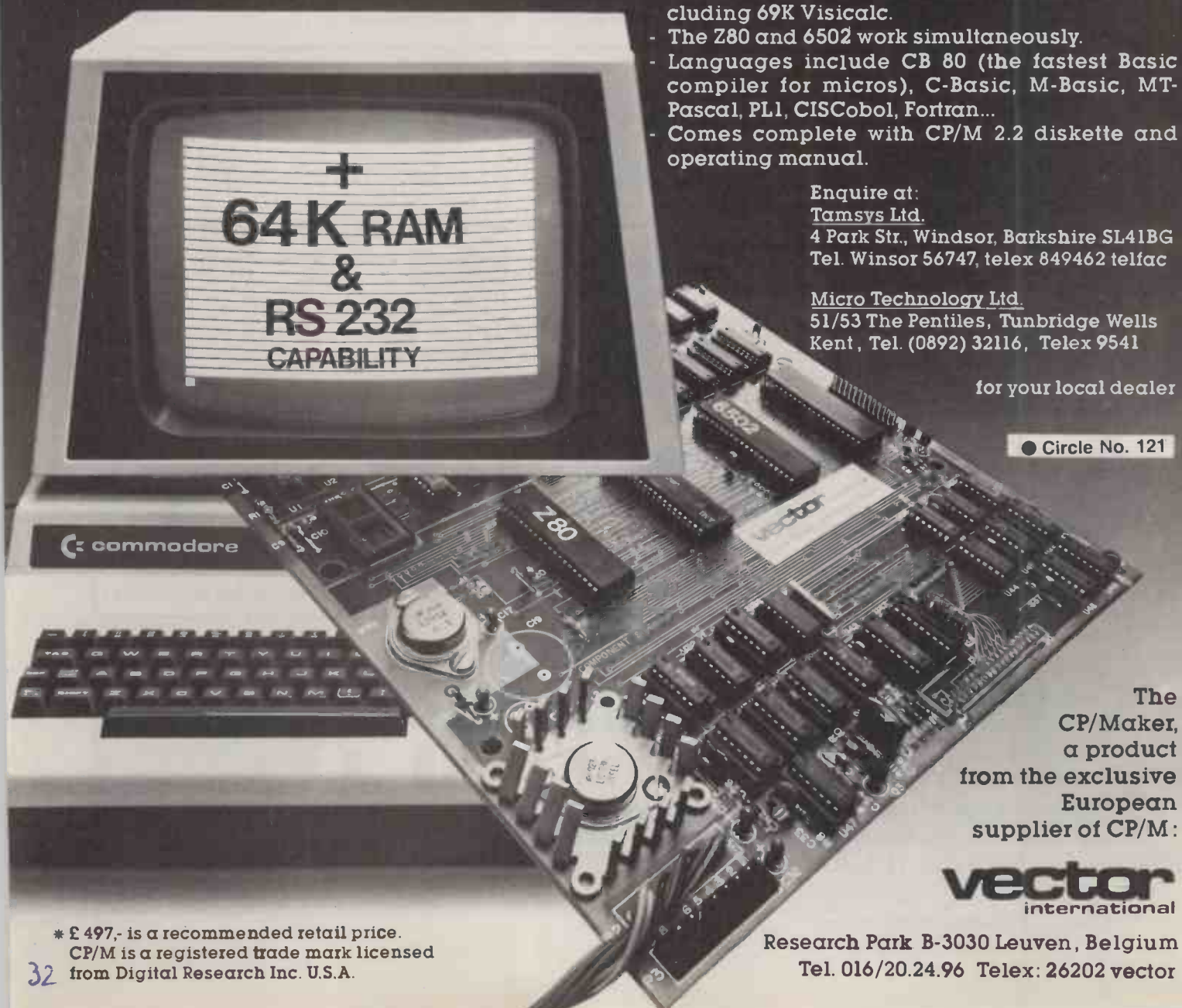

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New shape for the micro industry?

LAST MONTH'S issue bristled with new "home" computers. We had word of Sinclair's Spectrum, the NewBrain, the Vic-10 and the Vic-30. Epson was showing a neat little machine at Hanover and at the same time rumblings came from the heavy end of the market, with a new 820 rumoured from Xerox with add-on 8086 processor, Sirius-style graphics and improved disc drives. DEC recently announced its range of similar-sounding micros, while IBM potters on with its machine — finding out in the process, it seems, that the micro market is not as simple as it appears from the outside.

For the moment it seems that the wings of the micromarket are pulling ahead of the central body in their advance. Both elements have something to contribute. The question is, will anyone need the central market once they are through? Central market means the moderate-sized businesses which sell moderate-sized machines at moderate prices — the staples of the micro industry as we know it.

The low end is showing that low prices produce staggering volumes. The ordinary rule of thumb is that halving the price quadruples sales — Sinclair's claimed sales figures amply justify that. The theoretical equation — now proved by experiment — would not be very interesting if low price meant low performance.

However, large volumes applied to technology that is expensive in the small quantitites of present sales can also produce low prices: for example, the rumoured Rodime hard disc that Sinclair is said to be about to offer for £100. *Practical Computing's* readers are already asking why they should buy Apples at £1,500 when the Spectrum with Microdrives gives the same performance for £300.

What can the big companies contribute to this? Far from selling tens of thousands of units a month, they are happy to sell one or two. In software they look for a profit per package of thousands of pounds as against the £2 or £5 which publishers will earn from the low market. Superficially they look set to go out of business — as our May cover suggested. What they have to offer is a strong tradition of customer hand-holding and the staff to support it. People have long bought from IBM because, at the end of the day, it guarantees that your system will work. It might not work as well or as cheaply as you hoped, but you will not be left stranded.

IBM's success shows that people who buy computers care deeply about this safety net. Human nature being what it is, a similar approach will no doubt work as well in the micromarket as it did with mainframes. Both DEC and Xerox are offering this sort of service.

What about software? In an ideal world there would be a huge base of knowledgeable users who could choose between software products as deftly as they choose between the books and magazines they buy. Unhappily it just is not so. The software market is, and will remain for a long time, very unsteady on its pins. Here again the big companies have a role to play.

So far one has been cynical about their involvement in software. IBM's attitude to outside software authors until the last year or so was somewhat cavalier. They had to assign all their rights to IBM; in return they received a royalty of up to $10,000, and after that nothing. The implication clearly was that any software worth writing would be written by IBM staff. Well that is quite wrong for the mass market.

Just as the Soviet Union and the United States ought to produce better athletes simply because they have a larger population in which to look for freaks, so the talent in software ought to be found among computer users rather than inside computer firms. What the big computer companies can usefully do is play the role of the publisher. Just as a good publisher's imprint on a book gives some assurance that the contents are accurate and responsible, so a software publisher ought to assure potential customers that the programs it sells — even if they were not written by the publisher's staff — are still reasonably bug-free, useful and not noticeably illegal.

It seems there is no reason why small companies should not set up in this business and, since much of publishing depends on a single person's intelligence and empathy with the reader, why they should not do the job better than big companies. Yet, they cannot do the hand-holding part effectively. A one or two-or three-man-and-a-dog operation may produce spectacular software, but it cannot field 43 training reps in smart red blazers to show the punters how to make it work.

Perhaps we shall see a three-tier publishing system, in which individuals write programs for small publishing houses who then hope to sell them to the big computer companies which will in turn pass them on to their customers.

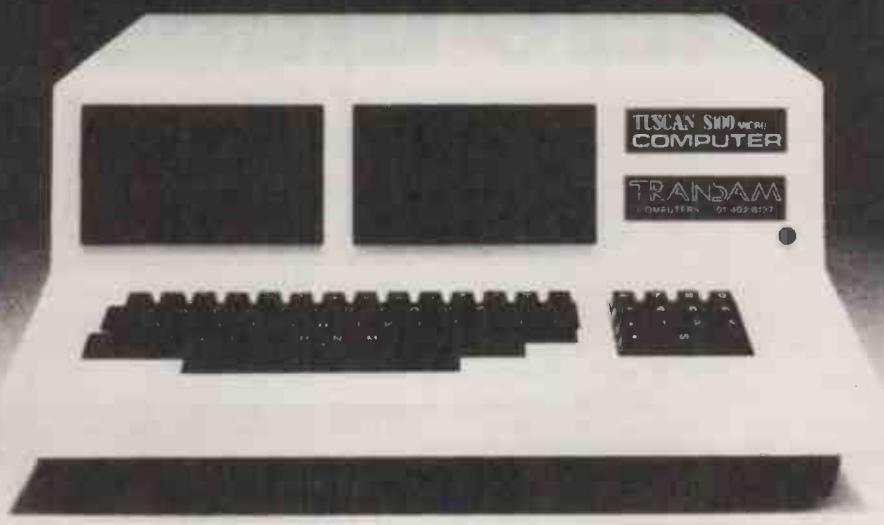
At the end of all this, there does not seem to be much of a future for the small computer manufaucturers. They lack the volume to compete with the low end and lack the staff and capital to compete with the customer services the big companies can offer. Eventually, one can see the low and high ends coming together, as machines become cheaper for the same power and the customer services learn to do more with less, as knowledge spreads. Then there really will not be any room for anything but the most specialised small manufacturers. It will be like the car industry: at the turn of the century there were dozens of builders, now there are two and a half. So it will be with us.

Finally, a sour-word about the reality of our thrusting Government's support for small enterprises. Readers with long memories may recall a bitter editorial about experiences with the Department of Industry's Software Support Scheme. This, for new readers, is an apparently magical arrangement which will either give you a 25 percent grant or a 50 percent loan, recoverable out of revenue, to write new software.

It sounds like the answer to a software publisher's prayer. Yet as so often with these things, it does everything short of helping. To be given help you have to have some 20 employees, have been trading for five years and have a turnover of half a million pounds. In short, you have to be a member of the Computer Services Association, which is a club of systems houses like Hoskyns, Logica and CAP.

Our editorial seemed to stir up some interest at the DOI and the NCC, which administers the scheme, in broadening it to give help to the small software producer with no one to back him up. But after a year of nothing happening Kenneth Baker, our own minister, has announced more of the same. The not spectacularly successful Software Support Scheme will receive an extra £10 million, and a guidance committee will help to spend it. Who is on the committee? Good old CSA stalwarts. We would be surprised — and very gratified — if they gave any small company the money to write a program that might sell by the tens of thousands to Sinclair users in America and Japan.

The model of good business.



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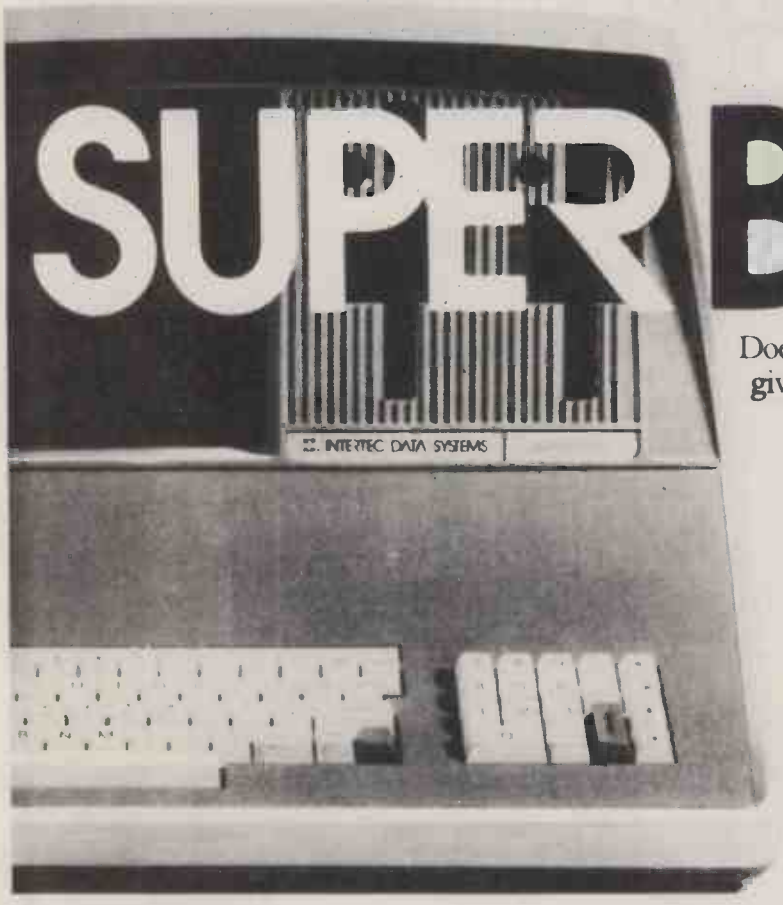

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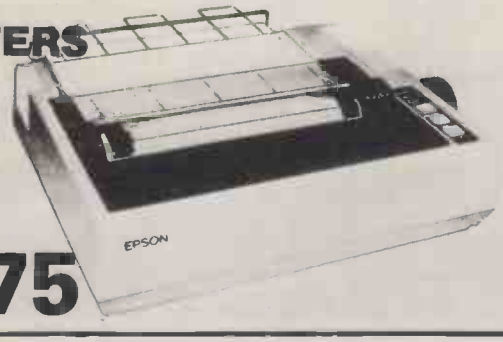

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Our Feedback columns offer readers the opportunity of bringing their computing experience and problems to the attention of others, as well as to seek our advice or to make suggestions, which we are always happy to receive. Make sure you use Feedback—it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

Source list bug

ON ENTERING the Source List program from "Open File: Apple Pie" in June's *Practical Computing* my Silentype printer reeled out great lengths of paper. This unfortunate phenomenon can be avoided by adding a semicolon to line 140, so that it reads:

```
140 GET Z$:PRINT D$;
```

A J Macefield,
Darlaston,
West Midlands.

BBC Basic

I WAS INTERESTED to read the article by John Gordon and Tony Shaw about BBC Basic. They say that there is no command for adding procedures to a program from cassette, and give a method involving playing around with Lomem. Obviously they had not at that stage discovered the commands *Spool and *Exec.

*Exec "prog" presents the contents of a cassette or disc file called "prog", as if it came from the keyboard, and *Spool creates a file of anything which is sent to the screen. So if you have a procedure at line numbers 10,000 to 10,200 which you want to use in another program all you do is:

*SPOOL "procedure"	start the spooling action
List 10000, 10200	output procedure to file
*SPOOL	stop the spooling
LOAD "program"	program to which procedure is to be added
*EXEC "procedure"	overlay the procedure; note that common line numbers will be overwritten

This is much easier and safer than messing around with Lomem, though with the 0·1 version of the machine operating system *Exec does produce spurious error messages, which should simply be ignored. Acorn says that in the 1·0 version of the operating system this command will have been tidied up a bit.

Paul Beverley,
Norwich.

Tachistoscope tapes

MY COMPUTER TACHISTOSCOPE article published in April's *Practical Computing* provoked surprisingly strong interest. At the end of the article I offered to supply a machine-readable copy of the program to any educational establishment sending a cassette or disc and return postage. Unfortunately several people who replied were under the impression that a machine-readable copy meant that any machine could read the program.

It is a sad fact of life that the many computers now available all use different systems for program storage and that a tape produced by one make of computer is not readable by any other. It is a veritable tower of Babel. Even if the Basic commands are similar the program as published will only run on the TRS-80 Model I.

However, in response to various requests I now have available the Tachistoscope program for the following TRS-80 models I and III, BBC Micro models A and B, and Pet machines. May I now extend my offer to any educational establishment to supply the program for any of these computers? Please write on headed note paper enclosing cassette and return postage.

Unfortunately I cannot extend this offer to the general public, but would nevertheless be very grateful for any comments as to how the program has been received by the teacher and pupils. Adverse and negative comments are as useful as praise, as only through such feedback is it possible to design programs that have a useful function and that are usable by non-computer personnel.

M K Cook,
Manchester.

WordStar trick

READERS MAY be interested in how I have overcome, fortuitously, what I regard as one of the principal deficiencies of WordStar, otherwise an excellent piece of software. As written, the program does not underline spaces and this gives text a very peculiar look indeed — see the Instruction Manual for an example of how untidy it looks.

Quite by accident, I entered a Control-PF instead of a Control-PS to terminate an underlining and printed. The space where I had typed Control-PF was underlined! I consulted the manual, and the excellent *Introduction to WordStar* by Arthur Naiman, and found that I had typed in a phantom space the exact graphic result of which, in the words of the manual, "depends on the print wheel in use". I am printing on an NEC 3500 so I am perhaps just lucky.

I had, incidentally, written to MicroPro about the underlining deficiency and the company was simply not interested. I was referred to the dealer from whom I had bought my program. I would have thought that this defect should be remedied, if at all, at source. But other WordStar users might like to try this trick with their daisywheel printers and they might be as pleasurably surprised as I was.

Dafydd Evans,
Hong Kong.

First sighting

I SAW my first Spectrum of summer on Friday 2nd July 1982.

Is this a record?

I Higton,
London E17.

That man again

I WAS INTRIGUED to see the correspondence in the May 1982 issue of *Practical Computing* on the merits or otherwise of languages and the example called Drunken Duncan. Here is the near equivalent code in APL which runs on a 64K micro.

Clear and Cursor are functions supplied by Micro APL, and their use is self-evident. No APL random number code is needed; the symbol ? does that. No decision is involved in moving the cursor; the current position P is updated on each entry to the line labelled Step and on being updated is tested to see if it is outside the range specified.

Line 20 sets the start position — 10, 15 in this case — the non-zero limit D, and initialises the counter N to 0 in a fairly compact way. The only other point to note is that this formulation causes the cursor to move in one of eight random directions: NE, NW, SE, SW are included.

Doubtless APL fans will have fun squeezing it on to only one line and will regard Forth, Comal, Fortran, Pascal, Basic, Coral, Cobol and all the others as tedious and cumbersome to write. But I agree with Frank Dale; it is a question of horses for courses.

John Steel,
Leatherhead,
Surrey.

Duncan in APL.

```
      ∇DUNCAN[⎕]∇
      ∇DUNCAN;D
[10] CLEAR
[20] N←1↑0=D←2×P←10 15
[30] STEP:→(1=+/(P>⍳D)∨0>P+P←¯1+3 3⊤7100+N+N←1)/0
[40] CURSOR P
[50] '*'
[60] →STEP
      ∇
```

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Up to 16 users each with its own private card which contains Z80A, 64 KBytes, VDU i/o and printer i/o, ie total of 16 Z80s and 1024 KBytes of RAM. (Optional 16 bit 8086 processors with 128 KBytes).

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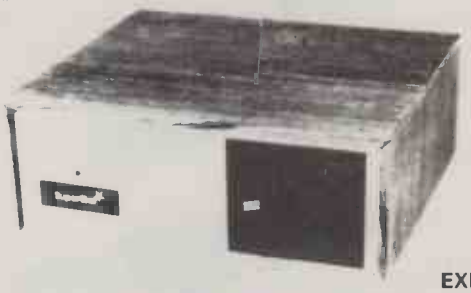
More power and faster processing time is offered through 16 bit private processor card based on 8086 CPU and 128 KByte RAM expandable to 1 MByte. The system automatically loads CP/M 86 to the 16 bit private processors.

The revolutionary Super Star Is the only system that allows the total integration of powerful 16 bit 8086 processors with the more standard Z-80 user processors. The system may be configured in any 8 bit/16 bit combination, or as a totally exclusive 16 bit system only to provide the ultimate in performance and flexibility in advanced micro systems.



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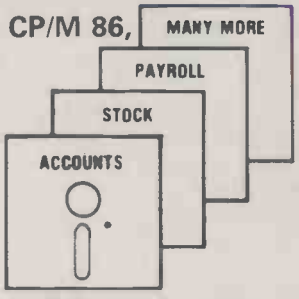

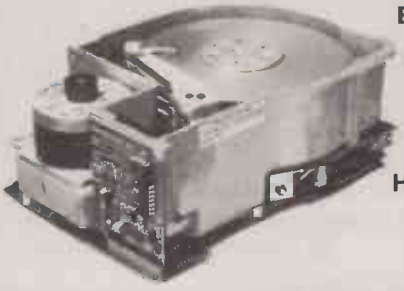

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Marine caps a success

CAP'S SEAVIEW work stations have successfully communicated with each other via satellite. SeaView is the worlds first viewdata-based electronic office for use at sea, and has been developed by CAP in conjunction with the Department of Industry, British Telecom and Siemens. The addition of satellite capability now offers some interesting new possibilities.

CAP's manager of maritime systems said of the trials that CAP is "delighted" at the ability to offer data-communication facilities, not just over short distances but worldwide. One work station is currently installed on the British Telecom marine cable ship *Alert*, operating out of Southhampton. Two other work stations are located at CAP's Reading offices.

Two-way data transfer using satellites was achieved between the *Alert* work station and a work station in Reading. Viewdata-type pages were exchanged using the Inmarsat geostationary satellite.

As well as accessing U.K. Prestel, both the Finnish and Hong Kong viewdata systems were accessed, the shipborne system being operated by non-expert ship personnel.

Coming events

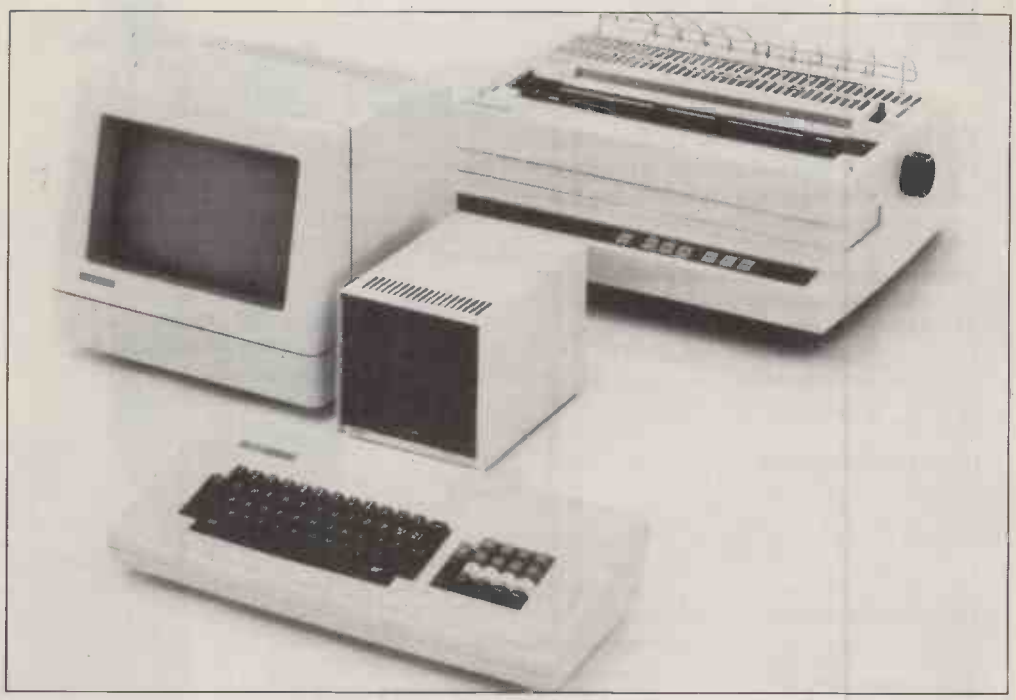
Computer Laboratory Annual Microprocessor Workshop: £72.00 per delegate; September 6/7 at the University of Liverpool. Telephone: 051-709 6022.

Can Micros Work For Me? £91 + VAT; October 14-15 and December 9-10 at Hull College of Higher Education. Telephone: 0482 41451 x 358.

The Northern Computer Fair: Personal Computers, Home Computing, Small Business Systems, Belle Vue, Manchester, November 25-27.

Programming my Micro: £65+ VAT; Eight evenings from October at Hull College of Higher Education. Telephone: 0482 41451 x 358.

Xerox pushes on



RANK XEROX is persevering in its efforts to break into the business micro market with the Mark II version of Xerox 820, which was launched last winter. The new machine is basically a Z-80, CP/M "cooking" machine, but with a well-graduated range of disc and other options.

The cheapest version, with 5·25in. drives, starts at £2,150. There are also 8in. drives, and double-density options are available on both sizes. Also on offer is a 5·2-in. Rodime hard disc offering 6Mbyte, and an 8in. Shugart with up to 34Mbyte.

Xerox has solved the tricky 16-bit question by offering an 8088 board for £500 — a more sensible solution than building a 16-bit machine and then offering a Z-80 board to let it do useful work. Users can now move up as and when they need to. There will be a high-resolution, 1,024-by-512 graphics board, and an extra 32K for the Z-80 machine.

The system includes a comprehensive configuration utility which allows, for instance, the specification of a CP/M command line to be executed when the machine starts up. There are terminal emulation routines in firmware, so the machine can pretend to be a terminal without any extra programming.

A range of printers, from the Epson dot matrix up to the Diablo daisywheel can be supplied. Simple networking will be offered on the 16-bit version, and there will also be an interface to Ethernet.

The 820-II seems a reasonably mature machine in the mainstream of current business micro ideas. More interesting perhaps than the hardware is the support that Xerox claims to give it: building on its large organisation. Xerox intends to have nationwide service and support.

Even if there were nothing else to make the machine attractive, the name on the box must give the customer some confidence that it will be mended if it goes wrong. As well as hardware support there is a "Helpline" telephone, manned by engineers and software people, which any user can ring for advice.

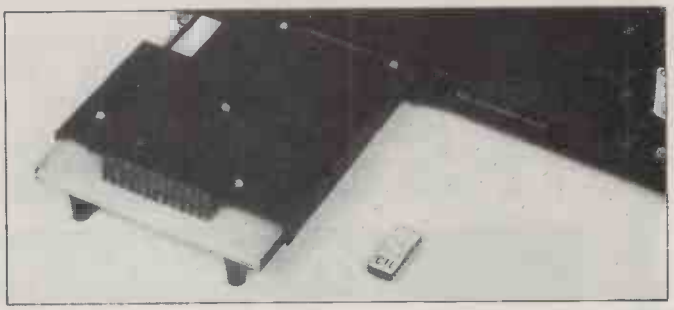
Stay-home poll

WILL THE HOME COMPUTER bring new opportunities to those whose responsibilities keep them housebound? Or will it simply perpetuate the low wages and isolation which is commonly the lot of women working at home? These are just two of the questions which have prompted a research project, funded by the Equal Opportunities Commission, which will examine the position of the new homeworkers.

Ursula Huws, author of *Your Job in the Eighties: A Woman's Guide to New Technology*, published recently by Pluto Press, is conducting the research and plans to contact as many homeworkers as possible during the year. If you work at home as a programmer or a systems analyst, or if you operate a word processor or perform any other function connected with new technology — or if you work for a company that operates in this area — please contact Ursula Huws. All replies will be dealt with in strict confidence, and there is no expense involved.

Write to her at Freepost, London N1 2BR (no stamp required) and she will send you a questionnaire to complete. No further contact will be made unless you wish.

This is a high-quality, high-speed analogue-to-digital converter which plugs into the user port at the rear of the Commodore Pet computer. The device comes with four multiplexed input channels, with a conversion time of around 50μs. There is a provision for trigger inputs which allow control of the A-D conversion. A versatile operating system is provided in EPROM, which allows discrete conversions from Basic. Up to 15,000 readings may be entered. The converter costs £195 from CIL Microsystems Ltd, Decoy Road, Worthing, Sussex. Telephone: (0903) 210474.



20K ROM module

JUST NINE months after it was originally promised the 20K BBC ROM conversion for the Acorn Atom is available. It supports the full set of BBC Basic commands, and is syntactically identical so that any program that does not rely on the BBC Micro's hardware can be run on an otherwise unmodified Atom.

The module works in parallel with Atom Basic and can be selected either by a switch or from the keyboard. It contains a 16K Basic ROM, a 4K operating system ROM and an additional 2K RAM. It also comes with a manual.

The module alters the Atom memory map so that RAM is available from 0000 upwards.

The module costs £49.95 including VAT and is available from Acornsoft, 4a Market Hill, Cambridge. Telephone: 0223 316039.

Reader survey

THE RESPONSE to *Practical Computing's* reader survey ran into several thousands, and more replies are still turning up every day. Many were accompanied by letters, most of them kind, but one reader was concerned about the security of our survey. There is no need to worry: the list of names and addresses will not be supplied for outside use.

The winners of the prizes are: Colin Hogben of Folkestone, in Kent, who received £50, and N S Hutchison of Bicester, Oxfordshire and T Wright of Bromsgrove, Worcestershire who each received £25.

Many thanks to everyone who took the trouble to complete the questionnaire.

32-bit micros set to invade industry

THE 16-BIT micro has been with us for some time now, and a number of 16-bit systems have found their way into various microcomputer installations. Now it looks as though these machines are to be upstaged by a new generation of 32-bit micros. Industry rumours say that Hewlett-Packard has a 32-bit machine on the way, to be joined by a 32-bit micro developed by Acorn in conjunction with National Semiconductor.

The chip comes from National Semiconductor and is claimed to be the only true 32-bit microcomputer. It is capable of supplying the user with the power of a minicomputer at about 10 percent of the cost.

This chip, and the others in the series, are to be incorporated by Acorn into two new products. As a second processor for the BBC Micro, it will come on a board with 256K of RAM and an operating system in ROM. The interface to this processor will be handled by the "tube".

The second product comprises the processor, up to 1Mbyte of RAM and one or two 5Mbyte Winchester discs, together with a specialised operating system which allows the user to connect it to an existing microcomputer, such as a Pet, Tandy or Apple, which can be used as a terminal. Communication is through a simple RS-232 link.

There is already an extensive selection of software support. Users will have the choice of Acorn, Unix or Idris operating systems together with a wide range of programming languages. Digital Research is currently developing a multi-tasking version of the CP/M operating system for the new chip.

Acorn expects to market this product worldwide to the existing user base of over 2,000,000 Apple, Pet and Tandy machines. The proposed name of the device is the Glueon — particle physicists, please note.

Technology films

JOHN CLEESE stars in Video Arts' latest training film. *What is a Word Processor?* Scripted by David Nobbs, writer of the Reginald Perrin series, the film is a comedy about two boss-secretary teams, one with a word processor, one without.

The film is a joint production between IBM and Video Arts, which has John Cleese as one of its directors. It is aimed at both managers and secretarial staff in companies thinking about introducing word processors, and in general emphasises the benefits technology brings.

By contrast, Education Media's new film *New Technology — Whose Progress?* looks at the drawbacks. It examines job loss and job changes following the introduction of new equipment into offices and factories, and is concerned not just with computers but with developments in robotics and communications. Tony Benn, trade unionist Mike Cooley, and Richard Sharpe, the editor of *Computing*, appear in the film.

What is a Word Processor? runs for 28 minutes and costs £56 to hire or £359 to buy. It is available as a 16mm. film or on VHS or Sony Umatic video cassette, from Video Arts, Dumbarton House, 68 Oxford Street, London W1N 9LA. Telephone: 01-637 7288. *New Technology — Whose Progress?* runs for 35 minutes and costs £13 to hire on VHS, Sony Betamax or Sony Umatic cassette, or £18 on 16mm. film. from Concord Film Council, 201 Felixstowe Road, Ipswich, Suffolk IP3 9BJ. Telephone: (0473) 76012.

Briefcase viewdata

BRIEFCASE VIEWDATA is the latest product from Tandata Marketing. It gives the user access to Prestel or private viewdata systems from any telephone in the U.K. The system consists of a Alpha Tantel adaptor and an acoustic coupler, which means that a user does not need a jack point.

Prestel or viewdata users are therefore now able to make use of the facility wherever they have access to a telephone and a television.

The complete Briefcase Viewdata weighs only 5lb. and costs £449. Contact Tandata Marketing, Clyde House, Reform Road, Maidenhead SL6 8BU. Telephone (0628) 74661; Prestel 799.

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AJEDIT

.....a new, simple to use, moderately priced word processor..

AJEDIT was introduced as a new word processor some months ago, having been written with ease of use as a prime design requirement. Since then it has achieved market success, so much so that it has gone through two additions, together with the introduction of a Manual specifically aimed at the first user. The documentation now totals about 60 A4 pages.

Arrangements have now been made with Logical Systems, Inc. of the United States, the authors of the LDOS disk operating system, for the inclusion in AJEDIT of a stripped-down version of this disk operating system, called smal-LDOS. This gives to AJEDIT a number of major benefits. For instance it now incorporates "type ahead". This means that if you are typing into the word processor whilst the machine is looking at something else, input is stored and then accepted by the program at its own convenience. One of the major advantages of this, of course, is that it is now pretty well impossible to outstrip AJEDIT in speed, particularly at the most critical end of line time, when the program is very busy tidying up. A further improvement given by the marriage between AJEDIT and smal-LDOS is the key repeat function. If the user's finger is kept on a key for longer than a certain time, then that key will repeat on the screen or, if it is a control key, its function will repeat. Both the delay time before the repeat starts, and the rate of repetition is adjustable. Yet another improvement is the addition of a screen print facility so that at any time the operator may (for instance) print out his source file from the screen, complete with all control characters.

To some users these additional functions and others, such as double density support, will not be of the greatest importance and as the smal-LDOS version of AJEDIT is higher in cost, we will be continuing the previous version.

Both versions of AJEDIT contain close to 100 commands, covering most word processor requirements, including two sets of dedicated printer commands for the Epson MX series and Centronics 737 machines. Three principle advantages of AJEDIT over some other word processors are the ability to access DOS commands from within AJEDIT, the facility to mail merge (whereby a names, addresses and salutations file can be married up to a standard letter), and most important of all, the fact that AJEDIT commands are so constructed that they are easily remembered by intermittent users.

AJEDIT needs 48K and one disk minimum, and is presently suitable for the TRS-80 Models I and III together with the Video Genie Models I and II.

Standard AJEDIT **£49.95**

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Zap into music

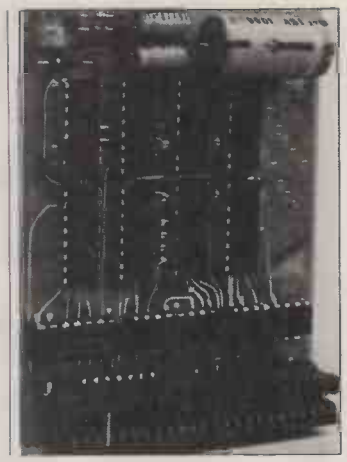
ZAPPLE is a board which will turn an Apple II microcomputer into a musical instrument. The Zapple, which comes complete with its driving software, works by using sound tables, created in a similar way to the shape tables.

A wide range of sound and musical effects is possible. The Zapple is equipped with a number of programs which make table creation easy, sounds being produced with one simple command.

The board is self-contained and includes the well-known AY-3-8910 programmable sound-generator chip, software in an on-board EPROM and a volume-controlled audio amplifier which can connect to the Apple speaker. Other features of the unit include sockets to plug in other sound-generator chips. This facility enables the number of voices to be increased from three to nine. There are terminals for connection to an external amplifier or speaker.

The Zapple will run with any size Apple II with disc or tape, and sells for £65. Further details are available from Meekrose Ltd. Telephone: 0525 370621.

The Econotech 16K RAMpack is the cheapest memory expansion for the ZX-81. Measuring about 2 in. by 3⅜ in. the Econotech RAMpack is the ultimate no-frills expansion for the hobbyist. The pack uses NMOS dynamic RAMs, which are economical on both power and space. It is compatible with the Sinclair ZX printer and is supplied together with a six-month guarantee. Econotech, 30 Brokenhurst Way, London SW16 4UD.



Sinclair languages

ONE OF the problems of using the ZX-81 is that Sinclair Basic, whatever its other merits, is slow. Writing in machine code is one answer for programmers, but this only produces fast code at the cost of much greater programming effort. Furthermore, the ZX-81 provides no machine-language monitor so the whole procedure is unnecessarily tedious.

What is needed is a fast, high-level language for the ZX-81, and to this end Artic Computing of Hull has come up with ZXForth, a version of the Forth language originally developed for controlling the tracking mechanism of telescopes. It is ideal for microcomputer applications as it produces code which executes rapidly but which is also very compact.

Artic's offering implements the Fig-Forth subset. Unlike Basic, Forth is relatively transportable between different machines because most versions of Forth conform to this standard.

ZXForth costs £135 on cassette and £70 on EPROM. Contact Artic Computing, 396 James Reckett Avenue, Hull, North Humberside HU8 0JA.

Computing holidays

THIS YEAR sees a record number of residential and non-residential courses aimed at teaching children about computers. Among them are those run by Beaumont Summer Camps, 100 New Kings Road, London SW6 6LX, telephone 01-736 3272, an established operator of the traditional riding, fishing and canoeing sort of camp. This year it is adding computers in the form of three-hours-a-day instruction, taking in Basic programming, computer games, and word processing using Commodore Pets. A week for a 10-to-17-year-old costs around £170 at Beaumont's Carlisle camp, and bookings run up to the end of August.

Beaumont is also running weekly Monday to Friday non-residential camps at Windsor, Sevenoaks and Mill Hill. Children will be bussed in daily. The daily camps cost around £100 per week and cater for 5-to-15-year olds.

Dolphin Camps, 8-10 Parkway, London NW1, telephone 01-267 6926, is running courses in association with Beaumont, at Carlisle, Sevenoaks and Mill Hill. Dolphin is oriented more towards the older 10-to-18 age group — parents can be smuggled in — and has obtained a £15-a-week subsidy from the Department of Industry for the non-residential courses, so their prices are slightly lower. A range of other technology activities, including film, animation, video, robotics and psychobionics is also on offer. The computers used are Apples at Mill Hill and Acorn/BBC machines at Sevenoaks.

Aldenham School, Elstree, Hertfordshire, telephone 01-779 7553, is organising non-residential weeks, running from the end of July to the end of August. For £94 for 9-to-13-year olds, and slightly less for younger ones, the children get two hours a day of computer instruction from the school's term-time staff on TI 99/4s. The rest of the time is spent on sports, sailing, drama, etc.

London Computer Summer School, Mortimer House, 37-41 Mortimer Street, London W1N 7RJ, telephone 01-886 4292, is running courses for 13-year olds upwards at Middlesex Polytechnic's Trent Park campus in Enfield. The cost for a week of five days is £150 non-residential and £195 residential; seven-day courses cost £195 and £265 respectively. The courses are intensively focused on computing, though sporting and recreational facilities are available. The machine used is the Vic-20, and bookings run up till mid September.

A much more laissez-faire apporach is favoured by Concorde Holidays, 25 Fore Street, Praze-an-Beeble, Camborne, Cornwall TR14 0JX, telephone (0209) 831274. Concorde has designated September 25 to October 1 as Computer Holiday Week at Bude Holiday Park — golf, sailing and surfing available — where £60 secures a caravan for six people. The idea seems to be that you descend en masse, taking your computer along with you. "No doubt many friendships will be struck up and a great deal learnt from each other" the brochure hopefully puts it.

Interface for Vic-20

AN INTERFACE has been developed to connect the Commodore Vic-20 microcomputer to a radio transmitter or receiver. The interface simply plugs in to the rear of the Vic, or if the computer has an expansion system, it fits into that.

The 4K of machine-code program needed to drive the interface is contained in EPROM. The card also contains a Morse and RTTY converter and decoder making it possible for the Vic to transmit or receive RTTY or Morse signals. On RTTY there is a choice of baud rate varying from a lethargic 45 baud to a sprightly 300 baud.

Three programmable buffers are each capable of holding 150 characters, and another five are pre-programmed with the station description, CQ call, CW ID, and the autostart message.

The Morse coder reads every Morse code message between the speeds of six and 60 words per minute.

The Converter/Decoder costs £89 excluding VAT, and is available from Computer World, Hilverstsweg 99, 1214 JB, Hilversum, Holland. Telephone: 31-35-12633.

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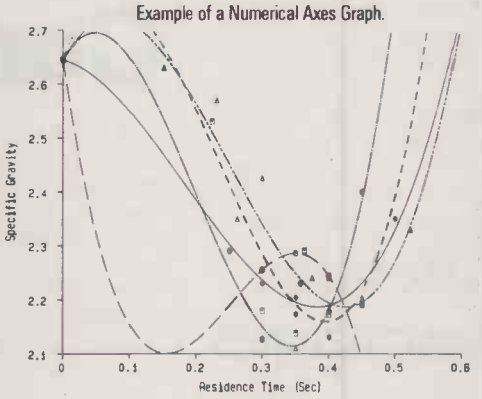

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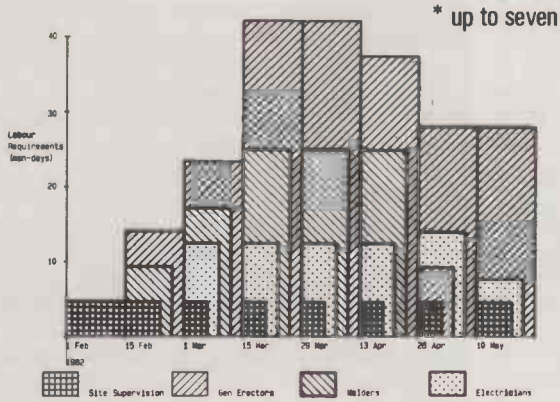

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* operates like GRAPH but structures in **block** format
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A quickly drawn PIE configuration
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* legends located in or outside boundary
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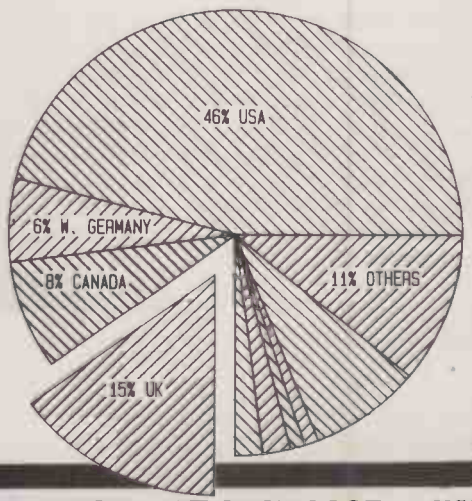

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● Circle No. 128

Sinclair goes flat

Peter Laurie takes a look at Sinclair's production line inside the Timex factory.

CLIVE SINCLAIR recently took a small party round the Timex factory in Dundee where Spectrums and ZX-81s are made under contract. We saw, as you might expect, a large number of industrious Scottish ladies making computers against time.

Having originally been in the business of making artillery fuses for the US forces, Timex went over to watchmaking after the Second World War and is now boldly migrating into electronics as the mechanical watch business fades away. On a part of the production line that makes a tiny electronics board for the three-dimensional camera, a couple of ZX-81s are used to drive an automatic circuit tester. If the board fails the test the ZX-81 prints out a diagnosis.

Spectrum tests

Further along the line there is a station where Spectrums are connected to a tape recorder, loaded with a test program and run through a complete set of hardware tests under software control.

A computer is a computer, but a tiny flat TV screen is an interesting gadget. The better half of the day was a tour of the brand-new, highly automated line that will produce Sinclair's long-awaited flat-screen TV tube. This device is about 3in. long, 1in. wide and ½in. deep. It produces a rather squashed picture on its inside that is viewed through the optically flat glass lid.

At first sight you would think that an electron beam fired parallel to the phosphor would produce a hopelessly distorted picture, but it turns out that with correct proportions all the errors cancel out. The most impressive part of the line is a chain of miniature robots which make the gun assembly, some of whose parts are so small you can only watch the operations under a microscope.

Cheapest alternative

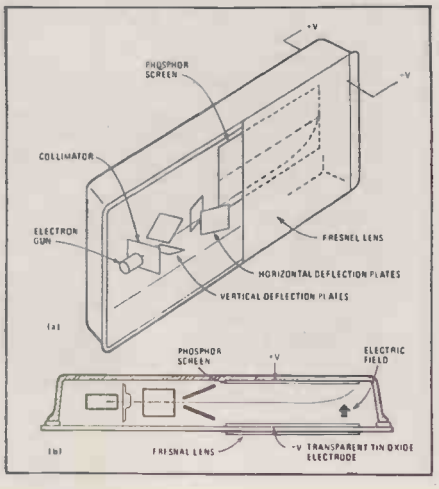
Sinclair says that when the line is running properly it will produce 1,000,000 tubes a year per shift. The price will be "considerably lower" than the equivalent conventional tube and still a lot cheaper than any possible LCD or LED display of the same size. Some members of the party doubted this, but Sinclair said that although a high-resolution, pixel-addressable screen might sound more advanced, it needed a vast amount of control logic, and for the forseeable future the analogue addressed TV tube would be cheaper.

Projected picture

Sinclair Research plans to absorb the whole production of the line in its own products, the first of which would be a pocket TV for less than £50. Later on, the tube will start to appear in computers.

Although there is only one size, a larger picture can be produced, Clive Sinclair said, by projection. Sinclair has had a revolutionary f1 lens designed to enlarge the image. Although a lens of this performance for your camera would cost £100 or more, the lens for the tube can be much cheaper because the phosphor can be curved to cancel out aberrations in the image. Brightness of the projected image is assured by running the tube at higher voltages: since the picture is seen through the inside of the tube, a heat sink can be applied to the back of the phosphor to stop it melting itself.

The scale of the production line is most impressive, although Timex, a privately owned American company, is a partner in the venture technological initiative on this scale is most unusual in Britain. One can only wish it well.



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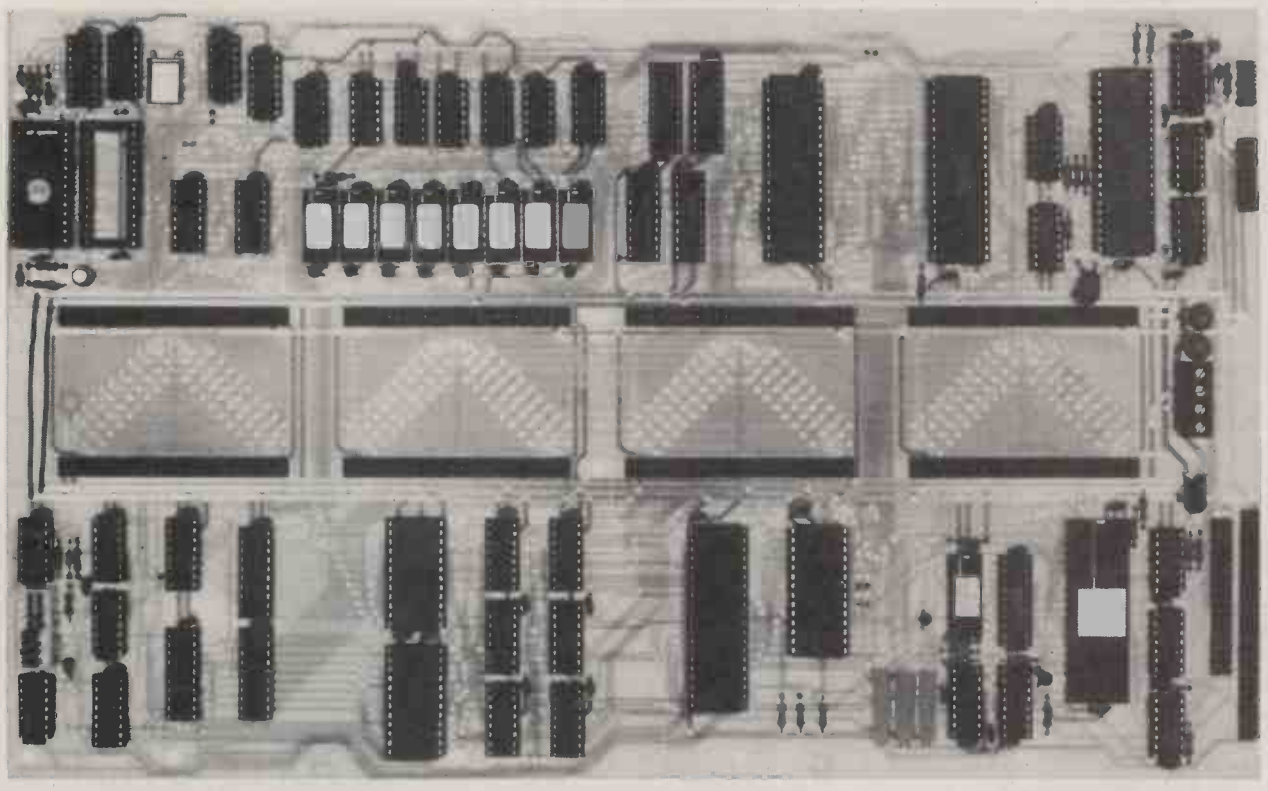

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● **Circle No. 129**

Bill Bennet looks at the latest hand-held micro from Sharp.

SHARP PC-1500

SHARP is the only Japanese name to have captured the imagination of microcomputer buyers in the U.K. The range of machines runs from large business micros supporting CP/M which cost thousands of pounds, through the MZ-80A, B and K, down to a coupe of hand-held microcomputers which look more like calculators.

Yet the PC-1500 is emphatically not a calculator. It is a real microcomputer which happens to be small enough for you to carry in your pocket. True, it does look like a calculator; it has calculator-style keys and an LCD display, albeit turned around along a side of the machine. The right-hand section of the keyboard is just like a conventional calculator keypad, but there is also a QWERTY-type set of keys, a space bar, and an Enter key.

There is also a Shift key, and a set of six keys across the top of the keyboard in the same position as other micros function keys; Sharp calls them "reservable" keys.

To the right of the machine is a power socket which takes the supply from a mains transformer when the machine is being used in an office. The PC-1500 also runs off four 1.5V batteries, which fit in a compartment under the machine, and continual use does not seem to wear them down too fast. The machine is consequently ideal for site work or working at a remote location, and should become a popular tool among engineers and builders.

The review machine came with a CE-151 memory module, a tiny plug-in 4K of RAM which fits into a slot under a cover on the base of the machine. Together with the 2.6K of RAM already available to the user, it provides a useful amount of memory.

The Basic implementation included in the Sharp is fairly standard, though using it is not. Before beginning to program, the machine must be put into the Program mode, and to run any entered program the machine must be put into the Run mode. After using the machine for a short while you become used to this procedure; working in the wrong mode causes an error to be shown, and it can be cleared by hitting the On key, which doubles as Break.

String functions are all supported, as is Print Using, with a number of editing characters. A Beep command enables the tiny speaker in the machine. It has the format:

BEEP a,b,c

where a is the number of times the beeping tone is repeated, b is its frequency and c its duration.

A number of special commands are included to handle the LCD display. For example, Cursor positions the cursor across the display, while GCursor positions the cursor at any one of the 156 dots across the width of the display. GPrint prints a pattern of dots on the display, and Point returns the number which represents the pattern of dots in a column.

The six reservable keys allow the user to recall a frequently typed phrase or keyword. Each one can recall any one of three reserved words, which can be selected by the Reserve Select key.

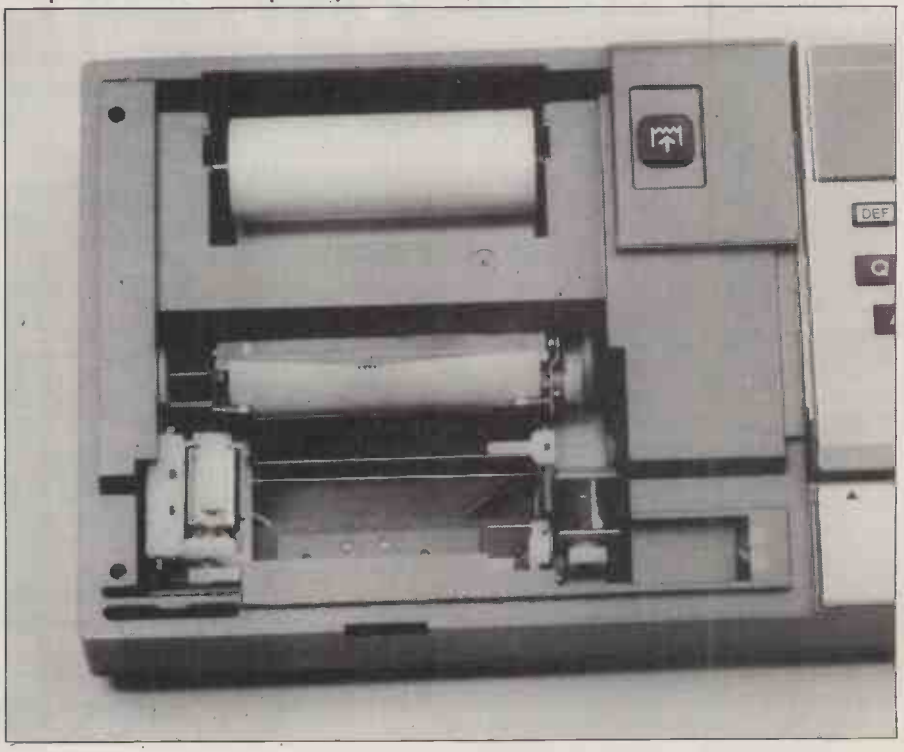
Powerful printer

The CE-150 printer and cassette interface turn this powerful and portable pocket computer into a useful desk-top tool. At around £150 the extra hardware may seem expensive until you examine the capabilities of the amazing little printer more closely. In reality more like a plotter than a printer it provides a choice of four colours, printed on to tally-roll paper about 1.75 inches wide. The roll sits in a cradle behind the printing ironmongery, while the colours are provided by four different ball-point pens. Nominally black, blue, green and red, they may be exchanged or substituted by other colours as the computer does not know which is which.

The four pens sit in a carousel which rotates on power-up to put the colour 0 — normally black — in position. Other colours can be invoked by the Colour command. The functioning of the printer, in particular the changing of pen colours, can be tested by using the Test command, which draws four boxes, each of a different colour across the width of the paper. It really is quite fascinating to watch this happening when the lid is taken off the printer: before the carousel is rotated it is returned to the extreme left position, as it does every time the pen colour is changed.

The PC-1500 incorporates a sophisticated error-detection facility which extends to the printer. Sometimes, on

The printer is more like a plotter, with a choice of four colours.



power-up the message "Check 6" appears, indicating a fault in the printer. If the pens are not in the correct rotational position the paper and carousel move about but no actual printing takes place.

The printer has a button for winding on the paper, which can also be done under software control. Vertical or diagonal lines are drawn by moving the paper itself. They can be up to about four inches in both the positive (up the paper) and negative (down the paper) directions. If there is not enough paper then what there is will rewind completely, though sometimes this means you have to re-feed the paper into the slot at the rear of the printer.

As an alternative to the low-resolution character-printing mode a high-resolution mode can be invoked by the Graphic command. In the character-printing mode there is a choice of print size — see table 2. The very large sizes are awkward to use but may be needed for printing tickets, labels and so on. The printing can be turned around on its side using the Rotate command. The argument of the Rotate expression is a number in the range 0 to 3 to choose any of the four possible orientations — see figure 1.

In the normal or character mode the paper can be wound back and forth with the line-feed command LF. As with the line command, the maximum distance of travel is about four inches. LPrint works just as LPrint on other micros the world over. An error message is given when CSize is too large for the whole of a number to be printed on a line.

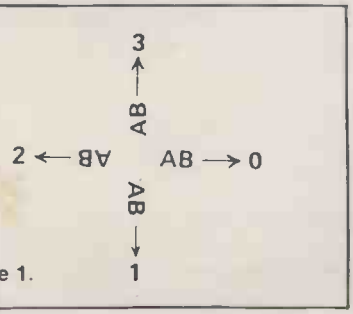


Figure 1.

LCursor positions the pen on the paper in a similar way to a command Cursor, which positions the cursor across the LCD display. Tab works from within a LPrint statement to do the same thing.

In the graphic mode the pen may be moved around the paper without printing anything. The GLCursor statement moves the pen to the x,y coordinate specified in brackets after the command. As with all other commands in the high-resolution mode the limits of x and y are −2047 to 2047.

Line commands

To establish the origin the command SOrgn is used. This sets the point at which the pen is currently located as the origin of the x,y coordinate system. The Line command is very flexible and may be used to draw 10 different types of line as shown in table 1. Line 9, that is pen-up, is an alternative to GLCursor. The Line command has the format:

LINE(X1,Y1)−(X2,Y2), line-type, colour, B

The bracketed coordinates after the command are the coordinates which have a line drawn between them. Normally there will be two of them, though more may be required in some cases. It is possible to have a list of up to six such pairs, making it possible for the user to define a personalised character set. For example, the listing:

```
10: GRAPH
20: LINE (0,0) - (0,10) - (5,15) - (10,10) -
    (10,0): LINE (0,5) - (5,5) - (5,6) - (10,6)
```

produces an "A" with a staggered cross-bar. Programmers do not normally have to go to these extremes, as there is a full character set complete with lower-case letters and a range of symbols.

The capital B at the end of the line command indicates that a box is to be drawn. The computer assumes that the first coordinate pair is one corner of the box and that the second coordinate pair gives the diagonally opposite corner. RLine is similar in concept to Line except that it draws a line relative to the current pen position.

Line-type Value	Resulting Line Size
0	Solid Line
1	0.4 mm dash
2	0.6 mm dash
3	0.8 mm dash
4	1.0 mm dash
5	1.2 mm dash
6	1.4 mm dash
7	1.6 mm dash
8	1.8 mm dash
9	Pen Up (no line)

Table 1.

Specifications

Operating system and monitor: in 16K ROM
Languages: Basic
Memory: 3.5K RAM, user area 2.6K; plug-in 4K available
Keyboard: 65 keys including user-definable function keys
Power: 6V dc power supply, or will run for 50 hours on dry batteries
Dimensions: 195 × 86 × 25.5mm
Weight: 375g
Display: 26-character liquid-crystal display, 7 × 156 dot graphics

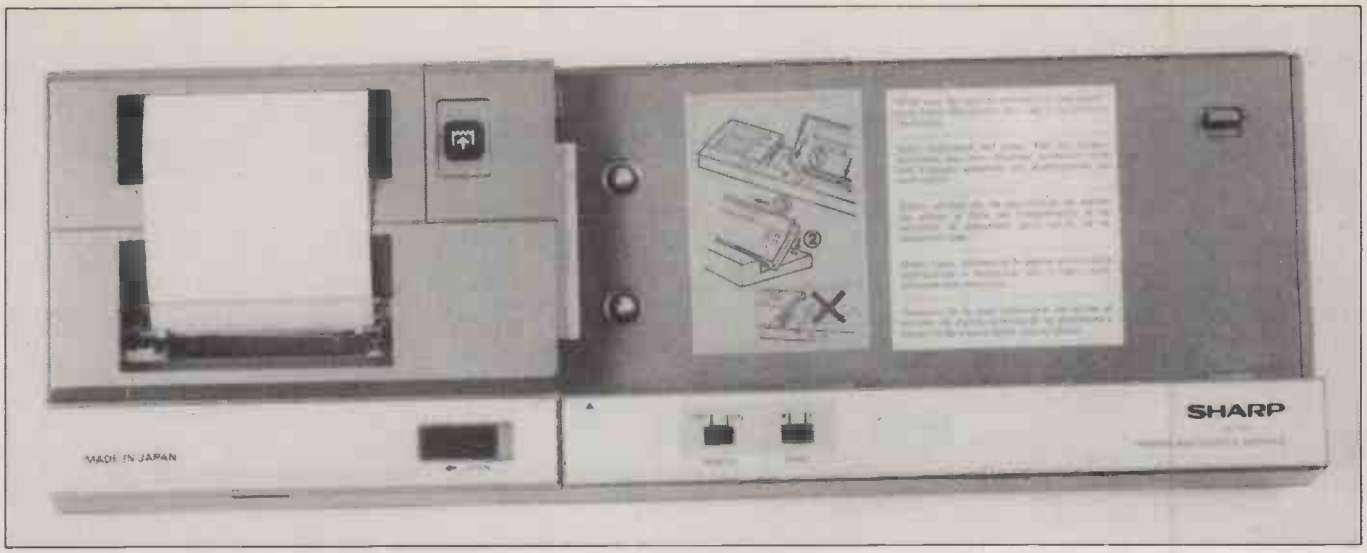
It is possible to print out the results of any calculation performed by the computer in the immediate mode by moving the print switch, located on the interface beneath the computer, to the P position.

All-in-all the capabilities of the CE-150 printer are very good. It is a shame that the printer cannot be connected easily to other computers as many would be greatly enhanced by it.

Loading and Saving cassettes on the Sharp is not the hit-and-miss business it can be on other machines. The CE-150 interface unit provides a solid base on which the cassette operating system works.

Apart from the standard cassette facilities, the PC-1500 will verify a program, merge programs and Chain them. Data can be Saved and recalled to and from

(continued on next page)



The pocket computer slots easily into the printer and cassette interface.

(continued from previous page)

tape as well. The applications tape provided by Sharp contains 14 programs for the computer which all loaded easily and appeared to work, though there were no instructions with the programs. The programs in the applications manual did include instructions, and the file names of the programs on the tape coincided exactly with those omitted from the applications manual.

Software supplied

The applications manual itself includes a wealth of material. The listings are presented in a clear and useful way, and the fundamental theory behind the programs is also shown, together with instructions on using them. Among the supplied programs are several devoted to the numerical chores that scientists and engineers could spend hours working out with slide rules and reams of paper. They include root-finding, matrix-processing and Fourier series. There are also correlation, linear regression and similar statistical routines, as well as programs to calculate loans and interest payments, graph-plotting routines, inventory control, purchase ledger, biorhythms and many others including some games.

Conclusions

- **The Sharp PC-1500 encapsulates an incredible amount of computing power in the smallest possible package.**
- **It is an ideal tool for people in the building, engineering or scientific professions to use "on-site". Business users may like find the Sharp useful as a super pocket calculator.**
- **Battery power means true hand-held computing.**
- **The CE-150 printer and cassette interface turn the super pocket calculator into a really useful and relatively sophisticated computer.**
- **The CE-150's printing capability is excellent, real high-resolution graphics in four colours.**

Table 2.

CSIZE	1	2	3	4	5	6	7	8	9
Characters per printed line.	36	18	12	9	7	6	5	4	4
Height of each character (mm)	1.2	2.4	3.6	4.8	6.0	7.2	8.4	9.6	10.8
Width of each character (mm)	0.8	1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2

Table 3. ASCII character code chart for the PC-1500.

Low Bit Positions b4, b3, b2, b1 ↓ / Upper Bit Positions → b7, b6, b5	Hexa decimal	000	001	010	011	100	101	110	111
		0	1	2	3	4	5	6	7
0000	0			SPACE	0	@	P		p
0001	1			!	1	A	Q	a	q
0010	2			"	2	B	R	b	r
0011	3			#	3	C	S	c	s
0100	4			$	4	D	T	d	t
0101	5			%	5	E	U	e	u
0110	6			&	6	F	V	f	v
0111	7			‿	7	G	W	g	w
1000	8			(	8	H	X	h	x
1001	9			)	9	I	Y	i	y
1010	A			*	:	J	Z	j	z
1011	B			+	;	K	√	k	{
1100	C			,	<	L	¥	l	¦
1101	D			−	=	M	π	m	}
1110	E			.	>	N	^	n	~
1111	F			/	?	O	_	o	▮

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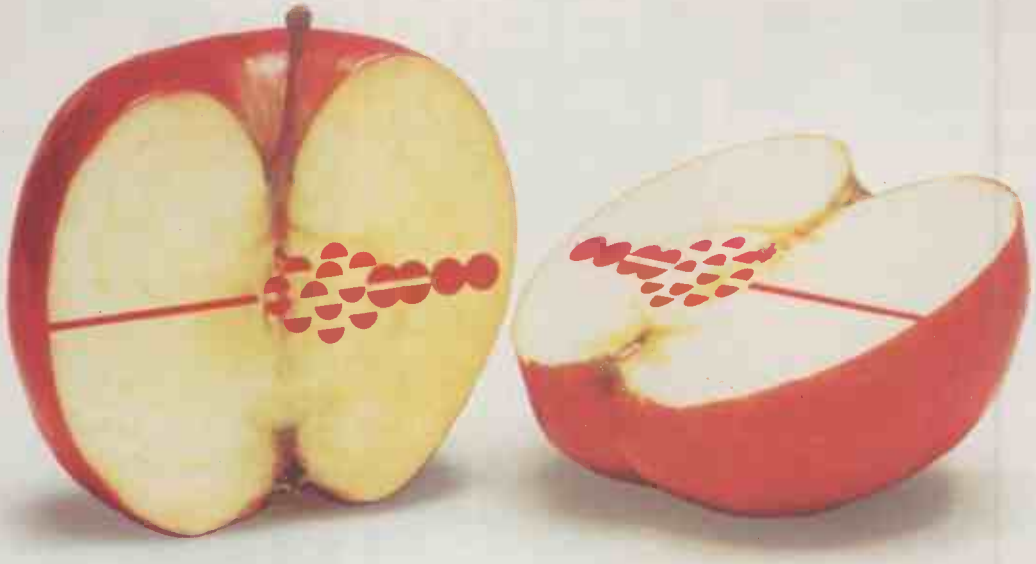

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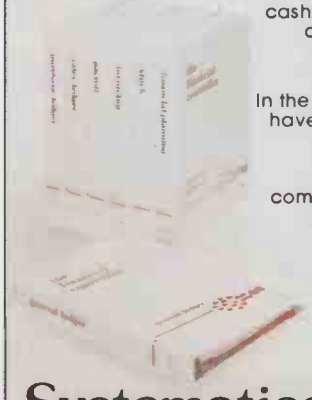

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TELEVIDEO 802

Chris Bidmead tries out a newcomer to the band of microcomputers offering a built-in hard disc.

THE NAME Televideo has been associated with clever video terminals capable of such party tricks as local text editing and field protection. Most spectacular of all is the facility for smooth scrolling, where the text moves up in front of your eyes like paper being rolled out of a typewriter.

A Televideo 950 terminal has already passed through this office in conjunction with the MicroPro PBM-1000 CP/M computer, reviewed in *Practical Computing*, May 1982. A thickish manual was supplied to explain its intriguing display facilities, but our exploration of the PBM's extended memory management left us little time for the terminal.

Now, with some physical horizontal stretching to make way for disc drives, 64K of internal RAM and a processor board, the Televideo has reappeared on our desk as a stand-alone CP/M-based micro. Options are available for dual floppies, hard discs or a multi-user quasi-network linked together through the new RS-422 standard serial asynchronous protocol.

The review machine was the 802H, equipped with a single Tandon mini-floppy drive, and a Seagate hard disc. The Stat DSK: listing in figure 1 shows the unusual backing store configuration: it is not uncommon for the physical hard disc to be divided up into two notional drives, but the Televideo Seagate is configured to provide a third drive, drive C, of 342K capacity that emulates the floppy.

Precisely why this should be, the manual does not say, but then there is quite a lot about this sophisticated hardware that the documentation passes over in silence. The intention may be that back-up files should be assembled on drive C with Pip, the normal CP/M Peripheral Interchange Program, in preparation for bulk transfer to the floppy with a sector-to-sector transfer program, but no such software is provided among the utilities.

In fact the Televideo 802H is the first hard-disc machine we have reviewed which offers no software provision for hard-disc back-up beyond Pip. With no means of splitting files retrievably between floppies, Pip cannot cope with the sort of large database files that a hard-disc machine uses. A serious omission, this, in a computer that must be at least partially destined for business use, though Chan Idnani of the London Computer Centre — who kindly supplied us with the machine — said he thought there was a Backup program on the way.

What unquestionably makes the Televideo 802H worthwhile is the hardware. The cabinet, without keyboard, but allowing for protruding plugs at the rear, takes up a desk space of about 40cm. deep by 57cm. wide, and stands under 30cm. high. The well-contoured edges of case and keyboard suggest that thoughtful design effort has been brought to bear on the product's cosmetics, without the flaunted shape-making of some recent micros.

