March 1982

Adventures — the greatest game
Giant mazes

Reviews:
16-bit Sirius
Sales Ledger

Satellite tracking

Programmers' aptitude test

Plus 15 pages of your software
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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Unimarker Printer, gives normal and double width characters as well as dot resolution graphics & Tractor feed. Parallel interface standard. £199.95.

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Price £69.95.

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- **NUMERIC Keypad (Ready built) £9**
- **4 x 4 matrix keyboard (red switch assembly) £4**
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Now available from stock at very competitive prices.

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- **25 way DIL socket £4.99**

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Connects directly to a colour TV set, 5K RAM expandable to 32K.

**CASSETER DECK for above including a free 8 program cassette £34.**

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The Smallest 80 Column Dot Matrix Printer.

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Circle No. 104
PRACTICAL COMPUTING March 1982
**OCTET 121™**

A multi-use communicating terminal and electronic typewriter

**OLIVETTI ET121**

**Telex-tape preparation**

The OCTET 121 is capable of punching man-readable 'headers'. The full 4K of memory can be text-edited prior to punching. The OCTET 121 will also read in tapes where fast telex tape handling is required. Multiple OCTETs to one tape punch station is also available.

**Micro-computer**

Use the OCTET 121 as a letter quality printer. A wide selection of Daisy Wheel typefaces are available. Terminal protocols to control the buffer are standard features.

**OCTET 121**

OCTET 121 communication is achieved by simple cable connection or through an acoustic modem. Ideal for remote offices who would like to use the main office telex facilities. Prepare text at the remote office and transmit to main office to cut tape for forward transmission.

**Mini/Mainframe computer**

The OCTET 121 is a true KSR with all standard control sequences for operating system use. Ideal for the user who requires 'letter quality' print at all times. Use as a standard typewriter or telex prep. when not in KSR mode.

OCTET 121 has many uses and can be installed very easily in your office. Call Duplex Communications Ltd. for more details. Telephone: Leire (0455) 209131 (Leicestershire)

*OCTET 121 is a trade mark of Duplex Communications*
Utilising the powerful 4MHz Z80A Microprocessor the GM811 CPU card can be used as either a stand alone controller or as the heart of a complex microcomputer system. Four ‘bytewide’ sockets allow great flexibility in the type and size of memory devices chosen. Input and output facilities include both programmable serial and parallel interfaces - RS232, 1200 baud CTS/RTS cassette interface, Z80 A/P, and an eight bit input port. In an expanded system the unique on-board RPIM monitor allows the creation of cassette or Eprom based programs or files which are upwards compatible with a disk based CP/M system.

Similar to the popular GM811 CPU card, the new GM813 CPU/RAM card has 64K of dynamic RAM replacing the ‘bytewide’ sockets. An extended addressing mode facilitates future memory expansion up to 2 megabytes. The RPIM 2 monitor retains full RPIM - CP/M compatibility.

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
- GM809 8K FDC card £125
- GM810 8K PS1 £69.50
- GM811 Z80 CPU card £125
- GM812 Z80 IVC card £140
- "Kit" £115

Software
- GM512 CPM 2.2 for Multiboard £90
- GM517 Gem-Zeppedisk tape £45
- GM518 Gem-Zeppedisk 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
- GM523 Gem Disassembler/ debugger tape £30
- GM524 Gem Disassembler/ debugger disk £30
- GM525 Comal-80 tape £10
- GM526 Comal-80 disk £100
- GM527 Comal-80 tape £100
- GM528 Comal-80 disk £200

GM801 GM810
5 amp PSU with an 8-slot Motherboard
3 amp PSU for the smaller system

Similarly, the GM811 CPU card, the new GM813 CPU/RAM card has 64K of dynamic RAM replacing the "bytewide" sockets. An extended addressing mode facilitates future memory expansion up to 2 megabytes. The RPIM 2 monitor retains full RPIM - CP/M compatibility.

With a 59 key full QWERTY layout, this ASCII encoded keyboard includes cursor control keys, caps lock, two key rollover and auto-repeat.

GM813 CPU/RAM

GM811 CPU

GM810 CPU

GM821 KEYBOARD

GM821 ASCII keyboard

GM524 Gem Dis assembles debugger tape £30
GM525 Gem Dis assembles debugger disk £30
GM526 Comal-80 tape £10
GM527 Comal-80 disk £100
GM528 Comal-80 disk £200

GM813 Z80 CPU/64K RAM card £125
GM814 Z80 CPU/64K RAM card with PS1 (305K) £125
GM815-1 Single drive disk unit with PS1 (700K) £325
GM815-2 Double drive disk unit with PS1 (700K) £550
GM816 Multi I/O board £140
AM519 Speech board £85
AM520 Light Pen £35
GM521 ASCII keyboard £57.50

GM524 Gem Dis assembles debugger tape £30
GM525 Gem Dis assembles debugger disk £30
GM526 Comal-80 tape £10
GM527 Comal-80 disk £100
GM528 Comal-80 disk £200

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GM524 Gem Dis assembles debugger tape £30
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GM528 Comal-80 disk £200
The GM812 Intelligent Video Controller card features an on-board Z80 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.

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.

GM 802 RAM

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

GM 812 IVC

The Arton Microelectronics speech board utilises the National Semiconductor Digitalker chip set. This gives a vocabulary of over 160 words and sub sounds. Output is from an on-board speaker.

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.

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 7979 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 3½" double density, double sided Pertec FD-256 drives. This gives a storage capacity of 350K per drive. Power for the drives is provided by an integral supply unit.

GM 808 EPROM

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

GM 803 EPROM BOARD

A new range of utilities, application software and languages.

GM 816 PIO BOARD

The Quantum Micro 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, A-D, opto-coupling and serial interface boards.

GM 809 FDC

The EVC IEEE 488 Controller card has been designed to fully implement all IEEE 485 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.

GM 814 IEEE 488

GM 816 IEEE 488

GM 815 DRIVE UNIT

A CPM 2.2 package is available with the GM 809 card and Pertec drives.

GM 808 PROGRAMMER

On screen editing, auto single double density selection and parallel or serial printers are supported. Running under CPM, it is a wide range of utilities, application software and languages.

FILL-UP WITH SOFTWARE

GM 803 EPROM BOARD

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

GM 808 PROGRAMMER

A CPM 2.2 package is available with the GM 809 card and Pertec drives.

GM 810 BOARD

GM 810 BOARD

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AUTO-EXCHANGE

All your RP/M software automatically transferred to CPM

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**NEW PRODUCTS**

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<td>8&quot; IBM FORMAT</td>
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<td>MICROSOFT INC.</td>
<td>$185</td>
<td>STRUCTURED SYSTEMS (All converted to UK Standard)</td>
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<td>BASIC-80 5.21</td>
<td>$205</td>
<td>SALES LEDGER</td>
<td>$350 £20</td>
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<td>BASIC Compiler 5.3</td>
<td>$260</td>
<td>PURCHASE LEDGER</td>
<td>$350 £20</td>
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<td>FORTRAN-80 3.43</td>
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<td>NOMINAL LEDGER</td>
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<td>COBOL-80 4.01</td>
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<td>$65</td>
<td>LETTERGET</td>
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<td>EDIT-80 2.02</td>
<td>$105</td>
<td>ANALYST (File Management Reporting System)</td>
<td>$125 £11</td>
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<td>MACRO-80 2.43</td>
<td>$110</td>
<td>NAD (Name and Address selection system)</td>
<td>$55 £11</td>
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<td>MULISP 2.10</td>
<td></td>
<td>QSORT</td>
<td>$55 £11</td>
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<tr>
<td>MUMATH 2.10</td>
<td>$130</td>
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### MICROTECH EXPORTS

<table>
<thead>
<tr>
<th>Software</th>
<th>Manual</th>
<th>Software</th>
<th>Manual</th>
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<tbody>
<tr>
<td>REFORMATTER</td>
<td>$98</td>
<td>DIAGNOSTICS 1</td>
<td>$45 £9</td>
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<tr>
<td>CP/M =&gt; IBM</td>
<td>$100</td>
<td>DIAGNOSTICS 2</td>
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<tr>
<td>CP/M =&gt; DEC</td>
<td>$130</td>
<td>TERM</td>
<td>$72 £7</td>
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### MT MICROSYSTEMS

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<th>Software</th>
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<th>Manual</th>
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<tbody>
<tr>
<td>PASCAL M+ 5.25</td>
<td>$150 £25</td>
<td>TDL SOFTWARE (Technical Design Labs)</td>
<td></td>
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<tr>
<td>PASCAL M+ 5.25 w SPP</td>
<td>$265 £50</td>
<td>BUSINESS BASIC</td>
<td>$80</td>
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<tr>
<td>Library Sources</td>
<td>$110</td>
<td>ZTEL (Teletype Editing Lang.)</td>
<td>$25 £5</td>
</tr>
<tr>
<td>Speed Programming Pkg. (Softbus)</td>
<td>$125 £25</td>
<td>LINKER</td>
<td>$35 £5</td>
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### OSEBNE & ASSOCIATES

<table>
<thead>
<tr>
<th>Software</th>
<th>Manual</th>
<th>Software</th>
<th>Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCOUNTS PAYABLE &amp; ACCOUNTS RECEIVABLE</td>
<td>$50</td>
<td>TINY-C ASSOCIATES</td>
<td>Tiny-C language for 8080, 8086, 8080</td>
</tr>
<tr>
<td>GENERAL LEDGER</td>
<td>$50</td>
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### PHOENIX SOFTWARE ASSOCIATES (For Z80 only)

<table>
<thead>
<tr>
<th>Software</th>
<th>Manual</th>
<th>Software</th>
<th>Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLINK—Disk to disk link loader</td>
<td>$72</td>
<td>MICROPRO</td>
<td>TBA</td>
</tr>
<tr>
<td>PASM—Macro assembler</td>
<td>$72</td>
<td>MICRO-AP</td>
<td>SELECTOR V</td>
</tr>
<tr>
<td>PEDIT—Line editor with Macros</td>
<td>$72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BUG—Very powerful debug</td>
<td>$15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PDEVELOP Package with all the above</td>
<td>$193 £23</td>
<td></td>
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<tr>
<td>PLINK—2 Overlay Link Loader</td>
<td>$185 £15</td>
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### BASF DISCS

The following formats are available from stock: 8" SSDD

- 5½" Soft Sectored, 5½" 10 Sectors, 5½" 16 Sectors

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Price Per Disc Ex VAT</th>
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<tbody>
<tr>
<td>1 - 50</td>
<td>£2.40</td>
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<tr>
<td>51 - 100</td>
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<tr>
<td>101 - 200</td>
<td>£1.80</td>
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<tr>
<td>201 - 500</td>
<td>£1.70</td>
</tr>
<tr>
<td>501 - 1000</td>
<td>£1.50</td>
</tr>
</tbody>
</table>

Minimum order quantity 10 discs. Orders must be in multiples of 10. Postage, Package & Insurance £6.50 per 10 Discs up to 50 Discs thereafter 17p per 10. Other formats on request.

### ORDER INFORMATION

When ordering CP/M software please specify the format you require otherwise software will be despatched on an 8" single density disc.

All software items are subject to VAT. Manuals, when purchased separately, are not subject to VAT.

Please add £3.45 for postage, packing and insurance on each item purchased. For overseas please add £6.50 per item.

Most software in this advertisement is available from stock and a 72 hour return service is thereby offered on most prepaid orders.

These details and prices are all current as of January 1982. Our prices reflect an exchange rate of U.S. $2.00 to £1.00. Should the exchange rate vary by more than 5 cents, a surcharge may be added or a discount given.

**MAIL ORDER**

**TELEPHONE ORDER**

**VISIT**

Send Cash, Cheque, Postal Order, MOM, Access or Barclaycard/Visa number to Microcomputer Products International Ltd., Room PC11, Cambridge House, Cambridge Road, Barking, Essex IG11 8NT.

All payments must be in Sterling and drawn against a U.K. bank.
The purpose of QUICKSCREEN is to provide a simple, cost-effective way for people to design screen forms on the computer. The sale for these forms can be as varied as the reasons people buy computers. With the computer revolution that has occurred since 1973, computers are finding their way onto the desks of managers, professional workers, and students. MPI Ltd welcomes this development. We hope that QUICKSCREEN will find a home on all these desks and help everyone to get more out of their computer.

Quickly, information should be displayed clearly, with titles, headings and other data. However, in most computer programming languages, this is clumsy and time-consuming.

For each phrase, word, or title, you must identify the exact line and column where it appears. Then, you must type each of these locations into the computer. Once you see the results on your VDU, you may not like the appearance so you would want to rearrange things. This means you will have to re-calibrate all line and column locations and type them in again.

Sounds like a waste of time? Fortunately, you won't have to go through that exercise again. With QUICKSCREEN, you simply type the form on your screen just as you would like it to look on paper. Then turn QUICKSCREEN on and it will automatically calculate the locations of everything, and automatically write a computer program for you, which will enable you to produce your form and allow you to begin entering information immediately.

Far more rapid than any other system of its kind.

MULTIPLE KEY FIELDS

Of the up to 50 data fields each record can contain, any or all may be assigned to be 'keys' so that records can be selected individually or collectively, by the content of those fields.

MUTLPLE FILE PROCESSING

SELECTOR V can process records from several different files at the same time. It can bring move information from one file to another. It can do this in a conditional basis, e.g. if a field matches a condition a field against another or a constant value, it can convert MANAGER to MGR, delete redundant records, multiply the QUANTITY by a factor against the STOCK PRICE in inventory records, add the results to a Receivables file, and update a demand file for all the result of a simple procedure definition that can be executed whenever needed.

The facets that make SELECTOR V more functional than any other system of its kind include:

- MULTIPLE KEY FIELDS
- MULTIPLE FILE PROCESSING
- SELECTOR V allows records to be selected in any order according to the most meaningful, compoundable criteria within the reporting purposes, or to create uniquely defined new data types. It can conditionally transform records into new formats and perform arithmetic procedures on the process.

REPORTS

With two report generators at your disposal, your data can be made absolutely producible. Both allow inputs from several different files, with conditional and arithmetical processing. The text is oriented to reporting to you about your data. We take care of the formatting. You just specify what information you want. You can strengthen up to 80 actual and derived fields to be reported upon.

The second report generator produces output in any format that you want. Anything from generated invoices to reports, automatics, sequentially numbered invoices, complete with text paragraphs, label the products all printed in combination forms of plain paper.

APPLICATIONS DEVELOPMENT SYSTEM

SELECTOR V is similar to that of managing dedicated dedicated applications. With its micro-batch capabilities, arithmetical processing devices, it will handle a variety of complex tasks with ease. The language coding in required. Procedures are defined as named definitions and can be executed as needed.

The reliability and performance of CIS COBOL are strongly emphasized by its continued qualification for U.S. government contracts. In January 1981 CIS COBOL entered its 2nd year of G.S.A. certification. CIS COBOL is powerful but simple to use. It has screenhandling, dynamic module loading and fast I/O so you take full benefit from microcomputer facilities. The FORMS-2 utility is a COBOL source code generator to help you create interactive applications with ease. Using the unique demonstration "How to create a COBOL program in 20 minutes," you can quickly try out new application ideas. And if you are developing software for resale, the variety of systems running CIS COBOL offers you a very large available market.

With CALCSTAR you will be able to manipulate data after test or running on an instantly available degree. The numeric data may either be constant or be dependent on other data. CalcStar has features for calculating, formatting, sorting, indexing, and printing of data. This is a free electronic workbook with 127 columns and 255 rows. Uses microcomputer. Standard.

Border statements, tax flow analysis, forecasting, general ledger, master records, cash flow, inventory and analysis, payroll records, profit and loss, accounts receivables, accounts payable, payroll, and management information. For small or large businesses.

Are you in business?

Can you afford to be without CALCSTAR?

CALCSTAR is a SPIRIT Company. Use CALCSTAR?

CALCSTAR has the answer.

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Warehouse enquires: Circle No. 107

CALCSTAR will find a home on all those desks and help people to get more out of their computer.

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Applications development system.
April 23-25, 1982
Earls Court, London

Friday & Saturday: 10am – 6pm
Sunday: 10am – 5pm

Admission £2.00 adults
£1.00 children under 16.

The computer is with us and soon to be as familiar in the home as your television, video or hi-fi. But much more versatile!

A home computer can be the family’s resident teacher, accountant, home economics expert, memory bank and endless source of amusement! It can do anything you programme it to do – from teaching mathematics to the children or computing the most economic use of household fuels for yourself, as well as providing hours of fun on a rainy afternoon. Most important of all, the home computer will teach you and your family about computers – and this is the technology that your children are growing up with.

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Bringing computers to everyday life

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Swap your views and know-how with hundreds of other home computer enthusiasts — and find out a whole lot more from computer professionals.

Plus — The Micro Mouse Contest.

Come and watch the incredible ingenuity of computer controlled "mice" and how they find their way (or not!) to the centre of a maze. The knockout heats and the Euromicro British Final can all be seen at The Computer Fair!

Bring the whole family — don't miss this opportunity of bringing computers into your everyday life.

for readers of Practical Computing

PRACTICAL COMPUTING March 1982
CP/M SOFTWARE

from

METROTECH

NEW CALCSTAR
CalcStar is MicroPro's new electronic spreadsheet and financial modelling Program — a sophisticated, yet easy to use calculating and planning tool. CalcStar also links with WordStar, so you can easily include your final calculations within your report.

New CALCSTAR

CalcStar £140/£20

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BCPL CINTCODE is full and extended implementation of the popular Systems programming language BCPL. CINTCODE gives a dramatic reduction in the space required for programs, requiring about a third the storage of fully compiled Z80 code.

New BCPL

BCPL £250/£35

NEW COMMUNICATIONS
BISYNC-80/3780 and BISYNC-80/3270 are full function IBM 2780/3780 and 3270 emulators for microcomputers.

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.

New COMMUNICATIONS

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BISYNC-80/3270 £445/£15
MET/TTY £95/£15

NEW DATA MANAGEMENT
SELECTOR III-C2
An easy to use Information Management System; requires CBASIC II

SELECTOR IV
An advanced Information Management System; requires CBASIC II

DATASTAR
Powerful data entry, retrieval and update system

New DATA MANAGEMENT

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DATASTAR £195/£30

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MicroPlan will perform most types of calculations working in rows and columns, as well as advanced financial analysis.

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MicroPlan £295/£20

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MICROSOFT BASIC COMPILER £195/£25

MICROSOFT FORTRAN 80 £215/£25

MICROSOFT COBOL 80 £315/£25

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MICROSOFT BASIC COMPILER £195/£25

MICROSOFT FORTRAN 80 £215/£25

MICROSOFT COBOL 80 £315/£25

MICRO DATA BASE SYSTEMS
MDBS is a database system offering full network CODASYL-oriented data structures, variable length records, read/write protection, one-to-one, one-to-many and many-to-many set relationships. Add on features are: an interactive report-writer and query system, a dynamic restructuring system and a recovery-transaction logging system.

New MICRO DATA BASE SYSTEMS

MDBS prices start from £600/£30

Primer manual £5

Prices are shown as Software with manual/Manual only.

Prices correct at time of going to press

METROTECH are sole U.K. distributors of DYNABYTE microcomputer systems.

14 PRACTICAL COMPUTING March 1982
CP/M HARDWARE
FROM
METROTECH

The basic Dynabyte features 64K RAM, a 4MHz Z80A, and one parallel and two serial ports. All systems run CP/M, MP/M and CP/NET.

A full range of software is available including word processing, communications, database, integrated business systems, all standard languages and viewdata.

The flexibility built into every Dynabyte computer assures you a smooth upgrade path, and it vastly extends the useful life of your equipment. Upgradeability can mean a lot to you — wasted time and disruption are eliminated with a smooth transition to a large Dynabyte system.

When you install a Dynabyte system, you're not just buying the system you need today, you're planning for the future. As your business expands and your needs change and grow, you simply add processing power and storage capacity — unit by unit, in a measured building block fashion. The Dynabyte systems provide the total solution for both your data processing and word processing needs.

The Dynabyte 5000 Family allows a very wide range of disk storage and can be configured to give multi-terminal and multi-tasking systems, networked and multi-processing. The net result is a system that serves your present needs exactly and is modularly expandable to meet your future demands.

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Please send more information on the Dynabyte 5000 series

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Title ..........................................................

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SEND TO: METROTECH LTD., MARKETING DEPT., WATERLOO ROAD, UXBRIDGE, MIDDLESEX UB8 2YW. TEL: 0895 58111 Exts 265, 267, 247 or 269.

METROTECH IS A MEMBER OF THE GRAND METROPOLITAN GROUP.

PRACTICAL COMPUTING March 1982
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Now once again Pearl Leads with

PERSONAL PROGRAMMER™

The Evolution in Software 1990's in 1982

It does what others are claiming

TM. RELATIONAL SYSTEMS INTERNATIONAL
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PERSONAL PROGRAMMER™

Create All the Business Programs You Want
Enjoy Your Computer Working for You
Empower Your Ideas with Personal Programmer —
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The Program That Shows You Why Everyone Will Want a Computer

No More Blind Alleys trying to figure out what programs to buy when none seem to be exactly what you need. Why waste time and money trying to decide how to develop custom programs when programmers are so expensive, and good ones are rare?

Why Go Through the Hassle of trying to find someone else to develop the program you need? Avoid the worry about whether the computer program is going to operate according to your requirements.

Even If You are a Professional Application Programmer, why waste your time coding in a computer language and debugging when Personal Programmer will do the work for you? You can use your problem-solving abilities to solve your customers' problems.

Why Purchase Several Different Programs designed for a variety of computer users? Particularly when you so often would like the programs to work in the same manner and to work together.

Have you wondered what you could accomplish if only you could put your ideas immediately to work? You cannot experience your true potential unless you have the resources to accomplish what you are capable of doing.

Unlock the Power of Your Computer. Personal Programmer is for use by people, all people, not just programmers. You can use PEARL Personal Programmer to create custom programs. As quickly as you can identify your program requirements, in English, Personal Programmer writes the new program for you.

You Know What You Need Better than Anyone Else. Use Personal Programmer to unlock your problem-solving abilities. Personal Programmer is the natural, human way to create new computer solutions.

Use Your Time Wisely Making a Profit. Profit comes from solving business problems and serving your customer, not from solving computer programming problems. Personal Programmer asks you for examples of the results you require from your computer. Personal Programmer then produces the application program.

Create a Library of Personal Programs, each tailored to your personal requirements. Accounting, cash disbursement, mailing lists, data files, data management, calculation reporting. You name it. Literally. Personal Programmer builds the program library of your choice, your way, for one price.

Empower Your Ideas through the capabilities of Personal Programmer. There is no limit to the number or variety of programs you can create. There are no artificial, technical limits built into Personal Programmer such as the number of records in a file, or record size, or the computer language used. Personal Programmer creates ready-to-run, high quality programs that do what you want.

Currently available for CP/M with 48K: other versions following.

Price at under £200 exclusive of VAT. For further details contact your local dealer or mail the form below.

Manufacture, OEM and dealer enquiries welcome.

To: PEARL INTERNATIONAL (UK) LTD, 15 GLENAIR RD, POOLE, DORSET BH14 8AA.
Please send me details of PERSONAL PROGRAMMER.

Name ........................................... Firm ...........................................
Address ........................................... Post Code ...........................................
Type of Equipment ...........................................
Disc Size & Format ...........................................

PRACTICAL COMPUTING March 1982
The CompuStar 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 configured in any fashion you like - whenever you want.

The secret behind our CompuStar DSS is its unique controller/multiplexor. It allows many terminals to "share" the resources of a single disk. So, not only can you use a electrical match to the system. The CompuStar's dual disk storage in addition to the disk system in the CompuStar. The Model 20 features 384K of RAM and 500K of disk storage. The Model 40 comes equipped with 64K of RAM and over 700K of disk storage. But, most importantly, no matter what your investment in hardware, the possibility of a dual disk storage system to perform tasks normally associated with the following list.

- Bureaux services
- General analysis
- Calc-type predictions
- Hospital indexing
- Profit analysis
- Simulations
- Stock control
- Address mailing
- Letter writing
- Time recording
- Edit records
- Addressing mailing
- Cashflow
- Recording
- Letter writing
- Profit analysis
- Tabulation
- 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. And, of course, involves no change in your investment if your computer is also needed to perform a transaction. And, if your terminal needs are more sophisticated, select either our CompuStar 20 or CompuStar 40 as user stations, both units offer dual disk storage in addition to the disk system in the CompuStar. The Model 20 features 384K of RAM and 300K of disk storage. The Model 40 comes equipped with 64K of RAM and over 700K of disk storage. But, most importantly, no matter what your investment in hardware, the possibility of having two user stations can be configured in any fashion you like - whenever you want.

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

**G.W. COMPUTERS LTD, 01-636 8210 01-631 4818**

*** 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.

<table>
<thead>
<tr>
<th>Accounting</th>
<th>Budgeting</th>
<th>Cashflow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock control</td>
<td>Simulations</td>
<td>Cashflow</td>
</tr>
<tr>
<td>Calculations</td>
<td>Simulations</td>
<td>Cashflow</td>
</tr>
<tr>
<td>Bureaux services</td>
<td>Simulations</td>
<td>Cashflow</td>
</tr>
<tr>
<td>Answering faxes</td>
<td>Simulations</td>
<td>Cashflow</td>
</tr>
<tr>
<td>Print reports</td>
<td>Simulations</td>
<td>Cashflow</td>
</tr>
<tr>
<td>Address mailing</td>
<td>Simulations</td>
<td>Cashflow</td>
</tr>
<tr>
<td>Letter writing</td>
<td>Simulations</td>
<td>Cashflow</td>
</tr>
<tr>
<td>Profiling analysis</td>
<td>Simulations</td>
<td>Cashflow</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Simulations</td>
<td>Cashflow</td>
</tr>
<tr>
<td>Tabulation</td>
<td>Simulations</td>
<td>Cashflow</td>
</tr>
<tr>
<td>Edit records</td>
<td>Simulations</td>
<td>Cashflow</td>
</tr>
</tbody>
</table>

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

**DATABASE MANAGEMENT + WORD-PROCESSING + MODELLING + DIY INTERPRETER + SERVICE**

<table>
<thead>
<tr>
<th>TWO TYPICAL PACKAGE DEALS</th>
<th>NORMALLY</th>
<th>UNLESS SPECIAL REQUEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 — SUPERBRAIN 64K RAM 320 K</td>
<td>2395.00</td>
<td>2395.00</td>
</tr>
<tr>
<td>02 — EPSON 4000 FT (OR SIMILAR)</td>
<td>1625.00</td>
<td>1625.00</td>
</tr>
<tr>
<td>03 — CABLE</td>
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- **Introduction to Microcomputers**: Feb 8, Apr 19
- **Fundamentals of Programming in Basic**: Feb 9/10, Apr 20/21
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There is a very touching play currently running in London. It is written about a most unpromising subject: the passions of the bibliophile. *84 Charing Cross Road* is contrived from the genuine correspondence of a lady living in New York during the Second World War, and a firm of antiquarian booksellers at the address mentioned.

She finds it easier to order the books she wants—many of them 100 years old or more—from London, than to struggle through New York's inferior shops. As the correspondence continues she becomes friends by post with the staff of the shop. When at last she comes to London to see them they are all dead or gone. The play ends with the bookshop being closed. Its shelves are empty: it is all very sad.

No doubt the audience just felt unhappy that she had failed to meet the people she had come to know so well by post. For us it ought to be doubly sad because it is clear that the bookshops of the world are in a like condition, and that we are the murderers.

Why should you care? Books are heavy, expensive, slow, immediately out-of-date. These criticisms apply to other paper publishing as well—technically this magazine is a fairly ridiculous object. It takes us months to produce each issue. It has to be copied on to 30 tons of paper and physically carried round the world. After a week, a month, a year, almost every copy has been thrown away. Print and paper cost us about half our income.

The people that are really keen on electronic publishing are, ironically enough, the conventional publishers of today—it will save them so much money. It is infuriating to have to produce thousands of identical sheets and spreading them around the place guaranteed permanence to ideas and exposed large numbers of people to them. Consequently, if the ideas behind steam engines were in the air, one could be confident that some day in Byron's London. In 20 years' time even the skimpy phernalia of scholarship help the whole process along, but the fundamental virtue of paper is that, given quite ordinary care, it is almost indestructible. We know what books Caxton printed and how much he charged for them because his books have survived long enough to be recognised as treasures.

Although many strong-minded regimes down the ages have tried to rewrite history by calling in and burning those books they disapproved of, experience shows that once a book has been printed and distributed it is virtually indestructible. In fact books that have completely disappeared are so rare as to rank as curiosities.

Perhaps one copy in every 1,000 that we print of this magazine will survive 100 years; one copy in 10,000 might last 1,000 years. If, then, it is interesting enough it can be translated into whatever language the English speak, re-edited, republished and sent off on another voyage through time and space. By the simple act of printing this sentence, the idea it contains is added indelibly to the store of human knowledge.

What happens when all this is done electronically? True, the transmission and display of information is potentially much faster and much cheaper than its paper equivalent. People can have just the information they want and they can ignore what they do not want. They can be helped to find what they want by the machine, so they can make use of a much bigger pool of data than would otherwise have been at their disposal.

On the down side, however, cheap computer storage becomes it is very unlikely to have the permanence that multiple copies of books have, if only because the data will only exist in one or two sites. It is as if only one, two, half a dozen copies were printed of any book. Their chance of surviving the carelessness or malice of posterity becomes small and they will disappear as so many thousands of handwritten Greek and Roman books have disappeared.

Future generations might be very interested—for reasons we cannot guess at now—to see *Practical Computing*’s first Prestel pages, just as we would be interested in a printing magazine published by Caxton. They cannot have them though—we cannot see them now—because they have all gone. The BBC recently wiped the early episodes of *Doctor Who*—not for any ideological reasons, but just to reclaim a few thousand metres of video tape.

Scripts of the plays and concerts that amused our parents are still to be found and give some idea of the real thing. But how much of the entertainment, the news reports or the documentaries of the last 20 years on TV will survive 100 years—or has survived even to today? Future generations will be presented with an invisible world. History will say what we did, but very little about what we thought we were doing while we did it.

Happily there is still a voluminous printed record, though it is already under fierce attack. In 20 years’ time the electronic record may be all there is.

The invention of the telephone has robbed us of enormous quantities of evidence. Think of the Victorians’ letters that detail every moment of their lives—there were 10 posts a day in Byron’s London. In 20 years’ time even the skimpy letters and newspapers of today will be electronic. For the purposes of the historian, they will be no more information than a mirage. No doubt the book and the magazine will survive, because time will show them to have advantages over electronic media, however they evolve. But at what cost? This summer you may see stalls at country bring-and-buys where books are sold for 10p each, and have difficulty in resisting the temptation to buy them all. If you can see that soon the cheapest book will cost £20 and that vast amounts of the world’s literature will never see print again, even an unreadable book at that price is a bargain, and anything which is any good becomes a gift from the gods.
We could simply scream at you 'Get a Sharp MZ-80K personal computer for only £305!'

But you know, and we know, that there's more to it than that. As your interest increases or your business grows, you will want to exploit the unique versatility of your Sharp system - MZ-80K, MZ-80B or PC-3201.

So we thought we would set your mind at rest about the cost of expansion. We print here all the prices relevant to system expansion on these three popular and widely recognised computers.

If you think this demonstrates a straightforward and workmanlike attitude on our part, just look at the prices. You will see that they are just as down-to-earth as the rest of our approach.

Butel-Comco support for Sharp users is complete. Advice is freely available. Maintenance contracts can be arranged. A wide range of supplies and software can be supplied.