The green, glare-resistant screen presents the most stable image we have yet seen on a serial terminal designed for U.S. voltages, and shows no sign of "transatlantic swim". The character set might usefully be larger, but the ascenders and descenders are well pro-

portioned. Descending characters like lower-case "p" and "g" have their upper portion very slightly lifted from the baseline, but the effect is legible and pleasing. adding an almost hand-written quality. Pascal and C programmers will be glad to know that curly, square and round brackets are well differentiated.

The excellence of the screen was initially spoiled by the fact that at normal desk height it tends, rather unhelpfully, to face the user square in the chest. We remembered from the PBM review that the terminal version has an extendable foot centrally placed under the screen to tilt it upwards. After some experiment to compensate for its absence on the 802H we found a judiciously placed paperback greatly improved the system's ergonomics. It was not until much later, when we entered the dismantling phase of our investigation, that we discovered a pair of discreetly hidden broad-headed screw shanks left and right of the undercarriage, clearly intended to serve just this purpose. A minor criticism of the arrangement — apart from the fact that it was well concealed and quite undocumented — was that without a stop at the end of the thread these came adrift from the case when screwed past their maximum adjustment.

As with the Televideo 9xx series of terminals, the bottom row of the screen displays an inverted video status line which on the left-hand side shows the cursor co-ordinates. The data that follows further along the status line is more useful, and is worth noting in the early stages of coming to grips with the hardware. Four sections display the current terminal modes that define the complex relationships the terminal is able to enter into with the internal serial line to computer. This can be confusing to both the user and the computer unless the point is well understood that the computer and the terminal, though cased together, are entirely separate logical entities.

Figure 1.

```
A: drive characteristics
27904: 128byte record capacity
3488: kilobyte drive capacity
512: 32byte directory entries
0: checked directory entries
256: records/extent
32: records/block
64: sectors/track
2: reserved tracks

B: drive characteristics
27904: 128byte record capacity
3488: kilobyte drive capacity
512: 32byte directory entries
0: checked directory entries
256: records/extent
32: records/block
64: sectors/track
438: reserved tracks

C: drive characteristics
2736: 128byte record capacity
342: kilobyte drive capacity
64: 32byte directory entries
0: checked directory enties
128: records/extent
16: records/block
64: sectors/track
875: reserved tracks

D: drive characteristics
2736: 128byte record capacity
342: kilobyte drive capacity
64: 32byte directory entries
64: checked directory entries
128: records/extent
16: records/block
72: sectors/track
2: reserved tracks
```

The manual devotes about 40 of its 100-odd pages to describing the refinements of the terminal, and the section seems to be a lightly edited version of the standard Televideo terminal-only manual. The depth of detail in which it describes the display possibilities contrasts with the elementary approach adopted elsewhere in the manual: "The lighted rectangular block which appears on the screen indicates the entry spot for the following character to be typed. It is called a cursor..."

Default to Local

The manual seems uncertain about its level of explanation, but does include some clear drawings of plugging in cables and handling diskettes. Sometimes the clarity of the simpler sections ignores the complexity of the hardware: "If you make an error while typing, simply press the Backspace key and the cursor will move to the left..."

Well, yes, on any ordinary computer it might. But one essential point buried rather too deeply in the manual is the terminal's distinction between Duplex and Local, displayed on the status line as Dupe and Loce. Unless expressly switched into Duplex mode — oddly, the default on power-up is Local — keys like Tab and Backspace will not pass their code down the line to the computer. One disconcerting result of this is that in WordStar the cursor keys can appear to move the cursor across the text, but the new location will be unknown to the program. This apart, WordStar works extremely well on the 802H, with the speed of the hard disc, the Direct Memory Access chip and the processor going a long way to disguise the overlays and heavy computational overhead of a word-processing package that often seems sluggish on floppy-based machines.

The confusion the cursor keys create is not destructive, and WordStar will pick up and carry on where it left off when it next receives a cursor instruction it understands. The seasoned programmer, used to the idiosyncrasies of keyboards, might well find the nuisance trivial. The fix, if anyone bothers to make it, is a breeze: patching WordStar to send ESC '1' as part of the initialisation string will turn on Duplex mode automatically.

The keyboard arrives set up to give an insistent "beep" with every keystroke, but there is a very welcome DIL switch to the rear of the machine to disable it. The keyboard connects to the mainframe by way of a coiled cable, and plugs in with an American miniature telephone jack. Following the puzzling convention adopted by other manufacturers, the keyboard cable enters the terminal at the rear, as if designed to be used by a typist working blind behind the computer while a colleague watches the screen from the front.

The central QWERTY cluster of the key layout is IBM-like, with one or two disconcerting differences. For example, a typist would expect the shift lock to unlatch when the shift is pressed, but the ordinary shift lock is missing from the keyboard. The key in its place, above the shift, is the alpha lock, which works as a straight toggle and gives access only to the upper-case letters, leaving the punctuation keys in their lower-case mode. There is no LED on the alpha lock to show when it is engaged.

The main character keys and the numeral pad keys on the right of the keyboard are in dark grey, a lighter grey being used to differentiate the line of 11 function keys that runs along the top. Both the upper and lower case of these keys are available for programming with preset code, either from the keyboard or from the computer. Instant keyboard programming turned out to be useful for frequently repeated commands: a kind of Submit facility built into the keyboard. Because the function keys are programmable from the computer, the more often used WordStar commands can be downloaded at the beginning of a session.

Working blind

There are 19 bolts on the underside of the case, some of which hold down the cover, the rest being structural. We proceeded cautiously, remembering the explorations of our youth into costly devices whose cases stayed clam-tight, rattling the while with more and more loose components as each wrong bolt is unscrewed. We found a sketch in the appendix to the user's manual that showed the four bolts to be removed, but from that point on our invasive surgery had to be made without further documentation: the hardware manual promised by Midlectron failed to arrive in time.

In fact you have to remove five bolts to free the top of the case. Inside is a rigid frame consisting of two sub-assemblies bolted together. On the left — viewed from behind — is the terminal chassis with the main computer electronics mounted horizontally beneath the neck of the CRT. Below that, well-shielded behind a metal plate and a heavy cage, is the power unit.

The mounting for the two disc drives is

(continued on next page)

(continued from previous page)

on the right-hand side: a sort of apartment-house shell with the floppy in the penthouse and the Seagate relegated to the basement, and ample room between them for one more mini-drive unit. Televideo's own hard-disc controller board is mounted vertically outside this chassis.

An unlabelled PCB, presumably the floppy-disc controller, is piggy-backed on to the main computer board, a "big-board" unit mounted horizontally some way beneath the neck of the CRT. With a little judicious wiggling to free descending protrusions that snag against the bottom of the case, this can be slid out like a drawer once four jumper blocks have been unhitched.

The operation flexed the board, something best avoided under normal circumstances but quite a good test of the soundness of the internal connections. No dry joints showed up in the process, confirming our visual impression that the construction was generally sound. The main big board may well be Japanese: the name Seiko appears on the underside.

Auxiliary chips

With this kind of accessibility a service engineer could swap the board over in about a quarter of an hour. We did not time the exercise, pausing instead to cast an eye over the selection of chips. It was gratifying to find a pair of Zilog SIOs taking care of the serial interfaces, a Zilog clock timer counter and a direct memory-access chip second-sourced from Sharp. These are high-priced components as eight-bit chips go, but can take much of the load off the Z-80 to speed up serial data transfer and disc accesses.

We found further evidence of state-of-the-art eight-bit electronics. The familiar four-by-eight array of 16K memory chips is replaced on the 802H main board by a thin gold line of eight Fujitsu MB8264-20 64K chips, nestling under the piggy-backed floppy-disc controller board. The video drive unit is positioned vertically on the left-hand side — again, looking from the rear. The preset focus, linearity, height and brightness controls are easily accessible, although only the contrast knob can be adjusted once the case has been replaced.

Visible from the rear with the cover off are four diagnostic LEDs on the big board which light up in sequence during power-up and are all steadily illuminated once the system has been correctly booted. Without a hardware manual it was impossible to know what precisely they were trying to tell us.

The standard OEM Seagate drive unit is designed so that its front panel can be mounted flush with the exterior of whatever casing it finds itself in, exposing to the outside world a reassuring little LED that a well-tuned Bios can flash to indicate the drive is being accessed. A similar arrangement is standard with floppies, but with hard discs it is even more useful. Unless you have a sharp ear it is impossible to tell whether the drive heads are responding. By burying the Seagate internally, the Televideo 802H loses this occasionally useful feature.

The memory appears to be used conventionally, except that it gives the system designer and the manual writer another opportunity to squabble. According to the manual, the power-up message is supposed to read

59K CP/M vers 2.2

In reality it says

64K CP/M vers 2.2

which seems to indicate that an arrangement has been made for the ROM bootstrap software, and something called "4K of diagnosic ROM" to be phantomed out once it has done its work. That is to say the address lines are switched automatically and the ROM is effectively replaced by a similar-sized block of RAM. Hardware documentation would have been very helpful in verifying this.

One of the set-up DIL switches on the rear enables the machine to boot either from the floppy or from the hard disc. This option is usually offered on a hard disc computer as a way of installing the operating system. Normally when booting from the floppy, which would then be seen as drive A, the hard disc is available as a secondary drive, or as a pair of secondary drives.

Idiosyncrasies

The Televideo implementation is eccentric, to say the least. Booting up on the floppy offers only two drives, A and B. Neither of these drives is the hard disc, which appears to be completely inaccessible to ordinary file operations, and both drives represent the same double surface of the floppy.

On setting the DIL switch to the Hard Disc Boot position the disc assignments revert to the configuration in figure 1. Curiously the bootstrap software still insists on going to the floppy drive first and giving it a whirl even if there is no disc in it. This behaviour added to our feeling that the software has too many rough edges and lags behind the sophisticated hardware, though it probably only needs a simple software fix.

Like the rest of the software tailoring, it should really be stitched in before terminal and internal computer are pulling together as a coherent CP/M machine; without it, the user is in danger of perceiving the kit as complicated and idiosyncratic. Together with a decent suite of utilities and fuller documentation, this is what is missing before the equipment begins to do justice to its capability as a system.

Only three utilities are provided: one each to format the hard and floppy disc, and a third that mops up bad sectors on the hard disc as necessary and tidies them away in a file called File.Bad.

A system should offer more than this. Televideo goes part of the way by including a complete listing of its Bios, that section of the operating system that has to be tailored by the manufacturer to link CP/M's standard package to the hardware. Though it may not mean much to many users, we found it an essential antidote to the manual, which flatly contradicts it in many places.

The output section of Bios has been written to provide two distinct ways to prevent buffer overflow at the printer attached to the serial port. Software hand-shaking — the exchange of control codes along the ordinary transmit/receive lines between computer and terminal — can be selected to match the protocol preferred by any particular printer. Modem flow control, which calls for additional lines that are toggled high and low to start and stop the movement of data, can be selected similarly.

So far so good. This sort of flexibility is what microcomputers are all about. But instead of a simple routine called, say, Set.Com to establish which kind of handling comes into use on power-up, the manual invites the user to participate in an unwelcome mystery tour of programmer's delights like Sysgen, Save and DDT, bearding the IObyte in its lair at address 0003. Putting aside the fact that this section of the documentation mistakenly transposes the printer module names in the opening paragraph, and contains two numerical errors in the quoted examples, the point is that a properly constituted system should not expose the user to this kind of excitement when all he or she wants to do is drive a Ricoh from CalcStar.

Certainly a lot of other so-called "systems" are still being launched upon the world in similar nakedness, swelling the murmur of discontent against CP/M. This is really rather unfair: CP/M's facilities are more or less limitlessly extendable through the addition of purpose-written .Com files. Yet for the most part dealers, importers and manufacturers have failed to settle among themselves whose responsibility the software effort should be.

Conclusions

● The Televideo 802H is a good-looking, fast, hard-disc, stand-alone computer, with plenty of hardware talent.

● The machine runs under CP/M, and is well behaved once you set the right parameters.

●The documentation is excellent in parts, but its level fluctuates between the obvious and the obscure. Important points are buried or omitted, and there are seriously misleading errors.

●The price of £4,400 makes it good value for money, but the raw state of the software will certainly mean you will have to pay more to do anything useful.

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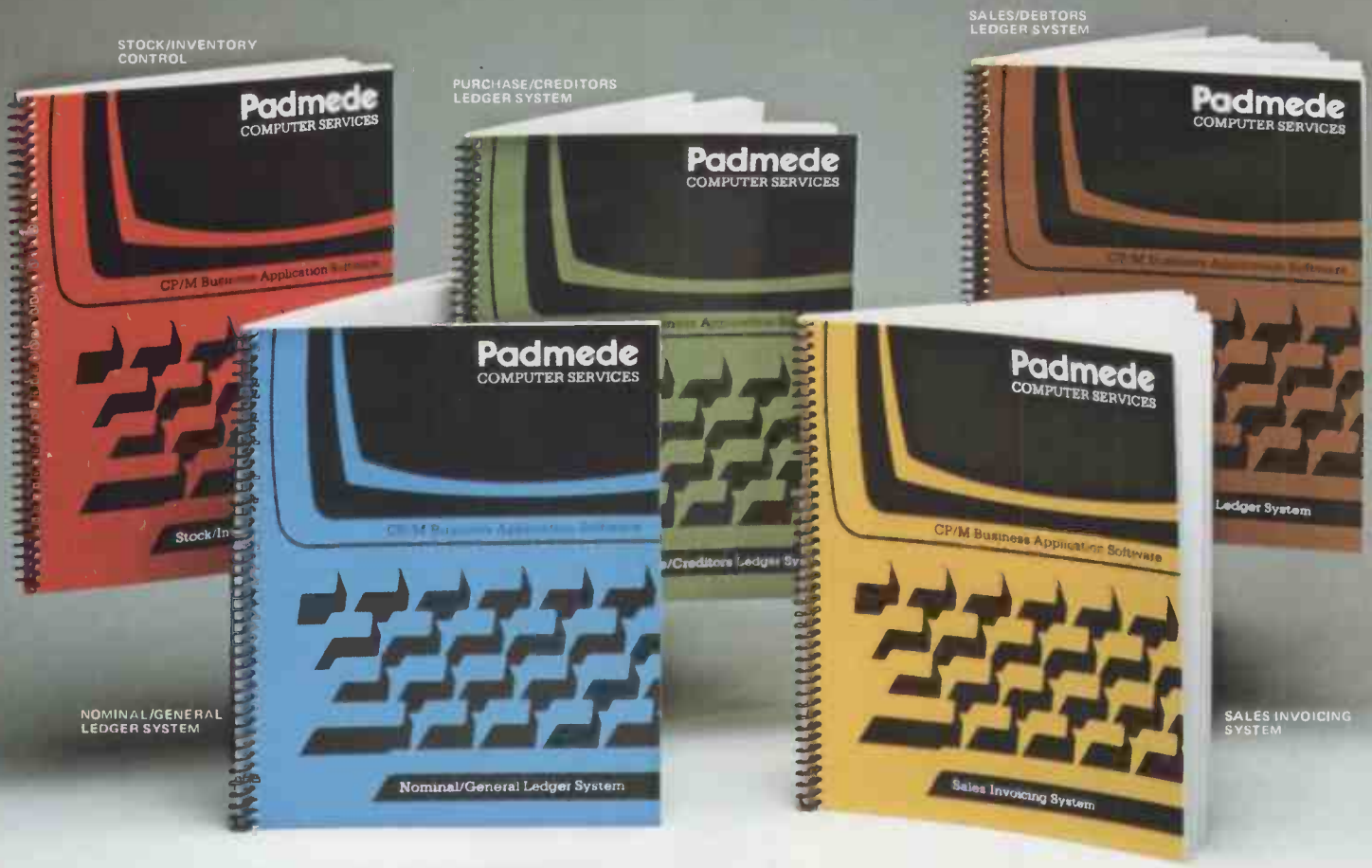

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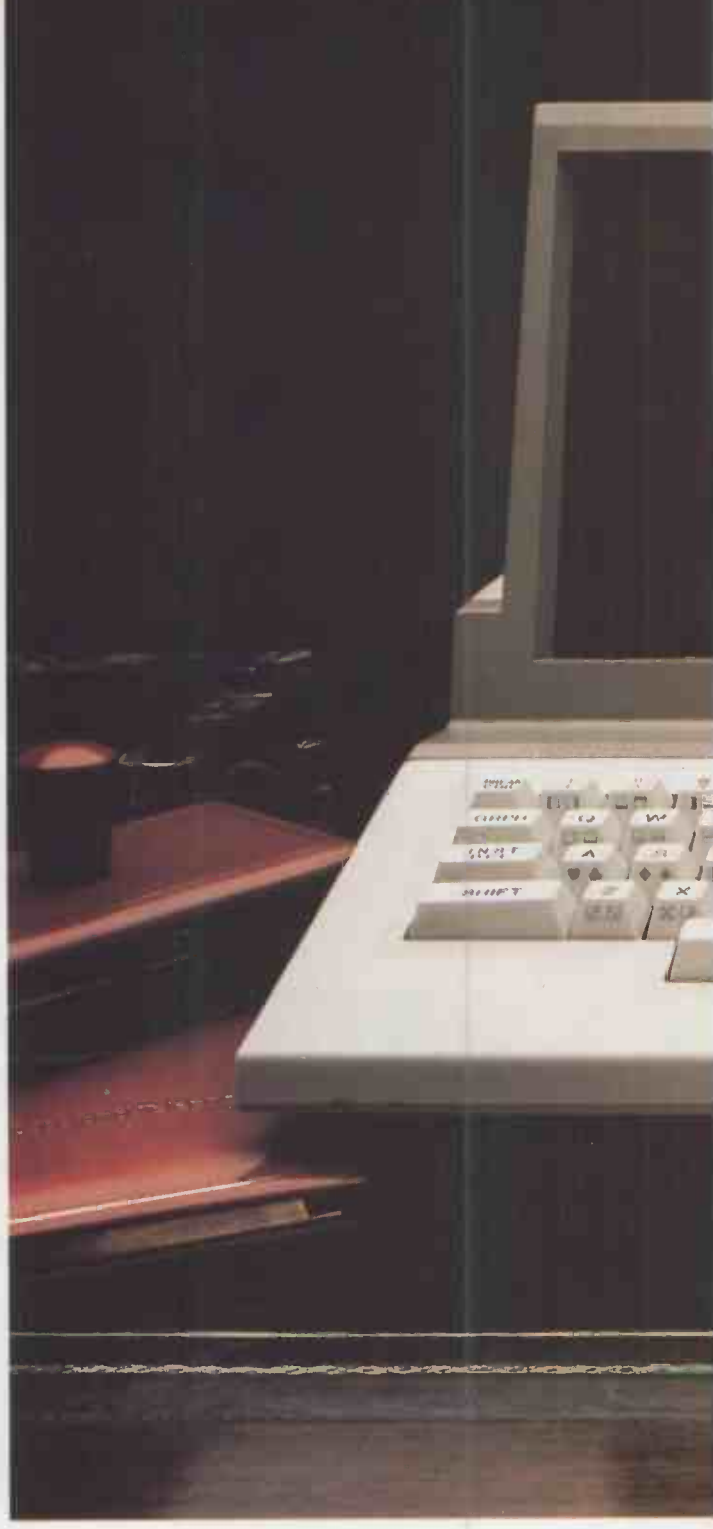

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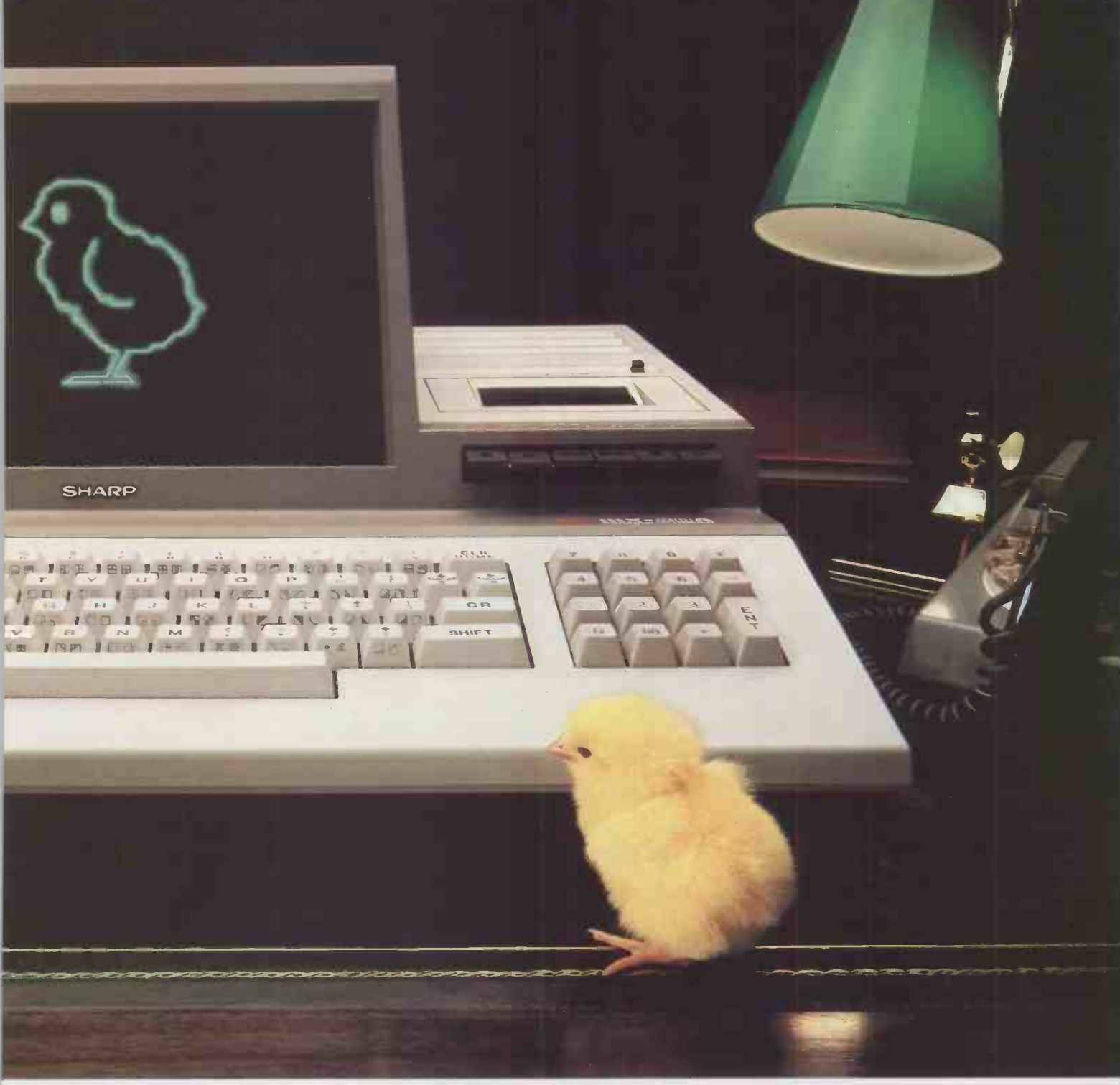

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GRAPHPAC

CCSoft's latest product provides some impressive graphics for Gemini and British Micro machines, executing even complex curves with ease. Nick Laurie analyses the effectiveness of this economic package.

MANY OF the current desk-top micros have integral graphics capabilities, but no way of accessing them easily. This package from CCSoft overcomes many of the problems.

The Gemini G-812 Intelligent Video Card, IVC, and both the Mimi's medium- and high-resolution graphics all suffer from the disadvantage of lack of suitable driving software, at least they did until CCSoft produced no less than three different versions of its Graphpac package. Although the implementation is slightly different on different machines, the essential commands are much the same for the Gemini Galaxy, the Gemini Multiboard system — provided that it uses an IVC — and the British Micro Mimi 801. Table 1 lists all these commands and describes briefly what they can do. The implementation supplied for this review was used on a Gemini Multiboard system and, for the first time, gave us a chance to put the G-812 IVC through most of its paces in comfort.

A short CP/M program called MBaslink is used to add the commands directly into your MBasic 5 vocabulary and to call up MBasic itself. Once loaded into a system configured for a minimum 48K CP/M, MBasic is used as normal but with the added ability to access this package without any help from the user.

One of the most impressive features of this package must surely be the execution speed; Circle was a particularly fine demonstration of this, especially when compared with many of the more commonly used Basic circle-drawing routines. The fact that a Ratio command is available to correct the height/width factor for different VDUs is an added bonus, as is the fact that you can at last specify an angle directly in degrees instead of having to mess about with radians.

Speedy execution

Plot, with its ability to use polar co-ordinates, came as something of a novelty. Curve drawing has always been something of a bugbear, but the ease and speed with which even quite complex curves can be plotted using this software is enough to endear it for a long time to come.

Graph plotting in MBasic is now by the command Down, which permits vertical labelling of axes. The only problem is that it is pure Down; leading "–" signs or horizontal groups of characters cannot easily be mixed directly into the Down command.

Now for a disappointment: PTest, which is used to check any pixel on the screen and return its condition — on, off or illegal co-ordinates — cannot return its result directly to a Basic variable. You will have to follow the PTest command with a Peek of a specified address to see what value has been returned. This is an unmitigated pain when compared to the ease of use of the other functions. A word with Bob Cullen of CCSoft confirmed that he was not happy with this solution, but that it was the only way it could be implemented at this stage. Since the light-pen supplied for the Gemini IVC card would also return its co-ordinates in the same clumsy way, Cullen felt that this was not the time to implement commands for handling PTest.

Thoughtful documentation

Most of the remaining commands are self-explanatory if you study the table carefully, although it is important to note that some of them may not be available on the particular version you might want. A full set of sales literature documenting these differences is available from CCSoft. Included on the disc is a demonstration program which provides some very impressive graphics — all the more impressive when you List and see how easily they have been created.

The documentation is divided into two parts, a command manual describing all the commands available under various versions of Graphpac, and a systems manual which tells the user how to implement Graphpac on a particular machine. Properly printed and well thought out, these manuals do credit to a product which, at £35, might expect to be far less well served.

Economy Basic

Apart from the Gemini Galaxy and Multiboard Microsoft Basic 5 CP/M versions, which are very similar, CCSoft supplies an 8K floating-point Basic known as Economy Basic, for use with cassette-based Gemini systems. Economy Basic lacks trigonometric and string-handling functions, but includes the Graphpac commands and brings this impressive controller within reach of the non-disc user.

The British Micro Mimi, a 64K CP/M machine, has its own internal graphics capability with both 256 by 256 low-resolution and 512 by 256 high-resolution modes. The Mimi package from CCSoft is known, once again, as Graphpac. It is booted into a 47K maximum CP/M where it behaves as an extended Bios, but still allows all normal CP/M software to run

(continued on page 64)

Table 1. Graphpac commands.

No one version includes all these commands but all versions include most of them. Check with your supplier for further details.

CLS — clear screen
GS and NS — toggle graphic/normal modes
CLEOL — clear to end of line
SCROLL N — limit screen scrolling to the bottom N lines of the display
SREEN CC,RR — move cursor to column CC of Row RR
VBAR CC,RR,N — draw a vertical bar of height N at co-ordinates CC,RR
VBARH — a half-tone version of VBAR
DOWN CC,RR — print a vertical string of characters
FCON and FCOFF — enable/disable toggle for trapping entry or use of illegal co-ordinates
G256 (Mimi) — use the low-resolution graphics mode
G512 (Mimi) — use the high-resolution graphics mode
PSET — set a specified pixel Bright
PRESET — set a specified pixel Dark
PTEST (+PEEK) — test the condition of a pixel
STARTAT — set a start position for the (invisible) cursor
PENUP, or PU — move the invisible cursor without affecting the pixels it passes through
PENDOWN (PD) — set any pixels touched by the invisible cursor
PENFLIP (PF) — invert them this time
PENERA (PE) — now erase them
PENRET (PR) — put the invisible cursor back to the last Startat location
DRAWTO X, Y — move the invisible cursor to a specified location
DRAW X,Y — move the invisible cursor to a relative X,Y point, not to an absolute address
PLOT A,D — move it using angle and distance information
DOCAP — flip the pixel at the current, invisible, cursor position
CIRCLE R,A1,A2 — draw an arc or even a complete circle
RATIO N — adjust the width/height ratio of a circle to allow for differently shaped VDU screens
PSI "Dr:Name" — save a screen image to disc
GSI "Dr:Name" — get a screen image from disc
CAP — print the invisible cursor, called the Current Active Point in the manual
CAP@ CC,RR — print it at a particular point
LCAP — print it on a printer
SPOKE — Poke a screen location

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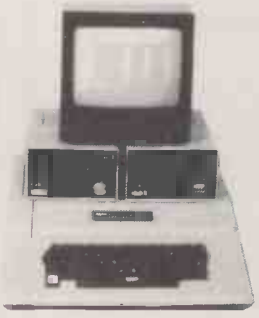

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74LS26	12p
74LS27	14p
74LS28	15p
74LS30	12p
74LS32	14p
74LS33	15p
74LS37	15p
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74LS42	30p
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74LS86	18p
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74LS93	24p
74LS95	40p
74LS96	50p
74LS107	40p
74LS109	27p
74LS112	22p
74LS113	22p
74LS114	22p
74LS122	36p
74LS123	34p
74LS124	90p
74LS125	24p
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74LS138	30p
74LS139	30p
74LS145	70p
74LS147	160p
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74LS151	40p
74LS153	40p
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74LS157	27p
74LS158	30p
74LS160	36p
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74LS165	60p
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74LS175	40p
74LS181	100p
74LS183	180p
74LS190	40p
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74LS399	160p
74LS445	100p
74LS540	75p
74LS541	100p
74LS640	160p
74LS641	170p
74LS642	200p
74LS643	200p
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74LS645	160p
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74S11	60p
74S20	60p
74S30	60p
74S32	90p
74S37	60p
74S74	90p
74S85	300p
74S86	180p
74S112	90p
74S113	90p
74S114	90p
74S124	300p
74S132	160p
74S133	75p
74S138	175p
74S139	225p
74S157	250p
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4 00MHz	150p
4 194MHz	250p
4 43MHz	110p
5 00MHz	175p
6 0MHz	150p
6 144MHz	150p
7 0MHz	150p
7 168MHz	200p
8 86MHz	175p
10 00MHz	175p
10 7MHz	250p
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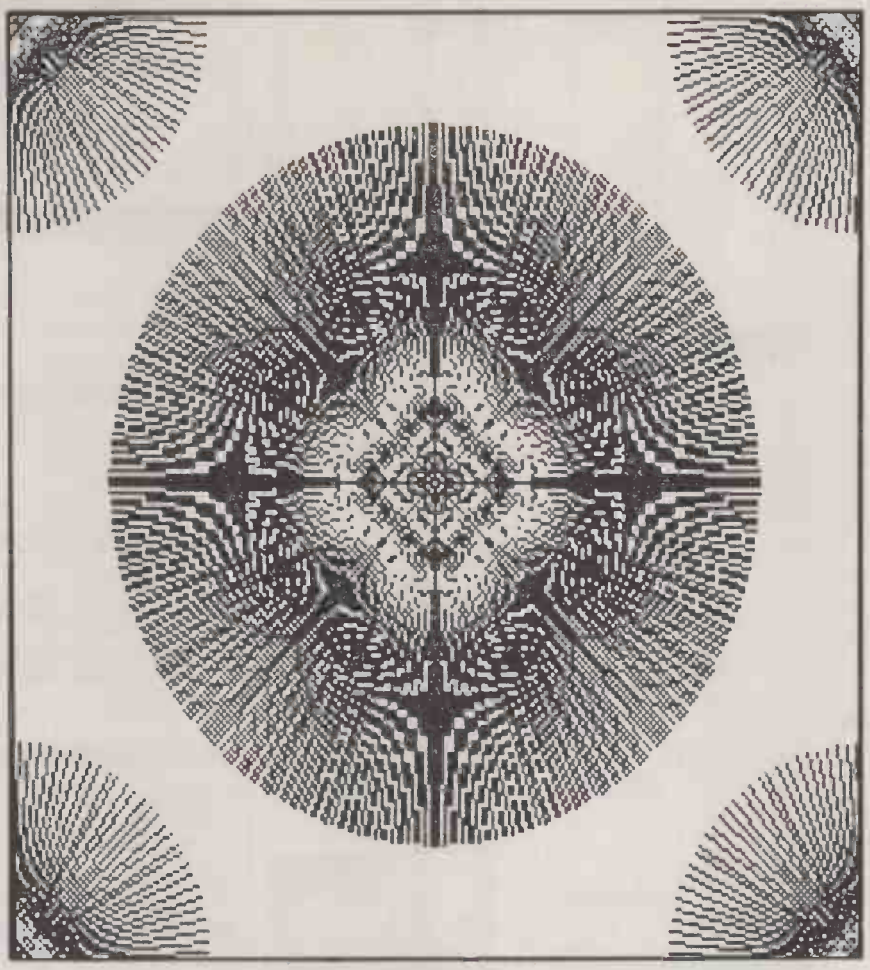
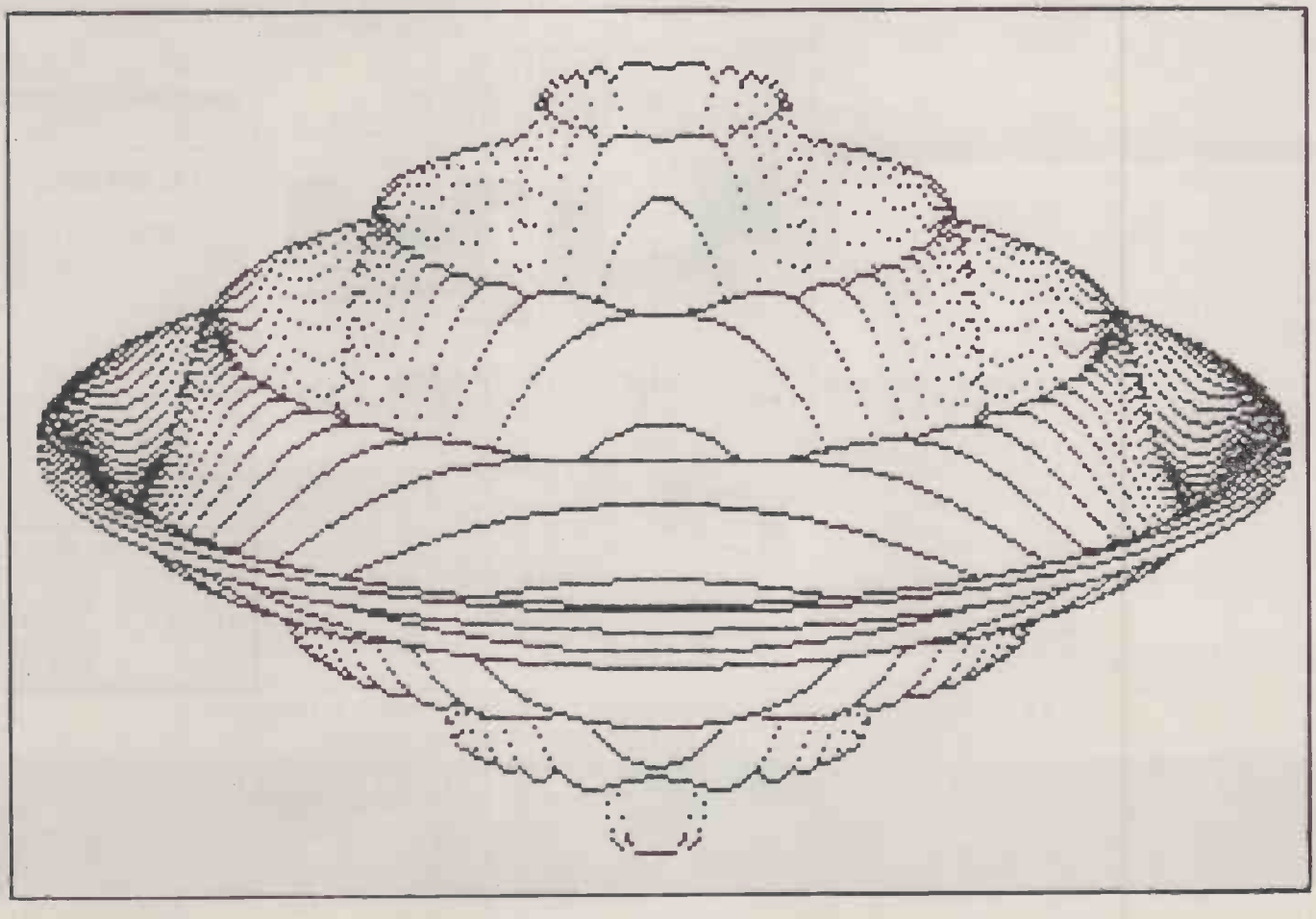


(continued from page 61)

correctly. An MBaslink, as described for the Gemini, is used to link the new commands into your own MBasic 5. CCSoft does not include a copy of Basic with the CP/M versions of Graphpac, so make sure you have a version 5 release of MBasic before you order.

Conclusions

- **At £35 — or £25 for the Economy Basic — Graphpac is very good value for money. By incorporating these sophisticated and fast routines into your ordinary MBasic, you can be sure that your existing software is not going to become suddenly redundant — a regular problem with many software additions.**
- **The lack of light-pen commands might be considered a handicap for some users, but until low-cost light-pens reach a higher level of sophistication I, for one, will not really miss them.**
- **CCSoft's customer service has always been impressive — even on a Sunday afternoon, when the package was being tested, they still came up smiling!**
- **Any system using a Gemini IVC really ought to include Graphpac as a simple, yet thorough, way of accessing its complex functions.**
- **For the Mimi 801 user Graphpac is an undoubted must if you want to get the best out of Mimi's almost inaccessible — but very good — graphics capabilities.**



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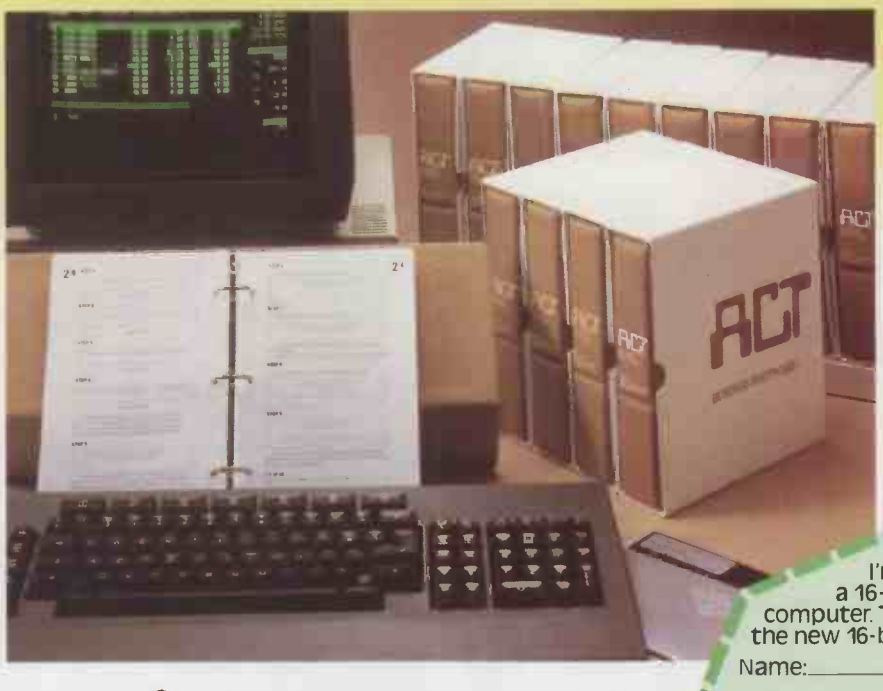

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65

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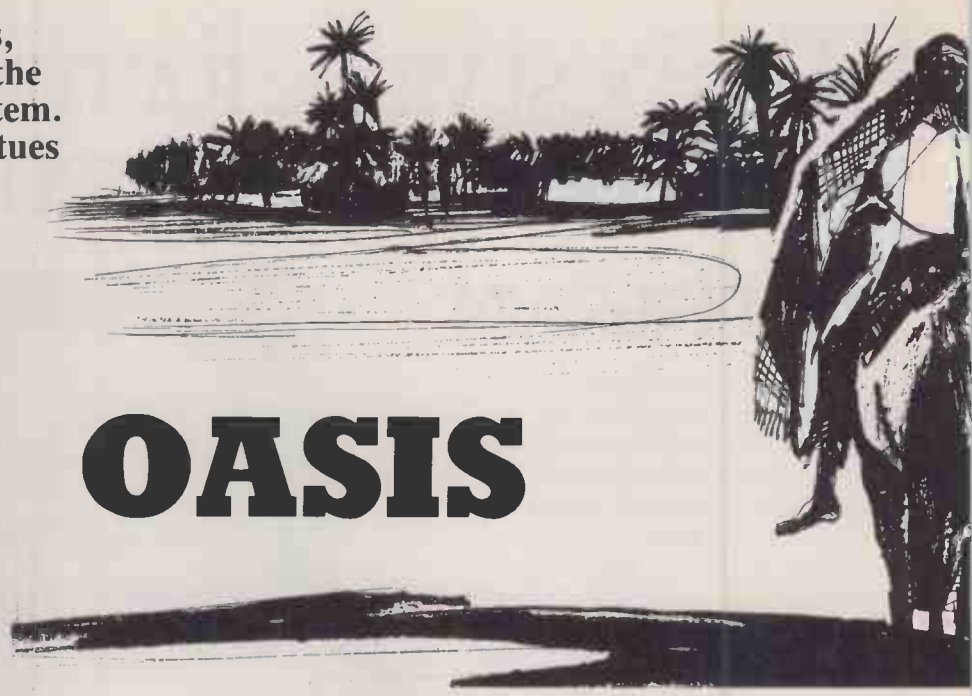
● **Circle No. 141**

Despite frequent complaints, CP/M has so far remained the premier Z-80 operating system. David Watt assesses the virtues of another contender.



OASIS

FOR MICRO SYSTEMS Digital Research's CP/M is much the most popular single-user operating system. It achieved this enviable position by being the first operating system which was easily transportable to different hardware, having a relatively small portion called Bios which needs to be rewritten for different systems.

Yet there are complaints about CP/M's difficulty of use, poor error reporting and poor documentation. In the past 18 months, there has been considerable interest in multi-user systems though MP M, Digital Research's answer to this demand, has been fraught with difficulties. As a result, some other operating systems have begun to make their name in the market, one of the most promising of which is Oasis.

Oasis was developed as an operating system for Z-80 systems by Phase One Systems of Oakland, California. Phase One, who was founded in 1977, now has about 25 staff and sales of about $2.5 million a year.

The operating systems may be supplied as a single-user or multi-user version, both being completely compatible. Included with the operating system are the following system development and support tools:

Exec — an interactive command language interpreter

Table 1. Oasis commands.

Disc-maintenance system diagnostics		
Archive	Recover	Memtest
Backup	Repair	Seek
Initdisc	Restor	Verify
Inittape		
File maintenance		
Assign	Erase	Peek
Attach	FileList	Rename
CopyFile	GetFIle	Sectore
Create	Kill	Sort
DumpDisk	List	State
Edit	Mount	TextEdit
Program development and execution		
Basic	Filt8080	Macro
Debug	Force	Patch
Edit	IntelHex	Relocate
Exec	Link	Run
Communications Oasis parameter maintenance		
Bisync	Account	Show
Maslbox	Change	Spooler
Msg	Load	Start
Receive	OwnerChange	Stop
Send	Set	Sysgen
Terminal	Share	Unload

Basic — interpreter/compiler
Edit — a line-oriented editor
Script — a text-formatting utility
Comm — a suite of programs for communications between terminals or other systems
Macro and Link for assembler-language programming

On initialising or booting the system, from disc, the Nucleus, Command String Interpreter device drivers and terminal class files are loaded from disc. The Nucléus is the core of Oasis, and handles the basic tasks of job scheduling, interprocess communication, memory management and file management.

The Command String Interpreter, CSI, checks the syntax of commands and loads and executes them. Table 1 lists the commands available. In most cases only one or two characters have to be typed, and there is an integer calculator. It uses reverse Polish notation, which means if you want to perform an operation on two numbers you have to type the two numbers first followed by the operand, thus typing

123 456 +

gives the result 579. This may seem a bit strange to use at first, but it is very simple to implement and efficient in operation.

The device drivers contain the routines to control input and output to the various peripherals used by the system: discs, printers, tapes, terminals. With a very diverse range of VDUs now available for using with computer systems, problems can arise if different types of VDU are used on the same system. In many operating systems different drivers have to be written for each VDU.

In Oasis a standard set of terminal functions is defined and a set of parameterised terminal class files is provided to set out the control character sequences used by different types of terminals. When configuring the system you can use the Attach command to assign a class file to a particular VDU. The Oasis manual has a list of about 30 different class files, although not all of them were supplied with our evaluation system. The manual describes how to set up new terminal class files if there is more for your particular VDU.

&BegStack	&Index	&Retcode
&BegType	&Len	&Skip
&Cat	&Line	&Space
&Control	&Lit	&Stack
&CRT	&Null	&Sub
&End	&Page	&Typ
&Error	&Quit	&Until
&Esc	&Read	&Wait
&Foto	&Repeat	&While
&If		

Table 2. Exec keywords.

When operating as a multi-user system, different accounts may be set up for each user of the system. Various levels of security are provided. Files created by a particular user belong to his account and may not be accessed by other users unless a file is designated as shareable, using the command Share.

All files in the System account are shareable but an account may be assigned a privilege level in the range 0 to 5. Only commands with a privilege level less than or equal to the account privilege may be used when in that account.

In order to use the system when in multi-user mode, the user has to LogOn to an account. An optional password may be required when logging on. An asterisk is displayed for each character of the password as it is typed in. The LogOn and LogOff commands may automatically update a history file providing a record of who is using the system.

The Z-80 processor can address 64K of memory at one time. Multi-user systems require more memory than this.

Auto	Load	Save
Bottom	Locate	Step
Break	LPList	Top
Change	LPXRef	Trace
Continue	Modify	Trace Vars
Delete	Name	Unbreak
Help	New	Untrace
Indent	Quit	Vars
Length	Renumber	XRef
List	Run	

Table 3. Oasis Basic commands.

Oasis is a bank-switching system. If more than 64K of memory is available to the system the first 16K is designated as shareable, non-switching memory. This contains the Nucleus plus certain re-entrant programs which may be used by all users.

Remaining memory is then split into separate banks; the total size of each bank plus shareable memory must not exceed 64K. Individual banks may be further split into smaller user partitions if required. When a program is loaded it remains permanently in memory, and there is no need for programs to be swapped out to disc.

The system turns on each bank in turn and executes a portion of code until either a predetermined time has passed or an input or output task is initiated. Because the processor would normally be idle during input or output it can be used more efficiently, but it appears to end-user as though the system is working exclusively on his task.

Four types of files are implemented by Oasis: sequential, direct, indexed and keyed. The routines for handling these files are contained within the Nucleus, and are thus available to all programs running under Oasis. Thus, indexed files may be accessed by assembler or Basic programs and are maintained in exactly the same format. Oasis also features automatic record locking and optional file locking; again the Nucleus manages these functions.

Indexed and keyed files are very similar in format. When adding a record, a hashing algorithm is used on the key to find the position in the file to write the record. If that position is already in use the key is rehashed to find a new location. A similar process is used when locating a record. Only one key is allowed for a file, and that key may be up to 128 characters long.

Indexed files differ from keyed files in that each record has associated with it a pointer to the next record in sequence. This means records can be read in sequence, but makes the process of adding a record slightly longer. Sequential access can start from any point in the file even if the first key specified is not found. The hashing technique for indexed and keyed files is reasonably efficient until the file becomes 70 to 80 percent full, so it is best to allocate extra space when creating the files.

Indexed and keyed files may have a key of up to 128 characters. The hashing technique does not permit duplicate keys — that is, two or more records in the same file with identical keys — though this can be simulated by adding a unique code to the end of a key.

A comprehensive job-control language, Exec, is provided with Oasis. It allows complex processes involving the use of several commands to be set up. Exec features conditional execution, branching, loops and the &CRT command to enable direct control of VDUs.

Case	If-Then	Put Port
Cend	Input	Quit
Chain	Let	Randomize
Clear	Link	Read
Close	LInput	Read Next
Common	Mat	Rem
CSI	Mat Input	Restore
Data	Mat Print	Resume
Def FN	Mat Read	Return
Delete	Mat Write	Run
DFM	Mount	Select
Else	Next	Sleep
End	On Error Goto	Stop
FNEnd	On Goto	Then
For	On Gosub	Wait
Get	Open	Wait Device
Device	Option	Wait Port
Get Memory	Otherwise Print	Wait Memory
Get Port	Print Using	Wend
Gosub	Put Device	While
Goto	Put Memory	Write

Table 4. Oasis Basic statements.

There are several Help facilities within Oasis. When using the system commands, Help may be used to list all the commands available, or information may be displayed on how to use a specific command. Help is also available when using the Basic interpreter to list the Basic commands, statements and functions. A useful feature when displaying long lists is the VDU screen wait, which occurs when a screenful of data has been displayed: the system waits for the space bar or Return key to be pressed before displaying the next screen. This feature can be switched on and off.

Basic is supplied as the standard high-level language for use with Oasis. RMCobol, Fortran 77 and Pascal compilers are also available.

Oasis Basic is both an interpreter and compiler, which means programs may be developed using the interpreter to give flexibility of modification and ease of debugging. When programs are debugged they may be compiled, making them faster to run and more economical with space on disc and in memory. Software suppliers need not supply the source code. One problem with this approach is that it is possible to write larger programs when they are compiled than when using the interpreter, but in this case the interpreter may still be used to test portions of the program.

Oasis Basic is a flexible implementation, whose features include multiple-line user functions using the Def FN, FNEnd combination; structured programming constructs, including Case and While-Wend; matrix input, output and assignment; interfaces to assembler routines, USR, and system commands, CSI; and 13-digit BCD arithmetic or floating-point values in the range 10^{+126} to 10^{-126}. The commands, statements and functions pro-

(continued on next page)

Table 5. Oasis Basic functions.

Abs(N)	EXT$(A$,N1,N2)	Match (A$,B$)	RPad$(A$,N)
Asca$	Fix(N)	Max(N1,N2)	PRT$(N1,N$)
AT$(N1,N2)	Float(N)	Mid$(A$,N1,N2)	RTrim$(A$)
ATN(N)	Format$(N,A$)	Min(N1,N2)	SCH(N1,A$,B$)
Bin(A$)	Hex(A$)	Mod(N1,N2)	Sel(A$)
BinOf$(N)	HexOf$(N)	NBR(A$)	SGN(N)
CHR$(N)	INP	Oct(A$)	Sin(N)
COS(N)	INS$(A$,N1,N2,B$)	OctOf$(N)	Space$(N)
CRT$(A$)	Int(N)	OVR$(A$,N1,N2,B$)	SQR(N)
Date$(N)	Left$(A$,N)	Page(N)	STR$(N)
Day(A$)	Len(A$)	Pi	Tan(N)
Del$(A$,N1,N2,B$)	Line(N)	Pos(N)	Time$(N)
DTE$(A$)	Log(N)	Rep$(A$,N1,N2,B$)	Trim$(A$)
EOF(N)	LPAD$(A$,N)	Right(A$,N)	USR(N1,N2)
ERL	LRL(N1,N2)	Rnd	USR$(N,A$)
ERR	LSL(N1,N2)	Round(N1,N2)	Val(A$)
Exp(N)	LTrim$(9$)		

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8
Interpreter using								
floating-point variables	3.7	9.3	26.0	29.1	32.1	57.5	81.2	17.1
integer variables	1.9	6.2	14.1	14.1	17.2	31.1	50.9	–
Compiler using								
floating-point variables	3.6	6.8	21.8	24.8	26.7	47.1	65.6	16.7
integer variables	1.3	4.2	9.5	9.6	11.8	21.3	34.6	–

Table 6. Kilobaud benchmarks for Oasis Basic on CIS 300.

(continued from previous page)

vided are listed in tables 3, 4 and 5.

The compiler seems to be reasonably efficient, with 30 percent improvement in timings obtainable when using integer variables. Floating-point arithmetic offers less of an improvement, averaging around 15 percent. Results using the Kilobaud benchmarks on a CCS 300 micro are shown in table 6.

Among the other useful facilities provided with Oasis is Edit, a flexible line-oriented editor whose commands include Modify, which allows a line to be edited on a character-by-character basis. You can move the cursor along the line, inserting or deleting characters as you go. Many of Edit's commands are also available when using the Basic interpreter to type in programs.

Script is the text-formatting processor which is provided for word-processing applications. Combined with a screen-oriented editor like Magic Wand this would make a very useful system for word processing.

Communications are provided in the shape of Bisync, an IBM 2780/3780 emulator, MSG and Mailbox for sending messages to other users, and Receive, Send and Terminal for emulating a terminal to another system.

The documentation for Oasis is supplied in a single manual split into sections covering an introduction to the system and the system commands Exec, Basic, Edit, Script, the communications programs, Macro, and the link editor Link. It is well laid out, and though no indexes are provided it is quite easy to find what you want. The manual always explains computer terms when they need to be used but avoids the tiresome jokey style of some micro documentation.

Phase One has recently announced Oasis 16 for the new 16-bit systems; C is also available, as Oasis 16 is being written in this language. There are one or two 8086-based systems with Oasis 16 already implemented, and there are expected to be more by the end of the year. A version for 68000-based systems is expected early in 1983. Oasis 16 will complement the existing operating system offering upwards compatibility from Z-80 systems.

Conclusions

● Oasis is a very flexible system. There are a considerable number of options in the way the system may be set up. The terminal class files are a very good idea, as they enforce consistent approach to handling terminal functions and make it easier to attach different terminals to the system.

● The routines to control disc-file handling are all part of the Nucleus, not the various languages available. So a file written by an assembler program could be read by a Basic program. Index sequential and keyed files are implemented, and file and automatic record locking are available. The index sequential access method used is based on using hash tables rather than the now more popular balanced tree structures, and does not permit multi-key files, or records with duplicated keys. Oasis 16, when it is implemented, will feature balanced-tree indices with these options.

● Oasis is certainly transportable, and is available on at least 20 Z-80-based systems including Altos, California Computer Systems, Cromemco, Godbout, Morrow Thinker Toys, North Star, Onyx, TRS 80 model II, and Vector Graphics.

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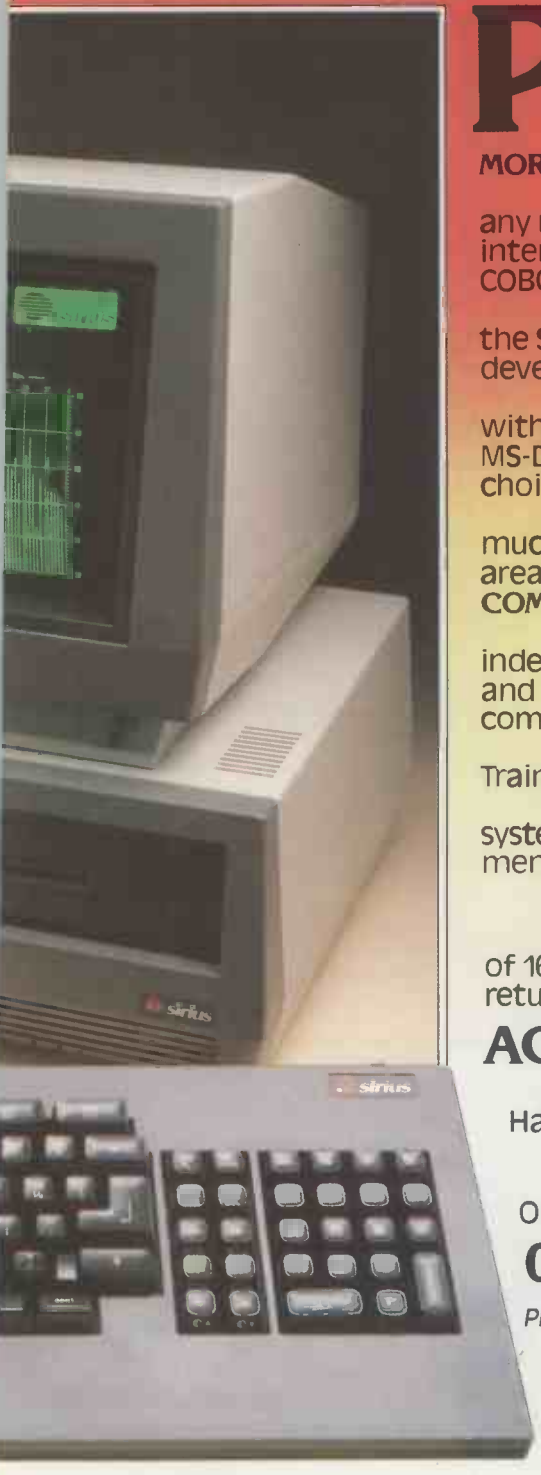

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Undue awe characterises attitudes towards programming for artificial intelligence, argues Mike Costello. Using the game of "eights" as an example he sets up a truly interactive game from a series of simple subroutines.

Basic steps towards intelligent programming

MANY MICRO OWNERS who are still feeling their way around Basic may think that the subject of artificial intelligence programming is altogether too esoteric for them. The logic of such programs must surely be very complex; they are usually written is assembly language and in any case they demand massive amounts of memory.

Although some AI programs conform to this description, the reality is that Basic is a suitable language for most AI applications. Memory capacity is not likely to be a handicap, and the logic of the programs is straightforward once the underlying principles are grasped. Everything depends on how you define artificial intelligence, of course, but a good working definition is a program which can carry out a "conversation" with a human player through the medium of a keyboard, giving intelligent responses to cues albeit within a strictly defined area of competence.

Chess problems

Much of the responsibility for the unnecessary awe in which AI programming is held can be attributed to the game of chess, or rather those who for many years now have been attempting to write chess-playing programs. The consensus is that chess is the most advanced of all games and that a program which simulates a human chess player will be the most convincing example of machine intelligence.

There is no agreed definition of intelligence, but it would generally be accepted that the complexity of chess lies in the need to look many moves ahead. Since there is only a negligible chance element in the game, and all the relevant circumstances which will affect both players are known to them in advance, the best chess program would have to look an infinite number of moves ahead. Clearly this is an impossibility, and more recent work in this area has concentrated on working out general rules of strategy that the computer can apply in order to shorten its search through the enormous number of possible moves.

It is questionable whether this activity can teach anything about the nature of games in general. The number of games in which there is no chance element is actually quite small — you would have to exclude all card games, for example. Equally, there are very few games in which it is possible to look more than a few moves ahead. Many games involve an element of bluff, which means that the opponent's state of mind must be considered; and there will be occasions — during a Poker game, for example — when you may decide to play in a non-optimal way in order to deceive your opponent, for the sake of a gain to be made later.

Eights is an excellent little two-player card game played with a standard 52-card deck. The dealer gives seven cards to each player. The non-dealer can discard any card, and the dealer then has to play a card which is either of the same suit or the same denomination. The non-dealer then plays a card of the same suit or denomination as dealer's card, and so on.

Rules of the game

If a player does not have a playable card, he must draw from the pack until he finds a card he can play. He is not compelled to stop drawing as soon as he finds such a card, but the game is won by the player who gets rid of all his cards first. The winner scores for the cards in his opponent's hand, scoring most for cards of a high denomination. The only complication is that all 8s are wild: an 8 can always be played, and the player stipulates the suit of the card that must be played on to it.

Although the rules are so simple, there is a considerable amount of skill in eights. Making the machine play intelligently turned out to be rather more difficult than expected. In particular, it was hard to give the program enough flexibility in its strategy to cope with different human opponents using different kinds of strategy. The solution was to incorporate an element of "bluff": the machine had to confuse and, if possible, mislead the player as to the kind of cards it was currently holding in its hand.

String variables

The listings, which are in TRS-80 Basic, show the part of the program which enables the machine to play intelligently against a human. Listing 1 sets up the initial values and storage areas for data within the program. There are 300 bytes set aside for string storage, after which all variables beginning with letters from M to Z will be regarded as integers, and all the others are defined as string variables.

A large number of arrays are defined, since using arrays freely is one of the secrets of writing this sort of program — though it does presuppose that you have no problems with shortage of memory. The first three arrays are used only to shuffle the cards at the start of each game. Array P should be thought of as a sheet of paper, ruled with horizontal and vertical lines. This "sheet" contains 13 rows and four columns. It is used to hold the cards currently in the player's hand during the game, a number which can never exceed 52, the maximum capacity of the array.

The advantage of using a two-dimensional array with 52 elements is that the machine can figure out what kind of card is stored in a particular location in this array just by being told where it is. The columns correspond to suits, and the rows to denominations. Rows 0, 1, 2 and 3 hold clubs, diamonds, hearts and spades, respectively.

If the player decides to play the king of diamonds, for example, the machine should go to row 13, column 1 of the array. If a positive value is stored there, the machine knows that the player is

(continued on page 79)

Listing 1.

```
15 CLEAR 300: DEFSTR A-L: DEFINT M-Z
18 '
20 DIM M(51), MT(51), MM(100), P(12,3), T(12,3), Q(3), QS(3), QT(3), QD(3): RAND
OM: V5=1:  S8=210: S7=274: RN=100: RM=51
54 '
```

(continued from page 77)

actually holding that card, and the card can be played. The positive value is replaced with a zero, signifying that the player will be unable to play that card again.

Array T represents cards in the machine's hand. The Q series of arrays are used by the machine to work out the best card to play next, and can be a little confusing if the distinctions between them are not kept clear. Each array can hold values corresponding to the four suits, as follows:

Q holds the current total number of cards in the discard pile for each suit.

QS holds the current total number of cards in the machine's hand for each suit.

QT is used for temporary storage of the values from QS during computation.

QD locations will each always hold one or zero. For example, a one in location 0 means that the machine has a club of the same denomination as the card just played by the player; a zero would mean no such match. The machine uses this information when deciding whether it is best to play a card of the same suit as the card led, or whether it is better to switch suits.

Improving procedure

The Random statement in line 20 tells the machine to improve its procedure for choosing random numbers. Random numbers have to be picked out when shuffling the cards; a version of Basic with such a statement will, all things being equal, be better at picking genuinely random numbers than one without. The other variable values set in line 20 refer to screen locations for the Print@ statement, the shuffling routine and the tally of the number of hands played so far in the game, V5.

In the full listing for the game of eights, a few lines print an introductory title on the screen. They are followed by a routine to shuffle the deck before dealing the first hand, that is by loading array M with 52 specific values in a genuinely random order — listing 2.

Line 100 uses four-digit numbers to store both the suit and the denomination of cards in each location of the array; the ASCII values for S, H, D and C are 83, 72, 68 and 67, respectively. The idea is to get the first two digits of the four-digit number, and print the CHR$ representation of them on the screen to show the suit. The final two digits, in the range 1 to D give the denomination.

Temporary array

Although this method works, it is not essential to store the information this way. Line 100 and the subroutine at 150 store the 52 values in a temporary array MT and then go into a loop which will "throw" the values into a larger, intermediate array MM at randomly chosen locations. Line 120 then picks the values out of MM one by one, and transfers them to the final array M from where they can be picked out as the machine "deals" cards.

Listing 2.

```
60 CLS: PRINT@256, "A MOMENT WHILE I SHUFFLE ...";
80 '
100 X=0: Y2=6701: GOSUB 150: Y2=6801: GOSUB 150: Y2=7201: GOSUB150: Y2=8301: G
OSUB 150: FOR X=0 TO 51: Y5=MT(X)
105 '
110 Y6=RND(100): IF MM(Y6))0 THEN 110 ELSE MM(Y6)=Y5
115 '
120 NEXT: Y6=0: FOR X=1 TO 100: IF MM(X)=0 THEN NEXT ELSE M(Y6)=MM(X): Y6=
Y6+1: NEXT
125 '
130 GOTO 200: REMARK: CONTROL PASSES TO RULES-DISPLAY ROUTINE
140 '
150 FOR Y=Y2 TO Y2+12: MT(X)=Y: X=X+1: NEXT: RETURN
```

Three arrays are used for shuffling. The problem in writing this routine is that it is really an inverse sort. There are plenty of routines to sort numbers in arrays, but routines to start with sorted numbers and mix them up are a rarity. You could dispense with the MM array altogether and transfer numbers from MT to M, but before putting a number in a randomly chosen location in M, the program must make a check that it has not already put one there. It tests for the presence of a value greater than zero in a location, and if it finds one, goes away and picks another at random.

Towards the end of the process, however, most of the array locations have been filled and the machine can spend an excessive time looking for a location that is still empty. The solution used was to transfer the numbers to MM, which has 201 locations, so that the machine would not waste much of its time addressing locations already filled — only about half the locations are filled at the end of the routine. The values are then moved from MM to the more compact M array one by one, ignoring the many zero locations in MM.

Dealing the cards

Once the 52 cards are sitting in M the first seven can be picked out and dealt to the player; the next seven are then picked out and given to the machine. On the TRS-80 display the machine's cards are shown as seven graphics blocks along the top of the screen, with more room for drawn cards later if necessary.

The player's cards are sorted into suits and then displayed in ascending numerical order, using an A to represent an ace, and so on. A little picture of the rest of the pack is drawn, showing an empty frame where the discards are going to appear.

It is worth noting that these routines took at least as long to write as the AI section of the coding. The program aims for maximum "user-friendliness", which is always desirable, but is also very time-consuming.

The method chosen for storing information makes it easy to write coding that will allow the machine to make intelligent decisions. Thus one major problem of AI programming has already been overcome, namely, how to translate the information that the machine needs in order to make its decisions into numeric values which the machine can easily access.

The machine's decisions must now be broken down into a series of steps, each one of which can then be translated into one or two program lines. This part of the program can be drafted in advance using pseudo-code, which is an intermediate step between ordinary English and the Basic program listing itself, and the pseudo-code for the AI ingredient of the eights program is shown in figure 1. This is not necessarily the best way of preparing to write a program. Much depends on the working habits of the individual programmer, but it is worth considering as a way of preparing for the job of writing the coding itself.

Play routine

The pseudo-code assumes that when the routine is used by the machine, the human opponent has just played a card and the machine must decide what response to give. The first step is to check whether the machine has some card in another suit of the same denomination as the card just played. The denomination of that card is stored as the variable WD, varying from 1 to D. The machine also knows the array address of the player's card: WC corresponds to the column in the P array for cards of that suit, and PD corresponds to the row for that denomination.

The machine will make a special check to see if the card is an 8; if it is, there is no point in wasting time looking for cards in other suits since the player can dictate the suit that must be played on to an 8. Otherwise, look for matching denominations in other suits in order to establish the full range of cards held by the machine which could legally be played.

If the routine finds that the machine has a choice of suits, the next thing to do is to establish the longest such suit. The machine will always choose to play from its longest suit if possible since its opponent will probably have to respond with another card of the same suit.

It may be that the machine's preferred suit is the suit of the led card anyway, either because it is also the machine's longest suit or because it does not have any matching denominations. In that case all that remains is to pick the highest

(continued on next page)

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denomination in that suit, since the machine wants to get rid of high-value cards which would count in favour of a winning opponent. The machine always saves up 8s for emergencies.

The routine for finding the highest card in a given suit works by a For-Next loop which counts down through the array column backwards, jumping back to the main routine when it finds a positive value. The same routine can be used even if the machine turns out to have no cards in that suit; in that case, control returns from the routine with the counter variable set at −1.

If this has happened and the machine cannot switch to another suit it has to consider whether it has any 8s.

Otherwise it will have to draw a card, and control passes to the appropriate routine. If it does, it has to weigh up the advantages of playing the 8 on the one hand — getting rid of another card and being able to force the suit to be played on to it — and choosing to draw on the other hand, keeping the wild card for a rainy day.