### THE BUTEL PRICE GUIDE

#### Sharp MZ-80K Personal Computer

- MZ-80K Computer 20K, 25cm CRT. Tape cassette. ASCII keyboard. £305.00
- MZ-80K Computer 48K. £347.20
- MZ-80U 28K upgrade. £80.00
- MZ-80 I/O Interface unit. £82.00
- MZ-80FD Dual disk drive. £893.00
- MZ-80FDK Additional dual disk drive. £816.00
- MZ-80 RS232 interface. £110.00
- MZ-80P3 Matrix printer. £395.00
- CP/M Operating system. £196.00
- MZ-80 I/O-1 Universal interface card. £50.00
- MZ-80BM BASIC manual. £7.00
- MZ-80T10B BASIC tape. £9.00
- MZ-80T20C Machine language tape and manual. £19.00
- MZ-80TU Assembler tape and manual (System Program). £395.00
- MZ-80T40E PASCAL Interpreter manual and application tape. £50.00

#### Sharp MZ-80B Personal Computer

- MZ-80B Computer 64K, 23cm CRT. Tape cassette. ASCII keyboard. £666.00
- MZ-80FD Twin floppy disk unit. £590.00
- MZ-80FDK Additional twin floppy disk unit. £590.00
- MZ-80PS Matrix printer, 80cps, 80col. £415.00
- MZ-80FI Floppy disk interface card. £100.00
- MZ-80MDF Master diskette and manual. £33.00
- MZ-80F15 Cable for MZ-80FD. £9.00
- MZ-F05 Cable for MZ-80FDK. £7.00
- MZ-80EJ Floppy disk cable printer. £115.00
- MZ-80EU Expansion unit. £50.00
- MZ-80GMK Graphic RAM-II option. £120.00
- MZ-80 I/O-2 Universal interface card. £45.00
- MZ-80T10C MZ-80K to MZ-80B converter tape. £150.00
- CP/M Operating system. £65.00

#### Sharp PC3201 Business Computer

- PC-3201 Computer 64K, ASCII keyboard. £1500.00
- CE-320C 80x25-character display terminal. £290.00
- CE-332C 80x25 character display terminal. £290.00
- RP-1600B 60cps, 132col daisywheel High-Q printer. £1450.00
- CE-331M Twin floppy diskette unit. £370.00
- CE-341M Floppy diskette interface. £125.00
- CE-350L Additional diskette drive cable. £30.00
- CE-332A 48K RAM upgrade. £150.00
- CE-340R RS232 interface card. £150.00
- CE-340G General purpose I/O parallel interface card. £145.00
- CE-350R Printer ribbon for 332P. £9.00
- CE-330B 10x5/10x8 diskettes. £30.00
- CE-330R Direct program generator. £120.00
- CP/M Operating system. £65.00
- Sales Ledger program and manual. £300.00
- Purchase Ledger program and manual. £300.00
- Nominal Ledger program and manual. £300.00
- Invoicing System program and manual. £300.00
- Stock Control program and manual. £300.00

Note: All prices quoted exclude VAT, freight costs and insurance.

All items are available through our fast and efficient Mail Order Service or come and collect it from our 'computer centre' counter. We accept Access and Barclaycard and can arrange Citibank hire purchase. Simply ask for a quotation.

Hours of business: Mon-Fri 9:30-5:30 and Saturdays from 9:30 until 1:00. All prices are correct at time of going to press.

Call, telephone or write to: BUTEL-Comco Limited, Garrick Industrial Centre, Garrick Road, Hendon, London NW9 6AQ. Telephone: 01-202 0262.

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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.

Business software
THE SERIES OF ARTICLES on business software by Charles Somerville were the most worthwhile that I have found in the popular computing magazines.

I now have a Superbrain, having started with a secondhand Pet to learn something of the art. My basic concept was to understand enough to obtain a management package for my consultancy practice. I did not want to use a computer for technical programs as I did not want my responsibility to rest upon somebody else's knowledge. In order to learn I found myself writing technical programs which are being "proved" for use.

The requirements of business-management packages do not seem to be met by the normally available and I have been advised to write the program myself. Charles Somerville's articles provide useful help—and there must be many other people in a similar situation.

R. E. Chittock, Tedworth, Surrey.

NEC PC-8001B
I WOULD LIKE to draw your attention to a number of inaccuracies in the review of the NEC PC-8001—Practical Computing, December 1981.

There are two types of expansion unit which are available in the U.K. One is the "rather large box" which contains a seven-slot mother-board which will accept various interface cards including hard disc, etc. The other contains various interfaces but cannot be configured by the user. This by its nature has a much lower profile.

The "noisy fan" referred to in the disc unit is, in fact, the drive motor whirring. None of the NEC units requires cooling as there is sufficient ventilation to dissipate any heat produced.

Perhaps the remark about the limiting effect of only being allowed 15 files per drive implies that the reviewers did not read the manuals. If they had, they would realise that you can open up to 15 file buffers within the system. This allows any program to access information on up to 15 data files concurrently, and that would be a very large and complex program. The number of program and data files that can be stored on a disc is limited only to the capacity of the diskette itself. Therefore there is no limitation in comparison with the Pet.

I was very pleased to hear that the Hitachi monitor performed so well, but the system as supplied for review included an NEC high-resolution colour monitor. What happened to it? Unfortunately our graphic resolution is only 160 by 100 points and not as stated.

The fact that we have CP/M available was omitted from your article and that of course implies a very large software base. We will provide technical support to any software house that wishes to implement its packages on the PC-8001.


Software market
I WAS FASCINATED by the article in the November 1981 issue on modelling the software market. I think this is the first time anybody has attempted such an exercise in print.

I would, however, quarrel with the conclusion. If we are to believe the figures quoted nobody is going to make any money until 1990, which is manifestly absurd. I have been through the assumptions very carefully to see where they might be going wrong.

While I realise that you are talking about CP/M-type disc-based machines your figures for the current market base seem a trifle low. Our own estimate, based only on feel and observation of the market place, is that the base is over 300,000 machines worldwide, and that the rate of sale of such machines is about 15,000 per month. I concur with your estimate of saturation point at 11 million machines. Overall, perhaps you should clip the top eight years out of your schedule.

John Phipps, Phipps Associates, Epsom, Surrey.

Speech synthesis
I WAS DISAPPOINTED in the article on speech synthesis in the November issue. For example, no mention has been made of the Computalker system which was a milestone in computer speech, introduced in 1977 with a complete machine-language driver for 8080 and S-100. Neither did the writer mention the Votrax Type-n-Talk, which costs only £275 and speaks from plain English text.

"Speakeasy" is the single most popular speech synthesiser in the U.K., suitable for absolutely any computer, and ought to have been described. Software exists for direct phonetic spelling, and the whole product costs only £69. Microspeed, though, costs an order of magnitude more.

David Sands, Royston, Hertfordshire.

The view from ICL
HOW NICE it is to be welcomed. The interesting editorial in the December 1981 issue of Practical Computing pointed out that the micro business adds up to 5 percent of IBM's turnover. ICL's turnover is a little larger than that, but no matter—it is of the same order of magnitude as that of the micro business as a whole and very much smaller than that of our principal competitor.

To survive at all in such circumstances requires exemplary management by ordinary standards. To prosper needs superlative direction and that is just what we do now have. So perhaps we are wrong to feel included in your welcome, because we are not really big boys—indeed a great deal of our present reorientation revolves around the frank acceptance of that very fact.

We see ourselves as part of a worldwide industry which is functioning more and more like the chemical industry or the petroleum industry—buying raw materials and intermediate products wherever they are available and combining them and processing them and supporting them to meet the needs of our customers. If our customers need a particular piece of hardware or software to complete a system, and we cannot best meet it from our own resources, then we must perform the world for it and ensure an adequate supply of the right item. That is how our scene is moving—though we still have some way to go before we have caught up with the older high-technology industries in this regard.

This change of point of view has two immediate consequences for ICL. On the one hand, we must not seek to rely on in-house production of components such as chips if, for volume or other reasons, these cannot be produced at world market prices. We must therefore seek alternative stable sources of supply for such basic raw material of our business. Similar considerations apply to firmware and software.

The other consequence lies at the extreme end of the long chain of productive processes stretching from raw silicon to the finished customer application (continued on page 45)
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system. The essence of successful applications development lies in achieving the right balance between "off the peg" applications and bespoke tailoring to meet particular needs.

On the one hand, there has to be a solid base of system hardware, software and applications development tools orientated towards networked systems, and that is what we can best supply. On the other hand, there is the great variety of situations encountered in each particular business. In Britain, this variety is immense and world wide it is overwhelming. Our experience with our System 10 products has conclusively demonstrated that it is the software houses who hold the key to efficient bespoke tailoring.

If we are to sell our products in the volumes required to achieve competitive prices, we have to develop entirely fresh market outlets and this also is an area in which the system houses are of crucial importance. Marketing strategy and customer applications both demand a quite different approach from that which was previously traditional in ICL.

At ICL, we believe that there will be a big part for the micro community to play in all this — especially those micro system houses with solid, in-depth knowledge of particular applications. Without this knowledge, the resulting products can fail to meet the customers' needs in quite elementary ways.

For example, a very competent but exasperated small business user has told us of a well-known micro product which only allowed four-line addresses for suppliers and of a payroll package which included the state pension scheme but not private pension schemes. Such solecisms are not tolerated by serious users.

Much of the effort of getting a worthwhile business application going involves the detailed study and appraisal of the way the business works, the way its data is structured, validated and accessed. Indeed, it is our experience that once the problems of data structure and data management have been adequately tackled, then — and only then — the programming reduces to a relatively straightforward task.

Applications development tools involving novel approaches such as non-procedural languages, artificial intelligence thinking and integrated data dictionaries and data bases are going to be essential to achieve the kind of simplicity of application which will be essential for the networked office systems of the future.

To achieve all this, all the different parts of the computer community must work together as never before and we for our part are ready, willing, experienced and determined to play our part. Conway Berners-Lee, ICL Corporate Communications, London.
**Twin-processor Torch may be leading light**

**THE TORCH COMMUNICATOR** is a new British computer that combines both the Z-80 and 6502 microprocessors in the same machine. The twin-processor machine has 96K of user memory together with powerful communications and network facilities. The basic machine is capable of handling Telex, Prestel and teletext, connecting directly to a dial-up telephone line. A built-in Modem services a direct 120cps telephone communicator.

Messages can be received without interrupting the current operating mode. The user is informed that a message is being received by the screen; if it is then stored until it is either called up and converted into hard copy or is sent to another station on the Econet network. It takes a mere 10 seconds to send a full screen of information to any destination in the world.

On-line backing storage of 1Mbyte is provided by the twin 5.25in. double-density mini-floppy disc unit. There is also a hard-disc option providing a maximum of 10Mbyte of on-line storage. The 80-column VDU is capable of providing high-resolution colour graphics, together with a teletext mode. The graphics capability is greatly enhanced by the twin processor. One processor can operate all the disc-handling functions while the other is sorting data.

The popular CP/M operating system opens up a vast library of tried and tested software to the user, including the ubiquitous VisiCalc and various standard accounting packages. All of them are of course, fully integrated.

A word-processing system which is fully integrated with the communications software allows letters to be typed, edited and speeded to their destination without the users ever leaving their seats. Languages include the popular Microsoft Basic, the currently fashionable BBC Basic, Pascal, Fortran, Cobol, Algol 68, Lisp, Forth and C.

The Communicator is a joint manufacturing venture between two British companies: Acorn Computer, the manufacturer of the powerful Atom and the BBC Microcomputer, has collaborated with the Climar Group. Acorn provides the hardware expertise gained during development of the Atom, the BBC Micro and the successful Econet. Experience in business software is Climar’s contribution.

The machine is entering a highly-competitive part of the market and, as a Torch spokesman pointed out, the machine is only half the price of the IBM equivalent. The Torch Communicator retails at £2,500 and will be manufactured in the U.K.

**Pascal learnt by video**

A VIDEO SERIES called Programming in Pascal consists of 16 half-hour programmes which teach this structured language to users with no previous experience.

At £1,250 plus VAT the tapes are no snip, but educational establishments will be able to purchase the series at a discount. The pace is slow at first but picks up momentum once the basic concepts have been tackled.

For more details contact the publishers, John Wiley and Sons, Baffins Lane, Chichester, West Sussex.

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**The Welsh connection**

IF YOU NEED to run a program that calculates the revenue of this year’s leek harvest, or if you want to run a stock-control program for your daffodil plantation, why not program in Basicym? If your programs Rhed rather than Run, and Liwy instead of Load, then you are probably a Welsh programmer and will find Basicym a boon — it is a version of Applesoft Basic in the Welsh language.

All Applesoft and DOS commands, the error messages and the relevant single-letter suffixes are all in Welsh. So, a syntax error becomes gwali, and should you see gor-chwynn anyngnwythchol, then all that is wrong is that it is not a direct command.

The language system has been written for a minimum configuration Apple with one disc drive and the language card — not the Welsh one — is available from Cardiff Microcomputers, 46 Charles Street, Cardiff, South Glamorgan. Telephone: 0222 373072.

**Form a model balance sheet**

MULTI-PHAN is a new software package designed for financial modelling. Income statements, balance sheet and cash flow can be produced for given inputs of production units. Multi-Plan is available from Keating Computer, 42 Knoll-Back Avenue, Brampton, Barnsley, South Yorkshire.

**Building a network of Pets with multi-headed Hydra**

THE LEGENDARY HYDRA was a many-headed beast; its electronic namesake has the same characteristic, the heads being Commodore Pet microcomputers. Networking systems are all the rage these days: inter-micro communication is only one of many facilities provided by such a network. Up to 255 items can be connected to Hydra, enabling users to share disc drives, printer devices, etc, with obvious financial savings.

Hydra itself comprises a small board which plugs into the Pet memory expansion port, together with some software in ROM. Installation is simple and it is available for the 3000, 4000 and 8000 Pets. The total length of the network can be up to one kilometre; four-way screen wire must be provided by the user.

Seven extra commands are provided in Basic, and facilities to restrict access to nominated drives are included. Hydra costs £125 plus VAT for each Pet in the system, and comes with a comprehensive manual. For details contact Wordcraft Systems, 9 Littleover Lane, Derby.
Chemists’ Pet prints message on a bottle

PRESCRIPTION LABELLING is a task that readily lends itself to computerisation. It is a boring, tedious job but the consequences of not doing it correctly could be disastrous. Pals — the Prescription Automatic Labelling System — is an applications package that performs the job on the Commodore Pet microcomputer.

A prescription is normally dispensed and labelled manually, which is inefficient and expensive in manpower. A further problem is that quality tends to deteriorate as pressure increases during peak dispensing periods. The label is the last link between the patient and the doctor, so clarity is essential. Research indicates that printed instructions are more likely to be followed correctly and completely. Pals provides labels with similar quality to typewritten labels at a higher speed.

The system runs on the Commodore Pet computer, together with a tape drive and the Epson printer. The end-user price for the system is £1,495, which includes installation and some training, plus 12 months’ maintenance on a same-day-service basis with an initial supply of pre-printed labels and plain printer stationery.

The system comes with a number of standard products and dosage instructions, all of which can be reprogrammed using the computer. Any standard item can be overwritten to produce a non-standard dispensing periods. The label is the last link between the patient and the doctor, so clarity is essential. Research indicates that printed instructions are more likely to be followed correctly and completely. Pals provides labels with similar quality to typewritten labels at a higher speed.

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PRACTICAL COMPUTING March 1982
Group boosts micros in primary schools

MICROCOMPUTERS and Primary Education is a non-profitmaking association of practising teachers which provides members with specialised help. The organisation aims to co-ordinate and initiate ventures into microcomputing by teachers of younger children. All affiliated schools receive the information pack, which is paid for by the central government and produced by the MEP project.

Members have access to a library of educational software, and are offered preferential insurance terms. Regular newsletters inform participating schools on various aspects of the microcomputer world. Mape, as the organisation is known, also provides primary teachers with a united voice and has been consulted by central government representatives on important issues.

In the light of the Government's decision to provide backing for microcomputers in primary schools, Mape is prepared for a massive response to an appeal for members among the 250,000 primary-school teachers. Membership of Mape costs £7.50 per school.

For further information contact the secretary, Barry Holmes, St Helen's County Primary School, Bluntisham, Cambridgeshire; a stamped, addressed envelope will be appreciated.

Primary-school teachers will also be interested to hear of the second conference of teachers involved in microcomputing which will be held at Exeter University at Easter. For further details and bookings, contact Roy Garland, College of Education, St Lukes, University of Exeter, Exeter, Devon.

Accounting to taste

AIRS stands for Accountants' Incomplete Records System, a modular package which may be expanded to meet particular requirements. Basic modules allow the user to prepare a cash and bank analysis with reconciliation.

The package costs £975 and can be purchased from MSS, 54 Chapel Road, Worthing, West Sussex. Telephone: Worthing (0903) 34755/6.

Speed-and-power theory of British Quantum

TWIN Z-80A PROCESSORS AND triple quad-density floppy drives make the new Quantum 2000 no ordinary microcomputer. However, this British-built machine would appear to be remarkable value at only £2,250 plus VAT. Internally the computer lives on a series of 8in.-by-8in. boards, making for easy servicing. Four empty slots leave room for expansion.

The basic system uses the two processors and the British-originated 80-bus standard to provide an unusually fast machine. Its advantages will be most strongly felt in the multi-user system. The triple quad-density mini-floppies offer a total of 2.1Mbyte of on-line storage in addition to the 64K user RAM available in the micro itself.

A 12in. green screen monitor is an integral part of the system and displays 80 by 25 characters mapped to the user RAM. A programmable character generator produces 128 graphics characters including pixel combinations. The built-in ASCII keyboard has a 128-character buffer and 16 special-function keys, as well as a numeric keypad.

For further details contact the manufacturer, Quantum Microns, 60/62 Balcony Unit, Merrion Centre, Leeds, West Yorkshire. Telephone: Leeds (0532) 45877.
Advanced Anadex makes its impact

Manufacturers are understandably enthusiastic about their products, but the WP-6000 printer may well live up to claims that it is the most advanced impact matrix printer. The 18-wire print head and the high-speed, bi-directional, logic-seeking servo system enable the machine to print correspondence-quality text at over 150 cps. In the rough-draft or data-processing modes, the speed can rise to over 500 cps.

Multiple resident character fonts and optional downloading of other fonts from a host computer are provided along with proportional-spacing and text-justification features. The scientific font will be welcomed by the scientific and engineering communities; Greek letters are available in both upper and lower case.

Contact Anadex, Weaver House, Station Road, Hook, Basingstoke, Hampshire. Telephone: Hook (025672) 3401.

Low-cost Camp cuts surveyors’ paperwork

Quantity Surveyors, consulting engineers and contractors will find Camp an attractive software package. The Contract Account and Measurement Program provides a low-cost facility for producing bills of quantity under all conditions of use.

Tender documents, interim valuations and forecasting are integral parts of the program. Price fluctuations can be carried out for Baxter, BEAMA, NEDO Series 2 building works, and NEDO Series 2 specialist engineering works.

The software runs on the Hewlett Packard-85 machine, with twin disc drive and printer. By using the HP-85 with integral cartridge, interim evaluations can be undertaken at site offices. For further details contact Civil and Structural Computing, Ash Court, 2 Ash Grove, Great Horton Road, Bradford BD7 1BN. Telephone: Bradford (0274) 391706.

New courses of action

A course to provide managers with training in the uses and applications of VisiCalc is just what the doctor ordered. Provided by IMCL, and supported by Practical Computing, the course promises to acquaint executives with powerful and affordable technology. There will be plenty of opportunity for hands-on experience.

IMCL also offers a two-day course in basic programming entitled Not so Basic Basic, again supported by Practical Computing. The aim of the course is to take managers from an elementary level to a standard where they can write their own business software.

Contact the Conference Registrar, IMCL, 197 Knightsbridge, London, SW7 1RN.

Variety of formats on bi-directional Facit

The Facit 4526 bi-directional printer costs £1,050. It offers 132 characters per line and a print speed of 150 characters per second. The 9-by-9 dot matrix, with true descenders, can produce a variety of character sets in addition to ASCII

A wide range of formats and printing modes is available, including hex trace. The printer uses minimum-distance sensing logic to ensure economy and speed of printing. The 4525, an 80-column version, is available at £938. For details contact Hi-Tek Distribution, Trafalgar Way, Bar Hill, Cambridge. Telephone: (0954) 81996.

Naming successor to The Last One

IT SEEMS that The Last One was poorly named; it was in fact only one in a string of program generators. The latest to come to our attention is an ingenious piece of software called the Program Writer/Reporter. It writes complete, running and debugged Basic programs that are fully documented and easily modified by the user.

The originators claim that users with no previous experience will be able to write their own programs within the hour, and that experienced programmers will be able to save up to 90 percent of their time. There are four versions of the program available: Apple II, Apple III, Apple CP/M and standard CP/M. Prices range from £220 to £260. The program, distributed by a nationwide network of dealers, is also available from Apple Computer and Taunton Electronics. Telephone: Taunton (0823) 433142 — 24-hour answering service.

* Circle No. 141
Sharp bring you the MZ8OB. A machine that offers you functions previously only associated with more powerful, more expensive computers; that gives you versatility to handle a huge range of software and hardware applications in scientific, business and personal use.

The MZ8OB opens up a new world of graphic display potential, more flexible data storage and retrieval, and ease of operation. Here is the computer from the future. Available today.

**Stunning Graphic Display.**

Seeing is believing. The large-screen, high-focus, green-face display incorporated in the MZ8OB gives you high-resolution graphics of 320 x 200 dots. An additional graphic RAM can be added which allows another 320 x 200 dot resolution pattern to be displayed. This dual high-resolution graphic ability is especially useful for simulating and displaying a dynamic picture. It can display 40 characters x 25 lines or 80 characters x 25 lines via software switching. In addition there are facilities for full, on-screen editing, reverse video, partial scrolling and a full range of graphic symbols.

**Character and Graphic Printer.**

This fast, quiet printer will reproduce your graphic displays and, of course, print-out upper and lower case letters and symbols. A tractor/friction feed version is also available.

**Data Storage/retrieval.**

The MZ8OB has a remarkable memory: 64K of RAM. And that constitutes all the memory area, giving flexible storage of any computer language and its software. The cassette deck is electromagnetically-controlled, with a data transfer speed of 1800 bits/sec combined with a unique programme search facility to make data storage and retrieval super-fast.

**Floppy Disk Drive.**

A twin Floppy Disk Drive unit can be added which will give you 560 bytes of storage on double-sided, double-density disks.

**Comprehensive Documentation.**

Each MZ8OB comes complete with a full set of documentation including an owner's manual giving full circuit diagrams, a monitor reference manual and programming manuals.

**Interfaces**

RS-232C and IEEE Interfaces are available from January 1982 allowing the MZ8OB to communicate with scientific instruments and other peripherals.

**CP/M2**

CP/M* is also available making a wide range of packages immediately available including wordprocessing, financial modelling, data base management to mention but a few. CP/M* also increases the disk capacity to 680K.

*CP/M* is a Trade Mark of Digital Research Ltd.
Hi-tech Electronics' new Processor and Memory (PAM for short) is a complete Z80 computer on a single board, fully compatible with North Star and Comart Communicator software. Features include a Z80A processor and 64K bytes of RAM (with bank and 8K block disable + phantom) 2K of 'ghosted' EPROM and monitor (extendable to 8K) two RS232C serial ports and a parallel port.

* and a Z80A processor!

Hi-tech Electronics (PAM for short) is a complete Z80 computer on a single board, fully compatible with North Star and Comart Communicator software. Features include a Z80A processor and 64K bytes of RAM (with bank and 8K block disable + phantom) 2K of 'ghosted' EPROM and monitor (extendable to 8K) two RS232C serial ports and a parallel port.

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MICROS for business and the consumer

The national retailing chains are keeping a canny eye on the potentially lucrative microcomputer market. Bill Bennett visited one which has already taken the plunge, and reports on how it is faring.

Birmingham was the first and, together with Leeds, is the most successful Micro-C branch. It is to be found tucked away near the back of Curry's huge city-centre showroom beyond the rows of televisions, refrigerators and washing machines. This shop-within-a-shop is reminiscent of those esoteric little departments in Harrods or Selfridges, an oasis for the enthused.

Micro-C subscribes to a philosophy which is becoming increasingly popular with microcomputer dealers - dealers, that is, as opposed to retailers. A Micro-C branch is not merely a shop where customers walk in with bulging wallets and leave with a box full of silicon chips. For the staff at one of these branches, the real work begins once the system has been bought.

Sizeable staff

The Birmingham branch has a sizeable staff led by Mike Griffin, who has been with Micro-C since its inception two years ago. He knows more about the sharp end of the business than most. Together with Carol Weaver, the branch software expert, and Tony Gwalchmai the salesman, they furnished me with the answers to my questions.

How does Micro-C operate? It all starts before the customer becomes involved, with experienced staff conducting rigorous tests on all equipment before it is put on the Micro-C list. Only equipment on this list is supported, but inclusion means the strength of Curry's brave foray into microcomputing.

Micro-C staff can provide advice and demonstrations. Once the relevant hardware and software has been selected, a Micro-C representative visits the prospective user's site. Tony Gwalchmai considers that this is one of the more important jobs after the feasibility study, because once the equipment has been ordered, the user must find somewhere suitable to put it. "It is surprising, but many customers believe that all they need is a single power point and that's it". He then went on to reveal that customers are taken aback when they discover that a Pet computer, a disc unit and a printer each require a power socket; in the case of the Apple II an extra point is required for the monitor.

The next stage of the process takes place when the truck carrying the equipment arrives at the branch. Once unloaded, the relevant machine is connected up and checked. Only when the system has been proved does the scene shift back to the customer's office as the system is reassembled by the Micro-C representative.

The supervised installation of a system is essential. Some might scoff, but to the inexperienced all those connecting wires are just so much spaghetti. At this stage the sales team can take a breather, or make another sale, because the support people take over. Carol Weaver is responsible for ensuring that the users can operate the software packages that they have bought. A customer buying a new system together with some software is given two days training free of charge. Weaver often finds that the people who will be operating the microcomputer have no idea about what it can or cannot do, and are absolutely clueless when it comes to making the beast work. The two days' training cannot be taken all at once. Not all the information is assimilated anyway, but small doses help to make it more digestible so sessions usually last half a day or less.

The economics of the training scheme are quite simple. A complete computer system costs around £2,000 and Curry's offers few discounts. The training is loosely structured, starting with a short session on how the hardware works and progressing to disc handling and practice sessions with dummy data. Weaver never lets users go live with their own data until she feels they are safe.

The longer term

Over the longer term, Curry's makes available post-sales support and Carol Weaver will follow up any phone calls requiring help. Customers can also buy further training if they wish, though this option has yet to be taken up. Buyers of one of the smallish software packages, such as VisiCalc, are entitled to about half a day of supplementary training as well as the initial two days.

Micro-C recognises that it cannot expect to supply all its customers' needs. Tony Gwalchmai reasons that there is a wide enough range of software on the Micro-C lists for most users, but there will always be some esoteric applications for which they will look elsewhere. Using software which has been bought from other sources does not affect the 12-month guarantee on the hardware parts and labour, nor does the addition of specified peripherals. Service within 24 hours can be assured for an extra charge.

Prudent buyers take up the option of a service contract at the time they buy the initial system. There are three levels of service; ordinary, 24-hour, and preventive maintenance. Ordinary service costs about 10 percent of the equipment cost - a little extra for printers and other service levels.

The question remains, how successful is the Micro-C approach? There are no precedents on which to form a judgement, though the staff at Birmingham are all sure that they are on the right lines, and within two years Micro-C has expanded from one branch to nine.

At the present each of the two Birmingham field salesmen sells, on average, one complete business system a week. This number is sure to increase as past customers return for more machines and the branch's reputation becomes known.
The Sirius is new 16-bit micro from Chuck Peddle, designer of the Pet. Will it take the top off the eight-bit market? Bill Bennett takes its top off to see.

THE ACT SIRIUS is the latest episode in the short but action-packed history of micros. The designer of the system, American Chuck Peddle, has already reserved his place in microcomputing history — he is the originator of the world-famous 6502 microprocessor and the one-time best-selling micro in the U.K., the Commodore Pet.

There are many critics of the Pet, but for all its faults that venerable old warhorse of a micro has kept millions of satisfied customers happy for years and continues to do so. The key to the Pet's success was that for one initial outlay a would-be computer user could buy a complete, self-contained system.

Air of confidence

In those days it was most unusual to find a microcomputer which you could plug in, switch on and start computing immediately. Originally, Pets were supplied with the keyboard, processor, screen and cassette drive all in one case at one price — a neat package with no extras to buy or trailing wires.

The Sirius — or the ACT Sirius to give the machine its full U.K. title — bears no resemblance to the Pet. The smart good looks of the Sirius — so important in desk-top computing where the executive image must be maintained at all times — places the Sirius far from the ugly utility of the Pet. Ergonomic to a fault, the Sirius has an air of lofty confidence about it — even when the power is off.

There is, however, one common thread between the ancient and modern; they are both complete in themselves. The system specification of the Sirius reads like next year's fashions in desk-top computing. Everything that the man who has everything could ever need — in one package.

Obviously this machine has been developed for the business user. The keyboard has all the conventional keys and more. To be pedantic, it "features an IBM Selectric-style nucleus with an additional range of special-function keys". The screen has the highest-resolution imaginable on a machine of this size, and the memory is an ample 128K of user RAM — which can be extended internally to 0.5MB and externally to 1MB.

The system supplied for review was one of the first to enter the U.K. By the time ACT starts installing the machines in volume, the manuals will have been written. For the purposes of the review I was furnished with a set of photocopied notes. Even these notes seemed comprehensive, there was little missing, and some manufacturers supply far worse documentation with production-model machines.

Operating system choice

Although the Sirius can work under the new IBM personal operating system, the review machine had a version of Digital Research CP/M called CP/M-86. In fact in the immediate future, ACT expects CP/M-86 to be the more popular choice, because of its similarity to CP/M rather than to the IBM operating system.

However all the indications are that the IBM system is set to take the personal computing world by storm. My own feelings are that it hinges on two matters: one, whether the IBM Personal Computer actually makes its mark and two, whether the applications, software written under commit to memory all the impressive things I had been shown and see if I could re-create them later. The high-resolution graphics were probably the greatest revelation. Not only is the resolution extremely good for a small machine, but the pictures can be called quickly — the product of its 16-bit processor and mammoth memory.

One other interesting point I discovered during this short demonstration was that the whole system is software-driven. By that, I mean that apart from the boot-up routines which are in PROM, all else is down-loaded from disc — even the character fonts. This gives the Sirius a flexibility that other microcomputers simply do not possess. Various character fonts can be loaded at will and the definition of the function keys can be changed, in fact there is total flexibility.
the system is of a sufficiently high quality. On the surface, CP/M-86 is very much the same as CP/M on any other machine. It differs because it was written for the Intel 8086 processor. The Sirius microcomputer does not use the 8086; it uses the Intel 8088 chip. This may seem unusual until you discover that the 8088 has exactly the same instruction set as its sister, the 8086. The difference between the two is that although they are both 16-bit processors internally, the 8088 is designed so it can interface to the eight-bit microcomputer world.

**CP/M commands retained**

To the user, CP/M-86 is the same as CP/M on eight-bit machines, it still uses the same commands. There is still the same A > prompt to tell which disc you are using. Dir works in the same way, if you type a file it appears in the same way and it even spots errors in the same way. Of course, all the bad aspects of CP/M have also been retained. If you were considering buying a Sirius, CP/M might be a problem for you if you have never met it before.

As an in-depth look at CP/M-86 will only really be of use to the professional programmer, I shall cover it only briefly here. If you want to know more, I suggest you read CP/M Programmers’ Guide and CP/M System Guide which are both written by Digital Research.

Sirius CP/M-86 is a control program, for a disc-based personal microcomputer. It provides the necessary tools for the writing, storing, editing and documentation of programs. In addition, it provides an assembler and a debugging aid. In much it is the same as CP/M. The difference lies in the assembly facilities which are for the 8086 assembly code, as are the dynamic test and debug program and not for Z-80 as conventional CP/M.

The list of recognizable file types under CP/M-86 are:

- A86 8086 assembly-language source code.

### Technical Specification

- **Processor:** Intel 8088 16-bit chip.
- **Memory:** 128K standard, expandable to 1MB.
- **Disk capacity:** 1.2MB to 10MB. Twin mini-floppies standard.
- **Operating systems:** CP/M-86, MDOS.
- **Keyboard:** 97 keys, Selectric nucleus, separate numeric pad.
- **Screen:** 11in. display in swivel mounting. Colour display optional.
- **Sound:** Codex speech generation and storage.
- **Languages:** Microsoft Basic, compiled Basic, Cobol, Pascal, Fortran.
- **Price:** £2,395.

**BAK** Back-up file created by Ed — the text editor.

**BAS** Basic source code.

**CMD** Executable command file.

**COB** Cobol Source code.

**DAT** Data file.

**FOR** Fortran source code.

**H86** Intel-format hexadecimal file.

**INT** Intermediate compiled code.

**LST** Listing of compilation or assembly.

**OVR** Overlay module.

**PRN** Listing of compilation or assembly.

**REL** Relocatable object-code module.

**SUB** Command file executed by Submit command.

**SYM** Symbol table of assembly.

**XRF** Cross-reference of absolute assembly.

**SSS** Temporary, system-generated file.

**CP/M-86** is included on the Sirius system disc. It automatically boots itself when the disc is inserted in the left-hand drive and when the drive door has been closed. On the review system there was no prompt for this until a disc was inserted. All that the screen showed was an identification message. On production models of the system there is a visual prompt which appears on the screen to tell the user to insert the systems disc.

Also included on the system disc is the provision for a myriad of escape codes. These can be used either directly from the keyboard or within a Basic program. For example, the escape code to clear the screen is escape E. This can be entered by pressing the escape key, followed by E and then return.

On the screen is the normal CP/M-86 prompt, then up-arrow, square bracket, a pair of symbols used to display escape, then E. When return is hit, the screen goes blank and, the prompt followed by the cursor reappear at the top of the screen.

### Programmable codes

One of the most interesting aspects of the Sirius is the provision for a myriad of escape codes. These can be used either directly from the keyboard or within a Basic program. For example, the escape code to clear the screen is escape E. This can be entered by pressing the escape key, followed by E and then return.

Finally, Stat.CMD is a program to display the disc files statistics. It marks files or directories as read-only and assigns physical devices to logical devices.

Also included on the system disc is the Basic 86. To all intents and purposes it is the same as normal Microsoft Basic. There is also a program called Pippin which, like Pip, is a file-transfer program. However, the purpose of Pippin is to transfer files between computers, or more specifically between a large ‘master’ computer and the Sirius.
— is escape Y followed by a pair of numbers. This code moves the cursor by direct addressing — that is, escape Y 1, C moves the cursor to line number 1, column number C — remember that these numbers are in hexadecimal.

The Sirius keyboard is larger than most, encased in a shallow, grey case about 8in. by 18in. It is a masterpiece of ergonomics and is very easy to use conventionally, say, when using the Word-Star package supplied with the review machine.

There are, however, a large number of keys, which can be confusing especially as some of the keyboard functions do not always work. This is because all such functions are loaded from the system disc.

A further complication in the keyboard are the keys whose functions change, and the multiple-key commands. No doubt those codes which are used often are learnt quickly.

One rather strange quirk of the review machine was that when in Basic 86, the dollar sign which is used to denote a string variable could not be summoned by shift followed by 6, which is where it is marked. After a short panic I discovered that the pound symbol — that is, shift followed by 4 — appears on the screen during Basic 86 as the dollar or string symbol.

This quirk is no doubt due to the ASCII character set used by the Basic being that used in the U.S. It is a problem that can be easily ironed out because of Sirius’ easily changeable software.

An ergonomic dream

The best aspect of Sirius’ separate keyboard is its construction; each key is moulded and located exactly how and where it feels it ought to be. For someone who uses a keyboard professionally, it will really be a revelation. The keyboard on the early Pet bore no resemblance to a typewriter, but later personal computers such as the Tandy, Apple and 8032 Pet all had keyboards which were approximations to typewriters. Much as I abhor word processing, using a word-processing package with an ergonomic keyboard like this must be merely a chore — as opposed to the usual nightmare.

There are, however, not only the typewriter-like central core of keys, but another four groups. To the left of the main typewriter part of the keyboard is a cluster of five keys, called the special-function key group.

The top key of the group — marked ESC — is used to initiate the escape codes. The second enables the intensity control, the third is used to switch the reverse-video mode, the fourth enables underlining and the last activates the auto-repeat mode.

Slightly to the right of the typewriter keys is a group of 10 keys called the editing key group. These keys provide such functions as returning the cursor to the home position, clearing the screen, the generation of special codes for the applications software, the lowering and raising of the loudspeaker volume, and controlling the brightness and contrast of the visual display.

Above the central typewriter group is a set of seven general-function keys, similarly for use from within applications programs, but which can be used in other modes. For example, when in CP/M-86 the first key will act like Dir-carriage return, and display the file directory. Key number three acts as Control-C, the break command.

On the far right is the numeric keypad, an arrangement found on almost all microcomputers which claim to be primarily for business use. The idea of such a pad is that pure numerical data can be input much faster. These keys can be used in any mode to display the number written on them, as can those operator signs included on this pad. It should, however, be noted that entering, say, $6.84 will not calculate anything; it just displays the symbols. The key marked Calc is intended for use from the applications software and Enter performs a carriage return.

The typewriter part of the keyboard is standard, nevertheless there are some anomalies. First, there are two keys that provide special functions: the Alt key, which enables the alternative function of another key, and the Cont key which provides the control-S CP/M facility. The other keys provide those characters printed on them.

As mentioned, the Sirius is entirely under software control. Unlike other machines, the character set or font is read from disc on booting. In other machines the font would be read from ROM. This means that the font need not always be the same. This is very important, because in the past, manufacturers have done one of two things: either they programmed a ROM with the font at source — usually in the U.S. — a process that meant U.K. users could print the dollar but not the pound sign. Or they would have available at slightly higher cost a font prepared for a particular market.

If a microcomputer was used, for example, by an engineering company for word processing, it would be difficult to produce scientific equations without changing the ROM. There are ways round this, but they are not really satisfactory. The Sirius circumvents this problem. The review model was supplied with a large number of founts, including German, and scientific characters, with the integration symbol, various Greek letters, and so on.

It is even possible to use the Edot program — supplied with the machine to create customised founts. Each fount can contain up to 256 different characters which can be reversed. It would appear that a similar process is used when drawing graphics.

High-resolution graphics

The screen display is the last word in high resolution graphics, though slightly smaller than a conventional 80-column display. This is because, although the system employs the same size tube, only the middle part has been used so eliminating the effect of the curved corners of the screen. This stops words of text from bending. The green mesh which covers the screen has been applied in such a way that it strengthens the “squareness” of the display.

The high-resolution graphics characters are on a grid of 25 lines by 80 columns. Each character is in a 9-by-12 dot matrix, within a 10-by-16 cell. When in the graphics mode, each dot within each square is addressable and there is a total resolution of 800 by 400 pixels.

To show off just how high the resolution on the screen is, a demonstration disc of pictures was provided. They were instantly recognisable as the pictures used to demonstrate the Apple II high resolution. The difference was that the Sirius showed four pictures to a screen. One neat feature about the screen is that it swivels and tilts to the user’s preferred viewing position.

Although this review machine was supplied without a printer, there is a full range available. I would suggest, however, that to make full use of the Sirius’ graphic capabilities a high-resolution printer is required. ACT suggests a graphics printer. Dimensional details of the machine are: height 18in., width 18in., depth 20in., weight 49lb, and operating temperature — environmental — 0 to 49°C.
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- uses the popular 6502 CPU
- bus compatible with the Z80 Firmware Card with CP/M and Microsoft BASIC
- Programming languages including BASIC, Fortran and Cobol etc., are available separately
- full PAL-colour video supplied as standard with sound through TV
- professional keyboard with function keys and number pad
  - Character set with 255 characters in reprogrammable EPROM, delivered standard with Upper and Lower Case characters, Greek and pseudo graphics, and a jumper selectable choice of QWERTY or AZERTY
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The North Star Horizon microcomputer is now available incorporating any of the mini-Winchester drives featured above.

S100 Sub-Systems
An upgrade kit for users of S100 microcomputers contains all the hardware required to add a Winchester in place of a mini-floppy drive. The XCOMP ST/S S100 controller is included together with an S100 card which provides the necessary power supplies to connect to the Winchester. Fitting to the microcomputer is straightforward – no soldering is required and the Winchester is housed in the same place as the floppy drive it replaces. Horizon users have a choice of software; either the high-performance HMSOS single/multi-user operating system or CP/M.

Z80 Sub-Systems
The sub-system for Z80-based microcomputers consists of a packaged drive and controller with power supply. The controller is the XCOMP ST/R custom designed microprogrammable controller. The two printed circuit boards are connected via a 50-way ribbon cable to an interface board which plugs into the Z80 socket in your microcomputer. The sub-system is housed in an alloy cabinet with a power supply. Source listings of CP/M drivers are available.

Sub-Systems are also available for APPLE and PET

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Review

RICOH RP-1600

We tested this recent daisywheel printer from Japan alongside Appropriate Technology's new Flowriter, based on the Ricoh mechanism. Chris Bidmead reports.

THE FASTEST daisywheel printers on the market today are Japanese, and the very latest models are claiming a speed of 80 characters per second. We thought Ricoh's specification of 60 cps impressive, but judging from the machines we have reviewed to date we were aware that the figures are probably derived from optimised runs on the manufacturer's test bench. They might not reflect actual speed in use.

Our usual tests proved this to be the case. The Ricoh RP-1600 is fast, and may well print at 60 cps in short single-line bursts with no carriage-returns. Sadly, few office documents fit that restriction.

Angularity avoided

The Ricoh's cream-coloured static-proof metal case is well styled, somehow managing to avoid the angularity of the Qume and latest Diablo. The machine is noticeably smaller than some of its rivals: its height without attachments is 20cm, and the front-to-back depth is about 40cm. The power pack is internal, so these dimensions represent the true size of the working machine.

The version under review — which is compatible with Sprint 3 — comes with no front panel, although other versions offer an option of a top-of-form switch and printer-state LED indicators. You reach the innards by lifting the spring-counter-balanced front cover, unclipping the platen in the fashion set by the old IBM golf-ball typewriter, and releasing two small captive bolts inside the cover to the left and right of the chassis. The top half of the case can then be lifted straight off, with no snagging mechanisms to be manipulated round and no trailing wires attached.

The printer chassis is a solid aluminium casting, nesting into the foam damping that lines the case and keeps the noise down to a claimed 59dB. The main motor, a high-torque device Ricoh makes in-house, is situated centrally under the platen, driving the print head via steel pulley wires in the conventional fashion. Any stretching of this wire in use is compensated by a powerful spring, and there is an arrangement to take up the slack with a screw thread when wear becomes excessive. The designer seems to have planned on a long life for these pulley wires, which are lubricated in manufacture and sealed in a plastic coating.

With the RP-1600 Ricoh has introduced yet another standard of daisywheel, though there is good sense behind this apparent contrariness. The Ricoh wheel is some 20 percent smaller in diameter than the familiar Diablo/Qume counterpart, keeping down the rotational inertia and thus helping to pep up the speed.

The number of petals is reduced to 64 while Diablo/Qume standard is 96. Each Ricoh petal carries two characters, so some of the characters have to be accessed by a shift mechanism like a typewriter's. The component that carries the burden of this extra task is called the "dog-bone," an electromagnetically operated articulation in the axle that drives the wheel. It seems a vulnerable piece of additional mechanics to have introduced at a time when the whole thrust of development is towards reducing the number of moving parts. But this is a theoretical objection only — during a long test period the "dog-bone" gave us no trouble.

There was some significant extra engineering in the daisywheel itself. The Diablo equivalent has the advantage of cheapness, being moulded as a single piece to be mass-produced more or less like a gramophone record. But the compromise requires the plastic to be both flexible and light for the petals, and impact-resistant for the character face. We have found that the founts on these single plastic wheels tend to flatten noticeably in use, particularly on a poorly-adjusted machine. Diablo does offer the alternative of a well-engineered metallised wheel, but at the hand-tailored cost of about £35.

Hand-tailoring

The Ricoh approach splits the difference. Tailoring very like that of the metal wheels has gone into the Ricoh daisywheels: a separate plastic is used for the body of the wheel and the flexible arms, which are embedded in a vibration-damping rubber-like base. By skipping the metallising stage, the end-user price of these wheels is kept below £12.

All the electronics of the basic machine are housed on a heat-dissipation panel screwed into the rear of the case. To reach the boards once the case is open you have to remove a heavy, perforated, metal, static shield. Again, the solidity and finish of this component are impressive.

The Sprint-3 interface is piggy-backed on to the main processor board. Although accessible, this pair do not exactly invite removal, being held on to the lower part of the case with two bolts concealed under a pair of plastic protection caps which also serve as feet when the machine is stood on end. We shirked the task of unclipping all the necessary connectors to get these boards out, but a peek at the components in place — the main processor is the 8085 — the speeded-up version of the 8080 — seems to confirm the manufacturer's claims that the electronics are "state-of-the-art".

While the electronics were uncovered we took the opportunity to run the self-test program, which puts the print mechanism through its paces while little (continued on next page)
winking LEDs on the processor board monitor its progress. We were reassured by the manufacturer's claim that had anything gone down, these on-board diagnostic LEDs would be enough to isolate the trouble without additional test gear. Nothing did go wrong during the course of a long trial. The claimed mean time between failures of over 2,000 hours is now becoming standard on the present generation of daisywheel machines, thanks to the reduction in the number of moving parts. The RP-1600 certainly seems extremely robust, and runs quietly and coolly even during day-long continuous use.

**Variety of guises**

Nexos is the exclusive OEM franchise agent for the RP-1600 in the U.K., Ireland, and most of Europe. A new daisywheel printer typically comes to the marketplace with the bare bones of its mechanism dressed up in a variety of guises. Nexos/Ricoh marketing is no exception, and in addition to the Sprint-3 look-alike we tested, Nexos also offers a Hi-Type II Diablo version, and a Centronics C-3 interface.

An RS-232 version was in preparation at the time of writing, but a firm by the name of Appropriate Technology, otherwise known as ApTec, is ahead of Nexos here. Dr Ali Baghdadi, the brains behind this small British company, was able to lend us an RS-232/Diablo-compatible version of his new Flowriter, a development of the RP-1600 basic mechanism that features a substantial character buffer for fast, smooth throughput at speeds up to 9,600 baud. This data-transfer rate is not, of course, matched by the print head: the idea of putting memory into the printer is to release the central processor in the computer from the need to stay hooked to the time-consuming needs of the "real-world" device.

There are two additional advantages to the RS-232/Diablo-compatible face of the Flowriter we had on loan. The data line is simple to install, as you can attach it to the computer with four wires — or three, if you do not overflow the buffer. As most commercial word-processing software is provided in versions that send Diablo codes, the printer should require no special software adaptation. ApTec, now manufacturing and marketing the project in association with Small Systems Engineering, has achieved this by adding a special interface board inside the machine. Printers normally employ some sort of buffer between the data line and the print head so that a jerky supply of characters can be translated into a smoother load for the moving parts.

Usually these buffers are of the order of 125 to 256 bytes. But Baghdadi has taken advantage of the space available on his interface board inside the Flowriter to put a 2K buffer, with a deluxe 8K option. The 8K buffer in the review version can deal with about five pages of A4 double-spaced text, and it proved very useful when printing out files of this size or larger to be able to leave the printer to get on with its work. To make the most of the facility, either continuous stationery or a sheet-feeder is essential.

If you are more used to working with single sheets it will take time to overcome the feeling of being out of control of the printer. The latest revision of the firmware implements the Diablo ESC CC P as an instruction to abort the buffer immediately, which returns a measure of control to the user's keyboard.

**Retaining control**

We suggested to ApTec that it would be an advantage to be able to switch out the buffer altogether. There are times when it is useful to retain control of the printer from the computer keyboard — to print a list from the screen on to an odd scrap of paper, for example. We gather that future versions will incorporate a buffer-defeat option into the software.

The flexibility of the RS-232 interface is gained at the expense of some speed: TTL logic inside the computer is being translated into a bit stream padded with start and stop bits, and then translated back again at the other end. But with proper handshaking — the Flowriter offers hardware handshaking or a choice of ETX/ACK or DC1/DC3 — the Ricoh mechanism can be driven at a speed almost rivalling that of the Qume-compatible version. The Flowriter is also available with either a Centronics or an IEEE interface.

**Conclusions**

- The Qume-compatible parallel-interface version is almost twice as fast as the Flowriter in graphics mode. But the Flowriter is only marginally slower during normal printing.
- The RS-232/Diablo version of the Flowriter we tested is simpler to connect to a variety of different computers, and the buffer makes for easier use in applications like batch mailing.
- The only disadvantage of either machine is the very slightly more ragged text the mechanism produces. This is really only appreciable to the eye when columns of vertical characters need to be critically aligned, as in the production of tables for camera-copy.
- Both machines reviewed were based on the Ricoh RP-1600 print mechanism, a fast and solidly-engineered device. The Diablo mechanism still produces the best-founded print we have seen, but for most normal office purposes this Japanese product, in both Flowriter and Qume-compatible versions, seemed to us to come out well ahead.
- Ricoh/Nexos Qume Sprint-3 version
  - Flowriter with 2K buffer £1,500
  - Flowriter with 8K buffer £1,720
  - Keyboard £250 extra
Why gamble on being right?

Choose the Daisy wheel printer compatible with any hardware or software you may have!!

The Ricoh Flowriter is the most advanced Daisy wheel printer on the market so far. With a 60 character/second speed and equipped with a Z80 microcomputer it combines the features of all advanced word processing and graphics printers on the market.

- Compatible with QUME SPRINT 5 and DIABLO 1640 standard and enhanced word processing commands.
- Auto bidirectional printing
- Auto logic seeking in both vertical and horizontal directions
- Graphics capability Down to 1/128”.
- Proportional spacing tables programmed internally
- 8K and 16K buffer under full program control — allows switching buffer on/off, or repeat printing buffer contents without a need for monitoring by computer.
- Three interfaces included internally: Centronics — IEEE 488 — RS232C with ETX/ACK, DC1/DC3 and DTR handshaking protocols.
- Detached keyboard option.

The printer that does more and costs less ........

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1980 saw a genuine breakthrough - the Sinclair ZX80, world's first complete personal computer for under £100. Not surprisingly, over 50,000 were sold.

In March 1981, the Sinclair lead increased dramatically. For just £69.95 the Sinclair ZX81 offers even more advanced facilities at an even lower price. Initially, even we were surprised by the demand - over 50,000 in the first 3 months!

Today, the Sinclair ZX81 is the heart of a computer system. You can add 16-times more memory with the ZX RAM pack. The ZX Printer offers an unbeatable combination of performance and price. And the ZX Software library is growing every day.

**Lower price: higher capability**
With the ZX81, it's still very simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8k BASIC ROM - the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements - the facility to load and save named programs on cassette, for example, and to drive the new ZX Printer.

**Higher specification, lower price - how's it done?**
Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

**New, improved specification**
- Z80A micro-processor - new faster version of the famous Z80 chip, widely recognised as the best ever made.
- Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tiresome typing. Key words (RUN, LIST, PRINT, etc) have their own single-key entry.
- Unique syntax-check and report codes identify programming errors immediately.
- Full range of mathematical and scientific functions accurate to eight decimal places.
- Graph-drawing and animated-display facilities.
- Multi-dimensional string and numerical arrays.
- Up to 26 FOR/NEXT loops.
- Randomise function - useful for games as well as serious applications.
- Cassette LOAD and SAVE with named programs.
- 1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- Able to drive the new Sinclair printer.
- Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip - unique, custom-built chip replacing 18 ZX80 chips.

**Kit:**

£49.95

**Built:**

£69.95

**Kit or built - it's up to you!**
You'll be surprised how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) - a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor - 600 mA at 9 V DC nominal unregulated (supplied with built version).

Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.
16K-byte RAM pack for massive add-on memory.

Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. With the RAM pack, you can also run some of the more sophisticated ZX Software – the Business & Household management systems for example.

Available now - the ZX Printer for only £49.95

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alphaneumers 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.

How to order your ZX81
BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day.

BY FREEPOST – use the no-stamp-needed coupon below. You can pay by cheque, postal order, Access, Barclaycard or Trustcard.

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

At last you can have a hard copy of your program listings – particularly useful when writing or editing programs.
And of course you can print out your results for permanent records or sending to a friend.

Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.
The ZX Printer connects to the rear of your computer – using a stackable connector so you can plug in a RAM pack as well. A roll of paper (65 ft long x 4 in wide) is supplied, along with full instructions.

8K BASIC ROM to fit ZX80.

Order

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

Please print.

Name: Mr/Mrs/Miss

Address:

FREEPOST – no stamp needed.
How the ZX81 compares with other personal computers

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<td>HI RES GRAPHICS (&gt;40000 pixels)</td>
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<td>USR (CALL, LINK)</td>
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<td>PEEK, POKE (OR EQUIV)</td>
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Sinclair software on cassette.

The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users. Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with others to form single-subject cassettes.

Software currently available includes games, junior education, and business/household management systems. You'll receive a Sinclair ZX Software catalogue with your ZX81 – or see our separate advertisement in this magazine.

The ultimate course in ZX81 BASIC programming.

Some people prefer to learn their programming from books. For them, the ZX81 BASIC manual is ideal.

But many have expressed a preference to learn on the machine, through the machine. Hence the new cassette-based ZX81 Learning Lab.

The package comprises a 160-page manual and 8 cassettes. 20 programs, each demonstrating a particular aspect of ZX81 programming, are spread over 6 of the cassettes. The other two are blank practice cassettes.

Full details with your Sinclair ZX81.

If you own a Sinclair ZX80...

The new 8K BASIC ROM used in the Sinclair ZX81 is available to ZX80 owners as a drop-in replacement chip. (Complete with new keyboard template and operating manual.)

With the exception of animated graphics, all the advanced features of the ZX81 are now available on your ZX80 – including the ability to drive the Sinclair ZX Printer.

Sinclair ZX81

6 Kings Parade, Cambridge, Cambs., CB2 1SN. Tel: (0276) 66104 & 21282.
Nick Laurie examines a high-powered, intelligent board for the Nascom micro.

ONE of the leading lights in the Gemini Microcomputers series of 80-Bus Multiboards, the Intelligent Video Card, uses a dedicated Z-80A CPU to control a keyboard, VDU and light-pen as well as providing more than 50 features. Gemini's 80-Bus resembles, and is generally totally compatible with, Nascom's Nasbus.

A number of manufacturers are producing 8in.-by-8in. cards suitable for this bus, but there can be little doubt that Gemini's Multiboard range is among the most comprehensive and compatible. After all, with John Marshall, Paul Greenhaulgh and various others who worked on the original Nascom, the experience behind the Multiboard designs is second to none.

Exotic applications

The IVC provides a sophisticated interface which, although provided with very comprehensive software for its on-board Z-80A, can be reprogrammed by the user to offer even more facilities. Plenty of spare RAM is available to hold user programs while the Bytewide socketing allows ROM and RAM to be interchanged for even more exotic applications.

As standard, it has a 128-character keyboard buffer which is interfaced to a socket suitable for most seven-bit ASCII keyboards. We tested it with a Nascom 2 keyboard and was pleased to find that it worked instantly and without problems. Connection is via a 16-pin IDS plug.

The video interface is, naturally, the most comprehensive part of the board; it provides a peak-to-peak 2V composite video signal capable of driving even the most overworked monitors. When used with a good-quality monitor, there is nothing one could fault in the quality of the final image.

Although the board defaults to 26 lines of 80 characters or 26 lines of 48 link-cathode interlace and skew factors, cursor types and screen widths. The various combinations are easily selected by loading the required hexadecimal values to the cathode ray tube controller (CRT) registers.

A number of the more common formats are selectable using escape sequences typed directly through the keyboard. The more technically-minded may be wondering how a crystal-controlled clock can provide all the possible timing combinations required. The answer is simple: there are two clocks, one crystal and the other a variable oscillator. There is no modulator on-board so this card will not drive a domestic TV set.

A five-pin socket allows connection of a range of light pens — Gemini will be producing one of its own very soon — and the software to read them is already present in the monitor. The outputs are +12V, +5V and ground, while the inputs are for a cleaned-up phototransistor output and a switch.

Simple interface

By keeping this interface as simple as possible, Gemini has made it possible for all but the most ham-fisted to construct a suitable pen without having to go out and buy yet more expensive peripherals.

There are two character generators. A PROM carries 128 of the usual alphanumeric and graphic characters, while a RAM chip can be automatically loaded and modified again among the escape codes — with the character set for minor modifications or with the inverse of the standard set.

Provision is made for creating, storing and down-loading characters of your own design. The Bytewide socketing allows you to replace the ROM with RAM or vice versa for even greater versatility.

Data is transferred between the IVC and the host computer via three I/O ports addressed through the 80-Bus. The first transfers data, the second carries the various handshake signals, and the third is used by the host system to reset the IVC. A 256-byte PROM is provided to assign the ports — 0 to 7, B1, B2 and B3 by default. The documentation explains how to recode this for use with other port addresses.

This PROM also provides the decoding required to maintain compatibility with Nascom systems. The whole board usually functions satisfactorily when plugged into a Nascom 2, though there is one exception. Nascom monitors such as Nas-Sys are suited to the memory-mapped screen system and rely heavily on screen-line mapping for user input.

Using the IVC — which is, in effect, a separate input/output terminal — means turning your back on most existing Nascom software unless you are willing to rewrite some of your input routines. However, if you have already taken the plunge and turned to CP/M, you will already have the answers to this problem and will find that the IVC card is one very good answer to overcoming the VDU limitations of the Nascom.

The table shows a summary of the standard functions available with the IVC. However, as with any complex product this table can do little more than sketch an outline of this outstanding device. The full documentation runs to nearly 40 A4 pages — and even then it barely touches on the possibilities.

The documentation is thorough though not particularly well presented. Written by engineers for engineers, it is definitely not for the faint-hearted.

Conclusions

• At £161 including VAT, the IVC represents good value for money, providing, as it does, the equivalent of a complete VDU terminal on a single 8in.-by-8in. board.

• It is hardware-compatible with Nascom systems, but some rearrangement of the Nas-Sys input routines is required if the current Nascom software library is to be maintained.

• A short length of Veroboard for a bus, a Gemini CPU card and RAM card, together with this IVC, provide one of the least expensive ways for users to build themselves a very sophisticated computer system.
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FASTPLAN FROM COMSHARE
Making the computer make sense.
With a wealth of software already imprinted on its mini-Winchester, the Kontron parades major attractions for the business user. Mike Hughes conducts the inspection.

Kontron Elektronik of Munich, West Germany, manufactures a range of computers carrying the prefix PSI-80. Variations within the range depend on whether or not disc drives are supported and, if so, which types. The PSI-80D/W5 is based on a Z-80A microprocessor operating at 4MHz. It has 64K of dynamic RAM, up to 16K of PROM or EPROM — it takes the 2716 type — and 16K of video-display memory, the equivalent of eight screen pages. Memory blocks are selected into or out of the system architecture via I/O channels.

Hardware layout

Standard peripheral devices on the D/W5 are a parallel-interface keyboard, which is separate from the main console, and a medium-persistence, green-phosphor 9in. display built into the console. A 5Mbyte mini-Winchester hard disc is built in, as is a single, soft-sectored floppy-disc station, configured to take single-sided double-density discs — 77 tracks, 16 sectors per track and 256 bytes per sector to provide 308K of storage.

In addition to the keyboard socket on the rear of the console there are terminations for serial and parallel interfaces driven from the internal S/O and P/O chips. One such termination is pin-configured to support a Centronics-type printer.

Serial baud rates can be software-selected via the internal CTC chip; by altering the position of an internal jumper, the rate can be driven by an external clock for synchronous applications. The video signal to the internal display is paralleled out to an auxiliary socket to allow an external video monitor to be used if required.

The front panel of the console carries the display, the mini-Winchester, the floppy drive, an on/off switch and a Master Reset panic button. Apart from these two fundamental controls all other functions are reached through the 58-position QWERTY keyboard. There is no numeric key pad.

An internal loudspeaker generates a half-second bleep which is software-triggered via a monostable from one bit of the status port. The frequency of the bleep can be selected by software through the internal CTC channel.

The master computer board inside the console contains the CPU, main memory, I/O devices and clocks. It is set neatly within the base of the unit. Removing the base cover gives easy access to the slide-on jumpers which can be used to alter the hardware configuration. Though this should be a simple operation, the board lacks silk-screened component designations and there is no drawing of the board layout in the hardware manual.

Ample software

Connections are taken from the main board through ribbon-cable links to the main section of the console where the video-display module is to be found together with the tube, which appears to be of Japanese origin. The power supply, which is well protected from fingers, the mini-Winchester and a Micropolis 5.25in. disc drive are housed in the same unit. All this is neatly laid out, leaving ample room for a multi-slot motherboard frame which carries an ECB busbar designed to take single- or double-width Eurocards. The busbar is buffered to take up to seven standard or 30 LS TTL loads. The positioning of the ECB expansion frame should make it quite easy to extend the busbar externally via an extra ribbon cable.

Kontron's own organisation, based at St Albans, Hertfordshire, markets the machine in the U.K. The system supplied for review was priced at £6,663, including a wealth of software already imprinted on the mini-Winchester. Kontron tells us that buyers receive over 330K of system and utility software which includes the KOS operating system, Kontron's own 17K Basic and a 10K editor. Together with the operating system's command files these three account for about 190K of the software; the balance comprises graphics and I/O drivers, together with a handful of sample "fun" programs written in Basic.

Other utilities are available free of charge if the user wishes to drive alternative peripherals such as digitising tablets, light pens, digital plotters or any other peripheral-interface ECB extension cards which Kontron supplies. We were supplied with a number of CP/M programs which Kontron normally sells as extras. These include MBasic, Pascal, Fortran, Cobol, Assembler and WordStar, which the system quite happily supported, justifying Kontron's claim that KOS is upwards-compatible to CP/M version 1.4.

Although the price buys much more (continued on next page)
Operating system

Kontron has written KOS to implement CP/M so as to retain access to the wide variety of software written in that system. At the same time the manufacturer claims to have incorporated state-of-the-art improvements to allow multi-tasking and the support of a wider range of mass-storage media through I/O channels. Up to 10 different variables can be selected, including single- and double-density floppy, Winchester, and bubble memories. Each medium can have a capacity up to 64 Mbyte and file size can range from zero to eight megabytes. KOS also provides secrecy through the optional use of hidden passwords and invisible or secret files.

Like CP/M, KOS has a number of internal commands, though they are more numerous and very different in style and format. The more complex utilities are run as external commands from .COM files; there are 23 such commands which carry out similar functions to CP/M utilities but, again, are of different format.

Internal commands require single-letter keywords followed, if necessary, by specific parameters defining addresses, the names of I/O devices, the disc-drive number, etc.

A — allocates memory to prohibit use by user or system programs.
C — reverses the function of the Shift key.
D — frees memory which has previously been allocated.
I — lists a short form index of files or file types on a specified memory medium.
M — displays the number of the current master medium — disc drive — or assigns a new drive number.
N — initializes a named I/O driver.
P — selects one of the eight pages of the video display.
R — allows a string of command macros to be stored in memory and subsequently executed in the sequence specified simply by typing "R".
S — saves a specified number of 128-byte blocks to a specified medium number.
X — executes a .COM program after it has been initially loaded; it is useful for repeating an operation without having to re-enter the file name.

The documentation is aimed squarely at the knowledgeable user and will not be of much help to the non-technical. Even if you accept that this approach is justified, the documentation has a number of shortcomings. Although presented in English, it has obviously suffered somewhat in translation from the German original which makes for difficult reading at times. The meaning is unclear in places.

The Technical Manual describes the intrinsic KOS internal and external commands as well as the drivers which are supplied as utility software. Several of these are used to control the use of high-resolution graphics on the internal display. The manual goes on to describe the Kontron Debugging Module, KDM, which is a near equivalent to CP/M DDT, and then goes into considerable detail on the inner workings of KOS. This is heavy going even for the most determined of readers. The final section deals with the software-to-hardware interface and gives details of the memory architecture, designation of I/O ports and pinning of the external sockets.

This section gives no details of circuitry or board layouts, and there is no components list. There are four unmarked sockets on the rear of the console unit, and a thorough search of the manual failed to reveal any information as to which is which. The only socket referred to is that for the keyboard which, fortunately, is identified in the section dealing with the initial setting up.

The User's Manual deals very briefly with initial setting-up, and is aimed at the user with floppy discs. There are no instructions on a system using a mini- Winchester. It then describes how to use the text editor and goes on to describe the instruction set of Kontron's own PS/ Basic in a section which is well peppered with short examples of the keywords used in their correct syntax.