This decision needs a separate routine, which checks things like how many cards the human player still holds and how many cards are left in the pack. If the machine decides to draw, it will be sent to the card-drawing routine with instructions to draw up to a specified number of cards. If it has not found a playable card by then it gives up and plays with its 8 anyway.

If the machine plays an 8, it still has to decide what suit to force to follow it, and the routine for this uses the "weighing factors" that are a feature of AI theory.

Listing 3.

```
6000 PD=WD-1: IF WD=8 THEN 6400 ELSE FOR X=0 TO 3: QD(X)=0:NEXT:X=0: FOR TC=0 TO
 3: Y=T(PD,TC): IF Y)0 THEN QD(TC)=1: X=X+1:NEXTELSE NEXT:REMARK:NOTE ANY MATCHI
NG DENOMINATIONS IN OTHER SUITS (UNLESS FOLLOWING 8, THEN ONLY  WANT TO LOOK AT
THE FORCED SUIT)
6010 IF X=0 THEN 6400: REMARK: WE JUMP TO 6400 IF THE MACHINE CANNOT MATCH THE D
ENOMINATION OFTHE CARD LED
6015 '
6020 GOSUB 7010: REMARK: ON  RETURN FROM THIS SUBROUTINE WE HAVE STORED THE LENG
TH OF EACH  SUIT HELD BY THE MACHINE IN THE ARRAY QS
6025 '
6030 FOR X=0 TO 3: IF QD(X)=0 AND X()WC THEN QS(X)=0: NEXT ELSE NEXT: REMARK: TH
IS TELLS THE MACHINE TO IGNORE SUITS  WITHOUT MATCHING DENOMINATIONS  BY NULLING
 THE VALUE IN QS
6035 '
6040 GOSUB 8600: REMARK: ON RETURN, X3 HAS A VALUE EQUAL TO THE COLUMN IN THE T
ARRAY FROM  WHICH THE MACHINE WILL PLAY ITS CARD
6045 '
6050 IF X3=WC THEN 6100: REMARK: TESTING TO SEE IF THE MACHINE'S PREFERRED SUIT
IS THE SAME AS THE PLAYER'S LED SUIT
6055 '
6060 TC=X3: TR=PD: GOTO 8000: REMARK: MACHINE'S CHOSEN SUIT IS IN X3 AND THE DEN
OMINATION IS  THE SAME AS THAT OF THE PLAYER'S CARD
6065 '
6100 GOSUB 7030 :TC=X3: TR=X: GOTO 8000: REMARK: ON RETURN FROM 7030 WE HAVE FOU
ND THE  HIGHEST CARD (OTHER THAN AN 8) IN THE CORRECT SUIT.  X3=THE  SUIT AND X=
THE DENOMINATION
6095 '
6400 X3=WC: REMARK: WE DON'T HAVE THE SAME DENOMINATION IN  ANOTHER SUIT, OR WE
ARE FOLLOWING AN 8 WHICH FORCES A PARTICULAR SUIT.  LOOK FOR A CARD IN THAT SUIT

6405 '
6410 GOSUB 7030: REMARK: ON RETURN, X= THE HIGHEST CARD WHICH  IS NOT AN 8
6415 '
6420 IF X=-1 THEN 6440: REMARK: WE HAVE NO CARDS IN THE LED OR  FORCED SUIT EXCE
PT PERHAPS AN 8
6425 '
6430 TR=X: TC=WC: GOTO 8000: REMARK: PLAY THE CHOSEN CARD  WHICH IS IN THE LED S
UIT
6435 '
6440 FOR X8=0 TO 3: IF T(7,X8))0 THEN 6460 ELSE NEXT: REMARK: IF THE VALUE IS GR
EATER THAN ZERO WE HAVE AN 8 AND JUMP TO 6460
6445 '
6450 GOTO 7600: REMARK: WE CAN'T PLAY A CARD SO WILL HAVE TO DRAW ONE
6455 '
6460 U6=0: IF U=1 THEN TC=X8: TR=7: GOTO 8000 ELSE GOSUB 7300: XF=X3: GOSUB 6490
: IF U6=0 GOSUB 7400: TC=X8: TR=7: GOTO 8000 ELSE U5=X8: GOTO 7600
6465 '
6490 IF PU(4 RETURN ELSE IF Z)45RETURN ELSE U8=INT(52-Z)/4:U7=0:U6=1: RETURN
```

Figure 1. Intelligent elements of program for eights.

Denomination in WD. Address is P(PD,WC)

if the card is an 8, player has forced us to play a given suit (WC) so go straight to routine A

— else go through machine's cards noting any matching denoms

if none, go to routine A

— else find out how many cards in each eligible suit

— then select the longest suit

if longest eligible suit or only eligible suit is led suit we can play any denom, so pick highest non-8 and go to card-play routine

— else we can only play the one card, the matching denom, so go straight to card-play routine

ROUTINE A
looking for cards in a particular suit

if any, choose highest and go to card-play routine

— else have we got any 8s?

— if not go to card-draw routine

— else decide whether playing or drawing up to specified number of cards first

if playing, go to card-play routine

— else go to card-draw routine with specified number

CARD/PLAY ROUTINE
play the card: if it is an 8, note the suit we are forcing rather than the suit we are playing; print a special message if we are playing our last card and it is an 8; else note that it is the player's turn next, and return from the AI section of coding

The machine is looking for suits in which cards are scarce from the player's point of view but are plentiful in the machine's hand.

It therefore scores, say, 20 for a card of a particular suit in its hand, and also scores, say, 4 for a card of that suit in the discards, since that indicates that there are fewer cards of that suit available to the player. After totting up the score for each suit, one suit emerges with the highest score, and that is the one to force.

The two weighting factors are different because holding a card of a suit is more important than knowing that the human opponent is unlikely to hold one; in practice, both values are likely to be altered during testing, to produce optimum play from the machine. A human player has much more trouble remembering the discards, of course, so the machine can be expected to be rather good at selecting just the right suit to force.

With this explanation in mind, the reader should be able to follow the actual program listing — listing 3. Lines 6020 and 6030 carry out the job of finding suits which have playable cards, either because they have matching denominations or correspond to the led suit. The specified number of cards the machine is prepared to draw before falling back on its 8 is calculated in line 6490, and so on. The plethora of Gosub calls tidies away all the procedures the machine has to go through to achieve its results into separate chunks of coding, leaving the main routine from 6000 to 6490 showing the flow of logic summarised in the p-code.

The subroutines themselves are shown in listing 4. The card-draw routine loops around indefinitely looking for a playable card, but always checking that it has not reached the end of the deck, Z = 52, and that the number of cards it is allowed to

(continued on page 83)

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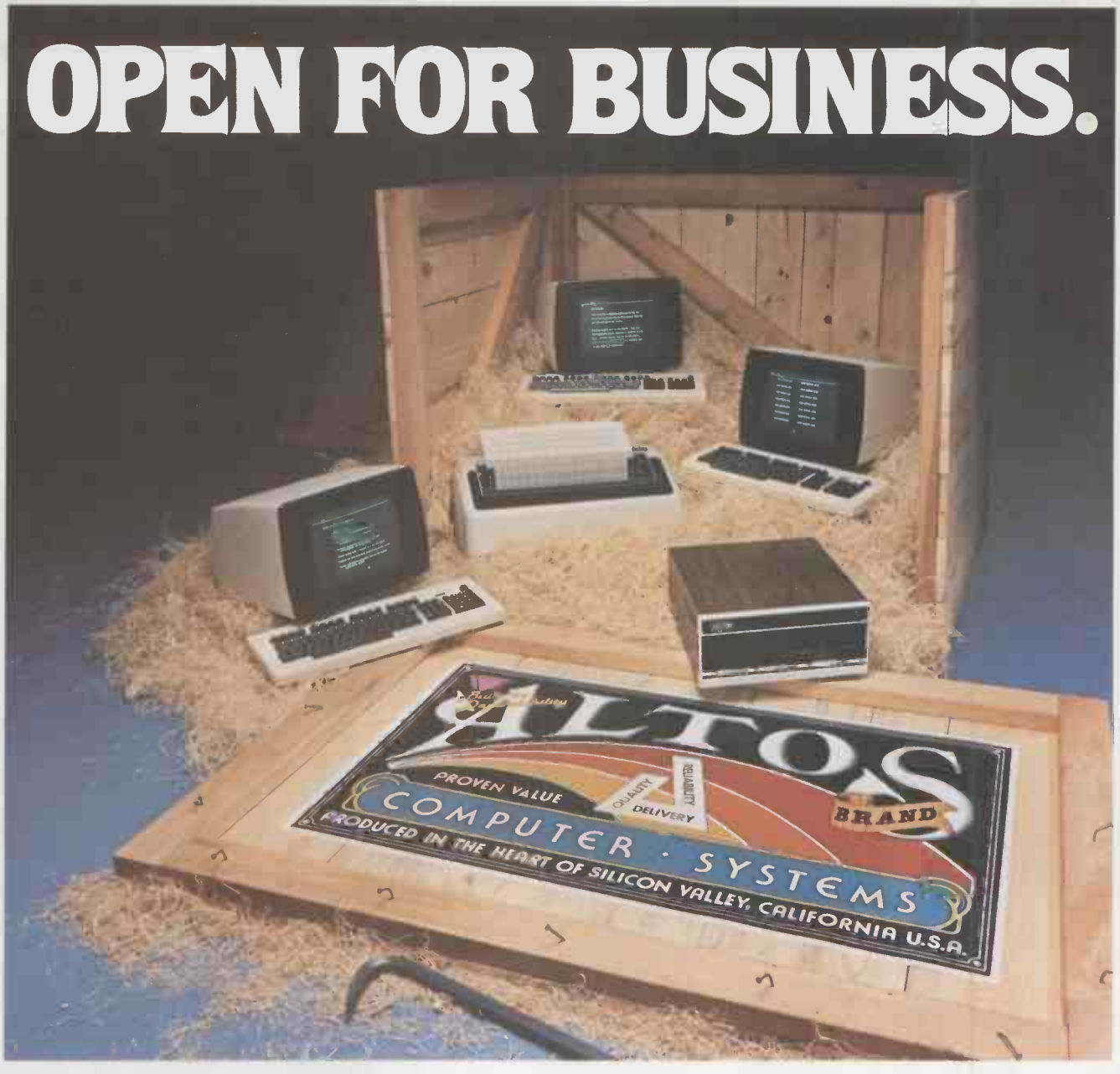

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draw, U7, has not reached the maximum. U8.

The program makes its decisions so fast that delay loops must be inserted into the program. Otherwise the player becomes bewildered by the screen display, which shows drawn cards appearing in the machine's hand, the machine's comments as it is playing, and so on.

When testing the program I generally played the machine to a draw, yet another player managed to beat it every time. At this stage the program did not include the routines which allow the machine to hold on to an 8 and draw from the pack instead of using the 8 up. I generally played an 8 rather than drawing, and I had unwittingly designed this thing in my own image, giving it my own strategy which turned out not to be the best.

The missing routines were therefore added, and the program is now much better able to cope with different play strategies from different human opponents, although of course it does not actually learn from experience. The effect of these routines is to make it much more difficult for the human player to guess what the machine holds in its hand, as the signals given by the machine concerning cards played and number of cards drawn are now often misleading.

There should be little difficulty in adapting the listings here for other dialects of Basic, such as the 8K ZX-81. One obvious point is that arrays start from 1 not 0 on the ZX-81, so you will need to store denominations in rows 1 to D rather than 0 to C. This actually makes the coding much easier because, for example, the denomination, WD, can also be used for the array address, PD, rather than always having to subtract 1. Local variable types may have to be used if there is no type declaration facility but as a bonus full-length variable names can be employed, making it much easier to trace the flow of the program from the actual listing.

Arrays, string storage, variable storage, run-time allocation	1,600 bytes
Titles and rules text	4,300 bytes
Screen formatting	1,300 bytes
Handling user-input and user-proofing	1,600 bytes
A.I.	2,300 bytes
End-of-hand and end-of-game routines	1,100 bytes
Subroutines common to several areas of the coding	1,100 bytes
Total	about 13,300 bytes

Memory requirements of eights program.

Multi-statement lines will, of course, have to be broken up into separate lines, although you may be able to acquire a machine-code utility that allows multi-statement lines, which certainly speeds things up. You do have to be careful when dealing with long lines involving the Else statement, not available in all Basics.

Line 6460 sends control in one of a number of different directions, depending on what conditions are fulfilled. It can be rewritten as single-statement lines, each of which repeats the same test. It cannot be assumed, however, that all possible conditions are covered in a line of this structure. There may be a default condition dealt with in the next line, and control drops through to it if none of the Else-If conditions are met.

Apart from this, the statements used in the program should correspond to statements available in the Basics of most popular models of microcomputer. The Radio Shack Basic which Microsoft wrote for the TRS-80 four years or so ago was one of its earliest and most thorough attempts, and most of the Basics that have become available since then are subset of this original version. It is a different story with hardware-dependent features like screen formatting statements which vary from one model to another.

Finally, some Basics are more lax about details than others. For example, the ZX-81 insists on the use of Let in assignment statements, and lines like

```
IF X=1 THEN 3000
```

should be rewritten

```
IF X=1 THEN GOTO 3000
```

Users of non-Microsoft Basics like the Atom are probably already used to translating program listings into their own dialect. Whatever hardware you are using it would be wise to make a preliminary estimate of the memory consumption of the whole program, which is considerably more than that required for the AI routines themselves.

A tape of the complete program is available from Entersoft, PO Box 22, Droitwich, Worcestershire, WR9 9HJ. It is currently available in a TRS-80 version, and is being rewritten for the ZX-81.

Listing 4.

```
6499 REMARK: ROUTINE TO BUILD UP VALUES IN QS
7000 GOSUB 7010: GOSUB 8600: GOSUB 7030: GOSUB 7050: TR=X: TC=X3: RETURN
7005 '
7010 FOR X=0 TO 3: QS(X)=0: NEXT: FOR TC=0 TO 3: FOR TR=0 TO 12:IF TR=7 THEN 702
0 ELSF IF  T(TR,TC))0 GOSUB 7025
7020 NEXT: NEXT: RETURN
7025 QS(TC)=QS(TC)+1: RETURN
7029 REMARK: ROUTINE TO FIND HIGHEST CARD
7030 FOR X=12 TO 0 STEP-1: IF X=7 THEN 7040 ELSE IF T(X,X3))0 THEN RETURN
7040 NEXT: RETURN
7049 REMARK: ROUTINE TO DISPLAY PLAYED CARD (CALLED BY LINE 8000)
7050 Q(X3)=Q(X3)+1: XL=T(X,X3): T(X,X3)=0: Y=XL: GOSUB 2550: PRINT@S8,"  ";: PRI
NT@S8,  CHR$(WS);: Y5=WD: GOSUB 2300:PRINT@S7,"  ";: PRINT@S7,F;: RETURN
7299 REMARK: ROUTINE TO WEIGHT  SUIT VALUES
7300 FOR ZZ=0 TO 3: QS(ZZ)=0:  NEXT: FOR ZZ=0 TO 3: FOR ZY=0 TO 12: GOSUB 7350:
NEXT: NEXT: VS=(Q(0)*5)+(QS(0)*20): VH=(Q(1)*5)+(QS(1)*20):  VD=(Q(2)*5)+(QS(2)*
20): VC=(Q(3)*5)+(QS(3)*20)
7305 IF QS(0)=0 THEN VS=0
7306 IF QS(1)=0 THEN VH=0
7307 IF QS(2)=0 THEN VD=0
7308 IF QS(3)=0 THEN VC=0
7309 REMARK: DON'T FORCE A SUIT MACHINE IS VOID IN, WHATEVER THEWEIGHTING FACTOR
S SAY
7310 QS(0)=VS: QS(1)=VH: QS(2)=VD: QS(3)=VC
7320 GOSUB 8600: REMARK: COME BACK WITH THE CORRECT SUIT TO FORCE = X3
7330 RETURN
7350 IF ZY=7 OR T(ZY,ZZ)=0 RETURN ELSE QS(ZZ)=QS(ZZ)+1: RETURN
7399 REMARK: ROUTINE TO PLAY AN 8
7400 IF U=1 THEN PRINT@384,"I'M AFRAID MY LAST CARD'S AN 8";:RETURN ELSE IF X3=0
 THEN J=C5 ELSE IF X3=1 THEN J=C6 ELSE IF X3=2 THEN J=C7 ELSE J=C8
7410 PRINT@384, "I'M GOING TO PLAY AN 8 - YOU WILL HAVE TO PLAY "J;: PRINT@832,
CHR$(30);: PRINT@896,"NOTE THIS SUIT, THEN PRESS ANY KEY";: PRINT@960, CHR$(30);
: GOSUB 16000: PRINT@384, CHR$(216);: PRINT@896,CHR$(30);:PRINT@960,C9;: RETURN
7599 REMARK: ROUTINE TO DRAW CARDS UNTIL PLAYABLE CARD FOUND OR OTHER CONDITIONS
 MET
7600 IF Z=52 GOTO 8500 ELSE  PRINT@384,"";: GOSUB 7700: GOSUB16100: Y=M(Z): Z=Z+
1: U7=U7+1:  GOSUB 2550: PRINT@384,CHR$(30);:IF Z=47 GOSUB 26000 ELSE IF Z=52GOS
UB 10500: REMARK: AT THIS POINT WD=DENOM. AND WS=SUIT
7610 GOSUB 2600: REMARK: TC NOW HAS VALUE FROM 0 TO 3
7620 T(WD-1,TC)=Y: U=U+1: GOSUB 2100: REMARK: DRAWN CARD HAS BEEN STORED IN MACH
INE'S HAND
7630 IF WD=8 OR WD-1=PD OR TC=WC THEN 7650: REMARK: 7650 IF IT  CAN BE USED AS D
ISCARD
7640 IF U6=0 THEN 7600 ELSE IF U7(=U8 THEN 7600 ELSE X3=XF: GOSUB 7400: TC=U5: T
R=7: GOTO  8000
7650 IF WD=8 THEN XT=X: TT=TC: GOSUB 7010: X=XT: TC=TT: GOSUB 7300: XF=X3: GOSUB
 7400: TR=7: GOTO 8000 ELSE TR=WD-1: GOTO 8000: REMARK: NOTE THE SUIT THE MACHIN
E IS FORCING IF PLAYING AN 8, FLSE JUST PLAY IT
7990 REM**************************
7995 REMARK: ROUTINES IN LISTING 3 JUMP HERE
8000 PRINT@384, "HERE'S MY DISCARD ....";: GOSUB 16100: PRINT@384, CHR$(216);: S
4=0: R6=0
8010 U6=0: X=TR: X3=TC: GOSUB 7050: U=U-1: GOSUB 2100: R=0: IF TR=7 AND U=0 THEN
 PRINT@384, "I WIN WITH AN 8!      ";: GOSUB 16200: RETURN ELSE IF TR=7 THEN TC=X
F: RETURN ELSE RETURN
8011 REM**************************
8499 REMARK: ROUTINE CALLED WHEN MACHINE CAN'T PLAY ONE AND PACK IS EMPTY
8500 R6=R6+1: IF R6=2 THEN 19900 ELSE PRINT@384,"I CAN'T GO; YOU TRY TO PLAY ONE
";: GOSUB 16100: GOSUB 16100: PRINT@384,CHR$(30);: R=0: TR=PD: TC=WC: RETURN
8599 REMARK: ROUTINE TO FIND SUIT WITH MOST CARDS IN AND STORE ITS ARRAY COLUMN
IN X3
8600 IF QS(0))=QS(1) THEN X1=0  ELSE X1=1
8610 IF QS(X1))=QS(2) THEN X2=X1ELSE X2=2
8620 IF QS(X2))=QS(3) THEN X3=X2ELSE X3=3
8630 RETURN
```

Morse code translated using pattern recognition

Christopher Dracup and Derek Wakelin show how a microcomputer program can encode and decode morse, and act as a morse code tutor. The basic rule is that a Dah or dash should be three times the length of a Dit or dot.

THE RADIO AMATEUR, unlike computer hobbyists, has one or two hurdles to straddle before being permitted to engage in this pursuit. Although anyone may receive broadcasts on the amateur bands, an amateur licence must be obtained in order to transmit. There are two classes of amateur licence. The class B licence is available only to those who have learned sufficient about the hobby to pass a multiple-choice examination held by the City and Guilds of London Institute. With such a licence the amateur may transmit speech on the 144MHz amateur band or higher-frequency amateur bands.

Restriction to these bands effectively rules out long-range intercontinental contacts, commonly known as DXing. To operate on the lower-frequency amateur bands where DX contacts are more common a class A licence must be obtained and in order to do so the amateur must have passed the Home Office test in morse.

Send and receive

In the test, 36 words averaging five letters per word must be sent, and 36 words received in two periods of three minutes each. Up to four errors are permitted in the copy received and up to four corrections may be made while sending; there must be no uncorrected errors in sending. In addition, 10 groups of five figures must be sent and 10 groups copied in two periods of 1.5 minutes each. A maximum of two receiving errors is permitted in this section, and up to two corrections made while sending.

Many amateurs refuse or fall at this hurdle who are determined to gain access to the more interesting amateur bands. Others are prepared to expend vast amounts of time and money attempting to learn the code to the required level of proficiency.

Morse tutors have been available commercially for many years, and include simple records of morse code which the learner plays first at, say, 33rpm, and later at say 45rpm. Besides having to cope with the resulting change in pitch, the learner may be learning the particular messages on the record rather than the code itself.

Recently, dedicated electronic devices have been built to generate bursts of random morse for the learner to decode. Since the characters generated are not displayed, it is not possible to check the accuracy of the learner's performance. Microcomputer programs have been written to replace these tutors but are little more than replicas of the commercial morse tutors.

All these have certain limitations:

- They are generated without any knowledge of human learning and hence cannot claim to be designed to maximise learning. In particular they disregard the importance of feedback.
- They do not give the learners an opportunity to create their own morse and have it decoded in order to check that recognisable morse is being produced.

This program attempts to overcome these limitations. In it the learner has a choice of four options, to be selected depending on skill and whether morse is to be encoded or decoded.

Learning mode

Option 1 is used for learning the code. The learner presses the key of any letter or number, and the machine produces the appropriate morse. The program uses the Get command of the Pet, allowing the learner to enter characters into the input buffer ahead of the morse produced. Words are separated by using the space bar.

A friend with no knowledge of morse could help the learner by typing in a message on the keyboard. The Pet converts it into morse and the learner can try to decode it. All letters are displayed on the screen so that the subject can check performace later. This part of the program could be made to operate a relay actually keying a transmitter, thus allowing even a relatively inexperienced class A licence holder to be certain of sending good morse.

In option 2, which is designed to improve speed, the machine produces morse code corresponding to a randomly selected letter and waits for the learner to press the appropriate key on the Pet. After a key is pressed, the correct letter is displayed on the screen. If the correct key is pressed within a preselected time the machine confirms the choice and the probability of the machine presenting this character in future is decreased.

If the correct key is pressed, but after the time limit has elapsed, the machine informs the learner that the response was too slow and makes no change to the probability of the character appearing again. If the learner does not correctly identify the morse and a wrong key is pressed then the morse code is presented again and the learner is required to enter the correct letter, which is displayed on the screen. The probability that the machine will present a wrongly identified character in the future is increased.

Problems identified

The time allowed to respond is determined by the learner at the beginning of each run and may be reduced as proficiency increases.

Pressing the # key at any point displays the probability associated with each letter. Higher values indicate those letters with which the learner has had problems, whereas lower values indicate those letters which the learner identified more readily. This option allows the presentation of numbers rather than letters.

Option 3 is a morse test simulator which allows the learner to decode random morse at speeds specified in the Home Office test, or at other speeds determined by the user. One difference between the program and the Home Office test is that random letters are produced rather than plain language. Plain language contains a certain amount of redundancy, so missed letters can often be guessed correctly by the context. This is not so with groups of random letters, and anyone capable of decoding random letters at 12 words per minute can be quite confident of being able to decode plain language at the same rate.

The characters are printed on the screen while the morse is presented, giving a major advantage over conventional random morse generators. The display allows the learner to check the accuracy of decoding. The program also allows the learner to have longer spaces between

(continued on next page)

First symbol	If Dit	$1 \times 2 \uparrow 0 = 1$
	If Dah	$2 \times 2 \uparrow 0 = 2$
plus		
Second symbol	If Dit	$1 \times 2 \uparrow 1 = 2$
	If Dah	$2 \times 2 \uparrow 1 = 4$
plus		
Third symbol	If Dit	$1 \times 2 \uparrow 2 = 4$
	If Dah	$2 \times 2 \uparrow 2 = 8$
plus		
Fourth symbol	If Dit	$1 \times 2 \uparrow 3 = 8$
	If Dah	$2 \times 2 \uparrow 3 = 16$

total gives characteristic value of character C.

This can be expressed by the equation:

$$C = \sum c_i \times 2^{(i-1)}$$

where $:c_i = 1$, if the symbol is Dit
$:c_i = 2$, if the symbol is Dah

For example, the value for F ··—· is
$1 \times 2 \uparrow 0 + 1 \times 2 \uparrow 1 + 2 \times 2 \uparrow 2 + 1 \times 2 \uparrow 3 = 19$

Figure 1.

(continued from previous page)

characters without slowing down the characters themselves. A learner wishing to test his ability at decoding plain language can use option 1.

Option 4 decodes correctly sent morse, and will test the learner's ability to produce morse. The letters or numbers that the Pet identifies are displayed on the screen, allowing feedback on the accuracy of timing when sending morse.

A Dah or dash should be three times the length of a Dit or dot, and the time interval between Dits and Dahs in a character should be of one Dit duration. The time between two characters in the same word should be three Dits long, and the interval between words five Dits.

The program works on the basis of these rules, which represents ideal morse, but does allow a degree of error during input. The program can estimate the speed of a learner's morse by averaging the result of three Vs. Alternatively the speed can be entered directly if it is known.

While devising the program, all the problems encountered by researchers in artificial intelligence were encountered, including representation, constraints, searches, etc. The precise method of overcoming them varied, but usually included a large dose of serendipity. This fairly straightforward program should demonstrate to amateurs and hobbyists that they are dealing with exactly the same difficulties that beseige researchers on sophisticated programs that understand language, or read handwriting.

It was intended to make the program easy to transfer from one machine to another, so Basic was used rather than machine code. One problem was whether an interactive non-compiled language like Basic would be able to work fast enough. Although the program is written for an 8K Pet, parts of it have run successfully on an Exidy Sorcerer and on a 1K ZX-81.

One of the obstacles encountered in work in artificial intelligence is the way knowledge should be represented, but representing morse code turned out to be fairly straightforward. Characters are conveyed in morse as a series of short and long pulses — Dits and Dahs — separated by pauses. In the program Dits are represented by the letter S, and Dahs by the letter L.

Array storage

The morse corresponding to each character is stored as an element in an array M$. The morse code for the letter A is ·—, and is stored in M$(1) as SL. Morse for a character is generated by the subroutine located at lines 300 to 380 and 400 to 440. S and L determine the duration of tones by controlling the number of iterations of a For loop. The duration for L is three times that for S — see lines 320 and 330.

The number of Dits and Dahs in the character is calculated in line 310. The tone is turned on at line 410, is presented by line 420 for the appropriate duration, and switched off at line 430. Line 350 presents the appropriate pause between successive Dits or Dahs within a character; line 370 presents the appropriate pause between characters in the same word; and lines 3200 and 1050 give the appropriate pause between words.

Anyone who has heard morse transmitted on the amateur bands will realise the tremendous range of speeds at which code is sent and must be received. It is, therefore, important for learners to be able to listen to morse at different speeds, and in particular to be able to operate comfortably at the speed specified by the Home Office test.

Adequate fit

An empirical approach to this problem resulted in the following:

DL = INT(EXP(5.28 − .21* NL)))*(3.0148−LOG(S)))

where

DL represents the number of iterations required to produce a Dit,
NL represents the number of letters per word,
S represents the required speed in words per minute.

This gives an acceptable fit, especially for speeds around 12 five-letter words per minute on the 8K Pet.

It is unlikely that this formula will work on other machines, highlighting the disadvantage of using an empirical method. However the calculation of a general solution based on the time for the machine to carry out particular instructions in Basic would have hardly justified the effort expended in calculating it. The formula is implemented at lines 1020 to 1024, 2020 to 2024 and 3030 to 3034.

Once the learner has become familiar with the code by using option 1, the next goal will be to speed up the process of recognition. Typically a learner recognises some characters almost immediately but will take quite a while to recognise others. A competent morse operator needs to recognise all the characters in the code immediately and automatically, and those characters with which the novice is experiencing difficulty must be identified in order to provide extensive practice on them. To provide this facility, option 2 alters the probability that a character will be presented in the future on the basis of the accuracy and speed of the learner's response.

The program starts by creating an array D, each element of which corresponds to a particular letter or number. In line 40 initially all the elements are set equal to one. Each character has the same probability of selection. Adjustments to the values associated with the characters are made in lines 2320 to 2400.

Line 2320 reduces the value of a character by a quarter when a correct identification within the time limit is made. Line 2340 increases such a value by a half when an incorrect identification is made. In order to prevent values becoming unworkably large or small, line 2270 is provided to rescale all values after each alteration. Lines 2312 to 2318 display the

Symbols used in the program.

B$ — characters in correct position for computer analysed morse
C — position of character in M$
CS — character space
D(43) — values associated with probability of presenting morse
DIT — Dit length when computer analysing morse
DL — Dit length for generated morse
DT — scaling factor used in option 3
DU — counter to measure speed of response
GR — parameter in determining speed of output, gradient
IC — parameter in determining speed of output, intercept
L5 — length of vocab: 10 for numbers, 26 for letters
M$(43) — morse codes for generating morse
MAX — delay factor
NL — number of letters per word
NS — timer for pause length when analysing morse
S — number of five-letter words per minute
SI — timer for tone length when analysing morse
SL — slowing factor, between characters
SY — type of vocab, numbers or letters
V(15) — used to calculate Dit length when analysing morse
W(15) — used to calculate pause length when analysing morse
Z$(64) — list of characters in correct position when analysing morse
T1, I2, I, A$, K, J and T are all working variables

probabilities associated with each character whenever the # key is pressed.

In order to analyse morse that an operator is sending, it is necessary to be able to recognise the difference between a Dit and Dah. In addition, it is necessary to distinguish between the pauses signifying the end of a character, those signifying the end of a word and those pauses that occur within a character. A machine which is to decode morse must, therefore, measure the duration of Dits, Dahs and pauses.

Real-time decisions

After determining that a character has been sent, the Pet must decide on the nature of the character. The program measures durations in real time in Basic, without the use of hardware clocks, and makes use of constraints within morse code to identify characters.

Measurement of the duration of pauses, Dits and Dahs is achieved by the use of If statements. The state of the input ports is examined, and while a particular state remains a count is implemented. For example, in line 4130, Peek (59471) checks the input port. While the morse key remains pressed to produce a tone, the counter, SI, is incremented. Line 4320 does an equivalent operation except, in this case, NS is incremented during a pause, that is while the morse key does not make contact.

Checks can then be made to ascertain whether the counters exceed a critical length. For example, in lines 4410 and 4420 a decision is made as to whether a Dit has been broadcast or a Dah by comparing the size of SI with "Dit". In line 4450 a decision is taken as to whether the pause is long enough to indicate the end of a character. Line 4330 calculates whether the end of a word has been reached.

Counting loops

All of these decisions make use of the fact that the number of iterations of an If statement that equate with a duration of one Dit is known. The program then becomes straightforward, line 4050 allowing the operator to specify a Dit length.

More usually, the speed at which an operator produces morse is not known. An option is available, however, which will calculate an operator's Dit length. This is done at line 4060, which asks the operator to enter a sample of his morse, and then applies the procedure using If statements, saving the duration of key contacts and releases in the arrays V and W. The result of several key presses are averaged to provide a cut-off.

Although it might appear that the operator has to enter extremely accurately times morse for it to be recognised by the machine, this is not the case. Any key press that is longer than the critical length is assumed to be a Dit, and any

(continued on page 89)

```
4 REM MORSE PROGRAM
5 REM PROGRAMME DEVISED THROUGH THE
6 REM COLLABRATIVE EFFORTS OF
7 REM CHRIS DRACUP & DEREK WAKELIN
11 DIM M$(43),D(43)
12 DIM Z$(64),V(15),W(15)
13 B$="ETINAMSDRGUKWOHBLZFCPQVX??YJ?56?7???8????????94???????3???2?10??"
14 FORI=1TO64:Z$(I)=MID$(B$,I,1):NEXT
20 POKE 950,0:POKE951,54:SYS845
30 POKE 950,7:POKE951,56:SYS845
40 FORI=1TO43:READM$(I):NEXT
50 FORI=1TO43:D(I)=1:NEXTI
100 PRINT"J"
110 PRINT"          MORSE TUTOR"
115 PRINT"          ----------":PRINT
120 PRINT"THE FOLLOWING OPTIONS ARE AVAILABLE"
130 PRINT
145 PRINT"COMPUTER GENERATED MORSE"
146 PRINT"------------------------"
150 PRINT"1. LEARNING THE CODE - SINGLE LETTERS"
160 PRINT"2. IMPROVING SPEED"
170 PRINT"3. MORSE TEST SIMULATOR - RANDOM WORDS"
180 PRINT:PRINT"COMPUTER ANALYSED MORSE"
182 PRINT"----------------------"
190 PRINT"4. LEARNING TO TRANSMIT"
200 PRINT:PRINT:PRINT"ENTER NUMBER OF SELECTED OPTION"
220 GET A$: IF A$=""THEN 220
230 ON (ASC(A$)-48) GOSUB1000,2000,3000,4000
240 GOTO 100
300 REM SUBROUTINE TO GENERATE MORSE
310 FORJ=1TOLEN(M$(C))
320 IF MID$(M$(C),J,1)="S" THEN T=DL
330 IF MID$(M$(C),J,1)="L" THEN T=3*DL
340 GOSUB 410
350 FORK=1TODL:NEXTK
360 NEXTJ
370 FORK=1TOCS:NEXTK
380 RETURN
400 REM TONE GENERATION
410 POKE 950,8:POKE951,12:SYS845
420 FORK=1TOT:NEXTK
430 POKE 950,8:POKE951,0:SYS845
440 RETURN
1000 REM SINGLE LETTERS
1005 PRINT"J"
1010 PRINT"ENTER REQUIRED SPEED"
1011 INPUT"(NUMBER OF 5 LETTER WORDS/MINUTE)";S
1015 PRINT"PRESS ANY LETTER OR NUMBER."
1020 GR=INT(EXP(5.28-.21*S))
1022 IC=3.10470588*GR
1024 DL=INT(IC-GR*LOG(S))
1026 CS=2*DL
1030 GETA$:IFA$=""THEN1030
1035 IFA$="*"THENRETURN
1040 PRINTA$;
1050 IF A$=" "THENFORK=1TODL*4:NEXT:GOTO1030
1060 C=ASC(A$)-47
1070 GOSUB 310
1080 GOTO 1030
2000 REM IMPROVING SPEED
2005 PRINT"J"
2006 SV=1
2007 INPUT "RANDOM WORDS OR NUMBERS. W/N";A$
2008 IF LEFT$(A$,1)="N"THEN SV=0
2009 L5=10+SV*16:DT=L5
2010 PRINT"ENTER REQUIRED SPEED"
2012 INPUT "(NUMBER OF 5 LETTER WORDS/MINUTE)";S
2014 PRINT"HOW MUCH TIME DO YOU WANT TO REPLY?  "
2015 INPUT"0 GIVES LEAST TIME, HIGHER NUMBERS MORE TIME";MAX:MAX=MAX*50
2018 PRINT"PRESS KEY TO START PROGRAMME."
2020 GR=INT(EXP(5.28-.21*S))
2022 IC=3.10470588*GR
2024 DL=INT(IC-GR*LOG(S))
2025 CS=2*DL
2026 GETA$:IFA$=""THEN2026
2027 FORK=1TOCS:NEXTK
2270 DT=L5/DT:FORK=SV*17+1TOL5+SV*17:D(K)=D(K)*DT:NEXTK:DT=L5
2280 K=RND(1)*L5:C1=0:C=0+SV*17
2282 C=C+1
2284 C1=C1+D(C)
2286 IF C1=<K THEN2282
2290 DU=0:GOSUB310
2300 GETA$:IFA$=""THENDU=DU+1:GOTO2300
2310 IF A$="*"THENRETURN
2312 IF A$<>"*" THEN2320
2314 FORI=SV*17+1TOL5+SV*17 STEP2
2316 PRINTCHR$(47+I);D(I)/L5;TAB(15);CHR$(47+I+1);D(I+1)/L5
2318 NEXT
2319 GOTO 2300
2320 IFDUC=MAXTHENDT=DT-D(C)/4:D(C)=D(C)-D(C)/4:GOTO2350
2340 IF DU>MAXTHENPRINT"TOO SLOW  ":
2350 PRINTCHR$(C+47)::IFA$=CHR$(C+47)THENPRINT"  CORRECT":GOTO2270
2400 DT=DT+D(C)*2:D(C)=D(C)+D(C)*2:PRINT:GOTO 2290
2410 GOSUB 310
2420 GETA$:IF A$=""THEN 2420
2430 IF A$=CHR$(C+47)THEN GOTO 2300
2440 GOTO 2410
3000 REM RANDOM WORDS
3005 PRINT"J"
3006 SV=1
3007 INPUT "RANDOM WORDS OR NUMBERS. W/N";A$
3008 IF LEFT$(A$,1)="N"THEN SV=0
3010 INPUT"NUMBER OF LETTERS PER WORD";NL
3020 INPUT"ENTER SPEED TO WHICH YOU ASPIRE";S
3030 GR=INT(EXP(5.28-.21*NL))
3032 IC=3.01470588*GR
3034 DL=INT(IC-GR*LOG(S))
3042 PRINT"HOW MUCH DO YOU WANT TO SLOW DOWN"
3044 PRINT"THE INTER LETTER INTERVAL ?"
3045 PRINT"ENTER 0 IF YOU DON'T WANT A CHANGE"
3046 PRINT"ENTER A NUMBER GREATER THAN 0 TO SLOW IT DOWN PROPORTIONATELY"
3047 INPUTSL
3050 CS=2*DL+100*SL
3100 FORI=1TONL
3120 C=INT(RND(1)*(10+SV*16)+1)+SV*17
3140 PRINTCHR$(C+47);
3160 GOSUB 310
3180 NEXTI
3200 FORK=1TO2*CS:NEXTK
3220 PRINT
3240 GETA$:IFA$="*"THENRETURN
```

(listing continued on page 89)

How would a matrix printer costing £850 sell?

The ASP-3500 matrix printer is a high speed bi-directional printer capable of up to 180 characters per second output. Compact and lightweight, it contains four languages as standard character set and is available in two versions: A with 7x9 matrix for business use, giving a true descender; and B with 9x9 matrix for graphics work.

Printing flexibility is what this machine understands best. With a maximum of 181 kinds of character patterns, the ASP-3500 can handle British and American English, German and French. Variable print capability permits 10 cpi for normal characters, 5 cpi, 6 cpi, and 8.25 cpi for elongated characters, and 12 cpi and 16.5 cpi for compressed characters. Easily adjustable forms tractor mechanism allows you to use any size standard pin feed form, from 5 inches to 16 inches.

Precision wire heads can pound-out up to two hundred million maintenance-free characters. Heads come in two types, and are replaceable in the field, keeping costly down-time to a minimum.

The ASP-3500 with its ease of operation, light weight, compact size and quiet operation make it welcome in any office environment. It features a standard systems self-test capability for maintenance ease. Heavy duty ribbon cartridge pops in, pops out, for clean, quick ribbon replacement. RS-232C standard interface, 20mA current loop or industrial standard parallel interface are also available.

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ASP3500
MATRIX PRINTER

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that is longer is assumed to be a Dah. The same applies to recognition of pauses within a character, between characters, and between words.

Once the machine is identifying when a character is being sent, the next task is to recognise the particular character that is present. As each Dit or Dah of a character is received it computes a running total, the final value of which uniquely identifies the character. The principle is shown in figure 1. This operation is performed in lines 4300 to 4480. I2 controls the raising of the power as each Dit or Dah in the character being received is identified.

T1 stores the running total for the character, and is then used as a pointer in the alphanumeric array Z$, so that the character is directly accessed and immediately printed on the screen by line 4450. This routine has successfully decoded ideal morse produced by running option 3 on an Exidy Sorcerer, and broadcast at speeds even exceeding those required for the Home Office test. It has also successfully decoded less than ideal morse code, inexpertly produced by the authors.

Random errors

Analysis of morse by the expert human operator is immediate and automatic and involves little if any conscious decision making. It is almost as if there is a direct link between the code and the character. The computer analysis of morse also possesses this quality of direct access. The running total produced by the real-time analysis of the Dits and Dahs points unequivocably to the correct character.

One difference between the program and the human operator is that humans make errors, and these errors are not of a random nature. Characters may be confused with their mirror images for example, ·— A, with —· N. The program does not make this kind of error, though errors do arise when it can no longer cope with the speed of input.

Another way in which the program differs from humans is that it can only identify individual characters, whereas humans soon learn to recognise familiar letter patterns. It is possible to envisage modifications to the program that would lead to a closer match between its performance and that of a human being if this were desired.

(listing continued from page 87)

```
3250 GOTO 3100
4000 REM DECODE MORSE
4005 PRINT"□"
4010 POKE59459,0
4040 INPUT"WOULD YOU LIKE THE MACHINE TO ESTIMATE  YOUR DIT LENGTH (Y/N)";A$
4050 IF A$="N"THENINPUT"LENGTH OF DIT";DIT:GOTO4250
4060 PRINT"TAP IN V,AT LEAST THREE TIMES"
4070 IF PEEK(59471)=255THEN4070
4080 FORI=1TO12:SI=0
4090 POKE950,8:POKE951,15:SYS845
4130 IFPEEK(59471)<>255THENSI=SI+1:GOTO4130
4141 POKE950,8:POKE951,0:SYS845
4150 V(I)=SI
4160 NS=0
4170 IFI=12THEN4210
4180 IFPEEK(59471)=255THENNS=NS+1:GOTO4180
4190 W(I)=NS
4200 NEXT
4210 DIT=V(4)+V(8)+V(12)
4220 DIT=INT((DIT/3)/2)+1
4240 PRINT"YOUR DIT LENGTH",DIT
4250 DL=40
4260 C=28:GOSUB310
4300 NS=0
4310 I=0
4320 IF PEEK(59471)=255THENNS=NS+1:GOTO4320
4330 IFNS>4*DITTHENPRINT" "
4340 T1=0:I2=1
4350 FORI=1TO5
4360 I2=I2*2
4370 POKE950,8:POKE951,12:SYS845
4380 SI=0
4390 IF PEEK(59471)<>255THENSI=SI+1:GOTO4390
4400 POKE950,8:POKE951,0:SYS845
4410 IF SI>DITTHENT1=T1+I2:GOTO4430
4420 T1=T1+I2/2
4430 NS=0
4440 IF PEEK(59471)<>255THEN4470
4450 NS=NS+1:IFNS>DITTHENPRINTZ$(T1);:GOTO4300
4460 GOTO4440
4470 NEXTI
4480 GOTO 4300
7000 DATA LLLLL,SLLLL,SSLLL,SSSLL,SSSSL,SSSSS
7010 DATA LSSSS,LLSSS,LLLSS,LLLLS
7020 DATASLSLSL,LLSSL,SSSLS,LLSLLSL
7030 DATALSLSLS,LLLSSS
7040 DATA SSSLLL
7070 DATA SL,LSSS,LSLS,LSS,S
7080 DATA SSLS,LLS,SSSS,SS,SLLL
7090 DATA LSL,SLSS,LL,LS,LLL
7100 DATA SLLS,LLSL,SLS,SSS,L
7110 DATA SSL,SSSL,SLL,LSSL,LSLL,LLSS
```

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System cost, including a Commodore 8000-series computer, twin floppy disk drives and one of a selection of printers depending on your needs, is between £3300 and £4000. The latter figure would include a letter-quality daisywheel printer. Both prices include the cost of Administrator and word-processing program, but do not include VAT.

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● **Circle No. 154**

APL — a high-level language whose time has come

To those used to the look of a Basic listing it may seem little more than a funny Greek language that executes backwards. Yet with a flexible and concise structure APL is set to come into its own, especially on the new generation of 16-bit machines. Adrian Smith explains why he has become an APL fan.

PEOPLE EITHER LOVE APL or hate it — there are few neutrals. Although the vast majority of APL systems at the moment are on mainframes, the new generation of 16-bit micros will be close to ideal as an environment for this language.

My own experience of computing has been of interactive Basic, and several years of batch PL/1, but two years of APL have convinced me that this language is usually a "better way".

Figure 1 based on "Obsolete Languages" from the house magazine of MicroAPL Ltd illustrates how concise APL can be. This example is rigged, but not as much as you might think. Software bureaux quote APL development costs at around one-fifth of the cost of the same system in, for instance, Cobol. Much of this saving simply reflects the vastly reduced keying time for the APL code.

APL uses some funny symbols: ÷ you may recognise, but there is also that Greek letter ρ to reckon with. As a result it needs specially adapted keyboards and printers, a considerable overhead when you first decide to try out APL. Fortunately most of the new generation of printers will take an APL daisywheel, and APL keyboards are an option on many standard ASCII screens. However, the character set remains a significant barrier to the wider acceptance of APL, and it needs simplifying.

APL-written systems can be run from normal keyboards, and you can cover for most of the common symbols with functions like:

MULT(α×ω LN: *ω ANY: ν/ω

To an APL devotee such a course would be insufferably frustrating, but it may be the best way of introducing APL ideas to the micro world.

APL functions execute independently of the shape and size of the data they are fed. Mean would happily average two numbers or 20,000, and with a minor modification it would give you the row averages of a 50-by-100 table. An APL function represents a mathematical concept — a mean is not dependent on the number of numbers input.

APL conspicuously lacks control structures. You will search in vain for

IF - THEN - ELSE,
DO WHILE . . .,
FOR I = 1 TO 10 . . . NEXT I

This is a dramatic divergence from mainstream computer languages.

The fundamental concept in commercial computing is the file. A commercial system consists of files which are updated, matched, merged and printed by a suite of programs. Each file consists of a number of identically structured records, each divided into fields.

In conventional data processing, the task of mapping a user's needs into files and programs, and deciding on the layout of the records within each file, falls to a systems analyst. The task of the programmer is to take the structures of the input and output files as given, and to devise the processing needed to map the one on to the other. The great triumph of the structured language is that it provides the ideal series of constructs through which the required mapping can take place.

Remember that APL is a mathematical notation, not a computer language. In a conventional employee-records file system each record contains the details of one employee, and the record layout might look something like figure 2. To answer a question such as "What is the total salary bill?", use the kind of structure illustrated in the figure.

Name	Age	Sex	Salary
CCol	20 21 22	23	24 30
BLOGGS F.	35	M	12300
HARRIS J.	62	M	5600
•	•	•	•
•	•	•	•

```
BEGIN
     DECLARE file structure;
     clear accumulator;
     UNTIL end of file DO
          READ a record;
          add salary to accumulator;
     END
     print accumulator;
END.
```

Figure 2. Typical employee-records file and a conventional approach to extracting information from it.

In an APL system, the files are treated simply as pigeon-holes for individual APL variables, rather than collections of identically structured records. The contents of each file component represent the values of one data item for all employees. For example if the company employed 1,200 people we might have:

AGE . . . a numeric list (vector) of 1,200 ages
NAME . . . a 1,200 by 20 character table of names etc.

To answer the question ". . . what is the average age in the company?", we need only type:

MEAN AGE

and

+/SALARY

will tell us the total salary bill.

(continued on page 93)

Figure 1. Routines for calculating arithematic means in Pascal, Basic and APL.

PASCAL

```
PROGRAM mean (input,output);
   VAR
      value,sum,mn:real;
      count:integer;
   BEGIN
      sum:=0;
      count:=0;
      read (value);
      WHILE not eof DO
         BEGIN
            sum:=sum+value;
            count:=count+1;
            read (value);
         END;
      mn:=sum/count;
      writeln ('Mean is ',mn)
   END.
```

BASIC

```
10 LET S=0
20 INPUT 1,M
30 FOR N=1 TO M
40 INPUT 1,V
50 LET S=S+V
60 NEXT N
70 PRINT S/M
```

APL

```
MEAN:(+/⍵)÷ρ⍵
```

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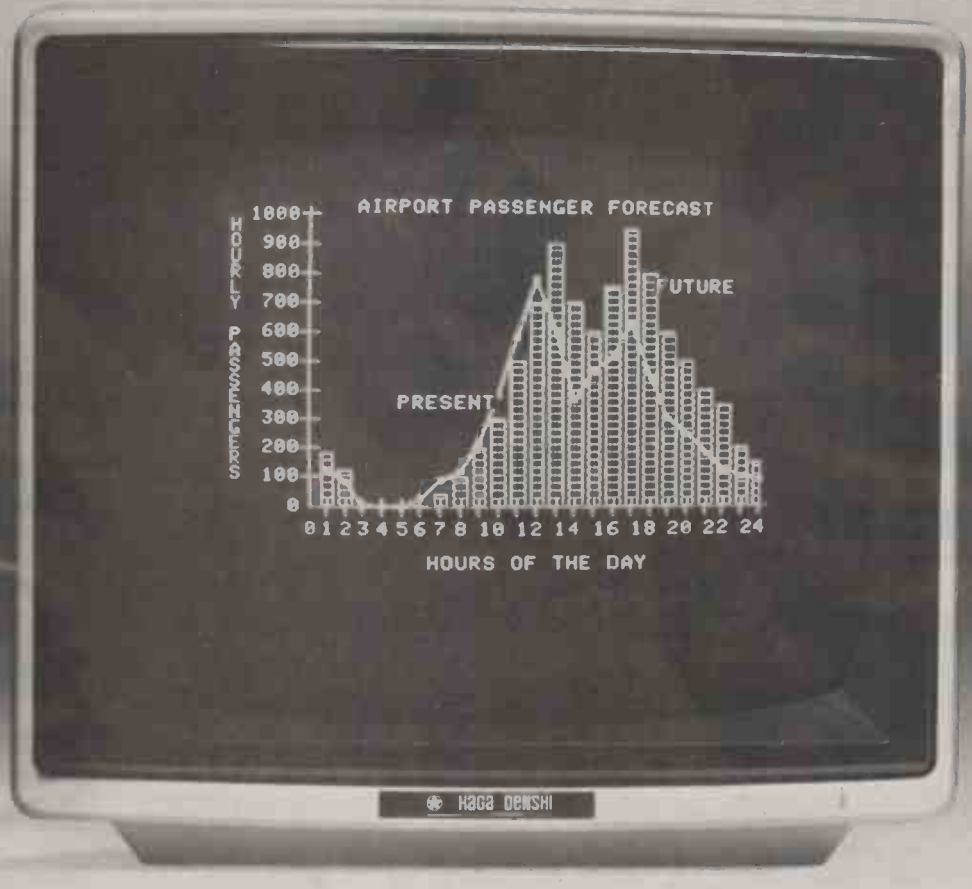

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The prime purpose of programming structures is to handle repetitive processing through files. When you can see all the data all the time, your life becomes a great deal more straightforward, and in practice the structures are rarely missed. APL is a consistent, concise mathematical notation. It handles lists and tables of data very naturally and is highly interactive. APL is also interpretive, and its workspace concept makes very considerable demands on a computer's working storage.

In APL, all data management is handled by the interpreter statement-by-statement. There are no Declare or Dimension statements at all. Consider the following three valid APL commands:

A←'CAT' . . . create a variable "A" with the value of a character vector "CAT"

A←100 50⍴10 . . . make "A" a numeric table (100 rows by 50 cols) with the value 10.

A←,A . . . "A" is now a numeric vector of length 5,000, still containing the value 10 throughout.

This gives the programmer an enormous amount of freedom in manipulating data. To aggregate 12 months' sales figures into four quarterly totals, one simply reshapes the figures as a four-by-three table:

FIGS←4 3⍴FIGS

and sums across the rows

QUART←+/FIGS

APL subroutine structures are flexible. Here is an alternative definition of the function Mean:

MEAN: (TOTAL ⍵) ÷ ⍴⍵

where the function Total looks like:

TOTAL: +/⍵

Any APL function can call any other APL function including itself without making special arrangements. Just as you can string together the familiar functions of mathematics such as ln cos ω, where each may have been previously defined at a lower level, so you can string together the functions of APL.

Functions old and new

To revert once more to the staff-file example — what would it cost the company to pay all its 21-year-old staff a 6 percent rise?

```
0.06 × TOTAL SALARY WHERE AGE = 21
1925.82
```

Here two primitive functions from mathematics, multiply and the test for equality, have been strung together with two of our own invention. Total has already been illustrated; the deceptively straightforward looking "Where" shows another facet of APL's data management at work:

WHERE: ⍵/⍺

This phenomenon is called "compression" and is probably best illustrated by another example:

```
'ABCDE' WHERE 0 1 1 0 1
BCE
```

Here a vector of length 5 has been passed through a logical sieve also of five elements; only where the corresponding element in the sieve is "on" do we pass the value in the original vector. The length of the result is clearly three — the same as the number of ones in the sieve.

If our company employs four 21-year-old staff, we might find:

```
SALARY WHERE AGE = 21
8760 5678 10001 7658
```

Finally, a passing swipe at all the computer languages which use = to double for assign. In APL the result of:

I = I + 1

is zero, meaning "this expression is false".

APL interpreters are hard to write and tend to be memory intensive. The toughest problem the interpreter has to handle is the organisation of the APL workspace. The microcomputer — with its serried ranks of directly addressable RAM — was always a tempting proposition. The solution was to compromise; implement a reasonable subset of APL and leave about half the magic 64K available as workspace. A smaller interpreter would have strayed too far from the mainframe standard; any larger and the lack of workspace would start to bite.

```
      COSTS←2 3 2 4
      SALES←5 6 6 5
      PROFIT←SALES-COSTS
      INFLATION←1.08 1.12 1.15 1.12
      DISCOUNTEDΔPROFIT←PROFIT××\⌽INFLATION

      '$ZZ9.9' PICFMT DISCOUNTEDΔPROFIT
 $2.7
 $2.4
 $2.8
 $0.6
```

Figure 3. Specifying rows as APL variables.

The result has been a string of very similar micros, running virtually the same APL at the same speed. The Superbrain and the Shelton Sig/Net are typical examples. The systems differ among themselves and from mainframe APL in their file handling. This has turned out to be something of a paradox: the restriction on workspace has forced the micro-APLs into file-access mechanisms which are often far superior to the IBM offering.

Typically a hybrid system will use APL's component files to store personnel details and conventional CP/M files to hold WordStar documents. WordStar can do what it is best at — document composition — to generate a set of "Dear Blank," letters. APL can select and massage data to fill in the appropriate blanks on the correct letters and print them out in a sensible sequence.

```
CIRCULATE 'BONUS.TEXT' TO STAFF
  WITH ABSENCE < 5
```

Micros are also closer to the real world than mainframes, and APL systems have been coupled up to all sorts of data-loggers and process-control systems. APL was never designed for this, but if you have to deal with an arbitrary splurge of binary data then it is handy to have a series of logical functions which will operate on practically anything as long as it has noughts and ones in it.

The major barrier to a full-scale micro-APL has always been the 64K addressing limit of the eight-bit systems. A typical APL application sits in about 250K of workspace, and a full APL interpreter probably needs about 100K on top of that. The answer of course, is already with us — with 16-bit addressing, the only remaining limit is the number of memory chips we can cram into the cabinet!

Future applications

The next generation of micros will be far better suited to the needs of APL than are many of today's big mainframes. APL does not run happily in virtual storage systems, particularly if it has to compete with batch jobs and conventional transaction processing. If you try and add up the last column of a 100K four-dimensional array you may get some dramatically variable response times as the system pages desperately through it.

In the megabyte micro the philosophy is totally different — storage is real, cheap, easily addressed and extremely fast. On a Motorola 68000 the response time to such a request would be well under a second, and it would be absolutely consistent. Add to this the fact that the new APLs are inheriting all the enhanced file access that the old eight-bit systems needed and the combination will prove hard for many of us mainframers to resist.

An early use of APL was as an advanced pocket calculator. Engineers frequently find themselves faced with systems of linear equations, and the APL matrix divide was implemented specifically to solve these. They also tend to need large tabulations of data, and APL will often do the job in a fraction of the time that a hand calculation would take.

Data manipulation

APL scored a more dramatic early success in the field of financial modelling. Even rather sophisticated economic models are simply built round tables of data. Some rows are entered by the user, some are calculated from combinations of these.

The early approach as shown in figure 3 was simply to specify the user's rows as APL variables, and to use primitive APL to evaluate the relationships. These days it is all wrapped up in user-friendly dialogues and menus.

APL has come into use as a tool for storing, manipulating and displaying simple tabular data. The staff file is typical, and other examples might include historical sales data, or a parts inventory for a warehouse. There is no doubt that the efficient manipulation of either text or

(continued on page 96)

New ZX81 Software from Sinclair.

A whole new range of software for the Sinclair ZX81 Personal Computer is now available – direct from Sinclair. Produced by ICL and Psion, these really excellent cassettes cover games, education, and business/household management.

Some of the more elaborate programs can only be run on a ZX81 augmented by the ZX 16K RAM pack. (The description of each cassette makes it clear what hardware is required.) The RAM pack provides 16-times more memory in one complete module, and simply plugs into the rear of a ZX81. And the price has just been dramatically reduced to only £29.95.

The Sinclair ZX Printer offer full alphanumerics and highly-sophisticated graphics. A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. So now you can print out your results for a permanent record. The ZX Printer plugs into the rear of your ZX81, and you can connect a RAM pack as well.

Games

Cassette G1: Super Programs 1 (ICL)

Hardware required – ZX81.
Price – £4.95.
Programs – Invasion from Jupiter. Skittles. Magic Square. Doodle. Kim. Liquid Capacity.
Description – Five games programs plus easy conversion between pints/gallons and litres.

Cassette G2: Super Programs 2 (ICL)

Hardware required – ZX81.
Price – £4.95.
Programs – Rings around Saturn. Secret Code. Mindboggling. Silhouette. Memory Test. Metric conversion.
Description – Five games plus easy conversion between inches/feet/yards and centimetres/metres.

Cassette G3: Super Programs 3 (ICL)

Hardware required – ZX81.
Price – £4.95.
Programs – Train Race. Challenge. Secret Message. Mind that Meteor. Character Doodle. Currency Conversion.
Description – Fives games plus currency conversion at will – for example, dollars to pounds.

Cassette G4: Super Programs 4 (ICL)

Hardware required – ZX81.
Price – £4.95.
Programs – Down Under. Submarines. Doodling with Graphics. The Invisible Invader. Reaction. Petrol.
Description – Five games plus easy conversion between miles per gallon and European fuel consumption figures.

Cassette G5: Super Programs 5 (ICL)

Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Martian Knock Out. Graffiti. Find the Mate. Labyrinth. Drop a Brick. Continental.
Description – Five games plus easy conversion between English and continental dress sizes.

Cassette G6: Super Programs 6 (ICL)

Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Galactic Invasion, Journey into Danger. Create. Nine Hole Golf. Solitaire. Daylight Robbery.
Description – Six games making full use of the ZX81's moving graphics capability.

Cassette G7: Super Programs 7 (ICL)

Hardware required – ZX81.
Price: – £4.95.
Programs – Racetrack. Chase. NIM. Tower of Hanoi. Docking the Spaceship. Golf.
Description – Six games including the fascinating Tower of Hanoi problem.

Cassette G8: Super Programs 8 (ICL)

Hardware required – ZX81 + 16K RAM.
Price – £4.95.
Programs – Star Trail (plus blank tape on side 2).
Description – Can you, as Captain Church of the UK spaceship Endeavour, rid the galaxy of the Klingon menace?

Cassette G9: Biorhythms (ICL)

Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – What are Biorhythms? Your Biohythms.
Description – When will you be at your peak (and trough) physically, emotionally, and intellectually?

Cassette G10: Backgammon (Psion)

Hardware required – ZX81 + 16K RAM.
Price – £5.95.
Programs – Backgammon. Dice.
Description – A great program, using fast and efficient machine code, with graphics board, rolling dice, and doubling dice. The dice program can be used for any dice game.

Cassette G11: Chess (Psion)

Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Chess, Chess Clock.
Description – Fast, efficient machine code, a graphic display of the board and pieces, plus six levels of ability, combine to make this one of the best chess programs available. The Chess Clock program can be used at any time.

Cassette G12: Fantasy Games (Psion)

Hardware required – ZX81 (or ZX80 with 8K BASIC ROM) + 16K RAM.
Price – £4.75.
Programs – Perilous Swamp. Sorcerer's Island.
Description – Perilous Swamp: rescue a beautiful princess from the evil wizard. Sorcerer's Island: you're marooned. To escape, you'll probably need the help of the Grand Sorcerer.

Cassette G13: Space Raiders and Bomber (Psion)

Hardware required – ZX81 + 16K RAM.
Price – £3.95.
Programs – Space Raiders. Bomber.
Description – Space Raiders is the ZX81 version of the popular pub game. Bomber: destroy a city before you hit a sky-scraper.

Cassette G14: Flight Simulation (Psion)

Hardware required – ZX81 + 16K RAM.
Price – £5.95.
Program – Flight Simulation (plus blank tape on side 2).
Description – Simulates a highly manoeuvrable light aircraft with full controls, instrumentation, a view through the cockpit window, and navigational aids. Happy landings!

Education

Cassette E1: Fun to Learn series – English Literature 1 (ICL)

Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Novelists. Authors.
Description – Who wrote 'Robinson Crusoe'? Which novelist do you associate with Father Brown?

Cassette E2: Fun to Learn series – English Literature 2 (ICL)

Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Poets, Playwrights. Modern Authors.
Description – Who wrote 'Song of the Shirt'? Which playwright also played cricket for England?

Cassette E3: Fun to Learn series – Geography 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Towns in England and Wales. Countries and Capitals of Europe.
Description – The computer shows you a map and a list of towns. You locate the towns correctly. Or the computer challenges you to name a pinpointed location.

Cassette E4: Fun to Learn series – History 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Events in British History. British Monarchs.
Description – From 1066 to 1981, find out when important events occurred. Recognise monarchs in an identity parade.

Cassette E5: Fun to Learn series – Mathematics 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Addition/Subtraction. Multiplication/Division.
Description – Questions and answers on basic mathematics at different levels of difficulty.

Cassette E6: Fun to Learn series – Music 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Composers. Musicians.
Description – Which instrument does James Galway play? Who composed 'Peter Grimes'?

Cassette E7: Fun to Learn series – Inventions 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Inventions before 1850. Inventions since 1850.
Description – Who invented television? What was the 'dangerous Lucifer'?

Cassette E8: Fun to Learn series – Spelling 1 (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £6.95.
Programs – Series A1-A15. Series B1-B15.
Description – Listen to the word spoken on your tape recorder, then spell it out on your ZX81. 300 words in total suitable for 6-11 year olds.

Business/household

Cassette B1: The Collector's Pack (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £9.95.
Program – Collector's Pack, plus blank tape or side 2 for program/data storage.
Description – This comprehensive program should allow collectors (of stamps, coins etc.) to hold up to 400 records of up to 6 different items on one cassette. Keep your records up to date and sorted into order.

Cassette B2: The Club Record Controller (ICL)
Hardware required – ZX81 + 16K RAM.
Price – £9.95.
Program – Club Record Controller plus blank tape on side 2 for program/data storage.
Description – Enables clubs to hold records of up to 100 members on one cassette. Allows for names, addresses, 'phone numbers plus five lots of additional information – eg type of membership.

Cassette B3: VU-CALC (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £7.95.
Program – VU-CALC.
Description – Turns your ZX81 into an immensely powerful analysis chart. VU-CALC constructs, generates and calculates large tables for applications such as financial analysis, budget sheets, and projections. Complete with full instructions.

Cassette B4: VU-FILE (Psion)
Hardware required – ZX81 + 16K RAM.
Price – £7.95.
Programs – VU-FILE. Examples.
Description – A general-purpose information storage and retrieval program with emphasis on user-friendliness and visual display. Use it to catalogue your collection, maintain records or club memberships, keep track of your accounts, or as a telephone directory.

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(continued from page 93)
tabular data requires a VDU. Packages like VisiCalc have shown the way, and the provision of good screen-based editors has been an enormous step forward for APL systems.

Consider the following dialogue to impose ad-hoc restrictions in a production-planning system:

```
Unavailable . . . the name of the function

Which machine ? :— Punch
Which day/shift :— Mon PM, Wed AM
Which machine ? :— Lath
<<Lath>> is not a known abbreviation . . .
  please retry
Which machine ? :— Lathe
and so on
```

On a VDU the whole rigmarole goes out of the window. You simply slap on the screen a table such as shown in figure 4, and type all over it. The VDU is a two-dimensional input device ideally suited to APL's table-handling capabilities.

Human replacement

Historically the aim of computer systems has been to replace humans as decision takers. When it has been a matter of rather simple decisions, the replacement has been extremely effective. Short-term planning has usually proved impossible to achieve. The failure of optimising algorithms when faced with multiple objectives, and the impossibility of including any political feel are major problems.

	MON			TUE			WED		
	AM	PM	EV	AM	PM	EV	AM	PM	EV
PUNCH	X						X		
LATHE									

Figure 4. VDU table display under APL.

Computers have been more successful taking care of the routine tasks, and helping the planner with carefully structured displays of the data.

It has often proved possible for a rather simple-minded algorithm to do 90 percent of a complex plan such as a school timetable very easily. The great strength of decision-support systems is knowing where to stop — that last 10 percent is far better left to the planner's intuition, experience, and political judgement.

Defining decision-support systems is important.

- They are highly interactive, with a genuine partnership between human and machine.
- They tend to be one-offs. Unless the program's internal model reflects accurately all the quirks and inconsistencies of the real world it is worse than useless. Of course there are common factors, but there is also a large amount of code which is highly specific.
- They must be extremely adaptable — as the world changes the system must follow it, and fast.
- The user interface must be responsive, sophisticated and robust — probably a VDU, possibly with colour and graphics.

First contact with a user to working prototype should take one week. From then on the pace at which the system evolves is governed largely by the rate at which the user adapts to it. APL's incredibly flexible subroutine structure makes it possible to pull a system apart and reassemble it in a different order. It also allows you to mess around with the dialogue without ever touching the algorithmic core of the program. As for the core itself, APL is first and foremost a means of expressing technical algorithms clearly and concisely and it is still supremely good at its job.

Versatility

People have used APL for the most unlikely things from computer-aided design, through word processing and document composition, to simulation and real-time process control. Graphics is the single future development that fascinates me most, particularly having realized that most of the things you do to graphic objects — translation, rotation and the like — can be expressed very simply in matrix algebra.

Because APL is so much higher level than, say, Basic or PL/1 it makes correspondingly heavier demands on the CPU. Computers however are getting cheaper — people are not — and in the end a move to higher-level languages is inevitable. For the next few years at least. APL looks to have the field pretty well to itself.

FDos routines inside CP/M can be put to practical use as a security system in machine-code programs of your own, explains Adrian Hill.

Secrets of the password

MACHINE-CODE routines within CP/M can be used as the basis of an effective "password" system. This program allows disc access to only those users able to input a specific password.

The system consists of two separate routines. CLOSE.COM changes the names of all files on a disc from the normal upper-case characters, to lower-case characters, rendering these files inaccessible in the normal manner. Before termination, CLOSE.COM searches the directory for a file named "open.com" and renames it "OPEN.COM". Thus this file will be the only one executable by the user.