Most information the technical user might need is contained somewhere within the manuals, but they are not clearly laid out and omit a considerable amount of important hardware information. The User's Manual will be of very little help to the inexperienced user. Unless the software backroom boys generate some automatic loading and running programs, available off the shelf, this will seriously limit the machine's appeal.

Conclusions

- The hardware is neat and tidy, and seems well designed. Flexible expansion is possible by adding Eurocards.
- More than 5 Mbyte of storage is available on the integral mini-Winchester unit— an impressive capacity for a desk-top machine.
- The software of the KOS disc-operating system is reliable, but only an experienced specialist will be able to make the most of its refinements.
- KOS is upwards-compatible to CP/M to provide a wide range of software for the more down-to-earth user.
- At £5,663 the Kontron is rather expensive compared with other small office systems, though for some users the built-in capacity for expansion may offset the extra cost.
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<table>
<thead>
<tr>
<th></th>
<th>ACT Sirius 1</th>
<th>Typical Personal Computers</th>
<th>Typical Business Systems</th>
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</thead>
<tbody>
<tr>
<td>Memory</td>
<td>128K-1024K</td>
<td>32K-64K</td>
<td>48K-256K</td>
</tr>
<tr>
<td>Disk Capacity</td>
<td>1.2Mb-10Mb</td>
<td>140K-1Mb</td>
<td>1.2Mb-10Mb</td>
</tr>
<tr>
<td>Processor</td>
<td>16 bit</td>
<td>8 bit</td>
<td>8 bit</td>
</tr>
<tr>
<td>Operating Systems</td>
<td>CP/M-86, MSDOS</td>
<td>CP/M or Machine Specific</td>
<td>Usually Machine Specific</td>
</tr>
<tr>
<td>Languages</td>
<td>Microsoft BASIC, Compiled BASIC</td>
<td>Microsoft BASIC, perhaps one or two others, eg PASCAL</td>
<td>BASIC and perhaps one or two others</td>
</tr>
</tbody>
</table>

ACT Sirius 1 is a new generation personal computer. Quite simply, it has no competition at the price.
It's the first personal computer developed from the outset for business and professional use.
It's launched with more software than anything before it.
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We test two contrasting packages for Apple microcomputers: a utility to help draw and manipulate shapes, and a structured Basic pre-compiler.

**SHAPE MANAGER**

There are two ways of presenting graphics during a program. You can either arrange for the user to watch the picture drawn line by line as the program runs, or you can fill the screen with a picture from memory all in one go. In the Apple "Lemonade" demonstration program, for example, 12 lines have been slowly drawn on the screen before anyone watching realises that the developing picture is of the inside of a living room. Rapid drawing is perhaps most useful when animation is required.

The only remaining problem is establishing the pictures, or some representation of them, in memory in the first place. Until we can afford light-pen or graphic-tablet accessories, utility programs which enable pictures to be stored and reproduced easily will be particularly valuable. The Sinta Shape Manager is such a utility designed to ease the burden of creating shape tables for the Apple II of ITT 2020 computers.

The Basic for these machines has five special commands which enable shapes to be manipulated: Draw, XDraw, Rot, Scale and ShLoad. Before these commands can be used, a shape must be defined by a shape definition. Then you can ShLoad and Draw it, rotate the shape and scale it up or down as necessary.

The Sinta Shape Manager provides help in the shape-creation stage. In order to draw a shape in the conventional manner it must first be converted into a series of plotting vectors — see figure 1.

Figure 2. The finished picture (a) can be constructed automatically from its two elements (b).

The software is robust, and contrives to have all the commands documented on the screen at the press of a CTRL-C or two. Sound from the speaker is used to assist you in a novel and enterprising way. Built-in utilities generate standard shapes such as regular polygons and ellipses.

If you can afford a graphics tablet, the Sinta Shape Manager will not be of interest. If not, the system can save hours of programming effort and enable you to enhance the graphics aspect of your programs considerably.

**Conclusions**

- This is an impressive first package from Sinta, available for about £60, which provides easily-accessible graphics for your programs.
- Commands are documented on the screen by simple keystrokes.
- The manual is easy to follow and lively.

**APLUS BASIC**

The pre-compiler provides 11 extra error messages:

- &C - convert structured Basic to Applesoft Basic
- &C - convert structured Basic to Applesoft Basic
- &L - indented listings
- &C - convert structured Basic to Applesoft Basic

Others may be available, depending on whether you have Renumber or AOPT.

Having established a system with structured Basic, what can you do? The new functions it provides are listed in table 1, and with them you can dispense with the Goto statement. Unfortunately the manual merely lists the new functions and briefly explains how to use them, but gives no good examples of a structured Basic program showing how they fit together. The sample program on the disc is no help either.

The pre-compiler provides 11 extra error messages:

(continued on page 79)
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ANOTHER TRIUMPH FROM ADLER
(continued from page 77)

Zombie menace

The best way to learn a new computer language is to write a program in it; I decided to write a game program to illustrate Aplus Basic. In the game of Zombie you are stuck on an island full of potholes and zombies. The zombies come straight for you, trying to eat you; to survive you must lure them into the potholes.

The game is in real time so you must think and act fast to survive. The keys to operate it are:

W — go up,
A — go to the left,
S — go to the right,
D — go down,
Z — jump at random to another free space on the screen; these jumps are limited in number.

And any other key to stop.

Since the program is in a block structure it is quite easy to see what is happening. The first section starts the game and runs while E, the game indicator, is 1. It calls the set-up section, then a delay, then the game itself and then the end section. The End block calls a routine called Lines to print three lines. If there are no more zombies left, it prints out congratulations, otherwise it prints out commissions. After finding out if you want another game it sets the game indicator accordingly.

The Lines routine just clears the screen and prints out three lines. Game is a very simple block which calls the Move routine to move you if there are some zombies left, and then calls Zombie to move the zombies.

The Move routine looks to see if you have hit a key; if you have, it sets the move variables, X1 and Y1 to zero; then it sees which key you hit and sets the move variables accordingly. If you want to make a jump, and have some left, it decrements the number of jumps, wipes you out with Wipe, then places you back on the board using First Set.

Setup sets up the initial game. It clears the screen, puts a border of potholes around it, decides upon a random number of zombies then places these on the screen in the array, using Place to find unused spaces. After doing the same for potholes, it puts you on the screen using First Set, then decides how many random jumps you can have.

Software review

Table 1. The new functions which are available in Aplus structured Basic.

<table>
<thead>
<tr>
<th>IF (LE)</th>
<th>SELECT (Variable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commands</td>
<td>SELECT (B)</td>
</tr>
<tr>
<td>FIN</td>
<td></td>
</tr>
<tr>
<td>UNLESS (LE)</td>
<td>Commands</td>
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<tr>
<td>FIN</td>
<td></td>
</tr>
<tr>
<td>WHEN (LE)</td>
<td>Commands</td>
</tr>
<tr>
<td>FIN</td>
<td></td>
</tr>
<tr>
<td>ELSE</td>
<td></td>
</tr>
<tr>
<td>Commands</td>
<td></td>
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<tr>
<td>FIN</td>
<td></td>
</tr>
<tr>
<td>WHILE (LE)</td>
<td>Here the condition is checked before the loop is carried out and if it is false the loop is not executed.</td>
</tr>
<tr>
<td>Commands</td>
<td></td>
</tr>
<tr>
<td>FIN</td>
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<td>END</td>
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<td>END</td>
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<td>Commands</td>
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<td>FIN</td>
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<tr>
<td>END</td>
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<tr>
<td>Commands</td>
<td></td>
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<tr>
<td>FIN</td>
<td></td>
</tr>
</tbody>
</table>

There can be more than two check values against the variable; OTHERWISE is also optional.

Table 1. The new functions which are available in Aplus structured Basic.

<table>
<thead>
<tr>
<th>Commands</th>
<th>Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIN</td>
<td></td>
</tr>
<tr>
<td>(Value 1)</td>
<td></td>
</tr>
<tr>
<td>CASE</td>
<td></td>
</tr>
<tr>
<td>(Value 2)</td>
<td></td>
</tr>
<tr>
<td>ELSE</td>
<td></td>
</tr>
<tr>
<td>Commands</td>
<td></td>
</tr>
<tr>
<td>FIN</td>
<td></td>
</tr>
<tr>
<td>(A = 1)</td>
<td></td>
</tr>
<tr>
<td>PRINT</td>
<td></td>
</tr>
<tr>
<td>&quot;TO procedure&quot;</td>
<td></td>
</tr>
<tr>
<td>Commands</td>
<td></td>
</tr>
<tr>
<td>FIN</td>
<td></td>
</tr>
<tr>
<td>PRINT</td>
<td></td>
</tr>
<tr>
<td>&quot;DO procedure&quot;</td>
<td></td>
</tr>
<tr>
<td>Commands</td>
<td></td>
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<tr>
<td>FIN</td>
<td></td>
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<tr>
<td>END</td>
<td></td>
</tr>
<tr>
<td>Commands</td>
<td></td>
</tr>
<tr>
<td>FIN</td>
<td></td>
</tr>
</tbody>
</table>

Commands are any legal Applesoft commands or any other structured Basic commands; LE is a logical expression, such as A = 6.

Place finds a free space in the game array; Delay causes a slight delay; Wipe wipes you out of the array and off the screen; and First Set decides on a place to put you, using Place, then puts you on the screen. Draw Zombies puts a zombie on the screen and in the array.

Program conversion

As you can see, programs that are well structured are easier to follow than unstructured ones. To convert a program in structured Basic you type &C. You are then asked if you have saved the program. If you say no, then it will not be converted. This is a useful precaution since you cannot convert from Applesoft back into your original program. If you have saved it, the pre-compiler will spend some time checking the program for any errors. If no fatal errors are found, conversion will take place, and the line numbers at which blocks occur will be printed on the screen.

The Applesoft object program differs considerably from the structured original. Lines containing non-Applesoft commands are converted to legal commands. Numerous colons are added to identify these lines. The pre-compiler’s conversion of IF-Then statements is surprising: for example E = 1 becomes NOT (E = 1) though E & 1 would be a simpler way of

(Listing continued on next page)
ING the program, finding a logic error of complex logical expressions appears to represent the same result. Conversion of complex logical expressions appears to be tedious. If the pre-compiler could run in an interpretative mode it would be easier to find and correct any logic errors.

Conclusions
- Aplus is distributed in Britain by SBD Software. It costs about £20 plus VAT. It is good value for money for Apple users who need access to a structured language.
- The indented listing is a useful feature, making programs easier to read than normal listings.
- The structured Basic commands allow programs to be written without Gotos, but you cannot pass parameters from one procedure to another.
- The software is let down by its barely adequate documentation, which lacks a good example of a structured program.

(Listing continued from previous page)
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CP/M is the registered trademark of Digital Research, Inc. Z-80 is a registered trademark of Zilog Corp.
Sales Ledger answers the stock questions

Taking advantage of the greater screen and memory capacity of the 8050 Pet, Sales Ledger from Anagram contains a complete stock-control system in one comprehensive suite. Peter Wood evaluates its features.

Stock item | Description | In stock
---|---|---
C-E | CBM to IEEE Cable | 19
CBM4022 | 80 col. dot matrix printer | 4
CBM8024 | 132 col. printer | 2
CBM8032 | CBM 8032 32K Micro | 8
CBM8050 | CBM 1Meg. Disc Drive | 15
E-E | IEEE to IEEE Cable | 7
PUR | Purchase Ledger Package | 0
SAL | Sales Ledger Package | 0
SCS | Stock Control Package | 0

and a number key, so that PFO is a shifted zero for instance. This may seem unnecessarily complex, but when there can be over 100 different screens in a program, it is a sensible way of allowing the user to move around the system quickly, without going through innumerable menus.

Each screen display has an associated "help" screen, which may be displayed by pressing PFD. It allows inexperienced operators to find their way around quickly and without continually referring to the manual, while leaving the main screens uncluttered by spurious information. Once the concept of PF keys has been grasped — which take the average user about five minutes — the system is remarkably easy to use and very friendly.

A file-create program has to be run when the system is first installed, in order to define the number of diskettes to be used or, in the case of the hard disc, the number of blocks to be allocated for the file. Once the file creation has been run, the user may begin entering data into the system.

The program is loaded, as are the majority of Pet programs, by pressing Shift and Run, with the program disc in drive and the data disc in drive 1. The system displays a copyright notice for a few seconds, while the main program is loaded, and then requests the date. If the system is being run for the first time ever, the period start date — first of the month — must also be entered.

Once the system has been told the year, you will never have to enter it again, as a full Gregorian calendar checks all date entries for validity. Pressing PF3 takes you to the Master Menu, which has five options:
- Sales Ledger menu,
- Stock Control menu,
- Produce an Invoice,
- General processing,
- File maintenance.

The screen invites you to "select the option required with the cursor and press shifted Return". Moving the cursor from line to line on the menu can be accomplished by pressing any unshifted key except Stop, which allows you to close down the system if required.

The first option to select when setting up the system initially is general processing. Through it you may enter the current VAT rates — four are permitted, with VAT Exempt as the fifth — the printing defaults and your firm's details. The printing defaults include standard messages for the various reports, such as terms of sale, settlement discount and settlement days; the next automatic invoice number, if automatic numbering is required; the number of invoice copies to be printed; whether letterhead stationery is to be used, in which case the firm's details are not printed by the system; and type of printer and size of paper.

The firm's details are name, four lines of address, including post code, telephone number; and VAT registration number. This flexibility means that you
may opt to use plain paper, letterhead or pre-printed stationery designed for use with the system. Once this information has been entered, it is used as the default for all future printing, but it may be amended at any time.

Selecting the sales-ledger option produces another menu of five options:

- Ledger Processing,
- Customer Processing,
- Sales Area Processing,
- Report Printing.

Customer Processing allows examination, addition, alteration or deletion of customer details.

Unlike most other systems, this pro-

gram stores and retrieves accounts by customer name rather than account code, which eliminates the problem of remembering account numbers and makes the process far simpler. Once stored, the account may, if required, be accessed by only the first few letters of the name, making for much faster operation. If the partial name is unique, then the account is displayed immediately; if more than one account matches the input, then all the possibilities are shown and the operator may select the correct one with the cursor.

Fail-safe feature

Another aspect of the program which makes for faster and easier operation is the way the system ignores upper and lower case when looking up a record, while retaining the correct case when printing. For instance the account "Practical Computing" would be printed exactly as entered, but may be looked up by simply typing "prac", for example. You cannot delete an account unless the balance is zero — a valuable safety feature which prevents costly mistakes.

If the operator is unsure of the name of an account, then an index of all the accounts may be displayed, and the correct one selected with the cursor. Accounts are automatically placed in alphabetical order as they are entered, which avoids time-consuming sorting and ensures that individual accounts are easy to find, even in a long list.

The ledger-processing option requests the account name, which is entered again as either the full name or a partial name. A menu of options is then displayed, along with the account name and the current balance. The program caters for the addition, alteration or cancellation of invoices, credit notes and payments as well as "unallocated credit", where a single credit note is to be issued against a number of unspecified invoices. This credit may then be allocated to the appropriate invoices at a later date.

The system is entirely "open item", which means that any unpaid invoices are held on file indefinitely. Partial payments of invoices and partial credits are also catered for. The account detail may be examined on the screen at any time, with all outstanding invoices, credits and payments appearing in date order. There is not enough space on a floppy diskette to store the full details of every invoice, so only the goods total, carriage, VAT and discounts are retained. The user is expected to keep a copy of the physical invoice.

The suspense account is provided for those awkward occasions when a cheque is received without remittance advice, and the account for which it is intended cannot be identified immediately. Posting the amount of the cheque, together with an appropriate note, into the suspense account, records the arrival of the payment in the system. As soon as the customer has been identified, the posting can be transferred from suspense to the correct account. There is a facility to clear down all the items in suspense, but a printout of all the postings occurs before this can take place.

The Sales Area Processing option provides for the examination, addition, alteration or deletion of sales areas, which may be used for the analysis of sales by area, salesman and so on. These areas are identified by a code of up to three characters, and carry a fuller description for reporting. For example, you may set up "SY" as a sales area, with "Surrey" as the description, for use as a report heading. Each customer can be assigned to a sales area, so that the analysis takes place automatically.

Selecting Report Printing produces one of the largest menus in the system, with eight different reports provided, each of which has further selection criteria that may be applied. The reports are:

- Sales List — equivalent to a sales day book.
- Credit Note List — equivalent to the other side of the sales day book.
- Current Balances shows the up-to-date account balances, and may be produced for all customers or only those with non-zero balances, for all sales areas or a specified area, and for all customers on file or a group.

Aged Debt Analysis — the traditional aged debitors' list, but shown for four months and over, three to four months, two to three months, one to two months and under 30 days. May be produced by area and by group if required.

Customer Statements may be selected for the following categories: only customers with an outstanding balance; customers with an outstanding balance and all accounts settled this month; customers with an outstanding balance which includes an invoice dated earlier than a date you specify; the same customers but including all accounts settled this month. You may specify also a sales area and a group of accounts for selection. Selecting Report Printing produces details of all suspense postings in date order. Customer Names and Addresses prints this information by sales area and by group. It may be printed with full detail on to plain paper, or as address labels on gummed label stationery.

The stock control menu consists of nine different options:

- Stock Inquiry,
- Stock Area Processing,
- Order Processing,
- Allocation Processing,
- Movement Processing,
- Stocktaking,
- Price Changes,
- Supplier Processing,
- Report Printing.

Stock Inquiry allows you to examine a "stock card", either by entry of the stock-item reference or by a partial name, similar in operation to the sales ledger. A stock-item reference may be up to 10 characters in length, and may be any mixture of letters or numbers. As with the sales ledger, upper case may be used for legibility when adding a new stock item, but lower case is sufficient for retrieval.

The first page of the stock card shows the stock-item reference and its description, a free-stock figure, which is physical stock plus quantity on order less quantity allocated; in-stock, on-order and allocated figures; the date of the last activity on this item; its bin number or location; "supersedes" and "superseded-by" information, the quantity description, e.g. dozen, kgs, gross; reorder level, reorder quantity, minimum stock level, maximum stock level, lead time, cost price, selling price and VAT rate. Pressing PF2 displays the name and address of the main supplier of the item, followed by as many pages as are required to show the sub-suppliers, with separate lead times and cost prices. The main cost price may be used as an average cost price, automatically calculated from the quantities received from each supplier at the price specified in the supplier record, or a price entered manually when the goods are received.

Pressing PF4 displays details of all outstanding orders for the item, with date of order, order reference, quantity ordered, date due, supplier code, quantity received (continued on next page)
to date, lead time and total order value. Each receipt or partial receipt of order may also be displayed. The original stock card may be redisplayed by pressing PF8. PF5 will show all the in and out movements for the month for the item, and PF6 will show all outstanding allocations. Allocation details displayed are: date required, allocation reference, quantity required, cost centre, quantity sent and total allocation. PF7 causes the entire stock card to be printed out.

The facility to flit about throughout the system provided by the PF keys makes the program very quick and easy to use, especially where a large amount of data is being held.

Stock-control options

Stock Item Processing is used to examine, add, alter or delete stock cards. The user is prevented from deleting any item that remains active.

Order Processing is split into two main sections: single item or bulk order. In both cases the options are to raise, alter or cancel an order, but the bulk-order facility allows easy batch-entry of information, plus optional printing of the order to be sent to the supplier, complete with the supplier's name and address. When raising a bulk order, the operator has only to enter the stock-item reference for the program to display the description and standard cost price automatically.

Once the date due has been entered for the first item on the order, the system will default to that date for every following item, although the user may overtype both the date and cost price if necessary. The total cost of each line of the invoice is calculated and displayed at each stage, apparently instantaneously, providing yet another visual check.

Allocation Processing acts as the complement of order processing, and provides for single or bulk allocations.

Movement Processing is used for receipt of orders, issues of allocations, and miscellaneous in and out movements. There is an option to process either a single item or a bulk order or allocation. In-movements may be used to update the standard cost price if required, and automatic averaging may be used. Stock may be issued at standard selling price or at a manually-entered figure. Each out-movement may be analysed to a cost centre if required.

The Stocktaking option is used for manual adjustment of stock figures after completing a stocktake, and generates an appropriate in- or out-movement with a reference of "stocktake" on the stock record.

The Price Changes option is used to either increase or decrease the cost and/or retail prices by a percentage specified by the operator. The 'changes may be selectively applied to only those items relating to a specific supplier, and further to only a range of items selected by item reference.

Supplier Processing simply provides the ability to examine, add, alter or delete a supplier record. A supplier record consists of a code of up to three characters, name, four lines of address, telephone number and contact name.

The stock-control Report Printing menu is thoroughly comprehensive, with 11 different reports, each of which may be selectively produced for a range of items, as well as by other criteria:

- Stock Cards — full page per item, showing a semi-permanent information about the item, together with suppliers, order history, in- or out-movements and allocation history. It may be selected for only those items which have had activity in the current month.
- Stock Level Highlights shows all items that are under reorder level and/or minimum-stock level or over maximum-stock level.
- Stocktaking List shows item reference, description, bin location, quantity description and quantity in stock, used to physically check stock items.
- Outstanding Orders shows items on order and total value of orders, either for all suppliers or for a specific supplier.
- Outstanding Allocations operates as for outstanding orders, but not by supplier.
- Stock Valuation gives total cost and retail value for each stock line, plus a total stock value.
- Stock Movement Analysis gives total cost of all in-movements and total selling value of all out-movements for each item, and computes the difference as a gross profit figure item by item.
- Cost Centre Analysis shows all movements for a specific cost centre.
- Inactive Stock prints all items that have had no activity since a specific date entered by the user.

Price List simply prints a price list.

List of Suppliers prints full details of all suppliers on plain paper.

The heart of the integration of this system is the produce-an-invoice option on the master menu. This section first requests a customer account name, or range of customers when disc space is at a premium.

The final option from the main menu is the file maintenance section which consists of a four-option menu:

- File Usage displays the amount of the space used, and the amount remaining at any time.
- Start of Month Processing is used to clear off all completed invoices, orders and allocations, to make room for the next month.

This section also sets the system date to the first of the next month.

Condense Customers is used to clear off completed invoices for a specific customer or range of customers when disc space is at a premium.

Condense Stock Items does for the stock items what the previous option does for customers.

During a fairly long and detailed evaluation, we were unable to crash this program in any way, by entering the wrong data, or selling items that we did not have, or turning the printer off, or any of the other "standard" ways of breaking a piece of software. It is a credit to the authors that they have managed to write a program that is both secure and convenient to use.

The Anagram Sales Ledger with Stock Control is available from most Commodoire dealers or direct from Anagram Systems, 60A Queen Street, Horsham, West Sussex. Telephone, (0403) 50854.

Conclusions

- The Anagram Sales Ledger with Stock Control System is a very comprehensive and detailed program which should provide most medium-sized companies with all they need for stock and ledger work.
- The standard of software is very high: it is easy to use and apparently unbreakable.
- The speed of operation is satisfactory, since machine code has been used.
- The accounting facilities seem more than adequate for most companies.
- The stock facilities are comprehensive and those we tested are generally suited to a marketing company. We understand a version exists for manufacturers.
- The use of PF keys may be slightly confusing at first, but they greatly speed up the operation of the system, and provide for greater flexibility than other methods we have seen.
- The package is well documented, and the help screens within the program provide an excellent back-up to the manual.
- At £799 the program represents good value for money.

PRACTICAL COMPUTING March 1982
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ATLANTIC MICRO SYSTEMS

PRACTICAL COMPUTING March 1982
Adventure, the classic microcomputing game, has spawned hordes of look-alike programs and seems destined to dominate the game-playing scene for some time. Dennis Ellis reviews its origins and looks ahead to the exotic versions of the future.

OF THE COUNTLESS computer games to have arisen in the last few years, the one called Adventure towers head and shoulders above all the rest. It is equalled in its popularity only by the immensely successful Space Invaders games. Adventure was written by Crowther and Woods of Stanford Research Institute, based on the game of Dungeons and Dragons by Gygax and Arneson.

Dungeon master

Dungeons and Dragons was the first role-playing game in which players assume alter-egos and use them to wander through strange, exotic lands or caves, encounter hideous monsters and strive to accumulate wealth while building up the personality of their particular character. Their origins can be traced back even further to the appeal of the sword-and-sorcery novels, by such authors as Michael Moorcock, that gained such popularity in the early 1970s. These games usually have a dungeon master who does not actually participate. He or she has a detailed map of the dungeon, and charts the progress of the players and other unsavoury inhabitants of the dungeon. At the start the players do not know the layout of the dungeon. They tell the dungeon master which passage they want to enter next, and the dungeon master describes their new location plus any objects around. If a confrontation with a creature takes place, the dungeon master throws dice to simulate the random element in any conflict, and after weighing up such factors as what weapons are being carried, how strong the contestants are — based on earlier skirmishes and blows suffered — the result is announced. As you can see, there are few limitations to the game, and some games have lasted for many weeks.

Will Crowther's computer program for Adventure was written in Fortran and undertook the role of the dungeon master for the players. You typed in your request and the program described your new location and its contents. Adventure was released to an unsuspecting world in 1976. It was added to the Decus library — the free software-exchange mechanism for the Digital Equipment Computer Users' Society — and installed mostly on Dec's PDP-11 systems. Within a short time its popularity was outstripping every other program on this library, which contained several thousand very worthy works.

In 1978, Dungeon was added to the Decus library. It amplified the concept even further, with more locations, descriptions, inhabitants and intriguing puzzles to solve. Dungeon was written by four members of the Programming Technology Division of the MIT Laboratory for Computer Science, Tim Anderson, Marc Blank, Bruce Daniels and Dave Lebling. Again, it proved a winner.

With so little information available about such popular public property, it is not surprising that modern myths are emerging around these programs. One of them relates how players telephoned the authors at 3 a.m. to ask how to get back across the Troll's bridge. It has been said that Dungeon was written in only four days — from Friday evening working solidly through to Monday morning, though it must take longer just to type in the text. So much interest was generated by Adventure that the wary Dungeon authors embedded a strong warning in the program to the effect that any personal callers would be rudely ejected from their premises.

Adventure and Dungeon both needed extensive disc back-up to store the database containing the descriptive text and the links between interconnecting passageways. Though this clearly made it unsuitable for the normal home computer, the floodgates opened and all...
The story then continued, depending on your choice of plot. The whole book was fragmented in this way, and its limitations are obvious. There have been stories in the computer trade papers based on people’s alter-ego adventures experienced in a game and expanded into a true sword-and-sorcery piece. Attempts at constructing unstructured plots in literature hark even as far as the old parlour game of Consequences. This idea spawned

<table>
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It comes as a surprise to learn that Adventure is not restricted to computers, and there have been several efforts to tailor the concept for other media. The original board game of Dungeons and Dragons came first, and is still very popular. There was even a book, published some years ago, with which you could construct your own Adventure-style plot. On reaching a certain point in the text, where our hero Mr Bloggins was poised before a door behind which he suspected a trap, the narration ended on the following note:
Games

**Games**

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<tr>
<th>Name</th>
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<th>Supplier</th>
<th>Price</th>
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Artic Computing, 396 James Reckitt Avenue, Hull HU8 0JA.
David Blagden, ZX-80/81 User's Club, PO Box 156, Kingston-upon-Thames, Surrey KT2 5UQ.
Calisto Computers, 119 John Bright Street, Birmingham B1 1BE. 021-632 6458.
Compukit, 290 Station Road, Stechford, Birmingham B33 9QR.
Crystal Computer, 12130 Steffs Ct., San Martin, California 95046, USA. (0408) 683 9986.
Essential Software, 47 Brunswick Centre, London WC1N 1AF. 01-837 3154.
Gatepost, Gate Microsystems, The Nethergate Centre, 35 Yeaman Shore, Dundee.

*These Adventure-style games were available in November 1981. At least one known supplier is given for each game, though it may be available elsewhere — it can pay you to shop around as prices vary considerably.*

some extremely funny computer games that inserted words into a pre-defined story at random.

The television has taken a stab at similar ideas. In the mid-1960s there was a children's serial that used to end each week with the invitation for people to write in with the script for the next episode. In 1979 the BBC brought out a programme called *The Adventure Game*, a thinly-disguised attempt to grab the popularity of the computer game. The show had three celebrities, held captive in an alien cave system, who used various obstacles to retrieve a special crystal needed for their spaceship. The show was said to be unscripted and the dungeon master was a friendly alien who appeared offering help whenever they got stuck. They even sat at a computer terminal and played a variation of *Adventure* at the start of each show.

**Solving teasers**

More recently, the BBC has screened *Now, Get Out Of That*, in which a group of strangers are dropped into the countryside pretending to be enemy saboteurs. They have to solve the usual mental and physical teasers before finally reaching the end-game of stealing a solar-powered battery from a castle.

Perhaps the most successful of this type of show was ITV's *Masterspy*, screened in 1978. It was really a game or quiz show, with three contestants pretending to be secret agents training for a mission. The first half of each show was a series of clever mental tests to score "agent ratings". The two higher scorers went on to the second half to participate in a strange play in which they were free to say and do anything, while the other parts were taken by actors.

A tremendous amount of imagination and effort went into each episode and the actors always managed to steer the contestants without spoiling the illusion. The dungeon master was William Franklyn and it was he who helped to make it all believable. Sadly, the show ended after the second series but it still remains one of TV's best attempts at creating a fictitious world for contestants.

More sophisticated programming languages and innovations in the hardware will allow future authors of Adventure games much greater scope. As memory becomes cheaper and on-line disc storage readily available to more users, Adventure games will undergo a dramatic increase in size.

**Restrictions lifted**

Once the storage space restrictions are lifted, many more "rooms" and their various connecting passages will be available for the games. Fast-access discs can hold enormous databases for Adventure programs and will lead to even more mind-stretching puzzles to solve. Perhaps there might be a version of Adventure implemented through the viewdata terminals tapping the mammoth databases there.

There will be a move towards graphical representation of scenes in the games. There are already Adventure games that use graphics to a limited extent. Future games will not just have "plan view" graphics but true isometric images and colour.

The recent television series *Cosmos* contained several computer-generated scenes of simulated fly-bys of planets as viewed from a passing spaceship. These images are realistic enough to equal modern photography, and their smooth movements rival conventional animation. Such software could be used to create vivid scenes on a screen in which objects can be manipulated and various creatures evolve around a fictitious landscape in real time.

In due course, we will have true three-dimensional images using red/green overlays or holographics. A three-dimensional Space Invaders computer game using holography techniques has already been aired at a computer-games exhibition in the United States.

(continued on page 93)
COMMAND-O ON TRIAL!

If you own a PET or CBM computer with disks then you ought to have a COMMAND-O chip. It's got all the facilities of that other chip (can't think of the name), plus BLEEP, EXECUTE, INITIALIZE, PRINT USING, AUTO-REPEAT — and you can scroll a program listing up and down the screen! There are lots more functions, but perhaps the best way to learn about COMMAND-O is to use one. If you order a COMMAND-O chip from SUPERSOFT before 31st March you'll qualify for our special money back offer. Just return it in good condition within 10 days and we'll refund your money in full! COMMAND-O is for Basic 4 users only and costs £59.95 plus VAT. It fits in the UD3 or UD12 socket and comes with a comprehensive, but readable manual.

ARROW is a chip that will be of particular interest for committed tape users — because it will LOAD, SAVE and VERIFY at 7 to 8 times normal speed! There are lots more features for just £30 plus VAT, but since we're making the same money back offer why not try it out. Don't forget to tell us which machine you own (it works on all models except the original Old Roms) and which socket is available.

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New programs in the catalogue include SIMPLICALC (£26 on tape, £32 on disk), INSTRING (£10) which searches for one string within another, and LINK & SHRINK (also £10), a fascinating program that saves space by joining Basic lines together.

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There are already an arcade game that creates a simple landscape. It shows a view as seen from the forward slit of a tank turret. As you manipulate the joystick, you can turn the turret and your view pans across a chequered horizontal plane filled with symmetrical geometric polyhedra and other tanks. These shapes obey the laws of perspective, giving the impression that your tank is moving forwards the plane.

**Wire-shape effect**

One major drawback is that all the edges of the figures are visible at once, giving a wire-shape effect rather than a true solid feel. Nevertheless, games like this are a big step forward in creating a world within the computer. Perhaps we may even see some form of Adventure game appearing in arcades in the future.