The second routine, OPEN.COM, asks the user to input the password, checks its validity against the real password, and if it is valid reverses the action of CLOSE.COM to convert all files from lower- to upper-case character names, restoring the disc directory to its original state. It thus allows normal disc access until CLOSE.COM is executed again.

To operate the system, the user simply executes CLOSE.COM at the termination of a CP/M session, and then executes OPEN.COM when starting the next session. Remember that Open and Close work on individual discs, and not the disc system itself. Each disc used must be individually Opened and Closed, which has the side-effect of allowing individual discs their own password, if required.

Each disc used under CP/M has an area known as the directory which contains a file-control block, FCB, for each file on the disc. The FCB contains the file name and file type together with various other information. CP/M contains no routines to allow direct access to the whole of the directory, so it is not possible to load it all into RAM as a single entity.

However, it is possible to load specific parts of the directory into the disc input/output buffer at default location 0080 to 00FFhex. This is accomplished using the primitive numbers 17 and 18 which search the directory for the first, 17, and subsequent, 18, files which match the file name and type in a key FCB at the location pointed to by register D/E.

When using these primitives, the disc buffer is filled with that part of the directory containing the FCB of the matching file. In the 80hex bytes, there is room for four FCBs of 20hex, or 32 decimal, bytes each. One of this four will be the required FCB; which one, is indicated by the value of the lowest two bits, that is 0, 1, 2, 3, in register A.

Further, there is no routine in the FDos which allows the contents of the directory to be loaded into RAM, in parts, from the beginning to the end. You can only search the directory for a file to match the name and type given in the FCB set up at the location pointed to by register D/E.

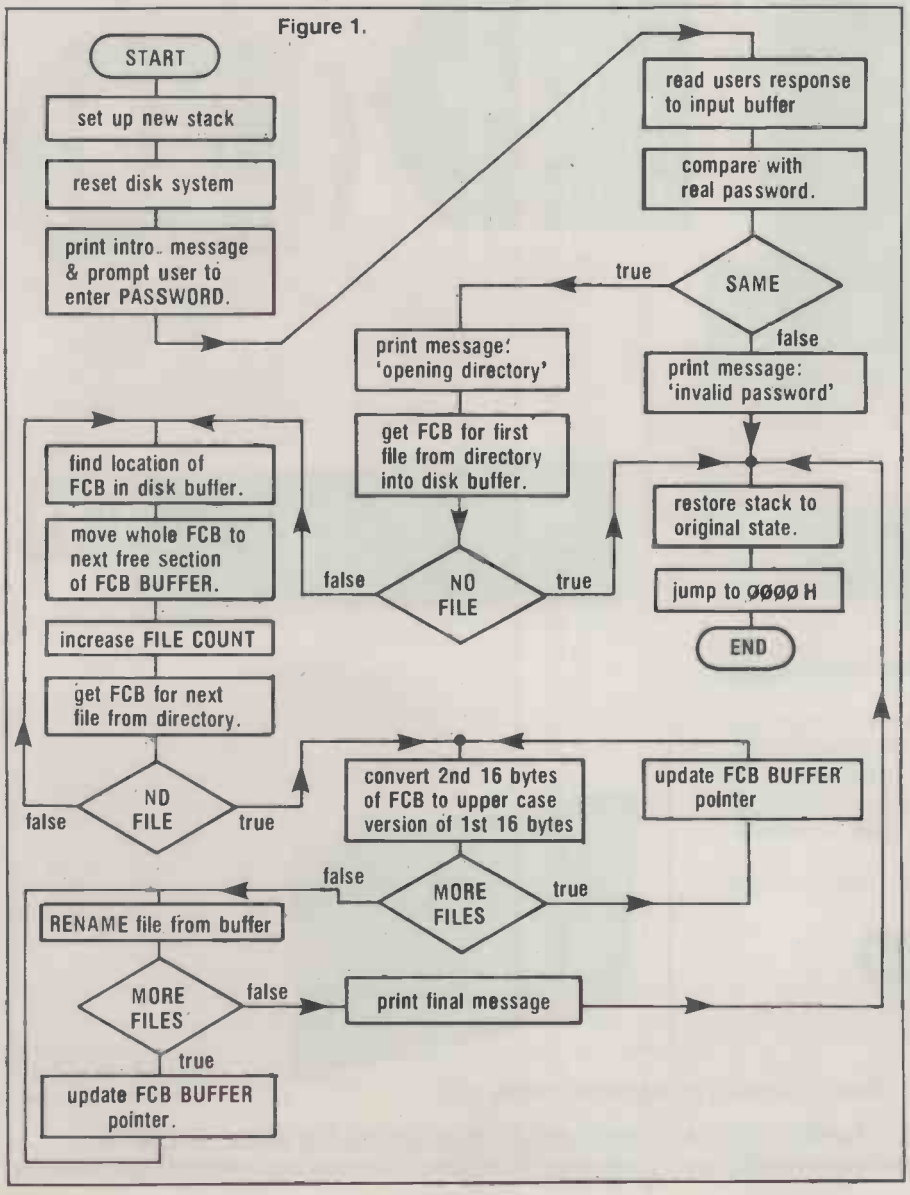
You can, however, achieve the same result by an indirect approach. CP/M has the facility to allow a "wild" character in a file name, which will be matched in the match FCB primitives by any character. The "wild" character is "?", so if the FCB which is set up contains the file name and type

????????.???

this will be matched by any possible file

(continued on page 101)

Figure 1.



Listing 1. CLOSE.COM routine.

```
0100              ORG 100H
0100 C3D801       JMP BEGIN
0005 =            FDOS            EQU 05H
0080 =            DIRECTORY       EQU 80H
0002 =            PRINT$CHAR      EQU 02H
0009 =            PRINT$CONS      EQU 09H
000A =            READ$CONS       EQU 10
0011 =            MATCH$1ST       EQU 17
0012 =            MATCH$NEXT      EQU 18
0017 =            RENAMEF          EQU 23
000D =            DISK$RESET      EQU 13
                  ;
                  ;
0103 20           INPUT$BUFFER  DB 32
0104               DS 32
0124 003F3F3F3FFCB DB 0,'???????????'
0130 0000000000 DW 0,0,0,0,0,0,0,0,0,0,0
                  ;
                  ;
0146 00           FCB$COUNT DB 0
0147 0703         FCB$LOCATION DW FCB$BUFFER
0149 00           FILE$COUNT DB 0
014A 00           FILE$TOTAL DB 0
014B 0000         OLD$SP DW 0
014D              STACK DS 32
016D =            STACK$TOP EQU $
                  ;
                  ;
016D 2020202041M1BUFFER DB '    A P H  SECURITY SYSTEM$'
0188 2020434C4FM2BUFFER DB '  CLOSING DIRECTORY - PLEASE WAIT.$'
01AB 2020444952M4BUFFER DB '  DIRECTORY NOW CLOSED.$'
                  ;
                  ;
01C3 C5D5E5       CRLF PUSH B! PUSH D! PUSH H
01C6 0E02          MVI C, PRINT$CHAR
01C8 1E0D          MVI E, 0DH
01CA CD0500        CALL FDOS
01CD 0E02          MVI C, PRINT$CHAR
01CF 1E0A          MVI E, 0AH
01D1 CD0500        CALL FDOS
01D4 E1D1C1        POP H! POP D! POP B
01D7 C9            RET
                   ;
                   ;
01D8 210000       BEGIN LXI H, 0
01DB 39            DAD SP
01DC 224B01        SHLD OLD$SP
01DF 316D01        LXI SP, STACK$TOP
01E2 0E0D          MVI C, DISK$RESET
01E4 CD0500        CALL FDOS
01E7 CDC301        CALL CRLF
01EA CDC301        CALL CRLF
01ED CDC301        CALL CRLF
01F0 0E09          MVI C, PRINT$CONS
01F2 116D01        LXI D, M1BUFFER
01F5 CD0500        CALL FDOS
01F8 CDC301        CALL CRLF
01FB CDC301        CALL CRLF
01FE 0E09          MVI C, PRINT$CONS
0200 118B01        LXI D, M2BUFFER
0203 CD0500        CALL FDOS
0206 CDC301        CALL CRLF
0209 CDC301        CALL CRLF
020C CDC301        CALL CRLF
020F 0E11         DONEIT MVI C, MATCH$1ST
0211 112401       DITLP1 LXI D, FCB
0214 CD0500        CALL FDOS
0217 FEFF          CPI 255
0219 CA5402        JZ ALL$MATCH
021C 0601          MVI B, 1
021E 0F            RRC
021F D22302        JNC NO$LSB
0222 04            INR B
0223 0F           NO$LSB RRC
0224 D22902        JNC NO$NSB
0227 04            INR B
0228 04            INR B
0229 216000       NO$NSB LXI H, DIRECTORY - 20H
022C 112000        LXI D, 20H
022F 19           FCBLP1 DAD D
0230 05            DCR B
0231 CA3702        JZ FCBSET
0234 C32F02        JMP FCBLP1
0237 3A4601       FCBSET LDA FCB$COUNT
023A 3C            INR A
023B 324601        STA FCB$COUNT
023E E5            PUSH H
023F 2A4701        LHLD FCB$LOCATION
0242 E5            PUSH H
0243 D1            POP D
0244 E1            POP H
0245 012000        LXI B, 32
0248 EDB0          DB 0EDH,0B0H
024A D5            PUSH D
024B E1            POP H
024C 224701        SHLD FCB$LOCATION
024F 0E12          MVI C, MATCH$NEXT
0251 C31102        JMP DITLP1
0254 3A4601       ALL$MATCH LDA FCB$COUNT
0257 324A01        STA FILE$TOTAL
025A 210703        LXI H, FCB$BUFFER
025D 111703        LXI D, FCB$BUFFER + 16
0260 0E0B         SUBLP0 MVI C, 11
0262 3E00          MVI A, 0
0264 12            STAX D
0265 23            INX H
0266 13            INX D
0267 7E           SUBLP1 MOV A, M
0268 FE20          CPI ' '
026A CA6F02        JZ NOSUB
026D C620          ADI 20H
026F 12           NOSUB STAX D
0270 23            INX H
0271 13            INX D
0272 0D            DCR C
0273 C26702        JNZ SUBLP1
0276 3E00          MVI A, 0
0278 0E04          MVI C, 4
027A 12           NSLP STAX D
027B 13            INX D
027C 23            INX H
027D 0D            DCR C
027E C27A02        JNZ NSLP
0281 3A4601        LDA FCB$COUNT
0284 3D            DCR A
0285 CA9902        JZ RENAME
0288 324601        STA FCB$COUNT
028B 011000        LXI B, 16
028E 09            DAD B
028F E5            PUSH H
0290 D5            PUSH D
0291 E1            POP H
0292 09            DAD B
0293 E5            PUSH H
0294 D1            POP D
0295 E1            POP H
0296 C36002        JMP SUBLP0
0299 3A4A01       RENAME LDA FILE$TOTAL
029C 210703        LXI H, FCB$BUFFER
029F E5           RENLP1 PUSH H
02A0 010C00        LXI B, 12
02A3 1E02          MVI E, 2
02A5 09           STLP DAD B
02A6 1604          MVI D, 4
02A8 3E00          MVI A, 0
02AA 77           LP MOV M, A
02AB 23            INX H
02AC 15            DCR D
02AD C2AA02        JNZ LP
02B0 1D            DCR E
02B1 C2A502        JNZ STLP
02B4 D1            POP D
02B5 D5            PUSH D
02B6 0E17          MVI C, RENAMEF
02B8 CD0500        CALL FDOS
02BB E1            POP H
02BC 112000        LXI D, 32
02BF 19            DAD D
02C0 3A4A01        LDA FILE$TOTAL
02C3 3D            DCR A
02C4 324A01        STA FILE$TOTAL
02C7 C29F02        JNZ RENLP1
02CA 0E17          MVI C,RENAMEF
02CC 11D502        LXI D, SPFCB
02CF CD0500        CALL FDOS
02D2 C3F202        JMP DONREN
02D5 006F70656ESPFCB DB 0,6FH,70H,65H,6EH,20H,20H,20H,20H
02DE 636F6D0000 DB 63H,6FH,6DH,0,0,0,0,0,'OPEN     COM',0
02F2 CDC301       DONREN CALL CRLF
02F5 CDC301        CALL CRLF
02F8 0E09          MVI C, PRINT$CONS
02FA 11AB01        LXI D, M4BUFFER
02FD CD0500        CALL FDOS
0300 2A4B01       FEND LHLD OLD$SP
0303 F9            SPHL
0304 C30000        JMP 0000H
0307 =             FCB$BUFFER EQU $
0307               END 100H
```

Listing 2. OPEN.COM routine.

```
0100              ORG 100H
0100 C35002       JMP BEGIN
                    ;
                    ;  declare all constants, variables
                    ;  and buffers to be used.
                    ;
0005 =            FDOS            EQU 05H
0080 =            DIRECTORY       EQU 80H
0002 =            PRINT$CHAR      EQU 02H
0009 =            PRINT$CONS      EQU 09H
000A =            READ$CONS       EQU 10
0011 =            MATCH$1ST       EQU 17
0012 =            MATCH$NEXT      EQU 18
0017 =            RENAMEF          EQU 23
000D =            DISK$RESET      EQU 13
                  ;
                  ;
0103 20           INPUT$BUFFER  DB 32
0104               DS 32
0124 0B           PASSWORD    DB PWEND - PWSTART
0125 435241434BPWSTART DB 'CRACKERJACK'
0130 =            PWEND           EQU $
```

(listing continued on page 101)

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(continued from page 98)

name. The match FCB primitives then have the effect of becoming "find first file" or "find next file" in the directory. rather than finding the first and next matching file.

Using this method it becomes possible to scan the directory effectively. The FDos also indicates when there are no further files in the directory by returning the value FFhex in register A on return from the match FCB primitives. This return value actually indicates that there is no file in the directory to match the selected FCB. As this would be matched by any file, it effectively indicates "no more files".

There is one major problem to be overcome when using this method. The disc buffer will only be large enough to hold four FCBs from the directory, so when it is full you must either rename these four files before proceeding, or move them to another, larger buffer. This decision is dictated by the fact that no intervening FDos calls can be made between use of the match FCB primitives, as the system would "lose its place in the directory" during other calls.

Thus a large buffer must be set up to hold an FCB for each file on the disc. You then have to move all the FCBs to this area when the FDos finds them, keep a count of the number of FCBs found, and then rename them all, once the last FCB has been moved.

The logic for this program is given in a procedural flowchart in figure 1, the program itself is in the assembler listing produced by ASM.COM. Both the flowchart and the listing refer to OPEN .COM, as this is the most complex of the pair of programs. CLOSE.COM is almost identical, except for variations:

None of the program lines referring to the password are required in CLOSE.COM. So delete the source lines in the listing, which are assembled at the locations 0124 to 0125 and 0276 to 02BEhex.

M2Buffer, M4Buffer and MIBuffer are not required in CLOSE.COM. M3Buffer should be relabelled M4Buffer.

MXBuffer in CLOSE.COM should read:

MXBUFFER DB ' CLOSING DIRECTORY — PLEASE WAIT.S'

The conversion of the file names in CLOSE.COM requires the value 20hex to be added to each character, not subtracted as in OPEN.COM. So delete the source lines at locations 0337 and 0339. In the line at location 033C, change SUI to ADI.

One extra piece of code must be added: the routine that will convert back to upper case the file now named "open.com", so that it will be executable by the user when he wishes to run it. Insert the following lines before

FEND LHLD OLD$SP

which is five lines from the end:

```
MVI C, RENAMEF
LXI D, SPFCB
CALL FDOS
JMP FEND
SPFCB DB 0,6FH, 70H, 65H, 6EH, 20H,
   20H, 20H, 20H, 63H, 6FH, 6DH
DB 0,0,0,0, 'OPEN COM', 0,0,0,0
```

These changes should be made to the source code for OPEN.COM and then assembled using ASM. The resulting hex file should be saved as a command file using DDT to load it into RAM.

The only other change concerns systems with an 8080 or 8085 processor, rather than a Z-80. These users must change the line assembled at 0312hex from the block move, EDB0, to a small routine which will move each of the 32 bytes individually.

(listing continued from page 99)

```
0130 003F3F3F3FFCB DB 0,'????????????'
013C 0000000000 DW 0,0,0,0,0,0,0,0,0,0,0,0
                ;
                ;
0152 00         FCB$COUNT DB 0
0153 AE03       FCB$LOCATION DW FCB$BUFFER
0155 00         FILE$COUNT DB 0
0156 00         FILE$TOTAL DB 0
0157 0000       OLD$SP DW 0
0159            STACK DS 32
0179 =          STACK$TOP EQU $
                ;
                ;
0179 2020202041M1BUFFER DB '    A P H  SECURITY SYSTEM$'
0194 2020202045M2BUFFER DB '    ENTER YOUR PASSWORD. >$'
01AF 2020444952M3BUFFER DB '  DIRECTORY CLOSED - NO ACCESS.$'
01CF 2020444952M4BUFFER DB '  DIRECTORY OPEN - CONTINUE.$'
01EC 20204F5045MXBUFFER DB '  OPENING DIRECTORY - PLEASE WAIT.'
020E 2020202020 CONT DB '           $'
021B 2020534F52MIBUFFER DB '  SORRY - NOT A VALID PASSWORD.$'
                ;
                ;
                  ;
                  ;  subroutine CRLF sends a CR/LF
                  ;  to the console.
                  ;
023B C5D5E5     CRLF PUSH B! PUSH D! PUSH H
023E 0E02        MVI C, PRINT$CHAR
0240 1E0D        MVI E, ODH
0242 CD0500      CALL FDOS
0245 0E02        MVI C, PRINT$CHAR
0247 1E0A        MVI E, OAH
0249 CD0500      CALL FDOS
024C E1D1C1      POP H! POP D! POP B
024F C9          RET
                  ;
                  ;  BEGIN is the start of the main
                  ;  program. The stack is set up
                  ;  and disk system reset.
                  ;
0250 210000     BEGIN LXI H, 0
0253 39          DAD SP
0254 225701      SHLD OLD$SP
0257 317901      LXI SP, STACK$TOP
025A 0E0D        MVI C, DISK$RESET
025C CD0500      CALL FDOS
                  ;
                  ;  introduction message and
                  ;  instruction to type password is
                  ;  printed at the console using
                  ;  PRINT$CONS primitive and CRLF.
                  ;
025F CD3B02      CALL CRLF
0262 CD3B02      CALL CRLF
0265 CD3B02      CALL CRLF
0268 0E09        MVI C, PRINT$CONS
026A 117901      LXI D, M1BUFFER
026D CD0500      CALL FDOS
0270 CD3B02      CALL CRLF
0273 CD3B02      CALL CRLF
0276 CD3B02      CALL CRLF
0279 0E09        MVI C, PRINT$CONS
027B 119401      LXI D, M2BUFFER
027E CD0500      CALL FDOS
                  ;
                  ;  users response is read into
                  ;  INPUT$BUFFER using READ$CONS
                  ;  primitive.
                  ;
02B1 0E0A        MVI C, READ$CONS
02B3 110301      LXI D, INPUT$BUFFER
02B6 CD0500      CALL FDOS
                  ;
                  ;  Actual password at PASSWORD is
                  ;  compared with that input by the
                  ;  user. If correct move to DONEIT,
                  ;  otherwise to WRONG.
                  ;
02B9 210501      LXI H, INPUT$BUFFER + 2
02BC 112401      LXI D, PASSWORD
02BF 1A          LDAX D
0290 4F          MOV C,A
0291 13          INX D
0292 1A         PWLP1 LDAX D
0293 47          MOV B, A
0294 7E          MOV A, M
0295 B8          CMP B
0296 C2A202      JNZ WRONG
0299 23          INX H
029A 13          INX D
029B 0D          DCR C
029C CAC102      JZ DONEIT
029F C39202      JMP PWLP1
                  ;
                  ;  Password is not valid. Directory
                  ;  will remain closed. Message is
                  ;  printed at console using
                  ;  PRINT$CONS primitive, and control
                  ;  jumps to terminating section FEND.
                  ;
02A2 CD3B02     WRONG CALL CRLF
02A5 CD3B02      CALL CRLF
02A8 0E09        MVI C, PRINT$CONS
02AA 111B02      LXI D, MIBUFFER
02AD CD0500      CALL FDOS
02B0 CD3B02      CALL CRLF
02B3 CD3B02      CALL CRLF
02B6 0E09        MVI C, PRINT$CONS
02B8 11AF01      LXI D, M3BUFFER
02BB CD0500      CALL FDOS
02BE C3A703      JMP FEND
                  ;
                  ;  Password is valid. Directory will
                  ;  be restored. Message is printed
                  ;  to console overwriting password.
                  ;
02C1 0E02       DONEIT MVI C,PRINT$CHAR
02C3 1E0D        MVI E, ODH
02C5 CD0500      CALL FDOS
02C8 0E09        MVI C,PRINT$CONS
```

(continued on page 103)

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(continued from page 101)

```
02CA 11EC01     LXI D, MXBUFFER
02CD CD0500     CALL FDOS
02D0 CD3B02     CALL CRLF
02D3 CD3B02     CALL CRLF
02D6 CD3B02     CALL CRLF
                  ;
                  ;  FDOS primitives MATCH$1ST and
                  ;  MATCH$NEXT are used to bring
                  ;  the FCB for each file on disk
                  ;  into the disk buffer at 0080H.
                  ;
02D9 0E11       MVI C, MATCH$1ST
02DB 113001     DITLP1 LXI D, FCB
02DE CD0500     CALL FDOS
02E1 FEFF       CPI 255
02E3 CA1E03     JZ ALL$MATCH
                  ;
                  ;  If 255 is returned from FDOS
                  ;  in reg. A, then no files are
                  ;  left on disk which match the
                  ;  filename in our FCB. This
                  ;  must mean no files remain as
                  ;  our FCB will match any filename.
                  ;
02E6 0601       MVI B, 1
02E8 0F         RRC
02E9 D2ED02     JNC NO$LSB
02EC 04         INR B
02ED 0F         NO$LSB RRC
02EE D2F302     JNC NO$NSB
02F1 04         INR B
02F2 04         INR B
02F3 216000     NO$NSB LXI H, DIRECTORY - 20H
02F6 112000     LXI D, 20H
02F9 19         FCBLP1 DAD D
02FA 05         DCR B
02FB CA0103     JZ FCBSET
02FE C3F902     JMP FCBLP1
                  ;
                  ;  When here, reg H contains the
                  ;  RAM location of the start of
                  ;  the FCB for the next file in
                  ;  the directory.
                  ;
0301 3A5201     FCBSET LDA FCB$COUNT
0304 3C         INR A
0305 325201     STA FCB$COUNT
0308 E5         PUSH H
0309 2A5301     LHLD FCB$LOCATION
030C E5         PUSH H
030D D1         POP D
030E E1         POP H
                  ;
                  ;  Now move the 32 bytes starting
                  ;  at the location in H, to the
                  ;  buffer area starting at the
                  ;  location in D. Thus the whole
                  ;  FCB for the next file is moved
                  ;  to the buffer FCB$BUFFER, the
                  ;  current start location of which
                  ;  is held in FCB$LOCATION.
                  ;
                  ;  This section cheats, using the
                  ;  Z80 block transfer code ED B0
                  ;  to move the FCB. This must be
                  ;  modified if 8080 CPU is used.
                  ;
030F 012000     LXI B, 32
0312 EDB0       DB 0EDH,0B0H
0314 D5         PUSH D
0315 E1         POP H
0316 225301     SHLD FCB$LOCATION
0319 0E12       MVI C, MATCH$NEXT
                  ;
                  ;  One FCB has now been moved to
                  ;  the buffer. Update the buffer
                  ;  and file pointers and jump
                  ;  back to the start of this loop
                  ;  at DITLP1, to move next FCBs.
                  ;
031B C3DB02     JMP DITLP1
031E 3A5201     ALL$MATCH LDA FCB$COUNT
                  ;
                  ;  when here, FCB$BUFFER contains
                  ;  a valid FCB for each file on
                  ;  the disk. Each FCB is 32 bytes
                  ;  not the full 33 as the current
                  ;  record field is not required.
                  ;
                  ;  Now insert nulls into all
                  ;  unused FCB fields. Then move
                  ;  the upper case equivalent of
                  ;  the lower case filename in the
                  ;  first 16 bytes into the second
                  ;  16 bytes. This simply involves
                  ;  subtracting 20H from the ASCII
                  ;  values.
                  ;
0321 325601     STA FILE$TOTAL
0324 21AE03     LXI H, FCB$BUFFER
0327 11BE03     LXI D, FCB$BUFFER + 16
032A 0E0B       SUBLP0 MVI C, 11
032C 3E00       MVI A, 0
032E 12         STAX D
032F 23         INX H
0330 13         INX D
0331 7E         SUBLP1 MOV A, M
0332 FE20       CPI ' '
0334 CA3E03     JZ NOSUB
0337 FE5A       CPI 5AH
0339 FA3E03     JM NOSUB
033C D620       SUI 20H
033E 12         NOSUB STAX D
033F 23         INX H
0340 13         INX D
0341 0D         DCR C
0342 C23103     JNZ SUBLP1
0345 3E00       MVI A, 0
0347 0E04       MVI C, 4
0349 12         NSLP STAX D
034A 13         INX D
034B 23         INX H
034C 0D         DCR C
034D C24903     JNZ NSLP
                  ;
                  ;  One FCB is now in the right
                  ;  format for use with RENAME
                  ;  primitive. If all FCBs have
                  ;  been processed proceed to
                  ;  renaming section, else jump
                  ;  back to start of loop after
                  ;  updating pointers etc.
                  ;
0350 3A5201     LDA FCB$COUNT
0353 3D         DCR A
0354 CA6803     JZ RENAME
                  ;
                  ;  Pointers will point to next FCB.
                  ;  Then jump back to SUBLP0
0357 325201     STA FCB$COUNT
035A 011000     LXI B, 16
035D 09         DAD B
035E E5         PUSH H
035F D5         PUSH D
0360 E1         POP H
0361 09         DAD B
0362 E5         PUSH H
0363 D1         POP D
0364 E1         POP H
0365 C32A03     JMP SUBLP0
                  ;
                  ;  Now use RENAME primitive with
                  ;  each FCB in the buffer to
                  ;  rename each file with its old
                  ;  upper case name. More nulls
                  ;  are added as required first.
                  ;
0368 3A5601     RENAME LDA FILE$TOTAL
036B 21AE03     LXI H, FCB$BUFFER
036E E5         RENLP1 PUSH H
036F 010C00     LXI B, 12
0372 1E02       MVI E, 2
0374 09         STLP DAD B
0375 1604       MVI D, 4
0377 3E00       MVI A, 0
0379 77         LP MOV M, A
037A 23         INX H
037B 15         DCR D
037C C27903     JNZ LP
037F 1D         DCR E
0380 C27403     JNZ STLP
0383 D1         POP D
0384 D5         PUSH D
0385 0E17       MVI C, RENAMEF
0387 CD0500     CALL FDOS
                  ;
                  ;  A file has been renamed. Update
                  ;  pointer to next FCB, and the
                  ;  file counter. Jump back to start
                  ;  of loop at RENLP1 if more files
                  ;  have yet to be renamed.
                  ;
038A E1         POP H
038B 112000     LXI D, 32
038E 19         DAD D
038F 3A5601     LDA FILE$TOTAL
0392 3D         DCR A
0393 325601     STA FILE$TOTAL
0396 C26E03     JNZ RENLP1
                  ;
                  ;  All files are now renamed. Print
                  ;  a final message to console.
                  ;
0399 CD3B02     DONREN CALL CRLF
039C CD3B02     CALL CRLF
039F 0E09       MVI C, PRINT$CONS
03A1 11CF01     LXI D, M4BUFFER
03A4 CD0500     CALL FDOS
                  ;  Terminate program by restoring
                  ;  stack to original state and
                  ;  jumping to CP/M boot location.
                  ;
03A7 2A5701     FEND LHLD OLD$SP
03AA F9         SPHL
03AB C30000     JMP 0000H
                  ;  FCB$BUFFER starts here as its
                  ;  length is dependant upon the
                  ;  number of files on the disk,
                  ;  and so will vary.
                  ;
03AE =          FCB$BUFFER EQU $
03AE            END 100H
```

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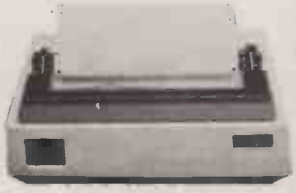

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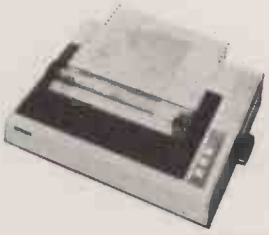

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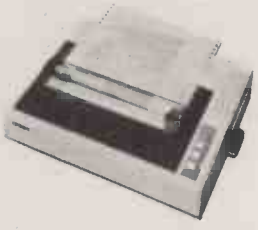

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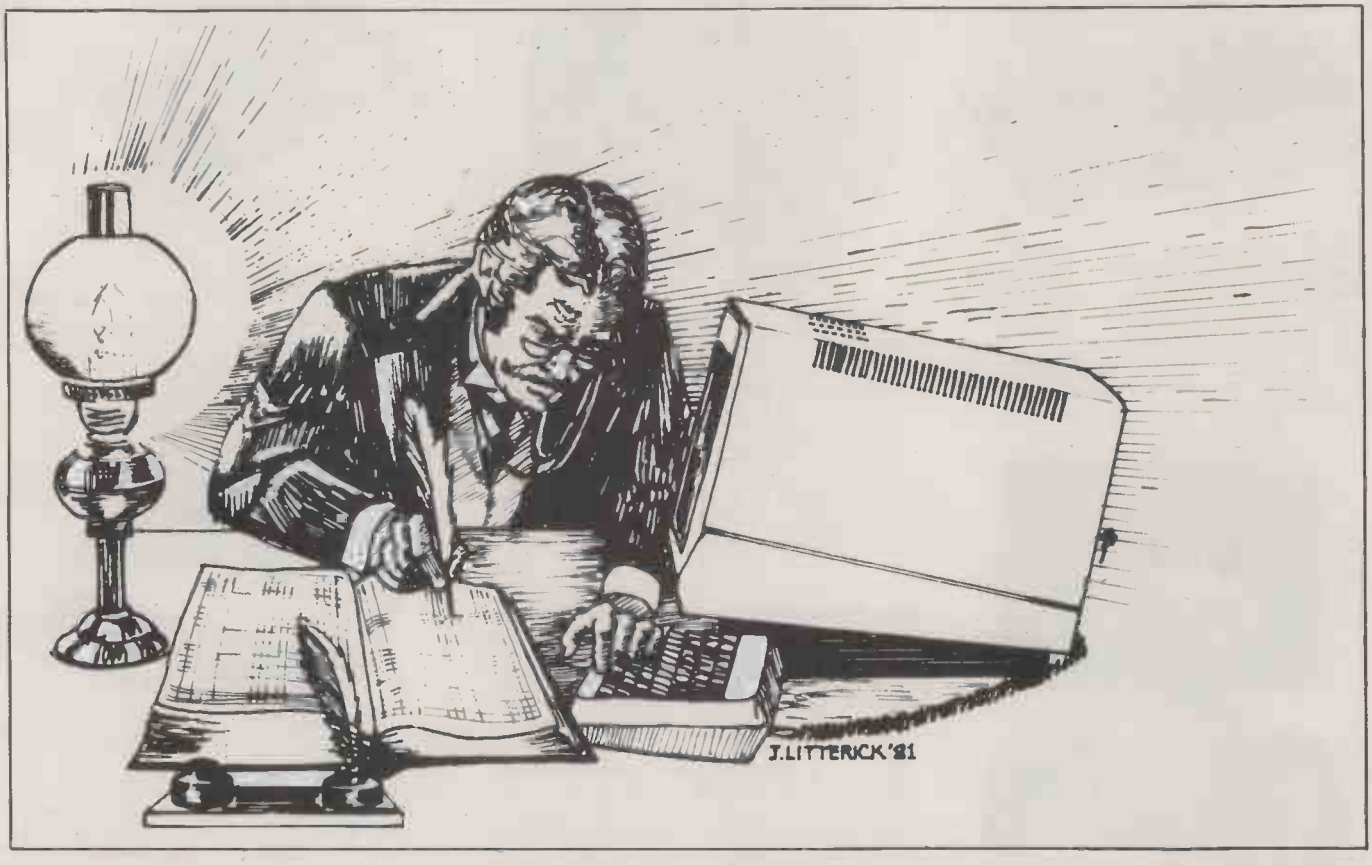
It is a waste of time to try and prove that programs are correct by using mathematical or logical proofs, argues Boris Allan. What matters is whether they work, and you can only discover that by running them.

Searching for truth



IT IS NOW realised that a scientific theory can never be given more than a provisional acceptance, one can only say that it has been "found to be true so far". Such provisional acceptance must be based on attempts to falsify the theory. It is only too easy to find confirmations of a theory; efforts should be directed towards trying to prove the theory wrong rather than making a vain attempt to prove it right.

This attitude to testing is generally associated with the name of Karl Popper. Though some of Popper's other ideas are the subject of a debate, the notion of falsification is relatively non-controversial. An implication of this approach is that you can never show a theory or hypothesis to be true, while a single disconfirming instance — an error in a prediction — shows that the theory or hypothesis is untrue.

In recent years theoretical computer scientists have expended much time, work and energy, on "proving programs correct", using purely mathematical and logical methods. Yet it is impossible to prove that a program is correct merely by testing it, as a famous quote from Dijkstra clearly states: "Program testing can be used to show the presence of bugs, but never to show their absence".

It is hoped that if a program is proved to be "correct" by mathematical means you can be assured of no errors or, in the jargon, no bugs. The use of these methods has a powerful appeal. The recent text by Linger and others declares: "The new reality [of programming] is that you can learn to consistently design and write programs that are correct from the beginning and that prove to be error-free in their testing and subsequent use".

Known by the soubriquet "structured" programming, there now exists a well-established approach to programming in which proofs of correctness play an important role in teaching the student programmer. To program in a structured manner does not require a knowledge of correctness proofs. Outside the confines of computer studies, most so-called structured programming is nothing but systematic or modular programming under another name.

It is worth being explicit about what is promised:

a. it is impossible to prove that a program is correct merely by testing the program, though testing may reveal that the program is incorrect.
b. it is possible to prove that a program is correct by mathematical means.

A program is an answer to a question and, in science, answers to qustions set by nature are called "theories". A computer program is a theory or hypothesis of how a computation should be; the execution of a program is the test of the theory — analogous to an experiment.

If the promises about correctness proofs for programs are written with the term "theory" in the place of "program" then you find:

a. it is impossible to prove a theory correct by testing the theory, though a theory can be shown to be incorrect;
b. it is possible to prove that a theory is correct by purely mathematical means.

Consideration "a" is the "Popperian falsificationist" position, but "b" is patently untrue — you can establish internal consistency by mathematical means, but never external truth. That a program or theory is internally consistent may mean that the program or theory is less likely to be false; reality is the ultimate arbiter,

(continued on page 107)

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The neglect of the consequences of induction is a key flaw in structured programming, particularly in the proving of program correctness. Techniques for proving program correctness have been held out as a means by which totally correct programs can be written, before the programs are even run on a computer.

The argument may be summarised as follows:

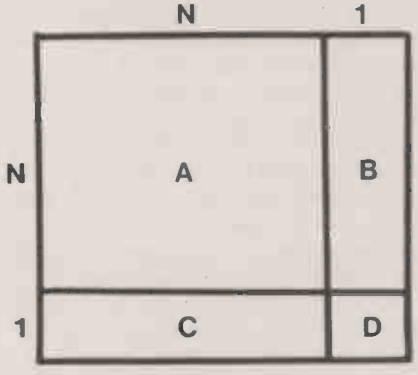
- It is impossible to prove a program is totally correct, by any means.
- Proponents of structured programming have confused verification, proving correct, with falsification or trying to prove incorrect.
- Methods of proving program correctness are merely methods of establishing program consistency — in itself no bad thing.
- Methods of proving program correctness are based on a method, induction, whose own correctness cannot be proven.
- Conventional mathematical methods do not work when you consider computations for floating-point numbers on a real computer.
- There can be no escape from the actual execution of a program on a computer — in fact the same program might be correct on one computer but not work at all on another.

(continued from page 105)

however, as the program, or theory, must at some point match reality.

It is not possible to prove programs correct by testing, only correct so far, though this is all that can be said of any scientific theory — only correct so far. If the necessity for any reference to reality is eliminated for programming, then science would have difficulty in following this pattern. In the case of a computer program, "reality" is the computer.

There are those who extoll the virtues of correctness proofs even to the extent of designing computer languages to facilitate such proofs. They have missed the point. No theory can ever be proven to be



correct, though it is possible that a theory may be proven to be consistent. Even then it is usually only trivial theories that afford such a proof, classical mechanics, for example. Proofs of consistency have been confused with proofs for "correctness". Anderson provides a simple introduction to correctness proofs.

The question of the proof of theories is tied up with the general question of induction. A theory can never be proved correct purely on the basis of past experience, however formal the past experience. Will the sun rise tomorrow?

How do the supporters of correctness proofs think they have circumvented the problem of induction? First, consider what is a "proof". If

$$F(N) = (N+1)^2$$

then simple algebra suggests that also

$$F(N) = N^2+2N+1$$

turning this argument into a proposition P1(N),

$$P1(N): F(N) = (N+1)^2 \equiv F(N) = N^2+2N+1$$

The question arises, how would the process of proof for P1(N) progress?

Those who have a strong visual imagery might think of a square with side N+1. Within it shape A has an area N^2, B and C both have area N, and D has an area of 1 unit. The area of the square of side N+1 is $(N+1)^2$. It is equal to the sum of the areas A+B+C+D, which is N^2+2N+1. P1(N) is thus proven correct.

A critic of this process of proof might then ask to be shown that the shape A, an N-by-N square, really has an area of N^2. The process of clarification and proof could be pushed further and further — like that annoying child's question "Why?" — and the critic still need not be satisfied. Only if the critic is "sensible" and displays some goodwill is the first diagram likely to suffice. Mathematical proof is based on goodwill.

Suppose the correctness of P1(N) is demonstrated by

$$\begin{aligned}(N+1)^2 &= (N+1)(N+1)\\ &= N(N+1) + 1(N+1)\\ &= N^2 + N + N + 1\\ &= N^2 + 2N + 1\end{aligned}$$

and this is the "proof". The critic says, "Fine, you have played with letters and numbers according to your rules, but prove it". A number is substituted for N — say, 0 — so that

$$(N+1)^2 = (0+1)^2 = 1$$

and

$$N^2+2N+1 = 0+0+1 = 1$$

thus the proposition P1(0) is correct.

The critic now says "It is true for N=0, but what about other numbers"? Even when every substitution for N shows P1(N) to be correct the critic may remain unconvinced. An appeal has to be made to the critic's goodwill, to "see", by induction, that P1(N) is true. Yet P1(N) need not necessarily be true for transfinite numbers.

The goodwill is codified as a standard method of proof called mathematical induction, which in its simplest form is as follows:

a. prove P1(0) is true;
b. prove that if P1(N) is true then P1 (N+1) is necessarily true.

It is intuitively clear that, by induction, "a" and "b" together provide a proof of P1(N) for all positive values of N, and with goodwill this can be accepted as proof. From the earlier discussion it can be seen that "b" is as open to query as any other proof. For example, it can be said "So it is true for N and N+1, but what about N+2".

In advanced work you have to assume the process of proof with equivalents to "a" and "b" as axioms. That mathematical induction is true cannot be proven, so methods of induction whose correctness cannot be proven are used to prove the correctness of programs. See Passmore's book which includes a general discussion of induction.

Mathematical reasoning can be perfectly valid as mathematical reasoning but need not be valid as practical reasoning. Examine proposition P2(*)

$$P2(*): *y = *z \equiv y = z$$

which reveals an old chestnut. If * = 1 and y = 2 then

$$1 \times 2 = 1 \times z$$

so that z = 2 and thus y = z. However, if * = 0, and y = 2, then $0 \times 2 = 0 \times z$ so that z may be any finite value: we have ourselves resorted to the critic's stance.

Mathematically, we could say P2(*) is true for all values of * other than zero, but on a computer P2(*) is not true for all values of * other than zero. If * lies between ±1E−38, on most computers then * is taken to be zero; the computer is a finite machine.

On a computer, if */2 = 0 then either * is zero or * is equal to the smallest value which that computer regards as being distinct from zero. These kinds of arguments may explain why discussions of correctness proofs for floating-point as against integer numbers do not exist.

Perhaps this may also explain why scientific users have been slow to move to "structured" languages and have remained with a very old language, Fortran. Scientific users are mainly interested in computations on floating-point numbers, whereas with some "structured" languages, especially variants of Pascal, the use of floating-point numbers seems to be an afterthought.

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Putting across your message in print

In order to achieve success, it is worth spending some time and effort to make sure that the words and pictures used in promoting your product are right for the job, writes Clive Wilkins.

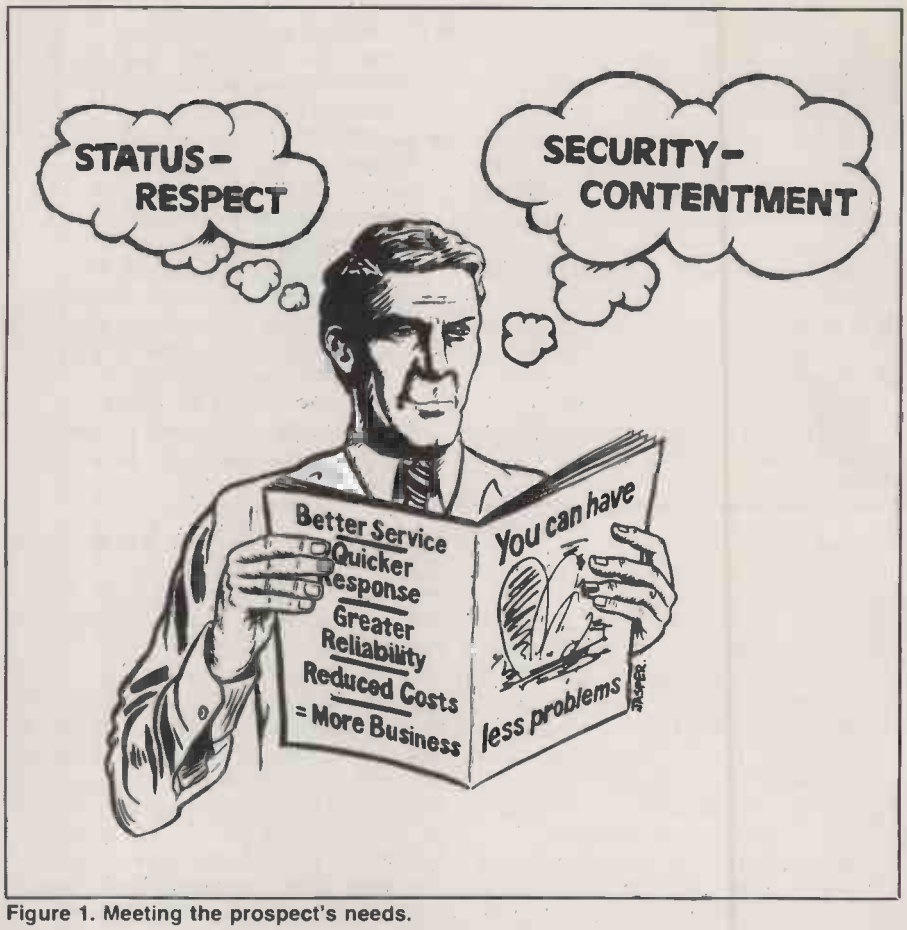

Figure 1. Meeting the prospect's needs.

STEVEN JOBS started Apple on the basis of having a good technical idea and has made himself a multi-millionaire by the age of 25. It is not surprising therefore that many others should want to follow suit. Technical expertise is to be found in abundance in the UK to produce a good crop of micro-products. But will they continue to sell? This depends partly on the quality of the products but crucially on whether or not there is sufficient marketing expertise to give them the start they need to build success. In many cases it is this element that is sadly lacking.

Microcomputer products are low priced and in general are not sold in bulk to end users. This means that employing salesmen is just not on for much of the market and the products have to be sold through response advertising or direct mail. In these cases, all the burden of putting across the sales message and getting the customer to sign is placed on the written word. In view of the importance to the future success of the product, it is worth spending some time and effort making sure that the words and pictures used are right for the job they have to do.

In function a piece of promotional literature is identical to a salesperson — it exists to achieve sales. This means it must

- grab prospective customers' attention
- stimulate their interest
- create a desire for the product
- initiate their action to buy

Before any of this can be done, there must be a very clear idea of who the prospective customers are, where they are, and what sort of needs they have. If writing the promotional materials causes these questions to be asked for the first time then there is something seriously wrong. They should have been asked before the product was developed in the first place.

Step one in producing publicity literature is to get out of the habit of thinking about the product and to think instead about the customers or prospects. It is all too easy to fill an advert with features of the hardware or software instead of thinking about how it answers the prospects' needs. People do not buy features — they buy answers to their needs.

A list of needs

Fundamentally, it boils down to needs like being content and secure, having status and being respected. No one is going to be content if it turns out that they have bought a piece of your hardware or software that does not work. The publicity must assure them that the product will not cause problems. This does not necessarily emerge from a list of features. Similarly, anyone buying hardware or software that can be proved to have saved money, or improve efficiency, will enhance their own status and the degree of respect they receive. The publicity must show how this can happen.

So before rushing into print, step aside and produce a list of needs which the prospects have and which the product can meet. Try to think about these from the customers' point of view.

It is no use, for example, saying that a payroll package meets the need to do payrolls. If the customers were honest their real need is not to do payrolls at all — they cost money and do not contribute to profit. As they cannot have this wish fulfilled, the next best is to get the payroll done with minimum fuss and this means quickly, easily, cheaply, accurately, reliably and regularly. These are the needs that a payroll package must meet.

Just by thinking about customer needs, some words such as quick, accurate, reliable, are emerging which provide the essential pegs for the publicity text. The idea of user-needs also provides the basis for deciding what form of publicity to produce. The same rules apply to publicity literature and adverts.

Beware of people who begin "We need a brochure for this product. They have probably decided what form the publicity will take without having any idea how it is to be used. Producing publicity literature should be just part of a marketing plan.

It is impossible to design a brochure and then decide what to do with it though it is surprising how many companies achieve the impossible. The function of a brochure should be one of its major design criteria.

If someone asked you to write a program for this computer you would first ask what the program was to be used for. The same applies to sales literature. You

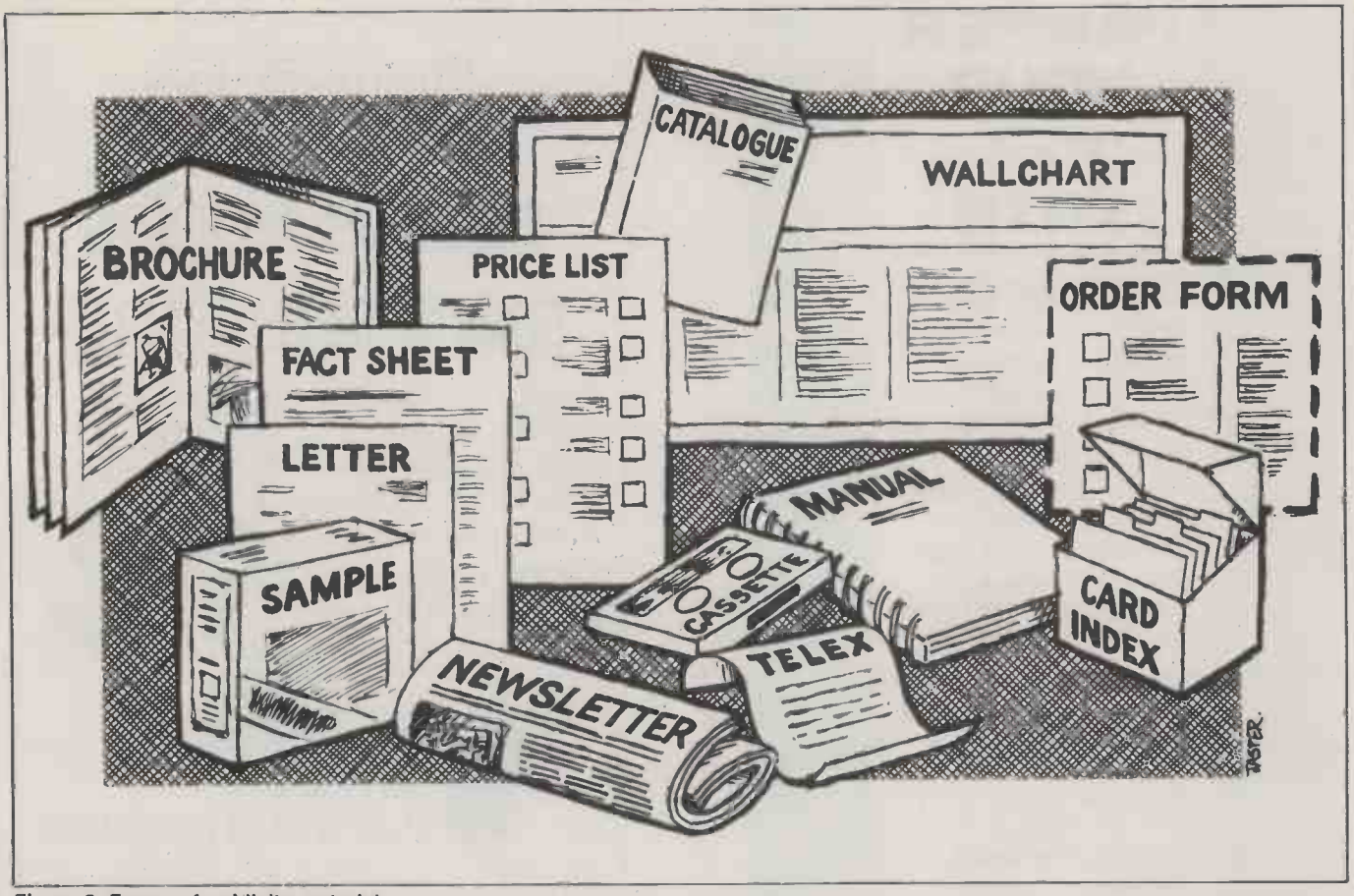

Figure 2. Forms of publicity material.

cannot design it without knowing what it is for, and how it is to be used.

Publicity literature can take many forms, some of them surprising to people with brochures on their minds.

If you are selling a wide range of cheap software then a typewritten stocklist with well thought-out copy describing each item is quite appropriate for the personal buyer to whom low cost is important. Similarly a folder containing fact sheets or case-history applications may be the right way to sell hardware to the naive user who is more interested in what the machine can do for him than technical details which he hardly understands anyway.

Importance of form

The form is of fundamental importance in determining how successfully the message is put across. A well thought-out low-cost solution may achieve infinitely more sales than a badly conceived expensive "brochure". Decide the function and the form before considering the contents.

Unless you are a design expert, you will probably get a qualified designer to produce the final version of your publicity material. Advertising agencies or graphic designers are often more concerned with appearances than function. So decide the balance of the contents yourself first, and then let the graphic designer advise you about the finer points of finished design and presentation.

Make a dummy of the finished article out of plain paper and sketch the main elements of contents on each page. This gives a clear idea of the balance of the contents and determines the amount of copy needed. The designer can adjust the number of words on a page and the layout to best effect, but can only work within the limits of the specification given.

It is no use handing over 16 pages of hardware jargon and saying, "put this on half a page and give it plenty of impact". The designer can do his best but it is an impossible task. Make your choice at the design stage. Either allow enough space to put over the message — or if you only allow half a page then limit the number of words.

"Do not code until the design is right" is the golden rule of programming. "Do not write publicity copy until the design is right" is a golden rule of marketing. Putting pen to paper is much easier when you know the specification for the piece you are writing and how it fits into the overall pattern of things.

At this preliminary design stage graphics have to be considered — the photographs, diagrams, graphs and drawings that are to accompany the text. Graphics have a strong impact on the reader and have a large influence on the tone of the piece — technical, amusing, informative, startling, friendly — whatever. Just as the words have to reflect answers to user-needs so too do the pictures.

Ask not whether a graphic has impact value or relevance to the product — but does it put the message across? A busty female may have plenty of impact but unless her picture contributes to the message being put across it has no value. Worse, it may actually conflict with the message the customer wants to receive. Umpteen pictures of the same piece of hardware do not necessarily increase the customer's understanding or desire.

Keep diagrams simple

Diagrams can be a very useful shorthand for putting across a technical message, but if you want the customer to read them they have to be simple. A natural reaction from people who understand the product in detail is to think that every plus point must be included and that every single correct linkage must be shown. But we are trying to think of the customer — and there is a limit to how much information can be absorbed from one diagram. Above this limit, adding more detail reduces the amount of information that the reader receives.

At the extreme, an exceedingly complicated diagram receives only the briefest glance and the only message received by the reader is one of complication.

Designers' graphic ideas often mesmerise technical people. There is a danger of accepting the first idea that comes along because it looks original.

The trick is to keep asking "Would that

(continued on page 111)

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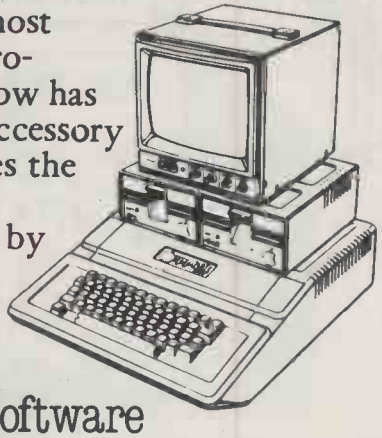

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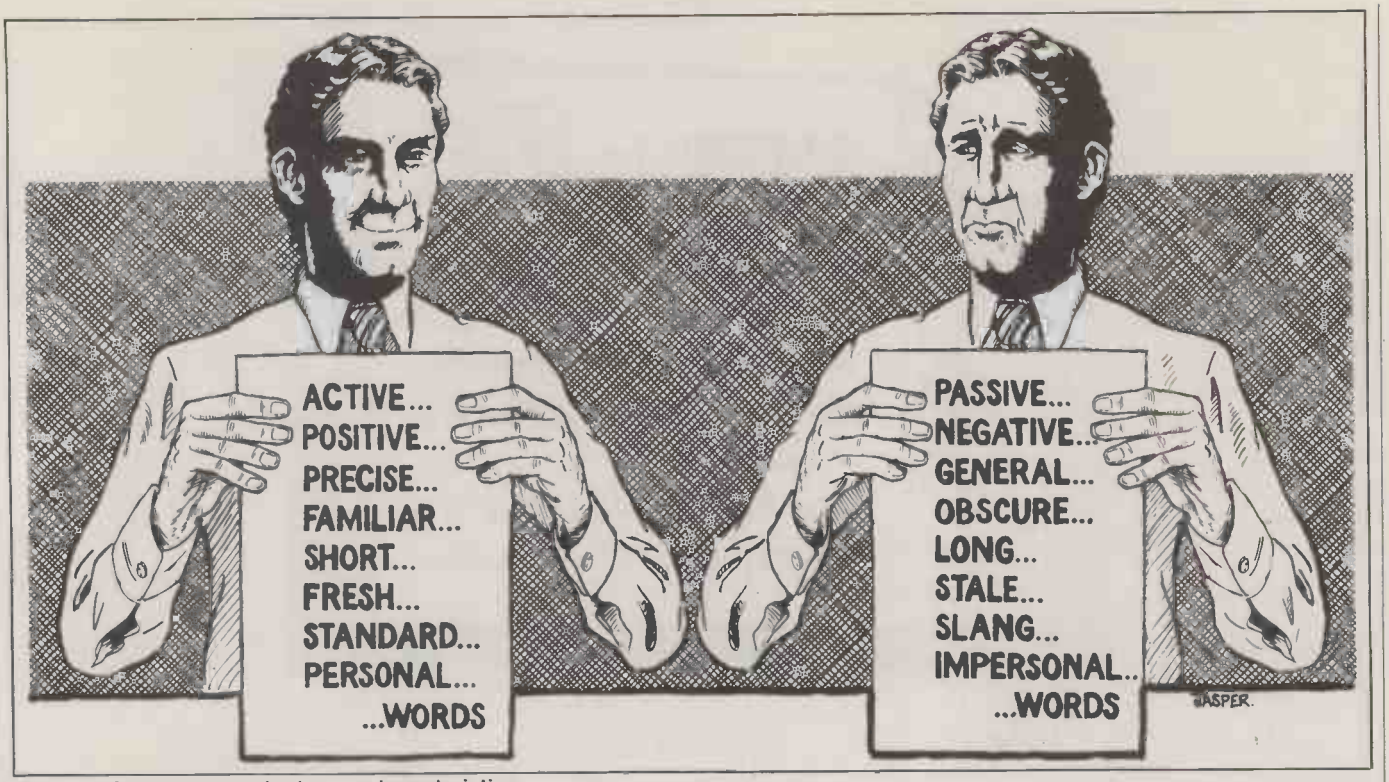

Figure 3. Good copy vs. bad copy characteristics.

(continued from page 109)

appeal to my needs if I were a customer"? Make the designer justify the design on this basis.

Copywriting is easy, but writing good copy is not. Even after a lot of practice, it always takes time and effort. You may feel disappointed that all you have to show for three or four hours of hard creative work is a paragraph of good copy, but when you see what one paragraph of good copy can achieve in sales, you will understand just how productive and valuable those hours of painful concentration were.

Copywriter's job

Armed with information on who the customers are, what their needs are, and how the product satisfies these needs, the copywriter's job is to:

- Remind or convince the prospects that they have needs
- Explain how the product satisfies a need — explicitly by describing what the need is and implicitly in the way that the product is described
- Convince the prospect that the product is the best way of satisfying the need
- Persuade the prospect to place the order

Any word of copy that does not contribute to one or more of these objectives must be ruthlessly expunged.

There is no easy way to turn average writers into brilliant copywriters but there are some simple tricks of the trade to help. First, words can be classified according to their characteristics as well as their meaning.

Sometimes words fall into contradictory categories. precise but long, personal but slang, and the copywriter has to decide whether the advantages outweigh the disadvantages. When in doubt the rule is — always prefer the word that is alive and interesting over the word that is dull but safe.

I find it helpful to jot down useful words on a list and refer to them from time to time to help out when stuck or just to ensure that the copy has the right sprinkling of active words. In general the adjectives should come from the user-need statements derived in the design step.

Choose the first word of a paragraph with care. It is a prime position and worthy of a good, interesting word. Here is an example:

The right small-business computer could make you money.

This isn't bad copy but it would be livelier if it started with a more powerful word, for example:

You can make money from the right small business computer.

Good words to start the first sentence include:

You
If
(any number)
Now
But
And
Go (or any verb)
How/What/Where/Why . . .?

Words that you should not use to start an initial sentence include:

The
It
A

Starting in this way makes the copy more lively and interesting to the reader — more likely to get your message across. Avoid burying the best words in the middle of a sentence or paragraph — give them a chance to shine. Do not be coy — spit it out. In particular, try to avoid those yawn-producing openings:

It is becoming increasingly important . . .
In recent years there has been a growing tendency . . .

Copy should always follow the rules of English — spelling, grammar, punctuation etc. with allowable exceptions such as short sentences with no verbs. Following the rules is particularly important when selling to people with programming experience who are so used to the disastrous effects of mis-spelling or faulty punctuation in programs that errors leap out of the page at them even in ordinary English.

This article will not teach you grammar but there are one or two points that may help you get one up on your competitors.

(continued on next page)

Identifying the market.

What needs does the product meet?

More efficient stock control
Quicker order taking
More reliable payroll

Who has these needs?

Industry sectors: eg manufacturing/finance/construction/local government
Particular types: eg estate agents/oil companies/small batch manufacturers
Prospect's job title: eg personnel manager/senior partner/management services manager

How many prospects are there in total?

Total prospects of the type specified
— minus those you do not know how to find
— minus those you cannot afford to contact
— minus those who are already happy with what they have

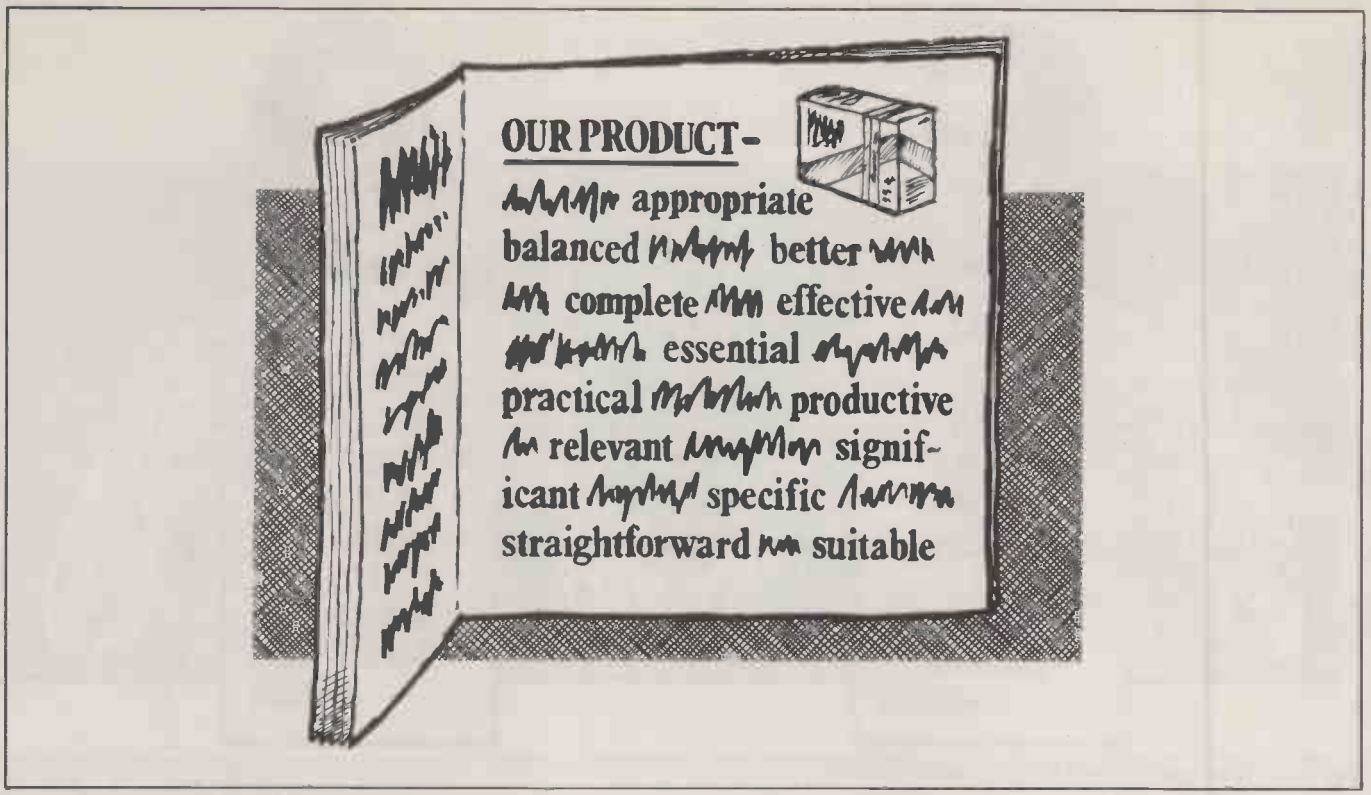

Figure 4. Some user-friendly adjectives.

(continued from previous page)

First, use the present tense whenever possible. Use "Our software gives you these benefits" rather than "Our software will give you these benefits" or "This personal computer produces 20 invoices a minute" rather than "will produce".

Second, be active rather than passive — "Take this opportunity . . ." not "This opportunity should be taken . . ."

Third, avoid negative constructs: "Get this package now", not "No one should avoid this opportunity of getting . . ."

Fourth, be consistent with names and technical terms. If you have described your product as stock-control software in one place do not call it the stock-control program or stock-control package elsewhere.

Finally, be kind to the readers and coax them through the copy gently, giving them suitable headings to help them on their way. For example, make sure that in any continuous block of copy the level of copy is consistent.

Checking the proofs.

Read all the headlines, flashes, and vital details

Concentrate on addresses, telephone numbers, prices, dates, order reference numbers.

These are crucial parts in which errors have disastrous results — even maybe the time and expense of reprinting.

Scan the text without absorbing the meaning

Look at each word as a separate entity — this should uncover most of the keying errors in typesetting.

Read the text concentrating on the meaning

This will uncover the type of error where one word has been converted to another word. "Now" converted to "Not" is an example and one which plays havoc with the meaning of the text.

Make sure the corrections are checked

Errors have a habit of slipping through at this stage because of the overwhelming desire to get the artwork to the printers as soon as possible.

Keep copy flow

Do not say "This computer system is the most sophisticated small computer for its price available today. The printer casing is painted an attractive green." This sort of jump in level is not uncommon and it is a ghastly experience for the reader. It is like flying into an air pocket. The difference in level hits you with a bang and stops your reading dead. Using conjunctions to start sentences can avoid discontinuities. And, but, so, — these are all words that link one sentence or thought with the next and, provided that the argument is a logical one, help the reader absorb your message.

Copy and the rough design are the raw materials of the designer who is responsible for producing the finished artwork for the printer. The interplay between the designer who knows about graphics and typography, and the people who know about the product is a subject in itself. But the fundamentals of the relationship have already been spelled out — make sure that the designer understands who the publicity is designed for, and how it is to be used.

Good designers should be able to explain how their designs meet the needs of the market you have specified. They should also be able to suggest minor changes to the copy that will improve the effectiveness of the finished article.

Having spent time and effort on getting the words and design right it is a tragedy to spoil the whole thing by letting mistakes through when the typesetting is done. It is very important to thoroughly check all the copy. Ignorance — real or simulated — is the best qualification for proof-reading. The human eye has a marvellous propensity for seeing what it expects to see even when this is different from what has been written.

This is accentuated when the proof-reader is also the original author, so if possible someone else should do the checking. Avoid that awful feeling of spotting a glaring error when the boxes of printed literature are delivered from the printer.

You have identified the market, and how you are going to get at it. You have produced a stunning selling document — now make sure the plans get carried through. Publicity material is expensive to produce but resist the temptation to over-order because the print costs for the extra copies are comparatively small. If you have no immediate plan for using them, they will probably never be used. If you have worked out a proper campaign with a specific rate of return, you will easily be able to afford a reprint when necessary incorporating the latest changes. It is amazing how many companies throw their hands up in horror at the cost of printing while throwing away unused publicity material which has outlived its usefulness.