Although these advances are the logical step in computer graphics for Adventure games, the most startling development comes from an improbable source, the American Central Intelligence Agency. The CIA is concerned that its agents may be unfamiliar with the layout of the streets of a town when they are acting as bodyguard or are on other duties. The CIA has developed a method of familiarising its agents with the streets in towns where they will be operating, based on a special form of video disc. A car travelling along all the streets of the town films the view from the driver's seat. The film is transferred on to a special video disc — which is simply a device for the random access of visual information.

With the aid of a micro and a monitor, trainees can then "drive" through the town without ever going there. At each junction, the driver decides which way to go, and the relevant section of film is selected off the disc with no loss of continuity.

Does the future hold Adventure video discs? Perhaps finely-detailed models and animation will be used for scenes, or we may find ourselves roaming down passages that tower over us on the scale of a Cecil B De Mille film set.

Adventure games of the future will also be able to use voice input and output in conjunction with the graphical images. You will be able to hear characters speak, and sound-effects will come into their own in no other game. Hear the crackling of fires, the clank of swords, the screaming cries of things not of this world!

**New horizons**

On the software side, we might see a special Adventure programming language which will make it easier for non-specialists to write new Adventures and thereby open new horizons to famous conventional authors. Imagine an Adventure program written by Isaac Asimov or Harold Robbins, or perhaps moving full circle with a game written by Michael Moorcock.

A further software development for future games would be the introduction of a time-sharing aspect. There are, as yet, no Adventure games that can support simultaneous access where one player can enter a room and meet another player who is also exploring the passages. Such a game could already be written using the resource-sharing minis and the capabilities of networking minis together, and several people using separate terminals could participate in the same game. They could enter the passageways together, split up to explore, and meet back at some prominent landmark to share their treasures. To each player, the other players would just be other objects in the Adventure universe.

**A fantasy universe**

You might be able to talk to one another, leave each other messages chalked on the walls of a cavern, or even fight and kill each other. Could gang warfare break out in Adventureland? You are not restricted by distance either. With modern telecommunications and satellites, you could be accompanied into the caves by someone sitting at a terminal in Australia.

Most current Adventures take place in a fantasy universe, but this need not be so. Why not a game where you can wander down faithful renderings of the streets of London? This would be handy for London cabbies "on the knowledge" or tourists finding their way round. You could even enter the Underground and catch a train. You could set a game in Medieval England populated with famous kings and queens and containing realistic descriptions of contemporary scenes.

---

(continued from page 91)

Graham Reif leads you down dark, winding corridors, through deep mines shaken by earthquakes in this maze game. This Basic program means you can generate as large a maze as you need — on even the smallest micro.

Consider the following simple algorithm for generating random numbers:

\[
N = 0.5 \quad \text{FOR } I = 1 \text{ TO } 1000
\]

\[
N = \text{FRAC}((\pi + N)I)
\]

PRINT N

NEXT I

It prints 1,000 random numbers between zero and one.

On the first line of the algorithm N is set with a seed value. In the For loop it is changed to successive random values — for purists, pseudo-random values. The function FRAC returns the fractional part of its argument. It is not a standard Basic function but it can be reproduced by

\[
X = \text{INT}(X)
\]

where INT(X) is usually available as a standard function which returns the integer part of its argument. FIX(X) is an alternative.

It is the process of discarding the most significant digits of N which makes the algorithm appear to be random. A similar principle can be applied to any function. For example, the third and fourth digits of \(\cos(X)\) for various X gives two-digit results which appear to be fairly random, provided that the values of X are not too close together.

One important feature is that while the results are random for different X, the same number is always returned by the function for any particular X. The Basic statements in listing 1 extract the third and fourth digits of \(\cos(X)\).

Mazes are two- or three-dimensional structures which can be defined by random functions of two or three co-ordinates. The function indicates whether any

(continued on page 95)
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given location is open corridor or solid wall. If the location is defined by co-
ordinates X, Y and Z — for unit measurements east, north and downwards — then a possible function would be computed by the Basic subroutine:

9000 U = 100 * SQR(X*X + Y*Y + Z*Z)
9010 W = U - INT(U)
9020 RETURN

Note that negative Z should be avoided before calling this subroutine. If W > T, where T is a constant “threshold” value set at the beginning of the program, a wall is present; otherwise the given co-ordinates X, Y, Z define a corridor location.

On the threshold

The maze represented by this function is clearly enormous. The co-ordinates are restricted only by the number of significant figures held for each variable in the particular computer. It requires no initial setting up and no data storage except for the threshold value, T. This threshold may be useful in Adventure games: by varying it only slightly some cells change from wall to corridor and vice versa, while most remain unaltered. In this way “earthquakes” can be simulated.

Once the function has been calculated for a given location the value returned, W, can provide further information about that location. By examining particular digits or groups of digits, and determining whether they lie within predetermined ranges, events or objects can be identified for the given location from preset tables which apply throughout the maze.

The probability of particular events or objects can be programmed into such functions of the type described you can organise so that the program can quickly determine whether there are any entries in it for the current location, e.g., by hash-coding the co-ordinates. This is a small price to pay for the other benefits.

Listing 2 shows a development program which experiments with these techniques. It is written in a general Basic, avoiding graphics, so that it will run on most machines, though it was developed in Tandy level-II Basic.

The program accepts six direction commands: east, north, west, south, up and down, each of which may be abbreviated to the initial letter. After each move, the initial letters of the directions of all open corridors leaving the new location are displayed. Invalid commands or attempts to move into the wall are greeted with the response “Impossible!”.

When Z=1 you have reached ground level, and further upward movement is prevented. The program starts at ground level, where you may wander freely until you find a mineshaft going down. There are some very deep mines, but it is possible to get back out of them. Here lies the joy of this technique: by using various functions of the type described you can invent your own structures and explore them without knowing in advance what you will find.

The particular function used in this program is only an example and probably a rather poor one at that because it takes a significant time to compute. A “torch” command, finding the length of a straight corridor, can take several seconds to give an answer. You may well be able to develop faster functions with the desired properties, particularly if you are willing to experiment with assembly code. By using several such functions, very complicated game structures can be created, even in the smallest machines.
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Heart of the labyrinth

Find your way to the centre of the maze with this intriguing machine-portable game presented by P J Goss.

This program creates a labyrinth through which the player has to move to find the centre. Four different sizes can be created with cells ranging from five by five to 11 by 11. The labyrinth is scrolled up the screen, leaving the player to move around in the dark. Occasionally the player is told how far away the centre is.

The program makes extensive use of arrays. The labyrinth is first created with all the cell walls intact and with no paths. This is done when array A is initiated. Arrays B and C are zeroed ready for use later on.

A path is then randomly created from the centre. A wall is removed from either the north, south, east or west side of a cell and from the adjoining cell until a continuous path is found to an outside wall.

10 REM LABYRINTH P, J. GOSS 2-9-81
20 DIM A[24,24], B[121], C[121]
30 PRINT "********** LABYRINTH **********"
40 PRINT
50 PRINT "FOUR SIZES OF LABYRINTH ARE AVAILABLE"
60 PRINT "AFTER SELECTING THE REQUIRED SIZE A"
70 PRINT "LABYRINTH WILL BE DISPLAYED AND THEN"
80 PRINT "DISAPPEAR FROM THE SCREEN."
90 PRINT "TO MOVE AROUND THE LABYRINTH YOU ARE"
100 PRINT "ASKED TO TYPE DIRECTIONS IN THE FORM"
110 PRINT "OF N,S,E OR W."
120 PRINT "TO FINISH TYPE F"
130 PRINT
140 PRINT "SIZE";
150 INPUT L
160 IF L<1 OR L>4 GOTO 130
170 LET M=7+(INT(L)*4)
180 GOTO 200
190 REM INITIATE ALL ARRAYS
200 FOR I=1 TO M+1 STEP 2
210 FOR J=1 TO M+1 STEP 2
220 LET AI,I,J=0
230 LET AI-1,J-1=1
240 LET AI,I,J-1=2
250 LET AI-1,J+1=3
260 NEXT J
270 NEXT I
280 LET AT(M+1)/2,(M+1)/2]=1
290 GOTO 300
300 FOR I=1 TO 121
310 LET BI]=CII]=0
320 NEXT I
330 REM SELECT RANDOM PATH FROM CENTRE
340 LET D=1
350 LET S=T=(M+1)/2
360 LET B[I]=CII]=S

Tests are made to stop the path turning back on itself, and to ensure that it is created with a pre-defined minimum length. The relevant values to signify the absence of a wall are stored in array A. The cell co-ordinates for the path to the centre are stored in arrays B and C.

The remainder of the labyrinth is created from the player's starting point. Tests are made in a clockwise sequence on the adjoining cells for a possible path. When one is found it continues until a dead end is reached. Further paths are then taken off the main route in the same way, when no further paths can be taken off the main route they are then taken off the secondary paths until the labyrinth is complete.

A subroutine is used to display the contents of the array A in a graphical form. The player's starting position is marked with a "?" and the centre with an "X". The screen is cleared by 23 line-feeds and the player is asked to move. If the display disappears too quickly a delay can be inserted before line 1340.

After each move the program decides if you have walked into a wall or tried to walk out of the labyrinth. A variable P keeps track of how far away the player is from the centre, and is displayed every six, five, four or three moves, depending on the size of the labyrinth. A continuous update of steps to the centre can be produced by making line 1780 an unconditional jump.

When P=0 the game is over and the labyrinth is displayed again, but this time showing the path to the centre and the final position of the player. The same will happen if you give up before reaching the centre by typing F.

PRACTICAL COMPUTING March 1982
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Akin picked up the instruction leaflet and, not for the first time, turned to a single paragraph printed in red. "This circuitry is copyright", it stated, "Any attempt to probe, study, or otherwise examine, will cause the toy to harmlessly destruct".

He picked up the doll itself, lying face down on the bed where Tina had left it. Its large, round, blue eyes stared owlishly at him, meeting his troubled gaze with dumb insolence. Maybe the thing could see as well as hear. Yes, there was definitely something disturbing about the Candy doll, and if Tina had not been so attached to it he would have tried taking it apart, without hesitating to probe, study, or otherwise examine, as the red paragraph had warned. He knew that any attempt to hint at his travail to Tina was futile; she was too young to understand, and if she had any awareness of his problems it would only make her feel deeply distressed.

Akin's worries were solely centred on his efficiency as a single parent. Having established that Tina was not misbehaving at school, and having been accused of over-reacting, he forced himself into silence. To have done anything else would have been to admit to his inadequacies.

He was determined to cope, despite increasing pressures at work brought about by the mounting international tension. Naturally, he had tried to listen at Tina's door, but Candy's sensitive instrumentation had detected him at once. The doll's cry of "Hello Daddy!" had made him feel faintly ridiculous. The last thing he wanted was to look foolish in the eyes of his own child.

Akin replaced the doll on the coverlet and quietly left the room. From now on, Tina and Candy would have privacy.

The young "fabulous Candy doll"! it said. "Candy walks! Candy talks! Candy will entertain. Answer the following questions about your child's IQ and environment, and send the reply with the order form. The Candy doll's vocabulary will be individually matched to your child's needs."

"Stocks are limited, so order without delay". The address was a box number at a central London office.

The price was astonishingly low. Akin had been unable to resist the offer, and a few days later had almost fallen over a large package on the front doorstep. In it was the doll, with its steely eyes and over-large head. Tina had loved it. She spent hours imparting all manner of childish confidences to the toy, while it replied in its precise, pedantic little speaking voice. Akin was able, after many a trying day, to relax in peace.

But that had been several weeks ago. Now there was too much silence, too much retreating into the nursery. Tina, the hitherto extrovert six-year-old, had become subdued and sullen. The doll had never responded to Akin's questions, apart from a peremptory "Give me back to Tina", so he had no idea what his child and the automaton had been discussing.

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Years of preparation had elapsed before the Candy promotions had been sent out. Akin and many other defence personnel had been under surveillance for a long time, ever since nuclear submarines had been discarded in favour of a less expensive land-based programme. Akin had always been high on the list of priority targets, but the departure of his wife had placed him at its head, for it rendered him vulnerable in a way which ideally suited Candy's creators.

Spies could be relied on to co-operate in small matters such as the updating of pass-codes, but the main objective — it had long been decided — could only be implemented by someone who was totally ignorant of the consequences.

Candy's programming was as complete as possible on delivery, but the doll still received certain updates at irregular intervals, in the form of coded FM transmissions. Daily, it received Tina's undivided attention.

Again, Candy! I want to hear Mummy again!" said Tina. "You heard her yourself, when you were three", Candy said placidly. "You heard why she was leaving Daddy. You were hiding on the stairs!"

"Play her again", Tina repeated. "You were very little when Mummy went away", said Candy in the same even tone. "Too little to understand why. Do you understand now?"

"Play her!" Tina was close to tears.

Finally, Candy obliged. Jean Akin had rejected her daughter as well as her husband, but any such suggestion had been edited out. What the child heard, issuing tinily through the doll's speech circuits, was: "I'm going away. Any other man would have seen the danger signs long ago, but not you. Too single-mindedly loyal to System Alpha. For five years I've had to put up with your unscheduled overtime, conferences, system malfunctions and Christ knows what else. Only I haven't been putting up with it, not for the past six months!"
Here, Jean had described her lover, but that had prudently been deleted as well. "If you want me to stay", her voice continued, "you will have to change your job." If you are not prepared to make that sacrifice then there is nothing more to be said".

Atkin had remained silent. His injured pride would not allow him to plead. "That's it, then", said Jean after a moment. "I'm going. Oh, don't look so hurt, darling — you've still got your damned computer. You don't really need me!!" The recording ended. Tina stared expressionlessly at the floor.

"Do you understand why Mummy won't" repeated Candy.

"Course I do", Tina said crossly. "Don't keep on. It was Daddy's job." "Would she come home if it were not for the job" asked Candy. "I think she would, don't you"?

"Yes. But Daddy won't give it up. Not ever".

Many miles away, the split-second decision was made. This was the right moment to initiate phase two of the operation.

"Daddy will not resign as long as the computer's working", said Candy after a long pause. "But if it stopped, he would have to stop too! Think how pleased Mummy would be".

"She'd come back to us, said Tina with utter conviction. "But Daddy says the computer never stops".

"I could stop it", said Candy quietly. "I know how. But you will have to take me there".

Tina looked apprehensive. "I don't know the way".

"I'll show you".

"I'm not allowed out on my own", said Tina, twisting her hands together nervously.

"I'm not a baby", said Candy sharply. "You will not be on your own — you'll have me".

Tina stood in front of a large security door which looked uncompromisingly shut. "Hold me up to the voice identification grid", said Candy. "You should just be able to reach it. And remember what I told you on the way here — no talking when I'm talking, or you will spoil everything".

"Yes, Candy", said Tina dutifully. She hefted the doll by its ankles. In a perfect resonant imitation of Atkin's voice, a Candy recited: "If music be the food of love, play on". The door rolled back.

"Candy, how did you do that"? Tina squealed.

"Quiet"! snapped Candy. "Do you want to get us caught? Run to the end of this passage, and hurry!!!"

Tina obeyed, scurrying fearfully along. High up in the walls, far above her head, were transparent panels, from behind which came the sound of movement and chatter. Candy had not told her what to do if she met anyone, and she dared not ask now. The passage remained clear and they reached the security doors leading to the computer room, and once more Tina raised the doll as high as she could.

"Ill met by moonlight!", pronounced Candy in Atkin's voice. The doors parted briefly, closing again as soon as Tina had stepped through. Inside, disc and tape drives whirred busily, but no people were in evidence. Beyond the rows of storage units was the unattended executive console.

Tina hesitated, warily hostile, before this array of hardware. "I don't like... she began in a whisper.

"At the other end of the room there is a little TV", said Candy brightly. "Go over to it, and sit me on the chair".

Reassured, the child crossed to the executive console and perched Candy on the swivel chair which faced the VDU. Then she waited, fidgeting.

"Tina", said the doll after another long silence. "I'm not high enough to watch the screen. Find something to put on the chair seat, and sit me on top".

Candy had never before mentioned an ability to see, but Tina was too preoccupied to notice anything out of the ordinary. Tiptoeing back into the computer section, she found some surplus disc packs and returned with a pair of them. "Good girl", said Candy after being repositioned. "I'm going to talk to the computer now, so stay absolutely quiet till I have finished. Do not go near the main doors. Is that clear"?

"Yes Candy". Tina took a couple of paces backwards and stood waiting.

"Shall I compare thee to a summer's day", Candy began, using Atkin's voice. "Request account utility".

The screen began to list options.

"Create new account holder", Candy continued.

"Priority levels one through six.

Request voice print"

Bored by this incomprehensible conversation, Tina turned her attention to the rather pretty display of lights on the diagnostic panel.

"The quality of mercy is not strained". Candy's own voice had returned, quoting words from the screen. The new LD was duly listed and acknowledged. Tina moved away and began to pick at a loose piece of wall tiling.


The screen blanked. Candy then proceeded to give the Shakespearean identities of several key personnel, with voices to match. Each time the VDU responded with the simple statement "account nullified".

Suddenly there was a sharp crack. Little fragments like hailstones spattered briefly against the console as Tina whirled round. Her shriek was followed by a flood of incredulous tears. Her doll had gone.

Seconds later, the sobbing child ran from the computer room. She was met by a throng of people who had been trying to get in. Atkin was among them.

"What on earth... " he began, seizing his daughter and shaking her. "Tina! Tina, what are you doing here?"

"We were stopped at the computer for Mummy", said Tina when she had calmed down enough to speak. "Candy talked in your voice and a lot of different voices. I put the things on the chair so she could talk to the television, and then she... she... her face crumpled once again.

"There is no possible error", said the general. "Norad confirms that ICBMs have been launched against the United Kingdom!"

"Then why don't the fools retaliate?"

"It looks like someone has taken out our defence network, sir. Have we your permission to launch a counter-strike"?

The President, unlike his predecessor, was not a warlike man. He paused only a moment before replying.

"No, Commander you have not".

"But sir", he protested. "The terms of the NATO alliance clearly state..."

"I am aware of the terms", snapped the President. "But unless the hostiles are aimed at our own shores, we do not use counter-force. That, gentlemen, is final".

The radar screens were dotted with traces, each heading for a selected target. Technicians worked frantically, trying to countermand Candy's instructions, though, like Atkin, they knew perfectly well there would not be enough time to start a launch.

One blue, glass eyeball, the single recognisable part of the wrecked doll, started accusingly at the viewer. Atkin stood next to his lost, lonely little daughter, who clutched earnestly at his arm.

"I'm sorry, Daddy", she whispered.

"Can I make it better, Daddy? Can I"?

Overwhelmed by a chilling sense of failure, Atkin gazed blankly at the screen as the traces moved steadily onward.
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PRACTICAL COMPUTING March 1982
ST HELENA is one of the most remote places on Earth. A tiny volcanic island about half the size of the Isle of Wight, it lies just over 2,000 km south of the equator in the South Atlantic. The west coast of Africa is 1,700 km away.

As one of the last few Crown colonies in Britain's possession, St Helena is administered by a rear guard of colonials. Its 5,000 inhabitants, despite their provenance from Africa, Asia and South America, share only seven family names and look to England as the centre of their world. Many households sport a picture of the Queen in their living rooms. The first video recorder arrived on the island complete with a recording of the wedding of the Prince and Princess of Wales, and it was almost done to death as the inhabitants clamoured to see the events which had taken place several weeks previously in London.

It was against this background that a recent expedition by a fieldwork group from University College, London introduced the microcomputer. The machine in question was an Acorn Atom with which the deputy leader of the expedition, Tony Nicholson, proposed to undertake statistical analysis of the results of human geography researches into the people of St Helena.

Use and abuse
So small and rugged is the island that there is no airstrip. Transport from the U.K. is strictly by boat, with stops at Tenerife and Ascension Island. The

unloaded from a lighter at St Helena, where the ship moors offshore since there is no proper harbour. It was demonstrated by team members to the ship's crew and passengers, and to the Public Works Department of the island's administration. Perhaps the most severe test of all came when it was hammered by classes of schoolchildren who had never before played, or even seen, Space Invaders. It was even used at sea, on deck, hooked up to the occasional deck power supply which is driven by the ship's generators at a nominal 60Hz.

Mainframe to micro
One of Nicholson's prime objectives was to see how a standard micro would behave in field conditions. Computing is nothing new to geographical and geological studies, and Nicholson had used Leicester University's Cyber CDC as an undergraduate. More recently he worked with University College's GEC minis which recently replaced an IBM 360 mainframe — and London University's Prime. Despite this mainframe-orientated background he sees the future of computing in geography departments lying with linked micros. Few departments will have sufficient funds, he believes, to replace equipment of this size.

The ship's faltering power supply was a severe test for the micro.

For most of us, computing is strictly an indoor occupation, but a fieldwork team from London University recently decided to expose their micro to the rigours of a South Atlantic expedition. Martin Hayman has been finding out how they fared.

14,000 km trip on the RMS St Helena — the last Royal Mail ship in existence — follows an old spice-trade route and takes three weeks. Once the micro was embarked at Avonmouth, there could be no looking back.

It is a credit to the construction quality and general reliability of the Atom that it performed almost flawlessly throughout the long period of use and abuse of the field trip. The computer was loaded and

Casting around for a suitable micro for geographical work, he had used both Pet and Sharp machines. He was looking, he says, for a robust, popular and cheap personal computer with good graphics. Acorn Computer became one of many sponsors who contributed, directly or indirectly, to setting up the expedition with its travel arrangements, supplies, equipment and insurance.

The Atom was finally delivered in kit form, one month before the ship was due to sail. In that period Nicholson assembled and tested the computer and wrote the necessary software in Basic, modelling its features on the statistical package implemented on the Prime mini.

The package offers the following facilities:
- Product-moment correlation coefficient and test statistic.
- Simple linear regression and test statistic.
- Analysis of variance (parametric).
- Student's T-test.
- Histogram — asterisks only, as the graphics space is used to store data.
- Mean and standard deviation; subsequently combined under the heading "descriptive statistics".
- Log 10 transformation, with the results of the transformation stored in a user-specified column.
- Autocorrelation.
- List one variable.
- Amend data.
- Save data set on tape.
- Input data set from keyboard or tape.

This formidable list of subroutines has been crammed into rather less than 6K, leaving the other partition, normally used as the graphics area, free for data.

Widespread interest
Data is stored as a series of columns, each representing a different variable. The main constraints are that variables should consist of equal numbers of cases and the data set should not exceed 1,000 items. After a data set has been entered, a prompt is printed to which the user replies with a four-line command to choose the operations required. The bulk of the program is loaded from 2900 hex and consists of a series of subroutines taking approximately 5K. A simple control program, loaded into the graphics area at 8200 hex, dimensions array space and then transfers control to the main program. The data set is thus loaded into the graphics area, optimising available memory space. Nicholson hopes to take advantage of the graphics feature — which he had specifically looked for — in a future map-plotting program.

The principal use of the computer to the expedition was in analysing the answers to 1,000 questionnaires on emigration which had been sent to St Helenites before the expedition set sail. Part of Tony Nicholson's purpose was to promote and popularise the microcomputer, and he succeeded in arousing interest in a number of quarters, including the Secondary Selective School and among island officials.
Satellite tracker scans the skies

Since the first Oscar satellite was launched in 1961 there has been an ever-increasing interest in the specialised techniques of space communications. The reception of cloud-cover pictures from the American NOAA and Soviet Meteor weather satellites has also proved to be an interesting challenge to many amateurs and professionals alike. The first British amateur satellite Uosat, launched last year, heralds a new era in amateur satellites. Uosat carries a number of experiments, which are designed to allow ground stations to investigate a variety of physical phenomena ranging from microwave propagation to solar particles.

For full use to be made of some of the ionospheric propagation experiments, ground stations must have orbital predictions of the highest possible accuracy.

The most important information required to track a satellite on a particular pass is a series of parameters known as "look angles". These are simply aerial aiming angles which specify the direction of the satellite as viewed by the observer. Look-angles have three elements:

Azimuth, AZ — the bearing, measured in degrees clockwise from north, to the point on the Earth's surface vertically below the satellite known as the sub-satellite point.

Elevation, EL — the vertical angle between the horizon and the satellite measured in the direction of the azimuthal bearing.

The time for which a particular set of AZ-EL data is valid.

The combination of ground-station location, satellite and time results in a unique look angle. Generating a set of look angles calls for extensive calculation using spherical trigonometry, and to simplify this procedure most stations adopt a graphical approach to tracking. This usually involves preparing a chart of true bearings from the station to various points on the Earth's surface, which is a tedious process in itself. Subsidiary charts of elevation and track must then be constructed for each satellite; when used with the true-bearing chart, they yield the look angles for a particular orbit.

Such charts are more than adequate for aerial-aiming. A chart error of 5° might seem large, but it is quite insignificant when used to aim an aerial with a beam width of perhaps 50°.

A program from David O'Neill with which you can pinpoint the position of any Earth satellite.

British Aerospace's transmission-test satellite was launched in May 1978.

Many stations do not attempt to track the satellite at all but use a simple, fixed, low-gain aerial such as a turnstile. Though this is adequate for overhead passes, it is less satisfactory on low-angle passes when the satellite is always close to maximum range. Higher transmission frequencies also favour the use of high-gain steerable aerials. For SHF propagation experiments using the Uosat microwave beacons on 2.401GHz and 10.470GHz steerable aerials are essential.

The main features of the program are:

- Generation of reference-orbit data.
- Generation of azimuth and elevation angles.
- Latitude and longitude of the sub-satellite track.
- Slant range of the satellite.
- Accurate rise and set times.
- Time of closest approach.
- Ease of updating changing orbital parameters.
- All times displayed in GMT, hours, minutes and seconds.

With the addition of the necessary hardware, the program can be adapted to automatically track the aerial as the satellite makes a pass.

The program displays time with a resolution of one second, though the accuracy of all calculated values is ultimately dependent on the accuracy of the orbital parameters used in the program. These parameters should be updated as frequently as possible.

All the equations used in the program assume a circular orbit and a spherical earth; satellites with markedly elliptical orbits will produce erroneous data.

When the EOQ time (equatorial crossing time) and longitude are input, the program calculates the EOQ time and longitude for the next 10 orbits, or more if requested.

After the EOQ time and longitude for the orbit of interest, the program requests a start time. This is the period of time

(Listing continued on next page)
time of closest approach can be found when its elevation is at its maximum. The rise time can be obtained. A subroutine for the following run, and the time increment between calculations.

The next request is for the time interval between EQX and the first calculation. Six sets of data should be printed out, starting at 14 52 30 and ending at 15 02 30.

The sub-satellite track is not normally required but is available and may be printed out with the AZ-EL data by including L3 and L4 in the relevant Print lines. The direct, line-of-sight distance between calculations.

The rise time of the satellite is the time at which it appears on the horizon, i.e., the angle by which the Earth rotates between two consecutive equatorial crossings. The inclination of the orbit plane is held in L1.

The values given in line 130 are typical of a Tiros-N spacecraft, and those in line 135 are the expected values for Uosat.

A subroutine enables all times to be displayed in the standard form of HH, MM, SS to permit direct readout of the GMT times for which the calculations are valid. The station longitude, L1 and latitude, L2, are set in line 85. Longitudes east of Greenwich are negative. Lines 75,80 are the image lines for Print Using statements. For machines without this facility the Print statements must be formatted accordingly.
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PRACTICAL COMPUTING March 1982
For the next generation of buyers, the packaging and charisma of the product will be more important than its technical niceties. Martin Hayman argues that manufacturers who ignore this trend do so at their peril.

IMAGE-MAKING is an under-rehearsed phenomenon in microcomputing. At present this is perhaps a welcome situation, for when one product so closely resembles another — who is to tell the difference between two floppy discs? — the essence of the product is in the features it offers to the user. Amateur computer users generally have a high level of awareness of what they are buying and using, and would feel slighted if anyone were to suggest otherwise. The kind of hype which surrounds the record and audio-cassette industry, you might think, is not for us.

Nevertheless, it will come. As entry-level systems get steadily cheaper, more of the uninhibited will be buying machines which they, at least, will call a "computer". No matter that it might only be capable of running Asteroids, and that the principal input is from a pair of joy-sticks rather than a keyboard. One of the future selling features of the games computers — which are becoming available in steadily increasing numbers in High Street electrical stores — will be upward compatibility with all sorts of other peripherals including, obviously, a keyboard.

Increasingly, the first sale will be made on availability, support, advertising, packaging, TV slots — perhaps, even, favourable reviews secured from journals like this one. In short, image-making and hype will be to the fore.

There are products which will not require any external boost to their image particularly, if they already have a sufficient recommendation in the name itself, but these are unlikely to be the High Street entry-level systems which will attract the future mass market for home-computing products. The BBC Micro will be one such, thanks to the august nature and intrinsic respectability of its sponsor. Another, of course, will be IBM's Personal Computer.

Charismatic element

Others will have to offer more before they even start to compete, and will have to develop their own selling techniques accordingly. In some cases an element of personal charisma may help to sell a product which is otherwise only the equal of its competitors.

One example is the Osborne briefcase micro. Doubtless it will soon be joined by other, smaller, faster, more powerful portable micmos. But it is likely to remain pre-eminent, not only because it was the first such computer on the scene, but also for the name of its creator, West Coast micro guru Adam Osborne.

Not for nothing do the crack salesmen — even in software — simply ask for the market, the price, the discount structure and the availability, and tell their masters: "Forget the features, just let me get on with the job of selling it". Does IBM send its Hursley research personnel into the field to argue the merits of their systems to the potenal customers? It does not.

To return nearer to our field, in which a herd of disconsolate telesoftware sheep are grazing. What about the manufacture of Mods, vital to any process of data communication? There can be no doubt that the Datel 600 Modem, which is supplied to many customers of British Telecom in scores of different configurations, is a solid and robust device. We even have one here at Practical Computing. It took about two months to agree the specification with British Telecom and to get it installed — a process which also involved getting BT approval for the Research Machines 380-Z, but that's another story.

In the meantime the swashbuckling proprietor of Modular Technology, John McNulty, had arranged for us to have one of his smaller, simpler and lighter Modems. It worked, which is more than can be said of the communications software attached to the Research Machines. McNulty's ModTech operation is an example of the high-profile — some might even say charismatic — approach to selling what is to the customer, little more than a small box. It may be significant that the ModTech modem is finished in poppy red while the Datel is a staid ironstone grey. Yes, of course everyone knows that BT now sells Mickey Mouse telephones, but look at all the cheap and mouthwatering appliances advertised in the mail-order catalogues.

ModTech's stand at recent Compec exhibitions, for example, has already been noted for its racy presentation. In 1980 there was a bevy of attractive young ladies scooting around on roller skates and last year it featured the concept "Linking the Unlinkable". The stand was divided into two parts, with space-age decor on one wing and an antique Louis XIV Hotel scene on the other. On the modern side there was a micro which was communicating with an obsolete teleprinter installed on the French farce side.

The ostensible message was that you can drive anything from anything else with a ModTech Modem. More to the point, it featured some very presentable young women who attracted heavy traffic to the ModTech stand from among the predominantly charcoal-suited gentlemen who attended Compec. Only the Naszaa Data Products stand, where they were giving away free vinyl footballs in exchange for your business card, attracted a comparable surge of clients. These, mark you, are business professionals. How much more will the newcomer be swayed by presentation and all the razzmatazz of packaging, presentation and good, old-fashioned hype?

The greyer products

The manufacturers of the greyer micro products would do well to take note of Atari's plans to establish a users' network in Britain. Along with its parent company, Ingersoll, Atari is owned by Warner Brothers — an organisation best known for its interests in film, cable TV and the record industry. An Atari users' club, communicating via the usual U.S. 300/300 baud standard, is already in operation in the States and Atari's U.K. outfit has expressed interest in implementing a Prestel-standard communications network. There is even a consultant working on the enhancement.

A Prestel interface for the Atari 400/800 would be a boost for Prestel telesoftware. Regular computer users might now think much of these brightly-packaged machines and their garish games cartridges, but the capability to load new games, or update with new versions of existing games from the telephone line — via Prestel and through the Gateway to Atari's own games database — could prove a strong sales point. Some of the exciting features of Atari's network service in the U.S. — which includes news of hardware developments and catalogues of Ingersoll's extensive range of electronic products, plus the possibility of ordering by direct credit-card debit — cannot fail to add to the attractions. In the end, it may be promotion rather than technical features which wins the struggle for the teenager's pocket money.
Assess your talent as a programmer with Michael Smith's Patsy, the Programmer Aptitude Testing System. It makes its choice according to analytical abilities.

THE MOST DIFFICULT problem in selecting people for training as programmers is ensuring that the trainees will have the necessary blend of abilities to benefit fully from the training course, and to make sure that they will develop, with experience on the job, into competent programmers. This requires an identification of the prerequisite skills, and a test or series of tests which will have the necessary predictive power to indicate which candidates will justify spending money and time to train.

There is considerable evidence that a programmer needs only three fundamental skills. This may startle some readers and infuriate others, but more than 20 years as a programmer in charge of the training and employment of programmers has convinces me of the truth of this assertion. I suggest that the basic skills are as follows:

* Literacy. The ability to read and write reasonably simple English.
* Numeracy. For most applications, certainly in the commercial field, the equivalent of O-level mathematics is quite adequate.
* Logical/analytical ability. The ability to break a problem down into its constituent parts or requirements, and then to build up a solution on a logical basis.

When testing for these abilities, it soon becomes apparent that the situation is not quite so simple. There are perfectly satisfactory methods of testing in the first two areas using "pencil and paper" types of test which have been in use for many years, but you come to the crunch when you start to think about the third requirement — perhaps the most crucial of all the three.

There are "pencil and paper" tests which claim to measure logical ability, for example the type sometimes called Progressive Matrices, or "fill in the next two numbers in the series". I have used a number of tests of this type, and though solving them requires an element of logical ability I feel they suffer from a number of drawbacks.

The most serious shortcoming is that the recommended procedure is usually to sit the candidate down at a table, give him the test paper and instructions, start the clock and leave him to it. At the end of the stipulated period his paper is removed and marked and you are, perhaps, convinced that you have tested something. However, many people have become very familiar with this type of test, and there is evidence that familiarity increases speed in completing these tests. A more serious criticism is that they provide no idea just how the candidate hit on the solutions even of those problems which were completed correctly. In other words, there is no test of the most vital factor — the analytical ability of the candidate. To test for it, the examiner needs to be able somehow to observe the mental processes brought to bear on the problem, or at least the nature of the steps which the candidate takes to solve it.

Patsy — Programmer Aptitude Testing System — presents the candidate with a set of 10 problems. It includes a demonstration problem which the examiner works through in the course of his explanation, and four grades of increasingly complex problems. There are alternative problems at each level of complexity, which can help to eliminate collision between successive candidates.

When the program is run, a menu of the 10 problems is displayed first. After a selection from the menu is made, the screen displays the numbers 1 to 9 arranged in a circle, with a letter X in the centre of the circle and a number of lines running across the circle from one number to another and to the central X. In the top left corner of the screen, the word "Day" appears. After an interval of some three seconds this alternates with the word "Night" in the same position. This alternation of day and night continues throughout the solution of each problem — see figure 1. The number of the problem being worked on is also displayed.

When a number key is pressed on the keyboard, a lighted graphics block or "light" appears on the screen next to the corresponding number, and remains on until the end of the time period during which it was switched on. At the start of the next period, the "light" goes out, and if a line on the screen connects that number to some other or to the centre, then the light for the latter number may be turned on, depending on a relationship which the line represents.

Solving the problem is very much a matter of discovering the relationships that exist within the problem. The principal rules of the problem are typed on a card which is available to the candidate throughout the testing session.

The program is written for a TRS-80 in level II Basic and fits into 16K. The rather crude representation of an arrow — rule 5 — is necessary because of the low-resolution graphics on the TRS-80. On a...
Converting the program to other micros should be straightforward, except for the routine which detects single or coincident key depressions, lines 3010 to 3050. On the TRS-80, RAM location 14352 contains a power of two from 2 to 2^n whenever a number key from 1 to 7 is pressed, or the addition of the corresponding powers if a combination of keys is pressed. Similarly, location 14368 contains 2^n when an 8 is pressed and 2^n for a 9.

The routine in question sorts out what has been pressed and turns the lights on accordingly. Your micro no doubt does things differently, and if you cannot see how to produce a routine which does the same thing, you probably have the Inkey$ function which you can make use of instead. You may have to introduce into the rules a prohibition on simultaneous key depressions.

If you want to change the problem setups which I give — although they are good ones — lines 10000, 10100, 10200, etc., give the start of each setup. Array T determines whether lights are day or night workers in any one problem — 1 for day, 2 for night. Lines 10n20 to 10n50 give the logical relations for day workers, and lines 10n60 to 10n80 give those for night workers, using Boolean operators: And and Not; n in the line number is the same thing, you probably have the Inkey$ function which you can make use of.

The procedure is, if anything, more understandable than the program. It is vital to have uniformity of testing conditions and procedure, and at the start of testing the candidate should always be provided with paper for notes, pencil and eraser. Any candidates who have never sat in front of a micro keyboard before should be allowed to spend a little time familiarising themselves with the keys, although only keys 1 to 9 will be used.

The examiner then runs the program and selects the demonstration problem, 0 on the menu. The examiner should work through this, first showing how an effector relation from light 9 turns on the centre block while a preventor from light 3 stops this from happening. All the other relations in this program are simple effectors and can be demonstrated as such, except for a combiner from lights 7 and 8 which turns on light 9. Thus all the possible types of relation between the various lights can be demonstrated. A solution involving only keys 4, 5 and 6 should then be shown.

The answer to the demonstration problem is to press 4 and 6 during the night period. Any questions which arise should be answered by the examiner, who should ensure at this stage that the candidate has a good understanding of what is involved.

When all is clear, press Enter to return to the menu. On the TRS-80, Clear can be used at any time to turn off all lights on the display. Problem 1A should then be selected and the candidate told to start.

There is no specific time limit for each problem, but I have found the following limits for each level:

- level 1: 10 minutes
- level 2: 15 minutes
- level 3: 17 minutes
- level 4: 20 minutes

A candidate who is clearly nowhere near a solution after these times should be told to abandon the problem. The relations involved in that problem are then explained and the solution demonstrated. An alternative problem at the same level is then presented. A candidate's session finishes if the second problem is not solved.

Table 1. An outline of the grading scheme used.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Recommendation</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>with MO</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>HR</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>16 minutes</td>
</tr>
<tr>
<td>A-</td>
<td>HR/R</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>20 operations on MO</td>
</tr>
<tr>
<td>B</td>
<td>MR/R</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>B-</td>
<td>MR/NR</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>C+</td>
<td>MR/NR</td>
<td>*</td>
<td>*</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>C-</td>
<td>NR</td>
<td>*</td>
<td>*</td>
<td>*</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>NR</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
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</tr>
<tr>
<td>D+</td>
<td>NR</td>
<td>*</td>
<td>*</td>
<td>X</td>
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<tr>
<td>D-</td>
<td>NR</td>
<td>X</td>
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</tr>
<tr>
<td>E+</td>
<td>NR</td>
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<td></td>
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<td>X</td>
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<tr>
<td>E</td>
<td>NR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key: HR: Highly recommended
R: Recommended
MR: Marginally recommended
NR: Not recommended
X: Problem solved at this level
MO: Partial solution due to excessive time or less than total understanding

Every problem is solvable. There are no "tricks" or "secrets" or ambiguous rules.

Summary of Principal Rules

The problem is solved when you manage to turn on the centre light three times in succession using only keys 4, 5 and 6. These are marked with an asterisk on the screen to remind you of their importance. The "best" solution will be derived from full understanding of the logical relations involved. You may be asked to explain your solution.

1. Time is derived into two periods called "day" and "night".
2. Every light is active in only one or other of the time periods.
3. The number keys do nothing except turn on their respective lights. Hold the key down. If the light does not come on after a fraction of a second, wait until the time changes and press the key again.
4. There are three kinds of relation between lights:
   - Effector — this turns on the light the line points to.
   - Combiner — this works only in combination with another light.
   - Preventor — this prevents a light from being turned on.
5. Each line indicates the existence of one relation. The small block permanently shown at one end of the line can be thought of as an arrow-head showing the direction of the line. If there is no line between two lights, neither one affects the other.
6. The relation takes effect in and only in the following time interval. After a light has gone out, it has no effect until turned on again. All relationships exist between lights; it makes no difference whether the light was turned on by pressing a key or as a result of a relation between lights.
7. Within a time interval the order of key depressions makes no difference. Keys may be pressed one at a time or simultaneously.
8. You may press any number keys or any combination at any time. You may combine asterisked keys and non-asterisked, you may press an asterisked key and follow up with a non-asterisked key or vice versa.
9. You may "back up" or start again at any time. That is, if you have tried an unsuccessful key combination, you may switch to non-asterisk key operations to get more information.
10. You may study the program diagram on the screen as long as you wish. You may take notes. You may refer to this sheet. You may ask questions to clarify the rules.
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different grades are allocated to what appears to be identical performance in the various levels of problem since performance on a particular problem is assessed on its logical and analytical content. A problem may be solved, but with varying evidence of these qualities. The following terminology is used:

Logical. Refers primarily to the correctness of the description of the solution.

Analytical. Refers primarily to method, the breakdown of actions into their component parts.

Analytical Characteristics Exhibited: Very little...Primary or Analytical on problem 1A, 2A, and 3A...Sporadically Analytical X Primarily Analytical on problems 4A and 4B...Adopts analytical methods when other approaches fail...

Little evidence of analytical ability Comments on performance: Ms O. demonstrates a concise, analytical attack over all problems. Her understanding of problem logic was accurate and thorough except for one relation on 2A and one on 3A. Her descriptions became more analytic and better organised with each succeeding problem. Recommendation: Ms O. is highly recommended for computer programmer training.

Figure 3 shows two typical performance reports, one for a pass candidate and one for a fail.

Mr/s. S. was examined by J. Buchanan on 22/7/81 from 2.00 to 3.45

Instructions used: Standard X Other

Sequence of problems 1A 1B 2A 3A 3B

Solved (S) Not solved (N) N S S N S

Minutes worked 10.5 6.1 15.4 21.4 7.7

Total operations 44 10 46 91 35

Quality Rating for Total Performance: C-

Analytical Characteristics Exhibited: Very little...Primary or Analytical (but very redundant) on problem 3A...Adopts analytical methods when other approaches fail...Initially analytical but abandons the method...

Little evidence of analytical ability Comments on performance: Mr S. attempted to solve the first three problems with the exclusive use of asterisk keys. His solutions to 1B and 2A appear to have been arrived at by chance. His descriptions of these problems were entirely in terms of the display phenomena with little reference to the exact nature of the relationships. He then used highly redundant analysis on 3A, but did not solve the problem because he failed to investigate one key relationship. Recommendation: Mr S. is not recommended for computer programmer training.

If your system has a real-time clock, it can be used to terminate each problem, and it should not be difficult to devise a form of automatic scoring.
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AMERICAN EXPRESS

* Circle No. 171

PRACTICAL COMPUTING March 1982
PRACTICAL COMPUTING March 1982

PROBLEM 1B

1020 \text{A}(0) = 543, \text{A}(1) = 167, \text{A}(2) = 372, \text{A}(3) = 629, \text{A}(4) = 878, \text{A}(5) = 927, \text{A}(6) = 848, \text{A}(7) = 585, \text{A}(8) = 330, \text{A}(9) = 151

1000 DEFINT A-B, D-Z

2010 \text{T}(1) = 1, \text{T}(2) = 1, \text{T}(3) = 2, \text{T}(4) = 2, \text{T}(5) = 1, \text{T}(6) = 2, \text{T}(7) = 1, \text{T}(8) = 1, \text{T}(9) = 2: \text{RESTORE}


230 DATA 240 DATA


1010 DEFEND 


2000 REM ** MAIN DAY

1070 IF \text{P}(< \text{CORP}) > 97 THEN 1060

10110 IF \text{B}(6) AND \text{B}(8) THEN \text{PRINT} \text{A}(9), \text{B}$;: \text{C}(9) = 1: \text{RETURN}

10300 IF \text{B}(5) THEN \text{PRINT} \text{A}(3), \text{B}$; \text{PRINT} \text{A}(9), \text{B}$;: \text{C}(3) = 1: \text{C}(9) = 1

10500 IF \text{C}(10) \text{THEN} \text{PRINT} \text{A}(10), \text{B}$; \text{PRINT} \text{A}(9), \text{B}$;: \text{C}(10) = 1

10700 \text{PRINT} \text{A}(3), \text{B}$; \text{PRINT} \text{A}(9), \text{B}$;: \text{C}(3) = 1: \text{C}(9) = 1

10900 \text{PRINT} \text{A}(10), \text{B}$; \text{PRINT} \text{A}(9), \text{B}$;: \text{C}(10) = 1

11000 \text{RETURN}

11200 \text{RETURN}

11300 \text{RETURN}

11400 \text{RETURN}

11500 \text{RETURN}

11600 \text{RETURN}

11700 \text{RETURN}

11800 \text{RETURN}

11900 \text{RETURN}

12000 \text{RETURN}

12100 \text{RETURN}

12200 \text{RETURN}

12300 \text{RETURN}

12400 \text{RETURN}

12500 \text{RETURN}

12600 \text{RETURN}

12700 \text{RETURN}

12800 \text{RETURN}

12900 \text{RETURN}

13000 \text{RETURN}

13100 \text{RETURN}

13200 \text{RETURN}

13300 \RETURN

(continued on next page)
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**MACHINES**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
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<tr>
<td>LA300</td>
<td>300cpe keyboard printer with integral stand, 132 columns</td>
<td>£450.00</td>
</tr>
<tr>
<td>LA300 with RS232 interface</td>
<td>£485.00</td>
<td></td>
</tr>
<tr>
<td>LA300-ED with optional RS232 interface</td>
<td>£970.00</td>
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**PROCEESSOR**

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Systems art draws patterns to order

THE ROYAL COLLEGE OF ART has departments dealing with textiles and tapestry, as well as an advanced textile-research unit. Students from these areas are amongst the keenest users of our computing facilities. They do not just concern themselves with ordinary fabrics: fibre-glass, feathers, leaves, paper and metal mesh have all been incorporated into more usual woven or knitted materials.

Sally Freshwater makes quite beautiful “tapestries” from paper. She took a sheet of plain paper and drew a horizontal pencil line across it, about half-way up. Then, from a point along the bottom edge of the paper, she fanned out lines at regular angles to meet the higher line, at points along its whole length.

She stuck small rectangles of translucent paper along the higher line with their corners each touching the line and one side lying parallel to the constructed “fan” line. The effect of these overlapping rectangles was much more interesting than it sounds, but it took her hours to try out one design.

We wrote the Texrec program to simulate the process on a screen or plotter. Each plot takes about two minutes to draw out on the Calcomp 81 plotter.

It provides an example of one particular use of computer graphics: the repetition of some action — in this case, drawing the rectangle — with one or more controlling factors or parameters changing slightly each time. Here the parameters are position and angle.

The results can often be “counter-intuitive” — they turn out to be more interesting than you imagined just from thinking about the process. A whole branch of art — called systems art — concerns itself with such phenomena. With some notable exceptions, it tends to lead to a rather sterile and perhaps ultimately boring result, but it can be very useful as a design aid, and is always fun the first few times you try it.

The results of two runs are shown here. Figure 1 is a normal run, and should be self-explanatory. Figure 2 used a massive rectangle, and windowed in on just part of the process. On screen, you should try adapting the program to produce a different shape, not merely a rectangle. If you know how, you might try ellipses or polygons, or introduce a random wobble.

If you don’t yet know how to produce ellipses, polygons and so on, read these pages in the coming months. Watch out for “instant”, curved, three-dimensional graphics.

BEGINNING GRA
Back to

WE SHOWED last month, in the simplest way possible, how a computer can store or display an image by using a symbolic representation. Now we will show how this technique can offer powerful ways of handling changes to images.

A small square seems to be a simple-enough shape from a computer-graphics point of view. How is it stored in the computer? Typically, a point that is to be at one end of a straight line is represented by a pair of numbers giving the position of the point in a flat space. Two numbers are...
**ANALOGY BOX**

A bug is an error you do not want. We hereby christen the "pug" — the creative mistake, which actually helps you. Do you have any good pugs?

---

**So what's new?**

**COMPUTER USERS** could be forgiven for believing that we are cursed for ever with the present kinds of graphic input and output devices, that they are somehow natural or inevitable. Must we really limit ourselves to addressing 50-year-old television technology via keyboards deriving, for heaven's sake, from 19th-century typewriters? We seem to have conned ourselves into believing that it is pleasant to sit for hours, with our face a few inches away from a TV screen, and that it is satisfying to type in endless numbers to produce an image.

Some new devices are beginning to appear that will radically alter our attitudes to communicating with computer hardware. So far they are only available in limited quantities, but they will soon be cheap and common enough to influence much of what we do.

Digitisers — devices for entering drawings, etc. into the computer — are at last coming cheaper, and that is a start. You can already by touch-sensitive displays in a variety of technologies, which allow you to use your finger to draw or point directly on to the TV screen.

The finest versions are pressure-sensitive as well as touch-sensitive. You can use them to "squidge" a shape, distorting or compressing it, for instance. Or you might turn your finger into a blue paintbrush, an italic nib or a flashing cursor. We have used one from the United States, but are also considering other, cheaper ways of controlling everything from the finger tip. Strain-gauges, ultrasonics and stress-sensitive conducting foam are possibilities which have come to mind. Some people in America have even used short-range radar to produce gesture-sensitive displays.

Flat display screens will soon emerge in general use as TV screens and will do away with the flickery, probably dangerous, cathode-ray tube. Little thicker than a newspaper they, above all, are making people wake up to the emerging information environment. They will be built into desks-tops, cars, telephones and, of course, personal computers.

---

**PHICS**

**front and upside down**

**The shapes on your monitor screen are defined by a few numbers held in memory.** Brian Reffin Smith explains how to apply some simple arithmetic so that you can alter those shapes at will.

Required because you are dealing with a two-dimensional shape. The fact that there will be lines connecting pairs of these points need not be stored — a standard program dealing with the points will manage that.

The co-ordinates of the corners are expressed in terms of the grid of the basic picture elements called "pixels", which are available to you. The stored pairs: 10,10 10,50 50,50 50,10 10,10 define a square. Notice that there are five sets of co-ordinates, not just four. The stored pairs: X(I) Y(I) to X(I+1), Y(I+1) sets of co-ordinates, not just four. The shapes on your monitor screen are defined by a few numbers held in memory.

Or: "Just to perform any one, or more, of the many things become interesting when you start translating them into a visual form, at the time or maybe later, when you have finished manipulating the symbolically-represented shape."

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**ART**

**Competition**

**YOUR TASK for this month arises from the graphics manipulations described on this page. One way to approach similar problems is in reverse, by asking: What has to be done to these co-ordinates to produce such-and-such a transformation?**

Submit a Basic program which enables a simple shape, such as a rectangle, to be rotated in two dimensions, by any angle, about any point on the screen. The £5 prize will go to the author of the shortest working routine; high marks will be awarded for tricks and "fudges" which make the routine simpler or quicker. Keep your program as general as possible so that it can be used, with the minimum of adaption, on any machine.

Send your entry to "Art", Practical Computing, Room L306, Quadrant House, Sutton, Surrey SM2 5AS.

One final note — do not worry too much about the mathematics and trigonometry you use. You can try referring to an old school maths textbook, or confound your old maths teacher and use first principles.

---

**Try these operations now, using a piece of paper or a computer. What happens?**

- **X = X * Y / 20**
- **Y = Y * SING(X)**

**Here, X and Y mean "all the X values" or "all the Y values".**

If you have not done so, try writing a program that lets you perform experiments on shapes like the one we have described. It must allow you to draw out some shape represented by pairs of numbers, and then allow you to alter all the numbers systematically and redraw the new shape. Use a For-Next loop, in Basic, to do the same thing to each X and/or Y.

You should now be able to see how a line drawing of a car body can rotate in those TV commercials. To work in three dimensions you just have to operate on the points with simple sines and cosines to give rotations — admittedly, there are a large number of points. The three-dimensional symbolic representation is then mapped onto a flat screen by altering each X and Y co-ordinate depending on how "deep" it is in the screen. A simple perspective algorithm does that.
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Open File

This new section of Practical Computing will be appearing in the magazine each month, incorporating Tandy Forum, ZX-80/81 Line-up and the other software interchange pages.

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.

Each month the best contribution will be awarded £20; others receive £6. Send contributions to: Open File, Practical Computing, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

Z-80 Zodiac: Print from 380-Z colour graphics; Music on the Sharp; List machine-code on Nascom

ZX-80/81 Line-up: Ghost-ship Attack; Fast-moving graphics; Read/data

6502 Special: Determinant evaluation on floating-point Atom; UK101 false error-code suppression; Direct equation entry to Superboard

Pet Corner: Bloodstream; Mailing list

Apple Pie: Paint a picture with standard paddles; Heart throb enhancement for Space Invaders; Toolkit fault; Grandfather clock; Data tabulator; Read-from-screen routine

Tandy Forum: Protecting code; Road racing

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.

The program requires Basic V 5.0 H, and a printer of at least 80 columns that can handle the "chunky" graphics; I use a Microline 80. It copies medium resolution — 160 by 95 — colour pictures, but obviously only distinguishing between colour 0 — black — and any other colour. It could be modified by changing the X and Y For loops for high resolution, but only if a 160-column printer is used.

Line 10 sets up the printer, and should be modified to suit. Line 20 fools the 380-Z into thinking it is a very wide printer, to prevent spurious Newline characters upsetting the output. This should not be changed. The X and Y loops step through the screen, starting at top left — 0,94 — in sections of 2-by-3 pixels. These sections are then converted to the ASCII chunky character codes, by adding the base colour, 128, to powers of two if that pixel is on.

e.g. =1+2+4+8+16+128=CHR$(155)

The function CALL "READ",X,Y,VARADR(P) calls a machine-code subroutine resident in the interpreter which loads P with the colour at the point X,Y.

(continued on next page)
**Sharp music**

Music is a small Basic program from C J Davison of Newton Abbott, Devon, that simulates a simple organ. It also allows you to include assembler programs in letters or explanatory notes, for example:

```
300 PRINT "CLS TOP ROW...SHARPS"
310 PRINT "CURSOR DOWN # 3" SECOND ROW...A-A-AB"
320 PRINT "CURSOR DOWN # 3" THIRD ROW...SHARPS"
330 PRINT "CURSOR DOWN # 3" LAST ROW...C-C-""
340 PRINT "CURSOR DOWN # 3" SHARPS ABOVE NOTES ***"
350 PRINT "CURSOR DOWN # 3" RELEASE KEY TO STOP***"
```

The program is written in assembler. The object code is included for those without an assembler — the last column is a check-sum and must not be entered.

**Zeap files transfer**

```
ORG $C80 ; THIS IS WHERE IT'S AT
LD HL,(E101A) ; NASPEN EOT PNTR
LD BC,0 ; TRANSFERRED CHAR COUNTER
EXX ; SHOP NASPEN & ZEAP PNTR
LD HL,(EFOO) ; START OF ZEAP TEXT
LD DE,$4H ; ADD OFFSET
ADD HL,DE ; ADD THE OFFSET
XOR A ; CLEAR A
 THERE LD A,(HL) ; GET 1ST ZEAP CHAR
 CP 0 ; IS IT ZERO
JR Z,CRLF ; IT IS
 INC HL ; IT ISN'T! SO...
 EXX ; GET NASPEN POINTER
 LD (HL),A ; PUT IN CHAR
 INC BC ; COUNT THIS
 INC HL ; POINT AT NEXT NASPEN SPACE
 EXX ; GET BACK TO ZEAP
 JR THERE ; DO IT AGAIN
CRLF INC HL ; CR LF SUBROUTINE
 LD A,(HL) ; GET NEXT ZEAP CHAR
 CP EF ; ZEAP ENDS WITH FFH
JR Z,END ; IT IS: GO TO END
 INC HL ; IT ISN'T, BYPASS NEXT CHAR
 INC HL ; GET NEXT CHAR
 LD A,(HL) ; LOOK FOR FLAG
 CP 20H ; IS IT A SPACE
 CALL Z,SPACE ; YES, MAKE A NOTE
 EXX ; GET BACK TO NASPEN
 LD (HL),$0D ; PUT IN CRLF
 INC BC ; COUNT THIS ONE
 INC HL ; MOVE ON
 LD (HL),$0D ; DOUBLE LINED IF YOU WANT
 INC BC ; COUNT THIS ONE
 INC HL ; MOVE ON
 LD A,(NOTE+1) ; THE PROGRAM
 CP 1 ; WAS MARKED
 JR NZ,HERE ; YES, IF SPACE, HAVE ANOTHER
; IF NOT, MUST BE FLAG SO MISS SPACE
```

The program should run on any machine since it only occupies 1.2K.

is not zero then HL is incremented, BC is decremented and the comparison is made again until the byte is found or BC becomes zero.
The unprecedented popularity of the ZX Series of Sinclair Personal Computers has generated a large volume of programs written by users. Sinclair has undertaken to publish the most elegant of these on pre-recorded cassettes. Each program is carefully vetted for interest and quality, and then grouped with other programs to form a single-subject cassette.

Each cassette costs £3.95 (including VAT and p&p) and comes complete with full instructions.

Although primarily designed for the Sinclair ZX81, many of the cassettes are suitable for running on a Sinclair ZX80 - if fitted with a replacement 8K BASIC ROM.

Some of the more elaborate programs can be run only on a Sinclair ZX Personal Computer augmented by a 16K-byte add-on RAM pack.

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

**8K BASIC ROM**

The 8K BASIC ROM used in the ZX81 is available to ZX80 owners as a drop-in replacement chip.

With the exception of animated graphics, all the advanced features of the ZX81 are now available on a ZX80 - including the ability to run much of the Sinclair ZX Software.

The ROM chip comes with a new keyboard template, which can be overlaid on the existing keyboard in minutes, and a new operating manual.

**16K_BYTE RAM pack**

The 16K-byte RAM pack provides 16-times more memory in one complete module. Compatible with the ZX81 and the ZX80, it can be used for program storage or as a database.

The RAM pack simply plugs into the existing expansion port on the rear of a Sinclair ZX Personal Computer.

---

**Make the most of your Sinclair ZX Computer...**

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£3.95 per cassette.

**Cassette 1 - Games**

For ZX81 (and ZX80 with 8K BASIC ROM)

- ORBIT - your space craft's mission is to pick up a very valuable cargo that's in orbit around a star. SNIPER - you're surrounded by 40 of the enemy. How quickly can you spot them and shoot them when they appear?

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

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

- WOLF PACK - your naval destroyer is on a submarine hunt. The depth charges are armed, but must be fired with precision.

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

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

For ZX81 with 16K RAM pack

CRASH - simple addition—the added addition of a car crash if you get it wrong.

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

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

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

ADDSUB - addition and subtraction with three levels of difficulty. Again, wrong answers are followed by an explanation.

DIVISION - with five levels of difficulty. Mistakes are explained graphically, and a running score is displayed.

SPELLING - up to 500 words over five levels of difficulty. You can even change the words yourself.

---

**Cassette 3 - Business and Household**

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

TELEPHONE - set up your own computerised telephone directory and address book. Changes, additions and deletions of up to 50 entries are easy.

NOTE PAD - a powerful, easy-to-run system for storing and retrieving everyday information. Use it as a diary, a catalogue, a reminder system, or a directory.

BANK ACCOUNT - a sophisticated financial recording system with comprehensive documentation. Use it at home to keep track of 'where the money goes,' and at work for expenses, departmental budgets, etc.

---

**Cassette 4 - Games**

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

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

TWENTYONE - a dice version of Blackjack.

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

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

CODEBREAKER - the computer thinks of a 4-digit number which you have to guess in up to 12 tries. The logical approach is best!

MAYDAY - in answer to a distress call, you've narrowed down the search area to 343 cubic kilometers of deep space. Can you find the astronaut before his life-support system fails in 10 hours time?

---

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

For ZX81 (and ZX80 with 8K BASIC ROM)

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

BALANCE - tests understanding of levers/fulcrum theory with a series of cube volume calculations.

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

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

BASES - convert from decimal (base 10) to other bases of your choice in the range 2 to 9.

TEMP - Volumes, temperatures - and their combinations.

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Pages 123 and 124 are missing
Dangerous addiction

THIS GAME is addictive, warns David Lawrence of Southampton; do not introduce your friends to it late in the evening, or you will still be sitting there in the early hours while they have "just one more try". Strikeout, the game in question, is an essentially simple game where you aim a projectile at a target on the screen, giving speed and trajectory for the shot which then follows a ballistic trajectory.

So what makes it addictive? The answer is that the whole trajectory is not printed out, only points along it. The interval between those points is randomly chosen for each new target position and remains constant until that target has been hit. To hit the target you not only have to make the trajectory pass through target position, but also make one of the plotted points coincide with it too.

The game begins by the setting of the target — an inverse space — on the right-hand side of the screen. The number of the shot and requests for speed and angle then appears in the top left-hand corner. Typical speeds range between 700 and 1,100 and angles are entered in degrees. The lower the speed, the smaller is the gap between plotted points, since the random element is the time interval at which the trajectory is plotted. At the end of each shot, whether it is a hit or a miss, the shot remains displayed on the screen until Newline is entered. The screen then clears and resets. If you have missed, the target resets in the same position.

The game strains the memory of a 1K ZX-81, not so much by the program itself but because of the demand for screen memory. On rare occasions, such as a high lob from one side of the screen to the other, you may run out of memory.

If you do not mind the small extra effort, you can replace the few remaining literals with variables whose value is entered in direct mode, remembering not to use Run. Note also that S=P=P and T=P=P are both three bytes shorter than S=1 and T=0.

When you are familiar with the game you can increase the difficulty. This can be done either by reducing the value by which RND is divided in line 220, thus increasing the randomness of the intervals, or by replacing the 0.5 in the same line by a larger value, thus increasing the average interval between plotted points.

Format subroutine

THE FORMAT SUBROUTINE by Mark Franklin of Erith, Kent, runs on the ZX-81, and ZX-80 with 8K ROM. Num is the number to be formatted. NS is the number on return from the subroutine, i.e., the number that is printed out. AF is the number of places after the decimal point. PL is the number of places before the decimal point. If AF = 0 the decimal point is completely suppressed. The maximum value of AF is eight, that is the number of zeros in the string in line 9050; the maximum for PL is 10, which must be the same as the number of spaces in line 9090.

Taxing demands

A PRACTICAL PROGRAM for the employees to check their pay, tax and National Insurance records comes from Sean Sweeney of Wootton, Bedfordshire. Weekly or monthly paid? — enter "W" or "M". Tax code? — this must be numeric only for standard codes, suffix H, L, P, T or V. Previous total taxable pay TD? — this is the total gross pay for the current tax year up to

ZXS81 Format Routine.

Mark Franklin.

```
9000 LET N$ = STR$ NUM
9010 FOR Z = 1 TO LEN N$
9020 IF N$(Z)="." THEN GOTO 9050
9030 NEXT Z
9040 LET N$=N$+".
9050 LET N$="00000000"
9060 IF AFC=0 THEN LET Z=Z-1
9070 LET N$(Z+1 TO )=N$(Z+1 TO AF+Z)
9080 IF AFC=0 THEN LET Z=Z+1
9090 LET N$="(10 SPACES )"
9100 RETURN
```

The tax and NI deductions are standard rate only — 30 percent and 7.5 percent respectively. They are calculated to agree with the manual tables and will probably differ from most computerised payrolls. When the program is run it will request:
and including the previous pay period.

Total tax deducted TO — this is the total net tax deducted/refunded for the current tax year, up to and including the previous pay period. Enter minus amount for refund.

Tax month/week number? — this pay period number, per tax year.

Basic pay? — normal pay for the period.

Tax month/week number? — this pay period number, per tax year.

Total tax deducted TD? — this is the total net tax deductible/refunded for the current tax year, up to and including the previous pay period. Enter minus amount for refund.

The following variables are used:

M$ for “monthly” or “weekly” calculation input.

TC tax code.

TG previous total gross taxable pay to date.

TT previous total tax deducted to date.

M month or week number.

B basic pay.

AP additional pay.

TF tax free pay.

OD other deductions.

Z free pay calculation — addition to tax code.