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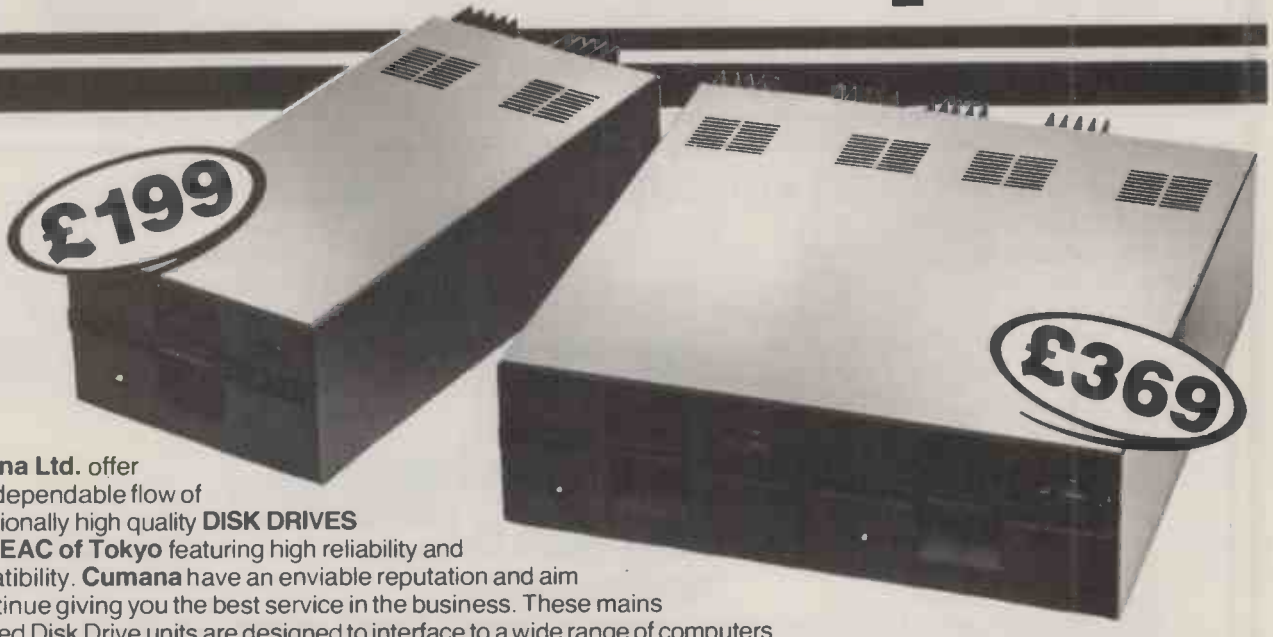

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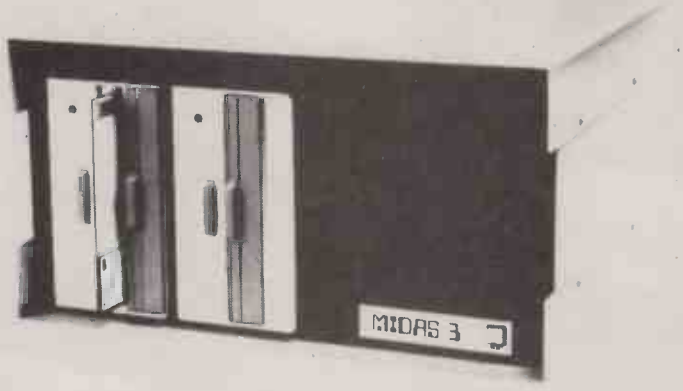

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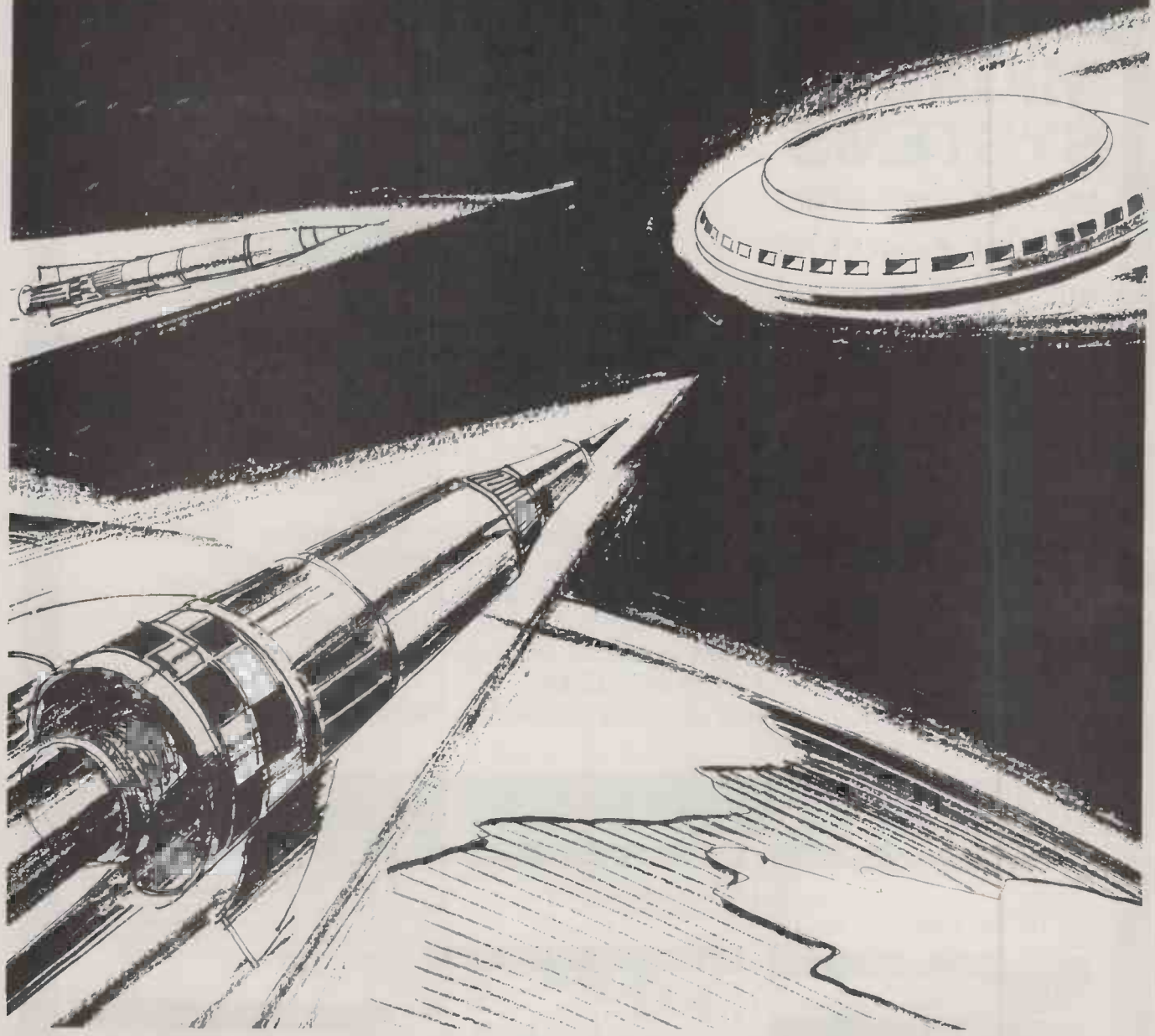
Alien blaster



YOU ARE STRANDED at the bottom of a large lunar crater, in charge of the only remaining laser blaster ship on the moon. A fleet of alien spacecraft has decided to invade the moon, and their objective is to land at the bottom of your crater, capturing the moon and enslaving mankind.

Your blaster ship is equipped with an array of laser-blast cannon, with which you must try to destroy the alien invaders. Every time you fire off a laser missile at the invading battle fleet, your phaser energy drops from a starting value of 1,000 at the beginning of the game, in steps of between 10 and 20 to a final value of zero. At that point your expertise is assessed, and the game comes to an end.

UFO Master Blaster is a fast, real-time space invaders program with good graphics. It is written for the North Star Horizon, and is suitable for any fast micro with some form of direct cursor addressing. It runs in about 8K of memory, using normal North Star Basic which has no specialised commands. The only shortening is the use of the exclamation mark to replace the print statement.

At any time there are a maximum of four invaders on the screen above your crater. As you shoot one out, a new alien is generated and displayed at a very fast rate. You will have your work cut out trying to keep them from descending too far down the screen.

Also on the screen from time to time will be either a bomb or a flying saucer, which score higher points than mere invader ships. There are two types of bomb and one type of flying saucer. The "o" bomb is a nasty weapon used by the invaders as it will aim for your laser blaster, and unless you shoot it out it will home in on your blaster and destroy it.

The other sort of bomb, the "y" bomb, does not aim for you but can be equally deadly as it descends in a random manner from one of the alien battle fleet.

Occasionally a flying saucer will fly

across the top of the screen; hitting it — which is quite difficult — will earn you 100 to add to your score. The current score, and the number of units of photon energy remaining in your laser missile banks are constantly updated on the screen to give you an idea of the state of the game.

At the start of the game the instructions are printed on to the screen. Once you have read them you press any key to start the game proper. First the lunar crater is drawn on the screen, your laser base is displayed and the first aliens are plotted at the top of the screen.

Now it is your turn to play the game. As this is a real-time game you must have your wits about you in order to keep alive, while dodging the aliens and their bombs.

To move your laser base left you press 4; to move right press 6; to remain stationary press 5 or any other key. Press 0 to fire your laser guns.

The program is divided into several subroutines:

8-33	Sets up all the variables and asks for skill rating.
40-103	Draws the lunar crater and sets up the screen.
120-175	The input routine in real time, and a very useful routine for those computers with an Inp statement but no Get function. Many PDP computers have this function, so you can easily modify their program to run on minicomputers of that ilk.
1000-2000	Fires your laser blast guns, draws the missile's path on the screen, and checks for any hits that you make on bombs, aliens or saucers.
3000-3020	Prints out the aliens.
4000-4050	Moves the invaders down the screen and checks to see if they land.
4600-4620	Sets up a bomb or flying saucer to drop from the aliens.
4700-4770	Draws the bomb or saucer on to the screen and checks for any hits on you.
5000-6000	End subroutine.
30000-30030	Aims the bomb if it is an "o" bomb for your laser base.
40000-40230	Instructions.

The main aid used in this program is that of direct cursor addressing, a feature which many terminals and computer systems have in some form or another. The system used in this example is that used by most PDP Basics and business basics in general.

To place the cursor at any point on the 80-by-24 screen the statement used is:

Print CHR$(27); "Y"; CHR$ (32+Y); CHR$ (32+X);"what you want to print".

which prints from the Yth row down the screen and the Xth column across the screen.

The command

print CHR$(27); "Y"

sets up the direct cursor addressing. The

(continued on next page)

```
1REM ********************************
2REM ** UFO MASTER-BLASTER GAME    **
3REM ** BY CHRIS HISTED 1981       **
4REM ********************************
5REM
6REM **** Set up the variables.****
7REM
8A=RND(-1)\DIMA(4,2)\FORI=1TO4\A(I,1)=1\A(I,2)=INT(RND(0)*40)+20\NEXTI
10!CHR$(12)
200$=CHR$(27)+"00"\01$=CHR$(27)+"0"+CHR$(64)\DIMA$(20)
30$$="/"+0$+":"+01$+"\"\H=40\A$="-["+0$+"£"+01$+"]-"\P=1000
31 GOTO 40000
32!CHR$(12)\!\INPUT" Skill rating (0 is easy ,20 very hard) >",S4
33IFS4<0THEN32\IFS4>20THEN32\IFS4<>INT(S4)THEN32\S4=S4*10
37REM
38REM **** Set up the screen ( draw lunar crater ) ****
39REM
40!CHR$(12)
50 !CHR$(27),"1"\FOR T=9 TO 20\!CHR$(27),"Y",CHR$(32+T),CHR$(51),"e"
60!CHR$(27),"Y",CHR$(32+T),CHR$(95),"e"
70NEXTT\!CHR$(27),"Y",CHR$(53),CHR$(51),"I",\FORT=1TO43\!"a",\NEXTT\!"M"
80!CHR$(27),"2"
90 FOR T=1 TO 9\T1=T1+2\!CHR$(27),"Y",CHR$(32+T),CHR$(33+T1),"\"\NEXT\T1=33
100 FOR T=1 TO 9\T1=T1-2\!CHR$(27),"Y",CHR$(32+T),CHR$(80+T1),"/"\NEXT
101!CHR$(27),"Y",CHR$(46),CHR$(33),0$,"Score :",01$,"0"
102!CHR$(27),"Y",CHR$(48),CHR$(33),0$,"Phasors :",01$,P
1036OSUB3000
110REM
115REM.**** Input routine from keyboard ( move your ship and fire ) ****
116REM
120N=INP(2)-176\H1=H
125 IF P<0 THEN 5000\G=G+1
130IFN=4 THEN H=H-2\IFN=6THENH=H+2
140IFH<20THENH=20\IFH>60THEN H=60\IF N=0 THEN 1000\IFH=H1THEN170
150!CHR$(27),"Y",CHR$(52),CHR$(32+H1)," "
160!CHR$(27),"Y",CHR$(52),CHR$(32+H),$$
165 IF B=0 THEN IF INT(RND(0)*100)+S4>80 THEN 4600
170IFINT(RND(0)*100)+S4>(80-(G/10))THEN4000
175 IFB<>0 THEN 4700\GOTO120
999REM
1000REM **** Fire your laser blaster guns ****
1001REM
1005E=0
1007IF B=0 THEN 1010\IF B2>H-1ANDB<>2ANDB2<(H+3)THEN1008\IFB=2ANDH<(B2+5) AND H>(B2-2) THEN1008\GOTO1010
1008IFB<>2THEN1009\!CHR$(27),"Y",CHR$(33),CHR$(32+B2),0$,"     ",01$,\FORW=1TO20\NEXT\!CHR$(27),"Y",CHR$(33),CHR$(32+B2),"     "
1009!CHR$(27),"Y",CHR$(32+B1),CHR$(32+B2)," "\S=S+7\B=0\T=(B1-1)\GOTO1120
1010! CHR$(7),\P=P-10-INT(RND(0)*5)\!CHR$(27),"Y",CHR$(4B),CHR$(42),P," "
1020 FOR I=1 TO 4\IF H<(A(I,2)+4) THEN IF H>(A(I,2)-2) THEN EXIT 1050\NEXT
1030 T=2\GOTO1120
1050S=S+10\E=1
1060!CHR$(27),"Y",CHR$(46),CHR$(39),S
1100 T=A(I,1)
1120FOR Q=18 TO T STEP-1\!CHR$(27),"Y",CHR$(32+Q),CHR$(33+H),"!"
1130!CHR$(27),"Y",CHR$(32+Q),CHR$(33+H)," "\NEXT
1160!CHR$(7),
1170 IF E=0 THEN 2000
1200!CHR$(27),"Y",CHR$(32+A(I,1)),CHR$(32+A(I,2)),0$,"     ",01$
1201FORW=1TO20\NEXTW
1205!CHR$(27),"Y",CHR$(32+A(I,1)),CHR$(32+A(I,2)),"     "\A(I,1)=2
1210A(I,2)=INT(RND(0)*30)+25
2000GOTO120
2999REM
3000REM **** Print out the aliens ****
3001REM
3010 FOR I=1 TO 4\!CHR$(27),"Y",CHR$(32+A(I,1)),CHR$(32+A(I,2)),A$\NEXT
3020RETURN
3999REM
4000REM **** Move the Aliens ****
4001REM
4005 FOR I=1 TO 4\!CHR$(27),"Y",CHR$(32+A(I,1)),CHR$(32+A(I,2)),"     "\NEXT
4010 FOR I=1TO4\A(I,1)=A(I,1)+1
4020M0=INT(RND(0)*5)\IFM0>2 THEN M0=(M0*-1)\A(I,2)=A(I,2)+M0
4030IFA(I,2)<25 THENA(I,2)=25\IFA(I,2)>55THENA(I,2)=55
4035 IF A(I,1)>19 THEN 5000
4040NEXT
4050GOSUB3010\GOTO175
4599REM
4600REM **** Set up a bomb to drop from the Aliens ****
4601REM
4605 B=1\B8=0\B9=INT(RND(0)*6)+12
4610 I=INT(RND(0)*4)+1\B1=A(I,1)+1\B2=A(I,2)+3
4615I=INT(RND(0)*10)+2\IFI>4THEN4617\B$="Y"\Z7=20
4616GOTO4620
4617B$="o"\Z7=30
4620 GOTO 4700
4699REM
4700REM **** Print out the bomb ****
4701REM
4710IFB=2THEN4800\B3=B1\B4=B2\!CHR$(27),"Y",CHR$(32+B3),CHR$(32+B4)," "
4715 IF B$="o"THEN IF B8<>-1 THEN 30010
4720I=INT(RND(0)*5)\IFI>2THENI=(I*-1)\B1=B1+1\B2=B2+I
4730IF B2<23THENB2=23\IFB2>57THENB2=57\IF B1<20 THEN 4760
4740IF B2>(H-1)THENIFB2<(H+3)THEN 5000\IFB4>(H-1)THENIFB4<(H+3)THEN5000\B=0\GOTO120
4750 FOR I=1 TO 1000\NEXT\GOTO5000
4760!CHR$(27),"Y",CHR$(32+B1),CHR$(32+B2),B$
4770GOTO 120
4797REM
4798REM **** Print out and move the flying saucer ****
4799REM
4800B4=B2\B2=B2+3+INT(RND(0)*3)\IFB2<70THEN4809\B=0\GOTO4815
```

(listing continued on next page)

(continued from previous page)

value of Y sends the cursor to the Yth row down and the value of X sends it to the Xth column across. This function allows you to print the invaders at any points on the screen, and its speed allows a very fast and flowing game with no pauses to draw on the screen.

Printing O$ will put the terminal into inverse video — whatever it prints following this command will appear black on white. Printing of O1$ will bring the terminal back to normal white on black, which is used when printing words on the screen, and in setting up the shapes of your space ship, S$, and the aliens, A$. When setting up the screen in lines 50 to 80 a function of the terminal which is a limited form of line graphics was used. Printing

CHR$(27); "1"

puts the terminal into graphics mode, and

CHR$(27); "2"

takes it out. These commands may be omitted on your machine but in the next three lines you should change lower-case "e" to vertical lines, and I, M and lower-case "a" to horizontal lines.

Once you start playing this game, it can become quite addictive. A good score for the first game is about 2,000 points, but once you are expert at the game an average score should be over 6,500. The record to beat is 8,014.

(listing continued from previous page)

```
4809!CHR$(27),"Y",CHR$(33),CHR$(32+B4),"    "
4810!CHR$(27),"Y",CHR$(33),CHR$(32+B2),"(",O$,"£££",O1$,")"\GOTO120
4815!CHR$(27),"Y",CHR$(33),CHR$(32+B4),"    "\GOTO120
4998REM
4999REM #### An Alien lands on your base ####
5000REM
5001!CHR$(27),"Y",CHR$(52),CHR$(32+H),O$,"  ",O1$
5005!CHR$(7),
5010FORX=1TO3000\NEXT
5020!CHR$(12)\!\!\!" You have finished the game , with a final Grand Score of ",
5030!(S#4)+(P3-0.5)+5+(S#10)
6000END
29999REM
30000REM #### If it is an 'o' bomb ,aim it for laser base ####
30001REM
30010 IF B2>H THEN M=-1\IF B2<H THEN M=1\IFB2=H THEN M=0
30020 G8=G8+1\IF G8<G9THEN 30030\G8=-1\GOTO4700
30030 B2=B2+M\B1=B1+1\GOTO4730
39999REM
40000REM #### Instructions ####
40001REM
40010!CHR$(12)\FORX=1TO100\NEXTX\!TAB(25),O$," Alien Invaders ",O1$\!
40020!" In this game , you control a laser armed Fighter Ship which is "
40030!" stranded at the bottom of a Lunar Crater. You start with 1000 "
40040!" points of phasor energy , and each time you fire your weapons "
40050!" this decreases by between 10 and 20 points "
40060!" You control the movement of your ship by the keys 4,5, and 6"
40070!" To move left press 4 ,right 6, and to remain in position press 5"
40080!" To fire your phasor gun , press 0 "
40090!" You will see a number of aliens drop from the sky towards you ,"
40100!" and it is your task to destroy these ,by positioning your ship "
40110!" under them , and firing your Weapon ....."
40120!" The aliens will drop two types of Bombs , an 'o' sort , which will"
40130!" aim for you , and probabely hit ,unless you destroy it ; and a 'Y'"
40140!" sort , which do not aim for you ;and a flying saucer worth 100 "
40141!" points may fly overhead ,every so often"
40150!" You get points for shooting down Aliens , and more for shooting "
40160!" down Bombs ( 'o' bombs score highest )"
40170!" The game will end when your energy goes below zero , or a bomb hits"
40180!" you , or the Aliens get down to the Bottom of the Crater "
40190!" This game was written 5th Feb. 1981 by Christopher Wisted !!! "
40200!" Press any key to start "
40210N=INP(2)
40220IFN =INP(2)THEN40220
40230 GOTO 32
```

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Fill-in-the-blanks used in structured programming

Using a few standard sentences, Program Description Language can be applied to any program and translated into the relevant language. Graham Beech continues his discussion on structured programming with a look at PDL.

PROGRAM DESCRIPTION LANGUAGE PDL is a simple language used in the design of structured programs as an alternative to flowcharts. Program design using PDL proceeds in three stages:

- Design the solution to a problem as a series of connected blocks.
- Design the content of the blocks with PDL.
- Translate the PDL sequences into a programming language such as Basic.

PDL consists of a few standard sentences or "constructs" which are used as if they were fill-in-the-blanks templates. In other words, you start with one of the standard sentences and insert the context appropriate to your particular program.

PDL is not completely standardised but, for present purposes, there are just five constructs to learn. The three original ones were:

- simple sequence,
- alternative clause,
- repetition.

Two others are added for convenience:

- iteration,
- case statement.

The PDL constructs can be translated almost automatically into the programming language of your choice. A design is written in PDL. By obeying a set of rules defined for your chosen language, known as the target language, you produce the target program. This process is illustrated in figure 1.

In the example used here, the target language is Basic. The final Basic program will, of course, not look like PDL, but will contain a mixture of Basic statements, including Gotos. The main advantages are that the Basic coding will be written more quickly and it will stand more chance of working first time.

The simple sequence is a series of simple statements that are to be executed in their order of presentation. For example,

1. Get out of bed
2. Get dressed
3. Have breakfast

and so on. One statement simply follows another.

The alternative clause has the form:

if a is true then perform x else perform y

It can be depicted in terms of a flow chart — see figure 3. There may not be an else sub-clause, in which case it is simply omitted.

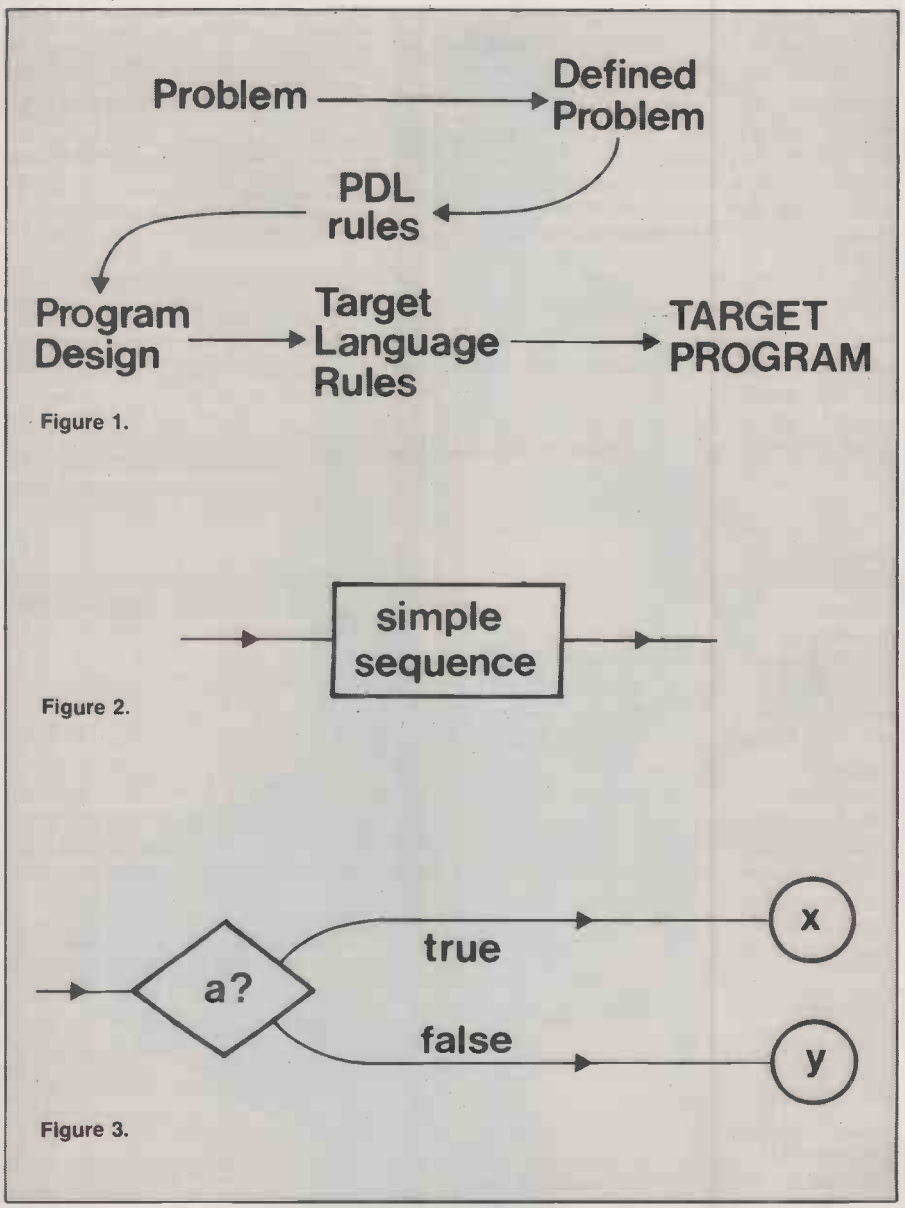


Figure 1.

Figure 2.

Figure 3.

To indicate the range of the if clause an indicator is used — as end is used as a terminator to begin, The convention end if allows the whole construct to be briefly stated as:

if a is true then perform x else perform y end if

where x and y are constructs which may, for example, be simple sequences. Notice that the PDL words such as if, then are underlined. An example is:

if age less than 5 then travel free else fare = miles × 10 end if

Some people use fi instead of end if, but this seems a little inelegant.

The Choice clause can be regarded as a convenient extension of the alternative clause. It permits the selection of one action from several in a similar fashion to multiple-choice test questions:

```
case of
  case 1: action 1
  case 2: action 2
  case n: action n
end case
```

This avoids the multiple usage of the alternative clause and is clearly equivalent to the flow chart structure shown in figure 4. Only one of the n possible cases will be executed. For example, an electricity tariff could be arranged:

```
case of
  no consumption: fixed charge only
  up to 100 units: fixed charge + units × 3
  over 100 units: fixed charge + 300 + (units
  − 100) × 2
end case
```

The notation esac is sometimes used instead of end case.

The repetition clause repeats some action until some condition is true; therefore, the action will be executed at least once:

do action b until a is true end do

where b is a construct. The flow chart for this is shown in figure 5. For example,

```
do
  type a line on page
  until the page is full
end do
```

Iteration is similar to repetition, having the form:

while a is true do action b end do

The difference is that the logical test is performed before performing the actions in b. Consequently, b will not be encountered if condition as is initially false. For example,

```
while the page is not full
  do type a line end do
```

Iteration or repetition are familiar concepts since one of them is directly available in most programming languages as a loop statement. The construct

for index initial by step until final do (b) end do

in which index is increased from "initial" to "final" in increments of "step" is recognisable as a special case of the more general while construct. It is represented by the flow chart in figure 7.

Notice the use of the back arrow ← as an assignment operator. The sequence b will never be executed if "index" is greater than "final", even at the beginning of the step. Omission of the "by step" implies a step size of 1.

For example:

```
for
  contents of tank ← one gallon by half-gallon
until full do add fuel end do;
```

but if the "by step" is omitted, a step size 1 is implied:

```
for count ← 1 until total do sum ← sum + 1
end do
```

The final value of sum, assuming it to be zero initially, would be equal to sum + total.

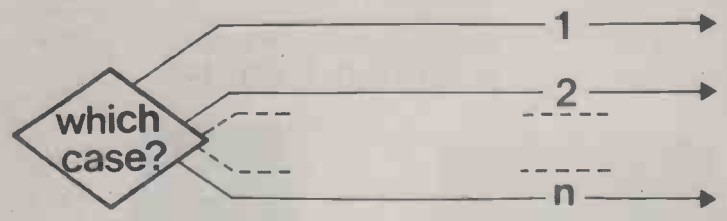


Figure 4.

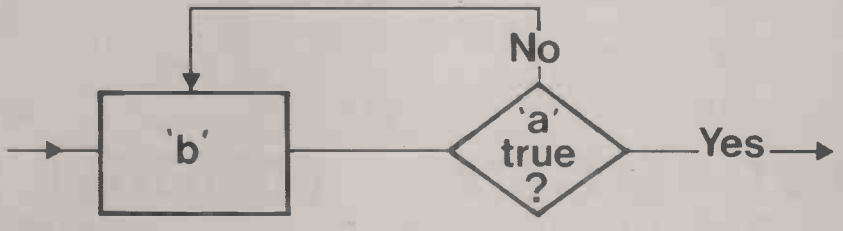


Figure 5.

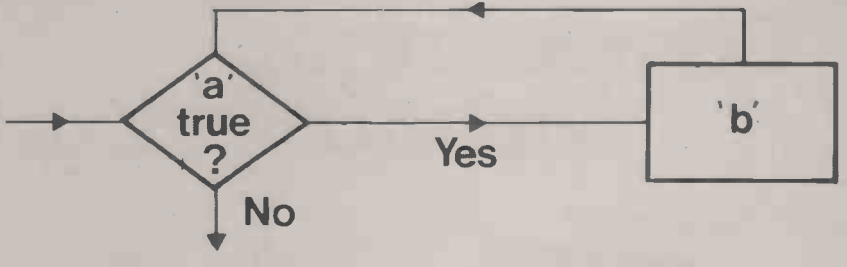


Figure 6.

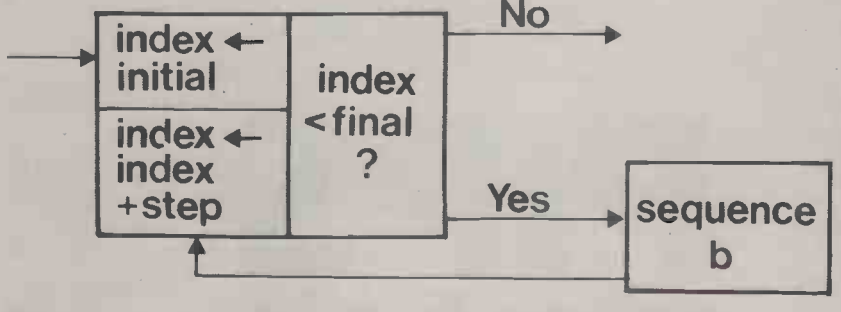
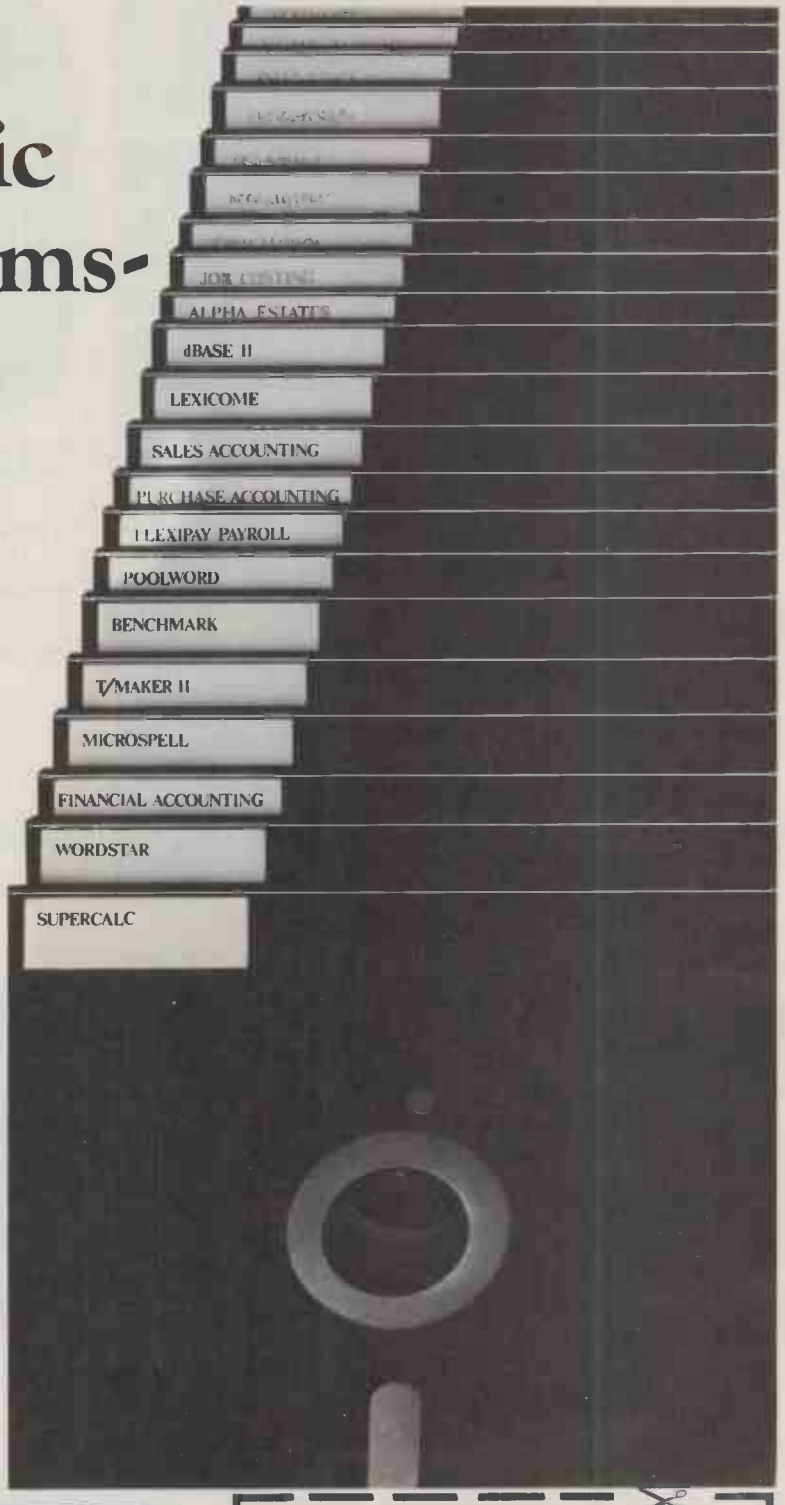


Figure 7.

Adler Alphatronic Microprograms- Superbly Simple Software.



When you see the Alphatronic you will agree that it is a superb machine. However, it's the software that ensures it will do what you want done. The large software library is designed to work perfectly with the Alphatronic and is backed by the company with an unrivalled reputation in office equipment and business systems.

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DP2

ANOTHER TRIUMPH FROM ADLER

● Circle No. 172

In these pages Brian Reffin Smith keeps you up to date with computer-based art and design and lays the foundations for graphics routines to use on your own micro.

Graphic-design bible

FOLEY AND VAN DAM: the names sound as though they belong to a pop group or a film title but, in fact, are responsible for the best book on computer graphics ever produced. *Fundamentals of Interactive Computer Graphics* is published by Addison Wesley as part of its Systems Programming series. It costs £15.95 in hardback, and has 664 pages, with many illustrations, 50 or so in colour.

You remember the Horizon programme on BBC TV around Christmas? The book reminds me visually of that, not least because it has some of the same pictures, but it goes beyond the TV programme in power and detail.

Much of the book is advanced, some is quite difficult, and a little is right at the cutting edge of what is becoming possible with the most complex graphics systems. But it is a book whose usefulness would grow with your knowledge of the area. Every art student should have access to a computer — and this book. Everyone who pretends to an interest in computer graphics for any reason at all, should understand sufficient of the contents to make them think, and do it better.

The book asks questions such as "What is interactive graphics?", answers them and then goes on to cover hardware and software, all the usual geometric transformations, three-dimensional modelling, graphic conversations, shading, colour and visual realism. Of the 17 chapters, 16 end with exercises, many of which could be done without resort to the most expensive graphics systems.

BBC noises

MICHAEL BATES writes from London N21: "After reading your article on the BBC sound system I thought you might like a routine I have found which makes strange sounds. The key is

```
* KEY1 "SOUND 2, - 15,100,1; SOUND
  3,103,100,1; M"
```

Try pressing Key 1 a few times, and after about the sixth a strange sound effect occurs. It can be changed by the tone of the Sound 2 command, and once a sound occurs it may be recreated by just using the Sound 3 command. I think that this has something to do with the envelope commands, but I would like to have your views on this".

Well, I tried it, and I suggest you do too. Remember that the weird sign before the M means "control", and puts Ctrl-M, Return, on to the key along with the sounds. The routine appears not to need the first part — Sound 2, etc — but perhaps it did actually set something up, as suggested. I cannot see why it does what it does, which is to alternate an ordinary tone with the best imitation of running water I have yet heard from a synthesiser, let alone a computer.

* *

The three-dimensional modelling system described in July's Arts pages is the work of John Frazer of Ulster Polytechnic. Apologies to John Frazer and his colleagues for not mentioning this in the article.

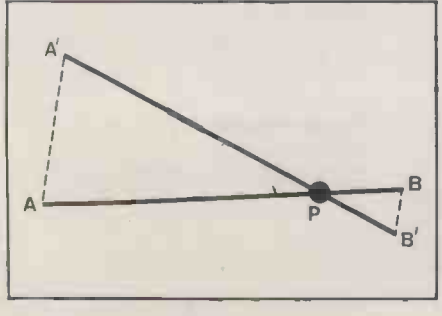
BEGINNING GRAPHICS

Relatively speaking

IN THE EARLY seventies, from a room above a head-shop — if you want to know what a head-shop is, ask any aging hippy — off London's Portobello Road there was published a fine book called *An Index of Possibilities*. I contributed one or two things to it, and as I look down the list of credits at the back, which include the local supermarket, for orange juice, I see that one Peter Laurie was also involved, only later rising to the dizzy heights of editor of this magazine.

This is not mere reminiscence. Relativity is well treated in the book, and I was struck by the idea of representing a single line on the computer screen, able to rotate about a point along its length, near one end. It should be clear that if you move the short end from B to B′ the long end will move from A to A′, like one half of a pair of scissors. Because the line pivots about the point P, a small movement at one end taking, say, 1 second gives a larger movement at the other end, also occurring in 1 second. So A moves faster than B, as long as P lies closer to B than to A.

Figure 1.



Imagine that you move the point B very fast, and that the distance AP is a million times as great as PB. Then, it might occur that the speed of the end A approaches the speed of light. Now, as something approaches light's speed, time slows down, mass increases, while length decreases — this is what relativity is all about. So what happens to the point A and, more difficult to work out, to the line as a whole?

Equations approximating to the alterations in mass, length and time are given in figure 2. Of course gravity comes into it as well, especially as the mass of the line, if it were a solid rod, would become almost infinitely large as it approaches light speed.

$$\text{Length: } L' = L\sqrt{1-\frac{v^2}{c^2}}$$

$$\text{Mass: } M' = \frac{M}{\sqrt{1-\frac{v^2}{c^2}}}$$

$$\text{Time: } t' = t\sqrt{1-\frac{v^2}{c^2}}$$

v = speed of body
c = speed of light

Figure 2.

Plot your line on the screen, using the two end positions. Move A to A′ and B to B′ in a number of steps. At each move, calculate the new length of the line — hence a new A′ — its mass, and so on. Plug these into the next step. Assume that the speed is constant and that the effects occur down the line, gradually being diminished as you reach the pivot, which does not itself move.

Does the line curve? Does it ever reach a final position? Can you show what happens graphically, and provide a read-out of parameters and values at the bottom of the screen?

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Hello — help for stock control!

```
   THE HELLO PROGRAM.....

10  ONERR  GOTO 150
20 D$ = ""
30  HOME : INPUT "DEMO PRINTOUT?";A
    $: IF A$ < > "Y" THEN CH$ = "
    NO"
40  REM HELLO PROGRAM
50  PRINT D$;"BLOAD STOCK LOGO,A$40
    00"
60  POKE  - 16299,0: POKE  - 16302,
    0: POKE  - 16297,0: POKE  - 16
    304,0
70  IF CH$ = "NO" THEN  GET CH$: IF
    CH$ < > " " THEN CH$ = "NO": GOTO
    70
80  IF CH$ = "NO" THEN  GOTO 97
90  PRINT D$;"PR#1"
100  PRINT
110  POKE  - 12524,0: POKE  - 12527
    ,20: POKE  - 12529,255
115  POKE  - 12525,64
120  PRINT  CHR$ (17)
130  PRINT D$;"PR#0"
140  POKE  - 12527,10
150  PRINT : PRINT D$;"RUNAPPLE STO
    CK"
```

APPLE STOCK is a complete stock-control program for small businesses. It enables itemisation of the entire stock on discs in various groups or classes together with cost and stock volume. Up to 450 items may be stored on each disc, and as many discs as necessary may be used.

Once the initial inventory is completed any item may be recalled with a few keystrokes, the total value of stock or of groups or classes may be checked against cost and sale prices, and items which need restocking may be listed. To facilitate rapid and easy retrieval the program is designed to hold the entire inventory in memory. Though this limits the volume to about 450 items per disc, it provides almost instant access to any product in the total inventory.

Apple quirk

In keeping with the spirit of business software, considerable effort has been made to ensure that the program is easy to use, and to make the operating environment "friendly". To this end two commands peculiar to the Apple are used. The first, Poke 214, 128 causes the program to be run whenever a valid Applesoft command is typed. In some instances the command may be ignored in

```
   THE MAIN PROGRAM.....
   LENGTH IS 11138 ($2882) BYTES

10 PASS$ = "ABRACADABRA"
20  POKE 214,128
30  ONERR  GOTO 210
40  PRINT
50 D$ =  CHR$ (4)
60  PRINT D$;"OPEN STOCK FILE,L60":
     PRINT D$;"READ STOCK FILE,RO"
    : INPUT A$,B$: IF VAL (B$) =
    0 THEN GOTO 110
70 B =  VAL (B$) + 1: DIM GN(B),PN(
    B),DE$(B),CP(B),SP(B),IS$(B),M
    L$(B),OO$(B):B = B - 1
80  FOR I = 1 TO B: PRINT D$;"READ
    STOCK FILE,R";I: INPUT GN(I),P
    N(I),DE$(I),CP(I),SP(I),IS$(I)
    ,ML$(I),OO$(I)
90  NEXT :MAX = B
100  PRINT D$;"CLOSE"
110 B = 0: FOR I = 1 TO MAX: IF GN(
    I) >  = B THEN B = GN(I)
120  NEXT
130  DIM GC(B),GS(B)
140 GP = B
```

Robin Kanagasabay's Apple Stock keeps a check on your inventory, holds the total value of stock, lists items which need restocking, and prints out a customised logo.

which case Run or PR#6 should be typed to continue.

The second, Onerr Goto x, where x is a valid line number not another Onerr command, causes a branch to line x whenever an error is encountered. This may be due to an error in entering the program, a Dos error, or more importantly a Ctrl-C. The code for the error is stored in location 222 decimal, and the error corresponding to this code is listed in the Dos 3.3 manual or the Applesoft manual.

Program segments

This is used in the program both to trap any I/O errors, and to provide a quick and convenient way of returning to the menu, by typing Ctrl-C. It would, of course, be possible to protect the Reset key by putting the address of a machine-code routine in the decimal address 1010 and 1011 and calling −1169 to set up the power byte. The Apple would then perform an unconditional jump to this address when the Reset key was pressed.

The program is in three parts. Part 1 is the Hello program which loads the second part, a customised logo, and asks whether you want a printout of this logo. This section is written for the Silentype printer though it could, no doubt, be modified to work on other graphics printers. It then runs the third part, the main Apple Stock program, while leaving the Apple displaying high-resolution page 1. If you do not want to use the logo facility you can dispense with the Hello program. Simply delete line 160 from the main program, and it may be run directly.

Garbage clearance

A hello program is used, instead of simply loading the logo from the main program, because of the sheer length of Apple Stock, about 11.2K, which means it over writes high-resolution Page 1. As the Apple Stock program is loaded, the high-resolution page will fill up with junk. If you object to this insert the following in line 145 in the Hello program:

```
145 TEXT:HOME:VTAB(10):?TAB(14)
Apple Stock":?:?TAB(14)"BY":?:?TAB(14)
  "ROBIN
  KANAGASABAY":?:?TAB(14)"(C)1981"
```

(continued on page 129)

```
150  GOSUB 2950
160  GET A$: IF A$ <  > " " THEN  GOTO
     160
170  TEXT : HOME : PRINT "ENTER PAS
     SWORD "; LEN (PASS$);" LETTERS
     "; FOR I = 1 TO  LEN (PASS$): GET
     A$
180  IF A$ <  >  MID$ (PASS$,I,1) THEN
      GOTO 170
190  NEXT
200 X =  FRE (0)
210  PRINT D$;"CLOSE": TEXT: HOME:
     PRINT TAB(18)"MENU"
220  PRINT "**********************
     *****************"
230  PRINT "1.......BUY OR SELL STO
     CK": PRINT
240  PRINT "2.......CREATE OR ALTER
      PRODUCTS": PRINT
250  PRINT "3.......REPORT ON STOCK
      AND PRICES": PRINT
260  PRINT "4.......REPORT ON GROUP
      VALUES": PRINT
270  PRINT "5.......REPORT ON STOCK
      BELOW MINIMUM": PRINT
280  PRINT "6.......SET NO. OF INVO
     ICE COPIES": PRINT
290  PRINT "7.......HELP": PRINT
300  PRINT "8.......EXIT OR RESET S
     YSTEM"
310  VTAB (24): PRINT "WHICH ONE ";
320  POKE  - 16303,0
330  GET A$
340  IF  ASC (A$) = 13 OR  ASC (A$)
      = 3 THEN  GOTO 330
350  PRINT A$;
360  GET B$: IF  ASC (B$) <  > 13 THEN
     A$ = B$: VTAB (24): HTAB (11):
      GOTO 350
370 CHOICE =  VAL (A$): IF CHOICE <
     1 OR CHOICE > 9 THEN  VTAB (24
     ): HTAB (11): GOTO 330
380  ON CHOICE GOTO 400,1060,1940,2
     330,2520,2810,2860,2900
390 A$ = "0": GOTO 370
400  TEXT : HOME :
410  ONERR  GOTO 210
420  PRINT  TAB( 11)"BUY OR SELL ST
     OCK": PRINT "**********************
     **********************"
430  POKE 34,2
440  PRINT : PRINT "A)SEARCH BY NAM
     E": PRINT
450  PRINT "B)SEARCH BY PRODUCT NUM
     BER": PRINT
460  PRINT "C)SEARCH BY RECORD NUMB
     ER": PRINT
470  PRINT "WHICH OPTION DO YOU WAN
     T? ";:
480  GET A$: IF A$ <  > "A" AND A$ <
      > "B" AND A$ <  > "C" AND A$ <
      >  CHR$ (3) THEN  GOTO 480
490  IF A$ =  CHR$ (3) THEN  GOTO 2
     10
500  IF A$ = "A" THEN  GOTO 530
510  IF A$ = "B" THEN  GOTO 590
520  IF A$ = "C" THEN  GOTO 630
530  HOME : PRINT : INPUT "ENTER TH
     E DESCRIPTION OF THE PRODUCT Y
     OUWISH TO FIND(FULL DESCRIPTIO
     N PLEASE)  ";DE$: PRINT
540  IF  LEFT$ (DE$,1) = " " THEN D
     E$ =  RIGHT$ (DE$,( LEN (DE$) -
     1)): GOTO 540
550  IF  RIGHT$ (DE$,1) = " " THEN
     DE$ =  LEFT$ (DE$,( LEN (DE$) -
     1)): GOTO 550
560  FOR I = 1 TO MAX: IF DE$(I) <
      > DE$ THEN  NEXT : GOTO 580
570  GOTO 660
580  GOTO 1010
590  HOME : PRINT : INPUT "ENTER PR
     ODUCT NUMBER ";A: IF A < 1 THEN
      GOTO 1010
600  FOR I = 1 TO MAX: IF (PN(I) <
      > A) THEN  NEXT : GOTO 620
610  GOTO 660
620  GOTO 1010
630  HOME : PRINT : INPUT "ENTER RE
     CORD NUMBER ";A
640  IF A < 1 OR A > MAX THEN  GOTO
     1010
650 I = A: GOTO 660
660  REM
670  PRINT : HOME
680 GN = GN(I):PN = PN(I):DE$ = DE$
     (I):CP = CP(I):SP = SP(I):IS$ =
     IS$(I):ML$ = ML$(I):OO$ = OO$(
     I)
690  TEXT : POKE 34,2: HOME
700  PRINT "GROUP NO.....";GN
710  PRINT "PRODUCT NO.....";PN
720  PRINT "DESCRIPTION....";DE$
730  VTAB (6)
740  PRINT "COST PRICE.....";CP
750  PRINT "SELLING PRICE..";SP
760  PRINT "IN STOCK.......";IS$
770  PRINT "MINIMUM LEVEL..";ML$
780  PRINT "ON ORDER.......";OO$
790  POKE 34,13
```

(listing continued on page 129)

(listing continued from page 127)

```
300  HOME : PRINT "A)BUY": PRINT "B
     )SELL": PRINT "C)ALTER AMOUNT
     ON ORDER": PRINT "D)EXIT": GET
     MODE$: IF MODE$ <  > "A" AND M
     ODE$ <  > "B" AND MODE$ <  > "
     C" AND MODE$ <  > "D" AND MODE
     $ <  >  CHR$ (3) THEN  GOTO 80
     0
810  IF MODE$ =  CHR$ (3) THEN  GOTO
     210
820  IF MODE$ = "D" THEN  GOTO 960
830  HOME
340  HOME : IF MODE$ = "B" AND  VAL
     (IS$) = 0 THEN  PRINT "YOU HAV
     E NONE TO SELL": PRINT : PRINT
     "TYPE <SPACEBAR> ";: GET A$: HOME
     : GOTO 800
850 FLAG = 1
860  IF MODE$ = "A" THEN  HOME : INPUT
     "NUMBER TO BE BOUGHT ";A: IS$ =
      STR$ (( VAL (IS$)) + A): POKE
     34,2: HOME
870  IF MODE$ = "A" THEN  IF INV <
      > 0 THEN  PRINT D$;"PR#1": FOR
     J = 1 TO INV: PRINT : PRINT "D
     ATE:";DTE$;" BOUGHT:";A;" ";DE
     $: PRINT ; PRINT : PRINT : NEXT
     : PRINT D$;"PR#0": GOTO 690
880  IF MODE$ = "A" THEN  GOTO 690
890  IF MODE$ = "B" THEN  HOME : INPUT
     "NUMBER TO BE SOLD ";A: IF A >
      VAL (IS$) THEN  HOME : PRINT
     "YOU DON'T HAVE THAT MANY TO S
     ELL": PRINT : PRINT "TYPE <SPA
     CEBAR> ";: GET A$: GOTO 800
900  IF MODE$ = "B" THEN IS$ =  STR$
     (( VAL (IS$)) - A): POKE 34,2:
      HOME
910  IF MODE$ = "B" THEN  IF INV <
      > 0 THEN  PRINT D$;"PR#1": FOR
     J = 1 TO INV: PRINT : PRINT "D
     ATE:";DTE$;" BOUGHT:";A;" ";DE
     $: PRINT : PRINT : PRINT : NEXT
     : PRINT D$;"PR#0": GOTO 690
920  IF MODE$ = "B" THEN  GOTO 690
930  IF MODE$ = "C" THEN  HOME : INPUT
     "AMOUNT ON ORDER ";A: OO$ =  STR$
     (A): HOME
940  IF MODE$ = "C" THEN  IF INV <
      > 0 THEN  PRINT D$;"PR#1": FOR
     J = 1 TO INV: PRINT : PRINT "D
     ATE:";DTE$;" ORDERED:";A;" ";D
     E$: PRINT : PRINT : PRINT : NEXT
     : PRINT D$;"PR#0": GOTO 690
950  IF MODE$ = "C" THEN  GOTO 690
960  IF GN(I) = GN AND PN(I) = PN AND
     DE$(I) = DE$ AND CP(I) = CP AND
     SP(I) = SP AND IS$(I) = IS$ AND
     ML$(I) = ML$ AND OO$(I) = OO$ THEN
      GOTO 210
970  PRINT : PRINT D$;"OPEN STOCK F
     ILE,L60": PRINT D$;"WRITE STOC
     K FILE,R";I
980  PRINT GN: PRINT PN: PRINT DE$:
      PRINT CP: PRINT SP: PRINT IS$
     : PRINT ML$: PRINT OO$: PRINT
     D$;"CLOSE"
990 IS$(I) = IS$
1000  GOTO 210
1010  HOME : PRINT : PRINT "I'M TER
     RIBLY SORRY BUT I CAN'T SEEM T
     O  FIND THAT PRODUCT"
1020  PRINT : PRINT "PERHAPS YOU GA
     VE AN INCOMPLETE OR FAULTYDESC
     RIPTION,OR A NON EXISTANT PROD
     UCT   OR RECORD NUMBER"
1030  PRINT : PRINT "PLEASE TYPE <S
     PACEBAR>";
1040  GET A$: IF A$ <  > " " THEN  GOTO
      1040
1050  HOME : GOTO 440
1060  TEXT : HOME
1070 FLAG = 0
1080  PRINT  TAB( 8)"CREATE OR ALTE
     R PRODUCTS": PRINT "**********
     **********************************
     "
1090  POKE 34,2: PRINT
1100 NUMBER = MAX + 1
1110  IF NUMBER >  = 1500 THEN  HOME
     : PRINT "DISK FULL": PRINT "TY
     PE <SPACEBAR>:GETA$:GOTO90
1120  HOME : PRINT
1130  IF NUMBER = 450 THEN NUMBER =
     NUMBER - 1: PRINT "DISK FULL":
      PRINT :FLAG = 9999: GOTO 1150

1140  PRINT "THE NEXT FREE PRODUCT
     NO. IS ";NUMBER: PRINT
1150  PRINT "ENTER ";NUMBER;" FOR A
      NEW PRODUCT": PRINT
1160  PRINT "ENTER A NUMBER LESS TH
     AN ";NUMBER: PRINT "TO ALTER A
     N  OLD PRODUCT": PRINT
1170  PRINT "ENTER <A> TO SEARCH FO
     R AN OLD PRODUCT  BY NAME": PRINT

1180  INPUT "WHAT NUMBER DO YOU WAN
     T";A$
1190  IF A$ = "A" THEN  GOTO 1840
1200  IF  VAL (A$) < 1 OR  VAL (A$)
     > NUMBER THEN  VTAB (14): GOTO
     1180
1210 OLD = NUMBER:NUMBER =  VAL (A$
     )
1220 MODE$ = "CREATE"
1230  IF FLAG = 9999 THEN  HOME : GOTO
      1500
1240 MODE$ = "ALTER"
1250 I = NUMBER:GN = GN(I):PN = PN(
     I):DE$ = DE$(I):CP = CP(I):SP =
     SP(I):IS$ = IS$(I):ML$ = ML$(I
     ):OO$ = OO$(I)
1260  PRINT D$;"CLOSE"
1270  HOME
```

(continued from page 127)

CHR$(17), Ctrl-Q is the code on the Silentype to print the high-resolution page, and the Pokes on line 110 of the Hello program set the Silentype to unidirectional mode, page 1, and the left margin at 20. The original logo was created by loading the "colossal" from the Dos Toolkit, typing directly on the high-resolution page, being careful to erase the prompts with spaces, pressing Reset, and then typing

Bsave Stock Logo, A$2000, L8192

The program uses arrays to store the product inventory, and whenever a new product is added to the inventory the program must be rerun as in line 1830. Applesoft does not allow you to re-Dim arrays. The following variables form the inventory:

MAX — current limit to the inventory, 1 to 450
GN(1) to GN(MAX) — group number
PN(1) to PN(MAX) — product number
DE$(1) to DE$(MAX) — description
CP(1) to CP(MAX) — cost price
SP(1) to SP(MAX) — selling price
IS$(1) to IS$(MAX) — stock level
ML$(1) to ML$(MAX) — minimum allowed stock level
OO$(1) to OO$(MAX) — number on order

The index of the arrays refers to the record number of the disc file where the product is stored, in this case 1.

GP — number of groups
GC(1) — used to add up cost
GS(1) — sale values of groups

Record O of the disc file is used to store two pieces of housekeeping information in the following format:

No. of groups: field
Number of products field 2

Set-up routine

Before running the program, this record will have to be set up. A suggested routine is:

```
10 D$=CHR$(13)+CHR$(14):REM(CR)
   +Ctrl-D
20 ?D$;"Open Stock File, L50"
30 ?D$; "Write Stock File, R0"
40 ?"00":?"00":
50 ?D$; "Close"
60 END
```

Table 1.

Language card	slot 0 (Irrelevant)
Silentype printer	slot 1
Mountain hardware	
CPS card	slot 4
Disc	slot 6

The program was developed on a micro configured as in table 1. The CPS card has a real-time clock, with batteries to keep it going when the Apple is turned off. If you do not possess one of these cards, or something similar such as the MH-365 Day Clock Card, then replace the subroutine of lines 2950 to 2990 with something like

```
2950 Text: Home
2960 Input "Please enter today's date (eg,
   11/11/81)";
2970 If Len(DTE$) (6 Then goto 2950
2980 Return
2990
```

(continued on next page)

```
1280  IF  LEN (DE$) > 23 THEN DE$ =
     LEFT$ (DE$,23)
1290  PRINT "A)GROUP NO.......";GN
1300  PRINT
1310  PRINT "B)PRODUCT NO.....";PN
1320  PRINT
1330  PRINT "C)DESCRIPTION....";DE$
1340  PRINT : VTAB (9)
1350  PRINT "D)COST PRICE.....";CP
1360  PRINT
1370  PRINT "E)SELLING PRICE..";SP
1380  PRINT
1390  PRINT "F)IN STOCK.......";IS$
1400  PRINT
1410  PRINT "G)MINIMUM LEVEL..";ML$
1420  PRINT
1430  PRINT "H)NO. ON ORDER...";OO$
1440  VTAB (20): PRINT : VTAB (20)
1450  PRINT "CHANGE WHICH ONE (Z TO
     END)": GET A$
1460  IF A$ =  CHR$ (3) THEN  GOTO
     210
1470  VTAB (20): PRINT "
     ": VTAB (20)
1480  IF A$ = "A" THEN  INPUT "GROU
     P NO.....";GN: GOTO 1270
1490  IF A$ = "B" THEN  INPUT "PROD
     UCT NO....";PN: GOTO 1270
1500  IF A$ = "C" THEN  INPUT "DESC
     RIPTION...";DE$: GOTO 1270
1510  IF A$ = "D" THEN  INPUT "COST
      PRICE.....";CP: GOTO 1270
1520  IF A$ = "E" THEN  INPUT "SELL
     ING PRICE..";SP: GOTO 1270
1530  IF A$ = "F" THEN  INPUT "IN S
     TOCK.......";IS$: GOTO 1270
1540  IF A$ = "G" THEN  INPUT "MINI
     MUM LEVEL.";ML$: GOTO 1270
1550  IF A$ = "H" THEN  INPUT "ON O
     RDER.......";OO$: GOTO 1270
1560  IF A$ = "Z" THEN  HOME : GOTO
     1730
1570 FLAG = 0: GOTO 1450
1580  INPUT "GROUP NO.......";GN
1590  PRINT  TAB( 16)NUMBER;: HTAB
     1: INPUT "PRODUCT NO.....";PN
1600  INPUT "DESCRIPTION....";DE$
1610  VTAB (6)
1620  INPUT "COST PRICE.....";CP
1630  INPUT "SELLING PRICE..";SP
1640  INPUT "IN STOCK.......";IS$
1650  INPUT "MINIMUM LEVEL..";ML$
1660  INPUT "ON ORDER.......";OO$
1670 FLAG = 1
1680  VTAB (20): PRINT "IS THIS ALR
     IGHT?";: GET A$: IF A$ = "N" THEN
      GOTO 1270
1690  HOME
1700  IF  LEN (DE$) > 23 THEN DE$ =
     LEFT$ (DE$,23)
1710  PRINT
1720  IF  RIGHT$ (DE$,1) = " " THEN
     DE$ =  LEFT$ (DE$,( LEN (DE$) -
     1)
1730 I = NUMBER: IF GN(I) = GN AND
     PN(I) = PN AND DE$(I) = DE$ AND
     CP(I) = CP AND SP(I) = SP AND
     IS$(I) = IS$ AND ML$(I) = ML$ AND
     OO$(I) = OO$ THEN  GOTO 210
1740  PRINT : PRINT D$;"OPEN STOCK
     FILE,L60": PRINT D$;"WRITE STO
     CK FILE,R";NUMBER
1750  PRINT GN: PRINT PN: PRINT DE$
     : PRINT CP: PRINT SP: PRINT IS
     $: PRINT ML$: PRINT OO$
1760  PRINT D$;"CLOSE"
1770  PRINT D$;"OPEN STOCK FILE,L60
     "
1780  PRINT D$;"READ  STOCK FILE,R0
     ": INPUT A$,B$: PRINT D$;"CLOS
     E"
1790  IF GN >  VAL (A$) THEN A$ =  STR$
     (GN)
1800  IF NUMBER >  VAL (B$) THEN B$
      =  STR$ (NUMBER)
1810  PRINT
1820  PRINT D$;"OPEN STOCK FILE,L60
     ": PRINT D$;"WRITE STOCK FILE,
     R0": PRINT A$: PRINT B$: PRINT
     D$;"CLOSE"
1830  RUN
1840  HOME : PRINT : INPUT "ENTER T
     HE DESCRIPTION OF THE PRODUCT
     YOUWISH TO FIND(FULL DESCRIPTI
     ON PLEASE)   ";DE$: PRINT
1850  IF  LEFT$ (DE$,1) = " " THEN
     DE$ =  RIGHT$ (DE$,( LEN (DE$)
     - 1)): GOTO 1850
1860  IF  RIGHT$ (DE$,1) = " " THEN
     DE$ =  LEFT$ (DE$,( LEN (DE$) -
     1)): GOTO 1860
1870  FOR I = 1 TO MAX: IF DE$(I) <
     > DE$ THEN  NEXT : GOTO 1890
1880 NUMBER = I: GOTO 1250
1890  HOME : PRINT : PRINT "I'M TER
     RIBLY SORRY BUT I CAN'T SEEM T
     O  FIND THAT PRODUCT"
1900  PRINT : PRINT "PERHAPS YOU GA
     VE AN INCOMPLETE ORFAULTY DESC
     RIPTION,OR A NON EXISTANT PROD
     UCT   OR RECORD NUMBER"
1910  PRINT : PRINT "PLEASE TYPE <S
     PACEBAR>";
1920  GET A$: IF A$ <  > " " THEN  GOTO
      1920
1930  HOME : GOTO 1060
1940  TEXT : HOME
1950  PRINT  TAB( 14)"STOCK REPORT"
     : PRINT "**********************
     ********************": POKE 34,
     2
1960  HOME : PRINT : INPUT "GROUP N
     O (=FOR ALL) ";A$:A =  VAL (A$
     ): IF A < 0 OR A > GP THEN  GOTO
     1960
```

(listing continued on next page)

(listing continued from previous page)

```
1970 Z$ = A$: IF Z$ = "=" THEN A =
     9999
1980  HOME : PRINT : INPUT "PRINTER
     ";A$: IF A$ = "Y" THEN  PRINT
     D$;"PR#1": HOME : GOTO 2160
1990  TEXT : HOME : IF A = 9999 THEN
      GOTO 2010
2000  PRINT "GROUP NUMBER ";A: PRINT

2010  PRINT "DESCRIPTION          NO
     .     COST     SALE**********
     **************************";

2020  FOR I = 1 TO MAX
2030  IF (GN(I) <  > A) AND A <  >
     9999 THEN  NEXT : GOTO 2300
2040  IF  LEN (DE$(I)) > 19 THEN DE
     $ =  LEFT$ (DE$(I),19): GOTO 2
     060
2050 DE$ = DE$(I)
2060  PRINT DE$;: HTAB (24 -  LEN (
     IS$(I))): PRINT IS$(I);
2070  IF  LEN ( STR$ (CP(I))) < 3 THEN
     CP$ =  STR$ (CP(I)):CP$ = CP$ +
     ".00": GOTO 2090
2080 CP$ =  STR$ (CP(I)): IF  MID$
     (CP$,( LEN (CP$) - 2),1) <  >
     "." AND  MID$ (CP$,( LEN (CP$)
      - 1),1) <  > "." THEN CP$ = C
     P$ + ".00"
2090  HTAB (33 -  LEN (CP$)): PRINT
     CP$;
2100  IF  LEN ( STR$ (SP(I))) < 3 THEN
     SP$ =  STR$ (SP(I)):SP$ = SP$ +
     ".00": GOTO 2120
2110 SP$ =  STR$ (SP(I)): IF  MID$
     (SP$,( LEN (SP$) - 2),1) <  >
     "." AND  MID$ (SP$,( LEN (SP$)
      - 1),1) <  > "." THEN SP$ = S
     P$ + ".00"
2120  HTAB (41 -  LEN (SP$)): PRINT
     SP$;
2130 FLAG = FLAG + 1: IF FLAG = 22 THEN
      GET A$:FLAG = 0
2140 NEXT
2150  GOTO 2300
2160  IF A = 9999 THEN  GOTO 2180
2170  PRINT "THE DATE IS ";DTE$: PRINT
2180  PRINT "DESCRIPTION
           GROUP        NO
        COST                  SALE":
      PRINT "**********************
     ******************************
     ****************************"
2190  FOR I = 1 TO MAX
2200  POKE  - 12528,5
2210  IF (GN(I) <  > A) AND A <  >
     9999 THEN  NEXT : GOTO 2300
2220  PRINT DE$(I);:C =  LEN (DE$(I
     )) + LEN ( STR$ (GN(I))): PRINT
      SPC( 34 - C);: PRINT GN(I);
2230 C =  LEN (IS$(I)): PRINT  SPC(
     09 - C);: PRINT IS$(I);
2240  IF  LEN ( STR$ (CP(I))) < 3 THEN
     CP$ =  STR$.(CP(I)) + ".00": GOTO
     2260
2250 CP$ =  STR$ (CP(I)): IF  MID$
     (CP$,( LEN (CP$) - 2),1) <  >
     "."-AND  MID$ (CP$,( LEN (CP$)
      - 1),1) <  > "." THEN CP$ = C
     P$ + ".00"
2260  PRINT  SPC( 18 -  LEN (CP$));
     : PRINT CP$;
2270  IF  LEN ( STR$ (SP(I))) < 3 THEN
     CP$ =  STR$ (SP(I)) + ".00": GOTO
     2290
2280 SP$ =  STR$ (SP(I)): IF  MID$
     (SP$,( LEN (SP$) - 2),1) <  >
     "." AND  MID$ (SP$,( LEN (SP$)
      - 1),1) <  > "." THEN SP$ = S
     P$ + ".00"
2290  PRINT  SPC( 19 -  LEN (SP$));
     : PRINT SP$;: NEXT : GOTO 2300

2300  PRINT : PRINT D$;"PR#0": PRINT
     "TYPE (SPACEBAR) ";
2310  GET A$: IF A$ <  > " " THEN  GOTO
     2310
2320  GOTO 210
2330  TEXT : HOME
2340  PRINT  TAB( 14)"GROUP VALUES"
     : PRINT "**********************
     ********************": POKE 34,
     2: PRINT
2350  HOME : PRINT
2360  INPUT "PRINTER ";HC$: IF HC$ =
     "Y" THEN  PRINT D$;"PR#1"
2370  PRINT "THE DATE IS ";DTE$: IF
     HC$ = "Y" THEN  PRINT
2380  HOME
2390  FOR I = 1 TO MAX
2400 GC(GN(I)) = GC(GN(I)) + CP(I) +
      VAL (IS$(I)):GS(GN(I)) = GS(G
     N(I)) + SP(I) +  VAL (IS$(I)):
     NEXT
2410  FOR I = 1 TO GP
2420 CO$ =  STR$ (GC(I)): IF  MID$
     (CO$,( LEN (CO$) - 2),1) <  >
     "." AND  MID$ (CO$,( LEN (CO$)
      - 1),1) <  > "." THEN CO$ = C
     O$ + ".00"
2430  IF  MID$ (CO$,( LEN (CO$) - 2
     ),1) <  > "." THEN CO$ = CO$ +
     "0"
2440 SA$ =  STR$ (GS(I)): IF  MID$
     (SA$,( LEN (SA$) - 2),1) <  >
     "." AND  MID$ (SA$,( LEN (SA$)
      - 1),1) <  > "." THEN SA$ = S
     A$ + ".00"
2450  IF  MID$ (SA$,( LEN (SA$) - 2
     ),1) <  > "." THEN SA$ = SA$ +
     "0"
2460  PRINT "GROUP    ";I;: HTAB (1
     9): PRINT "COST ";: HTAB (24 +
     (15 - ( LEN (CO$)))): PRINT CO
     $; HTAB (19): PRINT "SALE ";: HTAB
     (24 + (15 - ( LEN (SA$)))): PRINT
      SA$
2470  PRINT
2480  NEXT
2490  PRINT D$;"PR#0": PRINT "TYPE
     (SPACEBAR)"
2500  GET A$: IF A$ <  > " " THEN  GOTO
     2500
```

(continued from previous page)

Line 2940 is a remnant from an old routine, and can be omitted. Apart from in the Hello program, no special Silentype features are used.