W free pay calculation — 12 or 52 for months or weeks.

P used in free pay calculation.

FP free pay.

T taxable.

TD tax due.

X tax this week.

G gross taxable pay this week.

C used in NI calculation.

D used in NI calculation.

E employee’s NI this week.

H number of weeks’ holiday pay.

Deductions? — any other deductions after tax and NI.

Number of weeks holiday pay? — if holiday pay has been included in additional pay then enter number of weeks holiday period paid, i.e., 1, 2 or 3.

The following variables are used:

AP additional pay.

TF tax free pay.

OD other deductions.

Z free pay calculation — addition to tax code.

W free pay calculation — 12 or 52 for months or weeks.

P used in free pay calculation.

FP free pay.

T taxable.

TD tax due.

X tax this week.

G gross taxable pay this week.

C used in NI calculation.

D used in NI calculation.

E employee’s NI this week.

H number of weeks’ holiday pay.

...
Ghost-ship attack

In Grand Prix you are a racing driver. As the track looms in front of you, you must steer your way through the cones without hitting any of them. Added danger is provided by jamcars which appear at random.

Once again, cursor controls 5 and 8 move you to the left and right respectively. The program can be made more difficult by removing lines 120 and 130 and shortening the width of the track in line 100.

In Grand Prix a racing driver.

Drawings line

THE SKETCH-PAD program allows you to draw pictures on the screen and erase any mistakes, writes Antony Lugger of Ivybridge, Devon. When the program is run and any key depressed, a black dot appears in the centre of the screen. A line can be drawn from this dot in any direction by depressing the appropriate key. To erase a line, the shift key should be pressed with the key for the appropriate direction.

To change the starting position the values of X and Y in lines 10 and 20 should be changed.

Ghost-ship attack

MY GAME Ghost Ship Attack, will just squeeze into a 1K ZX-80, writes Noel Swanton of Wellington, New Zealand.

Apart from the command ship, all the raiders are cargo ships which are under fire from alien command ships. You have to dodge the many missiles fired at you by using cursor controls 5 and 8 to move to the left and right respectively. You may be hit five times before being totally obliterated.

If you have the 16K RAM pack, then the program can be made more difficult by changing line 120 to:

120 IF PEEK (P S) 23 THEN LET L=0-1

and adding:

115 FOR S=W TO W+2
125 NEXT S
or by adding:

85 PRINT AT 16,X 2;""
ZX-81 Read/Data

This routine by C Rouse of Gosport, Hampshire, will give the ZX-81 a version of Read/Data, and can be useful whenever information has to be printed on the screen.

The Basic is entered first and the decimal codes Poked into the first-line Rem from 16514 to 16536 using a standard machine-code loading program. Items to be printed are included in the program in Rem statements. Each item must be less than 64 characters long and must be enclosed in inverted commas.

More than one item may be included in each Rem as long as each one has its own inverted commas, e.g.,

```
100 LET "DATA""REM"
```

There is no space between the middle inverted commas.

The data Rems can be put anywhere in the program area and can be separated by both normal Rem statements and program lines. With the Basic entered as shown

```
XX GOSUB RESTORE
```

will set the pointer to the first item to be printed and the Step to 1.

```
XX GOSUB READ
```

will then print the items out, one at a time, moving the pointer to the next item.

In order to print the item in the middle of a sentence use the following format:

```
100 PRINT "THE NEXT" 110 GOSUB READ 120 PRINT "WILL ARRIVE SOON"
```

If no Rem data statements exist, or if the program tries to call more than are available, an Error Code R/.. will result. If the item to print is longer than the 64 characters an error code Q/.. will be the result. This will happen if the inverted commas are omitted from the end of the data.

The length of the last item printed is in 16519. Any value less than the total number of items can be Poked into Step at 16520. For example every other item can be printed by

```
XX POKE 16520, 2
```

Random items can be printed by

```
XX GOSUB RESTORE XX LET A = INT (RND* N) + 1
```

where N< total number of items. Gobus Restore will reset the Step to 1.

Table trouble

If you know anyone who is having trouble with their multiplication tables at school, Dean Asher of Harlow, Essex has a program for the 1K ZX-81 which may be of help.

Line 60 determines the number of lines; you can replace the number 20 with any other number you choose.

```
10 INPUT N
20 PRINT:N:"X TABLE"
30 LET C=0
40 LET C=C+1
50 PRINT C: ":X":N:"="C*N
60 IF C<20 THEN GOTO 40
```

Automatic run

The routine from J F Brown of Edenbridge, Kent, allows a ZX-81 program to run automatically after loading. This is particularly useful and convenient when a program question contains a large quantity of data in string variables or numeric arrays. The Run command erases all the variables, but the autorun preserves the data by using Goto statements instead. It is particularly useful for business software as no Basic commands have to be entered.

After typing in the program, run and load the data. Then save the program and variables on cassette, type New and try reloading the program. It will run automatically and the data will be preserved.

```
J. F. Brown.
10 DIM A(10)
20 FOR X=1 TO 10
30 INPUT A(X)
40 NEXT X
50 CLS
60 PRINT "DATA PROGRAM"
70 FOR X=1 TO 10
80 PRINT A(X)
90 NEXT X
100 REM SAVING ROUTINE
110 INPUT A$ 
120 CLS
130 SAVE A$ 
140 GOTO 60
```

(continued from previous page)
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Determmatg evaluator

THIS ROUTINE to evaluate any N-by-N determinant up to order 15 was written for the Acorn Atom with floating point by S Draper of Lincoln. Its recursive nature makes it considerably shorter than most other determinant evaluation routines, and does not suffer from division-by-zero errors since there are no divisions within the routine.

The determinant to be evaluated should be in the top left of the 15-by-15 array. For example, with a second-order determinant row one would go into the first two elements of row one of the array, and row two into the first two elements of row two of the array. Since the Atom only supports one-dimensional arrays, the second row of the array starts at the 15th element of the array, and the element X,Y should be in the top left of the 15-by-15 array. Note that in Atom Basic the % operator means floating point.

The program assumes the mono 2 monitor. For others, change the $38.9 numbers to those of the print vector of your monitor. AD to AE are used to save X and Y and are not normally free. Though 61 to 64 are often quoted as free memory, they are actually used by Basic: 64 blanks printing when bit 7 is set, for instance. DR to PF are unused by Basic, so are free for use.

The RND function can be seeded by a negative argument.

Equation entry

WHEN WRITING a graph plotter or similar program for the Superboard II, it becomes necessary to input an equation for plotting, writes Robert Schifreen of Edgware, Middlesex. This is usually done by asking the user to break in and add a line of the form

10 DEF FNA(X)=+(4*X)+7

and restart the program from line 10. However, the following segment of Basic will accept an equation as a string and Poke it directly into a statement. To use it, the start of the program must be at line 10 and must be exactly as follows:

10 DEF FNA(T)=+++++(50 OF THESE)++++-1

The T shows that the equation is in terms of T, and this subscript is asked for by the program. Then type in the equation. The equation is Poked to replace the corresponding number of + signs; the remaining + signs simply add and subtract 1 from the total, making no difference at all.

It is not possible to add 0, as this interferes with the end-of-line null used by Basic. The + signs are needed because pointers need to be set if a line length is altered, otherwise memory will be corrupted. The comparisons are needed because some characters are represented differently in a string and in an equation.

The program will not recognise any standard Basic functions: there are too many of them, and they will be tokenised by Basic. If you are going to use any functions frequently, find out their token by Peeking, and add an appropriate line by Basic. If you are going to use any functions frequently, find out their token by Peeking, and add an appropriate line by Basic.

If typing programs that Poke memory, ensure that they are saved before running.
and antibody cells. The game ends either when all the cancer cells have been obliterated or when the ship has been hit three times.

If at first you find the program too difficult to beat, you can give yourself more shields by changing the threes in lines 280 and 510 to sixes, and the 300 in line 430 to 150. If you master the game you can increase the number of enemies by lengthening the For loop in line 130 and changing the sizes in lines 380, 430 and 480 accordingly.

To save memory space, the data statements are over-written by the machine code program. You must, therefore, type in the program exactly as it is shown in the listing, including all Rems, and you must save the program when you stop it.
and various print formats are available as ordered by record number. Any character be very useful for clubs and societies for which handles business data. It will also Amend allows retyping of any line of the record. File Name is used to access a file when several directories prior to ending the program run. Drive targets either the program or the disc -DOS 2.1 or required. Lines are treated by File Name and may<br>

The program is written in Commodore's relative-file system. Record# positions the DOS record pointer prior to Print# or Input#. The variables DS and DS$ contain the appropriate line, while 0, a or Return will default to line 10. At the same time as the record is read during a sweep, the matching line is retained in the CBM memory. It will remain so until another access line is specified or the drive is changed. This feature allows rapid examination for a match in, memory, saving on disc-access time. If the record access line is not in the CBM memory. The pattern-matching rules are similar to those of the Commodore DOS:

- matches any character
- matches all subsequent characters

For example the command "?n?*" will find SMITH

When a match is found it is displayed on the screen. A print option appears, allowing one copy of the appropriate format to be printed. If a print is not required then the search proceeds by default. To create a memory image of all access lines will take about four minutes on a 4040 disc. This function is caused by using an unlikely match such as $" as the pattern match.

The Card and Mail Print function is intended to print either a record-card label - e.g. as a stick-on label for a customer's personal file - or a mailing label, providing the appropriate stationery is loaded into the printer. The Printout option applies only to the record displayed where only one printout is produced.

The Scan option behaves like Hunt, with a printout resulting from a match. An advice of print will be placed on the specified position in line 10. This is intended to show a particular operation has been performed, e.g. a catalogue has been sent. The advice character and position may be specified prior to printout.

Selection of position 25 will abort this function. As to which character is used for what function depends on the user. It could be for use by another program. The print function is as Card and Mail print, but the user may specify to print or ignore lines 3 to 9. If the line is ignored then a blank line is printed so as to maintain registration on any labels, etc. This function is intended for listing where sensitive areas of data are required to be omitted. Of course, any intending user

(continued on next page)
may modify these routines to their requirements.

During typing of data the normal Basic input is not used. Instead an input sub-routine only allows entry of characters which will not interfere with the DOS operation. To this end, entry of a null string or all spaces are disallowed as they would crash the program or lose the registration.

If no entry is required in a particular field, then a dot or other appropriate filler character should be used. During any routine only allows entry of characters in the specified lines to be used.

The system was slower in operation.

The function left$(i$s$ + c$,30) intended to clear garbage from previous error fields did not work.

Before setting-up, a relative file should be created to avoid any of these problems using the set-up routine.

10 DO ON1 VARIABLES "MAILING DATA", D1, L250 
19 DO XOR = ITO (required size): RECORD1, (Q), 
30 Q$ = "": FORX = ITO10: Q$ = Q$ + "$" + 
CHR$(13): NEXT: PRINT #1, Q$: NEXT 
40 DLOSE 

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<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>CUSTOM INTER-FACE OPTION</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>PRICE</td>
<td>£1675</td>
<td>£1950</td>
<td>£1950</td>
<td>£1450</td>
<td>£1450</td>
</tr>
</tbody>
</table>

The above information was gathered from distributors and abstracted from their current literature. Prices shown are those advertised at the present time.

Catherine Street, Macclesfield, Cheshire. SK11 6QY. Tel: Macclesfield 612759
Paint a picture

A program to produce pictures comes from R. Trimmer of Dunstable, Bedfordshire, making good use of the Apple II's graphics. The standard Apple paddles are used to create pictures on the high-resolution screen, the paddles themselves controlling a large part of the program.

When the program is running, you can call up the menu by pressing the button on the controller. The menu offers seven options: Save, Load, Colour, Rubout, Delete, New Exit. The Colour function allows parts of the picture to appear in different colours or shades. Rubout allows removal of lines or dots by the use of the paddles.

Up to seven pictures can be saved on a standard 5in. disc, together with the program. Each complete screen of high-resolution graphics requires 8K memory, or 34 tracks.

Heart throb

This memory-dump routine can be used to modify the Space Invaders program so that it will produce the famous menacing heartbeat, writes D T Jones of Woodside Park, London.

Enter the hexadecimal as listed:

```
6100- A9 00 8D 6A 61 8D 6C 61
6108- A9 50 6D 68 61 20 3D 4E
6110- 20 5B 70 00 5F EE 6A
6118- 61 AD 6A 61 C9 10 D0 IF
6120- A9 00 8D 6A 61 CE 6B 61
6128- AD 6B 61 C9 19 D0 05 A9
6130- 50 8D 6B 61 AD 6B 61 8D
6138- 5A 61 4A 4A 8D 4D 6B 6C
6140- 20 19 60 20 4A FF EE 6C
6148- 61 AD 6C 61 C9 14 B0 0E
6150- AD 30 00 4C 62 61 AD 6C
6158- 61 C9 50 90 05 A9 00 8D
6160- 6C 61 20 3F FF A5 19 C9
6168- PD 60 00 50 00 A9 14 8D
6170- 4D 61 A9 50 8D 65 A1 AH
6178- 00 8D 6A 61 8D 6C 61 A9
6180- 50 8D 68 61 4C 00 5F 00
```

To run, type `RUN INVADERS` and save it on tape by typing:

```
800.61FFW
```

With that done, the invaders will make the familiar increasing throb. To run the new version, type `6100G`.

To put the program on disc, type.

```
7FD: 4C 00 61
```

```
BSAVE INVADERS, A$7FD, L$5A03
```

To run up, type `BRUN INVADERS`.

Toolkit fault

BELIEVE IT or not I have discovered a fault in some Apple software, writes Shaun Hope of Milton Malsor, Northamptonshire. The disc in question is the DOS Toolkit — Apple part number A2D-0029 — and the problem appeared on the Applesoft Programmers Aid, APA, program.

At first I could not believe my eyes but finally decided that something must be wrong. I got in touch with Apple U.K., who confirmed the problem but have been unable to find a solution.

The fault arises with the &XREF command referred to on page 10 of the Toolkit manual. It is supposed to give a complete cross-reference of all variables used in a program but it does not always work. To see the problem run `Loadapa`, then type `New` and enter the following example program:

```
10 DATA 10
20 READ A
30 PRINT A
40 END
```

Typing &X should give

```
A 20,30
```

(continued on next page)
Grandfather clock

I HAVE ALWAYS wanted a grandfather clock, writes R D Walker of Sutton Coldfield, West Midlands. The trouble is that I also wanted an Apple computer, and the micro won.

Whilst delving into the more interesting parts of the Apple it soon became clear that the combination of graphics and sound could satisfy my other desire, and gave me the opportunity to get to know my new acquisition.

The program is rather novel in that it produces a circular clock face, displaying the hour and minute hands which will move in the normal way. The inclusion of a conventional second hand looked a little confusing, so the seconds are shown by a dot which steps around the clock face at one-second intervals. The clock strikes the hours in the same way as a grandfather clock.

A gesture to modern times is the inclusion of a digital display at the bottom of the clock face, which changes at the same time as the hands.

During the chiming sequence, no other activity is possible. The seconds dot must therefore be advanced afterwards by an amount determined by the time taken to chime the hours.

The clock does not depend on any internal timer, but uses the inherent delay caused of the For loop. Timing can be adjusted merely by modifying the value of TT in line 16. The accuracy of the seconds advancement each hour can be adjusted by altering the time taken for the chimes in line 5080.

The tone generator is set up in lines 1 to 7 and this machine-code program is called by the data in lines 5090 to 5120. Each of the numbers there causes a different note to be produced. It would be quite easy to extend the program to chime the quarter hours as well by selectively taking each of these lines as required.

Lines 10 to 13 set the co-ordinates of the circle and line 14 is the value of PI. Line 16 sets the clock accuracy and line 17 gives the hand lengths.

Lines 50 to 90 request the time to be set and this machine-code program is called by the data in lines 5090 to 5120. Each of the numbers there causes a different note to be produced. It would be quite easy to extend the program to chime the quarter hours as well by selectively taking each of these lines as required.

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Data tabulator

THE PROBLEM of tabulating data is tackled in this subroutine from S M Fraser of Glasgow. Instead of the Print-Using format it uses variables to specify some appropriate point by

Mathematics is written to the screen but if 2P is selected then the information is printed to the printer as well as being displayed on the screen. The printer should be turned off at some appropriate point by

Reading from screen

A USEFUL FEATURE in any data-entry program is the ability to edit any characters displayed on the screen, and to do this some way of reading from the screen is necessary. The routine devised by Phil Reese of Birmingham could provide the basis for such a function.

By supplying the row R - 0 to 23 — and the column C - 0 to 39 — of the screen position required, the character YS can be read from the screen.

The heart of the routine is the function defined at line 100 and used at line 110, which calculates the position in memory of the required row. Lines 130 to 190 are an optional routine which converts the character read into the range ASCII 32 to 95, i.e., the range of character values normally input from the keyboard. This routine is essential if inverse or flashing characters are to be read.

The majority of the remaining lines are for demonstration purposes only and all except 120 and 200 may be omitted. The routine reads any character from the text page display regardless of video mode and window settings.

Read-from-screen routine.

100 REM MENU SELECTABLE PRINTER
110 PRINT"1. PRINT TITLE,"PRINT
120 PRINT"2. PRINT DATE,"PRINT
130 PRINT"3. PRINT COST,"PRINT
140 PRINT"4. RETURN TO MAIN MENU"PRINT
150 UTAB20:HTABS:INPUT"SELECT <1 - 4> ":MP:PRINT
160 H=VAL(M$):IF H<1 OR (H>4) THEN 150
170 IF RIGHT$(M$.1)="P" THEN PR%="P":GOTO 190
180 PR%="NP"
190 ON H GOTO --

PRACTICAL COMPUTING March 1982 143
Protecting code

A YEAR AGO I acquired a Tandy hardware modification to my TRS-80 to enable lower-case video, writes Tom Corrigan of Houghton-le-Spring, Tyne and Wear. The result is excellent, but the driver software tends to get in the way of other routines. There are a number of methods of protecting a machine-code subroutine—the standard one reserves memory size so software tends to get in the way of other routines. It is common for two routines to occupy the same area of memory.

I have overcome this by having a modified ROM A installed, but for those who do not have this modification, I offer the following routine which finds space for itself in high RAM and reserves its own memory size.

The length of the operating routine is measured by the label Progl and this value is subtracted from the four vectors dependent upon memory size. The memory size reserved is increased by an amount equal to the length of the program, approximately 100 bytes. All addresses within the program are adjusted relative to the modified memory size, and the operating routine is relocated immediately above it and hence, immediately beneath any resident high-

RAM machine-code routine.

The TRS-80 keyboard produces lower-case characters with the shift key and upper-case without. To invert this and simulate a typewriter, alphabetic characters are trapped and exclusively ORed with 27H. At the same time, the video-driver address is exchanged with that stored at the location which, prior to relocation, is labelled Vidstr.

The character generator has a £ sign which can be displayed with the ASCII value 60H and obtained from the keyboard by shift @. This cannot, however, be used where it would be most desired: in the Print Using field specifier. The initialising part of the program asks if an exchange is required and, if so, substitutes 2OH (JR NZ) for 18H (JR) at line number 1490. If a dollar sign appears in the video stream, it is replaced with a £ sign. This has no other effect, although a £ sign follows all string variables, instead of the usual dollar sign in Basic program listings.

The program will run under level II or DOS, the exit address being selected by the routine in lines 850 to 890. However, if an expansion interface is connected, but no disc drive, then line 880 should be modified to read

JP 1A19H

Once the routine is initialised, the lower case and keyboard inversion may be switched in and out alternately, by typing shift zero. Those who have no editor/assembler can insert the object code directly into memory, using a monitor such as T-Bug.

| 0100 | ORS | 6000H |
| 0110 | MODIFY MEMORY SIZE |
| 0120 | START | DE,PROGL |
| 0130 | LD | HL,(40D4H) |
| 0140 | LD | MEM SIZE |
| 0150 | OR | A |
| 0160 | SBC | HL,DE |
| 0170 | LD | (40D5H),HL |
| 0180 | INC | HL |
| 0190 | LD | (409B1H),HL |
| 0200 | LD | HIEM FOR DOS |
| 0210 | DE | 24H |
| 0220 | A | (3808H) |
| 0230 | AND | 2 |
| 0240 | A | (3802H) |
| 0250 | OR | A |
| 0260 | LD | (SVEC1+1),HL |
| 0270 | LD | (SVEC2+1),HL |
| 0280 | LD | (KVEC-2),HL |
| 0290 | LD | (KVEC+1),HL |
| 0300 | LD | (4016H),HL |
| 0310 | LOCATE STACK |
| 0320 | POSITION PROGRAM ABOVE NEW MEM SIZE |
| 0330 | LD | HL,(4049H) |
| 0340 | LD | RETRIEVE START ADDRESS |
| 0350 | LD | (KVEC+1),HL |
| 0360 | INC | HL |
| 0370 | LD | (KVEC+2),HL |
| 0380 | LD | FOR KEYBOARD ROM CALL |
| 0390 | LD | DE,5AH |
| 0400 | ADD | HL,DE |
| 0410 | LD | (5VEC1+1),HL |
| 0420 | LD | TOGGLE KEYBOARD |
| 0430 | INC | HL |
| 0440 | INC | HL |
| 0450 | LD | (VIDSTR+1),HL |
| 0460 | LD | FOR VIDEO DRIVER |
| 0470 | LD | DE,24H |
| 0480 | ADD | HL,DE |
| 0490 | LD | (5VEC2+1),HL |
| 0500 | LD | FOR SHIFT 0 TO |
| 0510 | CALL | 1CH |
| 0520 | LD | HL,MESS |
| 0530 | LD | DE,3000H |
| 0540 | LD | FOR REQUESTING POUNDS |
| 0550 | LD | BC,MESBL |
| 0560 | LDIR |
| 0570 | SLEEP |
| 0580 | LD | A,(3802H) |
| 0590 | AND | 40H |
| 0600 | JR | NZ,NOPND |
| 0610 | LD | A,(3808H) |
| 0620 | JR | Z,LOOP1 |
| 0630 | LOOP1 |
| 0640 | JR | Z,LOOP1 |

(continued on page 147)
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Road racing
IN ROAD RACE, from John Taylor of Oregon State University, Kent, the two players race each other to finish the track first. As they move, each player collects a score.

There are two different levels of difficulty in this game: to leave a trail or not to leave a trail. If you leave a trail you increase your score more quickly, but you lose if you touch your track or your opponent's track. You also lose if you hit the side of the track.

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PRACTICAL COMPUTING March 1982
ZX-80s on the brain

The family trait that Son of Thezeus inherited from his father, Thezeus, is the use of a ZX-80 for a brain. Both mice were built from pieces that Alan Dibley found in his junk box. Nick Smith reports.

ONE OF the major advantages of using a ZX-80 as a Micromouse brain is the built-in sensor interface — otherwise known as the keyboard. The keyboard can be regarded as a set of switches which are continually scanned by software. There is nothing to stop you mounting extra switches across the keyboard contacts and using them for sensors. This is best achieved by soldering extra wires on to the printed-circuit board rather than to the key contacts themselves.

The ZX-80 cannot distinguish between a pressed key and a closed sensor which is not normally a problem because Alan Dibley has sawn off the keyboard and not normally a problem because Alan Dibley has sawn off the keyboard and is equivalent to a pressed key when it is receiving infra-red — see figure 2. Distance is calculated by counting the number of "spokes" that go past the receiver, i.e., the number of times the "key" appears to be pressed and released.

With this type of circuit the sensor must be checked much more rapidly than the disc can turn, otherwise you start losing distance. The surrounding area is painted matt black, and the sensors and disc are boxed in to protect them from external sources of light.

If you ever see Alan Dibley turning one of the wheels of his mice when they are off the maze, he is probably trying to move the sensor disc so that the receiver is switched off, to allow the keyboard to be used.

When this technique is being used for distance sensing, it is best to fit the sensor to a non-driven wheel, to avoid skidding and similar problems. Otherwise, when the mouse jams itself against a wall, the mouse brain may think it is moving if the driven wheels continue to revolve. One American mouse has a crash-recovery routine which is activated if the distance sensor remains static for a second or more.

Rumour has it that Dibley is well on the way to completing his third mouse. It will probably be a tricycle with the front wheel driven by stepper motors and the trailing pair steered by ordinary DC motors.

Following the success of the first Amateur Computer Club seminar on micro robotics Vernon Gifford is setting up a special-interest subgroup within the ACC. The group already has over 30 members including amateurs, academics, civil servants and manufacturers. If you are interested, write to Vernon Gifford, ACC Micro-Robotics, 111 Selhurst Road, London SE25 6LR, or telephone 01-653 3207.

Over 70 people attended the ACC seminar to listen to speakers on various aspects of robotics. The morning was devoted to constructing Micromouse, and in the afternoon Colne Robotics and Powertran Cybernetics demonstrated and talked about their robot arms.

As a warning to people designing mice, it was announced that a rule may be introduced for the 1983 competition that mice can only touch the tops of walls. Square mice will then no longer be able to use the walls to straighten themselves up: in other words, your mouse must steer itself.

In the more immediate future, the 1982 British Micromouse finals will take place from 23 to 25 April at the Computer Fair, Earl's Court, London. Details are available from John Billingsly, Department of Electrical and Electronic Engineering, Anglesea Building, Anglesea Road, Portsmouth PO1 3DJ. The European finals will take place in Israel in September.

Table 1.

<table>
<thead>
<tr>
<th>Hex code</th>
<th>Pseudo-mnemonic</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>06EF</td>
<td>B—EF</td>
<td>The 0 in bit 4 specifies the top.</td>
</tr>
<tr>
<td>0E00</td>
<td>C—00</td>
<td>Might not be necessary.</td>
</tr>
<tr>
<td>ED78</td>
<td>IN A, (C)</td>
<td>Read the keys into the accumulator.</td>
</tr>
<tr>
<td>2F</td>
<td>CPL</td>
<td>Complements the accumulator.</td>
</tr>
</tbody>
</table>

Dibley's sensors are connected to the 5, 7, 8, 9 and 0 keys at the top right-hand side of the keyboard. The software to read the keys is shoen in table 1. The result of the first three instructions is to set the status of the keys in the accumulator. Bit 4 = key 6; bit 3 = key 7; bit 0 = key 0. An open key sets the bit, while a closed key clears it. The complement instruction reverses the process so that a closed key sets the bit.

Apart from microswitches for wall-

Figure 1.

Matt black paint
thin strips of cellotape remove after painting
Polished tinplate disc

Figure 2.

(a) Infra-red transmitter
(b) Infra-red receiver

4.8 volts
150 n
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The command sets are extensive and sophisticated. Dozens of objects are scattered throughout the mazes and buildings. You can pick them up, burn them, throw them, etc. You may need the sword to fight off an ugly little man. Or a steel rod to hold apart crushing walls. Deathmaze 5000 and Labyrinth allow the traditional one and two word commands. Asylum incorporates our Advanced Language Interpreter which allows full sentence input Deathmaze and Labyrinth over 550 locations! Asylum 1200

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PRACTICAL COMPUTING March 1982
Programming Your Microcomputer in Basic

By Peter Golsting. £3.95. Macmillan Press.

There seems to be a never ending stream of books introducing Basic programming. Inevitably there is little to distinguish one from another but occasionally there is one that makes its mark. It may be due to originality of presentation or, as in this case, price.

Peter Golsting has written a book that is clear, concise and in the main accurate. The text is in the usual format of a description of one or two keywords and then a short program to illustrate their function.

In fact the book gives a feeling that it is really intended to accompany a course in Basic programming, even though the preface suggests that it was written to overcome the lack of clarity of many manuals. The suspicion is strengthened when it is realised that the author is a lecturer at a technical college. The book is admirably suited to such a purpose.

Although short, this book covers more of the language than many competitors and also provides several useful routines for common requirements such as sorting and the alignment of decimal values when printing.

Conclusions

**A straightforward little book which will provide a useful introduction to Basic especially used in conjunction with the manufacturer's manuals or as a course text-book.**

At £3.95 it would be a worthwhile purchase for a newcomer to Basic.

Martin Wilson

Software Metrics

By Alan J Perlis, Frederick G Sayward and Mary Shaw (editors). £17.50. MIT Press.

In 1979 the editors of this book were asked to evaluate the current state of the art in software metrics by the U.S. Office of Naval Research. Software metrics is the quantitative measurement of the quality of software. If this goal were attainable then the whole basis of many of the arguments about languages, operating systems and their merits would be changed completely. We would have concrete criteria for evaluating which language was best, which program design techniques were best and what constituted good software.

As the authors admit, the computer-science research community has a very low opinion of software metrics. The idea that it is possible to derive some invariant laws of software, like the laws of physics, is an appealing one. Unfortunately, there is little or no evidence that this is attainable. Software production is a human activity, the psychology of which is as yet unfathomable. The field has not been helped by the lack of a coherent methodology and the poor quality of much of the limited academic research that has been done.

As to the central theme of the book, this is best summed up in a quote attributed to E W Dijkstra on page 92 which simply says "Metrics is crap". This book offers little evidence to the contrary and plenty of confirmation. Unfortunately all the new initiatives suggested are either unworkable or methodologically unsound or both. On the strength of this book software metrics will remain in its current dire state for the foreseeable future.

Conclusions

- The bibliography is the most useful section of the book.
- Given the dubious status of metrics, this book cannot be recommended.

J Cookson

Using the Radio Shack TRS-80 in Your Home

By Kenniston W Lord Jr; Hardback 457 pages, £18.65. Van Nostrand Reinhold ISBN 0 442 25707 4

What this book does, it does reasonably well in dealing with programming in level I Basic from novice to competent amateur standard. However, the book must be judged on its rather unexciting presentation and the fact that it is clearly aimed at the American market, making several of the programs inappropriate and in need of much revision.

After an introductory chapter providing a mid-1970s view how computers will be used in the future, and suggesting applications for the home user, Donald Misquitta misleadingly headed How Computers Work. It does not tell the reader how computers work at all, though it does provide a good extension to the level I handbook, in explaining how to use a TRS-80 covering programming principles, use of variables, arrays, memory, relational operators, subroutines and the use of tape for storing data.

Chapters three and four develop these techniques and explain thoroughly the use of level I screen graphics. Sample programs are provided in both chapters and these are clearly explained. It should be noted that both arrays and graphics in level I are severely limited by today's standards. However, the author provides good advice on how to make the most of the facilities offered.

Chapter six provides programs for a shopping list, skiers wind-chill chart, drinks recipes, central heating oil consumption, household chores, car expenses and two novelty programs. The final two chapters deal with using the TRS-80 for games and a U.S. orientated personal accounts payable system.

The author claims that all the programs work and, most of those that were tried did run first time. He also admits that sometimes they could be written in more efficient fashion. However, he may be right to point out that his style of developmental programming helps the novice to understand the stages more clearly. What is disappointing is the lack of information on control applications which many home users might have found interesting.

Conclusions

- The limitations of level I Basic are, as the author admits, the real bugbear. However, if you are a novice and cannot afford an upgrade to level II this book will help you to make the most of level I.
- A book on TRS-80 Basic programming for £18.65 should be revised for the U.K. market and should either be level II based or provide more information on conversion.

Michael Trott
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All the fun of the computing fair

by Tony Roberts

AT the recent Alternative Technology (Computing) Fair there were five stands, arranged in a row opposite the free bar. When I arrived back the boss asked me to tell him about the products — but I find I have a bit of a problem remembering who's who.

I have listed all I can remember:

• The fluorescent yellow machine was next to the one that kept on changing colour which must have been the Chameleon. The Chameleon stand was next to the Beta stand.

• The Audromeda stand was on the end of the row, and stood next to the machine that was driven by clockwork and had the voice-generator that hiccuped.

• None of the machines had more than one input and one output device, or more than one source of power.

• The two with printers were on opposite ends of the row, and one had an optical scanner.

The wind-powered machine had a liquid-crystal display.

The elastic-driven machine was having difficulties because of the heat of the adjacent boiler on the steam-driven machine, which was so grimy its colour could not be seen.

The ones with paper-tape reader, VDU input and output, and a keyboard stood next to each other in that order.

The red-striped machine had a voice-recognition device and was to the right of the machine with ghastly blue polkadots.

Which machine was solar powered, and how did Epsilon produce its output?