The following observation about the Apple may be useful if you want to modify the program for other systems:

- It is an Apple DOS requirement that a DOS command is not preceded by a Get command; hence the surfeit of ?s.
- Home clears the text screen and puts the cursor at the top-left position.
- Poke 34, n sets the top limit of the text page at n lines down from the top.
- ? SPC(n) prints n spaces.
- x=PRE(0) performs "house-cleaning" on the Applesoft, plus string storage thus increasing the effective memory.
- CHR$(4), assigned to D$ is necessary before a deferred execution
- DOS command.
- On n GOTO a, b, c, d etc, it goes to the nth line number in the list. If n is greater than the number of entries in the list, then the command is ignored.
- CHR$(13)=Return, Ctrl-M
  CHR$(3)=Ctrl-C
  CHR$(4)=Ctrl-D

Do not simply type the program in and run it. The Poke 214, 128 will prevent you from Saving it. To aid the detection of typing errors you should omit the Poke 214,128 and the Onerr Goto commands at first, only adding them once you are quite sure that the program works.

List before running

Once you have added these commands, save the program before running it. From then on the only way to list the program will be to load the program and list it, not to run it first. A password facility has been added to ensure greater protection. The password is assigned, in line 10, to Pass

Output to screen and printer may be tidied up up the following decimal-point line-up routine:

```
10 REM NUMBER IN NU$
20 IF M10$ (NU$, (LEN(NU$)−2),1)( )"."
   and MID$ (NU$, (LEN(NU$)−1),1)()"."
   then NU$=NU$+ ".00": GOTO 40
30 If MID$ (NU$,(LEN(NU$)-1),1)="." then
   NU$=NU$+"0"
40 . . . . . .
```

In addition, names are rounded up to fit the screen or pointer as appropriate, and leading or trailing spaces are removed. Any screen information is displayed page by page.

The wildcard character = is supported in options 3 and 4 to specify all groups or products. Note that to prevent unnecessary disc wear, if you alter a product and then alter it back again, the program will not bother to update the disc, thus saving time and reducing disc wear.

The Help option runs a file on disc called "help" which may be in the form of an aide-memoire and could be written by the user according to needs. At any point typing Ctrl-C aborts the current operation and sends you back to the menu.

```
2510  GOTO 210
2520  TEXT : HOME
2530  PRINT  TAB( 10)"STOCK BELOW M
     INIMUM": PRINT "**************
     **************************": POKE
     34,2: PRINT
2540  HOME : PRINT
2550  INPUT "PRINTER ";HC$: IF HC$ =
     "Y" THEN  PRINT D$;"PR#1
           ": PRINT
2560  PRINT "THE DATE IS ";DTE$: PRINT
     : IF  LEFT$ (HC$,1) = "N" THEN
      HOME
2570  IF HC$ = "Y" THEN  GOTO 2660
2580  PRINT "DESCRIPTION        IN S
     TOCK      MIN LEVEL";: IF HC$ =
     "Y" THEN  PRINT : FOR I = 1 TO
     40: PRINT "*";: NEXT
2590  FOR I = 1 TO MAX
2600  IF  VAL (IS$(I)) >  = VAL (M
     L$(I)) THEN  GOTO 2650
2610  IF HC$ = "Y" THEN  PRINT : GOTO
     2630
2620  IF  LEN (DE$(I)) > 16 THEN  PRINT
      LEFT$ (DE$(I),16);: HTAB (27 -
      LEN (IS$(I))): PRINT IS$(I);:
      HTAB (41 -  LEN (ML$(I))): PRINT
     ML$(I);: GOTO 2640
2630  PRINT DE$(I);: HTAB (27 -  LEN
     (IS$(I))): PRINT IS$(I);: HTAB
     (41 -  LEN (ML$(I))): PRINT ML
     $(I);
2640 FLAG = FLAG + 1: IF FLAG = 19 AND
     HC$ = "N" THEN FLAG = 0: PRINT
     "PRESS (SPACEBAR) TO CONTINUE"
     ;: GET A$:
2650  NEXT : PRINT : PRINT D$;"PR#0
     ";: PRINT "PRESS (SPACEBAR) TO
      CONTINUE";: GET A$: GOTO 210
2660  PRINT "DESCRIPTION
           GROUP        NO       MIN
              COST              SALE";
      PRINT "**********************
     ******************************
     ****************************"
2670  FOR I = 1 TO MAX
2680  IF  VAL (IS$(I)) >  VAL (ML$(
     I)) THEN  NEXT : GOTO 2780
2690  PRINT DE$(I);:C =  LEN (DE$(I
     )) +  LEN ( STR$ (GN(I))): PRINT
      SPC( 34 - C);: PRINT GN(I);
2700 C =  LEN (IS$(I)): PRINT  SPC(
     09 - C);: PRINT IS$(I);
2710 C =  LEN (ML$(I)): PRINT  SPC(
     08 - C);: PRINT ML$(I);
2720  IF  LEN ( STR$ (CP(I))) < 3 THEN
     CP$ =  STR$ (CP(I)) + ".00": GOTO
     2740
2730 CP$ =  STR$ (CP(I)): IF  MID$
     (CP$,( LEN (CP$) - 2),1) <  >
     "." AND  MID$ (CP$,( LEN (CP$)
      - 1),1) <  > "." THEN CP$ = C
     P$ + ".00"
2740  PRINT  SPC( 15 -  LEN (CP$));
     : PRINT CP$;
2750  IF  LEN ( STR$ (SP(I))) < 3 THEN
     CP$ =  STR$ (SP(I)) + ".00": GOTO
     2770
2760 SP$ =  STR$ (SP(I)): IF  MID$
     (SP$,( LEN (SP$) - 2),1) <  >
     "." AND  MID$ (SP$,( LEN (SP$)
      - 1),1) <  > "." THEN SP$ = S
     P$ + ".00"
2770  PRINT  SPC( 14 -  LEN (SP$));
     : PRINT SP$;: NEXT : GOTO 2780

2780  PRINT : PRINT D$;"PR#0": PRINT
     "TYPE (SPACEBAR) ";
2790  GET A$: IF A$ <  > " " THEN  GOTO
     2310
2800  GOTO 210
2810  HOME : PRINT "AUTOMATIC INVOI
     CING(NO/NUMBER OF COPIES ";: GET
     A$
2820  PRINT A$: GET X$
2830  IF A$ = "N" THEN INV = 0: GOTO
     210
2840 INV =  VAL (A$): GOTO 210
2850  PRINT "NOT AVAILABLE ";: GET
     A$: GOTO 70
2860  HOME : PRINT "PLEASE TYPE (SP
     ACEBAR)":
2870  GET A$: IF A$ <  > " " THEN  GOTO
     2870
2880  PRINT
2890  PRINT D$;"RUN HELP"
2900  TEXT : HOME
2910  PRINT "DO YOU WANT TO LEAVE A
     PPLE STOCK?";: GET A$: IF A$ <
      > "Y" THEN  RUN
2920  HOME : VTAB (12): PRINT  TAB(
     18)"BYE!"
2930  END
2940  PRINT "OPEN STOCK FILE, L60":
      PRINT "WRITE STOCK FILE,R0": PRINT
     "02": PRINT "04": PRINT "CLOSE
     "
2950  PRINT D$;"PR#4": PRINT D$;"IN
     #4": PRINT "C": INPUT CD$: PRINT
     D$;"PR#0": PRINT D$;"IN#0"
2960 TH$(0) = "SUNDAY": TH$(1) = "MO
     NDAY": TH$(2) = "TUESDAY": TH$(3
     ) = "WEDENSDAY": TH$(4) = "THUR
     SDAY": TH$(5) = "FRIDAY": TH$(6)
      = "SATURDAY"
2970  DIM DH$(12):DH$(1) = "JANUARY
     ":DH$(2) = "FEBRUARY":DH$(3) =
     "MARCH":DH$(4) = "APRIL":DH$(5
     ) = "MAY":DH$(6) = "JUNE":DH$(
     7) = "JULY":DH$(8) = "AUGUST":
     DH$(9) = "SEPTEMBER":DH$(10) =
     "OCTOBER":DH$(11) = "NOVEMBER"
     :DH$(12) = "DECEMBER"
2980 DTE$ = TH$( VAL ( LEFT$ (CD$,2
     )) + " " +  MID$ (CD$,6,2) +
     " " + DH$( VAL ( MID$ (CD$,3,2
     )) + " " + "19" +  MID$ (CD$,
     9,2)
2990  RETURN
3000  FOR I =  LEN (A$) TO 1 STEP  -
     1: INVERSE : PRINT  MID$ (A$,I
     ,1);"";: NORMAL : PRINT  MID$ (
     A$,I,1);: NEXT : RETURN
```

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Open File is the part of the magazine written by you, the readers. All aspects of microcomputing are covered, from games to serious business and technical software, and we welcome contributions on CP/M, BBC Basic, Microsoft Basic, Apple Pascal and so on, as well as the established categories.

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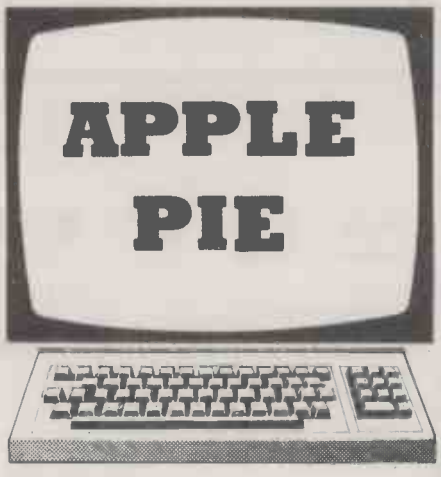
Guidelines for contributors

Programs should be accompanied by documentation which explains to other readers what your program does and, if possible, how it does it. It helps if documentation is typed or printed with double-line spacing — cramped or handwritten material is liable to delay and error.

Program listings should, if at all possible, be printed out. Use a new ribbon in your printer, please, so that we can print directly from a photograph of the listing and avoid typesetting errors. If all you can provide is a typed or handwritten listing, please make it clear and unambiguous; graphics characters, in particular, should be explained.

We can accept material for the Pet, Vic and Sharp MZ-80K on cassette, and material for the larger machines can be sent on IBM-format 8in. floppy discs.



Petcout

MICROCOMPUTERS HAVE adopted two ways on moving the cursor within a Basic program. notes M Phillips of Knutsford, Cheshire. It may be absolute like Applesoft's VTab and HTab, or relative like Pet's cursor-control characters. Each method has its advantages, and the owner of one can always program the other, but it seems silly not to have the control characters in Applesoft when the appropriate routines already exist within the monitor ROM to perform on-screen editing.

Petcout, a short 6502 subroutine, can be used to provide this feature. Once initialised by Brun or Bload followed by Call 768, it compares all output characters with a list given in the table at the base of the program. If it finds a match, it jumps to the given address for that character. If not, it jumps to the normal character output routine at $FDF0.

The table listed provides up, left, right, inverse, normal and home; cursor-down is already provided with Ctrl-J. You can use any codes and monitor, or your own routines as long as the table ends with F0, FD, 00 and contains no more than 85 definitions.

Petcout.

```
1    * 'PETCOUT'  APPLE II UTILITY
2    *
3    * TRAPS CONTROL CHARS GIVEN IN
4    * 'TABLE' BELOW AND JUMPS TO
5    * CORRESPONDING ADDRESS TO PROVIDE
6    * CURSOR CONTROL THRU' CHR$ IN
7    * A SIMILAR MANNER TO THE PET
8    *
9    * MAX PHILLIPS  DEC 81
10   *
11   * EQUATES ...
12   *
13   ACC      EQU  $45
14   IOSAVE   EQU  $FF4A
15   IOREST   EQU  $FF3F
16   *
17   * THIS VERSION AT $300
18   * PROGRAM CAN BE RELOCATED
19   * IF REFERENCES TO ENTER & VECTL/H  CHANGED
20   *
21            ORG  $300
22            OBJ  $300
23   *
24   * INITIALISE
25   *
26   * BRUN THE PROGRAM OR CALL 768 TO
27   * SEND ALL OUTPUT THRU' THIS ROUTINE
```

(continued on page 135)

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(continued from page 133)

```
                    28  *
                    29  * ROUTINE TURNED OFF BY RESET OR PR#0
                    30  *
0300: A9 0B         31  BRUN    LDA  #<ENTER
0302: 85 36         32          STA  $36
0304: A9 03         33          LDA  #>ENTER
0306: 85 37         34          STA  $37
0308: 4C EA 03      35          JMP  $3EA   ; EXIT THRU' DOS
                    36  *
                    37  * ENTER
                    38  *
                    39  * ALL OUTPUT PASSED TO HERE IN ACC
                    40  *
030B: 20 4A FF      41  ENTER   JSR  IOSAVE ; SAVE THE REGS
030E: A5 45         42          LDA  ACC    ; RECOVER ACC'S VALUE
0310: 29 7F         43          AND  #$7F   ; CLEAR MSB OF ACC
0312: 8D 36 03      44          STA  TEMP   ; READY FOR COMPARISION
                    45  *
0315: A0 FF         46          LDY  #$FF   ; INIT TABLE INDEX
                    47  *
0317: C8            48  LOOP    INY
0318: B9 39 03      49          LDA  TABLE,Y ; SET UP NEXT VECTOR
031B: 8D 37 03      50          STA  VECTL
031E: C8            51          INY
031F: B9 39 03      52          LDA  TABLE,Y
0322: 8D 38 03      53          STA  VECTH
0325: C8            54          INY
0326: B9 39 03      55          LDA  TABLE,Y ; GET NEXT CHAR
0329: F0 05         56          BEQ  DONE   ; IF 0 THEN END OF TABLE
032B: CD 36 03      57          CMP  TEMP   ; IS CHAR TO PRINT ?
032E: D0 E7         58          BNE  LOOP   ; IF NO, TRY NEXT ENTRY
0330: 20 3F FF      59  DONE    JSR  IOREST ; RESTORE REGS
0333: 6C 37 03      60          JMP  (VECTL) ; EXIT THRU' VECTOR
                    61  *
                    62  * DATA STORAGE LOCS
                    63  *
0336: 00            64  TEMP    HEX  00
0337: 00            65  VECTL   HEX  00
0338: 00            66  VECTH   HEX  00
                    67  *
                    68  * TABLE
                    69  *
                    70  * LIST OF DESTL,DESTH,ASCII OF CHAR TO TRAP
                    71  *
                    72  * MUST END WITH FO,FD,00 SO OTHERS GO TO NORMAL
                    73  * PRINTING ROUTINE AT $FDF0
                    74  *
0339: 1A FC 17      75  TABLE   HEX  1A,FC,17 ; UP   CRTL-W  $FC1A
033C: 10 FC 19      76          HEX  10,FC,19 ; <-   CRTL-Y  $FC10
033F: F4 FB 1A      77          HEX  F4,FB,1A ; ->   CRTL-Z  $FBF4
0342: 58 FC 0C      78          HEX  58,FC,0C ; CLS  CRTL-L  $FC58
0345: 80 FE 09      79          HEX  80,FE,09 ; RVS  CRTL-I  $FE80
0348: 84 FE 0E      80          HEX  84,FE,0E ; NML  CRTL-N  $FE84
034B: F0 FD 00      81          HEX  F0,FD,00 ; OTHERS TO $FDF0
```

Graphics print — listing 1.

```
10 Y = 0:X = 0
20 MC = 7936: REM  MACHINE CODE R
   OUTINE
30 TABLE = 8176
40 PD =  - 16240: REM  PRINTER BU
   FFER
50 PR =  - 15873: REM  PRINTER RE
   ADY BYTE
60 D$ =  CHR$ (4):FB = 8192
70  GOSUB 5000
80  TEXT
90  HOME : PRINT "NORMAL (N) : WH
   ITE GOES TO BLACK.
"
100  PRINT "INVERSE (I) : WHITE G
   OES TO WHITE."
110  PRINT : PRINT "WHICH MODE (N
   /I) ?";: GET A$: PRINT A$
120 TT = 0: IF A$ = "I" THEN TT =
   255
130  POKE 7968,TT: REM  SET ON/OF
   F FLAG
140  HGR2 : HGR : HOME : VTAB 22
150  INPUT "WHAT PICTURE NAME";N$

160  PRINT D$;"BLOAD";N$;",A$2000
   "
170  HOME : VTAB 22
180  PRINT "FRAME (Y/N) ?";: GET
   A$: PRINT A$: IF A$ <  > "Y"
    THEN 200
190  HCOLOR= 3: HPLOT 0,0 TO 279,
   0 TO 279,191 TO 0,191 TO 0,0

200  PRINT D$;"PR#1": POKE  - 163
   02,0
210  POKE PD,8: REM   SET GRAPHIC
   S MODE ON PRINTER
220  FOR Y1 = 0 TO 192 STEP 7
230  FOR Y = Y1 TO Y1 + 6: GOSUB
   1000:B(Y - Y1) = BV: NEXT
240  FOR X1 = 0 TO 39 STEP 10
250  IF  PEEK (PR) <  > 132 THEN
   250
260  POKE PD,27: POKE PD,16: POKE
   PD,(7 * X1 > 255): POKE PD,7
    * X1 - 256 * (7 * X1 > 255)
270  REM  27,16,HP,LP POSITIONS P
   RINTHEAD AT HP*256 + LP
280  FOR X = X1 TO X1 + 9
290  FOR Y = 0 TO 6: POKE TABLE +
   Y, PEEK (B(Y) + X): NEXT
300  CALL MC
310  NEXT : POKE PD,20: REM  PRIN
   T CHARACTERS IN BUFFER
320  NEXT X1
330  IF  PEEK (PR) <  > 132 THEN
   330
340  POKE PD,10
350  NEXT Y1
360  PRINT D$;"PR#0"
370  TEXT
380  HOME : VTAB 22: PRINT "ANOTH
   ER PICTURE ?";: GET A$: PRINT
   A$
390  IF A$ <  > "N" THEN  TEXT : GOTO
   90
400  END
1000  REM  FIND BYTE CONTAINING X
   ,Y
1010 LH = X:LV = Y
1020 BV = (LV -  INT (LV / 8) * 8
   ) * 1024
1030 BA =  INT (LV / 8):BV = BV +
   (BA -  INT (BA / 8) * 8) * 1
   28 +  INT (LV / 64) * 40 + F
   B
1040  RETURN
5000  REM  CREATE MACHINE CODE RO
   UTINE

5010  DATA 160,7,162,6,94,240,31,
   42,202,16,249,77,32,31,9
5020  DATA 128,141,144,192,173,25
   5,193,201,132,208,249,136,20
   8,229,96
5030  FOR T = 7936 TO 7965: READ
   X: POKE T,X: NEXT
5040  RETURN
65535  REM  HI-RES GRAPHICS DUMP

65535  REM  TO SEIKOSHA GP-80A

65535  REM  BY G.WATSON
```

Graphics print

THIS ROUTINE from Greg Watson of Manchester dumps the Apple's high-resolution page 1 to the Seikosha GP-809 printer. The program assumes that the interface card used is the Apple interface and that the interface is in slot 1.

Type in the Basic program in listing 1. Save it and Run the program. You will be asked if you want Normal or Inverse mode: Normal mode means that if a point is set on the screen it will also be set on the printer.

You are then asked for the name of the picture you want printed. It must be the name of a binary file on the disc. To save a high-resolution screen to disc type

BSAVE name, A$2000, L$2000

Once the picture has been loaded you have the option of having it "framed", and the program then dumps the screen on to the printer. Finally you have the option of another print.

The routine at 1000 returns the address of the byte which contains the point X, Y on the screen. The machine-code routine in listing 2 speeds up the bit manipulation required, since Basic is very slow in that task. Since the character buffer can only hold 90 characters at a time, each line has to be broken up into four segments, which is done by the repositioning sequence in line 260.

Disc patcher

THIS PROGRAM by P McPoland of Bristol has proved useful in debugging programs which manipulate disc files, since it allows you to easily display, print and

(continued on next page)

Grapics print — listing 2.

```
1          ORG  $1F00
2 ********************************
3 *                              *
4 *        SEIKOSHA              *
5 *                              *
6 *        HI-RES GRAPHICS       *
7 *                              *
8 *        BY   G.WATSON         *
9 *                              *
10 ********************************

11 BYTES    EQU  $1FF0
12 PREADY   EQU  $C1FF      ;$CNFF N=SLOT
13 PDATA    EQU  $C090      ;$C0N0 N=$8 + SLOT
14 ONOFF    EQU  $1F20      ;BIT MASK
15          LDY  #$07
16 LOOP     LDX  #$06       ;7 BITS AT A TIME
17 LOOP1    LSR  BYTES,X    ;GET NEXT BIT FROM BYTE
18          ROL  A          ;SHIFT BIT INTO ACCUMULATOR
19          DEX             ;HAVE WE DONE LOOP 7 TIMES?
20          BPL  LOOP1      ;NO SO REPEAT LOOP1
21          EOR  ONOFF      ;SET BITS ON OR OFF FOR NORMAL/INVERSE
22          ORA  #$80       ;SET M.S.BIT TO MAKE IT GRAPHICS DATA
23          STA  PDATA      ;SEND TO PRINTER BUFFER
24 CHECK    LDA  PREADY     ;CHECK PRINTER IS READY FOR NEXT BYTE
25          CMP  #$84
26          BNE  CHECK      ;NOT READY THEN CHECK AGAIN
27          DEY             ;HAVE WE DONE MAIN LOOP 7 TIMES?
28          BNE  LOOP       ;NO SO GO BACK TO LOOP
29          RTS             ;YES SO RETURN TO PROGRAM.
```

Disc patcher

THIS PROGRAM by P McPoland of Bristol has proved useful in debugging programs which manipulate disc files, since it allows you to easily display, print and

(continued on next page)

Disc patcher.

```
10  REM
11  REM  D K P A T C H  -  DISK PATCH UTILITY
12  REM  COPYRIGHT P MC POLAND 1982
13  REM
20  GOSUB 62000
30  GOSUB 61000
40  ON F GOSUB 20000,21000,22000,23000,24000,25000,26000,27000
50  GOTO 30
10000  REM
10001  REM  DISPLAY BUFFER
10002  REM
10010  IF F <  > 3 THEN  HOME
10015 OF = SP - 38400: FOR I = 1 TO  INT (LN / 8): GOSUB 10100: PRINT Z$;" ";
10020  FOR J = 0 TO 3: FOR K = 0 TO 1:Z =  PEEK (SP + 2 * J + K):Z$ =  MID$ (HX$
,1 +  INT (Z / 16),1) +  MID$ (HX$,1 + Z - 16 *  INT (Z / 16),1): PRINT Z$;: NEX
T K: PRINT " ";: NEXT J
10030  PRINT "  $";: FOR J = 0 TO 7:Z =  PEEK (SP + J): IF Z = 0 THEN Z$ = ".":
GOTO 10050
10040 Z$ =  MID$ (TR$,Z,1)
10050  PRINT Z$;: NEXT J: PRINT "$ ";: GOSUB 10100: PRINT Z0$;: IF F = 3 THEN  PR
INT
10055 SP = SP + 8: NEXT I
10060  PRINT "TRACK ";T;"  SECTOR ";S: RETURN
10100 Z$ =  STR$ ((I - 1) * 8 + OF)
10110  IF  LEN (Z$) < 3 THEN Z$ = "0" + Z$: GOTO 10110
10120  RETURN
20000  REM
20001  REM  READ A SECTOR
20002  REM
20010  GOSUB 60000: POKE 801,1: CALL 769: IF  PEEK (768) <  > 0 THEN  HOME : VTA
B 10: HTAB 14: FLASH : PRINT "I/O ERROR": RETURN
20020 SP = 38400:LN = 128: GOSUB 10000: RETURN
21000  REM
21001  REM  WRITE A SECTOR
21002  REM
21010  GOSUB 60000: POKE 801,2: CALL 769: IF  PEEK (768) <  > 0 THEN  HOME : VTA
B 10: HTAB 14: FLASH : PRINT "I/O ERROR": RETURN
21020  RETURN
22000  REM
22001  REM  PRINT A SECTOR
22002  REM
22010  PRINT D$;"PR#1": CHR$ (13); CHR$ (0): POKE 1657,80
22020 SP = 38400:LN = 256: GOSUB 10000
22030  PRINT D$;"PR#0": RETURN
23000  REM
23001  REM  CHANGE DATA
23002  REM
23010  VTAB 19: HTAB 1: INPUT "OFFSET(0-255)? ";Z$: IF  LEN (Z$) = 0 THEN  PRINT
  B$: GOTO 23010
23020  FOR I = 1 TO  LEN (Z$): IF  MID$ (Z$,I,1) < "0" OR  MID$ (Z$,I,1) > "9" T
HEN  PRINT B$;: GOTO 23010
23025  NEXT I
23030 J =  VAL (Z$): IF J > 255 THEN  PRINT B$;: GOTO 23010
23040 K = 255 - J: IF K > 14 THEN K = 14
23050 Z$ = "": FOR I = J TO J + K:Z =  PEEK (38400 + I):Z$ = Z$ +  MID$ (HX$,1 +
  INT (Z / 16),1) +  MID$ (HX$,1 + Z - 16 *  INT (Z / 16),1)
23060  NEXT I: VTAB 20: HTAB 1: PRINT "OLD DATA  ";Z0$
23070  VTAB 21: HTAB 1:  INPUT "NEW DATA? ";Z0$: IF  LEN (Z0$) = 0 OR  LEN (Z0$) > 3
0 OR  LEN (Z$) - 2 * INT ( LEN (Z$) / 2) <  > 0 OR  LEN (Z0$) > 2 * (K + 1) THEN
  PRINT B$;: GOTO 23070
23080  FOR I = 1 TO  LEN (Z$): FOR K = 1 TO  LEN (HX$): IF  MID$ (Z$,I,1) <  >
MID$ (HX$,K,1) THEN  NEXT K: PRINT B$;: GOTO 23070
23090  NEXT I
23100  FOR I = 1 TO  LEN (Z$): FOR K = 1 TO  LEN (HX$): IF  MID$ (Z$,I,1) <  >
MID$ (HX$,K,1) THEN  NEXT K
23110 Z = 16 * (K - 1):I = I + 1: FOR K = 1 TO  LEN (HX$): IF  MID$ (Z$,I,1) <
>  MID$ (HX$,K,1) THEN  NEXT K
23120 Z = Z + K - 1: POKE 38400 + J + I / 2 - 1,Z: NEXT I
23130 SP = 38400: IF J > 127 THEN SP = 38528
23140 LN = 128: GOSUB 10000: RETURN
24000  REM
24001  REM  RESET DEFAULT DRIVE
24002  REM
24010  VTAB 19: HTAB 1: INPUT "DRIVE(1 OR 2)? ";DI$: IF DI$ <  > "1" AND DI$ <
> "2" THEN  PRINT B$;: GOTO 24010
24020  VTAB 19: HTAB 1: CALL  - 958:D =  VAL (DI$): POKE 791,D: POKE 805,D: RETU
RN
25000  REM
25001  REM  END PROGRAM
25002  REM
25010  POP : HOME : NEW
26000  REM
26001  REM  SHOW SECOND SEGMENT
26002  REM
26010 SP = 38528:LN = 128: GOSUB 10000: RETURN
27000  REM
27001  REM  SHOW FIRST SEGMENT
27002  REM
27010 SP = 38400:LN = 128: GOSUB 10000: RETURN
60000  REM
60001  REM  RESET TRACK/SECTOR
60002  REM
60010  VTAB 19: HTAB 1: INPUT "TRACK(0-34)? ";TI$: IF  LEN (TI$) = 0 THEN  RETUR
N
60020  FOR I = 1 TO  LEN (TI$): IF  MID$ (TI$,1,1) < "0" OR  MID$ (TI$,I,1) > "9
" THEN  PRINT B$;: GOTO 60010
60030 T =  VAL (TI$): IF T > 34 THEN  PRINT B$;: GOTO 60010
60040  POKE 793,T
60050  VTAB 20: HTAB 1: INPUT "SECTOR(0 TO 15)? ";SI$: IF  LEN (SI$) = 0 THEN  P
RINT B$;: GOTO 60050
60060  FOR I = 1 TO  LEN (SI$): IF  MID$ (SI$,I,1) < "0" OR  MID$ (SI$,I,1) > "9
" THEN  PRINT B$;: GOTO 60050
60070 S =  VAL (SI$): IF S > 15 THEN  PRINT B$;: GOTO 60050
60080  POKE 794,S: RETURN
61000  REM
61001  REM  INPUT FUNCTION
61002  REM
61010  NORMAL : VTAB 19: HTAB 1: CALL  - 958
61020  HTAB 7: PRINT "ENTER FUNCTION =>"
61030  INVERSE : HTAB 7: PRINT "R";: NORMAL : PRINT "EAD  ";: INVERSE : PRINT "
D";: NORMAL : PRINT "RIVE"
61040  HTAB 7: INVERSE : PRINT "W";: NORMAL : PRINT "RITE  ";: INVERSE : PRINT "
F";: NORMAL : PRINT "ORWARD"
61050  HTAB 7: INVERSE : PRINT "P";: NORMAL : PRINT "RINT  ";: INVERSE : PRINT "
B";: NORMAL : PRINT "ACK"
61060  HTAB 7: INVERSE : PRINT "C";: NORMAL : PRINT "HANGE"
61070  HTAB 7: INVERSE : PRINT "E";: NORMAL : PRINT "XIT";
61080  VTAB 19: HTAB 26: INPUT "";FI$: IF  LEN (FI$) <  > 1 THEN  PRINT B$;: GOT
O 61080
61090  FOR F = 1 TO  LEN (F$): IF  MID$ (F$,F,1) <  > FI$ THEN  NEXT F: PRINT B$
;: GOTO 61080
61100  IF F <  > 3 THEN  VTAB 19: HTAB 1: CALL  - 958
61110  RETURN
62000  REM
62001  REM  INITIALISATION
62002  REM
62003  HOME : VTAB 8: HTAB 11: INVERSE : PRINT "DISK PATCH UTILITY": NORMAL : PR
INT : HTAB 15: PRINT "WRITTEN BY": PRINT : HTAB 12: PRINT "P MC POLAND 1982"
62005 F$ = "R#PCDEFB":B$ =  CHR$ (7):D$ =  CHR$ (4)
62010 TR$ = "..................................  !" +  CHR$ (162) + "#$%&'()*+,-./0
123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ" +  CHR$ (219) +  CHR$ (220) +  CHR$
(221) +  CHR$ (222) +  CHR$ (223) + ".ABCDEFGHIJKLMNOPQRSTUVWXYZ....."
62015 TR$ =  RIGHT$ (TR$,127) + TR$:HX$ = "0123456789ABCDEF"
62020  FOR I = 768 TO 809: READ J: POKE I,J: NEXT I
62030  RETURN
62040  DATA  0,169,0.141,0,3,169.3,160,21,32,217,3,144,5,169,1,141,0,3,96
62050  DATA  1,96,1,0,0,0,38,3,0,150,0,0,0,0,0,96,1,0,1,239.216
```

(continued from previous page)

change the contents of any Disc II sector directly. Other uses to which it might be put include rescuing deleted files, or patching machine code or data files on disc.

Disc sectors are read into part of the standard DOS buffer area, edited there, and rewritten on demand. Options are selected from a menu by entering the first character of the keywords displayed. They are:

Read — You will be prompted for the track, 0 to 34, and sector, 0 to 15. The sector is then read in and displayed. Note that by pressing Return on the track prompt, you can cause the program to use whatever values are currently in track/sector. At start-up, both values will be zero.

Write — You are prompted for track/sector as for the Read option. Usually you would wish to rewrite the current sector, so you would press Return at the track prompt. The program writes the buffer to the track/sector location specified.

Print — If you have a printer, the program can produce a listing of the sector buffer. Line 22010 sets up for a printer in slot 1, and the Poke is used to suppress screen display during printing, which would otherwise corrupt the display format. It applies to the MX-80 printer interface, so for other printers you would have to replace it with something equivalent.

Drive — This option allows you to set the current disc drive to 1 or 2, whatever you reply.

Forward/Back — The screen display is similar to the print layout shown, but only half as deep, so it is divided into two screens, offset 0 to 127 and offset 128 to 255. You can flip from one to the other using these options.

Change — This option allows you to change an area within the sector buffer to a hex string which you are asked to key in. You must enter the start offset where the overlay is to begin, and the program will display up to 15 bytes in hex currently at that location. You are then prompted to enter the overlay value as a hex string. The value you enter must have an even number of valid hex characters, and you cannot key any more characters than the number displayed. The main display is refreshed, showing the sector as it looks with your changes applied. The process can be repeated until you are happy with the result, when you can request that the sector be written back via the main menu.

Exit — Ends the program.

Sample disc-sector contents output by Disc Patcher routine.

```
000 01A5 27C5 07D0 18F5   *.'.....*  000
008 2B4A 4A4A 4A09 C085   *+JJJJ...*  008
016 3FA9 5C85 3E18 ADFE   *?)\.>...*  016
024 086D FF08 8DFE 08AE   *.M......*  024
032 FF08 3015 BD4D 0885   *..0..M..*  032
040 3DCE FF08 ADFE 0885   *=N.......*  040
048 27CE FE08 A62B 6C3E   *'N..&+L.*  048
056 00EE FE08 EEFE 0820   *.N..N.. *  056
064 89FE 2093 FE20 2FFB   *.. .. /.*  064
072 A62B 6CFD 0800 0D0B   *&+L.....*  072
080 0907 0503 010E 0C0A   *.........*  080
088 0806 0402 0F00 2064   *..... D*  088
096 A7B0 08A9 00A8 8D5D   *'0.)..(.]*  096
104 B691 40AD C5B5 4CD2   *6.@-E5LR*  104
112 A6AD 5DB6 F008 EEBD   *&-]6P.N=*  112
120 F5D0 03EE BCB5 A900   *5P.N<5).*  120
128 8D5D B64C 46A5 8DBC   *.]6LF%.<*  128
136 B520 A8A6 20EA A24C   *5 (& J"L*  136
144 7DA2 A013 B142 D014   *.} .1BP.*  144
152 C8C0 17D0 F7A0 19B1   *HH@.PW ..1*  152
160 4299 A4B5 C8C0 1DD0   *B.$5H@.P*  160
168 F64C BCA6 A2FF 8E5D   *6VL<&"..]*  168
176 B6D0 F600 0000 0000   *6PV.....*  176
184 0000 0000 0000 0000   *........*  184
192 0000 0000 0000 0000   *........*  192
200 0000 0000 0000 0000   *........*  200
208 2058 FCA9 C220 EDFD   * X.)B M.*  208
216 A901 20DA FDA9 AD20   *).  Z.)- *  216
224 EDFD A900 20DA FD60   *M.)  Z..*  224
232 0000 0000 0000 0000   *........*  232
240 0000 0000 0000 0000   *........*  240
248 0000 0000 0000 B609   *.......6.*  248
TRACK 0  SECTOR 0
```

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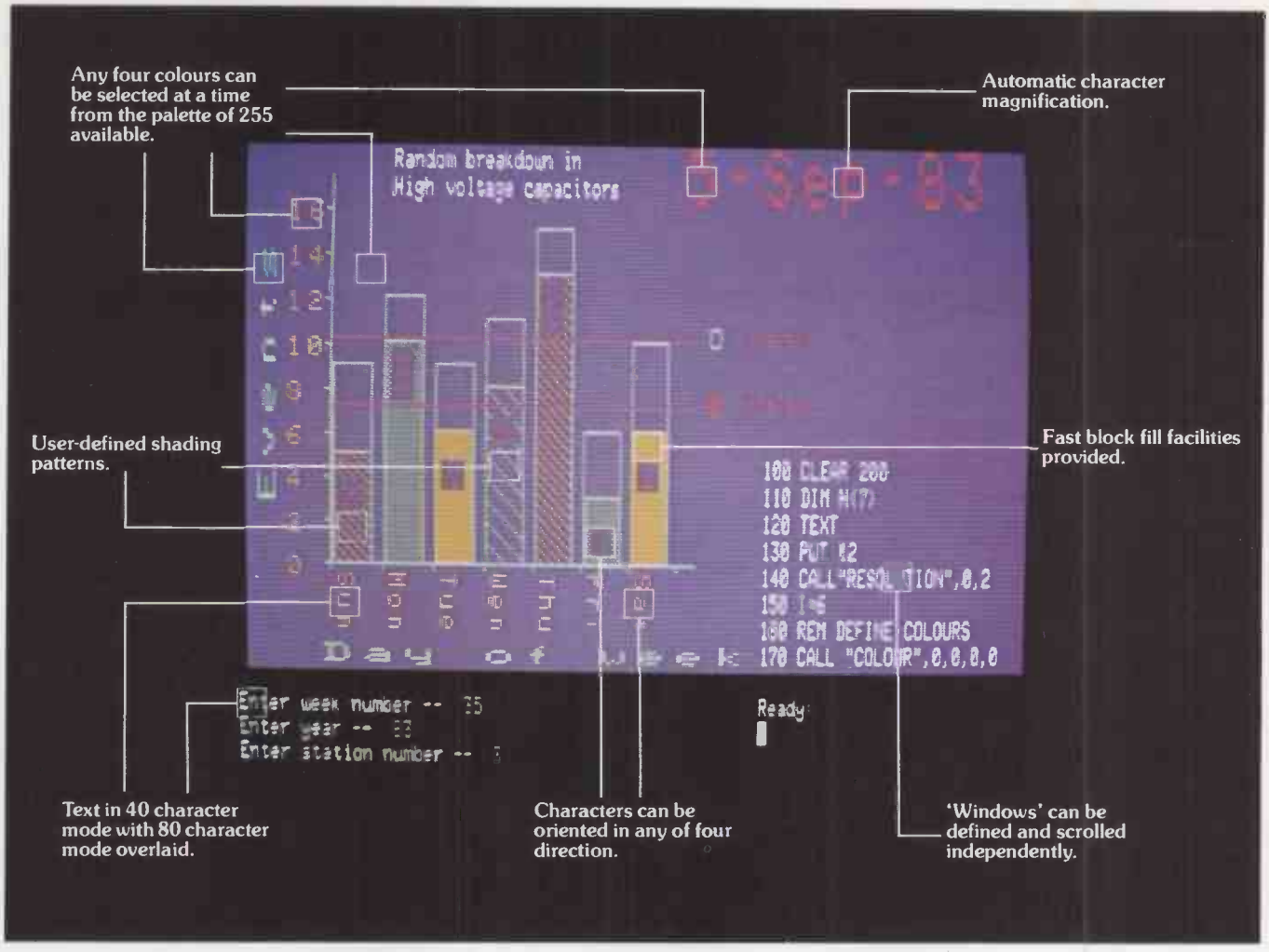

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Command exchange

THIS MACHINE-CODE routine for the ZX-81 by Michael Wood of Exmouth, Devon goes through any program contained within the RAM byte by byte and changes one command for another. In this example it changes all Print statements to LPrint statements. A feature of this routine is the ability for it to stop part way through a program. To achieve this you simply place a Stop statement in the program where you want it to stop.

To place the routine above RAMtop on the 1K machine:

- Poke 16388, 236.
- Poke 16389, 67.
- Execute New.
- Using program 1, enter each hexadecimal number separately.
- Execute New once again.

If you have a 16K RAM, change the first two steps to

- Poke 16388, 237.
- Poke 16389, 127.

You are now ready to test the routine. Enter:

```
10 PRINT
```

followed by

```
RAND USR 17388
```

The routine is at 32749 if you have a 16K RAM. After Newline you should immediately see 0/0. List the program, and you should see:

```
10 LPRINT
```

If you want to change some other characters, just Poke the code of the character you wish to change to 17398 — or to 32759 if you have 16K RAM. Then Poke the code of the character you want to change to 17403 — 32764 if you have 16K RAM.

Command exchange — program 1.

1K version.

```
10   FOR I=17388 TO 17406
20   INPUT A
30   POKE I,A
40   NEXT I
```

16K version.

```
10   FOR I=32749 TO 32767
20   INPUT A
30   POKE I,A
40   NEXT I
```

Machine code.

```
Decimal                    Z80 Assembler
33 128 64                  : ld hl,16513
35                         : inc hl
126                        : ld a,(hl)
254 227                    : cp 227 ("STOP")
200                        : ret z
126                        : ld a,(hl)
254 245                    : cp 245 ("PRINT")
194 *239* *67*             : jp nz 17391
54 225                     : ld (hl),225 ("LPRINT")
195 *239* *67*             : jp 17391


*--* if you have the 16k rampack change these to :

239 becomes 240
67  becomes 127
```

Physics routines

THIS PROGRAM by I J Moore of Nottingham provides a choice of standard physics calculations.

When you input variables, time should be in seconds, mass should be in kilograms, height, radius and distance moved should be in metres, and the force and heat supplied should be in joules.

The following variables are used:

A, B, C - the figures which are to be used in the following calculations; they match with A$, B$ and C$ respectively.
D - the option which is chosen.
Z - the answer which is obtained from the calculation.
A$, B$, - the names of the items which are to be input.
Y$ - the unit of the item being calculated.
Z$ - the item being calculated.

The program is divided into the following sections:

1-22 print out the options which are available.
23-25 input the option required by the user.
30-495 set up the variables in accordance to the option chosen.
1000-1170 input the figures which are to be used in the calculations.
1180-1280 execute the appropriate calculations.
1290-1300 print out the answer with its unit.
1310-1360 input the user's decision as to, the continuation of the program.
1370-1390 go to the relevant part of the program.

Physics routines.

```
1    REM PHYSICS CALCULATIONS
2    REM BY IAN MOORE
3    CLS
4    PRINT TAB 6;"OPTIONS AVAILABLE"
5    PRINT TAB 6;"-----------------"
6    PRINT "1. VOLTAGE IN A CIRCUIT"
7    PRINT "2. CURRENT IN A CIRCUIT"
8    PRINT "3. CHARGE IN A CIRCUIT"
9    PRINT "4. RESISTANCE IN A CIRCUIT"
10   PRINT "5. POWER IN A CIRCUIT"
11   PRINT "6. KINETIC ENERGY"
12   PRINT "7. POTENTIAL ENERGY"
13   PRINT "8. CENTRIPETAL FORCE"
14   PRINT "9. FORCE ON A MOVING OBJECT"
15   PRINT "10. WORK DONE"
16   PRINT "11. PRESURE ON AN AREA"
17   PRINT "12. DENSITY OF A SUBSTANCE"
18   PRINT "13. SPECIFIC HEAT CAPACITY"
19   PRINT "14. VELOCITY OF WAVES"
20   PRINT "15. IMPULSE DURING A  COLLISION"
21   PRINT "16. MOMENTUM OF AN OBJECT"
22   PRINT
23   PRINT "PLEASE INPUT YOUR OPTION ";
24   INPUT D
25   PRINT D
26   GOTO D*30
30   LET A$="CURRENT"
35   LET B$="RESISTANCE"
40   LET Z$="VOLTAGE"
45   LET Y$="V"
50   GOTO 1000
60   LET A$="VOLTAGE"
65   LET B$="RESISTANCE"
70   LET Z$="CURRENT"
75   LET Y$="A"
80   GOTO 1000
90   LET A$="CURRENT"
95   LET B$="TIME"
100  LET Z$="CHARGE"
105  LET Y$="C"
110  GOTO 1000
120  LET A$="VOLTAGE"
125  LET B$="CURRENT"
130  LET Z$="RESISTANCE"
135  LET Y$="-O- (OHMS)"
140  GOTO 1000
150  LET A$="VOLTAGE"
155  LET B$="CURRENT"
160  LET Z$="POWER"
165  LET Y$="W"
170  GOTO 1000
180  LET A$="MASS"
185  LET B$="VELOCITY"
190  LET Z$="KINETIC ENERGY"
195  LET Y$="J"
200  GOTO 1000
210  LET A$="MASS"
215  LET B$="HEIGHT"
220  LET Z$="POTENTIAL ENERGY"
225  LET Y$="J"
230  GOTO 1000
240  LET A$="MASS"
245  LET B$="VELOCITY"
250  LET C$="RADIUS"
255  LET Z$="CENTRIPETAL FORCE"
260  LET Y$="N"
265  GOTO 1000
270  LET A$="MASS"
275  LET B$="ACCELERATION"
280  LET Z$="FORCE"
285  LET Y$="N"
290  GOTO 1000
300  LET A$="FORCE"
305  LET B$="DISTANCE MOVED"
310  LET Z$="WORK DONE"
315  LET Y$="J"
320  GOTO 1000
```

(continued on next page)

Income tax

THIS TAX-ASSESSMENT PROGRAM by D A Pryce of Nottingham runs on 1K ZX-81s and is based on tax rates set by the March 1982 Budget. It can cope with:

- Standard or higher rate taxpayers.
- Married or single tax status.
- Joint assessments.
- Mortgage interest relief.

It should prove useful to taxpayers, accountants and even tax collectors.

When you run the program it will ask you if you are married, single or require a joint assessment, type M, S or J and press Newline. Enter your annual mortgage interest payment if you are entitled to this relief, otherwise type O and Newline.

The program then prints out your annual salary, national insurance, tax and net pay for the year. The following variables are used:

M$ - marital status
S - salary for tax purposes
I - annual mortgage interest payments
A - personal allowance
N - national insurance
T - taxable income
X - tax payable
G - net pay receivable

Hexad

HEXAD by Paul Morriss of Alford, Lincolnshire enables you to assemble and disassemble hex from and to Rem statements and will also allow full editing facilities. Either of the two sections can be entered when needed or both at once.

The program as it stands will assemble and disassemble into a Rem statement which is the first line of the program. If you want to do this then type 10 Rem and enough characters to hold the machine code. If you want to place it above RAMtop then replace lines 1000 and 2000 with

LET Y=16514

and lines 1010 and 2010 with

For X=address of first byte for machine code to address of last byte. Make sure these figures are accurate or you will overwrite the Basic.

To assemble the hex, place it in Rem statements like

20 REM 2A 0C 40.

The hex digits may be placed together or with any number of spaces in between. Remarks can be put in provided they start and finish with a *. Any number of Rem statements may hold the hex.

After typing in the hex it can be fully checked. To assemble the hex type Run. The program is best run in Fast mode as there is no display. At this speed it will assemble 30 bytes per second. The lines of hex may now be deleted.

Try the example program after entering the assembly program. After assembling it type

RAND USR 16514

To disassemble the machine code place some Rem statements at the beginning of the program, except for the first line if you are using it to hold the machine code. These Rem statements should contain three times as many characters as the number of bytes of machine code. If the machine code is 10 bytes long then type in:

20 REM .....

or

20 REM .....
30 REM .....

When you run the disassembly program with Run 2000 it will place the hex of the machine code into these statements with a space between each pair of digits. Now the Rems can be brought down with Edit, and more hex can be added or any deleted. Reassemable the hex by typing Run.

This offers comprehensive editing as with Basic statements. If you want no spaces to be put in between the hex digits then omit line 2050 and change line 2060 to

LET Y=Y+3.

When using the disassembly program make sure there is no line numbered 118, or this will cause a crash.

The program fits in 1K, but it is best suited to 16K users.

(continued from previous page)

```
330  LET A$="FORCE"
335  LET B$="AREA"
340  LET Z$="PRESSURE"
345  LET Y$="N/M**2"
350  GOTO 1000
360  LET A$="MASS"
365  LET B$="VOLUME"
370  LET Z$="DENSITY"
375  LET Y$="KG/M**3"
380  GOTO 1000
390  LET A$="MASS"
395  LET B$="TEMPERATURE CHANGE"
400  LET C$="HEAT SUPPLIED"
405  LET Z$="SPECIFIC HEAT CAPACITY"
410  LET Y$="J/KG K"
415  GOTO 1000
420  LET A$="FREQUENCY"
425  LET B$="WAVELENGTH"
430  LET Z$="VELOCITY"
435  LET Y$="M/S"
440  GOTO 1000
450  LET A$="FORCE"
455  LET B$="TIME"
460  LET Z$="IMPULSE"
465  LET Y$="N"
470  GOTO 1000
480  LET A$="MASS"
485  LET B$="VELOCITY"
490  LET Z$="MOMENTUM"
495  LET Y$="KG M/S"
1000 CLS
1010 PRINT "OPTION ";D
1020 PRINT "---------"
1030 PRINT
1040 PRINT A$;" :- ";
1050 INPUT A
1060 PRINT A
1070 PRINT
1080 PRINT B$;" :- ";
1090 INPUT B
1100 PRINT B
1110 PRINT
1120 IF D<>8 AND D<>13 THEN GOTO 1170
1130 PRINT C$;" :- ";
1140 INPUT C
1150 PRINT C
1160 PRINT
1170 PRINT
1180 IF D=2 OR D=4 OR D=11 OR D=12
                          THEN GOTO 1240
1190 IF D=6 OR D=8 THEN GOTO 1260
1200 LET Z=A*B
1210 IF D=13 THEN LET Z=C/Z
1220 IF D=7 THEN LET Z=Z*9.81
1230 GOTO 1290
1240 LET Z=A/B
1250 GOTO 1290
1260 LET Z=A*(B**2)
1270 IF D=6 THEN LET Z=Z/2
1280 IF D=8 THEN LET Z=Z/C
1290 PRINT Z$;" :- ";Z;" ";Y$
1300 PRINT
1310 PRINT "DO YOU WANT :- "
1320 PRINT
1330 PRINT "1. THE SAME OPTION"
1340 PRINT "2. A DIFFERENT OPTION"
1350 PRINT "3. THE END"
1360 INPUT L
1370 IF L=1 THEN GOTO 1000
1380 IF L=2 THEN GOTO 3
1390 STOP
```

Income tax.

```
  5 PRINT "MARITAL STATUS M,S,O,R,J ?"
 10 INPUT M$
 15 PRINT "SALARY?"
 20 INPUT S
 25 PRINT "MORTGAGE INTEREST?"
 30 INPUT I
 35 CLS
 40 LET A=(1565 AND M$="S") + (2445 AND M$="M") + (4010 AND
M$="J")
 50 LET N=(.0875*S AND (S>1534)) - (.0875*(S-11440) AND
(S>11440))
 60 LET T=S-A-I
 70 LET X=(T*.3 AND T>0) + ((T-12800) *.1 AND T>12800) + ((T-
15100) *.05 AND T>15100) + ((T-19100) *.05 AND T>19100) + ((T-
25300) * .05 AND T>25300) + ((T-31500) *.05 AND T>31500)
 80 LET G=S-X-N
 84 PRINT TAB 10;"#"
 85 PRINT "SALARY ",
 90 PRINT S
 95 PRINT "NI ",
100 PRINT N
105 PRINT "TAX ",
110 PRINT X
115 PRINT "NET PAY ",
120 PRINT G
```

Hexad.
Example program.

```
10 REM .................
20 REM 2134 40 CB46 2805
30 REM *BLACK* 3E80 D7 18F4 *RESTART*
40 REM *WHITE* AF D7 18F0 *END*
```

Assembly program.

```
1000 LET Y=16518+PEEK 16511+256*PEEK
1010 FOR X=16514 TO Y-7          16512
1020 IF PEEK Y=118 THEN LET Y=Y+6
1030 IF PEEK Y=23 THEN GOTO 1090
1040 IF PEEK Y=0 THEN GOTO 1110
1050 POKE X,16*PEEK Y+PEEK (Y+1)-476
1060 LET Y=Y+2
1070 NEXT X
1080 STOP
1090 LET Y=Y+1
1100 IF PEEK Y<>23 THEN GOTO 1090
1110 LET Y=Y+1
1120 GOTO 1020
```

Disassembly program.

```
2000 LET Y=16518+PEEK 16511+256*PEEK
                                 16512
2010 FOR X=16514 TO Y-7
2020 LET Y=Y+6*(PEEK Y=118)+7*(PEEK
     (Y+1)=118)+8*(PEEK (Y+2)=118)
2030 POKE Y,INT(PEEK X/16)
2040 POKE Y+1,PEEK X-INT(PEEK X/16)*16
2050 POKE Y+2,0
2060 LET Y=Y+3
2070 NEXT X
2080 STOP
```

Plakoto

THIS PROGRAM written by Peter Lawson for the Acorn Atom, is a follow-up to the article on Backgammon in the May 1981 issue of *Practical Computing*. Plakoto is a somewhat simpler version of the game played in Greece. The main difference is that in Plakoto all the pieces start from the farthest points. If a blot is hit, the opponent's piece is not sent to the bar but merely trapped until the trapping piece is moved away. Until this happens the point belongs to the trapper.

These slight differences simplify both illegal-move checking and the move-evaluation algorithm and make the game suitable for practising evaluation techniques. The evaluation routines are laid out here in decipherable form in subroutines m, o and p to give you the opportunity of rewriting this section of the program to make the computer harder to beat. Lines 701 to 707 and subroutine v are included for use in the design stage only. A printer is also needed.

Having established a preliminary algorithm, you play a game against the computer. After each of the computer's moves you are invited to view the move which has just been made. If you are dissatisfied with the computer's move, this option is exercised by entering Y, whereupon the available moves and the values placed on them are printed out, followed by a record of the board position after the move was made. At the end of the game you can study all the offending moves and adjust the algorithm accordingly.

After removing all the Rem statements, the program will run in the lower text space of an expanded Atom 4.75K. To save space extensive use has been made of abbreviations:

F. For
N. Next
G. Goto
E. End
S. Step
P. Print
GOS. Gosub
A. Absolute
R. Return or random
U. Until
LI. Link
? = Peek or Poke

(continued on next page)

Plakoto.

```
100 REM Plakoto
130DIMAA25,BB25,WW25,TT25,Y11,YY11,Z4
140S=#8000;V=#21C;G=24;H=1;C=0;W=2;K=0
150F.J=0TO25;BBJ=0;TTJ=0;N.
159 REM Start men
160BB1=-15;BB24=15
169 REM DisPlay board
170P.$12;?#E1=0;@=2;F.J=1TO12;P.13-J
180I=0;DOP.$9;I=I+1;U.I=28;P.12+J;N.
189 REM First roll
190GOS.a
200DOGOS.h;U.M=2;P."I THREW"Z?1","YOU THREW"Z?2
210IFZ?1>Z?2P." I BEGIN";A=1;LI.#FB7D;G.500
220P."YOU BEGIN";A=-1;GOS.i
299 REM Human's move
300P."YOUR GO WITH"Z?1","Z?2';F=0;IFW=2LI.#FB7D
310L=0
320L=L+1;GOS.w
330GOS.s
340IFU>0P."NO LEGAL MOVE WITH"Z?L"-HIT KEY";LI.#FFE3;G.600
350P."MOVE"Z?L" FROM";IN.#V
360IF?V=80GOS.x;LI.#FB7D;G.U
3700=VALV;IFO=0G.330
380D=O+Z?L;IFD>25D=25
390GOS.l
400IFU>0P." ILLEGAL MOVE TYPE"U"-HIT KEY";LI.#FFE3;U=0;G.330
410G.700
499 REM Atom's move
500P."MY GO WITH"Z?1","Z?2'
510L=0
520L=L+1;P=L%2
530GOS.k;GOS.n;IFO<0D=0
540IFB<0P." I PASS";LI.#FB7D G.600
550G.700
599 REM Pass checkin9
600K=K+L
610IFM=4G.800
620IFK=1G.(420+100*A)
630G.800
700GOS.r;GOS.a;GOS.J;IFW<>0GOS.t;G.900
701IFA=-1G.710
702?#DE=#A0;?#DF=#81;?#E0=25
703IN."VIEW"#V
705IF?V=89GOS.v
707F.T=441TO447;S?T=32;N.
710IFK=3G.800
720IFK+L=3 K=3;G.(410+100*A)
730IFL=M G.800
740G.(420+100*A)
799 REM Move over
800GOS.h;GOS.9;A=-A;K=0;G.(400+100*A)
899 REM Game over
900IFW>0G.930
910P.'"YOU WIN "-W" UNIT";G.950
930P.'"I WIN "W" UNIT"
9501FA.W=2 P."S (GAMMON)"
960IFA.W=3 P."S (BACKGAMMON)"
970IN.'"ANOTHER GAME"#V
980IF?V=89G.140
990E.
999 REM DisPlay men
1000aF.J=2TO378S.4;IFJ%32=30N.
1005S!J=#20202020;N.
1010F.J=1TO24;AAJ=0;HHJ=0
10201F TTJ<>0GOS.u;G.1090
1030IFBBJ<0HHJ=-BBJ
1040IFBBJ>0AAJ=BBJ
1050IFAAJ>01FAAJ<15GOS.d;G.1090
1060IFHHJ>0 IFHHJ<15 GOS.e;G.1090
10701FAAJ=15GOS.f;G.1090
1080IFHHJ=15GOS.9
1090N.;R.
1100bIFJ<13S?(386-32*J)=#44;R.
1110S?(32*J-387)=#4B;R.
1150cIFJ<13S?(386-32*J)=#C4;R.
1160S?(32*J-387)=#C8;R.
1200dI=0;DOI=I+1
12101FJ<13S?(385-TTJ-32*J+I)=#C4;G.1230
1220S?(32*J-I-386+TTJ)=#C8
1230U.I=AAJ;R.
1250eI=0;DOI=I+1
1260IFJ<13 S?(385+TTJ-32*J+I)=#44;G.1280
1270S?(32*J-I-386-TTJ)=#48
1280U.I=HHJ;R.
1300fF.T=375TO381;S?T=#E2;N.;S?374=#C8;R.
13509F.T=354TO360;S?T=#51;N.;S?361=#44;R.
1399 REM Dice toss
1400hF.J=1TO2;Z?J=A.R.%6+1;N.;IFZ?1=Z?2M=4;Z?3=Z?1;Z?4=Z?2;R.
1410M=2;IFW=2R.
1420IFZ?1<Z?2 GOS.i
1430R.
1450iZ?3=Z?1;Z?1=Z?2;Z?2=Z?3;R.
1499 REM Analyse Game
1500JG=0;F.J=0TO24;IFAAJ>0G=J
1502IFBBJ<0 N=J
1505N.
1510H=0;F.J=25TO1S.-1;IFHHJ>0H=J
1512IFBBJ<0X=J
1515N.
1520C=0;IFG<H C=2
1525IFX>G C=1
1530W=BB25/15;IFBB0=15 W=1
1540R.
1599 REM Array of le9al moves
1600kF.J=0TO11;Y?J=0;YYJ=0;N.;R=-1
1610F.J=24TO1S.-1;O=J;D=J-Z?L;IFD<0D=0
1620GOS.l;IFU>0G.1670
1630R=R+1;IFM=4GOS.p
1640IFM=2E=100;GOS.m
1650Y?R=E;YYR=25*O+D
1660IFR=11J=1
1670N.;R.
1679 REM Find best move
1680nI=0;B=-1;F.J=0TO11;IFY?J>I B=J;I=Y?J
1690N.;IFB<0R.
16950=YYB/25;D=YYB%25;R.
1699 REM Ille9al moves
1700lU=0;IFBBO*A<1 U=1;R.
1710IFBBD*A<-1 U=2;R.
1720IF TTO=A U=3;R.
1725IF TTD=A U=4;R.
1730IFA=-1G.1770
1740IFD=0IFG>6 U=7;R.
1750IFO<Z?L IFG>O U=8;R.
1760R.
1770IFD=25IFH<19 U=5;R.
1780IF(25-O)<Z?L IFH<O U=6
1790R.
1799 REM Move evaluations
```

(listing continued on next page)

(listing continued from previous page)

```
1800mIFG<7IFO=Z?L E=10+8*TTO;R.
1810IFG<7E=O+2+6*TTO;R.
1820IFC=2E=O;R.
1830IFC=1E=25+O+25*TTO;R.
1840IFBBD>1E=E+D/4-5*BBD
1850IFBBD=1IFTTD=0IFD>H E=E+55+2*D
1860IFBBD=0IFD>H E=E-75-D
1870IFBBD=-1E=E+95-2*D
1880IFD<X E=E+20
1900IFO>18E=E+O;IFN<11E=E+O
1910IFBBO=1IFTTO=0IFO>H IFBBD>0E=E+25+O;IFO>18IFN>9E=E+100
1915IFBBO=1IFTTO=0IFO>18IFO-N<10E=E+25
1920IFBBO=1IFTTO=-1E=E-120+O
1925IFBBO=1IFTTO=0IFBBO=1IFTTO=0E=E+30;IFP=0E=E+20
1930IFBBO>1IFTTO=-1E=E+O/4
1940IFBBO>2E=E+O/4
1950IFBBO=2IFTTO=0IFO>X E=E-60-O;IFO>18IFN>9E=E-90
1955IFO<7E=E-100
1960IFP=1 IFO<X GOS.o
1965IFE<1E=1
1970IFE>255E=255
1975R.
1979 REM Consider following roll
1980oF=D+Z?2;IFF>24R.
1985IFBBF=-1E=E+50
1990IFBBF=1IF TTF=0E=E+40
2000IFBBF>1E=E+20
2010F=D-Z?2;IFF<1R.
2015IFBBF=1IF TTF=0E=E+60
2020IFBBF>1IF TTF=-1E=E+20
2030IFBBF>2E=E+20
2040IFBBO<>2R.
2050F=O+Z?2;IFF>24R.
2055IFBBF=-1E=E+50
2060IFBBF=1IF TTF=0E=E+40
2070IFBBF>1E=E+20
2080F=O-Z?2;IFF<1R.
2085IFBBF>1IF TTF=-1E=E+20
2090IFBBF>2E=E+20
2100IFBBF=1IF TTF=0E=E+60
2110R.
2129 REM Double rolls
2130PE=100;IFP=0GOS.m;R.
2135IFBBD=2E=150+2*O;G.2170
2140IFBBO>2IFTTO=-1E=E+75-O;G.2150
2145IFBBO>2IFO>H E=E+75-O;G.2170
2150IFBBO>3IFO>H E=E+90-O.G.2170
2160GOS.m;R.
2170IFBBD=0IFD>H E=E+25
2175IFBBD=-1E=E+75
2180IFBBD=1IF TTO=0IFD>H E=E+50
2185IFD<H E=E+20
2190R.
2199 REM Move men
2200rIFBBD=-A;TTD=-A;BBD=0
2210BBD=BBD+A;BBO=BBO-A
2220IF TTO=-A;IFBBO=0 ;TTO=0;BBO=-A
2230R.
2299 REM Clear part of screen
2300sF.R=416TO511;S?R=32,N.;?#DE=#A0;?#DF=#81;?#E0=0;R.
2350qF.R=384TO511;S?R=32;N.;?#DE=#80;?#DF=#81;?#E0=0;R.
2399 REM Win margin
2400tIFW=-1IFBB0=0 W=-2,IFG>18W=-3
2410IFW=1IFBB25=0W=2;IFHK7W=3
2420R.
2499 REM Traps
2500uIF TTJK0HHJ=1;AAJ=BBJ;GOS.b;GOS.d;R.
2510AAJ=1;HHJ=-BBJ;GOS.c;GOS.e;R.
2599 REM Has human legal move?
2600wF.J=1TO24;O=J;D=J+Z?L;IFD>25D=25
2620GOS.l;IFU=0J=24;N.;R.
2640N.;R.
2650xIFL=1IFF=0F=1;P."FREE PASS";U=600;R.
2670U=330;P."ILLEGAL PASS";R.
2999 REM Record move
3000vP.$21$2
3010F.J=0TO11;IFY?J>0P.YYJ/25"-"YYJ%25"="Y?J","
3020N.
3050P.'"BEST MOVE "YYB/25"-"YYB%25'
3060F.J=1TO24;P.J"="BBJ",";IFTTJK>0P.TTJ"TRAP,"
3070N.
3085P."P="P",L="L",Z?1="Z?1",Z?2="Z?2''
3090P.$3$6
3100R.
```

(continued from previous page)

If more memory is required for the evaluation it could be obtained by using the free space pointer to put the arrays into the upper text space. To do this insert:

```
110 ?35 = 0; ?36 = #82
```

The following variables are used:

A. 1 if Atom's move, −1 if human's move.
B. Best move.
C. Contact flag.
D. Destination.
E. Evaluation of move.
F. Future move and free pass flag.
G. Atom's back man's position.
H. Human's back man's position.
K. Pass counter.
L. Dice counter.
M. Number of moves.
N. Human's front man's position.
O. Origin.
P. Odd move flag.
U. Illegal move flag and type.
W. 2 at start of game, later win type.
X. Human's back free man.

The arrays are as follows:

AA Atom's men.
BB Both men.
HH Human's men.
TT Traps.
Y Legal-move byte vector.
YY legal moves encoded.
Z Dice toss byte vector.

The byte vectors can only hold a value between 0 and 255, so the value of E is limited in lines 1965 and 1970.

In line 140, S is set to the start of screen memory, V to an unused area in page 2. In line 170, P$12 clears the screen and homes the cursor. ?#E1 = 0 turns off cursor, and @ = 2 sets numeric field width. Line 180 moves the cursor across the screen, and line 200 rejects doubles for the first roll.

In line 210, Link #FB7D gives a two-second delay, and in line 340, Link #FFE3 waits for a key to be pressed. In line 360 G.U goes to line 2500. In line 520, P is the remainder from L/2. Line 702 moves the cursor.

Lines 1000 to 1005 clear the centre of screen, but not the margins. In line 1100, #44 and #48 are single, white pixels; in line 1150, #C4 and #C8 are single, grey pixels; in lines 1300 to 1350, #E2 is a double grey pixel and #51 is double, white pixel. Line 3000 turns the screen off and turns the printer on, while line 3090 does the reverse.

Atom Print At.

```
10 @=0
20 DIM C45;P.$12;IN."PRINT AT -"A,B
30 P.$12;?#8000=32;?#E1=0
40 IF A>31 IF B>15 G.10
50 A=31-A:B=31+B
60 C="IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIJJJJJJJJJJJJJJJ"
70 $C+B="";$C=$C+A
80 FOR Z=0 TO LENC-1
90 P.$(C?Z-64)
100 NEXT Z
110 PRINT "HELLO"
120 END
```

Atom Print At

I HAVE ALWAYS been envious of the ZX-81 in that it has a Print At facility, writes John Ferguson of Chelmsford, Essex. My Atom does not have this function but I have found it possible to use a string of characters to move the cursor in the same way that cursor controls can be included in a string on a Pet.

The routine starts by setting the field width to zero, line 10, otherwise numbers in a Print statement would not be positioned at the cursor position. Line 20 dimensions the string, clears the screen and inputs the screen co-ordinates.

In line 30 a space is Poked into the top left corner of the screen to get rid of a block that would be left there and

```
?#E1=0
```

turns the cursor off. Then the two lines following check for quantities out of range and calculate the co-ordinates. Line 60 is the string of control characters: I is cursor forward, and J is cursor down.

String C in line 70 is shorterned by the Atom equivalent of Mid$, allowing for the co-ordinates.

The loop that follows prints each character as a cursor-control code by subtracting 64 so that the cursor is positioned correctly for printing "Hello": I is converted to 9, the code for horizontal Tab, and J is converted to 10 the code for Linefeed.

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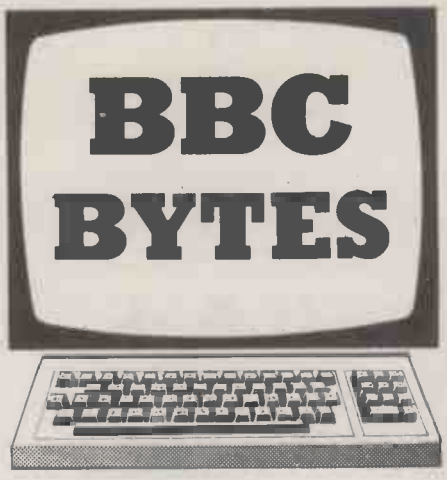


Multicoloured text

READING the provisional handbook, it appears that coloured text is only possible on the BBC Micro in modes 0–6, writes Sean Phillips of Huddersfield, West Yorkshire. Yet a full screen of text is difficult to read because of the size of the text screen. The following command, which does not appear in the provisional handbook, allows access to seven different text colours in Teletext mode, Mode 7:

PRINT: CHR$(&9X); "THIS WILL APPEAR IN COLOUR X"

Where X defines the colours:

1 = Red
2 = Green
3 = Yellow
4 = Blue
5 = Purple
6 = Turquoise
7 = White

Only the current line is affected, so each line could be a different colour if you really felt it necessary. One problem is that teletext characters are different from standard ASCII characters; try using lower case or punctuation, for example, and you will be presented with some very odd characters indeed.

Lack of lower case and punctuation is an acceptable limitation when writing program instructions. You can write the main text in white with lower case and punctuation available — and use coloured capitals for important points, for example, "Do not" messages in red, and instructions to the user in green.

Music function

THE TONE GENERATORS in the BBC Micro are capable of producing a wide range of notes, from A below middle-C to some high-pitched squeaks, notes K Penton of Reading, Berkshire. Yet it is a bit of a bind to have to set the pitch by numbers, especially as the successive notes of the major scale do not follow in regular increments.

This function converts note names, input as strings, to the required numeric form, allowing you to forget about the numbers involved and concentrate on getting the notes right. The note-name string must consist of two or three characters: the basic note, A-G; sharp, #, or flat — b — as required; plus its octave, 0-6. Octaves begin on C, C1 being middle-C.

The function works by finding the position of the note name in Note$, which contains the valid names with commas to pad out the natural notes to two characters. The second 12 names are alternatives for the first 12, and line 260 adjusts for this to produce an even number between 0 and 22 for a valid note; this is doubled in line 280 to produce one of 12 increments of four in the pitch variable. To this is added the multiple of 48 required to offset for the octave. Line 270 adjusts for A and B, which would otherwise end up an octave too low.

Validity checking is not comprehensive, but will catch the most common error — forgetting to add the octave number. C(b)0 will be rejected, although a valid note, since having the letter C in N2$ would have caused more frequent errors; so B0 should be used instead.

This simple demonstration program could be expanded to include control of channel and volume using Data statements. As it stands, the program ends with an out of Data error message.

Music functions.

```
  90 REM    b # b # b # b # b # b # b # b # b # b # b # b # b
 100 REM    # Musical Notation Conversion Function  #
 110 REM    b  For BBC Computer Sound Generators    b
 120 REM     #                                      #
 130 REM       b     (c) 1982  K.Penton           b
 140 REM         b # b # b # b # b # b # b # b #
 150
 160 REM initialise note-name strings
 170 Note$="A,A#B,C,C#D,D#E,F,F#G,G#,,BbCbB#Db,,EbFbE#Gb,,Ab"
 180 N2$="A.A#B.Bb"
 190 GOTO 500 : REM skip function definition
 200 REM N$ will be required pitch as note-name + octave, eg A3 , C#2, Eb4
 210 DEF FNM(N$)
 220 IF LEN(N$)<2 OR LEN(N$)>3 THEN 320
 230 N1$=LEFT$(N$,LEN(N$)-1) : OCT=VAL(RIGHT$(N$,1))
 240 IF OCT<0 OR (OCT=0 AND INSTR(N2$,N1$)=0) OR OCT>6 THEN 320
 250 Note=INSTR(Note$,N1$)
 260 Note=Note MOD 24 -1 : IF Note <0 THEN 320
 270 IF INSTR(N2$,N1$)<>0 THEN OCT=OCT+1
 280 PITCH=Note*2 + (OCT-1)*48
 290 IF PITCH<0 OR PITCH>255 THEN 320
 300 =PITCH
 310 REM - - - - - - - - - - - - - - -
 320 PRINT N$;" is not a valid note":  END
 330 REM - - - - - - - - - - - - - - -
 499 REM A little tune to demonstrate:
 500 REPEAT
 510   READ G$,D
 520   IF G$="R" THEN SOUND 1,0,0,D : GOTO 510 : REM REST
 530   SOUND 1,-10,FNM(G$),D
 540   SOUND 1,0,0,0 : REM TO SEPARATE EQUAL PITCHED NOTES
 550   UNTIL FALSE
1000 DATA C3,3,B2,3,C3,6,C2,6,C2,6,G2,3,F2,3,E2,3,G2,3,C3,3,B2,3,C3,6
1010 DATA D3,3,C#3,3,D3,6,D2,6,D2,6,D2,3,C2,3,B1,3,D2,3,G2,3,F#2,3,G2,6
1030 DATA A2,3,B2,3,C3,3,B2,3,A2,3,G2,3,A2,3,G2,3,F2,3,E2,3
1040 DATA F2,3,E2,3,D2,3,C2,3,C2,3,B1,3,A1,3,G1,3
1050 DATA A1,3,C2,3,B1,3,D2,3,C2,3,E2,3,D2,3,F2,3,E2,6,C2,6,C2,6
1060 DATA R,15,C2,1,E3,1,G3,1,C4,3
>
>
>*SPOOL
```

Hyperbolic calculations.

```
10 REM *** HYPERBOLIC FUNCTIONS ***
20 MODE 6:VDU 19,0,4;
30 *KEY 0 PROCsinh M
40 *KEY 1 PROCcosh M
50 *KEY 2 PROCtanh M
90 CLS:END
100 DEF PROCsinh
110 INPUT'"x=?"x
120 PRINT'"sinh ";x;" = ";(EXP(x)-
130 ENDPROC              EXP(-x))/2'
200 DEF PROCcosh
210 INPUT'"x=?"x
220 Y=VPOS
230 PRINT TAB(14,Y-1);"cosh ";x;" =
240 ENDPROC    ";(EXP(x)+EXP(-x))/2'
250 DEF PROCtanh
260 INPUT'"x=?"x
270 PRINT'"tanh ";x;" = ";(EXP(x)-
        EXP(-x))/(EXP(x)+EXP(-x))'
280 ENDPROC
```

Hyperbolic calculations

THIS PROGRAM by Paul Eaton of Cambridge allows the hyperbolic functions sinh, cosh and tanh to be calculated at the mere touch of a button. It runs on a model A machine using 150 hex blocks of memory. The three functions are assigned to three red user keys:

f0 — sinh x
f1 — cosh x
f2 — tanh x

For example, to calculate sinh 3.5, press f0 followed by 3.5 and Return.

The program demonstrates the use of key assignments in lines 30 to 50. Note

(continued on next page)

(continued from previous page)

that no inverted commas are used, unlike the example on page 17 of the User Guide, and that the colour command

```
VDU 19,0,4,0,0,0
```

can be shortened to

```
VDU 19,0,4;
```

Several published BBC Basic programs use Print to print a blank line, but it is much quicker to type ' as in lines 110, 120, etc. The display for the cosh routine shows a variation in which the answer is printed on the same line as the input, using the statement VPOS.

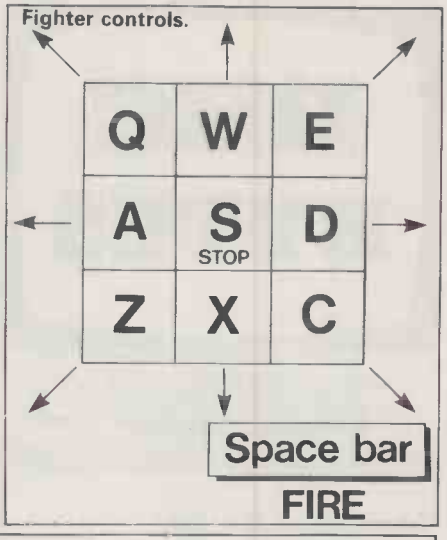
Fighter

THE OBJECT OF Fighter, by Brian Cassidy of Southport, Merseyside, is to destroy five enemy spacecraft in the shortest possible time. The screen shows the head-up display of your fighter.

The control cross is the gunsight and the two numbers at the bottom are the distance from the target, the left digit being the x co-ordinate and the right digit the y co-ordinate. At point (0, 0) the enemy fighter is directly in your gunsights.

The enemy fighter moves around the screen trying to dodge out of your gunsight but you must out-manoeuvre your enemy to destroy it. If the fighter is above your gunsight you should fly upwards to meet it. The controls are shown in the diagram — use the space bar to fire.

The program will run on a model A machine as long as you do not renumber or add additional lines or spaces.



Fighter

```
>listLIST
    1MODE5:VDU5,23,229,60,66,153,161,161,153,66,60,23,255,0,130,130,186,254,186,
130,130,23,225,255,255,255,255,255,255,255,255,19,1,2,0,0,0,19,3,6,0,0,0
    2P=230:DIM X(8),Y(8),A(8),B(8),L$(8)
    3FOR Q=1TO8:READ L$(Q),X(Q),Y(Q),A(Q),B(Q):NEXTQ:FOR NN=1TO16:FOR N=1TO8
    4MOVE X(N),Y(N):GCOL0,0:PRINTL$(N):X(N)=X(N)+A(N):Y(N)=Y(N)+B(N):GCOL0,2:MOV
E X(N),Y(N):PRINT;L$(N):SOUND0,-9,RND(3)-1,2:NEXT N,NN
    5FOR Q=1TO1200:NEXTQ:FOR Q=1TO10:SOUND1,-15,RND(200),1:NEXTQ:GCOL0,1:PRINTTA
B(13,4);CHR$(229);" 1982":PRINTTAB(5,25);"BY";TAB(1,27);"B. Cassidy"
    6 GCOL0,1:PRINTTAB(13,4);CHR$(229);" 1982":PRINTTAB(5,25);"BY";TAB(1,27);"B.
 Cassidy":FOR Q=1TO3000:NEXTQ
    7DATA F,660,1224,-32,-32,I,788,660,-32,0,G,916,96,-32,32,H,544,32,0,32,T,172
,-32,32,32,E,300,404,32,0,R,428,840,32,-32,.,1063,768,0,-32
    8CLS:PRINTTAB(7,2);"FLIGHT"''"DIRECTION CONTROLS":GCOL0,2:GCOL0,3:PRINTTAB(9
,7);"UP":GCOL0,2:PRINTTAB(7,9);"Q W E";:GCOL0,3:PRINTTAB(2,11)"LEFT ";:GCOL0,2:P
RINT"A S D ";:GCOL0,3:PRINT"RIGHT":GCOL0,2:PRINTTAB(7,13);"Z X C":GCOL0,3
    9PRINTTAB(8,15);"DOWN":GCOL0,3:PRINTTAB(0,20);"PRESS SPACE TO FIRE":GCOL0,1:
PRINT'"YOU WILL FLY IN THE"''"SELECTED DIRECTION"''"UNTIL A NEW COURSE"''"IS SEL
ECTED":REPEAT:SOUND1,-10,RND(14),3:UNTILINKEY$(0)<>""
   10CLS:X=RND(64)*20:Y=RND(51)*20+10:E=8:T=20:L=0:QQ=0:SC=0:TIME=0:K$="":Q$="":
U=15
   11REPEAT:A=RND(8):GCOL0,1:MOVE630,512:PLOT5,590,512:MOVE650,512:PLOT5,700,512
:MOVE640,502:PLOT5,640,452:MOVE640,522:PLOT5,640,562:GCOL0,0:MOVEX,Y:PRINTCHR$(2
25)
   12IFA=1ORA=2ORA=8 X=X-T
   13IFA=2ORA=3ORA=4 Y=Y-T
   14IFA=4ORA=5ORA=6 X=X+T
   15IFA=6ORA=7ORA=8 Y=Y+T
   16GCOL0,3:MOVEX,Y:PRINTCHR$(255):QQ$=Q$:Q$=INKEY$(0):*FX15,0
   17IFQ$=" " E=9:Q$=QQ$
   18IFQ$="" Q$=QQ$
   19GCOL0,0:MOVEX,Y:PRINTCHR$(225):IFQ$="A"ORQ$="Z"ORQ$="X"ORQ$="Q" X=X+T
   20IFQ$="C"ORQ$="D"ORQ$="E"ORQ$="W" X=X-T
   21IFQ$="Z"ORQ$="C" Y=Y+T
   22IFQ$="E"ORQ$="Q" Y=Y-T
   23GCOL0,3:MOVEX,Y:PRINTCHR$(255):GCOL0,0:MOVE320,64:PRINTSTRING$(3,CHR$(225))
:MOVE800,64:PRINTSTRING$(3,CHR$(225)):GCOL0,2:MOVE320,64:PRINT;(X-620)DIV20:MOVE
800,64:PRINT;(Y-530)DIV20
   24IFE=9 GCOL0,2:MOVE0,0:PLOT5,640,512:PLOT5,1240,0:SOUND0,-15,4,1:K$=""
   25IFE=9THENGCOL0,0:MOVE0,0:PLOT5,640,512:PLOT5,1240,0
   26IFE=9THENGCOL0,0:MOVE0,0:PLOT5,640,512:PLOT5,1240,0
   27GCOL0,3:MOVEX,Y:PRINTCHR$(255):IF POINT(640,512)=3 AND E=9 THEN PROCEXPL
   29ENVELOPE1,2,50,100,-60,11,100,120,50,106,-100,-10,100,80:SOUND 1,1,255-SQR(
(X-620)^2+(Y-530)^2)DIV6,1
   30E=0:UNTIL QQ=5
   31*FX15,0
   32PRINTTAB(0,7)"AVERAGE TIME WAS "'';SC/500;" SECONDS";TAB(0,21);"ANOTHER GO?
 ":IFGET$="N"THEN CLS:END ELSE VDU5:GOTO10
   33DEF PROCEXPL:E=8:QQ=QQ+1:SC=SC+TIME:X=640:Y=512:S=1
   36REPEAT:FORQ=1TO50:SOUND0,-U,4,1:V=V+1:R=RND(S):RR=RND(S):IFV=4 U=U-1:V=0
   37X=X-2:Y=Y-2:A=X+R:B=Y+RR:GCOL0,RND(3):PLOT69,A,B:S=S+4:IF S>287 THEN Q=50
   38S=S+4:IF S>287 THEN Q=50
   39NEXTQ:UNTIL S>287
   40VDU4:PRINT TAB(0,5)"YOU BLEW IT UP IN  ";TIME DIV100;" SECONDS":U=15:V=0:
FORG=1TO2000:NEXTG:X=RND(64)*20:Y=RND(51)*20+10:CLS:VDU5:TIME=0:QQ$="":*FX15,0
   41ENDPROC
```

Simple animation

THIS SIMPLE animation program by David Pearson of Swinton, Manchester allows you to switch screens, or move the screen about using only simple machine-language techniques. It is centred on the amazingly useful LDIR instruction — which stands for Load Increment and Repeat. The LDIR instruction requires three parameters, HL, DE and BC which are passed over in Registers. It performs what is called a Block Move which, in essence, moves one part of memory to another. In this case the screen is moved to high memory, or vice versa.

HL points to the start of the block to be moved.
DE points to the place where the block is to be moved to.
BC tells the computer how many bytes are to be moved.

Listing 1 gives an assembly language listing of a program to move 1.024 bytes — the number of bytes in a full screen — from memory location 0 to the screen. After assembling this program you will see the familiar message

MEMORY SIZE, RADIO SHACK LEVEL II BASIC

or

MEM SIZE R/S L2.

It appears because you are moving memory from the ROM, and the part you are looking at just happens to be the area with this data in it.

Listing 2 is a Basic program which uses this routine to animate a spinning globe. It is in two parts: the first creates the pictures, and dumps the screen to high memory. It takes about two minutes to run. The second part dumps the globe back on the screen, frame after frame, in rapid succession, making the globe spin.

Space orbit

THE MEAN HEIGHT of a satellite above the Earth's surface is determined by its velocity, and is in turn related to its period of revolution around the Earth, comments J Wilkinson-Latham from Paris. As the orbit shrinks due to air resistance, both the mean height and the period decrease so that the retarding effect of the air-drag actually causes the satellite to

(continued on next page)

Simple animation listing 1.

```
                00100 ;***********************************************
                00110 ;****                                       ****
                00120 ;****          ASSEMBLY LANGUAGE PROGRAMME  ****
                00130 ;****        TO DISPLAY THE FIRST KILOBYTE  ****
                00140 ;****      OF ROM... DEMONSTRATING THE      ****
                00150 ;****             *** LDIR ***              ****
                00160 ;****           INSTRUCTION                 ****
                00170 ;****                                       ****
                00180 ;***********************************************
                00190 ;
                00200 ;
7F00            00210          ORG     7F00H          ;CHANGE FOR 32K/48K
7F00 210000     00220          LD      HL,0000H       ;ADDRESS IN ROM
7F03 11003C     00230          LD      DE,3C00H       ;ADDRESS OF SCREEN
7F06 01FF03     00240          LD      BC,3FFH        ;1 K OF MEM
7F09 EDB0       00250          LDIR                   ;DO IT !!!!
7F0B C30B7F     00260 LOOP     JP      LOOP           ;ENDLESS LOOP
7F00            00270          END     7F00H          ;CHANGE AS ABOVE
00000 TOTAL ERRORS
LOOP    7F0B
```

Simple animation listing 2.

```
DO NOT FORGET TO SET MEMORY SIZE TO 28600
10 REM ***********************************************
20 REM ****                                       ****
30 REM ****      SPINNING GLOBE                   ****
40 REM ****         (EXAMPLE OF "LDIR")           ****
50 REM ****            (C),COPYRIGHT D.PEARSON    ****
60 REM ****                 APRIL 1982            ****
70 REM ****                                       ****
80 REM ****           GLOBE GENERATION            ****
90 REM ****             PROGRAMME                 ****
100 REM****                                       ****
110 REM***********************************************
120 GOSUB 370                          'POKE IN ROUTINE
130 PI = 3.1416 : FOR L = 1 TO 4 : CLS
140 FOR A = 1 TO 3 : READ J
150 FOR I = 0 TO PI STEP PI/60
160 X = 63 + 40 * COS ( J ) * SIN ( I ) 'HORIZONTAL AXIS
170 Y = 23 + 20 * COS ( I )             'VERTICAL AXIS
180 SET ( X , Y )
190 NEXT I
200 NEXT A
210 FOR A = 1 TO 3 : READ J
220 FOR I = PI TO PI * 2 STEP PI/60
230 X = 63 + 40 * COS ( J ) * SIN ( I ) 'HORIZONTAL AXIS
240 Y = 23 + 20 * COS ( I )             'VERTICAL AXIS
250 SET ( X , Y )
260 NEXT I
270 NEXT A
280 READ B , C                          'READ IN ADDRESSES
290 POKE 32754 , B                      'LSB OF HIGH MEM
300 POKE 32755 , C                      'MSB OF HIGH MEM
310 X = USR ( 0 )                       'CALL DUMP ROUTINE
320 NEXT L
330 GOTO560
340 REM          ROUTINE TO POKE MACHINE LANGUAGE INTO
350 REM      HIGH MEMORY.THIS IS THE ROUTINE TO "PUT" THE
360 REM      SCREEN UP SO IT CAN BE RECALLED LATER.......
370 CLS:PRINT"POKE-ING IN DATA"
380 FOR I = 32750 TO 32761
390 READ A
400 POKE I , A
410 NEXT I
420 ' DEFUSR0= 32750 ' DISK BASIC "USR" SETUP
430 POKE16526,238 : POKE16527,127 'NORMAL LEVEL 2 USR SETUP
440 RETURN
450 REM          THIS IS THE "MACHINE LANGUAGE" DATA
460 DATA 33,0,60:    ' LD         HL,3C00H
470 DATA 17,238,123:' LD          DE,31726
480 DATA 1,255,3:    ' LD         BC,3FFH
490 DATA 237,176:    ' LDIR
500 DATA 201:        ' RET
510 REM          THIS IS THE "GLOBE DRAWING" DATA
520 DATA 0,.7854,1.5708,0,.7854,0,238,123
530 DATA 0,.1963,.98174,0,.589,1.3744,238,119
540 DATA 0,.3927,1.178,0,.3927,1.178,238,115
550 DATA 0,.5890,1.3744,0,.98174,.19635,238,111
560 FORI=32750 TO 32761
570 READ A
580 POKE I , A
```

(listing continued on next page)

(listing continued from previous page)

```
590 NEXT I
600 DIM A(4),B(4)
610 FORI= 1 TO 4
620 READ A(I) , B(I)
630 NEXT I
640 FOR I = 1 TO 4
650 POKE 32751 , A(I)
660 POKE 32752 , B(I)
670 X = USR ( 0 )
680 NEXT I
690 GOTO640
```

```
700 REM              ROUTINE TO PUT HIGH MEM ONTO SCREEN
710 DATA 33,0,0:      'LD      HL,HIGH MEM
720 DATA 17,0,60:     'LD      DE,3C00H        ;SCREEN
730 DATA 1,255,3:     'LD      BC,3FFH
740 DATA 237,176:     'LDIR
750 DATA 201:         'RET
760 REM        THIS IS THE DATA WHICH TELLS THE ROUTINE
770 REM        WHERE THE SCREEN WAS PUT...
780 DATA 238,123
790 DATA 238,119
800 DATA 238,115
810 DATA 238,111
820 REM                END  OF  PROGRAMME
830 REM ************************************************
```

(continued from previous page)

move at a greater velocity, though in a smaller orbit.

The program, written in TRS-80 Model III disc Basic, calculates the parameters of a satellite's orbit from published data such as "Satellite X will orbit the Earth at a height of 110 miles" or "Satellite Y will orbit the Earth in 92 minutes". The computations in lines 10, 120, 190, 270 and 280 can be used as a basis for Space Invader programs.

The variables are as follows:

H — the mean height of the orbit.

Q — the mean height plus the Earth's mean radius, 3960 miles.

V — the mean velocity of the satellite in miles per minute.

T — the orbital time, in minutes.

Telephone bill

THE SHOCK of receiving a £200 telephone bill prompted this program, writes C R France of Huddersfield, West Yorkshire. Keep the computer next to the telephone with the program loaded. Press Enter whenever a telephone charge is incurred and the program will give you complete instructions.

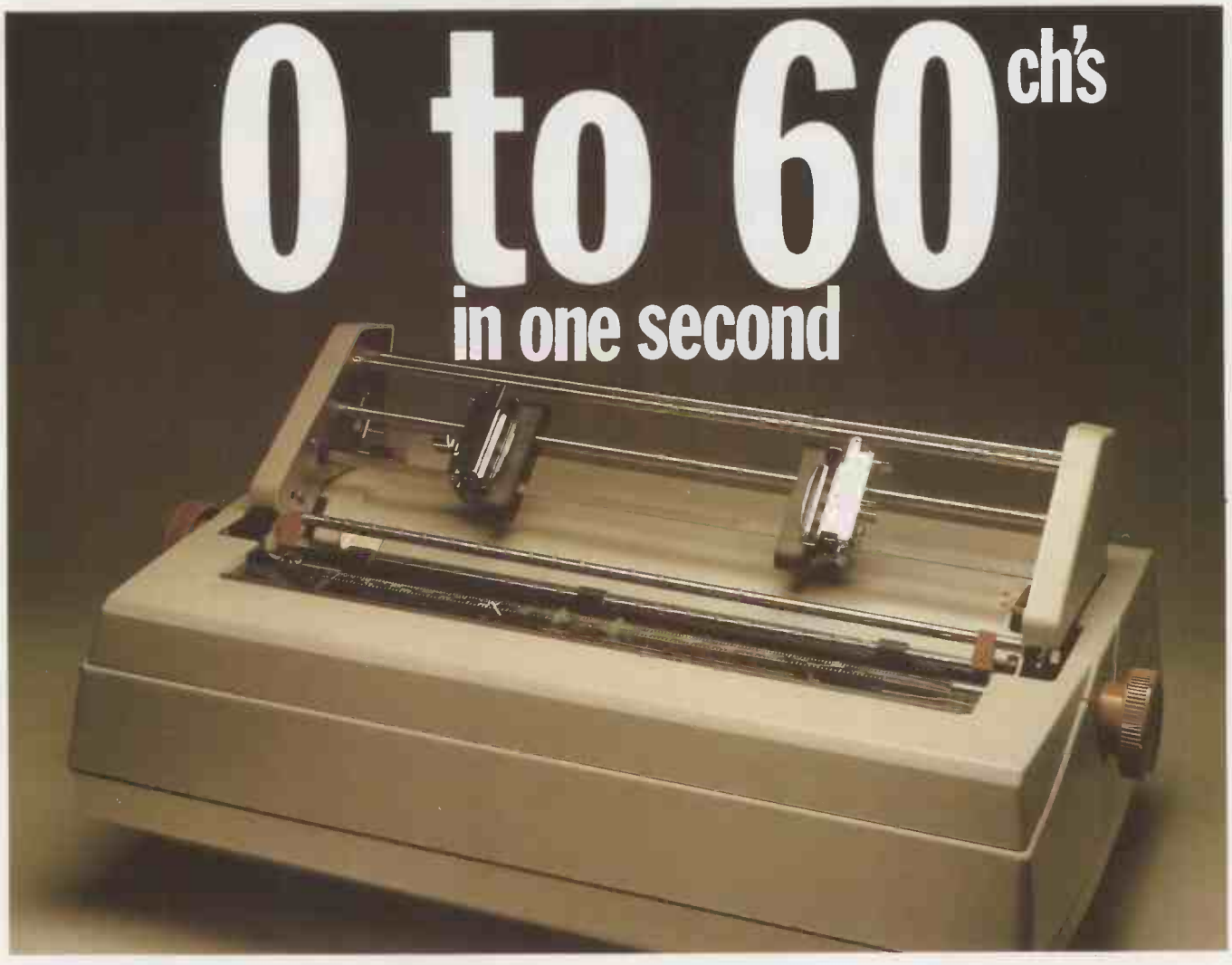
The file for total charges is named Phone/Bas. After a week or so you could find the total telephone costs and budget for the next bill.

Space orbit.

```
10 CLS:CLEAR2000:DEFFNX(T)=INT((((H+3960)*6.2831853)/V)*100)/100
20 PRINT@340,"S P A C E  O R B I T ":PRINT:GOSUB340:CLS
30 PRINT@128,"Satellites orbit at a height and speed that are in a f
ixed      relationship to each other!For each height there is a spee
d and vice-versa."!PRINT
40 PRINT"It follows that for each height or speed there is an orbita
l    time:The speed of the satellite slows as it gets higher":PRINT
50 PRINTTAB(10);"ACCURACY IS WITHIN + OR - 1/2 %"
60 PRINT:GOSUB340:CLS
70 PRINT@340,"1      TO OBTAIN SPEED AND TIME":PRINTTAB(20);"2      TO
 OBTAIN HEIGHT AND TIME":PRINTTAB(20);"3      TO OBTAIN HEIGHT AND SP
EED"
80 PRINT!PRINTTAB(25);"WHICH ?":PRINT:GOSUB350:CLS
90 ONVAL(R$)GOTO100,170,240
100 PRINT@320,"MEAN ORBITAL HEIGHT IN MILES":INPUTH
110 PRINT"HARD COPY ? (Y OR N)":GOSUB350:IFR$="Y"GOSUB370
120 V=INT(18650/SQR(H+3960)*100)/100
130 PRINT"VELOCITY = "V" MILES PER MINUTE"
140 PRINT"ORBITAL TIME = "FNX(T)" MINUTES"
150 GOSUB380
160 GOSUB340:CLS!GOTO70
170 PRINT@320,"MEAN ORBITAL VELOCITY IN MILES PER MINUTE":INPUTV
180 PRINT"HARD COPY ? (Y OR N)":GOSUB350:IFR$="Y"GOSUB370
190 H=INT(((18650/V)+2)*100)/100-3960
200 PRINT"MEAN HEIGHT OF ORBIT = "H" MILES"
210 PRINT"ORBITAL TIME = "FNX(T)" MINUTES"
220 GOSUB380
230 GOSUB340:CLS:GOTO70
240 CLS
250 PRINT"TIME OF ORBIT IN MINUTES":INPUTT
260 PRINT"HARD COPY ? (Y OR N)":GOSUB350:IFR$="Y"GOSUB370
270 Q=EXP(LOG((18650*T/6.28318)+2)/3):H=INT((Q-3960)*100)/100
280 V=INT((18650/SQR(Q))*100)/100
290 PRINT"MEAN ORBITAL VELOCITY = ";V;" MILES PER MINUTE"
300 PRINT"MEAN ORBITAL HEIGHT = ";H;" MILES"
310 GOSUB380
320 GOSUB340:CLS:GOTO70
330 GOSUB340:CLS:GOTO70
340 PRINT:PRINT"PRESS ANY KEY TO CONTINUE"
350 R$=INKEY$:IFR$=""THEN350
360 RETURN
370 CMD"Z","ON":RETURN
380 CMD"Z","OFF":RETURN
```

Telephone bill.

```
5 CLS
10 PRINT"Remember to always enter the time in DOS."
20 INPUT"Have you done that ";A$
30 IF A$="Y"THEN 40
31 IF A$="y"THEN 40 ELSE CMD"s"
40 INPUT"The distance of the call (if over 10 miles)";A
50 INPUT"Press <ENTER> when telephone is answered";B
55 PRINT"phone call charge started at     ";RIGHT$(TIME$,8)
56 C$=MID$(TIME$,13,2)
57 D=VAL(C$)
60 INPUT"Press <ENTER> when conversation is finished";B
70 PRINT"Phone call charge finished at    ";RIGHT$(TIME$,8)
80 C$=MID$(TIME$,13,2)
81 E=VAL(C$)
90 F=E-D
100 PRINT"Phone Call lasted for ";F;"minutes"
105 GOSUB500
110 IF A>10 THEN200
120 IF Z$="standard"THEN150
121 IFZ$="peak"THEN180
122 IFF<=5THENH=.05:GOTO1000
123 IFF>5THENH=.10:GOTO1000
150 IFF<=2THENH=.05:GOTO1000
151 IFF<=4THENH=.10:GOTO1000
152 IFF=5THENH=.15:GOTO1000
153 IFF>5THENH=.25:GOTO1000
180 IFF<=1THENH=.05:GOTO1000
181 IFF<=3THENH=.10:GOTO1000
182 IFF<=4THENH=.15:GOTO1000
183 IFF<=5THENH=.20:GOTO1000
184 IFF>5THENH=.25:GOTO1000
200 REM
210 IFZ$="peak"THEN230
211 IFZ$="cheap"THEN250
220 IFF<1THENH=.10:GOTO1000
221 IFF=2THENH=.15:GOTO1000
222 IFF=3THENH=.20:GOTO1000
223 IFF=4THENH=.30:GOTO1000
224 IFF=5THENH=.35:GOTO1000
225 IFF>5THENH=.69:GOTO1000
230 IFF<1THENH=.10:GOTO1000
231 IFF=2THENH=.20:GOTO1000
232 IFF=3THENH=.30:GOTO1000
233 IFF=4THENH=.40:GOTO1000
234 IFF=5THENH=.49:GOTO1000
235 IFF>5THENH=.99:GOTO1000
250 IFF<2THENH=.05:GOTO1000
251 IFF<4THENH=.10:GOTO1000
252 IFF=5THENH=.15:GOTO1000
253 IFF>5THENH=.25:GOTO1000
254 GOTO1000
500 C$=MID$(TIME$,10,2)
510 P=VAL(C$)
520 IF P<8THEN550
530 IFP<9THENZ$="stan":RETURN
540 IFP<13THENZ$="peak":RETURN
550 IFP<18THENZ$="stan":RETURN
560 Z$="cheap":RETURN
1000 PRINT"Cost of that phone call is £";H
1010 OPEN"R",1,"PHONE/BAS"
1020 FIELD1,255 AS H$
1035 GET1
1040 PRINT"Total cost of telephone calls to date is £";
1050 H=H+VAL(H$)                                  LEFT$(H$,8)
1060 PRINT"Type in total cost which is £";H
1065 CLOSE
1066 OPEN"R",1,"PHONE/BAS"
1067 FIELD1,255 ASH$
1070 INPUTY$
1071 T=VAL(Y$)
1075 IFT<>HTHENPRINT"Cheat!! Try Again!!":GOTO1070
1080 LSETH$=Y$
1090 PUT1
1100 CLOSE
1110 INPUT"Another call";G$
1120 IF G$="y"THENRUN
1130 IF G$="Y"THENRUNELSECMD"s
```



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AUTO LOGIC SEEKING	Yes	No	Yes	No	**Yes**
PROPORTIONAL PRINT CAPABILITY	Yes	Yes	Yes	No	**Yes**
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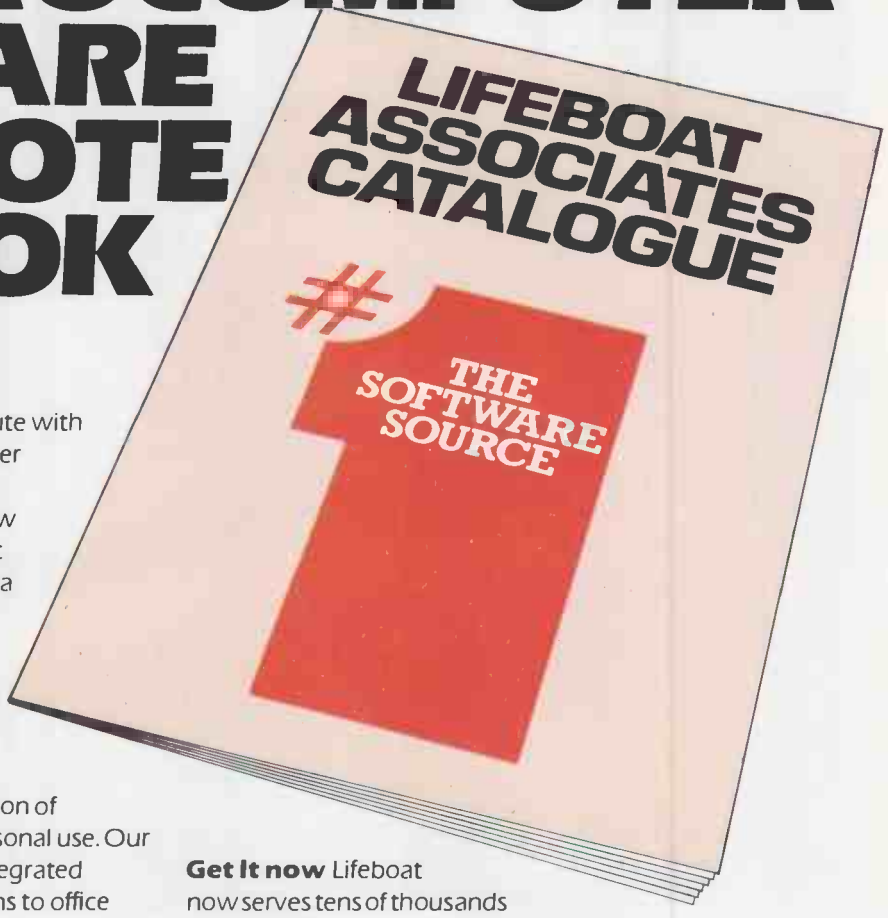

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Recovering Basic

I AM SURE it has happened to you, writes David Breen of Nairobi, Kenya, introducing this month's best contribution. Two o'clock in the morning, and when you save the latest Basic program, CP/M reports a BDOS error and leaves you staring at that dreaded A>. How are you to get back into Basic? You know typing "MBasic" will cold start and lose three hours work.

All is not lost, if you follow this procedure:

- Correct the source of the BDOS error, for example, change the disc — not the MBasic one — and type a ^C to warm reset.
- Type

  Save 0 @.COM Return

  This saves a command file which does not load, but executes at 100 hex.
- Type "@ Return", which will now warm start Basic. You can now Run, List, and Save your program. If MBasic reports a syntax error, ignore it.

This is so useful, as it also allows rerunning any long Com file still in memory, with less waiting. I usually keep @.Com on my discs as it takes up zero bytes, except for a directory entry.

MBasic renumber

MANY USERS need to re-enter an MBasic line with a new line number to change the sequence of lines in a program, writes David Green of Nairobi, Kenya. Here is an example of how to renumber line 160 as line 500:

- Enter EDIT 160 followed by an extra Return: line 160 will then display.
- Type ^A, and an exlamation mark will be displayed.
- Type I to turn on insertion mode.
- Type 500 followed by Return.

The line will now be duplicated at 160 and 500, if you wish 160 may be deleted by typing 160, followed by Return. If you find you are doing a lot of this you will probably be better off if you save your program in ASCII mode by keying

SAVE "NAME",A

and use a text editor such as WordStar to make the alterations.

Paging text files

THIS CP/M PROGRAM from Jonathan Palfrey of Warwick, written for the Microsoft assembler, pages through a text file on the screen. On invocation it displays the first 23 lines of the file named in the command line, then waits for:

Return:

when it displays the next line and waits;

Control-C:

when it returns to CP/M;

Any other key:

displays the next 23 lines and then waits.

It will cope intelligently with unusually long lines in the text file — the line count is of screen lines, not of CR-LF sequences in the file. In order to make this watertight, tabs are expanded explicitly in the program.

Paging text files.

```
.Z80

DFCB    EQU     5CH
TAB     EQU     9
LF      EQU     10
CR      EQU     13
EOF     EQU     26
SPACE   EQU     32

SETBYT  MACRO   ADDR,VALUE            ; LD (nn),nn
        LD      HL,ADDR
        LD      (HL),VALUE
        ENDM

INCBYT  MACRO   ADDR                  ; INC (nn)
        LD      HL,ADDR
        INC     (HL)
        ENDM

DECBYT  MACRO   ADDR                  ; DEC (nn)
        LD      HL,ADDR
        DEC     (HL)
        ENDM

FDOS    MACRO   FUNC                  ; call CP/M FDOS function
        LD      C,FUNC
        CALL    5
        ENDM

DCIO    MACRO   CHAR                  ; direct console I/O
        LD      E,CHAR
        FDOS    6
        ENDM

OUT$    MACRO   PTR$                  ; output string to console
        LD      DE,PTR$
        FDOS    9
        ENDM

OPENF   MACRO   FCB                   ; open file
        LD      DE,FCB
        FDOS    15
        ENDM

READF   MACRO   FCB                   ; read from file
        LD      DE,FCB
        FDOS    20
        ENDM

        ASEG
        ORG     100H

; start program:

        OUT$    DLINE                 ; put message on console
        OPENF   DFCB                  ; open the named file
        CP      0FFH
        JP      NZ,LOOP1
        OUT$    NOFILE                ; if file not found,
        JP      0                     ; stop

; start main loop:

LOOP1:  LD      HL,RPTR               ; check if end of buffer reached
        LD      A,0FFH
        CP      (HL)
        JP      NZ,NOREAD

        READF   DFCB                  ; if end of buffer, read new record
        CP      0
        JP      NZ,0                  ; if physical end of file, stop
        SETBYT  RPTR,80H              ; reset RPTR to beginning of buffer
        JP      GETCH

NOREAD: INC     (HL)

GETCH:  LD      HL,(RPTR)             ; get next character from buffer
        LD      A,(HL)
        CP      EOF
        JP      Z,0                   ; if end of file marker, stop
        CP      TAB
        JP      NZ,NOTTAB

EXPTAB: DCIO    SPACE                 ; output space to console
        CALL    EOLQ                  ; check for end of line
        DECBYT  POSB
        LD      A,(HL)
        CP      0                     ; reached next tab stop?
        JP      NZ,EXPTAB             ; no? carry on spacing
        LD      (HL),8
        JP      LOOP1

NOTTAB: PUSH    AF                    ; character is not a TAB
        DCIO    A                     ; output character to console
        POP     AF
        CP      CR
        JP      NZ,NOTCR              ; if carriage return
        SETBYT  POSB,8                ; reset tab stop count
        CALL    NEWLN                 ; and check for 23 lines
        JP      LOOP1

NOTCR:  CP      SPACE                 ; if not carriage return
        JP      M,LOOP1               ; don't count control characters
        DECBYT  POSB                  ; adjust tab stop count
        LD      A,(HL)
        CP      0
        JP      NZ,POSBNZ
        LD      (HL),8
POSBNZ: CALL    EOLQ                  ; check for end of line
        JP      LOOP1

; subroutines:

EOLQ:   INCBYT  LPOS                  ; check for end of screen line
        LD      A,(HL)
        CP      81
        RET     NZ                    ; if end of line, fall through to
NEWLN:  SETBYT  LPOS,1                ; end-of-line routine
        INCBYT  LNUM
        LD      A,(HL)                ; count number of lines
        CP      24                    ; and pause after 23
        JP      Z,WAIT
        RET

WAIT:   DCIO    0FFH                  ; wait for any key to be typed
        CP      0
        JP      Z,WAIT
        CP      CR
        JP      Z,ONELN               ; display just one line if CR
        CP      3
        JP      Z,0                   ; stop program if ^C
        SETBYT  LNUM,1                ; otherwise display 23 lines
        RET
ONELN:  SETBYT  LNUM,23
        RET

DLINE:  DEFB    'PAGE : jpr palfrey : 29 may 1981',CR,LF,'$'
NOFILE: DEFB    'File not found$'
RPTR:   DEFB    0FFH                  ; indicates position in read buffer
        DEFB    0
LNUM:   DEFB    1                     ; counts number of output lines
LPOS:   DEFB    1                     ; indicates position in output line
POSB:   DEFB    8                     ; TAB expansion variable
```

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Quick formatter

THE ABSENCE of a Print Using function is a serious drawback to the Pet user, writes M C Hart of Wigston, Leicestershire, and Commodore has not rectified the position with the release of Basic 4.0.

Of course there are "quick and dirty" methods of achieving the neat output particularly of columns of figures but they all suffer from a series of drawbacks, such as not coping with numbers in exponential format. On the other hand some of the Print Using routines that have been published are exceptionally long and complex and not easily adapted to suit the particular needs of the user.

Having originally developed a fairly long formatting program that covers most of the contingencies provided by the Print Using statement, I decided to scale down my original program to provide the bare elements that I would want a Print Using to achieve. These are:

- to round both positive and negative numbers correctly, avoiding the rogue .000001s that the Pet arithmetic function occasionally tags on to the end of certain numbers;
- to take care of the exponential format of numbers less than 0.01;
- to put in leading zeros for values less than ±1;
- to add a fractional part of trailing zeros to integers to ensure consistency with other output, for example, 2 becomes 2.000.

Other criteria I kept in mind were:

- that the routine should be economical and be contained in as few lines of coding as possible; those without Toolkits and the Append function can always tag it on to the end of a program quickly by typing in from the keyboard;
- that it should be easy to understand and be capable of alteration and expansion to meet particular needs

The routine eventually developed requires only four lines of code and 178 bytes. For a Basic routine it is quite fast, each subroutine call taking on average 80ms.

Line 60000 rounds the absolute value and converts both the integer and the fractional part into separate strings

Line 60010 pads the fraction string with zeros and then reconstructs an output string. If integer output is chosen, the decimal point is eliminated.

Quick formatter output.

```
              quick-formatter
               by m. c. hart
 press <return> only to retain sample
 VALUES ...OTHERWISE SUBSTITUTE YOUR
 OWN.

  ---required field length is  11
  ---number of decimal places in
     FIRST FIELD IS  4
  ---number of decimal places in
     SECOND FIELD IS  1
RANDOM VALUE          FORMATTED VALUE

 .114041549          0.1140       0.11
-958.227017       -958.2270    -958.23
 180.518585        180.5186     180.52
-31.9237856        -31.9238     -31.92
 404.860335        404.8603     404.86
 14.6913429         14.6913      14.69
 14.1522637         14.1523      14.15
-1.36321782         -1.3632      -1.36
-.599575934         -0.5996      -0.60
 .618702668          0.6187       0.62
 .588787114          0.5888       0.59
-.594855181         -0.5949      -0.59
 .176296465          0.1763       0.18
 .602271626          0.6023       0.60
 .161926194          0.1619       0.16

AVERAGE FORMATTING TIME= .0933 SECS

another run (y/n)   y
        ===end of demonstration===
```

Line 60020 restores the minus sign for negative numbers, stripped off by the Abs function in line 60000.

Line 60030 pads the output string to the left with blanks and then returns.

If space and/or time are not so critical then it is possible to add an extra line to signal over-long output — see lines 60480 to 60560. Similarly, accountants often like to work with trailing rather than with

(continued on next page)

Quick formatter.

```
100 PRINT" QUICK-FORMATTER "
110 PRINT " BY M. C. HART "
120 FOR J=1TO2000:NEXT
130 PRINT"PRESS <RETURN> ONLY TO RETAIN SAMPLE"
140 PRINT"VALUES ...OTHERWISE SUBSTITUTE YOUR"
150 PRINT"OWN.":PRINT
160 PRINT"---REQUIRED FIELD LENGTH IS  11";
170 INPUT"";ZF:PRINT:IF ZF<9THEN PRINT"! FIELD TOO SHORT !":GOTO160
180 ZF$=LEFT$("                    ",ZF)
190 PRINT"---NUMBER OF DECIMAL PLACES IN"
200 PRINT"FIRST FIELD IS  4";
210 INPUT"";ZP:PRINT
220 PRINT"---NUMBER OF DECIMAL PLACES IN"
230 PRINT"SECOND FIELD IS  1";
240 INPUT"",ZQ:PRINT
250 PRINT" RANDOM VALUE          FORMATTED VALUE   ":PRINT
260 ZL=3
270 FOR J=1TO15:ZD=ZP:ZR=1:IF ZD>0 THEN FOR I=1TOZD:ZR=ZR*10:NEXT I
280 Z=EXP(RND(0)*14-6)*SGN(RND(0)-.2)
290 ZC=Z:PRINTZ;:A=TI:GOSUB60000:B=TI:TT=TT+(B-A)
300 PRINT SPC(15-LEN(STR$(Z)))Z$;
310 ZD=ZQ:ZR=1:IF ZD>0 THEN FOR I=1TOZD:ZR=ZR*10:NEXT I
320 GOSUB 60000:PRINTZ$:NEXT J
330 TT=TT/(15*60):TZ=INT(TT*10000+.5)/10000
340 PRINT:PRINT"AVERAGE FORMATTING TIME="TZ"SECS"
350 FOR J=1TO35:PRINT"-";:NEXT:PRINT
360 PRINT"ANOTHER RUN (Y/N)  Y ";:INPUT"";A$
370 IF A$="Y"THEN130
380 PRINT: PRINT"===END OF DEMONSTRATION===":END
390 :
400 :
410 :
500 :
60000 Z1=INT(ABS(Z)*ZR+.5)/ZR:Z%=Z1:ZX$=STR$(INT((Z1-Z%)*ZR+.5)):ZT$=STR$(Z%)
60010 ZY$=RIGHT$("00000"+MID$(ZX$,2),ZD):Z$=ZT$+"."+ZY$:IFZD=0THENZ$=STR$(Z1)
60020 IF Z<0 THEN Z$="-"+MID$(Z$,2)
60030 Z$=RIGHT$(ZF$+Z$,ZF):RETURN
60040 :
60050 :
60060 :
60070 :
60080 :REM *** TABLE OF VARIABLES **
60090 :
60100 :REM      --MAIN PROGRAM--
60110 :REM
60120 :REM  ZP = NO OF DECIMAL PLACES
60130 :REM       REQUESTED FOR FIELD 1
60140 :REM  ZQ = NO OF DECIMAL PLACES
60150 :REM       REQUESTED FOR FIELD 2
60160 :REM  ZD = NO OF DECIMAL PLACES
60170 :REM       USED IN PROGRAM
60180 :REM  ZR = ROUNDING FACTOR
60190 :REM  ZF = REQUESTED FIELD LENGTH
60200 :REM  ZF$ = STRING OF BLANKS FOR
60210 :REM        PADDING
60220 :REM  ZL = INTEGER LENGTH +1
60230 :REM  ZC = COPY OF Z (=VALUE FOR
60240 :REM       FORMATTING)
60250 :REM
60260 :REM --FORMATTING SUB-ROUTINE--
60270 :REM   -- (CALLED AT 60000)--
60280 :REM
60290 :REM   Z = VALUE FOR FORMATTING
60300 :REM  Z1 = ROUNDED ABSOLUTE Z
60310 :REM  Z% = INTEGER OF Z1
60320 :REM  ZX$= STRING OF FRACTION
60330 :REM  ZT$= STRING OF INTEGER
60340 :REM  ZY$= ZX$ PADDED WITH ZEROES
60350 :REM  ZD = NO OF DECIMAL PLACES
60360 :REM       USED IN PROGRAM
60370 :REM  ZR = ROUNDING FACTOR
60380 :REM  ZF$ = STRING OF BLANKS FOR
60390 :REM        PADDING
60400 :REM  ZF  = LENGTH OF FIELD
60410 :REM  Z$  = OUTPUT STRING
60420 :
60430 :REM FOR TRAILING RATHER THAN
60440 :REM LEADING "-" ALTER 60020 TO
60450 :REM Z$=Z$+" ":IF Z<0 THEN Z$=
60460 :REM LEFT$(Z$,LEN(Z$)-1)+"-"
60470 :
60480 :REM TO SIGNAL INTEGER PART TOO
60490 :REM LONG FOR  A FIELD THEN :-
60500 :REM -SET 'ZL' TO INTEGER LENGTH
60510 :REM   (INCLUDING LEADING SPACE)
60520 :REM   IN MAIN BODY OF PROGRAM
60530 :REM   E.G. IN LINE 260
60540 :REM -INSERT NEW LINE 60025
60550 :REM (60025) IF LEN(ZT$)>ZL THEN
60560 :REM Z$="%"+MID$(Z$,2)
60570 :
60580 :REM ** END OF INSTRUCTIONS **
```

(continued from previous page)
leading minus signs, and this can be accommodated by changing line 60020 — documented in lines 60430 to 60460.

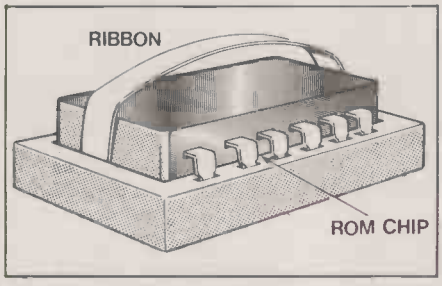
If users would like output to contain a leading character, such as a $ sign for financial transactions, this can be accommodated by the addition of one extra line as follows:

```
60015 Z$="$"+MID$(Z$,2): IFZ<0 THEN
  Z$="-"+Z$: GOTO 60030
```

The rounding function is placed at 270 and 310 in the main body of the program in order to save processing time, but if time is not at a premium and it is desirable to change formats within a program it is always possible to place it within the subroutine if desired.

ROM remover

SEVERAL TIMES in the past few months I have had to swap two alternative video character-generator ROMs in my Pet, and on one occasion the pins of one of them were irreparably damaged, writes Dan Rogers of Bexhill-on-Sea, Sussex. To avoid a repetition I made a loop of tape which I now keep entrapped under the ROM as shown in the sketch.



With two or three fingers of one hand in the loop an even lift can be exerted while the other hand controls the rate of withdrawal. Baby or shoulder-strap ribbon 7-10mm. wide seems eminently suitable: it is thin, strong and has reinforced edges. Adjust the length to suite the dimensions of the ROM.

Dodgeball

LIKE MOST popular video games, Dodgeball by Greg Hopkins of Reigate, Surrey is very simple yet in concept difficult to master and interesting enough to be played again and again. At the beginning all the player has to do is to dodge out of the way of a ball which is bouncing around a box on the screen. Another ball then appears, and then another; gradually the whole screen fills up with fast-moving circles which destroy everything in their paths, including sometimes the other balls. The player is forced to think more and more quickly in order to survive. The time in seconds is shown at the top of the screen — anything over one minute is a very good score.

In Basic the program would be far too slow to be playable, so a 260byte machine-code program to move the balls. The game was written on a new-ROM Pet but it will run equally well on an old-ROM machine if the keyboard check in line 590 is changed to Peek (515).

The program is split into three main sections. The first part prints instructions and Pokes the machine code into memory; the second sets up the variables and prints the box of random dimensions on to the screen. The final section is where the game is played.

After each part the computer waits for a key to be pressed before continuing. The level of difficulty can be altered by increasing or decreasing the value of the variable, originally set at 0.0002, in line 570.

Dodgeball.

```
3 REM*** DODGEBALL - BY GREG HOPKINS***
100 DATA 72, 169, 16, 141, 75, 232, 169, 15, 141, 74, 232
110 DATA 169, 64, 141, 72, 232, 104, 76, 96, 16, 78
120 DATA 234, 234, 234, 234, 234, 234, 234, 234, 234, 234
130 DATA 234, 96, 170, 170, 170, 170, 170, 234, 32, 16
140 DATA 64, 32, 16, 64, 32, 64, 16, 169, 0, 133
150 DATA 177, 133, 179, 169, 128, 133, 180, 169, 20, 133
160 DATA 178, 160, 90, 234, 234, 234, 234, 234, 234, 230
170 DATA 177, 230, 179, 208, 12, 230, 178, 230, 180, 169
180 DATA 131, 197, 180, 240, 202, 234, 234, 177, 179, 201
190 DATA 81, 208, 82, 177, 177, 168, 177, 179, 201, 32
200 DATA 208, 153, 152, 201, 90, 16, 84, 145, 177, 169
210 DATA 81, 145, 179, 160, 90, 169, 32, 145, 179, 152
220 DATA 145, 177, 76, 38, 16, 234, 234, 201, 227, 208
230 DATA 11, 152, 24, 105, 80, 160, 90, 145, 177, 76
240 DATA 56, 16, 234, 201, 229, 208, 11, 152, 24, 105
250 DATA 2, 160, 90, 145, 177, 76, 56, 16, 234, 201
260 DATA 228, 208, 44, 152, 56, 233, 80, 160, 90, 145
270 DATA 177, 76, 56, 16, 234, 177, 177, 201, 90, 240
280 DATA 144, 169, 81, 145, 179, 76, 38, 16, 234, 234
290 DATA 234, 145, 177, 76, 82, 16, 170, 170, 170, 170
300 DATA 170, 170, 170, 170, 170, 170, 170, 201, 231, 208
310 DATA 11, 152, 56, 233, 2, 160, 90, 145, 177, 76
320 DATA 56, 16, 234, 76, 71, 16, 170, 170, 170, 170
330 DATA 170, 170, 170, 170, 170, 170, 170, 170, 170, 160
340 DATA 90, 169, 20, 133, 178, 169, 0, 133, 177, 230
350 DATA 177, 169, 90, 145, 177, 165, 177, 208, 246, 230
360 DATA 178, 165, 178, 201, 23, 208, 238, 96,
370 PRINT"■"SPC(13);"■■■DODGE-BALL"
380 PRINT"■■       YOU LOOK LIKE THIS: 'O'
390 PRINT"■■■    THE BALLS LOOK LIKE THIS: '●'
400 PRINT"■■■■ AVOID THEM BY USING THE NUMBER KEYBOARD
410 PRINT"■■    SEE HOW LONG YOU CAN SURVIVE !!!"
420 IFPEEK(4064)<>72THENFORX=4064TO4332:READB:POKEX,B:NEXT
430 GETA$:IFA$=""THEN430
440 SYS4304
450 W=INT(RND(0)*30)+8:H=6+INT(RND(0)*10)
460 T=18-INT(W/2)
470 P=32768+(INT(RND(0)*(W-2)))+(INT(RND(0)*H)*40)+202+T
480 PRINT"■■■■"SPC(T);
490 FORX=1TOW+2:PRINT"■";:NEXT:PRINT
500 FORX=1TOH+2:PRINTSPC(T);"■"SPC(W)"■":NEXT
510 PRINTSPC(T);:FORX=1TOW+2:PRINT"■";:NEXT:PRINT
520 GOSUB700:POKEP,87
530 GETA$:IFA$=""THEN530
540 TI$="000000"
550 SYS4112:POKE59467,0
560 TJ=INT(TI/6)/10:PRINT"■■"SPC(T+.5*W+2-LEN(STR$(INT(TJ))));TJ
570 IFRND(0)>1-H*W*0.0002THENGOSUB700
580 IFPEEK(P)<>87THEN740
590 L=PEEK(151):IFL=255THEN550
600 IFL=50THENA=-40:GOTO680
610 IFL=18THENA=40:GOTO680
620 IFL=41THENA=1:GOTO680
630 IFL=42THENA=-1:GOTO680
640 IFL=57THENA=-39:GOTO680
650 IFL=58THENA=-41:GOTO680
660 IFL=25THENA=41:GOTO680
670 IFL=26THENA=39
680 IFPEEK(P+A+A)=32THENPOKEP,32:P=P+A:POKEP,87
690 GOTO550
700 D=201+(INT(RND(0)*W))+(INT(RND(0)*H)*40)+T
710 V=INT(RND(0)*2)*80+INT(RND(0)*2)*2+49
720 IFPEEK(32768+D)=32THENPOKE32768+D,81:POKE5120+D,V
730 RETURN
740 PRINT"■":FORX=1TOH+6:PRINT:NEXT
750 IFTJ<RTHEN770
760 PRINT"CONGRATULATIONS A NEW RECORD":R1=TJ
770 PRINT"THE RECORD WAS"R"SECONDS"
780 R=R1:PRINT"ANOTHER GAME ?"
790 GETA$:IFA$=""THEN790
800 IFA$="Y"THEN440
810 IFA$="N"THENEND
820 GOTO790
READY.
```

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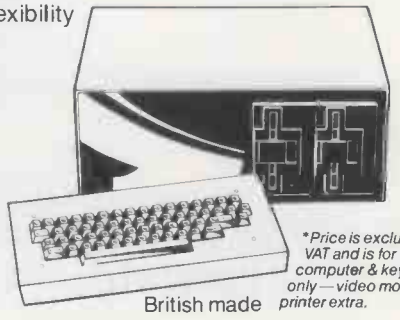

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● Circle No. 202

Using Microcomputers in Business

By Stanley S Veit. Published by Hayden. Paperback $9.95. ISBN 0 8104 5152 2.

THIS BOOK is intended for the would-be business user of a small computer system which, despite the title, could equally well be a minicomputer. The author maintains that the advice given has been valid since businesses started using computers, and will remain so in the future.

The book breaks down into two elements, the first concerned with describing what a computer system is and what it can do in the context of a business. The second explains the pitfalls and how to avoid them on the way to computerising a business.

The description of computer hardware and how it can be used in business is no better or worse than countless other books. Two chapters are devoted to word processing and database management systems, and both consist of a limited explanation of the facilities provided by a typical system, filled out with outlines of commercially available software packages. These outlines provide no more information than suppliers' advertisements or sales brochures — a lazy way of writing a book. There is also a chapter describing the more popular languages.

The second element is concerned with selecting, installing and using a computer system in a business environment. The coverage of this topic is so much better than the description of the computer systems that this must be the area in which the author's experience really lies. He makes the point that the buyer must know in some detail what the computer is to do and how, before starting to spend time and money on choosing a computer system or a consultant.

The advice goes into much more detail on how this may be achieved, and provides a similar level of advice on selecting both the hardware and software, installation and the need for continuing support from the suppliers after installation. The author also makes a good case for using consultants — not really surprising when he is a consultant himself, but no less valid for all that.

Conclusions

● This book is subtitled a "Guide for the Perplexed", but the technical descriptions will only add to the confusion. It is not specially bad, but like most books of this type it is rather superficial — perhaps because the author himself does not really understand it.

● The sections on selecting, installing and using a computer system contain excellent advice and probably justify buying the book. Any new user who followed the advice diligently would end up with a satisfactory system.

● A very uneven book whose purchase is worthwhile for the half that is good.

Martin Wilson

Starting Forth

By Leo Brodie. Published by Forth Inc. 348 pages. £12.80.

AN IMPORTANT FACTOR in the success of any computer language is the quality of the supporting literature. It is therefore clear that if Forth is to be successful it needs a high-quality book on the subject. Fortunately this book is it.

The foreword includes a eulogy in praise of the author by the originator of Forth, Charles H Moore and is the only part of the book to jar a little. The user wants to know about the language not about the personal qualities of the author.

Forth is in many respects a difficult language, but this book is distinguished by the clarity with which the complexities of the language are presented. The author uses graphics intelligently, especially in his discussion of stack-manipulation operations. Unlike many texts it has a good, almost conversational, style throughout and even the most naive user could learn the basics of the language from this text. It is a measure of the quality of the book that I read over 200 pages at one sitting without feeling overstuffed with information or bored at the end.

My only reservation stems from a remark about Forth attributed elsewhere to Charles Moore, in which he describes the language as amplifying the capabilities of good programmers and making bad programmers worse. There is not enough in the book to help the completely naive programmer to approach program design in the right manner.

Conclusions

● An excellent book, destined to be the Forth bible I suspect.

● Probably the book is most suitable for programmers who already have some experience of program-design principles acquired using another language.

John Cookson

Computer Software Protection

Editor Robert Muller. Published by Gower Publishing. 113 pages paperback. ISBN 0 566 03418 2

THIS BOOK is the edited transcript of the proceedings of a conference held during 1981. Though well covered in the computer press at the time, this "Computing in Business Report" contains more detail than the magazine articles published then.

The report starts with the editor's introduction which effectively sets the scene by outlining the development of software piracy and the consequent need for protection against such illicit copying. The introduction summarises the current methods used for software protection, both legal and illegal.

The first chapter describes the problem that illegal copying causes for those trying to market software and the need to plan for taking action against piracy. This covers preventative measures such as devices in the software to deter or, for some people, encourage copying, and the limited or doubtful legal remedies after the infringement.

The second chapter details some of the abuses and misuses and the consequent losses to those writing and selling software. It also highlights the consequent loss of choice to the would-be honest buyer because of the reduction of the number of software products that can pay their way in publishers' and dealers' lists, despite the piracy.

The third chapter provides the reasons for much illicit copying, for demonstration or evaluation purposes or purely to provide back-up or a realistic working environment. It is also suggested that much software is overpriced for its potential market and that few software houses have a realistic approach to multiple machine licences. A better level of service for annual licences, it is contended, would provide more encouragement to purchase legitimate copies rather than pirated ones.

The ever-present Mr Kelman provides his usual comprehensive treatise on the legal protection provisions and on the possible extension of legislation to cover software copyright. The latter chapters cover not only the conventional but some very unconventional approaches to the deterrence of illicit copyists. Hardware techniques such as the now infamous "dongle" are outlined, as are the effective approaches of using the legal system to cause the would-be pirate the maximum amount of embarrassment and to warn off his potential customers.

The final chapter, like the final section of each of the previous chapters, is a discussion among the panel members and a response to points raised from the floor of the conference. Many interesting questions were asked and perhaps there could have been more made of this aspect.

The appendices provide details of copyright legislation, both proposed and enacted, in the U.K. or the U.S.A. Also included is a summary of copyright limitations worldwide and an outline of some typical copyright problems.

Conclusions

● An interesting and thought-provoking discussion for anyone involved in the marketing of software. Much is already familiar thanks to the extensive coverage of this subject by the computer press, this book brings much of the thinking into one slim volume.

● This book raises more questions than it answers, but provides a useful starting point for the resolution of this serious problem.

Martin Wilson

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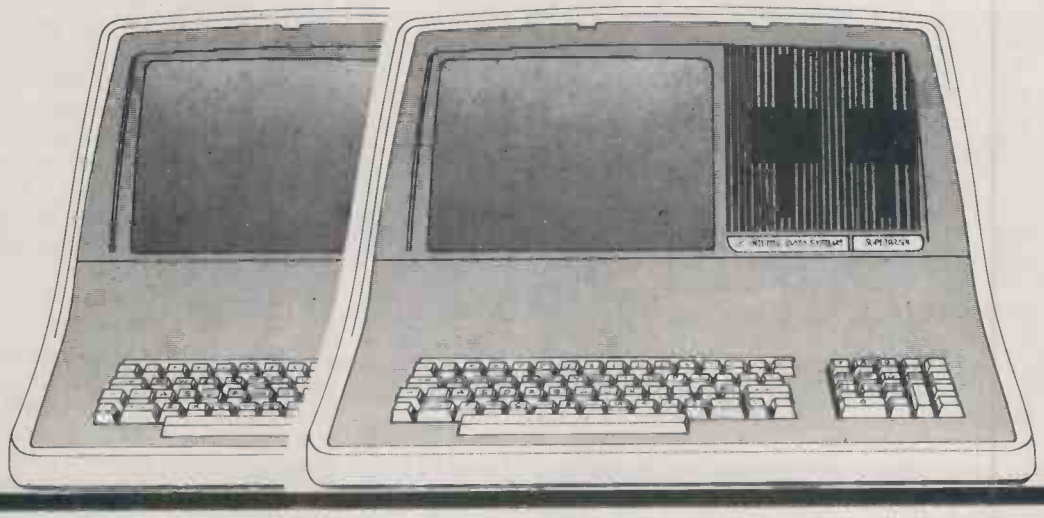

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● **Circle No. 203**

Highland mystery

by Douglas Tate

AN AMATEUR archeologist and anthropologist who has been studying the early electronic artefacts of the ancient peoples who live north of the wall was most stimulated by the new Rosetta stone which appeared on page 165 in *Practical Computing*'s June issue.

Imagine his delight when he was able with the help of our listing to at last decipher the ancient Highland PCB* which is believed to antedate the simple Skye matrix. Its markings are reproduced here.

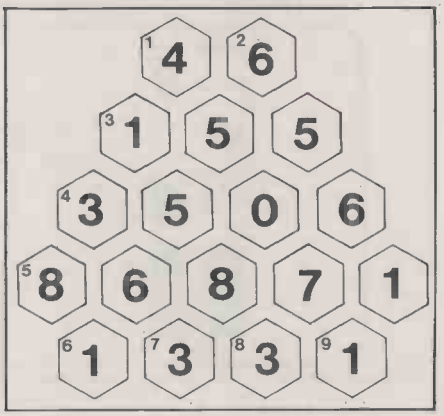
An exceedingly ancient, bearded and kilted apparition provided a clue to its solution, which runs as follows: "Sir. This is as twisted as my stick, not straight and nasty like your English ones. Our ancestors never wasted a thing but, like a haggis, you can only eat each bit the once".