Solution to January puzzle

THE SOLUTION to the Flowchart puzzle, which appeared in the January edition of Practical Computing, is that Y is an approximation within ±1 to the square root of X.

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A price list

from a Pet

The tedious, repetitive and costly task of keeping a carpet warehouse abreast of rising prices has been handed over to a micro. Mervyn Axon tells the story of how it was done.

In any business it is important for the staff to have an up-to-date price list. Maintaining these lists can be a very time-consuming task, particularly under the inflationary conditions of the last few years, and continual amendments can introduce expensive errors.

The problem described here concerns a carpet price list in a retail furniture business. A number of stock lines are carried, presenting no great difficulties, but in order to offer the widest possible choice to customers still prefer imperial measures.

Both prices are required because the supplier, whether or not the supplier is an approved retailer, carries, presenting no great difficulties, but in order to offer the widest possible choice to customers still prefer imperial measures.

Comparative price per square yard, retail price per square metre, quality name, code for the supplier, reference number, approximate 150 items, including:

Choice of hardware

Though this is just the sort of task that could be carried out most efficiently by a microcomputer, no commercially-available program could be found in 1978, when it was decided to computerise the price list. The hardware selected was an 8K Pet with calculator-type keyboard and a built-in cassette recorder, together with an external cassette recorder — disc drives were not available at that time — and a Teletype 43 printer with a suitable interface.

The first step in developing the software was to store the initial data on a cassette tape in the form of a file. This was done by entering the data as a program as

(continued on next page)
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Amending entries
The first entry on file A is loaded from cassette recorder 1 and displayed on the screen. It can then be inspected, and any necessary amendments are entered through the keyboard. The entry is then written to a new cassette in recorder 2, creating the new updated file B. The operation is then repeated until all the entries have been dealt with. Read/write operations with cassettes are slow, and an update usually affects 10 percent or less of the file entries, so the update program is divided into two parts to reduce the time spent creating the new file.

Figure 1. Flowchart of automatic update sequence.

A blank cassette was loaded into recorder 1 and the program was run to create the initial file.

Having stored the price-list data on a cassette, the next step was to write a program to print it out. Note that operating instructions are given on the VDU — see listing 2.

Some formatting of the output is required to produce an easily-readable and well laid-out list, which should preferably be in a convenient-sized page format rather than an continuous sheet. The

head of this article shows the output from the system.

The principle used for updating the files is similar to that used for creating them. The original data file, serial A, is updated to produce a new data file, serial B.

In listing 1. The process was repeated until all the data had been input, when the closing sequence was entered:

1000 PRINT 1, 0
1001 PRINT 1, "XX"
1002 PRINT 1, "END"
1003 PRINT 1, "XX"
1004 PRINT 1, "XX"
1005 PRINT 1, 0
1006 CLOSE 5

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Figure 1. Flowchart of automatic update sequence.
The main update program appears in listing 3.

Lines 100 to 290 contain data and instructions to set up the operation, the first part of which is in lines 300 to 530.

Initially this requests the reference numbers of entries to be amended or deleted and stores them in array B — line 410. If the entry is to be amended, the new cost price is stored in an array D(B) — line 510. The program then goes on to request details of any new entries which are stored in arrays Q(N), S(N), R(N) and G(N) — lines 660 to 700.

The other lines in this section are mainly concerned with validating the inputs and giving instructions to the operator on procedure, the exceptions being lines 370 to 380 which form a loop used to display the instruction in lines 350 to 360 for a reasonable period.

Print CHR$(147) is the Clear Screen instruction.

Since the data on a cassette tape can only be accessed in serial form, the reference numbers of entries to be amended or deleted must be entered in ascending numerical order and new entries must be entered in alphabetical order. Entering the changes only takes a few minutes, after which the operator can leave the machine to create file B. The flow chart of this operation is shown in figure 1 — describes the procedure, which is coded in lines 1020 to 1720.

Number reference

Variables G and S are needed to keep the reference numbers of the entries in the new file in sequence. G counts the number of new entries made and S the number of new entries. Suppose the reference number E of the current entry from the old file is 100, and that prior to this four deletions have been made and six new entries inserted, the number E + G + S is interpreted as 100 - 4 + 6 = 102, which is the reference number to be written to the new file.

File records alternate between A and B — lines 1090 and 1100 — they could just as easily have run from A to Z and then reverted to A to start the sequence again. Simply change the lines to:

1090 LET X = ASC(M) + 1
1100 IF X = 91 THEN X = 65

Lines 750 to 1010 are included as a matter of convenience: they give a printout of the alterations made to the file which can be kept as a permanent record of the alterations which have been made.

A small snag was encountered while creating the initial data tape, caused by the 8K memory capacity. Each entry requires about 80 bytes of store, so the full list of 150 entries could not be held in store at the same time. This was overcome by only entering the first 80 records before running the program to create a preliminary file which was then used in conjunction with the update program to complete the initial file. DIM C(50) and DIM D(50) were temporarily removed from line 280 of the update program and the remaining Dim statements changed to C$(80), etc. to allow this operation to be carried out.
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Prices on application

(continued from previous page)

550 PRINT "HOW MANY ADDITIONS TO BE MADE? (NOT MORE THAN 50)."
560 REP=0
570 IF M=0 THEN 00550
580 IF M=0 THEN 00730
590 PRINT "ARRANGE THE ENTRIES IN ALPHABETICAL ORDER."
600 PRINT "ORDER."
610 PRINT "ENTER THE DETAILS AS REQUESTED."
620 PRINT "TYPE 1 WHEN YOU ARE READY."
630 INPUT
640 PRINT "PRINT(REP+1)"
650 FOR M=1 TO N
660 INPUT "MAKE";M$(M)
670 INPUT "QUALITY NAME";P$(M)
680 INPUT "FILE YARN";Y$(M)
690 INPUT "FLOTEAT - Y OR N";F$(M)
700 INPUT "COST PRICE PER KG.";C$(M)
710 NEXT M
720 PRINT "FILE NOW UPDATED."
730 PRINT "THE FILE WILL NOW BE UPDATED."
740 PRINT "ORDER."
750 FOR N=1 TO (47-4A)
760 NEXT N
770 PRINT "FINISHED"
780 PRINT "STORE CASSETTE 2"
790 PRINT "STORE CASSETTE 1"
800 INPUT "REF ";C(N)
810 IF C(N)="D" THEN 01340
820 GOTO 01120
830 PRINT "FILE NOW UPDATED."
840 PRINT "STORE CASSETTE 2"
850 PRINT "STORE CASSETTE 1"
860 PRINT "REF ";C(N)
870 IF C(N)="D" THEN 01340
880 GOTO 01120
890 INPUT "REF ";C(N)
900 IF C(N)="D" THEN 01340
910 GOTO 01120
920 PRINT "ORDER."
930 FOR M=1 TO N
940 PRINT "REF ";C(N)
950 GOTO 00970
960 PRINT "ORDER."
970 IF RC(N)="N" THEN 00960
980 PRINT "ORDER."
990 FOR M=1 TO N
1000 PRINT "ORDER."
1010 PRINT "ORDER."
1020 PRINT "ORDER."
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PRACTICAL COMPUTING March 1982
Operating systems

The Unix road to power

Unix is pretender to the throne of the most-used operating system whose present incumbent, CP/M, has ruled virtually uncontested for the last two years. Before modular Unix can overthrow this reign, it must improve the image it presents to the user — or so argues Donald Norman.

Unix was developed by Dennis Ritchie and Ken Thompson of Bell Laboratories. Unix is trademarked by Bell and is available under licence from Western Electric. Although it is a relatively small operating system, it is quite powerful and general. It has found considerable favour among programming groups, especially in universities, where it is primarily used with DEC computers — various versions of the DEC PDP-11 and the Vax.

The operating system and its software are written in a high-level programming language called C, and most of the source code and documentation is available online. For programmers, Unix is easy to understand and to modify.

Hierarchical structure

For the non-expert programmer, the important aspect of Unix is that it is constructed from a small, basic set of concepts and programming modules, with a flexible method for interconnecting existing modules to make new functions. All system objects — including all I/O channels — look like files. Thus, it is possible to cause input and output for almost any program to be taken from or to go to files, terminals, or other devices, at any time, without any particular planning on the part of the module writer.

Unix has a hierarchical file structure. Users can add and delete file directories at will and then "position" themselves at different locations in the resulting hierarchy to make it easy to manipulate the files in the neighbourhood.

The command interpreter of the operating system interface — called the "shell" — can take its input from a file, which means that it is possible to put frequently used sequences of commands into a file and then invoke that file just by typing its name, thereby executing the command strings.

In this way, the user can extend the range of commands that are readily available. Many users end up with a large set of specialised shell command files. Because the shell includes facilities for passing arguments, for iterations, and for conditional operations, these "shell programs" have many uses, essentially calling upon all system resources including the editors — as subroutines. Many non-programmers have discovered that they can write powerful shell programs, significantly enhancing the power of the overall system.

Modular concept

By means of a communication channel known as a pipe, the output from one program can easily be directed — piped — to the input of another, allowing a sequence of programming modules to be strung together to do some task that in other systems would have to be done by a special-purpose program. Unix does not provide special-purpose programs. Instead, it attempts to provide a set of basic software tools that can be strung together in flexible ways using I/O redirection, pipes, and shell programs.

Technically, Unix is just the operating system. However, because of the way the system has been packaged, many people use the name to include all of the programs that come on the distribution tape.

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Many people have found it easy to modify the Unix system and have done so, which has resulted in hordes of variations on various kinds of computers.

The "standard Unix" discussed here is BTL Unix version 6 May 1975. The Fourth Berkeley Edition of Unix is more or less derived from BTL Unix version 7 September 1978 — with considerable parallel development at the University of California, Berkeley and some input from other BTL Unix versions. I am told that some of the Unix's failings raised in the article have been remedied; however, version 6 is still used by many people.

It may be difficult to discern that I am a friend of Unix. The negative tone should not obscure the beauty and power of the Unix software, file structure, and the shell. Unix is indeed a superior operating system. I would not use any other.

Some of the difficulties detailed result from the fact that many of the system modules were written by the early users of Unix, not by the system designers. Many individual idiosyncrasies have entered the system.

For all of its virtues as a system — and it is indeed an elegant system — Unix is a disaster for the casual user. It fails both on the scientific principles of human engineering and even in just plain common sense.

If Unix is really to become a general system, then it must be improved. I urge correction to make the elegance of the system design be reflected as friendliness towards the user, especially the casual user. Although I have learned to accept the vagaries of Unix's user interface, our secretarial staff persists only because we insist.

Crucial failings

Even I, a heavy user of computer systems for 20 years, have had difficulties: copying the old file over the new, transferring a file into itself until the system collapsed, and removing all the files from a directory simply because an extra space was typed in the argument string. The problem is that Unix fails several simple tests.

Consistency. Command names, language, functions and syntax seem to have no relationship to each other.

Functionality. The command names, formats, and syntax seem to have no relationship to their functions.

Friendliness. Unix is a recluse, hidden from the user, silent in operation. The lack of interaction makes it hard to tell what state the system is in, and the absence of mnemonic structures puts a burden on the user's memory.

What is good about Unix? The system design, the generality of programs, the file structure, the job structure, the powerful operating system command language — the "shell". Too bad the concern for system design was not matched by an equal concern for the human interface.

One of the first things you learn when you start to decipher Unix is how to list your file system. Now this sounds straightforward enough, but in Unix even this simple operation has its drawbacks.

Suppose I have a file called Testfile. I want to see what is inside of it. How would you design a system to do it? I would have written a program that listed the contents on to the terminal, perhaps stopping every 24 lines if you had signified that you were on a display terminal with only a 24-line display. Unix, however, has no basic listing command, and instead uses a program meant to do something else.

**Side-effects**

Thus if you wish to list the contents of a file called HappyDays, you use the command named Cat:

```
    cat HappyDays
```

Why Cat? Why not? After all, as Humpty Dumpty said to Alice, who is to be the boss, words or us? Cat, short for "concatenate" as in, take file 1 and concatenate it with file 2 — yielding one file, with the first part file 1, the second file 2 and put the result on the "standard output", which is usually the terminal:

```
    cat file 1 file 2
```

If you have only one file, Cat will put it on the standard output — the terminal. That accomplishes the goal, except for those of us with video terminals, who watch helplessly as the text goes streaming off the display.

The Unix designers believe in the principle that special-purpose functions can be avoided by clever use of a small set of system primitives. Why make a special function when the side-effects of other functions will do what you want? Well, for several reasons:

- Meaningful terms are considerably easier to learn than non-meaningful ones in computer systems, this means that names should reflect function, otherwise the names for the function will be difficult to recall.
- Making use of the side-effects of system primitives can be risky. If cat is used unwisely, it will destroy files.
- Special functions can do useful things for users, such as stop at the end of screens, or print page headings, or transform non-printing characters into printing ones, or get...
rid of underlines for terminals that cannot perform them.

Cat, of course, will not stop at terminal or page boundaries, because doing so would disrupt the concatenation feature. But still, it is elegant to use Cat for listing. Who needs a print or a list command?

Notice the lack of consistency in forming the command name from the function table 1. Some names are formed by using the first two consonants of the function name. Editor, however, is Ed, concatenating the first two consonants of the function table 1. Some names are formed by using the command name from the function name. Which name? The standard text editor is called Ed. I suppose I want to collect a set of files named paper.1 paper.2 paper.3 paper.4 into one file. I can do this with cat:

cat paper.1 paper.2 paper.3 paper.4 > newfilename

Unix provides "glob" to make the job even easier. Glob means to expand the file name by examining all files in the directory to find all that fit. Thus, I can redo my command as

cat paper* > newfilename

where paper* expands to paper.1 paper.2 paper.3 paper.4

This is one of the typical virtues of Unix: there are a number of quite helpful functions. But suppose I had decided to name this new file "paper.all":

cat paper*.> paper.all

In this case, paper* expands to paper.1 paper.2 paper.3 paper.4 paper.all, and so I am filling up a file from itself:

cat paper.1 paper.2 paper.3 paper.4 paper.all > paper.all

Eventually the file will burst. Does Unix check against this, or at least give a warning? No such luck. The manual does not alert users to this either, although it does warn of a related infelicity: "Beware of 'cat a b> a' which destroys the input files before reading them".

The command to remove all files that start with the word "paper"

rm paper

becomes a disaster if a space is inserted by accident:

rm paper  
for now the file "paper" is removed, as well as every file in the entire directory — the power of glob.

Why is there not a check against such things? I finally had to alter my version of rm so that when I said to remove files, they were moved to a special directory name "deleted" and preserved there until I logged off, leaving me lots of time for second thoughts and catching errors. This illustrates the power of Unix: what other operating system would make it so easy for someone to completely change the operation of a system command? It also illustrates the trouble with Unix: what other operating system would make it so necessary to do so?

The standard text editor is called Ed. I spent a year using it as an experimental vehicle to see how people deal with such confusing things. Ed's major property is

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shyness; he does not like to talk.

You invoke Ed by saying, reasonably enough, “Ed.” The result is silence: no response, no prompt, no message, just silence. Novices are never sure what that silence means. Ed would be a little more likeable if he answered, “thank you, here I am,” or at least produced a prompt character, but in Unix silence is golden. No response means that everything is alright. If something had gone wrong, it would have told you.

Then there is the famous append mode error. To add text into the buffer, you have to enter “append mode.” To do this, you simply type “a,” followed by Return. Now everything that is typed on the terminal goes into the buffer. Ed, true to form, does not inform you that it is now in append mode; when you type “u,” followed by Return the result is silence. When you have finished adding text, you are supposed to type a line that “contains only a . on it” to get you out of append mode. Ed does not tell you when he has left append mode. This problem is so obvious that even the designers recognised it, but their reaction, in the tutorial introduction to Ed, is merely to note wryly that even experienced programmers make this mistake. While they may be able to see humour in the problem, it is devastating to the inexperienced secretary, research assistant or student trying to use Unix as a word processor. an experienced tool, or just to help them learn about computers.

Suppose you have been working on a file for an hour and then decide to finish work, exiting Ed by saying “q.” The problem is that Ed would promptly quit, destroying your last hour’s work. Thank goodness for all those people across the country who immediately rewrote the text editor so that we normal people— who make errors— have some other choices besides Ed, editors that tell you politely when they are working, that tell you if they are in append or command mode, and that do not let you finish without saving your file unless you are first warned, and then only if you say you really mean it.

Users’ pet hates

As I wrote this paper I asked my colleagues to tell me of their favorite grouses. I got a lot of responses, all with much the same flavour, mostly commenting about the lack of consistency and the lack of interactive feedback. Thus, there is no standardisation of means to exit programs and because the “shell” is just another program as far as the system is concerned, it is very easy to log yourself off the system by accident.

There are very useful pattern matching features— such as the “*” function— but the shell and the different programs use the symbols in inconsistent ways. The Unix copy command— Cp— and the related C programming language "string

BELL LABS’ VIEW

WHILE Praising the Unix system design, Donald Norman makes a number of caustic remarks about command names and other aspects of the human interface. These might be ignored, since he has no experimental tests to justify them; or they might even be taken as flattery of Unix, since he does not name any system he likes better; but some of his comments are worth discussing.

Most of the command names Norman points to are indeed strange; some such as the comma on the last one” just like subjects who had learned the ordinary version of the editor."

In addition to the amusing but secondary discussions of command names, Norman does raise some significant issues:

* whether systems should be verbose or terse;
* whether they should have a few general commands or many special-purpose ones;
* whether they should try to anticipate typical mistakes.

Unix is undoubtedly near an extreme of terseness, partly because it was originally designed for slow hard copy terminals. However, the terseness is very valuable when connecting processes. If the command that lists the logged-on users prints a heading above the list, you cannot tell how many users are on by feeding the command output to a line counter. If the editor types acknowledgements now and then, its output may not be directly usable as input somewhere else.

Norman complains about using Cat for commands or many special-purpose ones; whether they should try to anticipate typical mistakes.

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Operating systems

copy" — strcpy — reverse the meaning of their arguments, and Unix move — Mv —
and copy — Cp — operations destroy existing files without any warning. Many
programs take special "argument flags" but the manner of specifying the flags is
inconsistent, varying from program to program.

The version of Unix I now use is called
the Fourth Berkeley Edition for the
Vax, distributed by Joy, Babaoglu, Fabry, and Sklouver at the University of
California, Berkeley — henceforth,
Berkeley Unix.

Among the advantages are: history
lists, aliases, a richer and more intelligent
set of system programs — including a list
program, an intelligent screen editor, an
intelligent set of routines for interacting
with terminals according to their capabili-
ties. It includes a job control that allows
you to stop jobs in the middle, start up
new ones, move things from background
to foreground and vice versa, examine
files, and then resume jobs. The shell has
been amplified to be a more powerful
programming language, complete with
file-handling capabilities, If Then Else
statements, While, Case and other good-
ies of structured programming.

Aliases are worthy of special comment.
They let users tailor the system to their
own needs, naming things in ways they
can remember. Names you devise your-
self are easier to recall than names pro-
vided to you. Aliases also allow abbrevia-
tions that are comprehensible to the indi-
vidual, without burdening everyone else
with your cleverness or difficulties.

To work on this paper, I need only type
the word "unix," for I have set up an alias
called Unix that is defined to be equal to
the correct command to change directo-
ries, combined with a call to the editor —
called Vi for "visual" on this system — on
the file:
alias unix "cdir /cs1/norman/papers/
CogEngineering; vi unix"

These Berkeley Unix features have
proved to be indispensable: the people in
my laboratory would probably refuse to
going back to standard Unix.

Outside system

The bad news is that Berkeley Unix is
jury-rigged on top of regular Unix, so it
cannot only patch up the faults: it does not
remedy them. GREP is not only still GREP,
but there is an Egrep and an Fgrep.

The generators of Berkeley Unix have
their problems: if Bell Labs people are
smug and lean, Berkeley people are cute
and overweight. Programs are wordy and
special features proliferate. The system is
so large that it no longer fits on the small-
er machines: our laboratory machine, a
DEC-11/45, cannot hold the latest
release of Berkeley Unix even with a full
complement of memory and a reasonable
amount of disc. I wrote this paper on a
Vax.

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Learning the system for setting up aliases is not easy for beginners, who may be the people who need them most. You have to set them up in a file called Cshrc, not a name that inspires confidence. The full stop in the file name means that it is invisible — the normal method of directory listing program will not show it.

The directory listing program, ls, comes with 19 possible argument flags, which can be used singly or in combinations. The number of special files that must be set up to tell all the facilities to work is horrendous, and they get more complex with each new release from Berkeley.

Too much bitching

It is very difficult for new users. The program names are whimsical rather than systematic. Whimsicality is probably better than standard Unix's lack of meaning, but there are limits. The listing program is called More — as in, "give me more". The program that tells you who is on the system is called Finger, and a keyword help file — most helpful, by the way — is called Apropos. I used the alias feature to rename it Help.

One reader of a draft of this paper — a systems programmer — complained bitterly: "Such whining, hand-wringing, and general bitchiness will cause most people to dismiss it as over-emotional nonsense."

...The Unix system was originally designed by systems programmers for their own use and with no intention for others using it. Other hackers liked it so much that eventually a lot of them started using it. Word spread about this wonderful system, and the rest you probably know. I think that Ken Thompson and Dennis Ritchie could easily shrug their shoulders and say 'But we never intended it for other than our personal use'.

This was the only complaint, and I sympathise with its spirit. It should be remembered, though, that Unix is nationally distributed in the U.S. under contract to the U.S. government. Western Electric's motives are not altogether altruistic. If Unix had remained a simple experiment on the development of operating systems, then complaints could be made in a more friendly, constructive manner. But Unix is more than that. It is taken as the very model of a proper operating system, and that is exactly what it is not.

In the development of the system aspects of Unix, the designers have done a magnificent job. They have been creative, and systematic. A common theme runs through the development of programs, and by means of their file structure, the development of "pipes" and "redirection" of both input and output, plus the power of the iterative "shell" system-level commands, you can easily combine system-level programs into self-tailored systems of remarkable power. For system programmers, Unix is a delight. It is well structured, with a consistent, powerful philosophy of control and structure.

Why was the same effort not put into the design at the level of the user? The answer is complex, but one reason is the fact that there really are no well-known principles of design at the level of the user interface. The three most important concepts for system design are:

- Be consistent. A fundamental set of principles ought to be evolved and followed consistently throughout all phases of the design.
- Provide the user with an explicit model. Users develop mental models of the devices with which they interact. If you do not provide them with one, they will make one up themselves, and the one they create is likely to be wrong.
- Do not count on the user fully understanding the mechanics of the device. Both secretaries and scientists are ignorant of the difference between the buffer, the working memory, the working files, and the permanent files of a text editor. They are likely to believe that once they have typed something into the system, it is stored in a permanent file. They are likely to expect more intelligence from the system than the designer knows is there. And they are likely to read into comments — or the lack of comments — more than you have intended.

Feedback is of critical importance in helping establish the appropriate mental model and in letting the user keep its current state in synchrony with the actual system.

- Provide mnemonics. For most purposes it is convenient to think of human memory as consisting of two parts: a short-term memory and a long-term memory — modern cognitive psychology is developing more sophisticated notions, but this is still a valid approximation. Five to seven items is about the limit for short-term memory, so do not expect a user to remember the contents of a message for much longer than it is visible on the terminal. Long-term memory is robust, but it faces two difficulties: getting stuff in so that it is properly organised, and getting stuff out when it is needed. Learning is difficult, unless there is a good structure and it is visible to the learner.

There are lots of sensible memory aids that can be provided, but the most powerful and sensible of all is understanding. Make the command names describe the function that is desired. If abbreviations must be used, adopt a consistent policy of forming them. Do not deviate from the policy, even when it appears that a particular command warrants doing so.

System designers take note. Design the system for the person, not for the computer, not even for yourself. Peole are also information-processing systems, with varying degrees of knowledge and experience. Friendly systems treat users as normal, intelligent adults who are sometimes forgetful and are rarely as knowledgeable about the world as they would like to be. There is no need to talk down to the user, nor to explain everything. But give the users a share in understanding by presenting a consistent view of the system. Their response will be your reward.
Printers

The Peripherals Buyers' Guide is a survey of printers suitable for small computers. We have excluded any system which costs significantly more than £2,000. The printers are listed in alphabetical order. The addresses of the main suppliers are listed at the end of the guide.

Printers may be divided into several categories. The highest-quality printing is produced by the daisywheel-type which creates text in various type-faces, according to the wheel used. The quality ranges from excellent typing to rather poor book printing and generally there is a proportional-spacing facility. Those machines tend to be expensive and slow. Daisywheels can be either plastic—inefficient, but must be replaced often—or metal—expensive but durable.

For faster printing, you must turn to dot-matrix machines. The print quality tends to be poor and the machines noisy. Older machines use a 7-by-5 matrix which puts the descenders of letters such as 'y' above the line. That makes bulk text difficult to read. Better printers use a matrix nine dots deep to give true descenders. Recently, several firms have produced dot-matrix printers which give an approximation to typewriter printing and proportional spacing. They are less expensive than daisywheel machines, work faster and could well be used for correspondence-quality work.

Some dot-matrix printers employ sensitised paper to produce printing by more direct electrical effects. They are often quiet and fast, but the paper can be expensive, unpleasant to handle and hard to obtain.

The trend is to build more processing power into printers. That means they offer increasingly varied features, so it is hard to categorise them precisely.

A printer has to be connected to the computer by a cable and a more or less standard interface. The normal interfaces are the Centronics parallel, RS232 serial port — also known as the V-24—and 20mA current loop. IEEE is a parallel interface used by Pet; 'cpi' means characters per line, 'cps' means printing speed in characters per second. Allow five characters to the word.

The more intelligent printer prints as its head moves in both directions across the paper — bi-directional printing. Still more intelligent ones end the head movement at the ends of short lines. These two features can more then treble the working speed.

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Centronics

Main U.K. agents Sintrom Distribution, ITT Electronic Services, Cable and Wireless, Dacoll Engineering.
Models 700, 701, 702 and 703
Impact dot matrix, uses fan-fold paper, parallel serial RS232C interfaces 132 cpl, up to 180 cps, 5x7 or 7x7 matrices.

Model 791
Demand-document printer, impact, dot matrix, up to 12-part forms using bottom feed tractor, standard parallel interface, with serial RS232C interface option, 80 cpl, 60 cps, 5x7 matrix.

Model 730
Impact dot matrix, uses roll paper up to 8.5 in. wide, fan-fold paper up to 9.5 in. wide and cut sheet up to three-ply paper and two carbons, parallel-standard interface with serial RS232 option, 80 cpl, 100 cps, 7x7 matrix. Also from: Datalc Ltd, Rair Ltd, Comma Computers and MIBF.

Model 737
Impact dot matrix, roll fan-fold or cut sheet paper, standard parallel interface, serial RS232C, up to 80 cps, 5x7 matrix. Mono-spaced, 80 cps proportional, and 9x7 proportional. Main U.K. agents Microbyte and MacIn-Zand Electronics Ltd.

Model PI Microprinter and Model SI Microprinter
Non-impact dot matrix electro-sensitive uses aluminium-coated paper roll, parallel interface, serial RS232C interface, up to 80 cpl, and 150 lines per minute, up to 200 cps. Also from: Datalc Ltd.

Model 780
Impact, dot Matrix, pinch-roll paper feed for roll paper, tractor feed option for rear- and bottom-feed forms and fan-fold paper, parallel interface with serial RS232C option, 80 cpl, 60 cps, 5x7 matrix.

Model 779
Impact, dot matrix, pinch-roll paper feed for roll paper, with fanfold, tractor feed option, standard parallel interface with RS232C option, 80-102 cpl, 60-110 cps, 5x7 matrix.

Model 704
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Main U.K. agent Rair Ltd
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DecWriter III
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RP-1600
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RP 8040
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Silent 700, 743 Keyboard send/receive version £1,105
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**D-DAY**

GAMES PLAYERS look to their computers to provide a ready-made opponent at any time of the day or night. The computers themselves are always ready to oblige, of course, but many commercial games programs turn out to be a sad disappointment. The D-Day program from Computer Simulations is a welcome exception to this pattern which goes some way to redress the balance.

D-Day is a historically faithful simulation of the Allied landings in 1944. The human player controls the Allied forces, while the computer controls the German ones. It is played on two overlapping maps of northern France that show differing terrain and towns, which are depicted by various alphabetic characters. It is somewhat confusing at first, but you soon understand what each character means.

**Victory tables**

The package consists of three separate programs: an historical descriptive program of about 9K, which is really quite superfluous; an animated 12.3K rules program; and the main game program of 13.1K. All will run on a 16K TRS-80 with no problems, though the main game program will require Dirtop/Zap to be run first if loaded from floppy tape.

Also included are written scene settings, explanations of commands, game rules, combat and victory tables, plus unit-strength charts. All programs load without any problems. Though the rules were well set out, the game is so complex that they fail to cover every contingency, which leads to some head-scratching and ad-hoc personal rule-making.

D-Day is a long, complex game which takes a beginner six hours to play through. It lasts from June 6, 1944 until the end of that month, each game turn lasting two days. At the start the human player has to decide where the five landing beaches are to be situated, and where initially to place the units at his command—he can either land units where and when he wishes, or follow the historical timetable which is included in the documentation. Turns then alternate between player and computer. Each moves its units until they are adjacent to an opponent’s unit. In this position they can choose to attack the other or not.

Attacks also involve allocating air and naval support, which are in turn affected by the weather conditions and the amount of supplies that the navy can land. The outcome of such attacks is either that both units’ strengths are diminished or one unit is wiped out, which happens after a unit’s strength has been considerably worn down, or a unit retreats.

Gradually, both sides’ units are worn down, wiped out or forced to retreat. The German side has only a limited number of units on the screen when the invasion commences, but they are constantly being reinforced by other units arriving from the south and from Germany. Allied forces, on the other hand, are all available from the beginning, but each unit’s individual strength can be reinforced overnight.

The aim of the simulation is for the Allied player to capture both Cherbourg and Caen, plus as many other towns as possible—a look-up table at various dates tells you how well you are doing.

D-Day is an extremely complex game which requires a considerable amount of understanding. Unfortunately, the battle program is so long that there does not appear to be any room left for error checking, etc. The program therefore relies on the human player’s honesty, apart from preventing two units being stacked in the same location on the map, it checks nothing that the human player inputs. It is, therefore, easy to cheat, though the game’s designer probably hoped that such low thoughts would never enter the head of prospective purchasers of this type of program.

**Aggressive role**

The computer logic is also somewhat disappointing in that it does not play a particularly aggressive role, though this may have been a conscious programming decision due to the German side’s inferior manpower position. A facility to play either side would have improved the program, as the German position seems to be the more challenging one to play. The rules themselves are complicated and at times anomalous. However, the lack of error-checking by the program allows you to modify the simulation to some extent. A shorter game can be played by assuming the Americans never entered the war.

The terrain/combat/supply rules appear to have little real effect on the outcome of the battles: they should have more obvious effects and handicap both sides more effectively than they do. Attacks themselves can be light, medium or heavy, but too often players use the latter, and overwhelming force always seems to win.

---

**Conclusions**

- D-Day is a complex game which offers the player a substantial challenge. It calls for tactical skill, planning and forward thinking which makes it very absorbing.
- The game’s realism and the sense of playing against a real opponent are considerable assets.
- The simulation can be recommended to anybody interested in tactical war games. Along with other campaign games in the same series it appears to be the nearest approximation to real war-gaming simulation available for the TRS-80.
- The program appears to be bug-free.
- **Ratings:**
  - **Physical quality**: Fair
  - **Perceived complexity**: Good
  - **Subject complexity**: Fair
  - **Realism**: Fair
  - **Play balance**: Good
  - **Overall**: Very good

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The introduction of a brand new word processor is a major event and AJEDIT is without doubt a major program. There are, however, quite a few Word Processors around and most of them are extremely good ones - why, therefore, another? The question is even more pertinent when it is known that we specifically commissioned the writing of it from an author of the status of Denville Longhurst of Enhanced Basic fame. The answer is that user feedback shows that a large number of customers do not need or want word processor programs which require a quantity of training before use. Scripsit, for instance, is an excellent program, but is complex to use; it even comes with a training course on tape. If one operator is dedicated to using the word processor then it makes sense to have her trained, and the more complex the program (so long as the complexity is accompanied by more and bigger functions) the better.

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