Our anthropological correspondent is sure that you will instantly see the significance of the remark and be able at once to decipher the code on the stone.

*Practical Computing Bible

C	L	A	C	Y	R	O	M	O	C	R	E	T	R	P	H	T
B	I	S	S	G	M	E	M	E	M	P	U	C	O	F	O	R	C
N	A	P	A	P	R	A	P	D	O	M	E	S	R	O	T	I	P
A	V	D	R	I	N	A	O	R	A	M	S	O	R	P	I	N	M
R	U	C	R	E	T	P	C	R	H	C	I	E	E	E	L	O	M
E	T	I	G	O	L	H	E	N	I	A	M	M	I	B	O	T	T
R	W	R	A	C	I	S	Y	S	T	E	M	I	N	O	O	T	I
A	D	R	O	H	E	P	I	C	C	C	L	O	B	Y	O	F	B
N	O	A	M	F	L	I	P	H	O	A	O	I	T	P	L	G	O
C	I	R	O	E	E	K	S	M	S	G	L	E	K	P	O	R	R
L	I	F	R	C	I	T	I	S	A	L	W	O	Y	B	L	A	P
S	N	I	A	M	M	T	E	D	B	U	S	D	R	O	C	M	

Solution to July puzzle



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 £3,000; 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
ACT 800	ACT Microsoft	From £500	
ACT Sirius	ACT Microsoft	£495	
Apple II and III	Systematics	From £250	
Apple II	Vlasak Electronics Ltd	£855	1,500 a/c 5,000 trans
Apple II	Dataforce (U.K.) Ltd	£855	
Apple II	Microsense Computers Ltd	£340	
Apple II	Southern Computer Systems	£1,000	varies
Apple II/ITT	Informex London Ltd	£298	500 a/c
Apple II	Star Systems Ltd	£750	2,000 a/c 6,000 trans
Commodore	Comsoft Associates	£750	
Commodore 3032	Compfer Ltd	£400	varies
Commodore 3032	Analog Electronics	£550	
Commodore 3032	Logma Systems Designs	£600	1-6 shops
Commodore 3032	Grama (Winter) Ltd	£475	varies
Commodore 3032	Bristol Software Factory	£300	1,000 a/c 6,000 trans
Commodore 3032	Compfer Ltd	£600	500 a/c 1,000 items
Commodore 3032	HB Computers	£695	500 s/c 2,500 trans
CP/M	Sail	£1,265	varies
CP/M	Bonsai	£1,875	
CP/M	D T Systems	£750	varies
CP/M	Wisbech Computer Services	£900	varies
CP/M	Graffcom Systems Ltd	£400	varies
CP/M	Benchmark CS Ltd	£950	varies
CP/M	Computastore Ltd	£1,000	
CP/M	Interface Computer Services	£350	
CP/M	Minicomputer CS Ltd	£1,250	varies
CP/M	Salmon Microcomputing	£750	1,600 items 1,000 trans
CP/M	Selven Ltd	£1,500	3K a/c 7K trans
CP/M	Map Computer Systems	£1,000	varies
CP/M North Star	Instar Business Systems	£999	600-2,900
CP/M North Star	Criterion Business Systems		

North Star DOS	Intelligent Artefacts	£510	1,500 a/c 5K trans
Ohio Scientific	Microcomputer BM	£656	
Ohio Scientific	Stratheden Ltd		
Tandy Model 2	Chess Consultancies	£1,200	
Tandy Model 2	Chess Consultancies	£995	5,000 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	Spider	£200	2,800 records
Apple II	ACT Microsoft Ltd	£75	
Apple II	Courtman Micro Systems	£106	100K characters
Apple II	Keen Computers	£425	up to 70Mbytes
Apple II/ITT	Systematics International Ltd	£72	
Apple II/ITT	Diskdean Ltd	£120	varies
Apple II/ITT	Systematics International Ltd	£125	1,000 references
Apple II/ITT	Informex London Ltd	£198	500-1,200 records
Apple II/ITT	The Software House	£140	900 records
Commodore	Comsoft Associates	£250	
Commodore 3000/8	Stage One Computers	£45-£150	650-2,400 records
Commodore 3000/8	Commodore BM (U.K.) Ltd	£150-£300	650-1,400-64,000 records
Commodore 3032	CPS (Data Systems) Ltd	£200	varies
Commodore 3032/8	Compsoft Ltd	£190	600-5,000 records
Compucorp	Verwood Systems	£376	
CP/M	Redwood	£120	
CP/M	Compsoft Ltd	£400	30,000 records
CP/M	Great Northern CS Ltd	£110-£210	and varies
CP/M	Microtek Computer Services	£250-£500	
CP/M	Cleno Computing Services	£90-£325	varies
CP/M	Interface Ltd	£200	varies
CP/M	Median-Tec Ltd	£500	
CP/M	Microbits	£145	varies
CP/M	Southdata Ltd	£650	up to 8Mbytes
CP/M SWTPC	Verwood Systems		
Metrotech System	Metrotech	£200-£1,000	
North Star	GW Computer	£575	
Ohio Challenger	U-Microcomputers Ltd	£175	
Ohio Scientific	Microcomputer BM	£175	
Superbrain	GW Computer	£575	
Superbrain	Alan Pearman Ltd	£295	varies
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/Cromenco	Xitan Systems Ltd	£850	4,000 records/disc

Engineering Design Systems

Machine type	Supplier name	Price	Notes
Apple II	Ismael CAD	varies	Range of building and engineering applications
Apple II	Gilmorehill Software	varies	Range of building and engineering applications
Apple II	Microcomp	From £200	Range of structural engineering applications
Apple II	Haden Young Ltd	From £50	Range of software for building/ engineering
Apple II	James C Steadman	£200	Erect concrete columns
Apple II	James C Steadman	£250	Multibay frames
Apple II/ITT	Aerco-Gemsoft	£175	Pipeline engineering
Commodore	Ismail CAD	varies	Provide a range of software for building/ engineering
Commodore	Comsoft Associates	£750	Engineering contractors estimates

Commodore 8000	The Computer Room	£1,500	Engineers production information control
Commodore 3032	Micro Computation	£300	Building-conversion specification
Commodore 3032	The Alphabet Co	£75	Time study and analysis
Commodore 3032	Comac Systems	£400	Asset register
Commodore 3032/8	Comac Systems	£400	Maintenance plan
Commodore 3032/8	Comac Systems	£400	Work orders
Commodore 3032/8	Comac Systems	£400	Plant history
Commodore 3032/8	Comac Systems	£400	Manpower analysis
CP/M	Ismael CAD	varies	Range of building and engineering applications
CP/M	Gilmorehill Software	varies	Range of building and engineering applications
CP/M	Hevacomp	£2,250	Heating and ventilation system design
CP/M	Hevacomp	£500	Building specification
CP/M	Hevacomp	£500	Building project cost control
CP/M	Median-Tec	£500	Plastic portal frames
CP/M	Median-Tec	£500	Slope-stability analysis
CP/M	Median-Tec	£500	Retaining wall design
Equinox	Equinox	£500	Civil/structural engineering design
Hewlett-Packard	CSC (Northern) Ltd	from £200	Engineering design systems
Superbrain	Stemmos	£2,500	Stress analysis for pipe networks
Superbrain	KGB	£2,500	Computer-aided 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	Atlanta	£750	
Apple II	Microsense	£500	
Apple II/ITT	Cyderpress	£650	
Apple II/ITT	Systematic	£850	
Commodore 3032	Stage Once Computers	£250	
Compucorp	Verwood systems	£700	Estate sales
Compucorp	Verwood systems	£1,200	Estate management
CP/M	Selven Ltd		Estate agents' sales and selection
Sharp MZ-80K	Wisbech Computer Services	£195	

Financial Systems

Machine type	Supplier name	Price	Notes
ACT 800	ACT Microsoft	£595	Micromodeller
ACT Sirius	ACT Microsoft	£150	SuperCalc
ACT Sirius	ACT Microsoft	£595	Micromodeller
Apple II	ACT Microsoft	£150	Micromodeller
Apple II	Personal Computers	£500	Income tax computations
Apple II and III	PE Consulting Group	£350	Microfinesse-financial planning
Apple II	Microdigital	£200	Sales analysis
Apple II	Microdigital	£130	Credit control
Apple II	Microsense	£194	Cashier retail/ wholesale
Apple II	PK Microsystems		Solicitors' accounts
Apple II	Dataforce	£80	Cashflow projection
Apple II	Informex	£98	VAT system
Apple II	Southern Computer Systems	£750	Financial controller
Apple II/ITT	Microsense	£125	VisiCalc
Apple II/ITT	Systematics	£295	Financial planning

Apple II/ITT	Systematics	£1,000	Financial controller
Apple II/ITT	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	Quote processing
Commodore 3032	CPS	£575	Invoice-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
Commodore 8000	ACT Microsoft	£595	Micromodeller
CP/M	Great Northern	£299	Minimodel
CP/M	Omicron	POA	Dual currency sales and bought-ledger systems
CP/M	Bytesoft	£95	Financial modelling
CP/M	Micromedia	£1,000	Invoice disc factoring
CP/M	Graffcom System	£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	Business Solutions	£395	Mars
Durango F-85	Kesho Systems	£1,000	Time recording/ ledger
IBM PC	ACT Microsoft	£595	Micromodeller
Superbrain	Alan Pearman Ltd	£315	Financial planning
Tandy TRS-80	Chess Consultancies	£800	Sales statistics
Tandy TRS-80	A J Harding	£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 and III	Systematics	£250	
Apple II	Computer Systems	£295	500 a/c 1,700 trans
Apple II	Dataforce (U.K.) Ltd	£225	200 a/c 1,000 trans
Apple	Style Systems Ltd	£250	1,000 a/c, 2,000 postings
Apple II	Southern Computer Systems	£750	1,000 a/c 12 branches
Apple II/ITT	Systematics International Ltd		
Apple II/ITT	Guestel Ltd	£300	200 a/c
Commodore	Comsoft Associates	£350	
Commodore 3032	Bristol Software Factory	£300	1,000 a/c 6,000 trans
Commodore 3032	Analog Electronics	£450	
Commodore 8000	Commodore BM (U.K.) Ltd	£300	600 a/c 3,000 trans
Compucorp	Verwood Systems	£250	
CP/M	Sail	£390	varies
CP/M	Wisbech Computer Services	£300	
CP/M	Business Solutions Ltd	£390	varies
CP/M	Bytesoft	£690	varies
CP/M	PR Daly & Co Ltd	£500	
CP/M	Haywood Associates Ltd	£500	
CP/M	Median-Tec Ltd	£500	500 a/c 5,000 trans
CP/M	Ludhouse Ltd	£500	200 a/c 5,000 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	1,000 a/c 3,000 trans
CP/M	Interface Computer Services	£350	varies
CP/M	Microbits Ltd	£500	varies
CP/M	Map Computer Systems	£300	250 a/c 3,500 + trans
CP/M North Star	Benchmark CS Ltd	£250	150 a/c 500 trans
Horizon	Claisse/Allen Computing	£500	999 a/c 99 entries, nine computers

North Star DOS	Intelligent Artefacts Ltd	£295	1,500 a/c 5,000 trans
Ohio Scientific	Stratheden Ltd	£500	varies
Tandy Model 2	Chess Consultancies Ltd	£400	1,000 a/c
Tandy TRS-80	Tridata Micros Ltd	£225	500 a/c 1,800 trans
Z-80	Liveport Ltd		
Z80/8080	Solitaire	£500	Up to 26 by 400 a/c
Zilog MCZ range	Microbits	£500	100 a/c 5,000 trans

Hotel and Travel Packages

Machine type	Supplier name	Price	Notes
Apple II	Dataforce	£525	Hotel management
Apple II	Informex Logic	£298	Travel agents' system
Apple II	Informex Logic	£298	Hotel administration system
Apple II/ITT	Guestel Ltd	£500	Hotel billing
Apple II	Diskwise Ltd	£695	Hotel reservation and guest billing
Commodore 3000	Landsler Software	£350	Hotel guest billing
CP/M	Sail	£600	Bar and food stock
CP/M	Sail	£1,200	Stock and accounting

Incomplete Records

Machine type	Supplier name	Price	Capacity
Apple II/ITT	Padmede Computer Services	£450	900 a/c 2,000 trans/ disc
Apple II	Keen Computers	£580	up to 70Mbytes
Apple II	Southern Computer Systems	£750	500 a/c 2,000 trans
Commodore	The Computer Room	£230	
Commodore 3032	Stage One Computers	£750	500 centres 2,300 a/c
Commodore 3032	Micro Computation	£555	120 a/c 5,000 trans
CP/M	Map	£1,250	
CP/M	Wisbech Computer Services	£750	
CP/M	CPL Ltd		250 headings, 2,000 trans per 5.25 disc
CP/M	Benchmark Ltd	£975	
CP/M	Bytesoft	£250	3,000 trans
CP/M	Criterion Business Systems	£375	2,500 entries
CP/M	Ludhouse Ltd	£1,000	variable
CP/M	Salmon Microcomputing	£950	5,000 entries
CP/M	Map Computer Systems	£550	
Durango F-85	Kesho Systems	£1,000	
Exidy Sorcerer	Basic Computing	£350	See also Micropute
Tandy Model 1	A J Harding (Molimerx)	£150	1,200
Tandy Model 1	Quickmet	£785	300 a/c 2,000 trans
Tandy Model II	IBIS Business Info Systems		9,000 a/c codes

Job Costing/Billing

Machine type	Supplier name	Price	Capacity
Apple II	Informex London	£498	1,000 emp-pro-exp codes
Apple II	Deltic Computing Ltd	£250	
Apple II	Southern Computer Systems	£750	
Apple II/ITT	Padmere Computer Services	£300	999 clients 99 rates
Apple II/ITT	TABS Ltd	£99	100 jobs 3,000 trans
Commodore	Comsoft Associates	£350	
Commodore 3032	CSM Ltd	£600	1,000 jobs 100 people
Commodore 3032	Stage One Computers	£100	300 appointments
CP/M	Bromley	£400	
CP/M	Vauntberry	£1,450	
CP/M	Business Solutions Ltd	£190	varies
CP/M	Map Computer Systems Ltd	£550	400-96,000 jobs
CP/M	Graffcom Systems Ltd	£400	varies
CP/M	Ludhouse Ltd	£1,000	1,000 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	CPL Ltd	£300	
CP/M	Goldcrest	£200	
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	Atlanta	£55	1,000 names and addresses
Apple II	Keen Computers	£495	32,767 records
Apple II/ITT	Systematics International Ltd	£300	500 addresses
Apple II/ITT	The Software House	£57	750 names and addresses
Apple II/ITT	Personal Computers Ltd	£50	400 entries
Commodore	Comsoft Associates	£150	
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	13,000
Compucorp	Verwood Systems	£250	
CP/M	Bromley	£400	
CP/M	Sail	£100	varies
CP/M	Goldcrest	£200	
CP/M	Compsoft Ltd	£400	27,000
CP/M	Structured Systems Group	£50	varies
CP/M	Graffcom Systems Ltd	£250	800-5,000 records
CP/M	Median-Tec Ltd	£500	
CP/M	Microbits	£230	varies
CP/M	Interface Computer Services	£200	varies
CP/M Horizon	Microtek Computer Services	£250	varies
CP/M North Star	Intelligent Artifacts	£250	
CP/M North Star	Micromedia Systems	£195	
CP/M Vector	Taylor Microsystems	£395	
North Star	Intelligent Artifacts	250	
North Star Horizon	Wisbech Computer Services	£195	1,200 per disc
Tandy TRS-80	AA J Harding (Molimerx)	£55	600-3,750 records
Tandy TRS-80	Comput-A-Crop	£78	varies
Z-80/8080	Intereurope SD Ltd	£200	30,000 entries
Z-80/8080	Micro Focus	£90	varies

Nominal Ledger

Machine type	Supplier name	Price	Capacity
Apple II	Logic Computers	£630	100 depts, 200 a/c
Apple III	Logic Computers	£630	500 depts, 500 a/c
CP/M	Map	£400	999 headings
CP/M	Bonsai	£475	999 headings
CP/M	Bromley	£400	
CP/M	P R Daly	£500	
CP/M	Vauntberry	£950	
CP/M	D T Systems	£750	

Order Entry/Invoicing

Machine type	Supplier name	Price	Notes
Apple II and III	Systematics	£250	Invoicing
Apple II	Informex	£198	Invoicing system
Apple II	Southern Computer Systems	£750	Invoicing
Commodore 3032	MMS Computers	£250	Order control
Compucorp	Verwood Systems	£250	
CP/M	Sail	£250	Invoicing/back orders
CP/M	Bromley	£400	Order processing
CP/M	P R Daly	£350	Invoicing
CP/M	Vauntberry	£950	Order processing
CP/M	Typestyle	£250	Invoicing
CP/M	Wisbech Computer Services	£600	
CP/M	Graham-Dorian	£500	200 invoices 1,500
CP/M	Goldcrest	£300	Invoicing
CP/M	P R Daly & Co	£200	Invoicing

CP/M	Graffcom Systems	£350	Order entry/invoicing
CP/M	Interface Ltd	£250	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	Logic Computers	£630	300 personnel
Apple III	Logic Computers	£630	1,000 personnel
Apple II and III	Systematics	£250	
Apple II	Dataforce (U.K.) Ltd	£375	
Apple II/ITT	TW Computers Ltd	£145	
Apple II/ITT	Informex London Ltd	£298	
Apple II/ITT	Algobel Computers	£295	500 employees
Apple II/ITT	Vlasak Electronics Ltd	£375	200 employees
Apple II/ITT	Computech Systems	£379	300 employees
Apple	Style Systems Ltd	£350	450 employees
Apple II/ITT	Tabs Ltd	£99	50 weekly 100 monthly
Commodore	Comsoft Associates	£350	500 employees
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	Map	£550	5,000 employees
CP/M	Bromley	£400	
CP/M	P R Daly	£350	
CP/M	Vauntberry	£950	
CP/M	Benchmark CS Ltd	£350	300 employees, 50 departments
CP/M	Haywood Associates Ltd	£350	
CP/M	Median-Tec	£500	1,000 employees
CP/M	Salmon-Microcomputing	£300	500 employees
CP/M	Map Computer Systems	£350	300-96,000 employees
CP/M	Daman Computer Services	£900	1,000 employees/ Byte
CP/M	Selven Ltd	£500	400 employees
CP/M	P R Daly & Co Ltd	£350	
CP/M	Graffcom Systems Ltd	£500	500 employees
CP/M	Horizon Software Ltd	£500	
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	Microbits	£500	Varies
CP/M North Star	Micromedia Systems	£495	350 employees
CP/M North Star	Intelligent Artefacts	£52	100 employees
CP/M Vector	Taylor Micro Systems	£490	
Durango F-85	Kesho Systems	£500	
Horizon	Claisse-Allen Computing	£500	250 employees
Ohio Scientific	Stratheden Ltd	£750	varies
Sharp MZ-80	Tridata Micros Ltd	£250	400 employees
Tandy TRS-80	A J Harding (Molimerx)	£120	
Tandy TRS-80	Chess Consultancies	£400	400 employees
Tandy TRS-80	FIBS	£429	
Tandy Model 2	P J Norris	£500	1,000 per disk
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
Z-80/8080	Solitaire	£500	200 employees
Zilog MCZ range	Microbits	£500	300 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	Informex Logic	£298	Employment agency system
Apple II/ITT	Informex Logic	£198	Medical records
Apple II/ITT	Informex Logic	£198	Hospital administration
Commodore 3000	Intext Datalog Ltd	£100	Hospital administration
Commodore 8096	Missing Link	£2,000	Personnel records
Compucorp	Verwood Systems	£250	
CP/M	MJN Consulting	£2,000	Integrated personnel records and payroll
CP/M	Median-Tec Ltd	£1,500	Employment agency system
CP/M North Star	Micromedia	£595	Personnel records
CP/M Vector	Taylor Microsystems	£500	Piece work
Superbrain	Micro-Pension	£950	Pensions administration
Z-80/8080	Intereurope	£500	Personnel records

Property Management

Machine type	Supplier name	Price	Capacity
Apple II/ITT	Cyderpress Ltd	£650	
Apple II/ITT	Informex London Ltd	£298	300 entries
Apple II/ITT	Cyderpress Ltd	£650	500 properties
Apple II/ITT	Algobel Computers Ltd	£650	400 properties
Commodore 3032/8	Compsoft Ltd	£190	13,000
CP/M	Compsoft Ltd	£400	27,000
CP/M	Algobel Computers Ltd	£650	2,000 trans
CP/M	Salmon Microcomputing	£900	
Z-80/8080	Graham Dorian Software	£325	varies

Purchase Ledger

Machine Type	Supplier name	Price	Capacity
Apple II	Logic Computers	£630	800 a/c, 1,500 trans
Apple III	Logic Computers	£630	2,000 a/c, 5,000 trans
Apple II and III	Systematics	£250	
Apple II	Dataforce (U.K.) Ltd	£315	200 a/c, 1,000 trans
Apple II	Logic Box Ltd	£490	400 a/c, 1,000 trans
Apple II	Deltic Computing Ltd	£250	1,000 trans
Apple II	Computech Systems	£295	500 a/c, 1,600 trans
Apple II	Southern Computer Systems	£750	variable
Apple II/ITT	Systematics International Ltd		
Apple II/ITT	Padmede Computer Services	£300	900 a/c, 4,500 trans/ disc
Apple	Style Systems Ltd	£250	650 a/c, 1,750 trans
Apple II/ITT	Guestel Ltd	£300	200 a/c
Commodore	Comsoft Associates	£350	1,000 a/c
Commodore 3000/8	CSM Ltd	£550	1,000-2,000 a/c 6,000-10,000 trans
Commodore 3000/8	Anagram Systems	£399	30200-2,000 a/c 800-16,000 trans
Commodore 3032	ACT (Petsoft) Ltd	£120	200 a/c 700 trans
Commodore 3032	Compfer Ltd	£300	1,000 trans 7,000 entries
Commodore 8000	Commodore BM Ltd	£300	600 a/c 4,500 trans
Compucorp	Verwood Systems	£250	
CP/M	Sail	£395	varies
CP/M	Bonsai	£475	
CP/M	Bromley	£400	
CP/M	P R Daly	£350	
CP/M	Vauntberry	£950	
CP/M	Typestyle	£250	
CP/M	Johnson	£200	
CP/M	DT Systems	£750	
CP/M	CPL Ltd	£300	
CP/M	Goldcrest	£300	

CP/M	Wisbech Computer Services	£300	
CP/M	Bytesoft	£400	varies
CP/M	Business Solutions Ltd	£390	varies
CP/M	Median-Tec Ltd	£500	500 a/c 5,000 trans
CP/M	Ludhouse Ltd	£500	500 a/c 5,000 trans
CP/M	Great Northern CS Ltd	£315	500 a/c
CP/M	Structured Systems Ltd	£460	varies
CP/M	Selven Ltd	£600	1,000 a/c 2,000 trans
CP/M	Salmon Microcomputing	£350	1,000 a/c 24,000 trans
CP/M	Map Computer Systems Ltd	£400	400-96,000 a/c
CP/M	Microbits	£500	varies
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	Interface Computer Services	£350	varies
CP/M	Selven Systems	£600	500 suppliers 5,000 trans
CP/M North Star	Benchmark CS Ltd	£250	100 a/c 300 trans
Durango F-85	Kesho Systems	£500	
Exidy Sorcerer	Basic Computing	£125	See also Micropute
Horizon	Claisse Allen Computing	£500	800 a/c 2,000 trans
Ohio Scientific	Stratheden Ltd	£500	varies
Tandy Models 1&2	Chess Consultancies Ltd	£250	300-500 a/c
Tandy TRS-80	FIBS	£750	part of integrated system
Tandy TRS-80	Tridata Micros Ltd	£225	125 a/c 1,000 trans
Zilog MCZ range	Microbits Ltd	£500	400 suppliers 1,000 trans
Z-80	Liveport Ltd		
Z80-8080	Solitaire	£500	200 by 26 a/c

Sales Ledger

Machine type	Supplier name	Price	Capacity
Apple II		£630	600 a/c, 1,500 trans
Apple III	Logic Computers	£630	2,000 a/c, 5,000 trans
Apple II and III	Systematics	£250	
Apple II	Computech Systems	£296	500 a/c 1,600 trans
Apple II	Dataforce (U.K.) Ltd	£315	200 a/c 1,000 trans
Apple II	Logic Box Ltd	£490	300 a/c 1,300 trans
Apple II	Deltic Computing Ltd	£250	1,000 a/c
Apple II/ITT	Padmede Computer Services	£300	900 a/c 4,500 trans/ disc
Apple II/ITT	Guestel Ltd	£300	200 a/c
Apple II/ITT	Systematics International Ltd		
Apple II	Southern Computer Systems	£750	
Apple	Style Systems Ltd	£250	650 a/c 2,500 trans
Commodore	Comsoft Associates	£350	
Commodore 3000/8	Anagram Systems	£299	250-2,000 a/c 500-10,000 trans
Commodore 3000/8	CSM Ltd	£550 and £650	1,000-2,000 a/c 6,000-10,000 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
Compucorp	Verwood Systems	£250	
CP/M	Map	£400	
CP/M	Bonsai	£475	
CP/M	Bromley	£400	
CP/M	P R Daly	£350	
CP/M	Vauntberry	£950	
CP/M	Typestyle	£250	
CP/M	Johnson	£200	
CP/M	Wisbech Computer Services	£300	
CP/M	Goldcrest	£300	
CP/M	CPL Ltd	£300	with invoices
CP/M	Business Solutions	£425	
CP/M	Bytesoft	£400	varies
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	Salmon Microcomputing	£350	1,000 a/c 24,000 trans
CP/M	Selven Systems	£600	500 a/c 5,000 trans
CP/M	Map Computer Systems Ltd	£300	400-96,000 a/c
CP/M	Daman Computer Services	£900	1,500 a/c 500 trans
CP/M	P R Daly & Co Ltd	£350	
CP/M	Interface Computer Services	£350	varies
CP/M North Star			
Durango F-85	Benchmark CS Ltd	£250	200 a/c 500 trans
Exidy Sorcerer	Kesho Systems	£500	
Horizon	Basic Computing	£125	See also Micropute
Tandy Models 1 & 2	Claisse-Allen Computing	£500	800 a/c 2,000 trans
Tandy TRS-80	Chess Consultancies Ltd	£250	300 a/c
Tecs	Tridata Micros Ltd	£225	175 a/c 1,350 trans
Z-80	Jar Software Systems	£550	500 a/c
	Liveport Ltd		

Stock Systems

Machine type	Supplier name	Price	Capacity
Apple II and III	Systematics	£250	
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	Southern Computer Systems	£1,000	
Apple	Style Systems Ltd	£250	900-80,000 items
Apple II/ITT	Microdigital Ltd	£225	625 items
Apple II/ITT	Vlasak Electronics Ltd	£285	500 items
Apple II/ITT	Systematics International Ltd	£500	200-2,500 items
Apple II/ITT	Guestel Ltd	£300	
Apple II/ITT	Padmede Computer Services	£300	2,000 postings
Apple II/ITT	The Software House	£80	800 items
Commodore	Comsoft Associates	£350	
Commodore 3000	Intex Datalog Ltd	£195	2,400-3,700 items
Commodore 3000/8	Commodore BM (U.K.) Ltd		600-2,000 items
Commodore 3000/8	Rockliff Brothers Ltd	£275	3,400-10,000 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 Microsoft Ltd	£75	1,200-5,900 items
Commodore 3032	Anagram System	£320	500-600 items 255 a/c
Commodore 3032	L & J Computers	£60	500 items
Commodore 3032	Bristol Software Factory	£300	2,300 items
Commodore 3032	Stage One Computers	£100 and	600-650 items
Commodore 3032	SMG Microcomputers	£395-£495	2,450-7,000 items
Commodore 3032	Compfer Ltd	£350	200 lines 20 bars
Commodore 3032/8	Compsoft Ltd	£190	13,000
Compucorp	Verwood Systems	£250	
CP/M	Bromley	£400	
CP/M	Sail	£250	
CP/M	P R Daly	£200	
CP/M	Typestyle	£250	
CP/M	Johnson	£200	
CP/M	CPL Ltd	£300	
CP/M	Goldcrest	£300	
CP/M	Wisbech	£300	
CP/M	Bytesoft	£700	2,000-8,000 lines
CP/M	Compsoft Ltd	£400	27,000

CP/M	Microtek Computer Services	£750	
CP/M	P R Daly & Co Ltd	£350	
CP/M	Great Northern CS Ltd	£375	1,500
CP/M	Haywood Associates Ltd	£350	
CP/M	Median-Tec Ltd	£500-£800	1,000 items
CP/M	Microbits	£500	varies
CP/M	Graffcom Systems Ltd	£350	350 records/disc
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	Interface Computer Services	£350	varies
CP/M	Selven Systems	£600	
CP/M Cromenco	Micromedia Systems	£1,000	
CP/M Horizon	Microtek Computer Services	£500-£1,000	varies
CP/M North Star	Benchmark CS Ltd	£450	350 items 275 trans
CP/M Vector	Taylor Micro Systems	£995	4,000 items/Mbyte
North Star DOS	Intelligent Artifacts Ltd	£195	
Exidy Sorcerer	Basic Computing	£125	
Tandy TRS-80	Chess Consultancies	£995	
Tandy TRS-80	A J 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	FIBS	£750	
Tandy TRS-80	Micro Gems	£150	1,000 items
Tandy TRS-80	Tridata Micros Ltd	£200-£375	630 items/disc
Tandy TRS-80	Microgems Software	£150	1,000-2,000 items
Tecs	Jar Software Services	£800	10,000 items 5,000 orders
Tecs	Jar Software Services	£850	1,000 items 300 a/c
Zilog MCZ range	Microbits	£500	2,300 items
Z-80/8080	Graham Dorian Software	£325	varies
Z-80/8080	Rogis Systems Ltd	£600	900-3,500 items
Z-80 MCZ	Software Architects Ltd	£600	varies
Z-80	Liveport Ltd		

Word Processing

Machine type	Supplier name	Price	Comments
ACT Sirius	ACT Microsoft	£295	WordStar
ACT Sirius	ACT Microsoft	£325	Select
Apple II	Rocon	£170	Zardax
Apple II	Dataforce (U.K.)Ltd	£190	
Apple II	SBD Consultants Ltd	£60	
Apple II	Keen Computers	£275	
Apple II/ITT	Systematics International Ltd	£75	
Apple II/ITT	Algobel Computers Ltd	£75	
Apple II/ITT	Personal Computers Ltd	£225-£300	
Commodore 3000	Stage One Computers Ltd	£125	
Commodore 3032	Dataview Ltd	£159	
Commodore 3032	ACT (Petsoft) Ltd	£325	
Compucorp	Verwood Systems	£500	
CP/M	Wisbech Computer Services	£245	
CP/M	Interface Computer Services	£200	
CP/M	Microbits	£230	
CP/M North Star	Intelligent Artifacts	£250	
CP/M Vector	Taylor	£395	
North Star ('c')	Intelligent Artifacts	£250	
Z-80 Superbrain	Alan Pearman Ltd	£225	

Miscellaneous

Machine type	Supplier name	Price	Application
Apple II	Wida	£120	German language-learning package
Apple	Attar	£280	Dental lab package

Apple II and III	Northern Computers	£290-£690	Price discounting
Apple II	Vlasak Electronics	£30	Petrol pump losses
Apple II	Humac Ltd	£1,000	Auctioneer's package
Apple II	Humac Ltd	£600	Invoicing sales — timber
Apple II	Humac Ltd		Microfiche records
Apple II	Keen Computers	£499	Inhouse teletext
Apple II	Keen Computers	£499	Graphics
Apple	Style Systems Ltd	£750	Retail warehouse management
Apple II/ITT	Informex Logic	£198	Insurance records
Apple II/ITT	Informex Logic	£198	Time records — solicitors
Apple II/ITT	Diskwise	£198	TV rental management system
Apple II/ITT	Cyderpress	£650	Auction system
Apple II/ITT	CPR Systems Ltd	£960	Insurance brokers system
Apple II/ITT	Personal Computers	£195	Operational research
Apple II/ITT	Personal Computers	£100	Time series analysis
Apple II/ITT	Padmede Computers	£500	Insurance brokers system
BBC Model B	Typestyle	£750	Retail newsagents
Commodore	Comsoft Associates	£450	Domestic central-heating estimates
Commodore Vic	The Computer Room	£250	Newsagents
Commodore 3000	Anagram Systems	£850	Media control system
Commodore 3000	Anagram Systems	£800	Slot machine monitor
Commodore 3000	The Alphabet Company	£350	Newsagent suite
Commodore 3032	Microland	£175	Printers quote 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	S A Systems	£550	Farming — office systems
Commodore 3032	L & J Computers	£420	Machine hire
Commodore 3032	Mandata Ltd	£1,000	Insurance brokers
Commodore 8000	Peach Data Services	£350	Library retrieval system
Commodore 8000	Peach Data Services	£550	Footware industry sales reporting
Commodore 8000	Peach Data Services	£995	Clients home accounting
Commodore 8000	Stage One	£800	General accounting package
Commodore 8000	Stage One	£330	Petaid/Wordcraft/Visi-Calc link
CP/M	Orchard	£200	Manufacturing shortage control
CP/M	Orchard	£150	Shortage progress chasing
CP/M	The Computer Room	£980	Newsagents accounts and distribution
CP/M	Core	£1,500	Advertisers accounts system
CP/M	Core	£1,500	Insurance brokers accounts system
CP/M	Core	£350	Recruitment agency system
CP/M	Bromley	£2,000	Bookmakers system
CP/M	Bromley	£1,000	Industrial cleaners system
CP/M	Bromley	£2,000	Investment brokers system
CP/M	Bromley	£400	Property management
CP/M	P R Daly	£1,050	Contract costing
CP/M	P R Daly	£2,000	Integrated solicitors accounting

CP/M	P R Daly	£500	Time recording
CP/M	Vauntberry	£1,950	Production control
CP/M	Vauntberry	£2,200	Requirements planning, bill of materials, stock control
CP/M	Vauntberry	£1,000	Double-glazing design and costing
CP/M	Johnson	£200	Insurance brokers
CP/M	Johnson	£200	Prestel software
CP/M	Basys	£1,000	Estate agents
CP/M	Benchmark Ltd	£350	Time recording
CP/M	Bytesoft	£850	Work in progress
CP/M	Bytesoft	£150	Perpetual inventory
CP/M	Bytesoft	£850	Bill of materials
CP/M	Byesoft	£200	Kit control
CP/M	Microtek	£500	Garage system
CP/M	Horizon Software	£1,000	Integrated business system
CP/M	Horizon Software	£400	Costing systems
CP/M	Research Resources	£240	Statistical analysis
CP/M	Sail	£1,000	Jewellers integrated system
CP/M	Sail	£1,850	Publishers integrated stock and accounts
CP/M	Sail	£600	Retail stock
CP/M	Salmon Microcomputer	£150	Appointments planner
CP/M	Selven Systems	£400	Nominal ledger
CP/M	Map Computer Systems	£450	Time recording
CP/M	Map Computing Systems	£760	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	Goldcrest	£300	Nominal ledger
CP/M North Star	Micromedia	£195	Vehicle maintenance
CP/M	Taylor Microsystems	£800	Bill of materials
Ohio Scientific	Stratheden Ltd	£300	Statistics package
Ohio Scientific	Stratheden Ltd		Insurance brokers system
Ohio Scientific	Stratheden Ltd		Hospital package
North Star DOS	Intelligent Artifacts	£52	Parts list management and ordering
North Star Horizon	Wisbech Computer Services	£750	Double-glazing manufacturer
North Star Horizon	Wisbech Computer Services	£750	Double-glazing costs
North Star Horizon	Wisbech Computer Services	£450	Time recording
SuperBrain	Alan Pearman Ltd	£190	Statistics package
SuperBrain	Alan Pearman Ltd	£105	APL utility functions
SuperBrain	Alan Pearman Ltd	£225	APL Text editor/ processor
SuperBrain	Alan Pearman Ltd	£125	Micro-mainframe communications
SuperBrain	Alan Pearman Ltd	£490	Modelling/simulation
SuperBrain	Alan Pearman Ltd	£325	Actuarial calculations
SuperBrain	Alan Pearman Ltd	£75	Password security system
SuperBrain	Alan Pearman Ltd	£225	Report formatting
SuperBrain	Alan Pearman Ltd	£195	CP/M networks
SuperBrain	Alan Pearman Ltd	£380	Hard graphics copy
Tandy TRS-80	Typestyle	£1,500	Wholesale newsagent
Tandy TRS-80	Chess Consultancies	£995	Haulage administration
Tandy TRS-80	Cleartone ADP	£300	WIP and invoicing system
Tandy TRS-80	Cleartone ADP	£500	Patient and drugs records
Tandy TRS-80	P J Norris	£1,000	Comprehensive sales and purchase

Tandy TRS-80	Quickmet	£785	Integrated accounts package
Zilog MCZ range	Microbits	£1,000	Insurance brokers system
Zilog MCZ range	Microbits	£1,000	Production control
Zilog MCZ range	Microbits	£1,000	Bill of materials
Z-80/8080	Intereurope	£500	Conference organiser

Alphabetical list of suppliers

Supplier	Address	Sales
3-Line Computing 0482-445496	36 Clough Road Hull HU5 1QL	Tim Hill
ACT Microsoft Ltd 021-454-8585	ACT House 111 Hagley Road Edgbaston Birmingham B16 8LB	Matthew Wauchope
Aerco-Gemsoft 04862-22881	27 Chobham Road Woking, Surrey	
A J Harding (Molimerx) 0424-22039	28 Collington Avenue Bexhill-on-Sea, East Sussex	John Harding
Alan Pearman Ltd 0244-46024/21084	Maple House, Mortlake Crescent Chester CH3 5UR	
Algobel Computers Ltd 021-233-2407	33 Cornwall Buildings Newhall Street Birmingham B3 3QR	Amanda Anders
Amplicon M S Ltd 0273-608331	Richmond Road Brighton, Sussex BN1 6JA	Peter Wood
Anagram Systems 0403-50854	60a Queens Street Horsham, West Sussex RH13 5AD	
Analog Electronics 0203-417761	47 Ridgeway Avenue Coventry	
Atlanta Data Systems Ltd 01-739-5889	350/356 Old Street London EC1V 9DT	Frank Laughton
Attar Computers Ltd Leigh 671491	211 St Helens Road Leigh, Lancashire WN7 3BR	David Isherwood
Basic Computing 0535-65094	Oakworth Road Keighley, West Yorkshire BD22 7LA	Mike Collier
Basys Ltd 01-953-7303	191-195 Shenley Road Borehamwood, Hertfordshire WD6 1AW	Cliff Gudgeon
Benchmark CS Ltd 0726-61000	7-8 Aylmer Square St Austell, Cornwall PL25 5LL	John Fisher
Bonsai Ltd 01-580-0902	112-116 New Oxford Street London WC1A 1HJ	Michael Kraftman
Bristol Software Factory 0272-277135	Kingsons House, Grove Avenue Queens Square, Bristol BS1 4QY	W J Kyle-Price
Bromley Computer Consultancy Ltd 01-464-8080	244A High Street Bromley, Kent BR1 1PQ	Anthony Burridge
Business Solutions Ltd 01-554-5985/0582	1 Park Avenue, Ilford Essex IG1 4LU	S Page
Bytesoft Systems Limited 0533-531441	16 New Street Leicester LE1 5NR	David Biggins
Chess Consultancies Ltd 061-832-6792	Progress House 31-33 Mount Street, Salford Manchester M3	D G West
Cleartone ADP 0495-244555	Prince of Wales Industrial Estate Abercarn, Gwent NP1 5RJ	C J Holbrook
Clenlo Computing Services 01-653-6028	15 South View Court The Woodlands, Beulah Hill London SE19	
Commodore BM (U.K.) Ltd Slough 74111	818 Leigh Road Slough Industrial Estate Slough, Berkshire	A Gould

Compfer Ltd 0772-57684	Preston Computer Centre 6 Victoria Buildings, Fishergate Preston, Lancashire	
Compsoft Ltd 0483-39665/505918	Great Tangley, Manor Farm Wonersh, Guildford, Surrey	
Comput-A-Crop 01-771-0867	32 Whitworth Road London SE25 6XH	Jenny Wilson
Computech Systems 01-794-0202	168 Finchley Road London NW3	Laurence Payne
Comsoft Associates 021-449-9151	..C-2D Wake Green Road Moseley, Birmingham B13 9EZ	E Chisman
Core International Ltd 0785-42611	92 Wolverton Road Stafford, Staffs ST17 4AH	D Fisher
CPL (CwmniPeirianneg Llyn Ltd) (0758) 3035	Liverpool House, Pwllheli Gwynedd LL53 5DE	L Roberts
CPR Systems Ltd 04492-5488	37-39 Ipswich Street Stowmarket, Suffolk	Roger Taylor
CPS (Data Systems) Ltd 021-707-3866	Arden House, 1102 Warwick Road Acocks Green Birmingham B27 6BH	
CSC (Northern Ltd) (0274) 391076	"Ash Court", 2 Ash Grove Great Horton Road Bradford BD7 1BN	Stewart Smith
CSM Ltd 021-382-4171	Refuge Assurance House Sutton New Road, Birmingham	Peter Mart
Cyderpress Ltd 0491-37769	2 Church Lane Wallingford, Oxfordshire	C Murphy
Daman Computer Services 061-793-7015	Kennedy House, Rutland Street Swinton, Manchester M27 2AU	L J Watson
P R Daly & Co Ltd 09274-29815	Oaklands Gate, Northwood Middlesex HA6 3AA	Peter Daly
Deltic Computing Ltd Basingstoke 59715	2nd Floor, May Place House May Place, Basingstoke, Hampshire	
Diskdean Ltd 01-242-7394	23 Bedford Row London WC1R 4EB	
Diskwise Ltd 05793-3780	25 Fore Street Callington, Cornwall	R Cornforth
D T Systems (0603) 27833	32 Surrey Street Norwich NR1 3NY	
Equinox Computer Systems 01-739-2387/9	Kleeman House, 16 Anning Street New Inn Yard, London EC2	M Kusmirak
Fully Integrated Business Systems Ltd 021-328-7920	18 Hanover Drive Gravelly Industrial Park Tyburn Road, Birmingham B24 8TE	John Metcalf
Gilmorehill Software Ltd 041-332-2013	26 Park Circus Glasgow G3 6AP	H Sigerson
Goldcrest Computer Services Newport Pagnell 613188/611988	67 Union Street, Newport Pagnell Buckinghamshire	C Hartnett
Graffcom Systems Ltd	52 Shaftesbury Avenue London	Barbara Castedine
Graham Dorian Software 01-379-7931	c/o Lifeboat Associates 32 Neal Street, London WC2H 9PS	
Great Northern Computer Services 0532-589980	16 Town Street Horsforth, Leeds LS18 4RJ	
Guestel Ltd 0225-65379	Refuge House 2-4 Henry Street, Bath	Allan Timpany
G W Computers Ltd 01-636-8210	55 Bedford Court Mansions Bedford Avenue, London WC1	Tony Winter
Hayden Young Ltd 01-387-4377	PO Box 117, 141 Euston Road London NW1 2AY	
Haywood Associates Ltd 01-428-9831	11 Station Approach Northwood, Middlesex	
HB Computers Ltd 0536-520910	22 Newland Street Kettering, Northamptonshire	Johnny Johnson

MICRO ADS

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VIDEO GENIE 16K extra keys VU meter and sound. Software assembler disassembler games. 6 months sub on magazine. As new in box. £275.01 946 1429.

Hevacomp Ltd Sheffield (0742) 52752	25 Byron Road Sheffield S7	A J Baxter
Horizon Software Ltd 0533-556550	Regent House, 16 West Walk Leicester LE1 7NG	
Humac Ltd Romford 752005	168-186 South Street Romford, Essex RM1 1TR	John Oatham
IBIS Business Information Systems Ltd 061-881-0585	Pargate House, Cross Road Chorlton-cum-Hardy Manchester M21 1DH	F Brown
Informex London Ltd 01-318-4213/7	8-12 Lee High Road London SE13 5LQ	
Instar Business Systems 01-680-5330	61 High Street Croydon, Surrey	
Intelligent Artefacts 0223-207689	Cambridge Road Orwell, Hertfordshire	
Intereurope SD Ltd 0734-789183	19-21 Denmark Street Wokingham, Berkshire RG11 2QX	
Interface Computer Services Ltd 0376-518112	First Floor, 17 Guithavon Street Witham, Essex	
Ismail CAD 01-802-0019	47a St Johns Road, Tottenham London N15 6QS	O Ismail
James C Steedman 0903-814923	18 Manor Road, Upper Beeding Steyning, Sussex	
Johnson Microcomputers Camberley (0276) 20446	Johnson House 75-79 Park Street, Camberley Surrey GU15 3XE	R V Johnson
Keen Computers 0602-583254	5b The Poultry Nottingham	Bob Ellis
Kesho Systems 041-226-4236	72 Waterloo Street Glasgow G2	Angus Nial
KGB Micros Ltd Slough (75) 38319	14 Windsor Road Slough, Berkshire SL1 2EJ	Sandy Saunderson
L & J Computers 01-204-7525	3 Crundale Avenue Kingsbury, London NW9 9PJ	Jack Goodman
Landsler Software 01-399-2476/7	29a Tolworth Park Road Surbiton, Surrey KT6 7RL	E Landsler
Liveport Ltd 0736-798157	The Ivory Works St Ives, Cornwall	
Logic Computers 01-222-1122	31 Palmer Street London SW1	
Logma Systems Design Bolton 389854	2-10 Bradshawgate Bolton, Lancashire	
Ludhouse Ltd 01-679-4321	2-6 Marian Road London SW16 5HR	M Ward
Map Computer Systems Ltd 061-624-5662	111 Union Street Oldham, Lancashire OL1 1RU	G Rigby
Median-Tec 0734-664969	120 Oxford Road Reading, Berkshire	
Metrotech 0895-58111	Waterloo Road Uxbridge, Middlesex UB8 2YW	
Micro Computation 01-882-5104	8 Station Parade Southgate, London N14	
Micro Focus	c/o Lifeboat Associates 32 Neal Street, London WC2	
Microact Ltd 021-454-8585	Act House, 111 Hagley Road, Edgbaston Birmingham B16 8LB	
Microbits 0734-792021	Barford House, Shute End Wokingham Berkshire RG11 1BJ	
Microcomp 0703-21397	125 High Street Southampton SO1 0AA	R A Adey
Microcomputer Applications 0734-470425	11 Riverside Court Caversham, Reading Berkshire	
Microcomputer BM 01-981-3993	4 Morgan Street London E3 5AB	
Microdigital Ltd 051-227-2535	25 Brunswick Street Liverpool L2 0BJ	Graham Jones

Microgems Software 0602-275559	32 Buckingham Avenue Hucknall, Nottinghamshire	
Microland 0723-70715	17 Victoria Road Scarborough, North Yorkshire	
Micromedia Systems Newport 59276/7	Seymour House 14-16 Chepstow Road Newport, Gwent	
Micro-Pension 01-394-2049	24 High Street Ewell, Surrey	Roger Millard
Micropute 0625-612818	Communique Place 9 Prestbury Place Macclesfield, Cheshire	
Microsense 0442-41191/48151	Finway Road Hemel Hempstead Hertfordshire	
Microtek 0689-26803	50 Chislehurst Road Orpington, Kent	
Minicomputer CS Ltd 0494-448686	Pilot Trading Estate 163 West Wycombe Road High Wycombe Buckinghamshire	
Missing Link 01-349-4711	Abacus House 53-55 Ballards Lane London N3	
MJN Consulting Ltd 01-941-3327	105 Walton Road East Molesey, Surrey KT8 0DR	Michael Norman
MMS Computer Systems 0234-40601	26 Mill Street Bedford	
Northern Computers Warrington (0925) 601683	Churchfield Road Frodsham, Cheshire WA6 6RD	Chris Piff
Omicron Management Software Ltd 01-636-6575	Mayfair House 39 Great Portland Street London W1N 5DG	
Orchard Microsystems Ltd 0455 209126	PO Box 12, Lutterworth Leicestershire LE17 5TA	R Tattersall
Padmede Computer Services 025-671-2434	112/116 High Street Odiham, Basingstoke Hampshire	John Packwood
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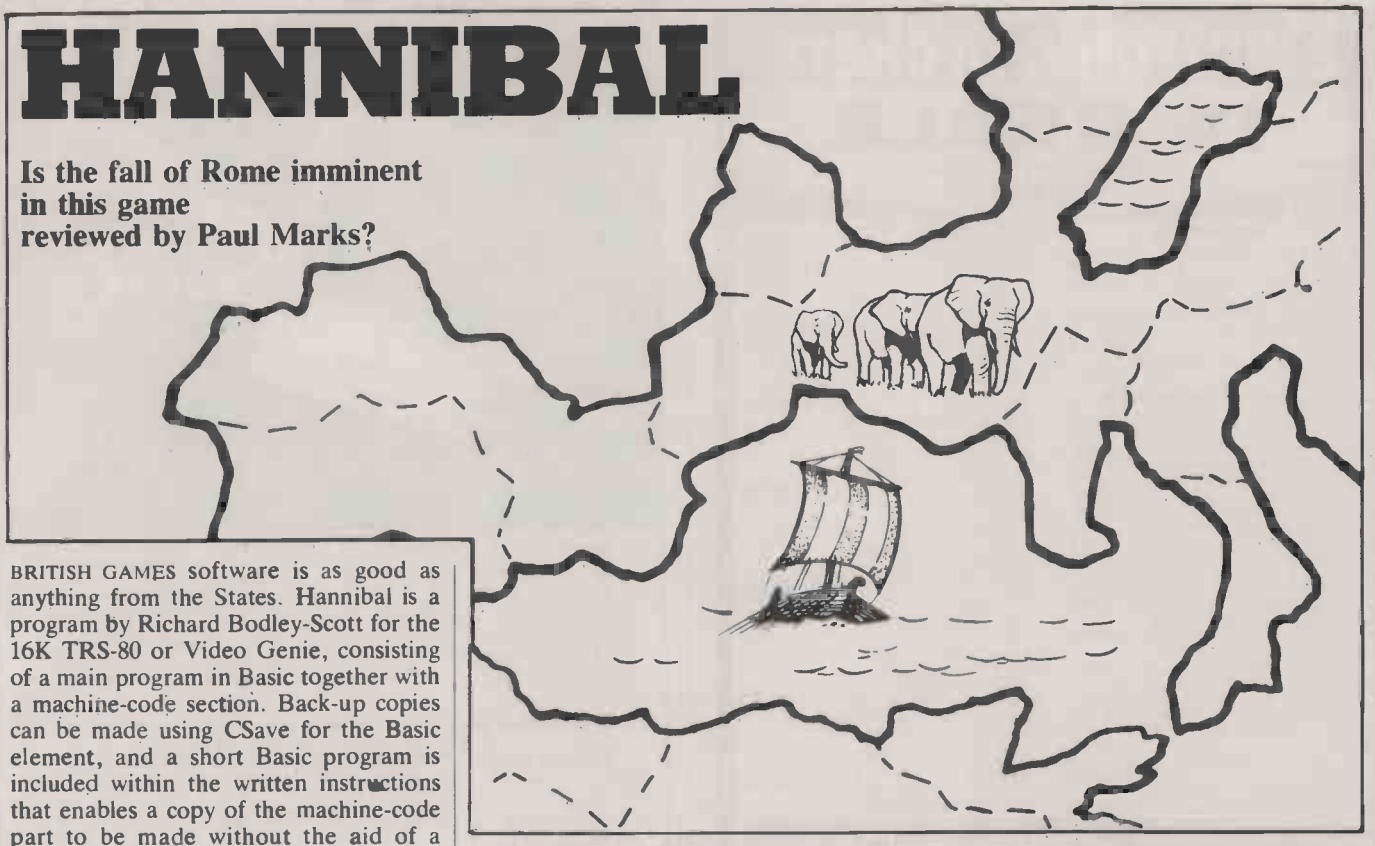
HANNIBAL

Is the fall of Rome imminent in this game reviewed by Paul Marks?



BRITISH GAMES software is as good as anything from the States. Hannibal is a program by Richard Bodley-Scott for the 16K TRS-80 or Video Genie, consisting of a main program in Basic together with a machine-code section. Back-up copies can be made using CSave for the Basic element, and a short Basic program is included within the written instructions that enables a copy of the machine-code part to be made without the aid of a specialist copying program.

The instructions consist of five pages of explanation plus two one-page appendices which list initial town ownerships and troop deployments. They are clear, and give the player a good idea of the scope of the game. They are slightly more detailed than is absolutely necessary but contrast superbly with the legalese of board-game rules.

The game is for two players, a Roman and a Carthaginian, though it also passes as a solo game for the purposes of working out tactics, etc. The two leaders join in conflict to achieve sole supremacy over the countries surrounding the Mediterranean. Victory occurs when either Rome or Carthage is captured by the opposing side, so a sudden victory is possible if one player can launch a sneak attack against the capital. In practice this is very difficult to achieve.

Machine-code maps

On running, a map of Italy is displayed together with a menu which lists maps of Africa, Sicily, and Spain, and Area Report, Treasury Report, Recruitment, Movement or End as options. The maps are held in the machine code and print virtually instantly, without disturbing any other information on screen.

The problem of having the map split into four is very largely overcome by the speed of printing. Major towns and sea areas are named and movement is from one such feature to an adjacent one. Ports are specified and are accessible to warships and naval transports. These play a very important role, allowing forces to be rapidly shifted from one front to another.

Area reports list the troops deployed in that area. Many towns start as neutrals but can usually be "persuaded" to join one side. Captured towns can be sacked or just occupied. Sacking yields immediate loot while occupying earns a regular tax income.

Treasury report gives your bank balance. Recruitment is restricted by cash to certain areas and troop types and levels. Eligible troop types are infantry, cavalry, elephants — good for scaring cavalry — warships, transport and artillery.

A player-turn generally moves through recces, recruiting and finally movement. There are three moves to a year and taxes are collected each winter. The order of play is Roman, Carthaginian, Combat, Carthaginian, Roman, Combat, etc.

Some form of combat is mandatory whenever there are opposing forces in the same area during the combat phase. This can be an open battle or a siege if one player is occupying a town.

Conclusions

- Hannibal is Richard Bodley-Scott's best effort to date.
- It is one of the very small number of programs that can claim to be both good games and historical simulations.
- **Ratings:**

Physical quality	Good
Subject complexity	High
Perceived complexity	Low
Play balance	Excellent
Realism	Good
Overall	Excellent

Combat results in varying losses which can be quite drastic for the loser. Motto — don't fight unless you are going to win. Sieges especially can be nasty if an assault is made rather than just waiting.

Economic war

You can achieve a victory by purely military means if you defeat the enemy in combat. In the longer term you can play an economic strategy by concentrating on the capture of towns, which increases your income and naturally restricts that of your opponent.

Like the Punic Wars the game can go on for a very long time until one side achieves a breakthrough. There are a couple of basic plans, but with numerous variations and with care you can quickly change your strategy. Fortunately you can store a half-played game, although it is fairly addictive and people will often play on to the small hours.

The program makes extensive use of Peeking and Poking and it is not easy to work out exactly what is going on. Given time, it could be done, but there is little point.

One area that could be improved covers the troop disposition information. Each player can obtain complete details of all areas. This could be altered to only allow reports on a limited number of areas, or perhaps only for areas in the vicinity of your own troops. PJ

The War Machine is a monthly magazine of reviews of games software from various manufacturers; it also covers game-assistance programs and programming theory. Write to Emjay, 17 Langbank Avenue, Rise Park, Nottingham NG5 5BU, England. Single issue £1.25 (overseas £1.75), annual subscription £13 (overseas £20).

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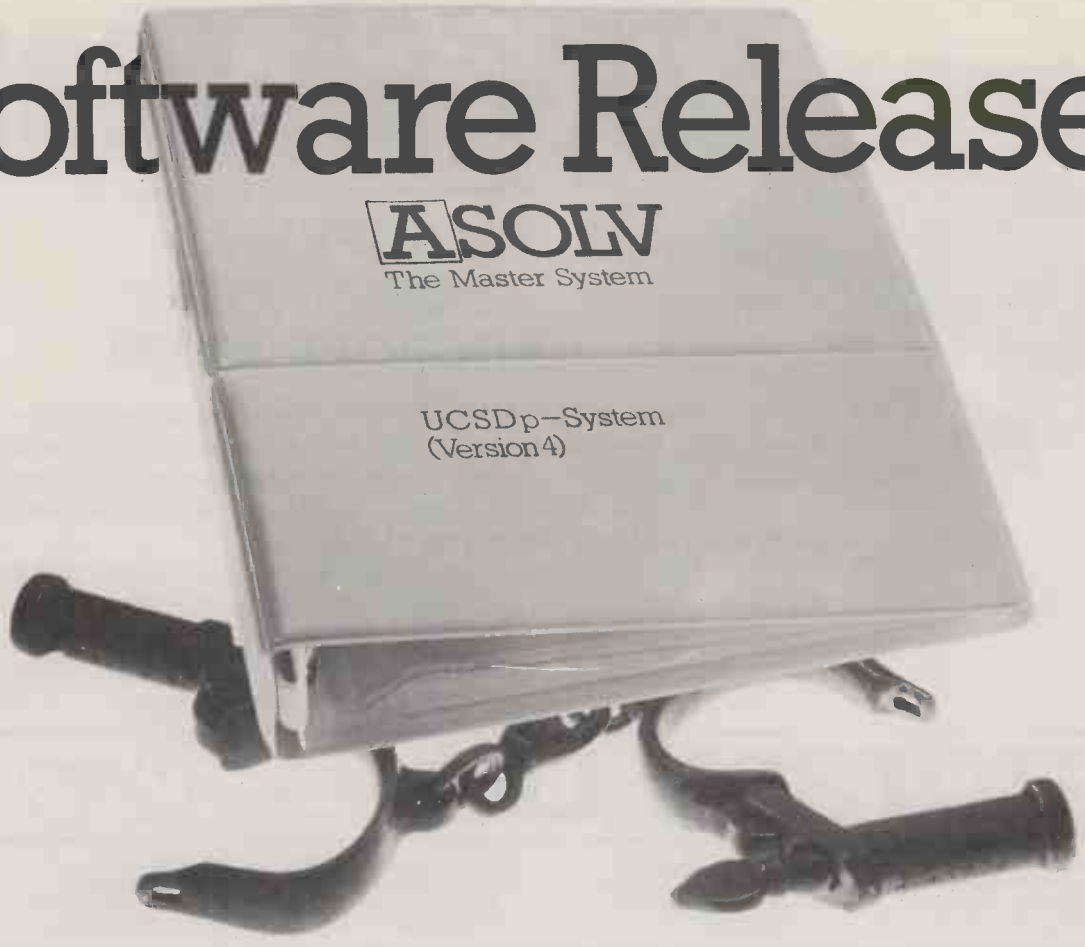

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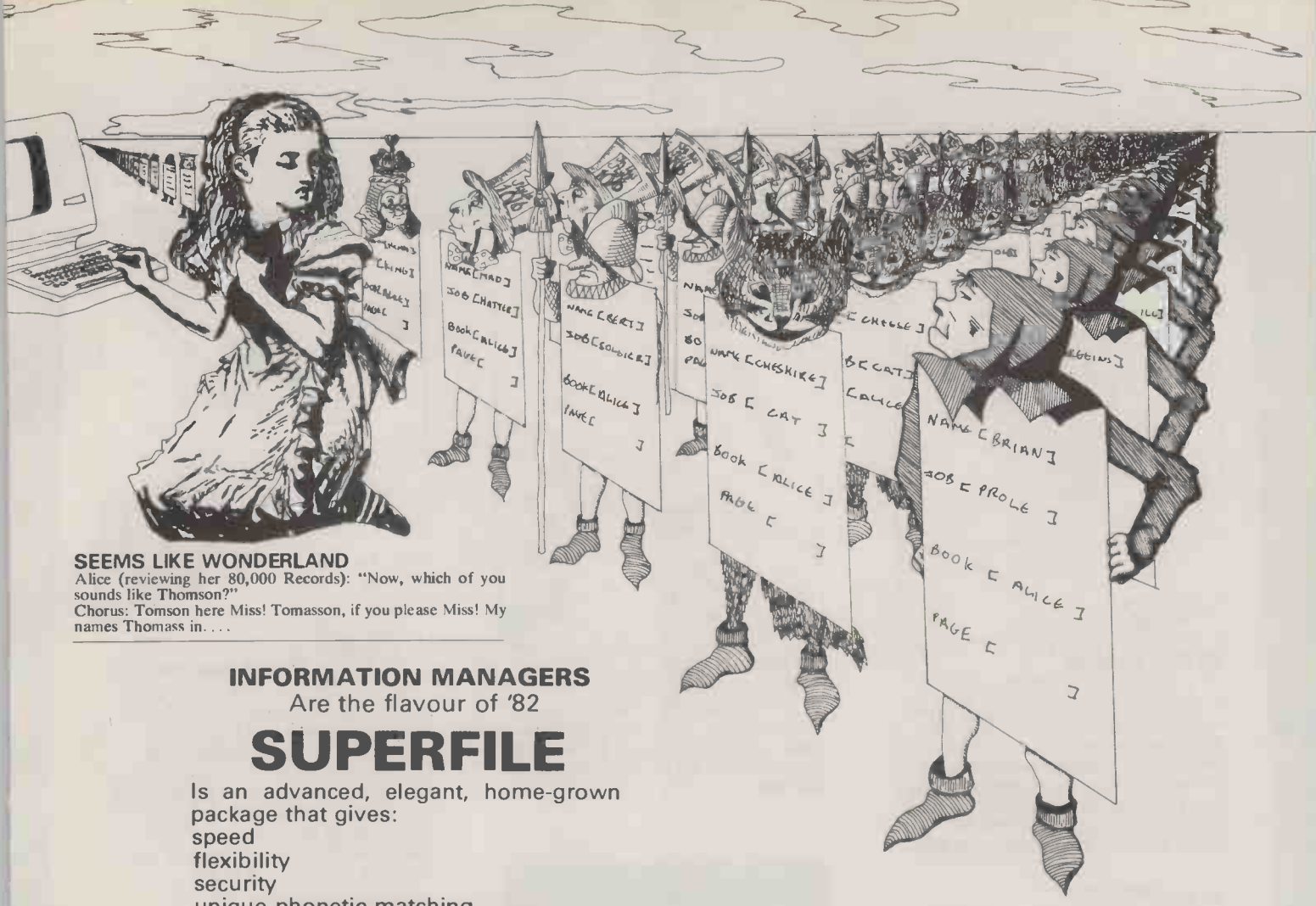

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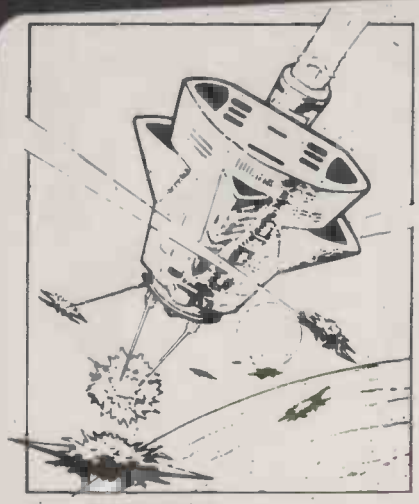

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QS - LOWER CASE

a b c d e f g h i j k l m n o p q r s t u v w x y z

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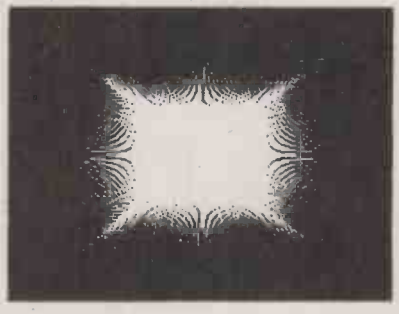

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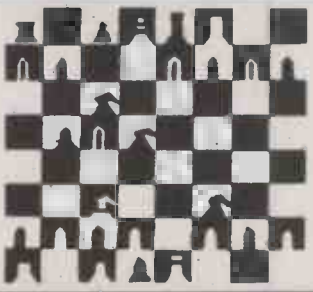

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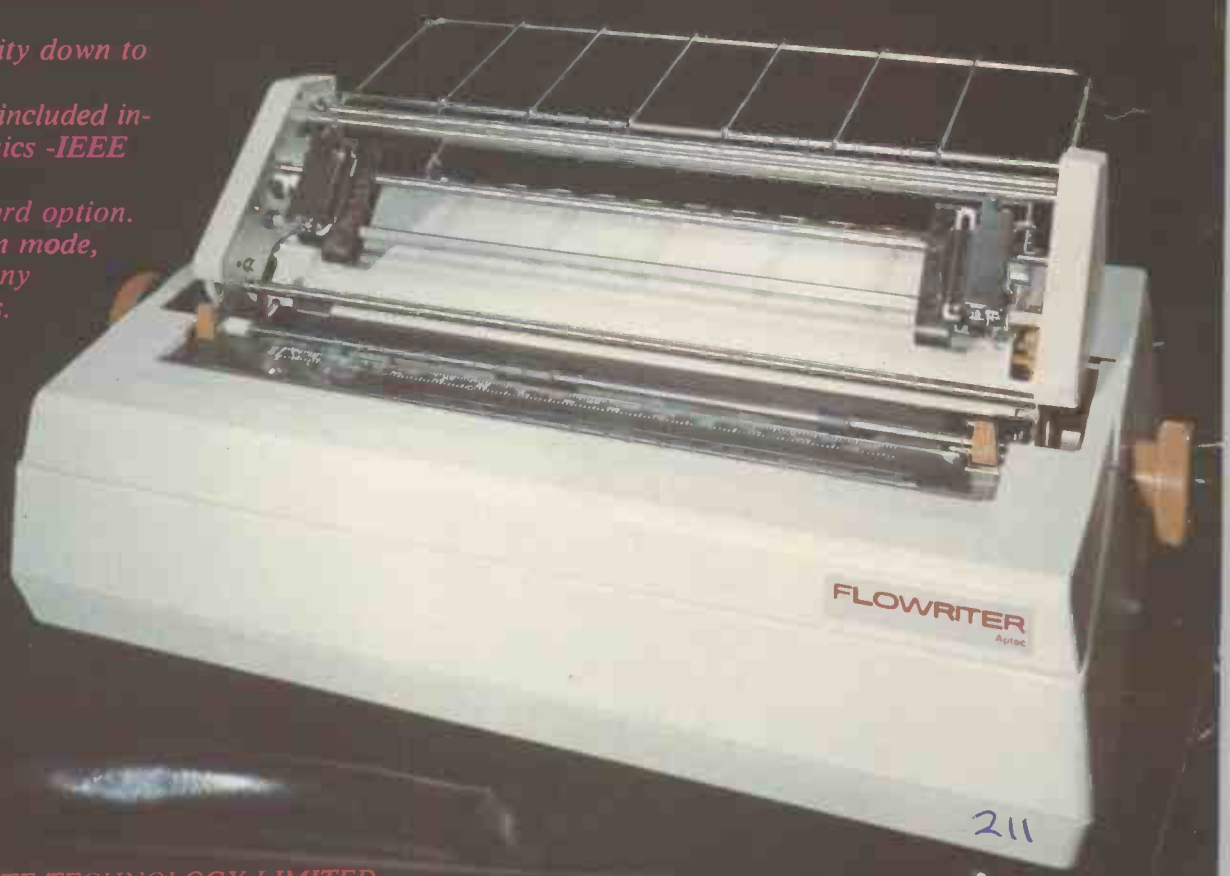

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